




Test Monitoring Center

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412-365-1000

Memorandum: 11-007
Date: May 4, 2011
To: Bill Buscher, Chairman, Sequence IVA Surveillance Panel
From: Richard E. Grundza 
Subject: Sequence IVA Semiannual Report: October 1, 2010 through March 31, 2011

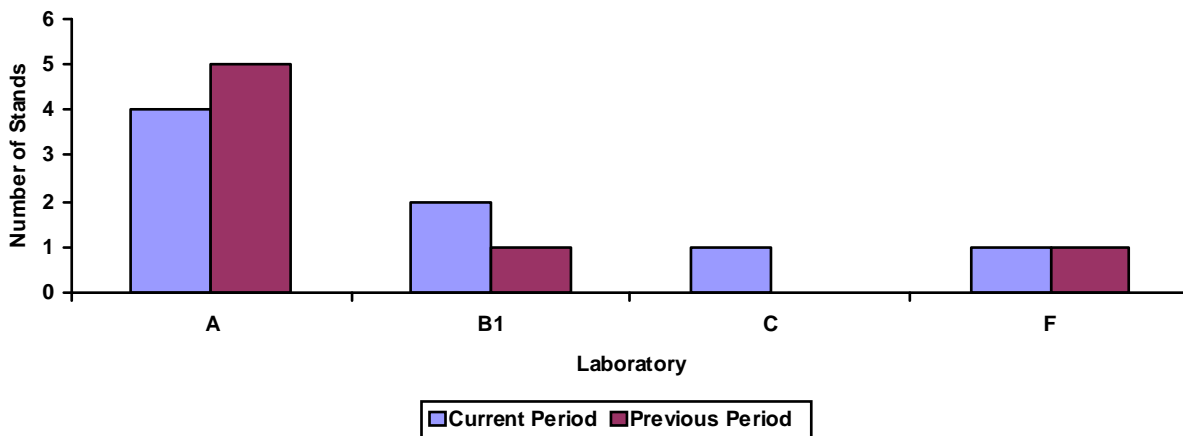
The following is a summary of Sequence IVA reference tests that were reported to the Test Monitoring Center during the period October 1, 2010 through March 31, 2011.

Lab/Stand Distribution

	Reporting Data	Calibrated as of March 31, 2011
Number of Laboratories:	4	4
Number of Test Stands:	8	7

The following chart shows the laboratory/stand distribution:

Laboratory/Stand Distribution



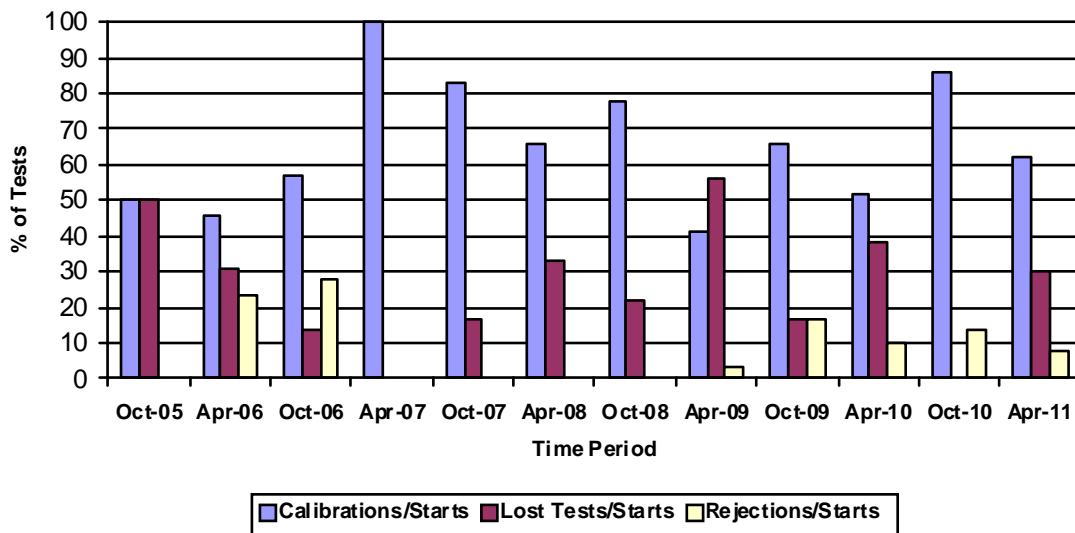
The following summarizes the status of the reference oil tests reported to the TMC:

Calibration Start Outcomes	TMC Validity Codes	No. of Tests
Operationally and Statistically Acceptable	AC	8
Operationally Valid, Statistically Unacceptable	OC	1
Operationally Invalid, Lab Determination	LC	4
Acceptable Donated Test	AG	4
Stand Shakedown	NN	1
Total		18

A total of four donated tests were reported this period. These tests were run to generate targets for the category reference oil, designated 1010.

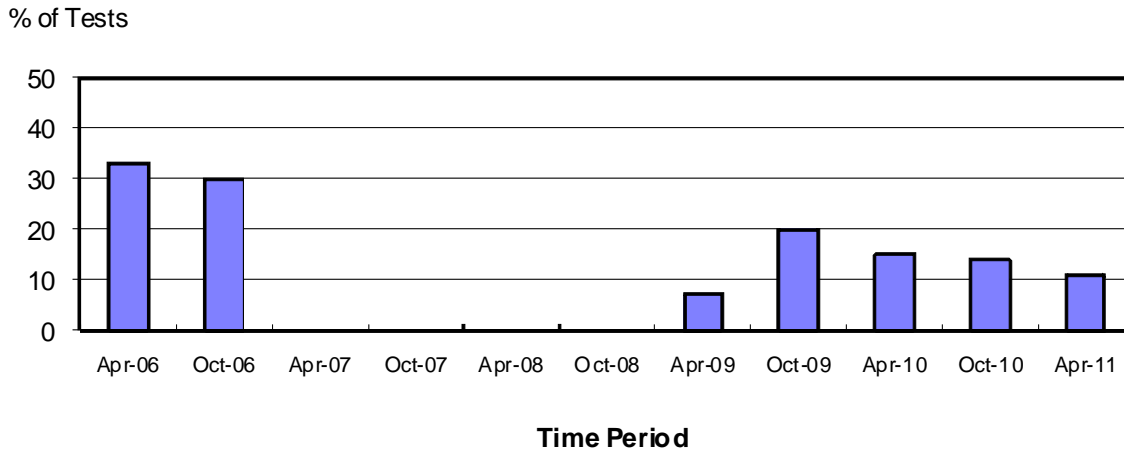
Calibrations per start, lost tests per start and rejection per start rates are summarized below:

Calibration Attempt Summary



The calibration per start rate has decreased since last period. The rejected test per start and lost test per start rates have increased this period. All rates compare well with the historical rates.

Rejected Test Rate for Operationally Valid Tests



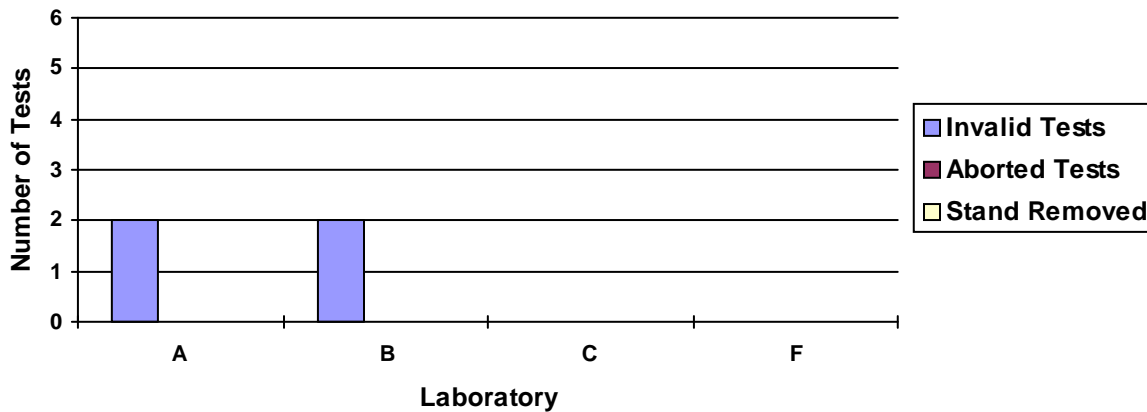
One test failed acceptance criteria. This test failed mild on average cam wear.

