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MEMORANDUM: 00-155

DATE: November 15, 2000

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

FROM: Thomas Schofield

SUBJECT: TMC Bench Reference Test Monitoring from October 1, 1999 through September 30, 2000

I respectfully submit the TMC's ASTM D02.B07 Bench Reference Test Monitoring Semiannual Report, with statistical summaries broken down by test area (Attachment 1).

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 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)
(i.e., "On average, how many standard deviations from the target mean are <u>all</u> the operationally valid calibration tests for each period?")

Note that the severity estimates (mean Δ/s) are independent of oil performance because they are normalized into (target) standard deviations for each oil. Also, using a pooled s for precision simplifies the interpretation of precision across all reference oil performance levels. These two calculations allow us to combine all calibration performance levels into single precision and severity estimates each period for a general comparison of current test performance to target performance, and to prior periods. Also note that Δ/s and Mean Δ/s are calculated using the targets that were effective at the time of test completion. 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 the entire prior report periods. To keep the information succinct, intermediate overlapping periods are no longer listed, and some of the oldest annual comparison periods are deleted.

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 my last report, and should remain the same lab in future reports. (My initial PCEOCP Bench Test Report, of November 8, 1996, did not cross reference the labs.)

All operationally valid test data and severity plots are available on the TMC's website. Please contact me if you require further information.

TMS/tms

Attachments

c: PCEOCP Bench Test Mailing List
J. Zalar
M. Lane
ftp://tmc.astm.cmri.cmu.edu/docs/bench/B07semiannualreports/mem00-155

Attachment 1

ASTM Test Monitoring Center

Semiannual Report

ASTM D02.B07 Bench Reference Test Monitoring
From October 1, 1999 through September 30, 2000

RR D02-1393: Volatility by Gas Chromatography (VGC by D 2887 Extended)

STATUS

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

TABLE 1

	No. of Tests
Statistically Acceptable and Operationally Valid	30
Operationally Valid but Failed Acceptance Criteria	2
Operationally Invalid	1
Total	**33**

Fail Rate of Operationally Valid Tests: 6.2%

Table 2 is a breakdown of the statistically unacceptable tests.

TABLE 2

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

INDUSTRY PERFORMANCE

Table 3 shows the current Industry precision and severity for the Sample % Volatized @ 371°C test parameter for all operationally valid tests for the report period. (First calibration test completed 5/10/96.)

TABLE 3

% Volatized @ 371°C, area %	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study	240	235	0.70	-----
10/1/96 through 9/30/97	34	29	0.68	-0.15
10/1/97 through 9/30/98	38	33	0.65	-0.28
10/1/98 through 9/30/99	34	29	0.86	0.12
10/1/99 through 9/30/00	32	27	0.94	0.34

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

TABLE 4

	n	Mean Δ/s
Lab A	10	1.08
Lab B	4	-0.02
Lab D	5	0.65
Lab G	4	-1.05
Lab H	4	0.56
Lab S	2	-1.77
Lab U	3	0.77

PRECISION AND SEVERITY

Precision this report period continues to degrade. 18 tests from 6 different labs are more than one standard deviation from target (6 tests mild and 12 tests severe). Three of those tests, from two different labs, are more than two standard deviations from target (one mild and two severe). No explanation for the worsening precision is immediately evident.

As noted six months ago, severity continues to move increasingly severe, shifting from moderately mild to moderately severe over the course of TMC monitoring. Overall severity trends are graphically represented in Figure 1 (attached). Labs G & S continue to calibrate substantially mild of targets, as they have since the beginning of TMC monitoring.

TMC MEMORANDA

There were no TMC technical memoranda issued this period for the D2887 Extended test.

METHOD UPGRADE

The TMC has been monitoring method D6417 since October 2, 2000. D6417 is expected to replace all references to D2887 Extended in Oil Specification D4485 (including previous API categories). The TMC will monitor D2887 Extended until instructed to stop by D02.B07.

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

STATUS

Table 5 summarizes the reference tests reported to the TMC this period (3 labs reporting):

TABLE 5

	No. of Tests
Statistically Acceptable and Operationally Valid	8
Operationally Valid but Failed Acceptance Criteria	1
Total	**9**

Fail Rate of Operationally Valid Tests: 11.1%

Table 6 is a breakdown of the statistically unacceptable tests.

TABLE 6

Reason for Fail	No. of Tests
Sample % Volatized Mild	1

INDUSTRY PERFORMANCE

Table 7 shows the current Industry precision and severity for the Sample % Volatized @ 371°C test parameter for all operationally valid tests for the report period. (First calibration test completed 5/20/96.)

TABLE 7

% Volatized @ 371°C, mass %	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study	140	135	0.65	-----
10/1/96 through 9/30/97	15	10	0.33	-0.52
*10/1/97 through 9/30/98	14	9	0.49	-0.58
*10/1/98 through 9/30/99	13	8	0.54	-1.10
New Targets Effective 12/7/00	52	47	0.49	-----
10/1/99 through 9/30/00	9	4	0.33	-0.57

*Exclusion of test result that was more than 7 standard deviations mild of target
(excluded per surveillance panel's recommendation; a different result excluded each period).

Table 8 shows the current severity for the Sample % Volatized @ 371°C parameter for each lab for all operationally valid tests for the report period.

TABLE 8

	n	Mean Δ/s
Lab A	4	-0.32
Lab G	3	-0.53
Lab L	2	-1.15

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

PRECISION AND SEVERITY

Precision has improved considerably this period with a pooled s of about half the initial target and also better than the revised target Pooled s (0.49). Severity is mild of targets this period and has been consistently mild of the matrix mean results, with all labs trending mild. Note that targets were adjusted (effective 12/7/99) to try to compensate for the consistent mild trends. Severity is graphically represented in Figures 2A & 2B (attached). Figure 2B shows when targets were recently adjusted. Though the overall severity for the period is moderately mild, Figures 2A & 2B indicate some recent leveling to near target (though the leveling did not occur immediately upon adjusting the targets).

However, we may not have the opportunity to gather sufficient data in the future (at least across several labs) to find out if the new targets will effectively bring calibration testing back on target. Labs G and L have indicated their decision to stop calibrating with the TMC under method D5480. Lab A is currently the only lab with a TMC calibrated D5480 instrument.

TMC MEMORANDA

There was one TMC technical memorandum issued this period for method D5480: Memo 99-210, December 16, 1999, concerning Changes to D5480 Reference Oil Targets and Acceptance bands.

D5800: Evaporation Loss of Lubricating Oils by the Noack Method

STATUS

Table 9 summarizes the reference tests reported to the TMC this period (7 labs reporting):

TABLE 9

	No. of Tests
Statistically Acceptable and Operationally Valid	28
Operationally Valid but Failed Acceptance Criteria	2
Operationally Invalid	1
Total	**31**

Fail Rate of Operationally Valid Tests: 6.7%

Table 10 is a breakdown of the statistically unacceptable tests.

TABLE 10

Reason for Fail	No. of Tests
Sample Evaporation Loss Severe	2

INDUSTRY PERFORMANCE

Table 11 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 11

Sample Evaporation Loss, mass %	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study	180	175	0.51	-----
10/1/96 through 9/30/97	26	21	0.70	0.43
10/1/97 through 9/30/98	22	17	0.71	0.56
10/1/98 through 9/30/99	32	27	0.46	0.84
10/1/99 through 9/30/00	30	25	0.38	1.03
New Targets Effective 9/26/00	178	175	0.56	-----

Table 12 shows the current severity for the Sample Evaporation Loss parameter for each lab for all operationally valid tests for the report period.

TABLE 12

	n	Mean Δ/s
Lab A	6	0.95
Lab G	5	0.90
Lab I	3	1.76
Lab J	4	0.88
Lab L	3	0.37
Lab R	6	1.21
Lab U	3	1.21

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

PRECISION AND SEVERITY

Precision this period is again improved and is much better than the initial matrix precision. However, overall severity continues to degrade and is trending significantly severe of target. The two statistically unacceptable tests are 2.5 and 3.0 standard deviations severe of target and account for some of the overall severe trend. Still, the reason for the increasing severity has not been determined. The severity trend is graphically represented in Figures 3A & 3B (attached). Figure 3B shows where targets were recently adjusted.

All labs are performing severe to different degrees, but four tests from four different labs were mild of target.

METHOD UPGRADE AND ADJUSTMENTS FOR TMC MONITORING UNDER GF-3

Note that the Surveillance panel voted to change acceptance bands and reference oils effective September 26, 2000 (see TMC Memoranda section below). The use of TMC reference 51, 53 & 54 has been discontinued, and a new reference oil, TMC oil 58, has been introduced. Also, new targets and acceptance bands for all three current reference oils (52, 55 and 58) have been implemented. There have been no calibration tests completed this very short period since the new targets became effective (9/26/00 – 9/30/00). At the same time, the TMC began monitoring the three proposed procedures under test method D5800 (Procedure A, Woods Metal Noack; Procedure B, non-Woods Metal Noack; Procedure C, Selby Noack).

TMC MEMORANDA

There was one TMC technical memorandum issued this period for method D5800: Memo 00-121, September 8, 2000, New D5800 Noack Procedures and Targets.

(There was also another important TMC Technical memorandum issued shortly after the report period: Memo 00-150, October 23, 2000, D5800 Test Method Update.)

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

STATUS

Table 13 summarizes the reference tests reported to the TMC this period (12 labs reporting):

TABLE 13
Reference Tests

	No. of Tests
Statistically Acceptable and Operationally Valid	57
Operationally Valid but Failed Acceptance Criteria	2
Operationally Invalid	1
Total	**60**

Fail Rate of Operationally Valid Tests: 3.4%

Table 14 is a breakdown of the statistically unacceptable tests.

TABLE 14
Reference Tests

Reason for Fail	No. of Tests
Gelation Index Severe	2

INDUSTRY PERFORMANCE

Table 15 shows the current Industry precision and severity for the Gelation Index and test parameter for all operationally valid tests for the report period. (First calibration test completed 4/20/96.) "Initial Tests" includes reference and donated tests; subsequent listings include only reference tests.

