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MEMORANDUM: 05-080

DATE: November 22, 2005

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

FROM: Thomas Schofield & Scott Parke

SUBJECT: TMC Bench Reference Test Monitoring from April 1, 2005 through September 30, 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/mem05-080.pdf

Distribution: Email

Attachment 1

ASTM Test Monitoring Center

Semiannual Report

ASTM D02.B07 Bench Reference Test Monitoring
From April 1, 2005 through September 30, 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	14
Operationally Valid but Failed Acceptance Criteria	3
Operationally Invalid (initially reported as)	0
Operationally Invalid (after informed of failing calibration)	4
Total	**21**

Fail Rate of Operationally Valid Tests: 17.6%

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

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
4/1/05 through 9/30/05	17	14	0.61	-0.21

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

TABLE 4

	n	Mean Δ/s
Lab A	5	-0.86
Lab B	4	0.72
Lab D	1	-0.16
Lab G	3	-0.93
Lab H	2	0.36
Lab S	2	0.00

PRECISION AND SEVERITY

D6417 calibration testing precision is worse than last period and worse than the target precision. Overall performance is mild of targets. Severity is represented graphically in Figure 1. Except for one very severe result, the figure shows a somewhat stronger mild trend for the period than the overall Mean Δ/s in table 3 suggests.

Lab B reported a 4s **severe** result early in the report period (with a subsequent passing result), but then reported a 3s **mild** result on the same instrument for their next quarterly calibration (with a subsequent passing result). There were also three other tests reported on that instrument initially reported as operationally valid ranging from 10s mild to 3s severe that were subsequently determined to be operationally invalid because an incorrect daily check sample was being used, but that does not adequately explain the erratic results. The lab has been contacted about the erratic results.

With three tests reported as operationally valid but failing to meet the acceptance criteria, the fail rate (17.6%) is unusually high this period, as it was last period (18.8%), and is due in part to Lab B's calibration results.

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	34
Operationally Valid but Failed Acceptance Criteria	0
Operationally Invalid (initially reported as)	2
Operationally Invalid (after informed of failing calibration)	0
Total	**36**

Fail Rate of Operationally Valid Tests: 0.0%

Table 6 is a breakdown of the statistically unacceptable tests.

TABLE 6

Reason for Fail	No. of Tests
Sample Evaporation Loss Severe	0
Sample Evaporation Loss Mild	0

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
4/1/05 through 9/30/05	34	31	0.55	0.23

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	1	0	---	-1.67
Procedure B	31	28	0.51	0.31
Procedure C	2	0	---	0.01

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

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

TABLE 9

	n	Mean Δ/s
Lab A	6	-0.25
Lab B	6	0.12
Lab D	2	0.01
Lab F	6	0.61
Lab G	4	0.00
Lab H	2	0.01
Lab I	4	0.72
Lab J	4	0.52

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 improved compared to the target precision, and better than all periods since new targets were introduced (Table 7). Overall performance is severe of targets. Severity is graphically represented in Figures 2A and 2B. Figure 2B better illustrates improvement in the severity trend following the revised oil targets timeline. Table 8 compares the procedures for the period; with only one Procedure A test and 2 procedure C tests reported this period it is hard to make any significant comparisons. There is insufficient data to make precision evaluations on Procedures A and C 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 0.0% to 5.7% for the last four periods. Figure 2A does show a fairly regular overall severe bias since oil targets were last revised.

TMC MEMORANDA

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

Memo 05-055, July 28, 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 (6 labs reporting):

TABLE 10
Reference Tests

	No. of Tests
Statistically Acceptable and Operationally Valid	20
Operationally Valid but Failed Acceptance Criteria	2
Operationally Invalid (initially reported as)	5
Operationally Invalid (after informed of failing calibration)	0
Total	**27**

Fail Rate of Operationally Valid Tests: 9.1%

Table 11 is a breakdown of the statistically unacceptable tests.

TABLE 11

Reason for Fail	No. of Tests
Gelation Index Mild	2
Gelation Index Severe	0

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
4/1/05 through 9/30/05	2	19	3.44	-0.17

*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	4	0.29
Lab B	3	0.58
Lab D	2	0.45
Lab G	3	-1.36
Lab I	6	0.03
Lab S	4	-0.89

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 worsened compared to last period and is worse than target precision. Overall testing is performing somewhat mild of targets. Fail rate of tests reported as operationally valid (9.1%) is somewhat better than the last three periods (24.3%, 18.5% and 14.7%). Severity is graphically represented in Figures 3A and 3B with a slight overall mild trend for the period. Attachment 3A shows oil 1009 running -1.07 s mild for the period (n = 7), compared to oil 58 at 0.35 s severe and oil 62 at 0.21 s severe (last period had oil 58 running unusually severe, substantially due to a single test result).

Lab G is running substantially mild this period compared to the other labs.

TMC MEMORANDA

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

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 (4 labs reporting):

TABLE 14

	No. of Tests
Statistically Acceptable and Operationally Valid	9
Operationally Valid but Failed Acceptance Criteria	2
Operationally Invalid (initially reported as)	0
Operationally Invalid (after informed of failing calibration)	2
Total	**13**

Fail Rate of Operationally Valid Tests: 18.2%

Table 15 is a breakdown of the statistically unacceptable tests.

TABLE 15

Reason for Fail	No. of Tests
Total Deposits Mild	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	-----
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
4/1/05 through 9/30/05	11	9	4.13	-0.73

*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	-1.83
Lab B	6	-0.33
Lab G	1	1.24

Lab I reported an operationally invalid test for the period.

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

PRECISION AND SEVERITY

Overall precision is improved this period to near target with overall testing performance substantially mild of targets. Severity is graphically represented in Figure 4 (attached) with an increasing overall mild trend since about October 2003 (though last report period was overall less mild). The cause of the increased mild performance is unclear. Both lab A and B are submitting mild results in excess of 1 s, though Lab A is overall performing milder than Lab B, while Lab G submitted only one test for the period, 1.2 s severe. All labs are using Rod Batch E.

In an informal inquiry by the TMC, all three labs report rods that some of the rods they are receiving have notable rust, particularly in the center of the rods. Lab A reports using an ultrasonic cleaning of all their rods prior to test runs, while Lab B reports a more thorough cleaning process using pipe cleaners to remove the rust. Lab G did not elaborate on their cleaning methods. Labs A and G seem to think that the rusting problem is getting worse with newer rod purchases. The TMC informed the parts supplier in November of what the labs reported to the TMC. Perhaps, a difference in the thoroughness of cleaning the rods is contributing to the differences in performance between labs.

TMC MEMORANDA

There were no TMC technical memos issued this report period for the D6335 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	33
Operationally Valid but Failed Acceptance Criteria	6
Operationally Invalid (initially reported as)	0
Operationally Invalid (after informed of failing calibration)	2
Total	**41**

Fail Rate of Operationally Valid Tests: 15.4%

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)	3

INDUSTRY PERFORMANCE

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

TABLE 20

Total Deposits	n	df	Pooled s	Mean Δ/s
Updated Targets Effective 6/1/01	80	76	5.40	-----
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**
Updated Targets Effective 6/30/05	42	39	4.60	-----
4/1/05 through 9/30/05	39	36	6.36	-0.17**

*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.

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

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	13	-0.62
Lab B	12	0.48
Lab D	3	-1.34
Lab G	10	0.29
Lab I	1	-3.50

PRECISION AND SEVERITY

Effective 20050519 the monitored labs began using the D7097-05 test method for TMC calibrations (moving from the previous "Version 2" test method). There is not expected to be a significant change in precision or severity as the methods are operationally similar.

Reference oil targets and acceptance bands were updated effective 20050630 based on all operationally valid TMC calibration data reported through 20050608 and using Rod Batch E parts.

Overall precision has worsened compared to last report period, and is worse than the new target precision. Overall performance is running slightly mild. Fail rate of operationally valid tests is higher than statistically expected. Attachment 3A shows a breakdown of performance by oil for the period. Severity for all three oils is only slightly mild of their target means, but precision is worse on all three oils. Targets should be re-evaluated after more reference data is collected using test method D7097 and Rod Batch E and F parts.

The MTEOS severity trend is graphically represented in Figures 5A & 5B, with Figure 5B showing when the new performance targets were implemented, when the monitored test method was changed and when labs began using Rod batch E **(note the introduction of Rod Batch F at the very start of the next report period)**. Figure 5A shows the period severity with an overall mild slope, and without the extreme results seen in last period's calibration data.

TMC MEMORANDA

There were two TMC technical memos, and one informational Email issued this report period for the MTEOS test method:

Memo 05-036, May 19, 2005: MTEOS Technical Update: Updated Test Method

Email dated May 27, 2005: MTEOS Report Form Update (editorial changes only, no version change)

Memo 05-053, June 29, 2005: MTEOS Technical Update: Adjusted Reference 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 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	10
Operationally Valid but Failed Acceptance Criteria	0
Operationally Invalid (initially reported as)	0
Operationally Invalid (after informed of failing calibration)	0
Total	**10**

Fail Rate of Operationally Valid Tests: 0.0%

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

D6082: High Temperature Foaming Characteristics of Lubricating Oils, continued

TMC 1007 INDUSTRY PERFORMANCE

Tables 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
4/1/05 through 9/30/05	10	62.0	25.30	-0.19

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	
4/1/05 through 9/30/05	10	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	3	-0.30
Lab B	2	1.00
Lab D	1	1.78
Lab G	2	-0.56
Lab I	2	-1.85

D6082: High Temperature Foaming Characteristics of Lubricating Oils, continued

PRECISION AND SEVERITY

Foam Tendency precision on 1007 has degraded considerably for the report period and severity is slightly mild 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; note the plot is increasingly more variable after the 01APR05 timeline indicating poorer precision for the period.

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 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.

D874-00 Standard Test Method for Sulfated Ash from Lubricating Oils and Additives

The TMC was approached by Joe Franklin to monitor the D874 Sulfated Ash Test. Preliminary discussions held between the TMC and Joe Franklin about oils and monitoring proposed that a daily QC check oil will be introduced (to be run with each set of candidate tests) as well as quarterly calibration audit using TMC blind reference oils (similar to D5800 and D6417 monitoring). The following progress has been made in this project:

- A daily check oil has been identified and received by TMC and is presently being screened to determine SAsh performance.

- The parties are trying to identify three reference oils for blind quarterly calibrations (<0.85%, 1.00%, >1.15% SAsh)

- Seven potential current TMC engine tests reference oils have been identified (the actual SAsh performance of each oil is uncertain at this time); suppliers of the seven oils have given their permission to screen; samples have been sent to screen for SAsh performance. If any of these oils are selected, the corresponding surveillance panels' that control the oils will be asked for permission to partition a small aliquot at the TMC for D874 monitoring.

