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

MEMORANDUM: 04-078

DATE: November 5, 2004

TO: Mr. Ted Selby, Chairman ASTM D02.B0.07

FROM: Thomas Schofield & Richard Grundza

SUBJECT: TMC Bench Reference Test Monitoring from April 1, 2004 through September 30, 2004

We respectfully submit the TMC's ASTM D02.B07 Bench Reference Test Monitoring Semiannual Report, 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, where:

Pooled s = Standard deviation pooled across reference oils
(i.e., The pooled precision of the test this period.)
Δ/s = [(Result) - (Target mean)] / (Target s)
(i.e., "How many standard deviations from the target mean is this test?")
Mean Δ/s = [Σ (Δ/s)] / n (across reference oils 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?")

Notice that the period severity estimates (mean Δ/s) can be pooled across oils of different performance levels because the individual test results used to calculate mean Δ/s have all been normalized into (target) standard deviations (Δ/s) for each corresponding reference oil. Using a pooled s for precision simplifies the interpretation of precision across all reference oil performance levels. These two calculations (pooled s and mean Δ/s) allow us to combine all calibration performance levels for each period into single 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 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. (The initial TMC PCEOCP Bench Test Report, of November 8, 1996, did not cross reference the labs.)

Beginning with the report period April 1, 2001 through September 30, 2001, we are reporting on consecutive six-month intervals for all test areas, rather than one-year intervals for some test areas and six-month for others. For more information on this decision, please refer to the TMC's web page:

ftp://ftp.astmtmc.cmu.edu/docs/bench/bo7semiannualreports/mem01-143.pdf

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/mem04-078.pdf

Distribution: Email

Attachment 1

ASTM Test Monitoring Center

Semiannual Report

ASTM D02.B07 Bench Reference Test Monitoring
From April 1, 2004 through September 30, 2004

D6417: Estimation of Engine Oil Volatility by Capillary Gas Chromatography

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	1
Operationally Invalid (initially reported as)	0
Operationally Invalid (after informed of failing calibration)	0
Total	**15**

Fail Rate of Operationally Valid Tests: 6.7%

Table 2 is a breakdown of the statistically unacceptable tests.

TABLE 2

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

INDUSTRY PERFORMANCE

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 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	-----
4/1/01 through 9/30/01	16	13	0.54	0.65
10/1/01 through 3/31/02	13	10	0.44	-0.45
4/1/02 through 9/30/02	16	13	0.34	-0.29
10/1/02 through 3/31/03	15	12	0.39	-0.47
4/1/03 through 9/30/03	14	11	0.36	-0.45
10/1/03 through 3/31/04	15	12	0.50	-0.42
4/1/04 through 9/30/04	15	12	0.40	0.28

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	5	0.72
Lab B	2	-0.16
Lab D	2	-0.25
Lab G	2	0.13
Lab H	2	1.06
Lab S	2	-0.50

PRECISION AND SEVERITY

D6417 calibration testing precision is improved this period and is slightly better than target. Overall severity is slightly severe of target. Severity is represented graphically in Figure 1. The figure shows relatively level severity for the first half of the period (timelines 01APR04 to 010704) followed by a relatively strong (1.0 s) severe trend. The data show that two severe points were contributed by one instrument at Lab A (a severe failing calibration attempt followed by a severe, but passing, calibration). Three more severe (passing) results by labs D, H & G follow for an overall severe trend in the second half of the period. Two more points, one severe fail and a mild pass from Lab B, follow after the end of the current period timeline. The severe results for the period are on oils 55 and 58. There doesn't seem to be a strong correlation with lab or oil (different labs and different oils are involved), and only one of the five severe results in the period was severe enough to fall outside of the acceptance bands. The severe trend in Figure 1 is unusual, but unexplained at the present time. The magnitudes of the severity of the individual test results are not that unusual, but the successive severe results show a significant severity trend that needs to be watched.

Lab H is substantially severe this period (Table 4). The overall results by oil (Attachment 3A) shows oil 52 performing mild and oil 58 performing severe.

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

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	29
Operationally Valid but Failed Acceptance Criteria	1
Operationally Invalid (initially reported as)	0
Operationally Invalid (after informed of failing calibration)	1
Total	**31**

Fail Rate of Operationally Valid Tests: 3.3%

Table 6 is a breakdown of the statistically unacceptable tests.

TABLE 6

Reason for Fail	No. of Tests
Sample Evaporation Loss Severe	1

The single statistically unacceptable test this period was by Procedure B

INDUSTRY PERFORMANCE

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
Initial Round Robin Study	180	175	0.51	-----
New Targets Effective 9/26/00	178	175	0.56	-----
4/1/00 through 3/31/01	47	42	0.69	0.98
4/1/01 through 9/30/01	35	32	0.61	1.21
10/1/01 through 3/31/02	33	30	0.66	0.79
4/1/02 through 9/30/02	35	32	0.79	1.00
10/1/02 through 3/31/03	34	31	0.63	1.03
New Targets Effective 7/15/2003	102	99	0.70	-----
4/1/03 through 9/30/03	29	26	0.70	0.44
10/1/03 through 3/31/04	32	29	0.64	0.29
4/1/04 through 9/30/04	30	27	0.64	0.24

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	3	1	0.42	-0.90
Procedure B	26	23	0.61	0.33
Procedure C	1	0	---	1.11

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	6	-0.69
Lab B	6	0.26
Lab D	1	1.11
Lab F	4	-0.06
Lab G	4	0.85
Lab H	2	0.62
Lab I	3	1.22
Lab J	4	0.12

PRECISION AND SEVERITY

Effective September 26, 2000, the TMC began monitoring the three Noack procedures under the revised D5800 test method. Revised reference oil targets and acceptance bands for all three current reference oils (52, 55 and 58), based on 18-months of TMC reference data, became effective July 15, 2003.

Overall precision for the report period is directionally better than the target precision. Overall severity is slightly severe of targets. Both precision and severity are comparable to last period. Severity is graphically represented in Figures 2A and 2B. Figure 2B better illustrates some improvement in the severity trend following the revised oil targets timeline. Table 8 shows the severity of the Procedure B results alone is somewhat more severe (0.33 s) than the overall period severity (0.24 s), and the three Procedure A tests reported this period contribute substantially mild results to the overall severity estimate (the same as last period). There is insufficient data to determine a pooled precision for the single Procedures C result reported this period.

Failure rates for tests reported to the TMC as operationally valid but evaluated as statistically unacceptable has dropped from a range of 15.2% - 25.7% for the five report periods prior to the revised targets, down to a more reasonable 3.1% last period and 3.3% this period.

TMC MEMORANDA

There was one TMC technical memo issued this report period for the D5800 test method:

Memo 04-059, July 28, 2004, D5800 Technical Update: Updated Test method.

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

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	22
Operationally Valid but Failed Acceptance Criteria	5
Operationally Invalid (initially reported as)	1
Operationally Invalid (after informed of failing calibration)	0
Total	**28**

Fail Rate of Operationally Valid Tests: 18.5%

Table 11 is a breakdown of the statistically unacceptable tests.

TABLE 11

Reason for Fail	No. of Tests
Gelation Index Mild	2
Gelation Index Severe	3

INDUSTRY PERFORMANCE

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 20011024 (Oils 52, 53 & 62 targets unchanged, added oil 58)	124	120	3.29	-----
10/1/01 through 3/31/02	30	26	4.76	-0.02
*4/1/02 through 9/30/02	32	28	2.15	0.43
*10/1/02 through 3/31/03	29	25	2.02	0.59
Revised Targets Effective 20030715 (Oils 58 & 62 targets unchanged, added oil 1009, dropped oils 52 & 53)	68	65	2.86	-----
4/1/03 through 9/30/03	27	22	2.30	0.06
10/1/03 through 3/31/04	37	34	5.86	1.73
4/1/04 through 9/30/04	27	24	3.05	0.40

*Excludes one data point as a rare event (for details, see the TMC's semiannual report for that period).

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	0.34
Lab B	4	0.46
Lab D	4	0.34
Lab G	5	-1.09
Lab H	2	0.36
Lab I	4	2.38

PRECISION AND SEVERITY

Effective July 15, 2003, new D5133 reference oils, targets and acceptance bands were implemented for TMC calibration monitoring. Oils 52 and 53 were dropped and oil 1009 was introduced using performance targets derived from an industry round-robin (targets for oils 58 & 62 continue without revision). Current GI reference oils are 58, 62 & 1009.

Prior to last period, calibration data was generally favorable, with good overall precision and severity, and a low fail rate (3.7%). However, last period had exceptionally (unprecedented) poor performance, overall. This period, precision has improved, but continues worse than target precision. Severity has also improved substantially, but is somewhat severe for the period. Fail rate of tests reported as operationally valid remains high (18.5% this period, 24.3% last period, 5% statistically expected).

Five failing results, both mild and severe, were reported this period as operationally valid. Two severe results were on oil 1009 and one on oil 58, while mild results were reported for oils 58 and 62. However, three of the five failing results were from lab A, and all three of those were on the same instrument. Clearly, that instrument is suspected to have an operational deficiency, but after achieving passing calibrations, the lab never followed up with the TMC as to an operational cause for the failing results, and those results remain in our statistics as operationally valid tests. Lab I reported one result (oil 1009) as operationally valid that was 8.4 s severe of target.

Severity is graphically represented in Figures 3A & 3B (attached). Figure 3A & 3B are the same severity data plots, but figure 3A shows three-month time-lines while Figure 3B shows lines corresponding to the occurrence of various technical changes over the history of TMC monitoring.

Attachment 3A shows a breakdown of performance by oil.

As mentioned last period, the TMC collects virtually no operational data for D5133 tests (including head ID, position, type, or software version), and the labs are permitted to select any single head, as they choose, to achieve a passing calibration status for the entire bath/instrument, which may include as many as eight separate heads.

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

TMC MEMORANDA

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

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

STATUS

Table 14 summarizes the reference tests reported to the TMC this period (2 labs reporting):

TABLE 14

	No. of Tests
Statistically Acceptable and Operationally Valid	4
Operationally Valid but Failed Acceptance Criteria	1
Operationally Invalid (initially reported as)	0
Operationally Invalid (after informed of failing calibration)	0
Total	**5**

Fail Rate of Operationally Valid Tests: 20.0%

Table 15 is a breakdown of the statistically unacceptable tests.

TABLE 15

Reason for Fail	No. of Tests
Total Deposits Mild (Oil 71)	1

INDUSTRY PERFORMANCE

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	-----
4/1/01 through 9/30/01	5	3	2.04	0.48
10/1/01 through 3/31/02	6	4	1.32	0.83
4/1/02 through 9/30/02	7	5	4.22	1.26
10/1/02 through 3/31/03	5	3	5.44	0.50
4/1/03 through 9/30/03*	6	4	12.15	2.54
4/1/03 through 9/30/03*	5	3	3.84	1.33
10/1/03 through 3/31/04	7	5	7.61	-0.56
4/1/04 through 9/30/04	5	3	3.89	-0.63

*Statistics with and without extreme result (8.58 s severe)

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	-0.54
Lab G	1	-0.98

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

PRECISION AND SEVERITY

Calibration testing has dropped significantly with the introduction of the MHT-4 TEOST to replace TEOST-33C for GF-3/SL.

Overall precision is substantially improved this period with severity mild. Severity is graphically represented in Figure 4 (attached).

TMC MEMORANDA

There was one TMC technical memo issued this report period for the D6335 test method:

Memo 04-053, June 8, 2004, TEOST Technical Update: Updated TEOST test method.

TEOST MHT-4, Version 2, 03.09.23: Determination of Moderately High Temperature Piston Deposits by Thermo-oxidation Engine Oil Simulation Test (MTEOS)

STATUS

Table 18 summarizes the reference tests reported to the TMC this period (4 labs reporting):

TABLE 18

	No. of Tests
Statistically Acceptable and Operationally Valid	32
Operationally Valid but Failed Acceptance Criteria	8
Operationally Invalid (initially reported as)	2
Operationally Invalid (after informed of failing calibration)	7
Total	**49**

Fail Rate of Operationally Valid Tests: 20.0%

Table 19 is a breakdown of the statistically unacceptable tests.

TABLE 19

Reason for Fail	No. of Tests
Total Deposits Mild (Oils 1006, 432, 433)	5
Total Deposits Severe (Oil 432)	3

INDUSTRY PERFORMANCE

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 6/1/01	80	76	5.40	-----
4/1/01 through 9/30/01	34	30	5.61	-0.47
10/1/01 through 3/31/02	44	40	6.56	-0.44
4/1/02 through 9/30/02	47	43	6.74	-0.80
10/1/02 through 3/31/03	42	38	6.77	-0.78
4/1/03 through 9/30/03	27	23	6.02	-0.83
Updated Targets Effective 2/18/04	50	46	4.92	-----
10/1/03 through 3/31/04	35	31	9.40	-0.69*
4/1/04 through 9/30/04	40	36	7.29	-0.55

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

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	-0.60
Lab B	12	-0.29
Lab D	5	-0.11
Lab G	9	-1.06

TEOST MHT-4, Version 2, 03.09.23: Determination of Moderately High Temperature Piston Deposits by Thermo-oxidation Engine Oil Simulation Test (MTEOS), continued

PRECISION AND SEVERITY

Effective November 1, 2003, the monitored labs began using the "Version 2" test method for TMC calibrations (moving from the previous "Draft 17" version of the test method). All labs were asked to recalibrate all monitored instruments effective November 1, 2003 because of the expected (but still unexplained) performance shift on the reference oils due to the change in test method version. New reference oil performance targets and acceptance bands were also implemented on November 1, 2003 using data collected from a Subcommittee 6 round-robin.