TABLE 15

Gelation Index	n	df	Pooled s	Mean Δ/s
Initial Tests 4/20/96 through 11/27/96	178	173	6.37	-----
10/1/96 through 9/30/97	66	61	5.60	-0.23
10/1/97 through 9/30/98	71	66	6.56	0.01
10/1/98 through 9/30/99	61	56	5.72	0.13
*10/1/99 through 9/30/00	59	54	5.46	0.29
**10/1/99 through 9/30/00	58	53	5.49	0.06

*Includes one data point more than 13 standard deviations from target on TMC 52 (included for information only; will exclude from future statistics.)
**Same statistics with extreme result excluded.

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

Table 16 shows the current severity for the Gelation Index for each lab for all operationally valid tests for the report period.

TABLE 16

	n	GI Mean Δ/s
*Lab A	7	2.45
**Lab A	6	0.57
Lab B	12	0.37
Lab D	8	-0.11
Lab E	2	-1.69
Lab G	8	-0.46
Lab H	2	-0.13
Lab I	3	0.09
Lab L	2	0.13
Lab R	5	1.15
Lab S	5	-0.32
Lab U	4	0.13
Lab V	1	-1.42

*Includes one data point more than 13 standard deviations from target on TMC 52 (included for information only; will exclude from future statistics.)
**Same statistics with extreme result excluded.

PRECISION AND SEVERITY

Note that last June, the Gelation Index Surveillance Panel had given approval for the TMC to stop monitoring Gelation Temperature, although the TMC is still collecting this data.

This period one operationally valid test was reported to be 13.75 standard deviations severe of target. The oil was TMC 52, with a target mean of 4.5, target s of 0.24 and a reported result of 7.8:

$$\Delta/s = (7.8 - 4.5) \setminus 0.24 = 13.75$$

Although the test is reported as operationally valid, the TMC intends to exclude this data point from future statistics. For comparison purposes, statistics this period are shown with and without the extreme datum.

Overall precision is improved again slightly, making this test more precise than ever. Excluding the extreme datum, Gelation Index severity is on target (slight severe bias). Severity is graphically represented in Figure 4 (attached).

TMC MEMORANDA

There was one TMC technical memorandum issued this report period: Memo 99-150 (Sept 10, 1999) concerning a new test reporting package and the upgrade of method D5133-96 to method D5133-99.

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

STATUS

Table 17 summarizes the reference tests reported to the TMC this period (6 labs reporting):

TABLE 17

	No. of Tests
Statistically Acceptable and Operationally Valid	22
Operationally Valid but Failed Acceptance Criteria	4
Operationally Invalid	6
Total	**32**

Fail Rate of Operationally Valid Tests: 15.4%

Table 18 is a breakdown of the statistically unacceptable tests.

TABLE 18

Reason for Fail	No. of Tests
Total Deposits Mild	1
Total Deposits Severe	3

INDUSTRY PERFORMANCE

Table 19 shows the current Industry precision and severity for the Total Deposits test parameter for all operationally valid tests for the report period. (First calibration test completed 2/13/96.)

TABLE 19

Total Deposits	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study	54	52	4.18	-----
10/1/96 through 9/30/97	42	40	4.71	-0.28
10/1/97 through 9/30/98	39	37	5.52	-0.14
10/1/98 through 9/30/99	31	29	4.85	-0.18
10/1/99 through 9/30/2000	26	24	8.39	0.40

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

TABLE 20

	n	Mean Δ/s
Lab A	6	0.22
Lab B	8	0.67
Lab G	6	0.15
Lab I	2	-0.40
Lab L	3	1.36
Lab V	1	-0.50

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

PRECISION AND SEVERITY

Overall precision is considerably poor for the reference tests this period and overall severity is severe of the round-robin target means for the first time. Two tests reported as operationally valid were considerably severe of target. Lab A reported a result on Oil 72 more than 4 s severe of target and Lab G reported another on oil 71 that was more than 6 s severe of target. Two other results were more than 2 s from target (one mild and one severe).

The severity trends are graphically represented in Figure 5 (attached). All the short term up and down patterns in the plot are unusual compared to prior history and indicative of exceptionally poor precision.

In summary, from April 1, 1998 (and particularly from July 1, 1998) through September 1998, we observed an exceptionally strong industry-wide mild trend in the TEOST reference data that was not reflected in the overall mean Δ/s for that report period due to an earlier severe trend. From October 1998 though October 1999, we observe that severity has leveled closer to targets (mild bias) for the entire period. Then this year we see considerable variability in the data and a shift from somewhat mild to moderately severe.

TMC MEMORANDA

There were no TMC technical memoranda issued this report period.

D6082: High Temperature Foaming Characteristics of Lubricating Oils

Unlike other monitored bench tests, the TMC has chosen to break down the D6082 calibration statistical analysis by oil. The reasons for doing so are:

1. The two reference oils (1002 and 1007) perform very differently, both in mean performance and precision. There are no other oils providing "intermediate" performance to provide continuity over the entire performance range for an analysis of performance that combines all the reference oils.

2. TMC 1007 has a Foam Stability (one minute after disconnect) target mean performance of zero ml and a target precision (standard deviation) of zero ml. Any negative (mild) result for this parameter is unlikely and any positive result would be "infinitely" severe in standard deviations (Δ/s). For Foam Stability, it is preferable to simply note the number of non-zero occurrences in order to flag any severity trends, and use the 1002 Foam Stability results to both verify and quantify the trend.

3. Introducing a combined 1002 & 1007 statistical analysis for any given period will make it very difficult to make a meaningful comparison to earlier calibration periods which were based only on 1002 calibration data.

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

STATUS

Table 21 summarizes the reference tests reported to the TMC this period (6 labs reporting):

TABLE 21

	No. of Tests
Statistically Acceptable and Operationally Valid	26
Operationally Valid but Failed Acceptance Criteria	4
Operationally Invalid	2
Total	**32**

Fail Rate of Operationally Valid Tests: 13.3%

Table 22 is a breakdown of the statistically unacceptable tests.

TABLE 22

Reason for Fail	No. of Tests
Foam Tendency Severe (1007)	1
Foam Tendency Severe & Foam Stability Severe (1002)	3

D6082: High Temperature Foaming Characteristics of Lubricating Oils, continued

TMC 1002 INDUSTRY PERFORMANCE

Tables 23 and 24 show the current industry precision and severity for the Foam Tendency, Foam Stability and Total Volume Increase test parameter for all operationally valid tests **on oil 1002** for the report period. (First calibration test completed 5/14/96.)

TABLE 23

1002 Foam Tendency, ml	n	Mean	s_R	Mean Δ/s
Initial Round Robin Study (targets)	32	410.63	58.78	-----
10/1/96 through 9/30/97	32	414.6	97.29	0.07
10/1/97 through 9/30/98	29	390.7	67.30	-0.34
10/1/98 through 9/30/99	16	391.9	76.53	-0.32
10/1/99 through 9/30/2000	14	450.7	106.44	0.68

TABLE 24

1002 Foam Stability @ 1 min., ml	n	Mean	s_R	Mean Δ/s
Initial Round Robin Study (targets)	32	37.81	45.41	-----
10/1/96 through 9/30/97	32	53.6	91.23	0.35
10/1/97 through 9/30/98	29	16.9	34.55	-0.46
10/1/98 through 9/30/99	16	26.9	60.85	-0.24
10/1/99 through 9/30/2000	14	76.4	114.13	0.85

Table 25 shows the current **1002** severity for the monitored result parameter for each lab for all operationally valid tests reported for the report period.

TABLE 25
TMC 1002

	n	Foam Tendency Mean Δ/s	Foam Stability Mean Δ/s
Lab A	2	0.41	0.49
Lab B	5	0.09	-0.44
Lab D	3	1.18	1.81
Lab G	3	1.97	2.84
Lab I	1	-1.20	-0.83

D6082: High Temperature Foaming Characteristics of Lubricating Oils, continued

TMC 1007 INDUSTRY PERFORMANCE

Tables 26 and 27 show the current industry precision and severity for the Foam Tendency, Foam Stability and Total Volume Increase test parameter for all operationally valid tests **on oil 1007** for the report period. (First calibration test on TMC 1007 completed 4/12/99.)

TABLE 26

1007 Foam Tendency, ml	n	Mean	s_R	Mean Δ/s
Initial Round Robin Study (targets)	28	65.71	19.28	-----
4/12/99 through 9/30/99	8	66.2	15.06	0.03
10/1/99 through 9/30/2000	16	67.8	17.22	0.11

TABLE 27

1007 Foam Stability @ 1 min., ml	n	Mean	s_R	
Initial Round Robin Study (targets)	28	0.00	0.00	
4/12/99 through 9/30/99	no non-zero occurrences			
10/1/99 through 9/30/2000	no non-zero occurrences			

Table 28 shows the current **1007** severity for the monitored result parameter for each lab for all operationally valid tests reported for the report period.

TABLE 28
TMC 1007

	n	Foam Tendency Mean Δ/s
Lab A	3	0.40
Lab B	4	-0.30
Lab D	3	0.48
Lab G	3	0.22
Lab I	2	0.22
Lab R	1	-0.81

PRECISION AND SEVERITY

Foam Tendency precision is significantly worse for oil 1002 and only somewhat better (compared to target) for 1007. Foam Tendency is severe of target, and severe compared to previous periods, for oil 1002 and only slightly severe for oil 1007. Foam Tendency severity trends are graphically represented in Figures 6 and 7 (attached).

