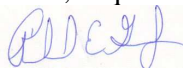




Test Monitoring Center

Carnegie Mellon University
6555 Penn Avenue, Pittsburgh, PA 15206, USA

<http://astmtmc.cmu.edu>
412-365-1000

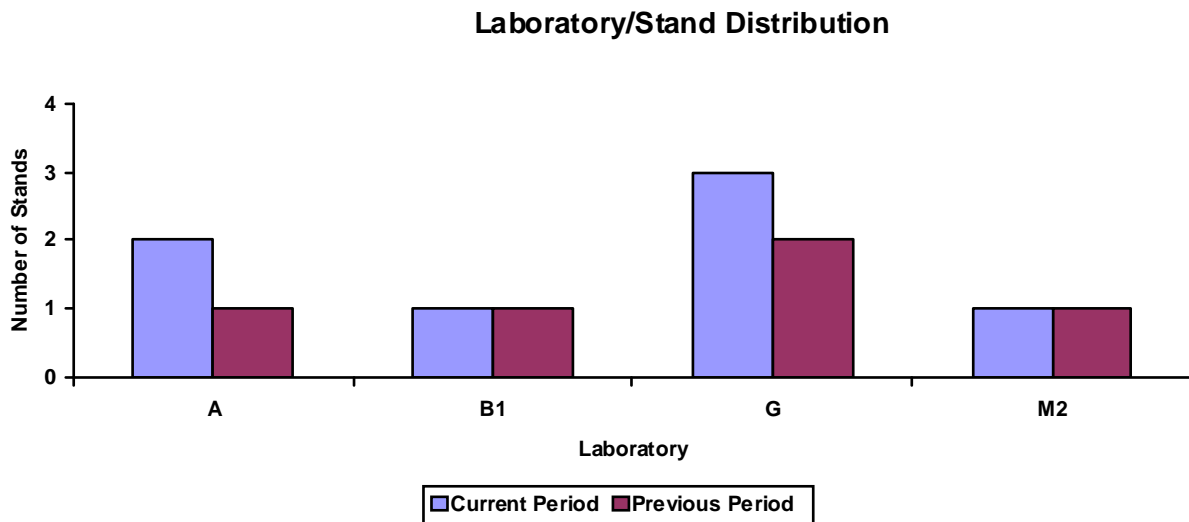
Memorandum: 11-010
Date: May 12, 2011
To: Dave Glaenzer, Chairman, Sequence IIIF Surveillance Panel
From: Richard E. Grundza 
Subject: Sequence IIIF Semiannual Report: October 1, 2010 through March 31, 2011

The following is a summary of Sequence IIIF reference tests that were reported to the Test Monitoring Center during the period October 1, 2010 through March 31, 2011.

Lab/Stand Distribution

	Reporting Data	Calibrated as of March 31, 2011
Number of Laboratories:	4	3
Number of Test Stands:	7	3

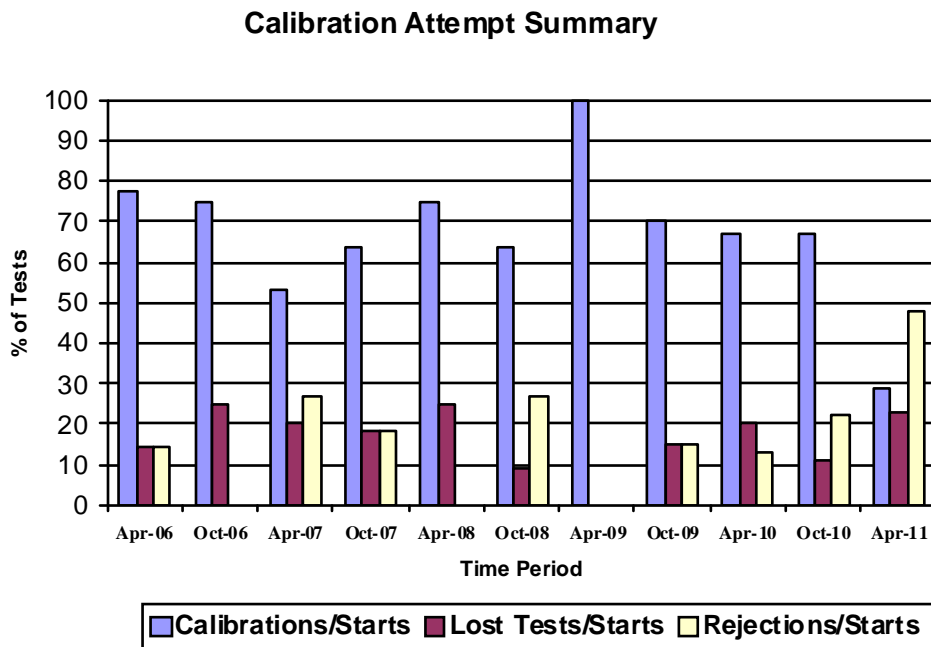
The following chart shows the laboratory/stand distribution:



The following summarizes the status of the reference oil tests reported to the TMC:

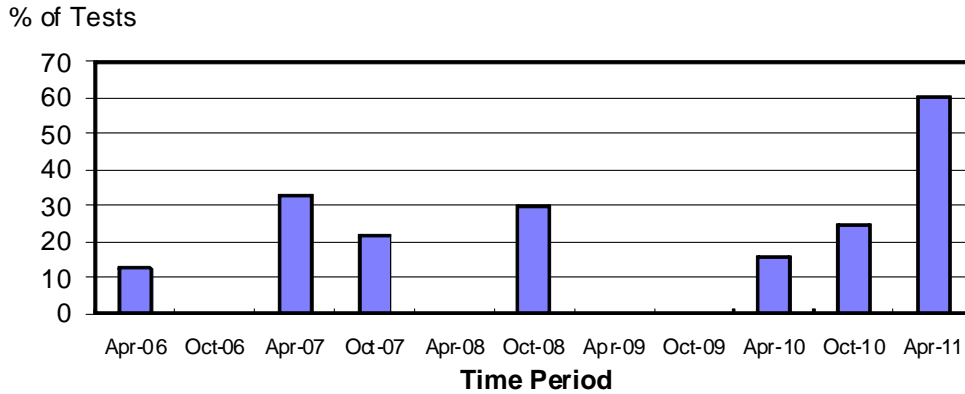
Calibration Start Outcomes	TMC Validity Codes	No. of Tests
Operationally and Statistically Acceptable	AC	9
Operationally Invalid (Lab Determination)	LC	5
Operationally Valid, Statistically Unacceptable, Charted	OC	9
Operationally Valid, Statistically Unacceptable, Not Charted	OC	6
Aborted	XC	1
Stand Abandoned	MC	1
Total		31

Calibrations per start, lost tests per start and rejection rates are summarized below:

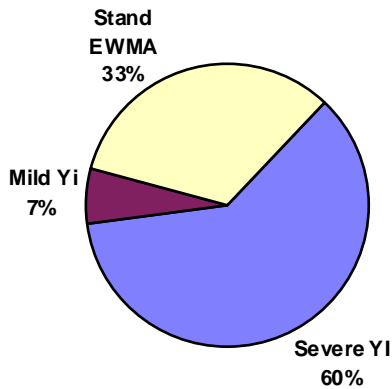


The calibration per start rate has decreased with respect to the previous period. The lost test per start and rejected test per start rates have increased this period. The lost test per start rate compares well with historical rates. The calibration per start rate is at the lowest level seen in the past five years, while the rejected test per start rate is at the highest level seen in the last five years.

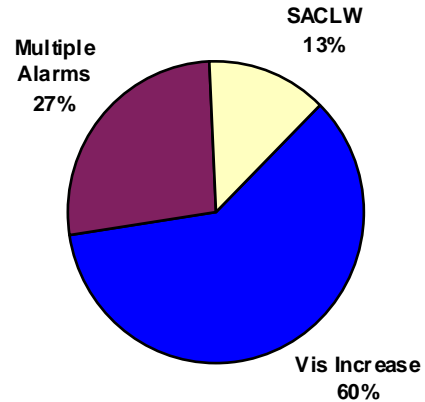
Rejected Test Rate for Operationally Valid Tests



Distribution of LTMS Stand Alarms



Distribution of Stand Alarms by Parameter



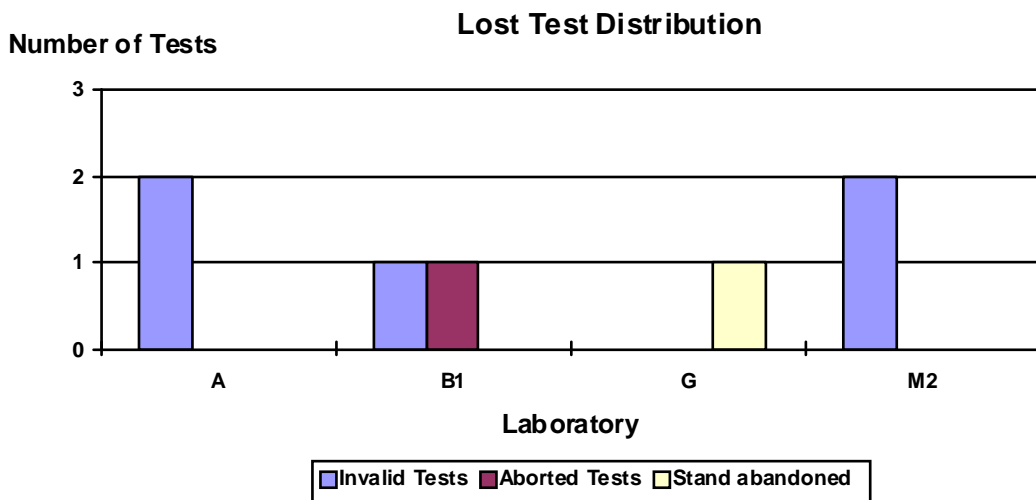
A total of fifteen tests were found to be statistically unacceptable, with thirteen of the fifteen failing for the percent viscosity increase parameter. Seven of these tests were severe on viscosity increase with an additional four having precision alarms for viscosity increase. Another two results failed for viscosity increase along with other parameters. The viscosity increase failures were primarily with reference oil 1006-2. During a March 17, 2011 conference call, the panel agreed to suspend the use of reference oil 1006-2. Another two tests were deemed unacceptable for screened ACLW >20 microns. Both results were on reference oil 433-1.

