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

MEMORANDUM: 05-018

DATE: May 3, 2005

TO: Mr. Ted Selby, Co-Chair ASTM D02.B0.07
Mr. Mark Devlin, Co-Chair ASTM D02.B0.07

FROM: Thomas Schofield & Rich Grundza

SUBJECT: TMC Bench Reference Test Monitoring from October 1, 2004 through March 31, 2005

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/mem05-018.pdf

Distribution: Email

Attachment 1

ASTM Test Monitoring Center

Semiannual Report

ASTM D02.B07 Bench Reference Test Monitoring
From October 1, 2004 through March 31, 2005

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	13
Operationally Valid but Failed Acceptance Criteria	3
Operationally Invalid (initially reported as)	0
Operationally Invalid (after informed of failing calibration)	0
Total	**16**

Fail Rate of Operationally Valid Tests: 18.8%

Table 2 is a breakdown of the statistically unacceptable tests.

TABLE 2

Reason for Fail	No. of Tests
Area % Volatized @ 371°C Severe	1
Area % Volatized @ 371°C Mild	2*

*Two consecutive mild fails reported by same lab and instrument; reported as operationally valid.

INDUSTRY PERFORMANCE

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

TABLE 3

Area % Volatized @ 371°C	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study	107	101	0.46	-----
10/1/02 through 3/31/03	15	12	0.39	-0.47
4/1/03 through 9/30/03	14	11	0.36	-0.45
10/1/03 through 3/31/04	15	12	0.50	-0.42
4/1/04 through 9/30/04	15	12	0.40	0.28
10/1/04 through 3/31/05	16	13	0.46	-0.04

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

TABLE 4

	n	Mean Δ/s
Lab A	6	-0.91
Lab B	3	0.90
Lab D	1	-0.55
Lab G	2	-0.30
Lab H	2	1.02
Lab S	2	0.67

PRECISION AND SEVERITY

D6417 calibration testing precision is directionally worse than last period and the equals the target precision. Overall severity is on target (slight mild bias). Severity is represented graphically in Figure 1. The figure shows a continuing severe trend, then a sudden, short mild trend with some leveling toward the end of the period. Lab A had two consecutive failing mild results (-2.2 s and -3.1 s) on the same instrument, and then finally achieved calibration on a third attempt (still mild, though at -1.5 s). The lab never recalled the two failing runs as operationally invalid, and therefore they are included in the period statistics. With three tests reported as operationally valid and failing to meet the acceptance criteria, the fail rate (18.8%) is unusually high this period.

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

TMC MEMORANDA

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

D5800: Evaporation Loss of Lubricating Oils by the Noack Method

STATUS

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

TABLE 5

	No. of Tests
Statistically Acceptable and Operationally Valid	33
Operationally Valid but Failed Acceptance Criteria	2
Operationally Invalid (initially reported as)	2
Operationally Invalid (after informed of failing calibration)	0
Total	**37**

Fail Rate of Operationally Valid Tests: 5.7%

Table 6 is a breakdown of the statistically unacceptable tests.

TABLE 6

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

*Both statistically unacceptable tests this period were by Procedure A; and both by the same lab, on the same instrument.

INDUSTRY PERFORMANCE

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

TABLE 7

Sample Evaporation Loss, mass %	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study	180	175	0.51	-----
New Targets Effective 9/26/00	178	175	0.56	-----
4/1/02 through 9/30/02	35	32	0.79	1.00
10/1/02 through 3/31/03	34	31	0.63	1.03
New Targets Effective 7/15/2003	102	99	0.70	-----
4/1/03 through 9/30/03	29	26	0.70	0.44
10/1/03 through 3/31/04	32	29	0.64	0.29
4/1/04 through 9/30/04	30	27	0.64	0.24
10/1/04 through 3/31/05	35	32	0.69	0.11

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

TABLE 8

Sample Evaporation Loss, mass %	n	df	Pooled s	Mean Δ/s
Procedure A	4	2	1.72	-0.27
Procedure B	29	26	0.43	0.12
Procedure C	2	0	---	0.74

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

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

TABLE 9

	n	Mean Δ/s
Lab A	8	-0.24
Lab B	6	0.07
Lab D	2	0.74
Lab F	5	0.34
Lab G	5	-0.26
Lab H	2	0.52
Lab I	3	0.49
Lab J	4	0.23

PRECISION AND SEVERITY

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

Overall precision for the report period is comparable to the target precision, and only directionally worse than the last two report periods. Overall severity is slightly severe of targets and closer to target than all previous periods. Severity is graphically represented in Figures 2A and 2B. Figure 2B better illustrates improvement in the severity trend following the revised oil targets timeline, with only a slight severe bias this period. Table 8 shows the severity of the Procedure B results alone (0.12 s) is comparable to the overall period severity (0.11 s), while the four Procedure A tests reported this period are substantially more mild. There is insufficient data to determine a pooled precision for the two Procedure C results reported this period.

Failure rates for tests reported to the TMC as operationally valid but evaluated as statistically unacceptable have dropped from a range of 15.2% - 25.7% for the five report periods prior to the revised targets, down to a more reasonable 3.1% to 5.7% for the last three periods

TMC MEMORANDA

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

Memo 05-004, January 17, 2005, D5800 Technical Update: Updated Test method.

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

STATUS

Table 10 summarizes the reference tests reported to the TMC this period (8 labs reporting):

TABLE 10
Reference Tests

	No. of Tests
Statistically Acceptable and Operationally Valid	29
Operationally Valid but Failed Acceptance Criteria	5
Operationally Invalid (initially reported as)	1
Operationally Invalid (after informed of failing calibration)	0
Total	**35**

Fail Rate of Operationally Valid Tests: 14.7%

Table 11 is a breakdown of the statistically unacceptable tests.

TABLE 11

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

INDUSTRY PERFORMANCE

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

TABLE 12

Gelation Index	n	df	Pooled s	Mean Δ/s
Revised Targets Effective 20011024 (Oils 52, 53 & 62 targets unchanged, added oil 58)	1	120	3.29	-----
10/1/01 through 3/31/02	3	26	4.76	-0.02
*4/1/02 through 9/30/02	3	28	2.15	0.43
*10/1/02 through 3/31/03	2	25	2.02	0.59
Revised Targets Effective 20030715 (Oils 58 & 62 targets unchanged, added oil 1009, dropped oils 52 & 53)		65	2.86	-----
4/1/03 through 9/30/03	2	22	2.30	0.06
10/1/03 through 3/31/04	3	34	5.86	1.73
4/1/04 through 9/30/04	2	24	3.05	0.40
10/1/04 through 3/31/05	3	31	2.51	0.40

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

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

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

TABLE 13

	n	GI Mean Δ/s
Lab A	7	0.12
Lab B	6	-0.41
Lab D	4	0.44
Lab G	5	-0.53
Lab H	2	1.19
Lab I	6	2.01
Lab R	2	0.87
Lab S	2	-0.07

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.

Overall precision has improved compared to last period and is better than target. Overall testing is severe of targets at the same level as last period. Fail rate of tests reported as operationally valid (14.7%) is somewhat better than the last two periods (24.3% and 18.5%). Severity is graphically represented in Figures 3A and 3B with an overall severe trend for the period. Attachment 3A shows oil 58 running 1.62 s severe for the period, compared to oil 62 at -0.22 s mild and oil 1009 at -0.31 s mild, however the severity on oil 58 is strongly influenced by a single result from Lab I that was 9.3 s severe (the lab reports this test as operationally valid). As mentioned in previous reports, oil 58 is a "non-gelling" oil that has proven to be a very good indicator of instruments that are beginning to experience operational problems. It is also possible that the target performance of oil 58 needs to be updated (targets were set on oil 58 with just 17 results, and on oil 1009 with just 16 results).

Labs H and I are running substantially severe this period compared to the other labs.

As noted below, a technical memo has been issued requiring the rotation of calibration heads, and the GI standard report package is updated to include the reporting of operational parameters for TMC calibration tests. These are tasks that were assigned at the last D02.B0.07 meeting.

TMC MEMORANDA

There were two TMC technical memos issued this report period for the D5133 test method:

Memo 05-003, January 19, 2005, Gelation Index Technical Update: Rotating Calibrations
Report Packet Revision Notice GI-20050310, May 3, 2005

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

STATUS

Table 14 summarizes the reference tests reported to the TMC this period (3 labs reporting):

TABLE 14

	No. of Tests
Statistically Acceptable and Operationally Valid	8
Operationally Valid but Failed Acceptance Criteria	2
Operationally Invalid (initially reported as)	0
Operationally Invalid (after informed of failing calibration)	0
Total	**10**

Fail Rate of Operationally Valid Tests: 20.0%

Table 15 is a breakdown of the statistically unacceptable tests.

TABLE 15

Reason for Fail	No. of Tests
Total Deposits Mild (Oil 71)	2

INDUSTRY PERFORMANCE

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

TABLE 16

Total Deposits	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study	54	52	4.18	-----
4/1/01 through 9/30/01	5	3	2.04	0.48
10/1/01 through 3/31/02	6	4	1.32	0.83
4/1/02 through 9/30/02	7	5	4.22	1.26
10/1/02 through 3/31/03	5	3	5.44	0.50
4/1/03 through 9/30/03*	6	4	12.15	2.54
4/1/03 through 9/30/03*	5	3	3.84	1.33
10/1/03 through 3/31/04	7	5	7.61	-0.56
4/1/04 through 9/30/04	5	3	3.89	-0.63
10/1/04 through 3/31/05	10	8	6.30	-0.32

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

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

TABLE 17

	n	Mean Δ/s
Lab A	4	-1.06
Lab B	4	-0.11
Lab G	2	0.73

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

PRECISION AND SEVERITY

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

TMC MEMORANDA

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

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

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

STATUS

Table 18 summarizes the reference tests reported to the TMC this period (5 labs reporting):

TABLE 18

	No. of Tests
Statistically Acceptable and Operationally Valid	32
Operationally Valid but Failed Acceptance Criteria	4
Operationally Invalid (initially reported as)	2
Operationally Invalid (after informed of failing calibration)	11
Total	**49**

Fail Rate of Operationally Valid Tests: 11.1%

Table 19 is a breakdown of the statistically unacceptable tests.

TABLE 19

Reason for Fail	No. of Tests
Total Deposits Mild (Oil 434)*	3*
Total Deposits Severe (Oil 432)	1

*In an unusual sequence of calibration attempts, one lab reported a failing mild result and subsequently found an operational fault to declare that test operationally invalid; the lab followed up with two more successive failing results on that same instrument (-6.1 s and -5.4 s mild) with no operational explanation to otherwise disqualify the two results, so they remain in the period statistics as operationally invalid. The lab finally qualified on a fourth calibration attempt for that instrument (at 1.8 s severe), without additional explanation. The sequence of results would strongly suggest an undetermined operational problem with the results reported as operationally valid.

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

INDUSTRY PERFORMANCE

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

TABLE 20

Total Deposits	n	df	Pooled s	Mean Δ/s
Updated Targets Effective 6/1/01	80	76	5.40	-----
4/1/01 through 9/30/01	34	30	5.61	-0.47
10/1/01 through 3/31/02	44	40	6.56	-0.44
4/1/02 through 9/30/02	47	43	6.74	-0.80
10/1/02 through 3/31/03	42	38	6.77	-0.78
4/1/03 through 9/30/03	27	23	6.02	-0.83
Updated Targets Effective 2/18/04	50	46	4.92	-----
10/1/03 through 3/31/04	35	31	9.40	-0.69*
4/1/04 through 9/30/04	40	36	7.29	-0.55
Updated Targets Effective 1/12/05	30	27	3.42	-----
10/1/04 through 3/31/05	36	31	5.15	-0.11**

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

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

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

TABLE 21

	n	Mean Δ/s
Lab A	12	0.38
Lab B	11	-1.06
Lab D	4	-0.30
Lab G	8	0.31
Lab I	1	1.73

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

PRECISION AND SEVERITY

Effective 20031101, the monitored labs began using the "Version 2" test method for TMC calibrations (moving from the previous "Draft 17" version of the test method). All labs were asked to recalibrate all monitored instruments effective November 1, 2003 because of the expected (but still unexplained) performance shift on the reference oils due to the change in test method version.