Foam Stability precision is also significantly worse for oil 1002 this period, and severity is significantly severe of target. Severity and precision comparisons are difficult to make for this parameter on oil 1007 due to the target mean and precision both having values of zero ml. There were no non-zero Foam Stability occurrences this period for 1007, indicating on target performance for this oil. Foam Stability severity for 1002 only is graphically represented in Figure 8 (attached). (Foam Stability results on oil 1002 are often the lower limit of zero ml. This phenomena accounts for the unusual "stair-like" trends observed in the 1002 Foam Stability CUSUM plot.)

Precision and severity on oil 1002 seems to be a serious problem this period. Performance on 1002 shifted from moderately mild in previous periods to substantially severe. There were four foam tendency results from two labs this period greater than 2 s from target (2.5, 2.3, 3.9 & 4.1 s). For Foam Stability, three results from two labs greater than 3 s from target on 1002 (3.4, 6.7 & 5.3 s). These last three test results correspond with the extreme Foam tendency results (that is, three of the four tests have extremely severe Tendency AND Stability results). No explanation for the extreme results was indicated, and the results are too numerous to be excluded as rare events.

TMC MEMORANDA

There were no technical memoranda issued this report period for the High Temperature Foam test. However, memo 00-136 was issued October 10, 2000 concerning D6082 Report Package Upgrade.

D02-1483: Ball Rust Test (BRT)

Note the very short period of time for collecting calibration data. Also 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 29 summarizes the reference tests reported to the TMC this period (3 labs reporting):

TABLE 29

	No. of Tests
Statistically Acceptable and Operationally Valid	26
Operationally Valid but Failed Acceptance Criteria	2
Operationally Invalid	3
Total	**31**

Fail Rate of Operationally Valid Tests: 7.1%

Table 30 is a breakdown of the statistically unacceptable tests.

TABLE 30

Reason for Fail	No. of Tests
Average AGV Mild	1
Average AGV Severe	1

INDUSTRY PERFORMANCE

Table 31 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 31

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

Table 32 shows the current severity for the Average AGV parameter for each lab for all operationally valid tests for the report period.

TABLE 32

	n	Mean Δ/s
Lab A	16	0.26
Lab B	6	1.32
Lab G	6	-0.21

PRECISION AND SEVERITY

Precision this report period is worse than found in the target matrix. Overall severity is trending mild of target with Lab B trending significantly mild. Severity is graphically represented in Figure 9 (attached).

TMC MEMORANDA

There was one technical memorandum issued this report period: Memo 00-014, February 7, 2000, concerning Ball Rust Test Data Reporting Package.

Engine Oil Filterability Test (EOFT)

Note the abbreviated period of time for collecting calibration data. Also note that, for EOFT, a positive Δ/s is mild, not severe (a more positive CIF result is considered to be a more mild result while a more negative CIF result is considered to be a more severe result.)

STATUS

Table 33 summarizes the reference tests reported to the TMC this period (3 labs reporting):

TABLE 33

	No. of Tests
Statistically Acceptable and Operationally Valid	36
Operationally Valid but Failed Acceptance Criteria	17
Operationally Invalid	1
Total	**54**

Fail Rate of Operationally Valid Tests: 32.1%

Table 34 is a breakdown of the statistically unacceptable tests.

TABLE 34

Reason for Fail	No. of Tests
Average % Change in Flow Mild (Oil 77)	16
Average % Change in Flow Mild (Oil 78)	1

INDUSTRY PERFORMANCE

Table 35 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 35

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

Table 36 shows the current severity for the Average % CIF parameter for each lab for all operationally valid tests for the report period.

TABLE 36

	n	Mean Δ/s
Lab A	33	2.10
Lab B	12	0.20
Lab G	8	1.89

PRECISION AND SEVERITY

Precision this report period is worse than found in the target matrix. Overall severity is trending considerably mild of target with Labs A and G trending significantly mild. Severity is graphically represented in Figure 10 (attached).

Labs A and G have had significant problems passing on TMC Oil 77, while, for a time, Lab B was having no trouble at all. Recently, Lab B has reported results as mild as Labs A and G were reporting all along. No similar severity shifts are seen for oil 78. Table 37 summarizes the statistics so far (Note: Statistics in Table 37 have been updated using all calibration data reported through 11/8/2000 rather than through the end of the report period 9/30/00):

Table 37
EOFT 20 – 25 ml Average % Change in Flowrate

	TMC Oil 77							TMC Oil 78						
	Calibration Data				Target Matrix			Calibration Data				Target Matrix		
Lab	n	Mean	s	Δ/s	n	Mean	s	n	Mean	s	Δ/s	n	Mean	s
A	18	-26.8	6.62	4.30	3	-43.88	---	21	16.5	4.06	0.11	3	13.21	---
B	9	-36.9	13.58	1.98	3	-49.54	---	8	15.7	3.01	-0.01	3	23.19	---
G	4	-30.0	1.25	3.56	3	-47.67	---	6	21.4	11.69	0.82	3	8.33	---
Overall	31	-30.2	9.72	3.53	12	-45.55	4.36	35	17.2	5.97	0.21	12	15.74	6.87

Note: Target Matrix overall n size of 12 includes one lab which contributed matrix data but does not calibrate with the TMC; for brevity, this lab is not listed in the table but their matrix results are factored into the overall statistics.

Presently, no participating lab can pass on Oil 77. Because of this the Engine Oil Filterability Surveillance Panel has voted to suspend the use of TMC 77 for calibration while the Surveillance Panel investigates the problem. At this time, only TMC 78 is being assigned as a TMC calibration oil. Because of this, we do not have a truly blind referencing system at the present time.

TMC MEMORANDA

There was one technical memorandum issued this report period: Memo 00-117, August 25, 2000, concerning EOFT Report Package Upgrade.

Engine Oil Water Tolerance Test (EOWT)

Note the abbreviated period of time for collecting calibration data at all water treat levels. Also note that, for EOWT, a positive Δ/s is mild, not severe (a more positive CIF result is considered to be a more mild result while a more negative CIF result is considered to be a more severe result).

Engine Oil Water Tolerance Test (EOWT): 0.6% 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	32
Operationally Valid but Failed Acceptance Criteria	2
Operationally Invalid	0
Total	**34**

Fail Rate of Operationally Valid Tests: 5.88%

Table 39 is a breakdown of the statistically unacceptable tests.

TABLE 39

Reason for Fail	No. of Tests
Average % Change in Flow Mild (Oil 77)	1
Average % Change in Flow Mild (Oil 78)	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	5.93	-----
5/4/00 through 9/30/00	34	32	6.25	-0.04

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	21	-0.50
Lab B	5	0.00
Lab G	8	1.14

PRECISION AND SEVERITY

Precision is directionally worse than target, and severity is on target (severe bias). Severity is graphically represented in Figure 11 (attached). Lab G is trending significantly mild.

Engine Oil Water Tolerance Test (EOWT): 1.0% 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	30
Operationally Valid but Failed Acceptance Criteria	2
Operationally Invalid	0
Total	**32**

Fail Rate of Operationally Valid Tests: 6.2%

Table 43 is a breakdown of the statistically unacceptable tests.

TABLE 43

Reason for Fail	No. of Tests
Average % Change in Flow Mild (Oil 77)	2
Average % Change in Flow Mild (Oil 78)	0

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	5.81	-----
5/4/00 through 9/30/00	32	30	6.99	0.12

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	19	-0.17
Lab B	5	-0.57
Lab G	8	1.23

PRECISION AND SEVERITY

Precision is worse than target and calibrations are trending slightly mild. Lab G is trending significantly mild. Severity is graphically represented in Figure 12 (attached).

Engine Oil Water Tolerance Test (EOWT): 2.0% 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	30
Operationally Valid but Failed Acceptance Criteria	1
Operationally Invalid	0
Total	**31**

Fail Rate of Operationally Valid Tests: 3.2%

Table 47 is a breakdown of the statistically unacceptable tests.

TABLE 47

Reason for Fail	No. of Tests
Average % Change in Flow Mild (Oil 77)	0
Average % Change in Flow Mild (Oil 78)	1

INDUSTRY PERFORMANCE

Table 48 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	7.08	-----
5/4/00 through 9/30/00	31	29	5.63	-0.07

Table 49 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	18	-0.35
Lab B	5	-0.63
Lab G	8	0.93

PRECISION AND SEVERITY

Precision is better than target and comparable to the other water treat level targets this period and severity is close to target (severe bias). Again Lab G is running considerably mild. Severity is graphically represented in Figure 13 (attached).

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

STATUS

Table 50 summarizes the reference tests reported to the TMC this period (3 labs reporting):

TABLE 50

	No. of Tests
Statistically Acceptable and Operationally Valid	28
Operationally Valid but Failed Acceptance Criteria	4
Operationally Invalid	0
Total	**32**

Fail Rate of Operationally Valid Tests: 12.5%

Table 51 is a breakdown of the statistically unacceptable tests.

TABLE 51

Reason for Fail	No. of Tests
Average % Change in Flow Mild (Oil 77)	0
Average % Change in Flow Mild (Oil 78)	4

INDUSTRY PERFORMANCE

Table 52 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 52

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	0.22

Table 53 shows the current severity for the Average % CIF parameter for each lab for all operationally valid tests for the report period.

TABLE 53

	n	Mean Δ/s
Lab A	19	-0.13
Lab B	5	-0.16
Lab G	8	1.30

PRECISION AND SEVERITY

Precision is comparable to target and calibrations are running somewhat mild. Severity is graphically represented in Figure 14 (attached).

EOWT TMC MEMORANDA

There was one technical memorandum issued this report period: Memo 00-117, August 25, 2000, concerning EOWT Report Package Upgrade.

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

The TMC began full monitoring of this test on October 16, 2000, although labs were permitted to "pre-calibrate" using the matrix data. Since monitoring began after the 20000930 report period cutoff, a more thorough report will be presented next report period, after more calibration data is collected.

D6417: Estimation of Engine Oil Volatility by Capillary Gas Chromatography

The TMC began full monitoring of this test on October 2, 2000, after the 20000930 report period cutoff. A more thorough report will be presented next report period, after more calibration data is collected.

