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Test Monitoring Center

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MEMORANDUM: 11-011

DATE: June 2, 2011

TO: Messrs. Ted Selby and Mark Devlin, Co-Chairs ASTM D02.B0.07

FROM: Tom Schofield

SUBJECT: TMC Bench Reference Test Monitoring Semiannual Report From October 1, 2010, through March 31, 2011, for Test Areas D6417, D5800, D6335 (TEOST), D7097 (MTEOS), D5133 (GI), D6082, D874 and D7528 (ROBO)

I respectfully submit the TMC's ASTM D02.B07 Bench Reference Test Monitoring Semiannual Report for Test Areas D6417, D5800, D6335 (TEOST), D7097 (MTEOS), D5133 (GI), D6082 D874 and D7528 (ROBO), with statistical summaries broken down by test area (Attachment 1).

Calibration testing precision and severity are monitored by comparing a recent period of reference test performance to "target" performance (as determined by the surveillance panels), and to performance over previous periods. The TMC monitors test precision by a pooled standard deviation (pooled s), and test severity by mean Δ/s ("mean delta over s"), where:

Pooled s = Standard deviation pooled across labs and reference oils
(i.e., The pooled precision of the test this period in standard deviations.)

Δ/s = [(Single Test Result) - (Reference Oil's Target Mean Performance)] / (R.O.'s Target Precision)
(i.e., "How many standard deviations from the target mean is this test?")

Mean Δ/s = [Σ (Δ/s)] / n (across reference oils and labs, and over a period of time)
(i.e., "On average, how many standard deviations from the target mean are all the operationally valid calibration tests for each period?")

Note that the period severity estimates (mean Δ/s) can be averaged across oils of different performance levels because the individual test results used to calculate mean Δ/s have all been normalized into standard deviations (Δ/s) for each corresponding reference oil. Using a pooled s for estimating precision simplifies the interpretation of precision across all reference oil performance levels. These two calculations (pooled s and mean Δ/s) allow all calibration performance levels to be combined into overall period precision and severity estimates for each test type, providing a means to compare current test performance (precision and severity) to target performance and to prior periods. Individual oil targets, and current performance summaries by oil, are also reported (Attachments 2 and 3).

The tables in Attachment 1, comparing current and previous period precision and severity, have become too large to conveniently show all prior report periods. Older period comparison periods have been eliminated to keep the information succinct and relevant.

The blind lab codes in this report are cross-referenced, as they were in previous reports. That is, in this report, Lab A represents the same lab in each section, which is the same as Lab A in previous reports, and should remain the same lab in future reports.

All operationally valid test data and severity plots are available on the TMC's website. Please contact the TMC if you require further information.

Attachments

c: D02.B07 Bench Test Mailing List
F. Farber, TMC
J. Clark, TMC
ftp://ftp.astmtmc.cmu.edu/docs/bench/bo7semiannualreports/mem11-011.pdf

Distribution: Email

Attachment 1

ASTM Test Monitoring Center

Semiannual Report

ASTM D02.B07 Bench Reference Test Monitoring
From October 1, 2010 through March 31, 2011

D6417, D5800, D6335 (TEOST), D7097 (MTEOS), D5133 (GI), D6082, D874 and D7528 (ROBO)

D6417: Estimation of Engine Oil Volatility by Capillary Gas Chromatography

MONITORED TESTING STATUS

Table 1 summarizes the reference tests reported to the TMC this period (6 labs reporting):

TABLE 1

	No. of Tests
Statistically Acceptable and Operationally Valid	19
Operationally Valid but Failed Acceptance Criteria	1
Operationally Invalid (initially reported as)	0
Operationally Invalid (after informed of failing calibration)	0
Total	**20**

Fail Rate of Operationally Valid Tests: 5.0%

There were no operationally invalid tests reported this period.

Table 2 is a breakdown of the statistically unacceptable tests.

TABLE 2

Reason for Fail	No. of Tests
Area % Volatized @ 371°C Severe	0
Area % Volatized @ 371°C Mild	1

PRECISION AND SEVERITY

Table 3 shows the current Industry precision and severity for the Sample Area % Volatized @ 371°C test parameter for all operationally valid tests for the report period. (First TMC calibration test completed 10/5/00.)

TABLE 3

Area % Volatized @ 371°C	N	df	Pooled s	Mean Δ/s
Initial Round Robin Study	107	101	0.46	-----
10/1/07 through 3/31/08	14	11	0.29	0.84
4/1/08 through 9/30/08	14	11	0.34	0.54
10/1/08 through 3/31/09	14	11	0.23	-0.10
4/1/09 through 9/30/09	15	12	0.34	0.23
10/1/09 through 3/31/10	13	10	0.33	0.08
4/1/10 through 9/30/10	16	13	0.30	0.41
10/1/10 through 3/31/11	20	17	0.38	0.06

Table 4 shows the current severity for the Sample Area % Volatized @ 371°C parameter for each lab for all operationally valid tests for the report period.

TABLE 4

	N	Mean Δ/s
Lab A	7	0.90
Lab B	2	-0.14
Lab D	5	-1.04
Lab G	2	0.53
Lab H	2	0.13
Lab S	2	-0.46

INDUSTRY PERFORMANCE

D6417 reference testing precision, as measured by pooled s, is slightly less precise than the previous report periods but remains more precise than the target precision (Table 3). Overall performance is on target at 0.06 standard deviations (Table 3). Lab D reported a result more than three s mild that influenced the slightly worse precision estimate for this period. Severity is graphically represented in Figure 1 showing a slight mild bias, overall, since at least the OCT08 timeline.

TMC MEMORANDA

There were no TMC technical updates issued this report period for the D6417 test method.

D5800: Evaporation Loss of Lubricating Oils by the Noack Method

MONITORED TESTING STATUS

Table 5 summarizes the reference tests reported to the TMC this period (8 labs reporting):

TABLE 5

	No. of Tests
Statistically Acceptable and Operationally Valid	32
Operationally Valid but Failed Acceptance Criteria	2
Operationally Invalid (initially reported as)	0
Operationally Invalid (after informed of failing calibration)	0
Total	**34**

Fail Rate of Operationally Valid Tests: 5.9%

There were no operationally invalid tests reported this period.

Table 6 is a breakdown of the statistically unacceptable tests.

TABLE 6

Reason for Fail	No. of Tests
Sample Evaporation Loss Severe	2
Sample Evaporation Loss Mild	0

PRECISION AND SEVERITY

Table 7 shows the current Industry precision and severity for the Sample Evaporation Loss test parameter for all operationally valid tests for the report period. (First calibration test completed 5/1/96.)

TABLE 7

Sample Evaporation Loss, mass %	n	df	Pooled s	Mean Δ/s
New Targets Effective 7/21/2003	102	99	0.70	-----
4/1/07 through 9/30/07	36	33	0.50	0.92
10/1/07 through 3/31/08	34	31	0.50	0.75
4/1/08 through 9/30/08	36	33	0.54	0.82
10/1/08 through 3/31/09	36	33	0.84	0.51
4/1/09 through 9/30/09	36	33	0.56	0.88
10/1/09 through 3/31/10	35	32	0.69	0.56
4/1/10 through 9/30/10	34	31	0.67	0.64
10/1/10 through 3/31/11	34	31	0.76	0.49

Table 8 shows statistical comparisons by procedure for all operationally valid tests for the report period.

TABLE 8

Sample Evaporation Loss, mass %	n	df	Pooled s	Mean Δ/s
Procedure A	0	0	---	---
Procedure B	30	27	0.63	0.76
Procedure C	4	2	0.16	-1.48

D5800: Evaporation Loss of Lubricating Oils by the Noack Method, continued

Table 9 shows the current severity for the Sample Evaporation Loss parameter for each lab for all operationally valid tests for the report period.

TABLE 9

	n	Mean Δ/s
Lab A	4	0.54
Lab B	8	0.22
Lab D	2	-1.62
Lab F	4	1.16
Lab G	7	0.25
Lab H	1	0.14
Lab I	4	1.59
Lab J	4	0.79

INDUSTRY PERFORMANCE

D5800 reference testing precision, as measured by pooled s, is less precise than the previous period and slightly less precise than the target precision (Table 7). Overall performance remains severe this period with seven of eight participating labs performing severe at some level (Table 9). Severity is graphically represented in Figures 2A and 2B. Figure 2A shows a long-term severe trend with an unexplained increase in severity since the 01JUL06 timeline. Oil 52 continues to perform more than 1 s severe (Attachment 3). Since April 1, 2009, twelve of fourteen statistically failing tests were on oil 52; all failed severe of acceptance bands.

Table 8 compares the procedures for the period. There were no Procedure A calibration tests reported and four Procedure C calibration tests reported this period.

TMC MEMORANDA

There were no TMC technical updates issued this report period for the D5800 test method.

D5133: Low Temperature, Low Shear Rate, Viscosity/Temperature Dependence of Lubricating Oils Using a Temperature Scanning Technique (Gelation Index or GI)

MONITORED TESTING STATUS

Table 10 summarizes the reference tests reported to the TMC this period (6 labs reporting):

TABLE 10
Reference Tests

	No. of Tests
Statistically Acceptable and Operationally Valid	26
Operationally Valid but Failed Acceptance Criteria	7
Operationally Invalid (initially reported as)	1
Operationally Invalid (after informed of failing calibration)	0
Total	**34**

Fail Rate of Operationally Valid Tests: 21.2%

The explanation for the one operationally invalid test is a power failure resulting in aborted run.

Table 11 is a breakdown of the statistically unacceptable tests.

TABLE 11

Reason for Fail	No. of Tests
Gelation Index Mild	6
Gelation Index Severe	1

PRECISION AND SEVERITY

Table 12 shows the current Industry precision and severity for the Gelation Index test parameter for all operationally valid tests for the report period. (First calibration test completed 4/20/96.)

TABLE 12

Gelation Index	n	df	Pooled s	Mean Δ/s
Revised Targets Effective 20030715 (Oils 58 & 62 targets unchanged, added oil 1009, dropped oils 52 & 53)	68	65	2.86	-----
4/1/06 through 9/30/06	29	26	3.76	-0.46
10/1/06 through 3/31/07	29	26	3.23	-0.68
4/1/07 through 9/30/07	24	21	3.35	-0.28
10/1/07 through 3/31/08	26	23	4.13	-0.31
4/1/08 through 9/30/08	27	24	3.54	0.18
10/1/08 through 3/31/09	24	21	2.32	0.10
4/1/09 through 9/30/09	33	30	2.79	-0.10
10/1/09 through 3/31/10	31	28	2.37	-0.15
4/1/10 through 9/30/10	24	21	3.89	0.12
10/1/10 through 3/31/11	33	30	3.17	-0.53

D5133: Low Temperature, Low Shear Rate, Viscosity/Temperature Dependence of Lubricating Oils Using a Temperature Scanning Technique (Gelation Index or GI), continued

Table 13 shows the current severity for the Gelation Index for each lab for all operationally valid tests for the report period.