New targets and acceptance bands were also introduced, effective 20031101 (based on selected data from a Subcommittee 9 round-robin) and again on 20040218 (adding additional round-robin data collected by B0.07 for reference oil 432). Targets and acceptance bands were again updated effective 20050112 by adding oil 434 and dropping oils 433 & 1006. It was hoped that the reference oil targets and acceptance bands would be further updated with additional reference data at the last B0.07 meeting, but imprecise data (thought to be strongly biased by Batch D rod inconsistencies) prevented an accurate assessment of true performance. The Section 07 TEOST Surveillance Panel should consider updating the present reference oil performance targets and acceptance bands when and acceptably precise data set can be collected (Attachment 2 shows the current reference oil performance targets and acceptance bands; note the small n sizes for all three current MTEOS reference oils).

Overall precision is worse than target precision, but better than most all previous periods (so, this might be a good time to consider updating our oil targets). Overall severity is running slightly mild. Fail rates of operationally valid tests are higher than statistically expected, but lower than recent prior periods. What is alarming, however, is the high number of tests that labs have reported with the mistaken understanding that they ran an operationally valid test, but subsequently uncover operational problems only after being informed that the calibration test result fails to meet the reference oil acceptance bands. Eleven tests out of forty-nine reported this period (a full 22%) fall into this category (those eleven tests were from four different labs).

Lab B (with 11 operationally valid tests reported this period) is running substantially mild for the period, while Lab R (with 1 test) is substantially severe. The past two periods all labs were running mild (mostly using Rod Batch D), while this period there is a mix of lab severities with all tests using Rod Batch E. Attachment 3A shows a breakdown of performance by oil for the period.

The MTEOS severity trends are graphically represented in Figures 5A & 5B, with Figure 5B showing when the new performance targets were implemented and when labs began using Rod batch E. Figure 5A shows the period actually had a stronger severe trend through most of the period that was sharply offset by two exceptionally mild results (as discussed under Table 19, above). Without those two strong mild results, the overall severity (n=34) would have been 0.22 s SEVERE rather than -0.11 s mild for all 36 period results. This might suggest that the reference oil targets are not set quite right and a careful adjustment would be appropriate.

TMC MEMORANDA

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

Memo 05-001, January 14, 2005, MTEOS Technical Update: Change in Selected Reference Oils

D6082: High Temperature Foaming Characteristics of Lubricating Oils

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

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

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

STATUS

Table 22 summarizes the reference tests reported to the TMC this period (5 labs reporting):

TABLE 22

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

Fail Rate of Operationally Valid Tests: 0.0%

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

D6082: High Temperature Foaming Characteristics of Lubricating Oils, continued

TMC 1007 INDUSTRY PERFORMANCE

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

TABLE 23

1007 Foam Tendency, ml	n	Mean	s	Mean Δ/s
Initial Round Robin Study (targets)	28	65.71	19.28	-----
4/1/01 through 9/30/01	9	71.1	14.53	0.28
10/1/01 through 3/31/02	11	64.5	15.07	-0.06
4/1/02 through 9/30/02	12	62.5	14.22	-0.17
10/1/02 through 3/31/03	11	62.7	17.52	-0.15
4/1/03 through 9/30/03	12	65.8	9.96	0.01
10/1/03 through 3/31/04	12	62.5	10.55	-0.17
4/1/04 through 9/30/04	13	72.3	15.89	0.34
10/1/04 through 3/31/05	12	72.9	16.30	0.37

TABLE 24

1007 Foam Stability @ 1 min., ml	n	Mean	s
Initial Round Robin Study	28	0.00	0.00
4/1/01 through 9/30/01	9	No non-zero occurrences	
10/1/01 through 3/31/02	11	No non-zero occurrences	
4/1/02 through 9/30/02	12	No non-zero occurrences	
10/1/02 through 3/31/03	11	No non-zero occurrences	
4/1/03 through 9/30/03	12	No non-zero occurrences	
10/1/03 through 3/31/04	12	No non-zero occurrences	
4/1/04 through 9/30/04	13	No non-zero occurrences	
10/1/04 through 3/31/05	12	No non-zero occurrences	

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

TABLE 25
TMC 1007

	n	Foam Tendency Mean Δ/s
Lab A	2	0.48
Lab B	4	0.35
Lab D	2	1.78
Lab G	2	-0.81
Lab I	2	0.09

PRECISION AND SEVERITY

Foam Tendency precision on 1007 has degraded somewhat and severity is slightly severe of target. There were no non-zero occurrences of Foam Stability on 1007 suggesting Foam Stability precision is as expected. Foam Tendency severity is graphically represented in Figure 6. Additionally, all discrimination tests reported this period meet the acceptance criteria (that is, all reporting labs could discriminate oil 66 as a GF-3 failing oil).

TMC MEMORANDA

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

D6922-03 Standard Test Method for Determination of Homogeneity and Miscibility in Automotive Engine Oils

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

D6557: Ball Rust Test (BRT)

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

STATUS

Table 26 summarizes the reference tests reported to the TMC this period (4 labs reporting):

TABLE 26

	No. of Tests
Statistically Acceptable and Operationally Valid	124
Statistically Unacceptable and Operationally Valid	3
Operationally Invalid (initially reported as)	5
Aborted	1
Total	**133**

Fail Rate of Operationally Valid Tests: 2.3%

Table 27 summarizes the reasons for failing reference tests this period:

TABLE 27

Reason for Fail	No. of Tests
Average Gray Value Mild (Oil 1006)	2
Average Gray Value Severe (Oil 82)	1

INDUSTRY PERFORMANCE

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

TABLE 28

Average AGV	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study (targets)	48	44	9.43	-----
8/15/00 through 9/30/00	28	25	10.50	0.38
10/1/00 through 3/31/01	112	109	8.48	0.42
4/1/01 through 9/30/01	156	153	8.90	0.36
10/1/01 through 3/31/02	116	113	12.46	0.67
4/1/02 through 9/30/02	138	135	11.38	0.76
10/1/02 through 3/31/03	143	140	7.76	0.69
4/1/03 through 9/30/03	119	116	10.95	0.27
10/1/03 through 3/31/04	71	68	10.21	0.14
4/1/04 through 9/30/04	97	94	7.25	0.25
10/1/04 through 3/31/05	127	124	8.29	0.18

D6557: Ball Rust Test (BRT), continued

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

TABLE 29

	n	Mean Δ/s
Lab A	67	-0.05
Lab B	22	0.51
Lab G	32	0.27
Lab D	6	1.17

PRECISION AND SEVERITY

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

TMC MEMORANDA

No technical memoranda were issued this report period.

Engine Oil Filterability Test (EOFT)

STATUS

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

TABLE 30

	No. of Tests
Statistically Acceptable and Operationally Valid	103
Operationally Valid but Failed Acceptance Criteria	2
Total	**105**

Fail Rate of Operationally Valid Tests: 2.3%

Table 31 is a breakdown of the statistically unacceptable tests.

TABLE 31

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

INDUSTRY PERFORMANCE

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

TABLE 32

Average % CIF	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study (targets)	24	22	5.76	-----
5/4/00 through 9/30/00	53	51	7.47	1.64
10/1/00 through 3/31/01	79	78	4.79	0.30
4/1/01 through 9/30/01	103	102	6.69	-0.08
10/1/01 through 3/31/02	84	83	5.67	-0.06
4/1/02 through 9/30/02	89	88	5.38	0.11
10/1/02 through 3/31/03	81	80	4.16	-0.27
4/1/03 through 9/30/03	71	70	3.70	0.02
10/1/03 through 3/31/04	66	65	8.68	-0.54
4/1/04 through 9/30/04	86	85	7.87	-0.13
10/1/04 through 3/31/05	105	104	6.58	-0.30

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

TABLE 33

	n	Mean Δ/s
Lab A	30	-0.98
Lab B	24	0.16
Lab G	51	-0.12

PRECISION AND SEVERITY

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

At this time, only TMC 78 is being assigned as TMC calibration oil. Based on current usage rates, there is about a one year supply of reference oil 78. A reblend of reference oil 78 is available at the Test Monitoring Center.

TMC MEMORANDA

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

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

STATUS

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

TABLE 34

	No. of Tests
Statistically Acceptable and Operationally Valid	112
Operationally Valid but Failed Acceptance Criteria	1
Total	**113**

Fail Rate of Operationally Valid Tests: 0.9%

Table 35 is a breakdown of the statistically unacceptable test.

TABLE 35

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

INDUSTRY PERFORMANCE

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

TABLE 36

Average % CIF	N	df	Pooled s	Mean Δ/s
Initial Round Robin Study (targets)	24	22	5.93	-----
5/4/00 through 9/30/00	34	32	6.25	-0.04
10/1/00 through 3/31/01	101	99	5.61	-0.17
4/1/01 through 9/30/01	123	121	6.28	0.05
10/1/01 through 3/31/02	88	86	6.12	-0.05
4/1/02 through 9/30/02	102	100	4.50	0.18
10/1/02 through 3/31/03	89	87	4.86	-0.08
4/1/03 through 9/30/03	93	92	3.89	0.01
10/1/03 through 3/31/04	90	88	5.12	-0.23
4/1/04 through 9/30/04	108	107	5.72	-0.13
10/1/04 through 3/31/05	113	111	6.18	-0.05

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	39	-0.89
Lab B	24	0.22
Lab G	50	0.48

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

PRECISION AND SEVERITY

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

Based on current usage rates, there is about a one year supply of reference oil 78. A reblend of oil 78 is available at the Test Monitoring Center.

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

STATUS

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

TABLE 38

	No. of Tests
Statistically Acceptable and Operationally Valid	112
Operationally Valid but Failed Acceptance Criteria	2
Total	**114**

Fail Rate of Operationally Valid Tests: 1.8%

Table 39 is a breakdown of the statistically unacceptable test.

TABLE 39

Reason for Fail	No. of Tests
Average % Change in Flow Mild (Oil 78)	1
Results between Samples >11.1% (Oil 77)	1

INDUSTRY PERFORMANCE

Table 40 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 40

Average % CIF	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study (targets)	24	22	5.81	-----
5/4/00 through 9/30/00	33	31	6.98	0.12
10/1/00 through 3/31/01	99	97	5.85	-0.19
4/1/01 through 9/30/01	115	113	5.79	0.26
10/1/01 through 3/31/02	89	87	7.20	0.02
4/1/02 through 9/30/02	105	103	4.30	0.25
10/1/02 through 3/31/03	89	87	3.42	0.25
4/1/03 through 9/30/03	94	93	3.64	0.17
10/1/03 through 3/31/04	88	86	3.89	0.17
4/1/04 through 9/30/04	106	105	4.69	0.13
10/1/03 through 3/31/04	114	113	5.64	0.21

Table 41 shows the current severity for the Average % CIF parameter for each lab for all operationally valid tests for the report period.

TABLE 41

	N	Mean Δ/s
Lab A	40	-0.65
Lab B	24	-0.04
Lab G	50	1.02

PRECISION AND SEVERITY

Precision has degraded when compared to the previous period and compares well with historical estimates. Industry data is trending severe. Lab A trended mild, while lab G was severe this report period. Lab B was on or near target for the period. Severity is graphically represented in Figure 10 (attached).

Based on current usage rates, there is about a one year supply of reference oil 78. A reblend of reference oil 78 is available at the Test Monitoring Center.

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

STATUS

Table 42 summarizes the reference tests reported to the TMC this period (3 labs reporting):

TABLE 42

	No. of Tests
Statistically Acceptable and Operationally Valid	112
Operationally Valid but Failed Acceptance Criteria	3
Total	**115**

Fail Rate of Operationally Valid Tests: 2.6%

Table 43 is a breakdown of the statistically unacceptable test.