REFERENCE OIL SUPPLIES

There is adequate supply of PCEOCP Bench Test reference oils on hand at the TMC. Table 54 lists the PCEOCP bench test reference oils currently on hand at the TMC.

Table 54

Oil	For Tests	Quantity Left (gallons)	Quantity Used Last 12 Months (gallons)
5A-3	BRT	1788.4	0.5
51	VGC, EVLO, GI	94.7	0.1
52	VGC, EVLO, GI	89.5	0.5
53	VGC, EVLO, GI	97.2	0.1
54	VGC, EVLO	97.8	0.1
55	VGC, EVLO, GI	94.1	0.5
^56	VGC, EVLO	51.2	0.0
^57	VGC, EVLO	51.2	0.0
58	VGC, EVLO	147.7	0.9
62	GI	16.4	0.0
71	TEOST	6.2	0.9
72	TEOST	5.6	0.3
74	MTEOS	2.9	0.1
77	EOFT, EOWT	250.2	17.2
78	EOFT, EOWT	244.6	17.0
80	BRT	26.5	0.2
81	BRT	22.2	0.7
**432	MTEOS	Adequate	-----
**433	MTEOS	Adequate	-----
*1002	FOAM	21.9	-----
*1006	BRT, MTEOS	55.0	-----
*1007	FOAM	21.2	-----

^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; a new drum of 1006 will soon be tapped for bench test use.
**Five gallon aliquot set aside for bench testing; hard to get an inventory reading on amount set aside.

REFERENCE OIL SUPPLIES, continued

Shipping aliquots are:

VGC	1 or 4 ml
EVLO	100 ml
GI	25 ml
MTEOS	17 ml
TEOST	125 ml
FOAM	525 ml
EOFT	290 ml
EOWT	290 ml
BRT	30 ml

MISCELLANEOUS

The TMC is now monitoring all the GF-3/SL oil category bench tests that require TMC monitoring.

The TMC posts PCEOCP bench test reference 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 (that is, as the tests are reported to the TMC, and a validity designation is assigned). Lab identifications are coded as they are on the previous pages of this report. Also posted are statistics, CUSUM plots, reporting forms and data dictionaries. Also posted is data from various matrix programs (like GF-3 test development and reference oil selection matrix programs). The TMC encourages all interested parties to access and download the data, statistics and plots for individual studies and analyses. Likewise, you are encouraged to access the web site to download the most recent test reporting forms and data dictionaries. The TMC's web site address is http://www.tmc.astm.cmri.cmu.edu.

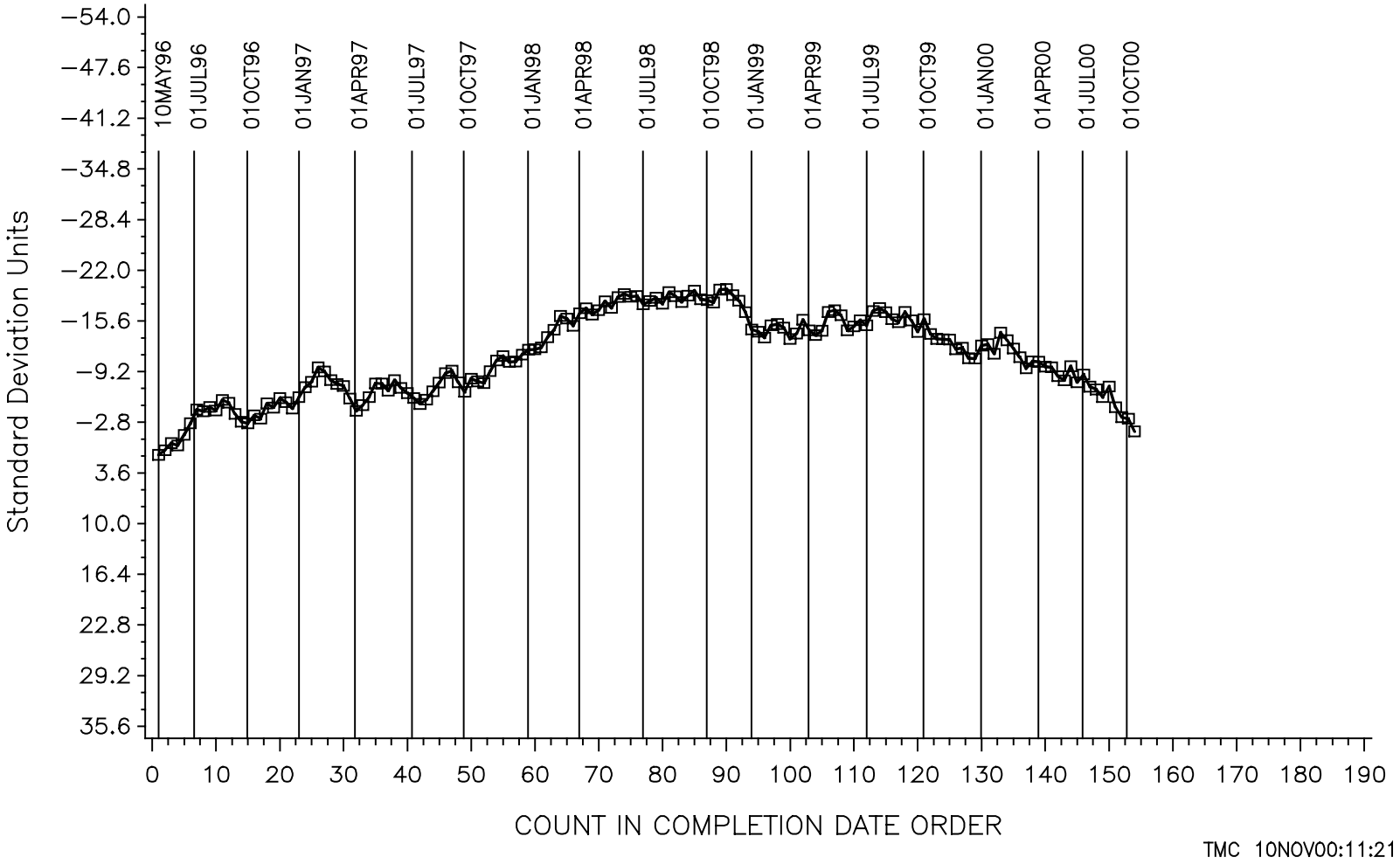
All currently monitored bench test data dictionaries and report form packages have been beta tested and approved by the Data Communications Committee (DCC) for electronic data transfer. TMC Memo 98-210 (September 16, 1998) was issued explaining the TMC's electronic data transmission protocols. In that memo, the TMC strongly encourages participating laboratories to use electronic data transfer for reporting reference test data to the TMC. If your lab should require additional information on this type of data reporting, please contact Tom Schofield at (412) 365-1011.

VGC–D2887 EXTENDED INDUSTRY OPERATIONALLY VALID DATA

Figure 1

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

CUSUM Severity Analysis



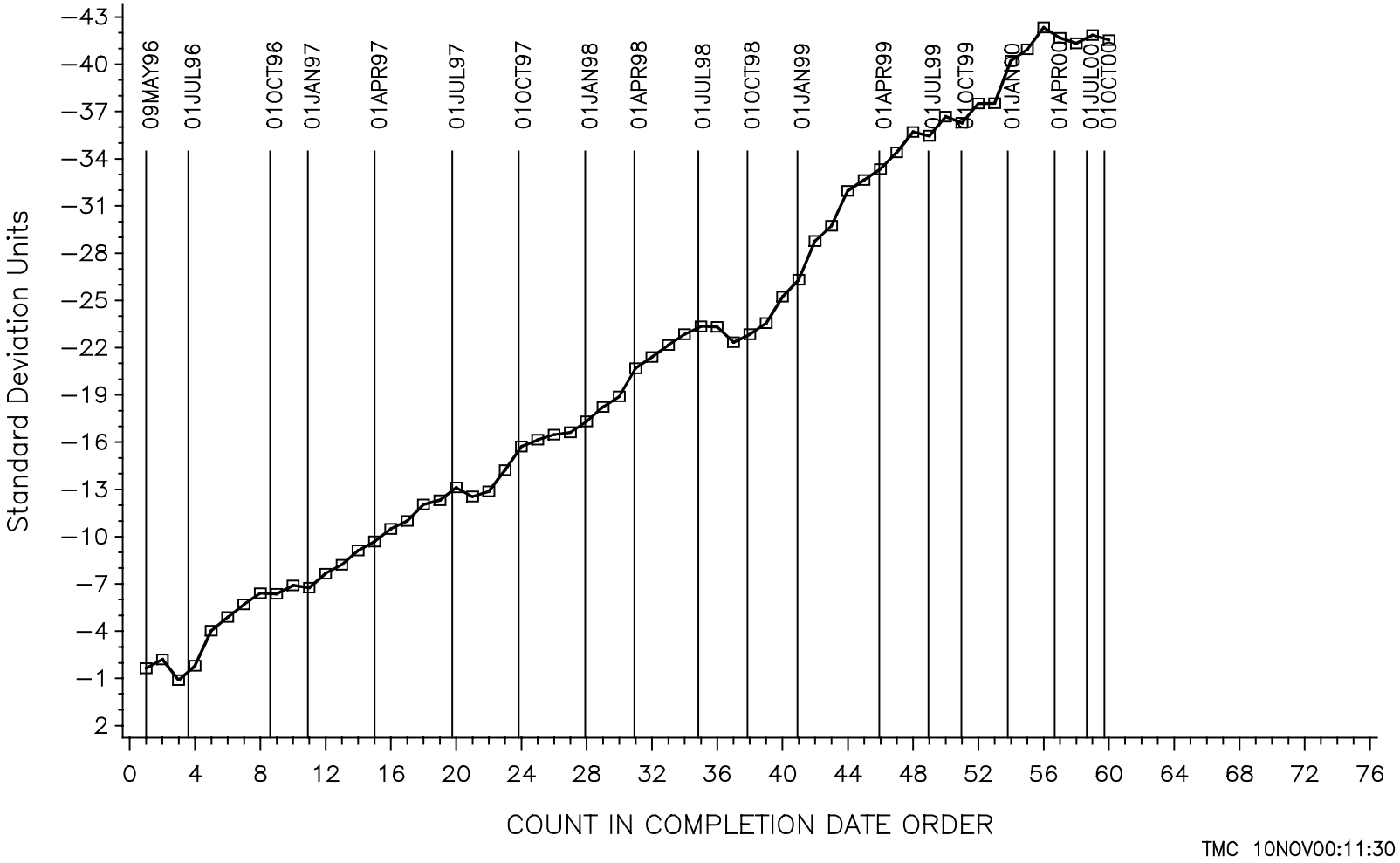
TMC 10NOV00:11:21

VGC–D5480 INDUSTRY OPERATIONALLY VALID DATA

Figure 2A

SAMPLE MASS % VOLATIZED @ 371'C ... 700'F (MASS %)

