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Committee D02 on PETROLEUM PRODUCTS AND LUBRICANTS

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Originally Issued: November 27, 2013

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Unapproved Minutes of the November 19, 2013
Sequence III Surveillance Panel Meeting

The meeting was called to order by Chairman Glaenzer at 10:15 AM Central Time.

The agenda is included as attachment 1.

A listing of participants is included as attachment 2.

Minutes from the August 8 and November 8, 2013 meeting were approved with no comments.

Action items from the previous meeting were reviewed and there are no open action items.

Cylinder Head Task Force
Sid Clark presented the work accomplished to date by the Cylinder Head Task Force. Attachment 3 contains Sid's presentation. In order to relieve confusion about cylinder heads, Sid

explained Type S cylinder head is the satellite seat head, 24052260-S with identified with a yellow label. The B type head is the current head being run with powered metal exhaust, intake is as cast since 1997. Part number is 24052260B on box. Green stock is partially machined head which is final machined by Schwartz machine. New stock is a fully machined type B cylinder. Scott Stap indicated there is about and 8 week lead time for seat material and Schwartz Machine should be able to process up to 50 green stock in 10 days. Based on lead time and processing time, heads should be available in January. Sid also discussed the installing of seats in new stock. Schwartz Machine uses the same process on new stock as green stock. CMM data suggests new stock and green stock are identical. Reworked new stock will also be identified as Type S. Labs will address excess inventory of new stock for rework with Schwartz, as Schwartz needs an idea of how much material to obtain from L E Jones. Sid noted that during development, GM had noted issues with exhaust valve recession. Because of this valve recession, powdered metal was added to exhaust. Intakes were induction hardened and when powdered metal process was added, the flame hardening was dropped. Schwartz also does valve guides and decking so additional reworking may be available to continue the reuse of these heads. Seat pocket diameter was made 0.010 larger and the pocket depth is the same depth as normal manufacturing tolerances for both new stock and green stock. This should have minimal impact on compression ratio. Valves are not lapped and lapping may need to be addressed when reuse is of these heads is discussed. Valve recession is typical not an issue in the field due to the use of induction hardening of the seats and EGR in field. Reworking used cylinder may not be necessary if multiple runs can be obtained with stellite seats. May have to deck reworked heads and alter seat insert. Scott Stap noted that decking may salvage some of the 100 or so scratched heads. Dave then presented the survey of cylinder heads (attachment). It would appear that there are enough new stock heads to take industry through January of next year. Given the timelines for receipt of material and processing, Charlie pointed out it may be well into February until heads become available. Dave asked if labs who have excess heads are willing to sell to others who don't? It was determined that there are 810 green stock heads in inventory and 120 are being used per month. Dave presented a survey he had conducted to determine how much material is available at the labs, included as attachment 4. Race shop is on hold, and it was asked if the panel should have the shop make more new stock. Dave asked if it was possible to move reference periods to accommodate introduction. No decision needs to be made today, however, the chairman needs to be advised of progress. Concerns expressed about timing and number of heads available, as well as the potential to affect test severity once these heads are introduced. The Cylinder Head Task Force will track the progress. An Action item was assigned to the chair to monitor progress and schedule conference call in mid December to advise members of the status of cylinder head modifications as well as further implementation. It was also decided to reconvene the Test Longevity Task Force to address the use of number 7 and 8 pistons and rings as well as what level of testing may be needed to determine acceptability of these hardware. Seat Material will ship 12/20/2013 and will be processing heads after the 1st of 2014.

PVIS and Hours to 275% Implementation

Rich Grundza gave a presentation regarding the effectiveness of the Hours to 275% viscosity increase monitoring. The conclusion of the statisticians was that the correction appears to be working as intended. The presentation is included as attachment 5.

ACLW Severity Concerns
Jo Martinez reviewed the results of analysis performed by the statistics group. A total of 390 results were analyzed and there was insufficient data to arrive at any meaningful conclusions regarding seat material. She did note that cam batch and lab interaction appear to be significant but there does not appear to be a reference oil effect. Pour code 18 is the mildest and Lab G provided the mildest ACLW. At this point a considerable discussion took place on whether wear occurs on cam or lifters and influence of batch. An action item was assigned to decode serial number from lifter set number. Serial number is a date code. Considerable discussion took place on severity shift and the panel will continue to monitor this trend. Jo's presentation is included as attachment 6.

Severity Discussions
Rich presented Sequence III items from the B0.01 Semi Annual report. (See attachment 7) The severity of PVIS and WPD parameters were in control, and WPD has been in a long term severe trend, as evidence by the summation delta/s plot for WPD. Jessica Buchanan, attending via telephone then gave a presentation regarding severity and test changes affecting the Sequence IIIG test, included as attachment 8. After some discussion, it was agreed to form a Task Force to study these long term trends. This task force will be chaired by George Szappanos. Dave Glaenzer insisted the task force define its scope and objective in next few weeks. Dave also stressed the desire for clear goals and objectives for this task force.

Copper Levels in Head Approval Tests
Addison Schweitzer presented an analysis conducted by Martin Chadwick regarding Copper levels and their potential effect on severity (attachment 9). Once results were normalized for oil consumption, Martin noted runs on the head were 20 ppm higher on average. Discussions took place regarding the source of copper in these tests and after considerable discussion, no conclusive source could be identified. The panel felt it worthwhile to continue to monitor copper and also requested the TMC contact the laboratories and obtain the missing copper data for the 24 results which did not have end of test copper included in the reference oil data base.

BC 10 Ring Introduction
Jason Bowden of OHT indicated that industry will run out of run 1 rings soon. Jason introduced a motion to introduce these rings with a donated test (Attachment 10) After considerable discussions about what testing if any would be required, the panel approved Jason's motion by a vote of 11–0– 4.

Chrysler Oxidation Test
Karin Hauman presented the work to date on the development of another oxidation test to replace the Sequence III in the next category, included as attachment 11 Twenty results have been completed to date. Final test conditions have been established. Oil Charge is 6 quarts with no oil additions during the test. WPD is weighted same as the Sequence IIIG, but varnish is determined at the pin bosses only as the pistons are coated. This test appears to exhibit higher oxidation and nitration values than IIIG (attachment 12). Vegas high is just a designation for taxi cab and not necessarily related to performance. Future work includes securing hardware, run replicate results, and conduct testing on 0W-16 oil. Karin indicated there was still a need to evaluate repeatability/reproducibility/discrimination and to define rebuilding procedures for this engine. The need to define rebuild procedures and define hardware came about as the original intent was to build individual engines, but obtaining the 3700 engines estimated to be required for this test would not be doable. The test sponsors are still working to determine if a CPD will

be needed or if the hardware can be obtained through Mopar. Data points on all three reference oils would be ideal but still need to get approval to generate these data. They still need to generate repeat data since many runs were tweaked. They are trying to obtain a total test length at 100 to 110 hours. A number of questions regarding specifics of the tests run to date followed. Pre and post test measurements were performed on these tests. Concerns about oil consumption were expressed, especially pertaining to 0W-16 oils, as the current test development does not provide for oil additions during the test, and all oils tested to date were 5W-20s. Current Fuel is EEE, and some tests have experimented with additive but additized fuel may not be necessary. All the results presented were EEE + 50 ppm sulfur except last test. Variability on these tests was similar to 435, but not as severe as 435. When asked about the timeline for continuing test development, Karin expected to continue running replicate data through January, with the precision matrix to be run on the current timeline. Questions were raised about other labs involvement in test development and precision matrix. Karin wasn't sure, as there was no consensus in development group, but she did feel there was a need to include IAR soon. The test stand can be set up, and there may be some small changes to stand components, but there are no set up kits. ECU calibration will change based on additional hardware changes. Right now, the variable valve timing is fixed through the ECU, and attempts are being made to obtain fixed timing gears made, and the fixed gears will need ECM calibrations changes. Finally, it is not certain whether Mopar will handle parts distribution or if a Central Parts distributor will be utilized for parts.

Jason noted that during the cylinder head tests, tests were reported with negative cam wear values and the procedure requires that negative values as 0. Labs were reminded of this requirement. The meeting was adjourned at 1:50 PM.

Action items from this meeting are included as attachment 12.

Scope and objectives, updated scope and objectives are included as attachment 13.

Attachment 1

Sequence III Surveillance Panel

November 19, 2013
11:00 CST
Call-in Number is: (866) 588-1857
Participant Passcode: 2105226802

Agenda

1.0) Attendance

1.1) Kaustav Sinha replaces Jo Martinez as voting member for Chevron Oronite

2.0) Approval of minutes

2.1) Minutes from the August 8, 2013 teleconference posted 08/08/2013.
2.2) Minutes from the November 8, 2013 teleconference posted 11/08/2013.

3.0) Action Item Review

3.1) None

4.0) Old Business

4.1) Cylinder head valve seat matrix Task Force report. S. Clark
4.2) Survey of existing #24502260B heads. Glaenzer
4.3) Test Longevity Task Force reconvene to address size 7 & 8 pistons. J. Bowden

5.0) New Business

5.1) Sequence IIIF PVIS correction factor 6 month review. J. Buchanan
5.2) Review of Sequence IIIG ACLW parameter. Stats Group / All
5.3) Review of EOT copper levels in Sequence IIIG. Chadwick
5.4) Introduction of BC10 rings for Sequence IIIG. J. Bowden

Motion: (Jason Bowden) The following procedure will be utilized to introduce Batch Code 10 Sequence IIIG rings. Each lab will donate one reference test on the new hardware. OHT will supply one engine kit of hardware to run this test. TMC will waive the reference reporting fees for this test and grant a one test calibration period extension if test is run prior to end of calibration period. The goal would be to have the labs run this donated test by end of February, 2014. The lab may still continue to use the existing batch code hardware. Once all testing is complete the panel will review the data.

5.3) Review Sequence III portion of ASTM B01 Semi-Annual report. Grundza
5.4) Chrysler Oxidation test development update. K. Haumann, B. Buscher
5.5) Sequence IIIG severity concerns; WPD, PVIS and ACLW. J. Buchanan

6.0) Review Scope and Objectives

6.1) All

7.0) Next Meeting

7.1) TBD

8.0) Meeting Adjourned

ASTM Sequence III Surveillance Panel (20 Voting members) date: 11/19/13

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Ed Altman Afton Chemical Corporation 500 Spring Street Richmond, VA 23219 USA	804-788-5279 804-788-6358 ed.altman@aftonchemical.com	Voting Member	Present
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Gordon Farnsworth

Mike McMillan

Jessica Buchanan

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ASTM Sequence III Surveillance Panel (20 Voting members) date: 11/19/13

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AL Lopez		AL		

Attachment 0

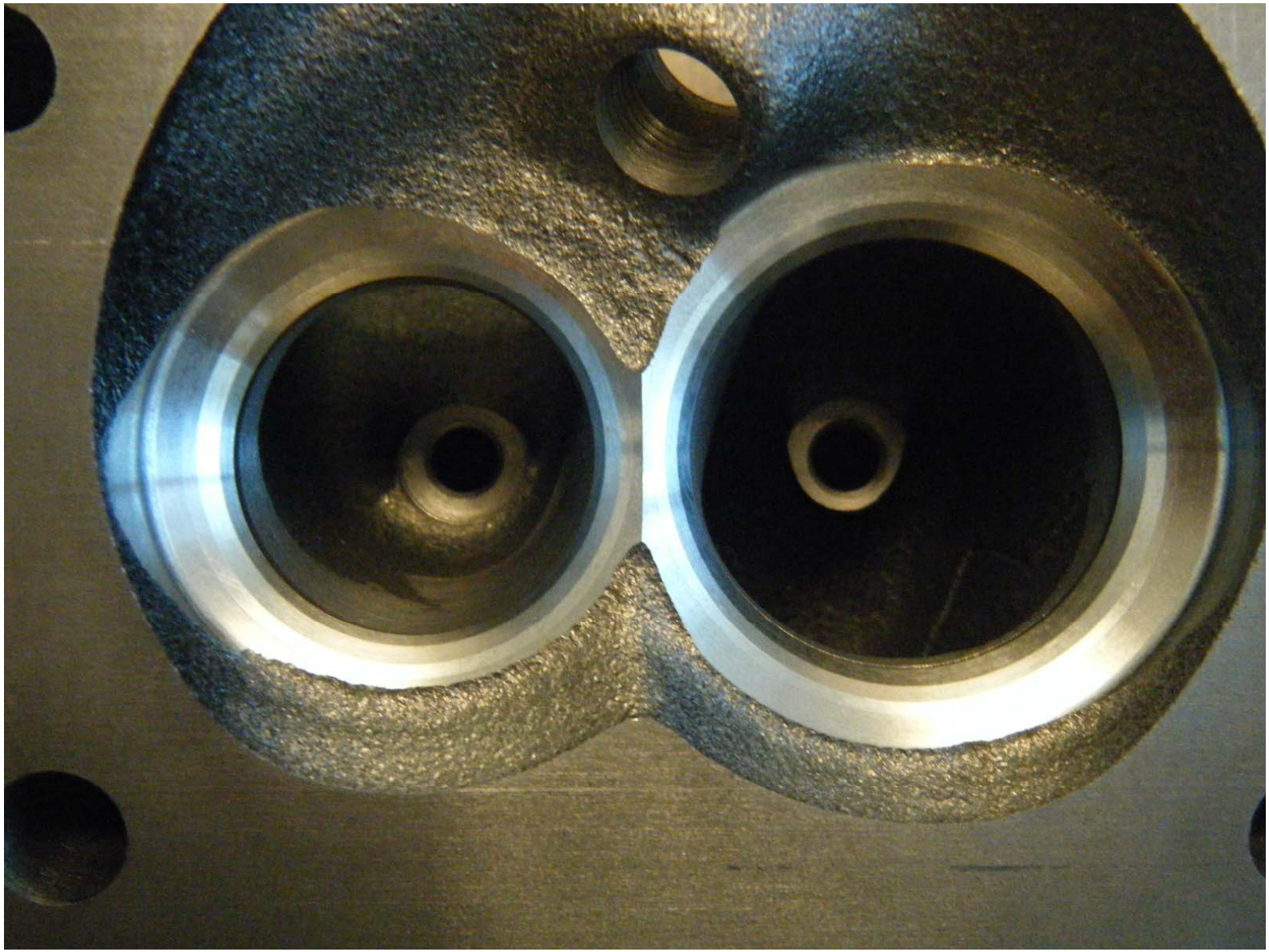
Sequence III
Cylinder Head Task Force

Update

Sid Clark

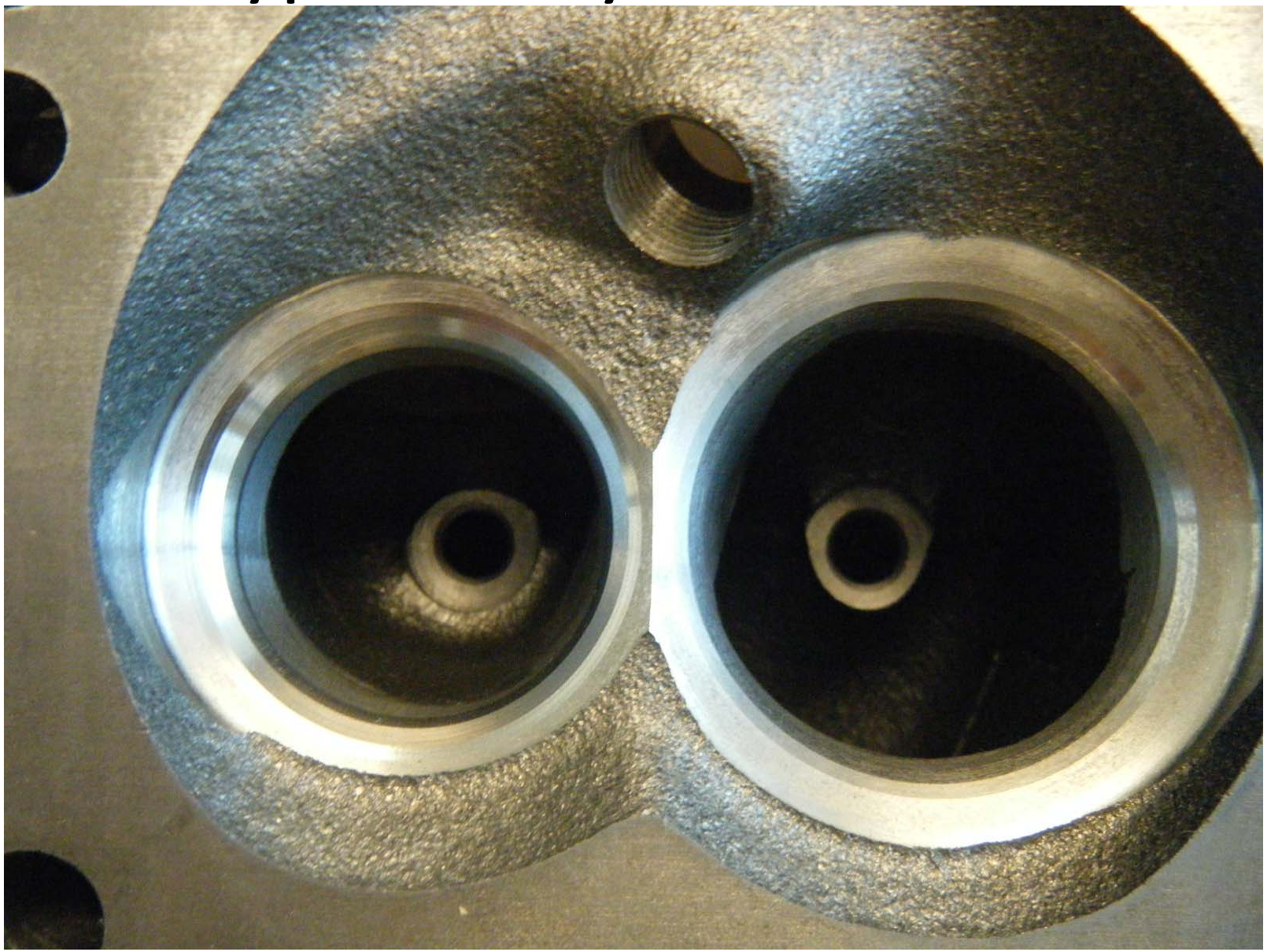
November 19, 2013

Type “S” Cylinder Head



Type “S” Cylinder Head

Type “B” Cylinder Head



Type “B” Cylinder Head

Why Stellite?

Background

- August 2013
  - Sequence III surveillance panel forms the Cylinder Head task force to investigate use of Stellite seat inserts in both the intake and exhaust positions in Sequence III testing

Background

- September 2013
  - Task force receives small batch of Stellite seats manufactured according to dedicated prints for the 3800 cylinder heads
  - Chevy Performance processes 20 cylinder heads through Schwartz Machine for prove-out testing
- October 2013
  - Test labs donate prove-out tests on TMC assigned Reference Oils

Background

- October 31 2013
  - Cylinder head task force reviews data and makes recommendation to the Sequence III surveillance panel for use of Stellite seat inserts in Sequence III testing

Cylinder Head Task Force Recommendation

The Cylinder Head Task Force has reviewed the prove-out testing valve seat recession and compression data from the recent industry donated tests and agrees the Stellite Seats provide better sealing and durability and recommends their future use in Sequence III testing.

Charlie Leverett / Bruce Matthews / Passed Unanimously

Background

- November 8 2013
  - Surveillance panel reviews Cylinder Head task force recommendation and unanimously approves the use of Stellite seat inserts in Sequence III testing

Surveillance Panel Motion
November 8, 2013

Approve use of cylinder heads machined with Stellite Intake and Exhaust seat inserts in both the IIIF and IIIG tests, and instruct GM to move forward with the processing of this material.

Pat Lang / Ed Altman / Passed Unanimously 13 – 0 – 0

Green Stock Processing

- Chevy Performance / Schwartz Machine
  - Chevy Performance will handle processing of remaining **Green Stock (un-machined)** cylinder head inventory and sell to labs
  - Stellite seat heads will have “S” after serial number
  - Chevy Performance has placed order with L.E. Jones for Stellite seat material
    - Ordered enough seat material for all remaining Green Stock cylinder heads
  - Estimating up to 8 week lead time to receive seat material
  - Schwartz Machine can process up to 50 Green Stock cylinder heads per every 10 business days
  - Estimate Green Stock, Stellite seat cylinder heads to be available starting in late January 2014, or sooner

New Stock Processing

- Labs / Schwartz Machine
  - Schwartz Machine has developed process for installing Stellite seats in **New Stock (finish machined and unused)** cylinder heads from laboratory inventories
    - New Stock is processed using same CNC tooling as Green Stock
  - A pair of New Stock cylinder heads provided by Lab A has been processed, CMM measured and compared to processed Green Stock cylinder heads
    - CMM data confirms processed New Stock and Green Stock cylinder heads are identical
  - Re-worked New Stock will have same “S” identification after serial number
  - Labs choosing to do so, will coordinate directly with Schwartz Machine to have Stellite seats installed in their New Stock cylinder head inventories
  - Schwartz Machine to place an order with L.E. Jones for Stellite seat material, once labs indicate quantities needed

Task Force Leader Questions

- Are New Stock and Green Stock, Stellite seat cylinder heads to be considered identical?
  - Schwartz Machine's CMM data indicates yes
- Can labs interchange New Stock and Green Stock, Stellite seat cylinder heads for referencing and candidate testing?
  - Schwartz Machine's CMM data indicates yes
- What action is needed to answer these questions?

