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MEMORANDUM: 02-108

DATE: November 20, 2002

TO: Mr. Ted Selby, Chairman ASTM D02.B07

FROM: Thomas Schofield & Richard Grundza

SUBJECT: TMC Bench Reference Test Monitoring from April 1, 2002 through September 30, 2002

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. Also, 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 test type into single precision and severity estimates for each period 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. To keep the information succinct, some of the older annual comparison periods have been eliminated.

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/mem02-108.pdf

Distribution: Email

Attachment 1

ASTM Test Monitoring Center

Semiannual Report

ASTM D02.B07 Bench Reference Test Monitoring
From April 1, 2002 through September 30, 2002

D6417: Estimation of Engine Oil Volatility by Capillary Gas Chromatography

STATUS

Table 1 summarizes the reference tests reported to the TMC this period (7 labs reporting):

TABLE 1

	No. of Tests
Statistically Acceptable and Operationally Valid	16
Total	**16**

Fail Rate of Operationally Valid Tests: 0.0%

INDUSTRY PERFORMANCE

Table 2 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 2

Area % Volatized @ 371°C	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study	107	101	0.46	-----
10/5/00 through 3/31/01	18	15	0.50	1.42
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

Table 3 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 3

	n	Mean Δ/s
Lab A	4	-1.19
Lab B	2	0.37
Lab D	2	-0.77
Lab G	3	-0.45
Lab H	2	0.36
Lab S	1	-0.94
Lab U	2	1.23

PRECISION AND SEVERITY

D6417 calibration testing precision is exceptionally good this period. Overall severity continues to be mild of target performance. Severity is represented graphically in Figure 1. The figure shows a large amount of variability in the results over the first half of the plot, as evidenced by the sharp up-and-down pattern in the CUSUM plot. The up-and-down pattern seems to mitigate significantly from the 01OCT01 time line, as we see precision improving. The figure shows some early leveling for the current period (01APR02 – 01OCT02 time lines), followed by a strong mild trend extending beyond the end of this period and into the next.

Lab A, which had previously been performing substantially severe compared to the other labs, and was performing somewhat closer to the performance of the other labs last period (though mild, mean $\Delta/s = -0.71$), is now performing substantially mild. This performance is countered somewhat by Lab U, which is performing substantially severe. (However, lab U's two-result performance is strongly biased by one unusually severe result, while lab A is performing consistently more than 1 s mild on all four reported test results this period).

The fail rate of the operationally valid tests is also exceptionally good, with no statistically unacceptable tests reported this period. Compare this to the 7.7% fail rate of last period, and the exceptionally high fail rate of 18.8% two periods back (a 5% fail rate is expected).

The gradual shift in overall severity from severe to mild (as illustrated by the overall "bowl" shape of the CUSUM severity plot in Figure 1), along with the improving precision and improved fail rate of testing, indicates some dynamic, industry-wide changes with this test. While the severity shift to mild is not exactly advantageous, the improved precision and remarkably lower fail rate is a positive observation. Perhaps the workshop conducted on January 29, 2002 had some effect on testing, as that is when testing severity appears to shift from severe to mild, and when the testing precision and fail rate improves.

TMC MEMORANDA

There were two TMC technical memoranda issued this report period for the D6417 test method:

Memo 02-046, May 9, 2002, D6417 Post-Workshop Round Robin Summary
Report Packet Revision Notice D6417-20020311 (effective June 11, 2002)

D5480: Engine Oil Volatility by Gas Chromatography (VGC by D5480)

STATUS

There were no D5480 calibration tests reported to the TMC this period. The last reported D5480 calibration test was completed on 7/23/2001. Due to lack of sponsorship, on June 17, 2002, D02.B07 granted the TMC permission to stop monitoring D5480 calibration testing (and cease all associated support) provided we had not received any notice of interest for continued monitoring by the end of this report period. The TMC has received no notice of interest and D5480 TMC calibration monitoring was formally terminated on October 10, 2002.

Future semi-annual summaries will no longer include a D5480 section.

TMC MEMORANDA

There was one TMC technical memorandum issued this report period for the D5480 test method:

Memo 02-075, October 10, 2002, Termination of TMC Monitoring

D5800: Evaporation Loss of Lubricating Oils by the Noack Method

STATUS

Table 4 summarizes the reference tests reported to the TMC this period (9 labs reporting):

TABLE 4

	No. of Tests
Statistically Acceptable and Operationally Valid	26
Operationally Valid but Failed Acceptance Criteria	*9
Operationally Invalid (initially reported as)	1
Operationally Invalid (after informed of failing calibration)	2
Total	**38**

Fail Rate of Operationally Valid Tests: 25.7%
*8 Statistically unacceptable test this period were by Procedure B

Table 5 is a breakdown of the statistically unacceptable tests.

TABLE 5

Reason for Fail	No. of Tests
Sample Evaporation Loss Severe	9

INDUSTRY PERFORMANCE

Table 6 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 6

Sample Evaporation Loss, mass %	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study	180	175	0.51	-----
5/1/96 through 3/31/97	31	26	0.68	0.70
4/1/97 through 3/31/98	22	17	0.72	0.75
4/1/98 through 3/31/99	28	23	0.59	0.49
4/1/99 through 3/31/00	33	28	0.42	0.90
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

Table 7 shows statistical comparisons by procedure for all operationally valid tests for the report period (there were no procedure C tests reported to the TMC this period).

TABLE 7

Sample Evaporation Loss, mass %	n	df	Pooled s	Mean Δ/s
Procedure A	8	5	0.88	0.39
Procedure B	27	24	0.69	1.18
Procedure C	0	0	--.--	--.--

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

Table 8 shows the current severity for the Sample Evaporation Loss parameter for each lab for all operationally valid tests for the report period.

TABLE 8

	n	Mean Δ/s
Lab A	8	1.35
Lab B	4	0.21
Lab G	5	1.38
Lab H	2	0.73
Lab I	4	1.33
Lab J	5	1.31
Lab R	2	2.25
Lab U	5	-0.27

Nine labs reported tests this period but only eight labs with operationally valid data. Lab D reported two calibration tests, but both were subsequently found to be operationally invalid after the lab was informed of the statistically unacceptable calibration status.

PRECISION AND SEVERITY

Effective September 26, 2000, the TMC began monitoring the three Noack procedures under the latest D5800 test method. Also effective September 26, 2000, new reference oils, targets and acceptance bands were implemented for TMC calibration monitoring. Oils 51, 53 and 54 were dropped, oil 58 was introduced and targets for oils 52 & 55 were revised.

Overall precision continues to run worse than target precision, and is as poor this period as it has ever been. Overall severity is trending more severe, again. The slopes of the plots in Figures 2A and 2B illustrate the continuous overall severe trend with D5800 calibration testing. Figure 2B shows that a strong severe trend that started a long time before new targets were established continues right on through the effective date of the new performance targets and up to the present time. A leveling to target would have been expected after the performance targets were updated in September 2000. (The severity appears to worsen after the 01OCT02 timeline that marks the end of the current report period).

Testing failure rates on tests reported to the TMC as operationally valid for the last three report periods are 22.9%, 15.2% and, now, 25.7% (5% is "statistically expected"). These widely differing fail rates for different periods is another indication the erratic severity in reference testing. This period's 25.7% fail rate is alarming. The reason for the high fail rate is likely a result of the labs not meeting the acceptance bands for oils 55 & 58. (Our round robin study does not indicate that oil 58 is any more variable in performance than oils 52 or 55, as some have suggested. Rather, it would appear that the target mean, at least for oil 58, and possibly for oil 55, is not accurate.)

Last period it was reported that tests on oil 58 seem to be performing substantially more severe than oils 52 & 55. This period, both oils 55 & 58 are substantially severe, with oil 55 being more severe than oil 58. Attachment 3 shows a detailed comparison of the individual oil performances over time. It is reasonably clear that targets on oil 58 are not accurate compared to the reference testing data, and that performance on oil 55 (with the most severe target of the reference oils) is erratic at best.

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

With an unusually high period fail rates and numerous operational problems reported by the labs to the TMC the previous two periods, B07 requested the EOVTSP to conduct a D5800 workshop. This workshop was conducted on March 13 & 14. A list of recommended practices was issued as a result of the workshop, and a follow-up round-robin study was also recently completed. The round-robin results were summarized in a separate TMC report. However, one conclusion of the TMC's round-robin summary was that the workshop does not seem to have improved overall precision or severity of reference testing (as is evident in Table 6 where precision and severity have worsened since the workshop; note that all reference tests included in the current period statistical summary were completed since April 1, 2002, after the March workshop).

Once again, Procedure B testing is substantially more sever than Procedure A testing, though, because not all labs run both methods, lab effects cannot be separated from the procedure severity (Mean Δ/s) comparison in Table 7. (That is, how much of the Procedure A & B severity differences are attributable simply to lab performance differences, rather the actual procedure-instrumental differences, cannot be determined from the reference testing data.) It is interesting to note, however, for the first time, that the Procedure B data this period is more precise than the Procedure A data. (Two periods ago the pooled precisions by procedure were comparable, and last period A data was substantially more precise than B.)

It would, however, appear, from reference testing over time and from the recently completed ASTM round-robin (as well as the CEC 2002 round-robin), that Procedure B is a more severe test, overall, than Procedure A. Accurately quantifying this difference is difficult, and when a correction is applied to individual test results the "translation" becomes suspect due to the variability in individual test results on the same oils (both within and between labs).

TMC MEMORANDA

There were three TMC technical memoranda issued this report period for the D5800 test method:

Report Packet Revision Notice D5800-20020325 (effective May 7, 2002)

EOVTSP Unapproved Minutes of the March 13-14 D5800 Workshop (this document includes the list of recommended practices generated by the workshop attendees for Procedures A & B)

Also issued (after the period end date):

Memo 02-102, November 8, 2002, D5800 A & B 2002 Post-Workshop Round-Robin Statistical Summary

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

STATUS

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

TABLE 9
Reference Tests

	No. of Tests
Statistically Acceptable and Operationally Valid	30
Operationally Valid but Failed Acceptance Criteria	3
Operationally Invalid (initially reported as)	1
Operationally Invalid (after informed of failing calibration)	1
Total	**35**

Fail Rate of Operationally Valid Tests: 9.1%

Table 10 is a breakdown of the statistically unacceptable tests.

TABLE 10

Reason for Fail	No. of Tests
Gelation Index Severe	3

INDUSTRY PERFORMANCE

Table 11 shows the current Industry precision and severity for the Gelation Index and test parameter for all operationally valid tests for the report period. (First calibration test completed 4/20/96.) "Initial Tests" includes reference and donated tests; subsequent listings include only reference tests.

TABLE 11

Gelation Index	n	df	Pooled s	Mean Δ/s
Initial Tests 4/20/96 through 11/27/96	178	173	6.37	-----
4/20/96 through 3/31/97	60	55	5.40	-0.06
4/1/97 through 3/31/98	64	59	5.20	-0.12
4/1/98 through 3/31/99	68	63	6.67	-0.07
4/1/99 through 3/31/00	62	57	6.30	0.09
*4/1/00 through 3/31/01	65	60	5.93	-0.15
4/1/01 through 9/30/01	33	28	2.84	0.13
10/1/01 through 3/31/02	30	26	4.76	-0.02
**4/1/02 through 9/30/02	33	29	2.28	1.03
**4/1/02 through 9/30/02	32	28	2.15	0.43

*Excludes one data point as a rare event. See the TMC's December 2000 report for more information.
**Summary statistics with and without LAB A result of 20 s severe of target, for comparison.

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

Table 12 shows the current severity for the Gelation Index for each lab for all operationally valid tests for the report period.

TABLE 12

	n	GI Mean Δ/s
*Lab A	9	2.57
*Lab A	8	0.39
Lab B	6	-0.21
Lab D	2	-0.62
Lab G	4	0.21
Lab H	2	0.59
Lab I	3	1.54
Lab R	1	1.16
Lab S	4	1.03
Lab U	2	0.68

*Lab A with and without result of 20 s severe of target, for comparison

PRECISION AND SEVERITY

Effective October 24, 2001, new D5133 reference oils, targets and acceptance bands were implemented for TMC calibration monitoring. Oils 51 and 55 were dropped and oil 58 was introduced (targets for oils 52, 53 & 62 continue without revision). Current GI reference oils are 52, 53, 58 & 62.