TABLE 43

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

INDUSTRY PERFORMANCE

Table 44 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 44

Average % CIF	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study (targets)	24	22	7.08	-----
5/4/00 through 9/30/00	31	29	5.63	-0.07
10/1/00 through 3/31/01	100	98	6.25	-0.16
4/1/01 through 9/30/01	114	112	6.57	0.22
10/1/01 through 3/31/02	89	87	5.75	-0.02
4/1/02 through 9/30/02	103	101	3.76	0.09
10/1/02 through 3/31/03	89	87	5.77	0.11
4/1/03 through 9/30/03	93	91	3.66	0.17
10/1/03 through 3/31/04	92	90	5.03	0.33
4/1/04 through 9/30/04	107	106	5.01	0.24
10/1/04 through 3/31/05	115	114	5.96	0.29

Table 45 shows the current severity for the Average % CIF parameter for each lab for all operationally valid tests for the report period.

TABLE 45

	N	Mean Δ/s
Lab A	41	-0.45
Lab B	24	0.03
Lab G	50	1.02

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

PRECISION AND SEVERITY

Precision for this period has degraded when compared with the previous period and compares well with the target estimates. Severity trended severe for the period. Lab A trended mild, Lab G trended severe, and Lab B was on or near target for the period. Severity is graphically represented in Figure 11 (attached).

Based on current usage rates, there is about a one year supply of reference oil 78. A reblend of reference oil 78 is available at he Test Monitoring Center.

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

STATUS

Table 46 summarizes the reference tests reported to the TMC this period (3 labs reporting):

TABLE 46

	No. of Tests
Statistically Acceptable and Operationally Valid	112
Total	**112**

Fail Rate of Operationally Valid Tests: 0.0%

INDUSTRY PERFORMANCE

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

TABLE 47

Average % CIF	N	df	Pooled s	Mean Δ/s
Initial Round Robin Study (targets)	24	22	5.79	-----
5/4/00 through 9/30/00	32	30	5.71	0.23
10/1/00 through 3/31/01	98	96	5.71	-0.01
4/1/01 through 9/30/01	122	120	6.46	0.34
10/1/01 through 3/31/02	89	87	5.82	0.31
4/1/02 through 9/30/02	108	106	4.69	0.56
10/1/02 through 3/31/03	89	87	5.09	0.50
4/1/03 through 9/30/03	94	92	3.29	0.55
10/1/03 through 3/31/04	90	88	3.74	0.52
4/1/04 through 9/30/04	109	108	4.50	0.56
10/1/04 through 3/31/05	112	111	5.08	0.61

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

TABLE 48

	N	Mean Δ/s
Lab A	38	-0.24
Lab B	24	0.35
Lab G	50	1.38

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

PRECISION AND SEVERITY

Precision has degraded when compared to the previous period and compares well with the target matrix. Severity trended severe of target for the period. Severity is graphically represented in Figure 12 (attached). Lab A trended mild while labs B and G trended severe of target during the period.

Based on current usage rates, there is about a one year supply of reference oil 78. A reblend of oil 78 is available at the Test Monitoring Center.

REFERENCE OIL SUPPLIES

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

Table 49A

Oil	For Tests	Quantity Left (gallons)	Quantity Used Last 12 Months (gallons)
^51	Obsolete Vol. & GI	94.6	0.0
52	D6417, D5800, GI	68.6	0.8
^53	Obsolete Vol. & GI	96.8	0.0
^54	Obsolete Volatility	97.8	0.0
55	D6417, D5800	73.6	0.6
^57	Old Volatility Candidate	51.2	0.0
58	D6417, D5800, GI	126.3	0.8
62	GI	1.8	0.1
66	D6082 (Discrimination)	101.8	0.6
71	TEOST	3.9	0.4
72	TEOST	4.0	0.4
74	MTEOS	2.1	0.1
77	EOWT	108.3	34.0
78	EOFT, EOWT	45.2	47.8
^80	BRT Candidate	26.5	0.0
81	BRT	17.4	1.1
82	BRT	9.1	0.4
^**432	Obsolete MTEOS	Adequate	-----
**433	MTEOS	Adequate	-----
**434	MTEOS	Adequate	-----
1006	BRT, MTEOS	42.1	1.4
*1007	D6082	Est. 28	-----
**1009	GI	Adequate	-----

^Not selected as reference oil; TMC holding for further instructions from Surveillance Panel.
*One drum of oil is set aside for bench calibration testing; the TMC has a larger supply of this oil.
**Five gallon aliquot set aside for bench testing; hard to get an inventory reading on amount set aside.

REFERENCE OIL SUPPLIES, continued

Table 49B

Oil	For Tests	Quantity Left (gallons)	Quantity Used Last 12 Months (gallons)
HMA	H&M (D6922)	200.8	2.8
HMB	H&M (D6922)	204.8	2.8
HMC	H&M (D6922)	190.8	2.8
HMD	H&M (D6922)	198.8	2.8
HME	H&M (D6922)	183.8	2.8
HMF	H&M (D6922)	206.5	4.0

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

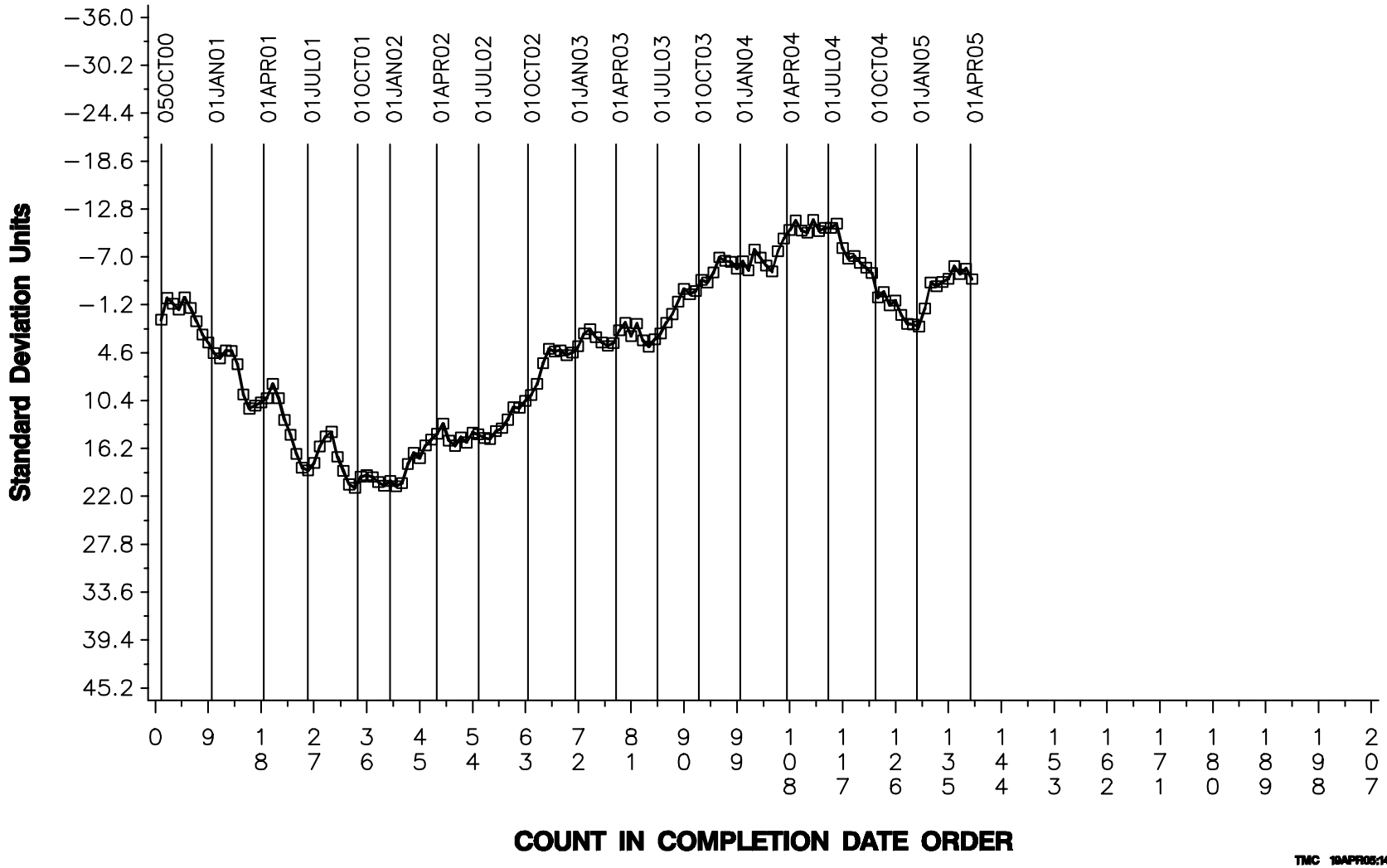
The TMC posts monitored bench test calibration data on the Internet. Selected parameters from all operationally valid reference tests are posted on the TMC's World-Wide-Web page in real time. Lab identifications are coded on the TMC's web site as they are on the previous pages of this report. Also posted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

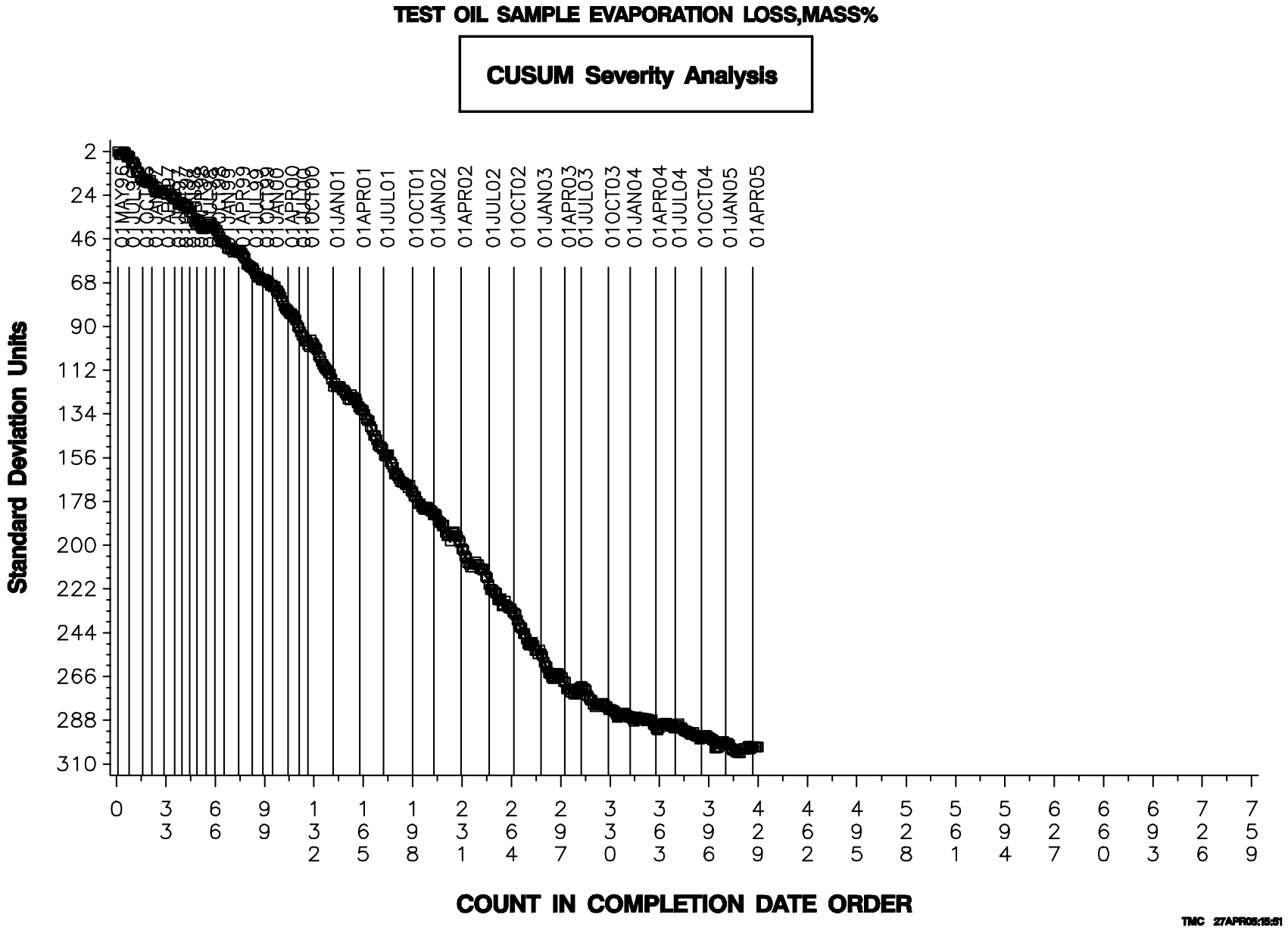
SAMPLE AREA % VOLATIZED @ 371'C ... 700'F