Four tests were declared operationally invalid by the laboratory. The reasons for operationally invalid and aborted tests are tabulated below:

Reason	Number of Tests
Damaged Driveshaft	1
Improper Flush Procedure Used	1
Driveline Damper Failed	1
Load Control Issues During First 20 Hours Due to Engine Misfire	1

Aborted and operationally invalid tests by laboratory are summarized with the following chart:

Lost Test Distribution



There were no LTMS Deviations written this period. Since its introduction in 1999, there have been four Sequence IVA LTMS deviations.

QI Deviations

There was one QI Deviation written this period. The QI deviation was issued for oil cylinder head temperature control generating a QI value below 0.000. The oil temperature thermocouple failed during the test and was replaced, but was not placed at the proper insertion depth. Once placed at the proper depth, proper oil temperature control was obtained, but was not sufficient to return the QI value into positive territory. A total of 27 QI deviations have been written to date.

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 report period. Also below is a summary of the average Δ/s value, by laboratory.

Industry Severity Summary			
Parameter	Average Δ/s	Pooled standard deviation (degrees of freedom)	Average Δ, in micrometers
ACW	-0.807	9.15 (df = 8)	7.38 μm

ACW Results, by Laboratory	
Laboratory	Average Δ/s
A	-0.677
B1	-0.235
C	-0.506
F	-1.654

Severity was in control for most of the period, but sounded two warning alarms at the end of the period. Precision was in control for the period. (see Figure 1).

The severity warning alarms appear to have been caused by one result from one stand, using reference oil 1007. Severity was mild for the period (see Figure 2) with an average Δ/s result of -0.807 which equates to -7.38 μm in reported units.

The pooled standard deviation for the period is 9.15 μm , which has improved when compared to the last period, and compares well with overall historical performance (see Figure 3).

Hardware

No hardware changes were made this period.

Lab Visits

No lab visits were conducted this period.

Information Letters

No information letters were issued this report period.

Reference Oils

Please note, 1007 cannot be resupplied and the surveillance panel needs to identify a suitable replacement oil.

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	5500	38	0	9	6	< 1 year ¹
1006-2	5500	3860	93	915	2	3+ years ^{1,3}
1007	2200	105	95	33	3	2+ years ^{1,2}
1009	1100	448	60	112	4	3+ years ¹
1010	1100	870	230	217	3	3+ years ¹

¹ Multiple test area reference oil; total TMC inventory shown.

² Cannot be reblended.

³ Suspended for use by the Surveillance Panel

REG/reg

Attachments

c: F. M. Farber, TMC
 J. A. Clark, TMC
 Sequence IVA Surveillance Panel
<ftp://astmtmc.cmu.edu/docs/gas/sequenceiv/semiannualreports/IVA-04-2011.pdf>