Lab A reported a result this period on oil 52 (non-gelling), as operationally valid, which was 20 s severe of target. (While 20 s seems extreme, the reported result is actually 9.3, with a target GI for oil 52 of 4.5 and acceptance bands 4.0 – 5.0 so the lab found the non-gelling oil to have a moderate gelation index; perhaps not quite as extreme, in reality, as “20 s severe” makes it seem.) For comparison, I have included statistical summaries for the current period in Tables 11 & 12, and in Figures 3A & 3B with and without the extreme result included. Unless there is objection from the panel, the TMC will consider this result a rare event and exclude it (as a non-chartable test) from future period summaries and analyses due to the undue bias it creates in the precision and severity estimates for the period.

Last period, for unknown reasons, there was a 20% fail rate among tests reported as operationally valid. The 9.0% fail rate this period is a notable improvement, though still higher than the statistically expected rate of 5%. Overall gelation index precision is very good (with or without the extreme result) and remains considerably better than target. Overall severity, on target last period, is moderately severe, and straying further from target than ever before. Severity is graphically represented in Figures 3A & 3B (attached). Figure 3B (with the extreme result excluded) better shows the disturbing severe trend starting from the 01APR02 timeline.

Excluding Lab A’s single extreme result, Labs I, R & S are performing substantially severe. Lab I contributed one test this period more than 2 s severe (oil 53) and Lab S contributed one result more than 3 s severe (oil 58).

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

An industry round-robin matrix was run on proposed GI reference oil 1009. The oil's performance in the matrix was somewhat milder than expected, but the results were reasonably precise across labs. The round-robin results are summarized in a separate TMC report.

TMC MEMORANDA

There were three TMC technical memoranda issued this report period for the D5133 test method:

Report Packet Revision Notice GI-20020204 (effective April 15, 2002)

Memo 02-054, May 30, 2002, Revised Standard D5133-01

Memo 02-098, October 22, 2002, D5133 Round-Robin Results: Proposed Reference Oil 1009

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

STATUS

Table 13 summarizes the reference tests reported to the TMC this period (2 labs reporting):

TABLE 13

	No. of Tests
Statistically Acceptable and Operationally Valid	5
Operationally Valid but Failed Acceptance Criteria	2
Operationally Invalid (initially reported as)	1
Operationally Invalid (after informed of failing calibration)	1
Total	**9**

Fail Rate of Operationally Valid Tests: 28.6%

Table 14 is a breakdown of the statistically unacceptable tests.

TABLE 14

Reason for Fail	No. of Tests
Total Deposits Severe	2

INDUSTRY PERFORMANCE

Table 15 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 15

Total Deposits	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study	54	52	4.18	-----
4/1/96 through 3/31/97	44	42	6.22	0.28
4/1/97 through 3/31/98	41	39	4.24	-0.10
4/1/98 through 3/31/99	36	34	5.68	-0.49
4/1/99 through 3/31/00	30	28	5.67	0.14
4/1/00 through 3/31/01	18	16	8.45	0.40
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

Table 16 shows the current severity for the Total Deposits parameter for each lab for all operationally valid tests in the report period.

TABLE 16

	n	Mean Δ/s
Lab A	4	1.48
Lab B	3	0.96

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 notably poorer this period, though comparable to target. Severity is unusually severe with both Labs A & B performing quite severe. The cause of the worsening precision and unprecedented severity is not known. The severity trends are graphically represented in Figure 4 (attached). The plot shows an increasing severe trend since July 2001.

TMC MEMORANDA

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

Report Packet Revision Notice TEOST-20020311 (effective May 8, 2002)

TEOST MHT-4, Draft 17, 00.08.11: Determination of Moderately High Temperature Piston Deposits by Thermo-oxidation Engine Oil Simulation Test (MTEOS)

STATUS

Table 17 summarizes the reference tests reported to the TMC this period (7 labs reporting):

TABLE 17

	No. of Tests
Statistically Acceptable and Operationally Valid	37
Operationally Valid but Failed Acceptance Criteria	10
Operationally Invalid	0
Total	**47**

Fail Rate of Operationally Valid Tests: 21.3%

Table 18 is a breakdown of the statistically unacceptable tests.

TABLE 18

Reason for Fail	No. of Tests
Total Deposits Mild	*7
Total Deposits Severe	3

*All 7 mild failing results this period are on oil 432 (though 1 severe fail is also on oil 432)

INDUSTRY PERFORMANCE

Table 19 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 19

Total Deposits	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study (1st half)	28	24	5.50	-----
9/6/00 through 3/31/01	52	48	6.67	-0.46
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

Table 20 shows the current severity for the Total Deposits parameter for each lab for all operationally valid tests in the report period.

TABLE 20

	n	Mean Δ/s
Lab A	15	-1.42
Lab AB	4	-1.10
Lab B	10	-0.09
Lab D	4	-0.85
Lab G	8	-0.67
Lab U	2	-1.24
Lab V	4	0.02

PRECISION AND SEVERITY

Overall precision continues to worsen. Severity is increasingly mild of target. Severity is presented graphically in Figure 5 where an overall mild slope is observed, with a significantly increasing slope (indicating increasingly mild performance).

Last period a high number of operationally invalid tests were reported (often with the lab not realizing a problem until informed they had failed on a TMC calibration oil). This period has no tests reported as operationally invalid, but does show an unusually high fail rate on tests reported as operationally valid.

It appears, over time, that the precisions of the individual reference oils (Attachment 3A) are fluctuating substantially. For example, two periods ago precision on 433 was better than target (s = 4.91 vs. target 5.26), while 1006 precision was significantly poor (s = 8.97 vs. target 5.93). Last period it was 433 with exceptionally poor precision (s = 9.18 vs. target 5.26) while 1006 precision was good, and 432 not terribly worse than target. This period, 432 and 433 precision is exceptionally poor, and 1006 is only mildly worse that target. Except for oil 74, there appears to be little consistency in the precision of the oils over time.

Severity this period is unusually mild. Lab A is performing, for the most part, exceptionally mild this period, significantly influencing the overall severity estimate (however, they also report an occasional severe result). However, other labs are also contributing both severe and mild results of more than 2 s.

It is unclear at this time why this test is experiencing worsening (and inconsistent) precision trends, and a substantial increase in mild performance this period.

The TMC does not track changes in rod batches (a critical hardware testing part in the MHT-4 TEOST). A serial number for each test rod is supplied to the TMC for each reported calibration test, but the TMC has no breakdown of how these serial numbers relate to manufacturer (is there more than one source for the rods?), or rod batches by a single manufacturer. Perhaps it would be useful for the TMC to collect this data to see if correlations can be found between critical test hardware batches and calibration performance.

TMC MEMORANDA

There was one TMC technical memorandum issued this report period for the MTEOS test method:

Report Packet Revision Notice MTEOS-20020121 (effective May 29, 2002)

D6082: High Temperature Foaming Characteristics of Lubricating Oils

On June 18, 2001, the section agreed to suspend the use of 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. A search for a suitable replacement oil has been initiated.

Note that TMC 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 "infinitely" severe in standard deviations (Δ/s). Therefore, for Foam Stability, it is preferable to simply note the number of non-zero occurrences in order 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 21 summarizes the reference tests reported to the TMC this period (5 labs reporting):

TABLE 21

	No. of Tests
Statistically Acceptable and Operationally Valid	12
Operationally Valid but Failed Acceptance Criteria	0
Operationally Invalid	0
Total	**12**

Fail Rate of Operationally Valid Tests: 0.0%

D6082: High Temperature Foaming Characteristics of Lubricating Oils, continued

TMC 1007 INDUSTRY PERFORMANCE

Tables 22 and 23 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 22

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	11	14.22	-0.17

TABLE 23

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		

Table 24 shows the current 1007 severity for the monitored result parameter for each lab for all operationally valid tests reported for the report period.

TABLE 24
TMC 1007

	n	Foam Tendency Mean Δ/s
Lab A	3	-0.12
Lab B	4	-0.69
Lab D	1	0.74
Lab G	2	-0.04
Lab I	2	0.22

PRECISION AND SEVERITY

Foam Tendency precision on 1007 is somewhat better than last period, and better than the target precision. Severity is trending slightly mild. There were no non-zero occurrences of Foam Stability on 1007; this would suggest Foam Stability precision is as expected. Foam Tendency severity is graphically represented in Figure 6 with some variability in the data but reasonably good overall leveling for the period (overall mild bias).

TMC MEMORANDA

There were three TMC technical memoranda issued this report period for the D6082 test method:

Report Packet Revision Notice D6082-20020311 (effective May 30, 2002)
Memo 02-055, May 30, 2002, Devised Standard D6082-01
Memo 02-069, September 16, 2002, D6082 Round-Robin Results: Proposed Reference Oil 66

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

TABLE 25

	No. of Tests
Statistically Acceptable and Operationally Valid	127
Operationally Valid but Failed Acceptance Criteria	11
Operationally Invalid	1
Aborted	2
Total	**141**

Fail Rate of Operationally Valid Tests: 8.0%

Table 26 is a breakdown of the statistically unacceptable tests.

TABLE 26

Reason for Fail	No. of Tests
Average AGV Mild	8
Average AGV Severe	3

INDUSTRY PERFORMANCE

Table 27 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 27

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

Table 28 shows the current severity for the Average AGV parameter for each lab for all operationally valid tests for the report period.

TABLE 28

	n	Mean Δ/s
Lab A	61	0.34
Lab B	39	1.20
Lab G	24	0.41
Lab D	14	2.04

D6557: Ball Rust Test (BRT), continued

PRECISION AND SEVERITY

Precision this report period has degraded when compared to the target matrix and has improved slightly when compared to the previous period. Overall severity is trending mild of target. Severity is graphically represented in Figure 7 (attached). All labs are trending mild of target. There were eight results from two labs, which were > 2 Δ/s from target. These results were all on reference oil 5A-3. When these results are removed, precision estimates improve from 11.38 to 8.61, which is more in line with the initial round robin estimates. The mild trend for this period also decreases from 0.76 Δ/s to 0.43 Δ/s when these eight results are removed.

TMC MEMORANDA

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

Engine Oil Filterability Test (EOFT)

STATUS

Table 29 summarizes the reference tests reported to the TMC this period (3 labs reporting).

TABLE 29

	No. of Tests
Statistically Acceptable and Operationally Valid	89
Operationally Valid but Failed Acceptance Criteria	0
Aborted	1
Total	**90**

Fail Rate of Operationally Valid Tests: 0.0%

One test was aborted because of a spilled test sample.

INDUSTRY PERFORMANCE

Table 30 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 30

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

Table 31 shows the current severity for the Average % CIF parameter for each lab for all operationally valid tests for the report period.

TABLE 31

	n	Mean Δ/s
Lab A	40	0.13
Lab B	20	-0.34
Lab G	29	0.39

PRECISION AND SEVERITY

Precision this report period has changed little when compared to the previous period and the target matrix. Overall severity is on or near target. Lab G is trending severe, while Lab B is trending mild. Lab A is on or near target. Severity is graphically represented in Figure 8 (attached).

At this time, only TMC 78 is being assigned as TMC calibration oil. The panel is pursuing a replacement oil for TMC 77, which had been providing results significantly mild of target.

Engine Oil Filterability Test (EOFT), continued

TMC MEMORANDA

There were no technical memoranda 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 32 summarizes the reference tests reported to the TMC this period (3 labs reporting):

TABLE 32

	No. of Tests
Statistically Acceptable and Operationally Valid	101
Operationally Valid but Failed Acceptance Criteria	1
Aborted	1
Operationally Invalid	1
Total	**104**

Fail Rate of Operationally Valid Tests: 1.0%

Table 33 is a breakdown of the statistically unacceptable tests.

TABLE 33

Reason for Fail	No. of Tests
Average % Change in Flow Mild (Oil 77)	1

INDUSTRY PERFORMANCE

Table 34 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 34

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	-0.039
10/1/00 through 3/31/01	101	99	5.61	-0.173
4/1/01 through 9/30/01	123	121	6.28	0.047
10/1/01 through 3/31/02	88	86	6.12	-0.048
4/1/02 through 9/30/02	102	100	4.50	0.181

Table 35 shows the current severity for the Average % CIF parameter for each lab for all operationally valid tests for the report period.