Overall precision is improved compared to last period, but remains poor compared to target. Severity is moderately mild of targets. Fail rate of operationally valid tests is high at 20%. As noted last period, all four reporting labs continue to perform mild, and are mild on all oils (Attachment 3A). However, at June ASTM, the rod supplier reported that some of the poor precision observed in reference testing might be due to variability in the available rods (the last of the batch D rods were, reportedly, not metallurgically uniform). Since then, the labs have stopped using batch D rods. Of the 40 operationally valid calibration tests reported this period, 24 used rod batches C or D and 16 used rod batch E. Table 22 shows an analysis of the Rod Batch E data.

TABLE 22
Period Summary Using Only Rod Batch E Data
(First Rod Batch E Result Reported 7/16/04)

Total Deposits	n	df	Pooled s	Mean Δ/s
7/16/04 through 9/30/04	16	12	6.03	-0.57

The precision using rod batch E data only is somewhat better, with comparable severity to the period results shown in Table 20. Typically in bench test monitoring, reference oil performance targets and acceptance bands are set using a round-robin, and then adjusted by adding in reference data results to create a more rigorous data set as our baseline. We did not add in reference data last period due to the exceptionally poor precision and in light of the possibility that Batch D rods might be the source of that imprecision. The surveillance panel should consider revising reference oil targets and acceptance bands, perhaps next period, using reference data collected on tests using rod batch E.

The MTEOS severity trends are graphically represented in Figures 5A & 5B, with Figure 5B showing when the new performance targets were implemented and when labs began using Rod batch E.

TMC MEMORANDA

There were no TMC technical memos issued this report period for the MTEOS test method.

D6082: High Temperature Foaming Characteristics of Lubricating Oils

On June 18, 2001, the section agreed to suspend the use of the severe performing TMC oil 1002 as a D6082 reference oil due to ongoing calibration precision and severity problems with that oil, and on June 17, 2002 the section voted to discontinue the use of 1002 altogether. On July 21, 2003 a severe performing "discrimination oil", TMC oil 66, was introduced to the monitoring system to be run by each participating lab once every six-months to show that each lab can discriminate a GF-3/SL passing oil (foam tendency) from a failing oil in the D6082 test method. The first discrimination test using oil 66 was completed on August 13, 2003. Because of apparent poor reproducibility of the D6082 test method on severe performing oils (greater than 100 ml foam tendency) in general, it was agreed that oil 66 discrimination results would not be statistically summarized by the TMC other than a count of the tests that do and don't meet the acceptance criteria.

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. Any negative (mild) result for this parameter is unlikely and any positive result would be indefinably severe in standard deviations (Δ/s). Therefore, for Foam Stability, only a count of non-zero occurrences is noted to flag any severity trends.

Note that in June 2000, the High Temperature Foam Surveillance Panel had given approval for the TMC to stop collecting data for Total Volume Increase.

STATUS

Table 23 summarizes the reference tests reported to the TMC this period (5 labs reporting):

TABLE 23

	No. of Tests
Statistically Acceptable and Operationally Valid	13
Operationally Valid but Failed Acceptance Criteria	0
Operationally Invalid (initially reported as)	0
Operationally Invalid (after informed of failing calibration)	1
Total	**14**

Fail Rate of Operationally Valid Tests: 0.0%

In addition to the calibration tests, there were four discrimination oil tests reported this period, all met the acceptance criteria for the discrimination oil.

D6082: High Temperature Foaming Characteristics of Lubricating Oils, continued

TMC 1007 INDUSTRY PERFORMANCE

Tables 24 and 25 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 24

1007 Foam Tendency, ml	n	Mean	s	Mean Δ/s
Initial Round Robin Study (targets)	28	65.71	19.28	-----
4/12/99 through 3/31/00	17	65.3	18.41	-0.02
4/1/00 through 3/31/01	14	67.5	11.22	0.09
4/1/01 through 9/30/01	9	71.1	14.53	0.28
10/1/01 through 3/31/02	11	64.5	15.07	-0.06
4/1/02 through 9/30/02	12	62.5	14.22	-0.17
10/1/02 through 3/31/03	11	62.7	17.52	-0.15
4/1/03 through 9/30/03	12	65.8	9.96	0.01
10/1/03 through 3/31/04	12	62.5	10.55	-0.17
4/1/04 through 9/30/04	13	72.3	15.89	0.34

TABLE 25

1007 Foam Stability @ 1 min., ml	n	Mean	s	
Initial Round Robin Study	28	0.00	0.00	
4/12/99 through 3/31/00	17	No non-zero occurrences		
4/1/00 through 3/31/01	17	No non-zero occurrences		
4/1/01 through 9/30/01	9	No non-zero occurrences		
10/1/01 through 3/31/02	11	No non-zero occurrences		
4/1/02 through 9/30/02	12	No non-zero occurrences		
10/1/02 through 3/31/03	11	No non-zero occurrences		
4/1/03 through 9/30/03	12	No non-zero occurrences		
10/1/03 through 3/31/04	12	No non-zero occurrences		
4/1/04 through 9/30/04	13	No non-zero occurrences		

Table 26 shows the current 1007 severity for the monitored result parameter for each lab for all operationally valid tests reported for the report period.

TABLE 26
TMC 1007

	n	Foam Tendency Mean Δ/s
Lab A	2	0.74
Lab B	6	0.40
Lab D	2	1.00
Lab G	2	-0.30
Lab I	1	-0.81

PRECISION AND SEVERITY

Foam Tendency precision on 1007 has degraded somewhat and severity is slightly severe of target. 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. Additionally, all discrimination tests reported this period meet the acceptance criteria (that is, all reporting labs could discriminate oil 66 as a GF-3 failing oil).

TMC MEMORANDA

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

D6922-03 Standard Test Method for 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.

D6557: Ball Rust Test (BRT)

Note that, for BRT, a positive Δ/s is mild, not severe (a higher AGV result is considered to be a more mild result while a lower AGV result is considered to be a more severe result.)

STATUS

Table 27 summarizes the reference tests reported to the TMC this period (4 labs reporting):

TABLE 27

	No. of Tests
Statistically Acceptable and Operationally Valid	97
Total	**97**

Fail Rate of Operationally Valid Tests: 0.0%

INDUSTRY PERFORMANCE

Table 28 shows the current Industry precision and severity for the Average AGV test parameter for all operationally valid tests for the report period. (First calibration test completed 8/15/00.)

TABLE 28

Average AGV	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study (targets)	48	44	9.43	-----
8/15/00 through 9/30/00	28	25	10.50	0.38
10/1/00 through 3/31/01	112	109	8.48	0.42
4/1/01 through 9/30/01	156	153	8.90	0.36
10/1/01 through 3/31/02	116	113	12.46	0.67
4/1/02 through 9/30/02	138	135	11.38	0.76
10/1/02 through 3/31/03	143	140	7.76	0.69
4/1/03 through 9/30/03	119	116	10.95	0.27
10/1/03 through 3/31/04	71	68	10.21	0.14
4/1/04 through 9/30/04	97	94	7.25	0.25

Table 29 shows the current severity for the Average AGV parameter for each lab for all operationally valid tests for the report period.

TABLE 29

	n	Mean Δ/s
Lab A	49	-0.14
Lab B	16	0.60
Lab G	29	0.68
Lab D	3	0.64

PRECISION AND SEVERITY

Precision this report period has improved when compared to the previous period and is better than the target matrix. Overall severity is trending slightly mild of target. Severity is graphically represented in Figure 7 (attached). Labs B, D and G trended mild of target, while lab A trended severe.

TMC MEMORANDA

No technical memoranda were issued this report period.

Engine Oil Filterability Test (EOFT)

STATUS

Table 30 summarizes the reference tests reported to the TMC this period (3 labs reporting).

TABLE 30

	No. of Tests
Statistically Acceptable and Operationally Valid	84
Operationally Valid but Failed Acceptance Criteria	2
Total	**86**

Fail Rate of Operationally Valid Tests: 2.3%

Table 31 is a breakdown of the statistically unacceptable tests.

TABLE 31

Reason for Fail	No. of Tests
Average % Change in Flow Mild (Oil 78)	2

INDUSTRY PERFORMANCE

Table 32 shows the current Industry precision and severity for the Average % Change in Flow (CIF) test parameter for all operationally valid tests for the report period. (First calibration test completed 5/4/00.)

TABLE 32

Average % CIF	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study (targets)	24	22	5.76	-----
5/4/00 through 9/30/00	53	51	7.47	1.64
10/1/00 through 3/31/01	79	78	4.79	0.30
4/1/01 through 9/30/01	103	102	6.69	-0.08
10/1/01 through 3/31/02	84	83	5.67	-0.06
4/1/02 through 9/30/02	89	88	5.38	0.11
10/1/02 through 3/31/03	81	80	4.16	-0.27
4/1/03 through 9/30/03	71	70	3.70	0.02
10/1/03 through 3/31/04	66	65	8.68	-0.54
4/1/04 through 9/30/04	86	85	7.87	-0.13

Table 33 shows the current severity for the Average % CIF parameter for each lab for all operationally valid tests for the report period.

TABLE 33

	n	Mean Δ/s
Lab A	33	-0.82
Lab B	19	0.24
Lab G	34	0.33

Engine Oil Filterability Test (EOFT), continued

PRECISION AND SEVERITY

Precision this report period has improved when compared to the previous period and is worse than the target matrix. Overall severity trended mild for the period. Labs B and G trended severe, while Lab A trended mild for the period. Severity is graphically represented in Figure 8 (attached).

At this time, only TMC 78 is being assigned as TMC calibration oil. Based on current usage rates, there is about a one year supply of reference oil 78.

TMC MEMORANDA

There were no technical memos issued this report period nor were any information letters issued this report period.

Engine Oil Water Tolerance Test (EOWT): 0.6% Water Treat Level

STATUS

Table 34 summarizes the reference tests reported to the TMC this period (3 labs reporting):

TABLE 34

	No. of Tests
Statistically Acceptable and Operationally Valid	106
Operationally Valid but Failed Acceptance Criteria	2
Total	**108**

Fail Rate of Operationally Valid Tests: 1.9%

Table 35 is a breakdown of the statistically unacceptable test.

TABLE 35

Reason for Fail	No. of Tests
Average % Change in Flow Mild (Oil 78)	2

INDUSTRY PERFORMANCE

Table 36 shows the current Industry precision and severity for the Average % Change in Flow (CIF) test parameter for all operationally valid tests for the report period. (First calibration test completed 5/4/00.)

TABLE 36

Average % CIF	N	df	Pooled s	Mean Δ/s
Initial Round Robin Study (targets)	24	22	5.93	-----
5/4/00 through 9/30/00	34	32	6.25	-0.04
10/1/00 through 3/31/01	101	99	5.61	-0.17
4/1/01 through 9/30/01	123	121	6.28	0.05
10/1/01 through 3/31/02	88	86	6.12	-0.05
4/1/02 through 9/30/02	102	100	4.50	0.18
10/1/02 through 3/31/03	89	87	4.86	-0.08
4/1/03 through 9/30/03	93	92	3.89	0.01
10/1/03 through 3/31/04	90	88	5.12	-0.23
4/1/04 through 9/30/04	108	107	5.72	-0.13

Table 37 shows the current severity for the Average % CIF parameter for each lab for all operationally valid tests for the report period.

TABLE 37

	N	Mean Δ/s
Lab A	52	-0.68
Lab B	20	0.42
Lab G	36	0.36

Engine Oil Water Tolerance Test (EOWT): 0.6% Water Treat Level, continued

PRECISION AND SEVERITY

Precision has degraded slightly when compared with the previous period, but compares well with the target matrix. Overall severity trended mild for the period. Severity is graphically represented in Figure 9 (attached). Labs B and G trended severe for the period, while Lab A trended mild.

Based on current usage rates, there is about a one year supply of reference oil 78.

Engine Oil Water Tolerance Test (EOWT): 1.0% Water Treat Level

STATUS

Table 38 summarizes the reference tests reported to the TMC this period (3 labs reporting):

TABLE 38

	No. of Tests
Statistically Acceptable and Operationally Valid	106
Total	**106**

Fail Rate of Operationally Valid Tests: 0.0%

INDUSTRY PERFORMANCE

Table 39 shows the current Industry precision and severity for the Average % Change in Flow (CIF) test parameter for all operationally valid tests for the report period. (First calibration test completed 5/4/00.)

TABLE 39

Average % CIF	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study (targets)	24	22	5.81	-----
5/4/00 through 9/30/00	33	31	6.98	0.12
10/1/00 through 3/31/01	99	97	5.85	-0.19
4/1/01 through 9/30/01	115	113	5.79	0.26
10/1/01 through 3/31/02	89	87	7.20	0.02
4/1/02 through 9/30/02	105	103	4.30	0.25
10/1/02 through 3/31/03	89	87	3.42	0.25
4/1/03 through 9/30/03	94	93	3.64	0.17
10/1/03 through 3/31/04	88	86	3.89	0.17
4/1/04 through 9/30/04	106	105	4.69	0.13

Table 40 shows the current severity for the Average % CIF parameter for each lab for all operationally valid tests for the report period.