Distribution: Electronic Mail

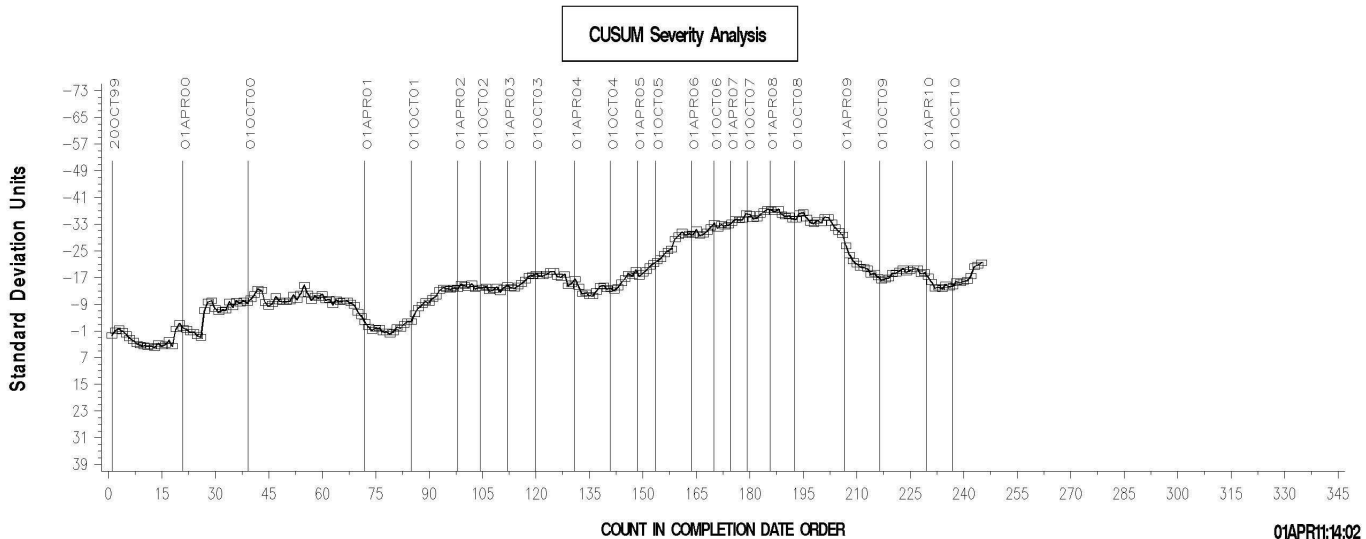
