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Test Monitoring Center

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MEMORANDUM: 09-017

DATE: May 18, 2009

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, 2008, through March 31, 2009, for Test Areas D6417, D5800, D6335 (TEOST), D7097 (MTEOS), D5133 (GI), D6082, D874 and 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 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.)
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 <u>all</u> 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. Some of the oldest 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
J. Zalar (TMC)
ftp://ftp.astmtmc.cmu.edu/docs/bench/bo7semiannualreports/mem09-017.pdf

Distribution: Email

Attachment 1

ASTM Test Monitoring Center

Semiannual Report

ASTM D02.B07 Bench Reference Test Monitoring
From October 1, 2008 through March 31, 2009

D6417, D5800, D6335 (TEOST), D7097 (MTEOS), D5133 (GI), D6082, D874 and 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	14
Operationally Valid but Failed Acceptance Criteria	0
Operationally Invalid (initially reported as)	0
Operationally Invalid (after informed of failing calibration)	0
Total	**14**

Fail Rate of Operationally Valid Tests: 0.0%

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	0

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	-----
10/1/05 through 3/31/06	11	8	0.23	-0.58
4/1/06 through 9/30/06	12	9	0.45	0.36
10/1/06 through 3/31/07	12	9	0.54	-0.17
4/1/07 through 9/30/07	12	9	0.31	0.22
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

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	4	0.29
Lab B	2	-0.65
Lab D	2	-0.36
Lab G	2	0.36
Lab H	2	0.13
Lab S	2	-0.79

INDUSTRY PERFORMANCE

D6417 reference testing is more precise, as measured by pooled s, compared to the previous period and remains more precise than the target precision (Table 3). Overall performance is only directionally mild at -0.10 standard deviations. Severity is represented graphically in Figure 1. An overall severe trend that had been developing since the 01JUL07 timeline has leveled off shortly after the 01OCT08 timeline.

TMC MEMORANDA

There were no TMC technical memos 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	31
Operationally Valid but Failed Acceptance Criteria	5
Operationally Invalid (initially reported as)	0
Operationally Invalid (after informed of failing calibration)	1
Total	**37**

Fail Rate of Operationally Valid Tests: 13.9%

Table 6 is a breakdown of the statistically unacceptable tests.

TABLE 6

Reason for Fail	No. of Tests
Sample Evaporation Loss Severe	3
Sample Evaporation Loss Mild	2

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	-----
4/1/06 through 9/30/06	35	32	0.62	0.54
10/1/06 through 3/31/07*	39	36	0.99	0.36
10/1/06 through 3/31/07*	38	35	0.61	0.51
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

*Period statistics with and without a single unusually mild result (-5.51 s) included

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	34	31	0.82	0.58
Procedure C	2	0	---	-0.64

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	0.33
Lab B	8	0.84
Lab D	1	0.41
Lab F	4	1.22
Lab G	6	-1.34
Lab H	2	2.38
Lab I	5	-0.15
Lab J	6	1.50

INDUSTRY PERFORMANCE

D5800 reference testing precision, as measured by pooled s, is less precise than the three most recent report periods, where pooled s precision had been essentially unchanged, and is less precise than the target precision. Overall performance is again severe this period with six of the eight participating labs performing severe at some level and twelve of thirty-six operationally valid tests more than 1 s severe and five tests more than 1 s mild. This is similar severe performance to the last two report periods, but this period has more mild results greater than 1 s, contributing to the overall poorer precision observed this period. Severity is graphically represented in Figures 2A and 2B. Figure 2A shows an unexplained increase in severity since the 01JUL06 timeline, with an additional increase in severity since the 01JAN07 timeline. It's also interesting to note the increasing severe performance on the mildest performing reference oil, Oil 52. Testing severity on Oil 52 has gradually shifted over the years from around the target mean of 13.8 to 14.5, or about 1.3 s severe of the expected target performance (Attachment 3). Labs H and I were the most severe performing labs last period, while labs H and J are the most severe performers this period.

A widely observed severe trend continues since at least January 2007, with less overall severe performance for this period, but only because the increased number of very mild test results partially offset the number of very severe results, causing poorer overall precision for the report period.

Table 8 compares the procedures for the period. There were no Procedure A calibration tests reported and only two Procedure C calibration tests reported this period, too few to estimate pooled s precision.

TMC MEMORANDA

There were no TMC technical memos 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	24
Operationally Valid but Failed Acceptance Criteria	0
Operationally Invalid (initially reported as)	2
Operationally Invalid (after informed of failing calibration)	0
Total	**26**

Fail Rate of Operationally Valid Tests: 0.0%

Table 11 is a breakdown of the statistically unacceptable tests.

TABLE 11

Reason for Fail	No. of Tests
Gelation Index Mild	0
Gelation Index Severe	0

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	-----
4/1/04 through 9/30/04	27	24	3.05	0.40
10/1/04 through 3/31/05	34	31	2.51	0.40
4/1/05 through 9/30/05	22	19	3.44	-0.17
10/1/05 through 3/31/06	22	19	3.09	-0.16
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

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	6	0.11
Lab B	5	0.03
Lab G	2	-0.71
Lab H	1	0.41
Lab I	6	0.43
Lab S	4	0.03

INDUSTRY PERFORMANCE

D5133 reference testing is more precise, as measured by pooled s, compared to last period and is more precise than the target precision for the first time since early 2005. Overall performance is just directionally severe of targets. Severity is graphically represented in Figures 3A and 3B.

Only one test this period is reported at more than 1 s mild, and four tests were 1 s or more severe, and all tests were less than 2 s mild or severe, with all reported operationally valid tests passing calibration. Compare this to last report period where twelve of twenty-seven operationally valid were 1 s or more from target (severe or mild), and individual tests as much as 2, 3 and 5 s mild or severe, and a fail rate of 14.8%. Two report periods prior had seventeen of twenty-six operationally valid tests at 1 s or more from target (severe or mild) and a fail rate of 7.1%.

So, overall GI testing precision and accuracy estimates show improvement this period. Precision is better than target and severity is only biased slightly severe at 0.10 s.

TMC MEMORANDA

There were no TMC technical memos 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	15
Operationally Valid but Failed Acceptance Criteria	3
Operationally Invalid (initially reported as)	2
Operationally Invalid (after informed of failing calibration)	1
Total	**21**

Fail Rate of Operationally Valid Tests: 16.7%

Table 15 is a breakdown of the statistically unacceptable tests.

TABLE 15

Reason for Fail	No. of Tests
Total Deposits Mild	0
Total Deposits Severe	3

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	-----
10/1/04 through 3/31/05	10	8	6.30	-0.32
4/1/05 through 9/30/05	11	9	4.13	-0.73
10/1/05 through 3/31/06	14	12	4.96	-0.29
4/1/06 through 9/30/06	10	8	5.11	-0.16
10/1/06 through 3/31/07*	12	10	8.66	0.14
10/1/06 through 3/31/07*	11	9	5.67	-0.45
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

*Period statistics with and without a single unusually 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	5	0.77
Lab B	5	1.10
Lab D	3	1.31
Lab G	3	1.81
Lab V	2	-0.54

INDUSTRY PERFORMANCE

Reference testing precision, as measured by pooled s, is improved compared the previous report period, but remains less precise than the overall target precision (Table 16). Performance is nearly 1 s severe. Severity is graphically represented in Figure 4 (attached) with a recent overall severe trend since the 01APR08 timeline.

A D6335 TEOST-33C and D7097 TEOST MHT workshop held in April 2008 seems to have improved testing precision. However, severity, which had improved considerably last report period, is once again running nearly 1 s severe, with four of five labs performing severe, and three of five labs performing more than 1 s severe. Nine of eighteen tests reported this period as operationally valid were more than 0.95 s severe. Two of those tests, from two different labs, were more then 3 s severe of target (both on oil 72), a third test was more than 2 s severe (oil 71). Attachment 3 shows test performance on both reference oils at nearly 1 s severe.

Two report periods prior, the TMC reported that this test was clearly in trouble in that precision was markedly degraded, fail rates were at 50% (and substantially higher if operationally invalid tests are counted) and all three participating labs at the time exhibited multiple consecutive failing tests (between three and six) that seemed to be instrument specific. Last period, it seemed that many of these issues had been substantially addressed by the workshop. This period there appears to be a significant severe trend, while overall precision has improved.

This period also brings two labs back into the monitoring system, Labs D & V, bringing the total participating labs up to five for the report period. All tests this period are reported as using Rod Batch H.

Oils 71 and 72 have virtually run out at the TMC, so replacement oils 71-1 and 72-1 are now being distributed; an Email was sent out about this from Tom Schofield on January 13, 2009. No reference tests this period used oils 71-1 or 72-1.

TMC MEMORANDA

There was one TMC technical update issued this report period for the D6335 test method:
Introducing Reference Oil Reblends, Email from Tom Schofield on January 13, 2009

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 (6 labs reporting):

TABLE 18

	No. of Tests
Statistically Acceptable and Operationally Valid	44
Operationally Valid but Failed Acceptance Criteria	9
Operationally Invalid (initially reported as)	6
Operationally Invalid (after informed of failing calibration)	0
Total	**59**

Fail Rate of Operationally Valid Tests: 17.0%

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	8*

*All six severe fails were on TMC oil 432, the severest performing reference oil.