CUSUM Severity Analysis



TMC 10NOV00:11:30

VGC–D5480 INDUSTRY OPERATIONALLY VALID DATA

Figure 2B

SAMPLE MASS % VOLATIZED @ 371'C ... 700'F (MASS %)

CUSUM Severity Analysis

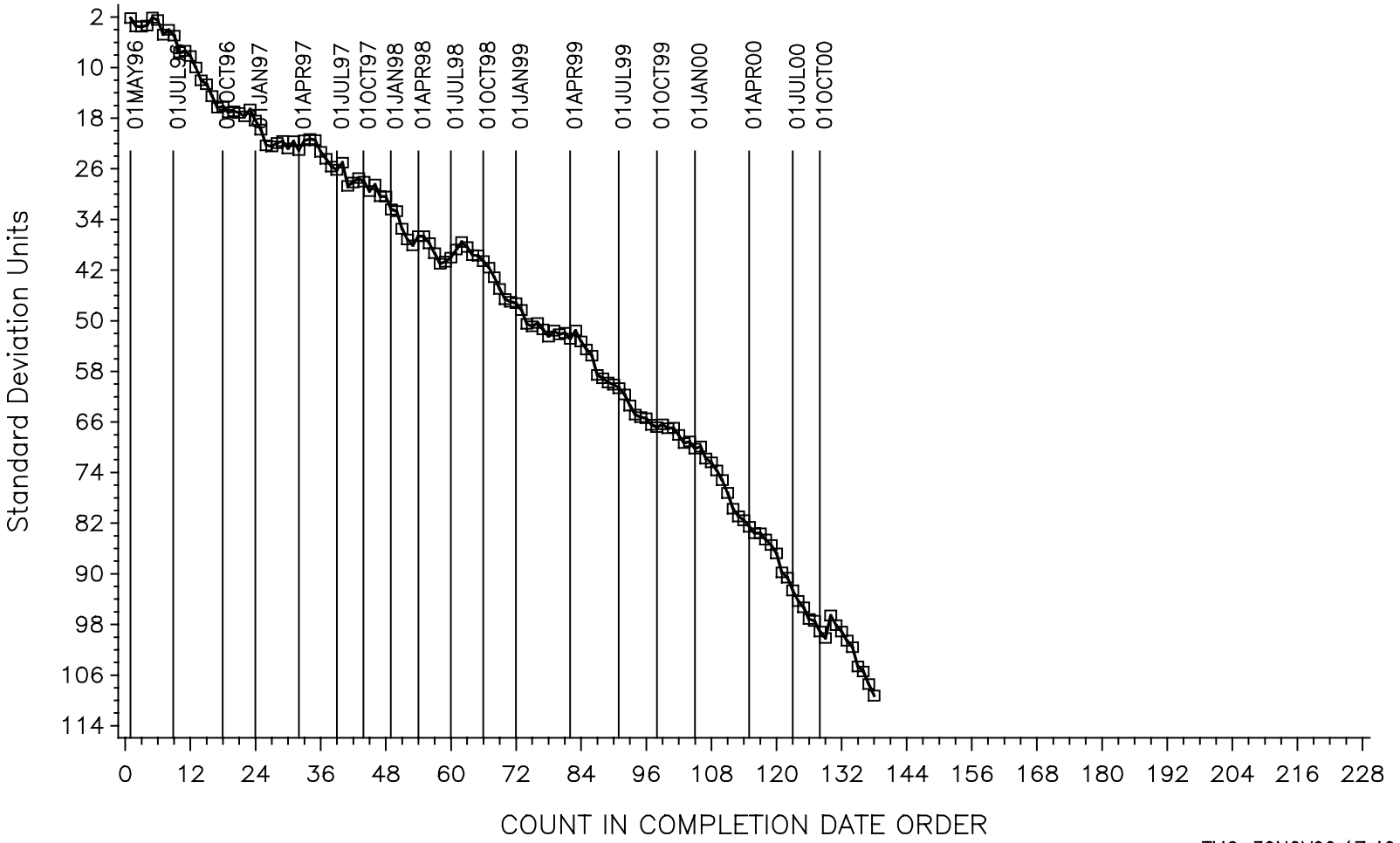
TMC 28NOV00:15:38

D5800 INDUSTRY OPERATIONALLY VALID DATA

Figure 3A

TEST OIL SAMPLE EVAPORATION LOSS (MASS %)

CUSUM Severity Analysis



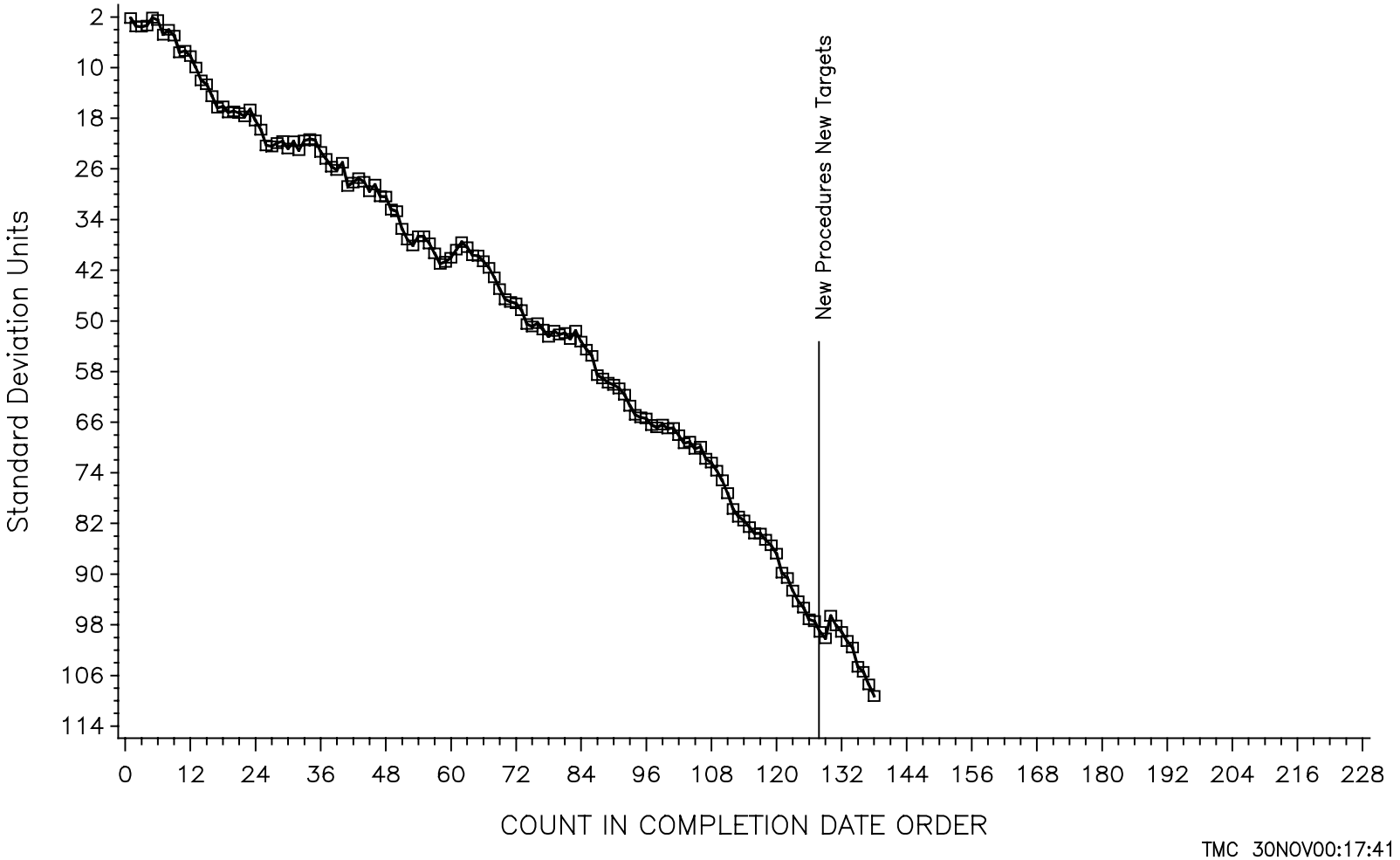
TMC 30NOV00:17:40

D5800 INDUSTRY OPERATIONALLY VALID DATA

Figure 3B

TEST OIL SAMPLE EVAPORATION LOSS (MASS %)