TABLE 13

	n	GI Mean Δ/s
Lab A	8	-0.57
Lab B	8	0.11
Lab D	2	-0.80
Lab G	3	-0.71
Lab I	7	-0.94
Lab S	5	-0.68

INDUSTRY PERFORMANCE

D5133 reference testing is more precise than last period, as measured by pooled s, but less precise than the three periods prior and less precise than the target precision (Table 12). Severity is mild at -0.53 s. Severity is graphically represented in Figures 3A and 3B (attached) showing a shift to mild since the JAN11 timeline. It seems notable that 5 of the 6 labs reporting this period are performing mild to some degree.

Out of 33 operationally valid tests reported this period, 7 failed statistically to meet the acceptance bands resulting in an unusually high fail rate of 21% (a 5% fail rate is expected). The 6 mild fails appear equally on both reference oils 58 and 62 (and one on oil 1009 after the 3/31 report period) and are reported from 5 different labs. So, there is no clear correlation to account for the unusually high fail rate this period.

TMC MEMORANDA

There were no TMC technical updates issued this report period for the D5133 test method.

D6335: High Temperature Deposits by Thermo-Oxidation Engine Oil Simulation Test (TEOST)

MONITORED TESTING STATUS

Table 14 summarizes the reference tests reported to the TMC this period (5 labs reporting):

TABLE 14

	No. of Tests
Statistically Acceptable and Operationally Valid	12
Operationally Valid but Failed Acceptance Criteria	2
Operationally Invalid (initially reported as)	0
Operationally Invalid (after informed of failing calibration)	0
Total	**14**

Fail Rate of Operationally Valid Tests: 14.3%

There were no operationally invalid tests reported this period.

Table 15 is a breakdown of the statistically unacceptable tests.

TABLE 15

Reason for Fail	No. of Tests
Total Deposits Mild	2
Total Deposits Severe	0

PRECISION AND SEVERITY

Table 16 shows the current Industry precision and severity for the Total Deposits test parameter for all operationally valid tests for the report period. (First calibration test completed 2/13/96.)

TABLE 16

Total Deposits	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study	54	52	4.18	-----
4/1/07 through 9/30/07*	10	8	9.59	0.43
4/1/07 through 9/30/07*	9	7	8.08	-0.11
10/1/07 through 3/31/08	22	20	9.65	0.92
4/1/08 through 9/30/08	15	13	6.99	0.20
10/1/08 through 3/31/09	18	16	4.90	0.98
4/1/09 through 9/30/09*	14	10	8.24	0.32
4/1/09 through 9/30/09*	13	9	3.71	0.68
10/1/09 through 3/31/10*	12	8	14.36	0.85
10/1/09 through 3/31/10*	11	7	6.46	0.18
4/1/10 through 9/30/10	16	12	4.70	0.16
10/1/10 through 3/31/11	14	10	6.25	0.14

*Period statistics with and without a single very severe result included

D6335: TEOST, continued

Table 17 shows the current severity for the Total Deposits parameter for each lab for all operationally valid tests in the report period.

TABLE 17

	n	Mean Δ/s
Lab A	4	0.00
Lab B	4	0.41
Lab D	2	0.62
Lab G	2	1.14
Lab V	2	-1.62

INDUSTRY PERFORMANCE

Reference testing precision, as measured by pooled s, is significantly less precise compared the previous report period and remains less precise than the target precision (Table 16). Performance is only slightly severe at 0.14 s. Severity is graphically represented in Figure 4 (attached) showing an overall severe trend since the 01APR08 timeline, but with more recent leveling since the 01OCT09 timeline. While there were no "extreme" test results reported this period, as has been seen in past periods and as indicated in Table 16, there were two results nearly -3 s mild of targets that were reported as operationally valid.

Two periods ago I reported a fail rate of 25%, precision at 14.6 mg total deposits, one extreme result at 8.2 s severe of target and overall severity performance at 0.85 s severe. Last period had significant improvements on all of those evaluations, with no extreme results reported. This period the precision has worsened again, but with nearly on-target overall performance. No "extreme" results were reported this period, but two results failed considerably mild.

Rod batch J was introduced last period. This period had two tests still using rod batch H and twelve tests using rod batch J.

Oils 71-1 and 72-1 were introduced three periods ago with a warning last period of pending depletion. Due to increased testing, those TMC oil supplies are nearly used up. While the oil supplier may have additional limited quantities of each oil to resupply the TMC, we believe we may have sourced suitable replacement reference oils with more current formulation technologies, as the existing reference oil technologies are at least 15 years old. A round robin study among the participating labs is presently underway to evaluate the suitability of the proposed replacement oils.

TMC MEMORANDA

There were no TMC technical updates issued this report period for the D6335 test method.

D7097: Determination of Moderately High Temperature Piston Deposits by Thermo-oxidation Engine Oil Simulation Test (MTEOS or MHT-4 TEOST)

MONITORED TESTING STATUS

Table 18 summarizes the reference tests reported to the TMC this period (7 labs reporting):

TABLE 18

	No. of Tests
Statistically Acceptable and Operationally Valid	50
Operationally Valid but Failed Acceptance Criteria	5
Operationally Invalid (initially reported as)	0
Operationally Invalid (after informed of failing calibration)	0
Total	**55**

Fail Rate of Operationally Valid Tests: 9.1%

There were no operationally invalid tests reported this period.

Table 19 is a breakdown of the statistically unacceptable tests.

TABLE 19

Reason for Fail	No. of Tests
Total Deposits Mild	1
Total Deposits Severe	4

PRECISION AND SEVERITY

Table 20 shows the current Industry precision and severity for the Total Deposits test parameter for all operationally valid tests for the report period. (First calibration test completed 9/6/00.)

TABLE 20

Total Deposits	n	df	Pooled s	Mean Δ/s
Updated Targets Effective 7/31/06	90	87	5.62	-----
10/1/06 through 3/31/07	47	44	7.53	-0.17
4/1/07 through 9/30/07	48	45	7.68	0.32
10/1/07 through 3/31/08	46	43	7.41	-0.21
4/1/08 through 9/30/08	46	43	6.09	0.01
10/1/08 through 3/31/09	53	50	5.25	0.73
4/1/09 through 9/30/09	48	45	4.35	-0.08
10/1/09 through 3/31/10	43	40	5.46	-0.19
4/1/10 through 9/30/10	55	52	4.45	-0.12
10/1/10 through 3/31/11	55	52	7.59	0.27

D7097: Determination of Moderately High Temperature Piston Deposits by Thermo-oxidation Engine Oil Simulation Test (MTEOS or MHT-4 TEOST)

Table 21 shows the current severity for the Total Deposits parameter for each lab for all operationally valid tests in the report period.

TABLE 21

	n	Mean Δ/s
Lab A	14	0.00
Lab AK	2	1.77
Lab B	13	-0.05
Lab D	6	0.18
Lab G	14	0.40
Lab J	4	1.86
Lab V	2	-1.04

INDUSTRY PERFORMANCE

D7097 (MTEOS) reference testing overall precision, as measured by pooled s, is considerably less precise compared to the prior report period and compared to the target precision (Table 20). Overall performance this period is 0.27 s severe of targets.

The D7097 severity is graphically represented in Figures 5A & 5B, with Figure 5B showing when the new performance targets were implemented, when the monitored test method was changed and when new rod and catalyst batches were introduced.

Lab J reported two consecutive severe fails on the same instrument (J1), followed by a passing calibration on that instrument. All three consecutive tests are reported to have no (zero) filter deposits, and all three are reported as operationally valid. This is unprecedented in the TMC's data base, and the TMC confirmed those reported filter deposit results with the lab. Still, the unprecedented three consecutive zero filter deposit results puts into question whether the operational validity of those tests is being accurately reported. Lab G reported both a severe and mild fail this period, consecutively, on the same instrument before passing calibration after the report period cutoff of 3/31/2011. These variable results, among others, helped to contribute to the poor overall precision this period.

Three tests this period were reported on rod batch H (coincidently, all were from lab J). All other tests are reported as using rod batch J. Catalyst batch 1011 was introduced this period, with 11 tests reported on batch 1011, and all others on batch 0911.

By Email ballot, the surveillance panel agreed to phase out TMC reference oil 74. The TMC is permitted to assign any blind coded inventory already shipped for TMC calibration assignments, but the TMC has stopped shipping any additional samples of oil 74 as directed by the panel. There were 6 operationally valid tests reported on oil 74 this period and, at this writing, there is only 1 samples of oil 74 remaining throughout the industry D7097 oil inventories of TMC blind reference samples.

TMC MEMORANDA

There were no TMC technical updates issued this report period for the D7097 test method.

D6082: High Temperature Foaming Characteristics of Lubricating Oils

MONITORED TESTING STATUS

Table 22 summarizes the reference tests reported to the TMC this period (3 labs reporting):

TABLE 22

	No. of Tests
Statistically Acceptable and Operationally Valid	8
Operationally Valid but Failed Acceptance Criteria	0
Operationally Invalid (initially reported as)	1
Operationally Invalid (after informed of failing calibration)	0
Total	**9**

Fail Rate of Operationally Valid Tests: 0.0%

The reason for the operational fail was that the blending option A was not performed (test aborted). In addition to the calibration tests, there were three discrimination oil tests reported this period; all met the acceptance criteria for the discrimination oil.

TMC 1007 PRECISION AND SEVERITY

Tables 23 and 24 show the current industry precision and severity for the Foam Tendency and Foam Stability test parameters for all operationally valid tests on oil 1007 for the report period. (First calibration test on TMC 1007 completed 4/12/99.)

TABLE 23

1007 Foam Tendency, ml	n	Mean	s	Mean Δ/s
Initial Round Robin Study (targets)	28	65.71	19.28	-----
4/1/07 through 9/30/07	10	63	18	-0.16
10/1/07 through 3/31/08	10	64	16	-0.13
4/1/08 through 9/30/08	10	65	16	-0.05
10/1/08 through 3/31/09*	11	72	34	0.31
10/1/08 through 3/31/09*	10	62	10	-0.21
4/1/09 through 9/30/09	10	61	10	-0.26
10/1/09 through 3/31/10	8	59	10	-0.38
4/1/10 through 9/30/10	8	65	16	-0.05
10/1/10 through 3/31/11	8	61	10	-0.25

*Period statistics with and without extreme results included.