CUSUM Severity Analysis

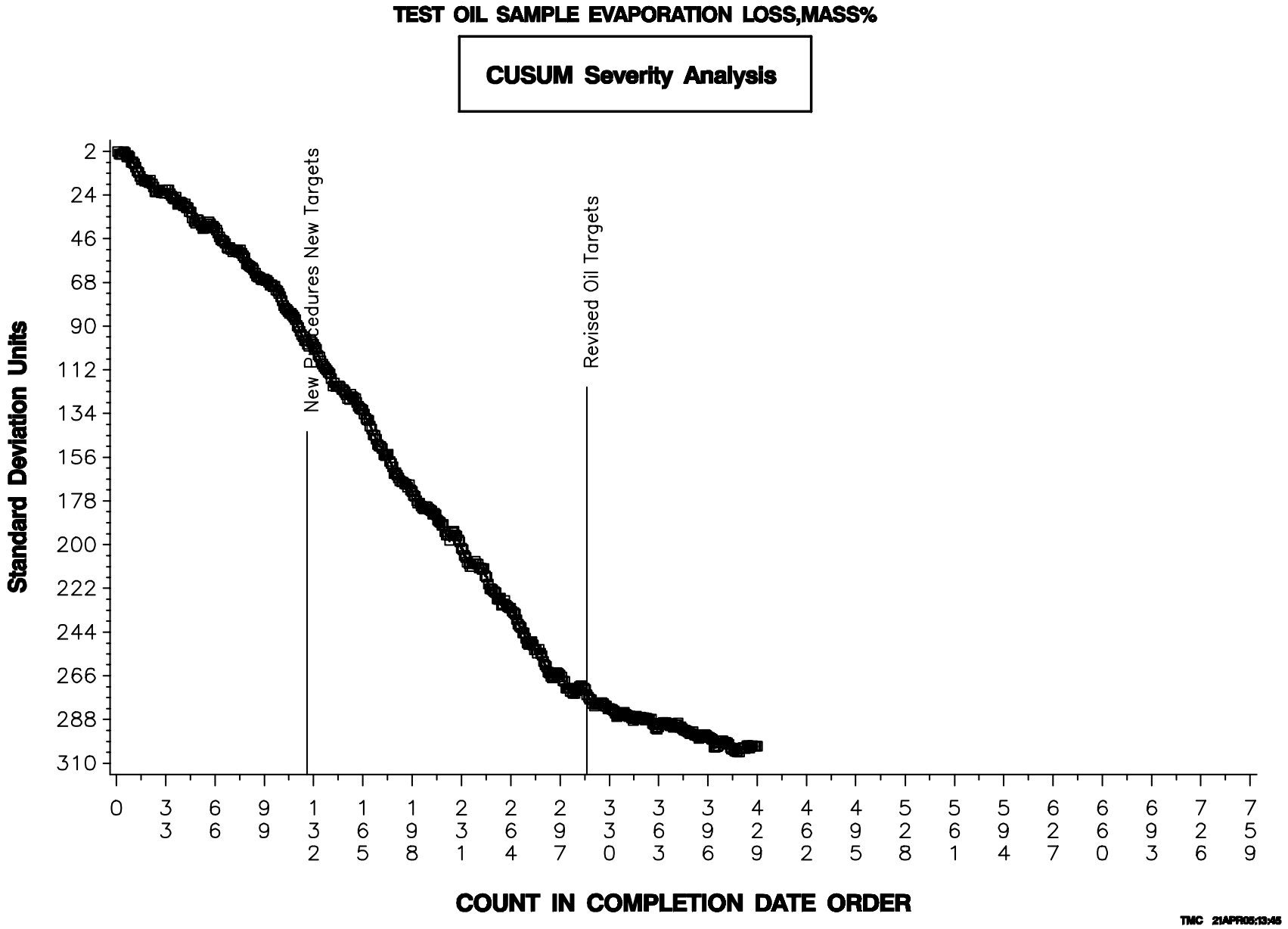


TMC 19APR05:14:39

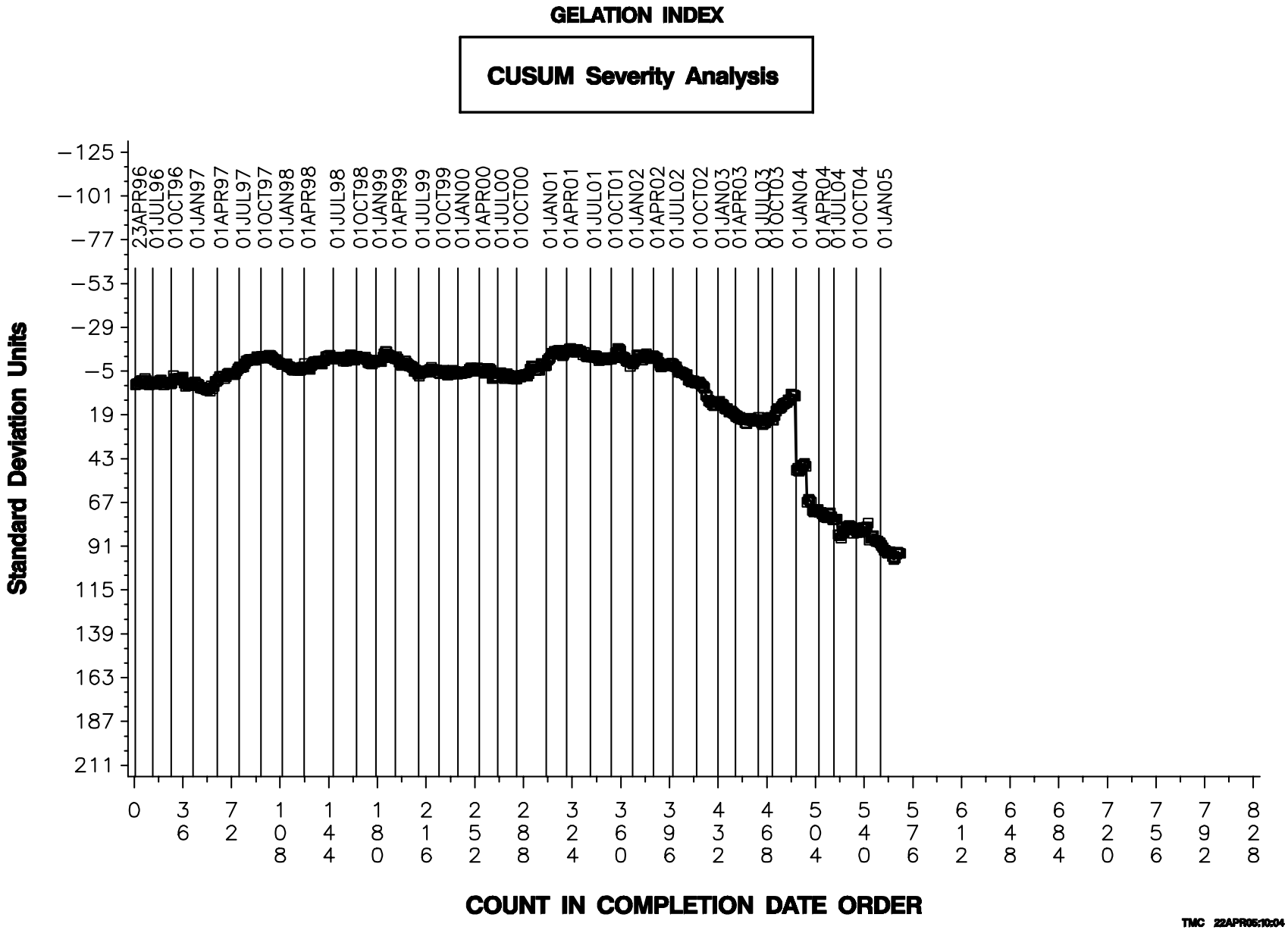
D5800 VOLATILITY BY NOACK INDUSTRY OPERATIONALLY VALID DATA



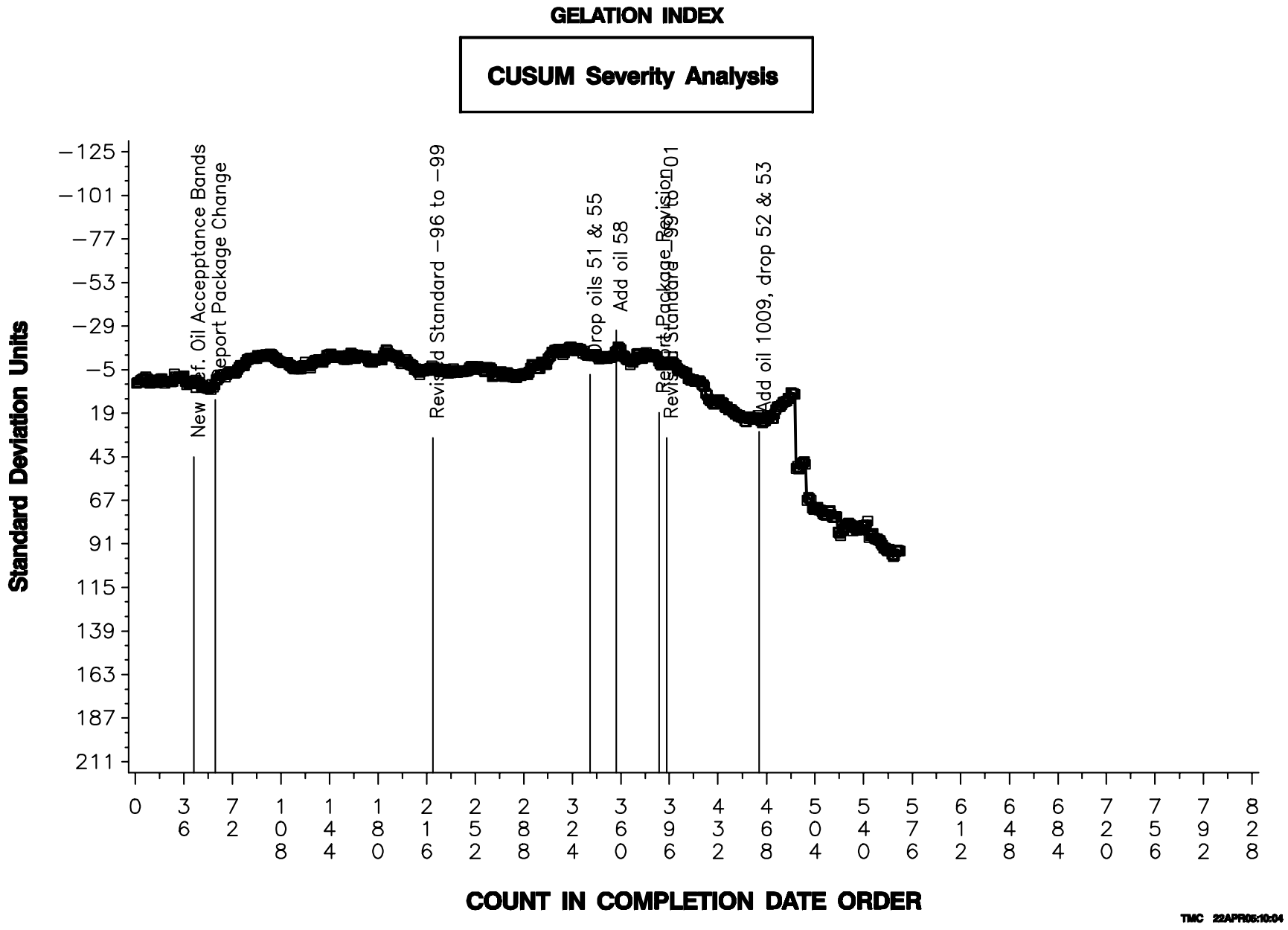
D5800 VOLATILITY BY NOACK INDUSTRY OPERATIONALLY VALID DATA



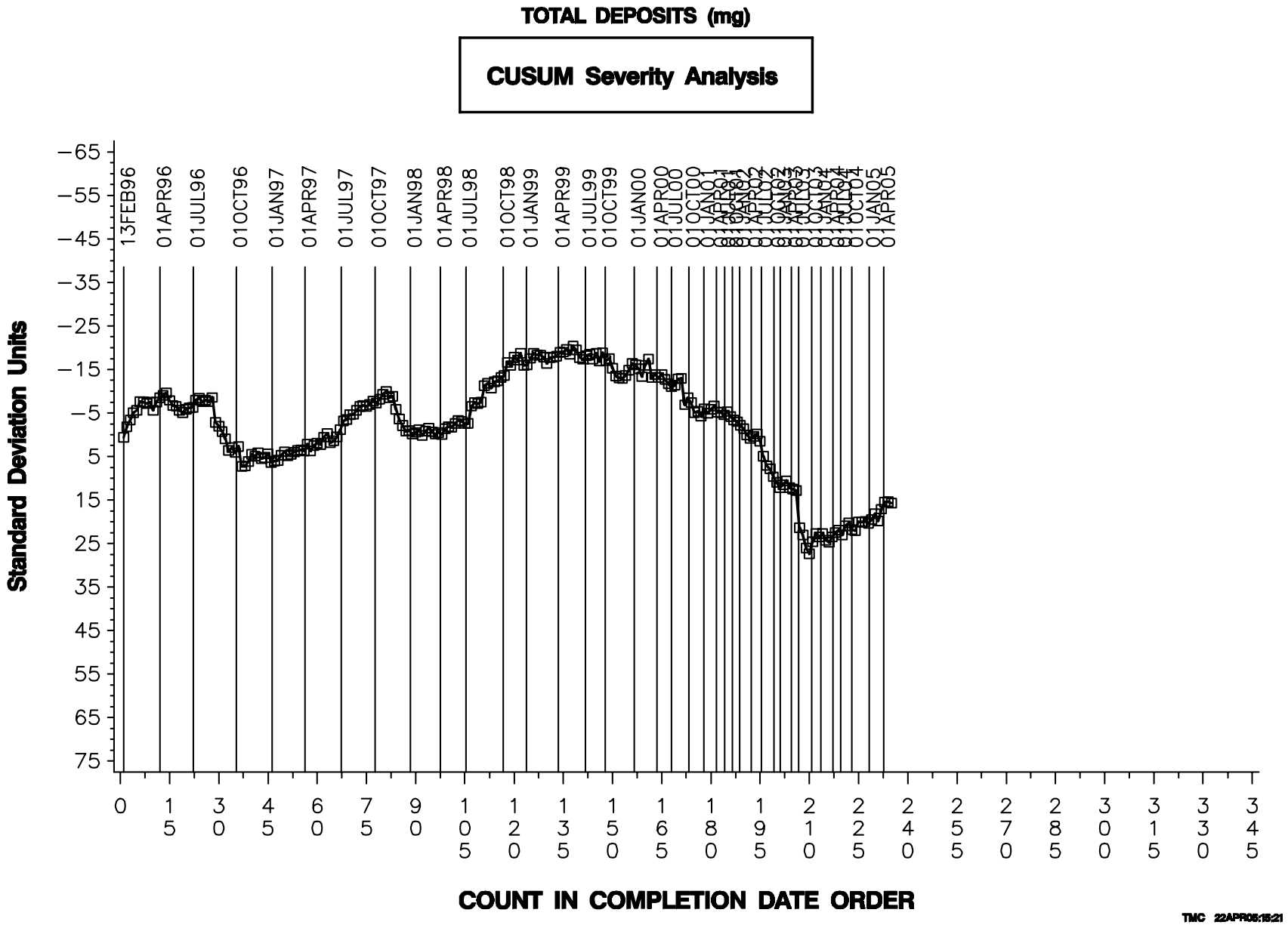
D5133 GELATION INDEX INDUSTRY OPERATIONALLY VALID DATA



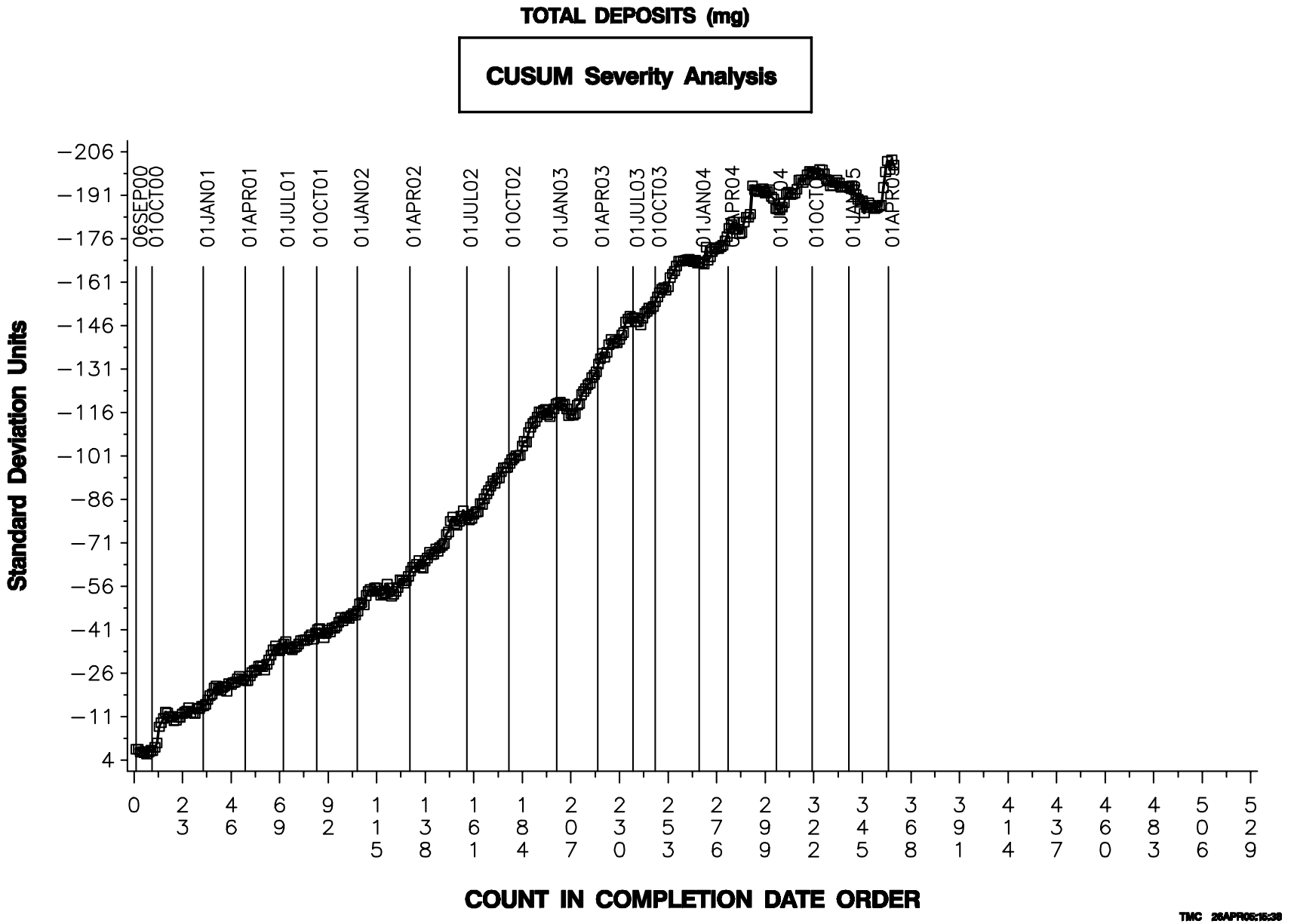
D5133 GELATION INDEX INDUSTRY OPERATIONALLY VALID DATA

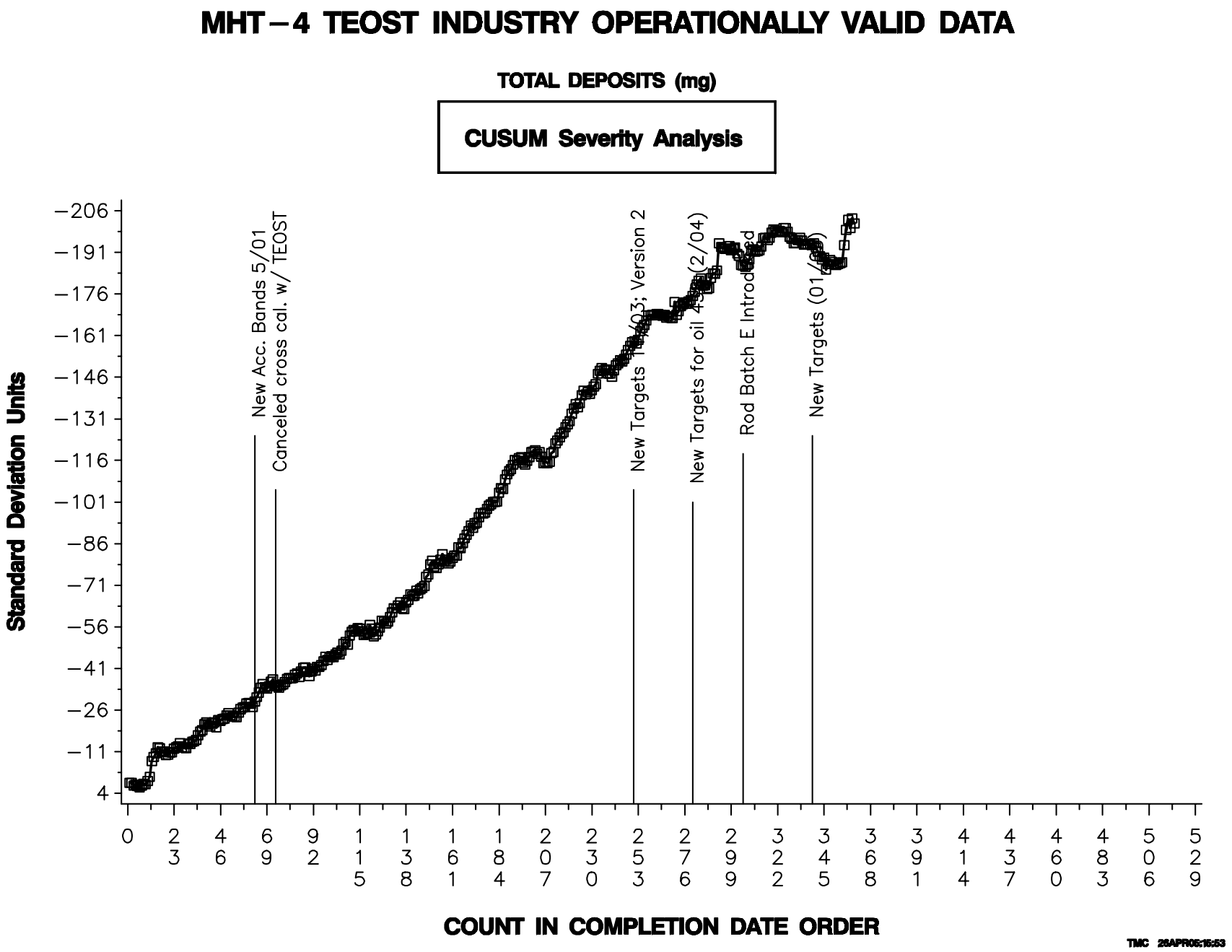


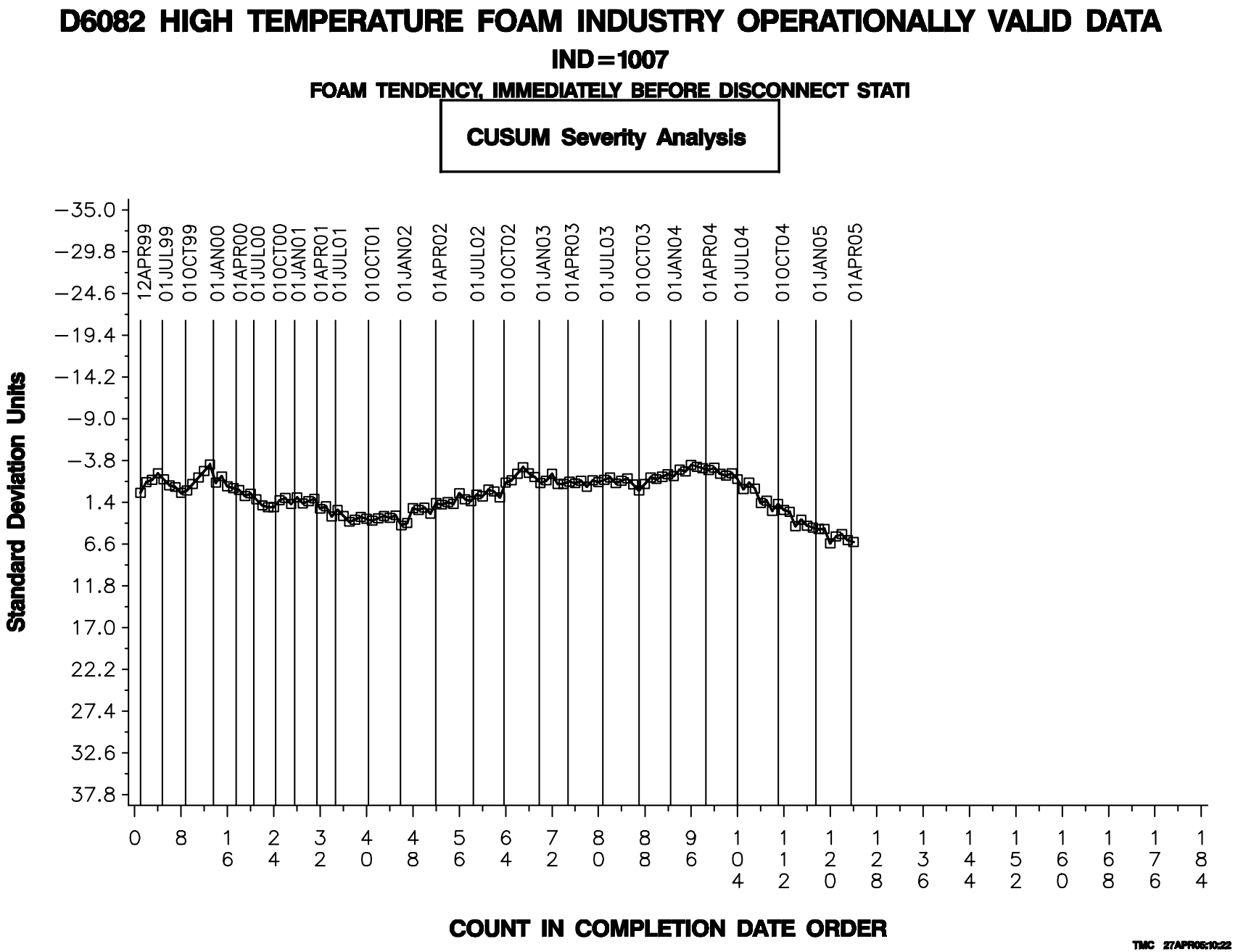
TEOST–33C INDUSTRY OPERATIONALLY VALID DATA



