

Sequence III Surveillance Panel

March 02, 2016 11:00 – 12:30 EST

Agenda

1.0) Attendance

The attendance is shown in Attachment 1.

2.0) Chairman Comments

Chairman Glaenzer noted that both the IIIH improvement Task Force and the Stats Group are making progress.

3.0) Approval of minutes

3.1) Minutes from 02/17/2016 Conference Call

The minutes of February 17, 2016 were approved unanimously.

4.0) Action Item Review

4.1) Analysis of IIIF & IIIG run 7-10 data for differences.

The Stats Group requests an additional week to finalize study.

4.2) Request to ASTM-TMC to query oil suppliers for MRV and P retention data on IIIH oils. **J. Clark**

Jeff Clark of the TMC reported on the status of the request:

- All suppliers were contacted with the request.
- 436 supplier said they would try to provide the data; nothing has been received to date.
- 438 supplier said the oil is a GF-3 vintage oil and no ROBO data is available.
- 434-2 aside from IIIGA/B data nothing has been provided.

5.0) Old Business

5.1) Test improvement Task Force. **Szappanos**

George Szappanos updated the group. Meetings have been ongoing and the task force is closing in on its remaining work. The build workshop noted differences in lab practice and the rebuild manual is being revised as a result. The blowby ventilation configuration has also been identified as an area of improvement via standardization. George expects the TF's work to conclude soon and then move to running some demonstration tests. Then followed a ranging discussion on how the recommended changes will be implemented. This will be a topic of future meetings.

5.2) Test procedure update. **Haumann**

Karin Haumann expects to have the update completed soon.

5.3) Engine Build manual update. **S. Clark**

Sid Clark expects to have the update completed soon.

6.0) New Business

6.1) Request by AOAP & PCEOCP for endorsement of IIIH test for MRV and Phos Retention use.

This topic was introduced at the previous meeting. The data requested (refer to Item 4.2 above) has not yet yielded new information. The Stats Group presentation (Attachment 2) was reviewed by Kevin O'Malley. Kevin's summary comments:

1. Strictly speaking, 434-2 is the only oil blend tested in both the IIIG and IIIH.
 - a. IIIG oils include: 434, 434-1, 434-2, 438, 435, 435-1, and 435-2
 - b. IIIH oils include: 434-2, 438-1, and 436
2. Both the IIIGA and IIIHA discriminate the MRV of 434-2 and 438 (434-2 > 438).
3. There is no significant difference between the PHOS of 434-2 and 438 in both the IIIGB and IIIHB.

During review, it was commented that the IIIG Phos retention for oil 436 was >85%. At this point the SP considered the original question 'Does the SP endorse the IIIH for MRV and Phos Retention use?' Chairman Glaenger asked if there was a motion; Karin Haumann moved that the SP recommend the IIIH is a suitable tool for MRV and Phos Retention (Tang second). After little discussion or comments, the motion passed 11-0-2. Chairman Glaenger will notify the AOAP and PCEOCP.

6.2) Update on LTMS plans for Sequence IIIH.
The will occur at a face-to-face meeting in SAT March 29.

7.0) Work Remaining

7.1 Set up LTMS. **Underway SAT March 29**

7.2) Determine whether matrix stands can be considered calibrated based on their matrix tests. **TBD**

7.3) Review and finalize the Qi Limits **TBD**

7.4) Determine calibration and referencing protocols. **Discuss at SAT March 29**

7.5) Appendix K Update. **Martinez**

7.6) Surveillance Panel recommendation regarding test readiness for the category. **June, 2015**

7.7) Publish research report **TBD**

8.0) Next Meeting

8.1) Teleconference on March 9, 2016.

8.2) Tentative, teleconference on March 17, 2016.

8.3) Face-to-Face on March 29, 2016.

9.0) Meeting Adjourned

The meeting adjourned at 11:55 am.

ATTACHMENT

ASTM Sequence III Surveillance Panel (22 Voting members)

date: 03/02/16

Conf. CALL

Name/Address	Phone/Fax/Email	Voting Member	Signature
Ed Altman	804-788-5279	Voting Member A	Present <input checked="" type="checkbox"/>
Jeff Betz	jeff.betz@fcagroup.com	Voting Member A	Present <input type="checkbox"/>
Jason Bowden	440-354-7007	Voting Member W	Present <input checked="" type="checkbox"/>
Timothy L. Caudill	606-329-1960 x5708	Voting Member A	Present <input checked="" type="checkbox"/>
Richard Grundza	412-365-1031	Voting Member W	Present <input type="checkbox"/> <i>by Jeff C</i>
Jeff Hsu, PE	j.hsu@shell.com	Voting Member A	Present <u>Kim W H</u>
Tracey King	947-517-4107	Voting Member	Present <input type="checkbox"/>
Teri Kowalski	734-995-4032	Voting Member	Present <input type="checkbox"/>
Patrick Lang	210-522-2820	Voting Member A	Present <input checked="" type="checkbox"/>
Addison Schweitzer	210-706-1586	Voting Member A	Present <input checked="" type="checkbox"/>
Bruce Matthews	248-830-9197	Voting Member	Present <input type="checkbox"/>
David Tsui	973-305-2337	Voting Member	Present <input type="checkbox"/>
Cliff Salvesen		Voting Member	Present <input type="checkbox"/>
Andrew Ritchie	908-474-2097	Voting Member A	Present <u>GR Farnsworth</u>
Ron Romano	313-845-4068	Voting Member A	Present <input checked="" type="checkbox"/>
Greg Shank	301-790-5817	Voting Member	Present <input type="checkbox"/>
Kaustav Sinha, Ph.D.	713-432-6642	Voting Member A	Present <u>Jo</u>
Thomas Smith	859-357-2766	Voting Member	Present <input type="checkbox"/>
Scott Stap	scott.stap@tgidirect.com	Voting Member	Present <input type="checkbox"/>
Mark Sutherland	210-867-8357	Voting Member	Present <u>rep. by Don L</u>
George Szappanos	440-347-2352	Voting Member A	Present <input checked="" type="checkbox"/>
Haiying Tang	248-512-0593	Voting Member A	Present <input checked="" type="checkbox"/>

Motions → 110-2

Kam LZ
Jan

ASTM Sequence III Surveillance Panel (22 Voting members)

date:

PAGE 2 of 3

Conf. CALL

3/2/16

Name/Address	Phone/Fax/Email		Signature
Ricardo Affinito	affinito@chevron.com	Non-Voting Member	Present _____
Art Andrews	856-224-3013	Non-Voting Member	Present _____
Dan Lanctot	TEI	Non-Voting Member	Present <input checked="" type="checkbox"/> _____
Doyle Boese	908-474-3176	Non-Voting Member	Present _____
Adam Bowden	440-354-7007	Non-Voting Member	Present _____
Dwight H. Bowden	440-354-7007	Non-Voting Member	Present _____
Matt Bowden	440-354-7007	Non-Voting Member	Present <input checked="" type="checkbox"/> _____
Jerome A. Brys	440 347-2631	Non-Voting Member	Present <input checked="" type="checkbox"/> _____
Bill Buscher III	210-240-8990	Non-Voting Member	Present _____
Bob Campbell	804-788-5340	Non-Voting Member	Present <input checked="" type="checkbox"/> _____
Chris Castanien	Chris.Castanien@gmail.com	Non-Voting Member	Present <input checked="" type="checkbox"/> _____
Martin Chadwick	210-706-1543	Non-Voting Member	Present _____
Jeff Clark	412-365-1032	Non-Voting Member	Present <input checked="" type="checkbox"/> _____
Sid Clark	586-873-1255	Non-Voting Member	Present <input checked="" type="checkbox"/> _____
Todd Dvorak	804-788- 6367	Non-Voting Member	Present _____
Frank Farber	412-365-1030	Non-Voting Member	Present _____
Joe Franklin	210-523-4671	Non-Voting Member	Present _____
David L. Glaenzer	804-788-5214	Non-Voting Member	Present <input checked="" type="checkbox"/> _____
Karin E. Haumann	281-544-6986	Non-Voting Member	Present <input checked="" type="checkbox"/> _____
Walter Lerche	313-667-1918	Non-Voting Member	Present _____
Josephine G. Martinez	510-242-5563	Non-Voting Member	Present <input checked="" type="checkbox"/> _____
Mike McMillan	mmcmillan123@comcast.net	Non-Voting Member	Present <input checked="" type="checkbox"/> _____
Bob Olree	248-689-3078	Non-Voting Member	Present _____
Kevin O'Malley	kevin.omalley@lubrizol.com	Non-Voting Member	Present <input checked="" type="checkbox"/> _____
Christian Porter	804-788-5837	Non-Voting Member	Present _____
Phil Rabbat	914-785-2217	Non-Voting Member	Present _____
Allison Rajakumar	440-347-4679	Non-Voting Member	Present _____
Scott Rajala	srajala@ilacorp.com	Non-Voting Member	Present _____

ASTM Sequence III Surveillance Panel (22 Voting members)

date:

Name/Address	Phone/Fax/Email	Cont. CALL	Signature 3/2/16
Jim Rutherford	510-242-3410	Non-Voting Member	Present _____
Amol Savant	606-320-1960 x5604	Non-Voting Member	Present <input checked="" type="checkbox"/>
Philip R. Scinto	440-347-2161	Non-Voting Member	Present _____
Don Smolenski	248-255-7892	Non-Voting Member	Present _____
Jim Linden		Non-Voting Member	Present _____
Tom Wingfield	wingftm@cpchem.com	Non-Voting Member	Present _____
Charlie Leverett		Non-Voting Member	Present _____
Terry Bates	ASTM Facilitator	Non-Voting Member	Present _____
Chris Taylor	VP Fuels	Non-Voting Member	Present _____

Travis Kurt SPI ✓
~~Don Lent~~ TEL ✓

ATTACHMENT 2

Sequence IIIH & IIIG MRV and PHOS Comparison

Statistics Group

February 29, 2015

Statistics Group

- Arthur Andrews, ExxonMobil
- Doyle Boese, Infineum
- Jo Martinez, Chevron Oronite
- Kevin O'Malley, Lubrizol
- Martin Chadwick, Intertek
- Richard Grundza, TMC
- Lisa Dingwell, Afton
- Todd Dvorak, Afton
- Travis Kostan, SwRI

Responses from all members were not received; contents do not imply consensus

IIIH Tests:

27 out of 28 Mx tests analyzed + 1 Post-Mx test

IIIH Matrix Test Status

	Lab-Stand	D-1	E-1	B-1	G-1	G-2	A-1	A-2
Run Order	1	434-2 106788-IIIH ✓	438-1 106784-IIIH Low MAP and Fuel Flow	438-1 106796-IIIH Oil Leak	36 106763-IIIH ✓	436 106764-IIIH Low MAP & Erratic Fuel Flow	438-1 106774-IIIH ✓	434-2 106778-IIIH ✓
			438-1 106785-IIIH ✓	438-1 106797-IIIH ✓		436 111422-IIIH ✓		
	2	434-2 106789-IIIH Loss of Oil Pressure	436 106782-IIIH Low MAP & Fuel Flow	436 106792-IIIH ✓	438-1 106767-IIIH ✓	434-2 107873-IIIH ✓	438-1 107869-IIIH ✓	438-1 107870-IIIH ✓
		434-2 106789A-IIIH ✓	436 106783-IIIH ✓					
	3	436 106786-IIIH ✓	434-2 106781-IIIH ✓	436 106793-IIIH ✓	438-1 106768-IIIH ✓	434-2 110227-IIIH ✓	434-2 106779-IIIH ✓	436 106775-IIIH ✓
	4	438-1 106791-IIIH ✓	434-2 106780-IIIH ✓	434-2 106795-IIIH ✓	434-2 110228-IIIH ✓	438-1 107872-IIIH ✓	436 106777-IIIH ✓	436 106776-IIIH ✓

✓ Indicates operational data has been reviewed and found to be operationally valid.

Test Reported
434-2
107883-IIIH

Invalid

Post-Mx Test



IIIG tests

MRV

IND	MRVTEMP	Number of Tests
434	-20	1
434	-25	2
434	-30	68
434-1	-25	1
434-1	-30	47
434-2	-30	5
438	-30	147
438	-35	2
435	-25	6
435	-30	95
435	-35	1
435-1	-30	5
435-2	-25	1
435-2	-30	38

Total of 419 Chartable IIIGA tests in LTMS file

434 and 438 are in common to both IIIGA and IIIHA (273 results)

14 results are at an MRV temp other than -30C

20 results either “NM” or “Solid”; all are on 435 blends

Phos

IND	N
434	2
434-1	60
434-2	5
438	69
435	24
435-1	5
435-2	40

Total of 205 Chartable IIIGB tests in LTMS file

434 and 438 are in common to both IIIGB and IIIHB (136 results)

Summary

1. Both IIIGA and IIIHA discriminate the $\ln(\text{MRV})$ of oils (434-2 > 438)

Sequence IIIGA Reference Oil Targets					
Oil	n	Effective Dates		MRV Viscosity ³	
		From ¹	To ²	\bar{X}	s
434	16	11-3-03	1-31-04	10.7440	0.38793
	20	2-1-04	5-31-04	10.7378	0.40442
	23	6-1-04	***	10.7881	0.45550
435 ⁴	--	11-3-03	***	--	--
435-2 ⁴	--	2-1-11	***	--	--
438	16	11-3-03	1-31-04	9.8632	0.19411
	22	2-1-04	5-31-04	9.8351	0.17518
	25	6-1-04	8-31-04	9.8405	0.16998
	30	9-1-04	***	9.8277	0.16646

Sequence IIIHA				
Oil	MRV Viscosity		MRV Viscosity TEMP = -30C	
	Ismean	Standard Deviation	Ismean	Standard Deviation
434-2	11.21	0.5880	11.1	0.5220
438-1	10.08	0.7209	9.82	0.9132
436	9.8	0.2423	9.8	0.2423

- 1 Effective for all tests completed on or after this date
- 2 *** = Currently in effect
- 3 Transformation is $\ln(\text{MRV})$
- 4 For oil 435, use Sequence IIIG PVIS Y_i value as MRV Y_i value

