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

MEMORANDUM: 03-097

DATE: November 12, 2003

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

FROM: Thomas Schofield & Richard Grundza

SUBJECT: TMC Bench Reference Test Monitoring from April 1, 2003 through September 30, 2003

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 all 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/mem03-097.pdf

Distribution: Email

Attachment 1

ASTM Test Monitoring Center

Semiannual Report

ASTM D02.B07 Bench Reference Test Monitoring
From April 1, 2003 through September 30, 2003

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	0
Operationally Invalid (initially reported as)	0
Operationally Invalid (after informed of failing calibration)	0
Total	**14**

Fail Rate of Operationally Valid Tests: 0.0%

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
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

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	0.20
Lab B	2	-1.52
Lab D	2	-0.99
Lab G	2	-0.62
Lab H	2	0.69
Lab S	2	-1.11

PRECISION AND SEVERITY

D6417 calibration testing precision is about the same as last period, and continues to be better than target. Overall severity continues mild of target performance at about the same level as last period. Severity is represented graphically in Figure 1. There is a strong six-test mild trend late in the period (starting just before the 01JUL03 time-line in Figure 1).

There are, however, some dynamic performance issues when the results are broken down by lab. Lab A was substantially mild last period (-1.29 s, n=5) and the period before, but overall is performing slightly severe this period (0.20 s, n=4). However, Lab A's results this period are unusually erratic compared to the other labs, with two results from two instruments coming in quite severe in the first quarter (1.63 s and 2.03 s) followed by quite mild results (-1.33 s and –1.53 s) for the next quarter on the same two instruments. Lab H is performing consistently severe (this period and prior), while the other labs (except for Lab A) are performing consistently mild on all oils this period. Lab B has shifted from 0.40 s severe last period to –1.52 s mild this period, and Lab S was significantly mild last period (-0.72 s, n=2) and has performed even milder (-1.11 s) this period.

Attachment 3A shows period performance on Oil 55 substantially more mild (-1.33 s) than performance on Oils 52 (-0.23 s) or 58 (0.03 s). However, the data also suggests that Lab A strongly influences Oil 55's performance this period, and other labs performing substantially mild on Oil 55 reported similarly mild results on other oils. The data does not suggest any specific problem with Oil 55 as a reference material.

The fail rate of the operationally valid tests is exceptionally good, with no statistically unacceptable test reported this period.

TMC MEMORANDA

There was one TMC technical memo issued this report period for the D6417 test method:

TMC Memo 03-069, July 14 2003: Updated D6417 Test method

D5800: Evaporation Loss of Lubricating Oils by the Noack Method

STATUS

Table 4 summarizes the reference tests reported to the TMC this period (8 labs reporting):

TABLE 4

	No. of Tests
Statistically Acceptable and Operationally Valid	26
Operationally Valid but Failed Acceptance Criteria	3
Operationally Invalid (initially reported as)	0
Operationally Invalid (after informed of failing calibration)	0
Total	**29**

Fail Rate of Operationally Valid Tests: 10.3%
All 3 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	3

(The unacceptably severe results were from three different labs; one fail on each oil.)

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	-----
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

Table 7 shows statistical comparisons by procedure for all operationally valid tests for the report period.

TABLE 7

Sample Evaporation Loss, mass %	n	df	Pooled s	Mean Δ/s
Procedure A	3	1	0.42	-0.33
Procedure B	22	19	0.72	0.60
Procedure C	4	1	0.64	0.11

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	-0.06
Lab B	4	1.18
Lab D	2	0.62
Lab F	2	0.05
Lab G	5	0.98
Lab H	3	1.32
Lab I	1	0.08
Lab J	4	-0.46

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) became effective July 15, 2003.

Overall precision for the report period matches the new target precision. Severity is slightly severe of targets (severity for individual test results is calculated using the targets that were in effect when each test was completed). Figure 2b shows some improvement in the severity trend following the revised oil targets timeline.

Testing failure rates on tests reported to the TMC as operationally valid for the last five report periods are 22.9%, 15.2%, 25.7%, 23.5% and, now, 10.3% (5% is "statistically expected"). So, revising the acceptance bands may have helped to improve the fail rate considerably.

The reference oil targets were revised 3.5 months into this 6-month report period so it will be interesting to see how the change affects calibration test results in future independent report periods.

TMC MEMORANDA

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

Memo 03-064, July 15, 2003: Revised Reference Oil Performance Targets and Acceptance Bands & 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 9 summarizes the reference tests reported to the TMC this period (7 labs reporting):

TABLE 9
Reference Tests

	No. of Tests
Statistically Acceptable and Operationally Valid	26
Operationally Valid but Failed Acceptance Criteria	1
Operationally Invalid (initially reported as)	0
Operationally Invalid (after informed of failing calibration)	0
Total	**27**

Fail Rate of Operationally Valid Tests: 3.7%

Table 10 is a breakdown of the statistically unacceptable tests.

TABLE 10

Reason for Fail	No. of Tests
Gelation Index Mild	1

INDUSTRY PERFORMANCE

Table 11 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 11

Gelation Index	n	df	Pooled s	Mean Δ/s
Revised Targets Effective 20010702 (Oils 52, 53 & 62 targets unchanged, dropped oils 51 & 55)	107	104	3.53	-----
4/1/01 through 9/30/01	33	28	2.84	0.13
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

*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 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	6	-0.13
Lab B	6	0.14
Lab D	5	-0.66
Lab G	2	0.44
Lab H	2	1.29
Lab R	3	0.67
Lab S	3	-0.23

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. Statistical severity estimates for this period are made using the targets and acceptance bands that were in place at the time that each test was completed.

The 3.7% fail rate this period is improved compared to 10.0% and 9.0% fail rates for the previous two report periods, and compares well to the statistically expected fail rate of 5%. Overall gelation index precision continues to be very good and is again better than target. Overall severity is on target (severe bias). Severity is graphically represented in Figures 3A & 3B (attached). Figure 3B illustrates a severe trend that seems to have turned mild after the change in reference oils effective July 15, 2003. Further monitoring will be required to see if the targets for 1009 will need to be adjusted by including additional calibration data in the performance target estimates. Attachment 3A shows the three current reference oils, 1009, 58 and 62, are performing reasonably close to the target mean performance estimates for the period. Precision on oil 1009 is also close to target (limited data this period), but precision estimates for oils 58 and 62 for the period are higher (worse) than target.

TMC MEMORANDA

There was one TMC technical memo issued this report period for the D5133 test method:

Memo 03-068, July 15, 2003, Reference Oil Changes for Gelation Index (GI) calibration Monitoring

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 (3 labs reporting):

TABLE 13

	No. of Tests
Statistically Acceptable and Operationally Valid	4
Operationally Valid but Failed Acceptance Criteria	2
Operationally Invalid (after informed of failing calibration)	1
Operationally Invalid (initially reported as)	0
Total	**7**

Fail Rate of Operationally Valid Tests: 33.3%

Table 14 is a breakdown of the statistically unacceptable tests.

TABLE 14

Reason for Fail	No. of Tests
Total Deposits Severe	2*

*Severe results on oils 71 and 72 from two separate labs

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	-----
4/1/01 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

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

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	3	1.53
Lab B	1	0.40
Lab G*	2	5.12
Lab G*	1	1.67

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

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.

One test result reported as operationally valid by Lab G is 8.58 s severe of target on oil 72. This is an unusually severe result. Period statistics are shown including and excluding the severe result. Overall precision, with the extreme result excluded, has improved this period. Severity is substantially severe of targets with or without the extreme result. The strong severity trend for the period 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 03-070, July 14, 2003, Updated TEOST Method

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 (5 labs reporting):

TABLE 17

	No. of Tests
Statistically Acceptable and Operationally Valid	23
Operationally Valid but Failed Acceptance Criteria	4
Operationally Invalid (initially reported as)	1
Operationally Invalid (after informed of failing calibration)	7
Total	**35**

Fail Rate of Operationally Valid Tests: 14.8%

Table 18 is a breakdown of the statistically unacceptable tests.

TABLE 18

Reason for Fail	No. of Tests
Total Deposits Mild	4*
Total Deposits Severe	0

*Two tests mild on oil 432 and two tests mild on oil 433

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
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

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	10	-0.49
Lab B	2	-1.02
Lab D	2	-2.28
Lab G	10	-0.54
Lab V	3	-1.89

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

PRECISION AND SEVERITY

Significantly fewer calibration tests were reported this period, presumably labs are waiting for the test method change allowing flask sample introduction (effective November 1, 2003, for TMC monitoring, after the end of current report period).

Overall precision, though directionally improved compared to last period, continues to be worse than target precision. Severity continues substantially mild of target, comparable to last period, with all labs again performing mild on the reference oils (though, as table 20 shows, some labs are performing substantially more mild than others). Severity is presented graphically in Figure 5 where an overall mild slope is observed.

Like last period, a high number of operationally invalid tests were reported (often with the lab not realizing a problem until informed that they had failed on a TMC calibration oil). Fail rates of tests reported as operationally valid continues to be high at 14.8% this period (last two period fail rates were 11.9% and 21.3%).

As pointed out in previous report periods, it appears, over time, that the mean performance and precision of the individual reference oils (Attachment 3A) have fluctuated substantially. A new test method (Version 2) was approved by the surveillance panel and introduced for TMC monitoring effective November 1, 2003 (after the end of the current report period). So, next period will begin TMC monitoring of the Version 2 test method. The reference oil targets for most of the next report period will have changed as suggested by a round-robin using the new method. All labs have been asked to recalibrate all instruments starting November 1 because oil performance using Version 2 is expected to be significantly different from the TMC monitored Draft 17 (as suggested by a round-robin).

As requested by the surveillance panel, the TMC is now capturing rod batch data.

TMC MEMORANDA

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

Report Packet Revision Notice MTEOS-20030411, May 7, 2003, effective June 10, 2003

There was also an important technical memo issued after the end of the report period:

Memo 03-101, October 15, 2003, Test Method update; Suspension of reference Oil 432; Revised Oil Targets

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 "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 (initially reported as)	0
Operationally Invalid (after informed of failing calibration)	1
Total	**13**

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.

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	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

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		
10/1/02 through 3/31/03	11	No non-zero occurrences		
4/1/03 through 9/30/03	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	2	0.74
Lab B	4	-0.43
Lab D	3	0.05
Lab G	2	-0.30
Lab I	1	0.74

PRECISION AND SEVERITY

Foam Tendency precision on 1007 is exceptionally good this period and severity is on 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). The fifth participating lab reported their discrimination test after the report period cut-off date (and also met the acceptance criteria).