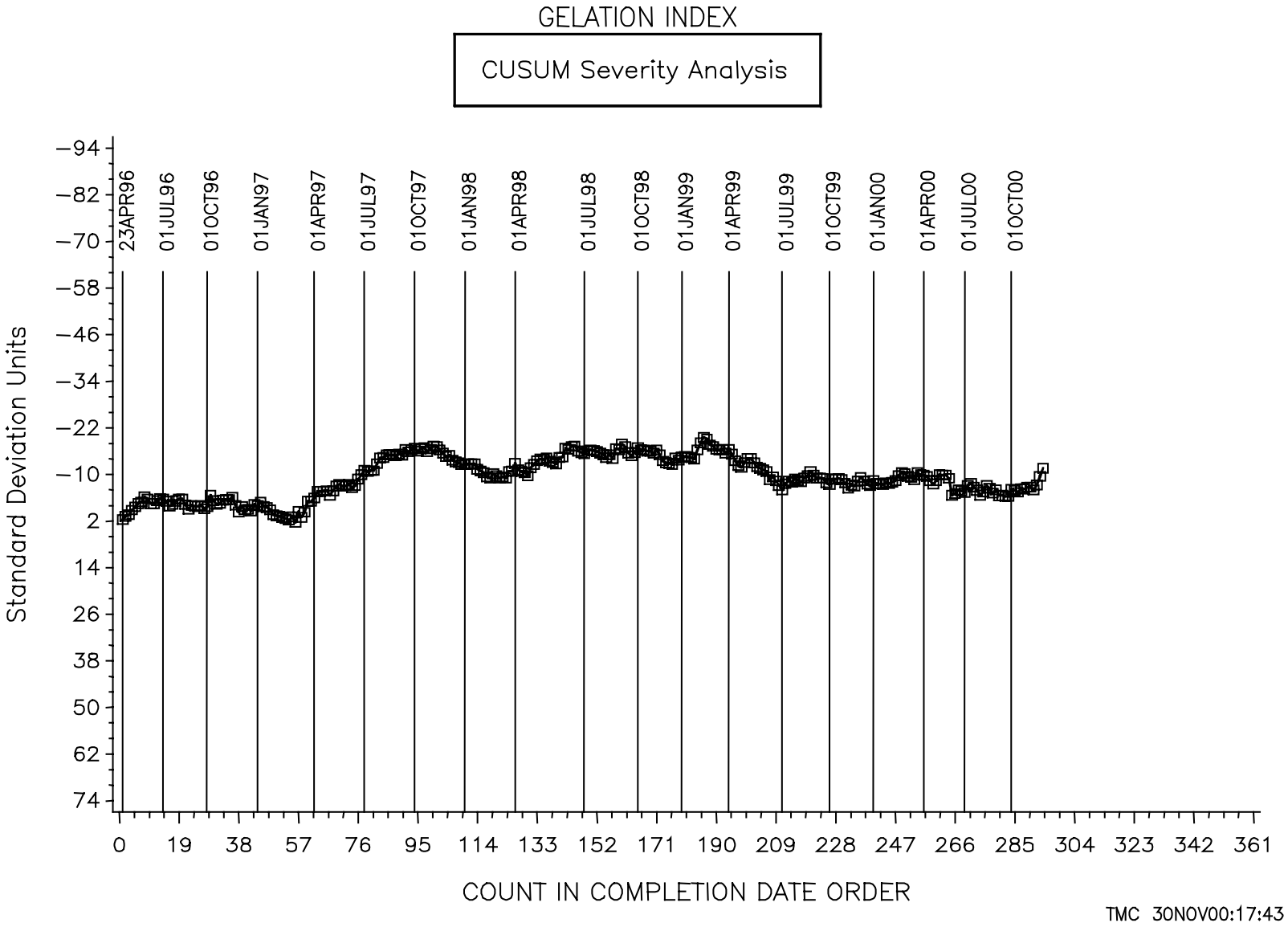
CUSUM Severity Analysis



TMC 30NOV00:17:41

GELATION INDEX INDUSTRY OPERATIONALLY VALID DATA

Figure 4

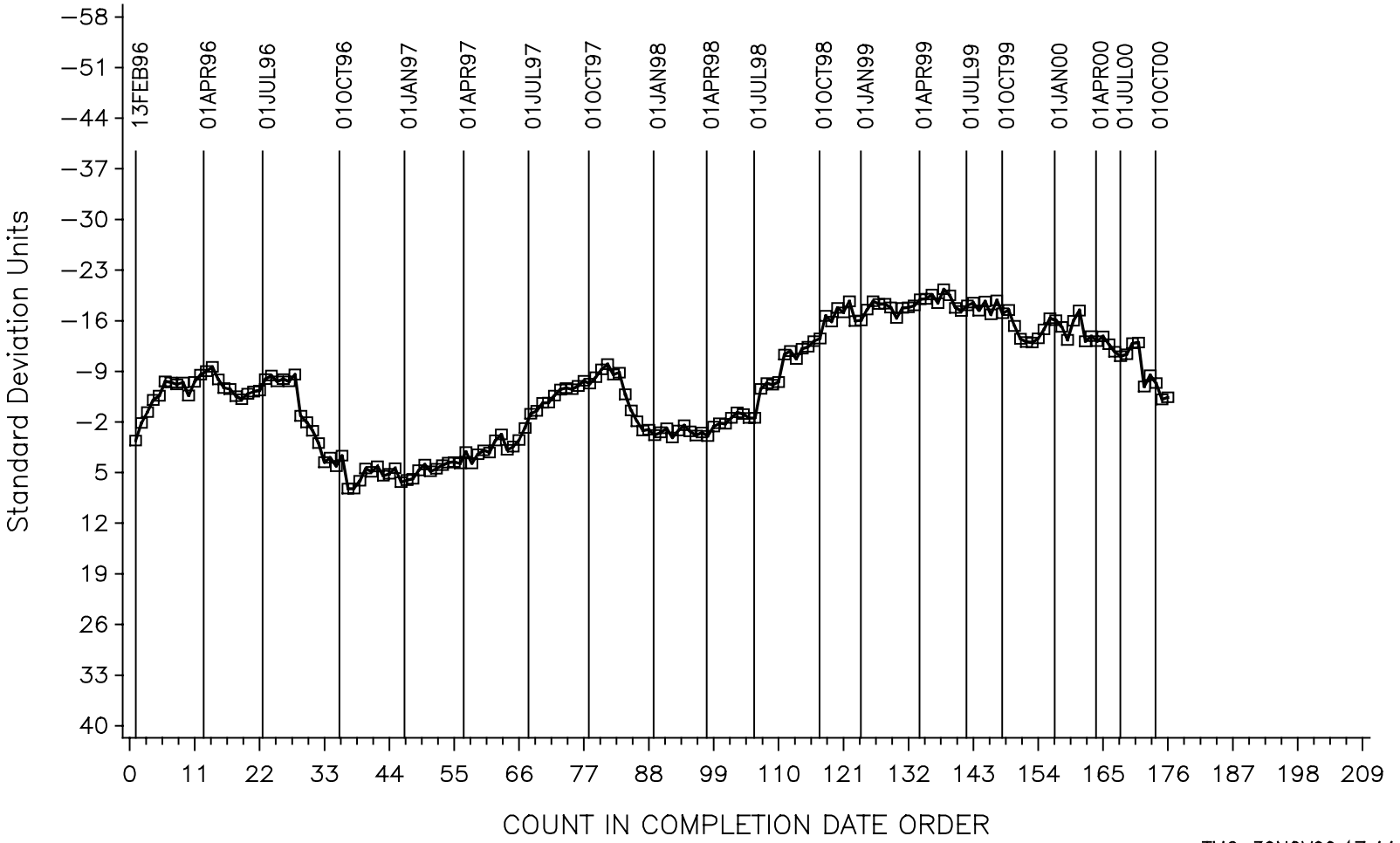


TEOST INDUSTRY OPERATIONALLY VALID DATA

Figure 5

TOTAL DEPOSITS (mg)