- The TMC created several potential report form versions for approval by a surveillance panel, along with questions on how test is to be monitored and how we will establish target performance of reference oils. The TMC is waiting for a response (a surveillance panel is not yet fully formed). The biggest question to resolve now, for TMC monitoring purposes, is how many runs will be required to calibrate (single or duplicate?).

- Very recently, Eric Olsen has volunteered to chair a D874 calibration monitoring surveillance panel under D02.B07. A surveillance panel is being formed and we are actively looking for additional participants.

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	104
Statistically Unacceptable and Operationally Valid	1
Operationally Invalid	1
Total	**106**

Fail Rate of Operationally Valid Tests: 1%

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

TABLE 27

Reason for Fail	No. of Tests
Average Gray Value Severe (Oil 81)	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
4/1/05 through 9/30/05	103	100	10.43	0.28

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	44	-0.110
Lab B	18	0.644
Lab D	7	1.051
Lab G	34	0.438

PRECISION AND SEVERITY

Precision as measured by pooled s has decreased (higher pooled s) from last period but is comparable to previous periods. Overall industry severity is slightly mild of target this period. Severity is graphically represented in Figure 7 (attached).

INFORMATION LETTERS

No information letters 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	98
Statistically Unacceptable and Operationally Valid	1
Operationally Invalid	1
Total	**100**

Fail Rate of Operationally Valid Tests: 1%

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)	1

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
4/1/05 through 9/30/05	98	97	6.74	-0.37

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

Engine Oil Filterability Test (EOFT), continued

TABLE 33

	n	Mean Δ/s
Lab A	31	-1.389
Lab B	35	-0.075
Lab G	32	0.282

PRECISION AND SEVERITY

Precision as measured by pooled s is nearly identical to last period and is comparable to previous periods. Overall industry severity is also nearly unchanged from last period and is slightly mild of target. 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 less than a one year supply of reference oil 78. A reblend of reference oil 78 is in the process of being procured by the Test Monitoring Center.

INFORMATION LETTERS

There were no 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	118
Statistically Unacceptable and Operationally Valid	0
Operationally Invalid	0
Total	**118**

Fail Rate of Operationally Valid Tests: 0%

Table 35 is a breakdown of the statistically unacceptable tests.

TABLE 35

Reason for Fail	No. of Tests
No fails this report period.	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	5.93	-----
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
4/1/05 through 9/30/05	118	116	5.11	-0.13

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

TABLE 37

	N	Mean Δ/s
Lab A	44	-0.723
Lab B	40	-0.058
Lab G	34	0.544

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

PRECISION AND SEVERITY

Precision as measured by pooled s is comparable to previous periods. Overall industry severity as measured by mean Δ/s is slightly mild of target but is also comparable to previous periods. Severity is graphically represented in Figure 9 (attached).

Based on current usage rates, there is less than a one year supply of reference oil 78. A reblend of reference oil 78 is in the process of being procured by the Test Monitoring Center.

INFORMATION LETTERS

There were no information letters issued this report period.

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	117
Statistically Unacceptable and Operationally Valid	0
Operationally Invalid	0
Total	**117**

Fail Rate of Operationally Valid Tests: 0%

Table 39 is a breakdown of the statistically unacceptable test.

TABLE 39

Reason for Fail	No. of Tests
No fails this report period.	0

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
4/1/05 through 9/30/05	117	115	4.15	0.24

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	43	-0.175
Lab B	40	0.065
Lab G	34	0.964

PRECISION AND SEVERITY

Precision as measured by pooled s is comparable to previous periods. Overall industry severity as measured by mean Δ/s is slightly severe of target but is also comparable to previous periods. Severity is graphically represented in Figure 10 (attached).

Based on current usage rates, there is less than a one year supply of reference oil 78. A reblend of reference oil 78 is in the process of being procured by the Test Monitoring Center.

INFORMATION LETTERS

There were no information letters issued this report period.

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	119
Statistically Unacceptable and Operationally Valid	2
Operationally Invalid	0
Total	**121**

Fail Rate of Operationally Valid Tests: 2%

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)	2

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
4/1/05 through 9/30/05	121	119	4.46	0.09

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	47	-0.339
Lab B	40	-0.054
Lab G	34	0.866

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

PRECISION AND SEVERITY

Precision as measured by pooled s is comparable to previous periods. Overall industry severity as measured by mean Δ/s is almost exactly on target and is also comparable to previous periods. Severity is graphically represented in Figure 11 (attached).

Based on current usage rates, there is less than a one year supply of reference oil 78. A reblend of reference oil 78 is in the process of being procured by the Test Monitoring Center.

INFORMATION LETTERS

There were no information letters issued this report period.

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	117
Statistically Unacceptable and Operationally Valid	2
Operationally Invalid	0
Total	**119**

Fail Rate of Operationally Valid Tests: 2%

TABLE 47

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

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 48

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
4/1/05 through 9/30/05	119	117	3.89	0.45

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

TABLE 49

	N	Mean Δ/s
Lab A	45	0.048
Lab B	40	0.280
Lab G	34	1.183

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

PRECISION AND SEVERITY

Precision as measured by pooled s is comparable to previous periods. Overall industry severity as measured by mean Δ/s is slightly severe of target but is also comparable to previous periods. Severity is graphically represented in Figure 12 (attached).

Based on current usage rates, there is less than a one year supply of reference oil 78. A reblend of reference oil 78 is in the process of being procured by the Test Monitoring Center.

INFORMATION LETTERS

There were no information letters issued this report period.

REFERENCE OIL SUPPLIES

There is adequate supply of B0.07 Bench Test reference oils on hand at the TMC. Tables 50A and 50B list the PCEOCP bench test reference oils currently on hand at the TMC.

Table 50A

Oil	For Tests	Quantity Left (gallons)	Quantity Used Last 12 Months (gallons)
^51	Obsolete Vol. & GI	94.6	0.0
52	D6417, D5800	68.3	0.8
^53	Obsolete Vol. & GI	96.8	0.0
^54	Obsolete Volatility	97.8	0.0
55	D6417, D5800	73.2	0.8
^57	Old Volatility Candidate	51.2	0.0
58	D6417, D5800, GI	124.7	2.1
62	GI	1.7	0.2
66	D6082 (Discrimination)	100.5	1.4
71	TEOST	3.5	0.6
72	TEOST	3.6	0.6
74	MTEOS	2.0	0.1
77	EOWT	83.2	39.8
78	EOFT, EOWT	9.0	55.5
^80	BRT Candidate	26.5	0.0
81	BRT	16.7	1.2
82	BRT	8.8	0.6
90	D874 Daily Check	49.5	0.0
**432	MTEOS	Adequate	-----
^**433	Obsolete MTEOS	Adequate	-----
**434	MTEOS	Adequate	-----
1006	BRT	41.8	1.5
*1007	D6082	Est. 27	-----
**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 50B

Oil	For Tests	Quantity Left (gallons)	Quantity Used Last 12 Months (gallons)
HMA	H&M (D6922)	197.2	5.0
HMB	H&M (D6922)	201.2	5.0
HMC	H&M (D6922)	187.2	5.0
HMD	H&M (D6922)	195.2	5.0
HME	H&M (D6922)	180.2	5.0
HMF	H&M (D6922)	203.0	6.2

Shipping aliquots are:

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

MISCELLANEOUS

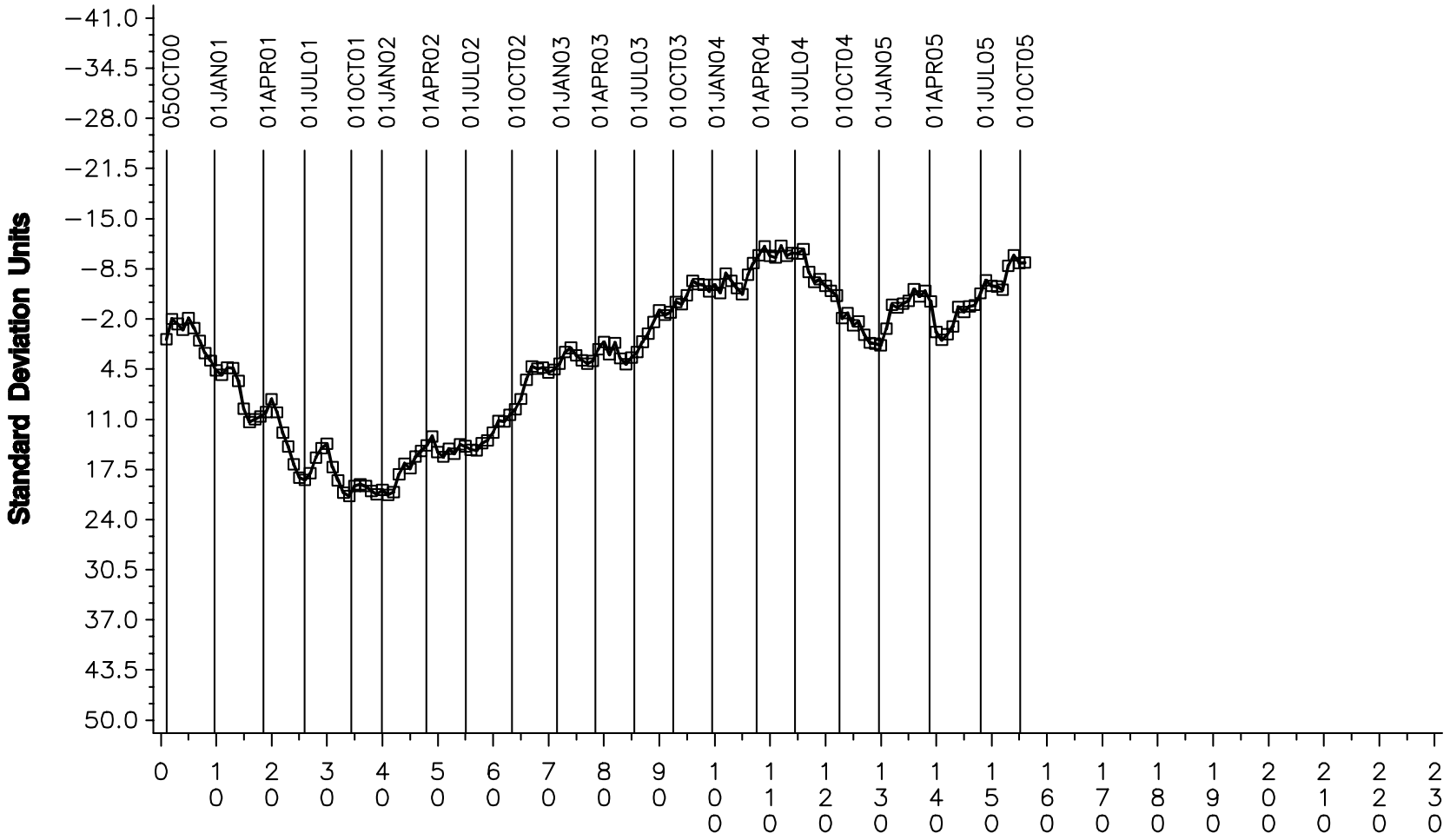
The TMC posts monitored bench test calibration data on the Internet. Selected parameters from all operationally valid reference tests are posted on the TMC's World-Wide-Web page in real time. Lab identifications are coded on the TMC's web site as they are on the previous pages of this report. Also posted are statistics, CUSUM plots, reporting forms, flatfile templates, data dictionaries and data from various round-robin matrix programs. The TMC encourages all interested parties to access and download the data, statistics and plots for individual studies and analyses. Likewise, you are encouraged to access the web site to download the most recent test reporting formats and data dictionaries. The TMC's web site address is www.astmtmc.cmu.edu.