D6082: High Temperature Foaming Characteristics of Lubricating Oils, continued

Note that TMC reference oil 1007 has a Foam Stability (one minute after disconnect) target mean performance of zero ml and a target precision (standard deviation) of zero ml. A negative (mild) result for this parameter is unlikely and a severity estimate for any positive result would be indeterminate in standard deviations (Δ/s). Therefore, for Foam Stability, only a count of non-zero occurrences is noted to flag any severity trends.

TABLE 24

1007 Foam Stability @ 1 min., ml	n	Mean	s
Initial Round Robin Study	28	0.00	0.00
4/1/07 through 9/30/07	10	No non-zero occurrences	
10/1/07 through 3/31/08	10	No non-zero occurrences	
4/1/08 through 9/30/08	10	No non-zero occurrences	
10/1/08 through 3/31/09	11	No non-zero occurrences	
4/1/09 through 9/30/09	10	No non-zero occurrences	
10/1/09 through 3/31/10	8	No non-zero occurrences	
4/1/10 through 9/30/10	8	No non-zero occurrences	
10/1/10 through 3/31/11	8	No non-zero occurrences	

Table 25 shows the current 1007 severity for the monitored result parameter for each lab for all operationally valid tests reported for the report period.

TABLE 25
TMC 1007

	n	Foam Tendency Mean Δ/s
Lab A	2	0.21
Lab B	4	-0.32
Lab G	2	-0.58

INDUSTRY PERFORMANCE

The D6082 Foam Tendency precision, as measured by standard deviation (s) on TMC oil 1007, is more precise than last report period, comparable again to prior periods and more precise than the target precision (Table 23). Overall Foam Tendency performance is -0.25 s mild. There were no non-zero occurrences of Foam Stability on 1007 suggesting Foam Stability precision is as expected. Foam Tendency severity is graphically represented in Figure 6.

All operationally valid discrimination tests reported this period meet the acceptance criteria (that is, all reporting labs could discriminate oil 66 as a GF-5/SN failing oil for Foam Tendency).

TMC MEMORANDA

There were no TMC technical updates issued this report period for the D6082 test method.

D874: Sulfated Ash from Lubricating Oils and Additives

MONITORED TESTING STATUS

Table 26 summarizes the reference tests reported to the TMC this period (3 labs reporting):

TABLE 26
Reference Tests

	No. of Tests
Statistically Acceptable and Operationally Valid	6
Operationally Valid but Failed Acceptance Criteria	0
Operationally Invalid (initially reported as)	0
Operationally Invalid (after informed of failing calibration)	0
Total	**6**

Fail Rate of Operationally Valid Tests: 0.0%

Table 27 is a breakdown of the statistically unacceptable tests.

TABLE 27

Reason for Fail	No. of Tests
Sulfated Ash Mild	0
Sulfated Ash Severe	0

There were no operationally invalid tests reported this period.

PRECISION AND SEVERITY

Table 28 shows the current Industry precision and severity for the Sulfated Ash Mass % test parameter for all operationally valid tests for the report period. (First calibration test completed 7/27/07.)

TABLE 28

Gelation Index	n	df	Pooled s	Mean Δ/s
Initial Round Robin Targets	81	79	0.07	-----
4/1/07 through 9/30/07	2	1	0.01	-0.50
10/1/07 through 3/31/08	5	2	0.11	-0.41
4/1/08 through 9/30/08	6	3	0.04	-0.62
10/1/08 through 3/31/09	6	3	0.07	-1.23
4/1/09 through 9/30/09	7	4	0.03	-0.41
10/1/09 through 3/31/10	7	4	0.04	-0.23
4/1/10 through 9/30/10	5	2	0.03	0.11
10/1/10 through 3/31/11	6	3	0.05	0.11

D874: Sulfated Ash from Lubricating Oils and Additives, continued

Table 29 shows the current severity for Sulfated Ash Mass % for each lab for all operationally valid tests for the report period.

TABLE 29

	n	Mean Δ/s
Lab A	2	0.00
Lab B	2	-0.11
Lab G	2	0.44

INDUSTRY PERFORMANCE

D874 precision, as measured by pooled s, is more precise than the target precision and performance remains slightly severe of targets. Severity is graphically represented in Figure 7.

TMC MEMORANDA

There were no TMC technical updates issued this report period for the D874 test method.

D7528: Bench Oxidation of Engine Oils by ROBO Apparatus

MONITORED TESTING STATUS

Table 30 summarizes the reference tests reported to the TMC this period (9 labs reporting):

TABLE 30
Reference Tests

	No. of Tests
Statistically Acceptable and Operationally Valid	95
Operationally Valid but Failed Acceptance Criteria	26
Operationally Invalid (initially reported as)	17
Operationally Invalid (after informed of failing calibration)	2
Operationally Valid but Never Passed Calibration on New Instrument (held out of statistics)	3
QC Evaluation of New Rig (held out of statistics)	3
Donated RR Test to Evaluate New Reference Oil (435-2)	3
Total	**149**

Fail Rate of Operationally Valid Tests: 21.5%

The explanations for the 19 operationally invalid tests are:

- Vacuum system leaks or failures (one test)
- Reactor temperature control problems (two tests)
- Problems with NO_2 flow (five tests)
- Thermocouple depth or calibration errors (three tests)
- Power or fuse failure (five tests)
- MRV temperature incorrect, insufficient sample to rerun (one test)
- Sample too viscous to measure at EOT (one test)
- Contaminated sample (one test)

Table 31 is a breakdown of the statistically unacceptable calibration tests.

TABLE 31

Reason for Fail	No. of Tests
MRV Viscosity Mild	14
MRV Viscosity Severe	12

D7528: Bench Oxidation of Engine Oils by ROBO Apparatus, continued

PRECISION AND SEVERITY

Table 32 shows the current Industry precision and severity for the transformed MRV viscosity test parameter for all operationally valid tests for the report period.

TABLE 32

Natural Log (MRV Viscosity)	n	df	Pooled s	Mean Δ/s
Initial Round Robin Targets	42	39	0.2309	-----
8/31/08 through 3/31/09	22	19	0.2302	-0.47
4/1/09 through 9/30/09	26	23	0.1872	-0.58
10/1/09 through 3/31/10	59	56	0.3989	-0.24
4/1/10 through 9/30/10	114	110	0.5134	-0.26
10/1/10 through 3/31/11*	121	118	0.7092	0.29
10/1/10 through 3/31/11*	120	117	0.4628	0.05

*Period results with one result of more than 29 s severe included and excluded for comparison.

Table 33 shows the current severity for the transformed MRV Viscosity for each lab for all operationally valid tests for the report period.

TABLE 33

	n	Mean Δ/s
Lab A	47	-0.28
Lab AM	14	-0.16
Lab AN	7	2.89
Lab AP	2	-0.08
Lab B	15	-0.18
Lab D	7	0.48
Lab G	28	1.07
Lab Q	1	-0.41

(Lab AO reported only operationally invalid tests this period)

INDUSTRY PERFORMANCE

ROBO precision, as measured by pooled s, is much less precise than the target precision and seems to be worsening each report period (Table 32). Performance is 0.29 s severe of targets. Severity is graphically represented in Figure 8. Results on tests reported as operatiaonally valid were again highly variable this period. A breakdown of Mean Δ/s values more than three standard deviations from target for tests reported as operationally valid is as follows:

3-6 s from target (mild & severe):	4 tests
6-9s from target (severe):	1 test
9-12 s from target (severe):	3 test
29-30 s from target (severe):	1 test

D7528: Bench Oxidation of Engine Oils by ROBO Apparatus, continued

However, one result with an MRV of nearly 23 million cP is reported as operationally valid (29 s severe on oil 435-1 by lab G). Recent changes adopted by the surveillance panel to report MRV results above 400,000 cP as >400,000, as the MRV test method instructs, would flag this test in future evaluations, as will new calibration requirements to evaluate volatiles at end of test. Though these new requirements were not in place when that extreme MRV result was reported, I have shown the statistical estimates in Table 32 with and without that extreme result included for comparison purposes. With that result removed (as it would be under the newly adopted requirements), the precision improves somewhat and performance moves to nearly on-target. There were no other results reported this period with the MRV above 400,000 cP.

Based on a review of the failing results that are influencing the test precision estimates, there were additional changes approved to the TMC calibration requirements, and additional operational fields are being added to the reporting format, to make the calibration requirements increasingly stringent in an ongoing effort to improve the monitored compliance with the test method.

On April 8, 2010 the panel agreed to replace reference oil 435 (nearly depleted) with a reblend, 435-1, with new targets and acceptance bands. However, the 435-1 aged oil MRV performance is generally considered to be milder than is optimal. Because of this, the TMC had been asked to pursue another reblend, preferably with somewhat more severe mean performance on the aged oil MRV. The reblend, 435-2, has been screened and the results suggest it will perform more severe than 435-1, and perhaps comparably to 435, as desired. An industry round robin study is underway to compare 435 and 435-2 performance directly.

TMC MEMORANDA

There was one TMC technical update issued this report period for the D7528 test method:

Email from Tom Schofield on 20110420, Updated ROBO TMC Calibration Guidelines (v 20110420)

D6922: Determination of Homogeneity and Miscibility in Automotive Engine Oils

The TMC distributes six reference oils for D6922 testing. The TMC does not collect data or monitor any test results for this test at this time.

D7563: Evaluation of the Ability of Engine Oil to Emulsify Water and Simulated Ed85 Fuel

The TMC distributes two reference oils for D7563 testing. The TMC does not collect data or monitor any test results for this test at this time.

REFERENCE OIL SUPPLIES

There is adequate supply of B0.07 Bench Test reference oils on hand at the TMC. Tables 34A – 34C list the bench test reference oils currently on hand at the TMC.

Table 34A
Current Reference Oils

Oil	For Tests	Quantity Left (gallons)	Quantity Used Last 12 Months (gallons)
52	D6417, D5800	63.4	0.3
55	D6417, D5800	68.6	0.4
58	D6417, D5800, GI	119.5	0.2
62	GI	1.7	0.0
66	D6082 (Discrimination)	93.9	0.6
71-1	TEOST	12 samples	0.0
72-1	TEOST	4 samples	3 samples
75	MTEOS	8.8	0.7
90	D874 & D874 Daily Check	38.1	1.0
91	D874	4.6	0.0
**432	MTEOS	Adequate	-----
434	MTEOS	5.5	0.2
820-2	D874	10.6	0.0
**1007	D6082	25.0	-----
**1009	GI	Adequate	-----
*434-1	ROBO	Adequate	-----
*435-1	ROBO	Adequate	-----
*435-2	ROBO/MTEOS	Adequate	-----
*438	ROBO	Adequate	-----

*One drum of oil is set aside for bench calibration testing; the TMC has a larger supply of this oil.
**Multi-Test Oil, aliquot set aside for bench testing; hard to get an inventory reading on amount set aside.