CUSUM Severity Analysis



TMC 30NOV00:17:44

Figure 6

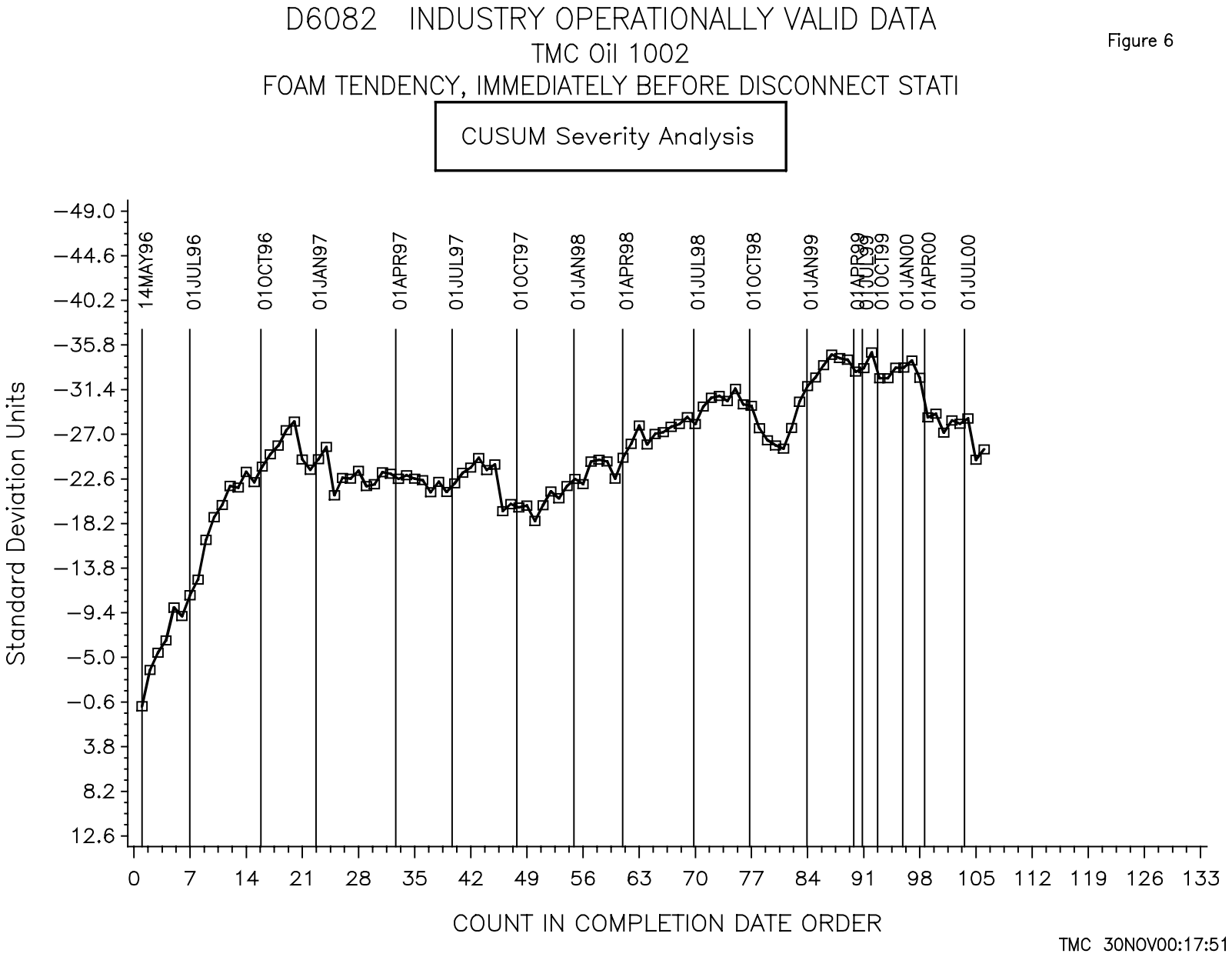

D6082 INDUSTRY OPERATIONALLY VALID DATA
TMC Oil 1002
FOAM TENDENCY, IMMEDIATELY BEFORE DISCONNECT STATI
CUSUM Severity Analysis
Standard Deviation Units
−49.0
−44.6
−40.2
−35.8
−31.4
−27.0
−22.6
−18.2
−13.8
−9.4
−5.0
−0.6
3.8
8.2
12.6
14MAY96
01JUL96
01OCT96
01JAN97
01APR97
01JUL97
01OCT97
01JAN98
01APR98
01JUL98
01OCT98
01JAN99
01APR99
01JUL99
01OCT99
01JAN00
01APR00
01JUL00
0 7 14 21 28 35 42 49 56 63 70 77 84 91 98 105 112 119 126 133
COUNT IN COMPLETION DATE ORDER
TMC 30NOV00:17:51

Figure 7

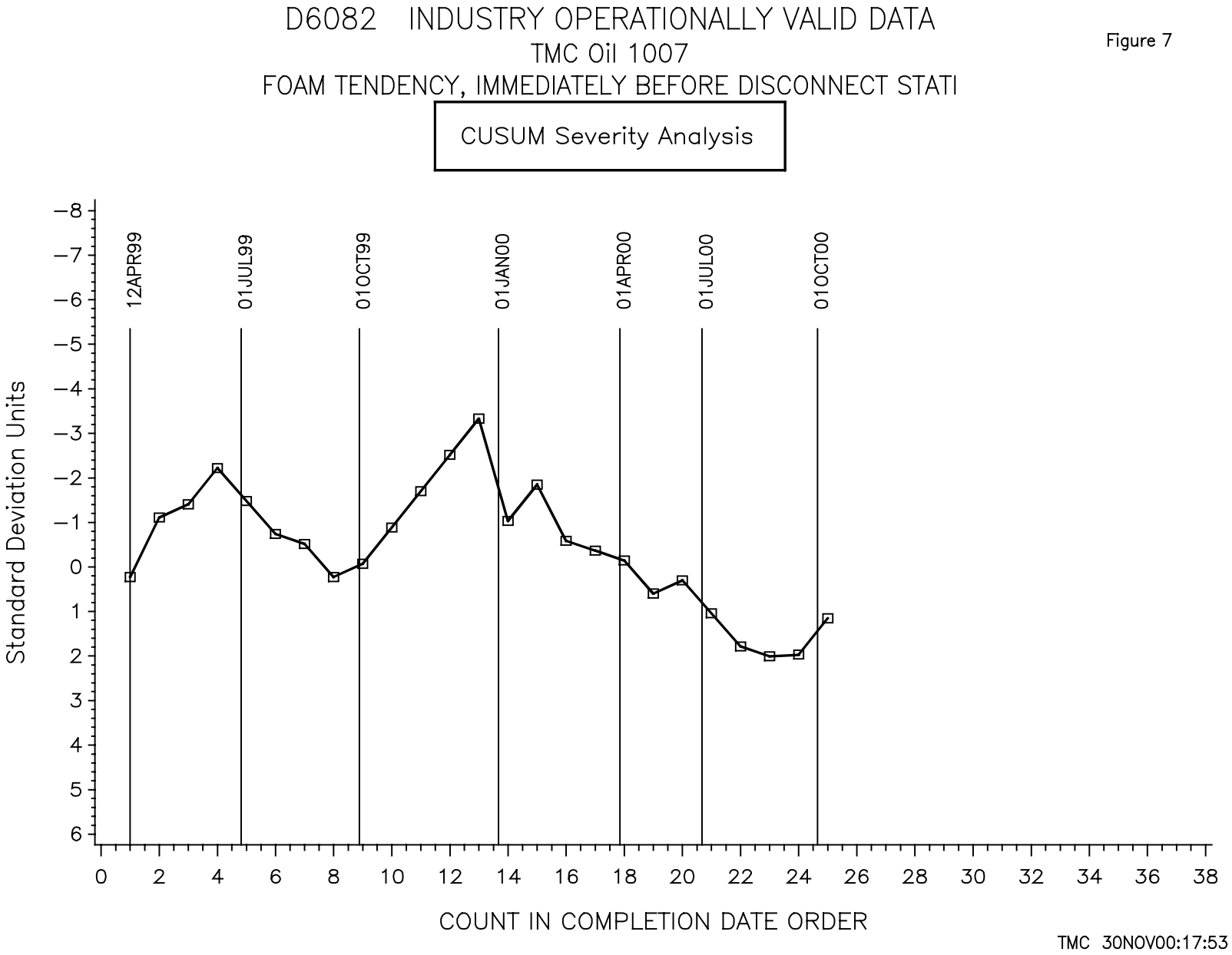
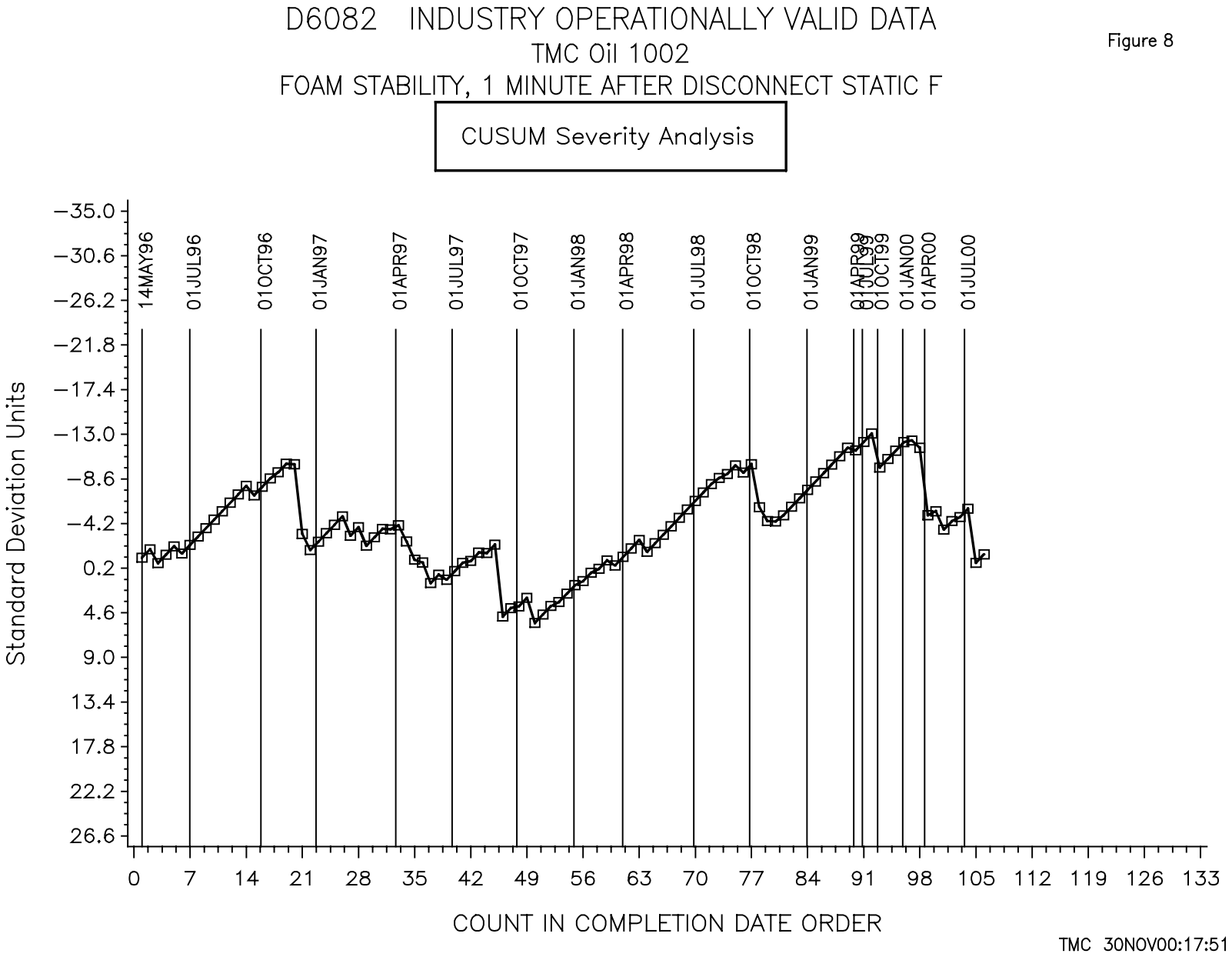

