



# Test Monitoring Center

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412-365-1000

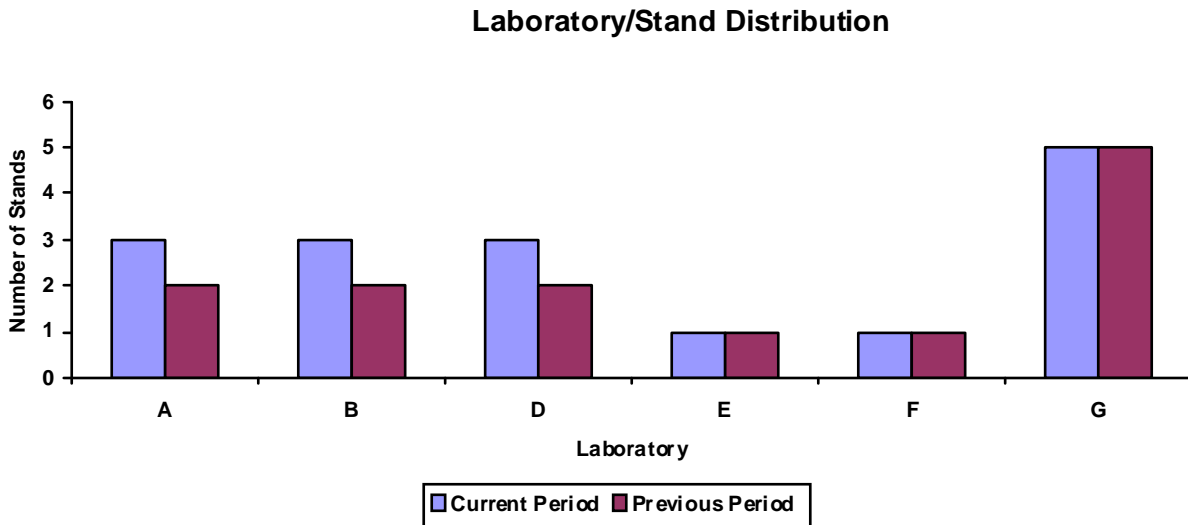
Memorandum: 10-009  
Date: April 21, 2010  
To: David Glaenzer, Chairman, Sequence III Surveillance Panel  
From: Richard E. Grundza *RE Grundza*  
Subject: Sequence IIIG/AB Semiannual Report: October 1, 2010 through March 31, 2010

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

## Lab/Stand Distribution

	Reporting Data	Calibrated as of March 31, 2010
Number of Laboratories:	6	6
Number of Test Stands:	16	16

The following chart shows the laboratory/stand distribution:

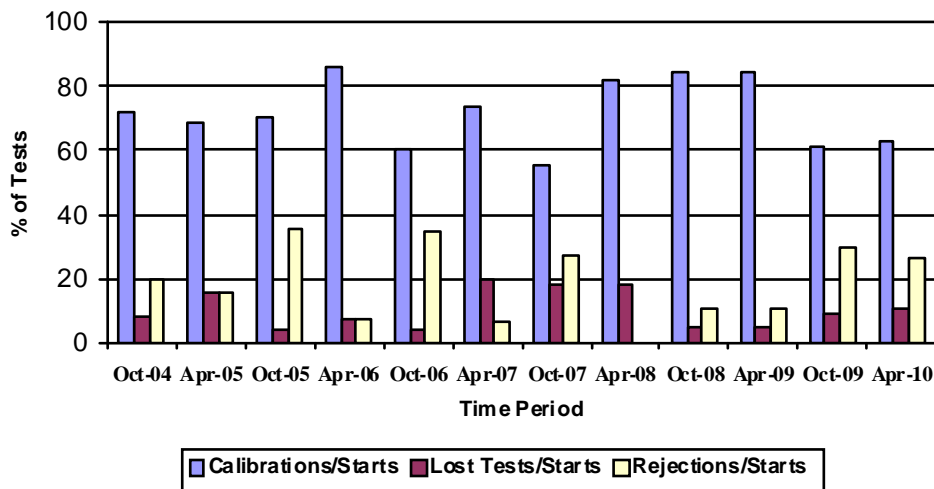


The following summarizes the status of the reference oil tests reported to the TMC:

Calibration Start Outcomes	TMC Validity Codes	No. of Tests
Operationally and Statistically Acceptable	AC	17
Failed Acceptance Criteria	OC	7
Aborted	XC	3
Total		27

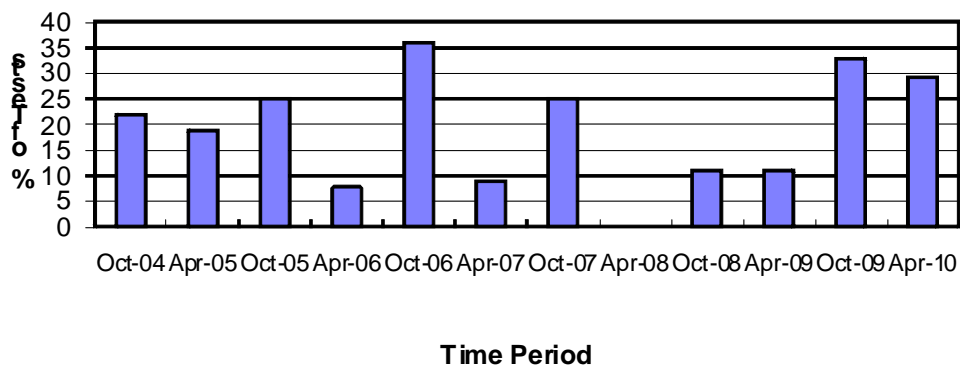
Calibrations per start, lost tests per start and rejection rates are summarized below:

### Calibration Attempt Summary



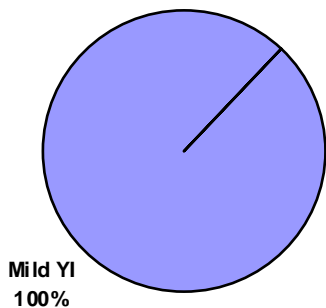
The calibration per start rate has increased slightly with respect to the previous period, while lost test has increased and rejected test per start rate has decreased with respect to the previous period.

### Rejected Test Rate for Operationally Valid Tests

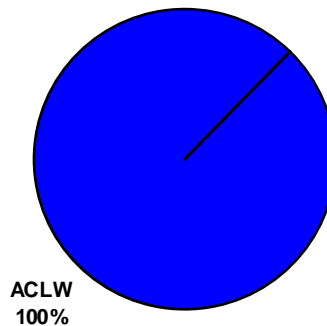


Seven tests failed the acceptance criteria during the period. The following charts summarize the reasons and breakdown by parameter for the failed test:

**Distribution of LTMS Stand Alarms**



**Distribution of Stand Alarms by Parameter**

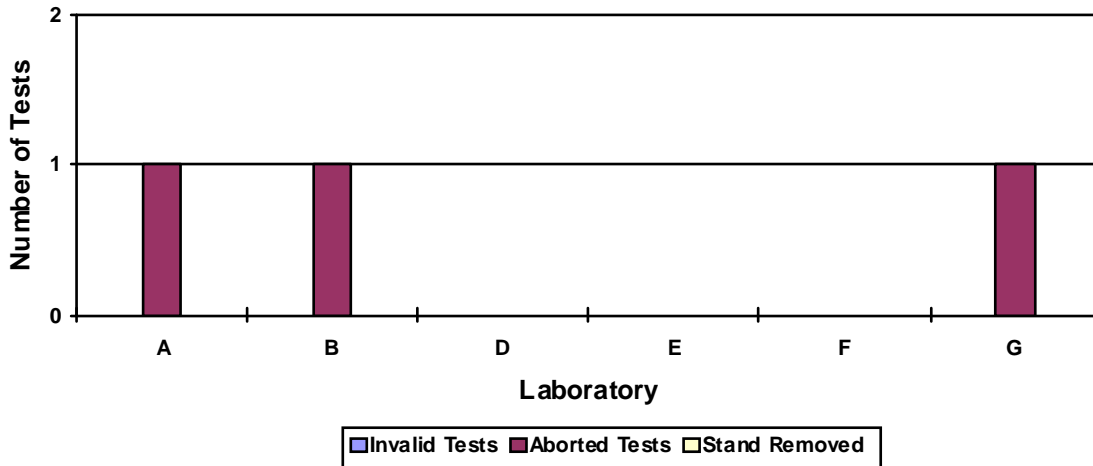


There were no LTMS Deviations written this period. Since its introduction in 2003, there has been one Sequence IIIIG LTMS deviation.

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

<b>Lab</b>	<b>Reason for Lost Test</b>	<b>Number of Tests</b>	<b>Breakdown of Tests (LC/RC/XC/MC)</b>
A	Oil Temperature Control	1	0/0/1/0
B	Test Not Needed Due To Surveillance Panel Action	1	0/0/1/0
G	Oil Leak	1	0/0/1/0

### Lost Test Distribution



#### Information Letters

There were two information letters issued this report period. Items changed with these information letters are documented in the IIIG/AB timeline (Figure 13).

#### Severity and Precision Analysis

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

Industry Severity Summary			
Parameter	Average $\Delta/s$	Pooled standard deviation (degrees of freedom)	Average $\Delta$ , in reported units
PVIS	0.080	0.259 (df=23)	3.1 % Viscosity Increase <sup>1</sup>
WPD	-0.599	0.444 (df=23)	-0.27 Merits
ACLW	-2.870	0.480 (df=23)	-44.6 $\mu\text{m}^2$
MRV <sup>3</sup>	0.596	0.206 (df=13)	N/A (no appropriate baseline) <sup>4</sup>
PHOS <sup>5</sup>	-0.530	3.121 (df=23)	-1.65% <sup>6</sup>

<sup>1</sup> At the GF-5 Pass Limit of 150% Viscosity Increase

<sup>2</sup> At the GF-5 Pass Limit of 60 $\mu\text{m}$

<sup>3</sup> Sequence IIIGA Test Parameter only; Reference Oil 435 data excluded from calculations

<sup>4</sup> MRV does not have a specific GF-4 Pass Limit; Pass Limit is lack of Yield Stress.