TABLE 35

	n	Mean Δ/s
Lab A	54	-0.11
Lab B	19	0.24
Lab G	29	0.67

PRECISION AND SEVERITY

Precision has improved compared with the previous period and the target matrix. Severity trended slightly severe during the period. Severity is graphically represented in Figure 9 (attached). Lab G is trending severe, while labs B is trending mild. Lab A is on or near target.

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

STATUS

Table 36 summarizes the reference tests reported to the TMC this period (3 labs reporting):

TABLE 36

	No. of Tests
Statistically Acceptable and Operationally Valid	104
Operationally Valid but Failed Acceptance Criteria	1
Aborted, Lost Sample	1
Invalid, Technical Error	1
Total	**107**

Fail Rate of Operationally Valid Tests: 1.0%

Table 37 is a breakdown of the statistically unacceptable tests.

TABLE 37

Reason for Fail	No. of Tests
Average % Change in Flow Mild (Oil 77)	1

INDUSTRY PERFORMANCE

Table 38 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 38

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

Table 39 shows the current severity for the Average % CIF parameter for each lab for all operationally valid tests for the report period.

TABLE 39

	n	Mean Δ/s
Lab A	57	0.12
Lab B	19	-0.31
Lab G	29	0.89

PRECISION AND SEVERITY

Precision has improved when compared to the previous period and historical rates. Industry data is trending severe. Lab G is trending severe, while labs A is trending slightly severe and B is trending mild this period. Severity is graphically represented in Figure 10 (attached).

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

STATUS

Table 40 summarizes the reference tests reported to the TMC this period (3 labs reporting):

TABLE 40

	No. of Tests
Statistically Acceptable and Operationally Valid	103
Operationally Valid but Failed Acceptance Criteria	0
Operationally Invalid	1
Aborted	1
Total	**105**

Fail Rate of Operationally Valid Tests: 0.0%

INDUSTRY PERFORMANCE

Table 41 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 41

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

Table 42 shows the current severity for the Average % CIF parameter for each lab for all operationally valid tests for the report period.

TABLE 42

	n	Mean Δ/s
Lab A	55	-0.01
Lab B	19	0.89
Lab G	29	0.53

PRECISION AND SEVERITY

Precision for this period has improved when compared to the previous period and has also improved when compared to the target estimates. Severity was on or near target for the period. Labs B and G trended severe for the period, while lab A was on or near target for the period. Severity is graphically represented in Figure 11 (attached).

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

STATUS

Table 43 summarizes the reference tests reported to the TMC this period (3 labs reporting):

TABLE 43

	No. of Tests
Statistically Acceptable and Operationally Valid	104
Operationally Valid but Failed Acceptance Criteria	4
Operationally Invalid	1
Total	**109**

Fail Rate of Operationally Valid Tests: 3.9%

Table 44 is a breakdown of the statistically unacceptable tests.

TABLE 44

Reason for Fail	No. of Tests
Average % Change in Flow Severe (Oil 78)	3
Average % Change in Flow Severe (Oil 77)	1

INDUSTRY PERFORMANCE

Table 45 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 45

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

Table 46 shows the current severity for the Average % CIF parameter for each lab for all operationally valid tests for the report period.

TABLE 46

	n	Mean Δ/s
Lab A	60	0.47
Lab B	19	0.18
Lab G	29	0.97

PRECISION AND SEVERITY

Precision has improved 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.

REFERENCE OIL SUPPLIES

There is adequate supply of PCEOCP Bench Test reference oils on hand at the TMC. Table 47 lists the PCEOCP bench test reference oils currently on hand at the TMC.

Table 47

Oil	For Tests	Quantity Left (gallons)	Quantity Used Last 12 Months (gallons)
5A-3	BRT	1787.2	0.6
51	D5480, GI	94.6	0.0
52	D5480, D6417, GI	71.6	16.9
53	D5480, GI	97.0	0.1
54	D5480	97.8	0.0
55	D6417, D5480, D5800	76.2	16.9
^57	Volatility Candidate	51.2	0.0
58	D6417, D5800, GI	129.4	17.0
62	GI	2.2	0.1
^66	D6082 Candidate	107.5	0.5
71	TEOST	5.4	0.4
72	TEOST	4.7	0.3
74	MTEOS	2.4	0.4
77	EOFT, EOWT	184.3	29.0
78	EOFT, EOWT	151.4	42.5
^80	BRT	26.5	0.0
81	BRT	19.6	1.2
**432	MTEOS	Adequate	-----
**433	MTEOS	Adequate	-----
^*1002	D6082	51.3	-----
*1006	BRT, MTEOS	45.4	-----
*1007	FOAM	11.3	-----

^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

Shipping aliquots are:

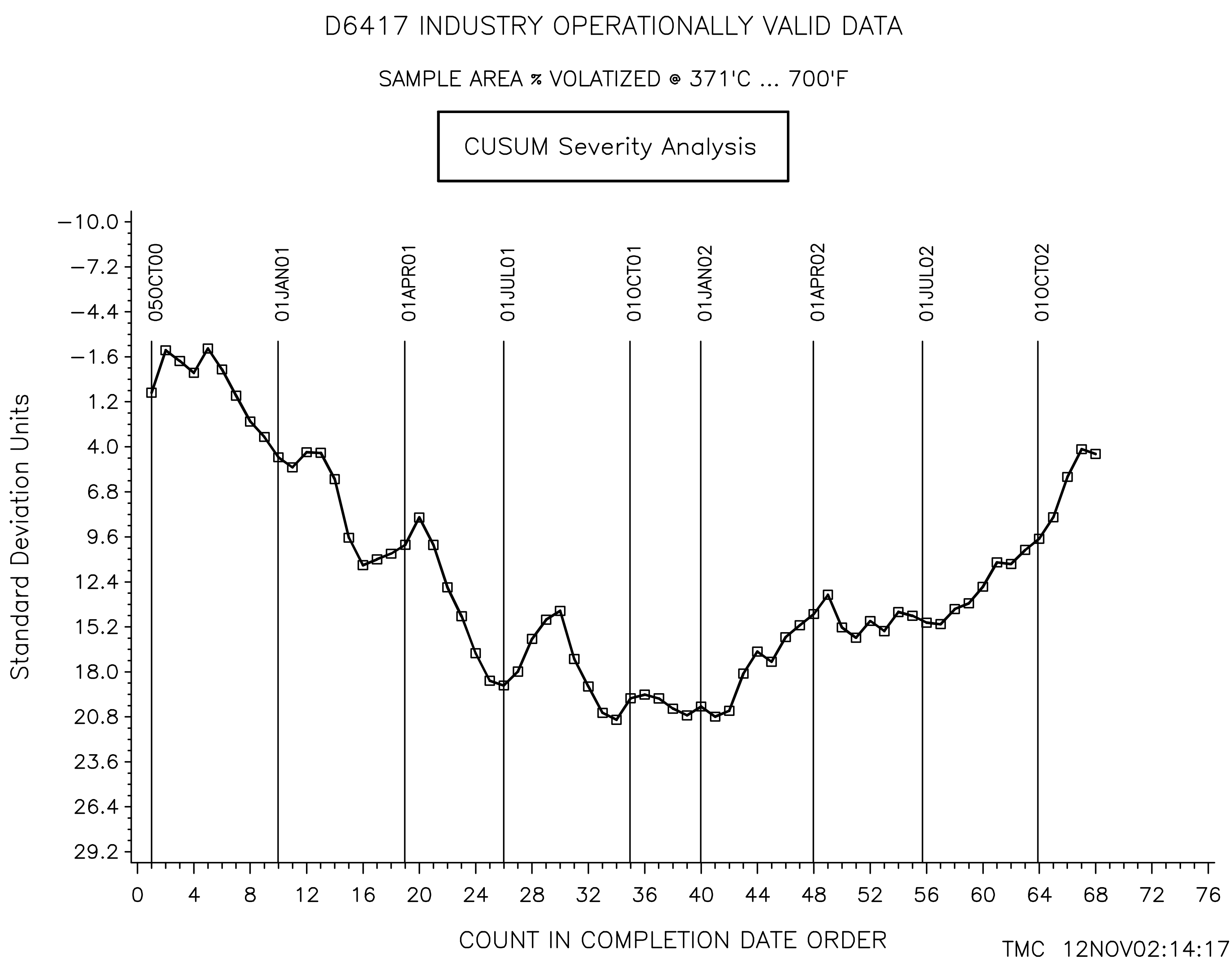
D6417	1 ml
D5480	4 ml
D5800	100 ml
GI	25 ml
MTEOS	17 ml
TEOST	125 ml
D6082	525 ml
EOFT	290 ml
EOWT	290 ml
BRT	30 ml

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 and data dictionaries and data from various matrix programs (like test development and reference oil selection 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 forms and data dictionaries. The TMC’s web site address is http://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. If your lab should require additional information on this type of data reporting, please contact Tom Schofield at (412) 365-1011 or Rich Grundza at (412) 365-1031.

Figure 1



D6417 INDUSTRY OPERATIONALLY VALID DATA
SAMPLE AREA % VOLATIZED @ 371'C ... 700'F
CUSUM Severity Analysis
Standard Deviation Units
−10.0
−7.2
−4.4
−1.6
1.2
4.0
6.8
9.6
12.4
15.2
18.0
20.8
23.6
26.4
29.2
05OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
01OCT02
0
4
8
12
16
20
24
28
32
36
40
44
48
52
56
60
64
68
72
76
COUNT IN COMPLETION DATE ORDER
TMC 12NOV02:14:17