Cylinder Head Task Force
Next Steps

- Assist in coordination of New Stock processing
- Proving out New Stock Stellite seat cylinder head equivalence, if required
- Developing plan for multiple runs on Stellite seat cylinder heads
  - Developing cleaning and rebuilding procedure
  - Proving out multiple runs
- Investigate re-working used cylinder head material

Appendix

Data Summaries

Data Summary

Post-test valve seat recession

	SwRI	IAR	Afton	Lubrizol
1 Intake	0.001	0.012	0.002	Not
1 Exhaust	0.003	0.005	0.001	Recorded
2 Intake	0.000	0.004	0.002	
2 Exhaust	0.001	0.009	0.001	
3 Intake	0.003	0.003	0.003	
3 Exhaust	0.003	0.005	0.000	
4 Intake	0.002	0.001	0.003	
4 Exhaust	0.002	0.005	0.001	
5 Intake	0.002	0.006	0.000	
5 Exhaust	0.002	0.008	0.003	
6 Intake	0.002	0.009	0.002	
6 Exhaust	0.002	0.001	0.001	

Post-test compression

Cyl	SwRI	IAR	Afton	LZ
1	195	175	200	175
2	190	170	205	180
3	195	170	198	180
4	195	170	208	185
5	190	170	201	170
6	190	170	205	180

TMC Data Summary

			Lab G					
Cyl. Head Run Oil				438	Reference Test Oil			
		Yi		Target		Yi		
	WPD	-1.485	2.71	3.2	2.83	-1.1212		
	PVIS	0.546	106.4	96.5	93.4	-0.1902		
	ACLW	-10.757	1.9	17.84	13.2	-1.4466		
			Lab A					
Cyl. Head Run Oil				434-1	Reference Test Oil			
		Yi		Target		Yi		
	WPD	-1.1563	3.69	4.8				
	PVIS	2.3757	282	178.36				
	ACLW	-4.0064	14.4	33.07				
			Lab B					
Cyl. Head Run Oil				438	Reference Test Oil			
		Yi		Target		Yi		
	WPD	-1.0909	2.84	3.2	2.96	-0.7276		
	PVIS	-1.0949	79.6	96.5	92.4	-0.2515		
	ACLW	-7.6782	3.6	17.84	19.8	0.5009		
			Lab D					
Cyl. Head Run Oil 435-2, EOT 10/12/2013				435	Reference Test Oil 435-2, EOT 9/28/2013			
		Yi		Target		Yi		
	WPD	0.052	3.62	3.59	3.54	-0.086		
	PVIS	0.769	226.3	178.4	175.9	-0.045		
	ACLW	-4.257	12.2	33.1	10.9	-4.738		

#24502260B Cylinder Heads				
Inventory	Use in November 2013	Use in December 2013	Use in January 2014	Surplus
42	6	18	18	0
80	14	28	28	10
132	16	24	24	68
18	2	4	4	8
10	0	0	0	10
80	32	62	44	-58
57	0	0	0	57
419	70	136	118	**95**

GM had 107
sent 50
to IAR

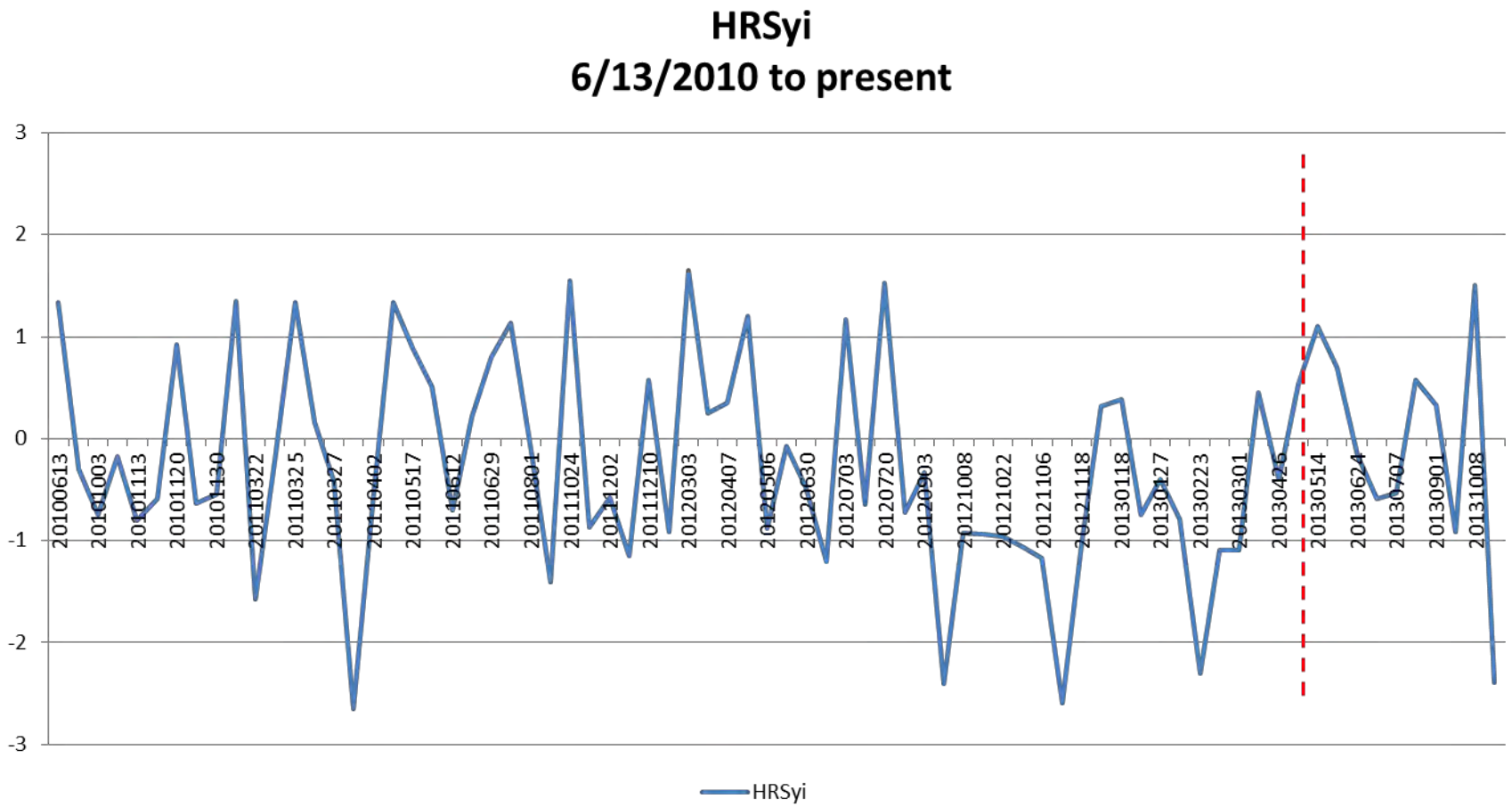
IIIF PVIS Hours Correction Factor 6 Month Review

Janet Buckingham, Martin Chadwick, Doyle Boese, Jessica Buchanan, Todd Dvorak, Jo Martinez, Rich Grundza, Andy Buczynsky

Summary

- There have been 11 operationally valid data points on Reference Oils since the revised method
  - Lab A (1)
  - Lab B1 (5)
  - Lab G (3)
  - Lab M2 (2)
- The industry chart is in control
- Two labs had SA's for PVIS (mild) prior to implementing the revised method
- One lab had an SA for hours (severe) upon implementation of the revised method; a different lab currently has an SA (severe) for hours

Hrs Yi


HRSyi
6/13/2010 to present
3
2
1
0
-1
-2
-3
20100613
20101003
20101113
20101120
20101130
20110322
20110325
20110327
20110402
20110517
20110612
20110629
20110801
20111024
20111202
20111210
20120303
20120407
20120506
20120630
20120703
20120720
20120903
20121008
20121022
20121106
20121118
20130118
20130127
20130223
20130301
20130426
20130514
20130624
20130707
20130901
20131008
HRSyi

Recommendations

- The new method introduced to monitor PVIS in hours is in control and the correction factor is working as intended.
- Conduct a review again in 6 months or upon a hardware or test change where review is deemed necessary by the Surveillance Panel

Sequence IIIG ACLW Severity Analysis

Stats Group

Nov. 14, 2013

Summary

- Cam Batch (or other factors that are confounded with Cam Batch variable) and Lab interaction significantly affects ACLWyi
- Not enough evidence to prove that Seat Material affects ACLWyi
- Reference Oil tested does not significantly affect ACLWyi
- Cam Pour Code significantly affects ACLWyi (for some subset of data with pour code info, n=45 out of 390)
  - Pour code 18 (cam batches 121218, 121227, 130114) is the mildest

ANOVA of ACLWyi

Dependent Variable: ACLWyi

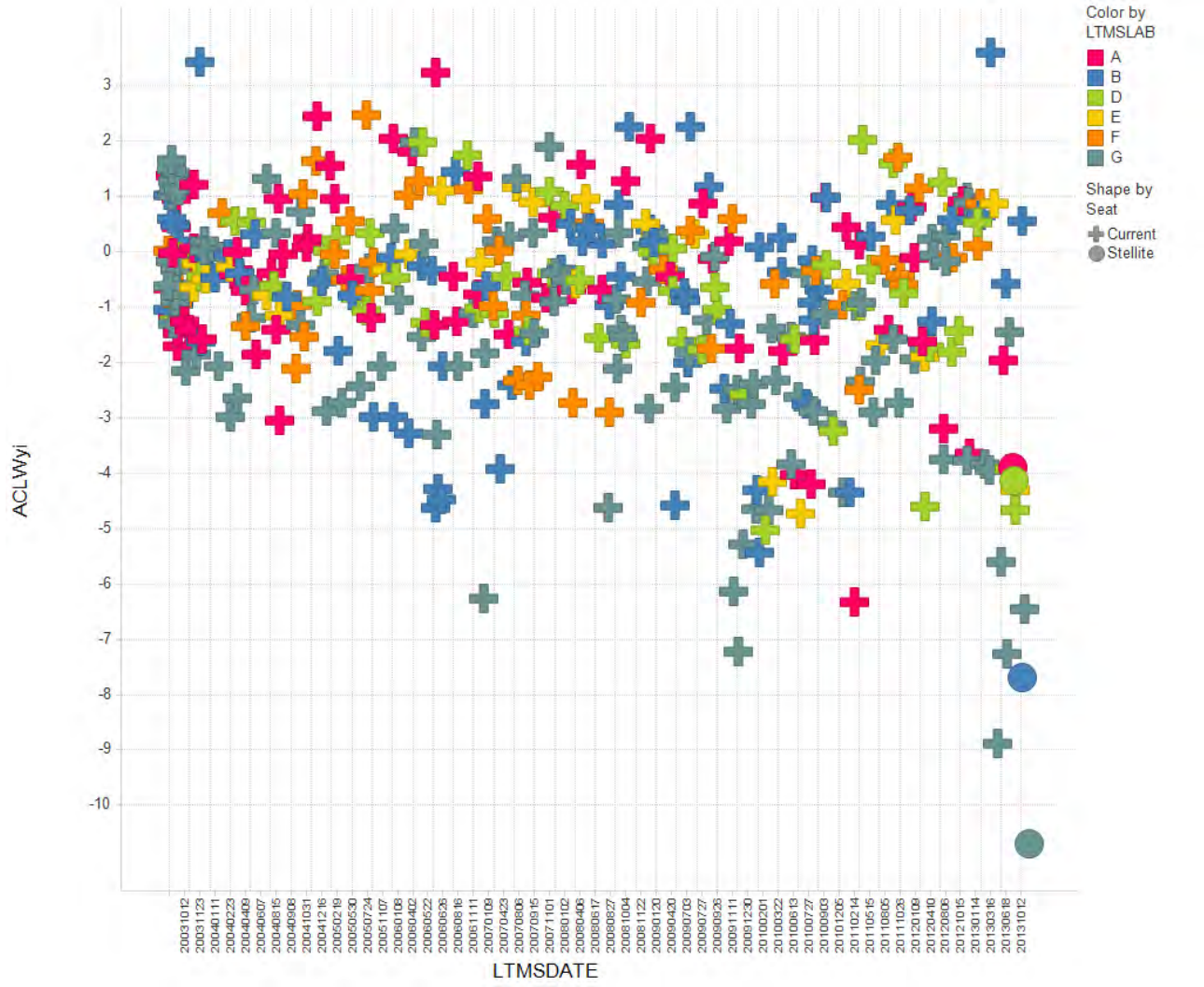
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	255	1248.596223	4.896456	3.15	<.0001
Error	134	208.210264	1.553808		
Corrected Total	389	1456.806487			

R-Square	Coeff Var	Root MSE	ACLWyi Mean
0.857078	-136.6291	1.246518	-0.912338

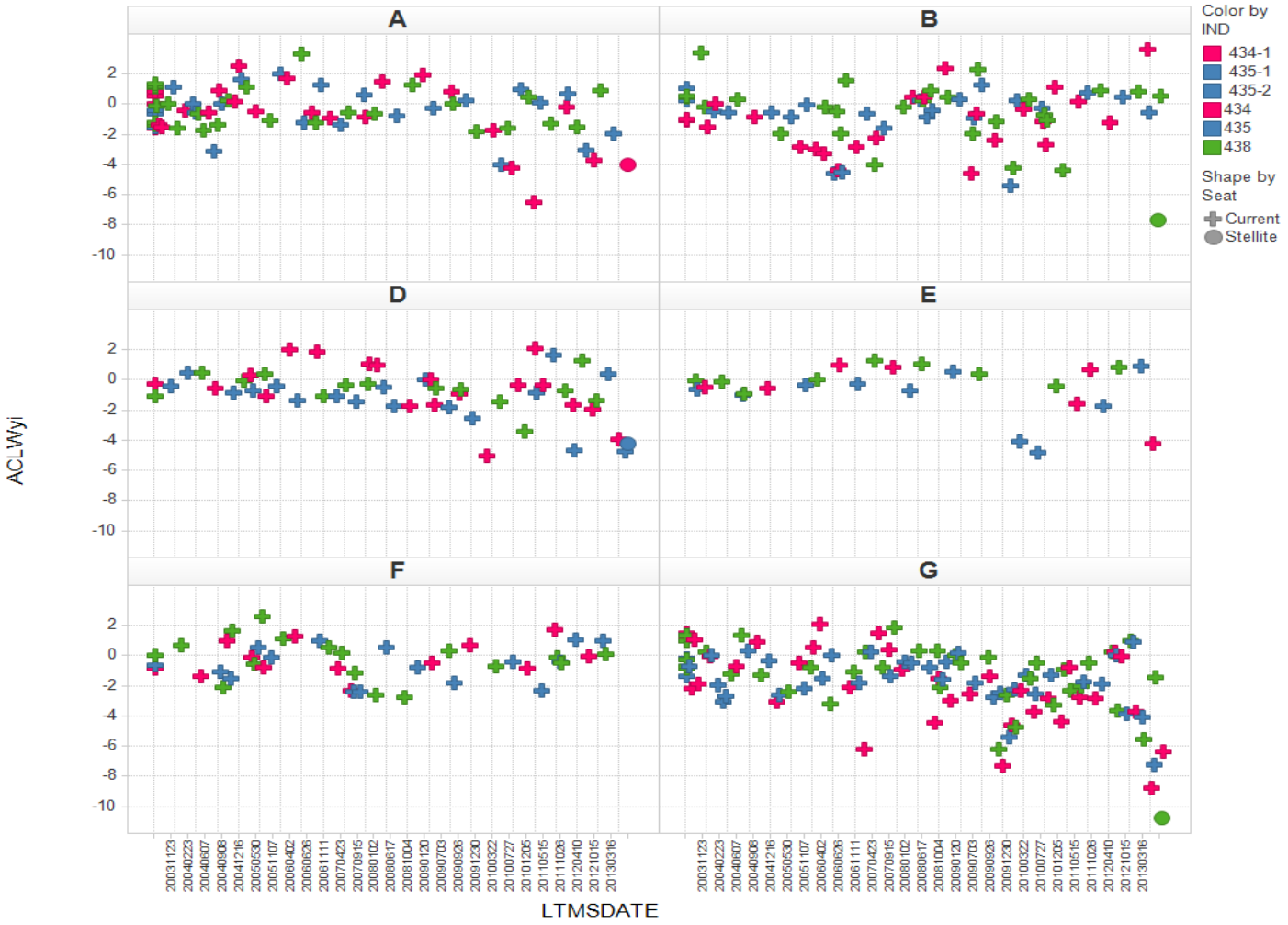
Source	DF	Type III SS	Mean Square	F Value	Pr > F
LTMSLAB	5	72.5215093	14.5043019	9.33	<.0001
CAMBAT(LTMSLAB)	244	932.9297643	3.8234826	2.46	<.0001
Seat	1	2.6547193	2.6547193	1.71	0.1934
IND	5	9.1408174	1.8281635	1.18	0.3240

Mild ACLW can be attributed to Cam Batch (or any factor confounded with Cam Batch) and Lab interaction more than the seat material or reference oil