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 6/30/05	42	39	4.60	-----
4/1/05 through 9/30/05	39	36	6.36	-0.17*
10/1/05 through 3/31/06	40	37	6.68	-0.26
Updated Targets Effective 7/31/06	90	87	5.62	-----
4/1/06 through 9/30/06	43	40	5.99	-0.09*
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

* New oil performance targets and acceptance bands were implemented during the period; severity is estimated using the targets that were in effect at the time each test was reported.

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	0.70
Lab AK	2	0.89
Lab B	15	0.41
Lab D	6	1.69
Lab G	13	0.63
Lab V	3	0.88

INDUSTRY PERFORMANCE

D7097 reference testing overall precision, as measured by pooled s, has improved compared to the prior report period and is better than the updated target precision. Overall performance is severe with all labs performing severe at some level.

All but two operationally valid tests reported this period were run using rod batch H, and all operationally valid tests are reported using catalyst batch 0804.

The MTEOS 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 batches are introduced. Figure 5A shows the period severity with overall sever performance for the report period.

Early in the report period it was found that calibration tests were running unusually severe, and labs were having difficulty passing calibration on the most severe reference oil, TMC oil 432, with most tests failing severe of the acceptance bands. Analysis of the TMC's reference data showed the severity shift to be coincident with the introduction of a new catalyst batch 0804. Based on the first 47 operationally valid results reported using catalyst batch 0804, overall testing shifted nearly 1 s severe compared to using catalyst batch 0511. Tests on TMC oil 432 shifted an average of 2.75 s severe, while performance on oil 434 shifted 0.5 s severe, and performance on oil 74 shifted 0.1 s severe. The observed severity shifts on oils 434 and 74 are not statistically significant, but the severity shift observed on oil 432 is significant.

D7097 (MTEOS or MHT-4 TEOST), continued

Since there was strong evidence that the severity shift was a result of the catalyst batch, the TMC opened up the high end of the acceptance bands on TMC oil 432 while the problem was studied and resolved. This allowed labs to pass calibration while still demonstrating discrimination on the severe performing reference oil 432. It wasn't particularly concerning that the labs were performing even more severe on the severe reference oil, the monitoring system was still assessing discrimination between the three reference oils, and performance around the GF-4 pass-fail limit did not appear to be significantly impacted by the catalyst. In a two-month period, the problem was carefully studied by the catalyst supplier, a new catalyst batch, 0902C, was prepared and distributed and a mini-round robin was run among the participating monitored labs. The results show that the test came back to expected performance using the new catalyst batch.

Once the severity bias introduced by catalyst batch 0804 was demonstrated to correct back to on-target performance by the introduction of the new catalyst batch 0902C, and all the participating labs had received the new catalyst, the TMC returned to the original acceptance bands for TMC oil 432. And, per a TMC technical update issued April 9, 2009, catalyst batch 0804 is no longer acceptable for TMC calibration purposes. In all, there were seven reference tests on oil 432 and catalyst batch 0804, over a period of two months, that were accepted using the "wide bands" while the problem was resolved and the new catalyst was shipped to the labs. There were no calibration tests reported on the new 0902C catalyst for this report period, only the mini-round robin results.

TMC MEMORANDA

There were two TMC technical updates issued this report period for the D7097 test method:
Expanded Acceptance Range on TMC oil 432, Email form Tom Schofield on January 26, 2009
D7097 TEOST MHT TMC Technical Update – take 2, Email from Tom Schofield on April 9, 2009

D6082: High Temperature Foaming Characteristics of Lubricating Oils

MONITORED TESTING STATUS

Table 22 summarizes the reference tests reported to the TMC this period (4 labs reporting):

TABLE 22

	No. of Tests
Statistically Acceptable and Operationally Valid	10
Operationally Valid but Failed Acceptance Criteria	1
Operationally Invalid (initially reported as)	0
Operationally Invalid (after informed of failing calibration)	0
Total	**11**

Fail Rate of Operationally Valid Tests: 9.1%

In addition to the calibration tests, there were four 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	-----
10/1/04 through 3/31/05	12	72.9	16.30	0.37
4/1/05 through 9/30/05	10	62.0	25.30	-0.19
10/1/05 through 3/31/06*	11	102	70	1.87
10/1/05 through 3/31/06*	9	74	19	0.45
4/1/06 through 9/30/06	12	66	16	-0.01
10/1/06 through 3/31/07	9	61	12	-0.26
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

*Period statistics with and without two extreme results included.
**Period statistics with and without one extreme result 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
10/1/04 through 3/31/05	12	No non-zero occurrences	
4/1/05 through 9/30/05	10	No non-zero occurrences	
10/1/05 through 3/31/06	11	No non-zero occurrences	
4/1/06 through 9/30/06	12	No non-zero occurrences	
10/1/06 through 3/31/07	9	No non-zero occurrences	
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	

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	-0.58
Lab B	4	0.21
Lab G	3	1.44
Lab I	2	-0.32

INDUSTRY PERFORMANCE

The D6082 Foam Tendency precision, as measured by standard deviation (s) on TMC oil 1007, is significantly worse than last report period and is much less precise than the target precision. Overall performance is somewhat severe. 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.

There was one result reported as operationally valid with a foam tendency that was more than 5 s severe of target. This single result is the cause of the unusually poor precision this period. With that result removed, Table 23 shows the precision improves to 10 ml of foam tendency, and performance changes to slightly mild.

D6082: High Temperature Foaming Characteristics of Lubricating Oils, continued

All operationally valid discrimination tests reported this period meet the acceptance criteria (that is, all reporting labs could discriminate oil 66 as a GF-4/SM failing oil for Foam Tendency).

TMC MEMORANDA

There were no TMC technical memos 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	5
Operationally Valid but Failed Acceptance Criteria	1
Operationally Invalid (initially reported as)	0
Operationally Invalid (after informed of failing calibration)	0
Total	**6**

Fail Rate of Operationally Valid Tests: 16.7%

Table 27 is a breakdown of the statistically unacceptable tests.

TABLE 27

Reason for Fail	No. of Tests
Sulfated Ash Mild	1
Sulfated Ash Severe	0

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

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	-0.19
Lab B	1	-0.50
Lab G	3	-2.18

D874 Sulfated Ash from Lubricating Oils and Additives, continued

INDUSTRY PERFORMANCE

D874 precision, as measured by pooled s, matches the target precision but performance is very mild of targets. Severity is graphically represented in Figure 7.

Lab G reported 3 very mild tests this period (-1.2 s, -2.1 s and -3.2 s); these three mild results contribute significantly to the very mild overall performance for the period.

ROBO (Romaszewski Oil Bench Oxidation Test; Sequence IIIGA Replacement Test)

MONITORED TESTING STATUS

Table 30 summarizes the reference tests reported to the TMC this period (6 labs reporting):

TABLE 30
Reference Tests

	No. of Tests
Statistically Acceptable and Operationally Valid	22
Operationally Valid but Failed Acceptance Criteria	0
Operationally Invalid (initially reported as)	1
Operationally Invalid (after informed of failing calibration)	6*
Total	**29**

Fail Rate of Operationally Valid Tests: 0.0%

*Six tests were reported as operationally valid but were on rigs that had never first achieved calibrated status, so the results were excluded form the overall statistical estimates for this period.

Table 31 is a breakdown of the statistically unacceptable tests.

TABLE 31

Reason for Fail	No. of Tests
MRV Viscosity Mild	0
MRV Viscosity Severe	0

PRECISION AND SEVERITY

Note: A Box-Cox analysis of the initial round robin study suggested that mathematical transform of the MRV Viscosity test parameter was suggested to better normalize the data distribution. A natural log (ln) transformation is applied to each MRV Viscosity test result before any statistical analyses are performed. The transformed test result has no unit of measure.

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. (The first calibration test, completed August 31, 2008, was given retroactive calibrated status as part of a round robin study.)

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

ROBO Test, continued

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	5	-0.52
Lab AM	3	0.79
Lab AN	1	-0.19
Lab AO	3	-0.07
Lab B	5	-0.99
Lab G	5	-0.97

INDUSTRY PERFORMANCE

Note: Participating labs were allowed to calibrate rigs retroactively using round robin test results; about half off the results in this report period are from the round robin study. So, this initial report period extends back to August 31, 2008, through March 31, 2009.

ROBO precision, as measured by pooled s, is about the same as the target precision (not unexpected as about half the test results were used to help establish the initial target precision), and performance is mild of targets. Severity is graphically represented in Figure 8.

Labs must calibrate new rigs by passing two consecutive TMC blind calibrations. Also, if the vacuum pump is changed or the vacuum control valve set position is changed after TMC calibrated status is attained, the lab must recalibrate as if it were a new rig. Therefore, most of the calibrations this period were two-test calibrations. Once the operation of a rig is established as TMC calibrated, subsequent audits require only periodic one-test calibrations.

Six tests were reported this period as operationally valid on rigs that were never previously TMC calibrated, or where the vacuum system was changed after a successful TMC calibration, but the tests failed to meet the TMC statistical acceptance criteria. These tests were NOT included in the period statistics as operationally valid because the labs had not adequately demonstrated that the rigs could pass an initial two-test blind calibration series. There are a large number of tests on new rigs, completed after the March 31 cutoff date for this report, that are also reported as operationally valid, but statistically failed to pass calibration. Some labs are failing three or more consecutive attempts at TMC calibration on a new or modified rig.

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.