REFERENCE OIL SUPPLIES, continued

Table 34B
Obsolete or Test Development Reference Oils

Oil	For Tests	Quantity Left (gallons)	Quantity Used Last 12 Months (gallons)
^51	Obsolete Vol. & GI	94.6	0.0
^53	Obsolete Vol. & GI	96.8	0.0
^54	Obsolete Volatility	97.8	0.0
71	Obsolete TEOST	4 Samples	-----
72	Obsolete TEOST	2 Samples	-----
74	Obsolete MTEOS	0.2	0.1
^83	Obsolete ROBO (RR)	47.3	0.0
^84	Obsolete ROBO (RR)	3.3	0.0
^85	Obsolete ROBO (RR)	3.3	0.0
^**433	Obsolete MTEOS	Adequate Supply	-----
435	Obsolete ROBO	9 Samples	-----

^Not selected as reference oil; TMC holding for further instructions from Surveillance Panel.
**Five gallon aliquot set aside for bench testing; hard to get an inventory reading on amount set aside.

Table 34C
Homogeneity and Miscibility Reference Oils

Oil	For Tests	Quantity Left (gallons)	Quantity Used Last 12 Months (gallons)
HMA	H&M (D6922)	176.5	6.5
HMB	H&M (D6922)	180.5	6.5
HMC	H&M (D6922)	166.5	6.5
HMD	H&M (D6922)	174.3	6.7
HME	H&M (D6922)	160.0	6.0
HMF	H&M (D6922)	182.8	6.0

Table 34D
Homogeneity and Miscibility Reference Oils

Oil	For Tests	Quantity Left (gallons)	Quantity Used Last 12 Months (gallons)
EM2	Emulsion Retention D7563	9.0	0.0
EM2-1	Emulsion Retention D7563	25.0	0.0
EM5	Emulsion Retention D7563	9.0	0.0
EM5-1	Emulsion Retention D7563	25.0	0.0

Shipping aliquots are:

D6417	1 ml
D6417QC	118 ml
D5800	100 ml
GI	25 ml
MTEOS	17 ml
TEOST	125 ml
D6082	525 ml
D874	32 ml
D874QC	1000 ml
ROBO	300 ml
ROBOQC	1000 ml
H&M	1000 ml
D7563	1000 ml

MISCELLANEOUS

The TMC posts monitored bench test calibration data on the TMC web sit. Lab identifications are coded on the TMC's web site as they are on the previous pages of this report. Also posted are statistics, CUSUM plots, reporting forms, flatfile templates, data dictionaries and data from various round-robin matrix programs. The TMC encourages all interested parties to access and download the data, statistics and plots for individual studies and analyses. Likewise, you are encouraged to access the web site to download the most recent test reporting formats and data dictionaries. The TMC's web site address is www.astmtmc.cmu.edu.

All currently monitored bench test data dictionaries and report form packages have been beta tested by the ASTM Data Communications Committee (DCC) and approved for electronic data transfer. Please contact Tom Schofield at (412) 365-1011 for more information.

Figure 1

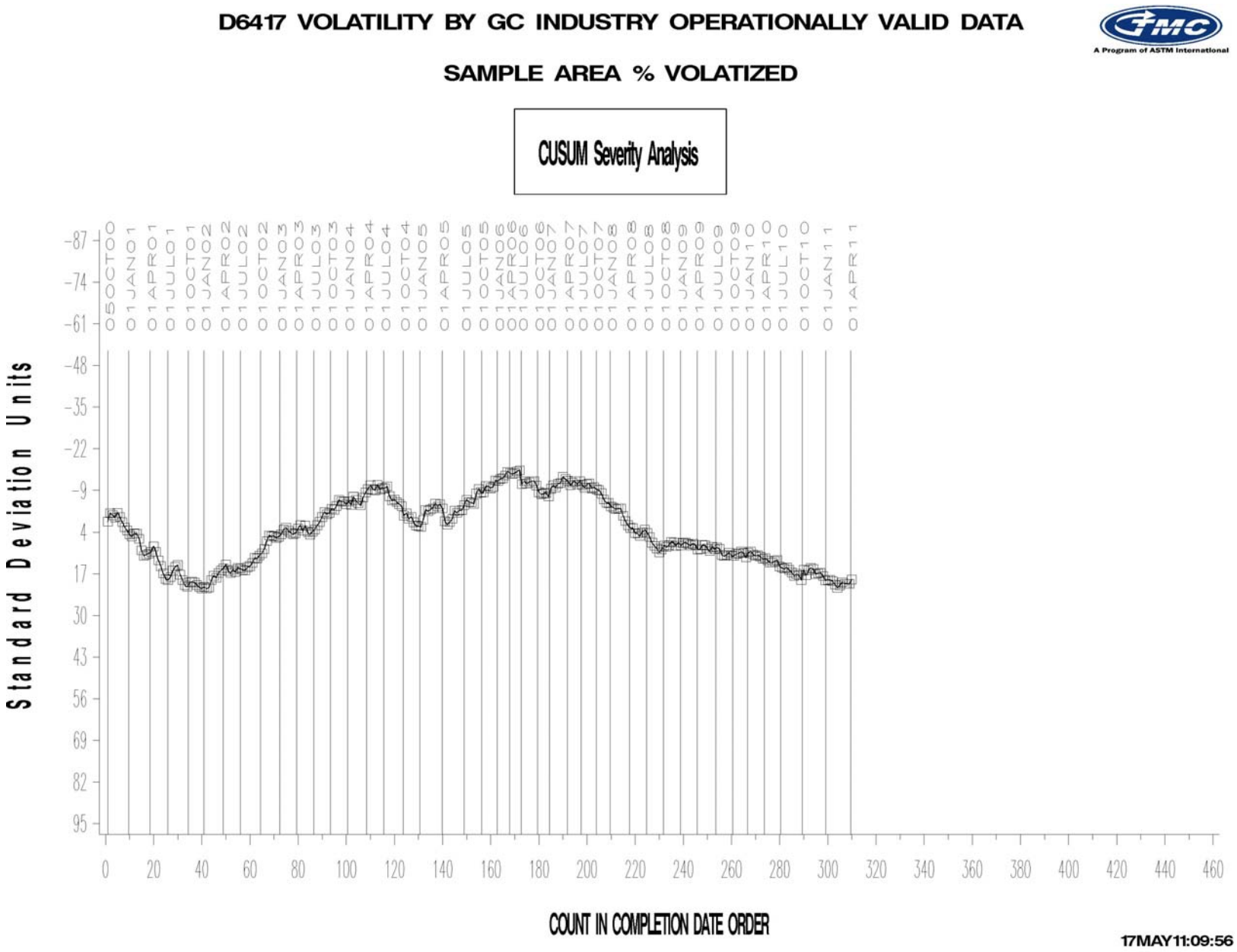

D6417 VOLATILITY BY GC INDUSTRY OPERATIONALLY VALID DATA
A Program of ASTM International
SAMPLE AREA % VOLATIZED
CUSUM Severity Analysis
Standard Deviation Units
-87
-74
-61
-48
-35
-22
-9
4
17
30
43
56
69
82
95
05OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
01OCT02
01JAN03
01APR03
01JUL03
01OCT03
01JAN04
01APR04
01JUL04
01OCT04
01JAN05
01APR05
01JUL05
01OCT05
01JAN06
01APR06
01JUL06
01OCT06
01JAN07
01APR07
01JUL07
01OCT07
01JAN08
01APR08
01JUL08
01OCT08
01JAN09
01APR09
01JUL09
01OCT09
01JAN10
01APR10
01JUL10
01OCT10
01JAN11
01APR11
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
400
420
440
460
COUNT IN COMPLETION DATE ORDER
17MAY11:09:56