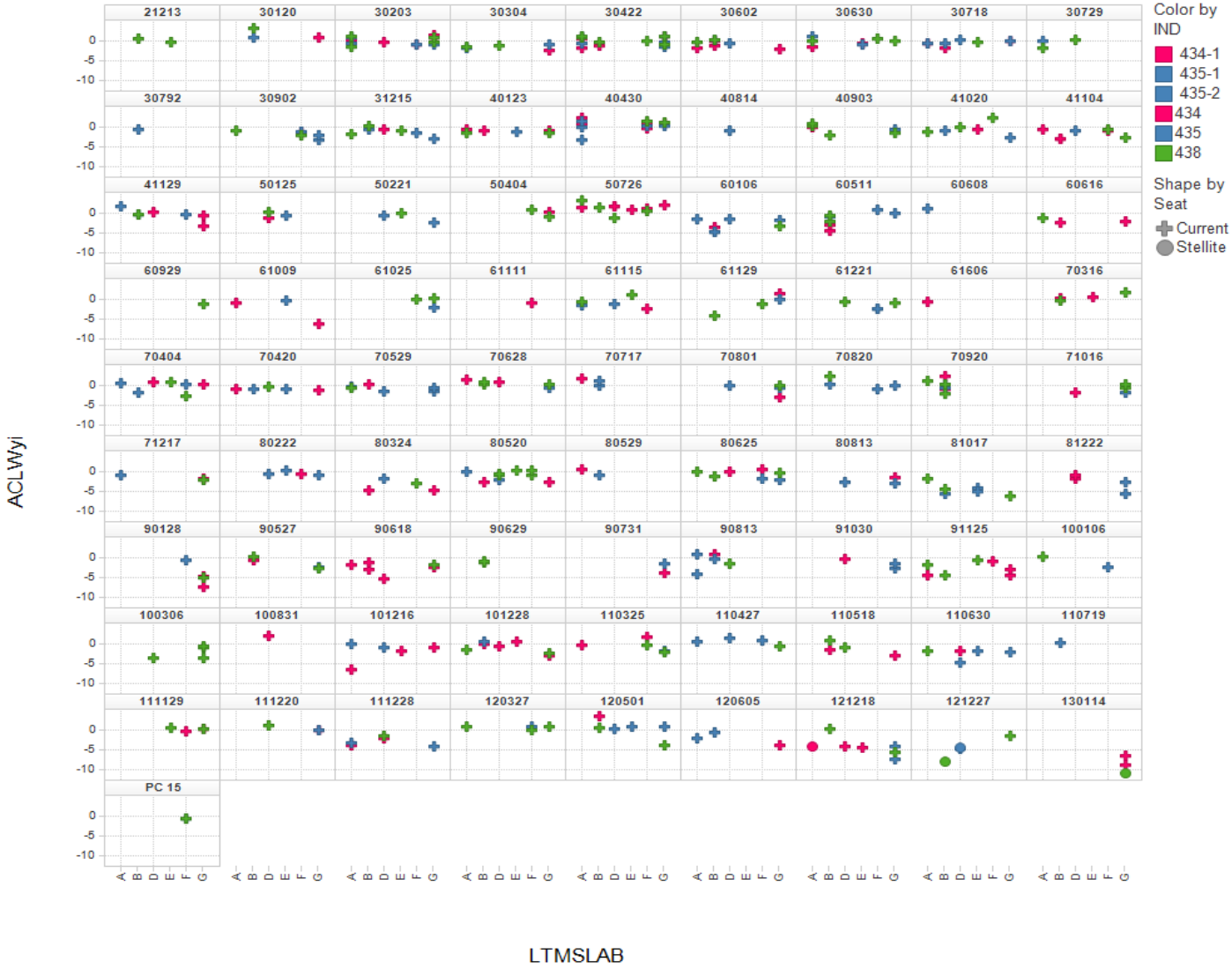
Lab G had the mildest ACLW in 2013



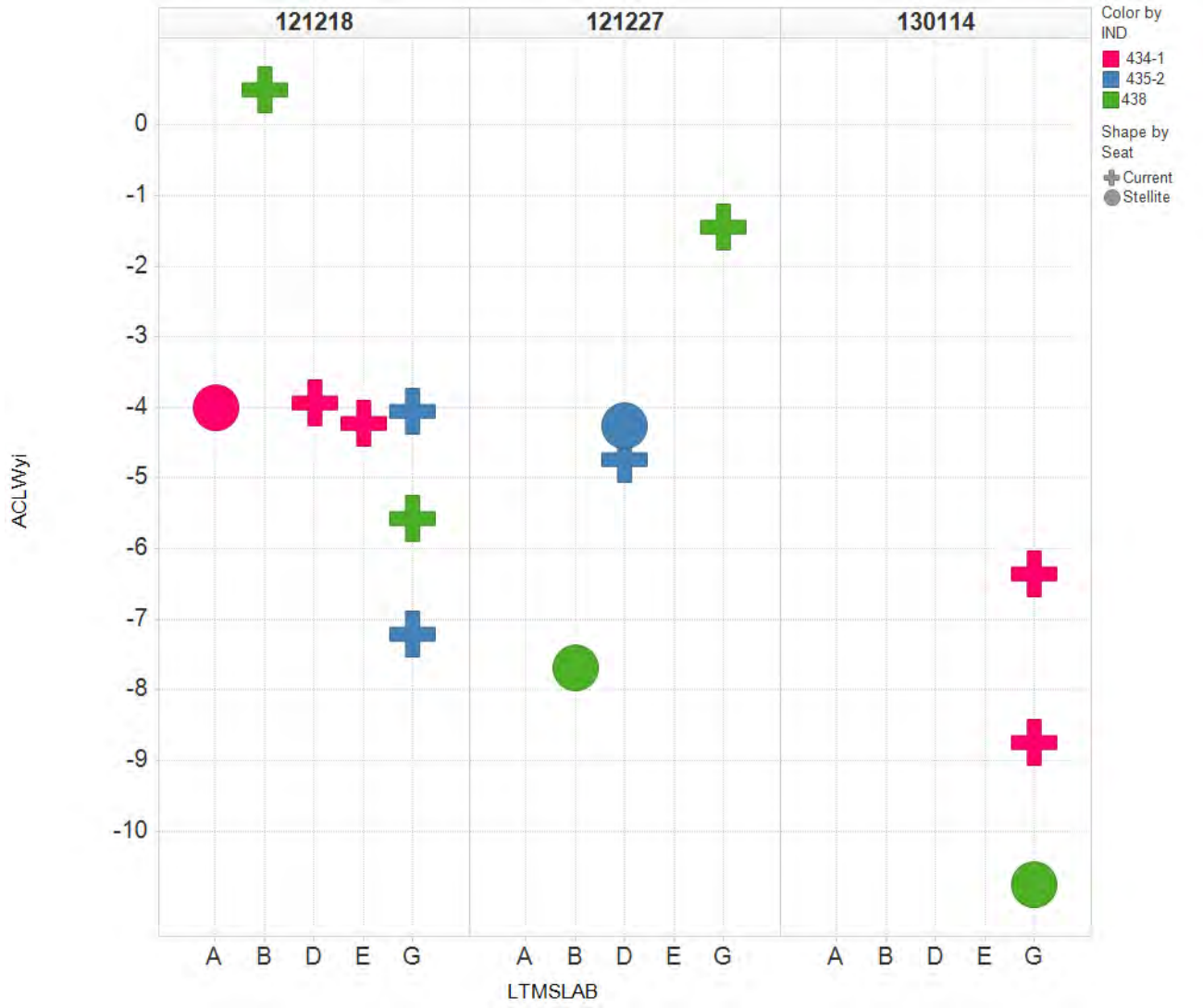
Mild ACLW across all Oils



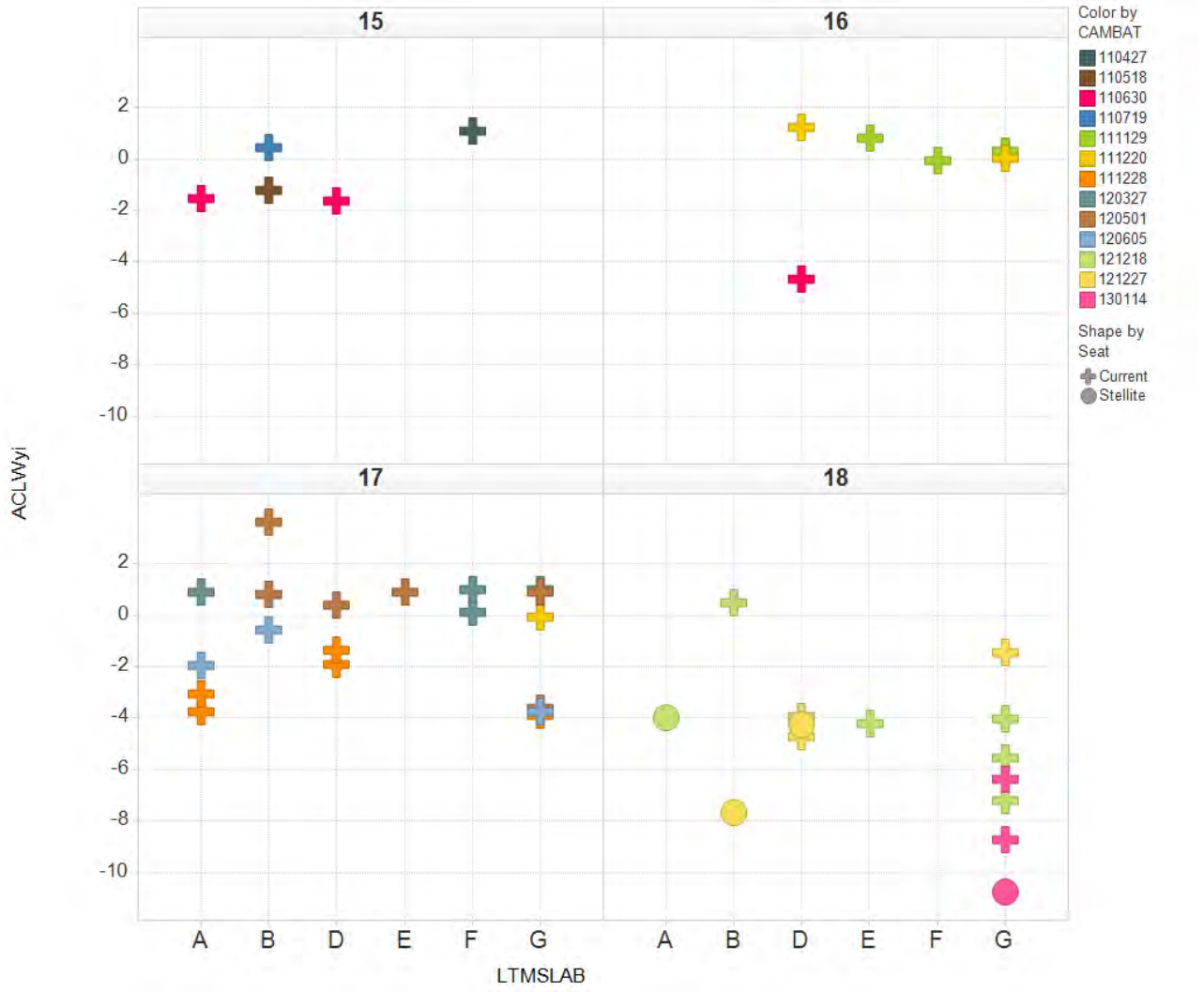
Mild ACLW within Lab and Cambatch



Mild ACLW within Cambatch and Seat Material



Mild ACLW with Cam Pour Code 18



Recommendation

- How to account for cam batch differences (or other factors confounded with cam batch)?
  - Since cam batch is not uniform for all labs, the differences can be accounted for by the lab severity adjustment

Attachment 7

Test Monitoring Center

http://astmtmc.cmu.edu

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ASTM D02.B1 Semi-Annual Report Passenger Car Reference Oil Testing

October 2013

Passenger Car Engine Oil Testing Executive Summary

- IIIF
  - 'Hours to 275% Vis Increase' replaced '% Vis Increase' as monitored and severity adjusted parameter.
- IIIG
  - Re-blend of oil 434 is currently in progress
  - 25 results on reference oil 435-2, target update when N = 30.

Calibrated Labs and Stands*

Test	Labs	Stands
IIIF	4	5
IIIG/A/B	5	13

*As of 9/30/2013

Test Activity Levels

- April 1, 2013 – September 30, 2013

Sequence Tests

Test Status	Validity Code	IIIF	IIIG
Acceptable Calibration Test	AC	9	9
Failed Calibration Test	OC	0	1
Operationally Invalid by Lab	LC	0	0
Aborted	XC	2	2
Test Stand Removed from LTMS	MC	0	2
Decoded/Donated	NN/AG	2	0
Total		**13**	**14**

Failed Tests

Test Status	Test	Number of Tests
Severe ACLW	IIIG	1
Severe ACW	IVA	1
FEI1 Mild	VID	2
FEI2 Mild	VID	2
FEI1 and FEI2 Mild	VID	1
FEI2 Severe	VID	1
Total		**8**

Lost Tests*

Test Status	Cause	IIIF	IIIG	IVA	VG	VID	VIII
Aborted	High Oil Consumption	2	2	0	0	0	0
Invalid	Stand Removed From System	0	2	0	0	0	0
Invalid	Driveline and Engine Mounting Failure	0	0	1	0	0	0
Aborted	Break-in not Performed on New Cylinder Head	0	0	1	0	0	0
Aborted	Cam Sensor Wiring Failed	0	0	0	1	0	0
(continued on next slide)							

*Invalid and aborted tests

Lost Tests*

Test Status	Cause	IIIF	IIIG	IVA	VG	VID	VIII
Invalid	Downtime Exceeded Procedural Limit	0	0	0	0	3	0
Aborted	Engine Coolant Leak	0	0	0	0	1	0
Invalid	Excessive Camshaft Wear	0	0	0	0	0	1
Invalid	High Mechanical Wear	0	0	0	0	0	1
Totals		2	4	2	1	4	2

*Invalid and aborted tests

Test Severity

- April 1, 2013 – September 30, 2013

Test Severity

- IIIF
  - WPD in control.
  - Hours to 275% Vis Increase in Control
  - APV
    - In severity action alarm, mild
    - Long-term mild trend continuing (Since October 2006)
  - PV60
    - In precision warning alarm

- Charts shown in Appendix 1.a.

Test Severity

- IIIG
  - MRV is in control.
  - PHOS in control.
  - WPD is in control.
    - Long-term severe trend continuing (Since late 2004)
  - PVIS is in control
  - ACLW in mild warning alarm .
    - Severity Action alarm (Mild direction)
    - Long-term mild trend

- Charts shown in Appendix 1.b.

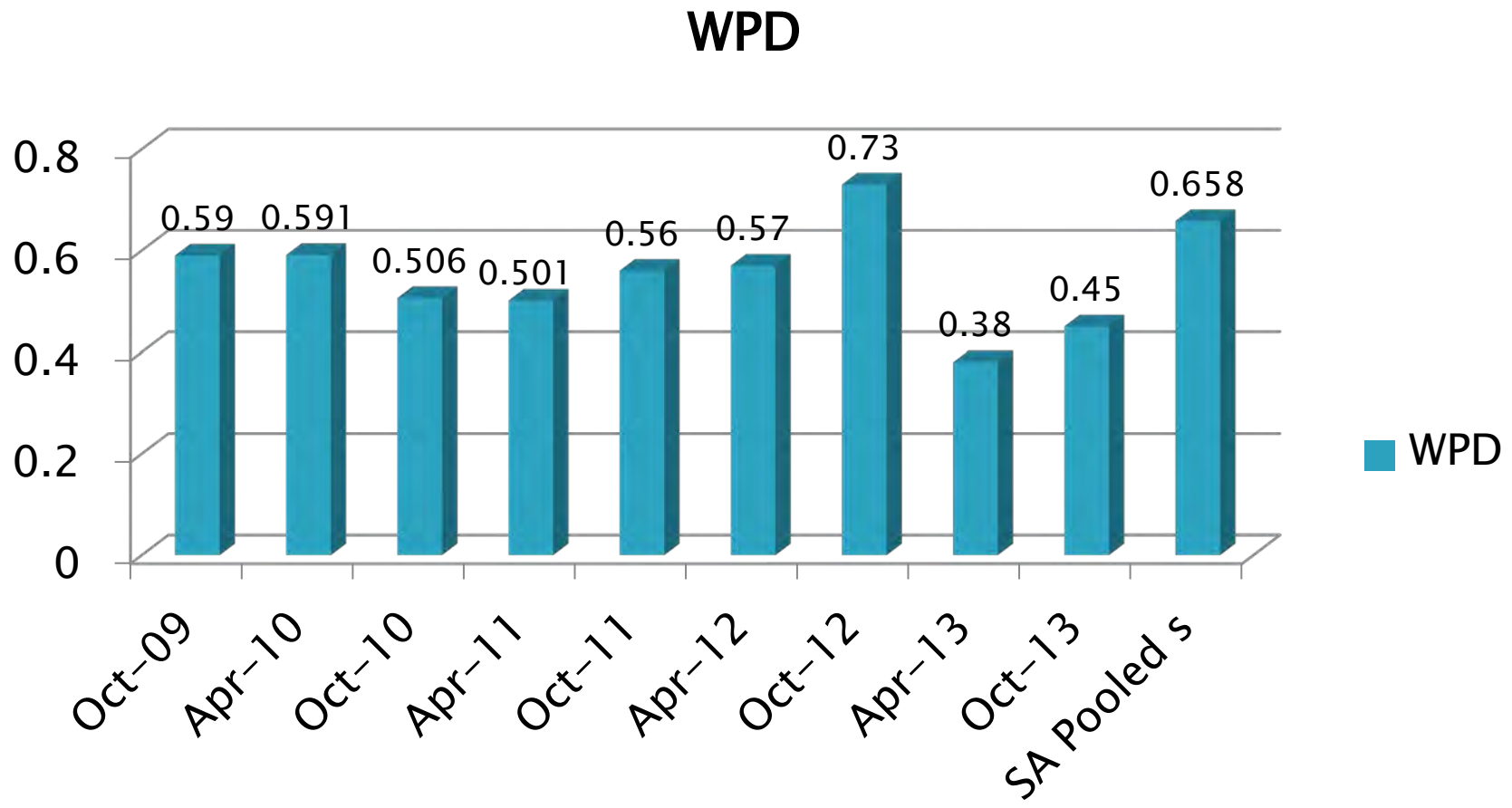
Test Precision

- April 1, 2013 –
  September 30, 2013

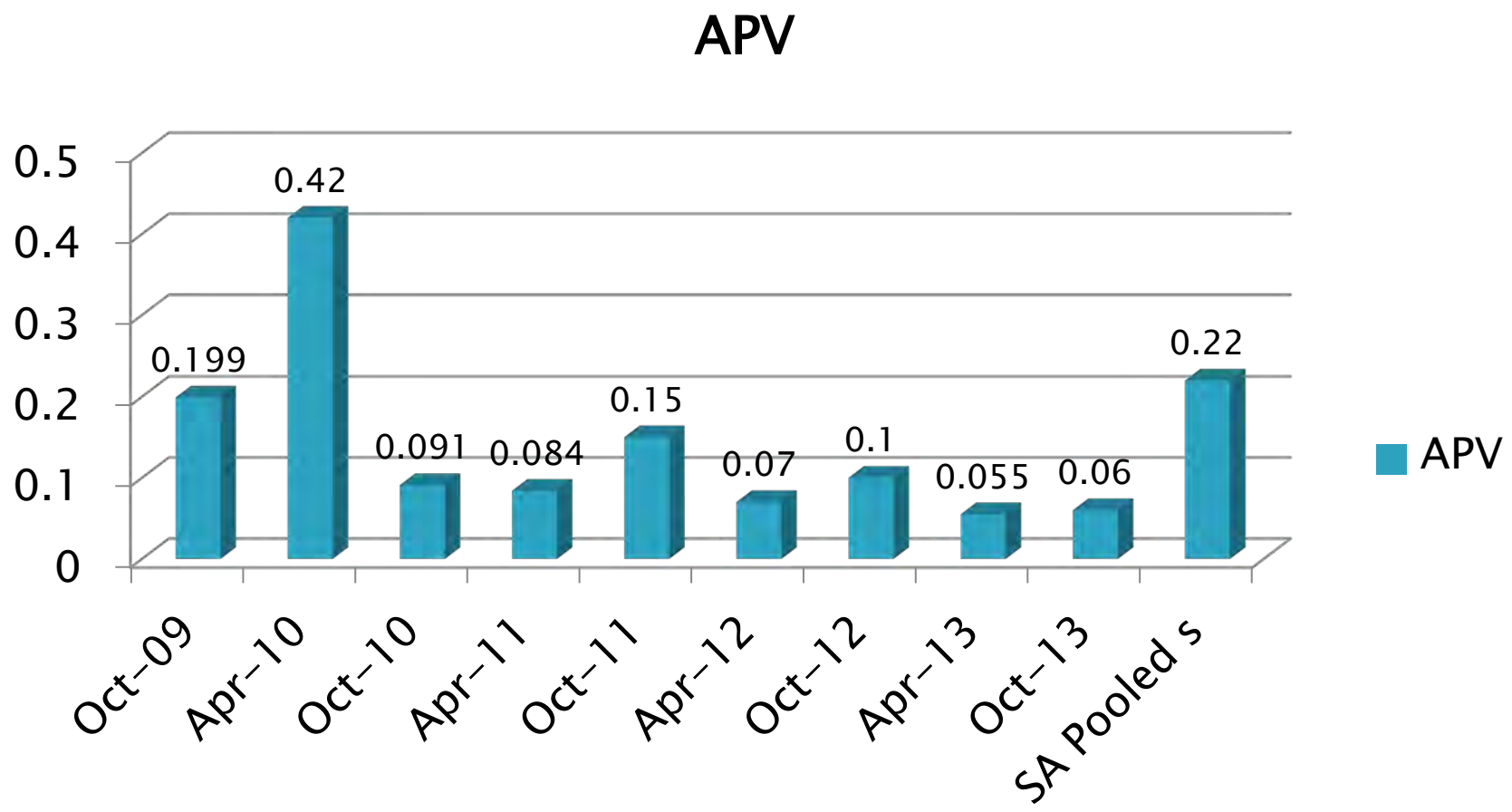
Test Precision Estimates

- Presented on a six month basis.
- Data presented for past four years.