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	64.9	0.8
55	D6417, D5800	69.9	0.9
58	D6417, D5800, GI	121.1	1.0
62	GI	1.2	0.1
66	D6082 (Discrimination)	96.2	1.2
71	TEOST	4 samples	1.3
71-1	TEOST	1.8	0.2
72	TEOST	2 samples	0.7
72-1	TEOST	1.6	0.4
74	MTEOS	0.4	0.2
90	D874 & D874 Daily Check	44.2	3.1
91	D874	4.6	0.1
**432	MTEOS	Adequate Supply	-----
**434	MTEOS	Adequate	-----
**820-2	D874	Adequate	-----
*1007	D6082	Est. 20	-----
**1009	GI	Adequate	-----
**434-1	ROBO	??	-----
**435	ROBO	Nearly Gone	-----
**435-1	ROBO	??	-----
**438	ROBO	??	-----

*One drum of oil is set aside for bench calibration testing; the TMC has a larger supply of this oil.
**Five gallon 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
^83	ROBO (RR)	47.3	1.7
^84	ROBO (RR)	3.3	1.7
^85	ROBO (RR)	3.3	1.7
^**433	Obsolete MTEOS	Adequate Supply	-----

^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)	183.0	4.8
HMB	H&M (D6922)	187.0	4.8
HMC	H&M (D6922)	173.0	4.8
HMD	H&M (D6922)	181.0	4.8
HME	H&M (D6922)	166.0	4.8
HMF	H&M (D6922)	188.8	4.8

Shipping aliquots are:

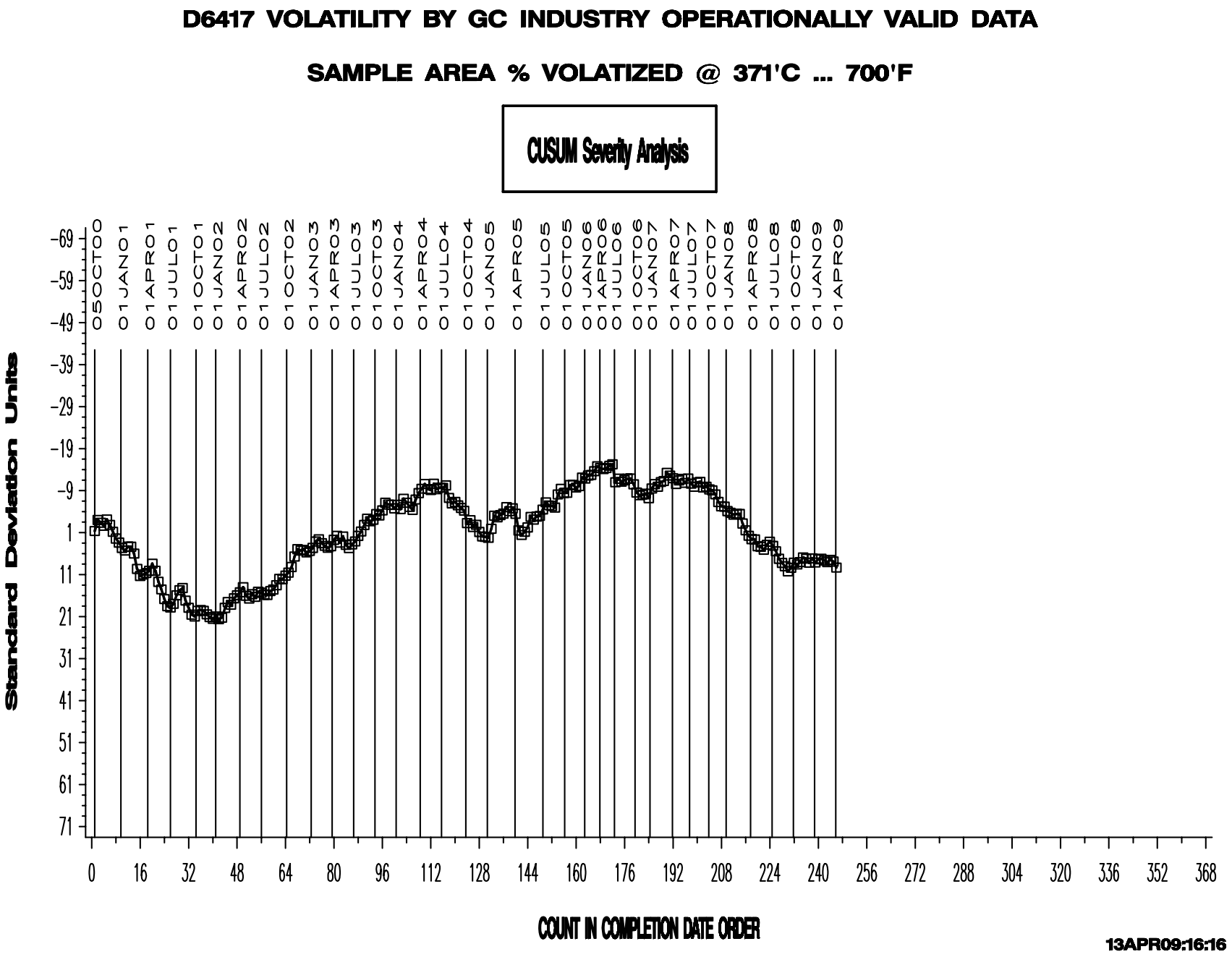
D6417	1 ml
D6417QC	118 ml
D5800	100 ml
GI	25 ml
MTEOS	17 ml
TEOST	125 ml
D6082	525 ml
D874	32 ml
ROBO	300 ml
ROBOQC	300 ml
H&M	950 ml

MISCELLANEOUS

The TMC posts monitored bench test calibration data on the Internet. Selected parameters from all operationally valid reference tests are posted on the TMC's World-Wide-Web page in real time. 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
SAMPLE AREA % VOLATIZED @ 371'C ... 700'F
CUSUM Severity Analysis
Standard Deviation Units
-69
-59
-49
-39
-29
-19
-9
1
11
21
31
41
51
61
71
05OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
01OCT02
01JAN03
01APR03
01JUL03
01OCT03
01JAN04
01APR04
01JUL04
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01JAN05
01APR05
01JUL05
01OCT05
01JAN06
01APR06
01JUL06
01OCT06
01JAN07
01APR07
01JUL07
01OCT07
01JAN08
01APR08
01JUL08
01OCT08
01JAN09
01APR09
0
16
32
48
64
80
96
112
128
144
160
176
192
208
224
240
256
272
288
304
320
336
352
368
COUNT IN COMPLETION DATE ORDER
13APR09:16:16

Figure 2A

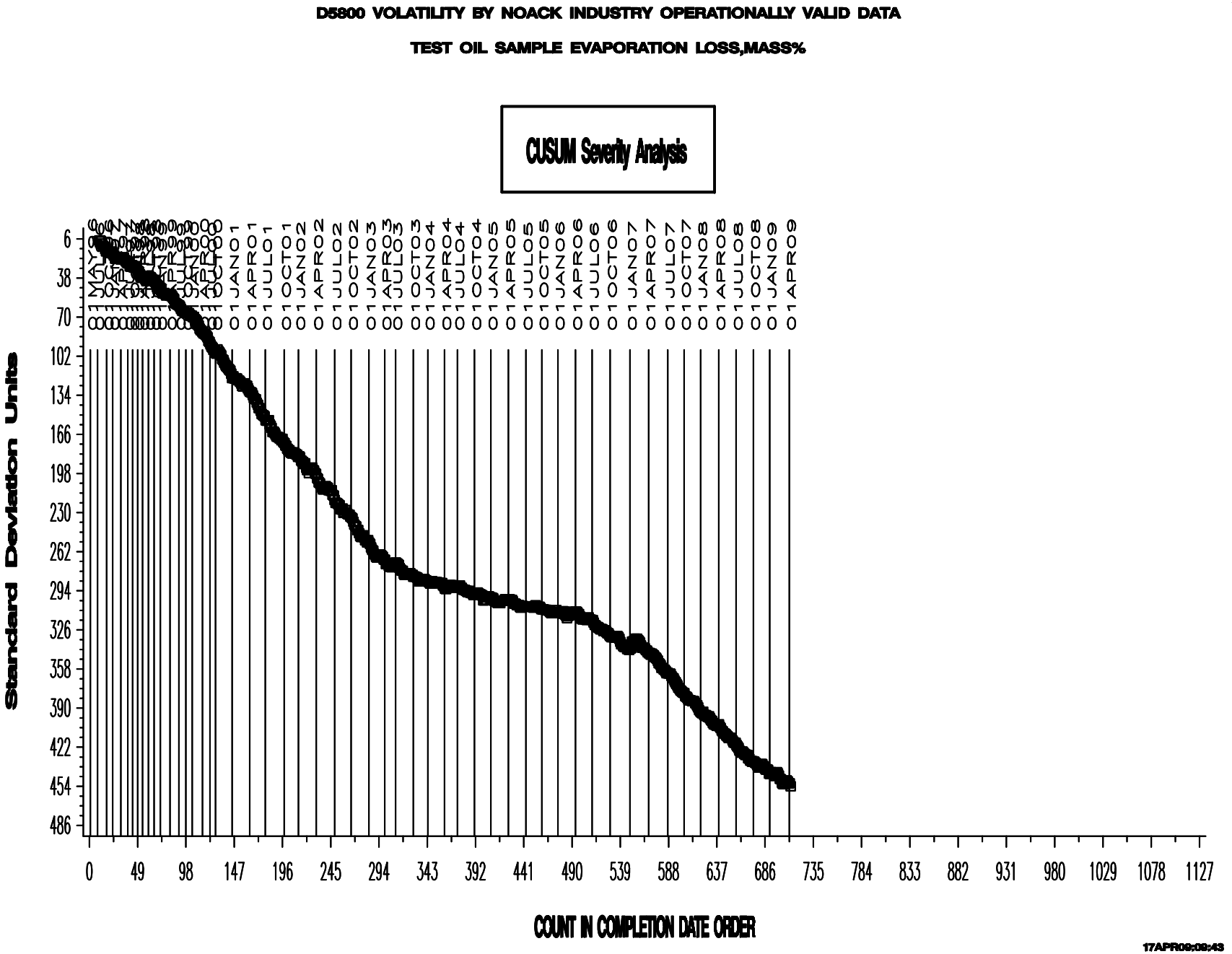

D5800 VOLATILITY BY NOACK INDUSTRY OPERATIONALLY VALID DATA
TEST OIL SAMPLE EVAPORATION LOSS,MASS%
CUSUM Severity Analysis
Standard Deviation Units
6
38
70
102
134
166
198
230
262
294
326
358
390
422
454
486
0 49 98 147 196 245 294 343 392 441 490 539 588 637 686 735 784 833 882 931 980 1029 1078 1127
COUNT IN COMPLETION DATE ORDER
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
17APR09:09:43