2. IIIGB and IIIHB do not discriminate between the PHOS of 434-2 & 438

Sequence IIIGB Reference Oil Targets					
Oil	n	Effective Dates		Phosphorus Retention	
		From ¹	To ²	\bar{X}	s
434	54	11-12-08	***	76.00	2.02
434-1 ³	--	11-12-08	***	76.00	2.02
435	51	11-12-08	***	82.40	2.28
435-2	--	2-1-11	***	82.40	2.28
438	53	11-12-08	***	78.20	2.56

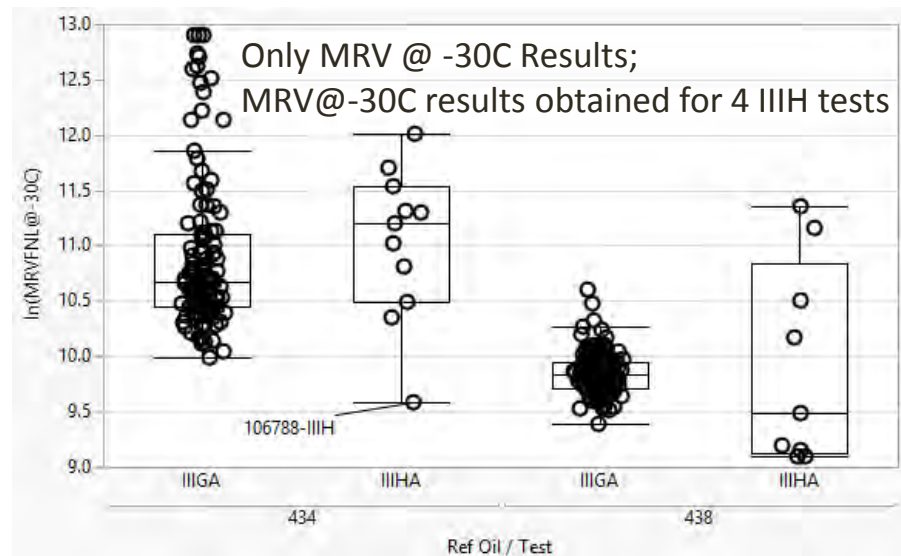
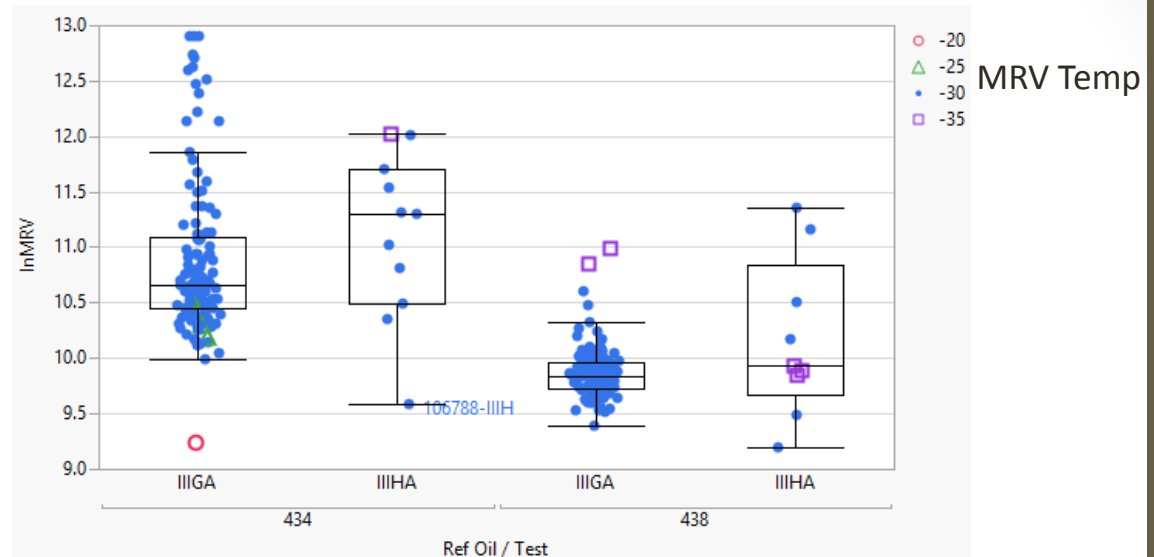
Seq IIIHB		
PHOS		
Oil	Ismean	Standard Deviation
434-2	79.95	1.58
438-1	78.92	1.54
436	94.15	2.02

- 1 Effective for all tests completed on or after this date
- 2 *** = Currently in effect
- 3 Targets based on oil 434

IIIGA vs. IIIHA

All chartable 434 and 438 tests are shown on the plots

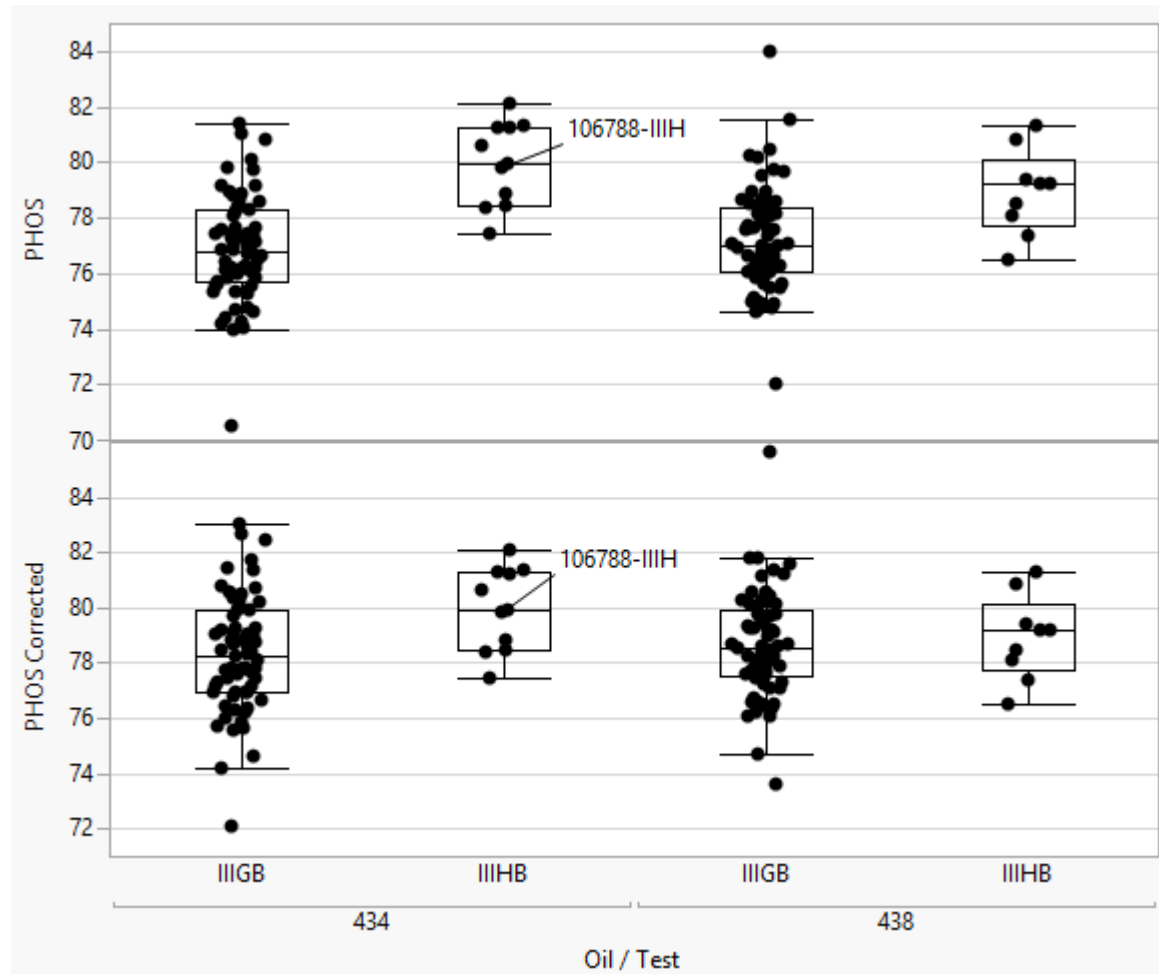
Both IIIGA and IIIHA discriminate oils (434-2 > 438)