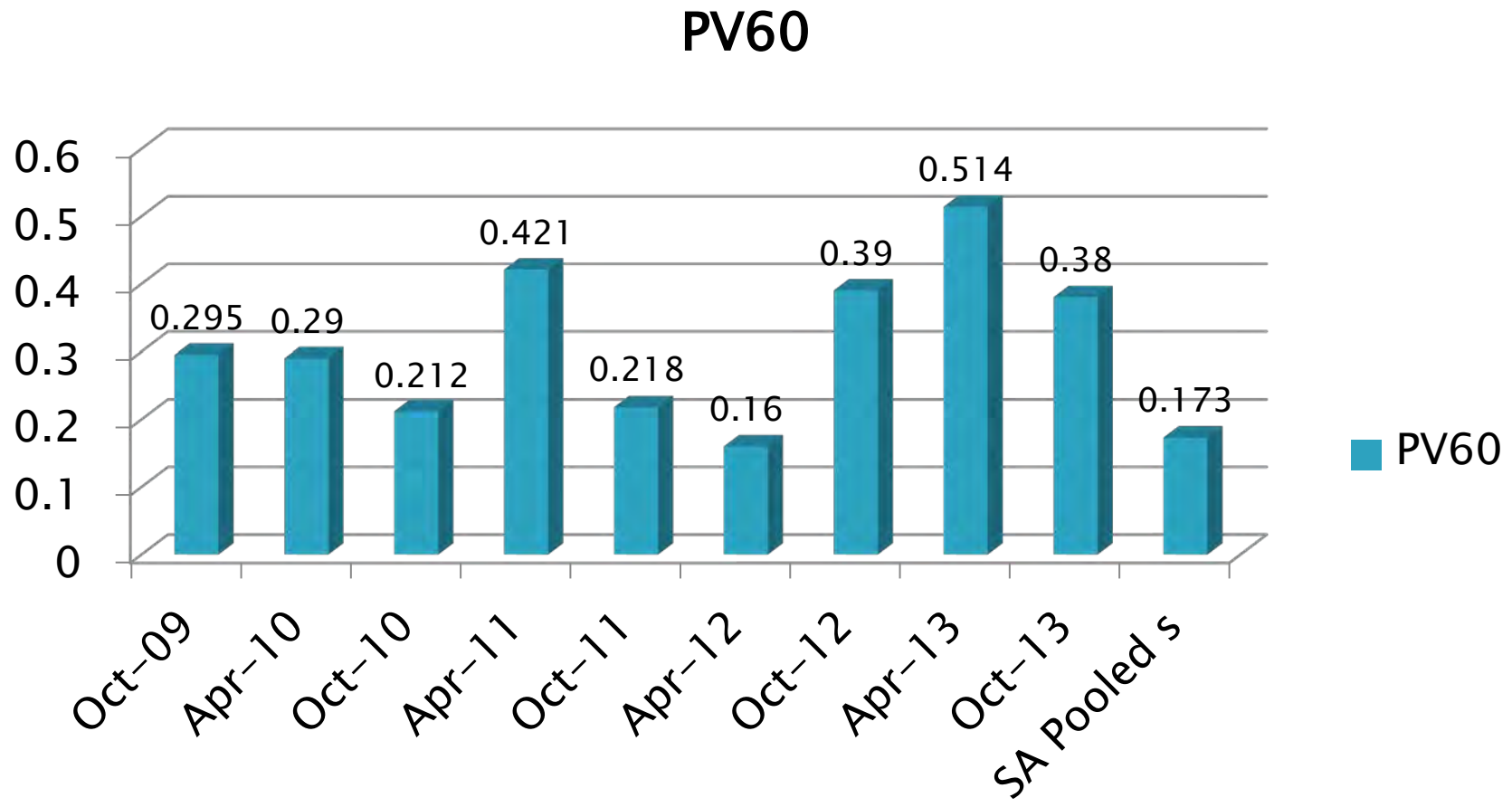
IIIF Precision Estimates



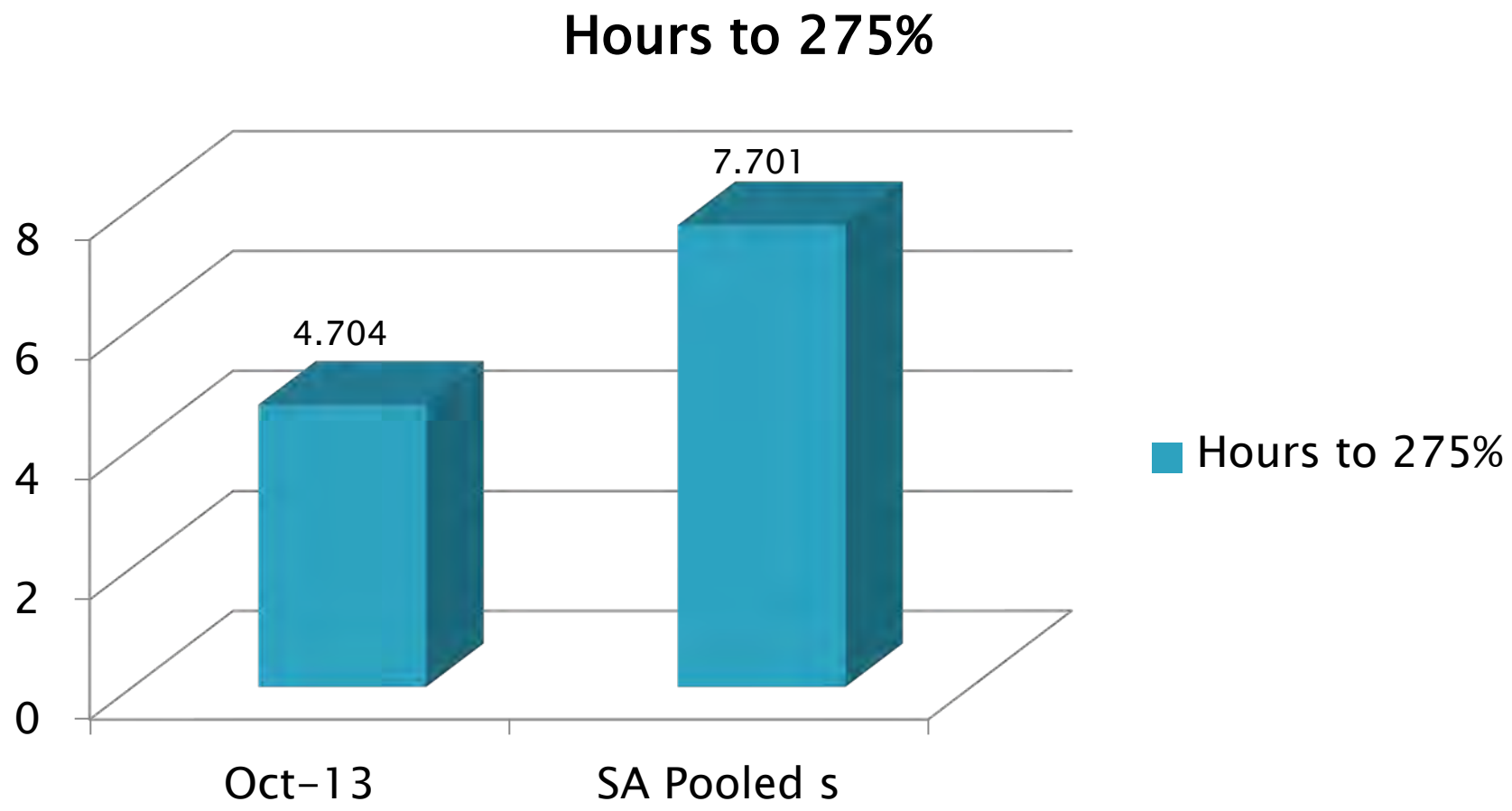
IIIF Precision Estimates



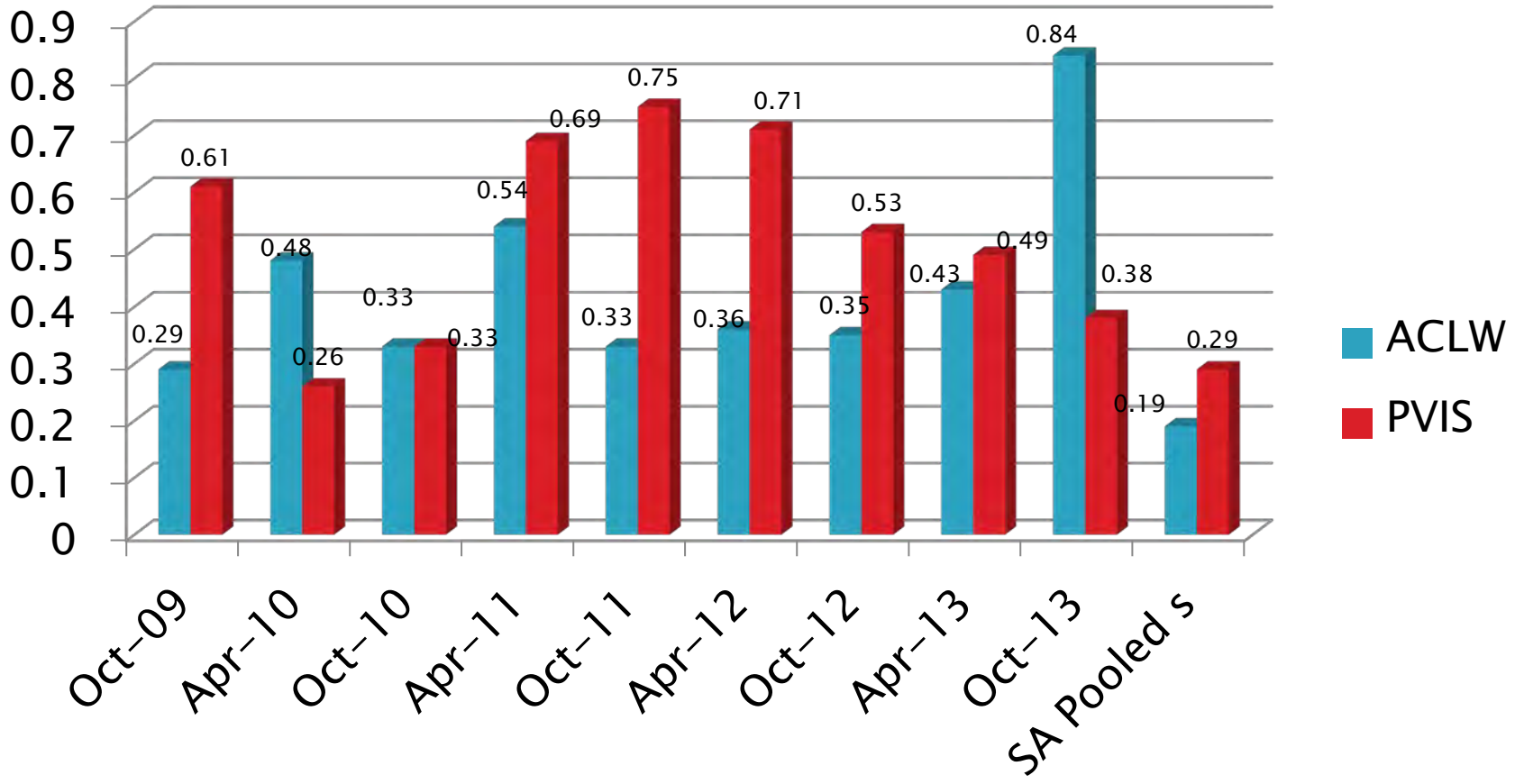
IIIF Precision Estimates



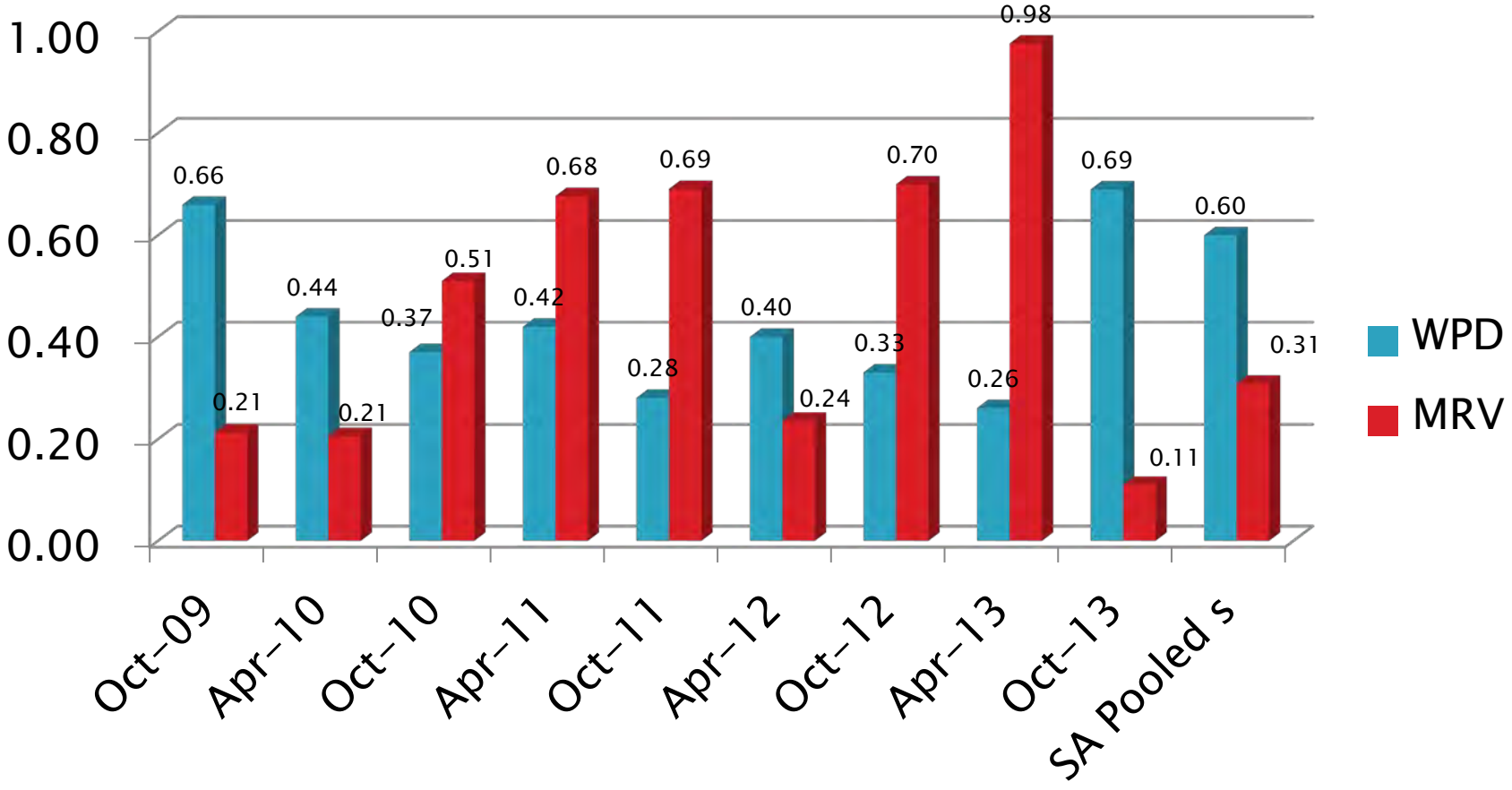
IIIF Precision Estimates



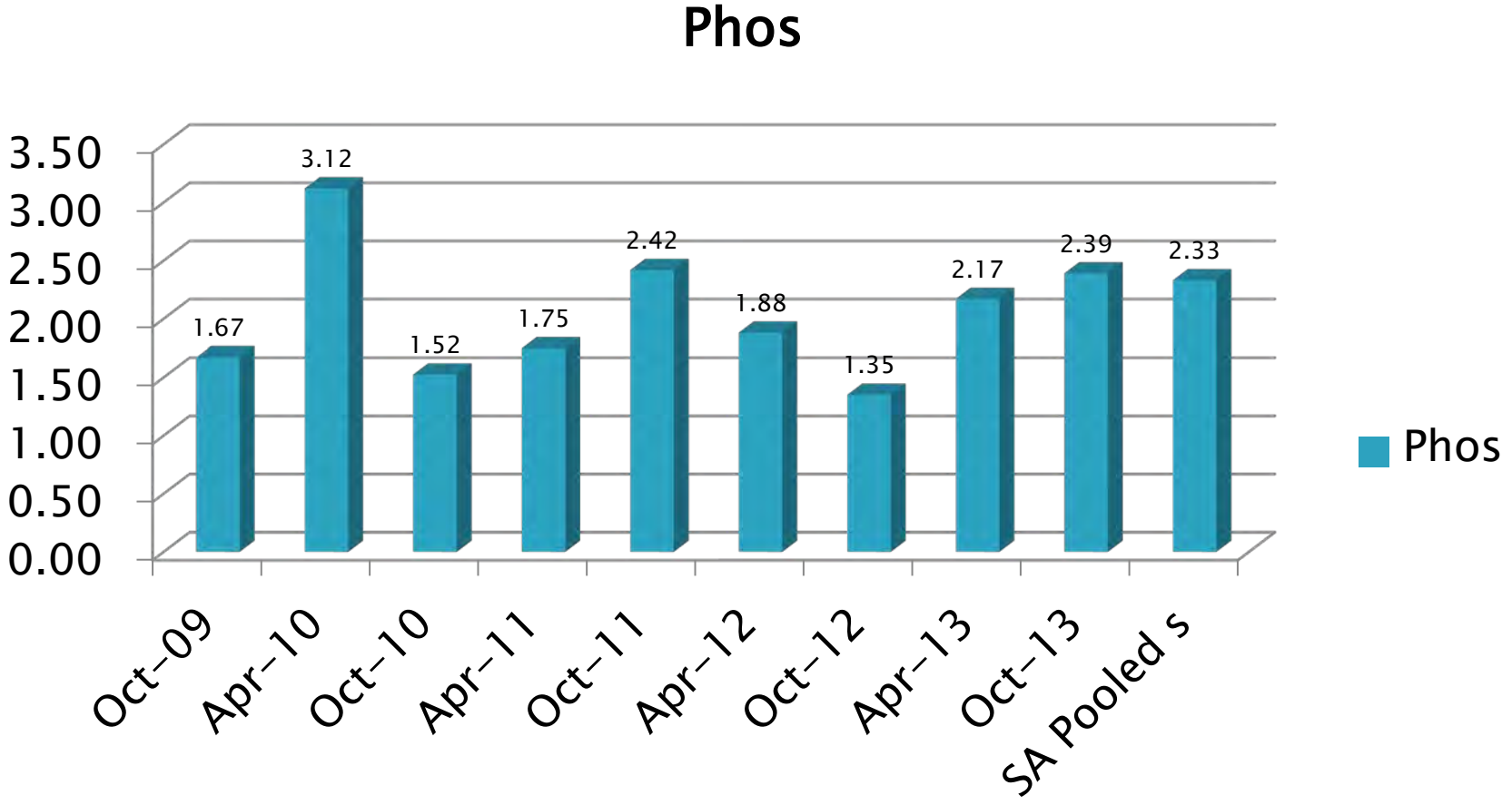
IIIG Precision Estimates



IIIG Precision Estimates



IIIG Precision Estimates



Information Letters

- April 1, 2013 – September 30, 2013

Information Letters*

Test	Date	IL	Topic
IIIF	20130509	13-2	Replaced PVIS with Hours to 275 % Viscosity Increase for reference test acceptance and correction of non-reference oil test results.
IIIF	20130918	13-3	Included provisions to address how to handle negative values when calculating Hours to 275% Viscosity Increase.

*Available from TMC Website

Return to Exec. Summary

Reference Oil Inventory

- Actions, Re-blends, Inventories and Estimated Life

Reference Oil Re-blends

- Oils affected
  - 434-1
  - Re-blend is in process
  - delivery expected in near future
  - 433-2 being introduced one test completed

one test scheduled

Return to Executive Summary

Reference Oil Inventory Estimated Life

Oil	Tests	Original Blend Amount	Quantity Shipped in last 6 months	TMC Inventory	Lab Inventory	Estimated Life
300	IVA	330	0	330	0	5+ years
433-1	IIIF	1045	28	8	44	<1 year
433-2	IIIF	500	16	484	12	3+ years
434	IIIG	550	0	<1	12	<1 year
434-1	IIIG	660	32	135	36	3 years
435	IIIG	550	0	2	4	<1 year
435-2	IIIG	550	28	322	24	5+ years
438	IIIG	990	16	192	24	3+ years
540	VID	1100	20	365	50	4+ years
541	VID	550	35	5	10	<1 year

Reference Oil Inventory Estimated Life

Oil	Tests	Original Blend Amount	Quantity Shipped in last 6 months	TMC Inventory	Lab Inventory	Estimated Life
541-1	VID	550	66	224	60	5+ years
542	VID	1100	60	49	40	1 year
542-1	VID	275	35	240	35	2+ years
704-1	VIII	897	12	180	14	5+ years
925-3	VG	975	0	10	6	<1 year
940	VG	560	15	496	36	5+ years
1006-2	IVA, VG, VIII	5500	171	3312	127	5+ years
1007	IVA, VG	1968	2	19	35	<1 year
1009	VG	1100	53	294	51	5+ years
1010	IIIG, VID	1100	66	409	86	5+ years

LTMS Deviations

- April 1, 2013 – September 30, 2013

LTMS Deviations

- One LTMS Deviation in Current Period
  - IIIF Stand removed from system, data returned to lab charts
    - change in parameter from PVIS to Hours negated the precision issues which caused a stand to be removed.
    - test data was returned to control charts
    - ltmsdate was changed to allow proper application of severity adjustments.