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

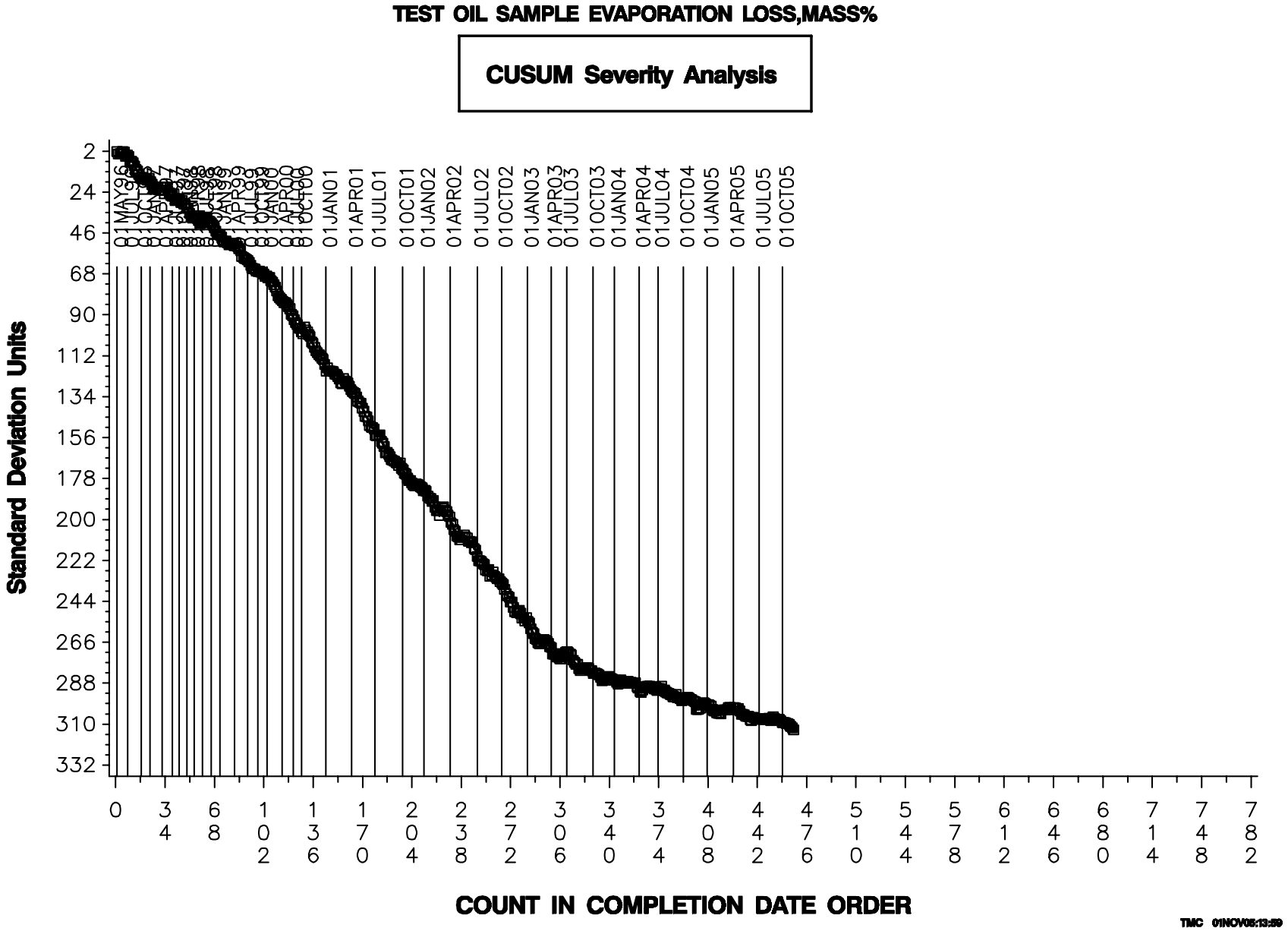
D6417 VOLATILITY BY GC INDUSTRY OPERATIONALLY VALID DATA

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

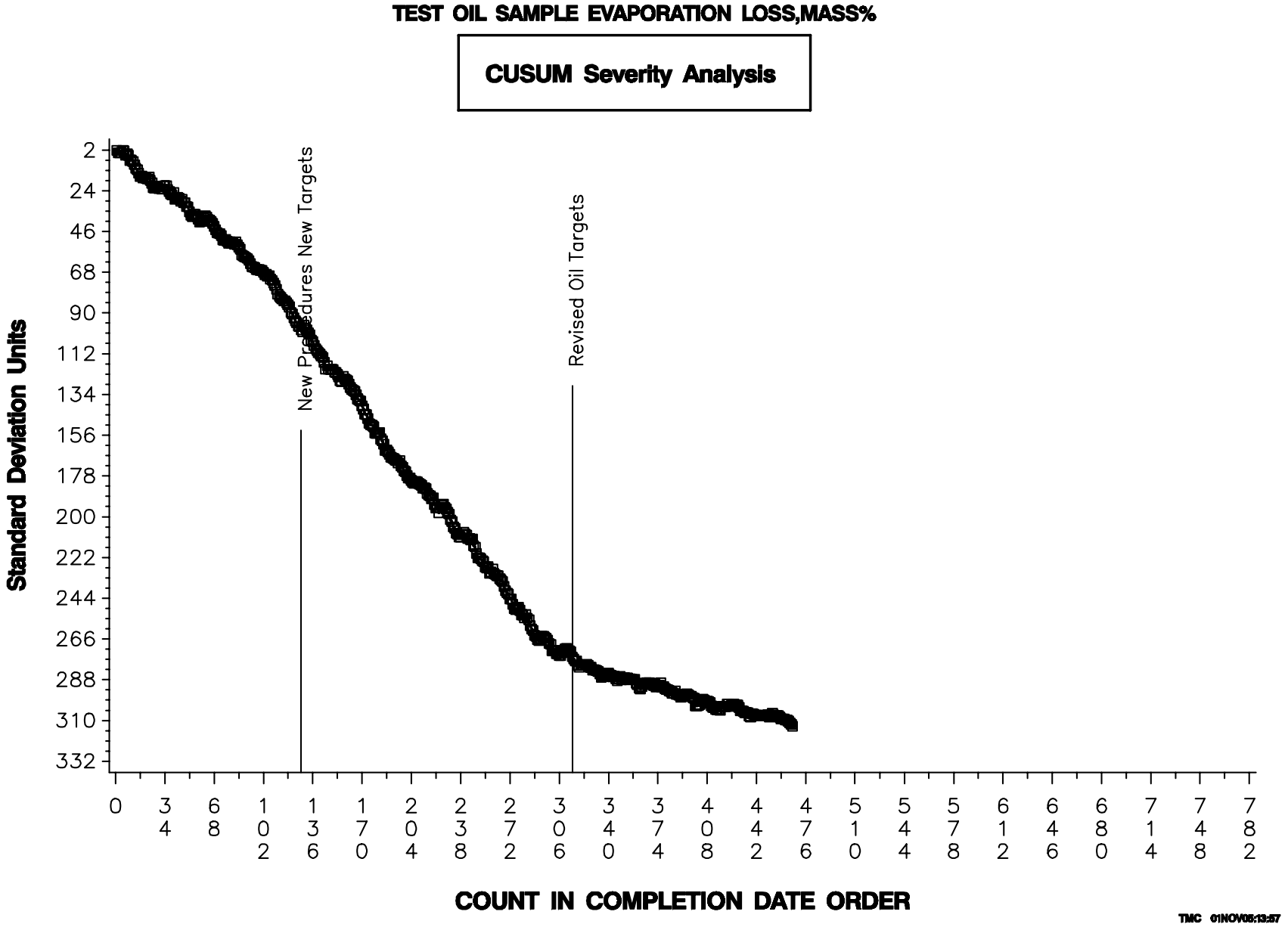
CUSUM Severity Analysis



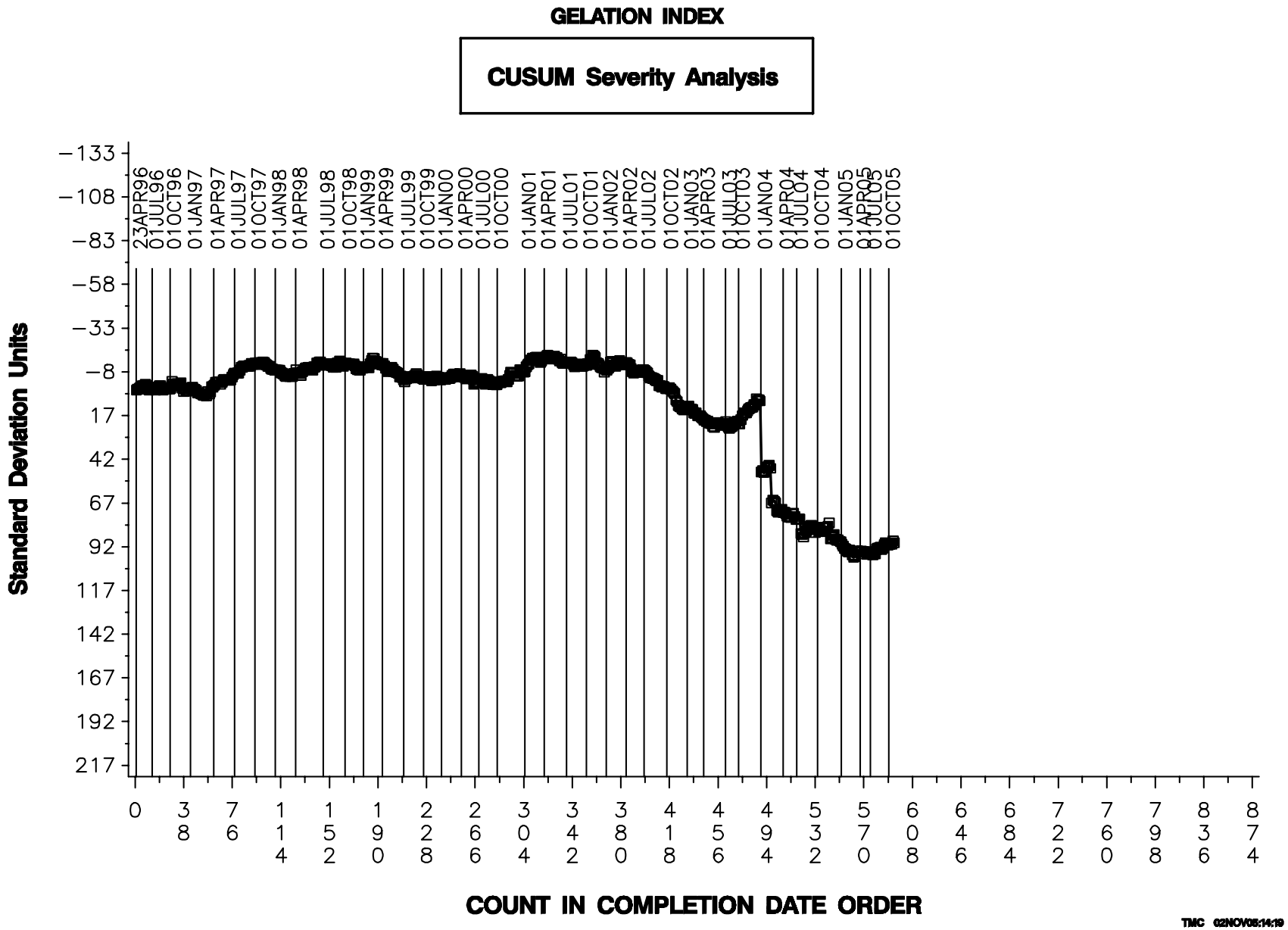
D5800 VOLATILITY BY NOACK INDUSTRY OPERATIONALLY VALID DATA



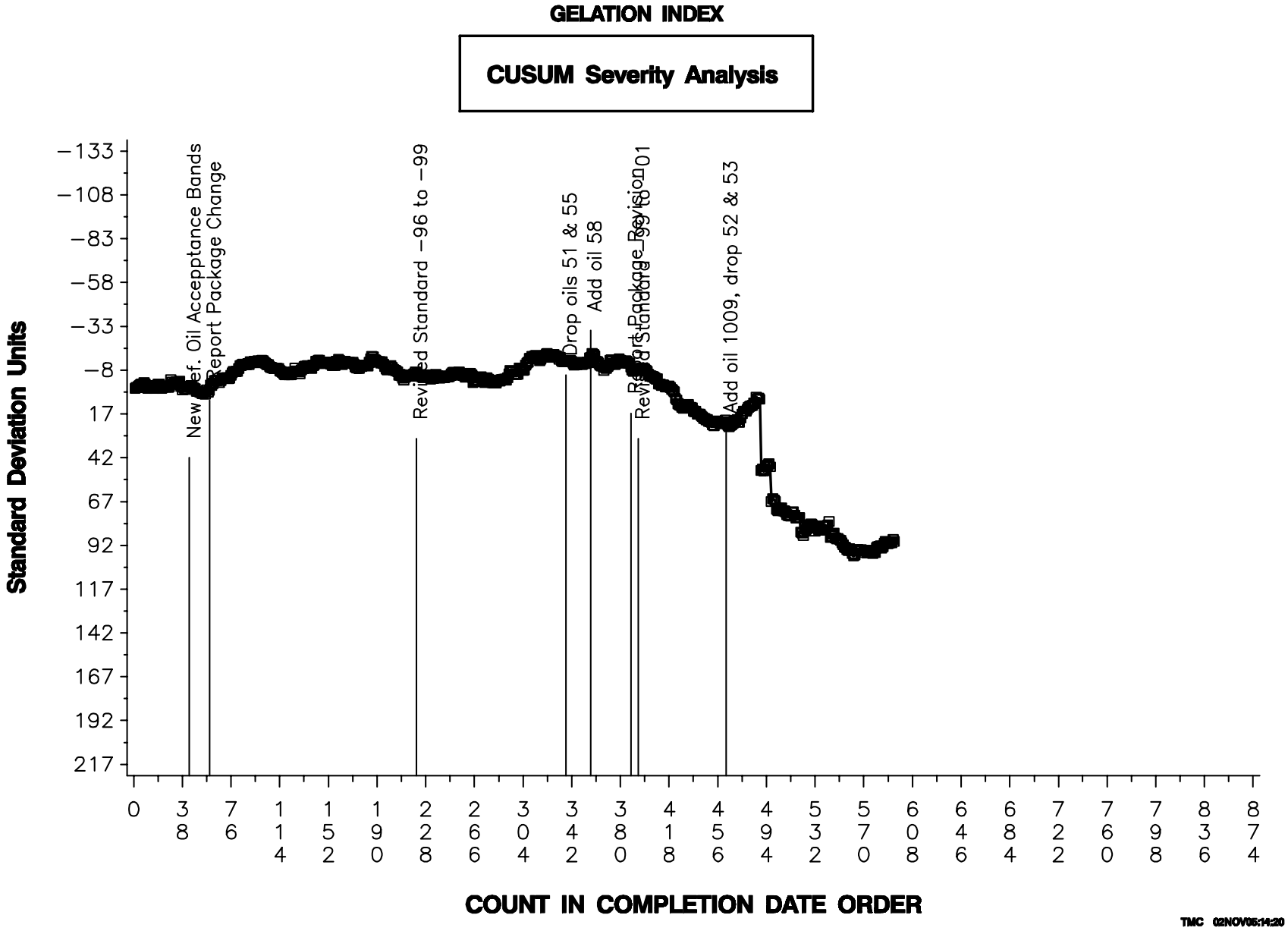
