Test Monitoring Center
6555 Penn Avenue
Pittsburgh, PA 15206-4489
(412) 365-1000

MEMORANDUM: 05-009

DATE: April 4, 2005

TO: Gordon Farnsworth, Chairman, Sequence VG Surveillance Panel

FROM: Richard E. Grundza

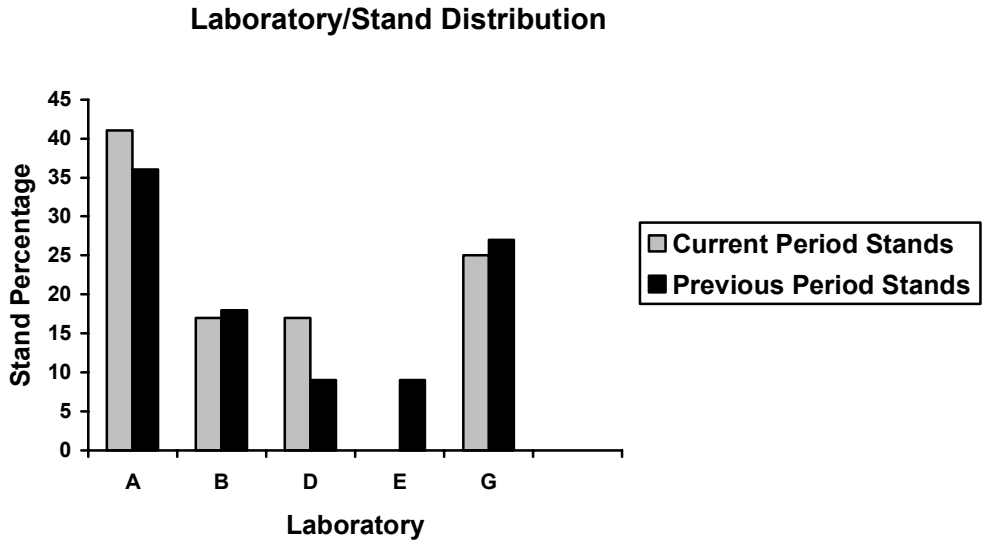
SUBJECT: Sequence VG Reference Test Status from October 1, 2004 through March 31, 2005

The following is a summary of Sequence VG reference tests that were completed during the period October 1, 2004 through March 31, 2005.

Lab/Stand Distribution

	Reporting Data	Calibrated as of 3/31/05
Number of Laboratories	4	4
Number of Stands	12	9

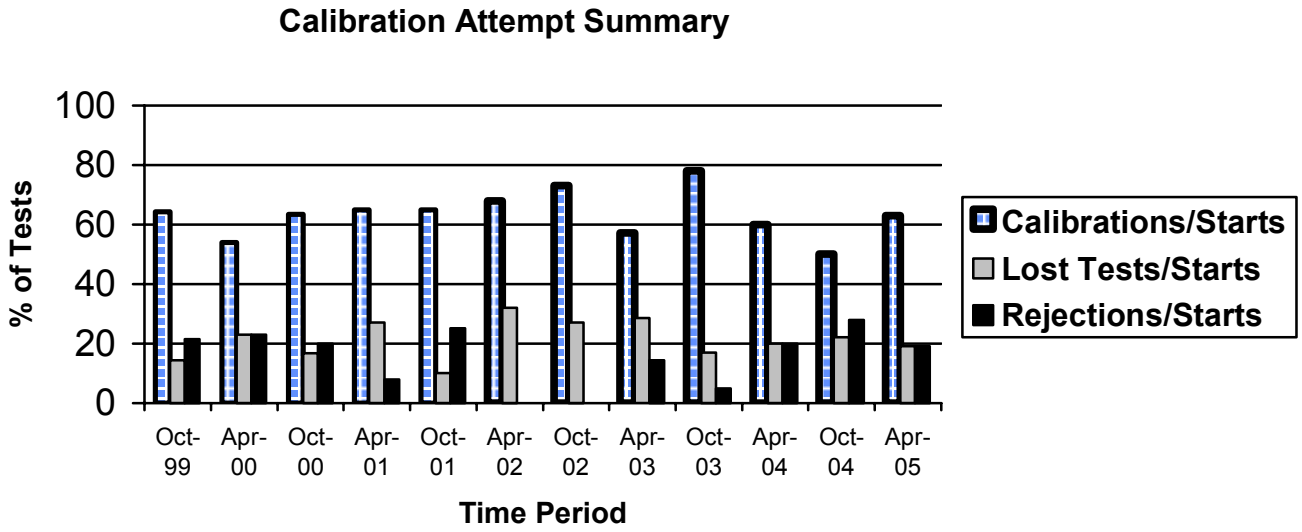
The following chart shows the laboratory/stand distribution:



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	10
Failed Acceptance Criteria	OC	3
Operationally Invalid, Lab Judgment	LC	2
Aborted	XC	1
Pending Final Validity Fuel Approval Test	PF	6
Total		22

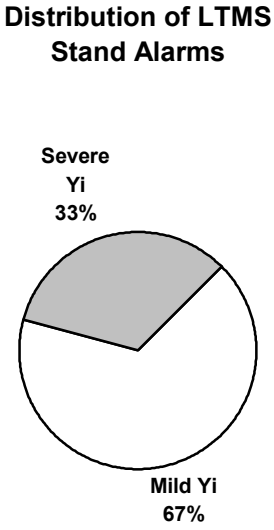
Calibrations per start, lost tests per start and rejections per start rates are summarized below:

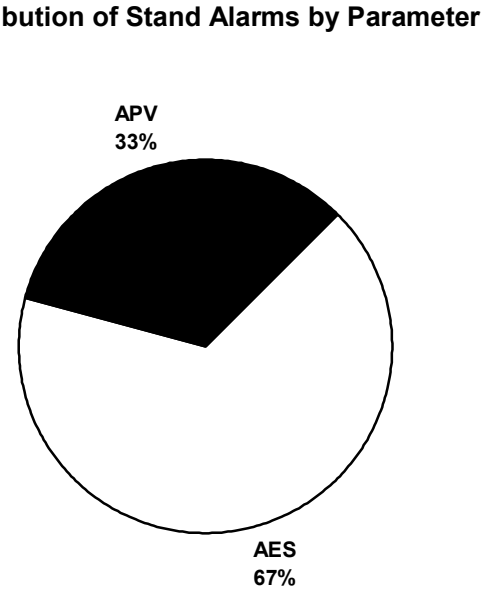


The calibration per start rate has increased with respect to the previous period and compares well with the historical rate. The lost test per start and rejected test per start rates have decreased with respect to the previous period. Both rates compare well with historical rates.

The following table lists the reasons for statistically invalid tests this period.

Reason for Statistical Failure	Number of Tests
Severe APV	1
Mild AES	2



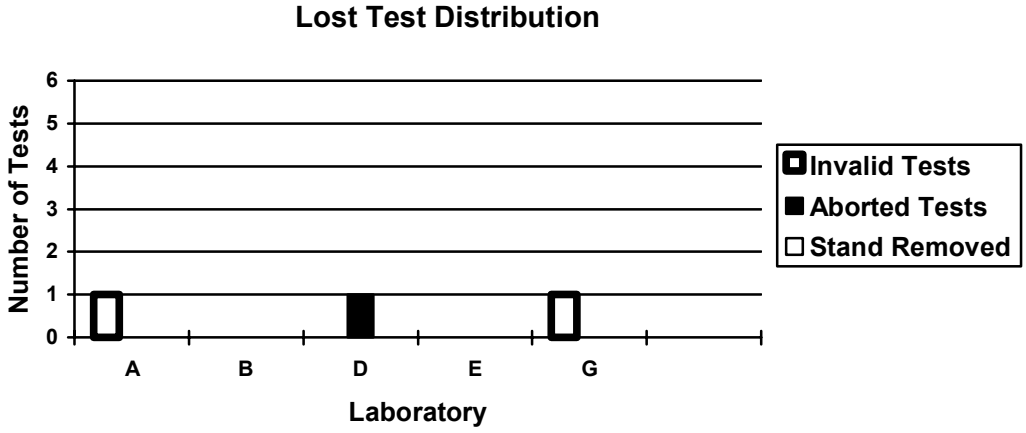


There were no LTMS deviations written during this report period. A total of six LTMS deviations have been written to date.

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

Reason	Number of Tests
Oil inlet temperature control, oil inlet temperature QI, high fuel dilution	1
Wrong dipstick	1
Blown head gasket	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	0.217	0.439	7.96 - 8.23	8.0	0.1
AES	0.641	0.553	7.77 - 8.52	7.8	0.39
APV	0.242	-0.536	7.22 – 7.52	7.5	-0.13
AEV	0.179	-0.145	8.77 – 8.98	8.9	-0.03
OSCR	0.893	-0.452	7.2 – 23.1	20	-7.0

The mean Δ/s for this period shows AEV (-0.145) and APV (-0.536) were severe, while AES (0.553), RAC (0.439) and OSCR (-0.452) were mild. 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 for the first three tests before sounding a series of a warning alarm, two action alarms, a warning alarm, an action and a warning alarm. The charts cleared for the remaining three tests reported during the period. The alarms were primarily caused by tests from one lab. This lab had a mean delta/s of 1.714 for the results reported during this period. AES precision also began the period in control. Three tests into the period a warning alarm sounded, followed by four action and four warning alarms, before clearing for two tests. The precision chart ended the period in warning alarm. The alarms are the result of several mild results from one lab, intermixed with on target to slightly severe results from other labs in industry. The industry summation Δ/s plot for AES shows severity trended mild for the period.

RAC severity and precision charts were in control for the period. The industry summation Δ/s plot for RAC shows severity trended mild for the period.

Industry control charts for AEV severity and precision were in control the entire period. The summation Δ/s plot for AEV reflect a slight severe trend during the period.

Industry control charts for APV severity shows a warning and action alarm sounded during the period. The severe results are primarily from one lab and do not appear to be an industry problem. Charts for APV precision were in control the entire period. The summation Δ/s plot for APV shows a severe trend for the period.

OSCR severity was in control the entire period. With the exception of two warning alarms near the beginning of the period, OSCR precision was in control for the 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 AES and RAC have degraded with respect to the previous period while OSCR precision has changed little with respect to the previous period. Precision for AES, OSCR and RAC parameters compares well with historical rates. Figure 7 shows precision for both APV and AEV has degraded with respect to the previous period. Both parameters precision compares well with historical estimates.

The following table compares the standard deviation used in the LTMS for severity adjustment calculation, 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 = 10)
AES	0.45	0.70
RAC	0.25	0.15
AEV	0.10	0.16
APV	0.20	0.27
OSCR	0.793	1.024

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	135	45	4	3 years
1006	0	0	2	< 1 year
1006-2	4719	1573	8	3+ years
1007	457	152	4	3+ years
1009	803	267	5	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 04-4 was issued December 14, 2004. This information letter clarified the requirement for solvents to meet ASTM D235, Type II Class C. The method now requires that the solvent meet ASTM D235, Type II, Class C specifications for Aromatic Content, Color and Flash Point only.

Information Memos

The following memos were issued by the TMC during this period.

Memo	Date	Subject
04-080	10/11/04	Sequence VG Semi-Annual Report
04-094	11/03/04	Target Update, Reference Oils 1006-2 (n=30), 1009 (n=30) and 925-3 (n=22)

Laboratory Visits

During this report period, there were no TMC lab visits conducted.