IIIGB vs. IIIHB

All chartable 434 and 438 tests are shown on the plots

IIIGB and IIIHB do not discriminate the PHOS of 434-2 & 438

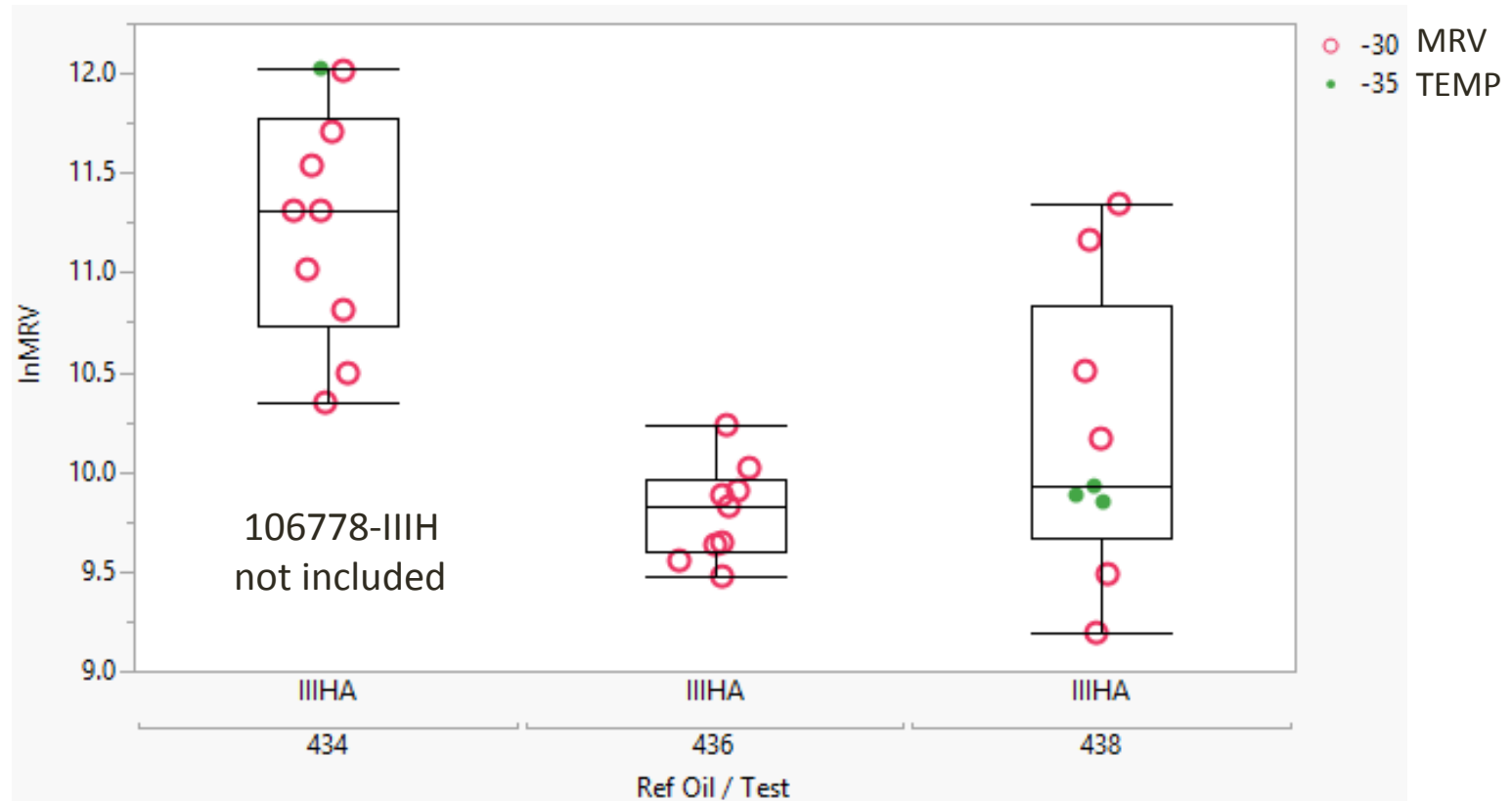


Appendix

IIIHA

MRV as reported in LTMS

LnMRV



IIIIHA LnMRV ANOVA

Model Summary

Summary of Fit			
RSquare			0.820021
RSquare Adj			0.74424
Root Mean Square Error			0.421429
Mean of Response			10.43819
Observations (or Sum Wgts)			28
Effect Tests			
Source	DF	Prob > F	
IND	2	<.0001*	
LTMSLAB	4	0.0145*	
LTMSAPP[LTMSLAB]	2	0.0342*	

Oil Differences

Least Squares Means Table			
Least			
Level	Sq Mean	Std Error	Mean
434-2	11.214945	0.13665006	11.2555
436	9.792273	0.14559523	9.7987
438-1	10.077894	0.14913983	10.1695
Least			
Level	Sq Mean		
434-2 A	11.214945		
438-1 B	10.077894		
436 B	9.792273		

Levels not connected by same letter are significantly different.

Lab Differences

Least Squares Means Table			
Least			
Level	Sq Mean	Std Error	Mean
A	10.633922	0.14968569	10.5273
B	10.204398	0.21274163	10.0620
D	9.751815	0.21265636	9.9651
E	10.806814	0.21265636	11.0201
G	10.411569	0.14971598	10.4827

Least		
Level	Sq Mean	
E A	10.806814	
A A	10.633922	
G A B	10.411569	
B A B	10.204398	
D B	9.751815	

Levels not connected by same letter are significantly different.