The surveillance panel's search for a severe performing reference oil has concluded with the introduction of TMC oil 66 as a severe performing discrimination oil. Refer to TMC technical memos 02-069, 03-058 and 03-072 for additional information on the round-robin performance and introduction of oil 66 to the D6082 test monitoring system.

TMC MEMORANDA

There were two TMC technical memos issued this report period for the D6082 test method:

Memo 03-058, May 27, 2003, D6082 Round-Robin Results: Proposed Reference Oil TMC 66 Second Round-Robin

Memo 03-072, July 21, 2003, D6082 Monitoring Changes: Discrimination Oil 66

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

TABLE 25

	No. of Tests
Statistically Acceptable and Operationally Valid	113
Operationally Valid but Failed Acceptance Criteria	6
Total	**119**

Fail Rate of Operationally Valid Tests: 5.0%

Table 26 is a breakdown of the statistically unacceptable tests.

TABLE 26

Reason for Fail	No. of Tests
Average AGV Mild	3
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
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

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

D6557: Ball Rust Test (BRT), continued

TABLE 28

	n	Mean Δ/s
Lab A	42	0.21
Lab B	24	0.91
Lab G	43	0.25
Lab D	10	-0.92

PRECISION AND SEVERITY

Precision this report period has degraded when compared to the target matrix and 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, with the exception of lab D, which is trending severe.

TMC MEMORANDA

There was one technical memo issued this report period. TMC Memo 03-079 was issued on September 15, 2003. This memo published the target mean and standard deviation for reference oil 82, which replaces reference oil 5A-3. Two information letters were issued this report period. Information Letter 03-1 was issued on April 23, 2003. This letter revised limits on the image analysis results obtained on the Calibration Reference Specimen at the beginning and end of the image analysis detailed in Test Method D6557. Information Letter 03-2 was issued July 22, 2003. This letter deleted the requirement to rinse the post-test samples in an organic solvent and replaced this rinse with an additional rinse in heptane.

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	71
Operationally Valid but Failed Acceptance Criteria	0
Aborted	0
Total	**71**

Fail Rate of Operationally Valid Tests: 0.0%

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
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

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	29	-0.09
Lab B	18	-0.25
Lab G	24	0.34

PRECISION AND SEVERITY

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

Engine Oil Filterability Test (EOFT), continued

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.

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

TABLE 32

	No. of Tests
Statistically Acceptable and Operationally Valid	93
Total	**93**

Fail Rate of Operationally Valid Tests: 0.0%

INDUSTRY PERFORMANCE

Table 33 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 33

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
10/1/02 through 3/31/03	89	87	4.86	-0.075
4/1/03 through 9/30/03	93	92	3.89	0.014

Table 34 shows the current severity for the Average % CIF parameter for each lab for all operationally valid tests for the report period.

TABLE 34

	n	Mean Δ/s
Lab A	44	-0.16
Lab B	20	0.34
Lab G	24	0.05

PRECISION AND SEVERITY

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

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

STATUS

Table 35 summarizes the reference tests reported to the TMC this period (3 labs reporting):

TABLE 35

	No. of Tests
Statistically Acceptable and Operationally Valid	94
Total	**94**

Fail Rate of Operationally Valid Tests: 0.0%

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	5.81	-----
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

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	45	0.19
Lab B	20	-0.24
Lab G	29	0.42

PRECISION AND SEVERITY

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

Engine Oil Water Tolerance Test (EOWT): 2.0% 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	93
Total	**93**

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	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

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	44	0.23
Lab B	20	-0.19
Lab G	29	0.33

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

PRECISION AND SEVERITY

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

Engine Oil Water Tolerance Test (EOWT): 3.0% 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	93
Operationally Valid but Failed Acceptance Criteria	1
Total	**94**

Fail Rate of Operationally Valid Tests: 1.1%

Table 42 is a breakdown of the statistically unacceptable test.

TABLE 42

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

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	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

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	45	0.60
Lab B	20	0.06
Lab G	29	0.81

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

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). Laboratories A and G trended severe of target during the period. Lab B was on or near target for the period.

REFERENCE OIL SUPPLIES

There is adequate supply of B0.07 Bench Test reference oils on hand at the TMC. Tables 45A and 45B list the PCEOCP bench test reference oils currently on hand at the TMC.

Table 45A

Oil	For Tests	Quantity Left (gallons)	Quantity Used Last 12 Months (gallons)
^5A-3	BRT	1787.1	0.1
^51	GI	94.6	0.0
52	D6417, D5800, GI	70.6	1.0
^53	GI	96.8	0.1
^54	Obsolete Volatility	97.8	0.0
55	D6417, D5800	75.4	0.8
^57	Volatility Candidate	51.2	0.0
58	D6417, D5800, GI	128.4	1.1
62	GI	2.0	0.2
66	D6082 (Discrimination)	102.8	4.6
71	TEOST	4.4	0.3
72	TEOST	4.5	0.2
74	MTEOS	2.3	0.1
77	EOWT	154.9	27.8
78	EOFT, EOWT	112.5	40.6
^80	BRT	26.5	0.0
81	BRT	18.8	0.9
82	BRT	9.7	0.3
**432	MTEOS	Adequate	-----
**433	MTEOS	Adequate	-----
1006	BRT, MTEOS	44.6	0.8
*1007	FOAM	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 45B

Oil	For Tests	Quantity Left (gallons)	Quantity Used Last 12 Months (gallons)
HMA	H&M (D6922)	204.5	7.5
HMB	H&M (D6922)	208.5	7.5
HMC	H&M (D6922)	194.5	7.5
HMD	H&M (D6922)	202.5	7.5
HME	H&M (D6922)	187.5	7.5
HMF	H&M (D6922)	211.5	7.5

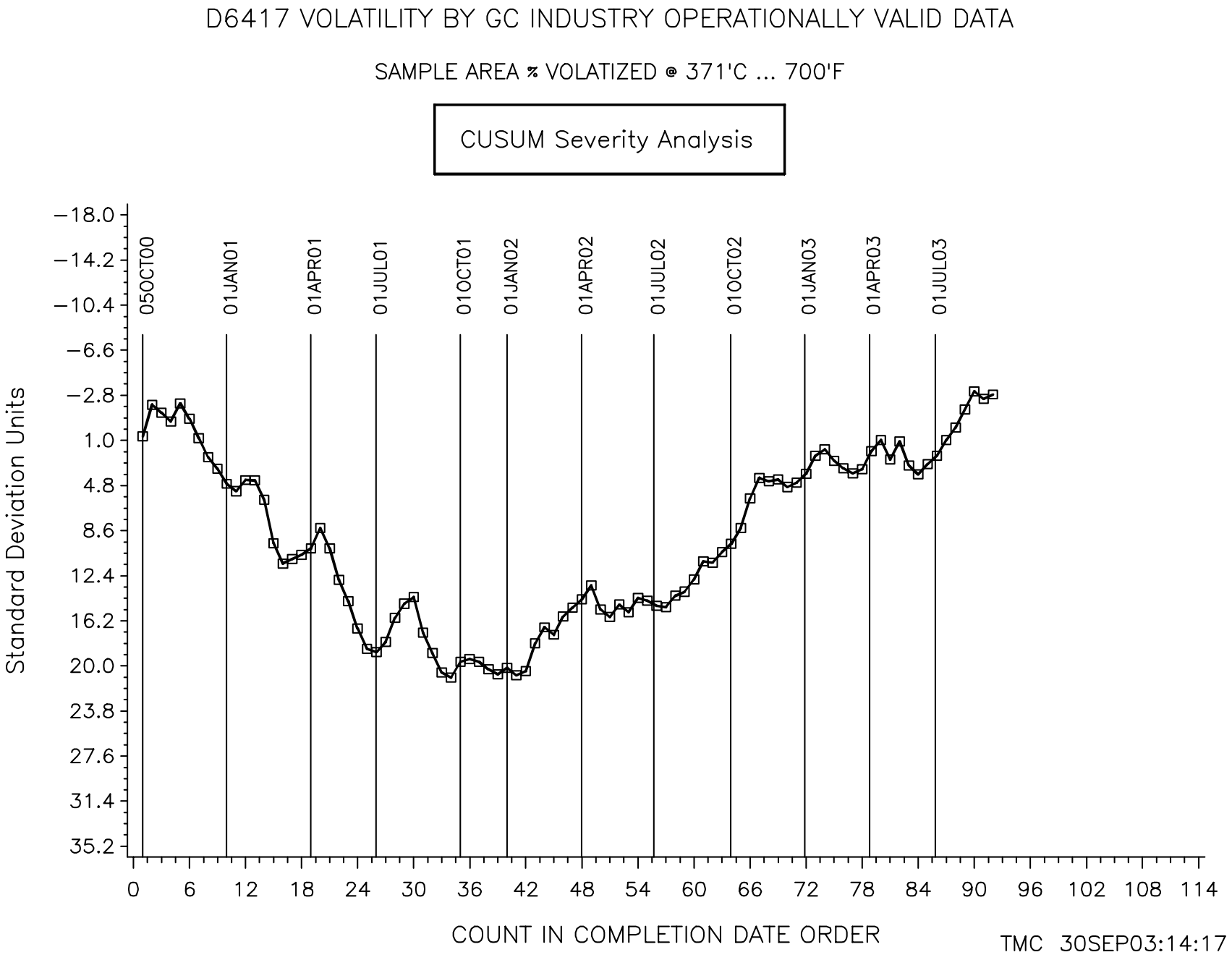
Shipping aliquots are:

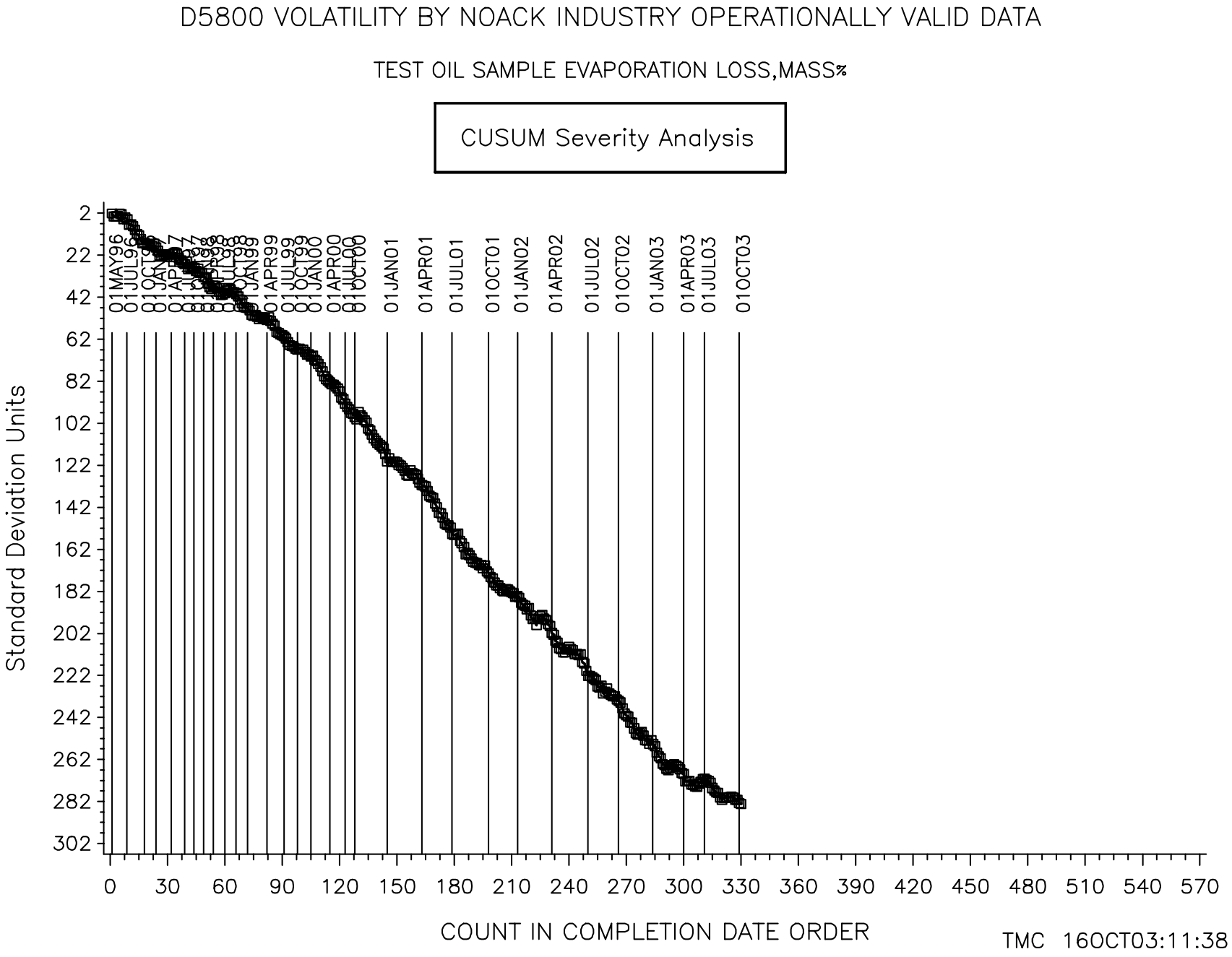
D6417	1 ml
D5480	4 ml
D5800	100 ml
GI	25 ml
MTEOS	17 ml
TEOST	125 ml
D6082	525 ml
H&M	950 ml
EOFT	290 ml
EOWT	290 ml
BRT	30 ml

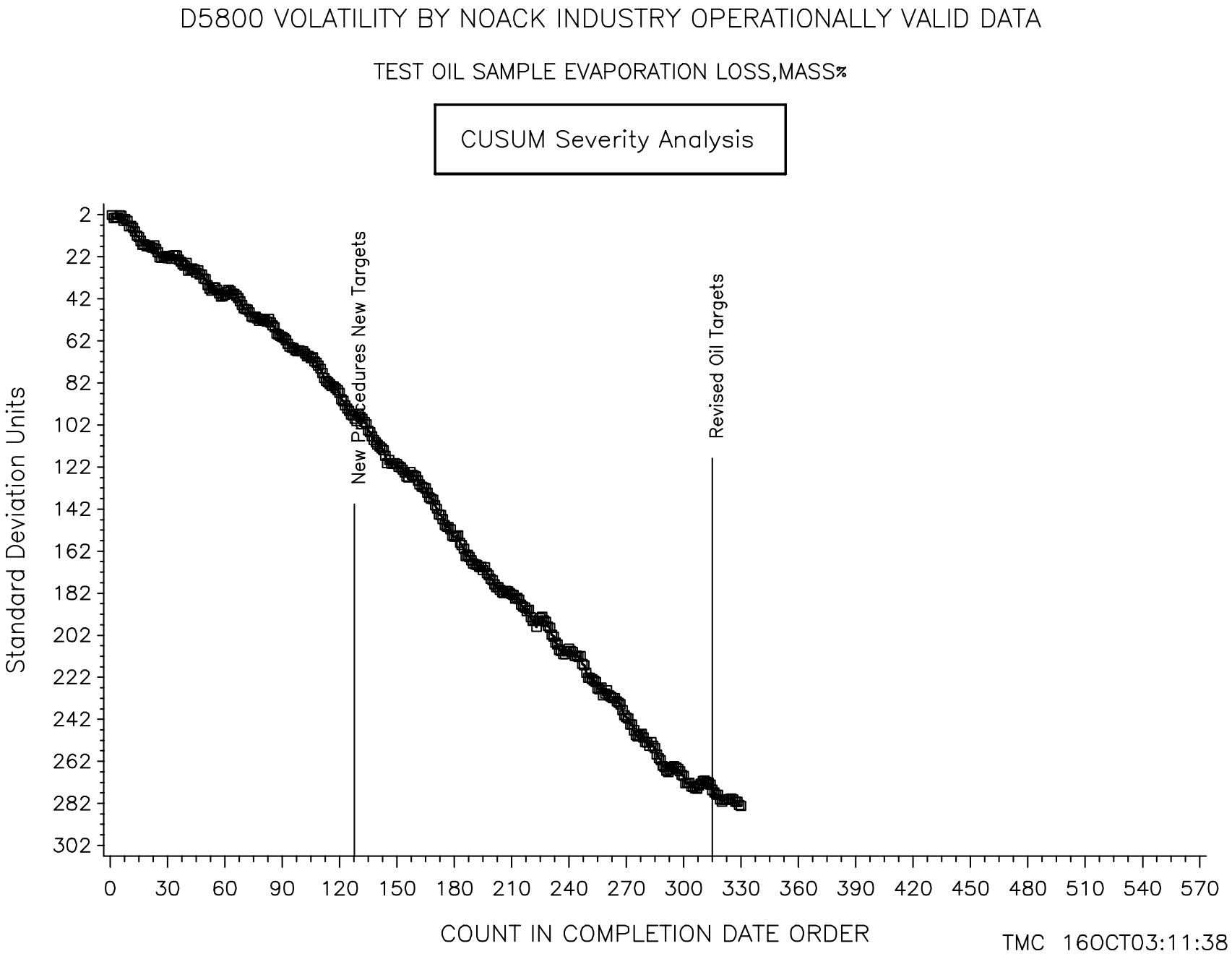
MISCELLANEOUS

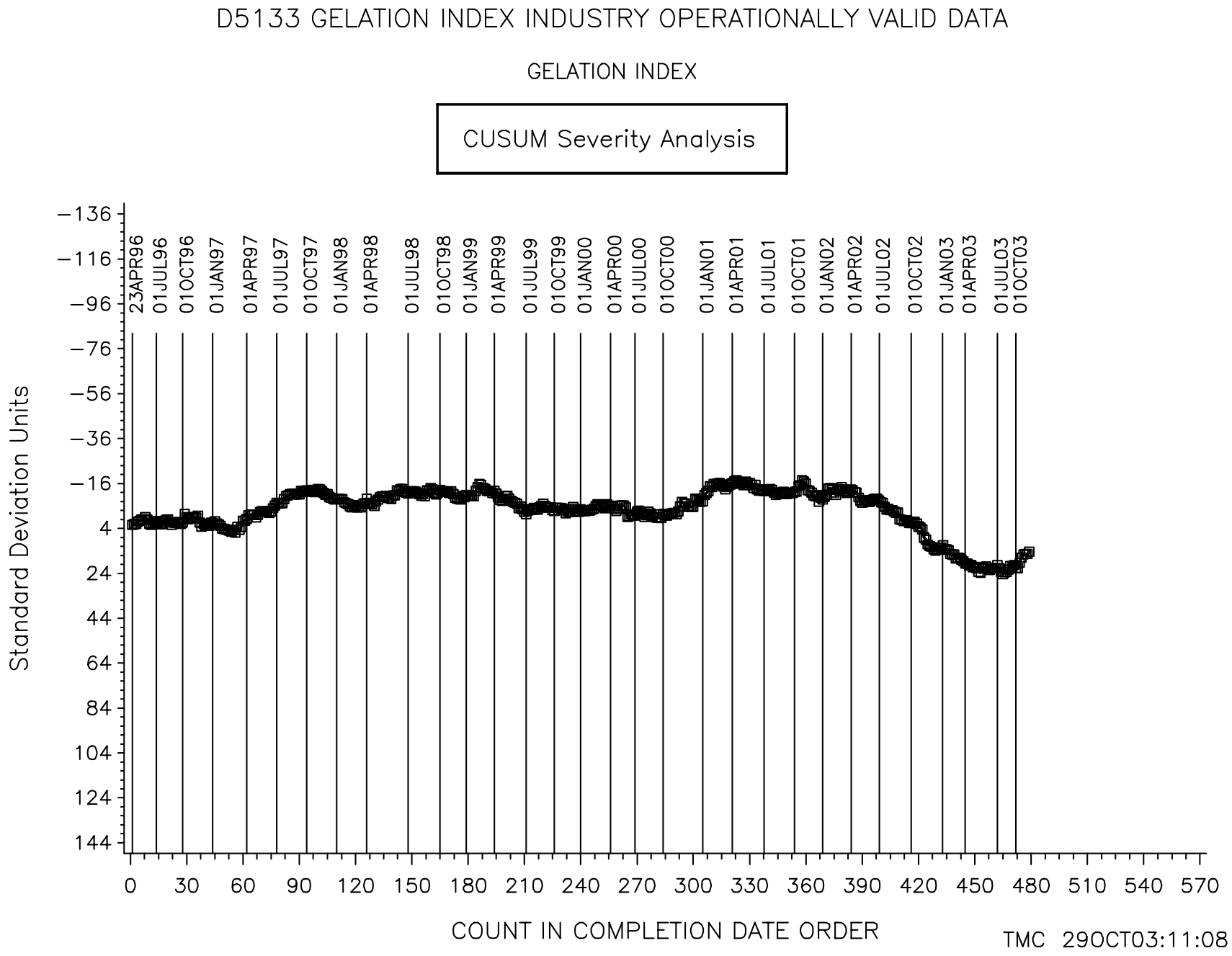
The TMC posts monitored bench test calibration data on the Internet. Selected parameters from all operationally valid reference tests are posted on the TMC's World-Wide-Web page in real time. Lab identifications are coded on the TMC's web site as they are on the previous pages of this report. Also posted 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.