<sup>5</sup> Sequence IIIGB Test Parameter only

<sup>6</sup> PHOS GF-5 Limit 79%

Average $\Delta/s$ Results, by Laboratory					
Laboratory	PVIS	WPD	ACLW	MRV <sup>1</sup>	PHOS
A	0.91	-1.00	-1.08	0.774	-0.655
B	-0.19	-0.84	-2.22	0.614	-0.175
D	-0.36	-0.41	-2.75	0.547	0.884
E	-0.75	-0.12	-4.09	---	-6.715
F	-0.45	-0.57	0.70	-0.404	-0.783
G	0.27	-0.44	-4.07	0.710	-0.477

<sup>1</sup> Reference oil 435 data excluded from calculations

#### *Percent Viscosity Increase (PVIS)*

PVIS began the period in warning alarm but was in control after seven tests were reported (see Figure 1). With the exception of two alarms at the beginning of the period, precision was in control for the remainder of the period. The average delta/s value for the period is 0.080 is on or near target (see Figure 4). The pooled standard deviation for the period, 0.259, has improved since last period.

#### *Weighted Piston Deposits (WPD)*

WPD began the period with a series of seven alarms and ended the period with a warning alarm (severe direction), while precision was in control for the period (see Figure 2). The average delta/s for the period, -0.599 was severe (see Figure 5). The pooled standard deviation for the period, 0.444, has improved compared to previous period (see Figure 8).

#### *Average Camshaft-plus-Lifter Wear (ACLW)*

ACLW has been in severity alarm the entire period (see Figure 3). Precision control charts began the period in control, but have been in alarm for most of the period. Severity for the period was mild with an average delta/s value of -2.780 (see Figure 6). The pooled standard deviation for the period, 0.480, has degraded with respect to the previous period (see Figure 9). A large number of very mild results (>4s) were noted toward the end of the period. These results were observed in multiple labs. A task force was formed to attempt to resolve the situation and was to report to the panel on or about April 6, 2010.

#### *Mini Rotary Viscometer (MRV)*

The MRV control charts are shown for informational purposes in Figure 10. With the exception of a warning alarm, severity was in control for the period. Precision was in control for the period. The average  $\Delta/s$  value for the period, 0.596, was severe for the period and is shown in Figure 11. The pooled standard deviation for the period, 0.206, has changed little, when compared to the last period and is shown in Figure 12.

#### *Phosphorus Retention (PHOS)*

PHOS severity and precision charts began the period in control, but ended the period in warning alarm (see Figure 13). The average  $\Delta/s$  value for the period, -0.530, was severe for the period and is shown in Figure 14. The pooled standard deviation for the period, 3.121, has degraded, when compared to the previous period and is shown in Figure 15. The severity and precision charts appear to be heavily influenced by one result, -6.715  $\Delta/s$  from target.

#### QI Deviations

There were a total of three QI Deviations written this period. One QI deviation was issued for oil temperature control generating a QI value below 0.000. A second QI deviation was issued for

condenser coolant temperature control issues and a third deviation was generated for right exhaust backpressure control issues. A total of nine QI deviations have been written to date.

### Hardware

H pour code cams were noted in the reference tests data base this report period.

### Reference Oils

Oil	TMC Inventory, in gallons	TMC Inventory, in tests (4 gal/test)	Laboratory Inventory, in tests	Estimated life
434	9	2	4	<1 year
434-1	467	116	3	~10 years
435	21	5	5	~ 2 years
435-1	600	150	5	~10 years
438	429	107	4	~10 years

One lab visit was conducted during this report period. No significant discrepancies were noted during this visit.

REG/reg

### Attachments

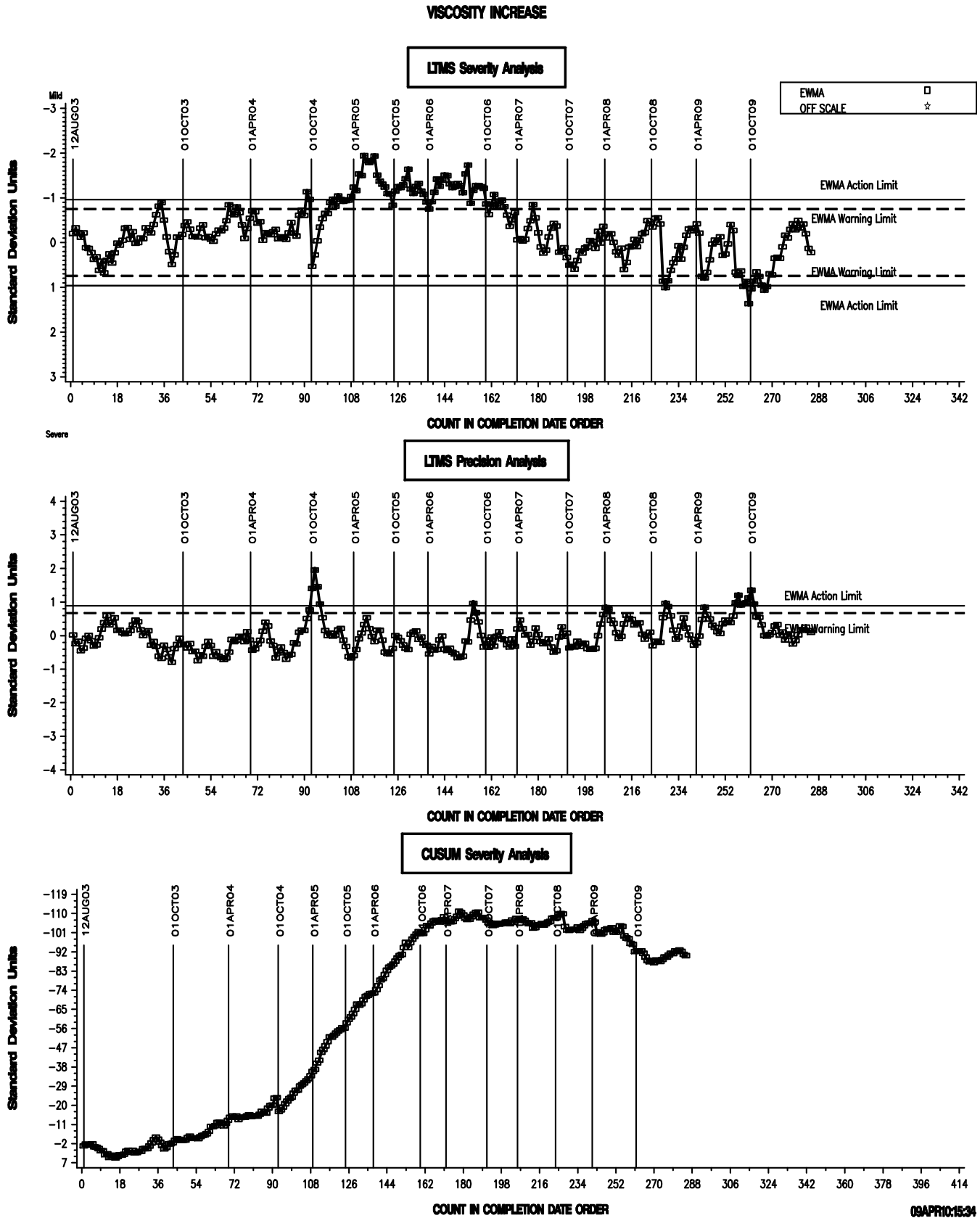
c: F. M. Farber, TMC  
J. A. Clark, TMC  
Sequence III Surveillance Panel  
<ftp://ftp.astmtmc.cmu.edu/docs/gas/sequenceiii/semiannualreports/IIIG-04-2010.pdf>

Distribution: Electronic Mail

List of Figures

- Figures 1, 2, and 3 are EWMA severity and precision control charts and also the CUSUM  $\Delta/s$  plots of PVIS, WPD, and ACLW, annotated with date lines, using the same data set as the EWMA severity and precision control charts. Transformed units are used, when appropriate.
- Figures 4, 5, and 6 are bar charts of average  $\Delta/s$ , by report period, for PVIS, WPD, and ACLW.
- Figures 7, 8, and 9 are bar charts of pooled standard deviation, by report period, for PVIS, WPD, and ACLW.
- Figure 10 is EWMA severity and precision control charts and also the CUSUM  $\Delta/s$  plots of MRV, annotated with date lines, using the same data set as the EWMA severity and precision control charts. Transformed units are used.
- Figure 11 is a bar chart of average  $\Delta/s$ , by report period, for MRV.
- Figure 12 is a bar chart of pooled standard deviation, by report period, for MRV.
- Figure 13 is EWMA severity and precision control charts and also the CUSUM  $\Delta/s$  plots of PHOS, annotated with date lines, using the same data set as the EWMA severity and precision control charts.
- Figure 14 is a bar chart of average  $\Delta/s$ , by report period, for PHOS.
- Figure 15 is a bar chart of pooled standard deviation, by report period, for PHOS.
- Figure 16 is the Sequence IIIIG/AB Timeline.