There was one LTMS Deviation written this period. This deviation removed a failing severe result from a laboratory's control charts, as the laboratory had made a process change after this result and there were concerns that the result may unduly influence severity adjustments. There have been five deviations from the LTMS since its introduction in June of 2000.

Lost Test Summary

Seven tests were lost this period. The reasons for the lost tests are shown in the following table:

Lab	Reason for Lost Test	Number of Tests
A	High Oil Consumption	1
A	Oil Temperature Control, Oil Temperature QI < 0.0	1
B1	Oil Filter Block Temperature QI < 0.0	1
B1	Oil Lost When Trying to Correct Improperly Installed Oil Thermocouple	1
G	Stand Abandoned	1
M2	Oil Filter Block Thermocouple Broken	1
M2	IIIG Valve Springs Installed	1



Information Letters

No information letters were issued this report period.

Severity and Precision Analysis

Below is a summary of the average Δ/s , pooled standard deviation, and average Δ in reported units for the tests reported during this period. Also below is a summary of the average Δ/s values, by parameter, for all laboratories reporting data during this period.

Industry Severity Summary			
Parameter	Average Δ/s	Pooled standard deviation (degrees of freedom)	Average Δ, in reported units
PVIS	-0.726	0.032 (df=17)	452% Viscosity Increase ¹
APV	1.567	0.084 (df=17)	0.13 Merits
WPD	-0.261	0.501 (df=17)	-0.13 Merits
PV60 ²	0.959	0.421 (df=17)	146.7% Viscosity Increase ³

¹ At the GF-3 Pass Limit of 275% Viscosity Increase

² Not a pass/fail parameter in the Sequence III F test; Sequence III FHD use only

³ At the CH-4 Pass Limit of 295% Viscosity Increase @ 60 Hours; Sequence III FHD use only.

Average Δ/s Results, by Laboratory				
Laboratory	PVIS	APV	WPD	PV60
A	-1.472	0.533	-0.488	2.035
B1	-1.095	0.926	-1.133	0.283
G	-0.471	1.431	-0.505	1.643
M2	0.031	1.726	0.658	1.101

Percent Viscosity Increase (PVIS)

The industry severity control charts started the period in control but sounded a series of warning and action alarms, which clear with the last six tests reported during the period. Industry performance was severe for the period, with an average Δ/s value of -0.726 (see Figures 1 & 5), which equates to a shift of 452 % severe in reported units. With the exception of one action and two warning alarms midway through the period, precision was in control for the period. Pooled precision estimates have degraded with respect to the previous period (see Figure 9). The summation delta/s chart shows the severity shift which began in April 2007 continuing through this period.

Weighted Piston Deposits (WPD)

Industry control chart for severity was in control this report period. Precision was in control at the beginning of the period, but sounded a series of six warning and action alarms, and was in control for the remainder of the period. Industry performance was severe for the period, with an average Δ/s value of -0.726 (see Figures 2 & 6), which equates to a shift of -0.13 merits severe in reported units. Precision is essentially unchanged with respect to the previous period with a standard deviation of 0.501 (see Figure 10). The summation Δ/s chart shows the severe trend which began in April of 2008 moderating somewhat for the report period.

Average Piston Skirt Varnish (APV)

Industry severity has been action alarm the entire period. Industry was mild for the period with an average Δ/s value of 1.567 or 0.13 merits (see Figures 3 & 7). Precision has changed little when compared with the previous period with a pooled standard deviation of 0.084 (see Figure 11). The summation Δ/s chart shows the mild trend which started in April of 2006 continuing through the report period.

Average Camshaft-plus-Lifter Wear (ACLW)/Screened Average Camshaft-plus-Lifter Wear (SACLW)

Two failing results for ACLW/SACLW were reported this period. Both results were obtained with reference oil 433-1, but in different laboratories and stands

Percent Viscosity Increase at 60 Hours

The industry control chart for PV60 is shown in Figure 4. The average Δ 's and pooled standard deviation for this period, and previous report periods, are shown in Figures 8 and 12 respectively. This parameter is not a pass-fail parameter in the Sequence III F test and is used only in Sequence III FHD testing. Therefore, the industry control charts are presented for information purposes only and any alarms shown on those charts do not require action by the Sequence III F Surveillance Panel. A review of Figure 4 shows that severity has been in alarm for almost the entire period. Precision began the period in warning alarm and continued in alarm for most of the period, but was in control at the end of the period.

QI Deviations

There were no QI Deviations written this period. There have been a total of 25 QI Deviations written since the test was introduced in June of 2000.

Hardware

Four results on J cams were reported this period, while the remainder of the tests reported this period were on H cams.

Reference Oils

Oil	Original Blend, in gallons	TMC Inventory, in gallons	Quantity Used past six months	TMC Inventory, in tests	Laboratory Inventory, in tests	Estimated life
1006-2	5500	3860	93	915	6	~3+ years ¹
433-1	1045	291	76	72	5	~2 years

¹ Multiple test area reference oil; total TMC inventory shown

With the suspension of reference oil 1006-2, the supply of 433-1 is estimated at 2 years based on current usage and current industry activity. Any changes in activity and usage will have a significant effect on the life of this oil.

REG/reg

Attachments

c: J. A. Clark, TMC

F. M. Farber, TMC

Sequence III F Surveillance Panel

<ftp://ftp.astmtmc.cmu.edu/docs/gas/sequenceiii/semiannualreports/IIIF-04-2011.pdf>

Distribution: Electronic Mail

List of Figures

- Figures 1, 2, 3, and 4 are EWMA severity and precision control charts and also the CUSUM Δ/s plots of PVIS, WPD, APV, and PV60, annotated with date lines, using the same data set as the EWMA severity and precision control charts. Transformed units are used, when appropriate.
- Figures 5, 6, 7, and 8 are bar charts of average Δ/s , by report period, for PVIS, WPD, APV, and PV60.
- Figures 9, 10, 11, and 12 are bar charts of pooled standard deviation, by report period, for PVIS, WPD, APV, and PV60.
- Figure 13 is the Sequence IIIIF Timeline.

Figure 1

SEQUENCE IIIIF INDUSTRY OPERATIONALLY VALID DATA



% VISCOSITY INCREASE

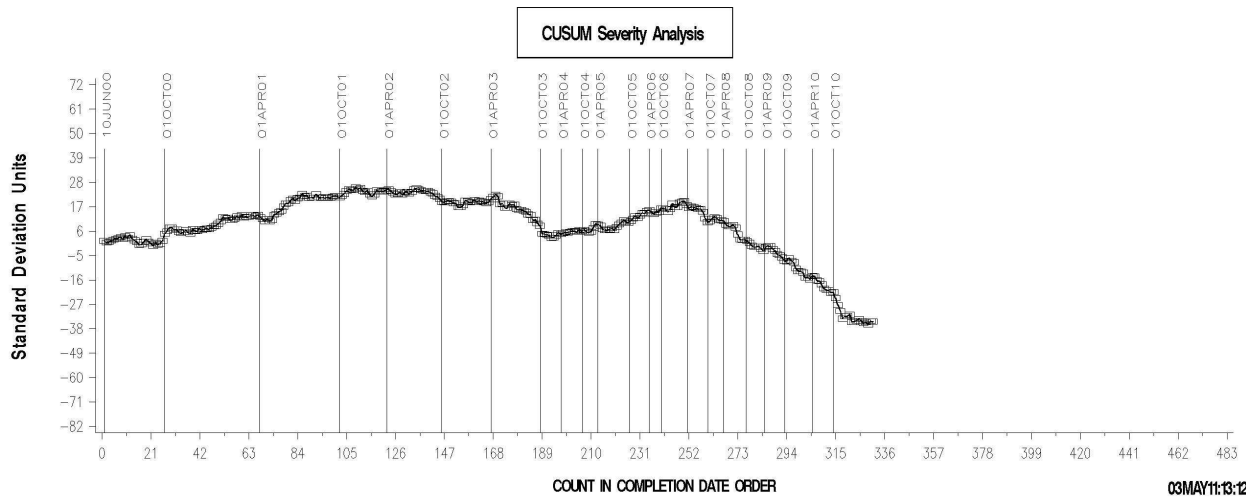
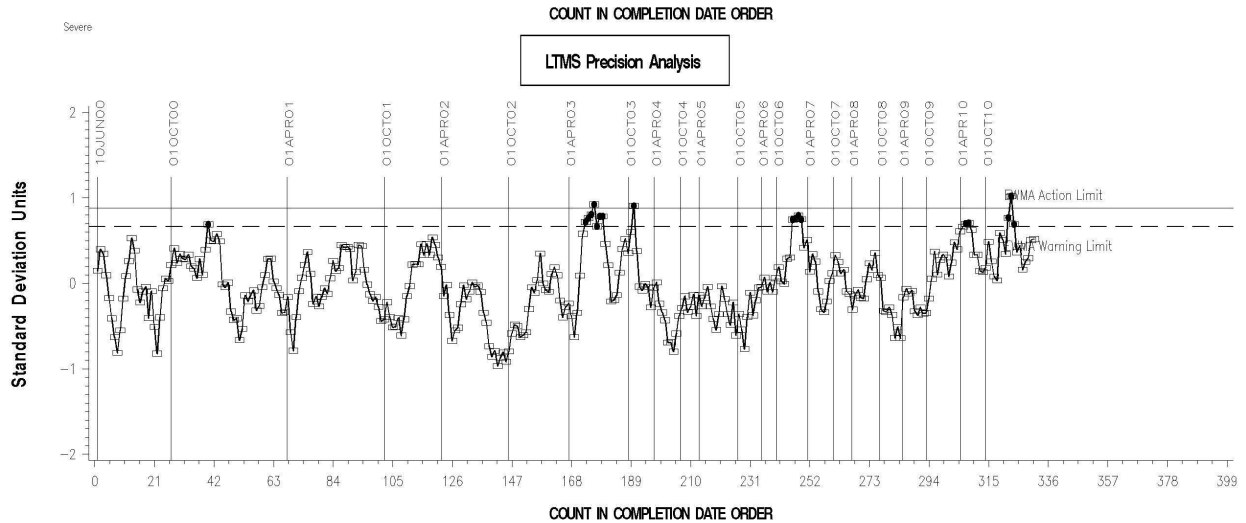
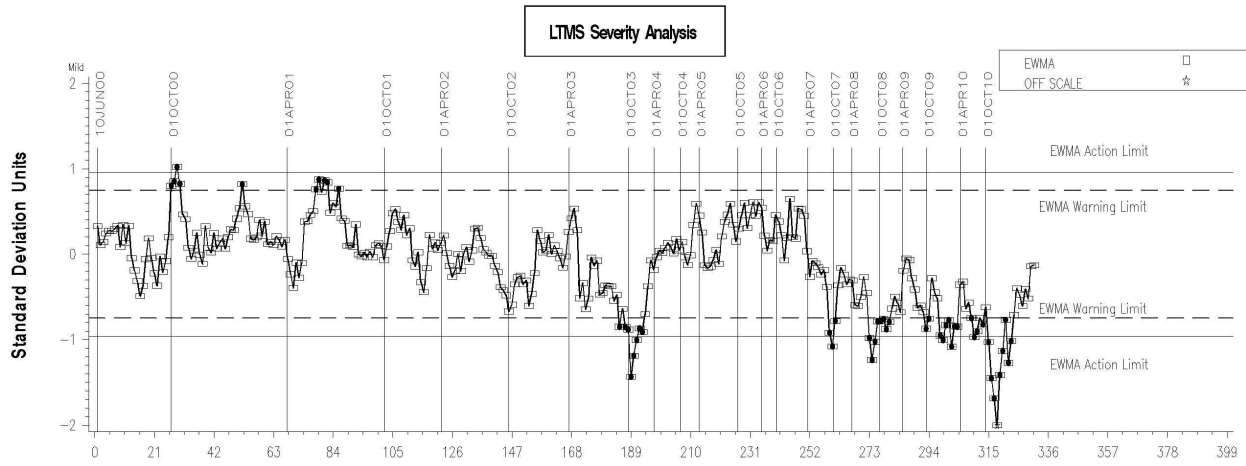