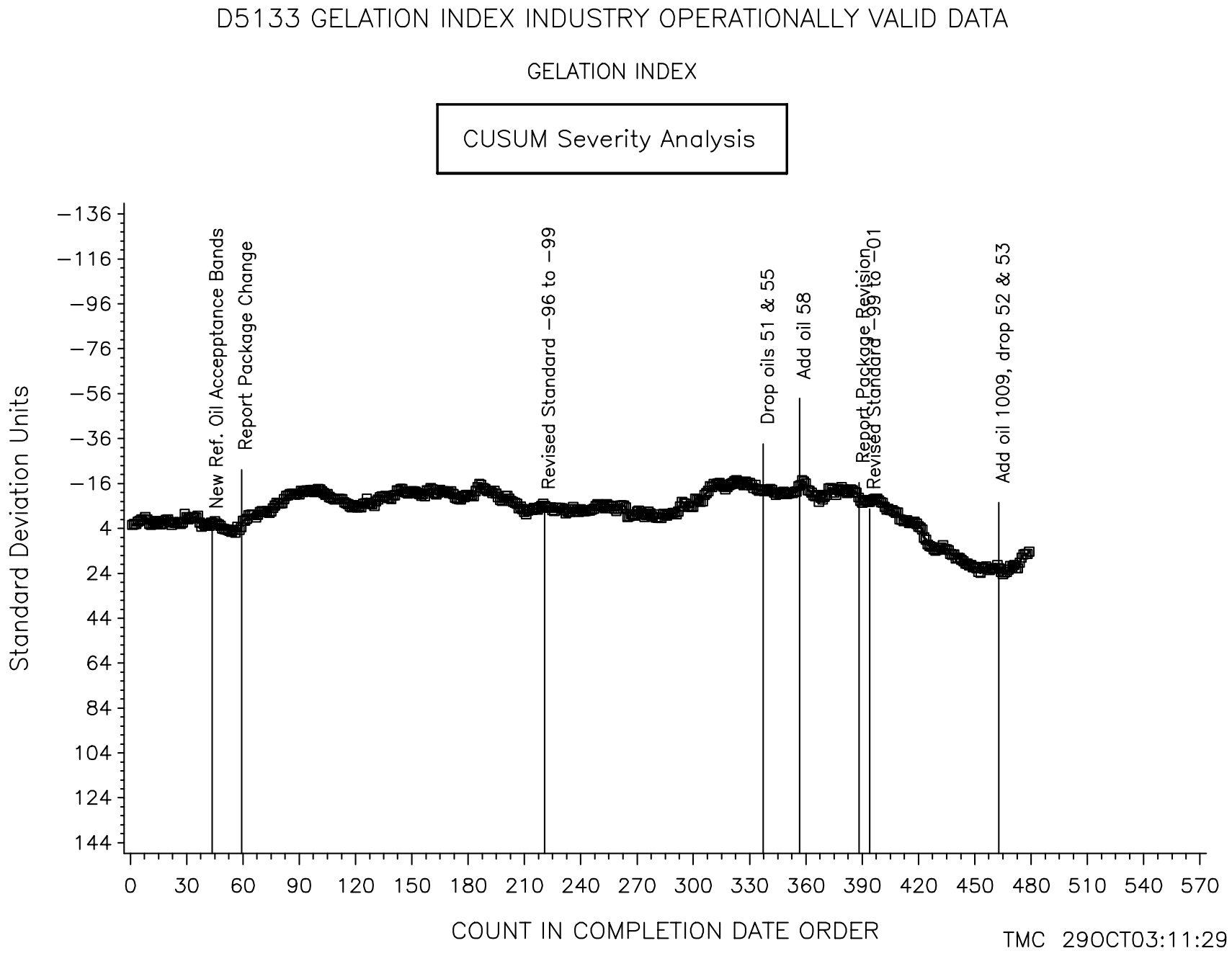
All currently monitored bench test data dictionaries and report form packages have been beta tested by the ASTM Data Communications Committee (DCC) and approved for electronic data transfer. Please contact Tom Schofield at (412) 365-1011 or Rich Grundza at (412) 365-1031 for more information.

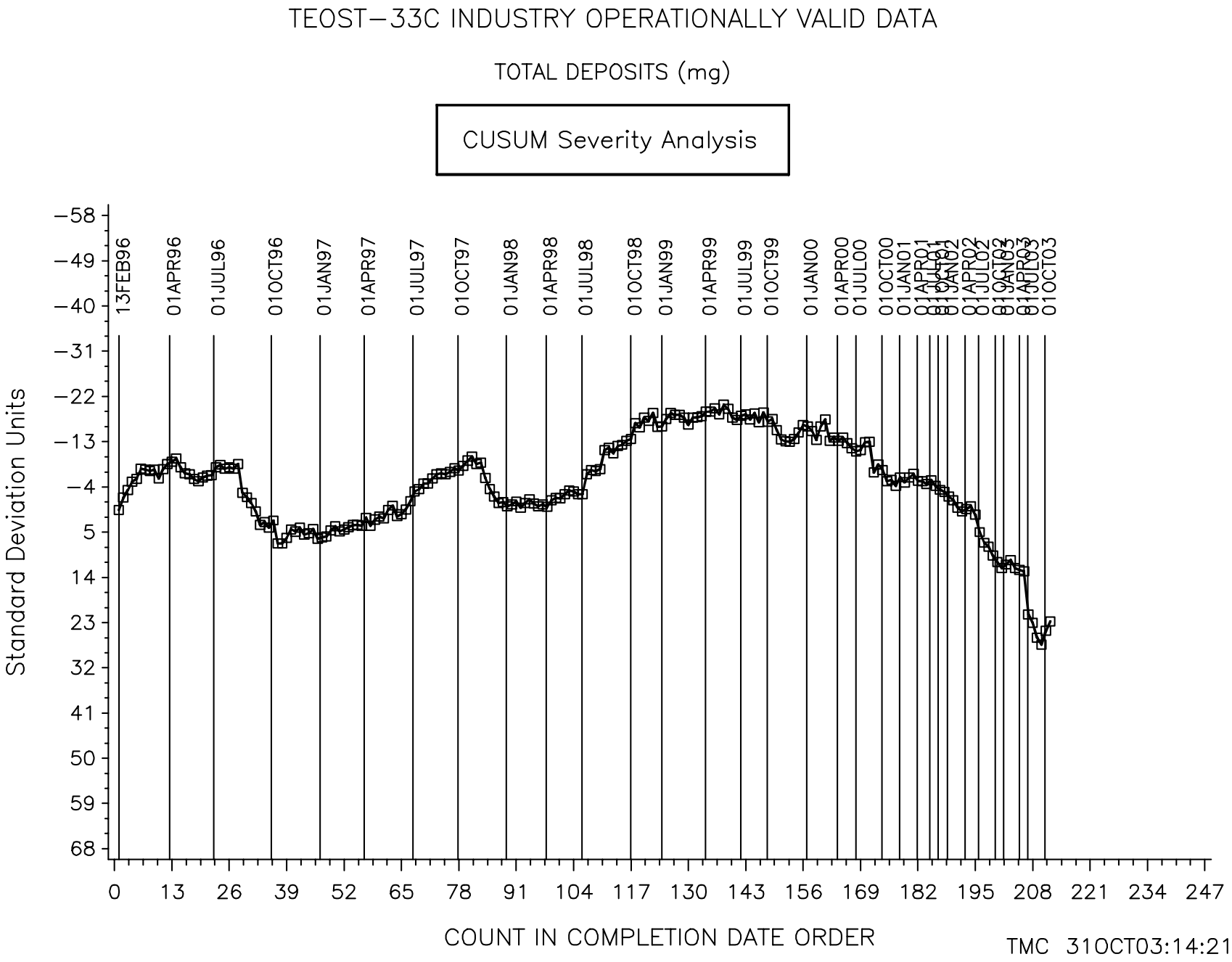

D6417 VOLATILITY BY GC INDUSTRY OPERATIONALLY VALID DATA
SAMPLE AREA % VOLATIZED @ 371'C ... 700'F
CUSUM Severity Analysis
Standard Deviation Units
−18.0
−14.2
−10.4
−6.6
−2.8
1.0
4.8
8.6
12.4
16.2
20.0
23.8
27.6
31.4
35.2
05OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
01OCT02
01JAN03
01APR03
01JUL03
0 6 12 18 24 30 36 42 48 54 60 66 72 78 84 90 96 102 108 114
COUNT IN COMPLETION DATE ORDER
TMC 30SEP03:14:17