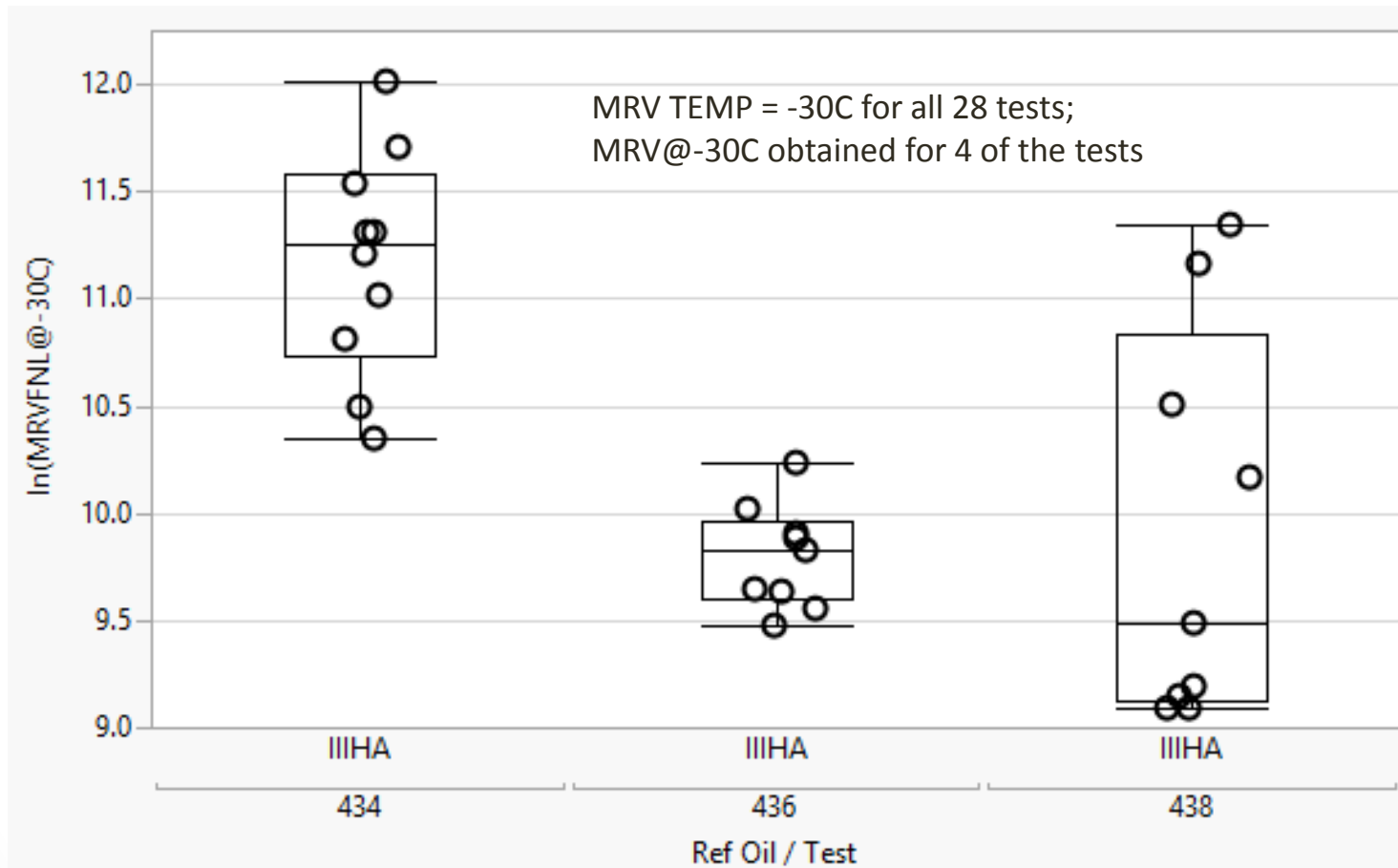
Stand within Lab Differences

Least Squares Means Table			
Least			
Level	Sq Mean	Std Error	
[A]1	11.012799	0.21274163	
[A]2	10.255046	0.21274163	
[G]1	10.212827	0.21274163	
[G]2	10.610311	0.21265636	

LTMSLAB[A];LTMSAPP[1]	0.3788765	0.151173	2.51	0.0215*
LTMSLAB[G];LTMSAPP[1]	-0.198742	0.151083	-1.32	0.2040

IIIHA
MRV @ -30C

LnMRV



IIIIHA LnMRV ANOVA

Model Summary

Summary of Fit			
RSquare			0.796396
RSquare Adj			0.710668
Root Mean Square Error			0.472464
Mean of Response			10.32579
Observations (or Sum Wgts)			28
Effect Tests			
Source	DF	Prob > F	
IND	2	<.0001*	
LTMSLAB	4	0.0339*	
LTMSAPP[LTMSLAB]	2	0.0138*	

Oil Differences

Least Squares Means Table			
Least			
Level	Sq Mean	Std Error	Mean
434-2	11.110677	0.15319843	11.1736
436	9.785386	0.16322687	9.7987
438-1	9.818910	0.16720072	9.9109

Least		
Level		Sq Mean
434-2	A	11.110677
438-1	B	9.818910
436	B	9.785386

Levels not connected by same letter are significantly different.

Lab Differences

Least Squares Means Table			
Least			
Level	Sq Mean	Std Error	Mean
A	10.636311	0.16781269	10.5273
B	9.976633	0.23850473	9.8634
D	9.747037	0.23840913	9.9651
E	10.597114	0.23840913	10.8152
G	10.234528	0.16784664	10.2911

Least		
Level		Sq Mean
A	A	10.636311
E	A B	10.597114
G	A B	10.234528
B	A B	9.976633
D	B	9.747037