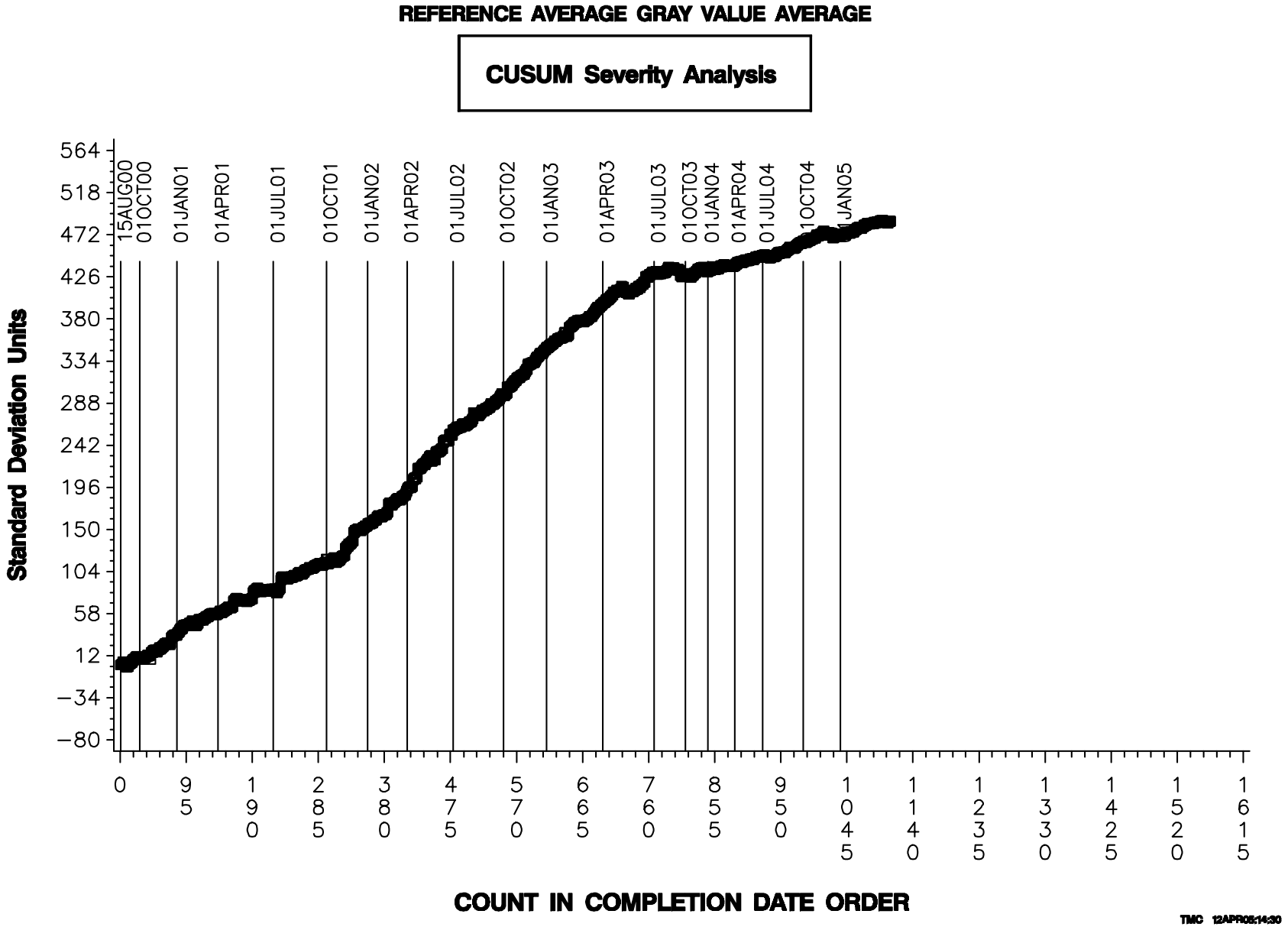
MHT−4 TEOST INDUSTRY OPERATIONALLY VALID DATA




MHT−4 TEOST INDUSTRY OPERATIONALLY VALID DATA
TOTAL DEPOSITS (mg)
CUSUM Severity Analysis
Standard Deviation Units
−206
−191
−176
−161
−146
−131
−116
−101
−86
−71
−56
−41
−26
−11
4
New Acc. Bands 5/01
Canceled cross cal. w/ TEOST
New Targets
New Targets for oil
Rod Batch E Introduced
New Targets (01/
0
23
46
69
92
115
138
161
184
207
230
253
276
299
322
345
368
391
414
437
460
483
506
529
COUNT IN COMPLETION DATE ORDER
TMC 26APR05:15:53


D6082 HIGH TEMPERATURE FOAM INDUSTRY OPERATIONALLY VALID DATA
IND=1007
FOAM TENDENCY, IMMEDIATELY BEFORE DISCONNECT STATI