Figure 2A

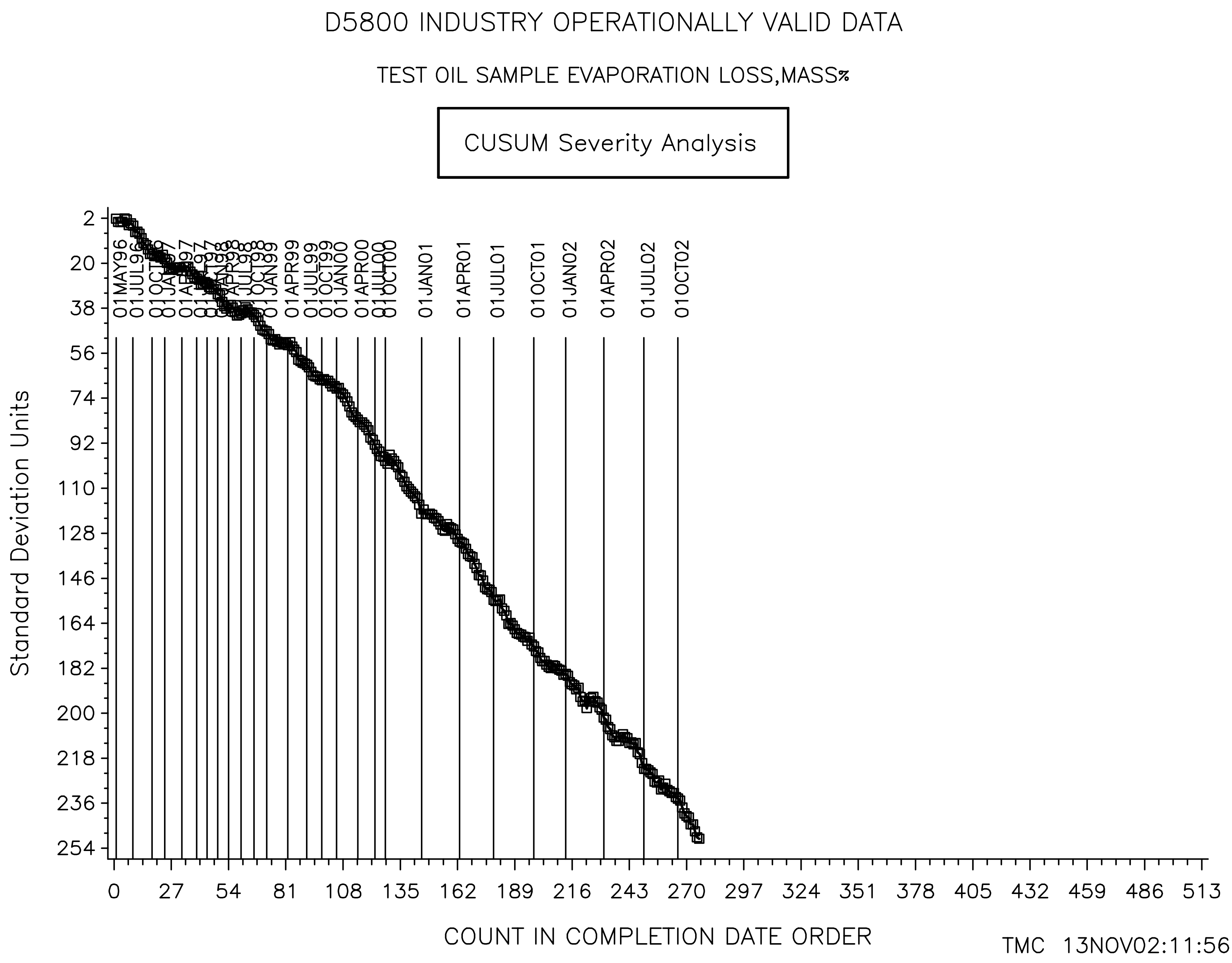
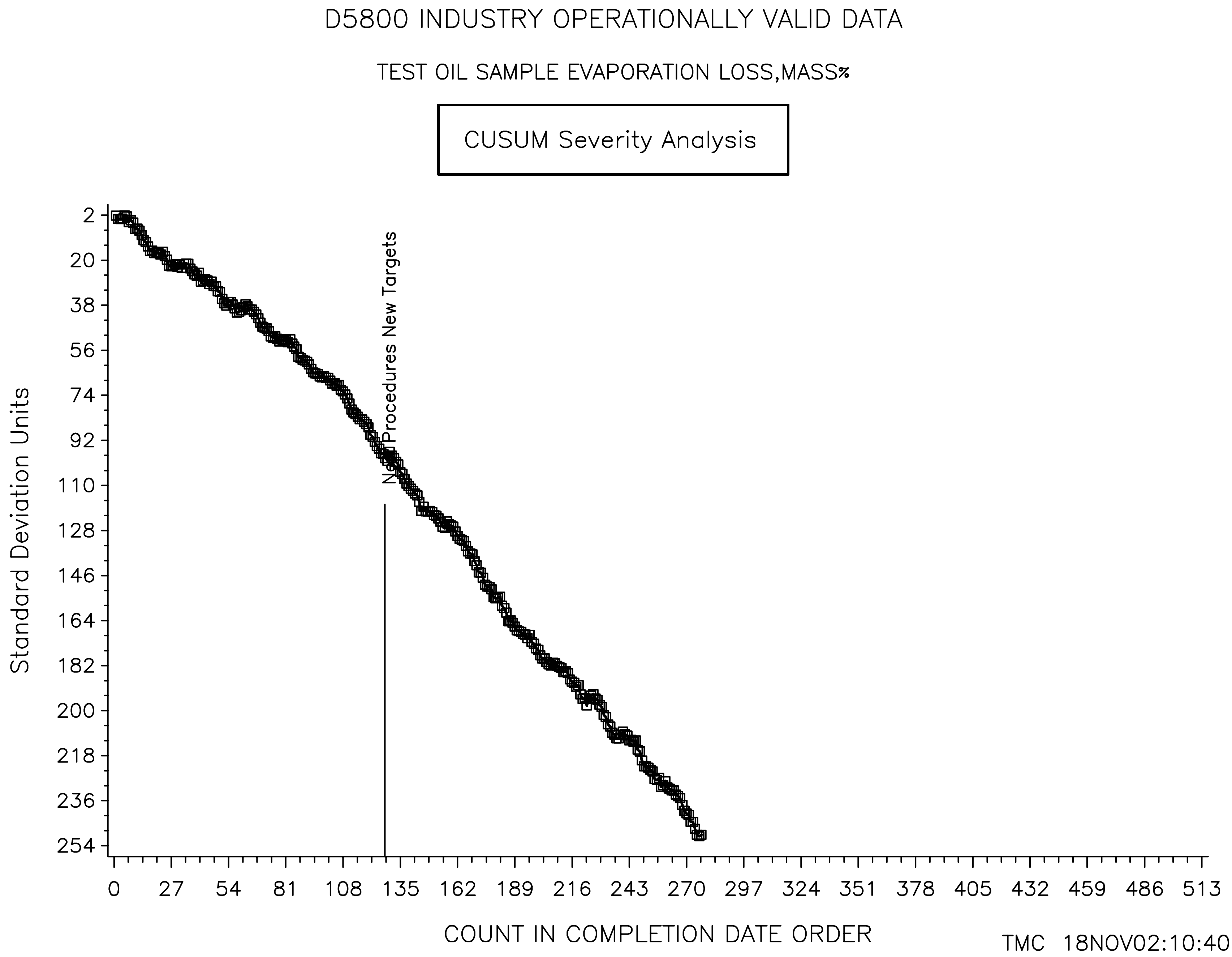

D5800 INDUSTRY OPERATIONALLY VALID DATA
TEST OIL SAMPLE EVAPORATION LOSS,MASS%
CUSUM Severity Analysis
Standard Deviation Units
2
20
38
56
74
92
110
128
146
164
182
200
218
236
254
01MAY96
01JUL96
01APR99
01JUL99
01OCT99
01JAN00
01APR00
01OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
01OCT02
0
27
54
81
108
135
162
189
216
243
270
297
324
351
378
405
432
459
486
513
COUNT IN COMPLETION DATE ORDER
TMC 13NOV02:11:56

Figure 2B


D5800 INDUSTRY OPERATIONALLY VALID DATA
TEST OIL SAMPLE EVAPORATION LOSS,MASS%
CUSUM Severity Analysis
Standard Deviation Units
2
20
38
56
74
92
110
128
146
164
182
200
218
236
254
New Procedures New Targets
0
27
54
81
108
135
162
189
216
243
270
297
324
351
378
405
432
459
486
513
COUNT IN COMPLETION DATE ORDER
TMC 18NOV02:10:40

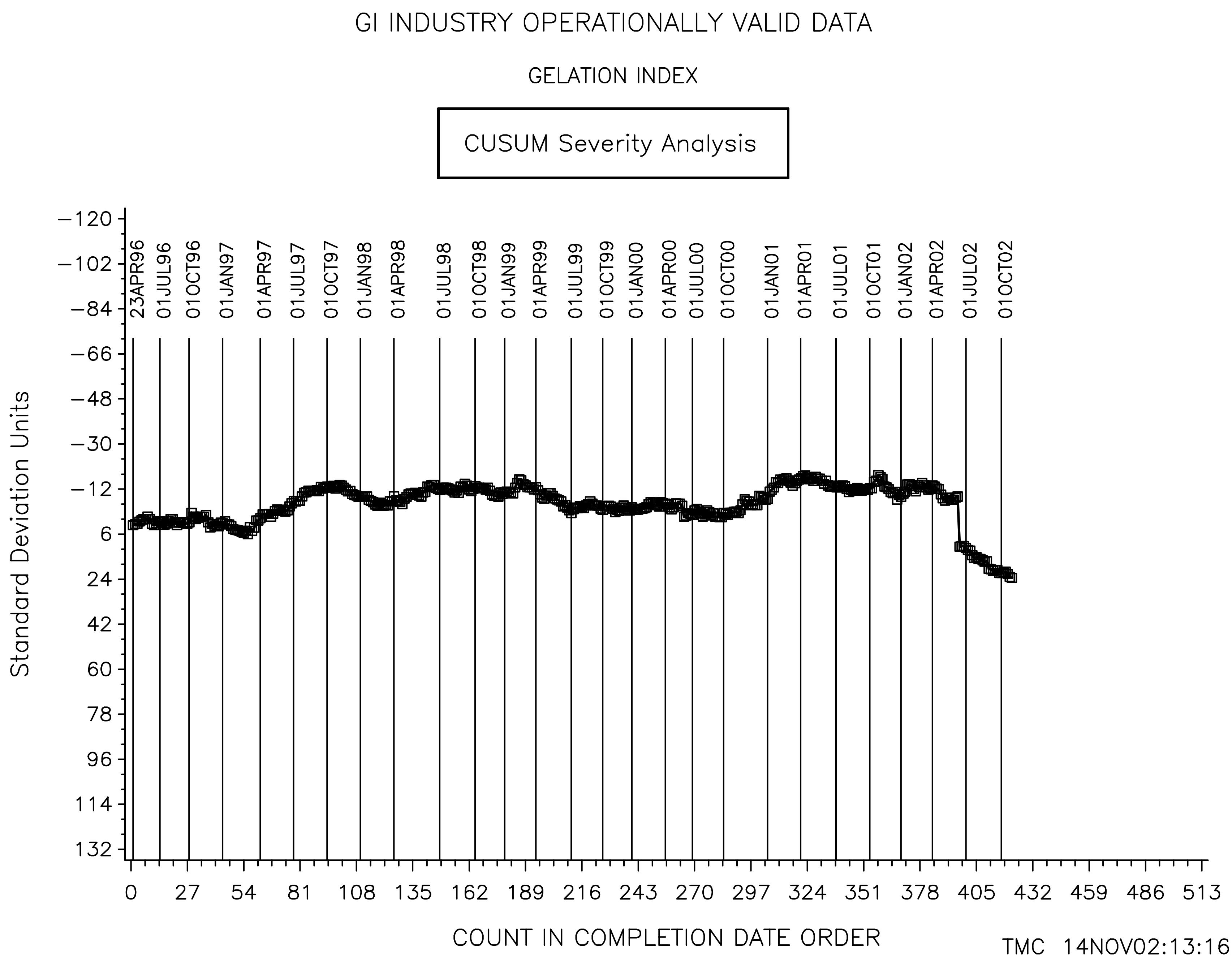
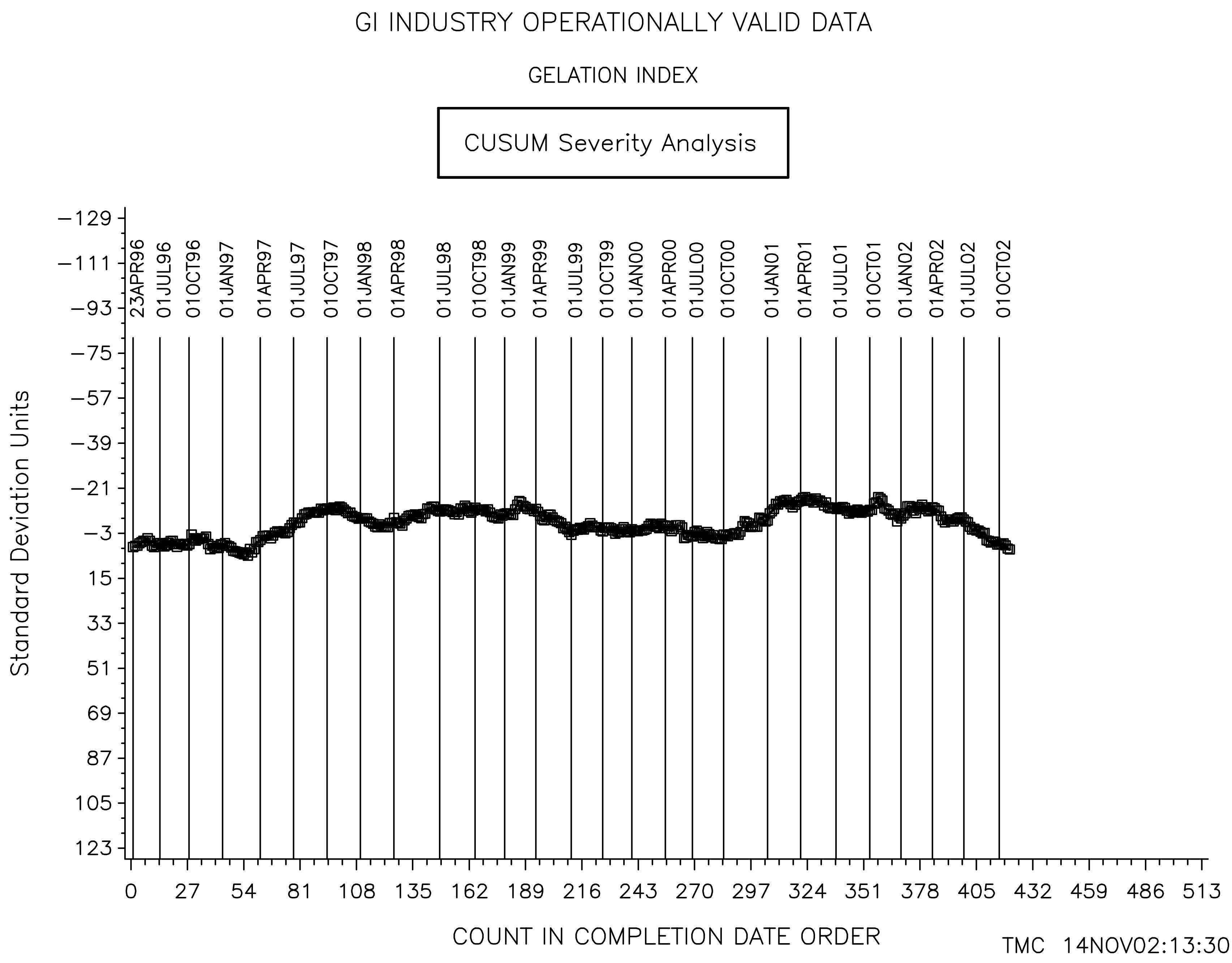
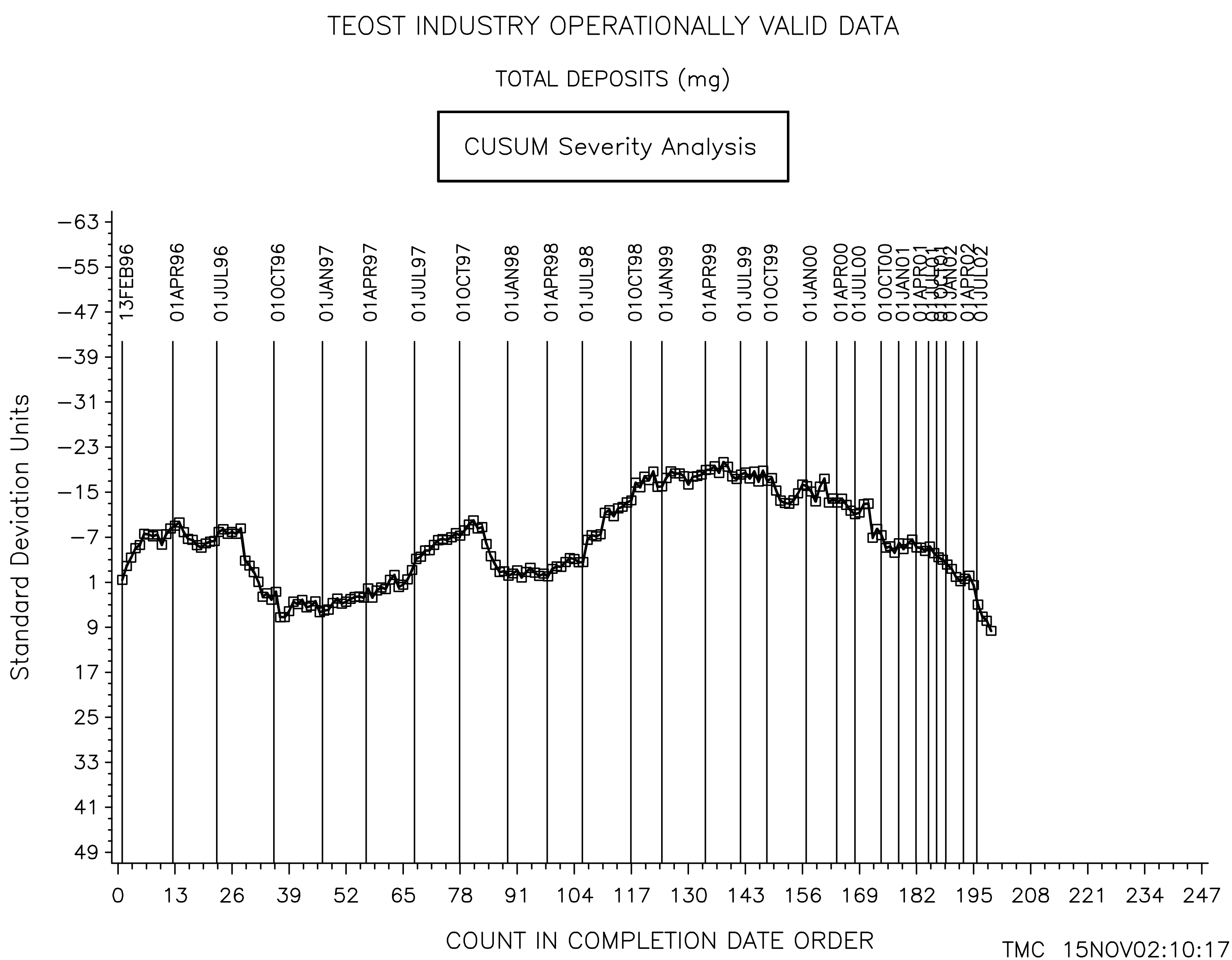

