Test Monitoring Center
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Pittsburgh, PA 15206-4489
(412) 365-1000

MEMORANDUM: 06-063

DATE: October 2, 2006

TO: Andrew Ritchie, Chairman, Sequence VG Surveillance Panel

FROM: Richard E. Grundza

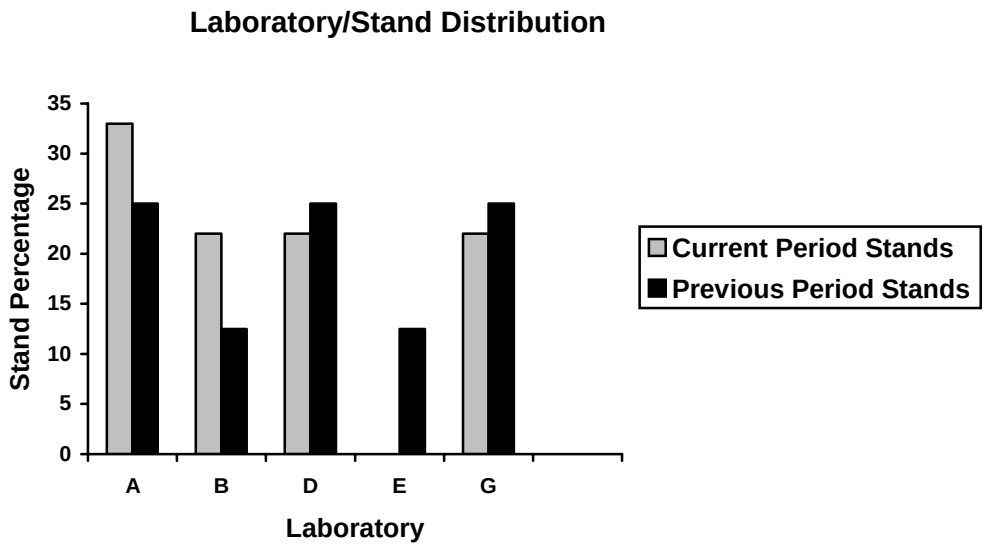
SUBJECT: Sequence VG Reference Test Status from April 1, 2006 through September 30, 2006

The following is a summary of Sequence VG reference tests that were completed during the period April 1, 2006 through September 30, 2006.

Lab/Stand Distribution

	Reporting Data	Calibrated as of 9/30/06
Number of Laboratories	4	4
Number of Stands	9	7

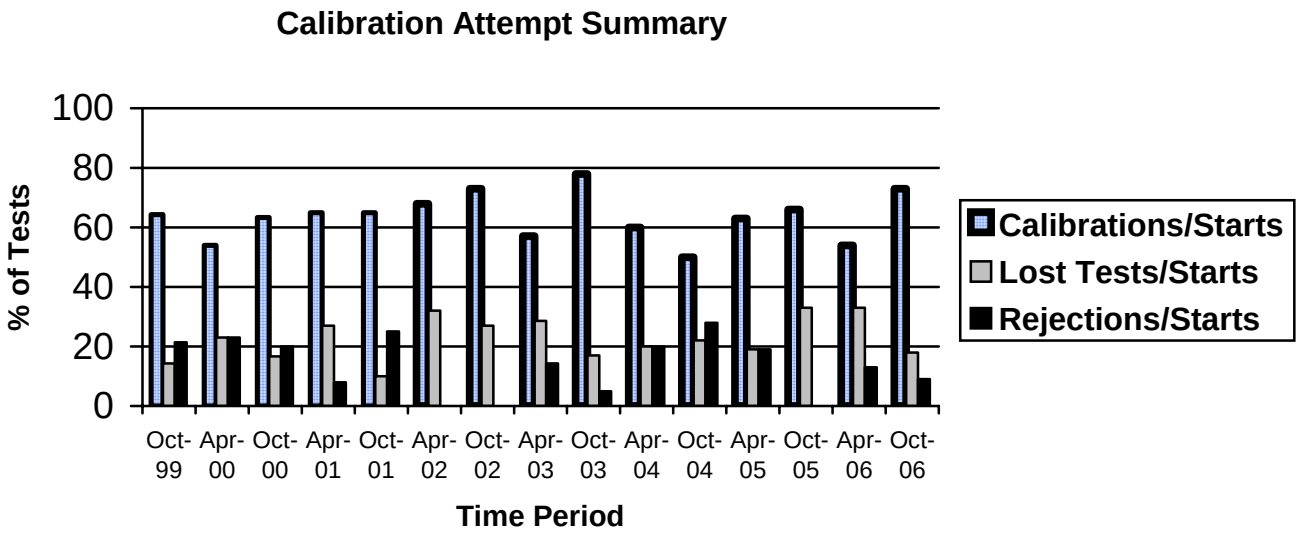
The following chart shows the laboratory/stand distribution:



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

	TMC Validity Codes	No. of Tests
Operationally and Statistically Acceptable	AC	8
Operationally Invalid, Lab Judgment	LC	2
Statistically Unacceptable, Operationally Valid	OC	1
Total		11

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



The calibration per start rate has increased with respect to the previous period. The lost test per start and rejected test per start rates have both decreased with respect to the previous period. All rates compare well with historical rates.