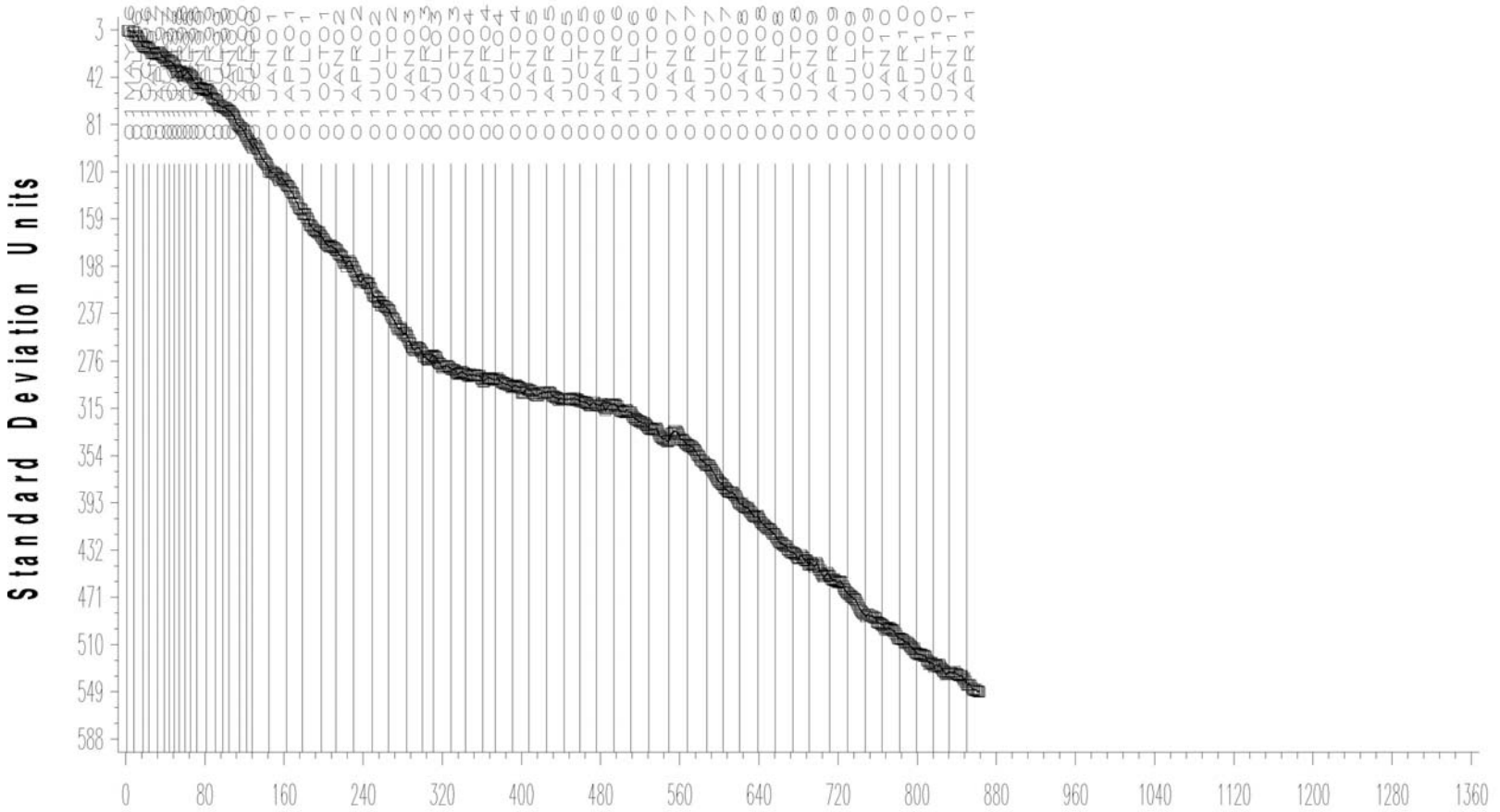
Figure 2A

D5800 VOLATILITY BY NOACK INDUSTRY OPERATIONALLY VALID DATA

A Program of ASTM International

EVAPORATION LOSS, MASS%

CUSUM Severity Analysis



18MAY11:15:35

Figure 2B

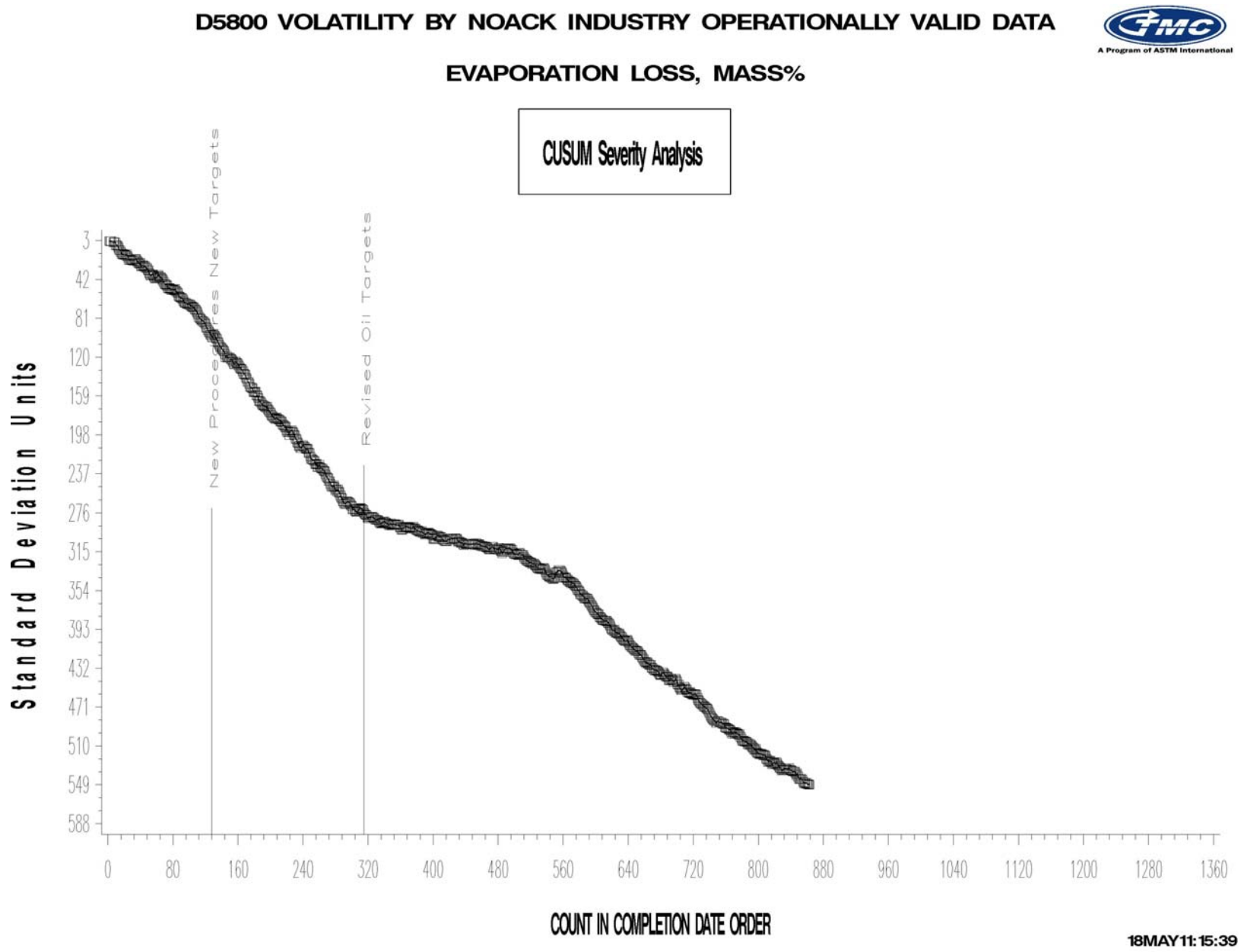

D5800 VOLATILITY BY NOACK INDUSTRY OPERATIONALLY VALID DATA
EVAPORATION LOSS, MASS%
CUSUM Severity Analysis
New Procedures New Targets
Revised Oil Targets
Standard Deviation Units
3
42
81
120
159
198
237
276
315
354
393
432
471
510
549
588
0
80
160
240
320
400
480
560
640
720
800
880
960
1040
1120
1200
1280
1360
COUNT IN COMPLETION DATE ORDER
18MAY11:15:39

Figure 3A

D5133 GELATION INDEX INDUSTRY OPERATIONALLY VALID DATA

A Program of ASTM International

GELATION INDEX

CUSUM Severity Analysis

20MAY11:10:57

Figure 3B

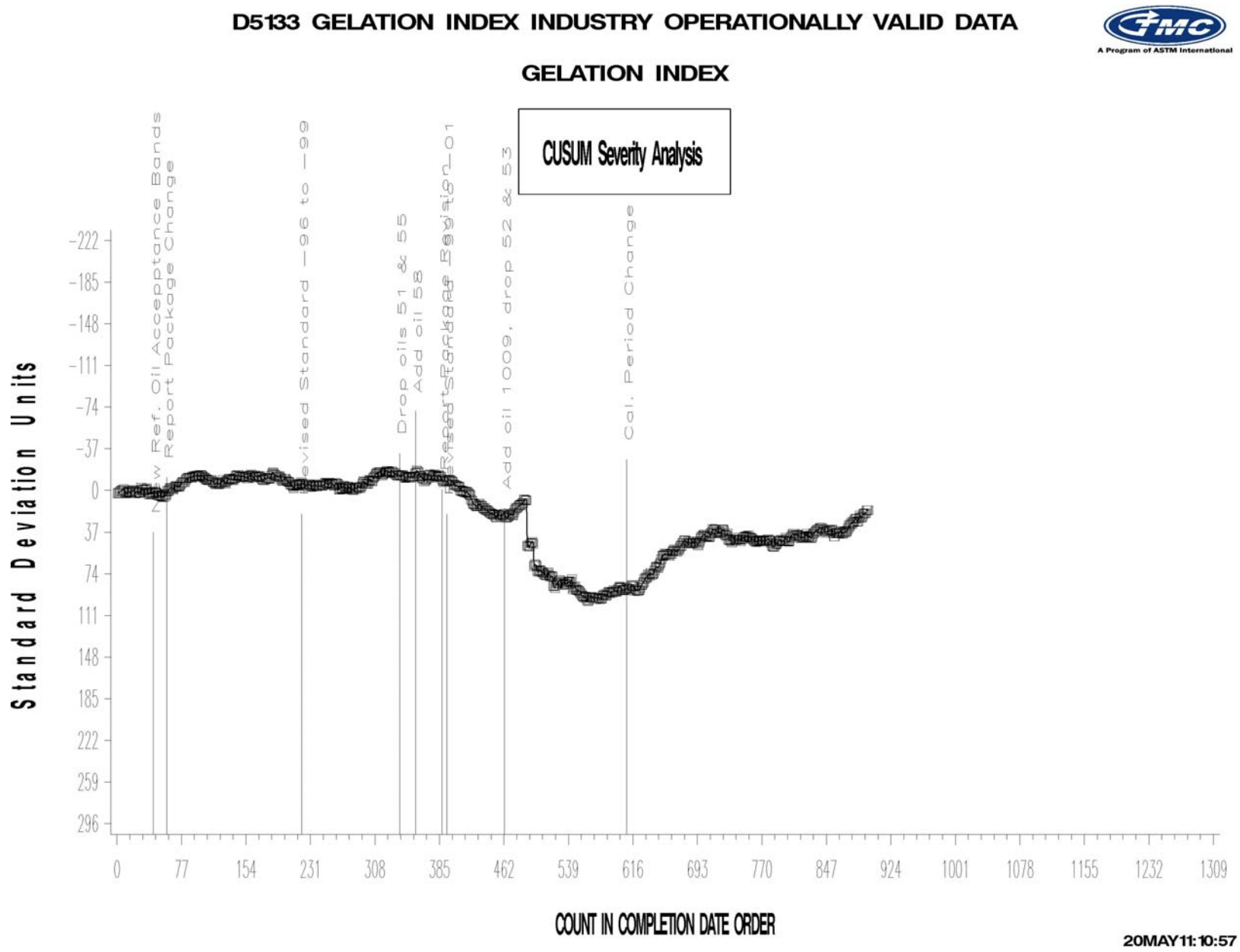

D5133 GELATION INDEX INDUSTRY OPERATIONALLY VALID DATA
A Program of ASTM International
GELATION INDEX
CUSUM Severity Analysis
New Ref. Oil Acceptance Bands
Report Package Change
Revised Standard -96 to -99
Drop oils 51 & 55
Add oil 58
Report Package Region_01
Add oil 1009, drop 52 & 53
Cal. Period Change
Standard Deviation Units
-222
-185
-148
-111
-74
-37
0
37
74
111
148
185
222
259
296
0
77
154
231
308
385
462
539
616
693
770
847
924
1001
1078
1155
1232
1309
COUNT IN COMPLETION DATE ORDER
20MAY11:10:57