D5800 VOLATILITY BY NOACK INDUSTRY OPERATIONALLY VALID DATA



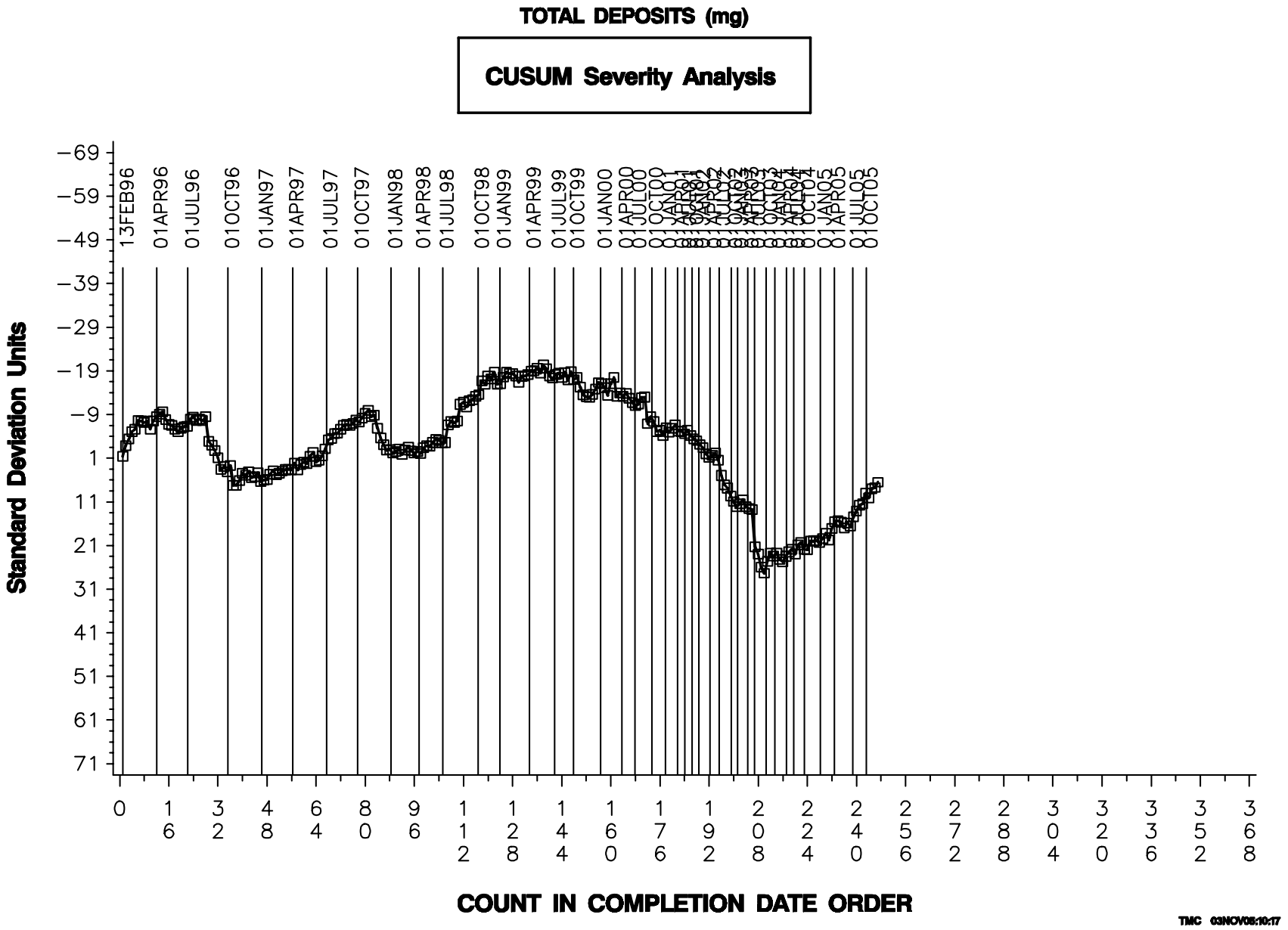
D5133 GELATION INDEX INDUSTRY OPERATIONALLY VALID DATA

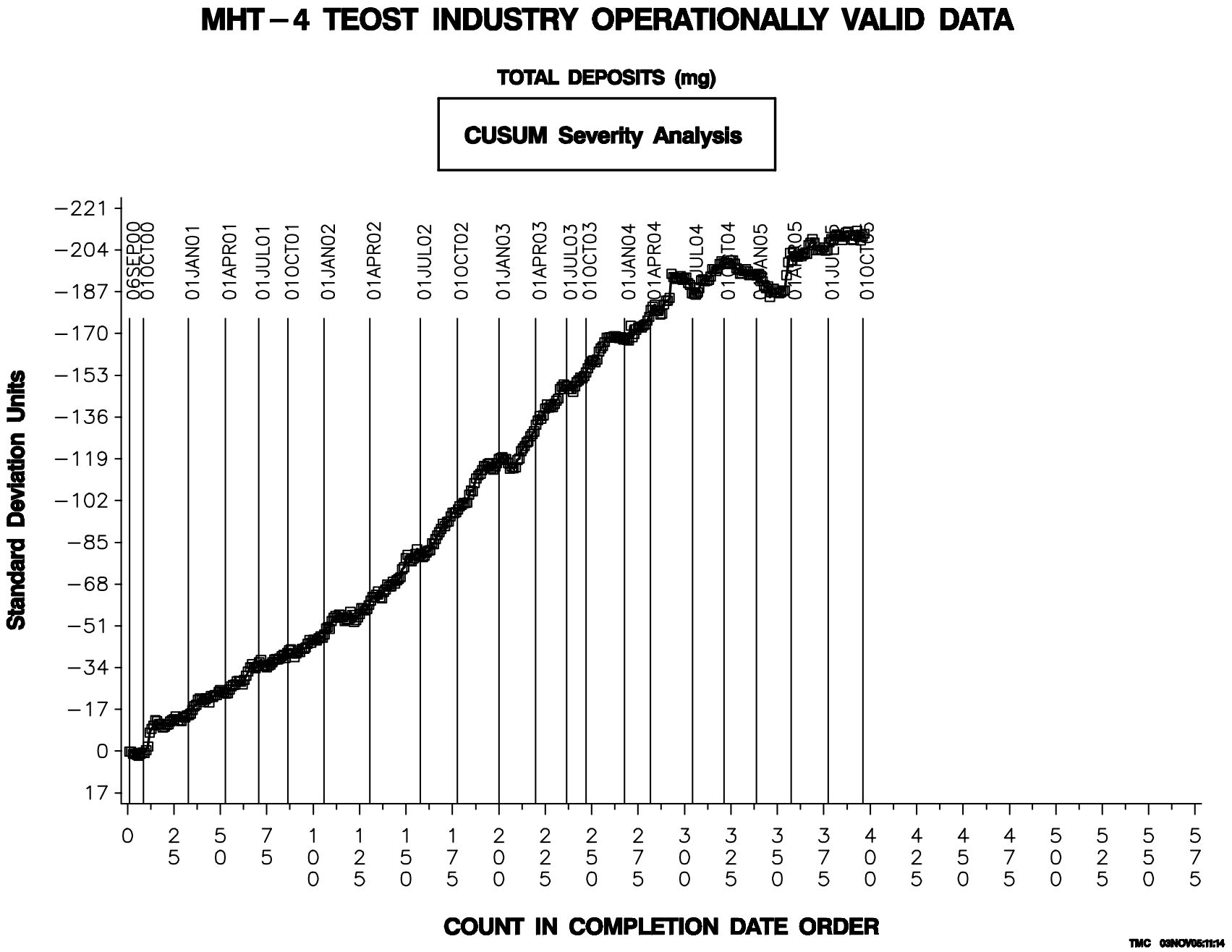


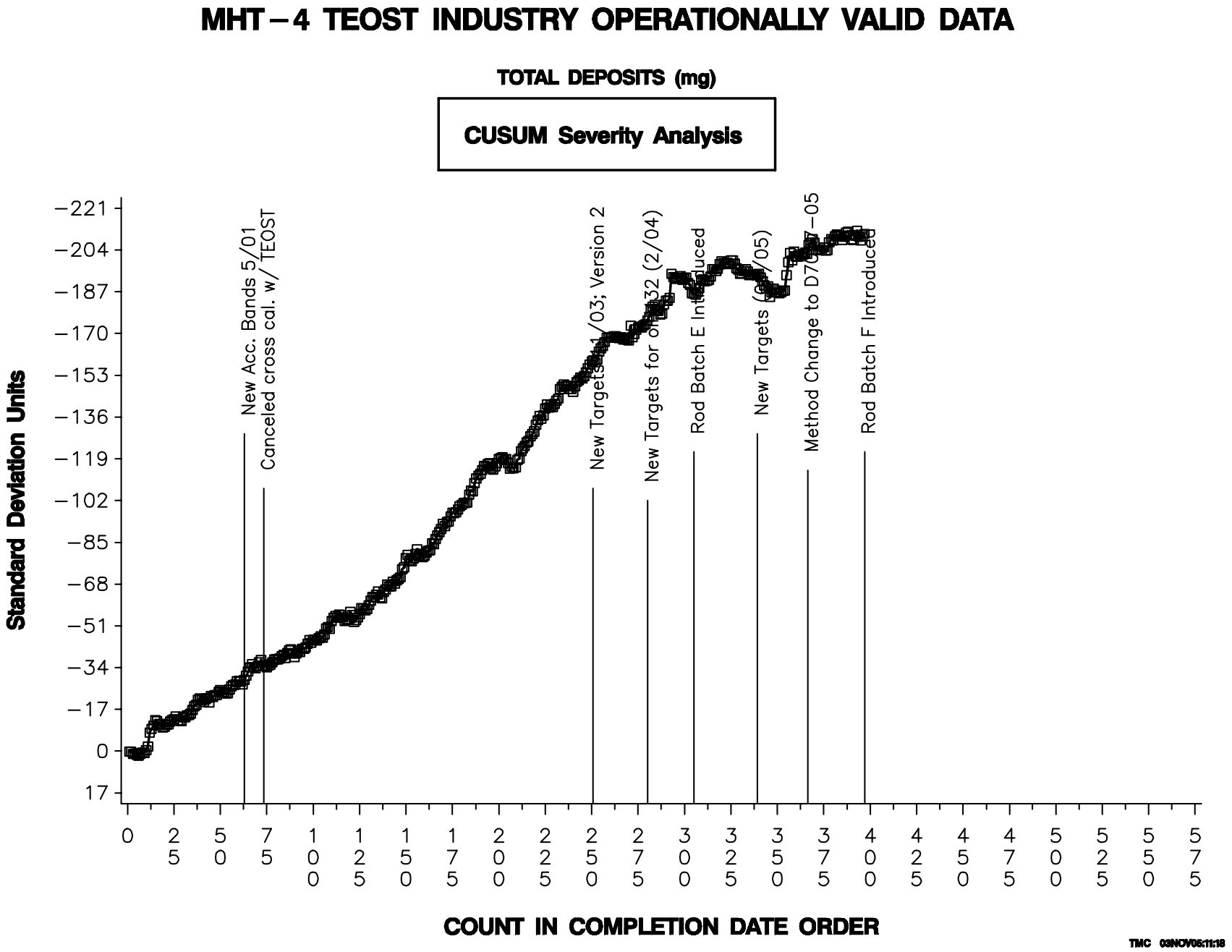
D5133 GELATION INDEX INDUSTRY OPERATIONALLY VALID DATA

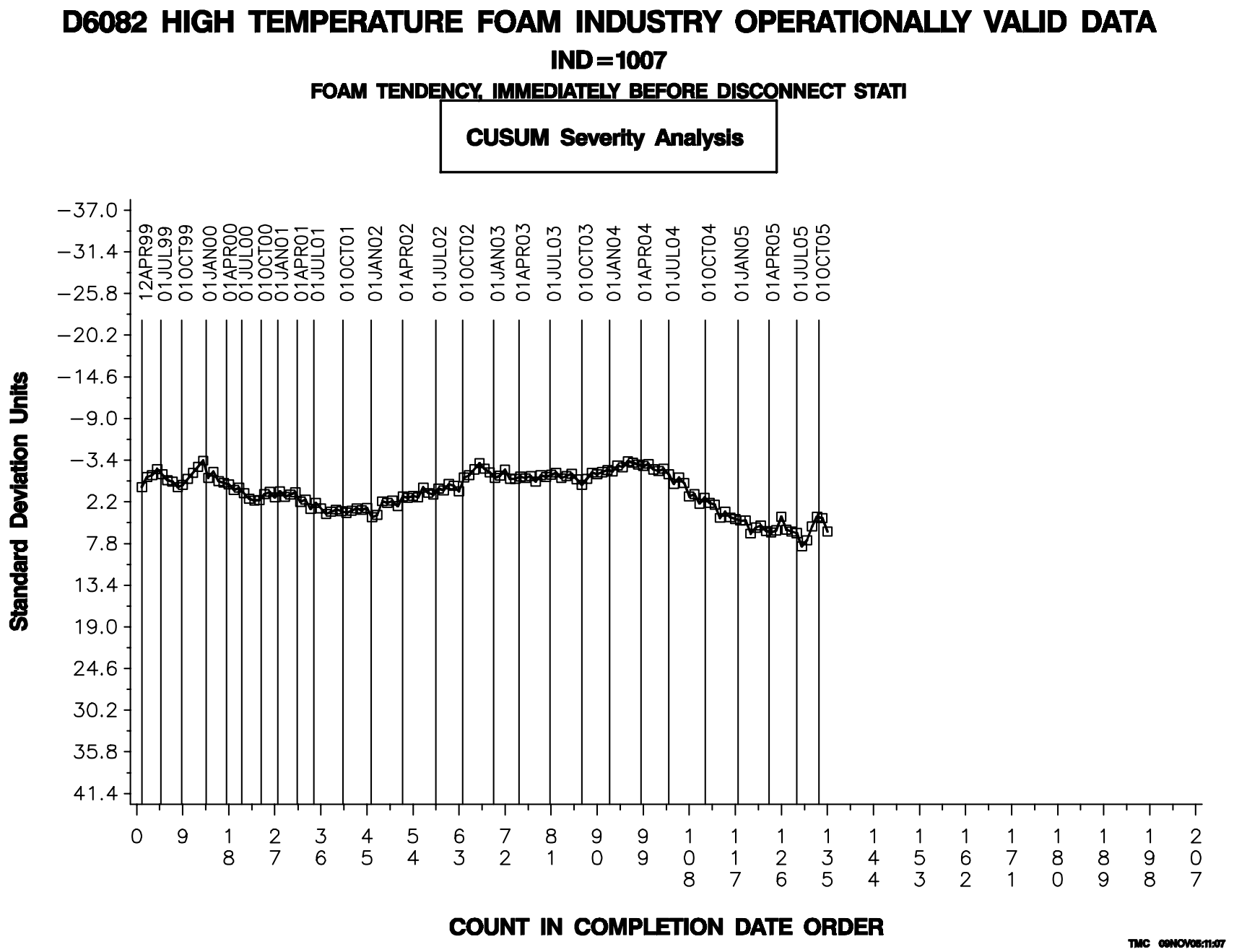


TEOST–33C INDUSTRY OPERATIONALLY VALID DATA




MHT – 4 TEOST INDUSTRY OPERATIONALLY VALID DATA
TOTAL DEPOSITS (mg)
CUSUM Severity Analysis
Standard Deviation Units
−221
−204
−187
−170
−153
−136
−119
−102
−85
−68
−51
−34
−17
0
17
06SEP00
01OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
01JUL02
01OCT02
01JAN03
01APR03
01JUL03
01OCT03
01JAN04
01APR04
0 25 50 75 100 125 150 175 200 225 250 275 300 325 350 375 400 425 450 475 500 525 550 575
COUNT IN COMPLETION DATE ORDER
TMC 03NOV05:11:14