LTMS Deviations

Historical Count of PCEO LTMS Deviations

Test	LTMS Deviations
IIIF	6
IIIG	6
IVA	7
VG	8
VID	2
VIII	3

Quality Index Deviations

- April 1, 2013 –
  September 30, 2013

Quality Index Deviations

- One IIIF Quality Index Deviation this period for right exhaust backpressure control

Historical Count of PCEO Quality Index Deviations

Test	Quality Index Deviations
IIIF	25
IIIG	11
IVA	28
VG	38

TMC Laboratory Visits

- April 1, 2013 –
  September 30, 2013

TMC Lab Visits

Test	Number of Labs Visited
III	4
IVA	1
VID	4
VIII	1

Test Area Timelines

- April 1, 2013 –
  September 30, 2013

Test Area Timeline Additions*

Test	Date	Topic	IL
IIIF	20130514	Dropped Percent Viscosity Increase a calibrated parameter and replaced it with Hours to 275% Viscosity increase. Defined procedure to interpolate Percent Viscosity Increase from Hours to 275% Viscosity Increase for non-reference oil results.	13-2
IIIF	20130918	Specified use of 0.1% for percent viscosity increase when negative values are encountered for viscosity increase	13-3

*As of 09/30/2013

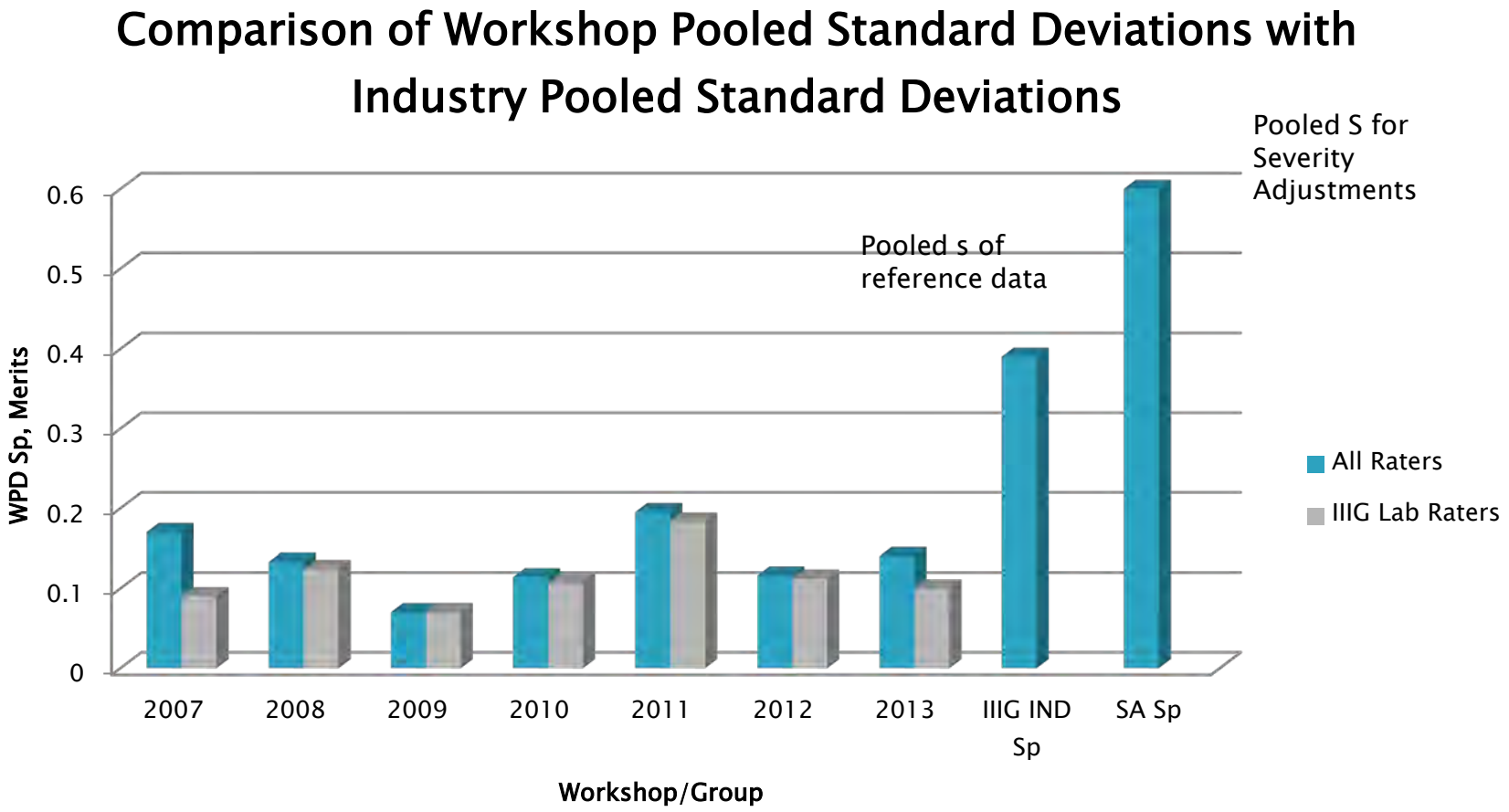
Additonal Information

- April 1, 2013 – September 30, 2013

Additional Information

- Summary of Precision Data From Light Duty Rating workshops:
  - VG Average Piston and Average Engine Varnish.
  - IIIG WPD.

Sequence IIIG Precision Estimates



Additional Information

- Available on TMC Website:
  - Live Reference Test Data Bases
  - Surveillance Panel Meeting Minutes
  - Test Area Alarm Logs
  - Complete Test Area Timelines
  - LTMS Manual

- www.astmtmc.cmu.edu

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Appendix 1
PCMO Reference Oil Testing Control Charts

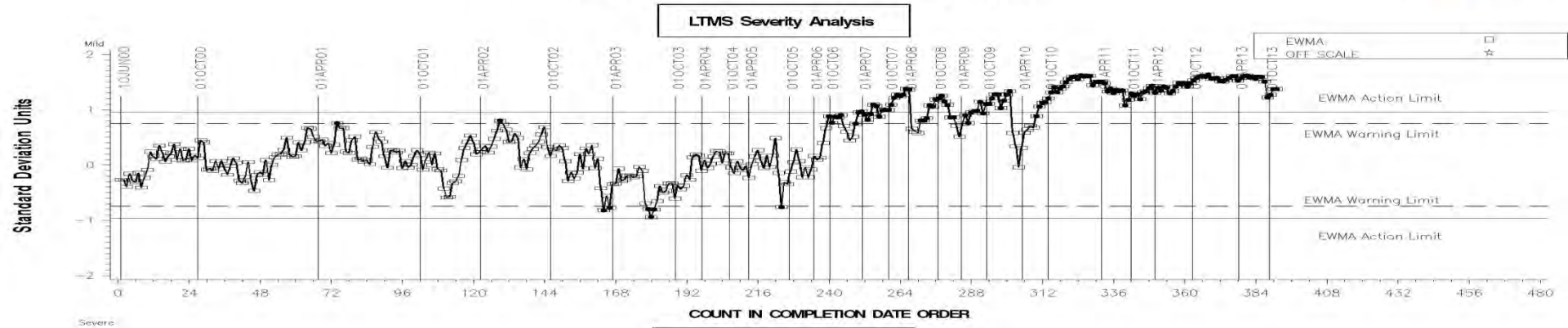
October 2013

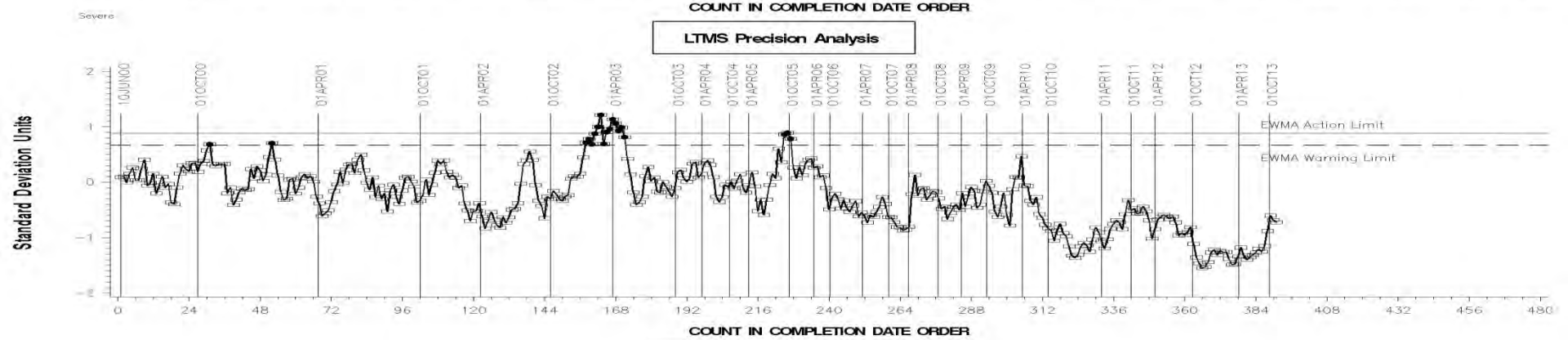
Appendix 1.a
IIIF Control Charts

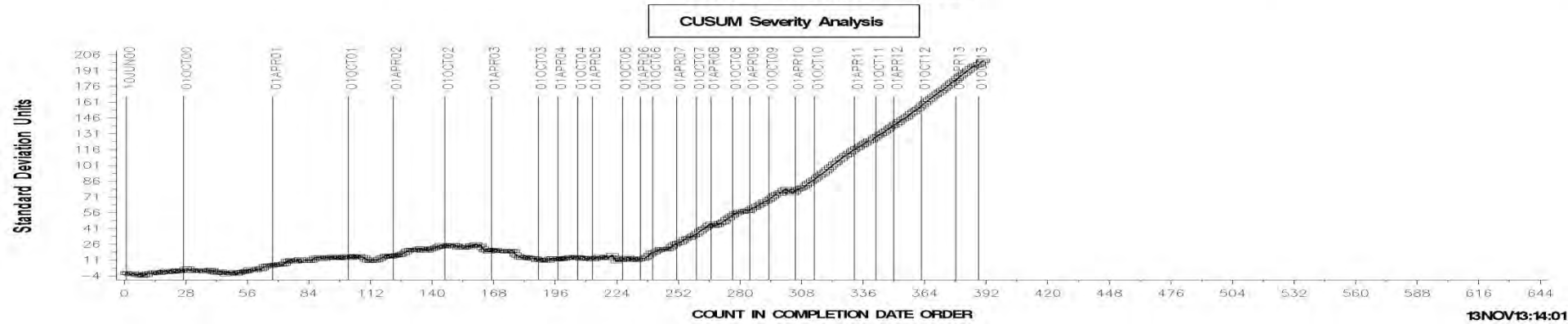
- Severity, Precision, and CuSum

SEQUENCE IIIF INDUSTRY OPERATIONALLY VALID DATA

AVERAGE PISTON SKIRT VARNISH FINAL ORIG UNIT RES







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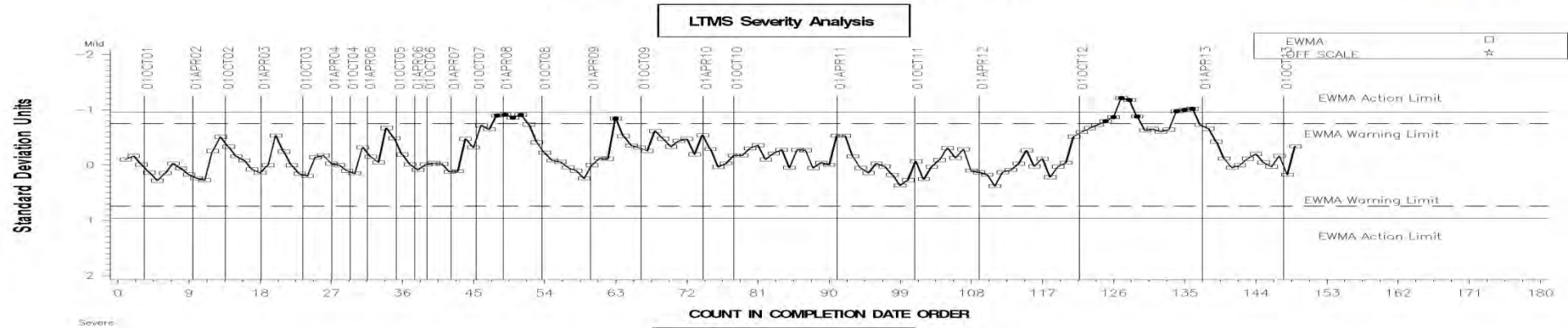
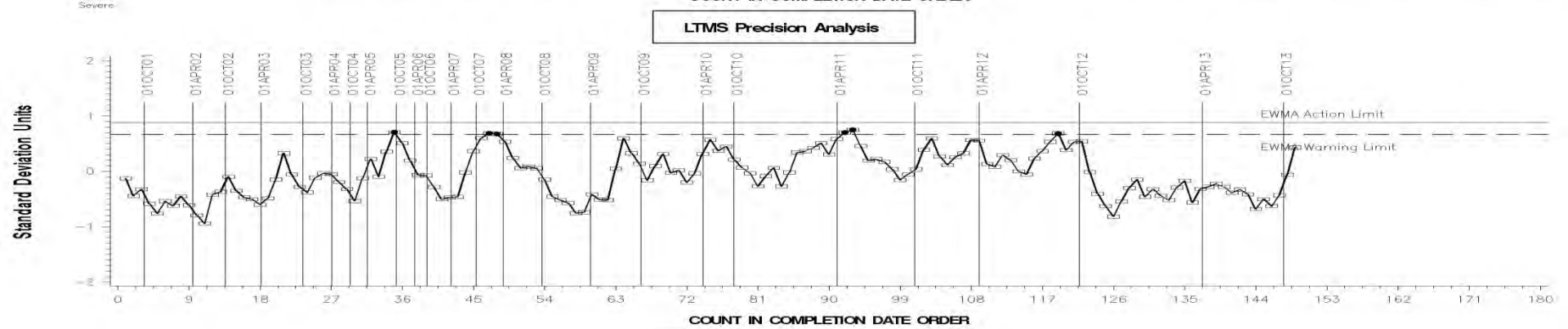
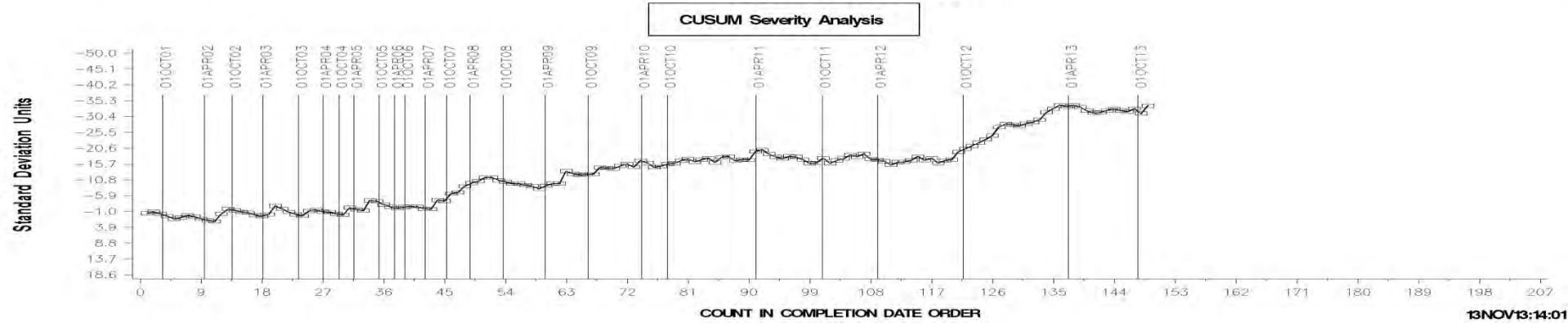
SEQUENCE IIIF INDUSTRY OPERATIONALLY VALID DATA

HOURS FINAL ORIG RES (REFERENCE TESTS ONLY)







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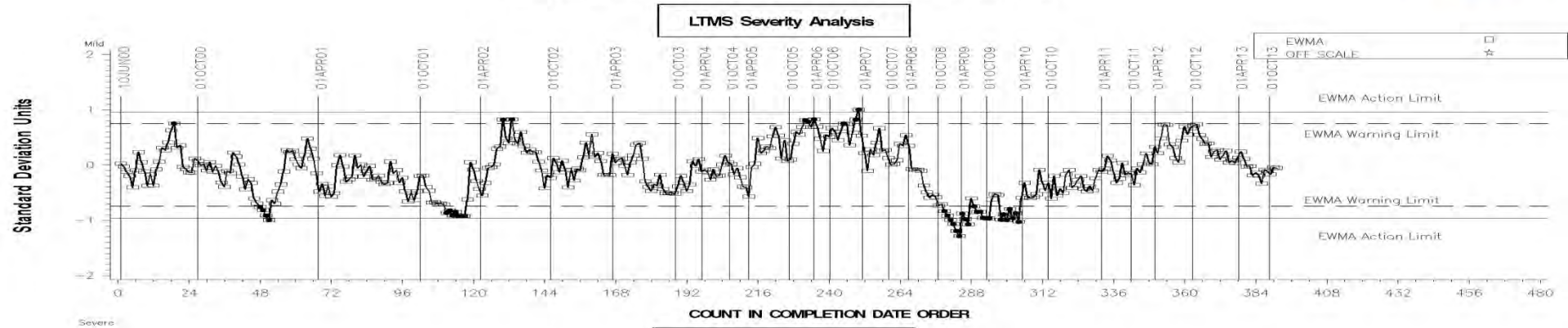
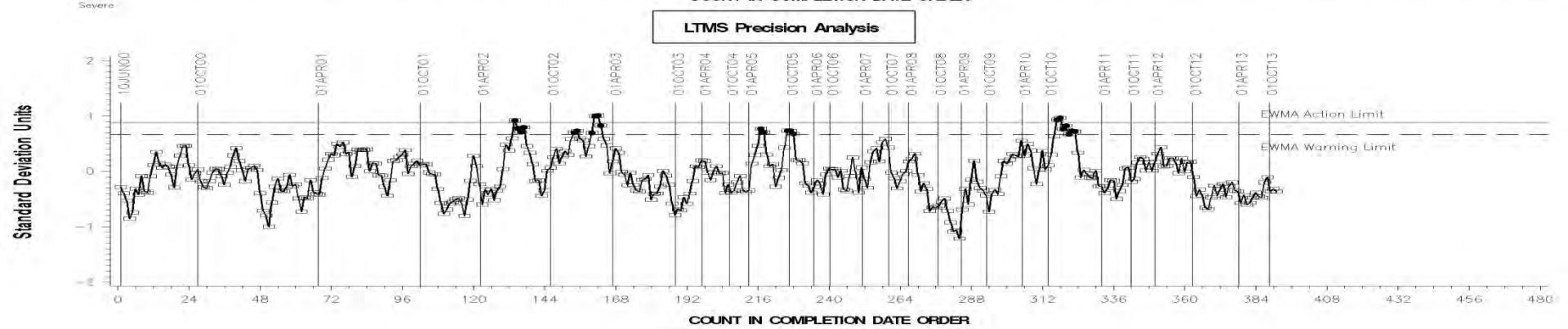
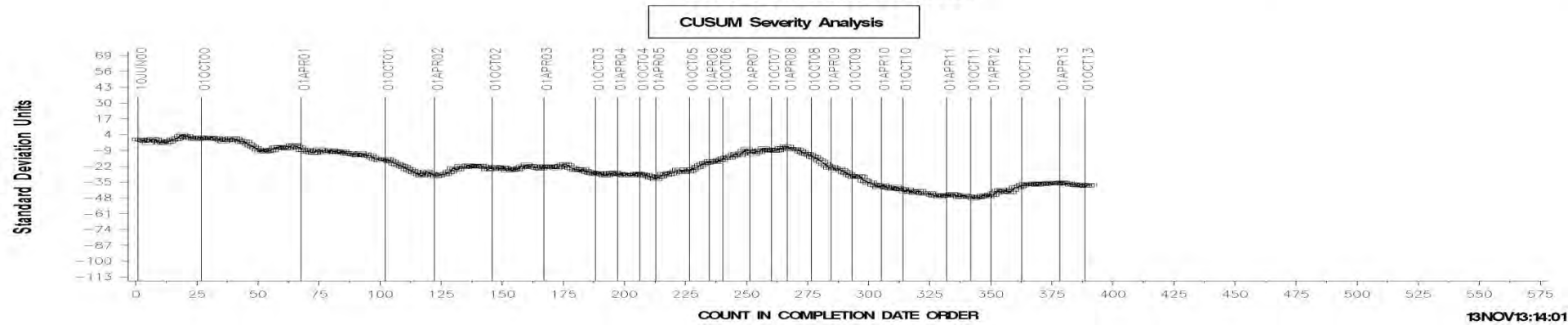
SEQUENCE IIIF INDUSTRY OPERATIONALLY VALID DATA