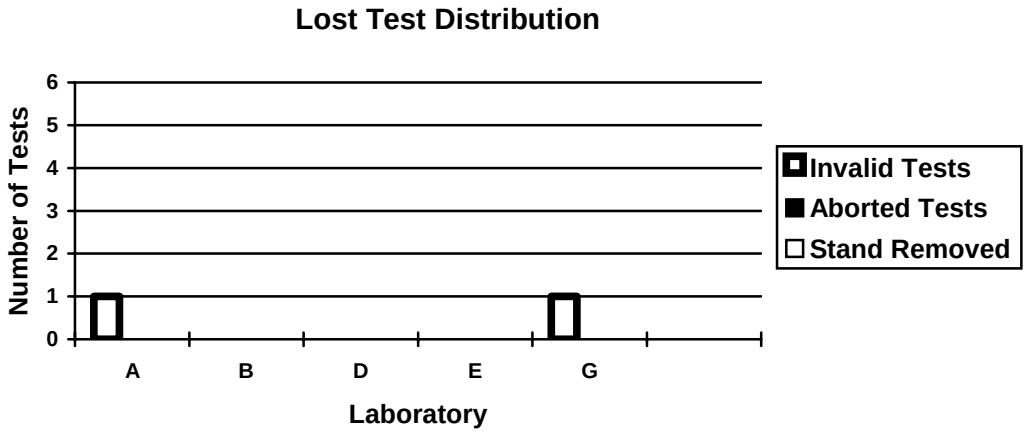
There were no LTMS deviations written during this report period. A total of six LTMS deviations have been written to date.

One test failed the acceptance criteria for severe AEV on oil 1007.

The following table lists the reasons for operationally invalid and aborted tests this period.

Reason	Number of Tests
Coolant flow transducer failure	1
Quality Index below 0.000, intake air pressure	1

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



Severity and Precision

Based on the mean delta/s values and pooled standard deviation for the current period, 95% confidence intervals representing severity for the current period are given below in reported units.

Variable	Pooled s All Oils	Mean Delta/s	Confidence Interval	Based on	Delta in Reported Units
RAC	0.25	0.765	8.00 - 8.38	8.0	0.19
AES	0.36	0.658	7.76 - 8.32	7.8	0.24
APV	0.18	0.218	7.40 – 7.68	7.5	0.04
AEV	0.15	-0.206	8.76 – 8.98	8.9	-0.03
OSCR	0.564	-0.297	10.1 – 26.9	20	-2.3

The mean Δ/s for this period shows AES (0.658), APV (0.218), RAC (0.765) and OSCR (-0.297) were mild, while AEV (-0.206) was severe. Figures 1 through 5 are current industry severity and precision EWMA control charts and plots of summations Δ/s for AES, RAC, AEV, APV, and OSCR.

Industry control charts for AES show that severity began the period in control, but sounded a warning alarm with the second test reported during the period. With the last test reported, severity is back in control. Precision is in control for the entire period. The industry summation Δ/s plot for AES shows severity trended mild for the period. Three of the four labs have trended mild for the period.

Much like AES, RAC severity began the period in control, before sounding a series of action and warning alarms. The charts are in control with the last test reported during the period. Precision charts were in control for the period. The industry summation Δ/s plot for RAC shows severity trended mild for the period. RAC was mild in three of the four labs

Industry control charts for AEV severity has been in control for the period. With the exception of two warning alarms midway through the period, precision was in control for the period. The summation Δ/s plot for AEV reflects a severe trend late in the period.

APV severity began the period in warning alarm before coming back in control, and remains in control through the end of the period. Precision was in control for the period. The summation Δ/s plot for APV shows near target for the period.

OSCR severity and precision were in control the entire period. The summation Δ/s plot for OSCR shows OSCR trending mild for the period.

Figures 6 and 7 chart the pooled precision estimates for all monitored parameters, by ASTM report period. Figure 6 shows precision for AES, RAC and OSCR has degraded with respect to the previous period. Figure 7 illustrates that precision for AEV has degraded with respect to the previous period, while precision for APV has not changed with respect to the previous period. Precision for all parameters compares well with historical rates.

The following table compares the standard deviation used in the LTMS for severity adjustment calculations, which is a pooled estimate of precision based on oils 1009, 1006, and 1007, with the current pooled precision of the oils 1006, 1007, and 1009.

Parameter	Severity Adjustment Standard Deviation (n = 120)	Pooled Standard Deviation, Oils 1006, 1007 and 1009 (n = 8)
AES	0.45	0.36
RAC	0.25	0.25
AEV	0.10	0.15
APV	0.20	0.18
OSCR	0.793	0.564

Fuels and Reference Oils

Reference oil quantities available at the laboratories and TMC as well as estimated life of these oils, are tabulated below.

Oil	TMC Inventory, in gallons	TMC Inventory, in tests	Laboratory Inventory, in tests	Estimated life
925-3	103	34	6	3 years
1006	0	0	2	< 1 year
1006-2	4,616	1538	3	3+ years
1007	422	140	5	3+ years
1009	717	239	4	3+ years

Note: Oils 1006, 1006-2, 1007 and 1009 are used across multiple test areas, TMC inventory represents total amount of that oil on hand.

Information Letters

Information Letter 06-1 was issued June 16, 2006. This information letter allows the use of camshafts for as many as four test engine builds.

Information Memos

The following memo was issued by the TMC during this period.

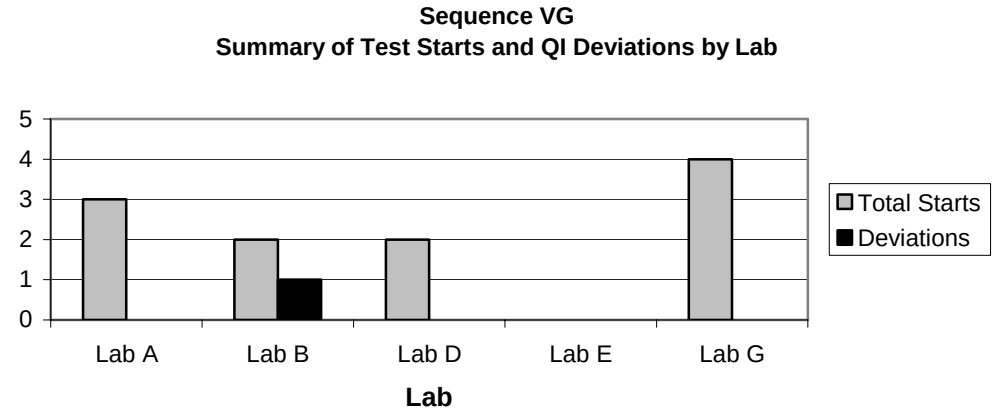
Memo	Date	Subject
06-020	4/10/06	Sequence VG Semi-Annual Report

Laboratory Visits

During this report period, there were three TMC lab visits conducted. Any discrepancies noted have been identified to the laboratories.