MHT–4 TEOST INDUSTRY OPERATIONALLY VALID DATA
TOTAL DEPOSITS (mg)
CUSUM Severity Analysis
Standard Deviation Units
−221
−204
−187
−170
−153
−136
−119
−102
−85
−68
−51
−34
−17
0
17
New Acc. Bands 5/01
Canceled cross cal. w/ TEOST
New Targets 1/03; Version 2
New Targets for oil 32 (2/04)
Rod Batch E Introduced
New Targets (6/05)
Method Change to D7
Rod Batch F Introduced
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
400
425
450
475
500
525
550
575
COUNT IN COMPLETION DATE ORDER
TMC 03NOV05:11:18


D6082 HIGH TEMPERATURE FOAM INDUSTRY OPERATIONALLY VALID DATA
IND=1007
FOAM TENDENCY, IMMEDIATELY BEFORE DISCONNECT STATI
CUSUM Severity Analysis
Standard Deviation Units
−37.0
−31.4
−25.8
−20.2
−14.6
−9.0
−3.4
2.2
7.8
13.4
19.0
24.6
30.2
35.8
41.4
12APR99
01JUL99
01OCT99
01JAN00
01APR00
01JUL00
01OCT00
01JAN01
01APR01
01JUL01
01OCT01
01JAN02
01APR02
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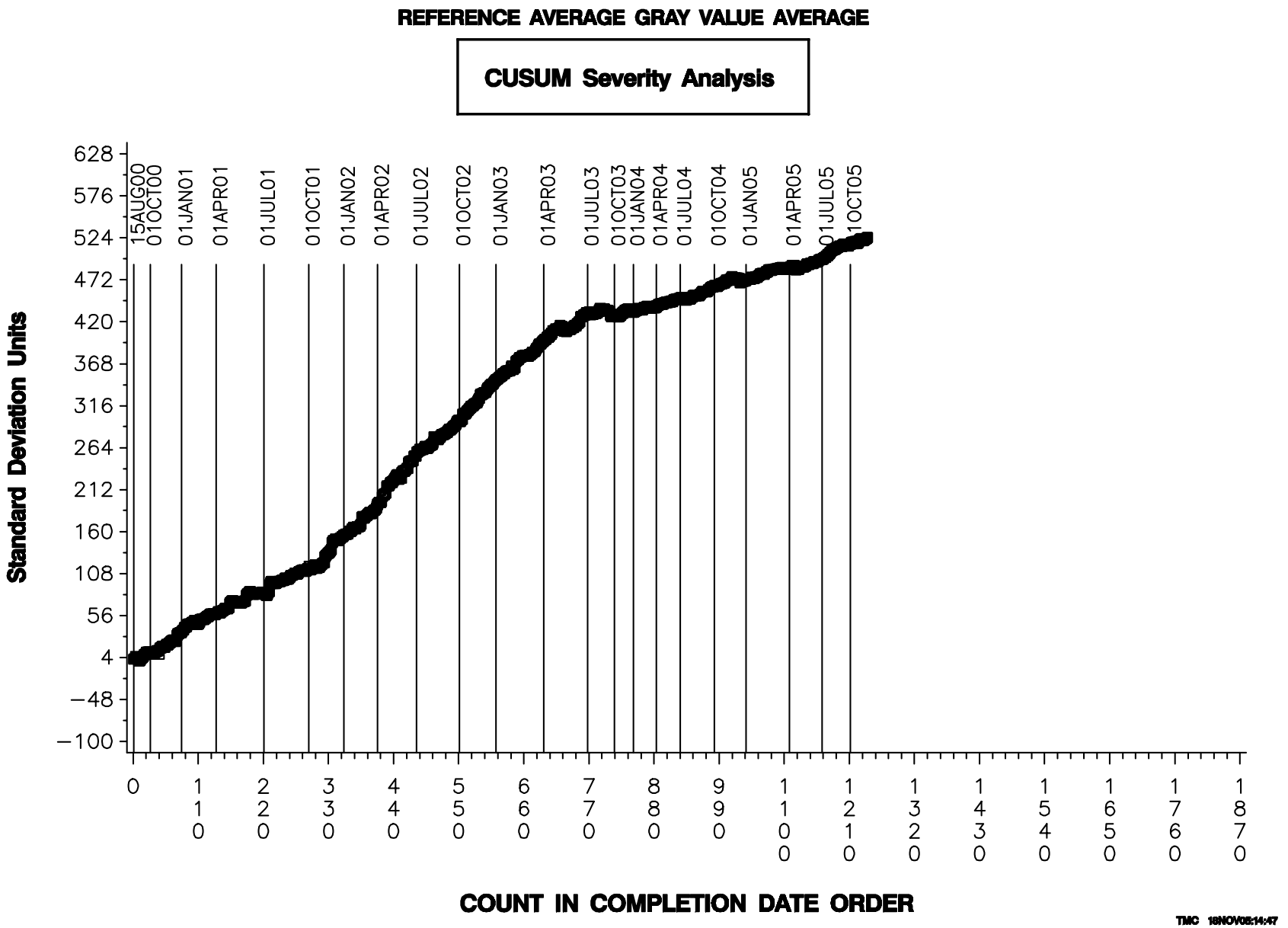
01JAN04
01APR04
01JUL04
01OCT04
01JAN05
01APR05
01JUL05
01OCT05
0
9
18
27
36
45
54
63
72
81
90
99
108
117
126
135
144
153
162
171
180
189
198
207
COUNT IN COMPLETION DATE ORDER
TMC 09NOV05:11:07

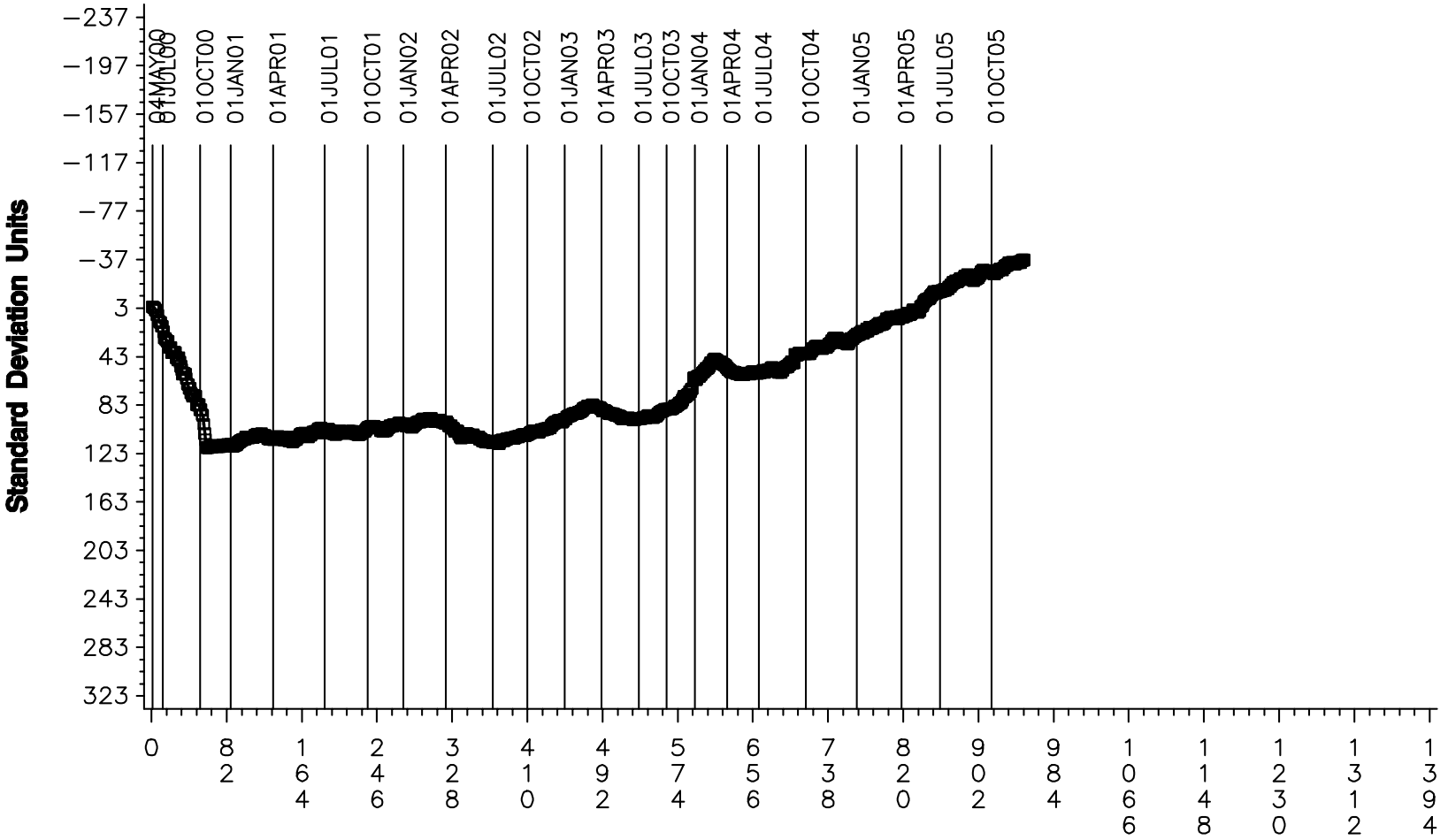
BALL RUST TEST INDUSTRY OPERATIONALLY VALID DATA



EOFT INDUSTRY OPERATIONALLY VALID DATA

20 – 25 ML CHANGE IN FLOWRATE AVERAGE (%)