Figure 2
SEQUENCE IIIF INDUSTRY OPERATIONALLY VALID DATA



AVERAGE WEIGHTED PISTON DEPOSITS FNL ORIG UNIT RES

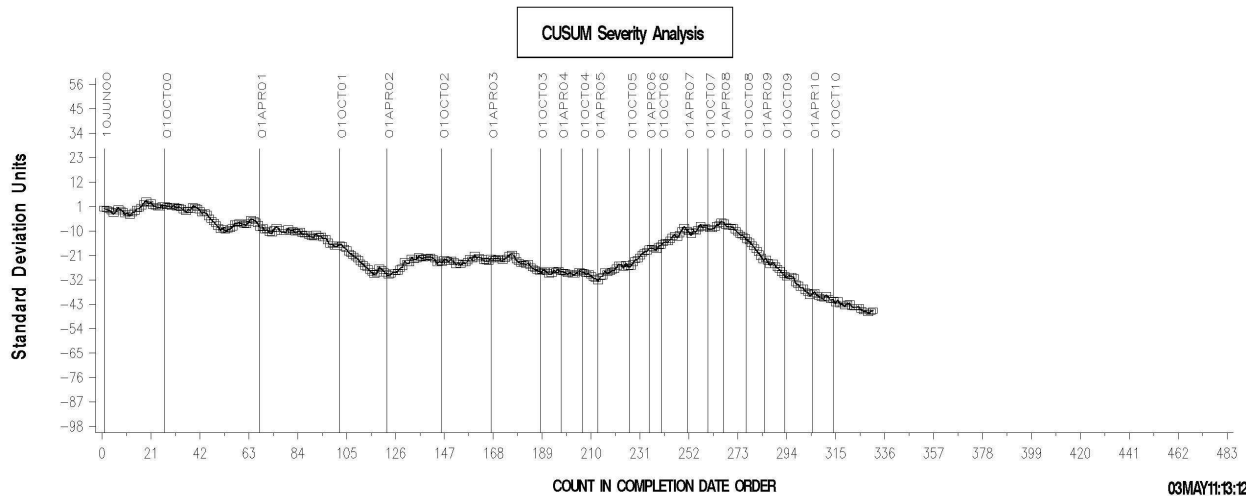
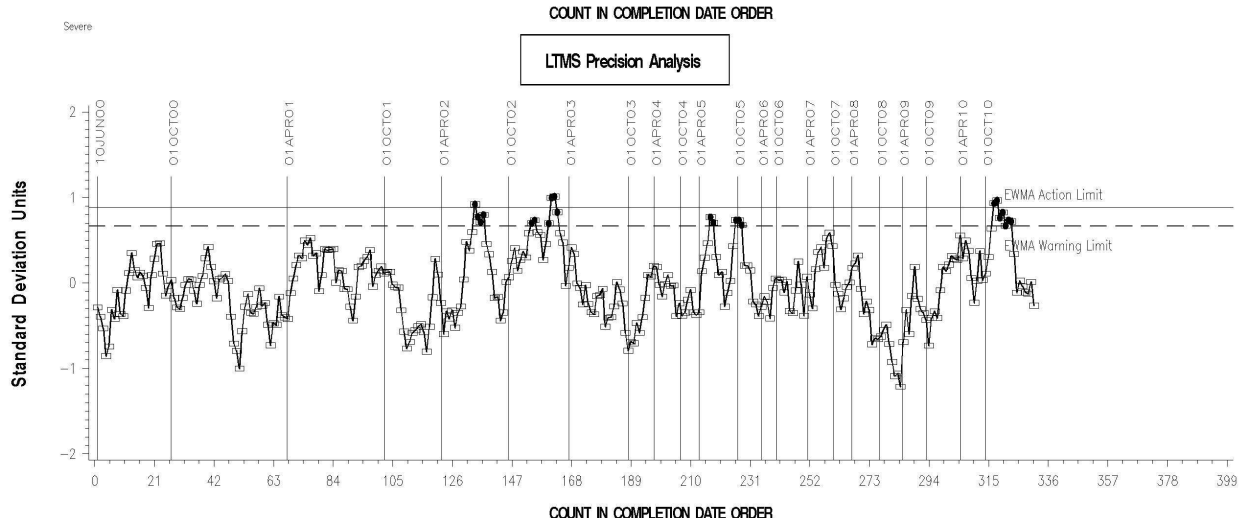
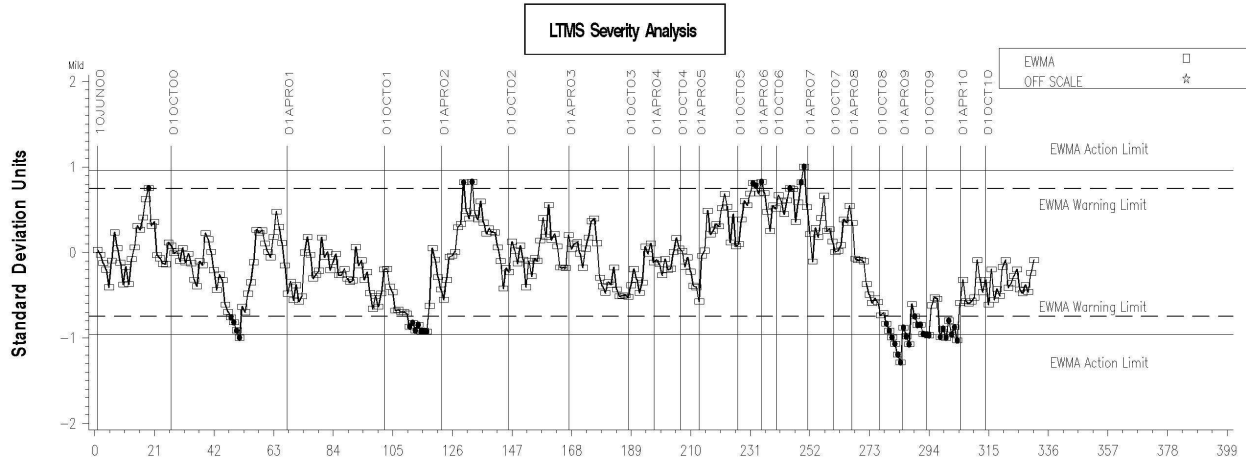