TABLE 40

	N	Mean Δ/s
Lab A	50	-0.25
Lab B	20	-0.21
Lab G	36	0.85

PRECISION AND SEVERITY

Precision has degraded when compared to the previous period and is better than historical estimates. Industry data is trending severe. Labs A and B trended mild, while lab G was severe this report period. Severity is graphically represented in Figure 10 (attached).

Based on current usage rates, there is about a one year supply of reference oil 78.

Engine Oil Water Tolerance Test (EOWT): 2.0% Water Treat Level

STATUS

Table 41 summarizes the reference tests reported to the TMC this period (3 labs reporting):

TABLE 41

	No. of Tests
Statistically Acceptable and Operationally Valid	105
Operationally Valid but Failed Acceptance Criteria	2
Total	**107**

Fail Rate of Operationally Valid Tests: 1.9%

Table 42 is a breakdown of the statistically unacceptable test.

TABLE 42

Reason for Fail	No. of Tests
Average % Change in Flow Mild (Oil 78)	2

INDUSTRY PERFORMANCE

Table 43 shows the current Industry precision and severity for the Average % Change in Flow (CIF) test parameter for all operationally valid tests for the report period. (First calibration test completed 5/4/00.)

TABLE 43

Average % CIF	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study (targets)	24	22	7.08	-----
5/4/00 through 9/30/00	31	29	5.63	-0.07
10/1/00 through 3/31/01	100	98	6.25	-0.16
4/1/01 through 9/30/01	114	112	6.57	0.22
10/1/01 through 3/31/02	89	87	5.75	-0.02
4/1/02 through 9/30/02	103	101	3.76	0.09
10/1/02 through 3/31/03	89	87	5.77	0.11
4/1/03 through 9/30/03	93	91	3.66	0.17
10/1/03 through 3/31/04	92	90	5.03	0.33
4/1/04 through 9/30/04	107	106	5.01	0.24

Table 44 shows the current severity for the Average % CIF parameter for each lab for all operationally valid tests for the report period.

TABLE 44

	N	Mean Δ/s
Lab A	51	-0.19
Lab B	20	-0.09
Lab G	36	1.02

Engine Oil Water Tolerance Test (EOWT): 2.0% Water Treat Level, continued

PRECISION AND SEVERITY

Precision for this period has not changed when compared with the previous period and compares well with the target estimates. Severity trended severe for the period. Lab A trended mild, Lab G trended severe, and Lab B was on or near target for the period. Severity is graphically represented in Figure 11 (attached).

Based on current usage rates, there is about a one year supply of reference oil 78.

Engine Oil Water Tolerance Test (EOWT): 3.0% Water Treat Level

STATUS

Table 45 summarizes the reference tests reported to the TMC this period (3 labs reporting):

TABLE 45

	No. of Tests
Statistically Acceptable and Operationally Valid	106
Operationally Valid but Failed Acceptance Criteria	3
Total	**109**

Fail Rate of Operationally Valid Tests: 2.8%

Table 46 is a breakdown of the statistically unacceptable test.

TABLE 46

Reason for Fail	No. of Tests
Average % Change in Flow Severe (Oil 78)	3

INDUSTRY PERFORMANCE

Table 47 shows the current Industry precision and severity for the Average % Change in Flow (CIF) test parameter for all operationally valid tests for the report period. (First calibration test completed 5/4/00.)

TABLE 47

Average % CIF	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study (targets)	24	22	5.79	-----
5/4/00 through 9/30/00	32	30	5.71	0.23
10/1/00 through 3/31/01	98	96	5.71	-0.01
4/1/01 through 9/30/01	122	120	6.46	0.34
10/1/01 through 3/31/02	89	87	5.82	0.31
4/1/02 through 9/30/02	108	106	4.69	0.56
10/1/02 through 3/31/03	89	87	5.09	0.50
4/1/03 through 9/30/03	94	92	3.29	0.55
10/1/03 through 3/31/04	90	88	3.74	0.52
4/1/04 through 9/30/04	109	108	4.50	0.56

Table 48 shows the current severity for the Average % CIF parameter for each lab for all operationally valid tests for the report period.

TABLE 48

	n	Mean Δ/s
Lab A	53	0.21
Lab B	20	0.11
Lab G	36	1.31

Engine Oil Water Tolerance Test (EOWT): 3.0% Water Treat Level, continued

PRECISION AND SEVERITY

Precision has degraded when compared to the previous period and compares well with the target matrix. Severity trended severe of target for the period. Severity is graphically represented in Figure 12 (attached). All laboratories trended severe of target during the period.

Based on current usage rates, there is about a one year supply of reference oil 78.

REFERENCE OIL SUPPLIES

There is adequate supply of B0.07 Bench Test reference oils on hand at the TMC. Tables 49A and 49B list the PCEOCP bench test reference oils currently on hand at the TMC.

Table 49A

Oil	For Tests	Quantity Left (gallons)	Quantity Used Last 6 Months (gallons)
^5A-3	Obsolete BRT	1787.1	0.0
^51	Obsolete Vol. & GI	94.6	0.0
52	D6417, D5800, GI	69.1	1.5
^53	Obsolete Vol. & GI	96.8	0.1
^54	Obsolete Volatility	97.8	0.0
55	D6417, D5800	74.0	1.4
^57	Old Volatility Candidate	51.2	0.0
58	D6417, D5800, GI	126.8	1.5
62	GI	1.9	0.1
66	D6082 (Discrimination)	101.8	1.0
71	TEOST	4.1	0.2
72	TEOST	4.2	0.2
74	MTEOS	2.2	0.1
77	EOWT	123.0	31.7
78	EOFT, EOWT	65.0	46.4
^80	BRT Candidate	26.5	0.0
81	BRT	18.0	0.8
82	BRT	9.4	0.3
**432	MTEOS	Adequate	-----
**433	MTEOS	Adequate	-----
1006	BRT, MTEOS	43.3	1.3
*1007	D6082	Est. 28	-----
**1009	GI	Adequate	-----

^Not selected as reference oil; TMC holding for further instructions from Surveillance Panel.
*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 49B

Oil	For Tests	Quantity Left (gallons)	Quantity Used Last 12 Months (gallons)
HMA	H&M (D6922)	202.2	2.2
HMB	H&M (D6922)	206.2	2.2
HMC	H&M (D6922)	192.2	2.2
HMD	H&M (D6922)	200.2	2.2
HME	H&M (D6922)	185.2	2.2
HMF	H&M (D6922)	209.2	2.2

Shipping aliquots are:

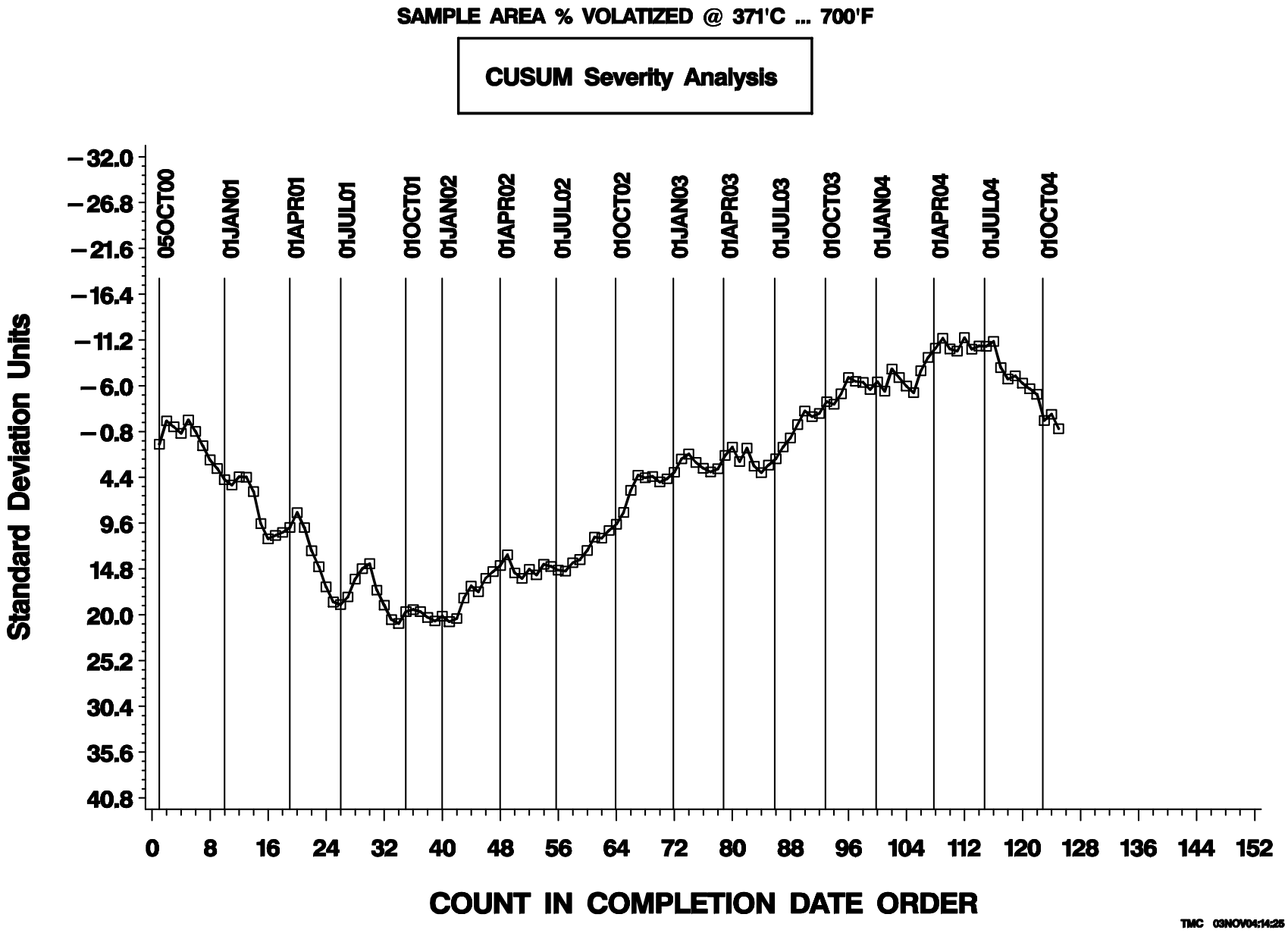
D6417	1 ml
D5480	4 ml
D5800	100 ml
GI	25 ml
MTEOS	17 ml
TEOST	125 ml
D6082	525 ml
H&M	950 ml
EOFT	290 ml
EOWT	290 ml
BRT	30 ml

MISCELLANEOUS

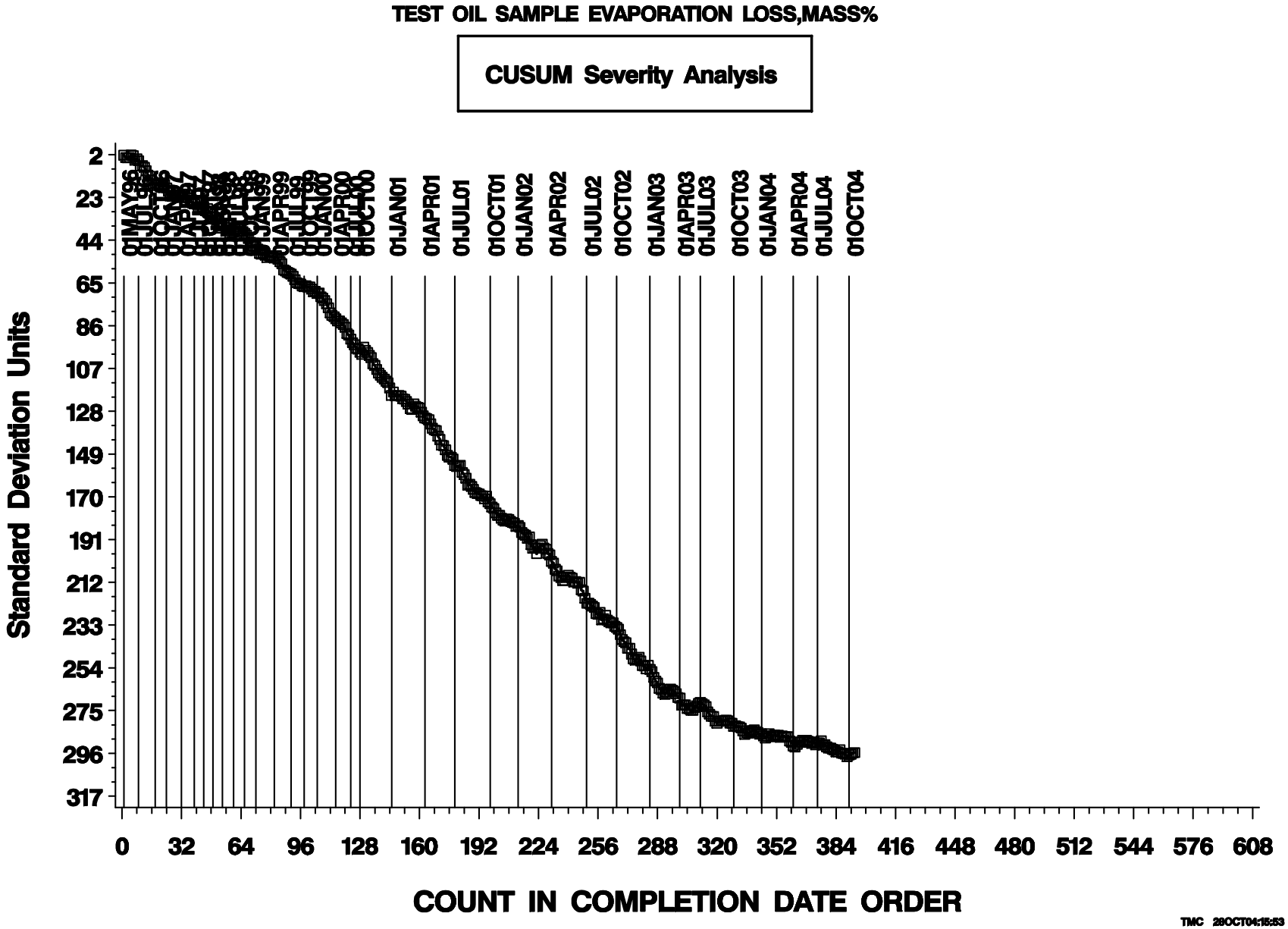
The TMC posts monitored bench test calibration data on the Internet. Selected parameters from all operationally valid reference tests are posted on the TMC's World-Wide-Web page in real time. Lab identifications are coded on the TMC's web site as they are on the previous pages of this report. Also posted 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 or Rich Grundza at (412) 365-1031 for more information.