CUSUM Severity Analysis
Standard Deviation Units
−35.0
−29.8
−24.6
−19.4
−14.2
−9.0
−3.8
1.4
6.6
11.8
17.0
22.2
27.4
32.6
37.8
12APR99
01JUL99
01OCT99
01JAN00
01APR00
01JUL00
01OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
01OCT02
01JAN03
01APR03
01JUL03
01OCT03
01JAN04
01APR04
01JUL04
01OCT04
01JAN05
01APR05
0
8
16
24
32
40
48
56
64
72
80
88
96
104
112
120
128
136
144
152
160
168
176
184
COUNT IN COMPLETION DATE ORDER
TMC 27APR05:10:22

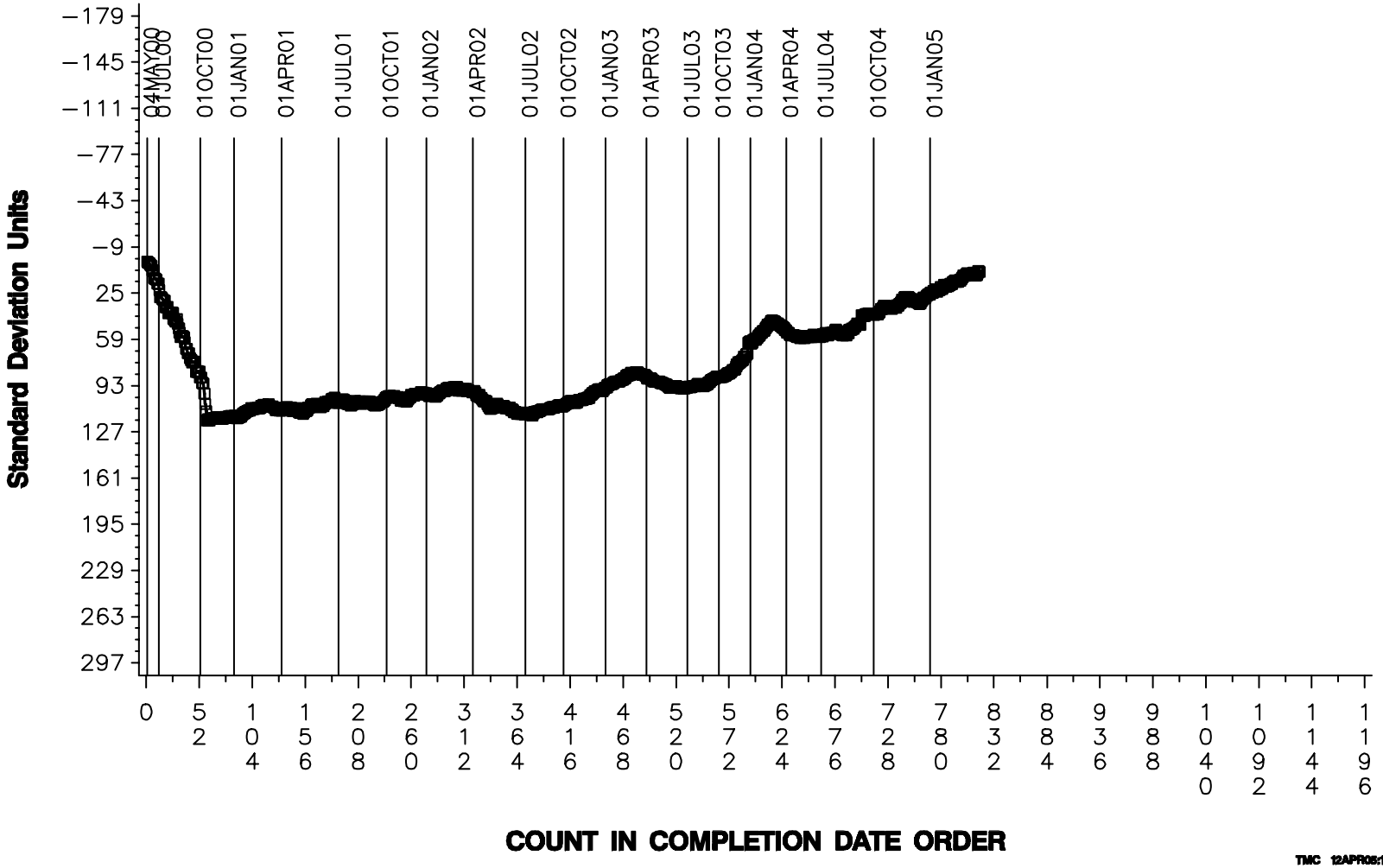
BALL RUST TEST INDUSTRY OPERATIONALLY VALID DATA



EOFT INDUSTRY OPERATIONALLY VALID DATA

20 – 25 ML CHANGE IN FLOWRATE AVERAGE (%)