QI Deviations

There were no QI deviations reviewed by the Test Monitoring Center for this report period.

Summary

The calibrations per start rate has increased with respect to the previous period and compares well with historical rates. The lost test per start and rejected tests per start rates have decreased with respect to the previous period and compare well with historical rates. AEV and APV were severe, while AES, RAC and OSCR trended mild for the period. AES, AEV, APV and RAC precision has degraded with respect to the previous period. OSCR precision has improved slightly with respect to the previous period. Precision for all parameters is well within 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-04-2005.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.

SEQUENCE VG INDUSTRY OPERATIONALLY VALID DATA

Figure 1

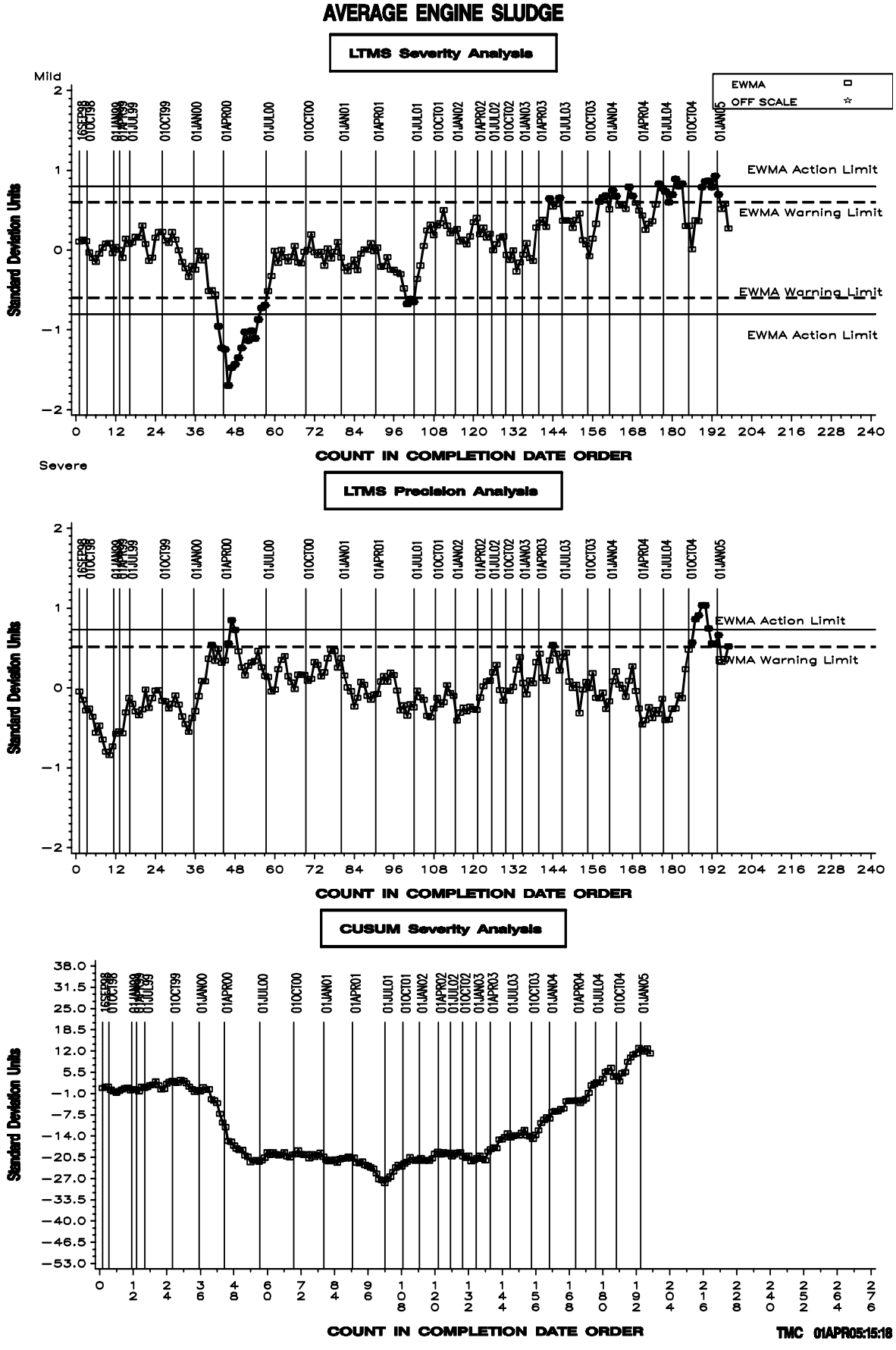


Figure 2

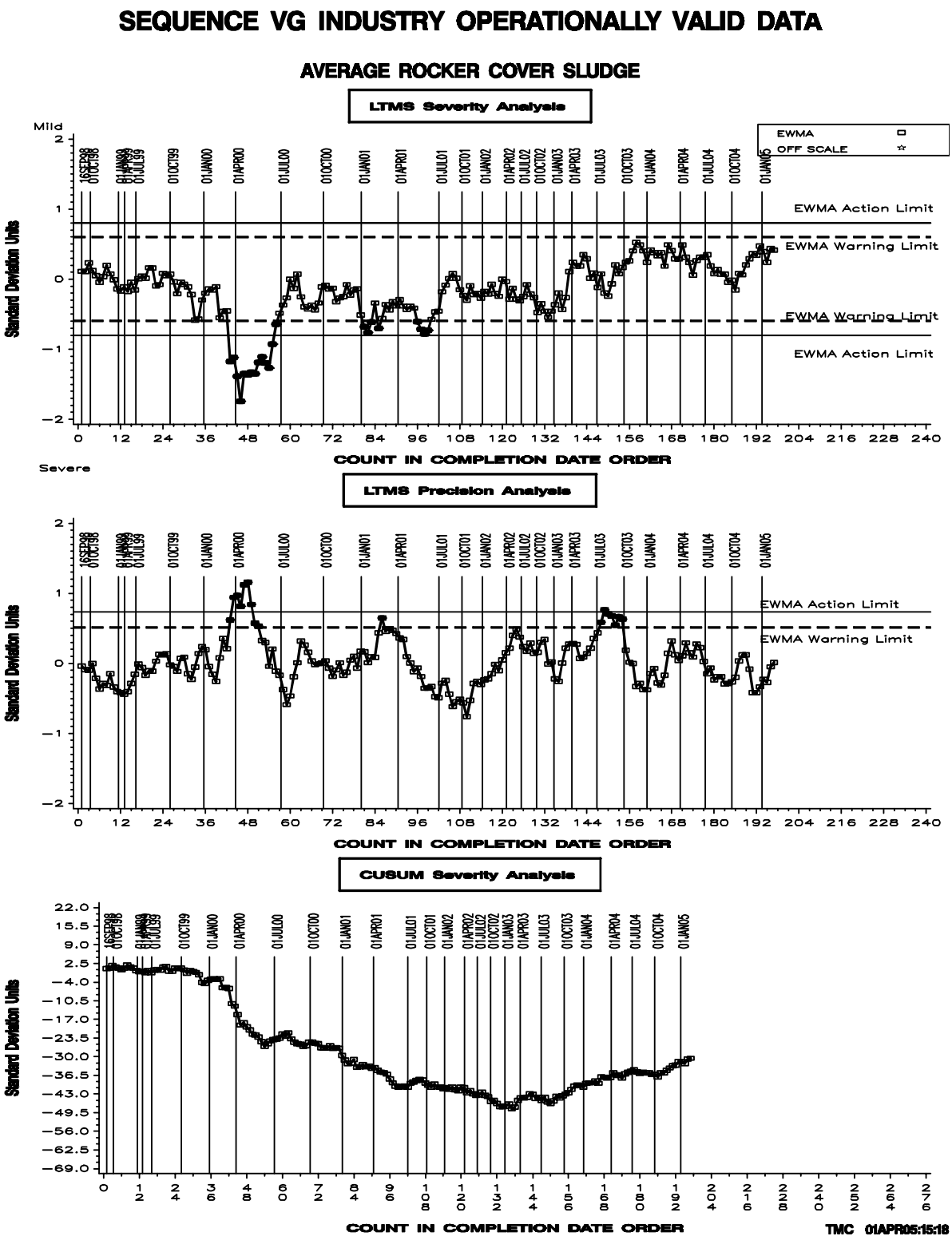
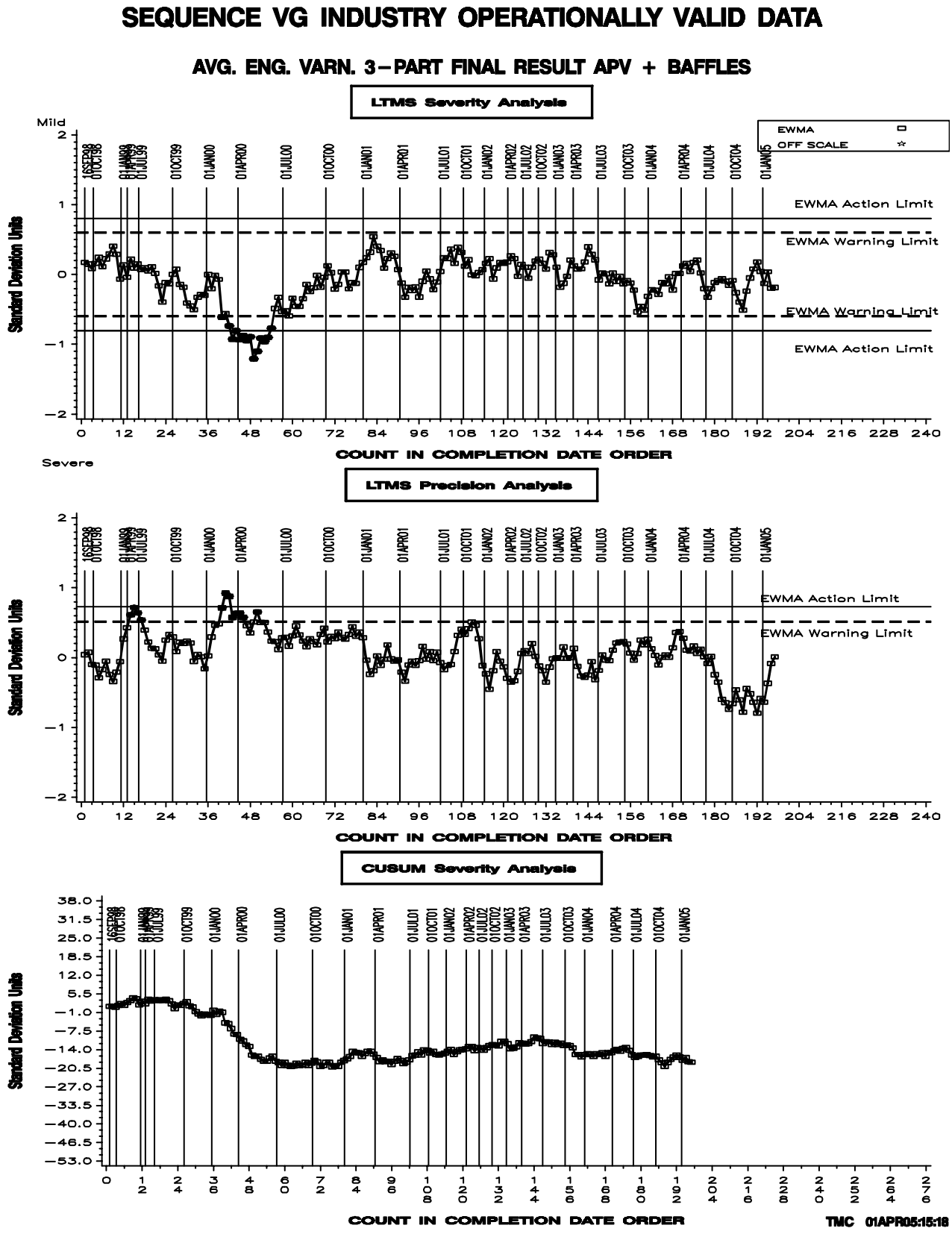
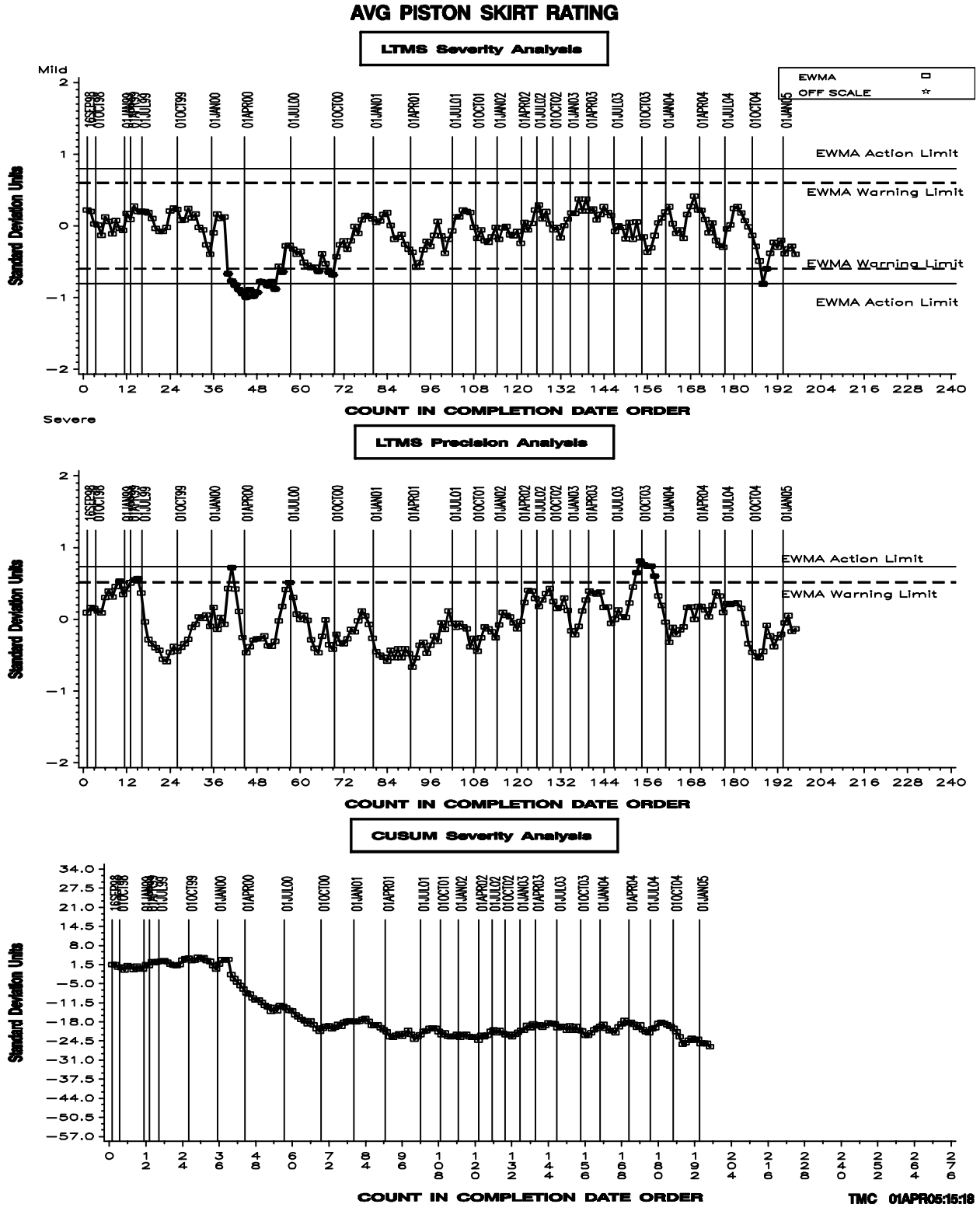