GI INDUSTRY OPERATIONALLY VALID DATA
GELATION INDEX
CUSUM Severity Analysis
Standard Deviation Units
−120
−102
−84
−66
−48
−30
−12
6
24
42
60
78
96
114
132
23APR96
01JUL96
01OCT96
01JAN97
01APR97
01JUL97
01OCT97
01JAN98
01APR98
01JUL98
01OCT98
01JAN99
01APR99
01JUL99
01OCT99
01JAN00
01APR00
01JUL00
01OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
01OCT02
0
27
54
81
108
135
162
189
216
243
270
297
324
351
378
405
432
459
486
513
COUNT IN COMPLETION DATE ORDER
TMC 14NOV02:13:16

Figure 3B



GI INDUSTRY OPERATIONALLY VALID DATA
GELATION INDEX
CUSUM Severity Analysis
Standard Deviation Units
−129
−111
−93
−75
−57
−39
−21
−3
15
33
51
69
87
105
123
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
0 27 54 81 108 135 162 189 216 243 270 297 324 351 378 405 432 459 486 513
COUNT IN COMPLETION DATE ORDER
TMC 14NOV02:13:30

Figure 4



TEOST INDUSTRY OPERATIONALLY VALID DATA
TOTAL DEPOSITS (mg)
CUSUM Severity Analysis
Standard Deviation Units
-63
-55
-47
-39
-31
-23
-15
-7
1
9
17
25
33
41
49
13FEB96
01APR96
01JUL96
01OCT96
01JAN97
01APR97
01JUL97
01OCT97
01JAN98
01APR98
01JUL98
01OCT98
01JAN99
01APR99
01JUL99
01OCT99
01JAN00
01APR00
01JUL00
01OCT00
01JAN01
01APR01
01APR02
01JUL02
0
13
26
39
52
65
78
91
104
117
130
143
156
169
182
195
208
221
234
247
COUNT IN COMPLETION DATE ORDER
TMC 15NOV02:10:17