Figure 3
SEQUENCE IIIF INDUSTRY OPERATIONALLY VALID DATA



AVERAGE PISTON SKIRT VARNISH FINAL ORIG UNIT RES

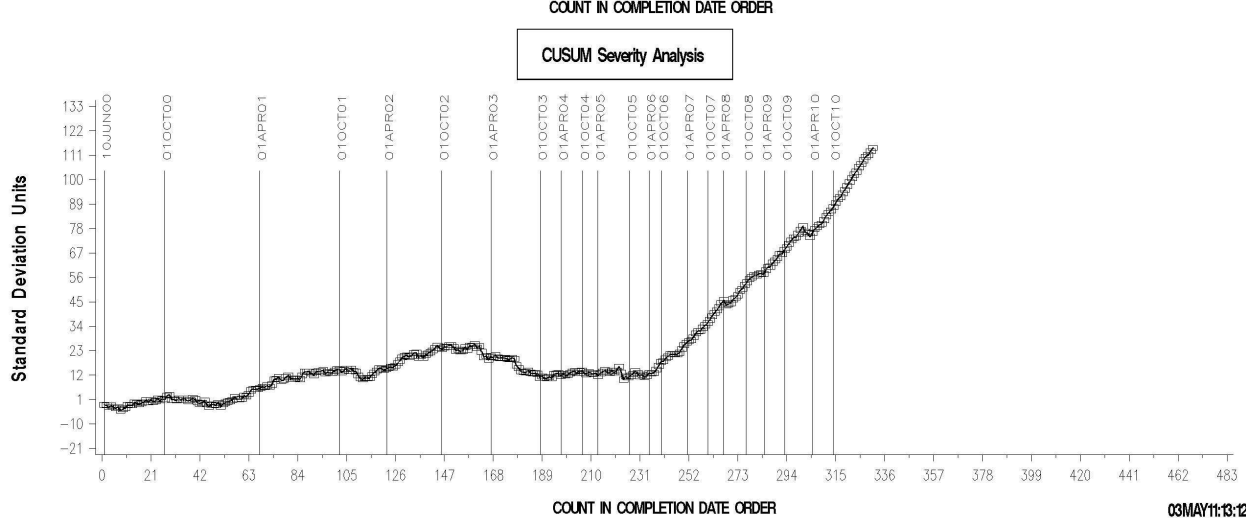
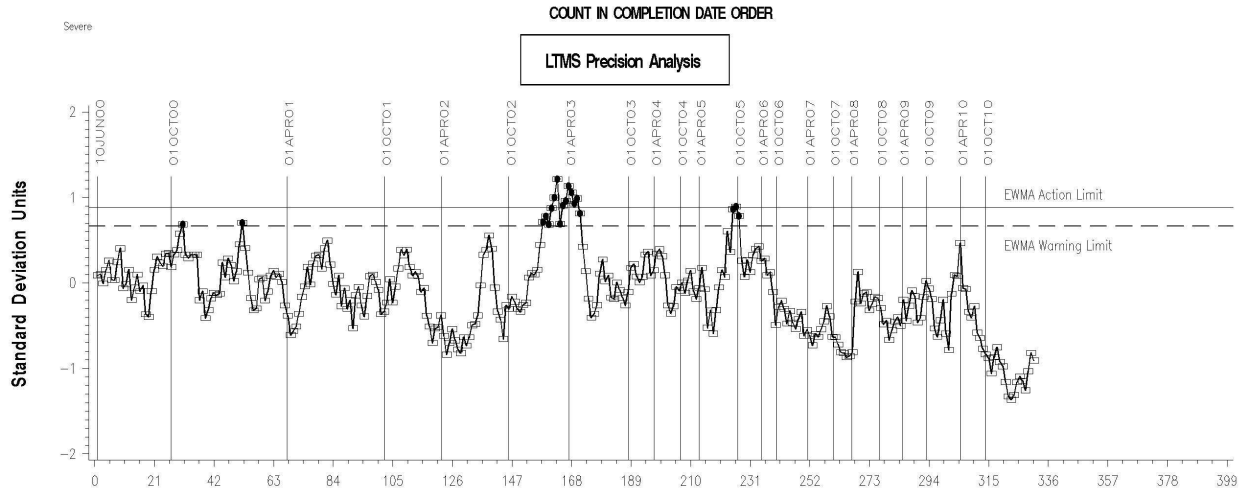
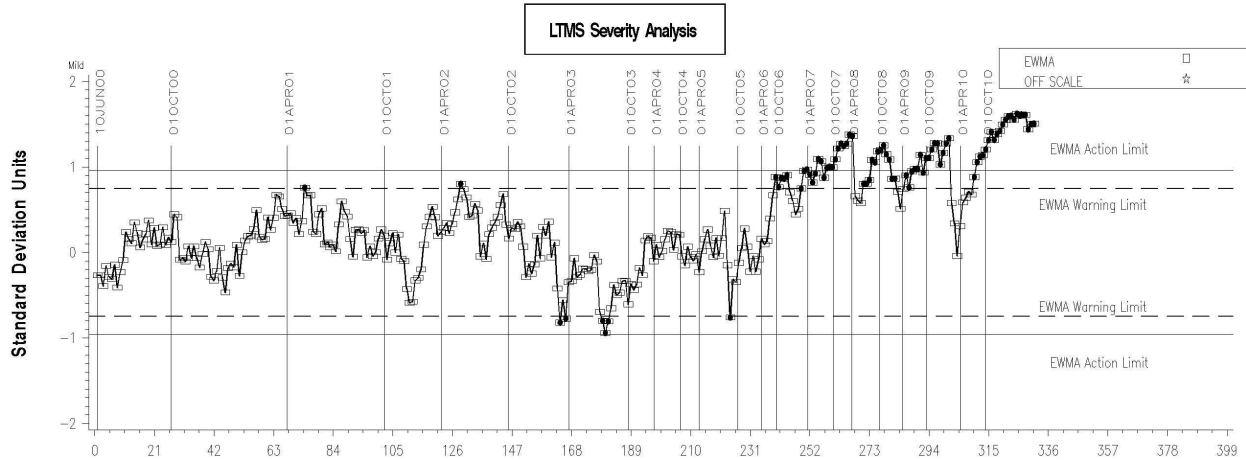


Figure 4
SEQUENCE IIIF INDUSTRY OPERATIONALLY VALID DATA



% VISCOSITY INCREASE @ 060 HOURS

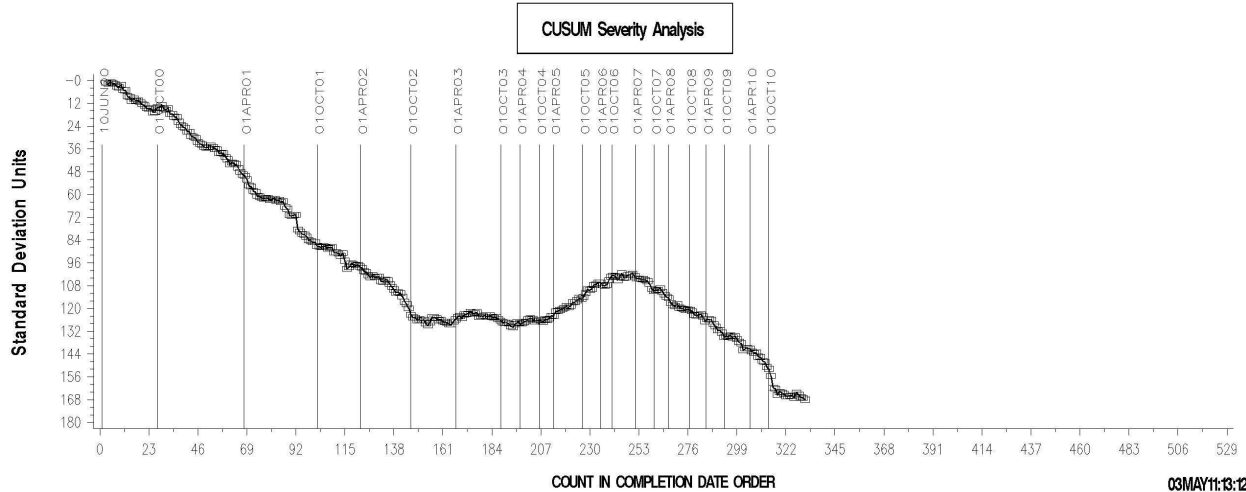
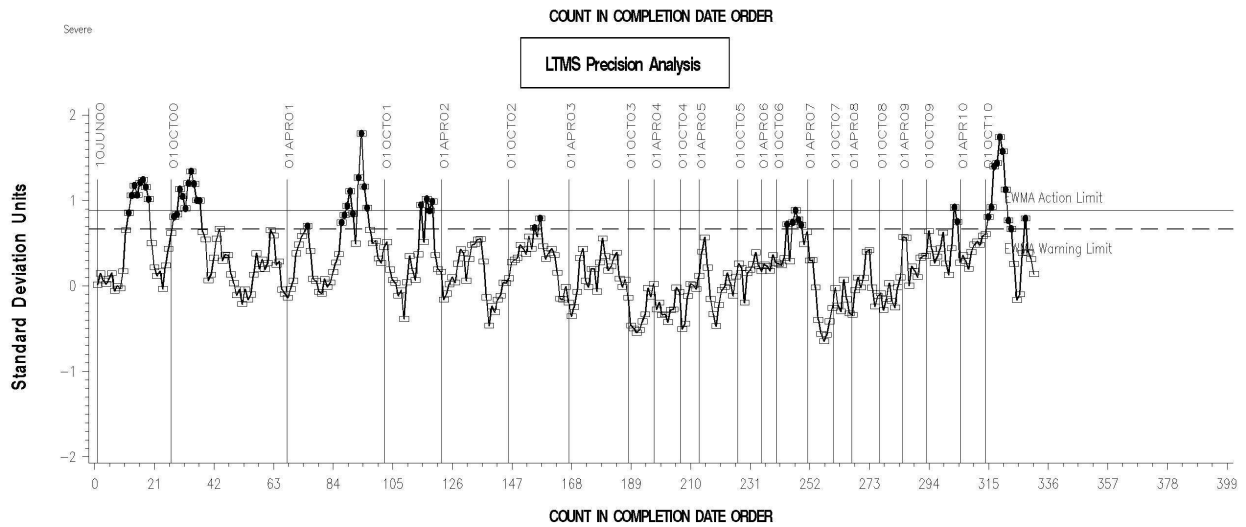
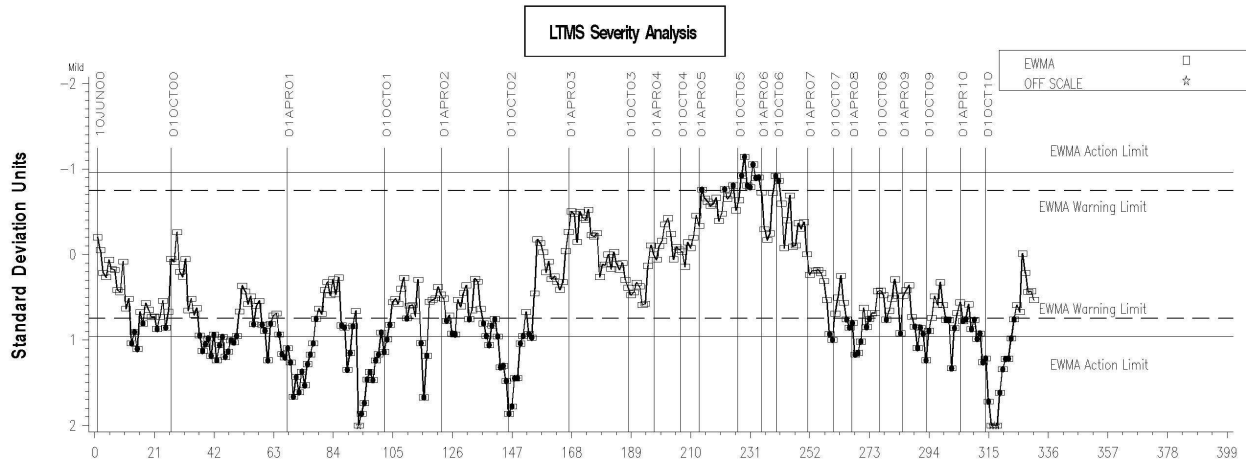