SEQUENCE VG INDUSTRY OPERATIONALLY VALID DATA
AVERAGE ROCKER COVER SLUDGE
LTMS Severity Analysis
Mild
Severe
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
LTMS Precision Analysis
EWMA Action Limit
EWMA Warning Limit
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
CUSUM Severity Analysis
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
TMC 01APR05:15:18

Figure 3


SEQUENCE VG INDUSTRY OPERATIONALLY VALID DATA
AVG. ENG. VARN. 3–PART FINAL RESULT APV + BAFFLES
LTMS Severity Analysis
Mild
Severe
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
LTMS Precision Analysis
EWMA Action Limit
EWMA Warning Limit
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
CUSUM Severity Analysis
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
TMC 01APR05:15:18

SEQUENCE VG INDUSTRY OPERATIONALLY VALID DATA Figure 4



SEQUENCE VG INDUSTRY OPERATIONALLY VALID DATA Figure 5

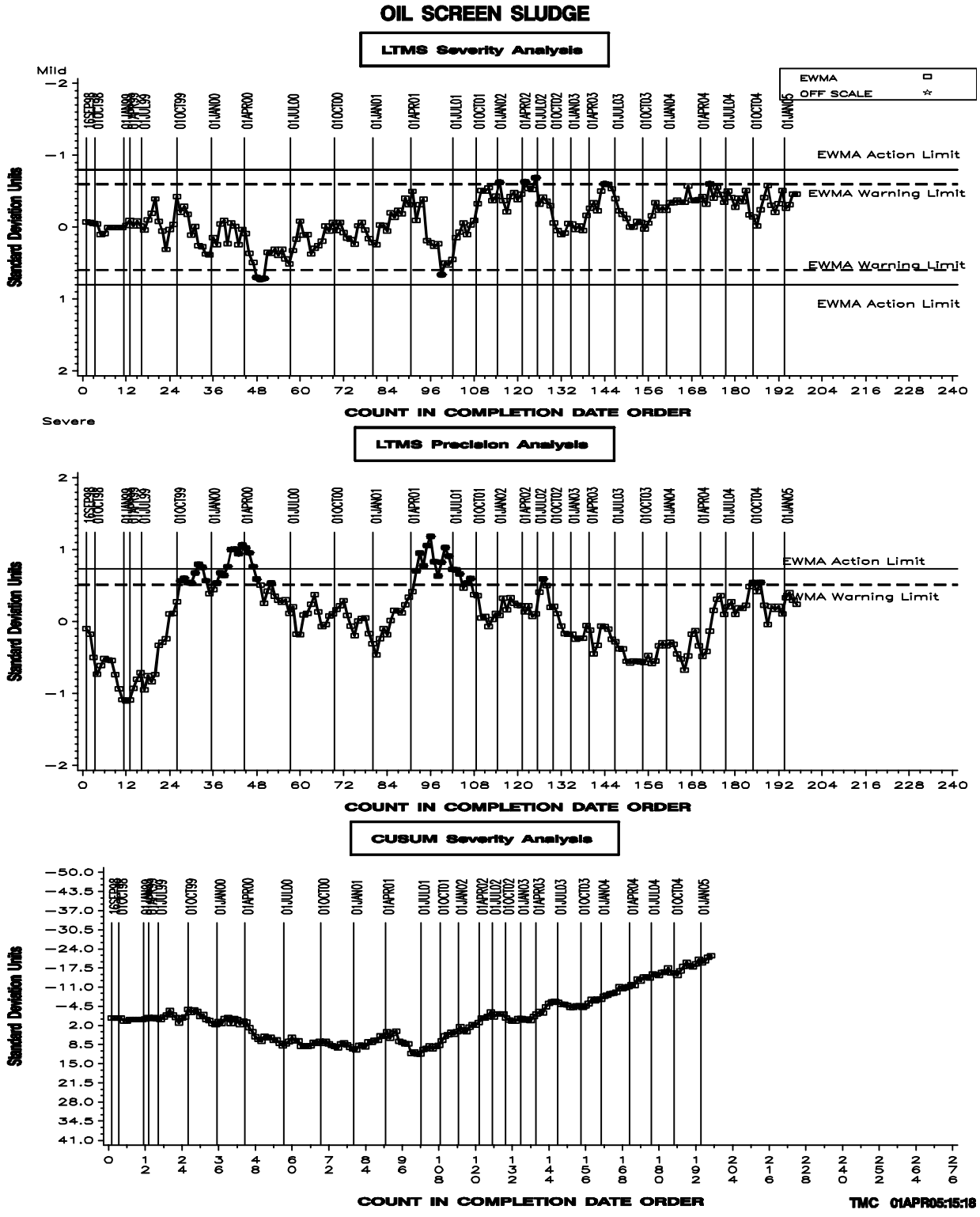


Figure 6

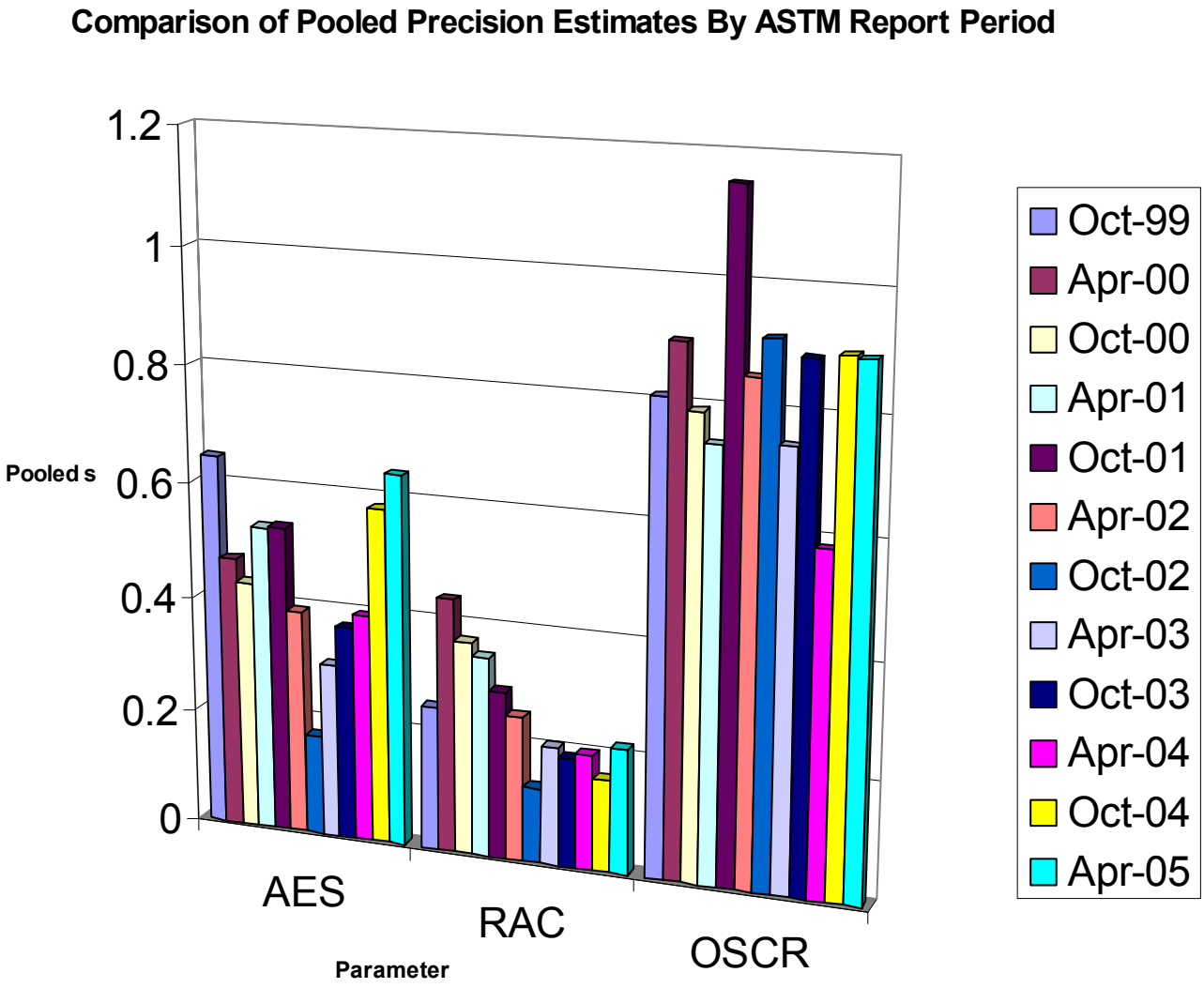

Comparison of Pooled Precision Estimates By ASTM Report Period
1.2
1
0.8
0.6
0.4
0.2
0
Pooled s
AES
RAC
OSCR
Parameter
Oct-99
Apr-00
Oct-00
Apr-01
Oct-01
Apr-02
Oct-02
Apr-03
Oct-03
Apr-04
Oct-04
Apr-05

Figure 7

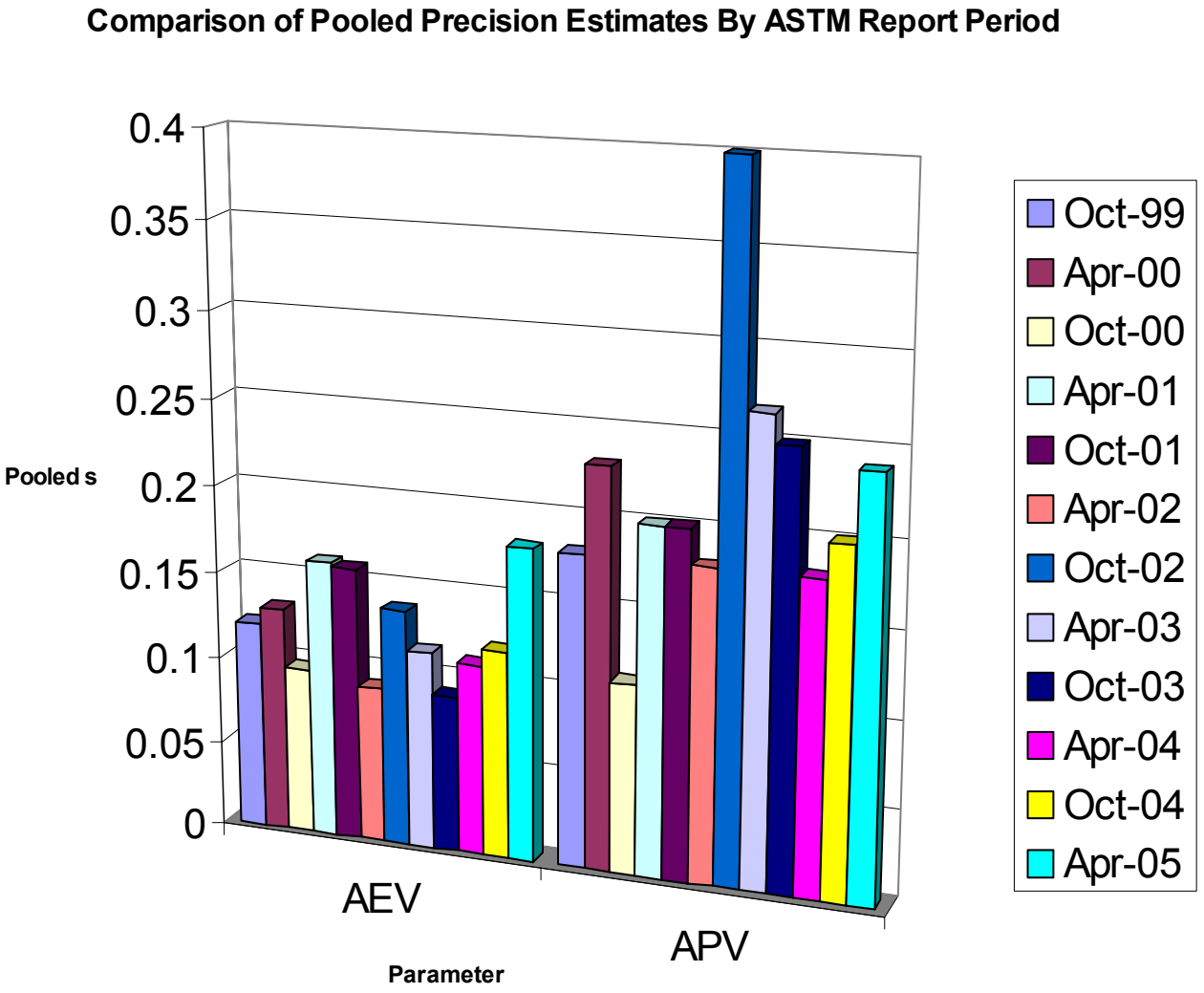

Comparison of Pooled Precision Estimates By ASTM Report Period
Pooled s
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
AEV
APV
Parameter
Oct-99
Apr-00
Oct-00
Apr-01
Oct-01
Apr-02
Oct-02
Apr-03
Oct-03
Apr-04
Oct-04
Apr-05