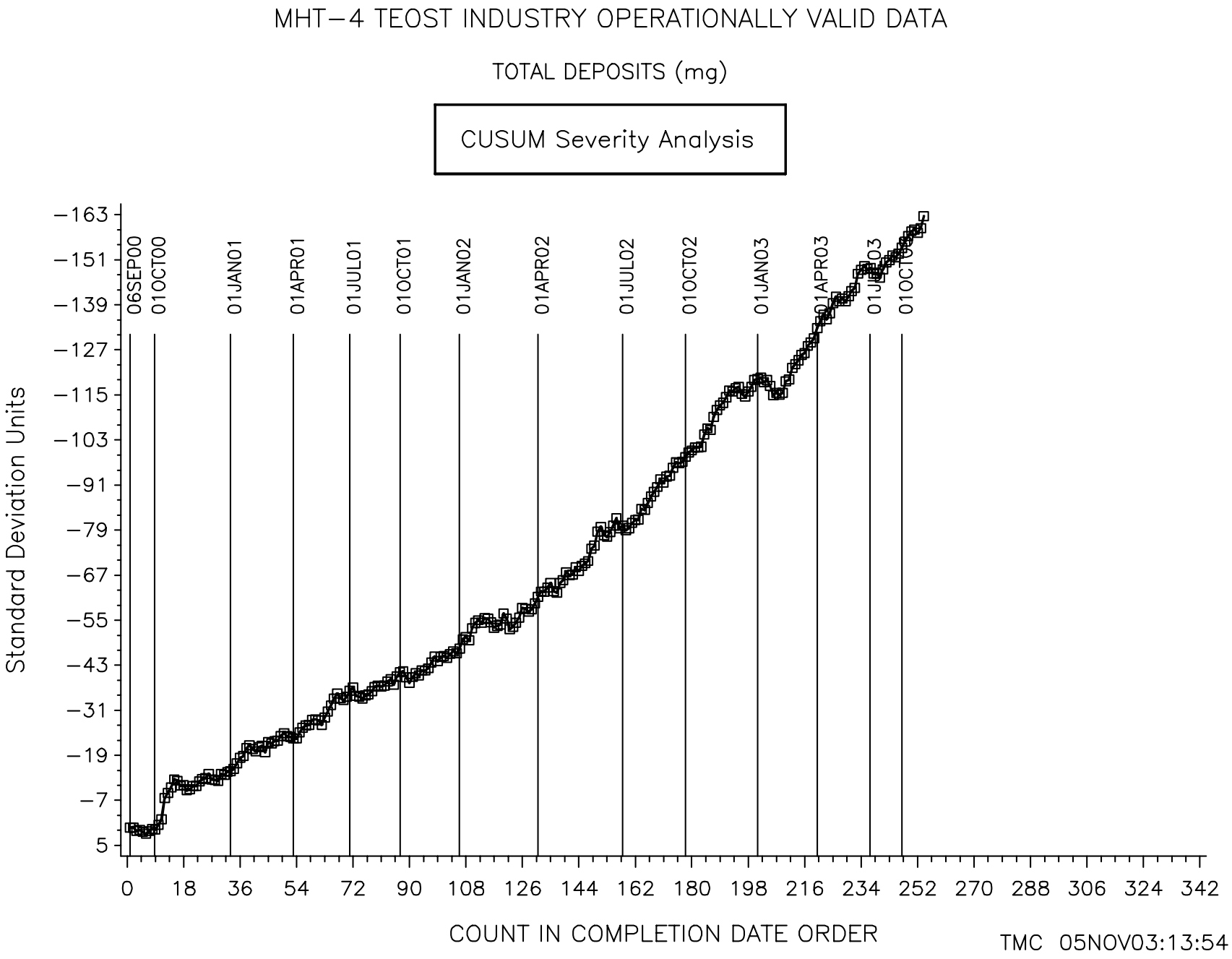

D5800 VOLATILITY BY NOACK INDUSTRY OPERATIONALLY VALID DATA
TEST OIL SAMPLE EVAPORATION LOSS,MASS%
CUSUM Severity Analysis
Standard Deviation Units
2
22
42
62
82
102
122
142
162
182
202
222
242
262
282
302
01MAY96
01JUL96
01APR99
01JUL99
01OCT99
01JAN00
01APR00
01JUL00
01OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
01OCT02
01JAN03
01APR03
01JUL03
01OCT03
0
30
60
90
120
150
180
210
240
270
300
330
360
390
420
450
480
510
540
570
COUNT IN COMPLETION DATE ORDER
TMC 16OCT03:11:38

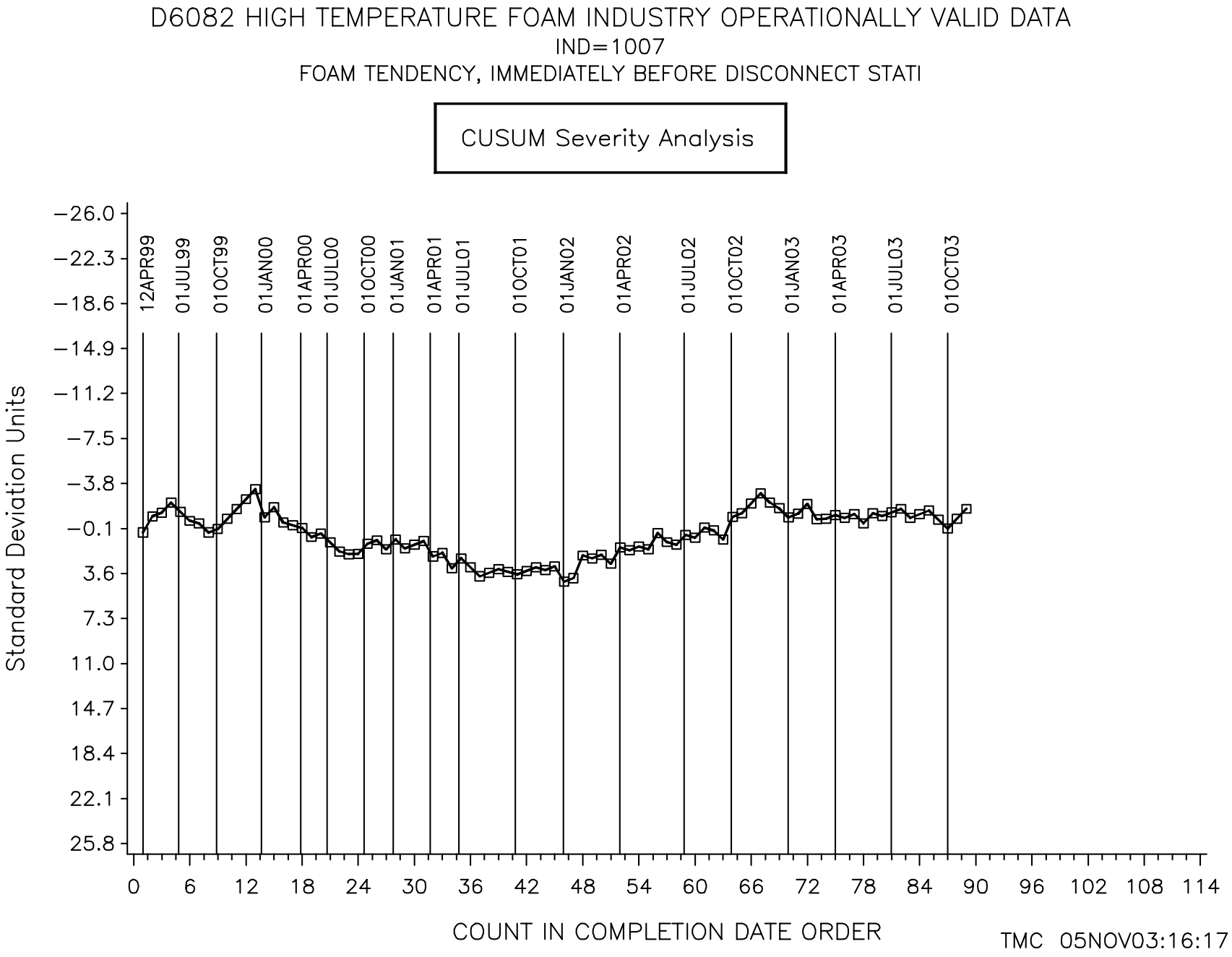

D5800 VOLATILITY BY NOACK INDUSTRY OPERATIONALLY VALID DATA
TEST OIL SAMPLE EVAPORATION LOSS,MASS%
CUSUM Severity Analysis
Standard Deviation Units
2
22
42
62
82
102
122
142
162
182
202
222
242
262
282
302
New Procedures New Targets
Revised Oil Targets
0
30
60
90
120
150
180
210
240
270
300
330
360
390
420
450
480
510
540
570
COUNT IN COMPLETION DATE ORDER
TMC 16OCT03:11:38

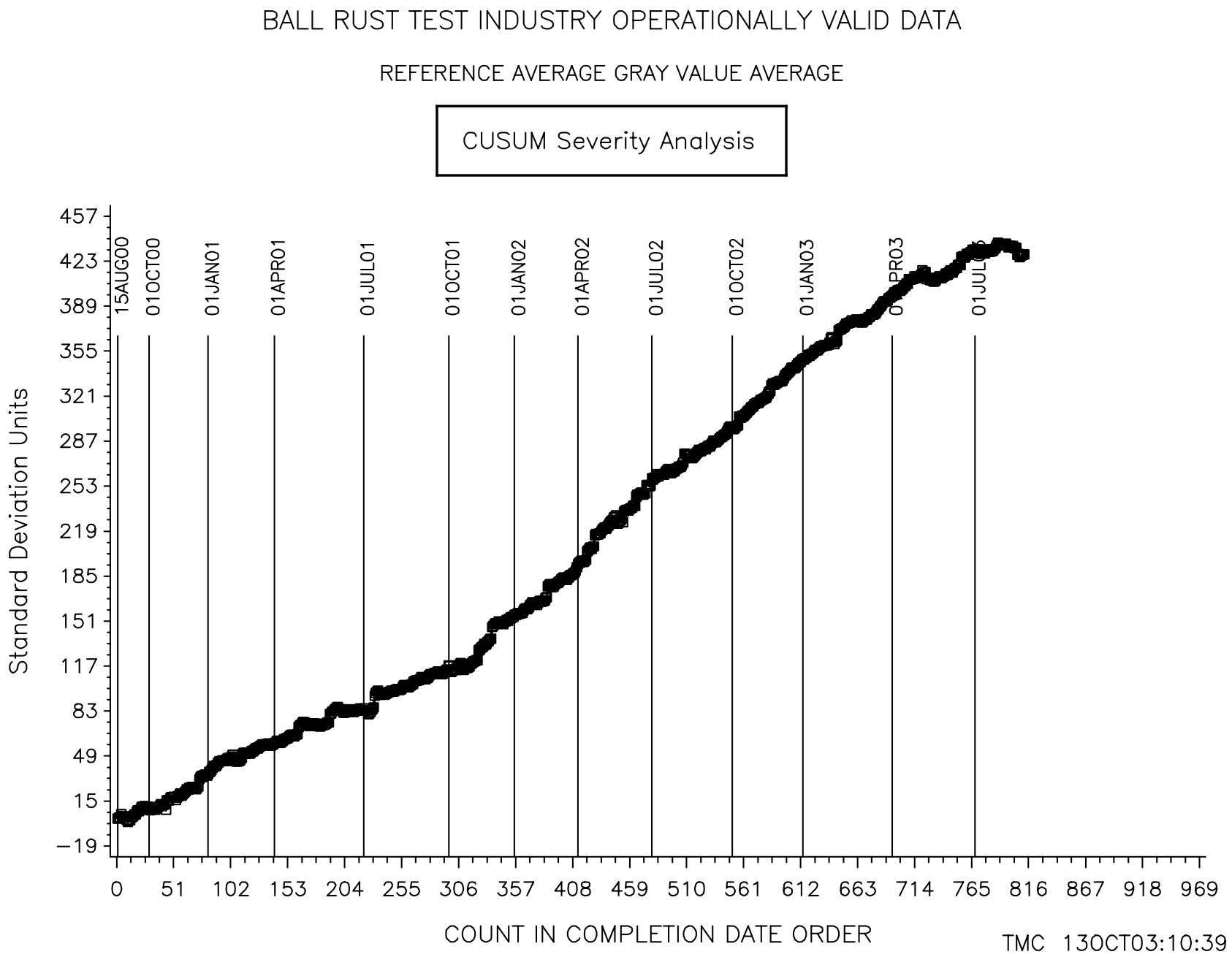

D5133 GELATION INDEX INDUSTRY OPERATIONALLY VALID DATA
GELATION INDEX
CUSUM Severity Analysis
Standard Deviation Units
−136
−116
−96
−76
−56
−36
−16
4
24
44
64
84
104
124
144
23APR96
01JUL96
01OCT96
01JAN97
01APR97
01JUL97
01OCT97
01JAN98
01APR98
01JUL98
01OCT98
01JAN99
01APR99
01JUL99
01OCT99
01JAN00
01APR00
01JUL00
01OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
01OCT02
01JAN03
01APR03
01JUL03
01OCT03
0
30
60
90
120
150
180
210
240
270
300
330
360
390
420
450
480
510
540
570
COUNT IN COMPLETION DATE ORDER
TMC 29OCT03:11:08