Figure 5-Percent Viscosity Increase Delta/s

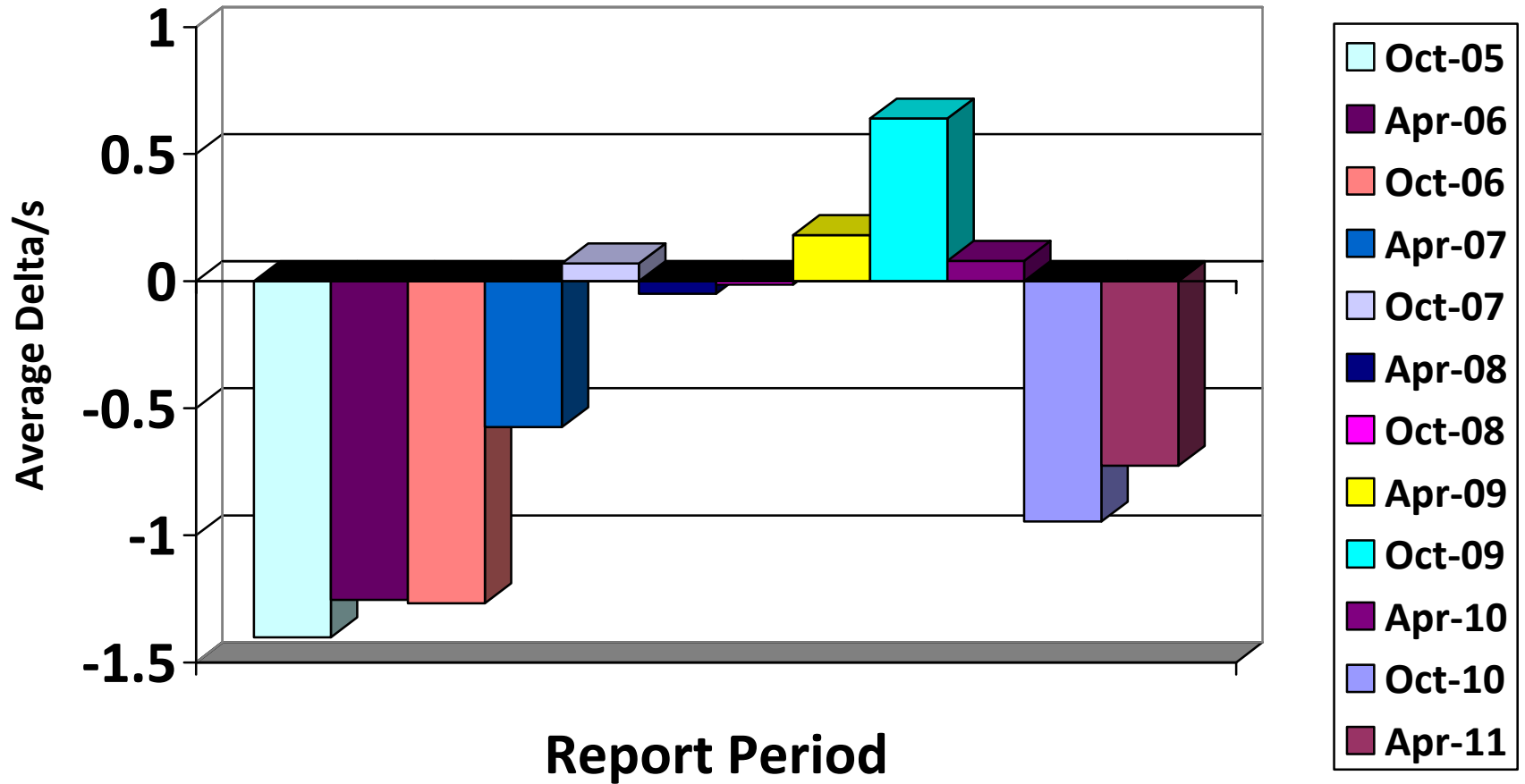


Figure 6-Weighted Piston Deposit Delta/s

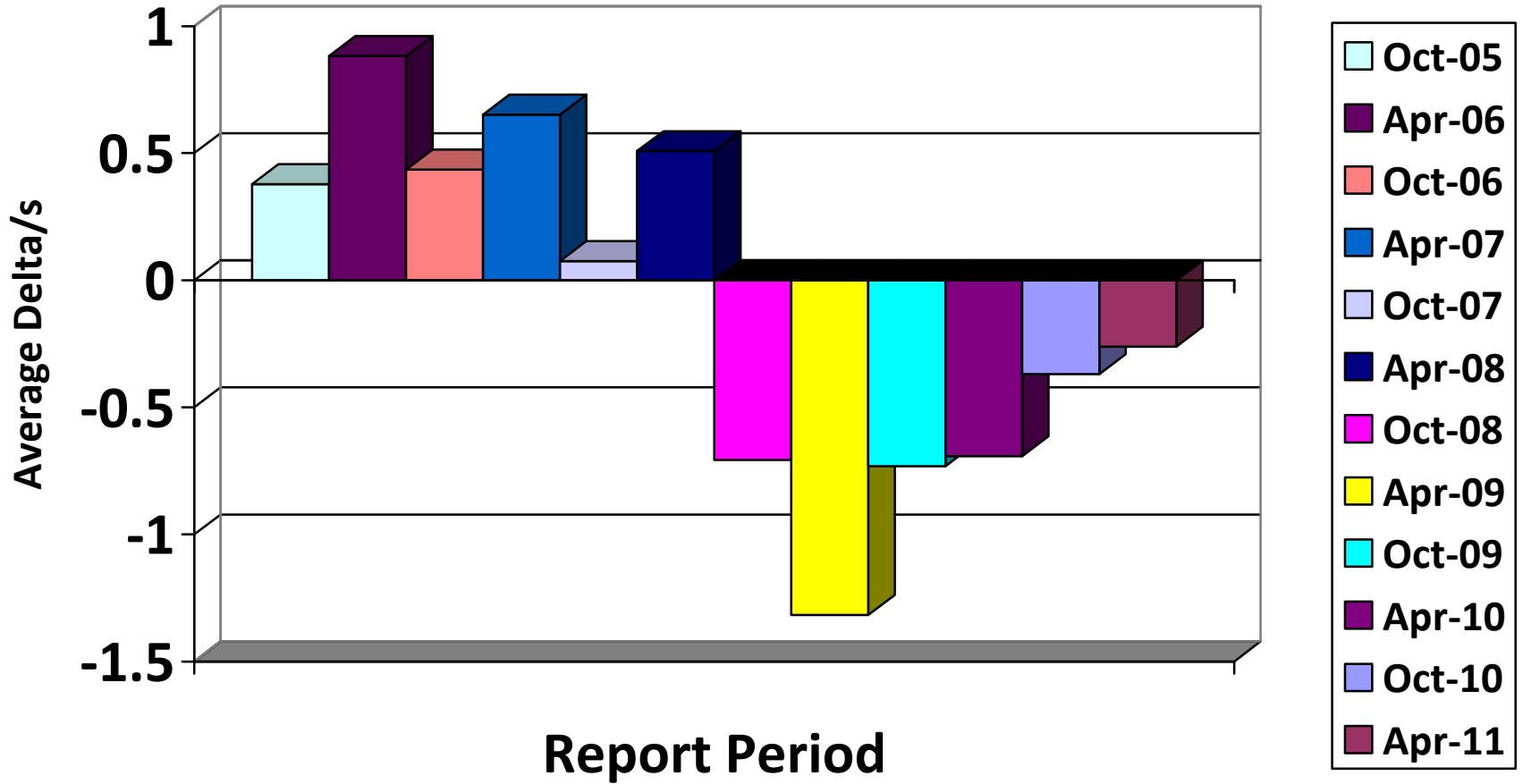
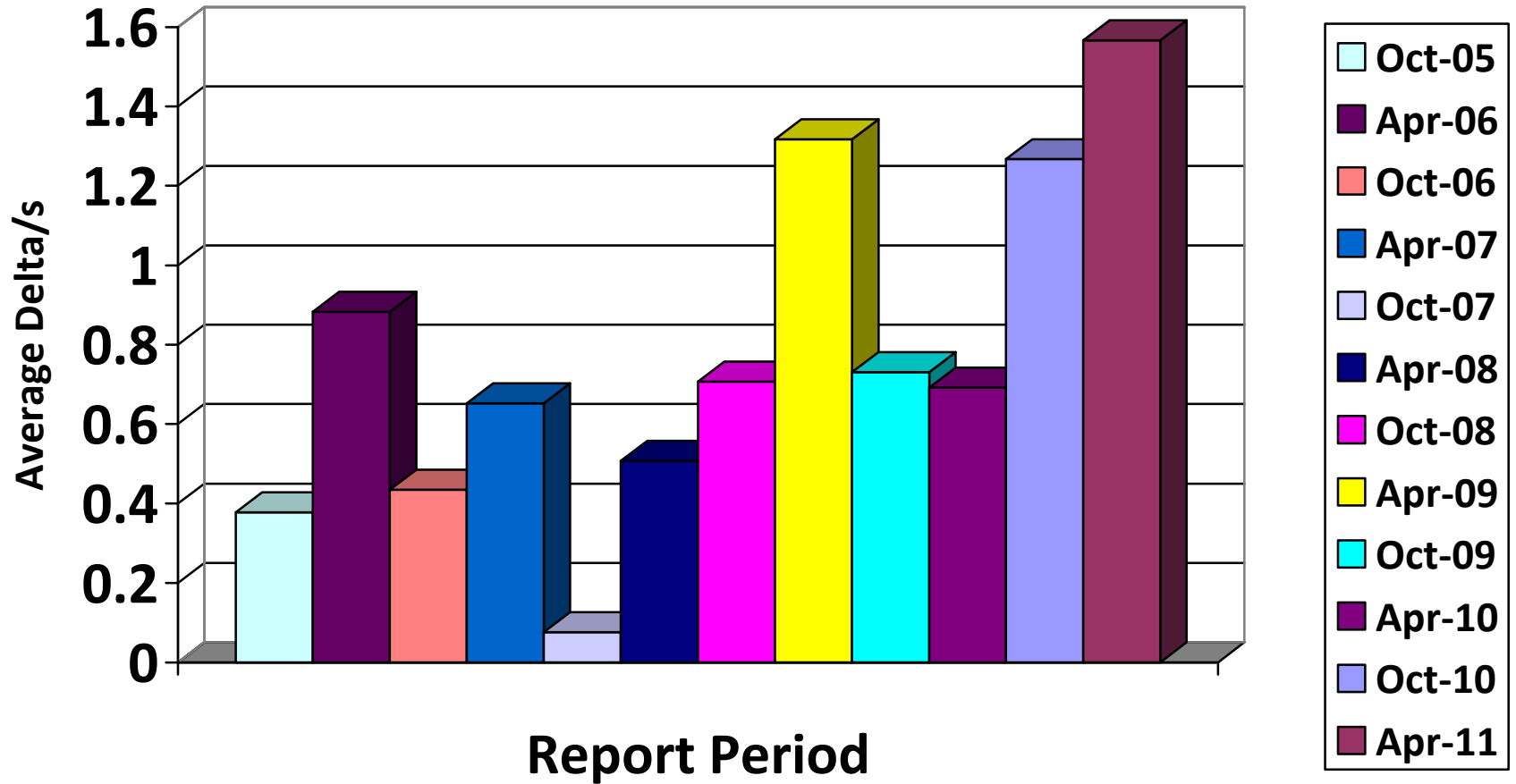