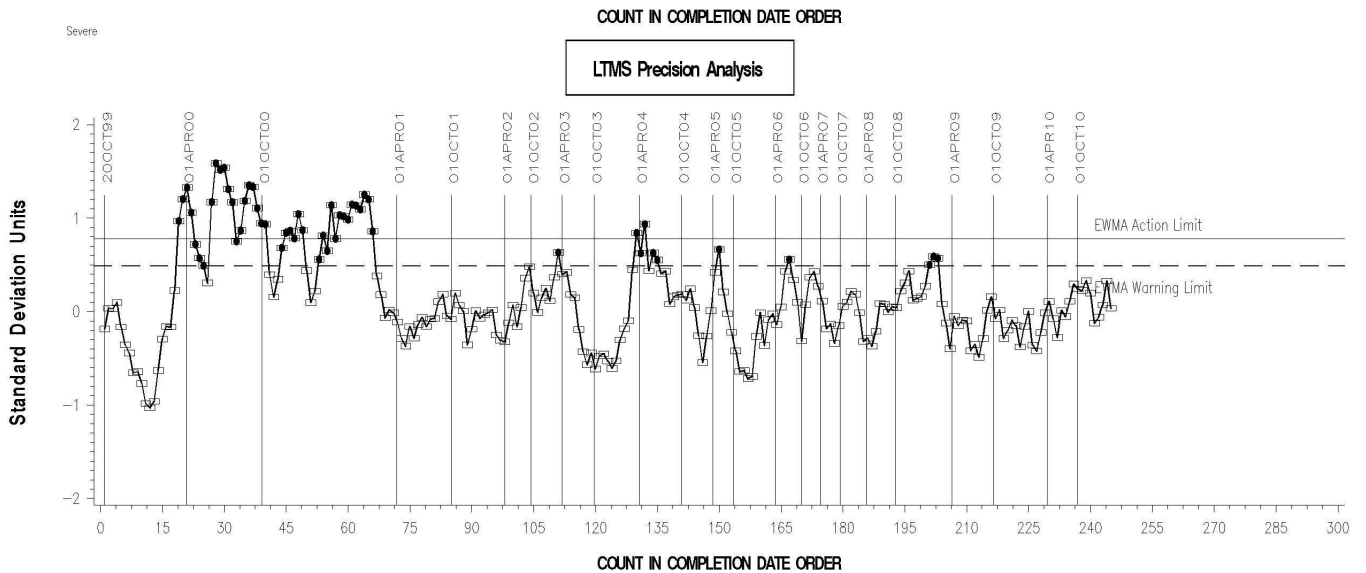
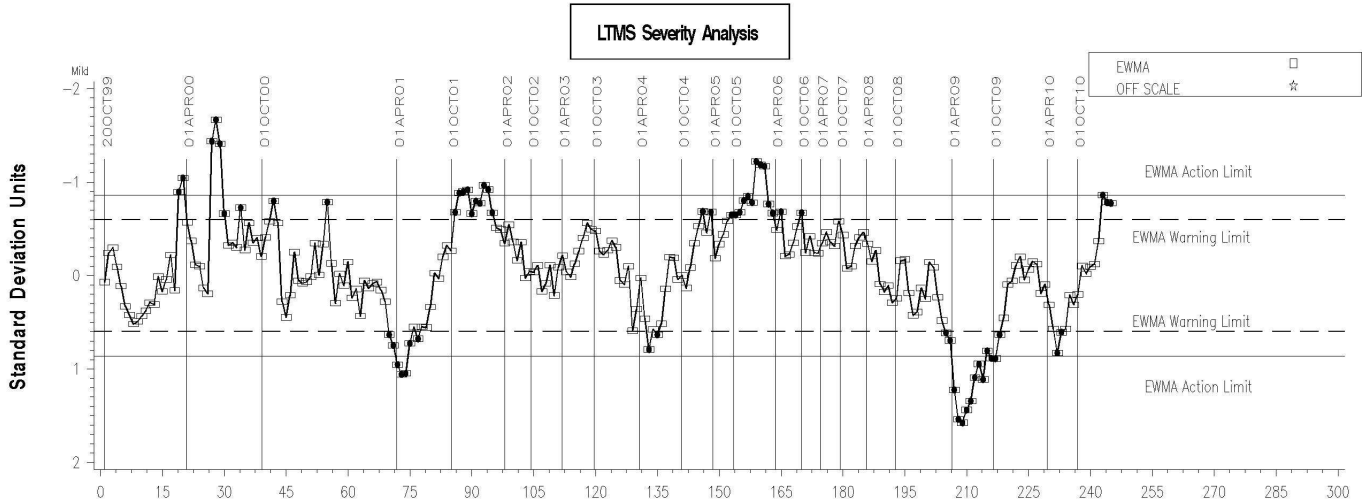
List of Figures