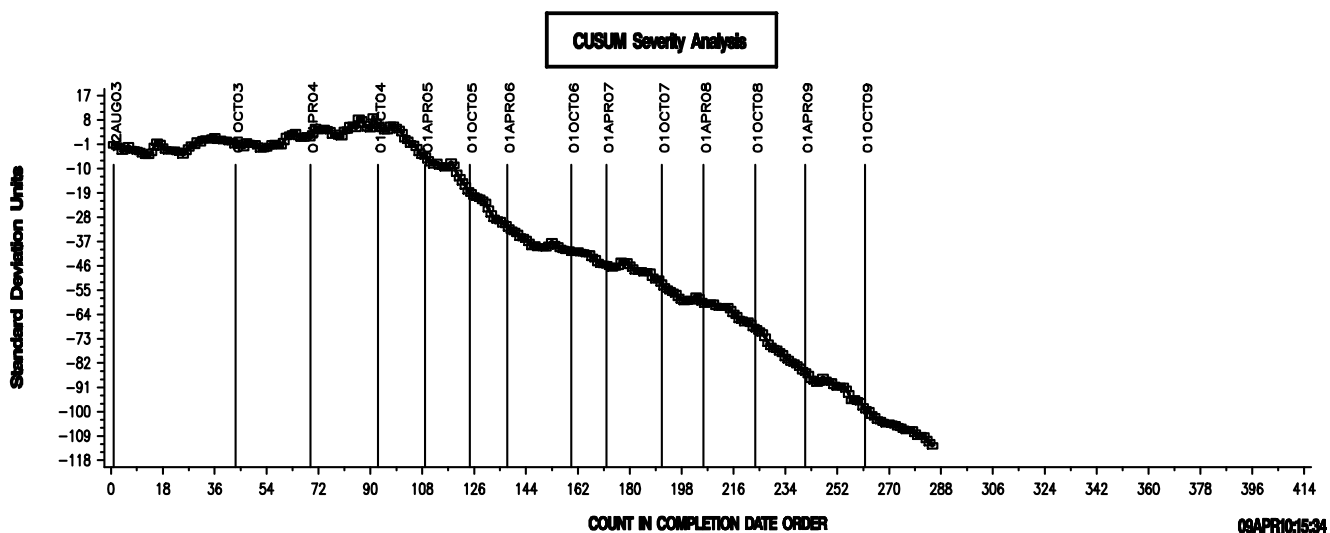
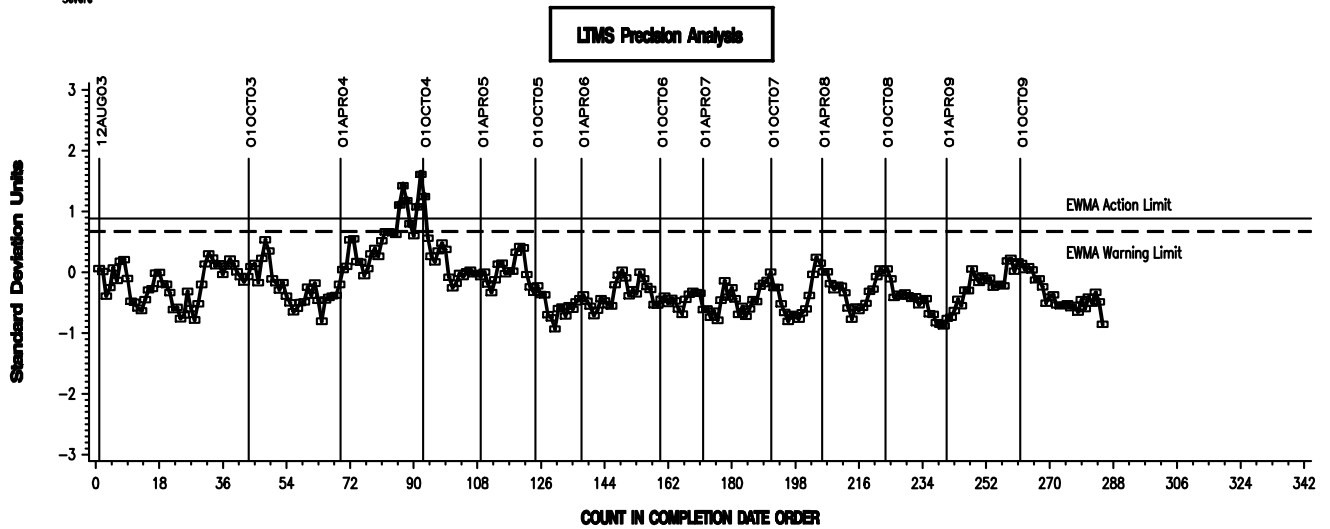
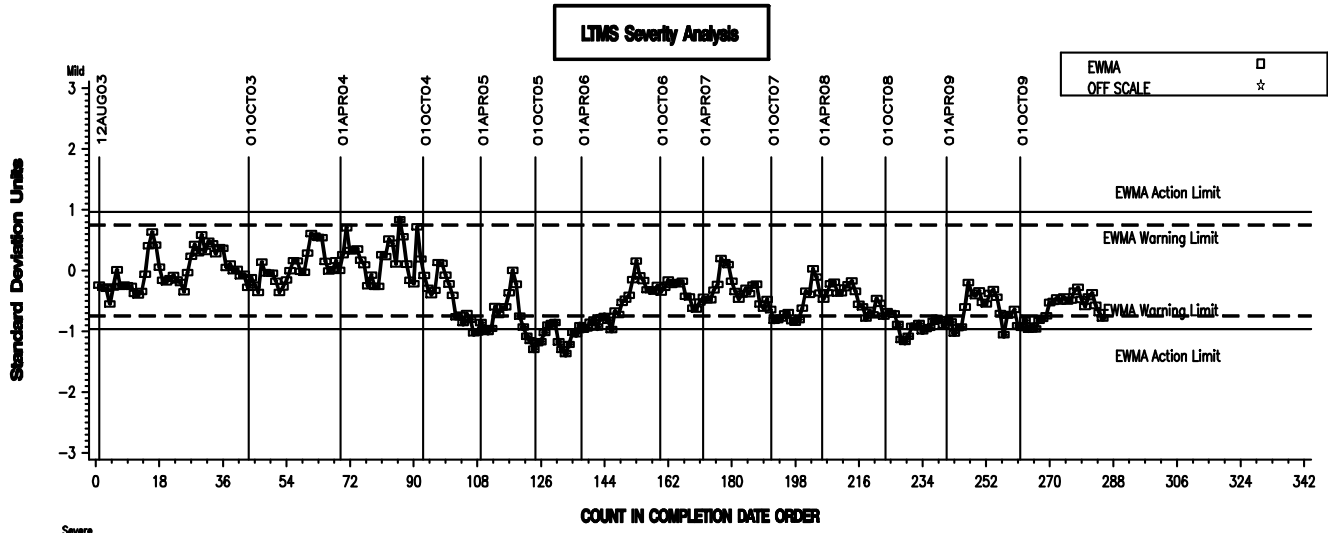
**Figure 1**  
**SEQUENCE III G INDUSTRY OPERATIONALLY VALID DATA**





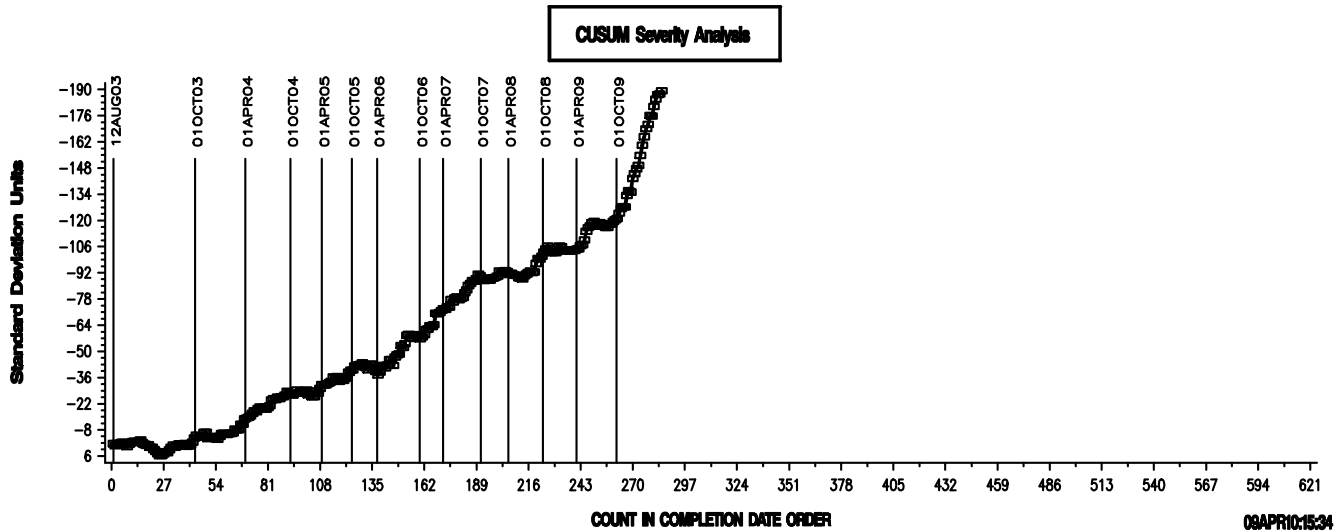
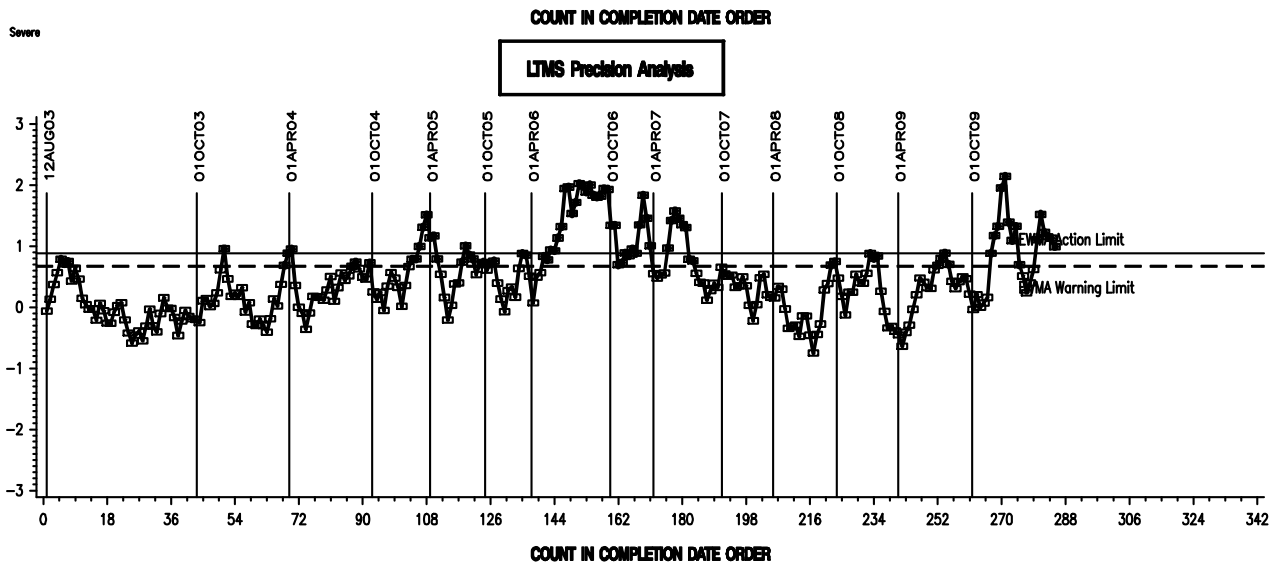
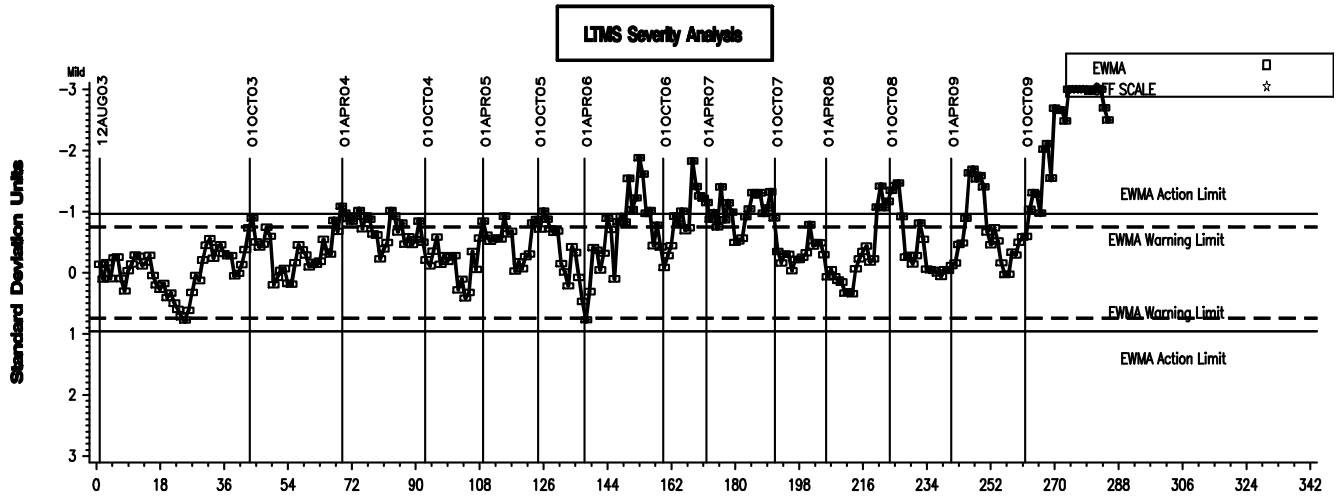
**Figure 2**  
**SEQUENCE III G INDUSTRY OPERATIONALLY VALID DATA**