AVERAGE WEIGHTED PISTON DEPOSITS FNL ORIG UNIT RES







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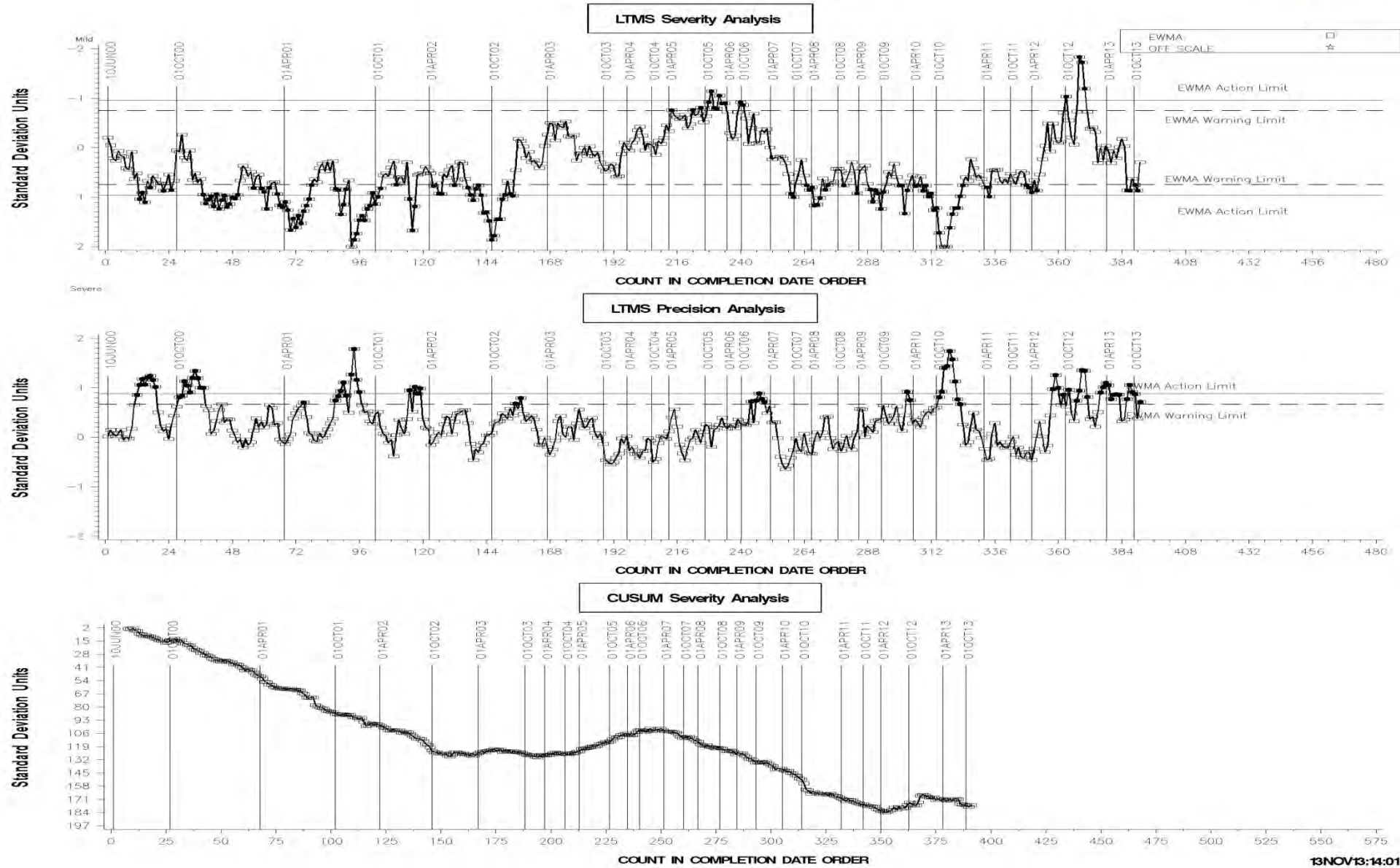
SEQUENCE IIIF INDUSTRY OPERATIONALLY VALID DATA

% VISCOSITY INCREASE @ 060 HOURS



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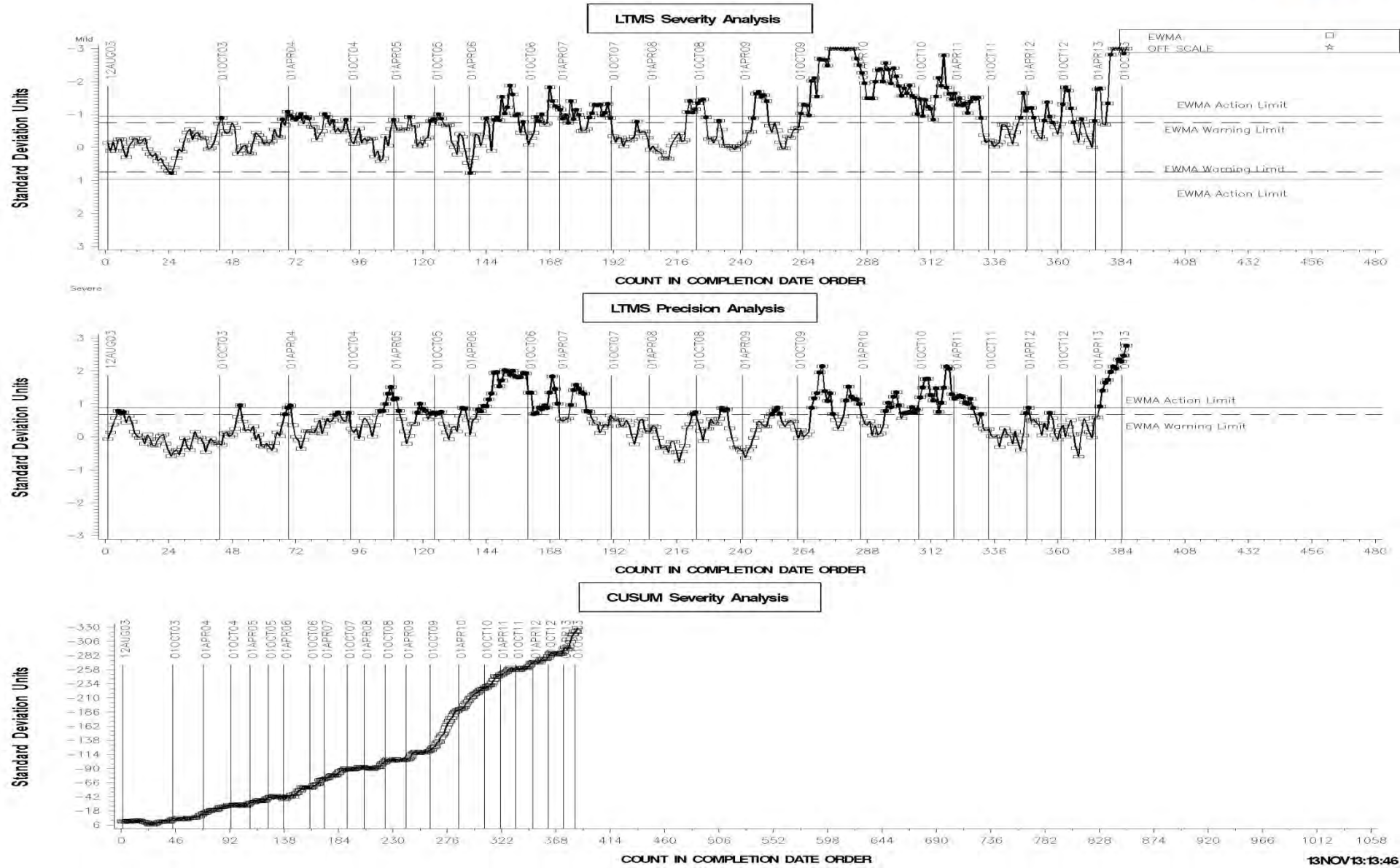
Return

Appendix 1.b
IIIG/A/B Control Charts

- Severity, Precision, and CuSum

SEQUENCE IIIG INDUSTRY OPERATIONALLY VALID DATA

AVERAGE CAM + LIFTER WEAR



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SEQUENCE IIIG INDUSTRY OPERATIONALLY VALID DATA

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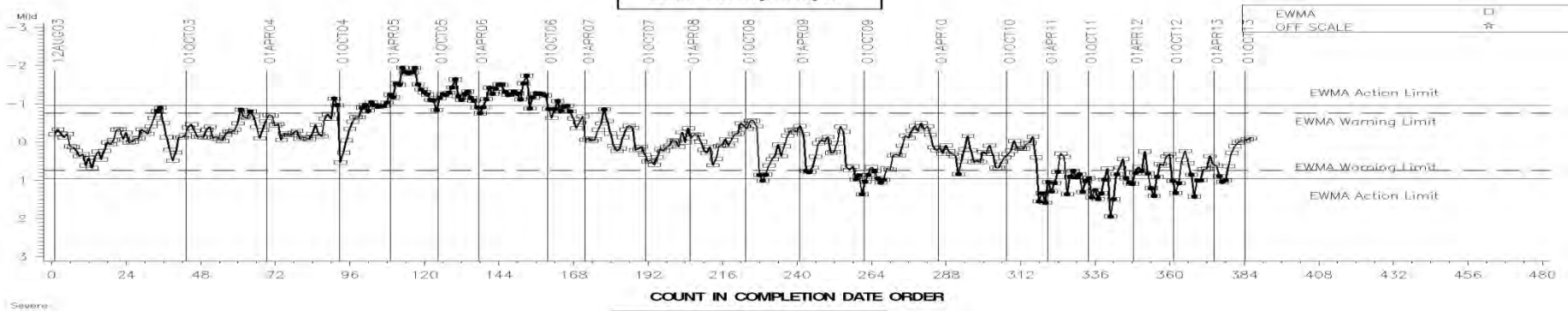
VISCOSITY INCREASE

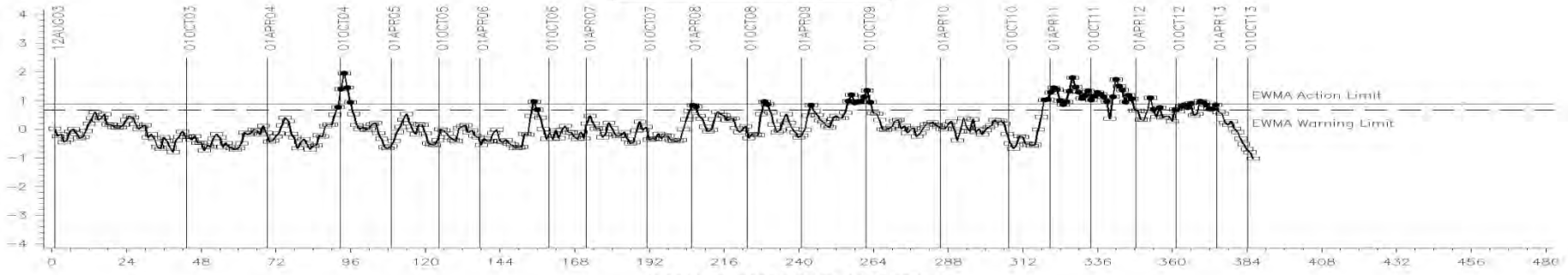
LTMS Severity Analysis



Standard Deviation Units

COUNT IN COMPLETION DATE ORDER

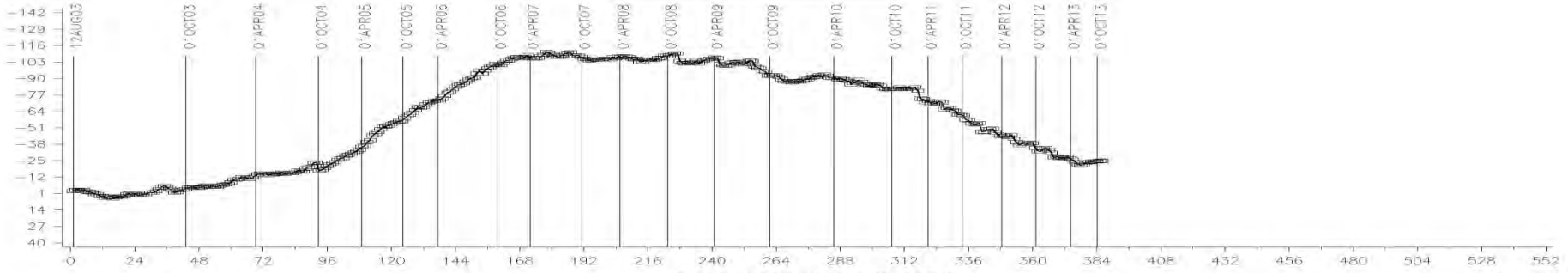
LTMS Precision Analysis



Standard Deviation Units

COUNT IN COMPLETION DATE ORDER

CUSUM Severity Analysis



Standard Deviation Units

COUNT IN COMPLETION DATE ORDER

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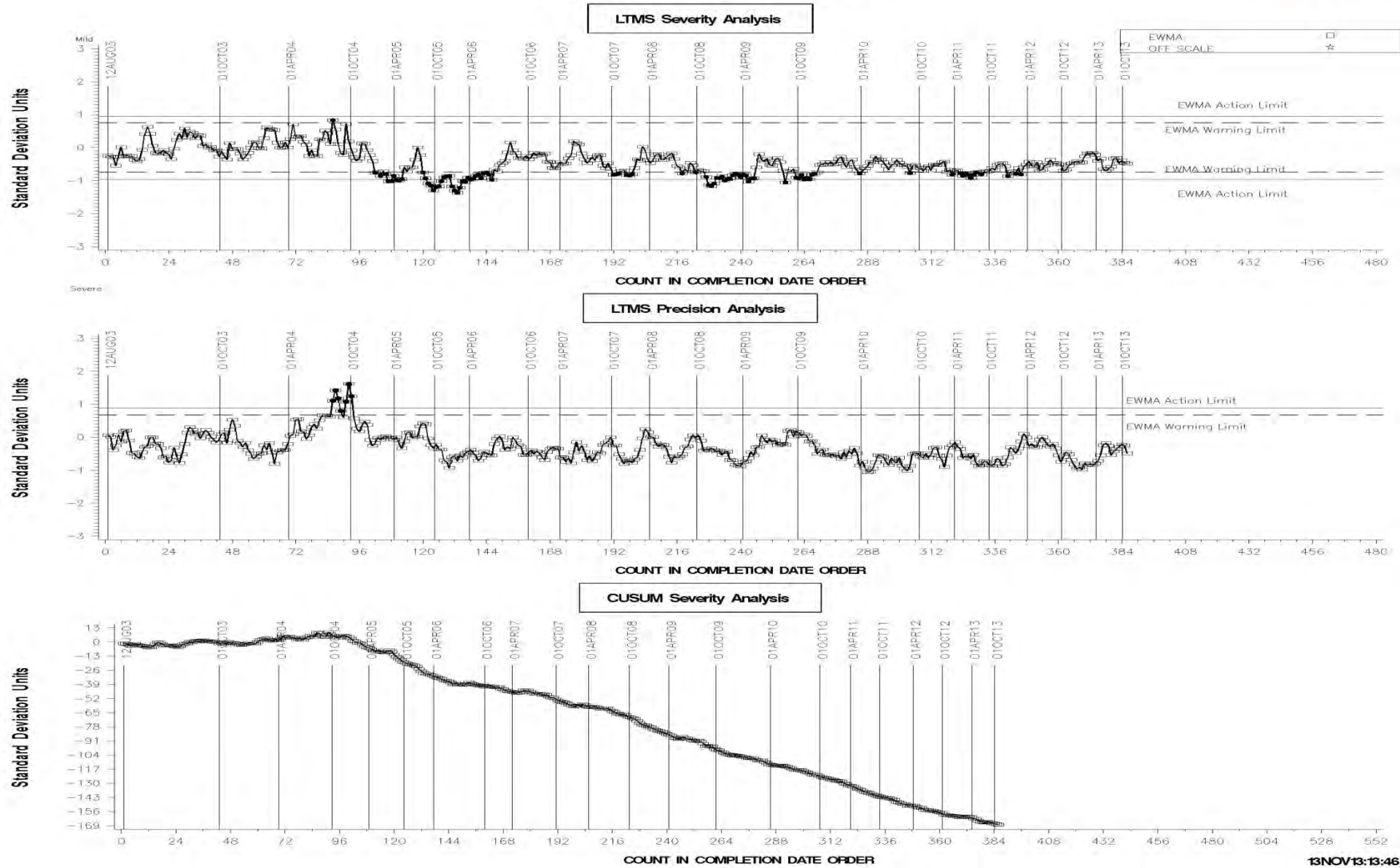
SEQUENCE IIIG INDUSTRY OPERATIONALLY VALID DATA

AVERAGE WEIGHTED PISTON DEPOSITS



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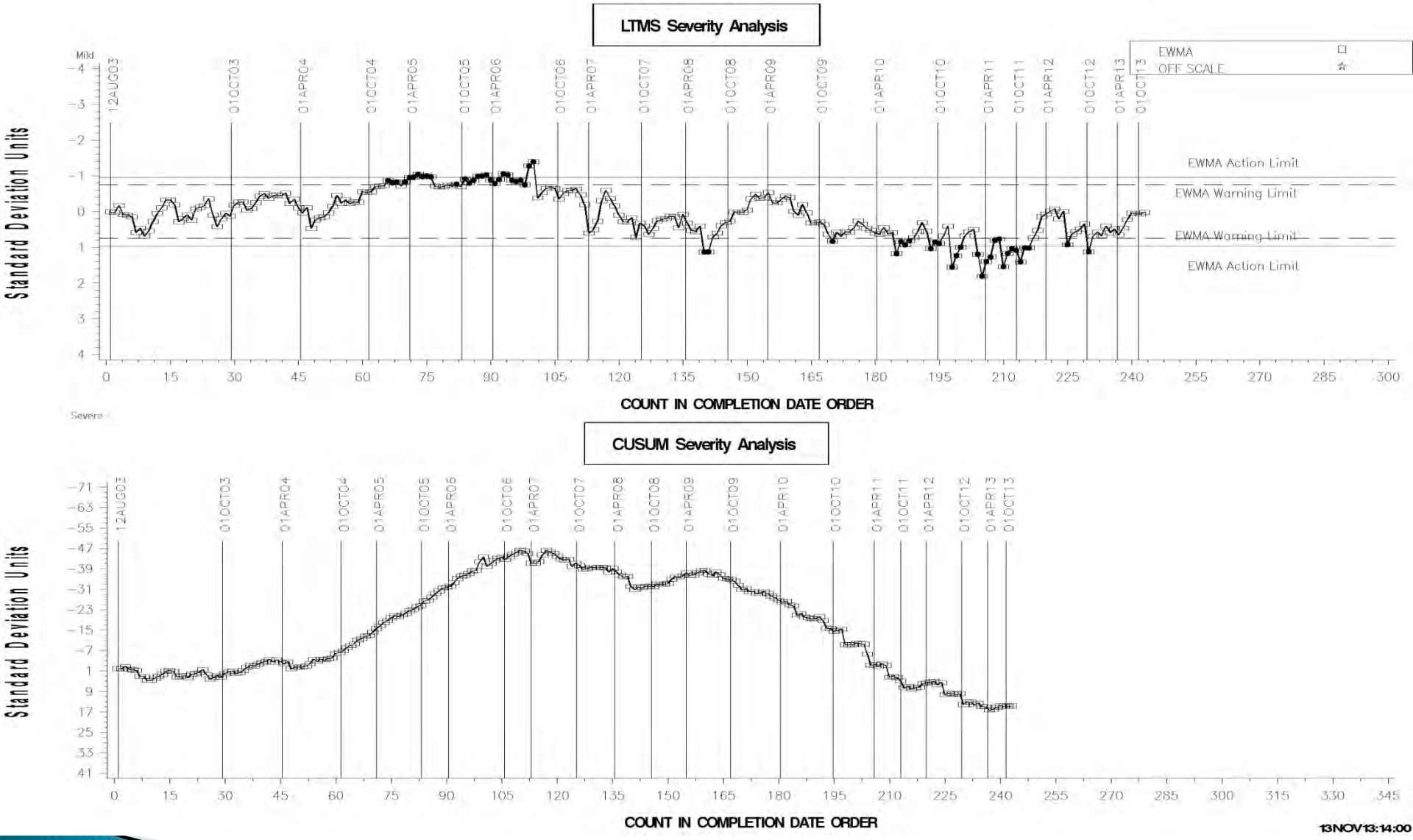
SEQUENCE IIIGA INDUSTRY OPERATIONALLY VALID DATA
435 Results not Charted
MRV VISCOSITY RESULT