Figure 2B

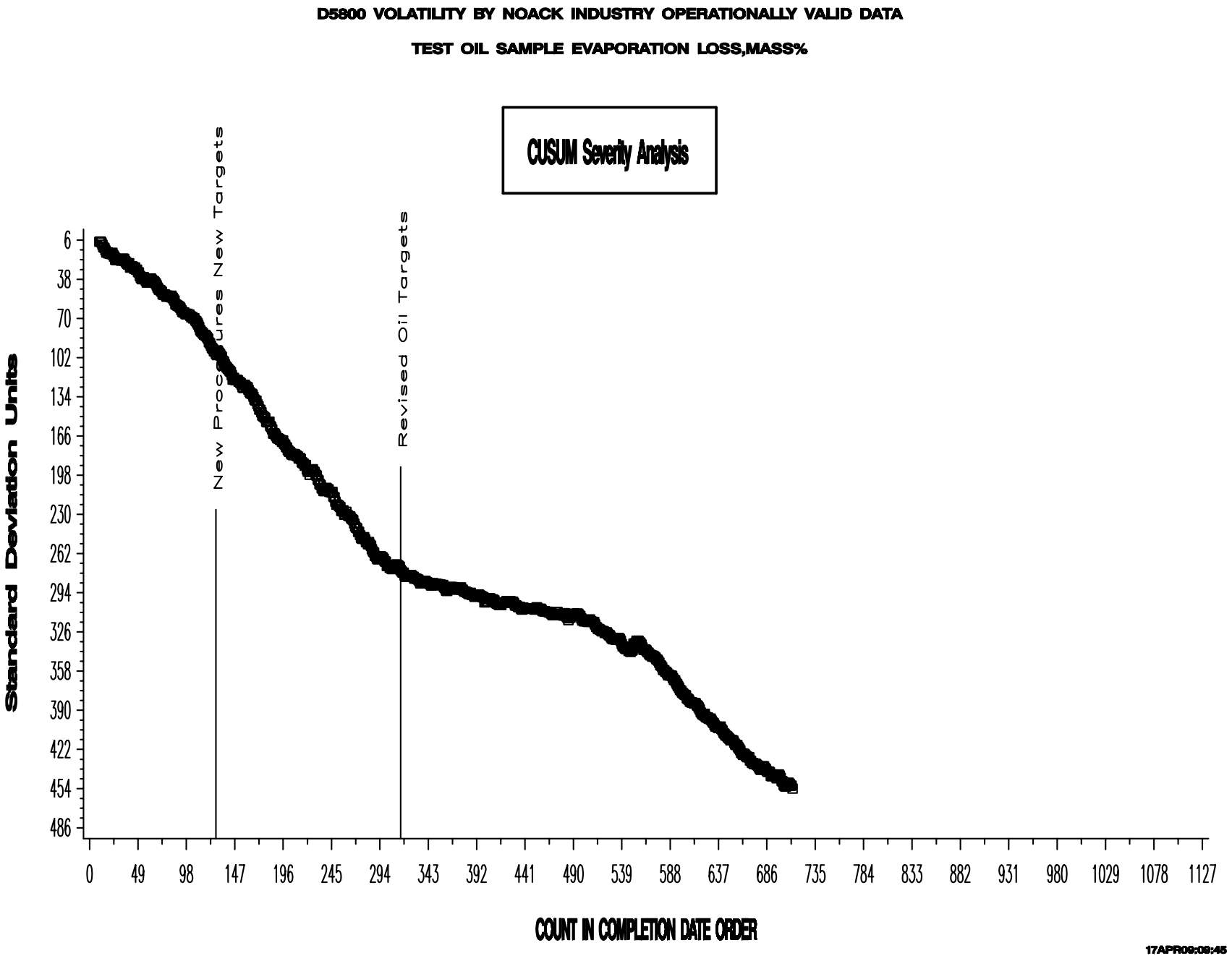

D5800 VOLATILITY BY NOACK INDUSTRY OPERATIONALLY VALID DATA
TEST OIL SAMPLE EVAPORATION LOSS,MASS%
CUSUM Severity Analysis
New Procedures New Targets
Revised Oil Targets
Standard Deviation Units
6
38
70
102
134
166
198
230
262
294
326
358
390
422
454
486
0
49
98
147
196
245
294
343
392
441
490
539
588
637
686
735
784
833
882
931
980
1029
1078
1127
COUNT IN COMPLETION DATE ORDER
17APR09:09:45

Figure 3A

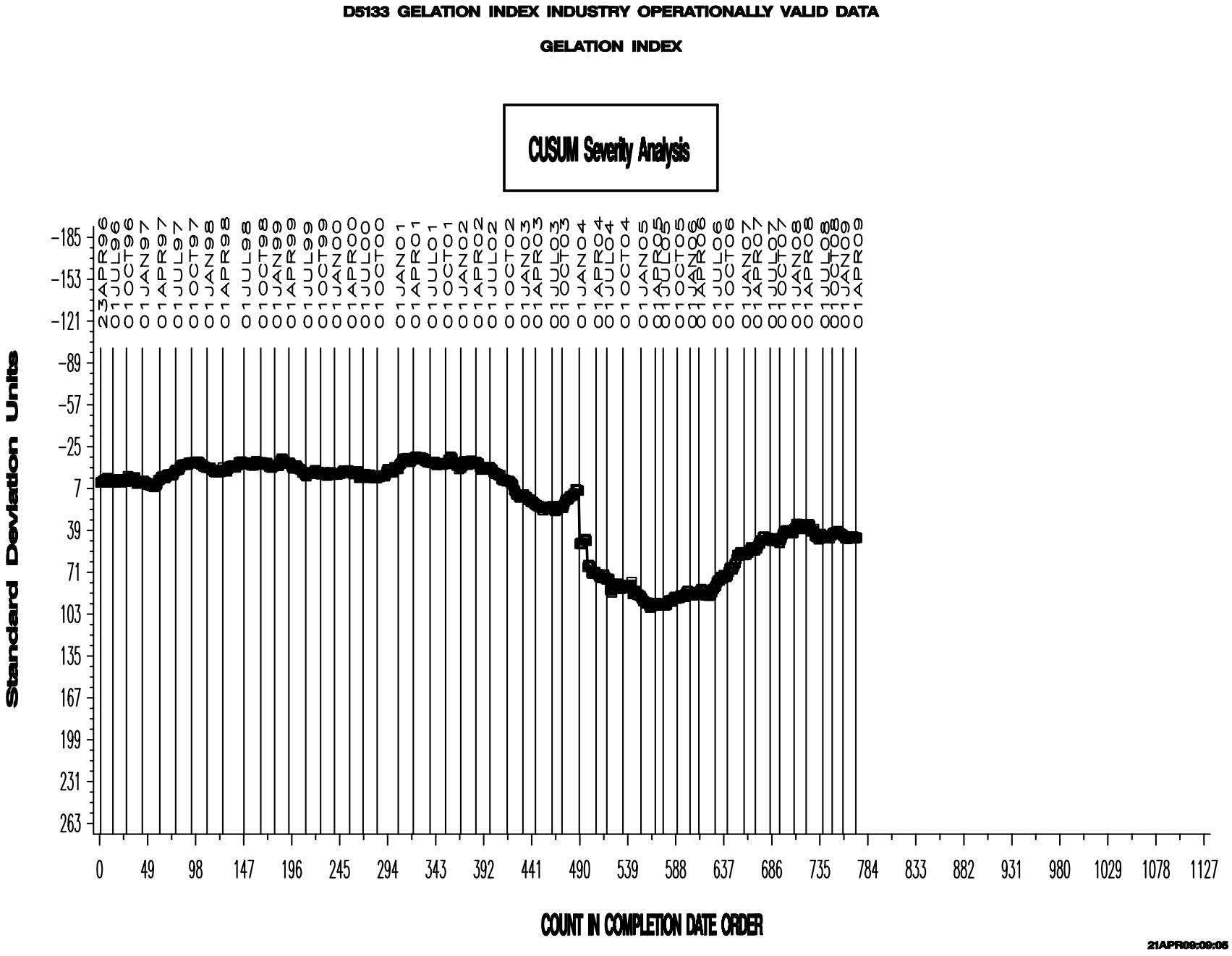

D5133 GELATION INDEX INDUSTRY OPERATIONALLY VALID DATA
GELATION INDEX
CUSUM Severity Analysis
Standard Deviation Units
-185
-153
-121
-89
-57
-25
7
39
71
103
135
167
199
231
263
23APR96
01JUL96
01OCT96
01JAN97
01APR97
01JUL97
01OCT97
01JAN98
01APR98
01JUL98
01OCT98
01JAN99
01APR99
01JUL99
01OCT99
01JAN00
01APR00
01JUL00
01OCT00
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
0
49
98
147
196
245
294
343
392
441
490
539
588
637
686
735
784
833
882
931
980
1029
1078
1127
COUNT IN COMPLETION DATE ORDER
21APR09:09:05