CUSUM Severity Analysis



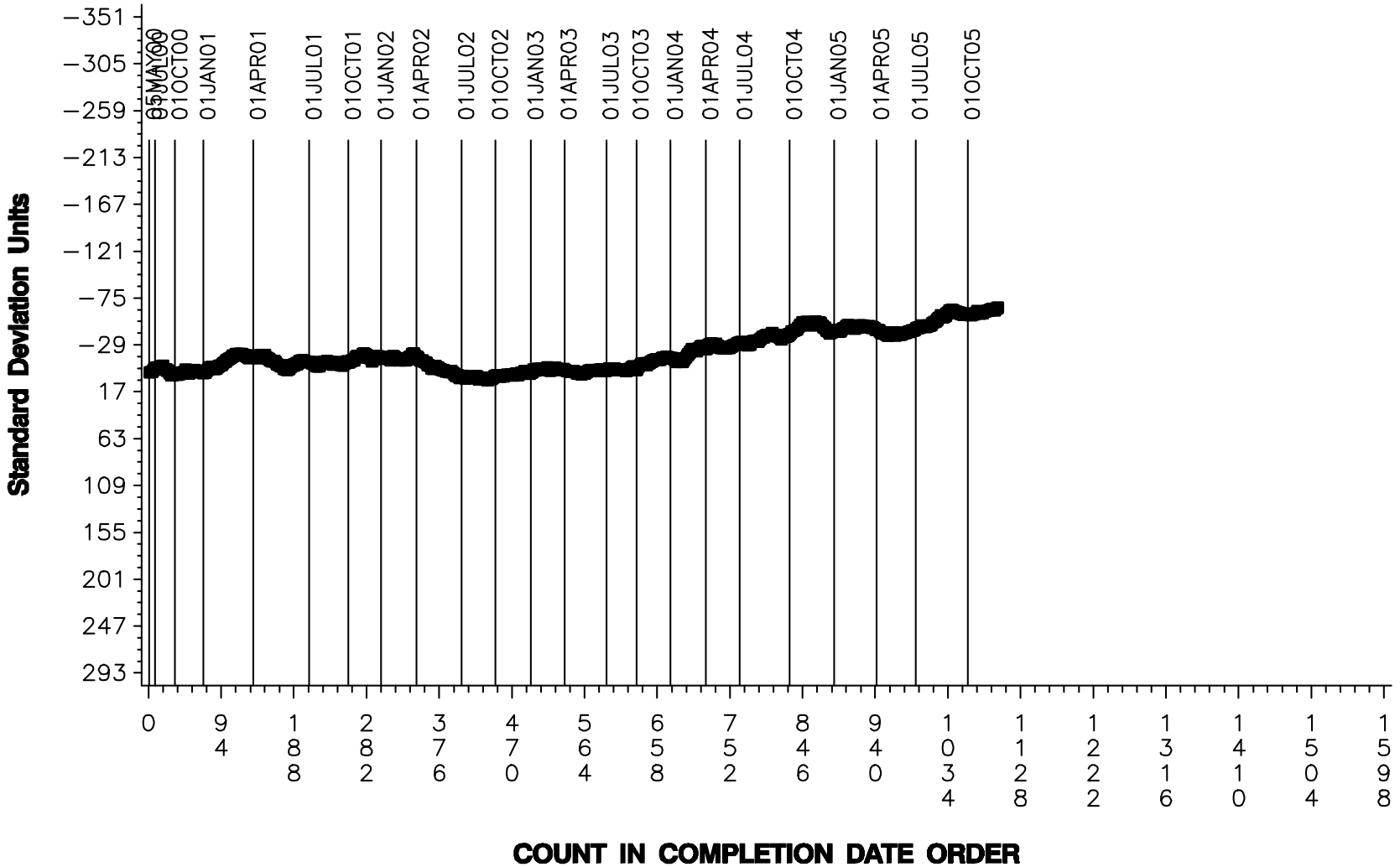
TMC 18NOV05:14:49

EOWT INDUSTRY OPERATIONALLY VALID DATA

0.6% Water Treat Level

TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE

CUSUM Severity Analysis



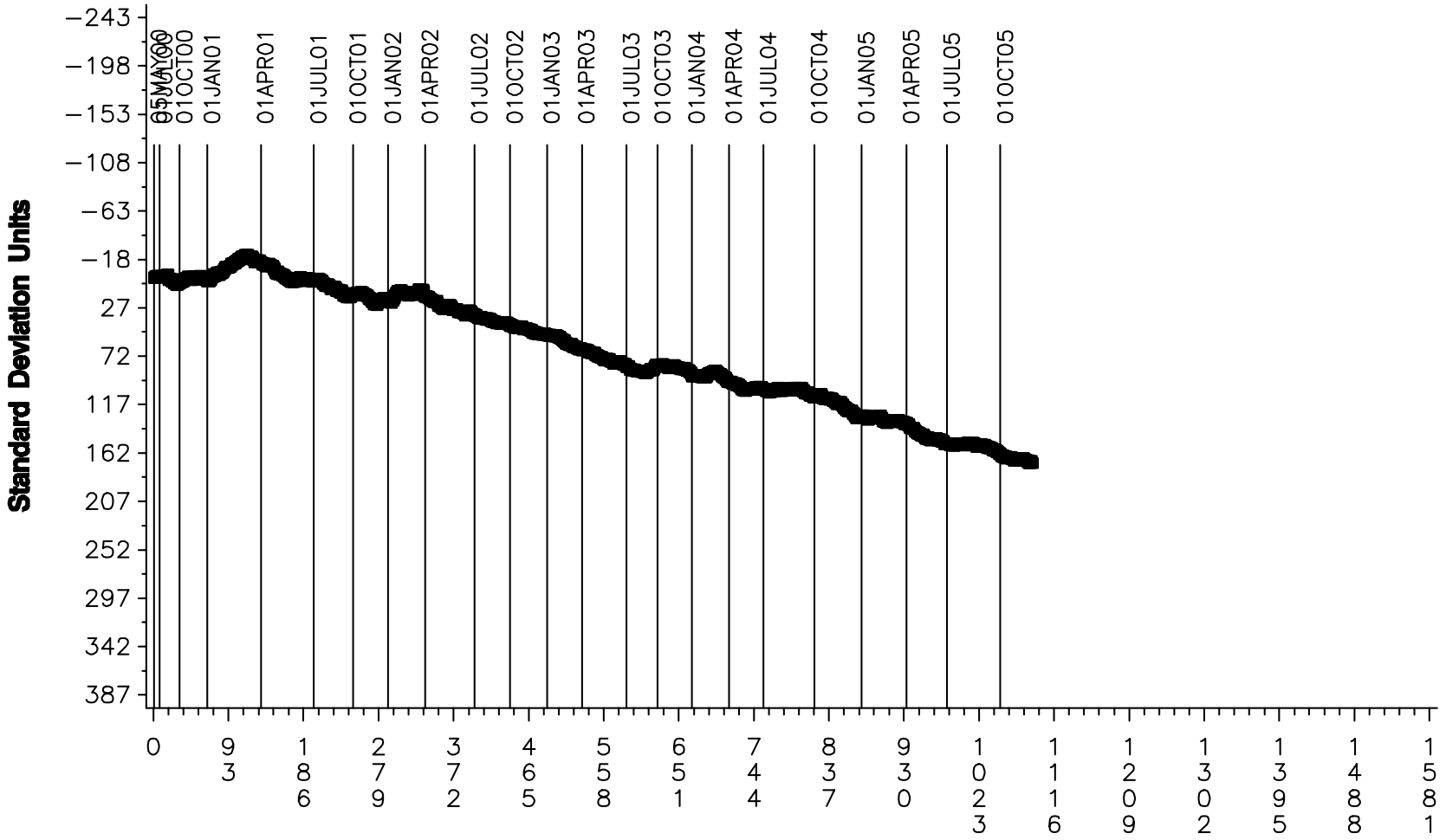
TMC 18NOV05:15:17

EOWT INDUSTRY OPERATIONALLY VALID DATA

1.0% Water Treat Level

TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE

CUSUM Severity Analysis



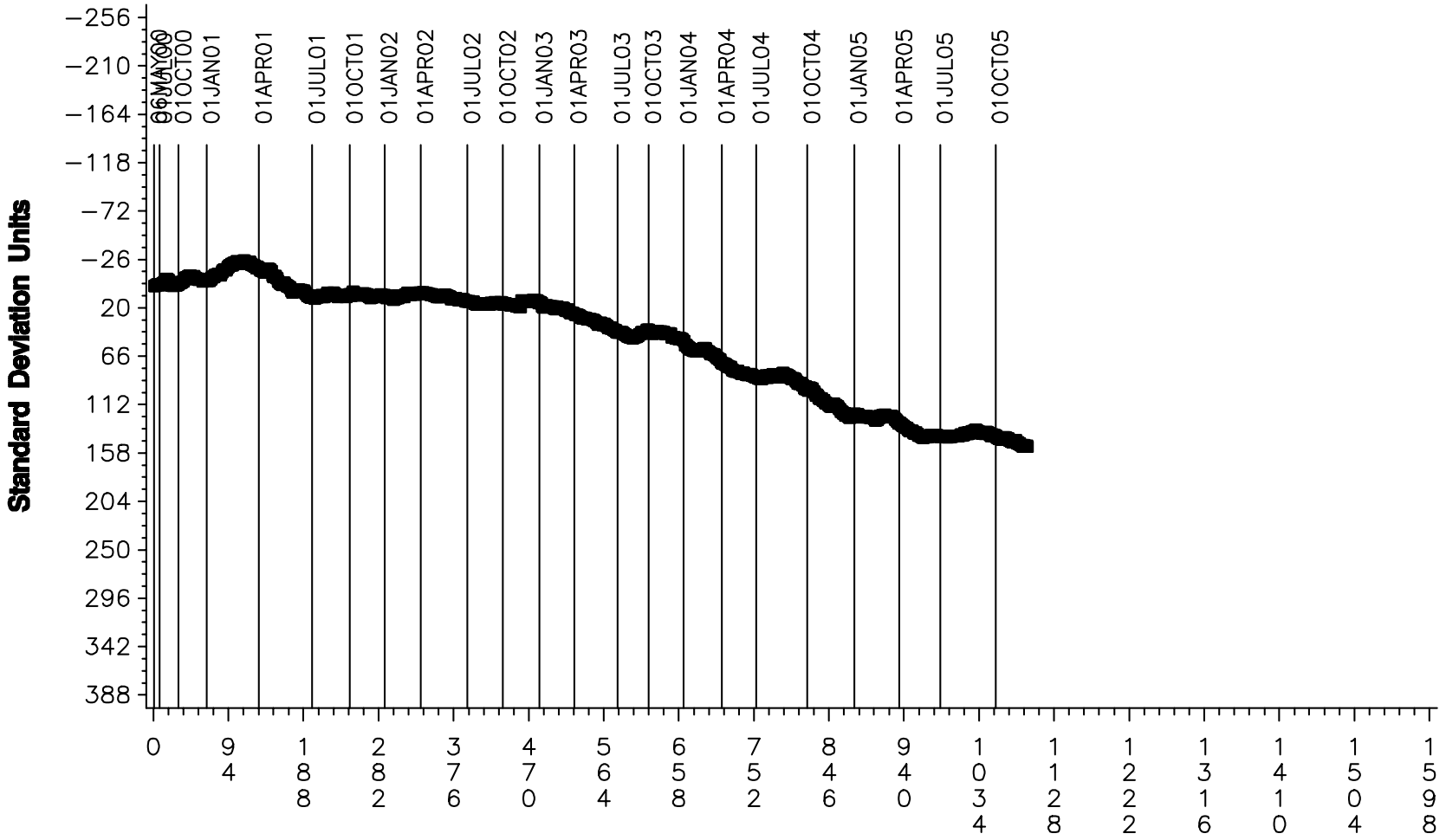
TMC 18NOV05:15:09

EOWT INDUSTRY OPERATIONALLY VALID DATA

2.0% Water Treat Level

TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE

CUSUM Severity Analysis



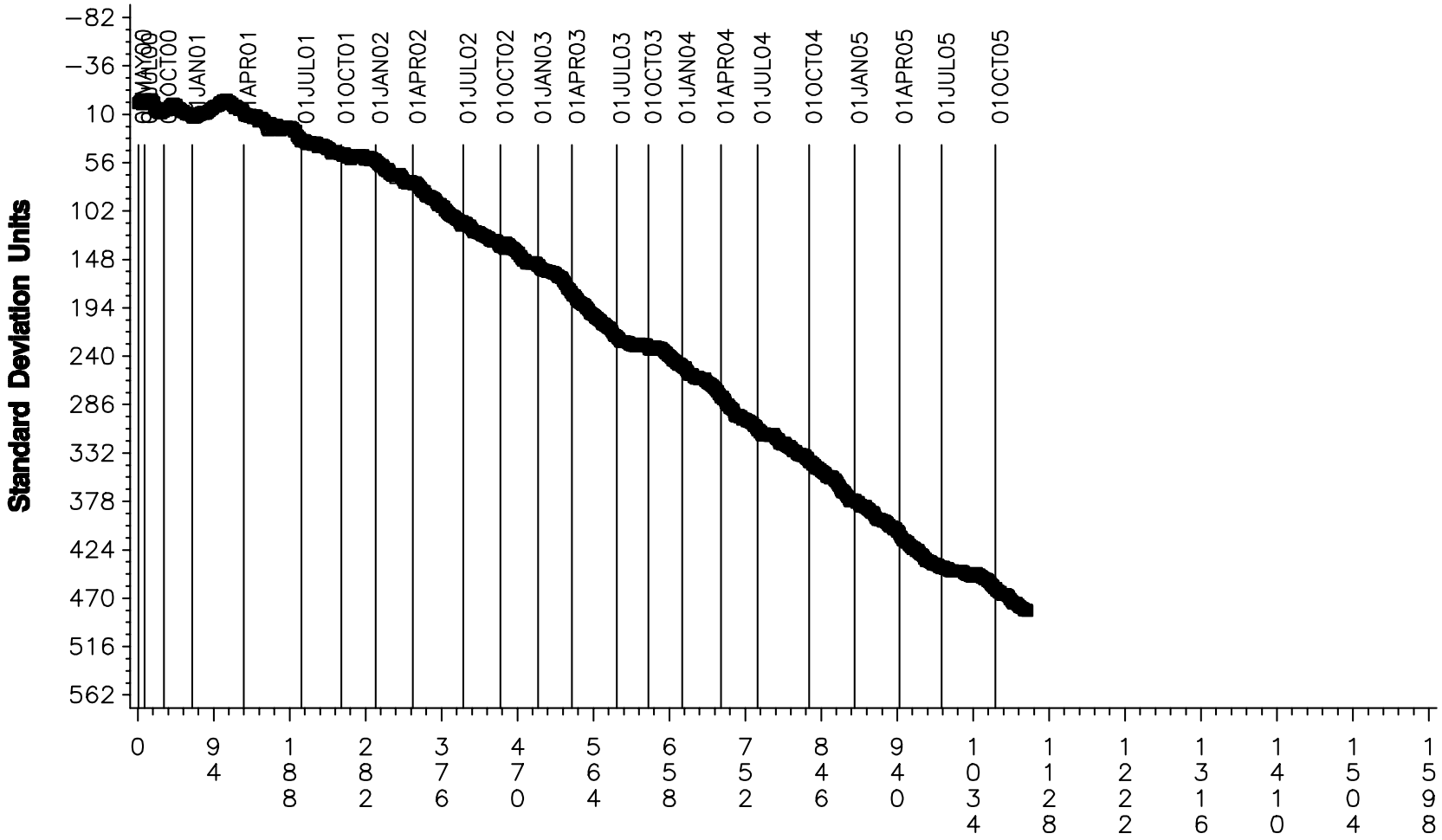
TMC 18NOV05:15:11

EOWT INDUSTRY OPERATIONALLY VALID DATA

3.0% Water Treat Level

TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE

CUSUM Severity Analysis



TMC 18NOV05:15:14

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	74	Total Deposit wt. (mg)	17	12.74	4.60	3.7	21.8
D7097-05	432	Total Deposit wt. (mg)	14	47.99	3.67	40.8	55.2
New Targets	434	Total Deposit wt. (mg)	11	27.68	5.57	16.8	38.6
20050630							
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			4/1/04 - 9/30/04				10/1/04 - 3/31/05				4/1/05 - 9/30/05			
			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	2	6.6	0.21	-1.03	8	6.8	0.50	-0.63	6	7.0	0.75	0.20
	55	Area % Volatized	18	11.68	0.51	7	11.8	0.40	0.21	2	11.8	0.07	0.33	7	11.3	0.59	-0.77
	58	Area % Volatized	18	5.61	0.30	6	5.8	0.42	0.80	6	5.8	0.45	0.63	4	5.6	0.35	0.13
D5800	52	% volatility loss	33	13.75	0.61	12	14.1	0.54	0.56	11	14.0	0.88	0.42	10	13.9	0.41	0.26
**	55	% volatility loss	32	17.09	0.76	8	17.0	0.54	-0.18	14	16.9	0.70	-0.24	12	17.3	0.63	0.24
	58	% volatility loss	37	15.20	0.72	10	15.3	0.80	0.18	10	15.4	0.36	0.25	12	15.3	0.55	0.20
TEOST	71	Deposit wt. (mg)	27	51.79	4.79	3	45.9	3.75	-1.23	5	48.0	8.17	-0.80	5	45.5	3.87	-1.30
(D6335)	72	Deposit wt. (mg)	27	26.72	3.46	2	27.6	4.17	0.27	5	27.2	3.54	0.15	6	25.8	4.33	-0.25
MTEOS	432	Deposit wt. (mg)	14	47.99	3.67	13	44.7	9.30	-0.19	12	48.3	3.46	1.15	11	46.0	5.08	-0.23