Figure 5

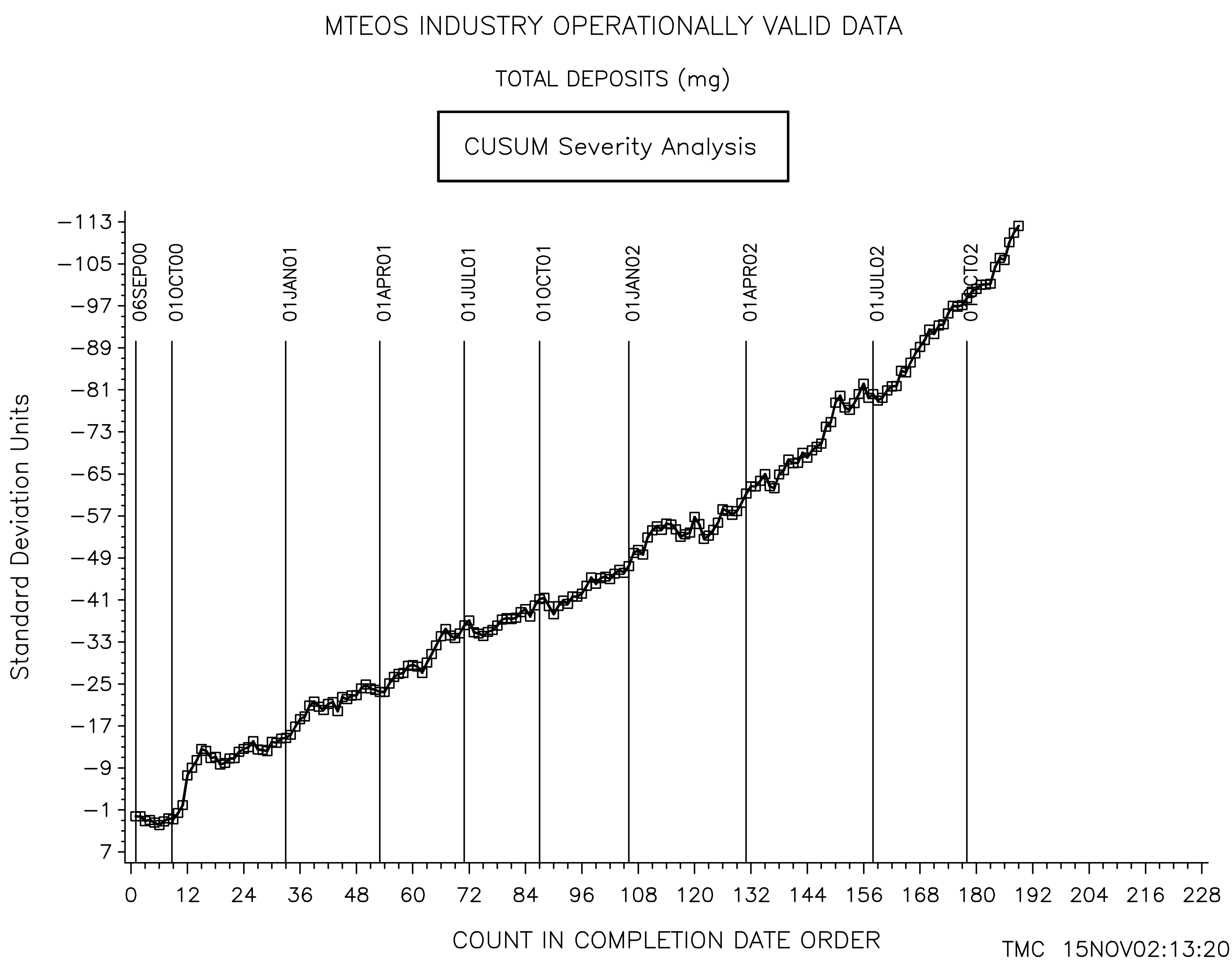
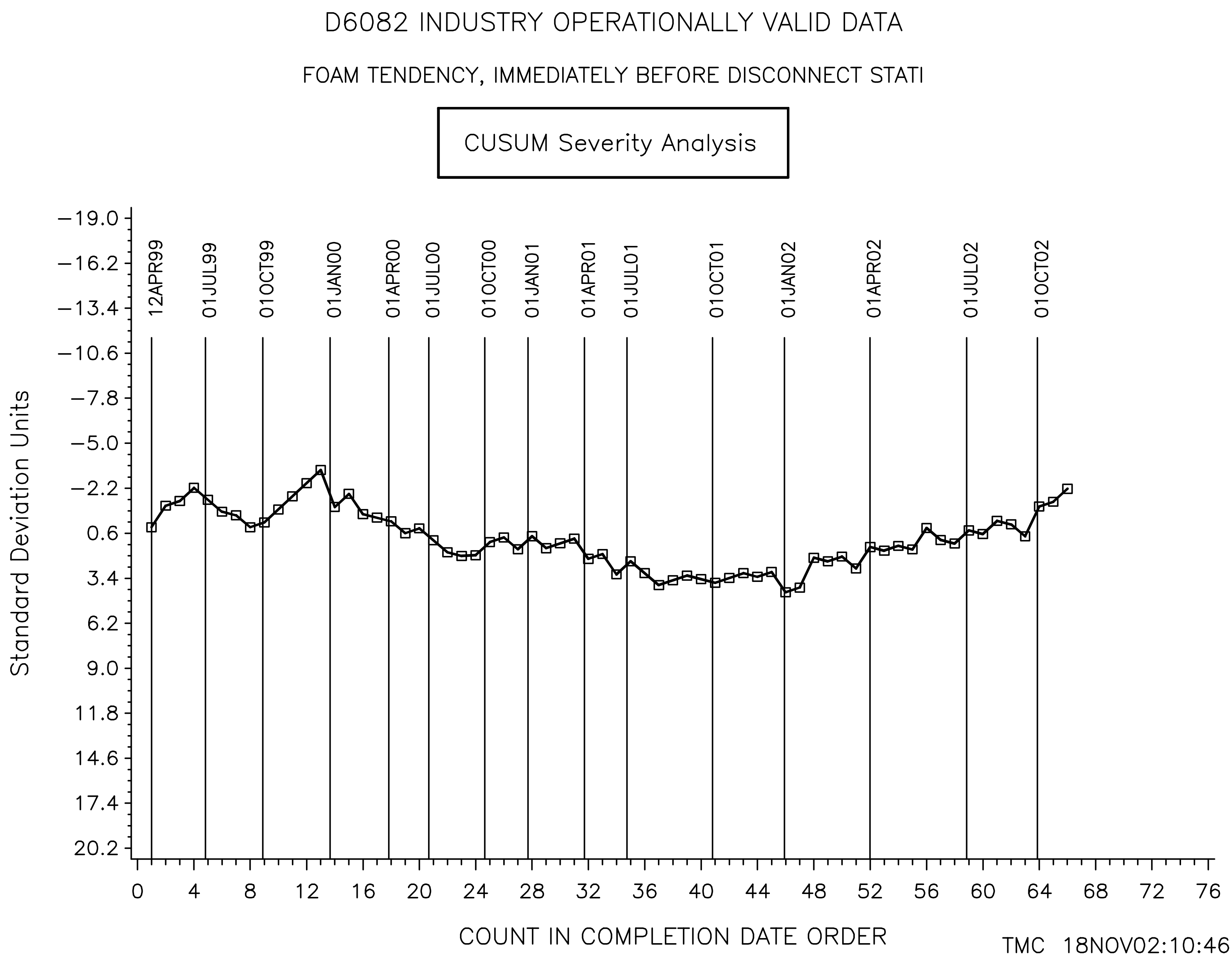
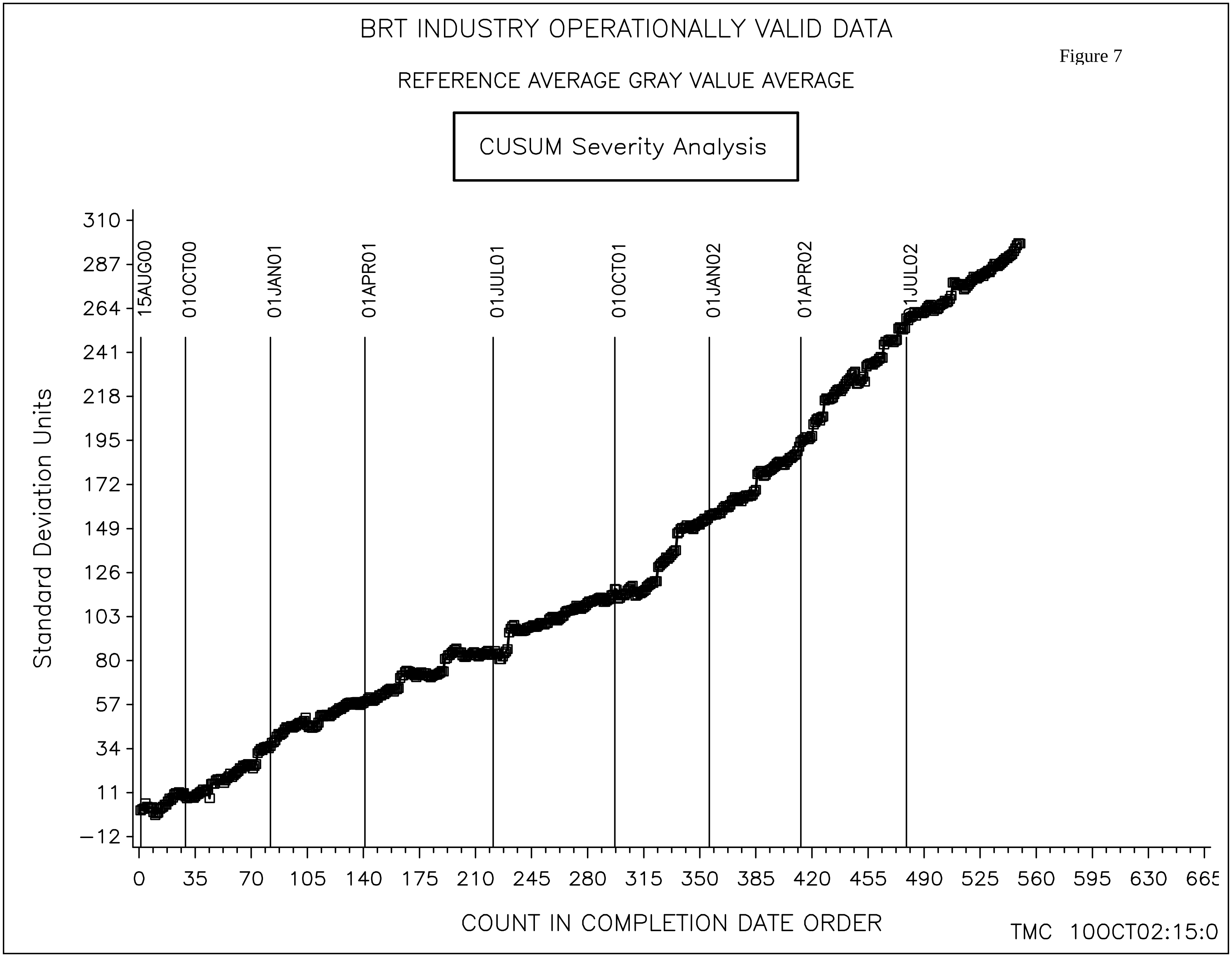

MTEOS INDUSTRY OPERATIONALLY VALID DATA
TOTAL DEPOSITS (mg)
CUSUM Severity Analysis
Standard Deviation Units
-113
-105
-97
-89
-81
-73
-65
-57
-49
-41
-33
-25
-17
-9
-1
7
06SEP00
01OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
01OCT02
0
12
24
36
48
60
72
84
96
108
120
132
144
156
168
180
192
204
216
228
COUNT IN COMPLETION DATE ORDER
TMC 15NOV02:13:20

Figure 6



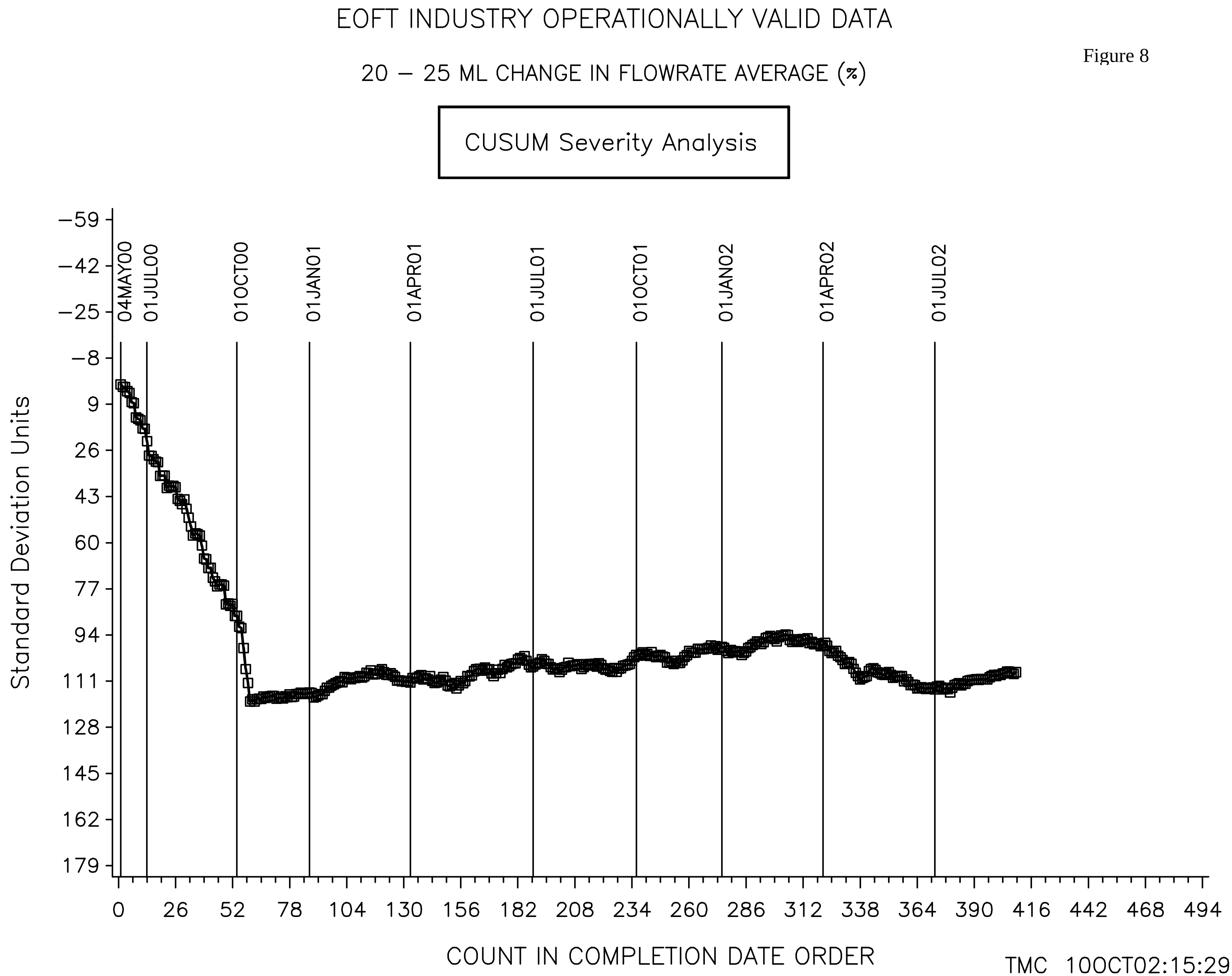
D6082 INDUSTRY OPERATIONALLY VALID DATA
FOAM TENDENCY, IMMEDIATELY BEFORE DISCONNECT STATI
CUSUM Severity Analysis
Standard Deviation Units
-19.0
-16.2
-13.4
-10.6
-7.8
-5.0
-2.2
0.6
3.4
6.2
9.0
11.8
14.6
17.4
20.2
12APR99
01JUL99
01OCT99
01JAN00
01APR00
01JUL00
01OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
01OCT02
0
4
8
12
16
20
24
28
32
36
40
44
48
52
56
60
64
68
72
76
COUNT IN COMPLETION DATE ORDER
TMC 18NOV02:10:46