Figure 3B

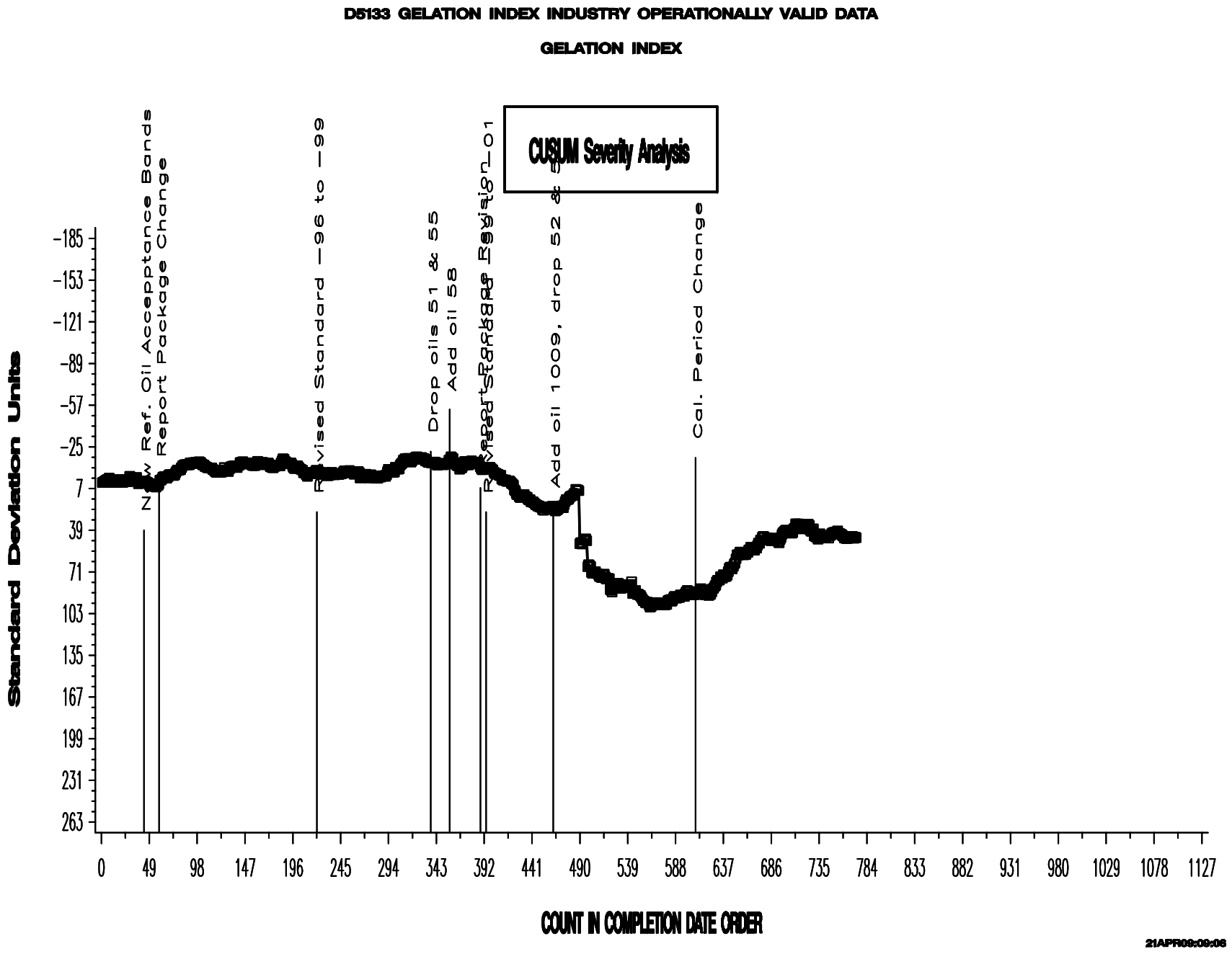

D5133 GELATION INDEX INDUSTRY OPERATIONALLY VALID DATA
GELATION INDEX
CUSUM Severity Analysis
New Ref. Oil Accepptance Bands
Report Package Change
Revised Standard -96 to -99
Drop oils 51 & 55
Add oil 58
Report Package Revision_01
Add oil 1009, drop 52 &
Cal. Period Change
Standard Deviation Units
-185
-153
-121
-89
-57
-25
7
39
71
103
135
167
199
231
263
0
49
98
147
196
245
294
343
392
441
490
539
588
637
686
735
784
833
882
931
980
1029
1078
1127
COUNT IN COMPLETION DATE ORDER
21APR09:09:06

Figure 4

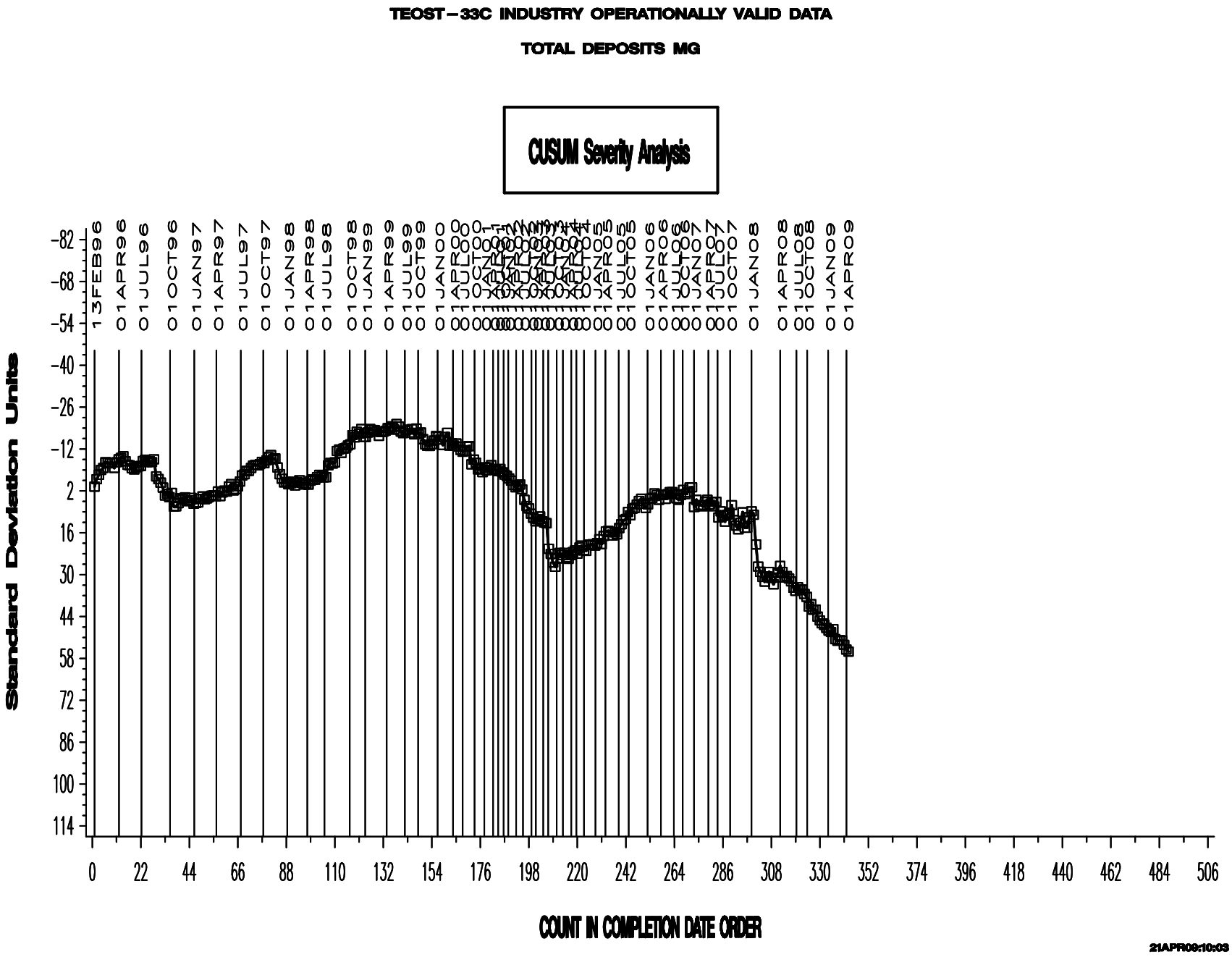

TEOST – 33C INDUSTRY OPERATIONALLY VALID DATA
TOTAL DEPOSITS MG
CUSUM Severity Analysis
Standard Deviation Units
-82
-68
-54
-40
-26
-12
2
16
30
44
58
72
86
100
114
13FEB96
01APR96
01JUL96
01OCT96
01JAN97
01APR97
01JUL97
01OCT97
01JAN98
01APR98
01JUL98
01OCT98
01JAN99
01APR99
01JUL99
01OCT99
01JAN00
01APR00
01JUL00
01OCT00
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
0
22
44
66
88
110
132
154
176
198
220
242
264
286
308
330
352
374
396
418
440
462
484
506
COUNT IN COMPLETION DATE ORDER
21APR09:10:03