D6417 VOLATILITY BY GC INDUSTRY OPERATIONALLY VALID DATA



D5800 VOLATILITY BY NOACK INDUSTRY OPERATIONALLY VALID DATA



D5800 VOLATILITY BY NOACK INDUSTRY OPERATIONALLY VALID DATA

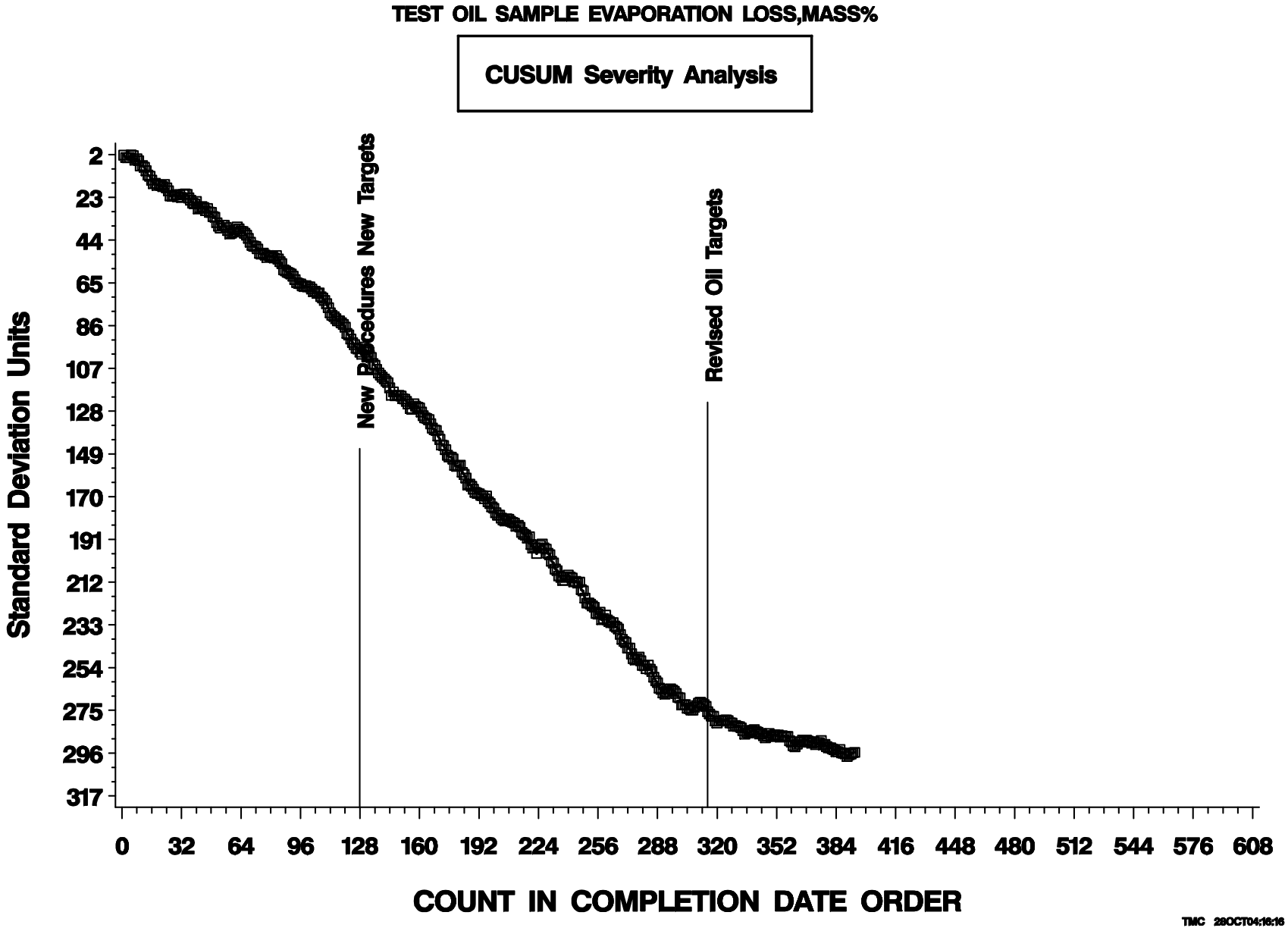
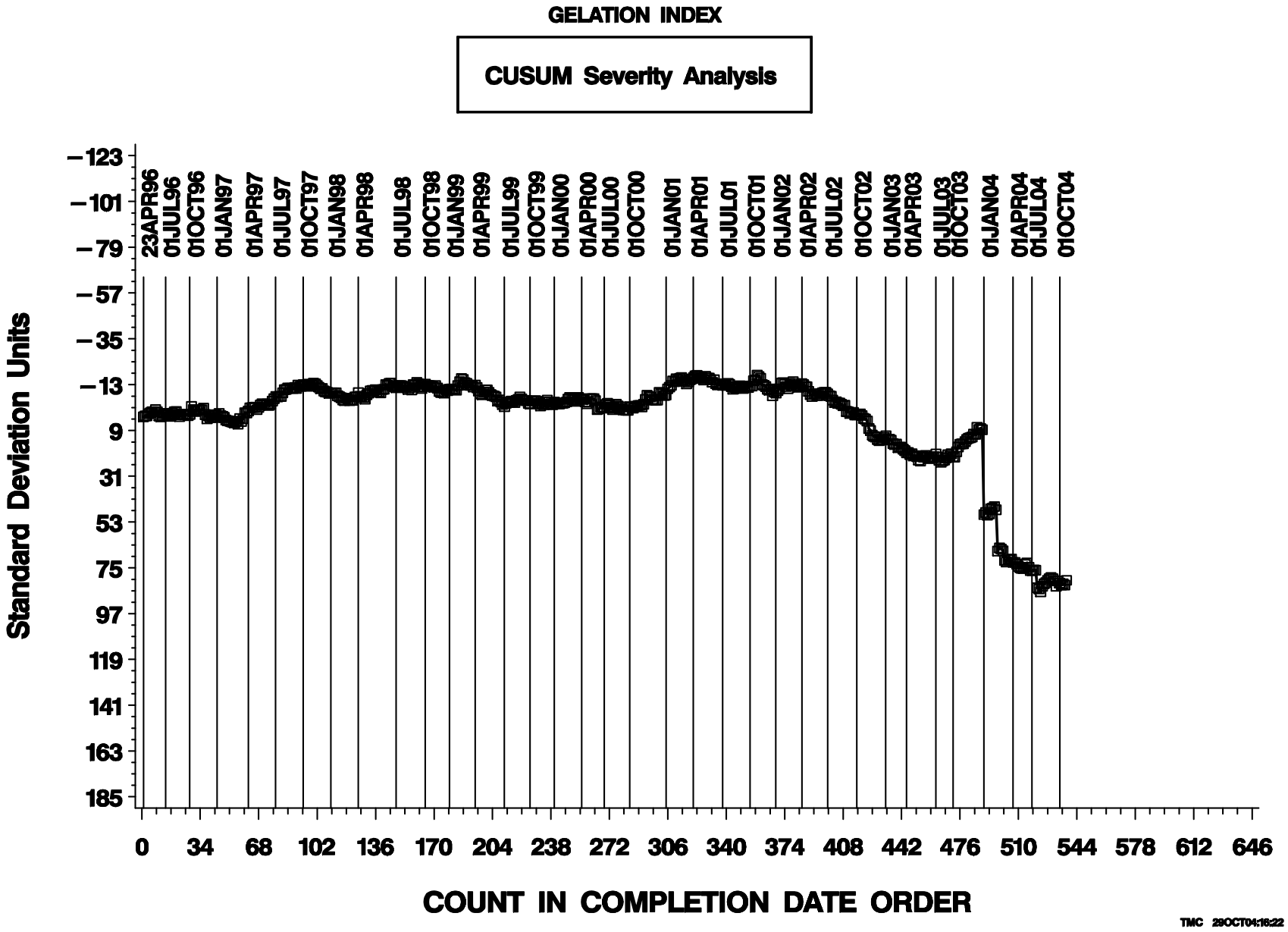