- Figure 1 graphically presents the Industry control charts for ACW and also the CUSUM delta/s plot (by count in completion date order) of average camshaft wear for operationally valid tests.
- Figure 2 graphically presents a historic perspective for ACW mean delta/s by report period.
- Figure 3 graphically presents a historic perspective for ACW pooled standard deviations by report period.
- Figure 4 is the Sequence IVA Timeline, created to track changes in test hardware and operations.

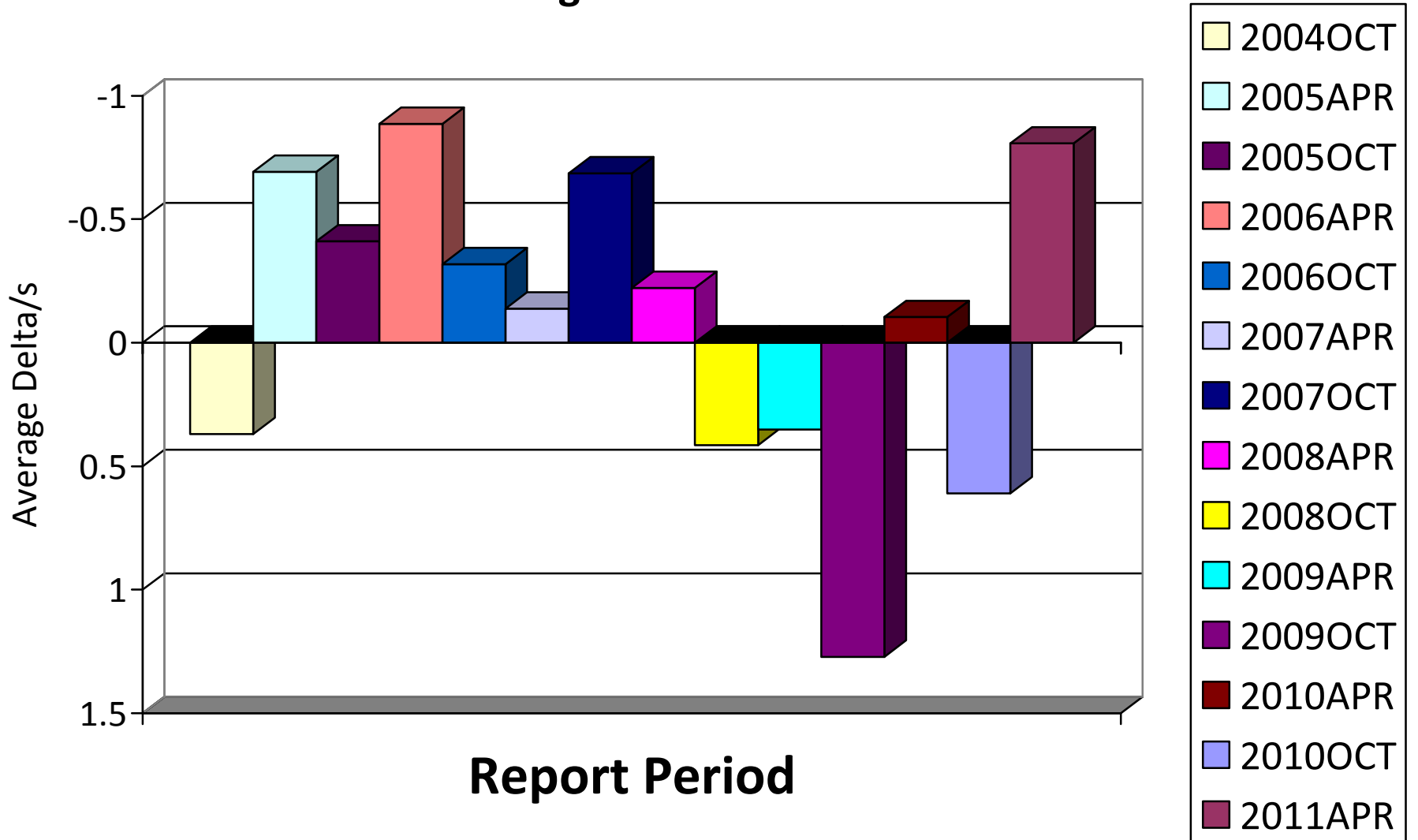
Figure 1
SEQUENCE IVA INDUSTRY OPERATIONALLY VALID DATA