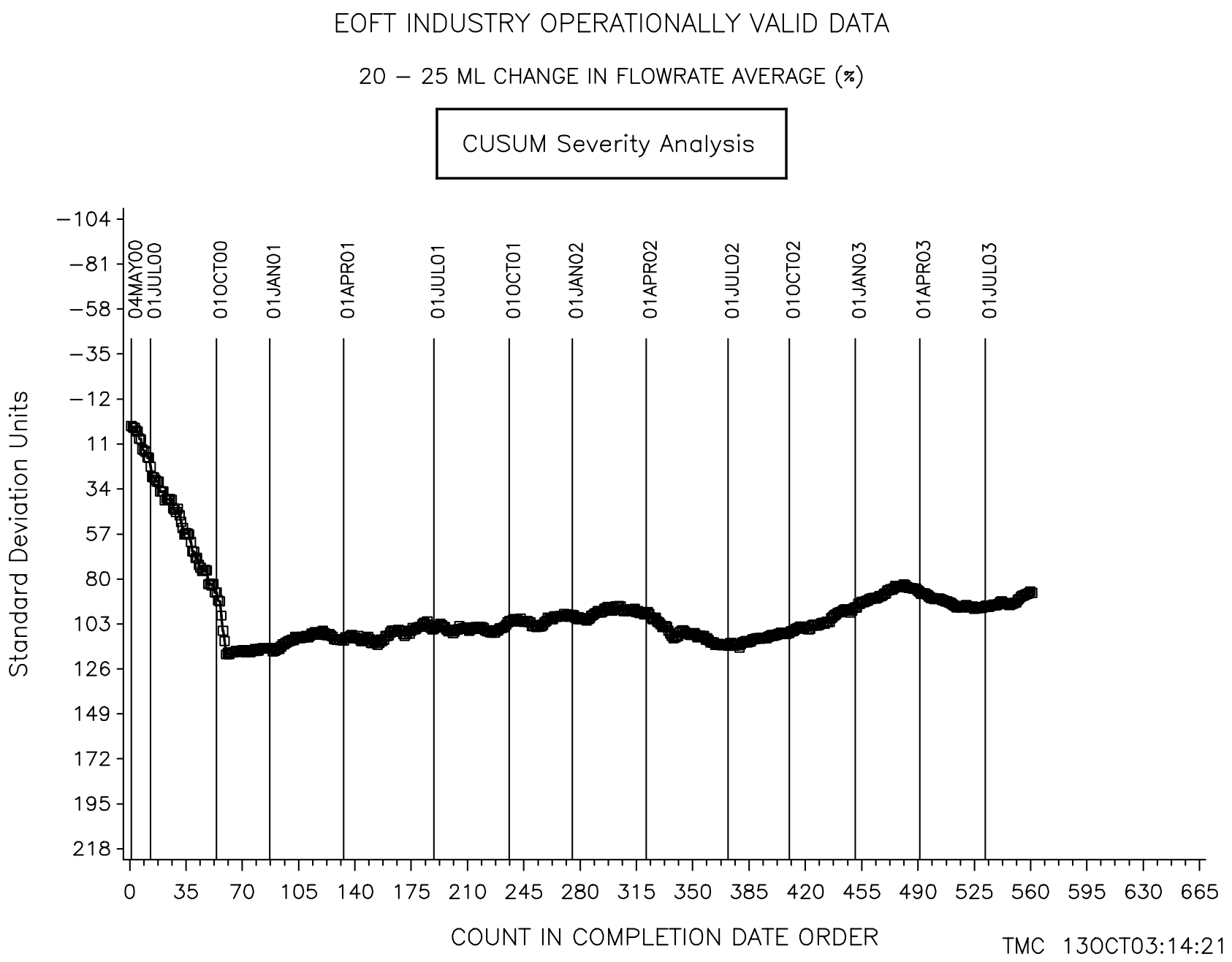

D5133 GELATION INDEX INDUSTRY OPERATIONALLY VALID DATA
GELATION INDEX
CUSUM Severity Analysis
Standard Deviation Units
−136
−116
−96
−76
−56
−36
−16
4
24
44
64
84
104
124
144
New Ref. Oil Accepptance Bands
Report Package Change
Revised Standard −96 to −99
Drop oils 51 & 55
Add oil 58
Report Package Revision
Revised Standard −99 to −01
Add oil 1009, drop 52 & 53
0 30 60 90 120 150 180 210 240 270 300 330 360 390 420 450 480 510 540 570
COUNT IN COMPLETION DATE ORDER
TMC 29OCT03:11:29

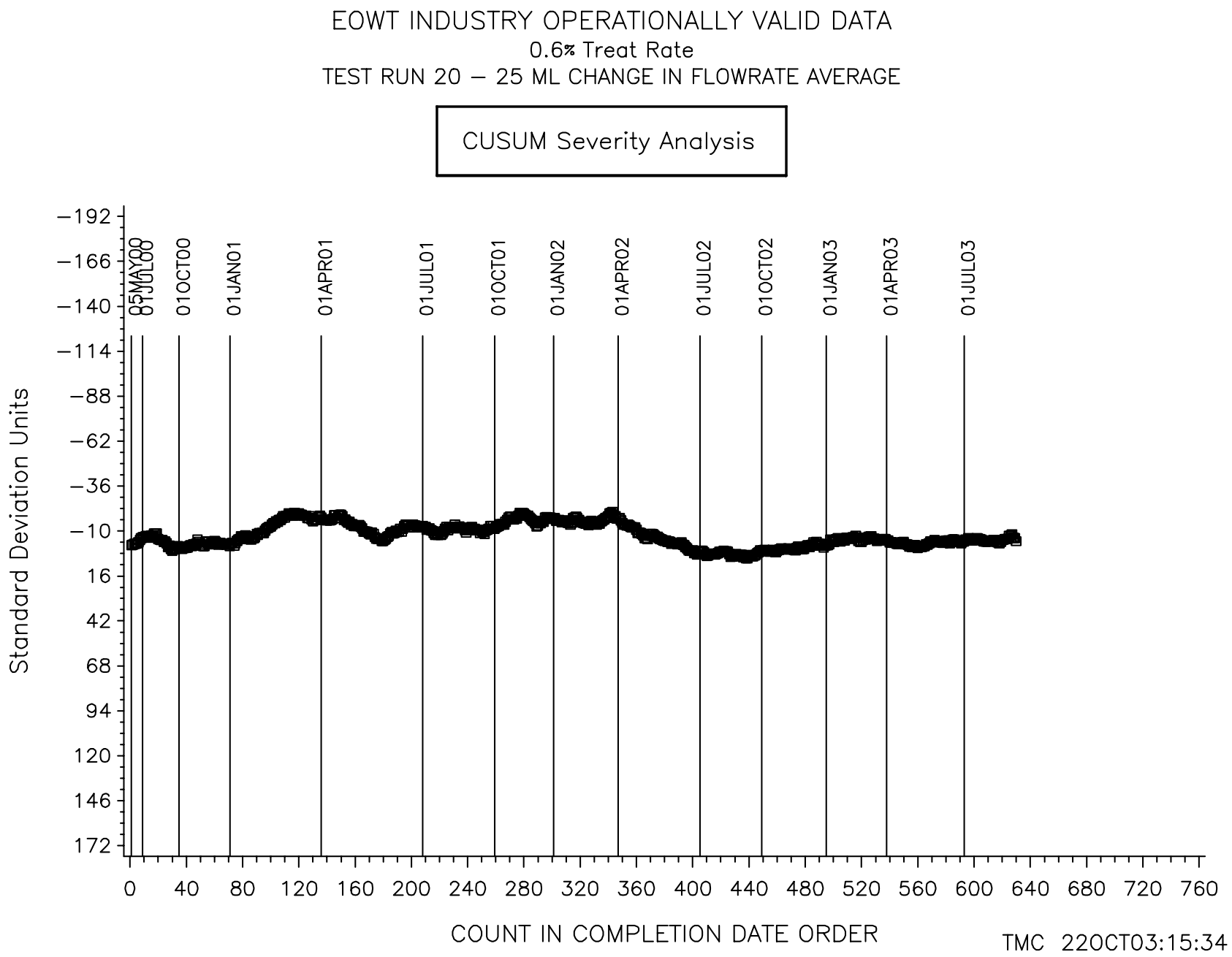

TEOST–33C INDUSTRY OPERATIONALLY VALID DATA
TOTAL DEPOSITS (mg)
CUSUM Severity Analysis
Standard Deviation Units
−58
−49
−40
−31
−22
−13
−4
5
14
23
32
41
50
59
68
13FEB96
01APR96
01JUL96
01OCT96
01JAN97
01APR97
01JUL97
01OCT97
01JAN98
01APR98
01JUL98
01OCT98
01JAN99
01APR99
01JUL99
01OCT99
01JAN00
01APR00
01JUL00
01OCT00
01JAN01
01APR02
01JUL02
01APR03
01JUL03
01OCT03
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 31OCT03:14:21