Figure 3A

D5133 GELATION INDEX INDUSTRY OPERATIONALLY VALID DATA



D5133 GELATION INDEX INDUSTRY OPERATIONALLY VALID DATA

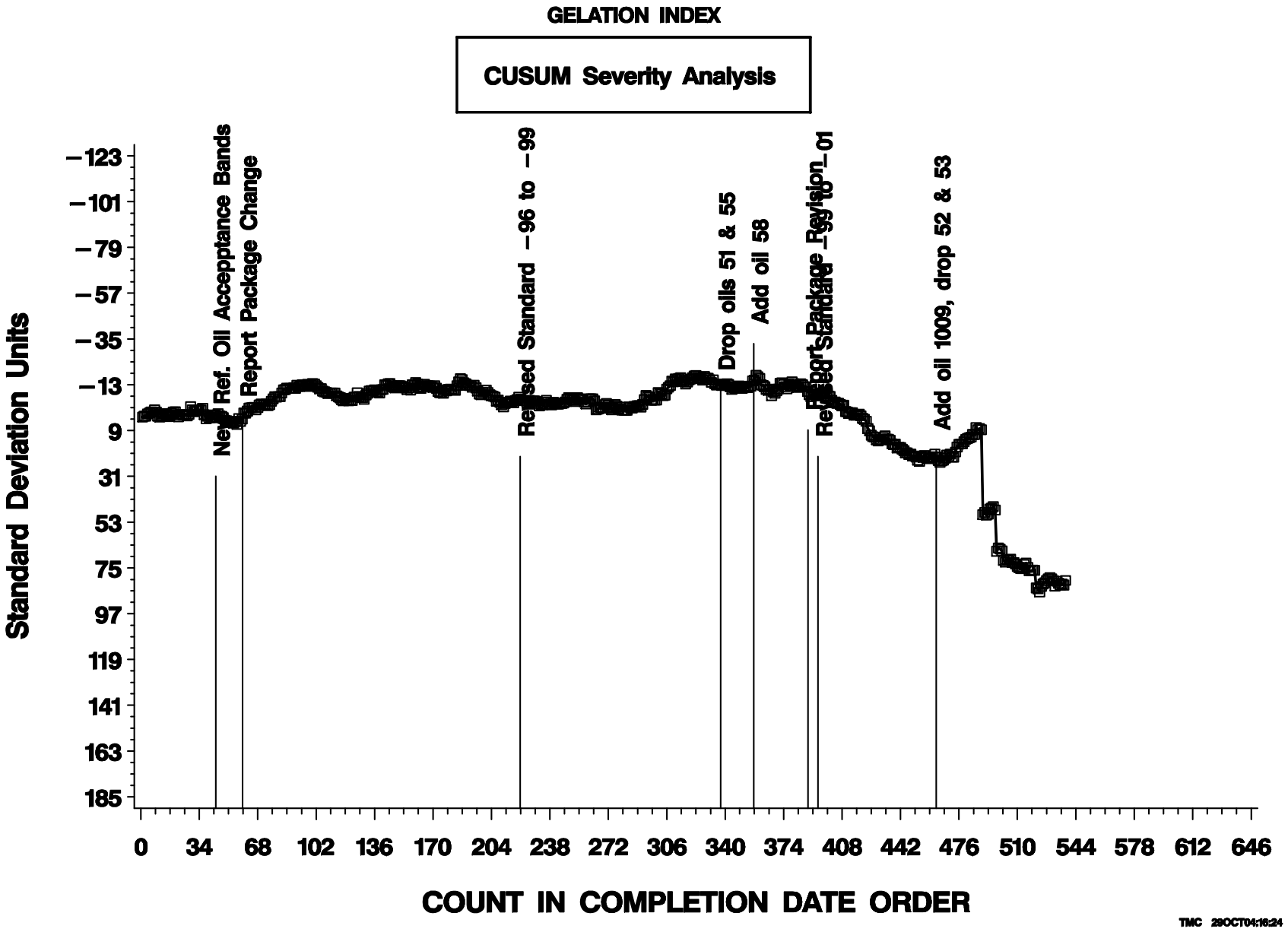


Figure 4

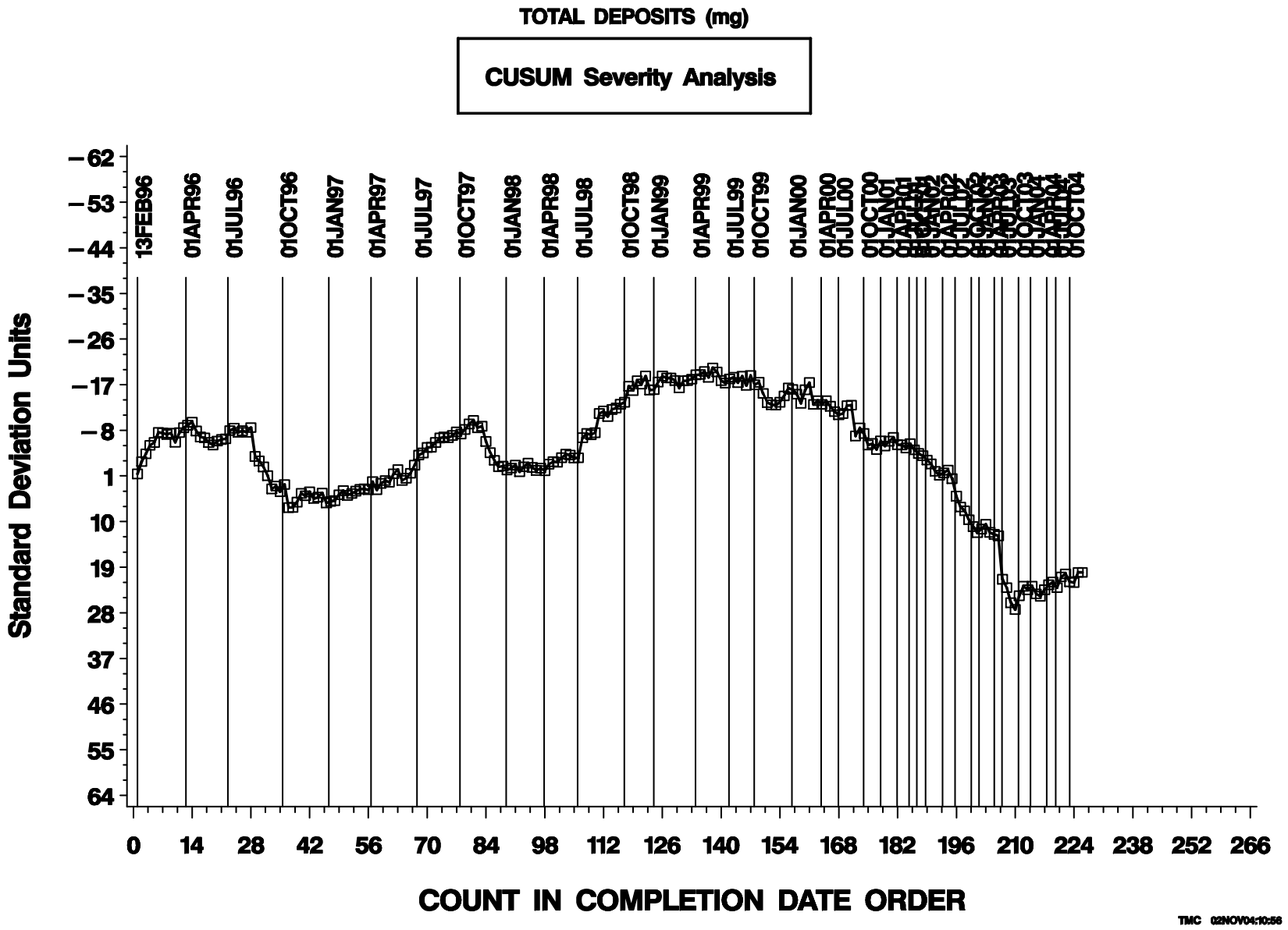
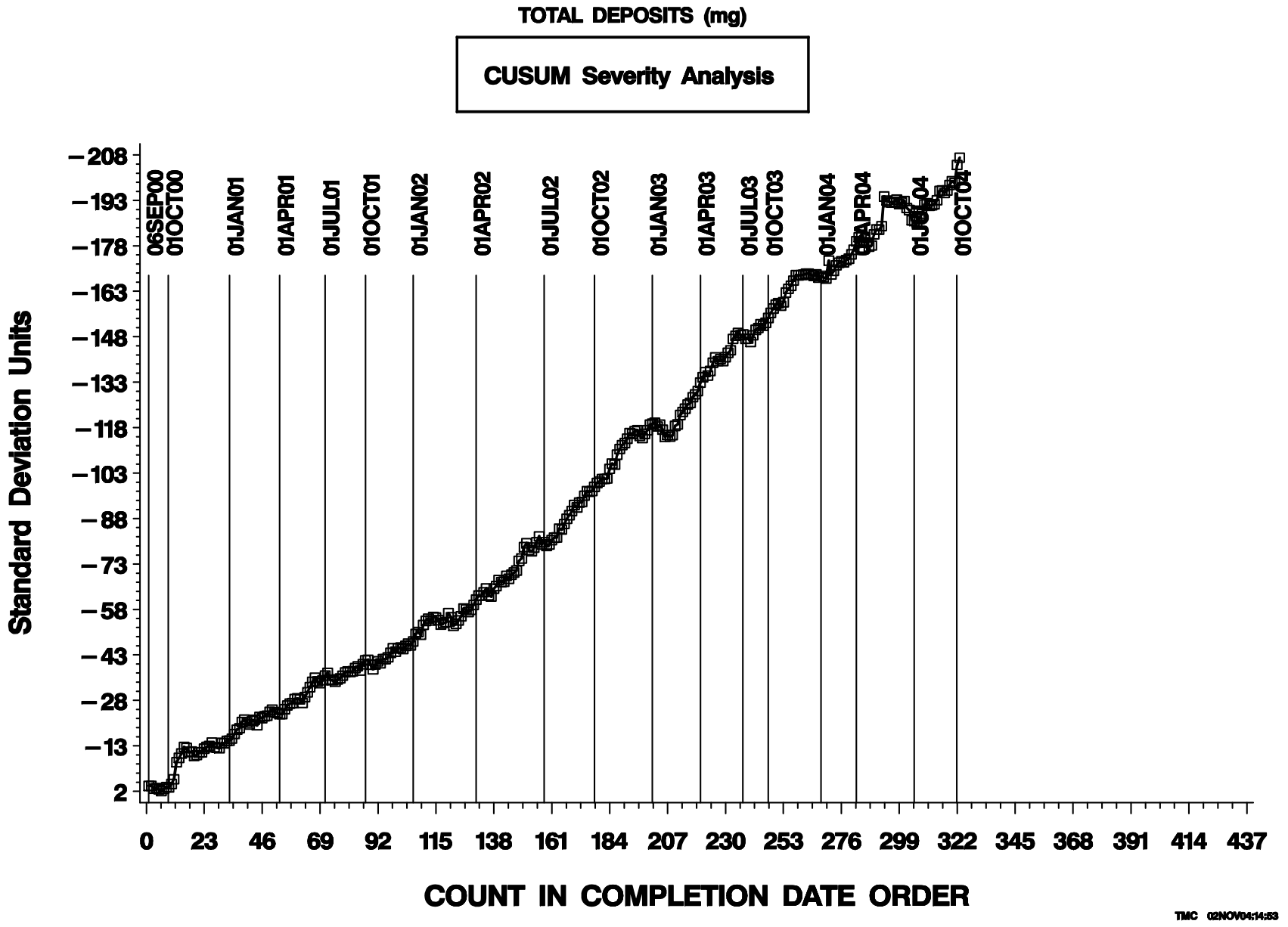

TEOST – 33C INDUSTRY OPERATIONALLY VALID DATA
TOTAL DEPOSITS (mg)
CUSUM Severity Analysis
Standard Deviation Units
– 62
– 53
– 44
– 35
– 26
– 17
– 8
1
10
19
28
37
46
55
64
13FEB96
01APR96
01JUL96
01OCT96
01JAN97
01APR97
01JUL97
01OCT97
01JAN98
01APR98
01JUL98
01OCT98
01JAN99
01APR99
01JUL99
01OCT99
01JAN00
01APR00
01JUL00
01OCT00
0
14
28
42
56
70
84
98
112
126
140
154
168
182
196
210
224
238
252
266
COUNT IN COMPLETION DATE ORDER
TMC 02NOV04:10:56

Figure 5A


MHT−4 TEOST INDUSTRY OPERATIONALLY VALID DATA
TOTAL DEPOSITS (mg)
CUSUM Severity Analysis
Standard Deviation Units
−208
−193
−178
−163
−148
−133
−118
−103
−88
−73
−58
−43
−28
−13
2
06SEP00
01OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
01OCT02
01JAN03
01APR03
01JUL03
01OCT03
01JAN04
01APR04
01JUL04
01OCT04
0
23
46
69
92
115
138
161
184
207
230
253
276
299
322
345
368
391
414
437
COUNT IN COMPLETION DATE ORDER
TMC 02NOV04:14:53