QI Deviations

There was one QI deviation reviewed by the Test Monitoring Center for this report period. This QI deviation was for coolant outlet temperature below 0.000.



Summary

The calibration per start rate has increased with respect to the previous period and compares well with historical rates. The rejected test per start rate has decreased with respect to the previous period and compares well with historical rates. The lost test per start rate has decreased with respect to the previous period. AES, RAC, OSCR and APV trended mild for the period. AEV was severe for the period. Precision for all parameters has degraded when compared to the previous period. Precision for all parameters compares well with historical estimates.

REG/reg

Attachments

c: Sequence VG Surveillance Panel
J. L. Zalar
F. M. Farber
ftp://ftp.astmtmc.cmu.edu/docs/gas/sequencev/semiannualreports/vg-10-2006.pdf

Distribution: Email

Listing of Tables and Figures Included as Part of This Report to the Sequence VG Surveillance Panel

Figures 1 through 5 are the Industry control charts for AES, RAC, AEV, APV and OSCR.

Figures 6 and 7 compare pooled precision estimates from this report period with previous periods.

Figure 8 is the Industry Timeline.

Figure 1

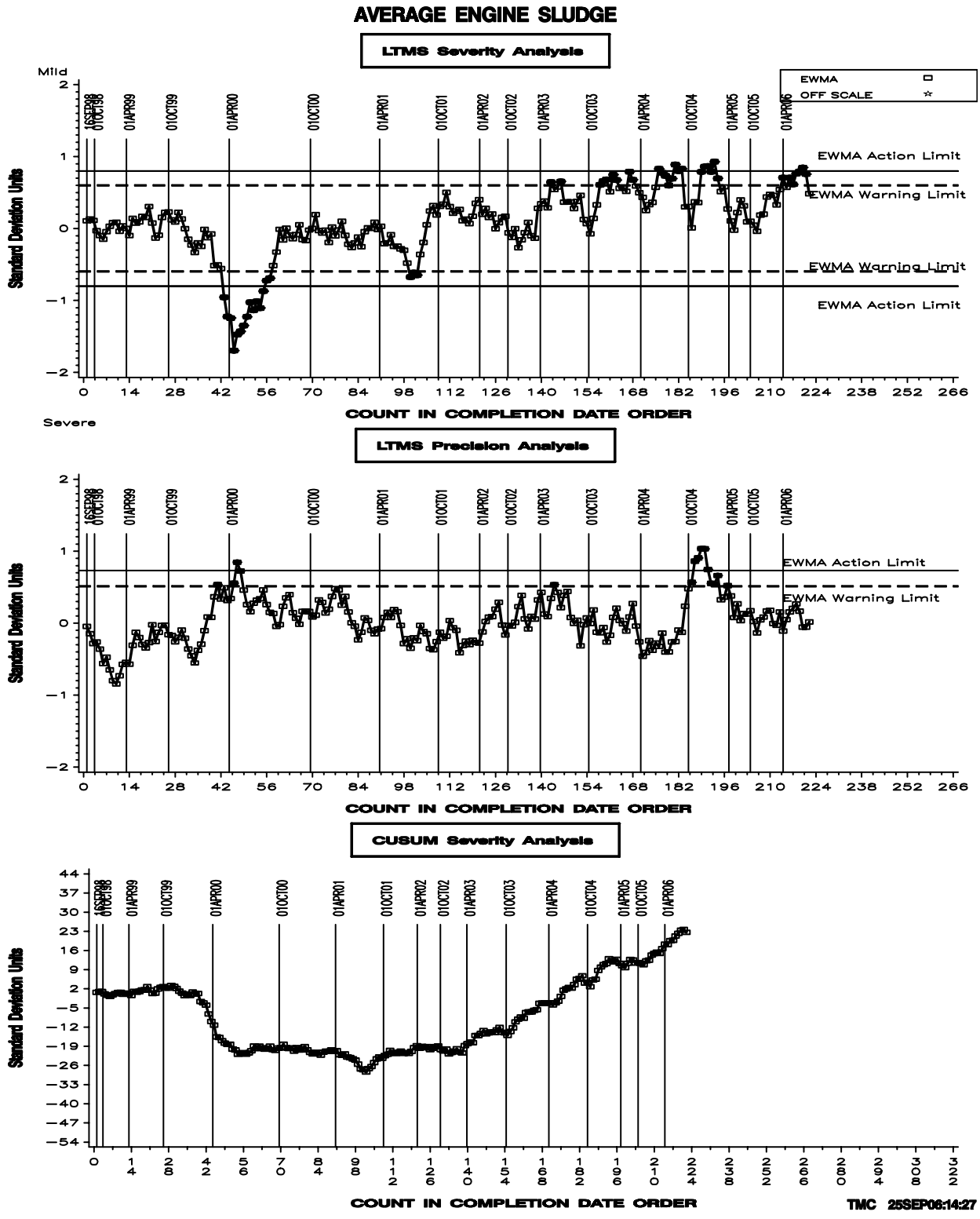

SEQUENCE VG INDUSTRY OPERATIONALLY VALID DATA
AVERAGE ENGINE SLUDGE
LTMS Severity Analysis
Mild
Severe
Standard Deviation Units
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
16SEP98
01OCT98
01APR99
01OCT99
01APR00
01OCT00
01APR01
01OCT01
01APR02
01OCT02
01APR03
01OCT03
01APR04
01OCT04
01APR05
01OCT05
01APR06
COUNT IN COMPLETION DATE ORDER
LTMS Precision Analysis
CUSUM Severity Analysis
TMC 25SEP06:14:27