Stand within Lab Differences

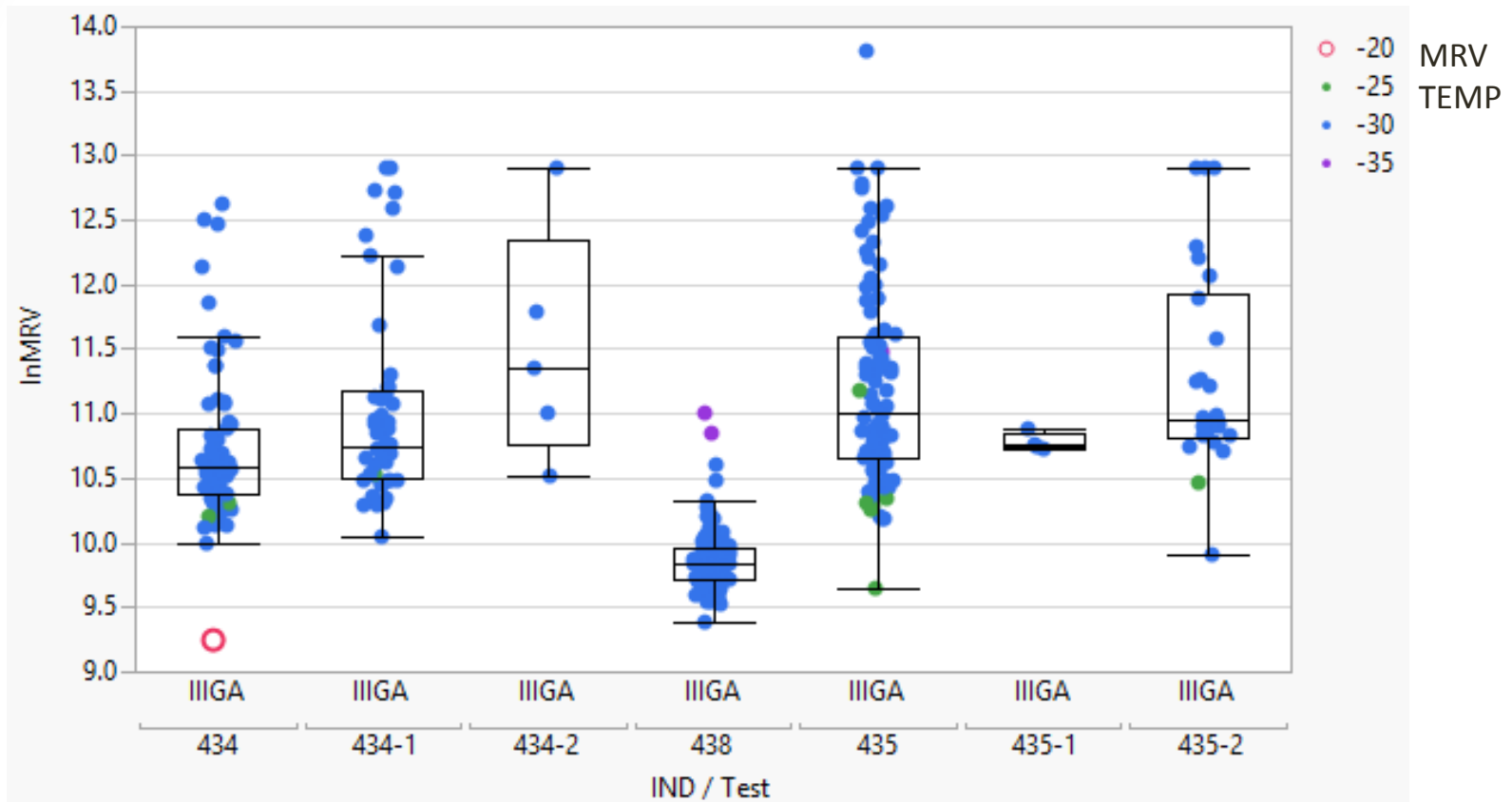
Least Squares Means Table			
Least			
Level	Sq Mean	Std Error	
[A]1	11.046700	0.23850473	
[A]2	10.225923	0.23850473	
[G]1	9.863521	0.23850473	
[G]2	10.605534	0.23840913	

LTMSLAB[A]:LTMSAPP[1]	0.4103887	0.16948	2.42	0.0256*
LTMSLAB[G]:LTMSAPP[1]	-0.371006	0.169379	-2.19	0.0412*

IIIGA

MRV as reported in LTMS

IIIGA LnMRV



IIIGA LnMRV ANOVA

Model Summary

Summary of Fit	
RSquare	0.546148
RSquare Adj	0.533248
Root Mean Square Error	0.571368
Mean of Response	10.60316
Observations (or Sum Wgts)	399
Effect Tests	
Source	DF Prob > F
LTMSLAB	5 <.0001*
IND	6 <.0001*

Lab Differences

Least Squares Means Table			
Least			
Level	Sq Mean	Std Error	Mean
A	11.015721	0.08551755	10.7042
B	10.802698	0.08556326	10.4630
D	10.731145	0.10262890	10.3581
E	10.607630	0.11733164	10.3107
F	10.812298	0.10698922	10.4599
G	11.050975	0.07004352	10.8117
Least			
Level	Sq Mean		
G	A	11.050975	
A	A B	11.015721	
F	A B C	10.812298	
B	B C	10.802698	
D	B C	10.731145	
E	C	10.607630	

Levels not connected by same letter are significantly different.

Oil Differences

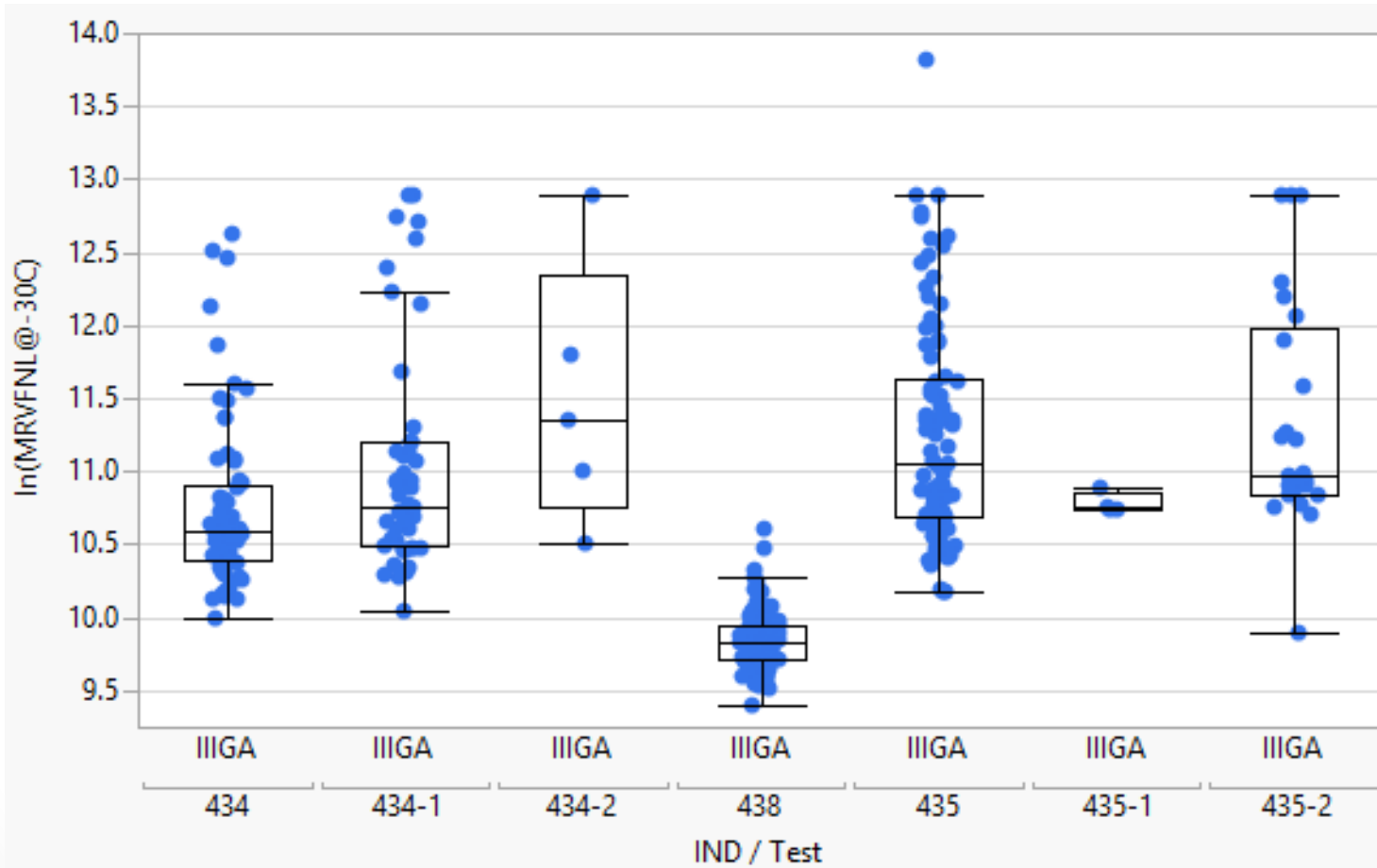
Least Squares Means Table			
Least			
Level	Sq Mean	Std Error	Mean
434	10.649862	0.06963965	10.7211
434-1	10.950877	0.08466597	11.0325
434-2	11.353332	0.25789859	11.5109
438	9.804839	0.04868249	9.8631
435	11.133111	0.06029017	11.2046
435-1	10.738745	0.28732245	10.7801
435-2	11.226446	0.11390777	11.3066
Least			
Level	Sq Mean		
434-2	A B	11.353332	
435-2	A	11.226446	
435	A	11.133111	
434-1	A B	10.950877	
435-1	A B	10.738745	
434	B	10.649862	
438	C	9.804839	

Levels not connected by same letter are significantly different.