**AVERAGE WEIGHTED PISTON DEPOSITS**

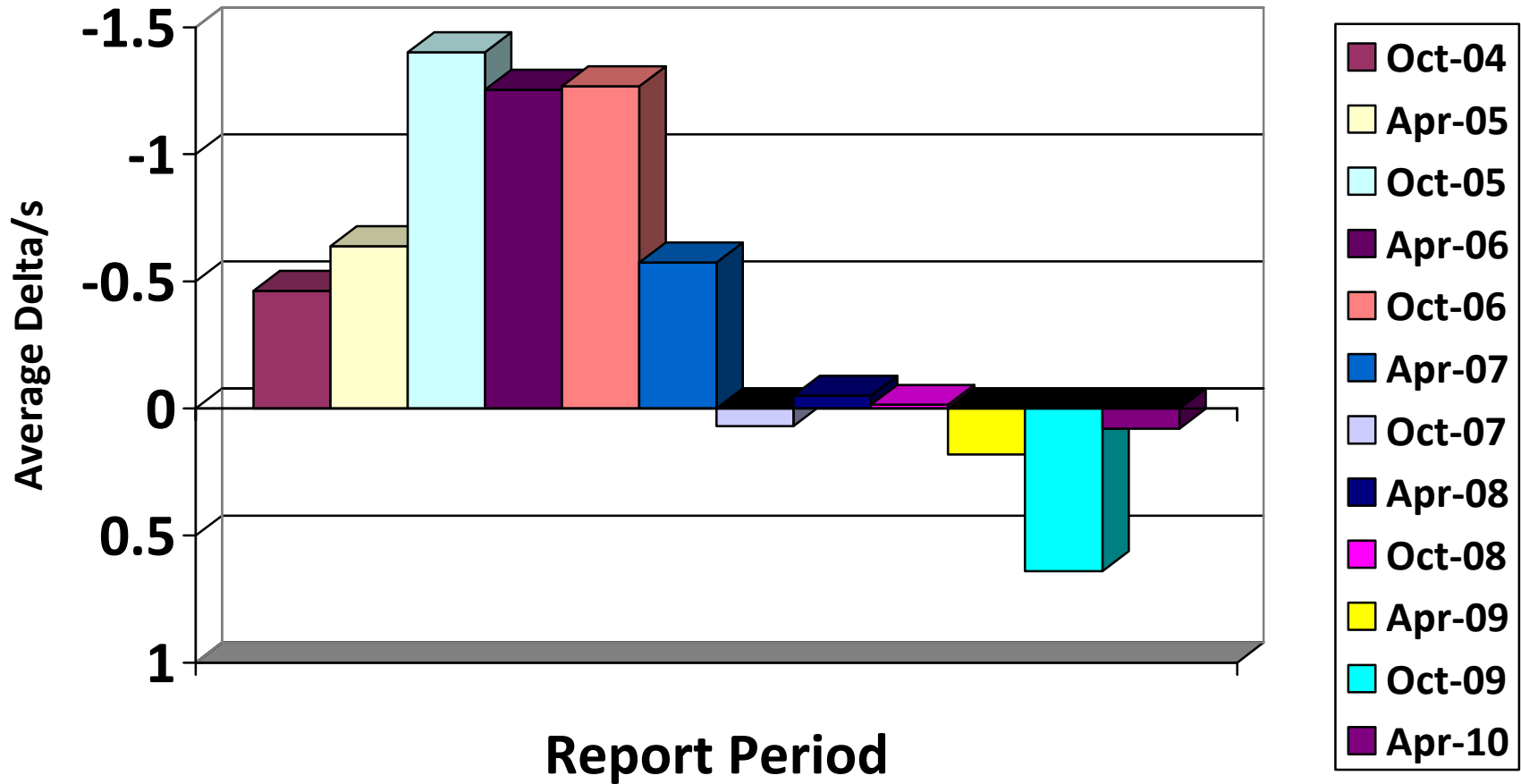


**Figure 3**  
**SEQUENCE III G INDUSTRY OPERATIONALLY VALID DATA**

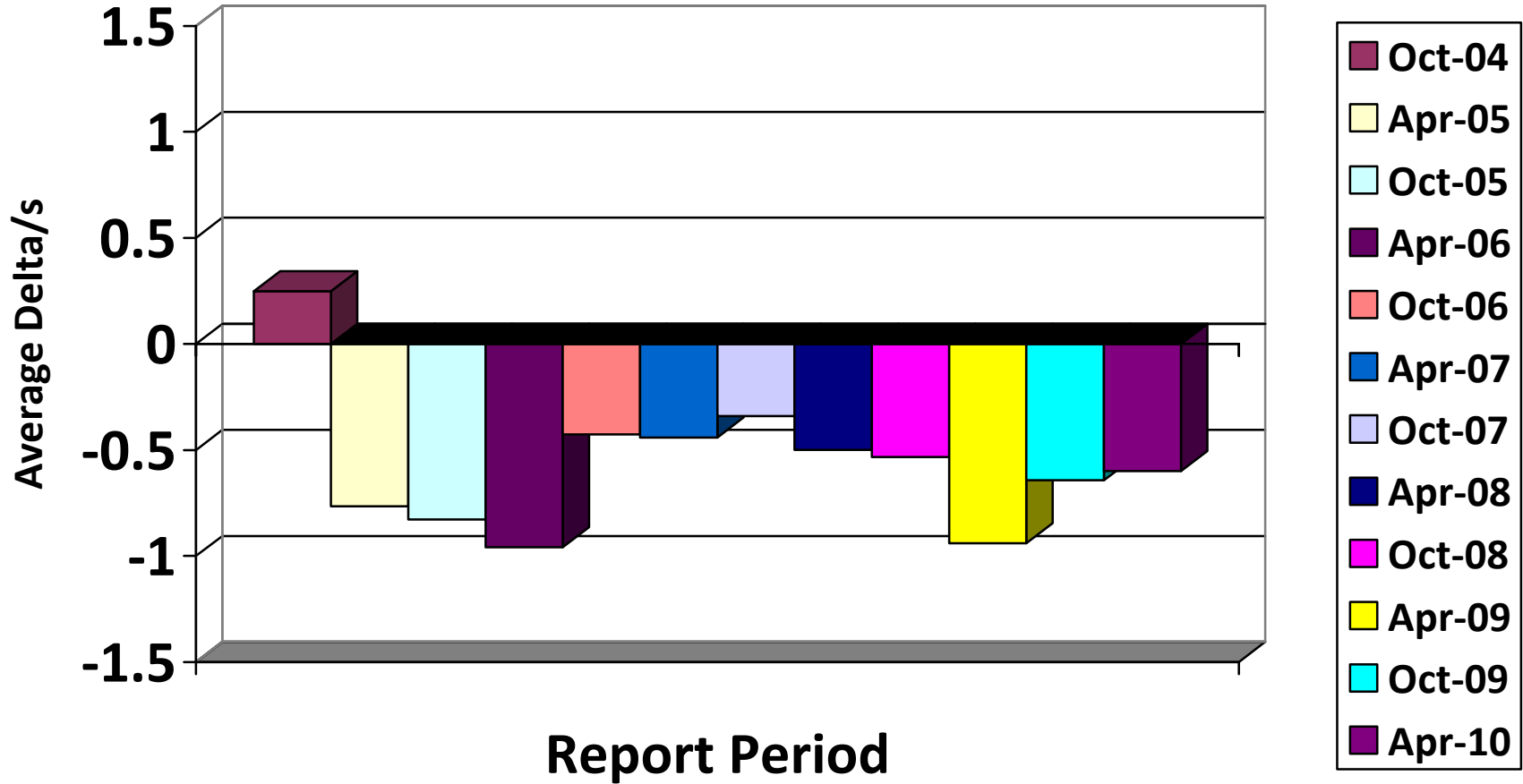
**AVERAGE CAM + LIFTER WEAR**



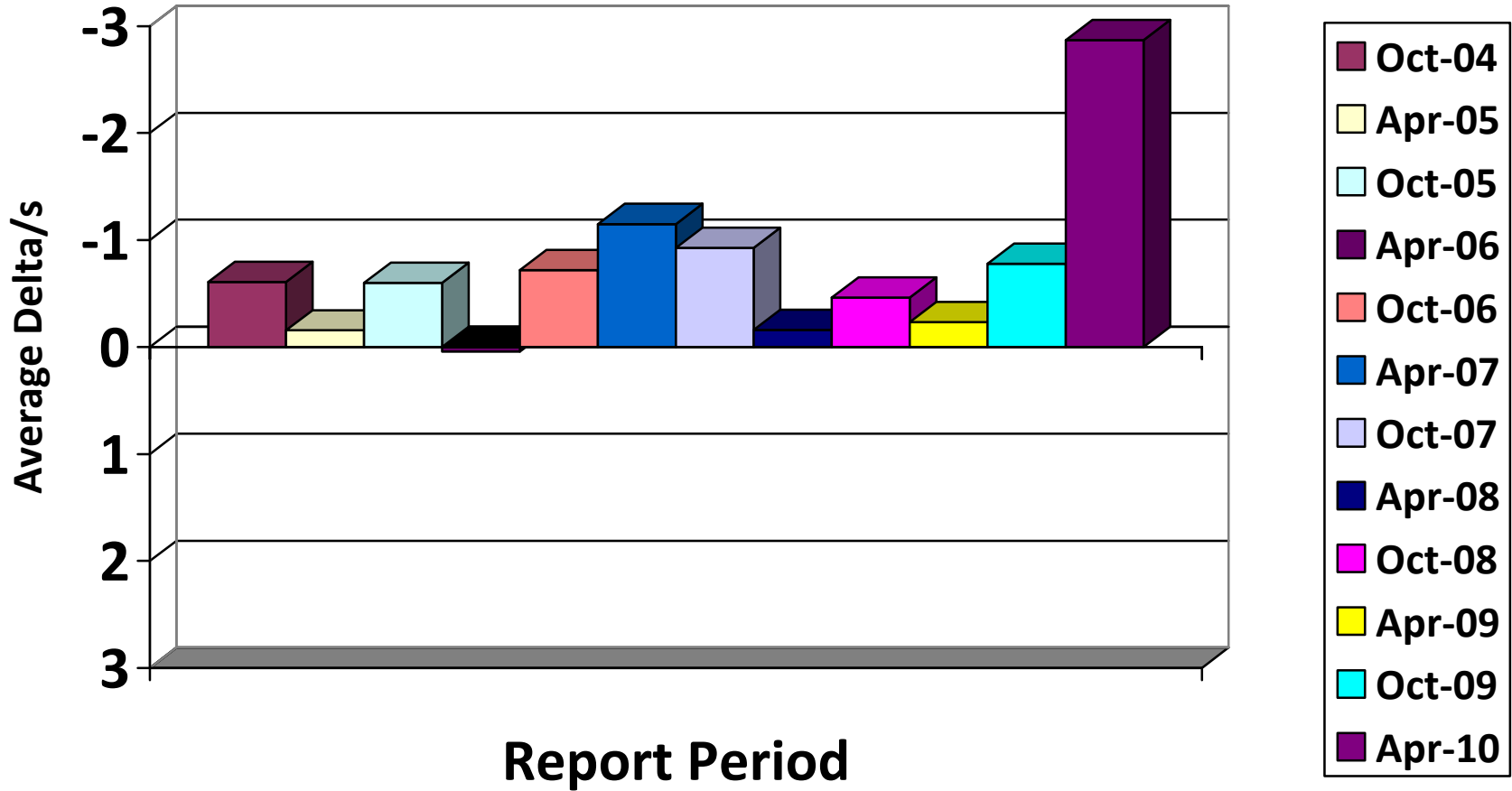