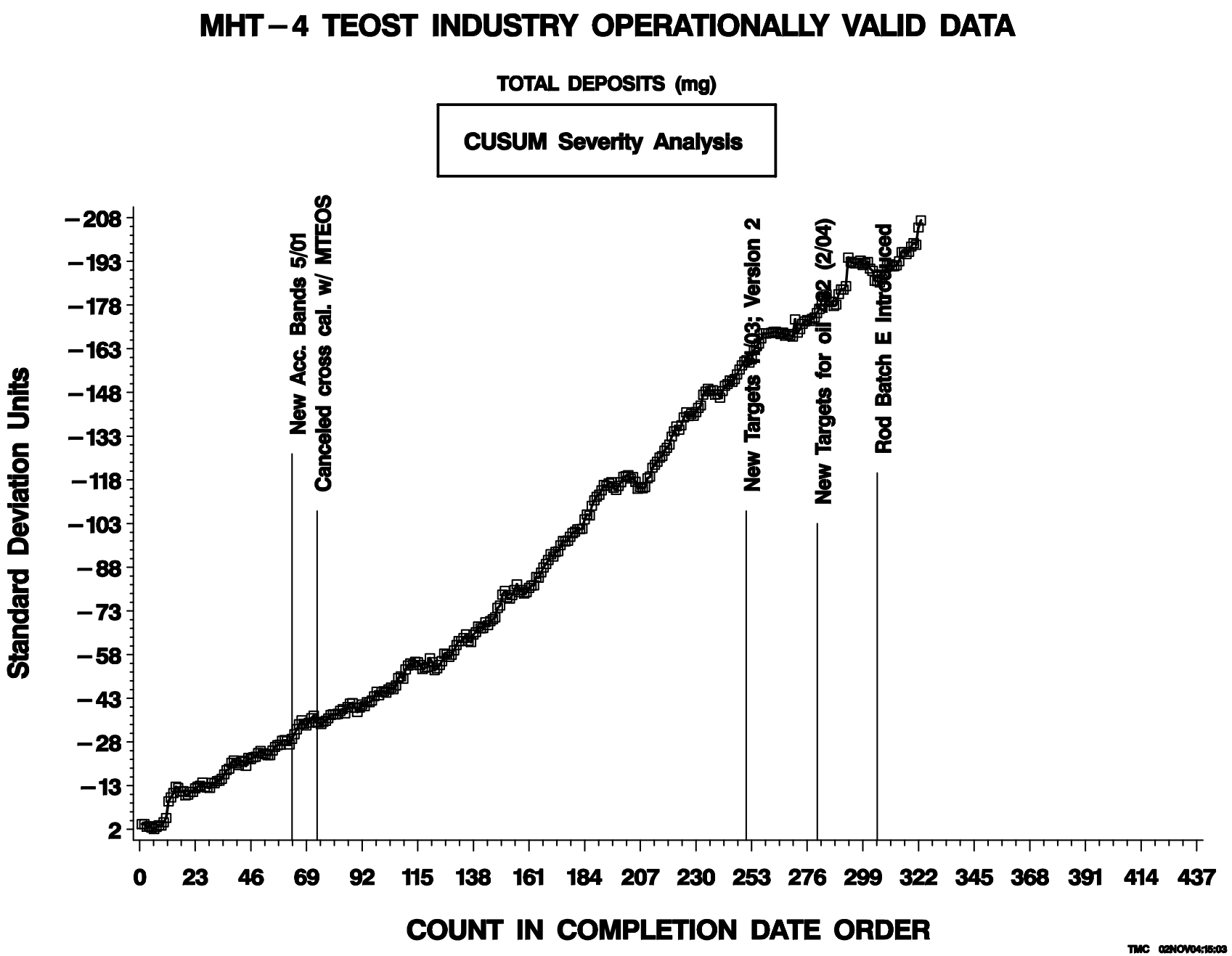
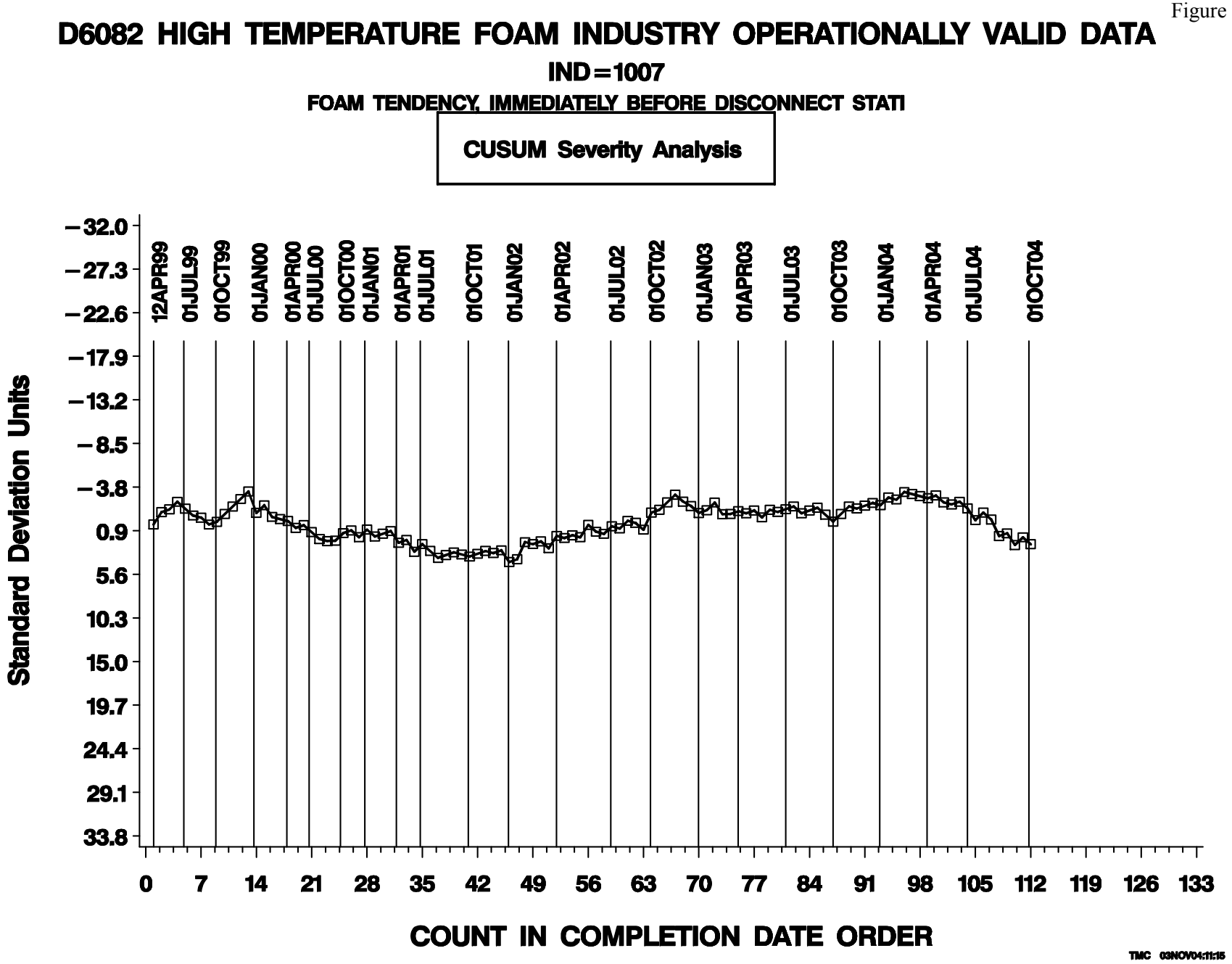
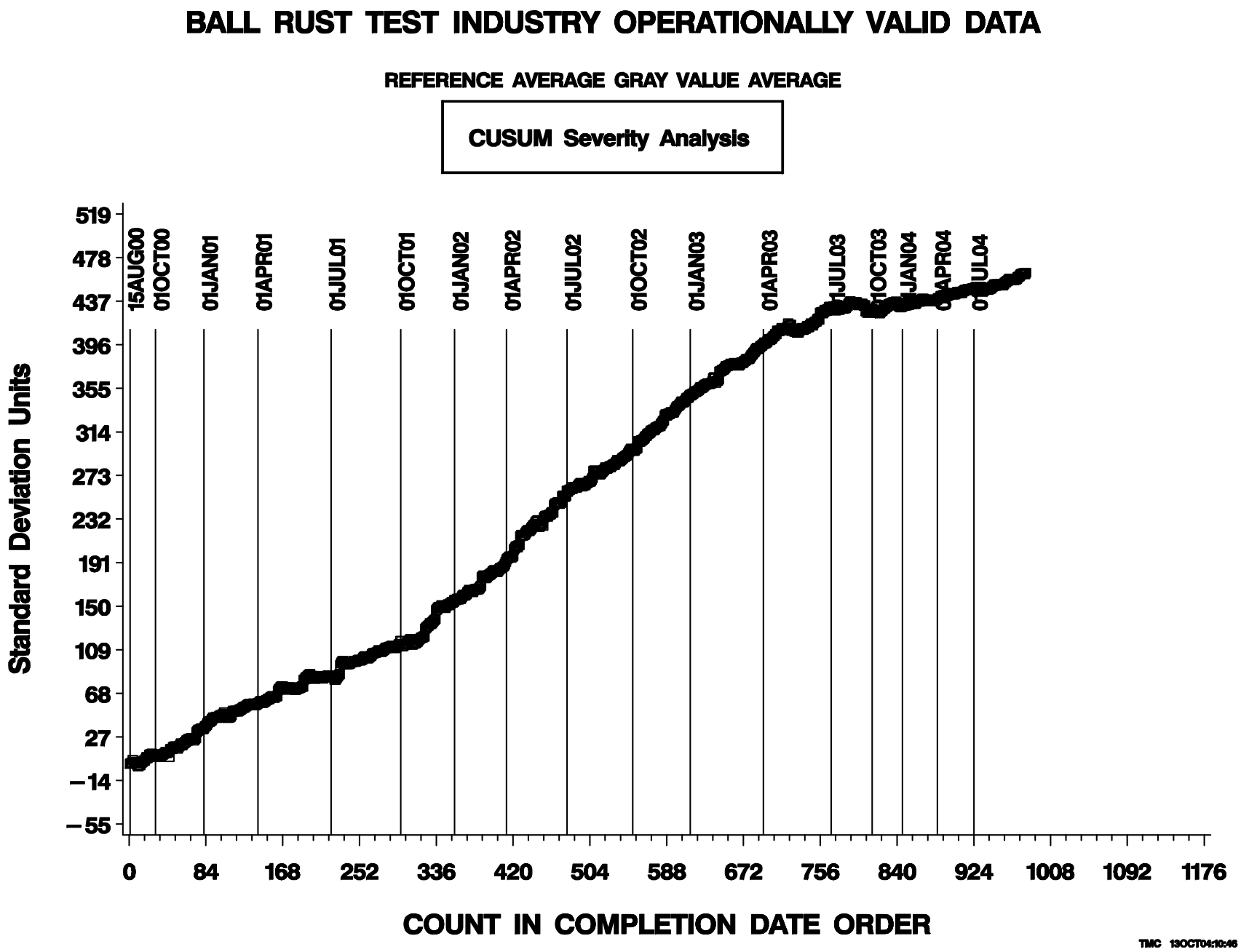

MHT−4 TEOST INDUSTRY OPERATIONALLY VALID DATA
TOTAL DEPOSITS (mg)
CUSUM Severity Analysis
Standard Deviation Units
−208
−193
−178
−163
−148
−133
−118
−103
−88
−73
−58
−43
−28
−13
2
New Acc. Bands 5/01
Canceled cross cal. w/ MTEOS
New Targets 4/03; Version 2
New Targets for oil 2 (2/04)
Rod Batch E Introduced
0
23
46
69
92
115
138
161
184
207
230
253
276
299
322
345
368
391
414
437
COUNT IN COMPLETION DATE ORDER
TMC 02NOV04:15:03

Figure 6

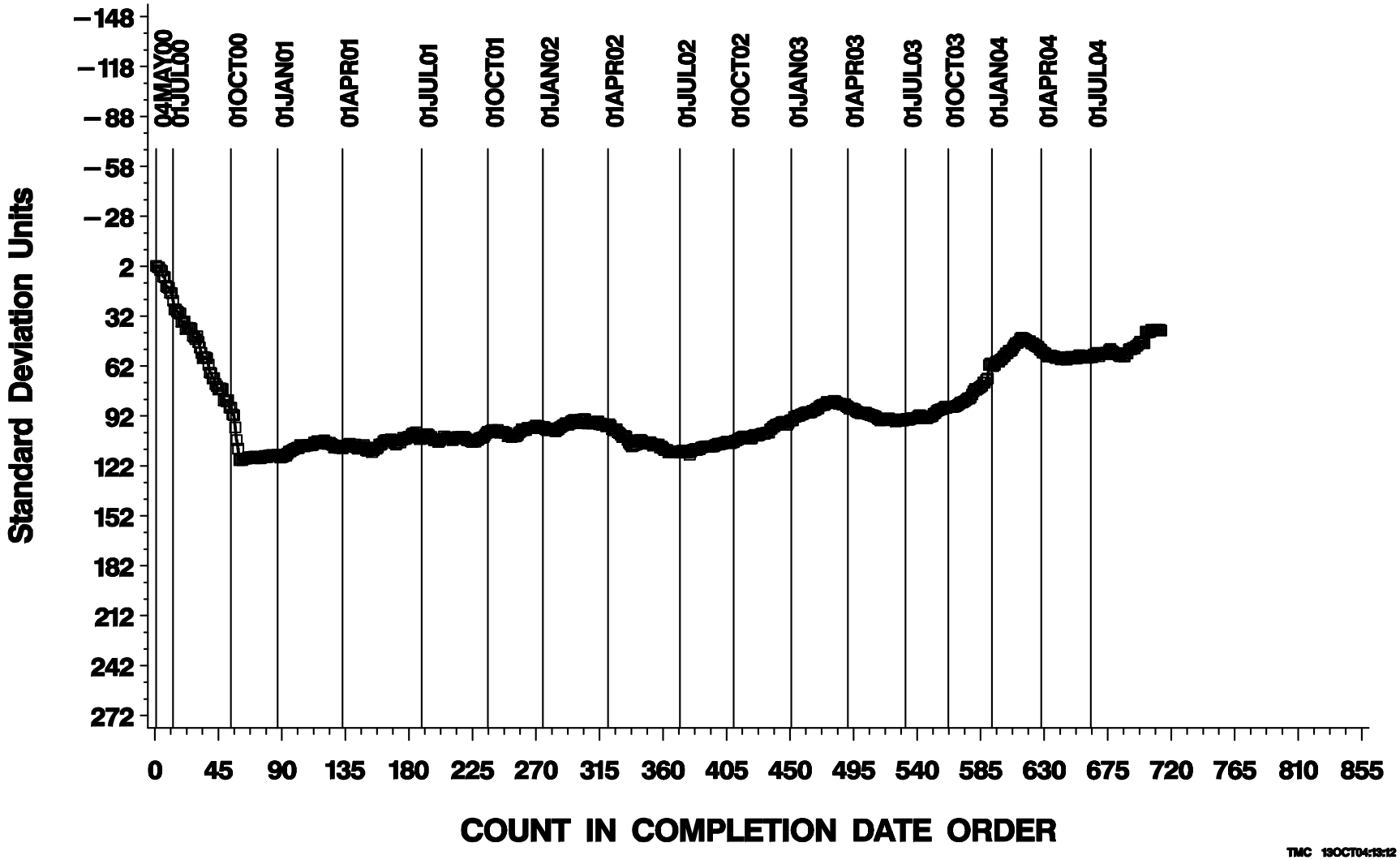

D6082 HIGH TEMPERATURE FOAM INDUSTRY OPERATIONALLY VALID DATA
IND=1007
FOAM TENDENCY, IMMEDIATELY BEFORE DISCONNECT STATI
CUSUM Severity Analysis
Standard Deviation Units
−32.0
−27.3
−22.6
−17.9
−13.2
−8.5
−3.8
0.9
5.6
10.3
15.0
19.7
24.4
29.1
33.8
12APR99
01JUL99
01OCT99
01JAN00
01APR00
01JUL00
01OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
01OCT02
01JAN03
01APR03
01JUL03
01OCT03
01JAN04
01APR04
01JUL04
01OCT04
0
7
14
21
28
35
42
49
56
63
70
77
84
91
98
105
112
119
126
133
COUNT IN COMPLETION DATE ORDER
TMC 03NOV04:11:15