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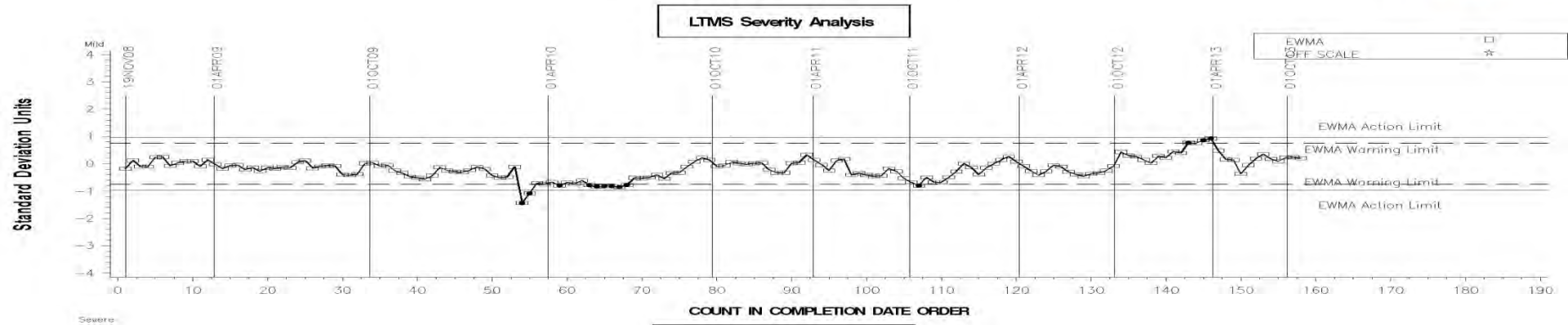
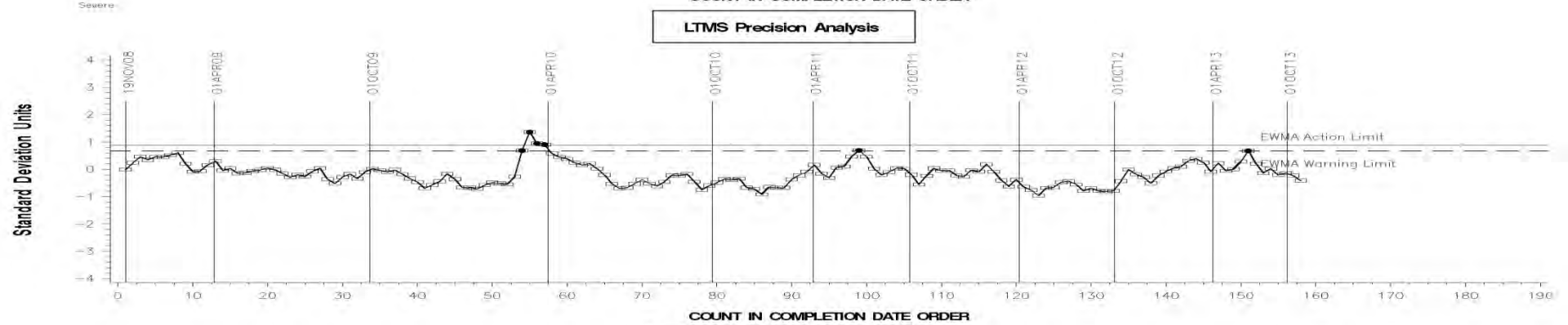
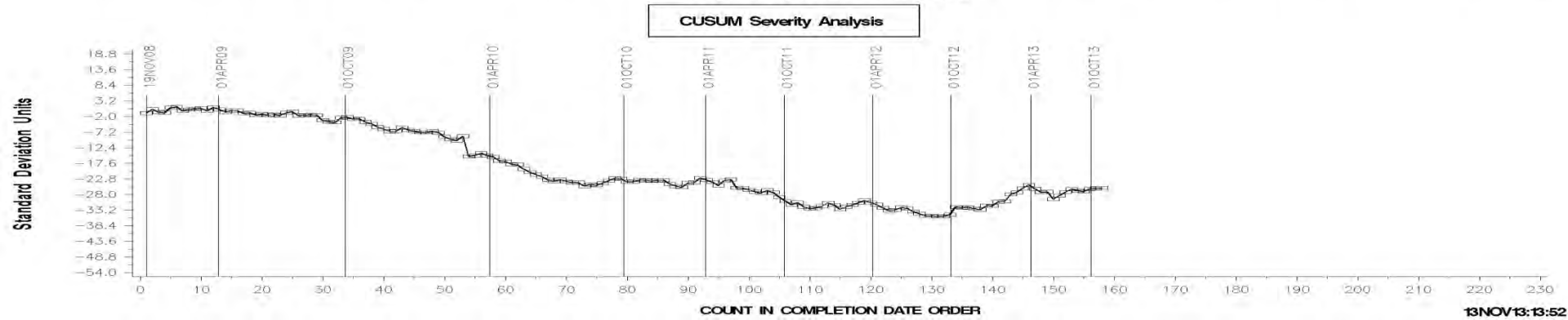
SEQUENCE IIIGB INDUSTRY OPERATIONALLY VALID DATA

PHOS RETENTION







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Return

Attachment 8

Sequence IIIG Percent Viscosity Increase, Weighted Piston Deposits, Average Cam and Lifter Wear

We are Concerned

November 19, 2013

Lubrizol

Executive Summary

SUCCESS TOGETHER

- Parameters in the IIIG test deserve investigation
  - WPD is in a stable, long term severe trend
  - PVIS is in a long term severe trend
  - ACLW is in a long term mild trend
- Every effort should be made to ensure that the Reference Oils are accurately capturing test severity
  - Sequence IIIG likely to be around at least until 2017
  - This ensures that quality oils will pass the test
  - Ensures equal requirements for newer and older formulations
- These issues should be investigated and addressed by a Task Force

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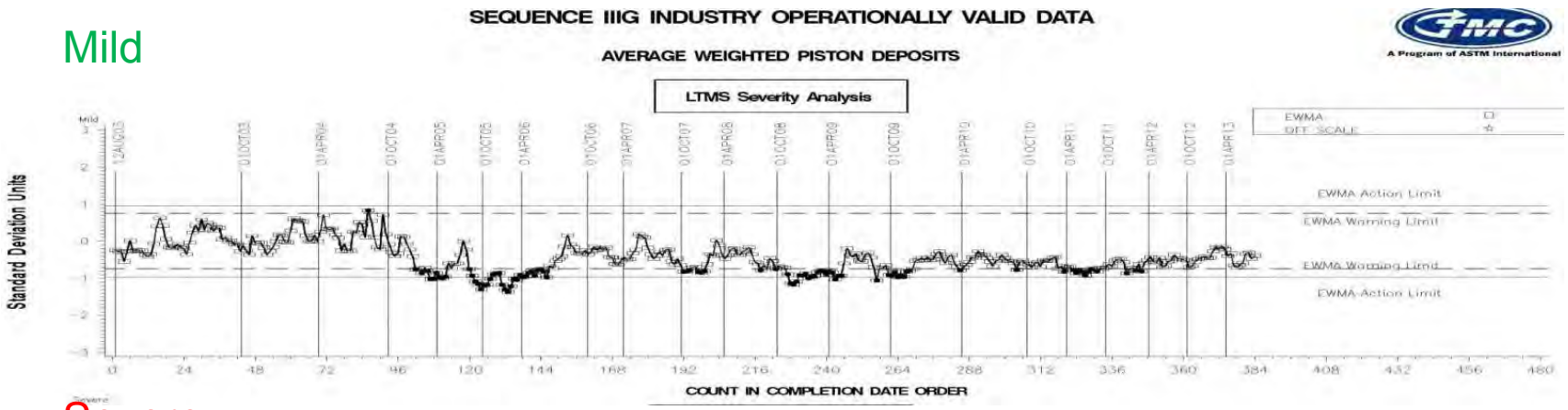
WPD Reference Severity

SUCCESS TOGETHER

- It is common knowledge that the issue has been going on for quite some time
  - "Long-term severe trend continuing" (from October 2013 B01 PC Reference Testing Semiannual Report)
- WPD severity is well documented, yet we still allow candidates to be under-corrected

Mild



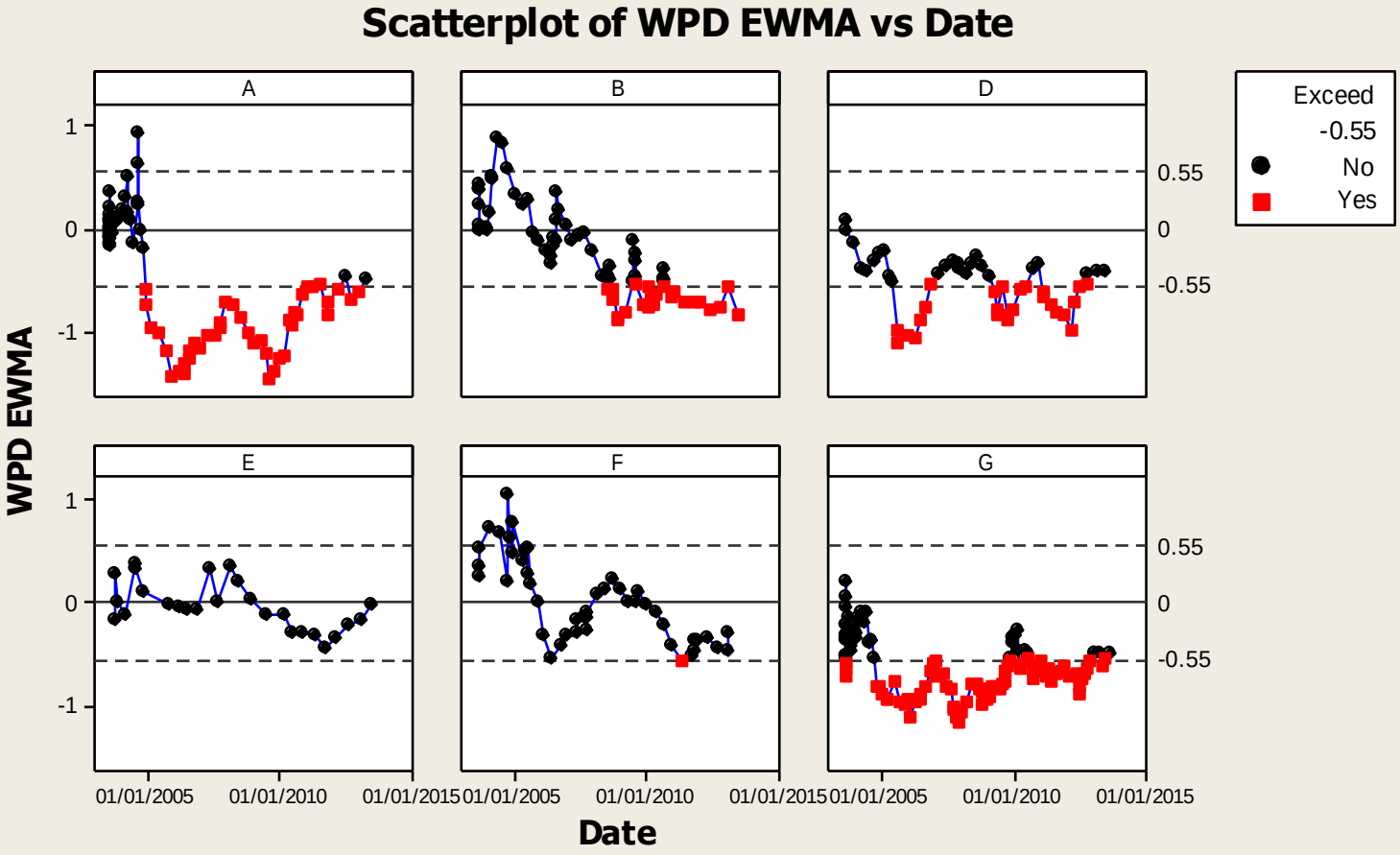
Severe

EWMA is hovering around the lab limit for SAs

Lubrizol

WPD EWMA

SUCCESS TOGETHER



EWMA is hovering around the lab limit for SAs

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WPD Reference Severity

SUCCESS TOGETHER

- Cause for concern since the EWMA is consistently near the lab SA limits
  - Candidates need reliable and valid severity adjustments
  - Small bounces could have large impact on candidates
    - EWMA = -0.52, then SA = 0
    - EWMA = -0.57, then SA = 0.34
    - This creates variability in the SA for a relatively stable and consistent EWMA
- Industry control chart has been fairly consistent for a number of years now
  - Investigate the root cause of the shift and address

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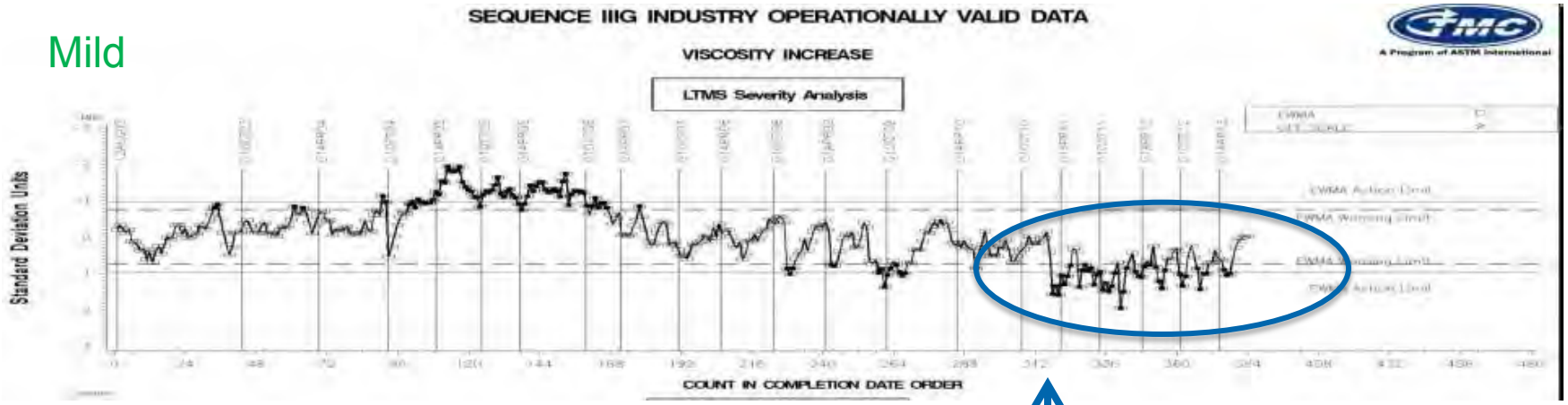
PVIS Reference Severity

SUCCESS TOGETHER

- Reference Oil data shows increasing severity, with cause for concern around January 2011

Mild



Severe

Jan 2011

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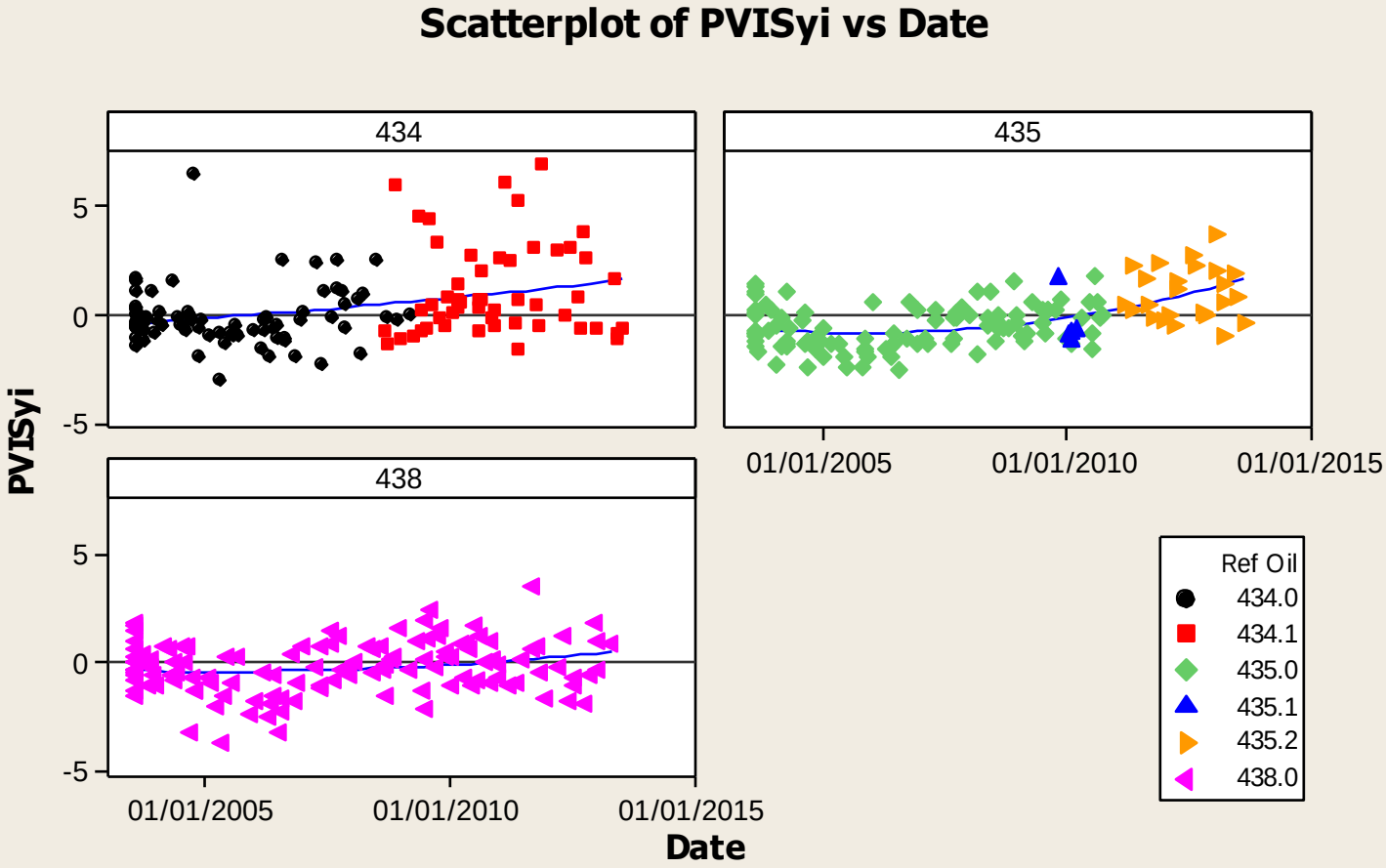
IIIG PVISyi over time, for each Reference Oil

SUCCESS TOGETHER



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PVIS Reference Severity

SUCCESS TOGETHER

- 2 of the 3 reference oils have been re-blended
- There have been unified engine builds and other procedural enhancements
- At least two ROs (434, 435) show signs of change in severity and variability (expect these to be related)
  - For PVIS, these are the poor and mid RO's
  - Changes are correlated with time
- Investigate and address the root cause of any changes or shifts
  - RO means and/or SD's may have changed

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ACLW Reference Severity (Mild)

SUCCESS TOGETHER

- Already being addressed as a separate agenda item

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Next Steps

SUCCESS TOGETHER

- Verify analysis
- Assemble Task Force
  - Objective: To understand any changes in the severity and variation of WPD, PVIS (and ACLW) in the IIIG over time

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SUCCESS TOGETHER

Working together, achieving great things

When your company and ours combine energies, great things can happen. You bring ideas, challenges and opportunities. We'll bring powerful additive and market expertise, unmatched testing capabilities, integrated global supply and an independent approach to help you differentiate and succeed.

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Intertek Automotive Research

EOT Copper in Modified Head Runs

Martin Chadwick
11/18/2013

Background

- **Four industry tests were conducted using heads with both intake and exhaust seats hardened. The method to harden the seats differed from the method used in the past to harden exhaust seats.**
- **Initial review of the test at IAR found copper levels in the oil were higher than expected.**
  - **EOT Cu was 115 ppm and range of past results was 43-109 on 39 tests on oil 438.**
- **This initiated a review of the industry head runs which found that all three runs with a duplicate produced higher copper on the head evaluation run than the charted reference.**
- **These observations were made available to the SP on the conference call on November 8th and the Chairmen requested additional information regarding copper levels in the head runs.**

Data Set

- **All charted references and the four head runs were used as the starting data set (n=390)**
  - **There were 24 data points that did not include CUWMH100 and were not used.**
  - **Past review of copper in the IIIG had found that block run was significant and so block run was included for this review. There were 30 data points where block run was not available.**
    - **Lab E does not report ENGINENO in a form that seems to include block run and four other tests had missing block runs or a discrepancy in the block run and piston size.**
- **Due to the short time frame available for review, the issues in the data set above, and the small number of head runs this analysis should only be considered as a starting point for further review or discussion and not conclusive.**

Review Process

- **Initial review included oil consumption, lab, oil, block run, and the new heads.**
- **The review indicated that a transform of 1/sqrt(CUWMH100) was suggested (this is the same transform used for IIIF PVIS) and was adopted for further work.**
- **A coefficient for oil consumption was obtained to adjust 1/sqrt(CUWMH100) to the average oil consumption for all charted tests. Further analysis suggested that the oil consumption correction was reasonable.**

GLM Output

General Linear Model: Cu100oca versus Block Run, INDx, CHART, LTMSLAB

Factor	Type	Levels	Values	
Block Run	fixed	6	1, 2, 3, 4, 5, 6	
INDx	fixed	3	434, 435, 438	***<<< Reblends were grouped with original blend***
CHART	fixed	2	H, Y	***<<< H indicates four runs on modified heads***
LTMSLAB	fixed	5	A, B, D, F, G	***<<< Lab E is not included as block run was not identifiable***