Figure 5A

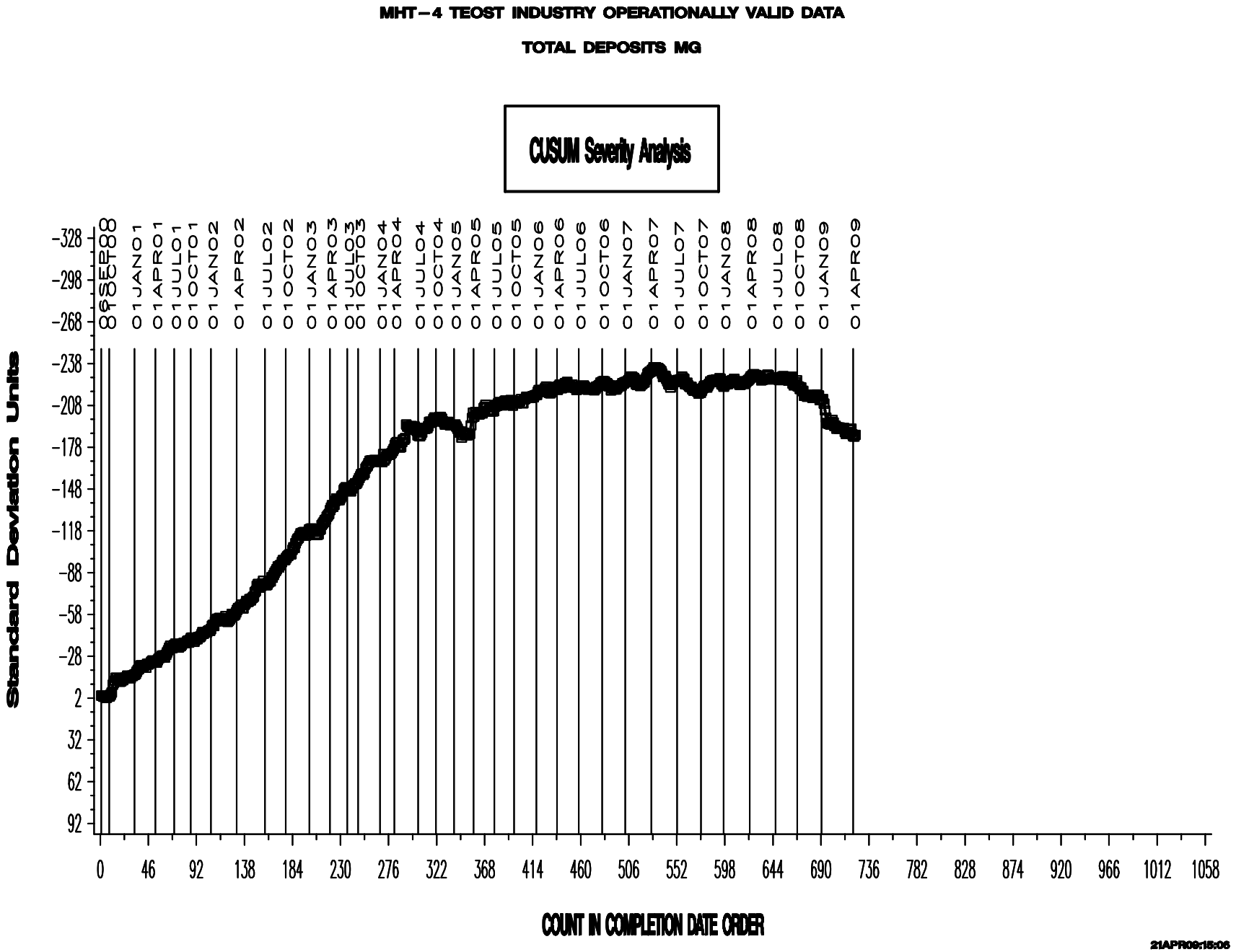

MHT-4 TEOST INDUSTRY OPERATIONALLY VALID DATA
TOTAL DEPOSITS MG
CUSUM Severity Analysis
Standard Deviation Units
-328
-298
-268
-238
-208
-178
-148
-118
-88
-58
-28
2
32
62
92
06SEP88
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
01OCT02
01JAN03
01APR03
01JUL03
01OCT03
01JAN04
01APR04
01JUL04
01OCT04
01JAN05
01APR05
01JUL05
01OCT05
01JAN06
01APR06
01JUL06
01OCT06
01JAN07
01APR07
01JUL07
01OCT07
01JAN08
01APR08
01JUL08
01OCT08
01JAN09
01APR09
0
46
92
138
184
230
276
322
368
414
460
506
552
598
644
690
736
782
828
874
920
966
1012
1058
COUNT IN COMPLETION DATE ORDER
21APR09:15:06

Figure 5B

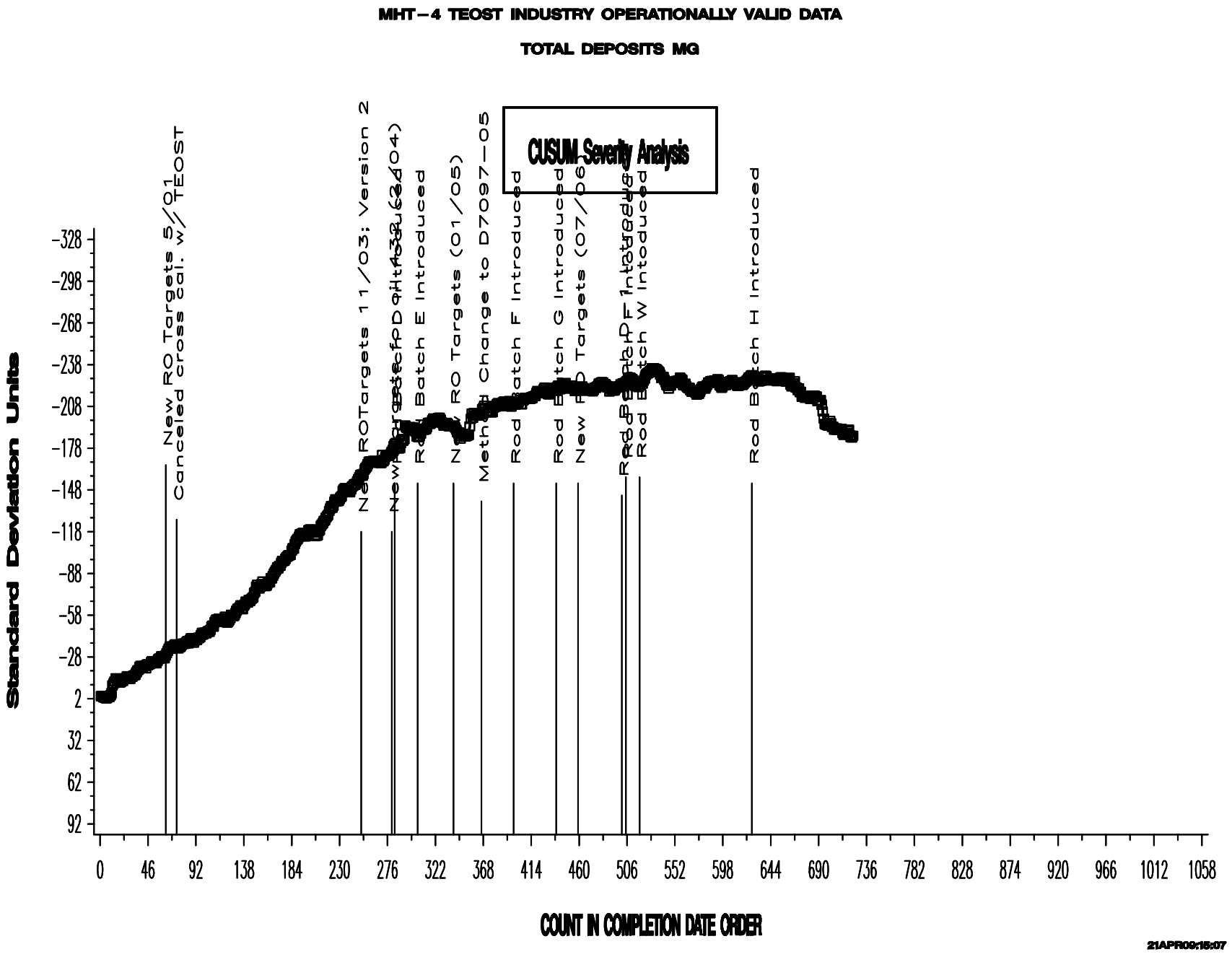

MHT–4 TEOST INDUSTRY OPERATIONALLY VALID DATA
TOTAL DEPOSITS MG
CUSUM Severity Analysis
Standard Deviation Units
-328
-298
-268
-238
-208
-178
-148
-118
-88
-58
-28
2
32
62
92
0
46
92
138
184
230
276
322
368
414
460
506
552
598
644
690
736
782
828
874
920
966
1012
1058
COUNT IN COMPLETION DATE ORDER
21APR09:15:07