Figure 7-Average Piston Varnish Delta/s



**Figure 8-Percent Viscosity Increase @ 60 Hours
Delta/s**

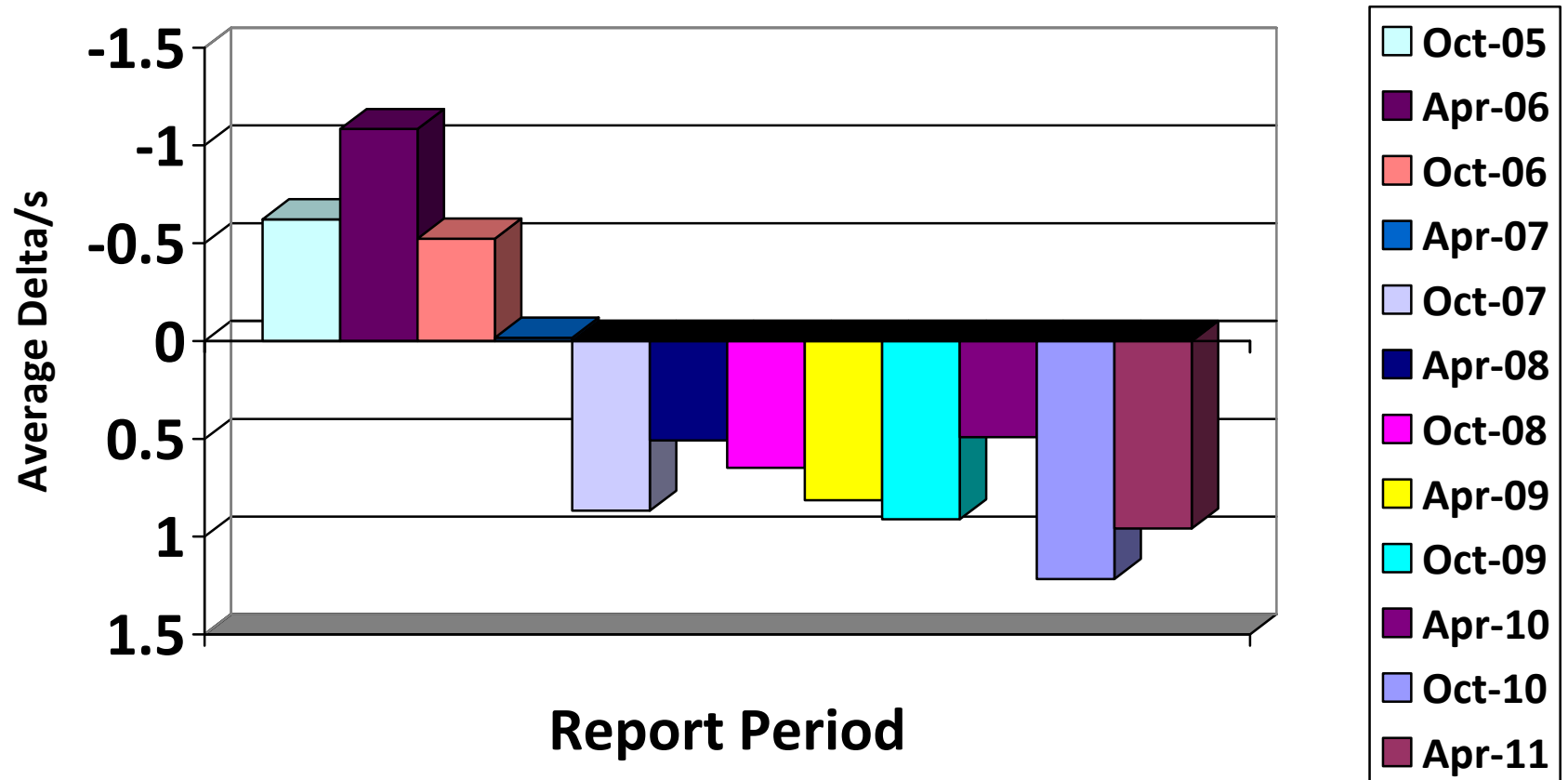


Figure 9-Percent Viscosity Pooled Standard Deviation