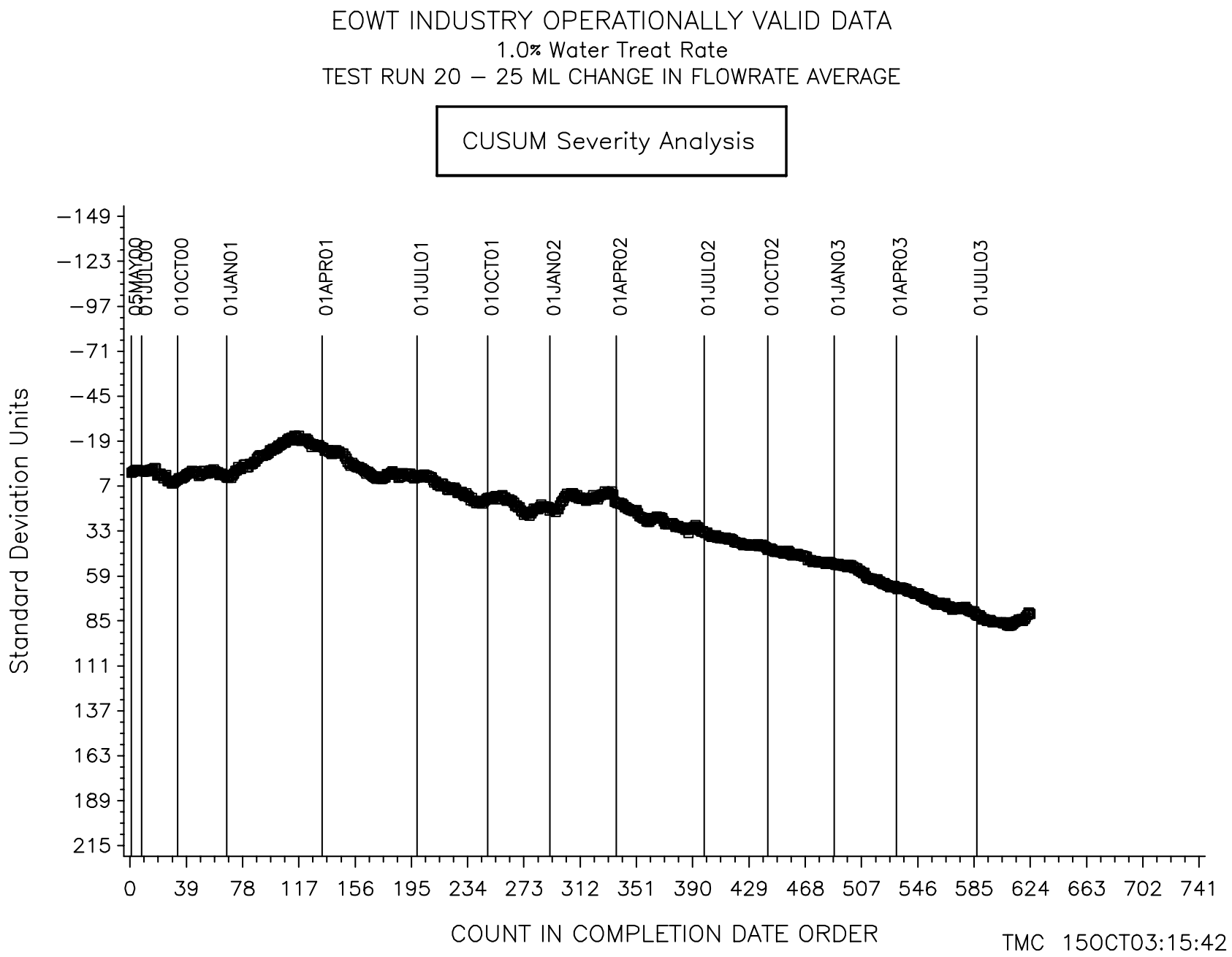

MHT–4 TEOST INDUSTRY OPERATIONALLY VALID DATA
TOTAL DEPOSITS (mg)
CUSUM Severity Analysis
Standard Deviation Units
–163
–151
–139
–127
–115
–103
–91
–79
–67
–55
–43
–31
–19
–7
5
06SEP00
01OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
01OCT02
01JAN03
01APR03
01JUL03
01OCT03
0
18
36
54
72
90
108
126
144
162
180
198
216
234
252
270
288
306
324
342
COUNT IN COMPLETION DATE ORDER
TMC 05NOV03:13:54

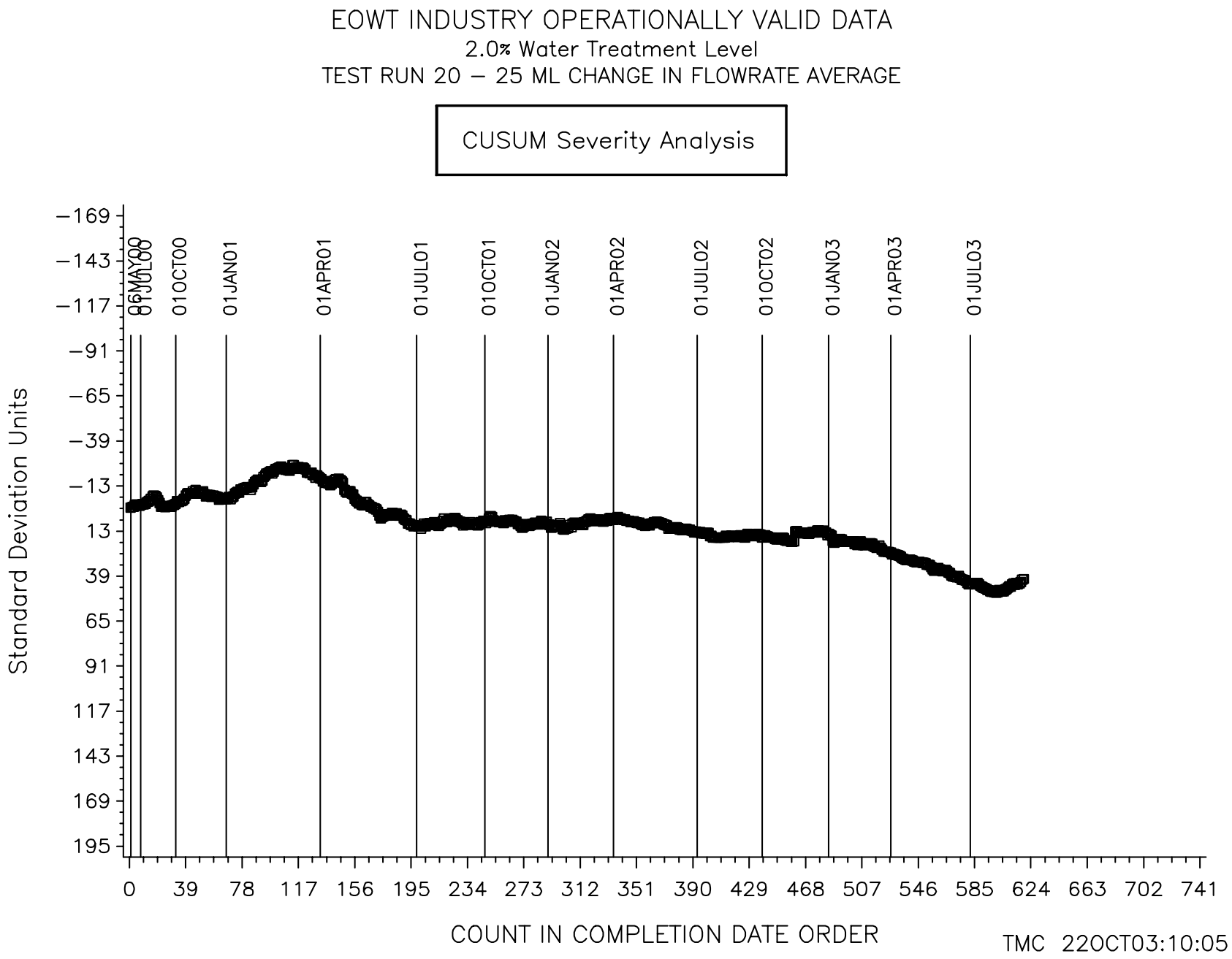

D6082 HIGH TEMPERATURE FOAM INDUSTRY OPERATIONALLY VALID DATA
IND=1007
FOAM TENDENCY, IMMEDIATELY BEFORE DISCONNECT STATI
CUSUM Severity Analysis
Standard Deviation Units
−26.0
−22.3
−18.6
−14.9
−11.2
−7.5
−3.8
−0.1
3.6
7.3
11.0
14.7
18.4
22.1
25.8
12APR99
01JUL99
01OCT99
01JAN00
01APR00
01JUL00
01OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
01OCT02
01JAN03
01APR03
01JUL03
01OCT03
0
6
12
18
24
30
36
42
48
54
60
66
72
78
84
90
96
102
108
114
COUNT IN COMPLETION DATE ORDER
TMC 05NOV03:16:17