### Figure 4-Percent Viscosity Increase Delta/s



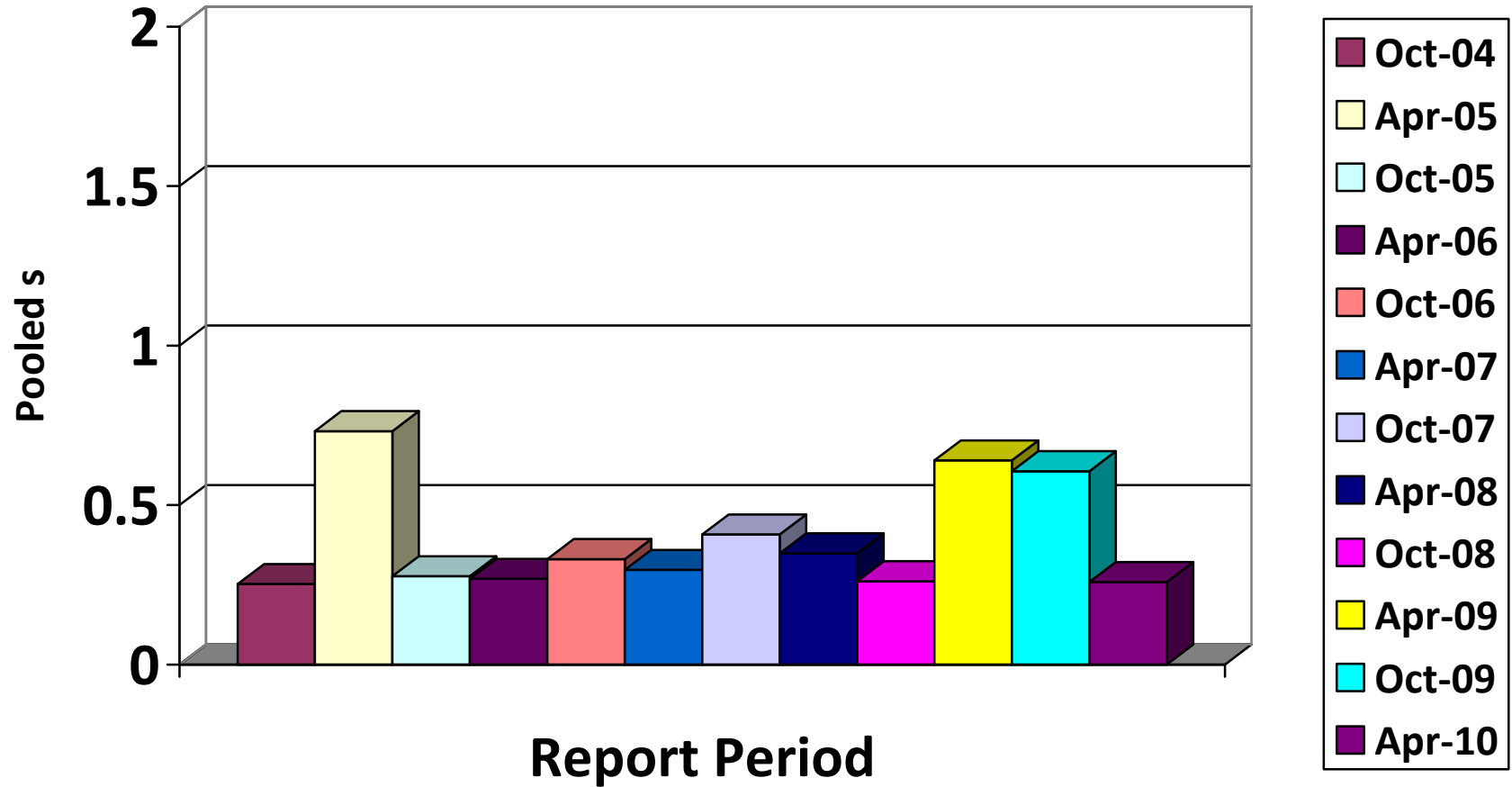
### Figure 5-Weighted Piston Deposit Delta/s



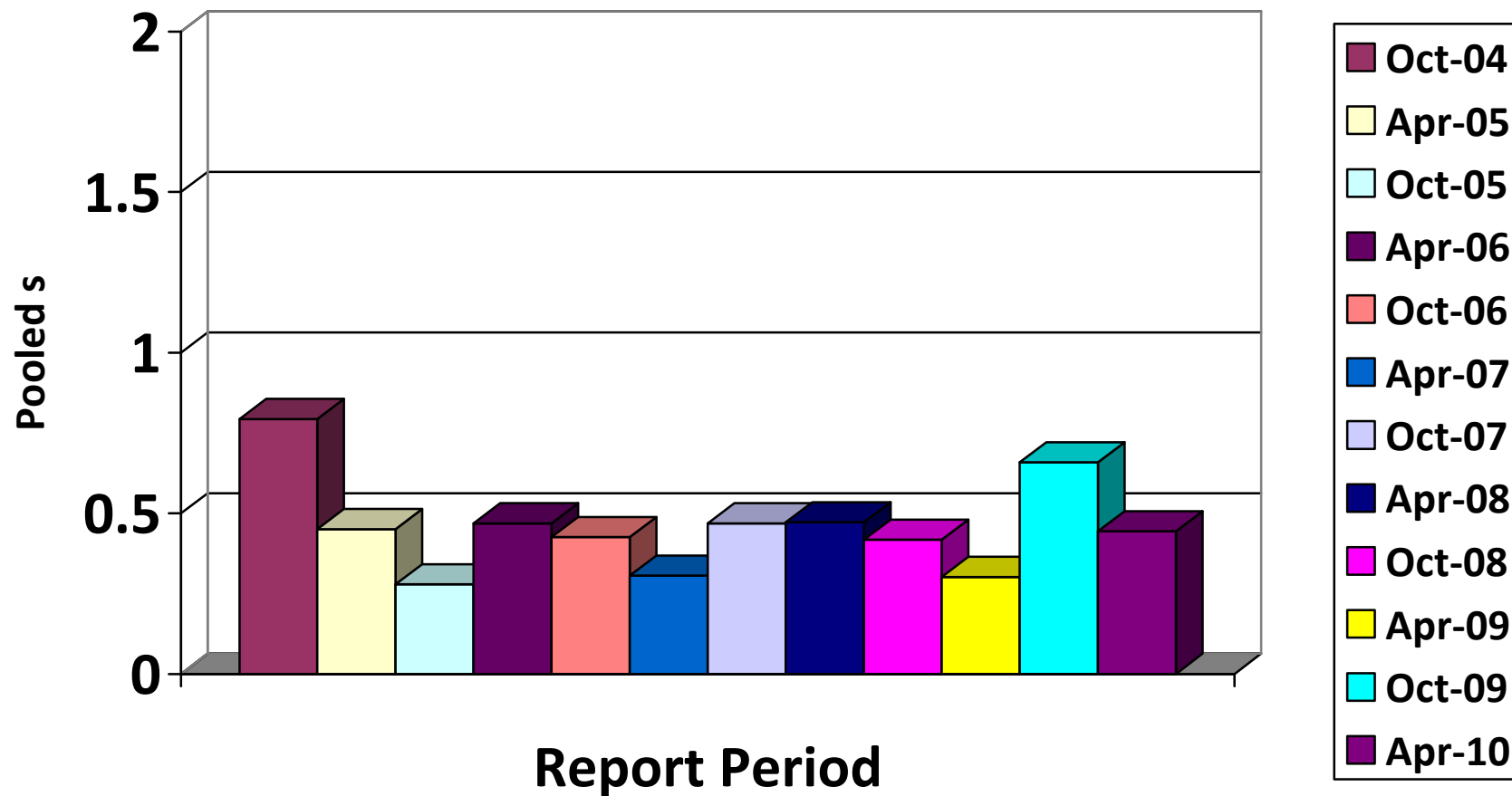
**Figure 6-Average Cam and Lifter Wear Delta/s**