Figure 7



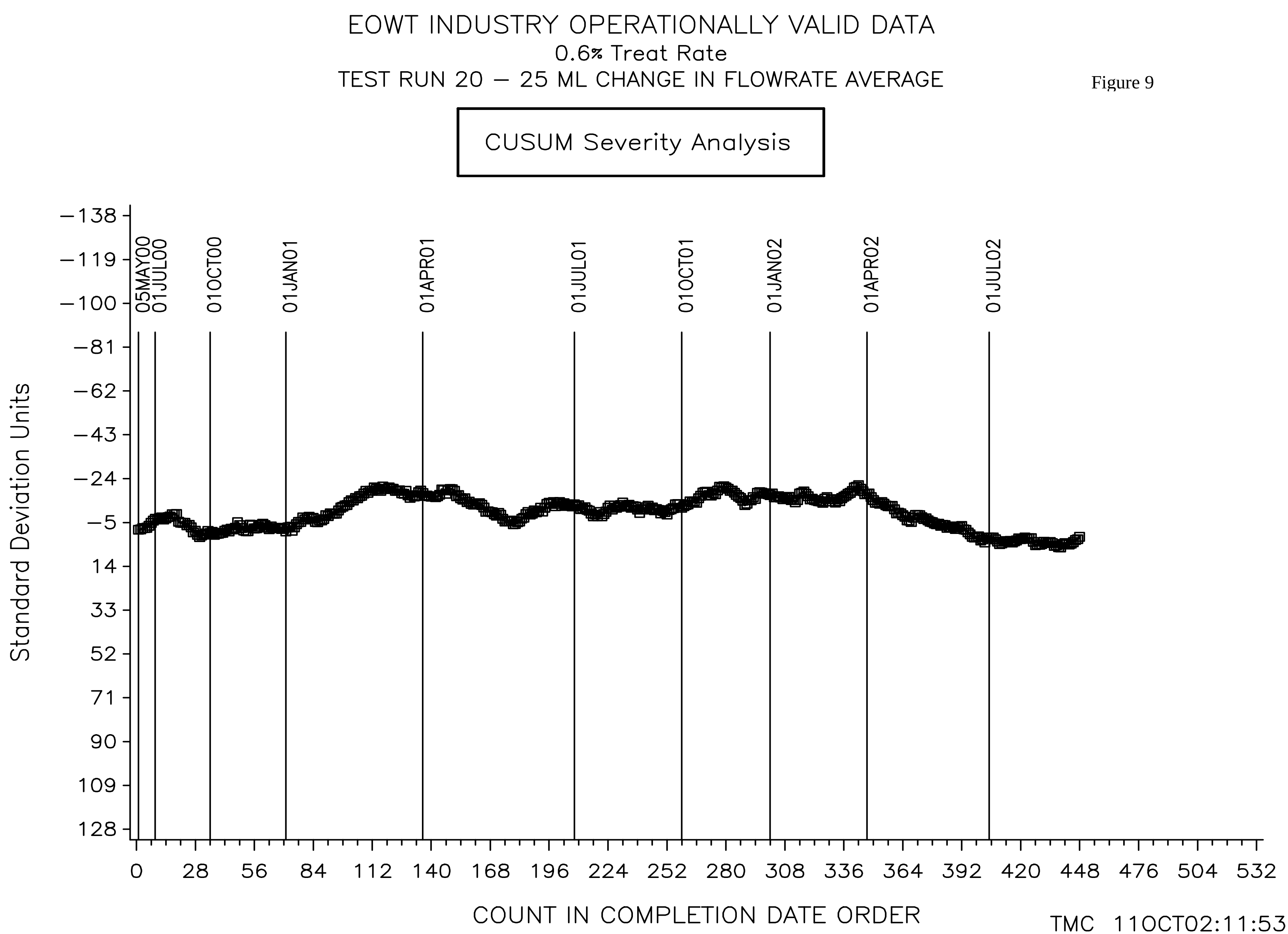
BRT INDUSTRY OPERATIONALLY VALID DATA
REFERENCE AVERAGE GRAY VALUE AVERAGE
CUSUM Severity Analysis
Standard Deviation Units
310
287
264
241
218
195
172
149
126
103
80
57
34
11
−12
15AUG00
01OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
0
35
70
105
140
175
210
245
280
315
350
385
420
455
490
525
560
595
630
665
COUNT IN COMPLETION DATE ORDER
TMC 10OCT02:15:0

Figure 8



EOFT INDUSTRY OPERATIONALLY VALID DATA
20 – 25 ML CHANGE IN FLOWRATE AVERAGE (%)
CUSUM Severity Analysis
Standard Deviation Units
-59
-42
-25
-8
9
26
43
60
77
94
111
128
145
162
179
04MAY00
01JUL00
01OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
0
26
52
78
104
130
156
182
208
234
260
286
312
338
364
390
416
442
468
494
COUNT IN COMPLETION DATE ORDER
TMC 10OCT02:15:29

Figure 9

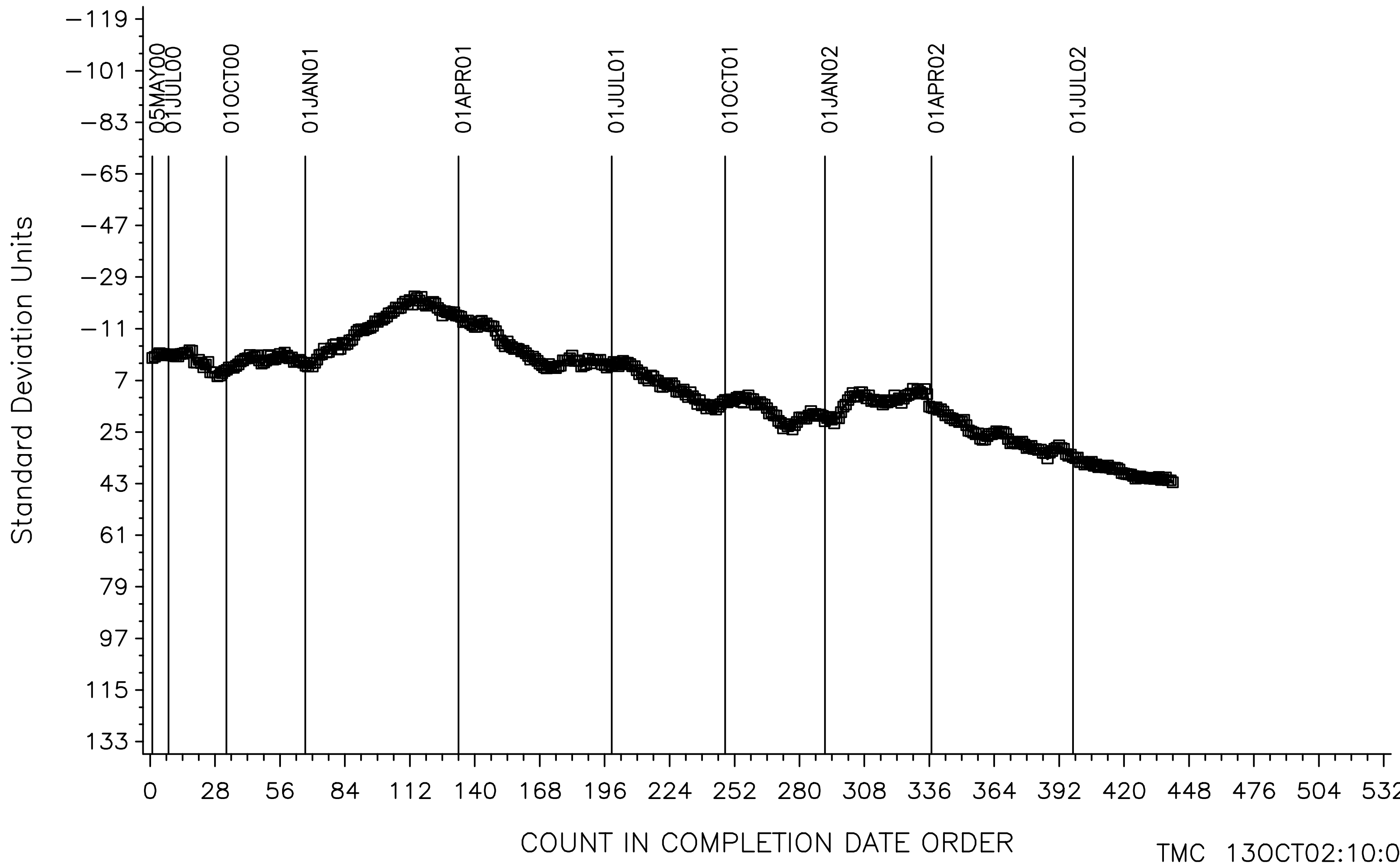


EOWT INDUSTRY OPERATIONALLY VALID DATA
0.6% Treat Rate
TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE
CUSUM Severity Analysis
Standard Deviation Units
−138
−119
−100
−81
−62
−43
−24
−5
14
33
52
71
90
109
128
05MAY00
01JUL00
01OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
0
28
56
84
112
140
168
196
224
252
280
308
336
364
392
420
448
476
504
532
COUNT IN COMPLETION DATE ORDER
TMC 11OCT02:11:53

Figure 10

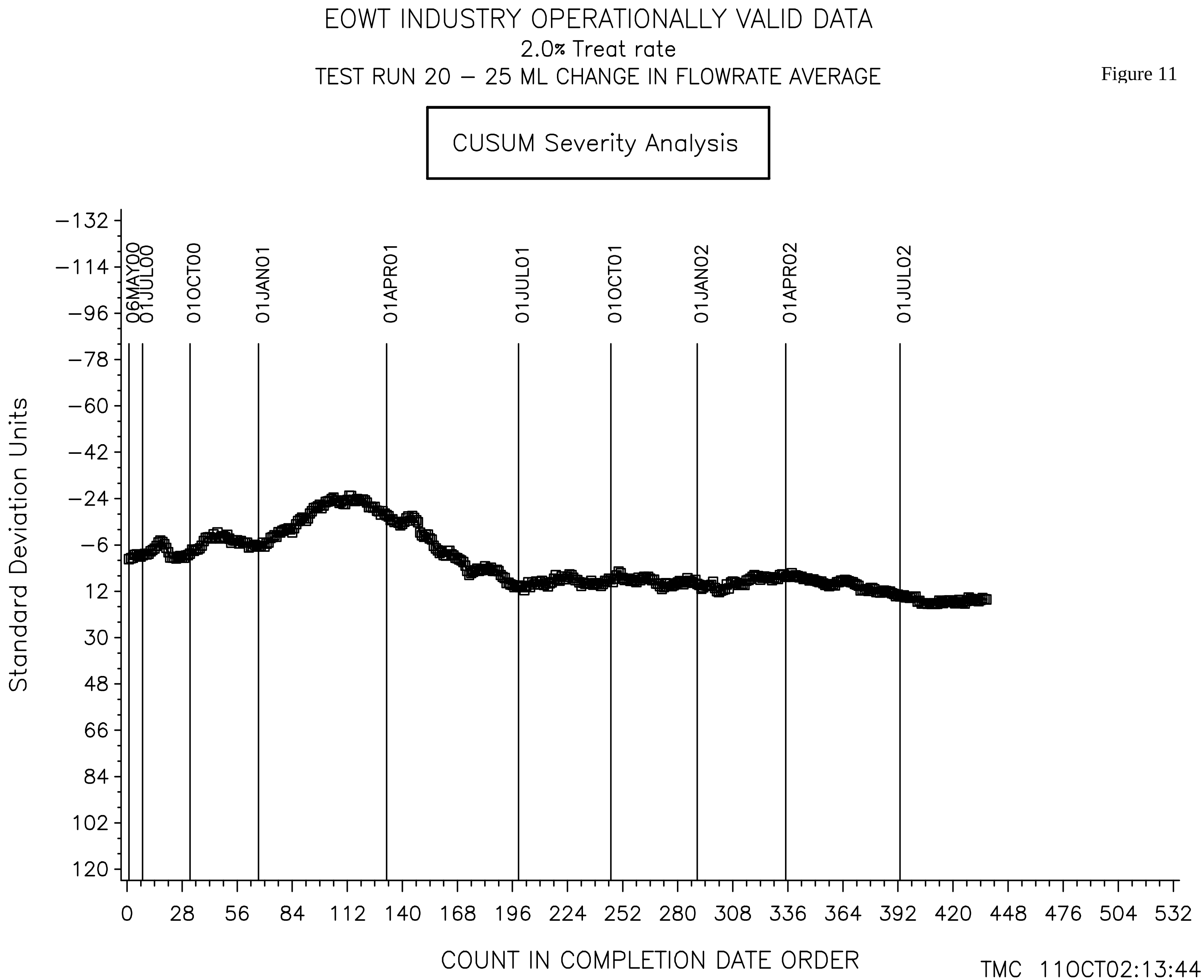
EOWT INDUSTRY OPERATIONALLY VALID DATA
1.0% Treat Rate
TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE

CUSUM Severity Analysis



TMC 13OCT02:10:09

Figure 11

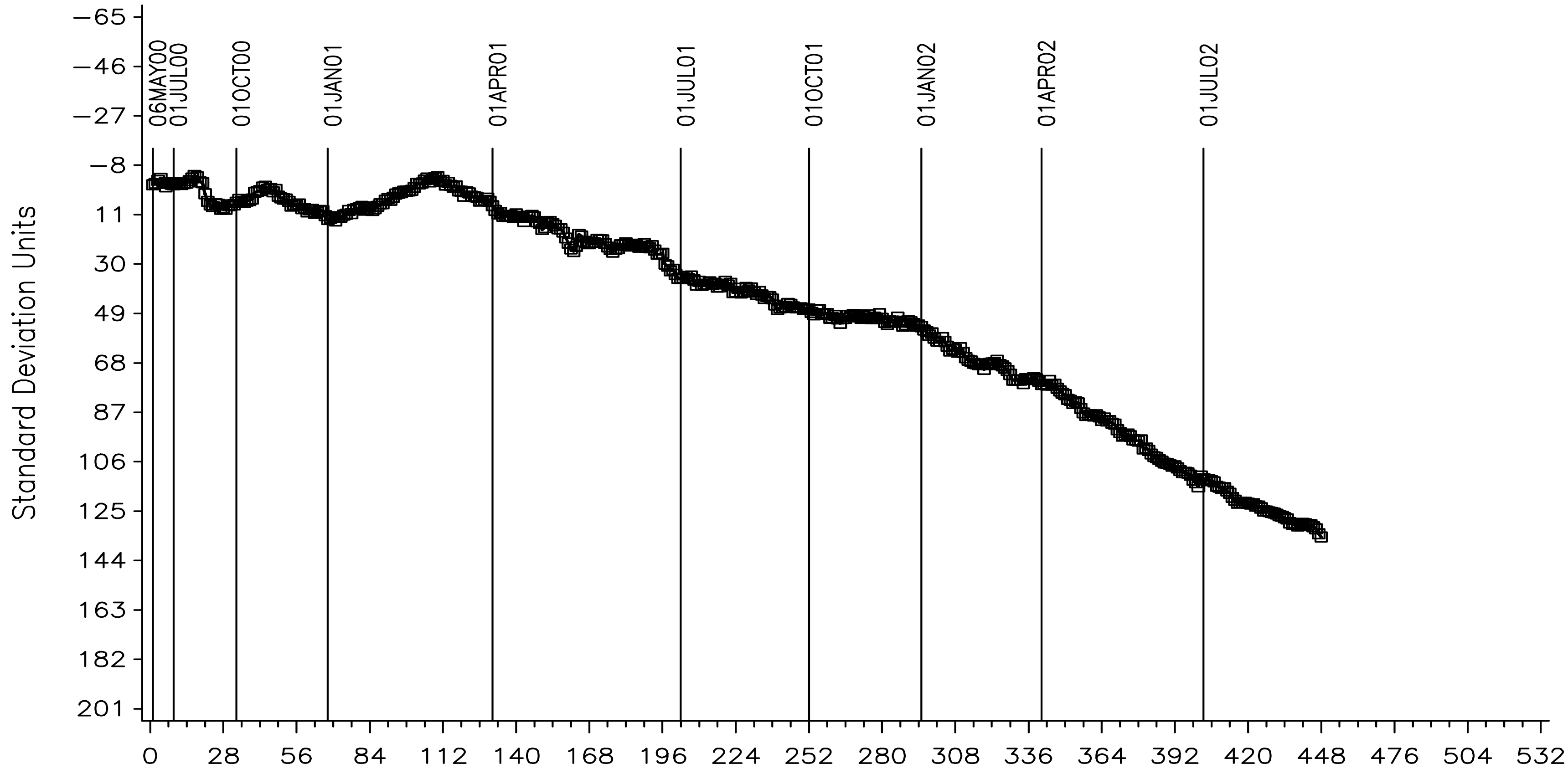


EOWT INDUSTRY OPERATIONALLY VALID DATA
2.0% Treat rate
TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE
CUSUM Severity Analysis
Standard Deviation Units
−132
−114
−96
−78
−60
−42
−24
−6
12
30
48
66
84
102
120
06MAY00
01JUL00
01OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
0
28
56
84
112
140
168
196
224
252
280
308
336
364
392
420
448
476
504
532
COUNT IN COMPLETION DATE ORDER
TMC 11OCT02:13:44

Figure 12

EOWT INDUSTRY OPERATIONALLY VALID DATA
3.0 Treat Rate
TEST RUN 20 — 25 ML CHANGE IN FLOWRATE AVERAGE

CUSUM Severity Analysis



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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**
VGC by	51	area % volatility loss	48	13.07	0.66	11.8	14.4
D2887	52	area % volatility loss	48	6.88	0.43	6.0	7.7
Extended	53	area % volatility loss	48	17.92	0.76	16.4	19.4
	54	area % volatility loss	48	19.16	0.87	17.5	20.9
	55	area % volatility loss	48	11.56	0.71	10.2	13.0
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
VGC by	51	mass % volatility loss	10	11.85	0.47	10.9	12.8
D5480	52	mass % volatility loss	11	6.22	0.23	5.8	6.7
(New Targets	53	mass % volatility loss	10	16.74	0.66	15.4	18.0
Effective	54	mass % volatility loss	10	17.89	0.68	16.6	19.2
12/7/1999)	55	mass % volatility loss	11	10.71	0.29	10.1	11.3
D5800	52	mass % volatility loss	59	13.61	0.49	12.6	14.6
New Targets	55	mass % volatility loss	60	16.39	0.66	15.1	17.7
9/26/00	58	mass % volatility loss	59	14.46	0.52	13.4	15.5
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
6/1/01	1006	Total Deposit wt. (mg)	24	34.53	5.93	22.9	46.2
	~~51~~	~~Gelation Index~~	~~35~~	~~63.3~~	~~12.01~~	~~39.8~~	~~86.8~~
GI by	52	Gelation Index	35	4.5	0.24	4.0	5.0
D5133	53	Gelation Index	37	44.7	4.64	35.6	53.8
	~~55~~	~~Gelation Index~~	~~36~~	~~22.3~~	~~4.84~~	~~12.8~~	~~31.8~~
	58	Gelation Index	17	5.8	0.69	4.4	7.2
	62	Gelation Index	35	17.0	3.90	9.4	24.6
~~D6082~~	~~1002~~	~~Tendency (ml)~~	~~32~~	~~410.63~~	~~58.78~~	~~295~~	~~526~~
~~(HT FOAM)~~	~~1002~~	~~Stability (ml)~~	~~32~~	~~37.81~~	~~45.41~~	~~0~~	~~127~~
D6082	1007	Tendency (ml)	28	65.71	19.28	28	103
(HT FOAM)	1007	Stability (ml)	28	0.00	0.00	0	0
BRT by	81	Average AGV	12	112	14.00	85	140
D02-1483	1006	Average AGV	12	128	7.21	114	142
(D6557)	5A-3	Average AGV	12	76	6.47	63	89
EOFT by	77	Δ Flowrate (%)	12	-45.55	4.36	-54.10	-37.00
(Draft 6)	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
(Draft 5)	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 n	Targets Mean	Targets sR	4/1/01 - 9/30/01 n	4/1/01 - 9/30/01 Mean	4/1/01 - 9/30/01 sR	10/1/01 - 3/31/01 n	10/1/01 - 3/31/01 Mean	10/1/01 - 3/31/01 sR	10/1/01 - 3/31/01 Mean Δ/s	4/1/02 - 9/30/02 n	4/1/02 - 9/30/02 Mean	4/1/02 - 9/30/02 sR	4/1/02 - 9/30/02 Mean Δ/s
D6417	52	Area % Volatized	18	6.97	0.31	8	7.2	0.49	3	6.9	0.15	-0.12	7	6.9	0.38	-0.36
	55	Area % Volatized	18	11.68	0.51	2	12.2	0.49	6	11.2	0.57	-0.84	5	11.7	0.33	0.00
	58	Area % Volatized	18	5.61	0.30	6	5.8	0.61	4	5.6	0.29	-0.12	4	5.4	0.24	-0.53
D5800	52	% volatility loss	59	13.61	0.49	12	14.0	0.60	11	13.8	0.60	0.48	10	13.7	0.73	0.10
**	55	% volatility loss	60	16.39	0.66	10	17.1	0.54	9	16.6	0.58	0.34	14	17.3	0.85	1.42
	58	% volatility loss	59	14.46	0.52	13	15.4	0.67	13	15.2	0.75	1.36	11	15.1	0.76	1.28
TEOST	71	Deposit wt. (mg)	27	51.79	4.79	2	50.0	2.83	3	55.6	0.29	0.79	5	61.2	4.71	1.96
(D6335)	72	Deposit wt. (mg)	27	26.72	3.46	3	30.4	1.50	3	29.8	1.84	0.88	2	25.0	0.28	-0.50
MTEOS	1006	Deposit wt. (mg)	24	34.53	5.93	5	35.7	8.97	14	36.1	5.11	0.26	7	31.8	6.32	-0.46
***	432	Deposit wt. (mg)	18	50.13	4.88	8	46.8	6.26	11	46.9	5.98	-0.67	16	42.5	7.05	-1.56
	433	Deposit wt. (mg)	18	50.28	5.26	11	46.2	4.91	12	46.5	9.18	-0.72	11	48.3	8.31	-0.37
	74	Deposit wt. (mg)	20	16.84	5.28	10	15.1	3.43	7	11.5	4.01	-1.01	13	14.7	4.80	-0.41
GI	52	Gelation Index	35	4.5	0.24	12	4.4	0.15	4	4.3	0.13	-1.04	8	4.4	0.12	-0.36
(D5133)	53	Gelation Index	37	44.7	4.64	10	48.1	3.43	7	47.6	5.90	0.63	9	49.9	3.12	1.13
****	58	Gelation Index	17	5.8	0.69	-----	-----	-----	9	5.9	1.18	0.11	8	6.4	0.66	0.80
	62	Gelation Index	35	17.0	3.90	7	18.4	2.67	10	16.3	6.41	-0.19	7	17.2	2.85	0.04
D6082	1007	Tendency (ml)	28	65.71	19.28	9	71.1	14.53	11	64.5	15.08	-0.06	12	62.5	14.22	-0.17

**D5800 Targets Adjusted 10/2/00; new oils selected; new procedures approved

***MTEOS Targets Adjusted 6/1/01 per direction of TEOST Surveillance Panel (based on completed Matrix 6 data)

****GI Added new 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)

Oil Code	Parameter	Targets			4/1/00 - 9/30/00			10/1/00 - 3/31/01			4/1/01 - 9/30/01			10/1/01 - 3/31/02			4/1/02 - 9/30/02		
		n	Mean	sR	n	Mean	sR	n	Mean	sR	n	Mean	sR	n	Mean	sR	n	Mean	sR
1006	Average AGV	12	128	7.21	7	123.1	5.30	26	123.7	6.79	39	124.4	5.77	29	125.0	5.19	30	123.0	9.11
5A-3	Average AGV	12	76	6.47	7	82.0	12.03	31	81.6	13.72	38	83.4	12.60	28	87.6	15.69	38	89.7	15.52
81	Average AGV	12	112	14.00	14	121.0	11.50	55	121.0	6.06	79	117.8	7.99	59	121.2	13.22	70	121.3	9.38
77	Avg. % CF	12	-45.55	4.36	26	-32.4	8.56	5	-18.5	7.03	0	-----	-----	0	-----	-----	0	-----	-----
78	Avg. % CF	12	15.74	6.87	27	17.9	6.24	74	15.1	4.64	103	15.2	6.67	84	15.3	5.67	89	16.5	5.39
77	0.6 H2O Avg. %CF	12	-24.90	5.68	18	-25.6	6.19	53	-23.8	4.71	63	-24.8	5.64	47	-24.6	5.45	61	-24.5	4.15
77	1.0 H2O Avg. %CF	12	-17.94	5.45	15	-17.4	6.72	45	-17.8	5.25	59	-16.3	5.71	41	-17.3	6.70	52	-16.4	4.17
77	2.0 H2O Avg. %CF	12	-17.96	8.47	17	-18.1	6.26	50	-17.0	6.72	56	-16.1	6.25	47	-17.9	5.34	47	-16.7	3.87
77	3.0 H2O Avg. %CF	12	-18.23	6.83	16	-21.7	4.96	48	-18.4	6.19	60	-17.7	6.44	46	-17.0	5.46	50	-16.9	5.70
78	0.6 H2O Avg. %CF	12	10.87	6.16	16	11.2	6.32	48	8.6	6.46	60	11.4	6.90	41	9.9	6.80	41	13.0	5.00
78	1.0 H2O Avg. %CF	12	7.54	6.15	17	8.4	7.21	54	5.3	6.30	56	8.9	5.87	48	7.1	7.61	52	8.9	4.42
78	2.0 H2O Avg. %CF	12	5.17	5.33	14	4.5	4.74	50	2.8	5.75	58	6.4	6.85	42	4.9	6.18	56	5.4	3.67
78	3.0 H2O Avg. %CF	12	-0.54	4.52	16	3.8	6.37	50	-0.6	5.22	62	2.2	6.48	43	1.5	6.18	58	3.4	3.59