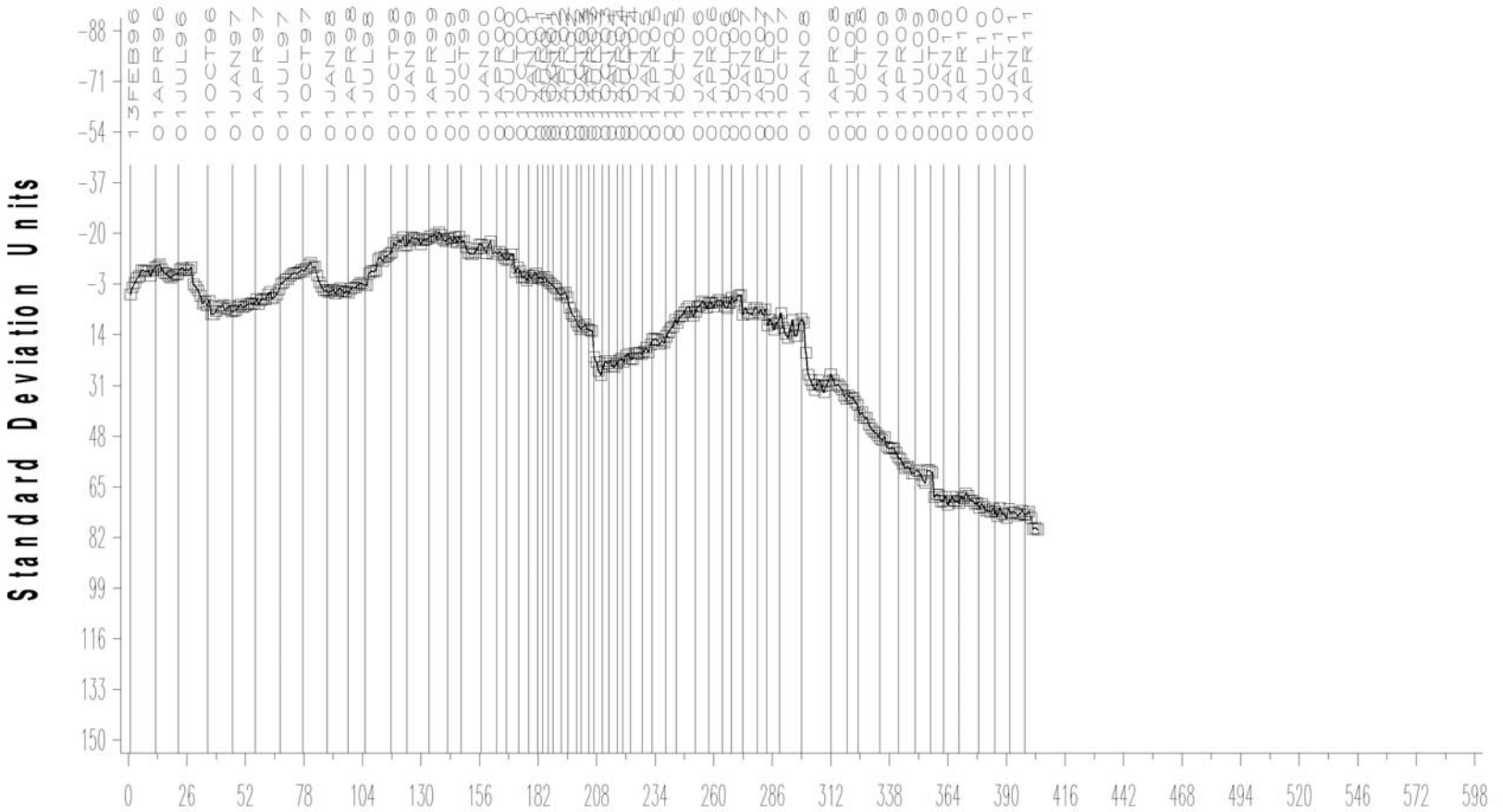
Figure 4

TEOST—33C INDUSTRY OPERATIONALLY VALID DATA

A Program of ASTM International

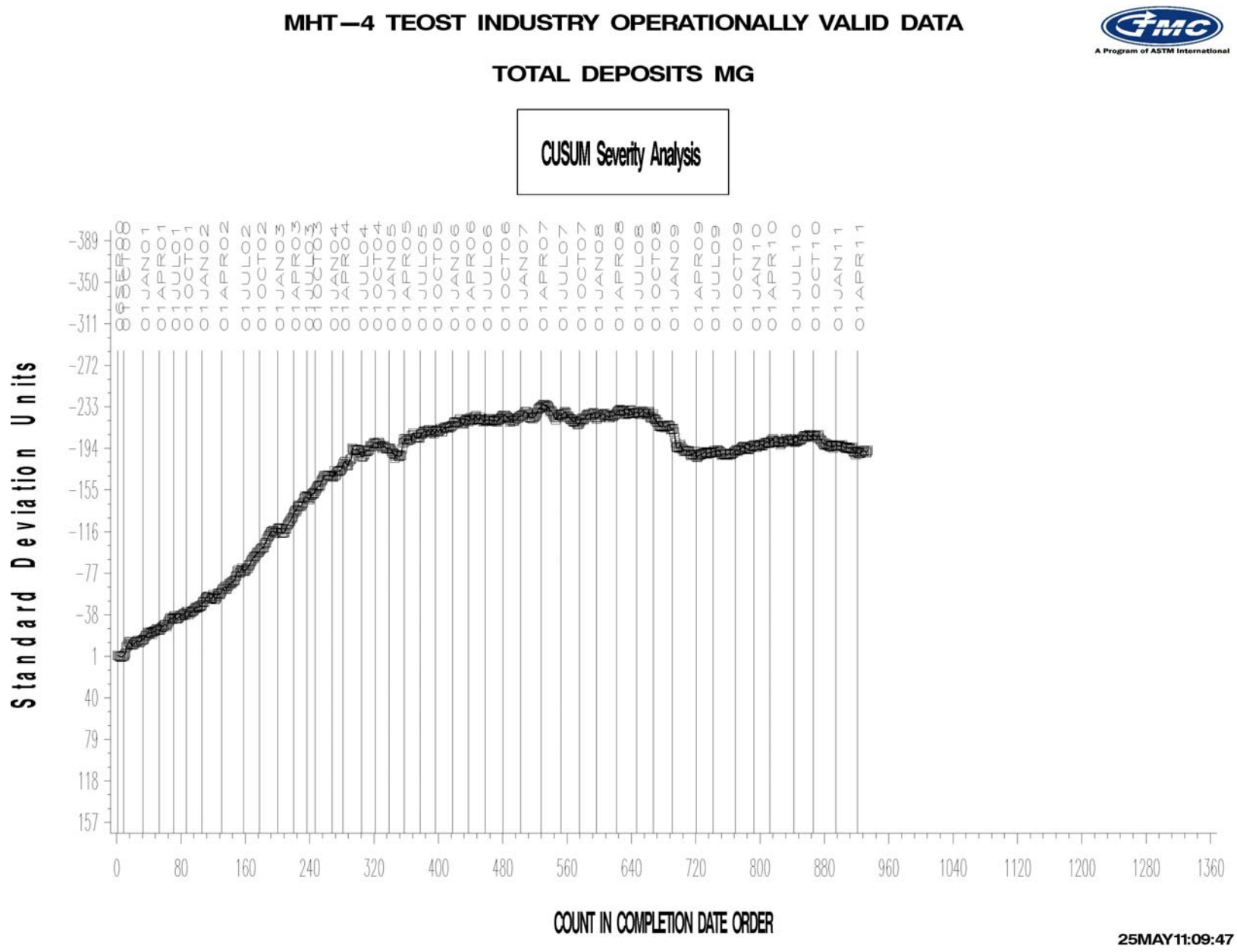
TOTAL DEPOSITS MG

CUSUM Severity Analysis



20MAY11:14:21

Figure 5A


MHT—4 TEOST INDUSTRY OPERATIONALLY VALID DATA
A Program of ASTM International
TOTAL DEPOSITS MG
CUSUM Severity Analysis
Standard Deviation Units
-389
-350
-311
-272
-233
-194
-155
-116
-77
-38
1
40
79
118
157
06SEP88
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
01OCT02
01JAN03
01APR03
01JUL03
01JAN04
01APR04
01JUL04
01OCT04
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01JAN08
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01OCT08
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01APR10
01JUL10
01OCT10
01JAN11
01APR11
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80
160
240
320
400
480
560
640
720
800
880
960
1040
1120
1200
1280
1360
COUNT IN COMPLETION DATE ORDER
25MAY11:09:47

Figure 5B

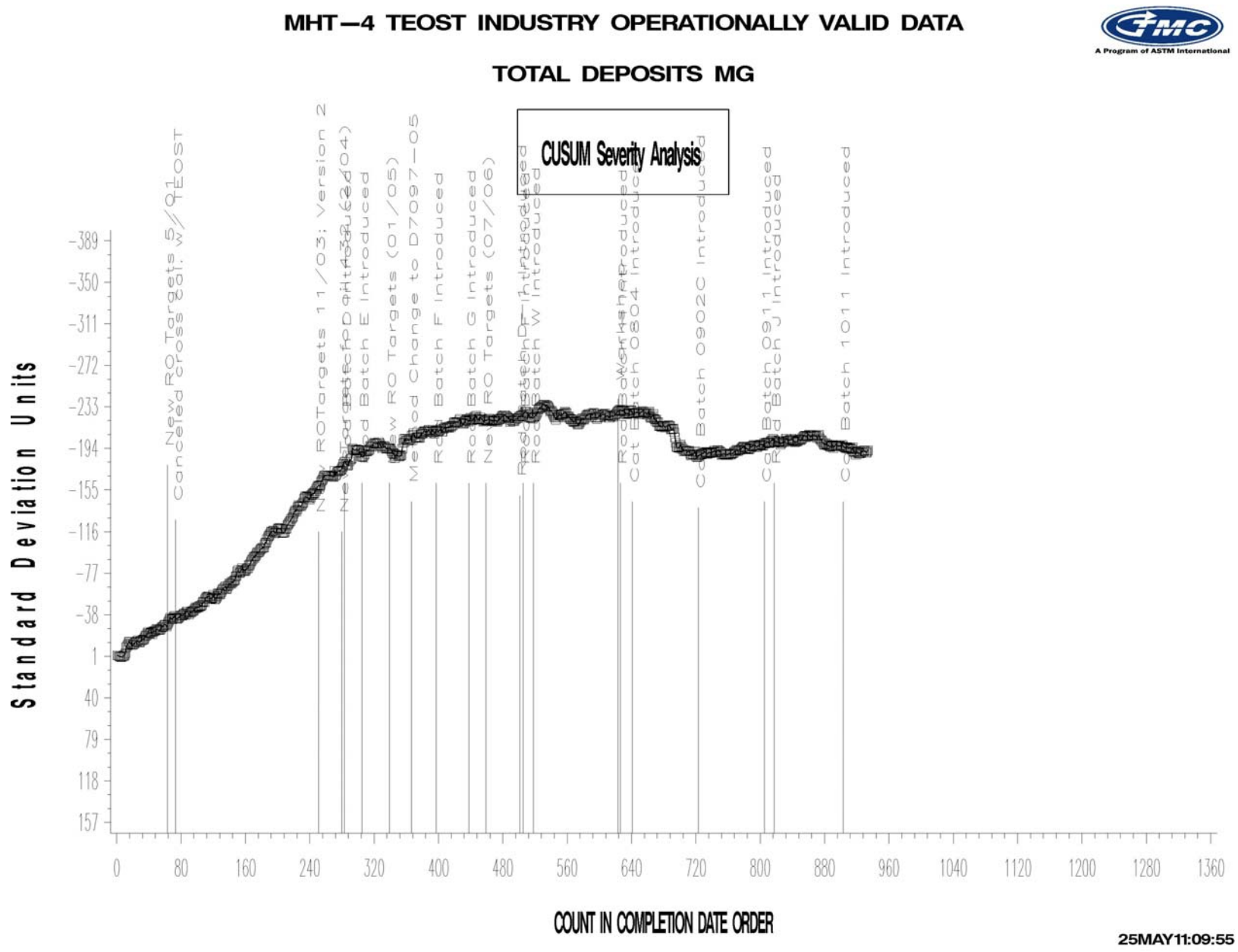

MHT—4 TEOST INDUSTRY OPERATIONALLY VALID DATA
TOTAL DEPOSITS MG
CUSUM Severity Analysis
Standard Deviation Units
-389
-350
-311
-272
-233
-194
-155
-116
-77
-38
1
40
79
118
157
0
80
160
240
320
400
480
560
640
720
800
880
960
1040
1120
1200
1280
1360
COUNT IN COMPLETION DATE ORDER
25MAY11:09:55