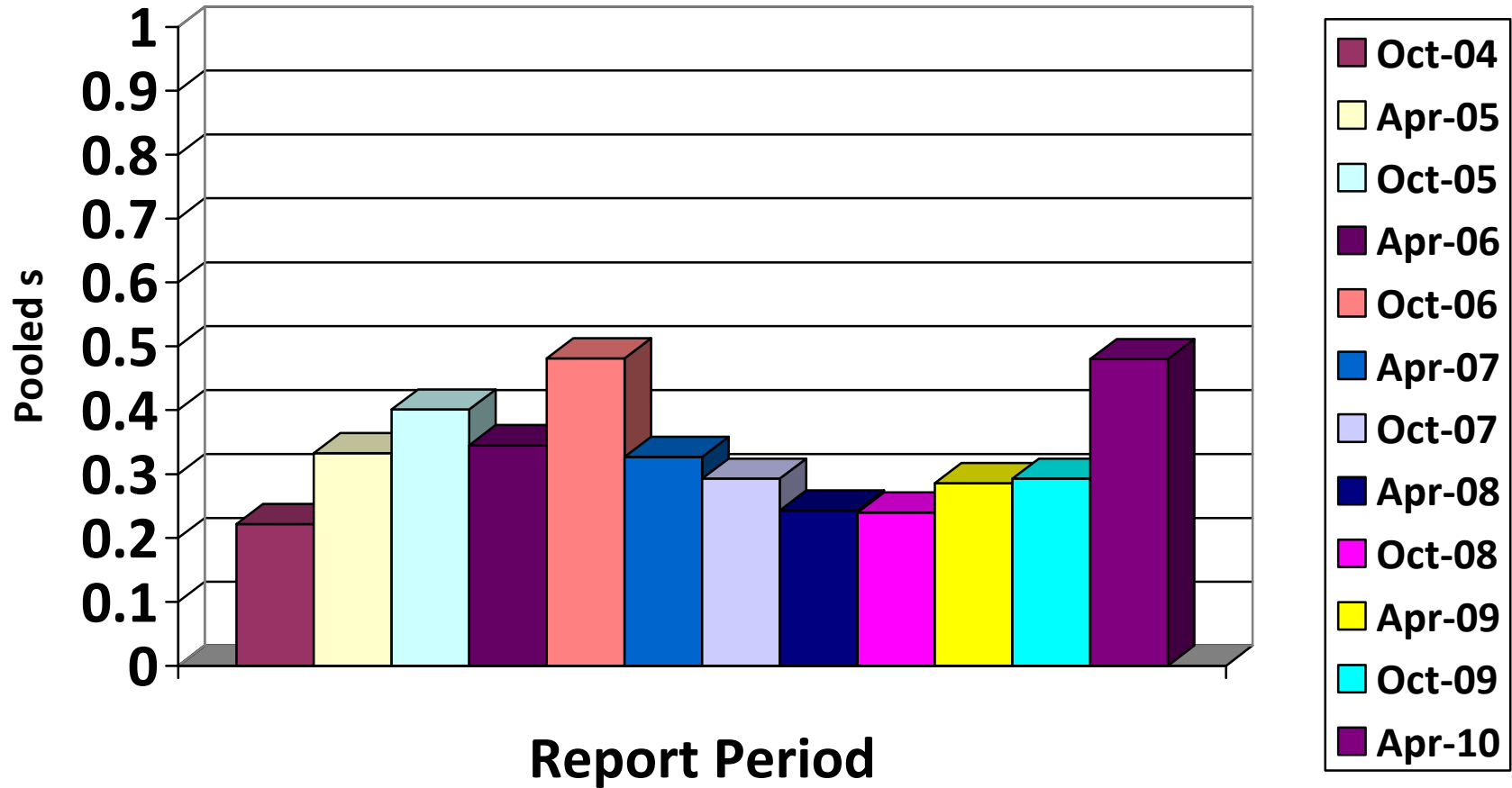
**Figure 7-Percent Viscosity Increase Pooled s**