CUSUM Severity Analysis



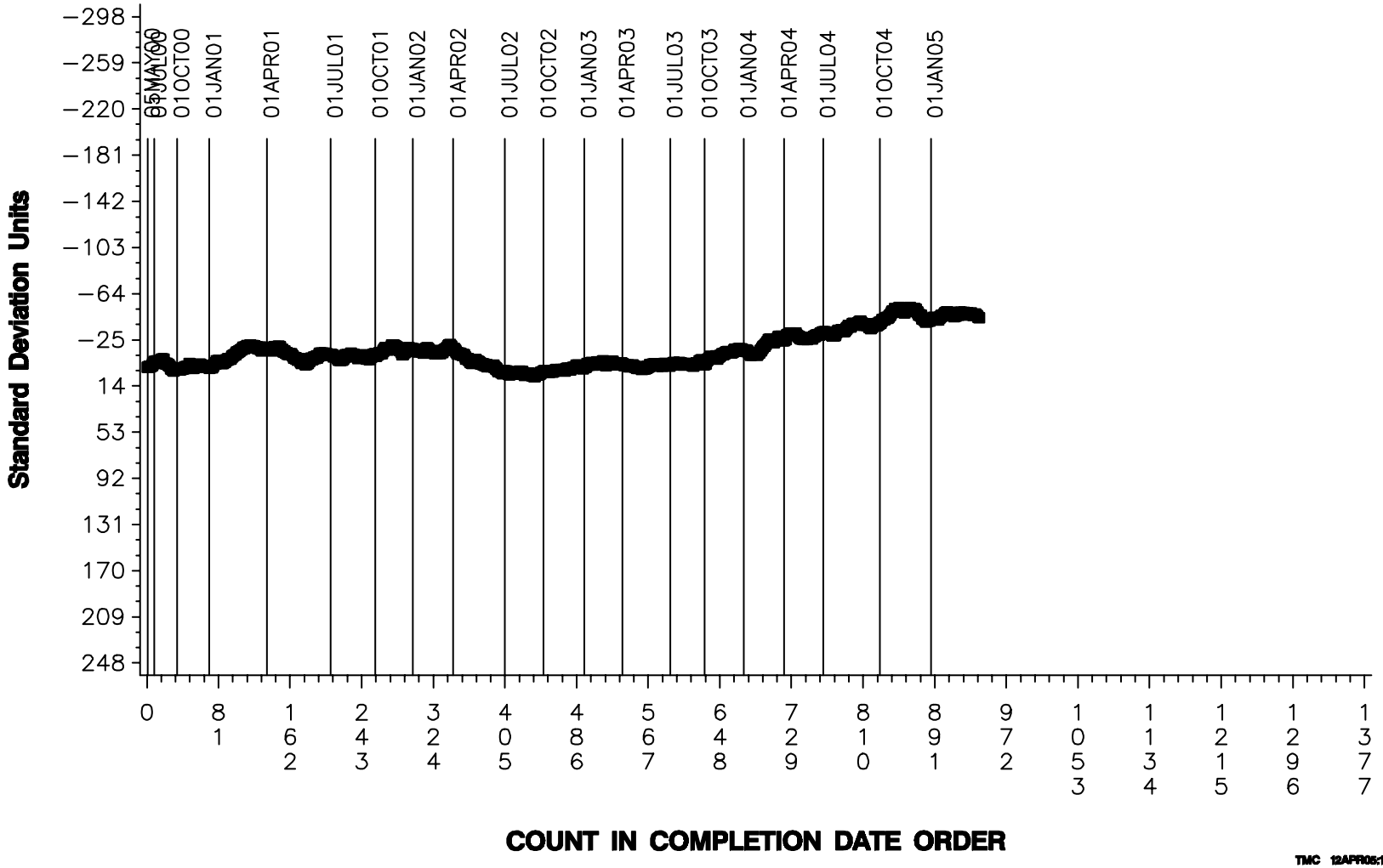
TMC 12APR05:14:33

EOWT INDUSTRY OPERATIONALLY VALID DATA

0.6% Water Treat Level

TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE

CUSUM Severity Analysis

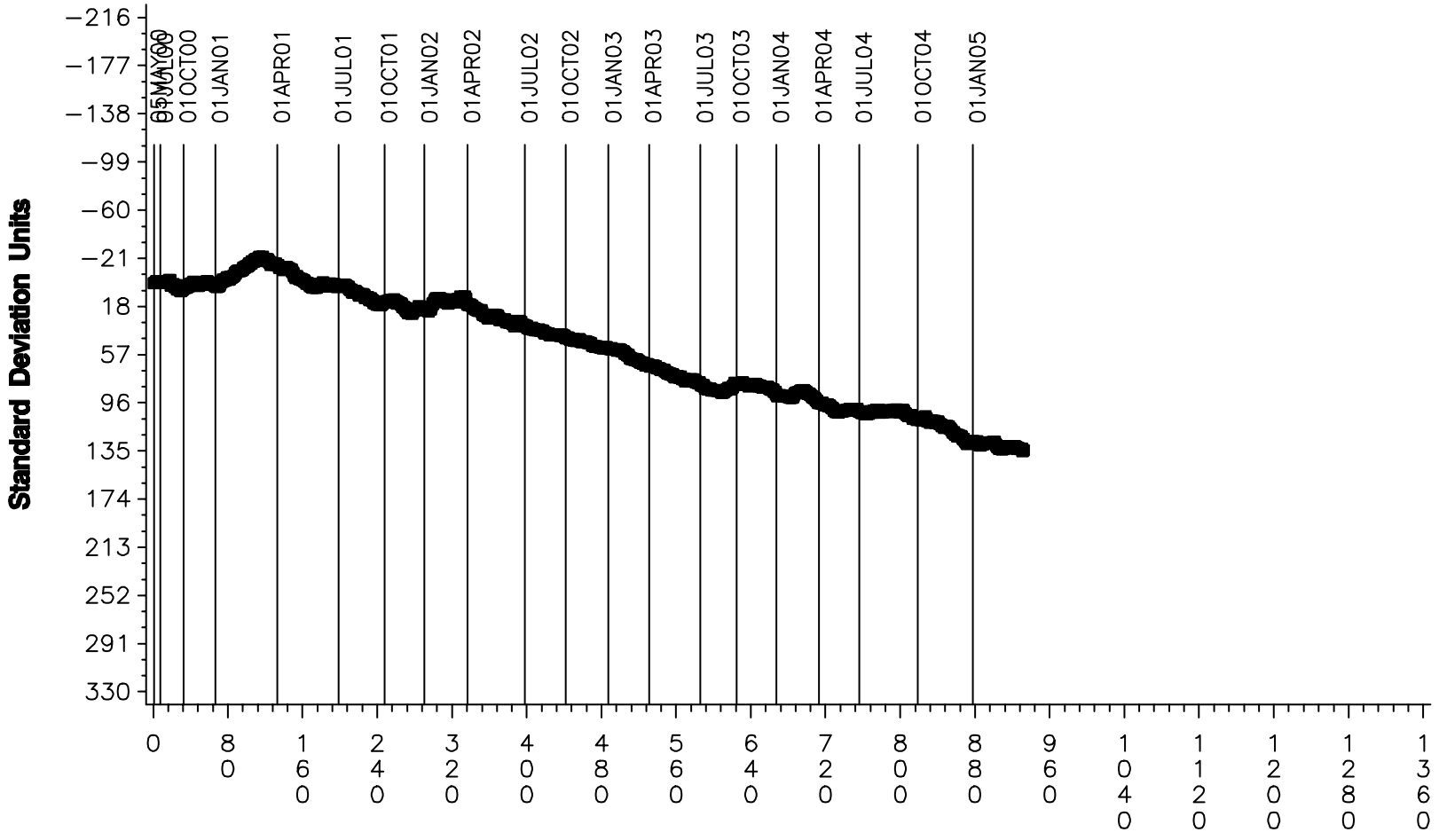


EOWT INDUSTRY OPERATIONALLY VALID DATA

1.0% Treat Rate

TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE

CUSUM Severity Analysis



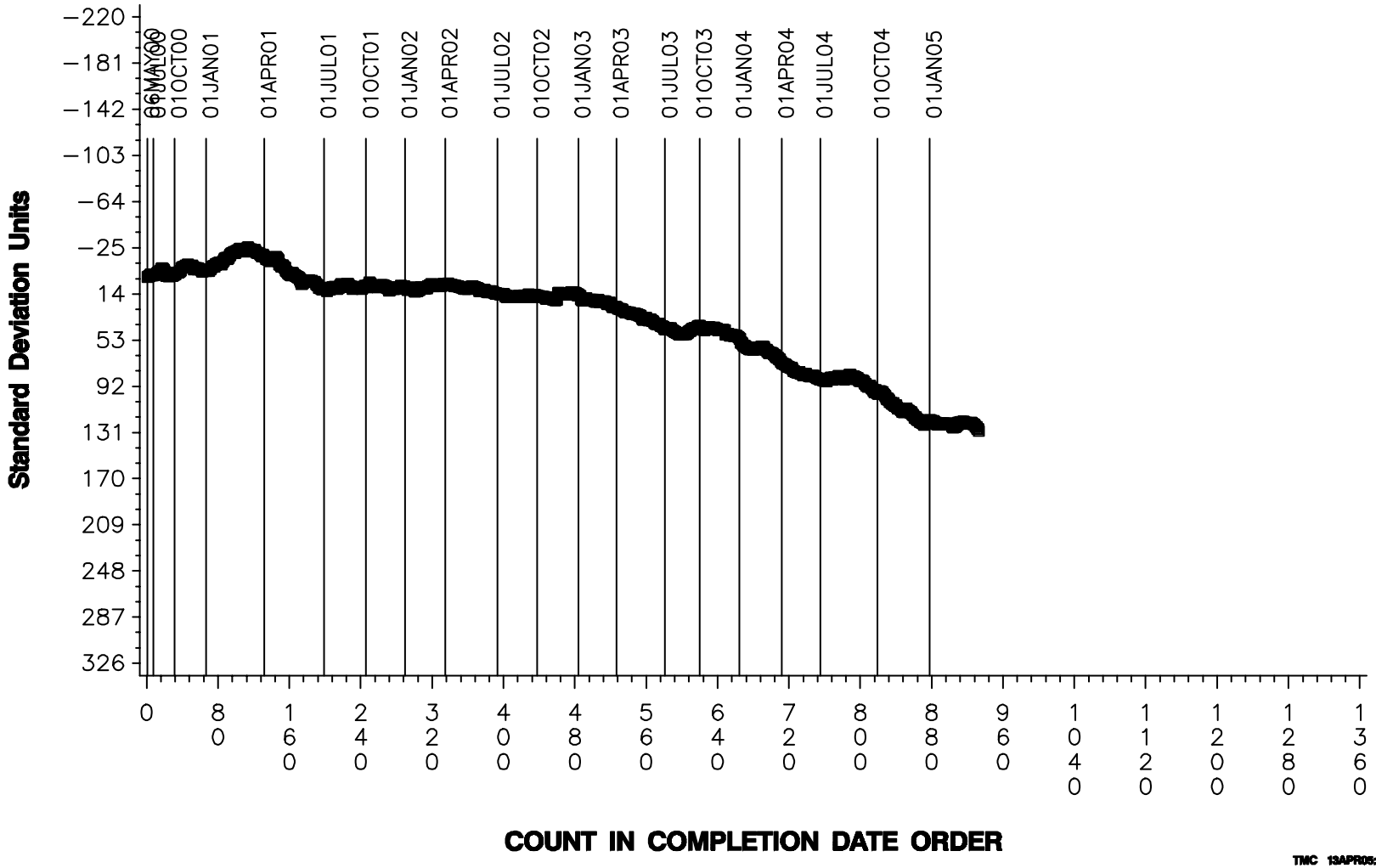
TMC 13APR05:13:59

EOWT INDUSTRY OPERATIONALLY VALID DATA

2.0% Treat Rate

TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE

CUSUM Severity Analysis

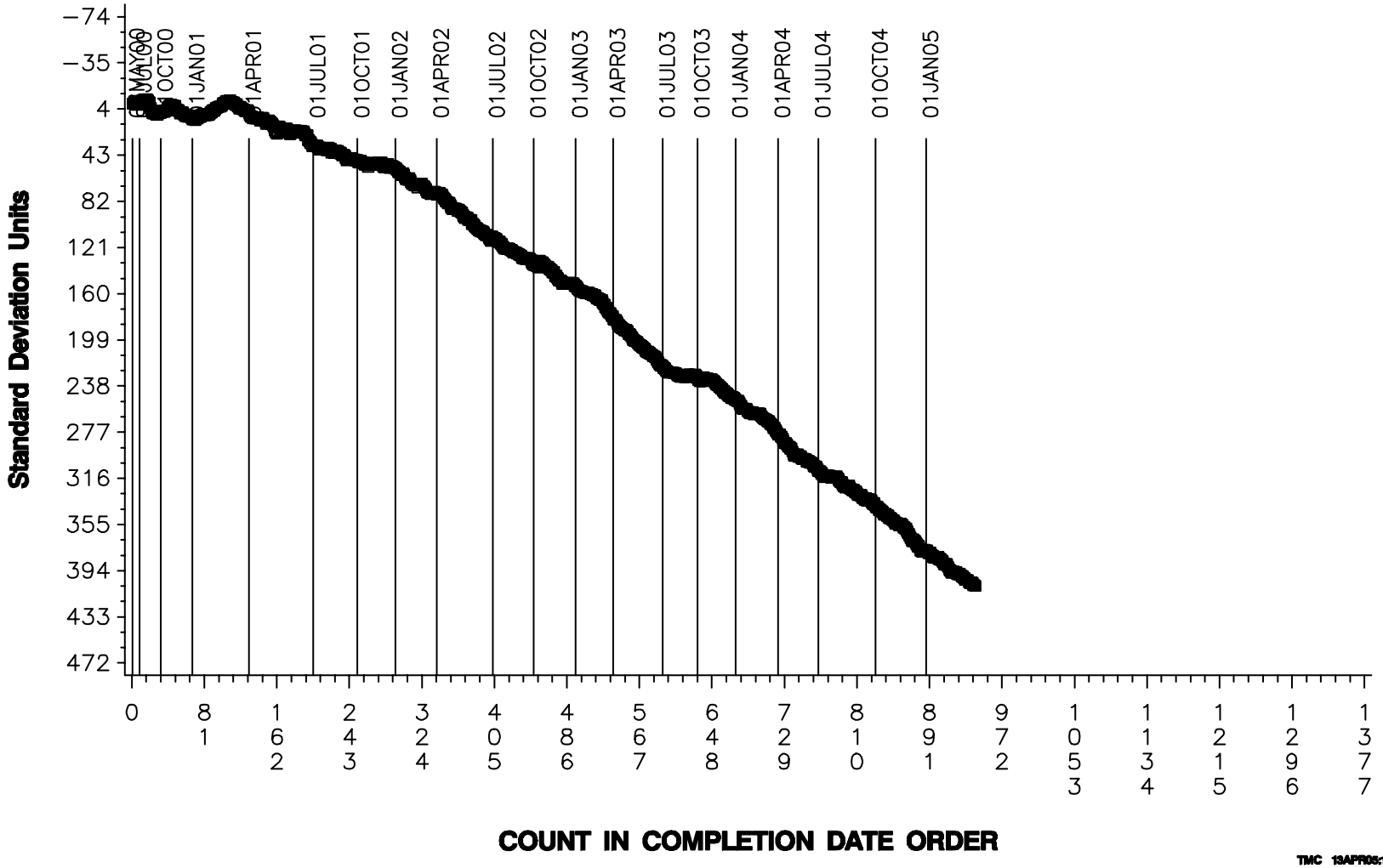


EOWT INDUSTRY OPERATIONALLY VALID DATA

3.0% Treat Rate

TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE

CUSUM Severity Analysis



Attachment 2

TMC Monitored Bench Tests
Reference Oil Test Targets and Acceptance Bands

						Acceptance Bands *	
						95%	
Test	**Oil Code**	**Parameter**	**n**	**Mean**	**sR**	**Lower**	**Upper**
D6417	52	area % volatility loss	18	6.97	0.31	6.4	7.6
	55	area % volatility loss	18	11.68	0.51	10.7	12.7
	58	area % volatility loss	18	5.61	0.30	5.0	6.2
D5800	52	mass % volatility loss	33	13.75	0.61	12.6	14.9
New Targets	55	mass % volatility loss	32	17.09	0.76	15.6	18.6
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 Version 2,	74	Total Deposit wt. (mg)	14	13.59	3.97	5.8	21.4
03.09.23	432	Total Deposit wt. (mg)	8	45.18	2.73	39.8	50.5
New Targets	434	Total Deposit wt. (mg)	8	30.51	2.89	24.8	36.2
20050112							
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
(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

Attachment 3A

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

Test	Oil Code	Parameter	Targets			10/1/03 - 3/31/04				4/1/04 - 9/30/04				10/1/04 - 3/31/05			
			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	8	6.7	0.39	-0.75	2	6.6	0.21	-1.03	8	6.8	0.50	-0.63
	55	Area % Volatized	18	11.68	0.51	4	11.4	0.79	-0.65	7	11.8	0.40	0.21	2	11.8	0.07	0.33
	58	Area % Volatized	18	5.61	0.30	3	5.8	0.12	0.74	6	5.8	0.42	0.80	6	5.8	0.45	0.63
D5800 **	52	% volatility loss	33	13.75	0.61	8	13.8	0.46	0.04	12	14.1	0.54	0.56	11	14.0	0.88	0.42
	55	% volatility loss	32	17.09	0.76	12	17.3	0.79	0.24	8	17.0	0.54	-0.18	14	16.9	0.70	-0.24
	58	% volatility loss	37	15.20	0.72	12	15.6	0.58	0.51	10	15.3	0.80	0.18	10	15.4	0.36	0.25
TEOST (D6335)	71	Deposit wt. (mg)	27	51.79	4.79	5	48.1	8.33	-0.78	3	45.9	3.75	-1.23	5	48.0	8.17	-0.80
	72	Deposit wt. (mg)	27	26.72	3.46	2	26.7	3.39	-0.01	2	27.6	4.17	0.27	5	27.2	3.54	0.15