Figure 6

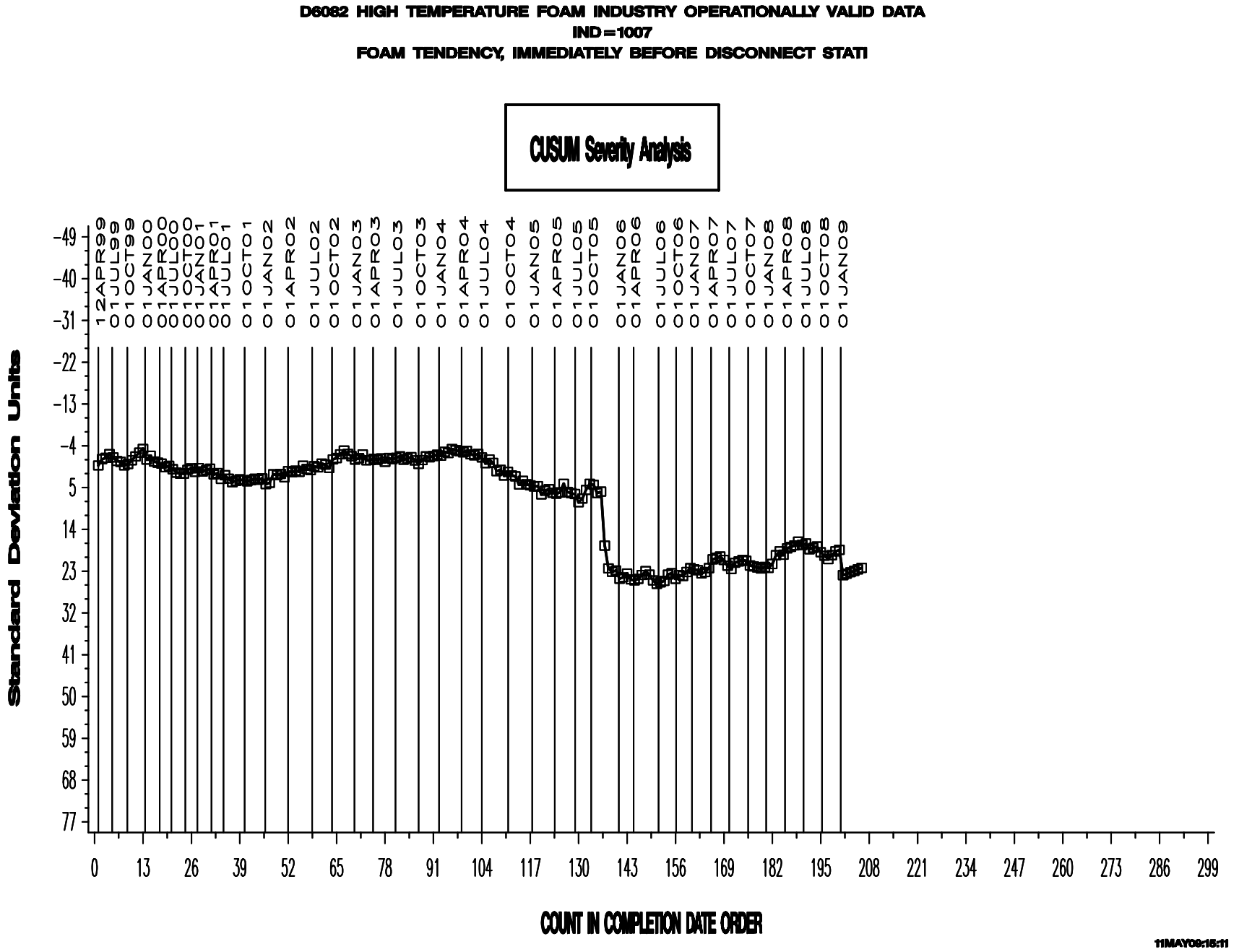

D6082 HIGH TEMPERATURE FOAM INDUSTRY OPERATIONALLY VALID DATA
IND=1007
FOAM TENDENCY, IMMEDIATELY BEFORE DISCONNECT STATI
CUSUM Severity Analysis
Standard Deviation Units
-49
-40
-31
-22
-13
-4
5
14
23
32
41
50
59
68
77
12APR99
01JUL99
01OCT99
01JAN00
01APR00
01JUL00
01OCT00
01JAN01
01APR01
01JUL01
01OCT01
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
0
13
26
39
52
65
78
91
104
117
130
143
156
169
182
195
208
221
234
247
260
273
286
299
COUNT IN COMPLETION DATE ORDER
11MAY09:15:11

Figure 7

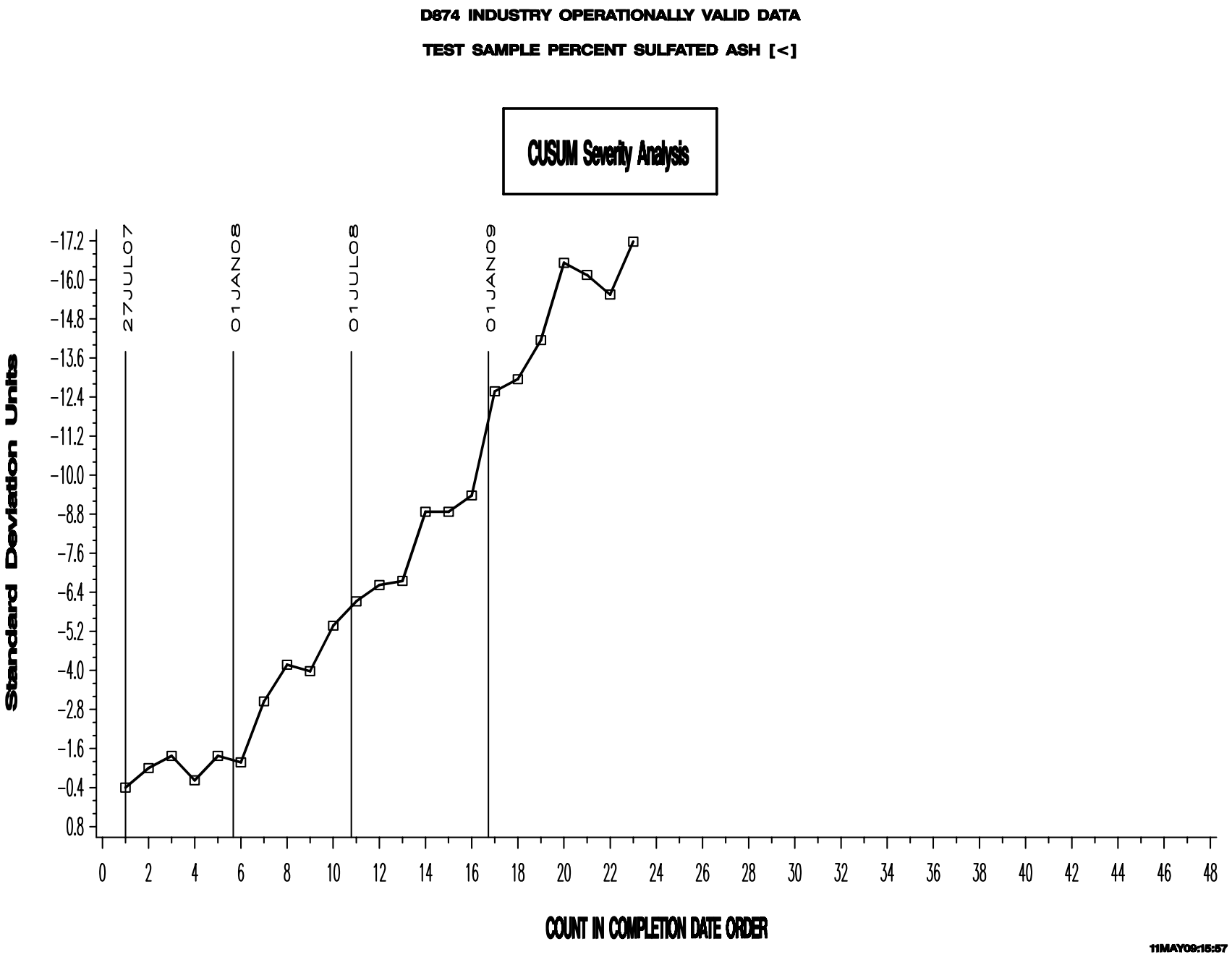
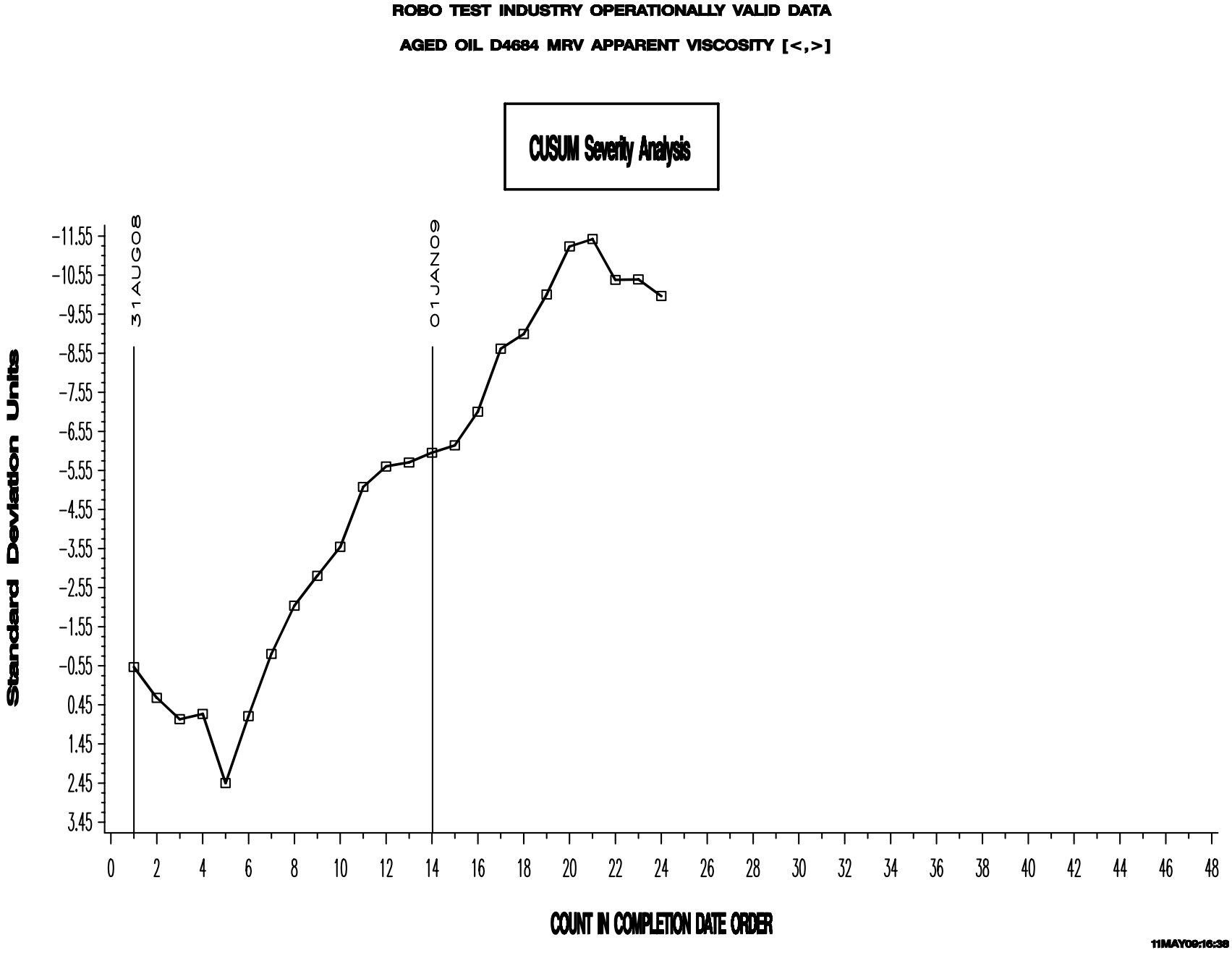