Figure 2

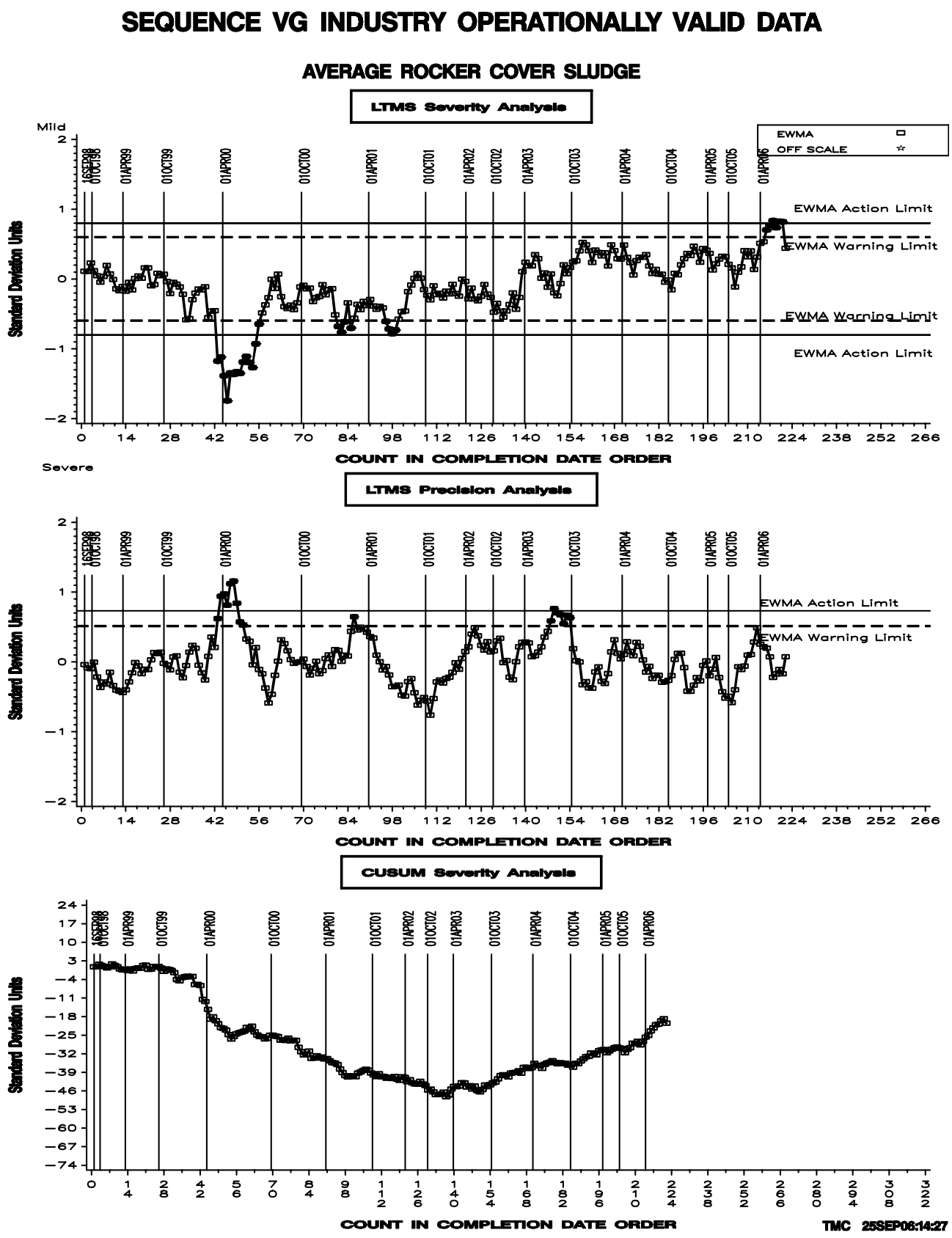

SEQUENCE VG INDUSTRY OPERATIONALLY VALID DATA
AVERAGE ROCKER COVER SLUDGE
LTMS Severity Analysis
Mild
Severe
Standard Deviation Units
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
16SEP98
01OCT98
01APR99
01OCT99
01APR00
01OCT00
01APR01
01OCT01
01APR02
01OCT02
01APR03
01OCT03
01APR04
01OCT04
01APR05
01OCT05
01APR06
COUNT IN COMPLETION DATE ORDER
LTMS Precision Analysis
CUSUM Severity Analysis
TMC 25SEP06:14:27