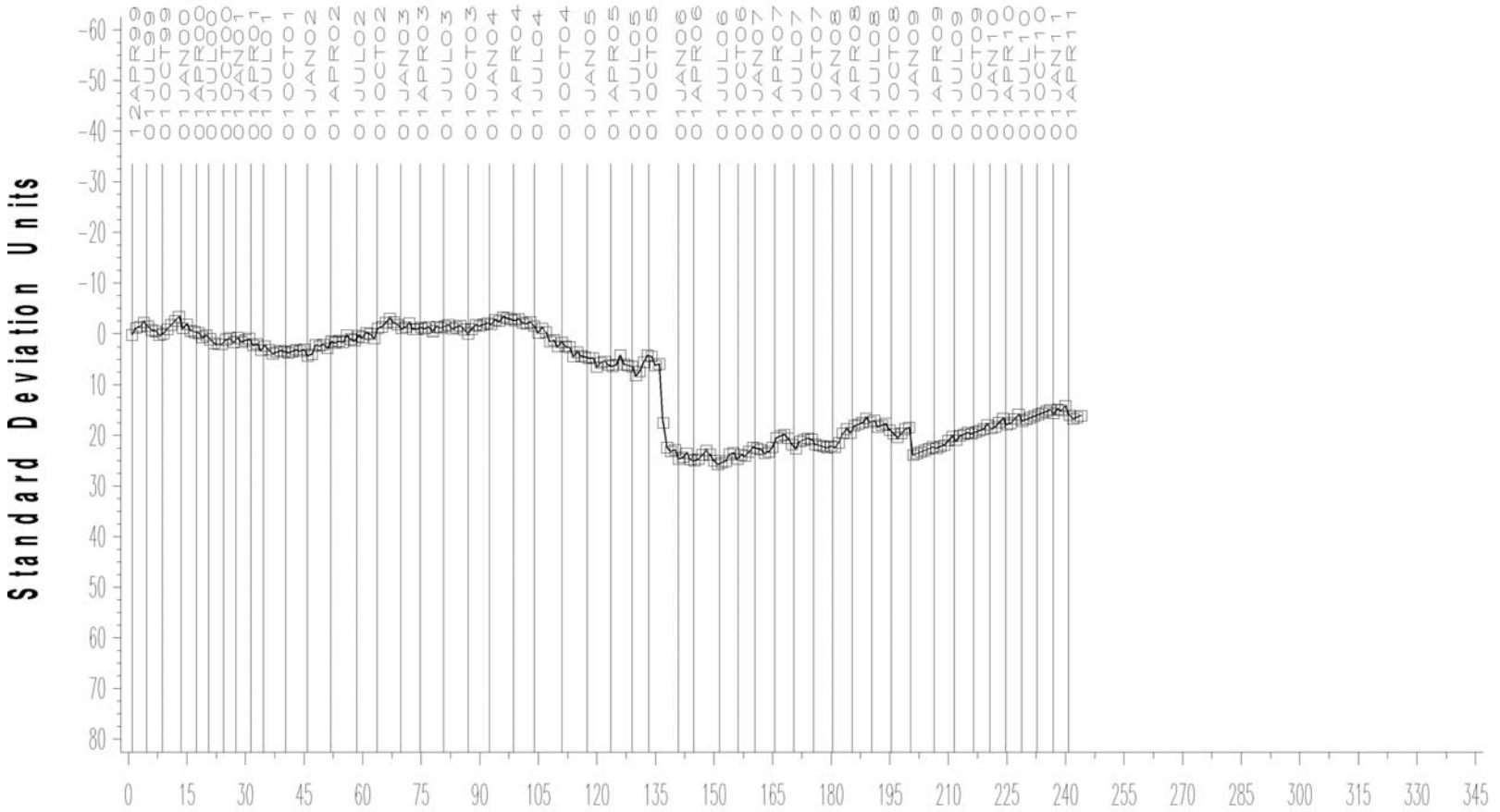
Figure 6

D6082 HIGH TEMPERATURE FOAM INDUSTRY OPERATIONALLY VALID DATA

IND= 1007

FOAM TENDENCY

CUSUM Severity Analysis



20MAY11:11:32

Figure 7

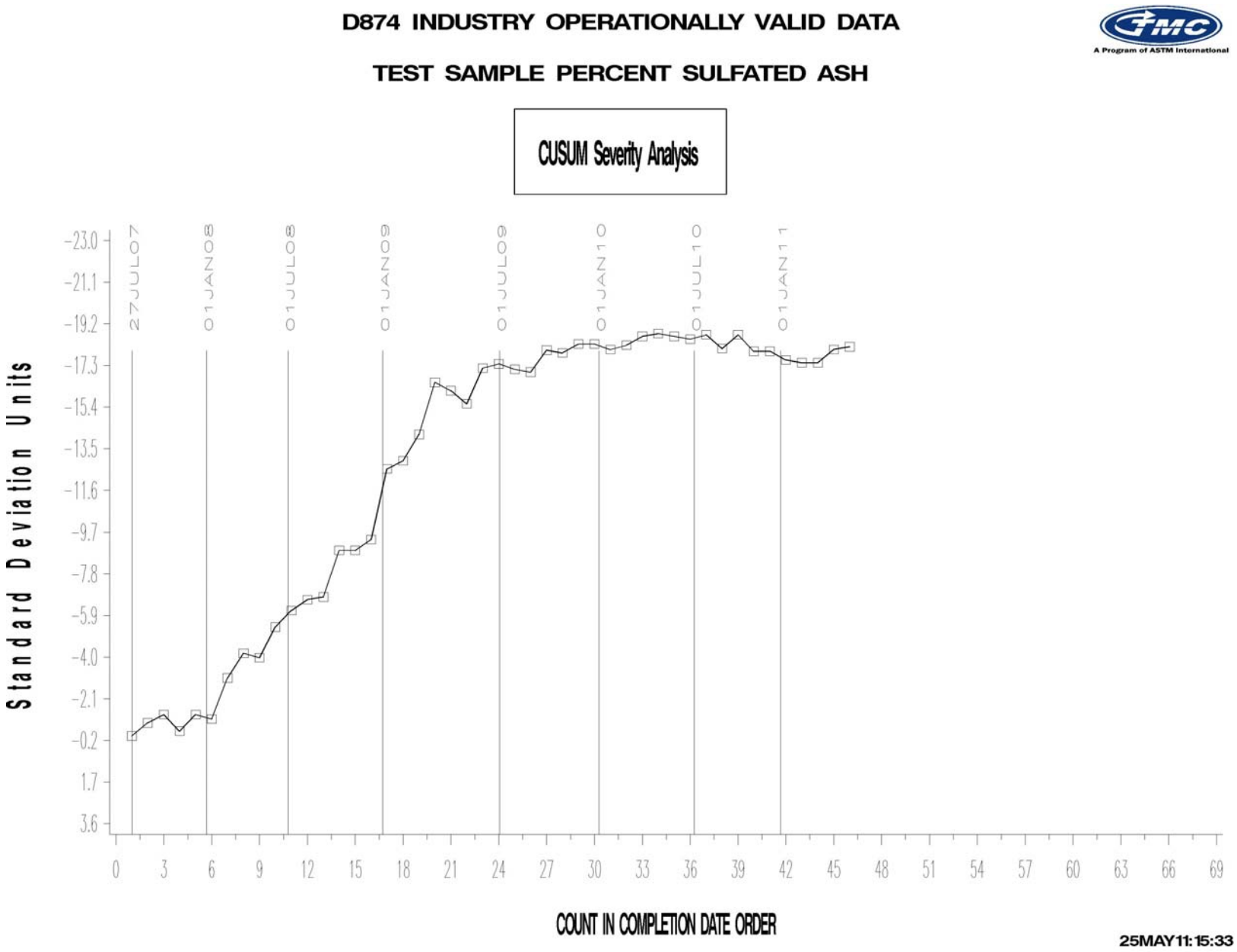
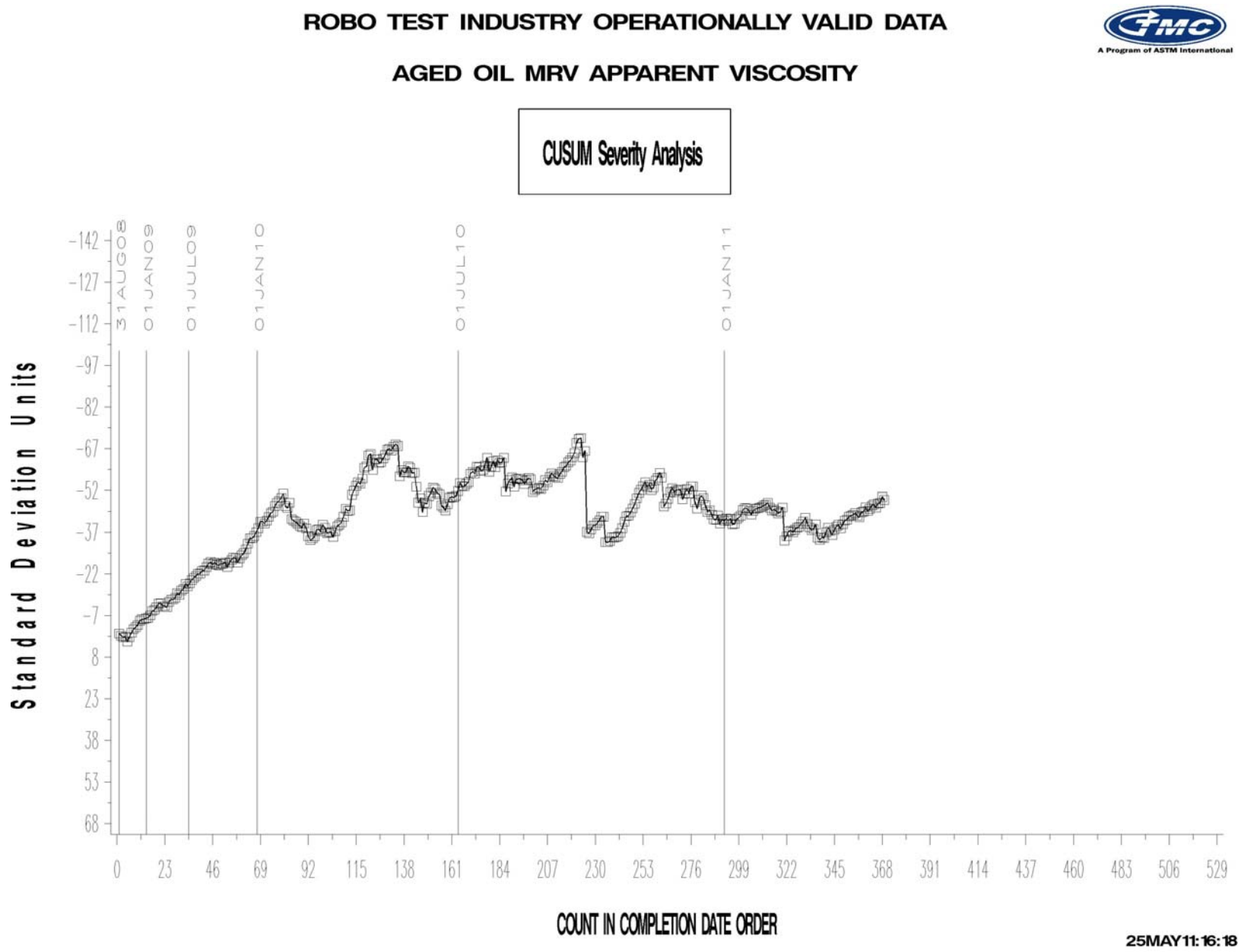