### Figure 8-Weighted Piston Deposits Pooled s

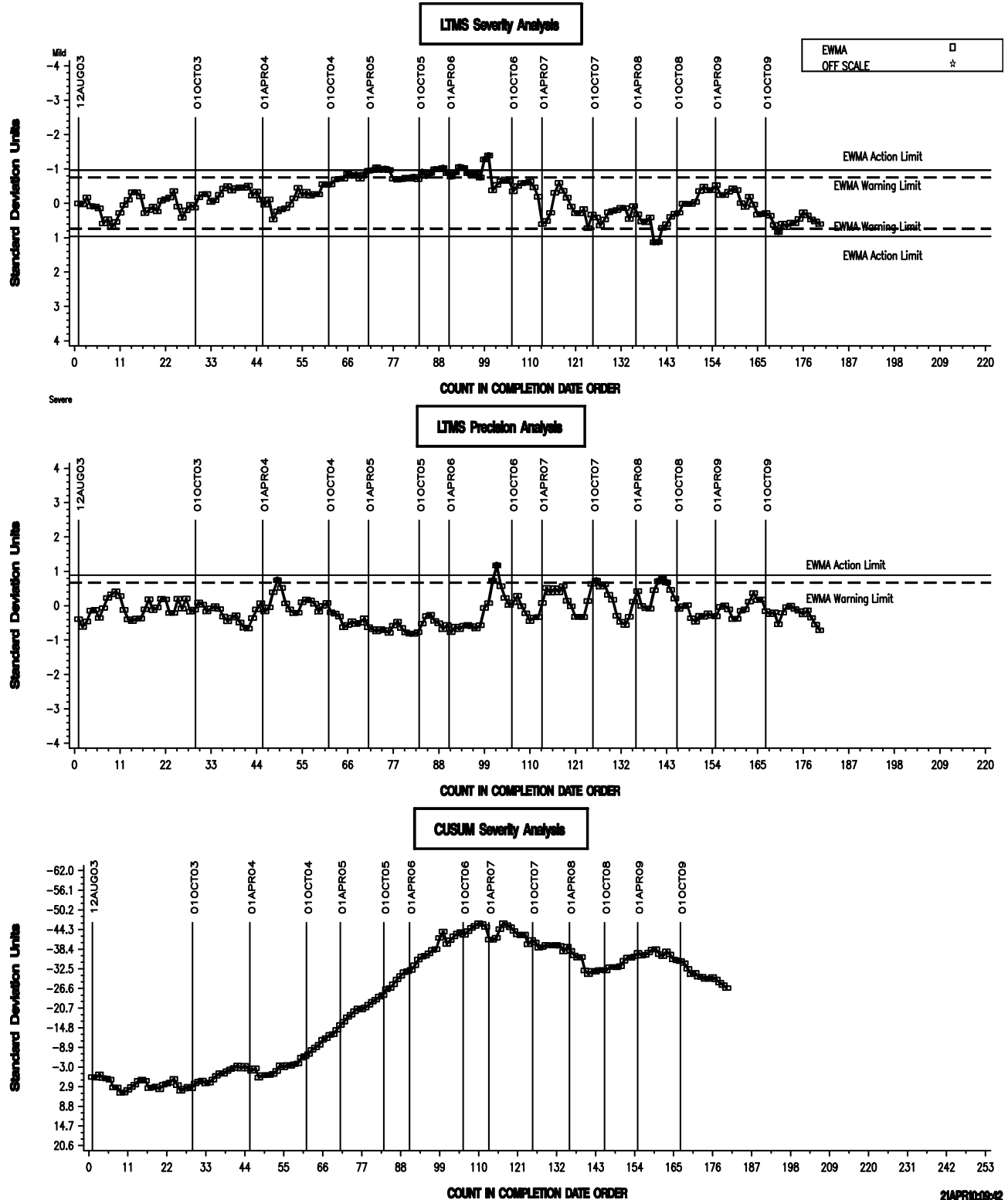


**Figure 9-Average Cam and Lifter Wear Pooled s**

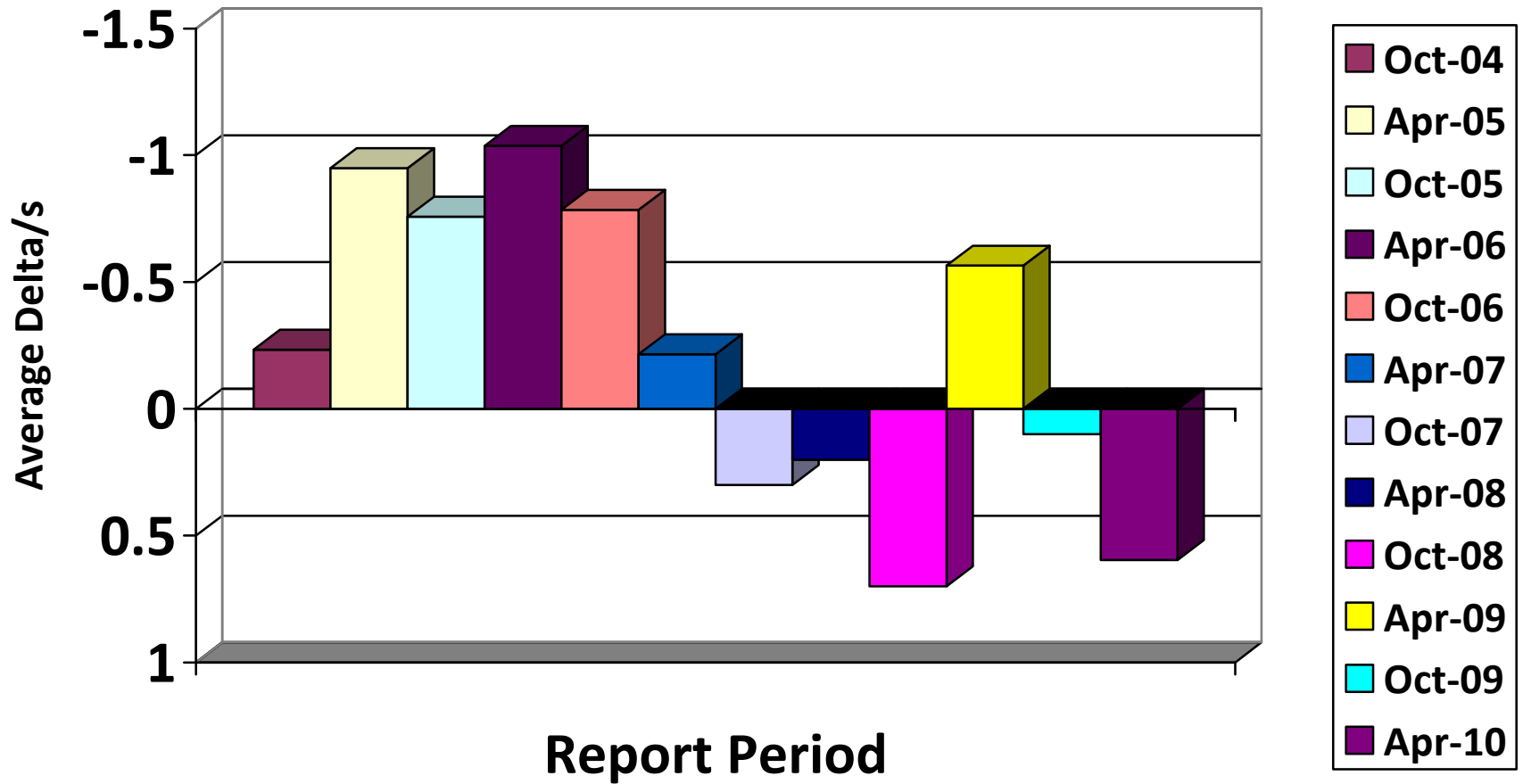




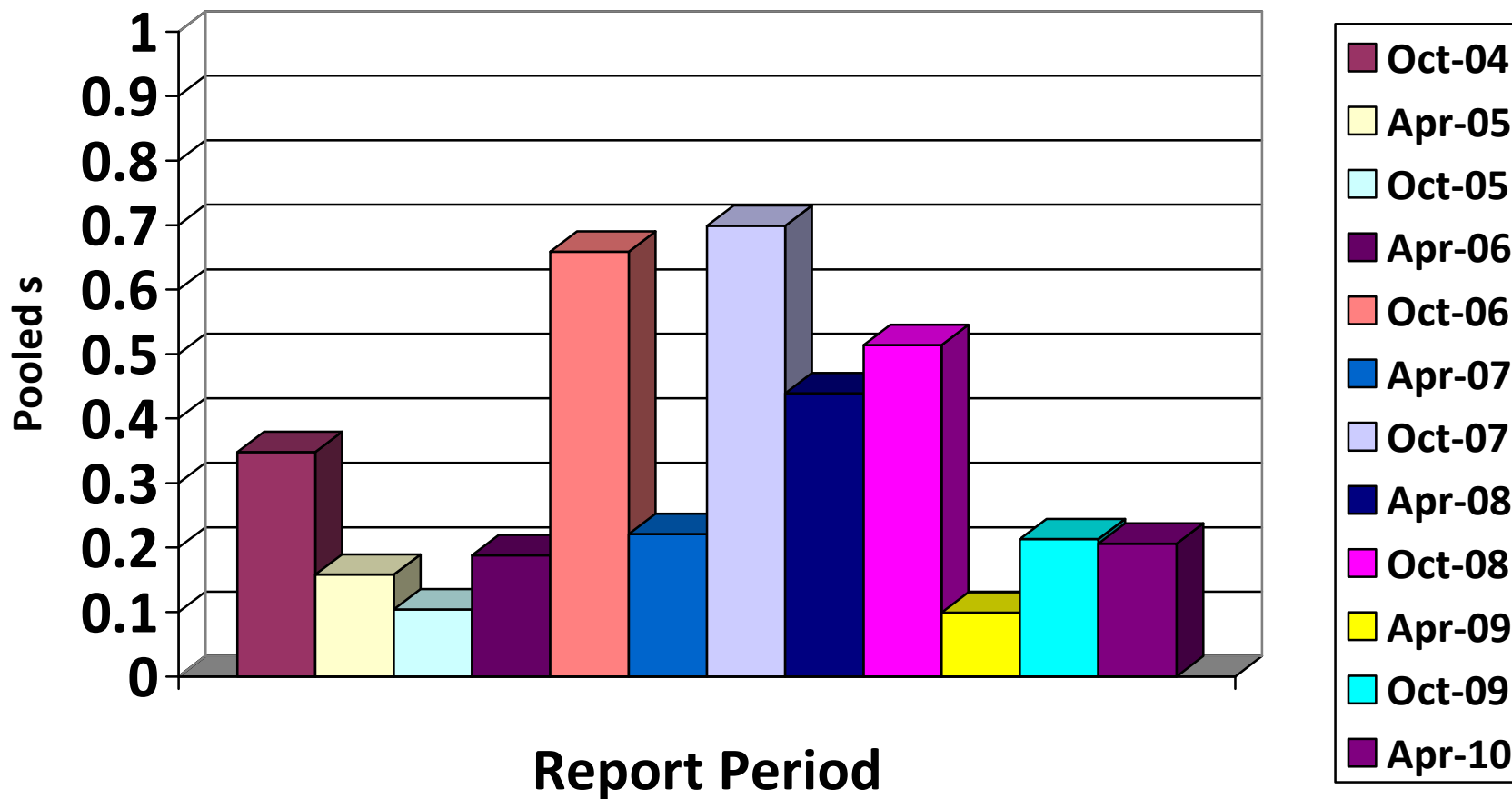
**Figure 10**  
**SEQUENCE III GA INDUSTRY OPERATIONALLY VALID DATA**  
Oil 435 Results not Charted  
MRV VISCOSITY RESULT