Figure 8

Sequence VG Industry Timeline

19980901		Matrix testing begins
19990211		Sequence VG Test approved, matrix stands charted and calibrated where applicable
19990503	99-1	Information Letter 99-1 issued, adding ring weight loss, bore wear and pin wear measurements; as well as other procedural changes
19990615	99-2	Numerous procedure updates as identified in Information Letter 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	99-3	Revised Exhaust Backpressure limits for stages I and II to 102 and 106 kPa, respectively
19991025	99-3	Deleted rating of Underside of Block sludge and revised report forms and data dictionary accordingly
19991025	99-3	Added Section 11 to document stand referencing requirements
19991025	99-3	Added Section 16 and Annex A14, which give precision and bias statements
19991025	99-3	Updated listing of kit parts given in Sections 7.2 and 7.3 and Annex A5
19991025	99-3	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
19991115		Update reference oil targets for oils 1006 and 1007 (n=10), also revised severity adjustment standard deviation
20000215	00-1	Revised Exhaust Backpressure Limits for stages I and II to 104 and 107 kPa, respectively
20000215	00-1	Deleted varnish ratings for cam baffles, oil pan, timing chain cover and rear seal housing.
20000215	00-1	Revised Form 8 to not allow value to be entered for oil added at cycle 54 and deleted form 7.
20000802	00-2	Added Oil Ring Clogging Rating, changed follower pin wear measurement from all 8 cylinders to cylinder 8 only Changed bore wear measurements from all cylinders to cylinders 1 and 8.
20000802	00-2	Changed from ring weight loss to ring gap increase on cylinders 1 & 8.
20000802	00-2	transformation for oil screen clogging. Deleted photos for cam baffles, timing chain cover rear seal housing varnish.
20000802	00-2	Report forms and Data dictionary changes, version 20000713
20001101	00-3	Revised Section 13.4.1. Report forms and Data dictionary changes, version 20000831
20010115	01-1	Changed analysis method for water in fuel, deleted Section 7.1.1, enhanced the measurement techniques for bore wear, oil screen clogging, pin wear and top ring gap increase, changed RAC inlet temperature ramp for stage III to I, removed ring chamfer measurements, changed calibration frequency for temperature and pressure measurement sensors. Changed dipstick calibration procedure, dropped stage I blowby measurements, dropped 0.5% O2 calibration gas, modified fuel injector flow requirements and updated Appendix X2.
20010320	01-2	This information letter was issued against Test Method D6593 to incorporate information letters not included in the initial issue of the method and to correct the precision statement in the method.

20010320	01-3	This information letter dropped the requirement to measure benzene in the fuel, defined a process for concensus rating and no longer requires analysis of used oil for TBN, vis @100 °C and pentane insolubles.
20011114	02-1	This information letter dropped the requirement to measure NOx, monitor Power Qi, addressed rating changes recommended by the Light Duty Rating Task Force and allow adjustments to blowby flow rates during the first 48 hours of the test.
20020301	02-2	This information letter replaced CO, CO2 and O2 measurements with Lambda measurement.
20020408	02-3	Revised references to CRC manuals 12 and 14 with CRC manual 20.
20020515	02-4	This information letter allowed use of power supply for EEC and Lambda sensor power, replaced Rocker Arm cover varnish with cam baffle varnish, revised lambda sensor calibration frequency and dropped requirement to measure bore wear.
20020809		Test Targets, Reference oil 1009, n = 3.
20021023		Test Targets, Reference oil 1009, n = 5.
20021025	02-5	Removed remedial statements from test method and addressed other editorial changes.
20030128		Test Targets, Reference oil 1006-2, n = 10.
20030227	03-1	Removed requirement to include photographs of rated parts in final test report.
20030227	03-2	Corrected Table 6, Section 12.1.1.2 and 12.1.1.6 to remove exhaust gas analysis value and replace with appropriate Lambda values
20030515		Test Targets, Reference oil 1009, n = 10.
20030710		First Test on Romeo Hardware completes.
20030905	03-3	Change solvent from aliphatic naphtha to a solvent meeting ASTM D235, Type II, Class C specification
20030905	03-3	Procedure changes to accomplish build activities and parts required for using Romeo engine for Sequence VG testing.
20030905	03-3	Corrected Section 16.1.1 and modified A7.1 to add ACC Conformance Statement.
20040105		Test Targets, Reference oil 1006-2, n = 20.
20040217		Test Targets, Reference oil 1009, n = 20.
20040109	04-1	Change in calibration period from last candidate start within 171 days to last candidate start within 180 days of reference oil test completion.
20040109	04-1	Editorial changes to precision statement, revised table 8 to reflect that oil screen clogging has a log transformation.
20040526	04-2	Revised U & L's for Exhaust Backpressure and Manifold Absolute Pressure.
20040526	04-2	Allowed removal of piston staining before installation of piston into the engine.
20040701	04-3	Revised Section 12.1.1.5 to address ring gap adjustments during the first 48 hours of the test.
20041214	04-4	Revised Section 7.1.1 to require solvent meeting D235, Type II, Class C for aromatic content, color and flash point only.
20041103		Test Targets, Reference oil 1006-2, n = 30.
20041103		Test Targets, Reference oil 1009, n = 30.
20041103		Test Targets, Reference oil 925-3, n = 22.
20050101		Revised standard deviations used SA calculations for all parameters