D874 INDUSTRY OPERATIONALLY VALID DATA
TEST SAMPLE PERCENT SULFATED ASH [<]
CUSUM Severity Analysis
27JUL07
01JAN08
01JUL08
01JAN09
Standard Deviation Units
-17.2
-16.0
-14.8
-13.6
-12.4
-11.2
-10.0
-8.8
-7.6
-6.4
-5.2
-4.0
-2.8
-1.6
-0.4
0.8
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48
COUNT IN COMPLETION DATE ORDER
11MAY09:15:57

Figure 8


ROBO TEST INDUSTRY OPERATIONALLY VALID DATA
AGED OIL D4684 MRV APPARENT VISCOSITY [<,>]
CUSUM Severity Analysis
31AUG08
01JAN09
Standard Deviation Units
-11.55
-10.55
-9.55
-8.55
-7.55
-6.55
-5.55
-4.55
-3.55
-2.55
-1.55
-0.55
0.45
1.45
2.45
3.45
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
COUNT IN COMPLETION DATE ORDER
11MAY09:16:38

Attachment 2

TMC Monitored Bench Tests
Reference Oil Test Targets and Acceptance Bands

						Acceptance Bands *	
						95%	
Test	**Oil Code**	**Parameter**	**n**	**Mean**	**sR**	**Lower**	**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
New Targets	55	mass % volatility loss	32	17.09	0.76	15.6	18.6
20030721	58	mass % volatility loss	37	15.20	0.72	13.8	16.6
TEOST by	71	Total Deposit (mg)	27	51.79	4.79	42.4	61.2
D6335	71-1	Total Deposit (mg)	27	51.79	4.79	42.4	61.2
	72	Total Deposit (mg)	27	26.72	3.46	19.9	33.5
	72-1	Total Deposit (mg)	27	26.72	3.46	19.9	33.5
MTEOS by	74	Total Deposit (mg)	30	12.85	5.59	1.9	23.8
D7097	432	Total Deposit (mg)	30	47.04	4.50	38.2	55.9
New Targets	434	Total Deposit (mg)	30	27.37	6.57	14.5	40.2
20060731							
GI by	58	Gelation Index	17	5.8	0.69	4.4	7.2
D5133	62	Gelation Index	35	17.0	3.90	9.4	24.6
New Targets	1009	Gelation Index	16	7.3	0.68	6.0	8.6
7/15/2003							
D6082	1007	Tendency (ml)	28	66	19	29	103
(HT FOAM)	1007	Stability (ml)	28	0	0	0	0
D6082	66 (DISCRIM)	Tendency (ml)	--	-----	-----	>100	-----
(HT FOAM)	66 (DISCRIM)	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	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)
	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			10/1/07 - 3/31/08				4/1/08 - 9/30/08				10/1/08 - 3/31/09			
			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	4	7.1	0.13	0.50	4	6.9	0.28	-0.31	6	7.0	0.22	-0.01
	55	Area % Volatized	18	11.68	0.51	4	12.0	0.44	0.73	6	12.0	0.46	0.66	4	11.4	0.21	-0.65
	58	Area % Volatized	18	5.61	0.30	6	6.0	0.24	1.13	4	6.0	0.10	1.22	4	5.7	0.28	0.30
D5800 **	52	% volatility loss	33	13.75	0.61	12	14.6	0.46	1.37	12	14.6	0.43	1.35	13	14.5	0.68	1.28
	55	% volatility loss	32	17.09	0.76	10	17.6	0.58	0.72	12	17.6	0.73	0.68	10	17.1	1.01	0.00
	58	% volatility loss	37	15.20	0.72	12	15.3	0.46	0.15	12	15.5	0.39	0.44	13	15.3	0.84	0.13
TEOST (D6335)	71	Deposit wt. (mg)	27	51.79	4.79	11	44.5	8.01	-1.53	8	49.6	9.06	-0.45	10	56.6	4.38	1.01
	72	Deposit wt. (mg)	27	26.72	3.46	11	38.4	11.04	3.37	7	30.0	3.19	0.94	8	30.0	5.50	0.94
MTEOS (D7097) ***	432	Deposit wt. (mg)	30	47.04	4.50	13	46.7	5.31	-0.08	19	49.1	7.34	0.47	17	60.0	6.05	2.87
	434	Deposit wt. (mg)	30	27.37	6.57	21	26.6	9.21	-0.12	10	24.5	6.52	-0.44	21	26.2	5.76	-0.18
	74	Deposit wt. (mg)	30	12.85	5.59	12	10.1	5.42	-0.49	17	11.5	3.90	-0.24	15	10.4	3.01	-0.43
GI (D5133) ****	58	Gelation Index	17	5.8	0.69	7	6.3	0.65	0.72	10	6.5	1.39	1.00	6	6.2	0.51	0.51
	62	Gelation Index	35	17.0	3.90	10	13.5	6.54	-0.89	9	16.2	5.85	-0.22	10	18.3	3.52	0.33
	1009	Gelation Index	16	7.30	0.68	9	7.0	0.75	-0.47	8	7.0	1.17	-0.39	8	7.0	0.26	-0.48
D6082	1007	Tendency (ml)	28	65	19	10	64	16	-0.13	10	65	16	-0.05	11	72	34	0.31
D874	820-2	Sulfated Ash m%	27	1.57	0.08	2	1.52	0.02	-0.56	2	1.54	0.02	-0.31	1	1.40	--	-2.13
	90	Sulfated Ash m%	27	1.07	0.08	2	1.02	0.15	-0.56	2	1.00	0.02	-0.94	2	1.04	0.01	-0.44
	91	Sulfated Ash m%	27	0.82	0.05	1	0.83	--	0.20	2	0.79	0.06	-0.60	3	0.75	0.08	-1.47
ROBO	434-1	ln (MRV Vis)	13	10.6599	0.1672	--	--	--	--	--	--	--	--	8	10.5971	0.1692	-0.38
	435	ln (MRV Vis)	15	11.4895	0.2932	--	--	--	--	--	--	--	--	9	11.3553	0.3078	-0.46
	438	ln (MRV Vis)	14	10.2676	0.2037	--	--	--	--	--	--	--	--	5	10.1330	0.1101	-0.66

**D5800 Targets Adjusted 10/2/00; new oils selected; new procedures approved; targets adjusted again 7/21/03
***MTEOS Targets Adjusted: 6/1/01 (matrix); 11/1/03 (SC9 RR2); 2/18/04 (add 432); 1/12/05 (add 434, drop 433 & 1006); 6/30/05 (Batch E ref. data); 6/31/06 (updated ref. data n=30)
****GI: Added oil 1009 and dropped oils 52 & 53 10/15/03; added oil 58 10/24/01; dropped oils 51 & 55 7/2/01