### Figure 11-MRV Viscosity Delta/s

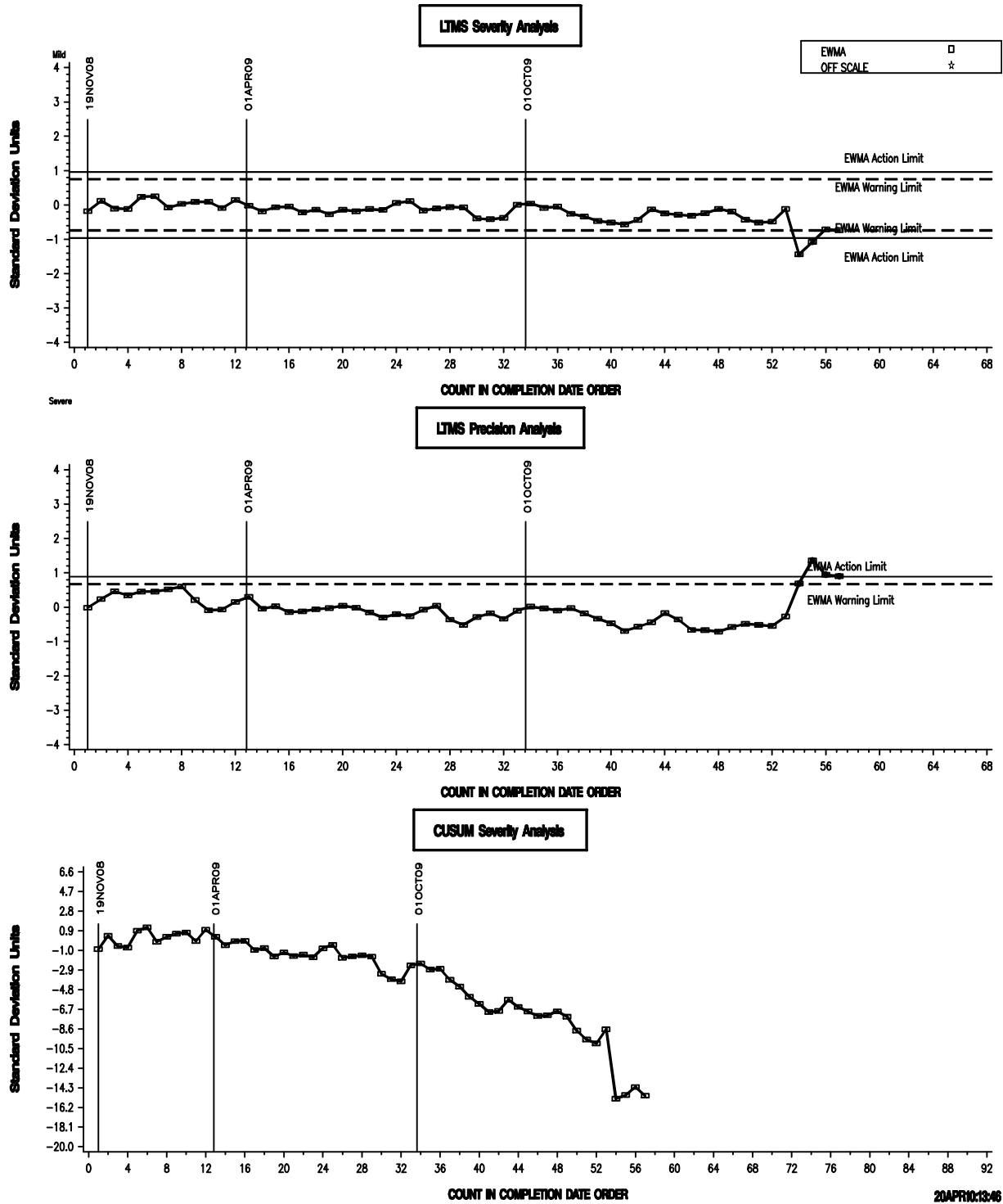


### Figure 12-MRV Viscosity Pooled s

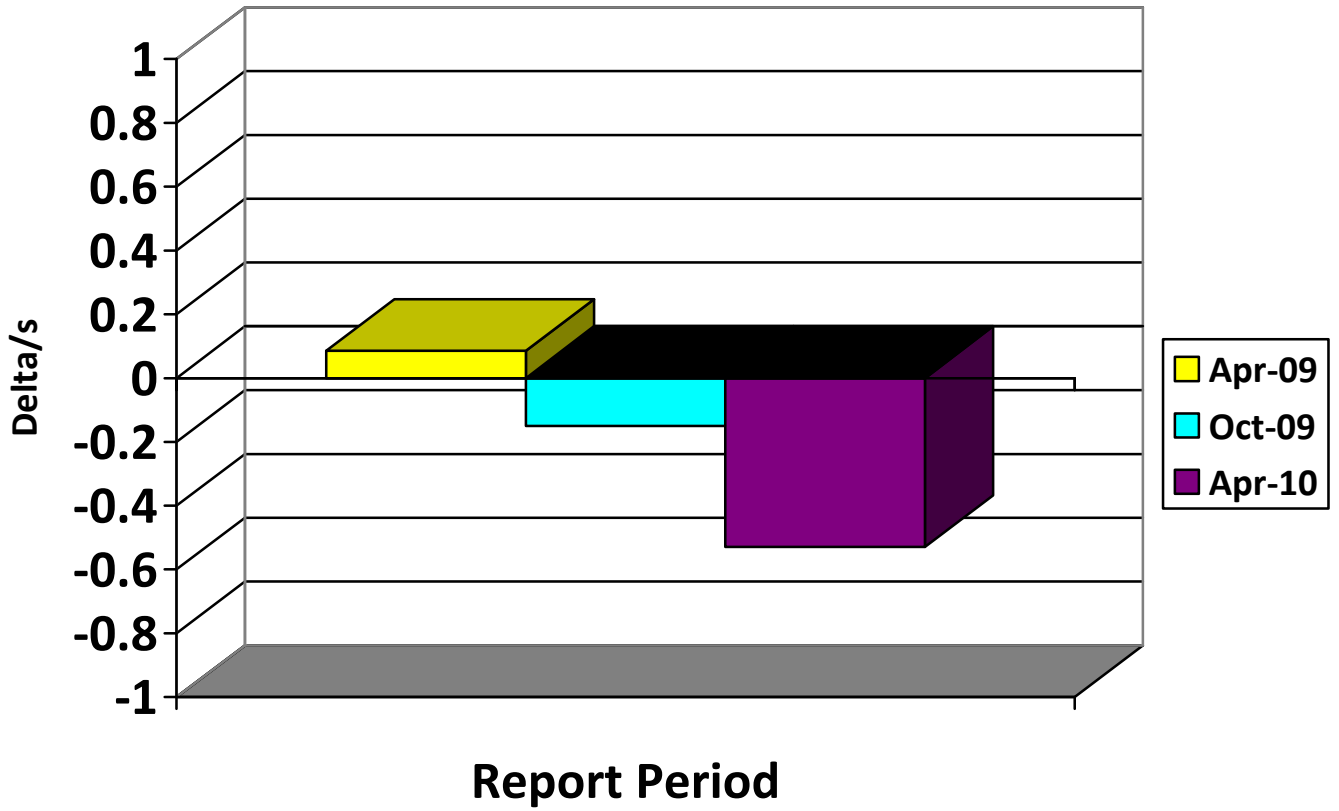


**Figure 13**  
**SEQUENCE IIIIB INDUSTRY OPERATIONALLY VALID DATA**

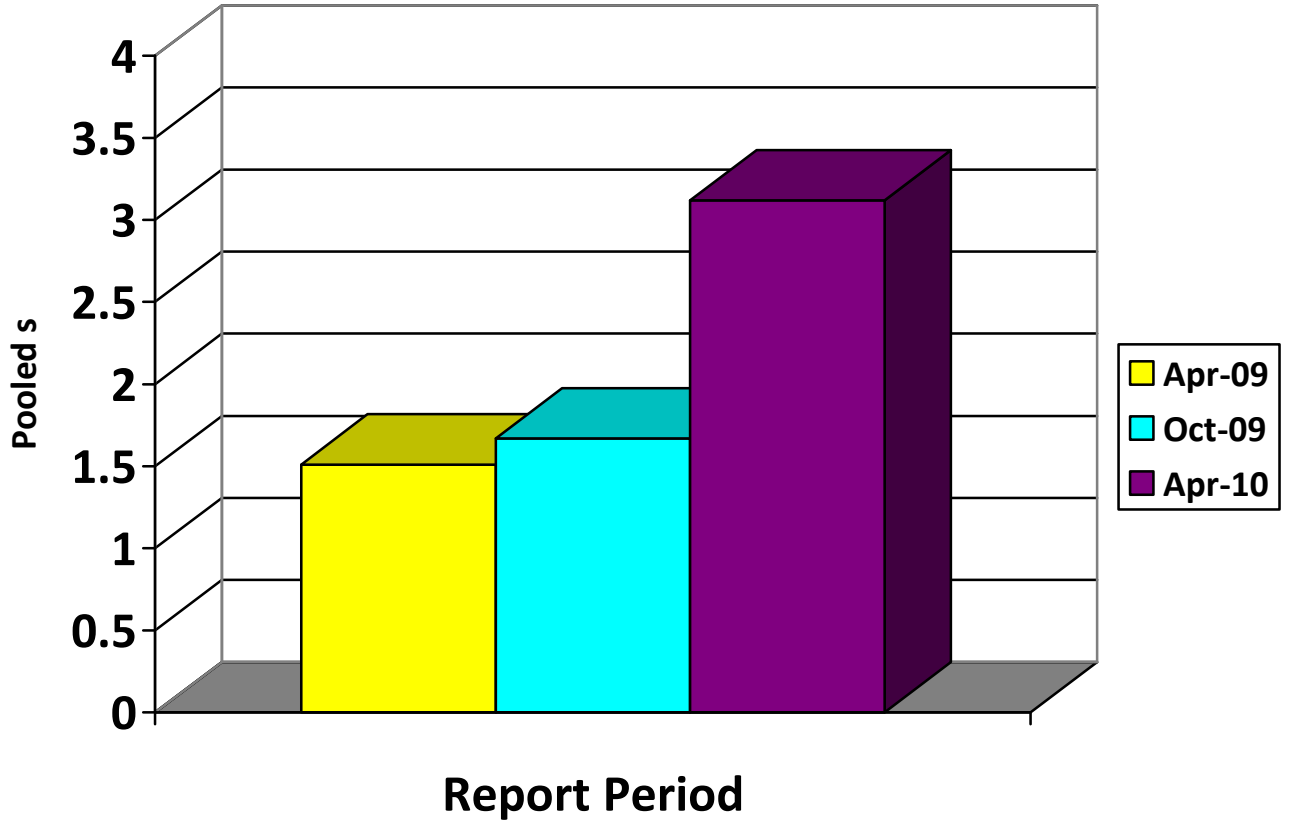
**PHOS RETENTION**



**Figure 13-Percent Phosphorus Average Delta/s**



**Figure 14-Percent Phosphorus Pooled s**



**Figure 16 – Sequence IIIG/AB Timeline**

<b>Effective Date</b>	<b>Topic</b>	<b>Info Letter</b>
8/19/2003	Draft Sequence IIIG Test Procedure Issued	03-1
9/9/2003	Revised Valve Spring Load Specifications	03-2
9/23/2003	Revised Test Numbering Methodology	03-3
10/29/2003	Revised Fuel Pressure Specification	03-4
10/29/2003	Automatic Parts Cleaning Machine Maintenance Requirements Added	03-4
10/29/2003	Main Bearing Bore Mandrel Made Optional	03-4
10/29/2003	Piston Ring Cleaning Requirements	03-4
10/29/2003	Additional Allowable RTV Sealing Compound Allowed	03-4
10/29/2003	Main Bearing Cap Bolt Replacement Specifications	03-4
10/29/2003	Revised Camshaft Measurement Procedure	03-4
10/29/2003	Revised Camshaft Lubrication & Installation Procedure	03-4
10/29/2003	Revised Oil Consumption Reporting Procedure	03-4
10/29/2003	Fluid Conditioning Module Equipment Specifications	03-4
10/29/2003	Revised Camshaft Measurement Equipment Specifications	03-4
10/29/2003	Rating Workshop Attendance Requirement	03-4
11/4/2003	Elimination of CCS & MRV from IIIG test (creation of IIIGA test)	03-4
12/15/2003	New Honing Technique approved and added to Assembly Manual	
1/20/2004	Elimination of transform from ACLW results on oil 438 in LTMS; other oils still transformed	
1/20/2004	New Pooled s for ACLW SA calculation, based upon 434 and 435 only	
3/23/2004	Transform put back on 438 ACLW results, for all data. Control charts recalculated and effective today	
4/2/2004	Revised Intake Manifold Gasket	04-1
4/2/2004	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	Editorial Corrections to Draft 2D	04-2
5/12/2004	MRV Reporting	04-2
5/12/2004	Amount of Oil Used for Camshaft & Lifter Lubrication	04-2
8/4/2004	First Occurrence of Powdered Metal Rods	
8/22/2004	First Occurrence of BC-4 rings	
11/4/2004	Powdered Metal Connecting Rod Torque Specifications	04-3
11/4/2004	New Front and Rear Main Seals	04-3
11/4/2004	New Oil Pan Gaskets	04-3
11/4/2004	New Exhaust Valves	04-3
11/4/2004	Editorial Change to Precision Statements	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
8/8/2005	First occurrence of BC-5 rings	
11/29/2005	Revision to requirements for attendance to rater workshops	05-2
11/29/2005	Allows the use of torque wrench ETW-E180	05-2
3/29/2006	First occurrence of BC-6 rings	
04/04/2006	Added requirement to monitor fuel at lab and revised aromatic content in fuel specification	06-1
08/18/2006	Procedure changes as a result of UEB and revised Table A4 to clarify units and test methods	06-2

10/03/06	Change in connecting rod (PMNS) and updated part numbers	06-3
10/008/06	First occurrence of powdered metal non-slotted connecting rods (PMNS)	
11/06/06	Changes in rater calibration requirements	06-4
3/19/07	Added IIIGVIS procedure to test method	07-1
4/01/07	Start of new cylinder head torquing procedures	
6/05/07	Revised designation of IIIGVIS to IIIGVS	07-2
6/05/07	Changed values in Table A4 to metric	07-2
6/05/07	Revised ring gap delta values and revised stand instrumentation calibration requirements	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
12/13/2007	Revised instrumentation calibration requirements	07-3
5/20/2008	Clarified definition of downtime during oil leveling and sampling	08-1
6/08/2008	1 <sup>st</sup> occurrence of BC-7 rings	
11/06/2008	Added IIIGB test procedure to test method	08-2
11/24/2008	Added Snap on torque wrench to test method	08-3
11/24/2008	Updated source of Perfect seal number 4 gasket sealer	08-3
11/24/2008	Addressed several editorial changes	08-3
3/09/2009	Added section addressing oil filter and cooler replacement	09-1
3/09/2009	Corrected conversion error in dry bulb temperature	09-1
5/28/2009	Added requirement to repeat fuel analysis when values are found out of spec	09-2
5/28/2009	Added requirement to report the results of all tests run to completion, regardless of validity	09-2
5/28/2009	Allowed use of new oil pan gasket	09-2
7/28/2009	Added industry correction factor for Phosphorus retention	09-3
8/13/2009	Dropped requirement to send hard copy test report to the TMC	09-4
10/12/2009	Added a tolerance to the bath temperature for cylinder head cleaning	09-5
10/12/2009	Corrected the part number for the cylinder head gaskets	09-5
10/12/2009	Deleted the requirement to clean cylinder heads with a brush	09-5
10/12/2009	Add a requirement to the have the cylinder hone load output and current checked annually by the manufacturer	09-5
11/18/2009	Corrected valve spring part number	09-6
11/18/2009	Corrected Annex reference in 10.8.10.1	09-6
11/18/2009	Allowed use of teflon tape and 1/16" thermocouple	09-6
11/18/2009	Revised U & L values used in QI calculation for condenser coolant temperature	09-6