AVERAGE CAM WEAR



**Figure 2-Sequence IVA Reference Oil Data
Average Camshaft Wear**



**Figure 3-Sequence IVA Reference Oil Data
Average Camshaft Wear**

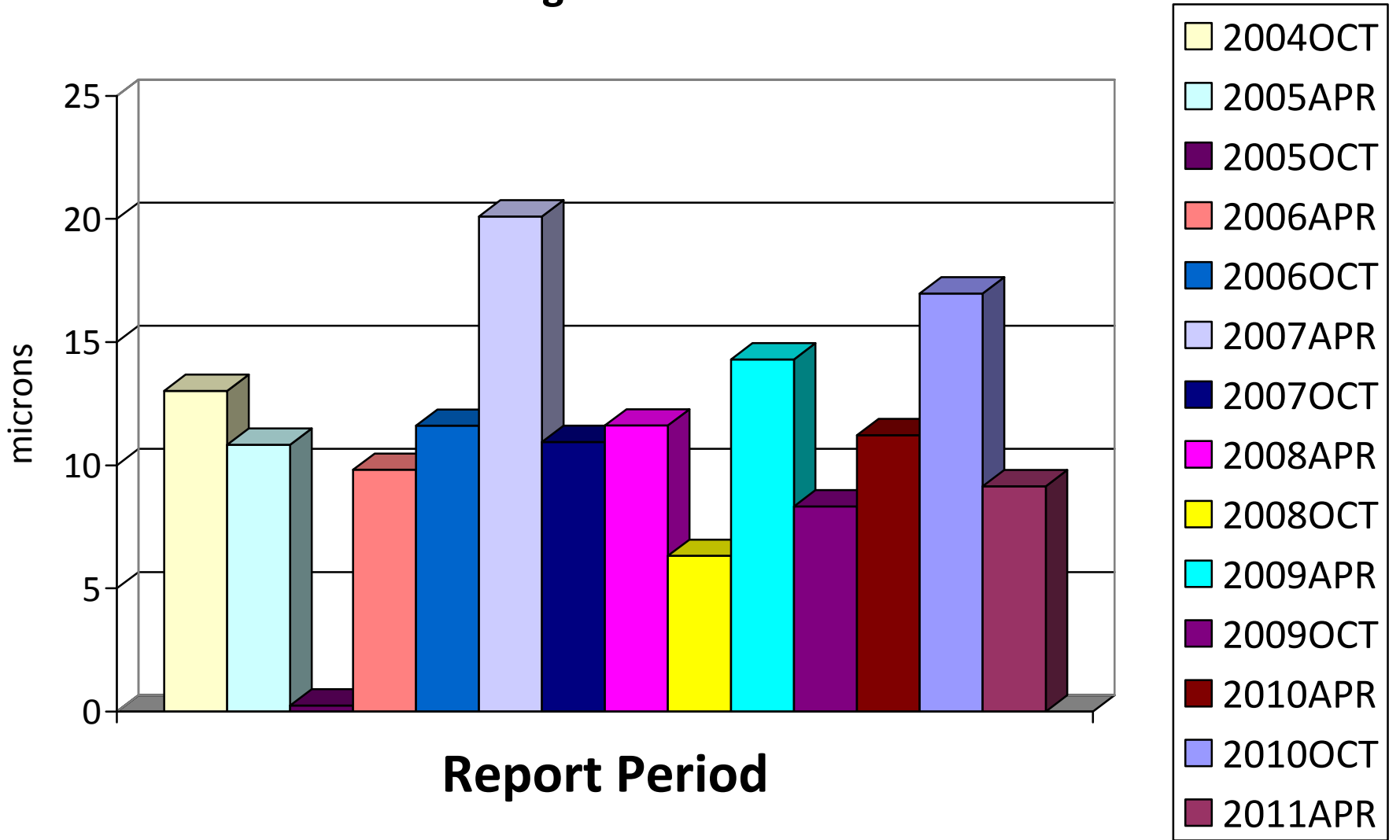


Figure 4 - Sequence IVA Timeline		
Date	Topic	Information Letter
2/10/1999	SEQUENCE IVA TEST LTMS ESTABLISHED BY SURVEILLANCE PANEL	
11/17/1999	CALIBRATION STATUS RESUMED	
2/16/2000	DRAFT 4 OF TEST PROCEDURE ISSUED. INCORPORATED JACKETED ROCKER COVER, CONTROLLED FLOW OF FRESH AIR TO ROCKER COVER, AND OIL CYLINDER HEAD AS OIL TEMPERATURE CONTROL POINT.	00-1
8/1/2000	REVISED DATA DICTIONARY AND REPORT FORM SET (VERSION 20000126) GOES INTO EFFECT.	00-2
6/12/2000	REVISED DOUBLE-FLUSH COOLANT CONTROL REQUIREMENTS EFFECTIVE	00-3
6/12/2000	REVISED ENGINE STARTING PROCEDURE EFFECTIVE	00-3
6/12/2000	ELIMINATE THE REQUIREMENT FOR LINEAR RAMPING OF TRANSIENT PARAMETERS	00-3
6/12/2000	REVISED OIL SAMPLING PROCEDURE	00-3
6/12/2000	REVISED DOUBLE-FLUSH OIL DRAIN REQUIREMENT	00-3
6/12/2000	REVISED COMPRESSION TEST REQUIREMENTS	00-3
6/12/2000	NEW CAMSHAFT CLEANING REQUIREMENTS	00-3
1/24/2001	CAMSHAFT LOT RESTRICTIONS	00-4
7/22/2001	ROCKER COVER COOLANT FLOW MEASUREMENT & REPORTING	01-1
5/24/2001	REVISED CYLINDER HEAD AND TEST ENGINE REPLACEMENT REQUIREMENTS	01-2
5/25/2001	REVISED TEST NUMBERING REQUIREMENTS	01-2
2/12/2002	REVISED ENGINE BREAK-IN SPECIFICATIONS	02-1
2/12/2002	UPDATED DRAFT STANDARD OF SEQUENCE IVA TEST PROCEDURE RELEASED	02-1
4/5/2002	REVISED CAMSHAFT MEASUREMENT PROCEDURES	02-2
5/14/2002	STAND CALIBRATION REQUIREMENT REVISIONS	02-3
5/14/2002	STAND INSTRUMENTATION CALIBRATION REQUIREMENT REVISIONS	02-3
6/1/2002	REVISED OIL SAMPLE TAP LOCATION	02-3
12/16/2002	LUBRICATION OF CAMSHAFT DURING INSTALLATION	02-4
5/11/2004	CAMSHAFT BEARING BORE MEASUREMENTS ELIMINATED EXCEPT FOR INITIAL ENGINE BUILD	04-1