MTEOS ***	~~1006~~	Deposit wt. (mg)	14	42.43	6.10	13	37.7	10.91	-0.59	8	34.7	6.69	-1.27	5	40.9	4.83	-0.26
	432	Deposit wt. (mg)	8	45.18	2.73	2	42.8	0.35	-1.51	13	44.7	9.30	-0.19	12	48.3	3.46	1.15
	~~433~~	Deposit wt. (mg)	14	42.10	5.34	10	37.7	11.46	-0.82	13	39.1	6.55	-0.56	3	46.3	3.50	0.79
	434	Deposit wt. (mg)	8	30.51	2.89	--- --	-----	-----	-----	--- --	-----	-----	-----	8	24.9	8.17	-1.95
	74	Deposit wt. (mg)	14	13.59	3.97	10	11.6	3.76	-0.51	6	12.2	3.05	-0.34	8	11.9	3.86	-0.42
GI (D5133) ****	58	Gelation Index	17	5.8	0.69	12	10.1	8.68	6.27	12	6.0	0.94	0.33	12	6.9	1.78	1.62
	62	Gelation Index	35	17.0	3.90	12	14.5	5.51	-0.64	8	15.3	5.12	-0.44	10	16.1	4.14	-0.22
	1009	Gelation Index	16	7.30	0.68	13	7.1	0.54	-0.27	7	8.3	2.23	1.47	12	7.1	0.74	-0.31
D6082	1007	Tendency (ml)	28	65.71	19.28	12	62.5	10.55	-0.17	13	72.3	15.89	0.34	12	72.9	16.3	0.37

**D5800 Targets Adjusted 10/2/00; new oils selected; new procedures approved; targets adjusted again 7/21/03
***MTEOS Targets Adjusted: 6/1/01 (matrix); 11/1/03 (SC9 RR2); 2/18/04 (add 432); 1/12/05 (add 434, drop 433 & 1006)
****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			4/1/03 - 9/30/03			10/1/03 - 3/31/04			4/1/04 - 9/30/04			10/1/04 - 3/31/05		
Test	Oil Code	Parameter	n	Mean	sR	n	Mean	sR	n	Mean	sR	n	Mean	sR	n	Mean	sR
BRT	1006	Average AGV	12	128	7.21	44	123.5	7.76	17	125.8	5.57	14	127.6	4.30	27	124.3	10.57
	5A-3	Average AGV	12	76	6.47	14	87.6	16.30	---	---	---	---	---	---	---	---	---
	81	Average AGV	12	112	14.00	60	119.9	11.46	38	120.7	11.81	58	121.5	6.90	69	122.2	6.84
	82	Average AGV	12	48	11.50	1	55.0	0.00	16	41.6	9.74	26	41.8	9.10	82	42.4	9.01
EOFT	77	Avg. % CF	12	-45.55	4.36	0	-----	-----	0	-----	-----	0	-----	-----	0	-----	-----
	78	Avg. % CF	12	15.74	6.87	71	15.8	3.70	66	12.1	8.68	86	14.8	7.90	105	13.7	6.58
EOWT	77	0.6 H2O Avg. %CF	12	-24.90	5.68	51	-23.6	3.77	49	-26.6	4.76	56	-25.4	4.55	59	-25.8	5.32
	77	1.0 H2O Avg. %CF	12	-17.94	5.45	47	-15.4	3.48	42	-16.7	3.06	52	-16.9	2.92	54	-15.8	4.59
	77	2.0 H2O Avg. %CF	12	-17.96	8.47	49	-14.2	3.55	51	-14.9	4.63	55	-15.3	2.77	56	-13.5	6.00
	77	3.0 H2O Avg. %CF	12	-18.23	6.83	42	-16.3	3.01	42	-16.5	3.69	53	-16.2	3.83	59	-15.0	5.30
EOWT	78	0.6 H2O Avg. %CF	12	10.87	6.16	42	9.4	5.00	41	10.0	5.52	52	9.9	6.76	54	11.3	7.01
	78	1.0 H2O Avg. %CF	12	7.54	6.15	47	6.8	4.42	46	8.3	4.52	54	8.0	5.92	60	7.9	6.44
	78	2.0 H2O Avg. %CF	12	5.17	5.33	44	4.5	3.67	41	6.8	5.48	52	6.0	6.05	59	5.5	5.93
	78	3.0 H2O Avg. %CF	12	-0.54	4.52	52	2.9	3.59	48	2.9	3.78	56	3.1	5.06	53	2.9	4.76