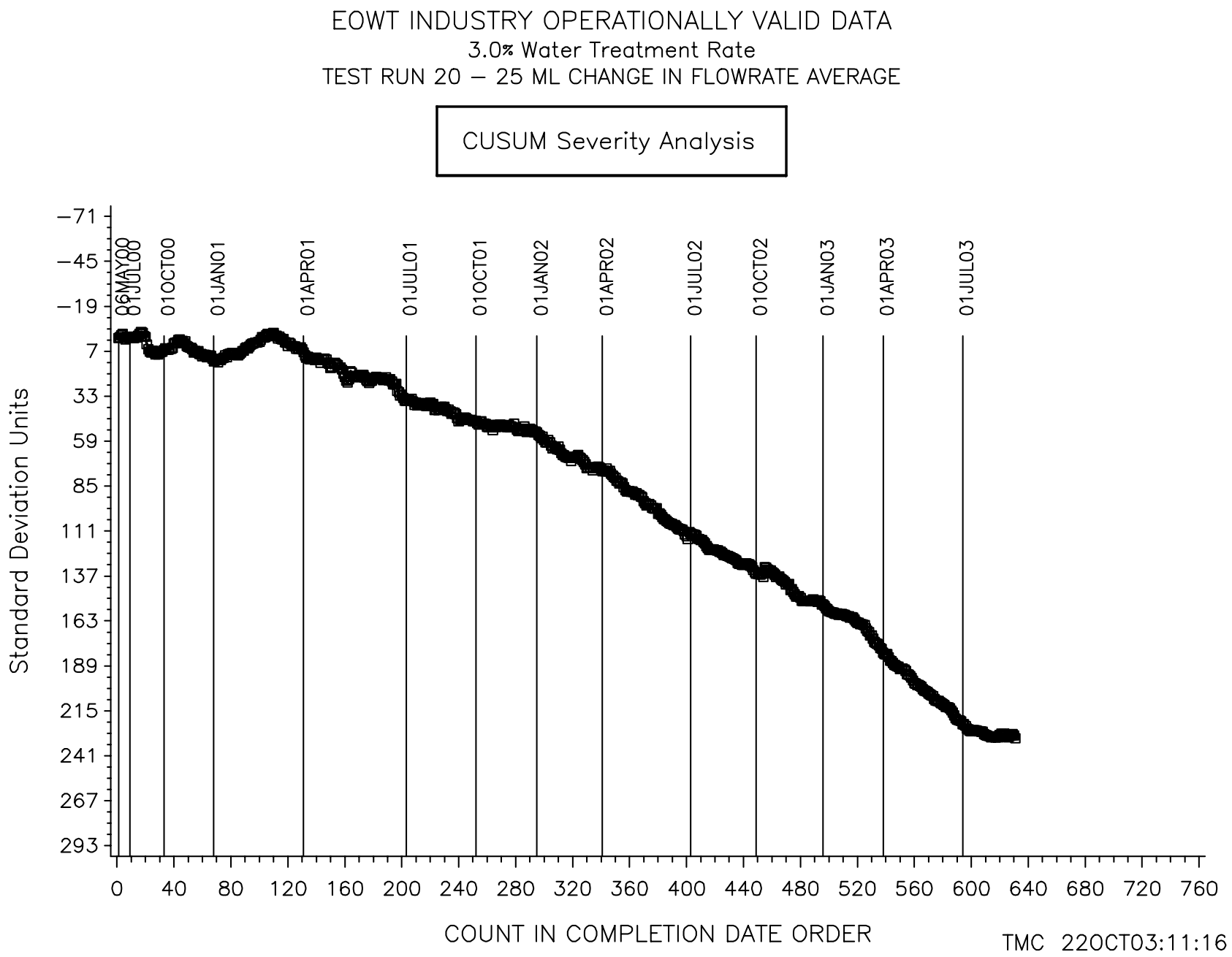

BALL RUST TEST INDUSTRY OPERATIONALLY VALID DATA
REFERENCE AVERAGE GRAY VALUE AVERAGE
CUSUM Severity Analysis
Standard Deviation Units
457
423
389
355
321
287
253
219
185
151
117
83
49
15
−19
15AUG00
01OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
01OCT02
01JAN03
01APR03
01JUL03
0
51
102
153
204
255
306
357
408
459
510
561
612
663
714
765
816
867
918
969
COUNT IN COMPLETION DATE ORDER
TMC 13OCT03:10:39


EOFT INDUSTRY OPERATIONALLY VALID DATA
20 – 25 ML CHANGE IN FLOWRATE AVERAGE (%)
CUSUM Severity Analysis
Standard Deviation Units
−104
−81
−58
−35
−12
11
34
57
80
103
126
149
172
195
218
04MAY00
01JUL00
01OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
01OCT02
01JAN03
01APR03
01JUL03
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 13OCT03:14:21


EOWT INDUSTRY OPERATIONALLY VALID DATA
0.6% Treat Rate
TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE
CUSUM Severity Analysis
Standard Deviation Units
−192
−166
−140
−114
−88
−62
−36
−10
16
42
68
94
120
146
172
05MAY00
01JUL00
01OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
01OCT02
01JAN03
01APR03
01JUL03
0
40
80
120
160
200
240
280
320
360
400
440
480
520
560
600
640
680
720
760
COUNT IN COMPLETION DATE ORDER
TMC 22OCT03:15:34


EOWT INDUSTRY OPERATIONALLY VALID DATA
1.0% Water Treat Rate
TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE
CUSUM Severity Analysis
Standard Deviation Units
−149
−123
−97
−71
−45
−19
7
33
59
85
111
137
163
189
215
05MAY00
01JUL00
01OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
01OCT02
01JAN03
01APR03
01JUL03
0
39
78
117
156
195
234
273
312
351
390
429
468
507
546
585
624
663
702
741
COUNT IN COMPLETION DATE ORDER
TMC 15OCT03:15:42


EOWT INDUSTRY OPERATIONALLY VALID DATA
2.0% Water Treatment Level
TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE
CUSUM Severity Analysis
Standard Deviation Units
−169
−143
−117
−91
−65
−39
−13
13
39
65
91
117
143
169
195
06MAY00
01JUL00
01OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
01OCT02
01JAN03
01APR03
01JUL03
0
39
78
117
156
195
234
273
312
351
390
429
468
507
546
585
624
663
702
741
COUNT IN COMPLETION DATE ORDER
TMC 22OCT03:10:05


EOWT INDUSTRY OPERATIONALLY VALID DATA
3.0% Water Treatment Rate
TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE
CUSUM Severity Analysis
Standard Deviation Units
−71
−45
−19
7
33
59
85
111
137
163
189
215
241
267
293
06MAY00
01JUL00
01OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
01OCT02
01JAN03
01APR03
01JUL03
0
40
80
120
160
200
240
280
320
360
400
440
480
520
560
600
640
680
720
760
COUNT IN COMPLETION DATE ORDER
TMC 22OCT03:11:16

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			4/1/02 - 9/30/02				10/1/02 - 3/31/03				4/1/03 - 9/30/03			
			n	Mean	sR	n	Mean	sR	Mean Δ/s	n	Mean	sR	Mean Δ/s	n	Mean	sR	Mean Δ/s
D6417	52	Area % Volatized	18	6.97	0.31	7	6.9	0.38	-0.36	2	6.6	0.21	-1.03	5	6.9	0.48	-0.23
	55	Area % Volatized	18	11.68	0.51	5	11.7	0.33	0.00	7	11.2	0.51	-0.91	4	11.0	0.14	-1.33
	58	Area % Volatized	18	5.61	0.30	4	5.4	0.24	-0.53	6	5.7	0.19	0.24	5	5.6	0.33	0.03
D5800	52	% volatility loss	33	13.75	0.61	10	13.7	0.73	0.10	12	13.8	0.55	0.29	11	13.9	0.53	0.40
**	55	% volatility loss	32	17.09	0.76	14	17.3	0.85	1.42	9	17.2	0.61	1.21	12	16.9	0.81	0.38
	58	% volatility loss	37	15.20	0.72	11	15.1	0.76	1.28	13	15.3	0.71	1.59	6	15.3	0.74	0.63
TEOST	71	Deposit wt. (mg)	27	51.79	4.79	5	61.2	4.71	1.96	3	51.7	6.66	-0.01	2	62.2	5.44	2.16
(D6335)	72	Deposit wt. (mg)	27	26.72	3.46	2	25.0	0.28	-0.50	2	31.1	0.28	1.27	4	36.2	13.68	2.73
MTEOS	1006	Deposit wt. (mg)	24	34.53	5.93	7	31.8	6.32	-0.46	14	31.4	8.72	-0.52	4	39.0	1.81	0.75
***	432	Deposit wt. (mg)	18	50.13	4.88	16	42.5	7.05	-1.56	8	41.8	6.62	-1.70	10	44.7	3.34	-1.12
	433	Deposit wt. (mg)	18	50.28	5.26	11	48.3	8.31	-0.37	13	47.2	5.00	-0.59	7	41.4	9.09	-1.70
	74	Deposit wt. (mg)	20	16.84	5.28	13	14.7	4.80	-0.41	7	13.5	4.95	-0.63	6	14.7	6.75	-0.41
GI	~~52~~	~~Gelation Index~~	~~35~~	~~4.5~~	~~0.24~~	~~8~~	~~4.4~~	~~0.12~~	~~-0.36~~	~~7~~	~~4.6~~	~~0.20~~	~~0.36~~	~~3~~	~~4.3~~	~~0.10~~	~~-0.83~~
(D5133)	~~53~~	~~Gelation Index~~	~~37~~	~~44.7~~	~~4.64~~	~~9~~	~~49.9~~	~~3.12~~	~~1.13~~	~~5~~	~~47.0~~	~~3.73~~	~~0.50~~	~~6~~	~~47.3~~	~~2.12~~	~~0.55~~
****	58	Gelation Index	17	5.8	0.69	8	6.4	0.66	0.80	8	6.6	1.00	1.09	9	5.8	0.95	-0.03
	62	Gelation Index	35	17.0	3.90	7	17.2	2.85	0.04	9	18.5	2.21	0.37	6	18.1	4.15	0.27
	1009	Gelation Index	16	7.30	0.68	-----	-----	-----	-----	-----	-----	-----	-----	3	7.2	0.60	-0.20
D6082	1007	Tendency (ml)	28	65.71	19.28	12	62.5	14.22	-0.17	11	62.7	17.52	-0.15	12	65.8	9.96	0.01

**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			4/1/01 - 9/30/01			10/1/01 - 3/31/02			4/1/02 - 9/30/02			10/1/02 - 3/31/03			4/1/03 - 9/30/03		
Test	Oil Code	Parameter	n	Mean	sR	n	Mean	sR	n	Mean	sR	n	Mean	sR	n	Mean	sR	n	Mean	sR
BRT	1006	Average AGV	12	128	7.21	39	124.4	5.77	29	125.0	5.19	30	123.0	9.11	38	126.0	5.09	44	123.5	7.76
	5A-3	Average AGV	12	76	6.47	38	83.4	12.60	28	87.6	15.69	38	89.7	15.52	23	85.9	14.43	14	87.6	16.30
	81	Average AGV	12	112	14.00	79	117.8	7.99	59	121.2	13.22	70	121.3	9.38	82	124.6	5.98	60	119.9	11.46
	82	Average AGV	12	48	11.50	---	---	---	---	---	---	---	---	---	---	---	---	1	55.0	0.00
EOFT	77	Avg. % CF	12	-45.55	4.36	0	----	----	0	----	----	0	----	----	0	----	----	0	----	----
	78	Avg. % CF	12	15.74	6.87	103	15.2	6.67	84	15.3	5.67	89	16.5	5.39	81	13.9	4.16	71	15.8	3.70
EOWT	77	0.6 H2O Avg. %CF	12	-24.90	5.68	63	-24.8	5.64	47	-24.6	5.45	61	-24.5	4.15	48	-24.5	4.15	51	-23.6	3.77
	77	1.0 H2O Avg. %CF	12	-17.94	5.45	59	-16.3	5.71	41	-17.3	6.70	52	-16.4	4.17	47	-16.2	2.49	47	-15.4	3.48
	77	2.0 H2O Avg. %CF	12	-17.96	8.47	56	-16.1	6.25	47	-17.9	5.34	47	-16.7	3.87	36	-15.1	5.21	49	-14.2	3.55
	77	3.0 H2O Avg. %CF	12	-18.23	6.83	60	-17.7	6.44	46	-17.0	5.46	50	-16.9	5.70	46	-16.2	4.53	42	-16.3	3.01
EOWT	78	0.6 H2O Avg. %CF	12	10.87	6.16	60	11.4	6.90	41	9.9	6.80	41	13.0	5.00	41	10.5	5.41	42	9.4	4.06
	78	1.0 H2O Avg. %CF	12	7.54	6.15	56	8.9	5.87	48	7.1	7.61	52	8.9	4.42	42	8.6	4.23	47	6.8	3.80
	78	2.0 H2O Avg. %CF	12	5.17	5.33	58	6.4	6.85	42	4.9	6.18	56	5.4	3.67	53	4.9	6.12	44	4.5	3.79
	78	3.0 H2O Avg. %CF	12	-0.54	4.52	62	2.2	6.48	43	1.5	6.18	58	3.4	3.59	43	2.6	5.64	52	2.9	3.51