D7097	434	Deposit wt. (mg)	11	27.68	5.57	---	-----	-----	-----	8	24.9	8.17	-1.95	14	29.3	7.07	-0.24
***	74	Deposit wt. (mg)	17	12.74	4.60	6	12.2	3.05	-0.34	8	11.9	3.86	-0.42	14	12.9	6.49	-0.07
GI	58	Gelation Index	17	5.8	0.69	12	6.0	0.94	0.33	12	6.9	1.78	1.62	5	6.0	0.66	0.35
(D5133)	62	Gelation Index	35	17.0	3.90	8	15.3	5.12	-0.44	10	16.1	4.14	-0.22	10	17.8	4.97	0.21
****	1009	Gelation Index	16	7.30	0.68	7	8.3	2.23	1.47	12	7.1	0.74	-0.31	7	6.6	0.38	-1.07
D6082	1007	Tendency (ml)	28	65.71	19.28	13	72.3	15.89	0.34	12	72.9	16.3	0.37	10	62.0	25.30	-0.19

**D5800 Targets Adjusted 10/2/00; new oils selected; new procedures approved; targets adjusted again 7/21/03
***MTEOS Targets Adjusted: 6/1/01 (matrix); 11/1/03 (SC9 RR2); 2/18/04 (add 432); 1/12/05 (add 434, drop 433 & 1006); 6/30/05 (Batch E ref. data)
****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)

Test	Oil Code	Parameter	Targets			4/1/04 - 9/30/04			10/1/04 - 3/31/05			4/1/05 - 9/30/05		
			n	Mean	sR	n	Mean	sR	n	Mean	sR	n	Mean	sR
BRT	1006	Average AGV	12	128	7.21	14	127.6	4.30	27	124.3	10.57	23	126.5	5.12
	5A-3	Average AGV	12	76	6.47	---	---	---	---	---	---	--	--	--
	81	Average AGV	12	112	14.00	58	121.5	6.90	69	122.2	6.84	60	121.2	12.59
	82	Average AGV	12	48	11.50	26	41.8	9.10	31	42.5	9.01	20	44.3	7.08
EOFT	77	Avg. % CF	12	-45.55	4.36	0	-----	-----	0	-----	-----	--	--	--
	78	Avg. % CF	12	15.74	6.87	86	14.8	7.90	105	13.7	6.58	98	13.2	6.74
EOWT	77	0.6 H2O Avg. %CF	12	-24.90	5.68	56	-25.4	4.55	59	-25.8	5.32	55	-25.3	4.80
	77	1.0 H2O Avg. %CF	12	-17.94	5.45	52	-16.9	2.92	54	-15.8	4.58	51	-15.7	2.95
	77	2.0 H2O Avg. %CF	12	-17.96	8.47	55	-15.3	2.77	56	-13.5	5.99	70	-15.5	4.15
	77	3.0 H2O Avg. %CF	12	-18.23	6.83	53	-16.2	3.83	59	-15.0	5.35	57	-16.9	3.93
EOWT	78	0.6 H2O Avg. %CF	12	10.87	6.16	52	9.9	6.76	54	11.3	7.01	63	9.7	5.37
	78	1.0 H2O Avg. %CF	12	7.54	6.15	54	8.0	5.92	60	7.9	6.44	66	8.2	4.87
	78	2.0 H2O Avg. %CF	12	5.17	5.33	52	6.0	6.05	59	5.5	5.93	51	4.2	4.86
	78	3.0 H2O Avg. %CF	12	-0.54	4.52	56	3.1	5.06	53	2.9	4.76	62	2.5	3.85