6/2/2004	NEW SOLVENT SPECIFICATIONS	04-1
7/19/2004	REVISED PRECISION DEFINITIONS	04-1
11/19/2004	REVISED REPLACEMENT CRITERIA FOR CYLINDER HEADS AND ENGINES	05-1
11/19/2004	CLARIFIED SOLVENT SPECIFICATION REQUIREMENTS	05-1
11/19/2004	REVISED QI U&L VALUES FOR COOLANT OUTLET TEMPERATURE	05-1
11/19/2004	REVISED CALIBRATION FREQUENCY FOR INSTRUMENTATION CHANNELS	05-1
11/19/2004	ADDED SECTIONS AND ANNEX TO DEFINE ROLE OF TMC AND EXTEND CALIBRATION PERIODS FOR DONATED TEST PROGRAMS	05-1
6/8/2005	UPDATED PRECISION ESTIMATE	05-2
12/13/2005	ADDED TOLERANCES TO MEASUREMENT DEVICE LOCATIONS	05-3
12/13/2005	INCREASED NUMBER OF RUNS ALLOWED ON BLOCK AND HEADS	05-3
12/13/2005	ADDED/REVISED SCHEDULE FOR OIL COOLER, PCV VALVE AND COOLANT SYSTEM CLEANING/REPLACEMENT	05-3
12/13/2005	ADDED LIMITS ON LOST OPERATIONAL DATA	05-3
12/13/2005	REVISED FUEL TEMPERATURE CONTROL LIMITS	05-3
12/13/2005	REVISED TORQUE CONTROL STRATEGY	05-3
02/16/2006	REVISED WEAR MEASUREMENT TECHNIQUES	06-1
02/16/2006	ADDRESSED EDITORIAL CHANGES	06-1
11/16/2007	UPDATED REFERENCE OIL TARGETS (N = 29) REFERENCE OIL 1009	
11/20/2008	CLARIFIED CALCULATIONS FOR QI WHEN MISSING OR BAD QUALITY DATA ARE ENCOUNTERED	08-1
11/20/2008	CORRECTED TYPOGRAPHICAL ERROR	08-1
6/18/2009	DROPPED VALVE SPRING FREE LENGTH AND OUT OF SQUARE MEASUREMENTS, ADDED VACUUM CHECKS TO ASSEMBLED CYLINDER HEAD	09-1
6/18/2009	ADDED MONITORING OF ROCKER COVER INLET AND OUTLET TEMPERATURES, ENGINE COOLANT PRESSURE AND FRONT COVER FRESH AIR FLOW	09-1

6/18/2009	INCREASED THE NUMBER OF ALLOWED RUNS ON CYLINDER HEADS AND BLOCKS	09-1
9/22/2009	DELETED REQUIREMENT TO MAIL HARD COPY TEST REPORT TO TMC	09-2
1/4/2010	ALLOW ALTERNATE BLOWBY DEVICE AND 3.2 mm VALVE, REVISED FIGURE 3 AND A3.18	10-1