D874 INDUSTRY OPERATIONALLY VALID DATA
TEST SAMPLE PERCENT SULFATED ASH
CUSUM Severity Analysis
A Program of ASTM International
Standard Deviation Units
-23.0
-21.1
-19.2
-17.3
-15.4
-13.5
-11.6
-9.7
-7.8
-5.9
-4.0
-2.1
-0.2
1.7
3.6
27JUL07
01JAN08
01JUL08
01JAN09
01JUL09
01JAN10
01JUL10
01JAN11
0 3 6 9 12 15 18 21 24 27 30 33 36 39 42 45 48 51 54 57 60 63 66 69
COUNT IN COMPLETION DATE ORDER
25MAY11:15:33

Figure 8


ROBO TEST INDUSTRY OPERATIONALLY VALID DATA
AGED OIL MRV APPARENT VISCOSITY
CUSUM Severity Analysis
Standard Deviation Units
-142
-127
-112
-97
-82
-67
-52
-37
-22
-7
8
23
38
53
68
31AUG08
01JAN09
01JUL09
01JAN10
01JUL10
01JAN11
0
23
46
69
92
115
138
161
184
207
230
253
276
299
322
345
368
391
414
437
460
483
506
529
COUNT IN COMPLETION DATE ORDER
25MAY11:16:18

TMC Monitored Bench Tests
Reference Oil Test Targets and Acceptance Bands

Test	Oil Code	Parameter	n	Mean	sR	Acceptance Bands * 95% Lower	95% Upper
D6417	52	area % volatility loss	18	6.97	0.31	6.4	7.6
	55	area % volatility loss	18	11.68	0.51	10.7	12.7
	58	area % volatility loss	18	5.61	0.30	5.0	6.2
D5800	52	mass % volatility loss	33	13.75	0.61	12.6	14.9
	55	mass % volatility loss	32	17.09	0.76	15.6	18.6
	58	mass % volatility loss	37	15.20	0.72	13.8	16.6
TEOST by D6335	71	Total Deposit wt. (mg)	27	51.79	4.79	42.4	61.2
	71-1	Total Deposit wt. (mg)	27	51.79	4.79	42.4	61.2
	72	Total Deposit wt. (mg)	27	26.72	3.46	19.9	33.5
	72-1	Total Deposit wt. (mg)	27	26.72	3.46	19.9	33.5
MTEOS by D7097	74	Total Deposit wt. (mg)	30	12.85	5.59	1.9	23.8
	432	Total Deposit wt. (mg)	30	47.04	4.50	38.2	55.9
	434	Total Deposit wt. (mg)	30	27.37	6.57	14.5	40.2
GI by D5133	58	Gelation Index	17	5.8	0.69	4.4	7.2
	62	Gelation Index	35	17.0	3.90	9.4	24.6
	1009	Gelation Index	16	7.3	0.68	6.0	8.6
D6082	1007	Tendency (ml)	28	66	19	29	103
	1007	Stability (ml)	28	0	0	0	0
D6082	66	Tendency (ml)	--	-----	-----	>100	-----
	66	Stability (ml)	--	-----	-----	0	0
D874	90	mass % Sulfated Ash	27	1.07	0.08	0.91	1.23
	91	mass % Sulfated Ash	27	0.82	0.05	0.72	0.92
	820-2	mass % Sulfated Ash	27	1.57	0.08	1.40	1.73
ROBO D7528	434-1	ln MRV, ln(mPa-s)	13	10.6599 (42612)	0.1672	10.3322 (30706)	10.9875 (59130)
	435	ln MRV, ln(mPa-s)	15	11.4895 (97685)	0.2932	11.0021 (60000)	12.0642 (173546)
	435-1	ln MRV, ln(mPa-s)	22	11.0416 (62420)	0.20295	10.7048 (44570)	11.4394 (92910)
	438	ln MRV, ln(mPa-s)	14	10.2676 (28785)	0.2037	9.8683 (19308)	10.6669 (42912)

Attachment 3

TMC Monitored Bench Tests – Individual Reference Oil Statistics
(Operationally Valid Tests Only)

Test	Oil Code	Parameter	Targets			10/1/09 - 3/31/10				4/1/10 - 9/30/10				10/1/10 - 3/31/11			
			n	Mean	sR	n	Mean	sR	Mean Δ/s	n	Mean	sR	Mean Δ/s	n	Mean	sR	Mean Δ/s
D6417	52	Area % Volatized	18	6.97	0.31	5	6.9	0.27	-0.16	4	7.1	0.14	0.42	7	6.9	0.49	-0.32
	55	Area % Volatized	18	11.68	0.51	6	11.8	0.38	0.20	7	11.9	0.37	0.43	5	11.7	0.37	0.08
	58	Area % Volatized	18	5.61	0.30	2	5.7	0.28	0.30	5	5.7	0.29	0.37	8	5.7	0.28	0.38
D5800	52	% volatility loss	33	13.75	0.61	12	14.4	0.79	1.13	15	14.4	0.71	1.07	10	14.5	0.52	1.18
**	55	% volatility loss	32	17.09	0.76	9	17.5	0.61	0.60	9	17.4	0.63	0.45	15	17.5	0.91	0.49
	58	% volatility loss	37	15.20	0.72	14	15.2	0.65	0.05	10	15.3	0.66	0.17	9	15.0	0.70	-0.27
TEOST	71	Deposit wt. (mg)	27	51.79	4.79	4	55.9	9.40	0.86	3	53.8	6.91	0.43	2	54.2	5.87	0.49
D6335	71-1	Deposit wt. (mg)		51.79	4.79	3	61.1	26.11	1.94	4	54.2	3.42	0.51	6	47.7	7.99	-0.85
	72	Deposit wt. (mg)	27	26.72	3.46	2	24.8	3.61	-0.54	1	28.5	---	0.51	1	32.3	----	1.61
	72-1	Deposit wt. (mg)		26.72	3.46	3	29.1	2.15	0.68	8	26.2	4.39	-0.16	5	29.8	3.00	0.88
MTEOS	432	Deposit wt. (mg)	30	47.04	4.50	12	45.7	4.07	-0.29	20	50.8	4.19	0.83	25	49.8	4.56	0.60
D7097	434	Deposit wt. (mg)	30	27.37	6.57	17	27.6	7.32	0.04	22	23.1	5.50	-0.65	24	26.9	9.90	-0.07
***	74	Deposit wt. (mg)	30	12.85	5.59	14	10.8	3.45	-0.37	13	9.0	2.23	-0.69	6	14.2	6.93	0.24
GI	58	Gelation Index	17	5.8	0.69	11	6.1	0.90	0.38	8	6.2	0.85	0.58	12	5.9	1.27	0.10
D5133	62	Gelation Index	35	17.0	3.90	8	14.3	4.59	-0.70	9	16.5	6.23	-0.14	12	13.1	5.06	-1.00
****	1009	Gelation Index	16	7.30	0.68	12	7.1	0.49	-0.28	7	7.2	0.49	-0.08	9	6.8	0.58	-0.72
D6082	1007	Tendency (ml)	28	65	19	8	59	10	-0.38	8	65	16	-0.05	8	61	10	-0.25
D874	820-2	Sulfated Ash m%	27	1.57	0.08	1	1.57	---	0.00	3	1.59	0.03	0.21	1	1.58	-----	0.12
	90	Sulfated Ash m%	27	1.07	0.08	3	1.05	0.06	-0.21	1	1.08	----	0.12	3	1.07	0.06	0.04
	91	Sulfated Ash m%	27	0.82	0.05	3	0.80	0.01	-0.33	1	0.81	----	-0.20	2	0.83	0.01	0.20
ROBO	434-1	ln (MRV Vis)	13	10.6599	0.1672	11	10.7927	0.2007	0.79	26	10.6193	0.3449	-0.24	34	10.5785	0.1904	-0.49
	435	ln (MRV Vis)	15	11.4895	0.2932	43	11.3003	0.4272	-0.65	7	10.9061	0.6195	-1.99	0	---	---	---
	435-1	ln (MRV Vis)	22	11.0416	0.20295	--	-----	-----	---	61	11.0385	0.5042	-0.02	54	11.1361	0.9054	0.47
	438	ln (MRV Vis)	14	10.2676	0.2037	5	10.4582	0.4591	0.94	20	10.1871	0.6677	-0.40	33	10.4293	0.6779	0.79