BALL RUST TEST INDUSTRY OPERATIONALLY VALID DATA
REFERENCE AVERAGE GRAY VALUE AVERAGE
CUSUM Severity Analysis
Standard Deviation Units
519
478
437
396
355
314
273
232
191
150
109
68
27
−14
−55
15AUG00
01OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
01OCT02
01JAN03
01APR03
01JUL03
01OCT03
01JAN04
01APR04
01JUL04
0
84
168
252
336
420
504
588
672
756
840
924
1008
1092
1176
COUNT IN COMPLETION DATE ORDER
TMC 13OCT04:10:46

EOFT INDUSTRY OPERATIONALLY VALID DATA

20 – 25 ML CHANGE IN FLOWRATE AVERAGE (%)

CUSUM Severity Analysis



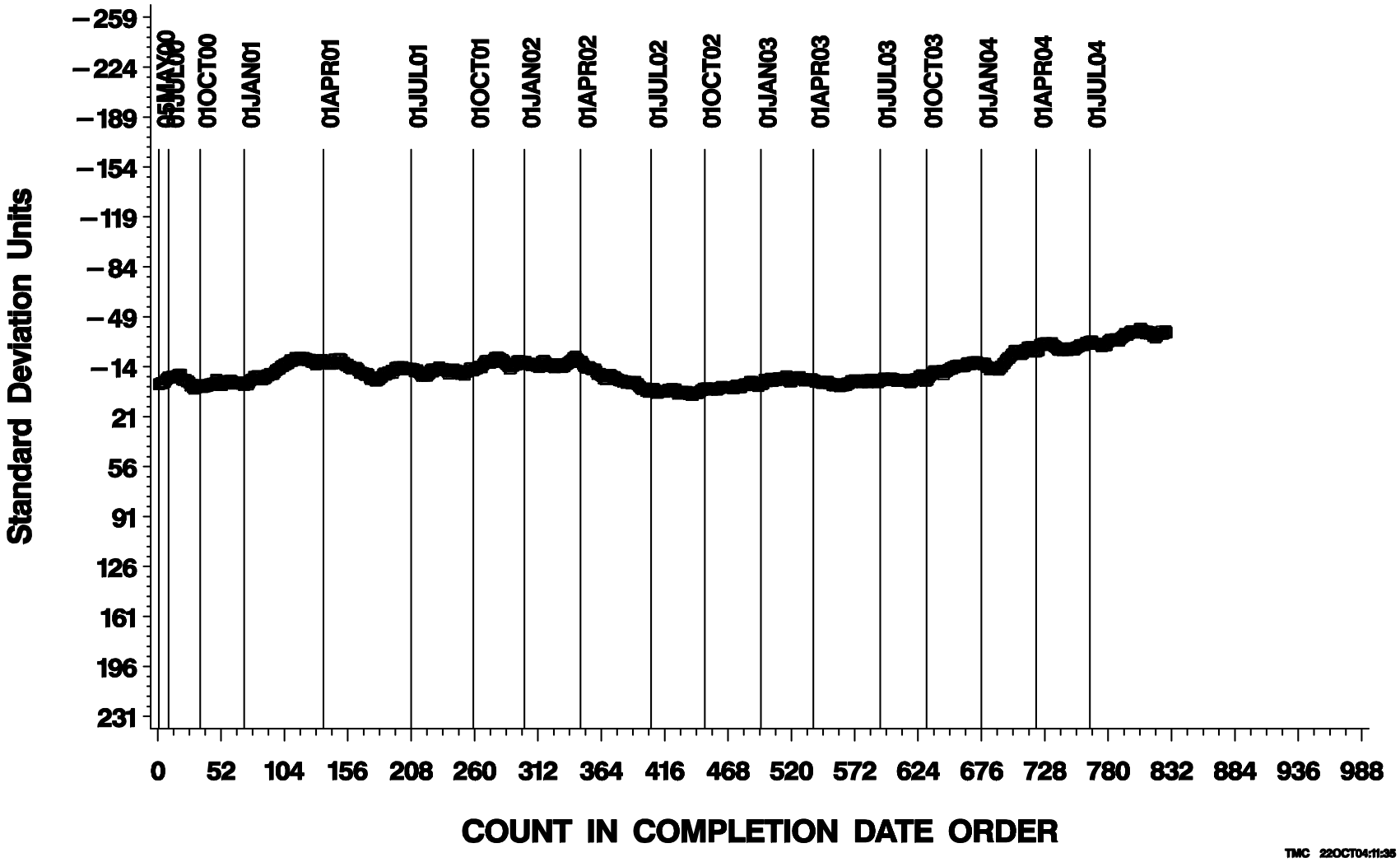
TMC 13OCT04:13:12

EOWT INDUSTRY OPERATIONALLY VALID DATA

0.6% Treat Level

TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE

CUSUM Severity Analysis

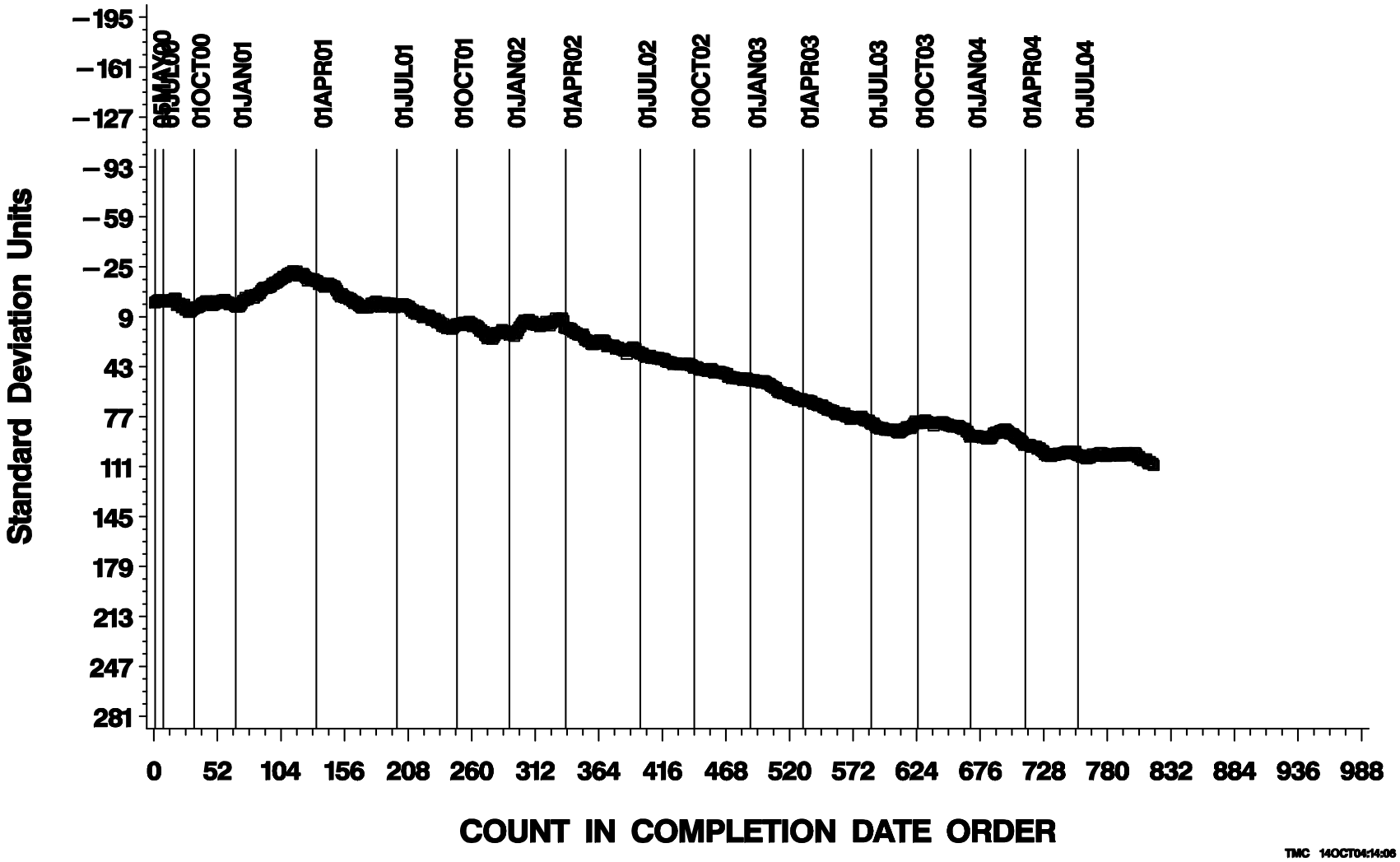


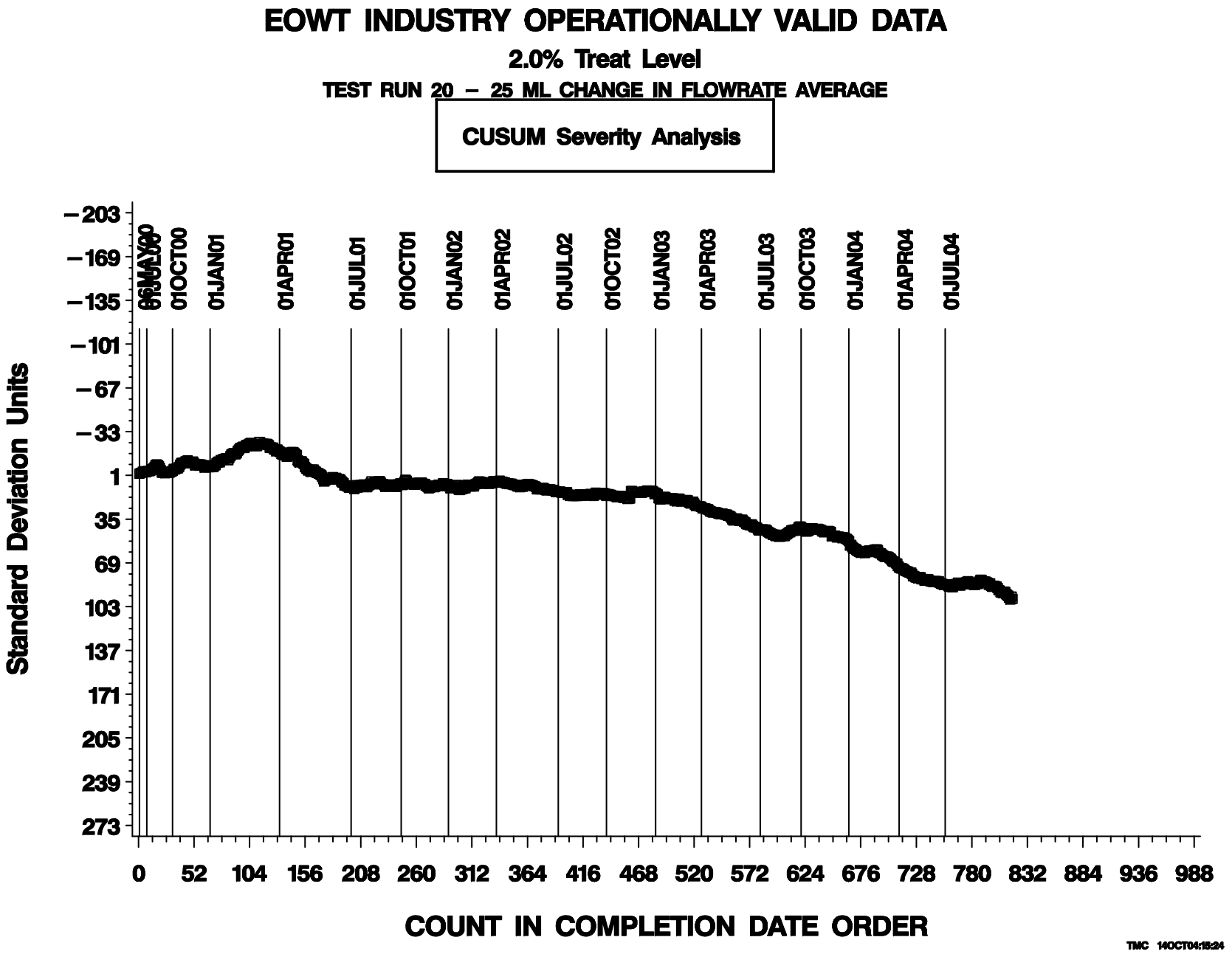
EOWT INDUSTRY OPERATIONALLY VALID DATA

1.0% Treat Level

TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE

CUSUM Severity Analysis



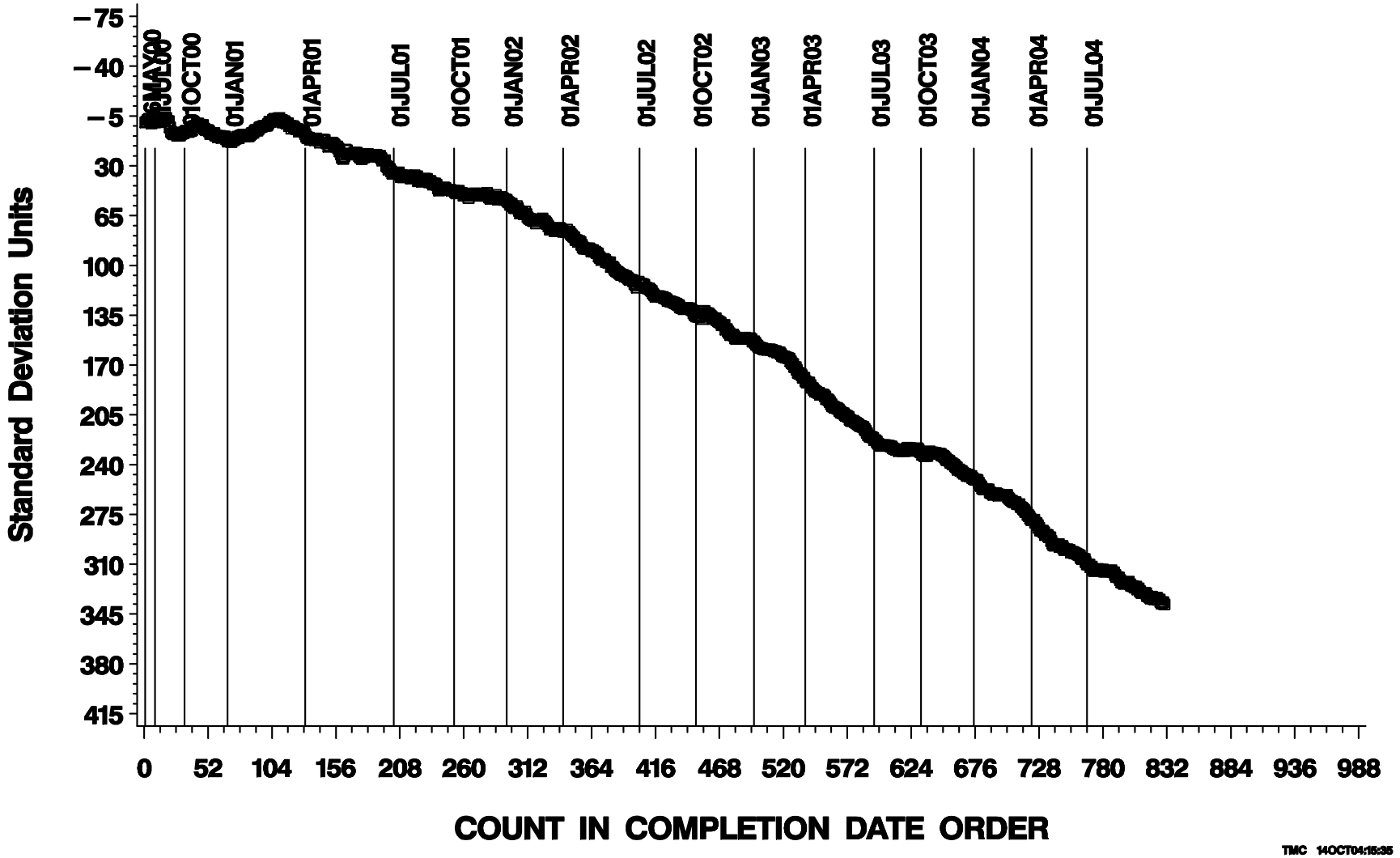

EOWT INDUSTRY OPERATIONALLY VALID DATA
2.0% Treat Level
TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE
CUSUM Severity Analysis
Standard Deviation Units
−203
−169
−135
−101
−67
−33
1
35
69
103
137
171
205
239
273
01OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
01OCT02
01JAN03
01APR03
01JUL03
01OCT03
01JAN04
01APR04
01JUL04
0
52
104
156
208
260
312
364
416
468
520
572
624
676
728
780
832
884
936
988
COUNT IN COMPLETION DATE ORDER
TMC 14OCT04:15:24

EOWT INDUSTRY OPERATIONALLY VALID DATA

3.0% Treat Level

TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE

CUSUM Severity Analysis



TMC Monitored Bench Tests
Reference Oil Test Targets and Acceptance Bands

Test	Oil Code	Parameter	n	Mean	sR	Acceptance Bands 95% Lower	Acceptance Bands 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
New Targets	55	mass % volatility loss	32	17.09	0.76	15.6	18.6
7/21/2003	58	mass % volatility loss	37	15.20	0.72	13.8	16.6
TEOST by	71	Total Deposit wt. (mg)	27	51.79	4.79	42.4	61.2
D6335	72	Total Deposit wt. (mg)	27	26.72	3.46	19.9	33.5
~~MTEOS by~~	~~74~~	~~Total Deposit wt. (mg)~~	~~20~~	~~16.84~~	~~5.28~~	~~6.5~~	~~27.2~~
~~Draft 17 00.08.11~~	~~432~~	~~Total Deposit wt. (mg)~~	~~18~~	~~50.13~~	~~4.88~~	~~40.6~~	~~59.7~~
~~New Targets~~	~~433~~	~~Total Deposit wt. (mg)~~	~~18~~	~~50.28~~	~~5.26~~	~~40.0~~	~~60.6~~
~~20010601 to 20031031~~	~~1006~~	~~Total Deposit wt. (mg)~~	~~24~~	~~34.53~~	~~5.93~~	~~22.9~~	~~46.2~~
MTEOS by	74	Total Deposit wt. (mg)	14	13.59	3.97	5.8	21.4
Version 2, 03.09.23	432	Total Deposit wt. (mg)					
New Targets	433	Total Deposit wt. (mg)	14	42.10	5.34	31.6	52.6
20031101	1006	Total Deposit wt. (mg)	24	42.43	6.10	30.5	54.4
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	65.71	19.28	28	103
(HT FOAM)	1007	Stability (ml)	28	0.00	0.00	0	0
D6082	66 (DISCRIM)	Tendency (ml)	--	-----	-----	>100	-----
(HT FOAM)	66 (DISCRIM)	Stability (ml)	--	-----	-----	0	0
BRT by	81	Average AGV	12	112	14.00	85	140
D6557	82	Average AGV	12	48	12.50	25	70
(D02-1483)	1006	Average AGV	12	128	7.21	114	142
	5A-3	Average AGV	12	76	6.47	63	89
EOFT by	77	Δ Flowrate (%)	12	-45.55	4.36	-54.10	-37.00
D6795	78	Δ Flowrate (%)	12	15.74	6.87	2.27	29.21
EOWT by	77	0.6% H20 Δ Flowrate (%)	12	-24.90	5.68	-36.03	-13.77
D6794	77	1.0% H20 Δ Flowrate (%)	12	-17.94	5.45	-28.62	-7.26
	77	2.0% H20 Δ Flowrate (%)	12	-17.96	8.47	-34.56	-1.36
	77	3.0% H20 Δ Flowrate (%)	12	-18.23	6.83	-31.62	-4.84
EOWT by	78	0.6% H20 Δ Flowrate (%)	12	10.87	6.16	-1.20	22.94
(Draft 5)	78	1.0% H20 Δ Flowrate (%)	12	7.54	6.15	-4.51	19.59
	78	2.0% H20 Δ Flowrate (%)	12	5.17	5.33	-5.27	15.62
	78	3.0% H20 Δ Flowrate (%)	12	-0.54	4.52	-9.40	8.32