Figure 3

SEQUENCE VG INDUSTRY OPERATIONALLY VALID DATA

AVG. ENG. VARN. 3–PART FINAL RESULT APV + BAFFLES

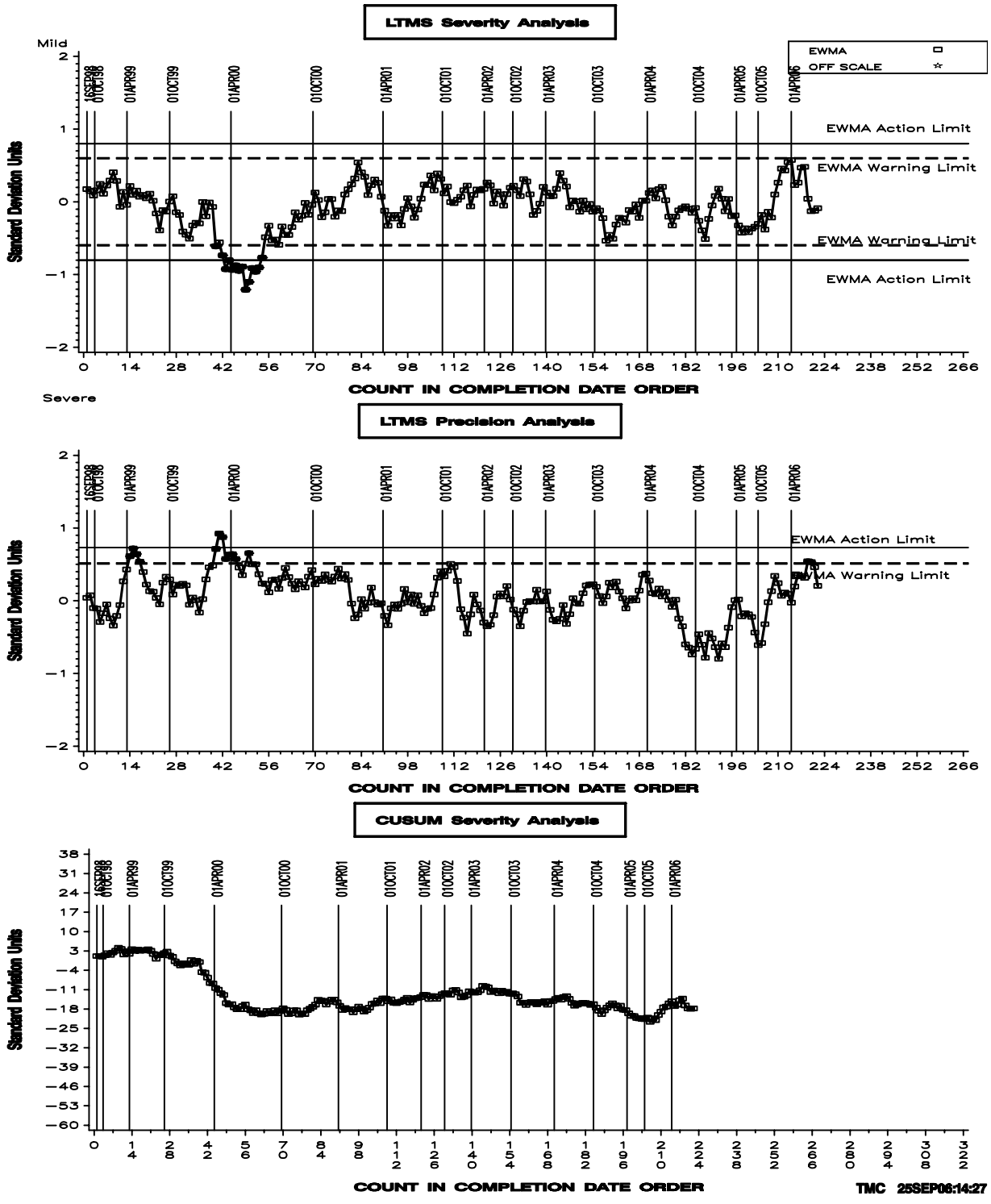


Figure 4

SEQUENCE VG INDUSTRY OPERATIONALLY VALID DATA