IIIGA

MRV @ -30C results only

IIIGA LnMRV only MRVTEMP = -30C



IIIGA LnMRV only MRVTEMP = -30C

Model Summary

Summary of Fit		
RSquare		0.573309
RSquare Adj		0.560726
Root Mean Square Error		0.559482
Mean of Response		10.60926
Observations (or Sum Wgts)		385
Effect Tests		
Source	DF	Prob > F
LTMSLAB	5	0.0015*
IND	6	<.0001*

Oil Differences

Least Squares Means Table			
Least			
Level	Sq Mean	Std Error	Mean
434	10.687979	0.07149246	10.7566
434-1	10.970259	0.08462620	11.0431
434-2	11.379848	0.25289015	11.5109
438	9.799276	0.04870213	9.8487
435	11.187649	0.06324330	11.2601
435-1	10.745693	0.28144784	10.7801
435-2	11.256417	0.11420350	11.3404

Lab Differences

Least Squares Means Table			
Least			
Level	Sq Mean	Std Error	Mean
A	11.016154	0.08383507	10.7042
B	10.787866	0.08414253	10.4556
D	10.786782	0.10222363	10.3765
E	10.689639	0.13709896	10.2203
F	10.833626	0.10572698	10.4627
G	11.052037	0.06864441	10.8117

Least		
Level	Sq Mean	
434-2	A B	11.379848
435-2	A	11.256417
435	A	11.187649
434-1	A B	10.970259
435-1	A B	10.745693
434	B	10.687979
438	C	9.799276

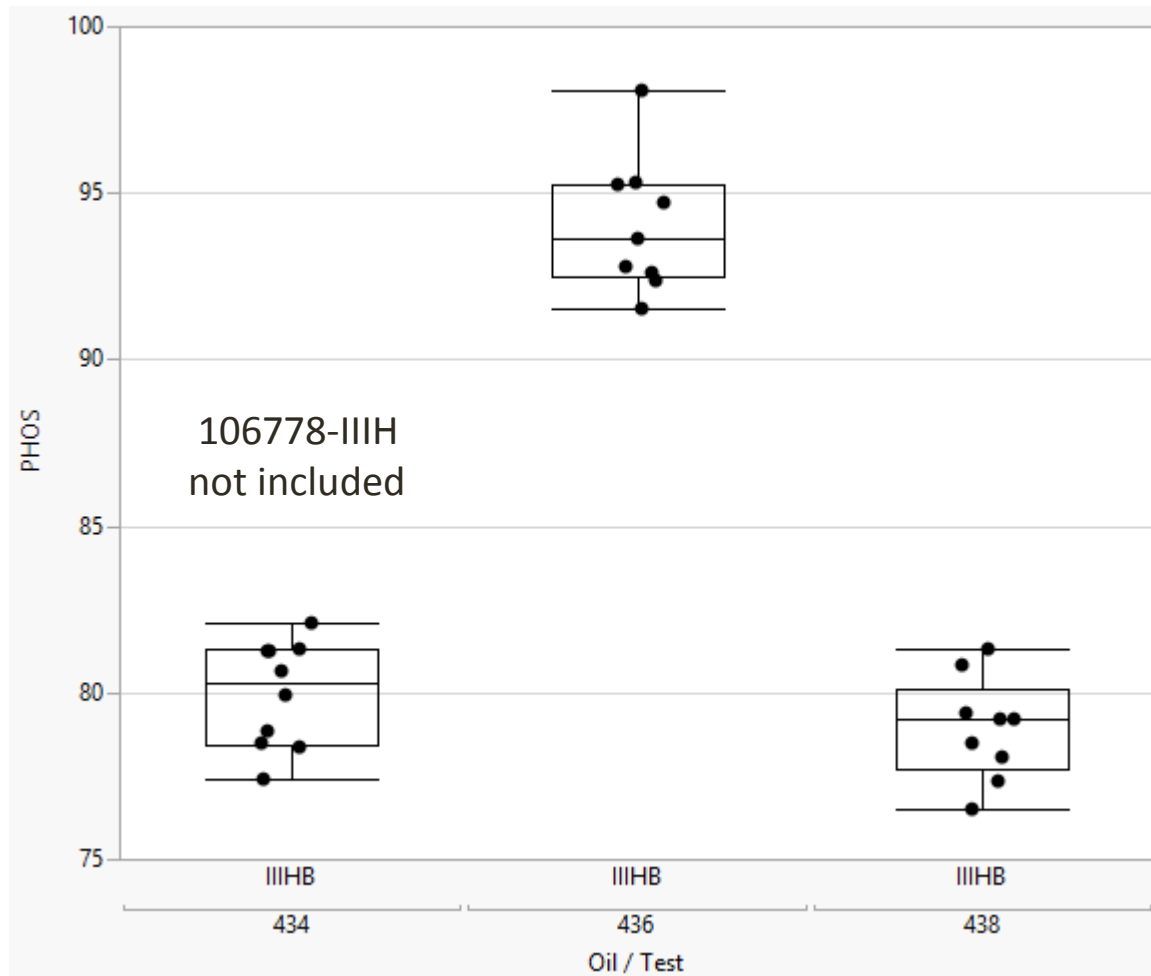
Levels not connected by same letter are significantly different.

Least		
Level	Sq Mean	
G	A	11.052037
A	A B	11.016154
F	A B	10.833626
B	B	10.787866
D	A B	10.786782
E	A B	10.689639

Levels not connected by same letter are significantly different.

IIIHB
PHOS

IIIBB PHOS



IIIHB PHOS

Model Summary

Summary of Fit	
RSquare	0.967394
RSquare Adj	0.953666
Root Mean Square Error	1.534392
Mean of Response	84.15357
Observations (or Sum Wgts)	28
Effect Tests	
Source	DF Prob > F
IND	2 <.0001*
LTMSLAB	4 0.0475*
LTMSAPP[LTMSLAB]	2 0.7215

Lab Differences

Least Squares Means Table			
Least			
Level	Sq Mean	Std Error	Mean
A	83.005174	0.54499535	83.5538
B	84.936902	0.77457772	87.3900
D	84.597153	0.77426725	83.5000
E	83.687153	0.77426725	82.5900
G	85.470299	0.54510563	84.2438

Least		
Level		Sq Mean
G	A	85.470299
B	A B	84.936902
D	A B	84.597153
E	A B	83.687153
A	B	83.005174

Levels not connected by same letter are significantly different.