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

Test	Oil Code	Parameter	Targets			4/1/03 - 9/30/03				10/1/03 - 3/31/04				4/1/04 - 9/30/04			
			n	Mean	sR	n	Mean	sR	Mean ∆/s	n	Mean	sR	Mean ∆/s	n	Mean	sR	Mean ∆/s
D6417	52	Area % Volatized	18	6.97	0.31	5	6.9	0.48	-0.23	8	6.7	0.39	-0.75	2	6.6	0.21	-1.03
	55	Area % Volatized	18	11.68	0.51	4	11.0	0.14	-1.33	4	11.4	0.79	-0.65	7	11.8	0.40	0.21
	58	Area % Volatized	18	5.61	0.30	5	5.6	0.33	0.03	3	5.8	0.12	0.74	6	5.8	0.42	0.80
D5800	52	% volatility loss	33	13.75	0.61	11	13.9	0.53	0.40	8	13.8	0.46	0.04	12	14.1	0.54	0.56
**	55	% volatility loss	32	17.09	0.76	12	16.9	0.81	0.38	12	17.3	0.79	0.24	8	17.0	0.54	-0.18
	58	% volatility loss	37	15.20	0.72	6	15.3	0.74	0.63	12	15.6	0.58	0.51	10	15.3	0.80	0.18
TEOST	71	Deposit wt. (mg)	27	51.79	4.79	2	62.2	5.44	2.16	5	48.1	8.33	-0.78	3	45.9	3.75	-1.23
(D6335)	72	Deposit wt. (mg)	27	26.72	3.46	4	36.2	13.68	2.73	2	26.7	3.39	-0.01	2	27.6	4.17	0.27
MTEOS	1006	Deposit wt. (mg)	14	42.43	6.10	4	39.0	1.81	0.75	13	37.7	10.91	-0.59	8	34.7	6.69	-1.27
***	432	Deposit wt. (mg)	8	45.18	2.73	10	44.7	3.34	-1.12	2	42.8	0.35	-1.51	13	44.7	9.30	-0.19
	433	Deposit wt. (mg)	14	42.10	5.34	7	41.4	9.09	-1.70	10	37.7	11.46	-0.82	13	39.1	6.55	-0.56
	74	Deposit wt. (mg)	14	13.59	3.97	6	14.7	6.75	-0.41	10	11.6	3.76	-0.51	6	12.2	3.05	-0.34
GI	~~52~~	~~Gelation Index~~	~~35~~	~~4.5~~	~~0.24~~	~~3~~	~~4.3~~	~~0.10~~	~~-0.83~~	--	----	----	----	--	---	---	---
(D5133)	~~53~~	~~Gelation Index~~	~~37~~	~~44.7~~	~~4.64~~	~~6~~	~~47.3~~	~~2.12~~	~~0.55~~	--	----	----	----	--	---	---	---
****	58	Gelation Index	17	5.8	0.69	9	5.8	0.95	-0.03	12	10.1	8.68	6.27	12	6.0	0.94	0.33
	62	Gelation Index	35	17.0	3.90	6	18.1	4.15	0.27	12	14.5	5.51	-0.64	8	15.3	5.12	-0.44
	1009	Gelation Index	16	7.30	0.68	3	7.2	0.60	-0.20	13	7.1	0.54	-0.27	7	8.3	2.23	1.47
D6082	1007	Tendency (ml)	28	65.71	19.28	12	65.8	9.96	0.01	12	62.5	10.55	-0.17	13	72.3	15.89	0.34

**D5800 Targets Adjusted 10/2/00; new oils selected; new procedures approved; targets adjusted again 7/21/03
***MTEOS Targets Adjusted 6/1/01 per direction of TEOST Surveillance Panel (based on completed Matrix 6 data)
****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

Attachment 3B

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

			Targets			10/1/02 - 3/31/03			4/1/03 - 9/30/03			10/1/03 - 3/31/04			4/1/04 - 9/30/04		
Test	Oil Code	Parameter	n	Mean	sR	n	Mean	sR	n	Mean	sR	n	Mean	sR	n	Mean	sR
BRT	1006	Average AGV	12	128	7.21	38	126.0	5.09	44	123.5	7.76	17	125.8	5.57	14	127.6	4.30
	5A-3	Average AGV	12	76	6.47	23	85.9	14.43	14	87.6	16.30	---	---	---	---	---	---
	81	Average AGV	12	112	14.00	82	124.6	5.98	60	119.9	11.46	38	120.7	11.81	58	121.5	6.90
	82	Average AGV	12	48	11.50	---	---	---	1	55.0	0.00	16	41.6	9.74	26	41.8	9.10
EOFT	77	Avg. % CF	12	-45.55	4.36	0	-----	-----	0	-----	-----	0	-----	-----	0	-----	-----
	78	Avg. % CF	12	15.74	6.87	81	13.9	4.16	71	15.8	3.70	66	12.1	8.68	86	14.8	7.90
EOWT	77	.6 H2O Avg. %C	12	-24.90	5.68	48	-24.5	4.15	51	-23.6	3.77	49	-26.6	4.76	56	-25.4	4.55
	77	.0 H2O Avg. %C	12	-17.94	5.45	47	-16.2	2.49	47	-15.4	3.48	42	-16.7	3.06	52	-16.9	2.92
	77	.0 H2O Avg. %C	12	-17.96	8.47	36	-15.1	5.21	49	-14.2	3.55	51	-14.9	4.63	55	-15.3	2.77
	77	.0 H2O Avg. %C	12	-18.23	6.83	46	-16.2	4.53	42	-16.3	3.01	42	-16.5	3.69	53	-16.2	3.83
EOWT	78	.6 H2O Avg. %C	12	10.87	6.16	41	10.5	5.41	42	9.4	5.00	41	10.0	5.52	52	9.9	6.76
	78	.0 H2O Avg. %C	12	7.54	6.15	42	8.6	4.23	47	6.8	4.42	46	8.3	4.52	54	8.0	5.92
	78	.0 H2O Avg. %C	12	5.17	5.33	53	4.9	6.12	44	4.5	3.67	41	6.8	5.48	52	6.0	6.05
	78	.0 H2O Avg. %C	12	-0.54	4.52	43	2.6	5.64	52	2.9	3.59	48	2.9	3.78	56	3.1	5.06