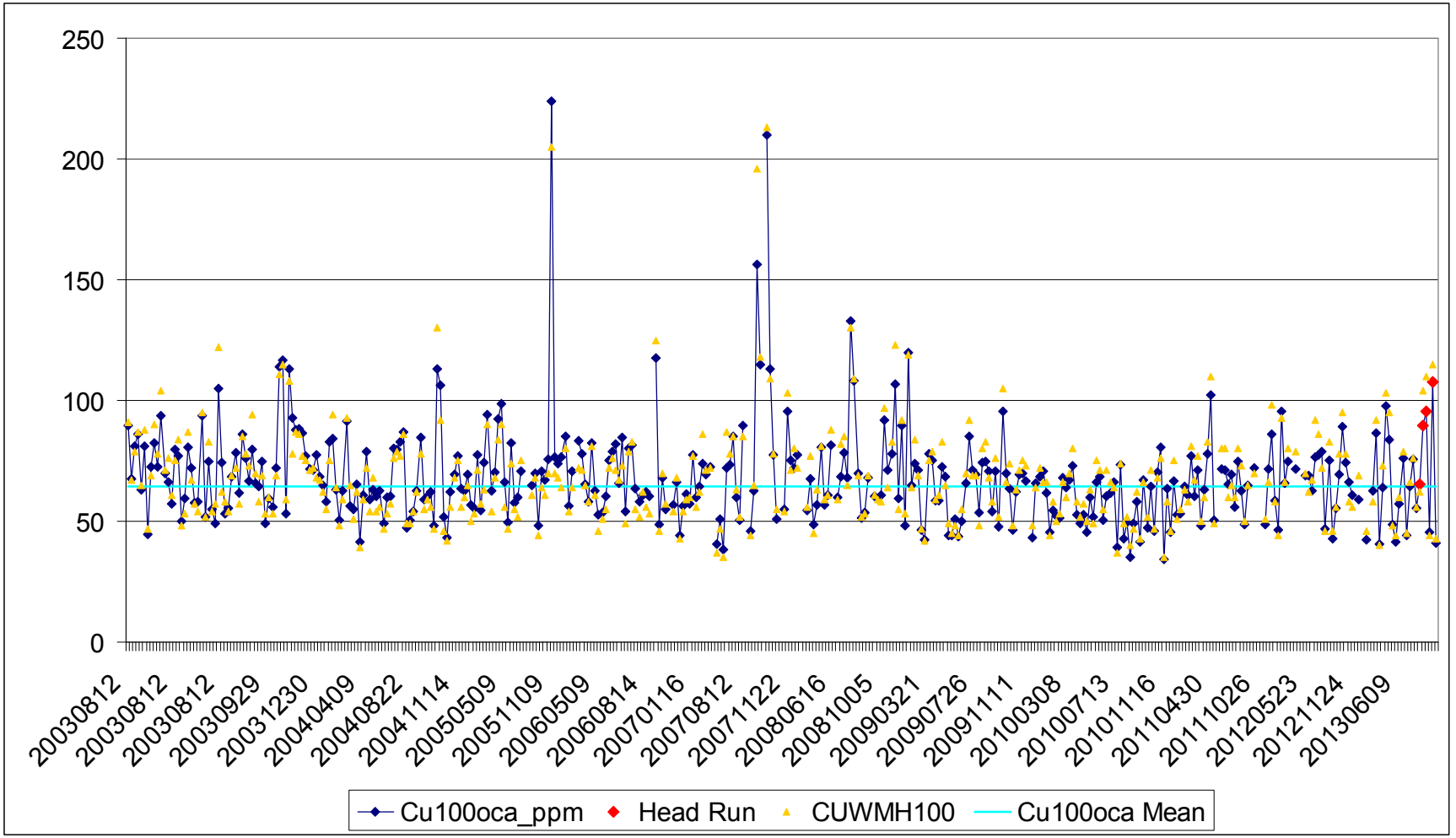
Analysis of Variance for Cu100oca, using Adjusted SS for Tests

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Block Run	5	0.0143524	0.0124879	0.0024976	16.21	0.0000
INDx	2	0.0025979	0.0028363	0.0014182	9.21	0.0000
CHART	1	0.000907	0.0008907	0.0008907	5.78	0.0170
LTMSLAB	4	0.0025196	0.0025196	0.0006299	4.09	0.0030
Error	325	0.0500692	0.0500692	0.0001541		
Total	337	0.070446				

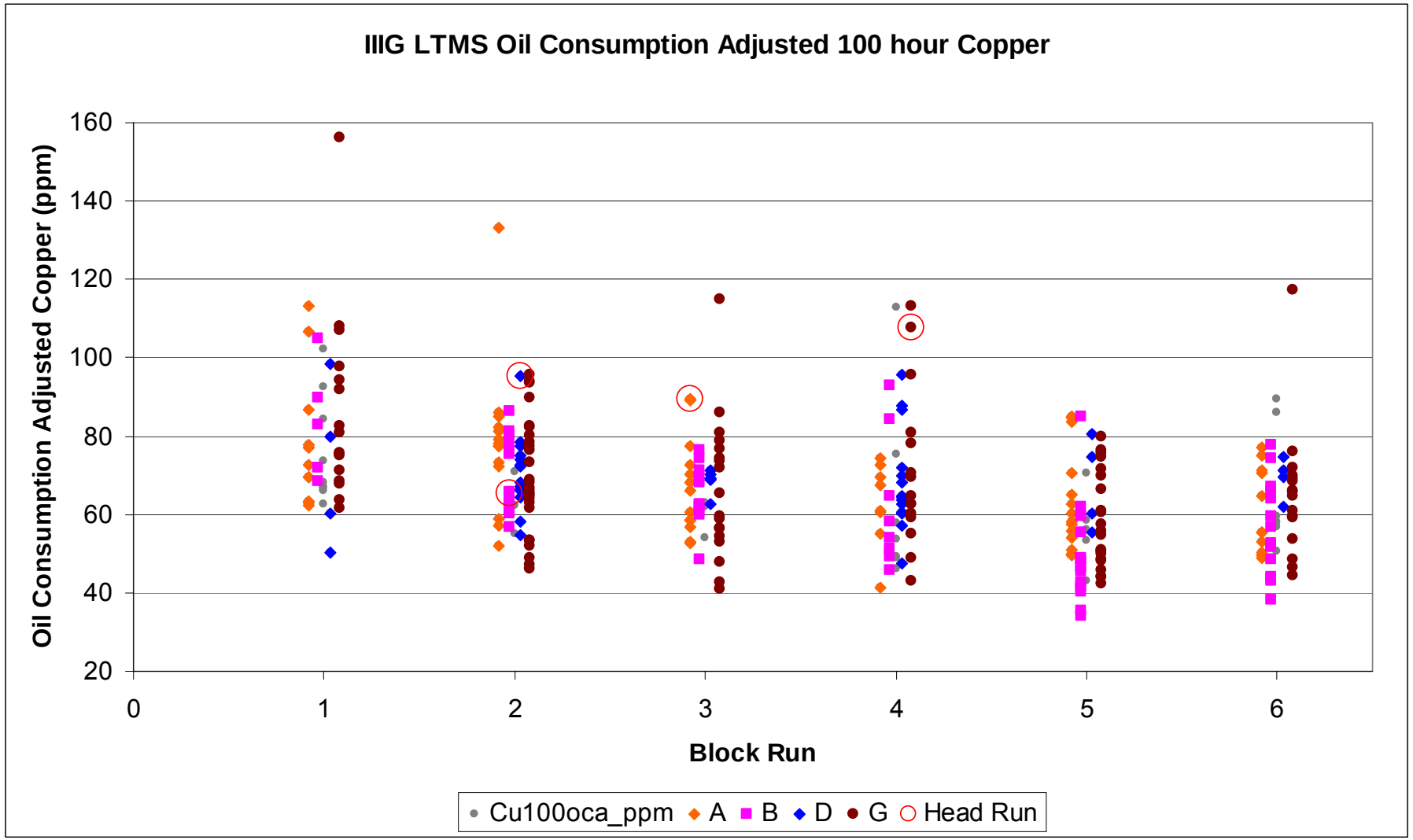
S = 0.0124121 R-Sq = 28.93% R-Sq(adj) = 26.30%

- **1st run blocks had more copper than other runs**
- **5th run blocks had less copper than runs one through four.**
- **Lab B had lower copper than Labs A, D, and G.**
- **The head runs had higher copper than charted references.**
- **Oil 434 has less copper than 435 and 438**

Charted tests indicate that Cu has been relatively stable over time



Data by block run finds that three of the four head runs had at or near the highest oil consumption adjusted copper results in a lab for the given block run



Conclusions

- **The four runs to date indicate that higher copper in the oil may occur if the tested configuration is adopted.**
  - **The small number of data points make an estimate of magnitude questionable but to help judge the need for additional work the LS Means difference between charted tests (64) and the head runs (84) was 20 ppm or approximately 30%.**

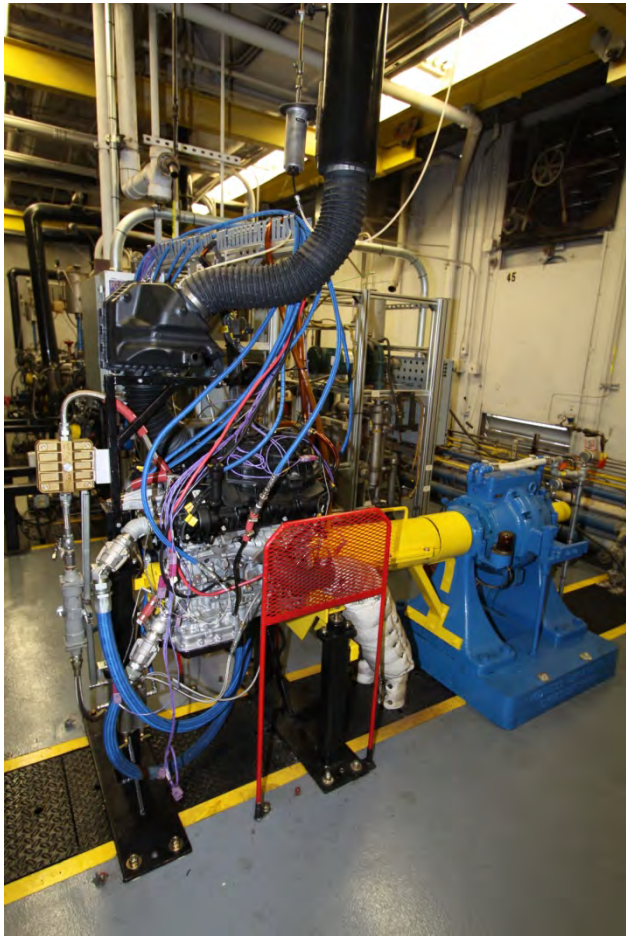
Motion: (Jason Bowden) The following procedure will be utilized to introduce Batch Code 10 Sequence IIIG rings. Each lab will donate one reference test on the new hardware. OHT will supply one engine kit of hardware to run this test. TMC will waive the reference reporting fees for this test and grant a one test calibration period extension if test is run prior to end of calibration period. The goal would be to have the labs run this donated test by end of February, 2014. The lab may still continue to use the existing batch code hardware. Once all testing is complete the panel will review the data.

Chrysler Oxidation and Deposit Engine Test Development for GF-6

Update
November 2013

Engine and Stand Status

- 2012 PentaStar 3.6L V6
  - 20 tests conducted at SwRI
- “Final” Test Conditions
  - 3900 RPM
  - 240 Nm
  - 150C Oil Temp
  - 6 qt. oil charge, no oil additions
  - PCV re-routed (no fresh air in sump)
- Stand buildup (2), shakedown and mapping completed.



Repeatability and Severity

- Evaluating tests 13, 14, 16, 17, 18, 20
  - Latest Engine Speed (3900 RPM) and Load.
  - "Locked" Test Conditions
- Oil 435-1 at 100 hours in Chrysler Test
  - **106% avg. pVis - 3.6 avg. WPD in Chrysler Ox. Test**
  - **178% avg. pVis - 3.6 avg. WPD in IIIG Test**

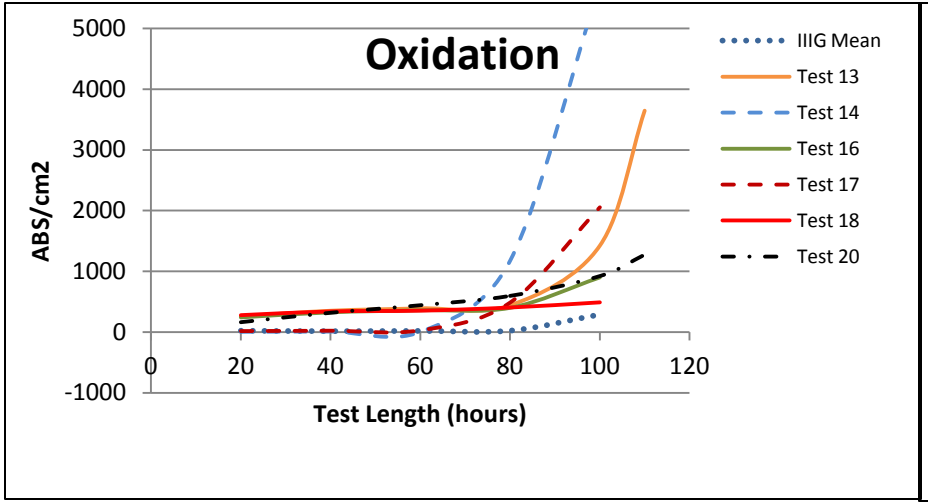
Test #	Oil	Result	
		pVis	WPD
13 (Stand #1)	REO 435-1	132%	3.2 *
16 (Stand #2)		115%	3.55
18 (Stand #2)		68%	4.03

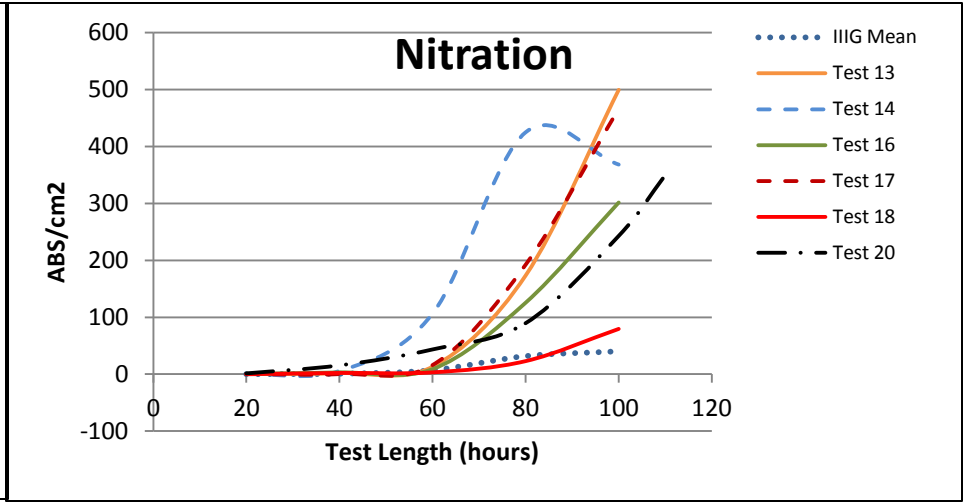
*Pistons were rated at 110 hours, 110 hour pVis was 328.75 %

- Chrysler Oxidation Test shows good repeatability of oil oxidation resistance and piston deposits (WPD)
- WPD severity is comparable to IIIG.
- pVis is milder than IIIG

Oxidation and Nitration

- pVis is milder than IIIG, however, oxidation and nitration are higher than IIIG





Dashed lines are the to Vegas reference oils, solid lines are RO 435-1 and black line is the Shell demonstration oil.

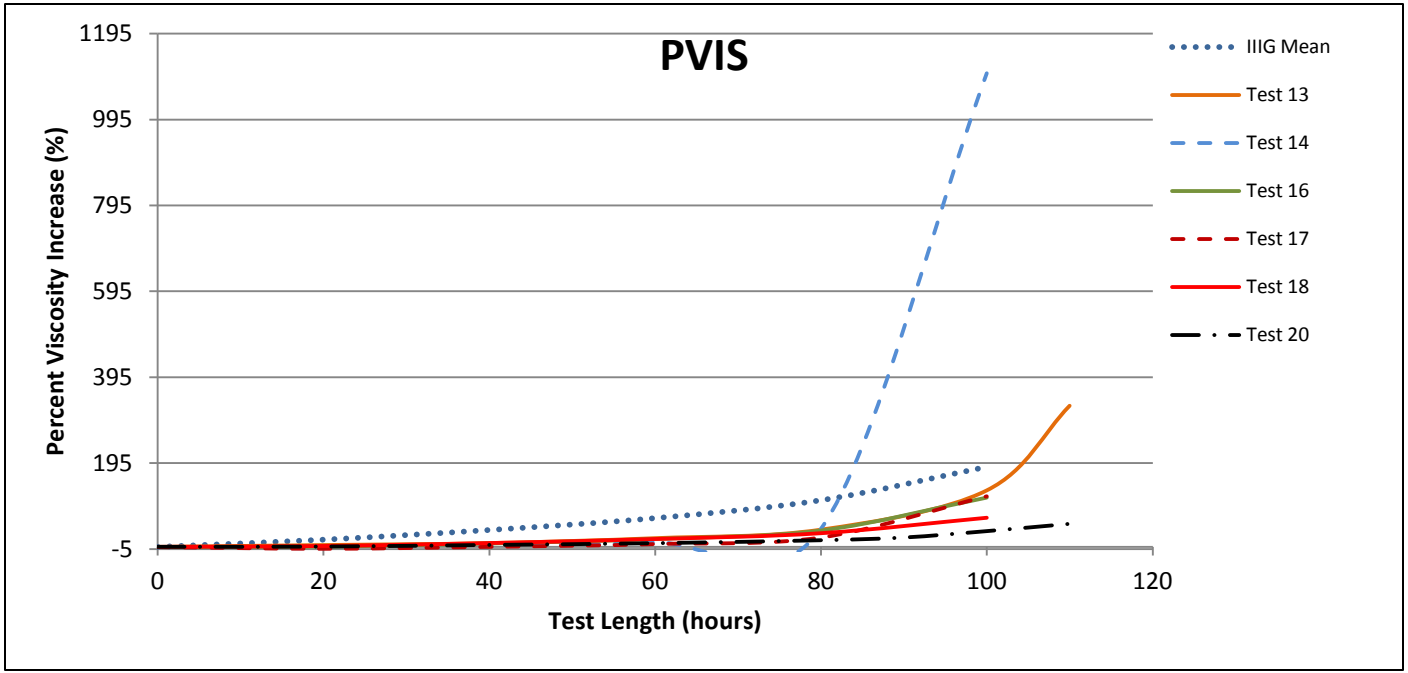
Oil Performance Discrimination

- Chrysler Oxidation Test demonstrates severity, and can discriminate between oils with different antioxidant performance

Test #	Oil	PVis	WPD
14	Vegas High REO with reduced antioxidant	1102%	2.99
17	Vegas High REO	118%	4.65
20	Shell Demonstration Oil	37%*	6.06*

*Pistons were rated at 110 hours,110 hour pVis was 54%

PVIS (percent viscosity increase)



- **Chrysler Test shows good repeatability of oil oxidation resistance**
- **Chrysler Test demonstrates severity, and can discriminate between oils with different antioxidant performance.**

Future Work

- Repeat tests on oils run to date
- Standardize Parts Supply
- Evaluate Other Oils for Repeatability/Reproducibility/Discrimination

Thank You !

Any Questions ?

ASTM SEQUENCE III SURVEILLANCE PANEL

SCOPE & OBJECTIVES

SCOPE

The Sequence III Surveillance Panel is responsible for the surveillance and continual improvement of the Sequence IIIF and IIIFHD tests documented in ASTM Standard D6984 as update by the Information Letter System. The Sequence III Surveillance Panel is also responsible for the surveillance and continual improvement of the Sequence IIIG, IIIGA and IIIGB tests documented in ASTM Standard D7320 as updated by the Information Letter System. Data on test precision will be solicited and evaluated at least every six (6) months for Sequence III test procedures. The Surveillance Panel is to provide continual improvement of rating techniques, test operation, test monitoring and test validation through communication with the Test Sponsor, ASTM Test Monitoring Center, the Central Parts Distributor, Fuel Supplier, ASTM B0.01 Passenger Car Engine Oil Classification Panel, ASTM Committee B0.01, ACC Monitoring Agency and ASTM Deposit/Distress Workshop. Actions to improve the process will be recommended when appropriate based on input to the Surveillance Panel from one or more of the previously stated groups. This process will provide the best possible Sequence III Type Test Procedure for evaluating engine oil performance with respect to its ability to prevent oil thickening, varnish formation, oil consumption and engine wear.

OBJECTIVES	TARGET DATE
Monitor industry hardware inventory	Ongoing
Review Seq IIIF PVIS for effectiveness of hours calculation	May, 2014
Monitor Seq IIIG used oil ICP copper levels	May, 2014

David L. Glaenzer, Chairman
Sequence III Surveillance Panel

Updated 11/19/2013
San Antonio, TX

Sequence III Surveillance Panel
November 19, 2013
11:00AM – 3:00PM
Southwest Research Institute
San Antonio, TX

Motions and Action Items
As Recorded at the Meeting by Bill Buscher

1. Action Item – Cylinder head task force leader and surveillance panel chair to monitor the status of industry cylinder head inventory and progress of "S Type" cylinder head processing.

2. Action Item – Surveillance panel chair to schedule a follow up surveillance panel conference call in December 2013 to review the status of industry cylinder head inventory and progress of "S Type" cylinder head processing.

3. Action Item – Test longevity task force to reconvene to address size 7 & 8 pistons.

4. Action Item – OHT to provide lifter data for reference oil tests to the industry statisticians group for analysis.

5. Action Item – Form a Sequence IIIG test severity task force with George Szappanos as task force leader. Anyone interested, to contact George to join the task force. George to convene group within the next 3 – 4 weeks, to establish the task force scope and objectives.

6. Action Item – Cu levels in used oil samples to be monitored and reported by the TMC to the surveillance panel on a 6 month interval.

7. Motion – The following procedure will be utilized to introduce Batch Code 10 Sequence IIIG rings. Each lab will donate one reference test on the new hardware. OHT will supply one engine kit of hardware to run this test. TMC will waive the reference reporting fees for this test and grant a one test calibration period extension if test is run prior to end of calibration period. The goal would be to have the labs run this donated test by end of February 2014. The lab may still continue to use the

existing batch code hardware. Once all testing is complete the panel will review the data.

Jason Bowden / Charlie Leverett / Passed 11 – 0 – 3

8. Action Item – Surveillance panel chair to survey the CPDs and labs for current inventories of critical test parts.