Oil Differences

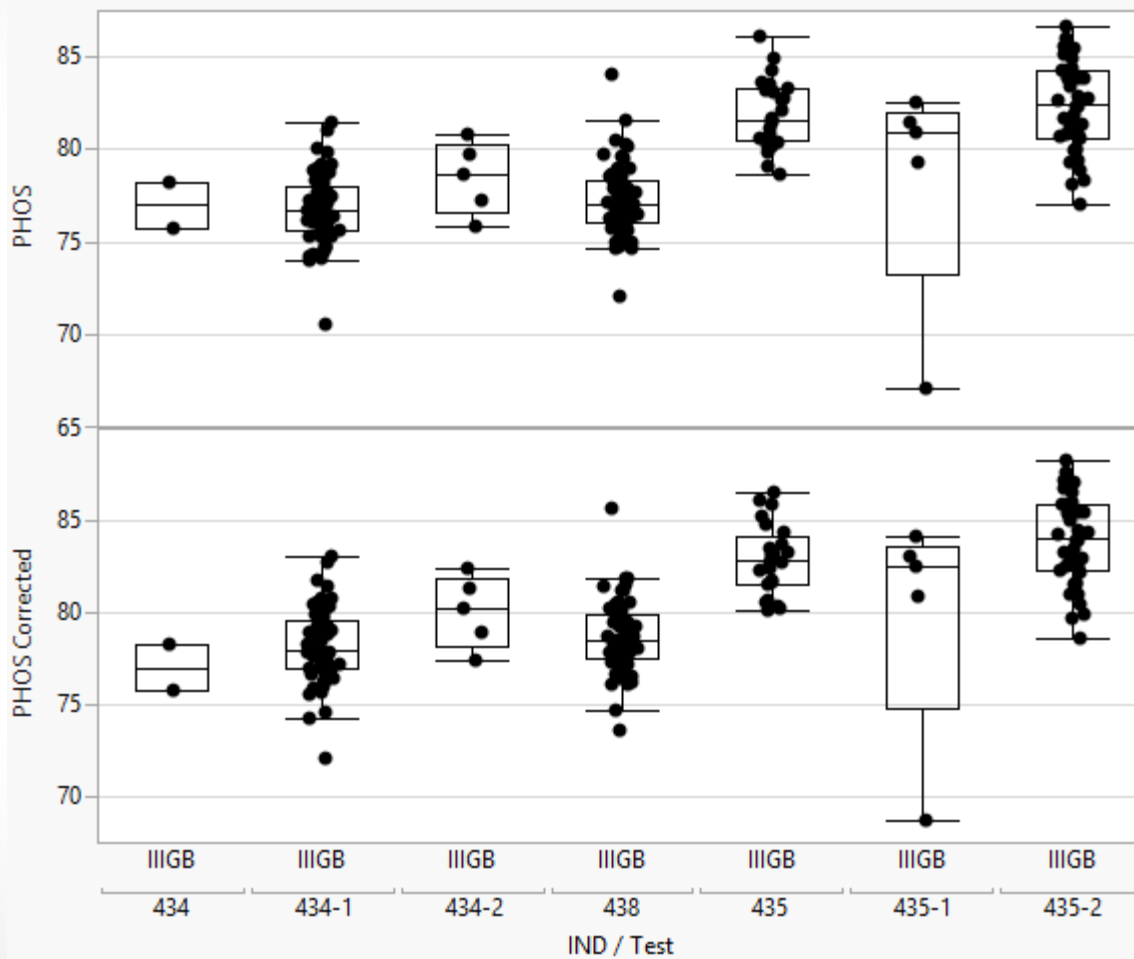
Least Squares Means Table			
Least			
Level	Sq Mean	Std Error	Mean
434-2	79.950725	0.49753350	79.9630
436	94.151730	0.53010228	94.0267
438-1	78.915553	0.54300792	78.9367

Least		
Level		Sq Mean
436	A	94.151730
434-2	B	79.950725
438-1	B	78.915553

Levels not connected by same letter are significantly different.

IIIGB
PHOS

IIIIGB PHOS



If date \geq 7/24/09, then
add 1.61 to PHOS

IIIGB PHOS

PHOS Model Summary

Summary of Fit	
RSquare	0.617715
RSquare Adj	0.595926
Root Mean Square Error	2.03339
Mean of Response	78.68102
Observations (or Sum Wgts)	205

Effect Tests		
Source	DF	Prob > F
LTMSLAB	5	<.0001*
IND	6	<.0001*

PHOS Corrected Model Summary

Summary of Fit	
RSquare	0.607221
RSquare Adj	0.584834
Root Mean Square Error	2.077865
Mean of Response	80.10254
Observations (or Sum Wgts)	205

Effect Tests		
Source	DF	Prob > F
LTMSLAB	5	<.0001*
IND	6	<.0001*

Lab Differences

Least Squares Means Table			
Level	Sq Mean	Std Error	Mean
A	77.933097	0.45716076	77.8659
B	78.600503	0.41465886	78.2846
D	80.210961	0.43377114	80.0926
E	78.900113	0.61989756	79.2338
F	77.081061	0.56912807	77.4282
G	78.902059	0.34089029	78.7656

Oil Differences

Least Squares Means Table			
Level	Sq Mean	Std Error	Mean
434	76.028122	1.4527236	76.9800
434-1	76.594470	0.2769001	76.7693
434-2	78.402677	0.9260610	78.4460
438	77.036615	0.2619979	77.2187
435	81.828609	0.4209808	81.8779
435-1	78.207066	0.9171383	78.2500
435-2	82.134866	0.3299449	82.3213

Lab Differences

Least Squares Means Table			
Level	Sq Mean	Std Error	Mean
A	79.228684	0.46715988	79.3648
B	79.753117	0.42372838	79.6198
D	81.471367	0.44325868	81.5132
E	80.075454	0.63345611	80.5962
F	78.336870	0.58157618	78.8488
G	80.178469	0.34834632	80.2169

Oil Differences

Least Squares Means Table			
Level	Sq Mean	Std Error	Mean
434	75.995742	1.4844979	76.9800
434-1	78.036738	0.2829565	78.2183
434-2	79.993219	0.9463161	80.0560
438	78.477213	0.2677284	78.6654
435	82.830868	0.4301886	82.8842
435-1	79.817822	0.9371981	79.8600
435-2	83.733018	0.3371616	83.9313

Level	Least Sq Mean
D A	80.210961
G B	78.902059
E A B C	78.900113
B B C	78.600503
A B C	77.933097
F C	77.081061

Level	Least Sq Mean
435-2 A	82.134866
435 A	81.828609
434-2 B	78.402677
435-1 B	78.207066
438 B	77.036615
434-1 B	76.594470
434 B	76.028122

Level	Least Sq Mean
D A	81.471367
G B	80.178469
E A B C	80.075454
B B C	79.753117
A B C	79.228684
F C	78.336870

Level	Least Sq Mean
435-2 A	83.733018
435 A B	82.830868
434-2 B C	79.993219
435-1 B C	79.817822
438 C	78.477213
434-1 C	78.036738
434 C	75.995742

Levels not connected by same letter are significantly different.