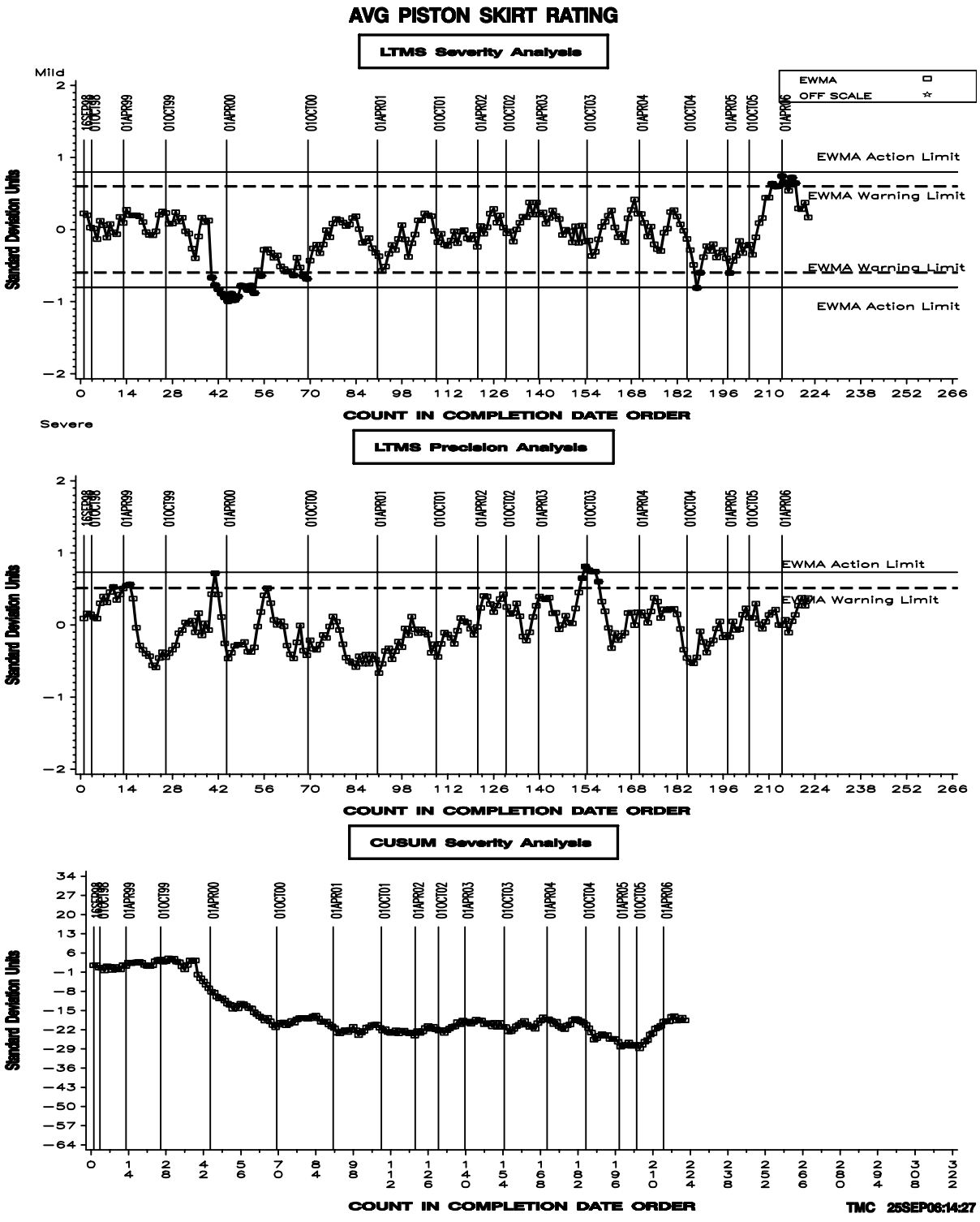


Figure 5

SEQUENCE VG INDUSTRY OPERATIONALLY VALID DATA

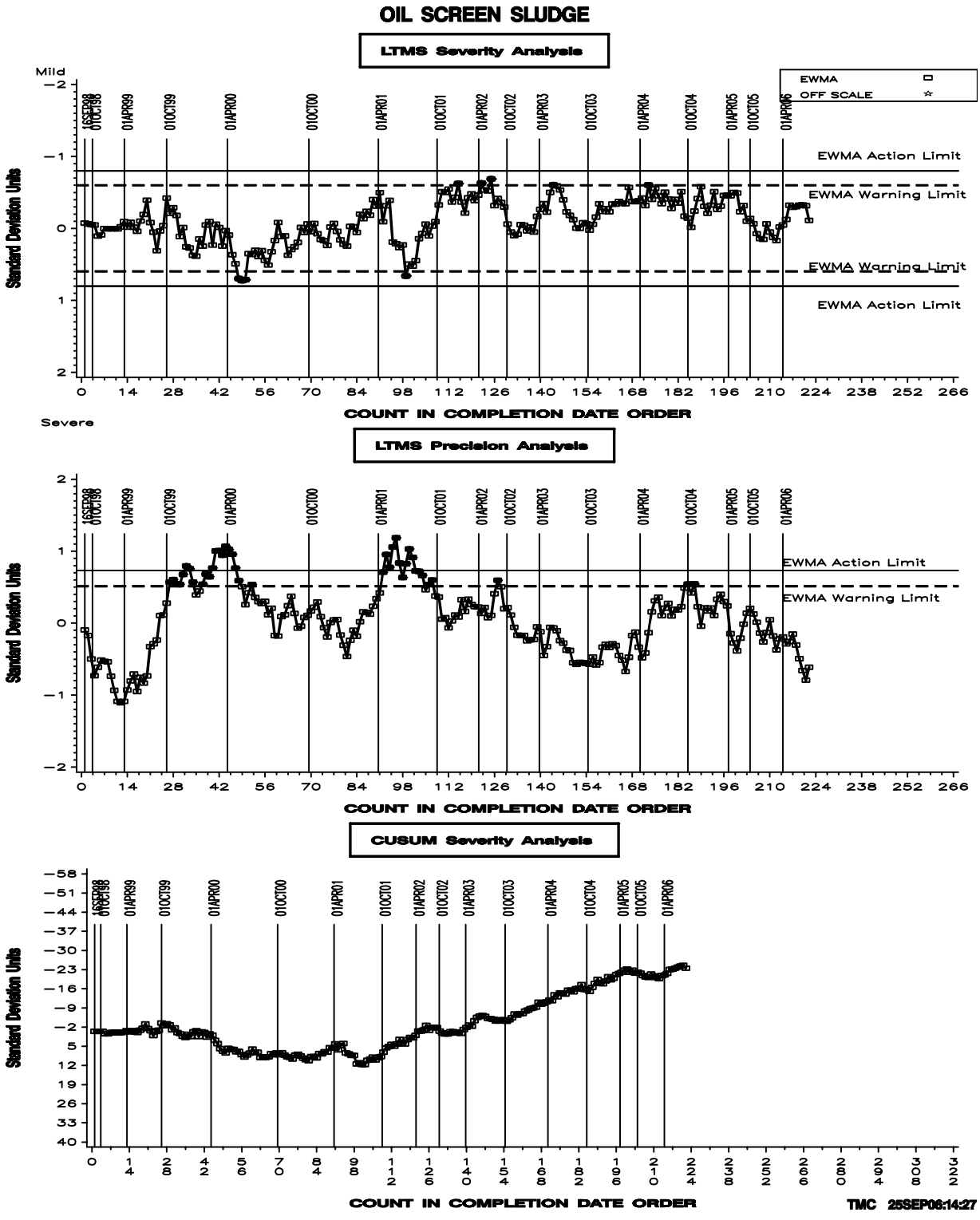


Figure 6

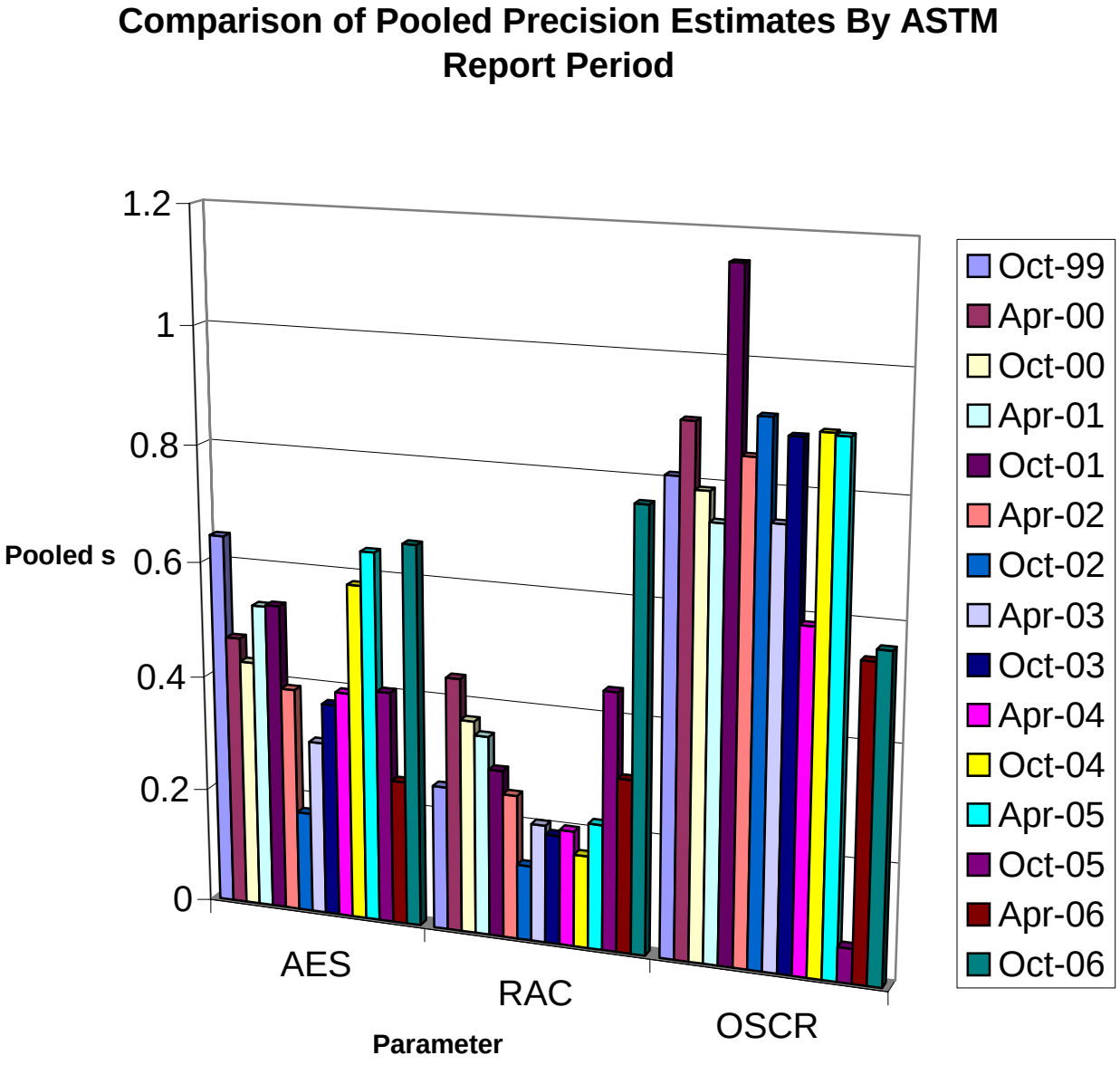

Comparison of Pooled Precision Estimates By ASTM Report Period
Pooled s
1.2
1
0.8
0.6
0.4
0.2
0
AES
RAC
OSCR
Parameter
Oct-99
Apr-00
Oct-00
Apr-01
Oct-01
Apr-02
Oct-02
Apr-03
Oct-03
Apr-04
Oct-04
Apr-05
Oct-05
Apr-06
Oct-06