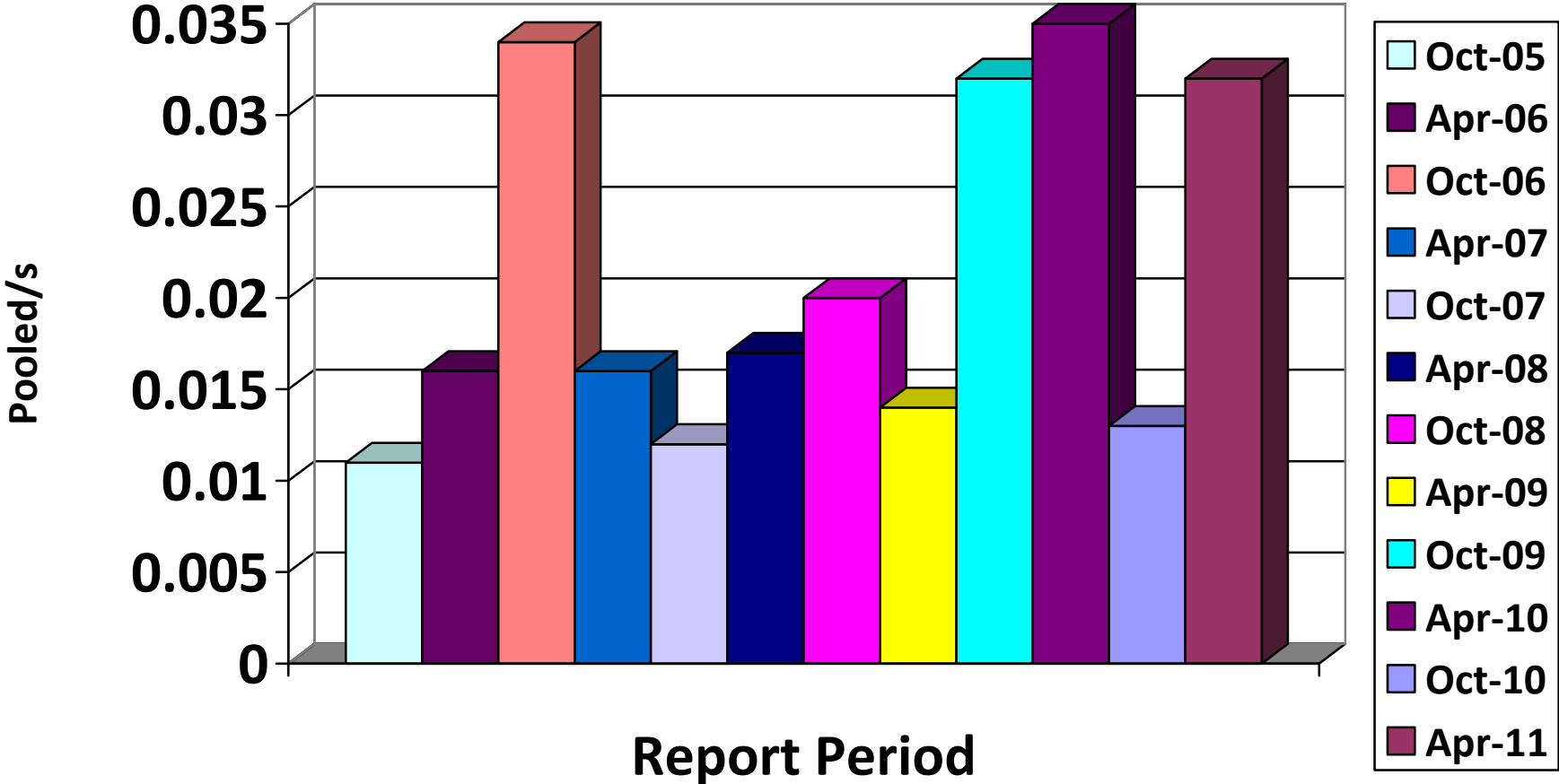


Figure 10-Weighted Piston Deposit Pooled Standard Deviation

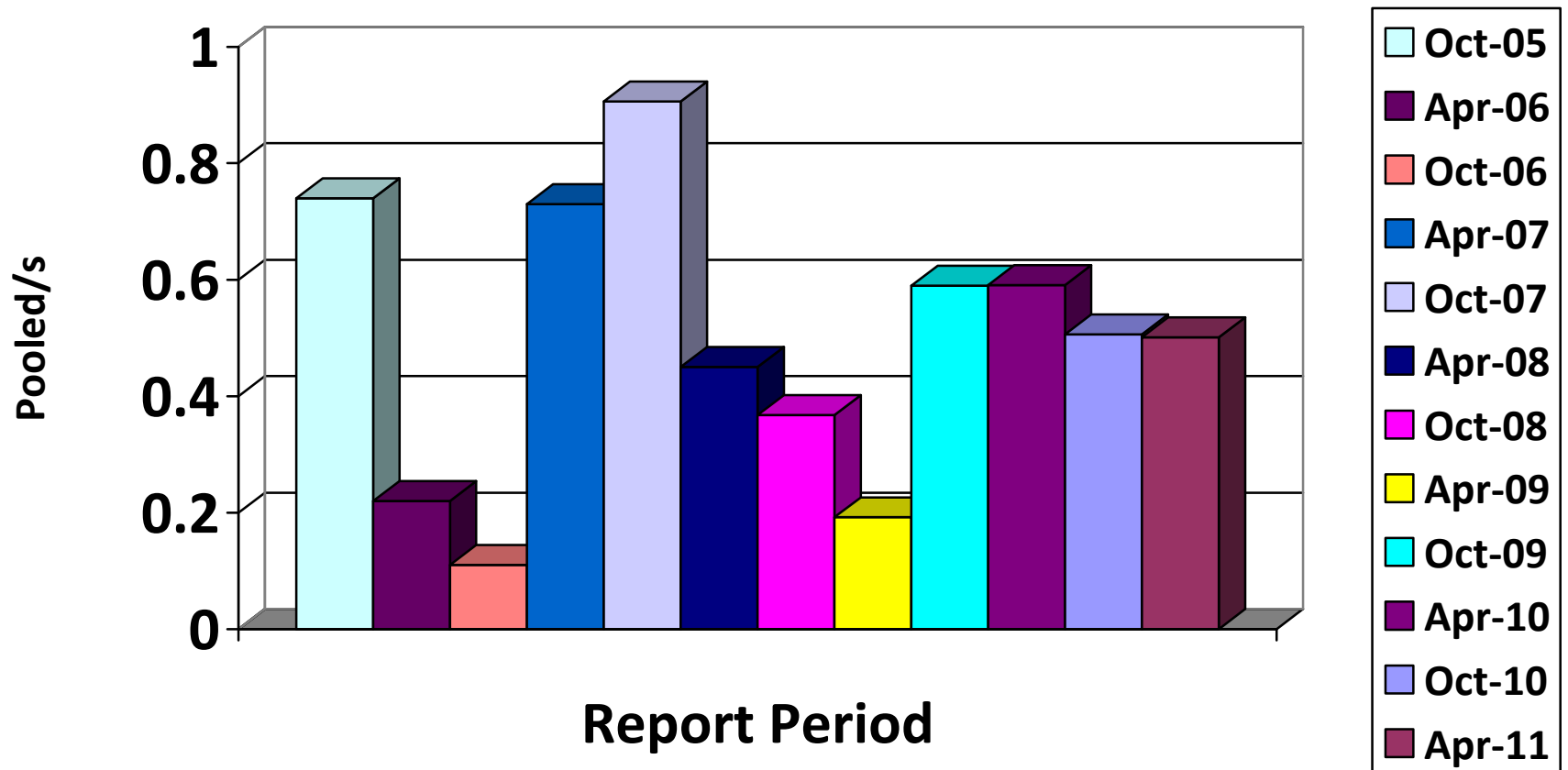
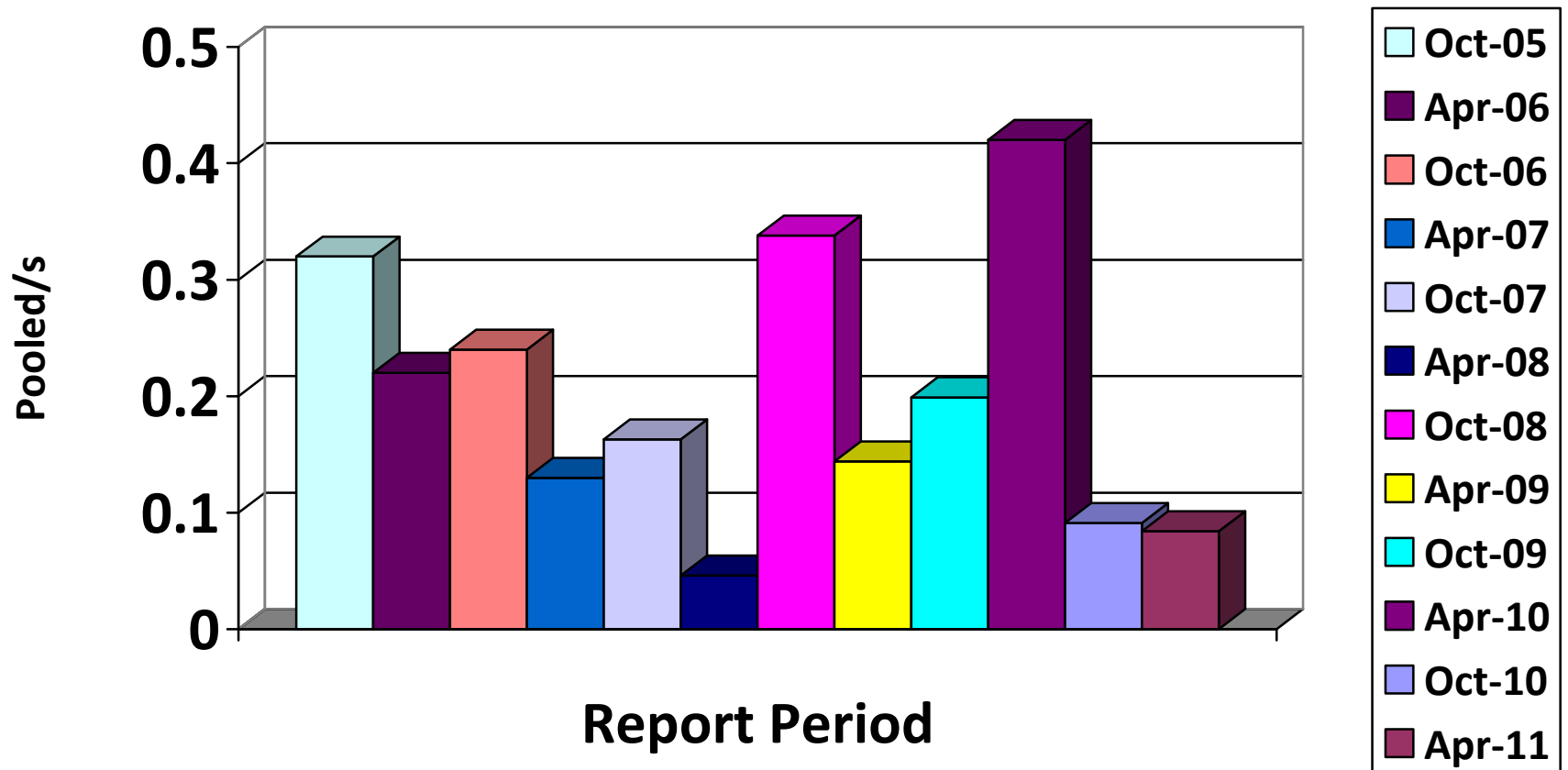


Figure 11-Average Piston Varnish Pooled Standard Deviation



**Figure 12-Percent Viscosity Increase @ 60 Hours
Pooled Standard Deviation**

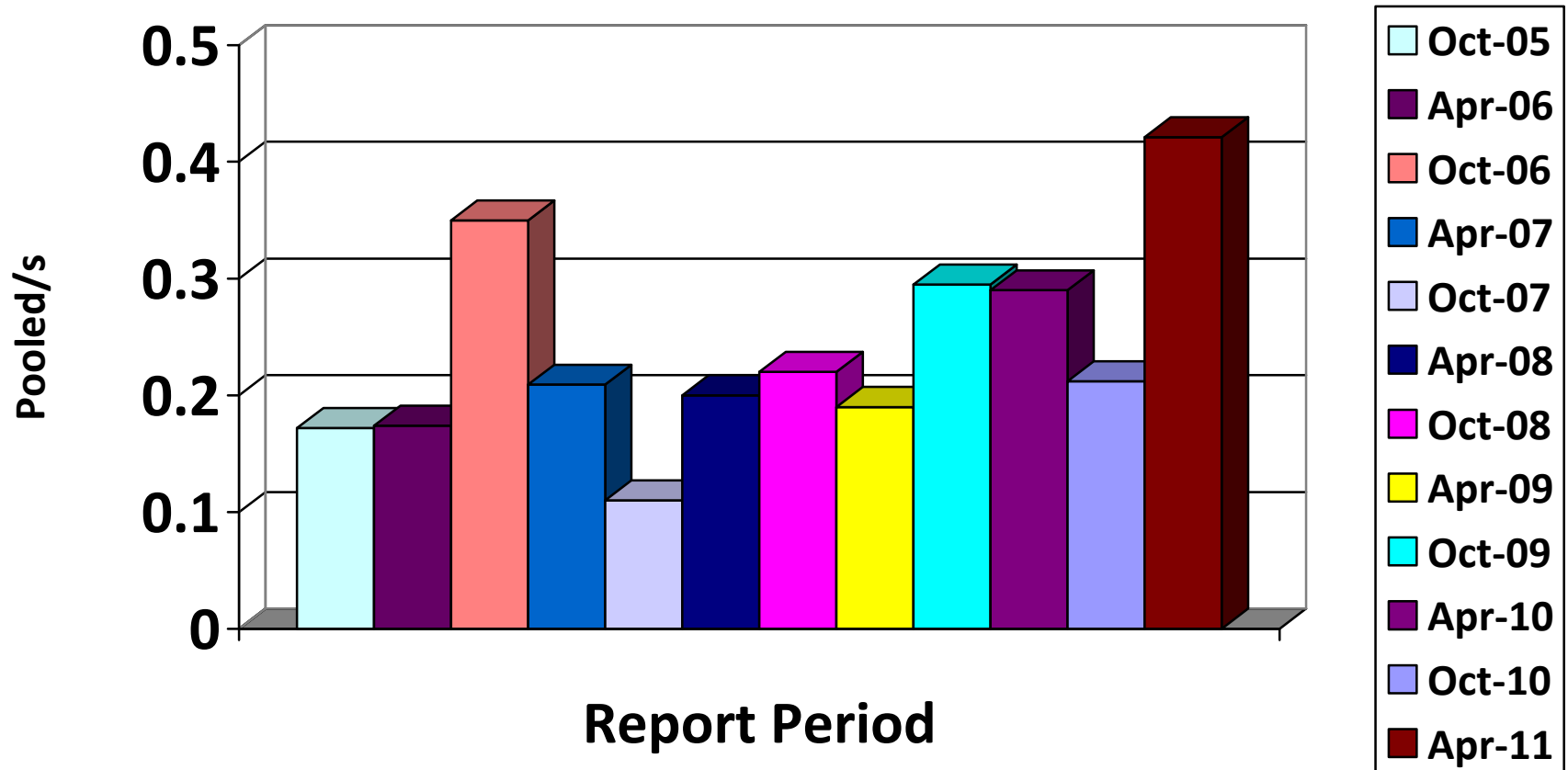


Figure 13 – Sequence IIIF Timeline

Date	Topic	Information Letter
6/10/2000	Revised Ring Sticking definitions implemented	00-2
7/25/2000	Oil Consumption as a test validity criteria dropped	00-2
8/28/2000	First occurrence of LC camshafts in LTMS data	
9/8/2000	Draft 3 of the Sequence IIIF Test Procedure released	00-1
9/27/2000	MRV & CCS Testing of used oil samples added	00-2
9/27/2000	Valve train assembly using build up oil implemented	00-2
10/4/2000	New QI U&L Values implemented	00-2
10/8/2000	First occurrence of Valve train assembly using build up oil in LTMS	00-2
12/6/2000	Oil Consumption as a test interpretability criteria added	00-3
4/25/2001	First occurrence of MB camshafts in LTMS data	
5/23/2001	Condenser Flow QI requirements dropped	01-1
5/23/2001	New oil addition at EOT dropped	01-1
5/23/2001	Condenser part number corrected	01-1
5/23/2001	Revised dipstick calibration curve implemented	01-1
5/23/2001	Revised MRV & CCS test procedures	01-1
5/23/2001	Upper limit of 8000cSt for viscosity measurements established	01-1
5/23/2001	Reexamination of Engine Speed and Condenser Coolant Out Temperature QI U&L values performed; no changes made	01-1
9/8/2001	Screened Average Cam-plus-lifter Wear (SACLW) replaces Average Cam-plus-lifter Wear (ACLW) as pass/fail parameter	01-2
9/8/2001	Valve train assembly using test oil reintroduced into IIIF test	01-2
9/12/2001	First occurrence of engine builds using test oil for valvetrain lubrication in LTMS	
11/28/2001	Sequence IIIF-HD Test Procedure Published	01-3
3/1/2002	Revised Sequence IIIF Test Procedure Published	02-1
3/15/2002	Sequence IIIFHD Test Procedure added to Revised Sequence IIIF Test Procedure. Editorial changes to IIIF Test Procedure also made and do	02-2
4/23/2002	Oil Filter and Oil Cooler Replacement Guidelines issued	02-3
6/1/2002	External Oil Bypass Valve System & Modified Oil Filter Adapter	02-4
12/15/2003	New Honing Procedure approved and added to Assembly Manual	
5/30/2003	New Oil Filter	03-1
6/30/2003	New Front Cover and Oil Filter Housing	03-1
6/30/2003	Sequence IIIG Dipstick	03-1
6/30/2003	Calibrated Flask for Initial Oil Charge	03-1
12/31/2003	New Solvent Specifications	03-1
10/29/2003	Revised Fuel Pressure Specification	03-3
10/29/2003	Automatic Parts Washing Machine Maintenance Requirement	03-3
10/29/2003	Main Bearing Bore Mandrel Procedure made optional	03-3
10/29/2003	Piston Ring Cleaning Requirements	03-3
10/29/2003	Additional Allowable RTV Sealing Compounds	03-3
10/29/2003	Main Bearing Cap Bolt Replacement Specification	03-3
10/29/2003	Revised Camshaft Measurement Procedure	03-3
10/29/2003	Revised Camshaft Lubrication & Installation Procedure	03-3
10/29/2003	Revised Oil Consumption Reporting Procedure	03-3
10/29/2003	Fluid Conditioning Module Equipment Specifications	03-3
10/29/2003	Revised Camshaft Measurement Equipment Specifications	03-3
10/29/2003	Rating Workshop Attendance Requirement	03-3
4/13/2004	Revised Intake Manifold Gasket	04-1
4/13/2004	Additional Allowable Sealing Materials	04-1
5/12/2004	Undercrown Rating Area Definition Clarification	04-2
5/12/2004	Flow Meter Specifications	04-2
5/12/2004	MRV Reporting	04-2
5/12/2004	Amount of Test Oil used for Camshaft & Lifter Lubrication	04-2
11/4/2004	Torque Specs for Powered Metal Rods	04-3
11/4/2004	Editorial Changes to Precision Statements	04-3
11/4/2004	New Front and Rear Main Seals	04-3
11/4/2004	New Exhaust Valves	04-3
11/4/2004	New Oil Pan Gasket	04-3
1/7/2005	Updated Precision Statements	05-1

1/7/2005	Engine Build Worksheets	05-1
1/7/2005	Clarification of Solvent Specifications	05-1
1/7/2005	Provisions for Adjustment to Calibration Period for Donated Oil Test Programs	05-1
8/10/2005	Corrections to Table A7.1	05-2
12/16/2006	Revised Rating Workshop Attendance Requirements	05-3
12/16/2006	Acceptance of Torque Wrench ETW-E180	05-3
4/4/2006	Added requirements for fuel monitoring and revised aromatic content in fuel specification	06-1
8/18/2006	Procedural enhancements from unified engine build	06-2
8/18/2006	Revised Table A4 to clarify methods and measurement units	06-2
10/3/2006	Change to PMNS connecting rods	06-3
11/7/2006	Change in rater calibration requirements	06-4
3/19/2007	Added IIIFVIS test procedure	07-1
4/1/2007	Revised Cylinder head torquing procedure in engine assembly manual	
6/5/2007	Changed designation of IIIFVIS procedure to IIIFVS	07-2
6/5/2007	Changed values in Table A4 to metric	07-2
12/13/2007	Added substitute Rocker Cover Bushing to Test Method	07-3
12/13/2007	Change name of Rater Calibration workshop	07-3
12/13/2007	Added provisions to allow test stand to be calibrated as IIIF and IIIG	07-3
9/1/2009	Deleted requirement to send hard copy final report to TMC	09-1
10/1/2009	BC7 Valve springs to be scrapped	
12/14/2009	Allowed use of Teflon tape and 1/16" Thermocouples	09-2
12/14/2009	Corrected reference to annex in Section 10.8.10.1	09-2
12/14/2009	Revised U & L limits for condenser coolant outlet temp QI calculations	09-2
5/21/2010	Added additional criteria for oil filter change	10-1
5/21/2010	AFR real time measurements for AFR verification	10-1
6/24/2010	Enhancements for pre and post test camshaft and lifter handling	10-2
7/19/2010	NOx measurements no longer required	10-3
8/3/2010	Revised calibration periods for multiple stand labs	10-4
3/15/2011	1st Occurrence of J cams	