Figure 7

Comparison of Pooled Precision Estimates By ASTM Report Period

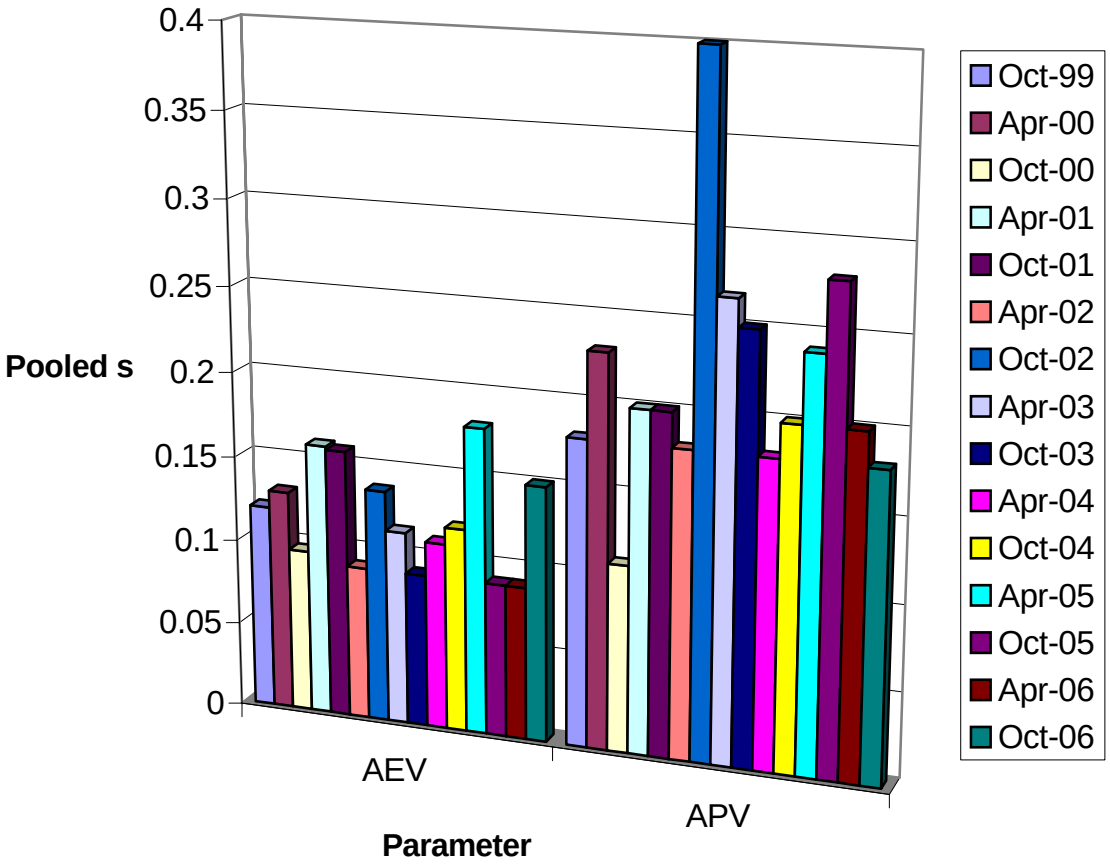


Figure 8

Date	Item Changed	Information Letter
19980901	Matrix testing begins	
19990211	Sequence VG Test approved, matrix stands charted and calibrated where applicable	
19990503	Information Letter 99-1 issued, adding ring weight loss, bore wear and pin wear measurements; as well as other procedural changes	99-1
19990615	Numerous procedure updates as identified in Information Letter 99-2	99-2
19990830	In conjunction with approval of VG fuel batch 996416, new test targets were published for oils 1006 and 1007	
19990830	Batch 996416 was approved for qualified testing at 8/13/99 Surveillance Panel meeting	
19991025	Revised Exhaust Backpressure limits for stages I and II to 102 and 106 kPa, respectively	99-3
19991025	Deleted rating of Underside of Block sludge and revised report forms and data dictionary accordingly	99-3
19991025	Added Section 11 to document stand referencing requirements	99-3
19991025	Added Section 16 and Annex A14, which give precision and bias statements	99-3
19991025	Updated listing of kit parts given in Sections 7.2 and 7.3 and Annex A5	99-3
19991025	Revised the type of oil filter and screen size, Sections 7.4.9 and 8.3.2.2 and A3.8 changed to reflect this	99-3
19991115	Update reference oil targets for oils 1006 and 1007 (n=10), also revised severity adjustment standard deviation	
20000215	Revised Exhaust Backpressure Limits for stages I and II to 104 and 107 kPa, respectively	00-1
20000215	Deleted varnish ratings for cam baffles, oil pan, timing chain cover and rear seal housing	00-1
20000215	Revised Form 8 to not allow value to be entered for oil added at cycle 54 and deleted form 7	00-1
20000802	Added Oil Ring Clogging Rating, changed follower pin wear measurement from all 8 cylin-	00-2
20000802	ders to cylinder 8 only. Changed bore wear measurements from all cylinders to cylinders	00-2
20000802	1 and 8. Changed from ring weight loss to ring gap increase on cylinders 1 & 8. Added	00-2
20000802	transformation for oil screen clogging. Deleted photos for cam baffles, timing chain cover	00-2
20000802	rear seal housing varnish. Report forms and Data dictionary changes, version 20000713	00-2
20001101	Revised Section 13.4.1 Report forms and Data dictionary changes, version 20000831	00-3
20010115	Changed analysis method for water in fuel	01-1
	Deleted 7.1.1, Changed D1744 to D6304. Clarified procedures for bore wear, follower pin	01-1
20010115	, wear, oil screen clogging and top ring gap increase. Revised stage III rocker cover inlet temp	01-1
20010115	Ramp. Deleted ring groove chamfer measurement. Revised dipstick calibration. Revised temperature and pressure calibration frequency, changed dipstick calibration procedure, dropped stage I blowby measurement. Dropped 0.5% O_2 calibration gas	01-1
20010115	Modified fuel injector flow requirements and deleted Appendix X2.	01-1
20010320	Information Letter written to incorporate information letters not incorporated into Test Method D6593	01-2

20010320	Dropped requirement to measure Benzene in fuel, defined a process for consensus rating and no longer requires analysis of used oil for TBN, vis@100 °C and pentane insolubles	01-3
20011114	Dropped NOx measurements, monitor Power QI, addressed rating changes recommended by Light Duty Rating Task Force and allowed adjustments to blowby flow rates during 1st 48 hours of the test	02-1
20020301	Replaced, CO, CO_2 and O_2 measurements with Lambda	02-2
20020408	Revised references to CRC manuals 12 and 14 to manual 20	02-3
20020515	Allowed use of power supply for EEC and Lambda sensors, revised calibration frequency for Lambda sensor and dropped requirement to measure bore wear Dropped rating of RAC covers for varnish and added Cam baffle varnish ratings	02-4
20020809	Initial targets (n=3) for reference oil 1009	
20021023	Initial targets (n=5) for reference oil 1009	
20021025	Removed remedial statements and made other editorial changes	02-5
20030128	Target Update (n=10) for reference oil 1006-2	
20030327	Removed requirement to include photographs in final report	03-1
20030410	Deleted exhaust gas values for stages I and II	03-2
20030515	Target Update (n=10) for reference oil 1009	
20030905	Corrected Section 16.1.2.1 and revised Section A7.1 to include ACC Conformance Statement. Procedure changes to address processes necessary to use Romeo Engines for calibrated testing Replaced Aliphatic Naphtha with ASTM D235 Type II, Class C solvent	03-3
20040105	Target Update (n=20) for reference oil 1006-2	
20040109	Increased last non reference oil start date from 171 to 180 days Editorial changes to precision statements	04-1
20040207	Target Update (n=20) for reference oil 1009	
20040513	Revised U & L values for MAP and EBP Allowed removal of piston staining	04-2
20040701	Revised section 12.1.5 to allow ring gap adjustments during 1st 48 hours of test	04-3
20041103	Target Update (n=30) for reference oil 1006-2 Target Update (n=30) for reference oil 1009 Target Update (n=22) for reference oil 925-3	
20041214	Revised section 7.1.1 to require degreasing solvent that meets requirements of D235 for Aromatics, color and flash point and require a Certificate of analysis for each batch	04-4
20050101	Revised standard deviation for severity adjustment calculation for all parameters	
20050601	Deleted ring gap increase and follower pin wear, clarified Oil screen rating, updated precision statement, added limits for lost test data, editorial changes	05-1
20050719	Approved fuel batch TA1921LS15, with correction factors for AES, RAC, AEV and APV	05-2
20050726	Changed fuel batch designation from TA1921LS15 to TF2221LS20	05-3
20051209	Allowed use of an alternate AFR measuring device	05-4
20051209	Added tolerance to location of AFR measuring device sensor	05-4
20051209	Required raters to attend Rating Workshop on an annual basis	05-4
20060616	Allowed camshafts to be run for 4 tests	06-1