D6082 INDUSTRY OPERATIONALLY VALID DATA
TMC Oil 1007
FOAM TENDENCY, IMMEDIATELY BEFORE DISCONNECT STATI
CUSUM Severity Analysis
12APR99
01JUL99
01OCT99
01JAN00
01APR00
01JUL00
01OCT00
Standard Deviation Units
−8
−7
−6
−5
−4
−3
−2
−1
0
1
2
3
4
5
6
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
COUNT IN COMPLETION DATE ORDER
TMC 30NOV00:17:53

Figure 8


D6082 INDUSTRY OPERATIONALLY VALID DATA
TMC Oil 1002
FOAM STABILITY, 1 MINUTE AFTER DISCONNECT STATIC F
CUSUM Severity Analysis
Standard Deviation Units
−35.0
−30.6
−26.2
−21.8
−17.4
−13.0
−8.6
−4.2
0.2
4.6
9.0
13.4
17.8
22.2
26.6
14MAY96
01JUL96
01OCT96
01JAN97
01APR97
01JUL97
01OCT97
01JAN98
01APR98
01JUL98
01OCT98
01JAN99
01APR99
01JUL99
01OCT99
01JAN00
01APR00
01JUL00
0 7 14 21 28 35 42 49 56 63 70 77 84 91 98 105 112 119 126 133
COUNT IN COMPLETION DATE ORDER
TMC 30NOV00:17:51

BALL RUST TEST INDUSTRY OPERATIONALLY VALID DATA

Figure 9

REFERENCE AVERAGE GRAY VALUE AVERAGE

CUSUM Severity Analysis

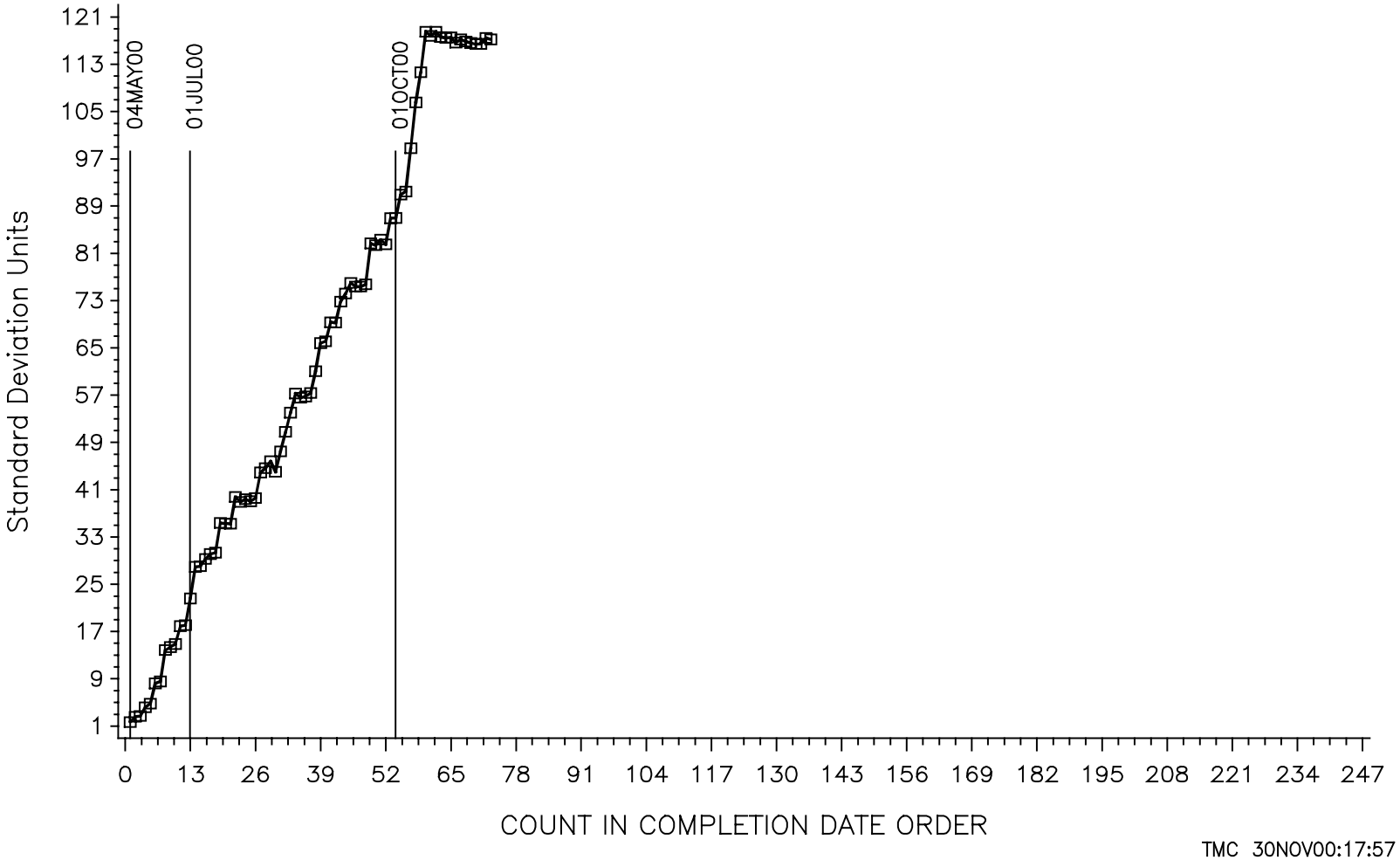
TMC 30NOV00:17:55

EOFT INDUSTRY OPERATIONALLY VALID DATA

Figure 10

20 – 25 ML CHANGE IN FLOWRATE AVERAGE (%)

CUSUM Severity Analysis



TMC 30NOV00:17:57

EOWT INDUSTRY OPERATIONALLY VALID DATA

0.6% Water Treatment

TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE (%)

CUSUM Severity Analysis

Figure 11

TMC 30NOV00:18:00

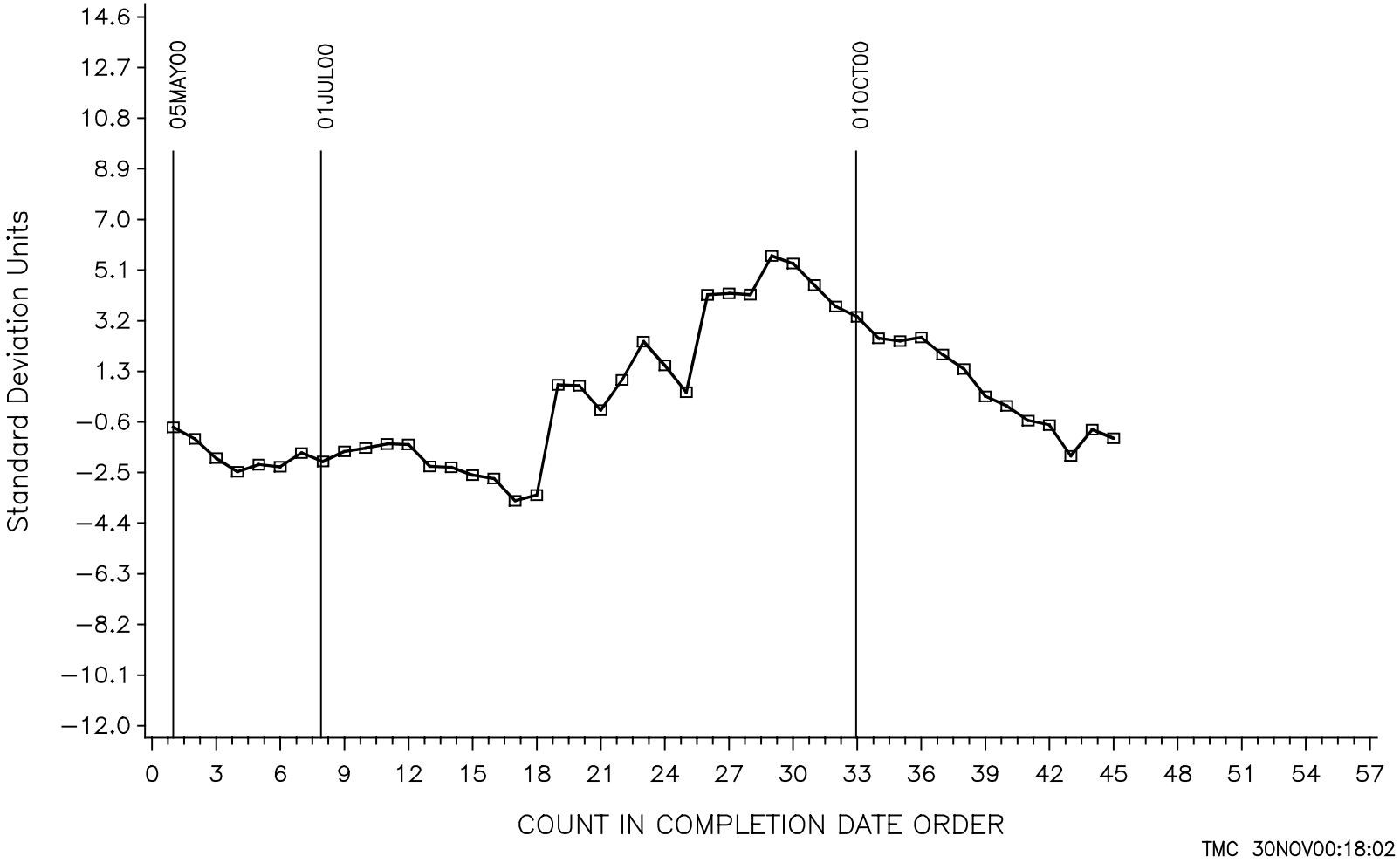
EOWT INDUSTRY OPERATIONALLY VALID DATA

1.0% Water Treatment

TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE (%)

CUSUM Severity Analysis

Figure 12



TMC 30NOV00:18:02

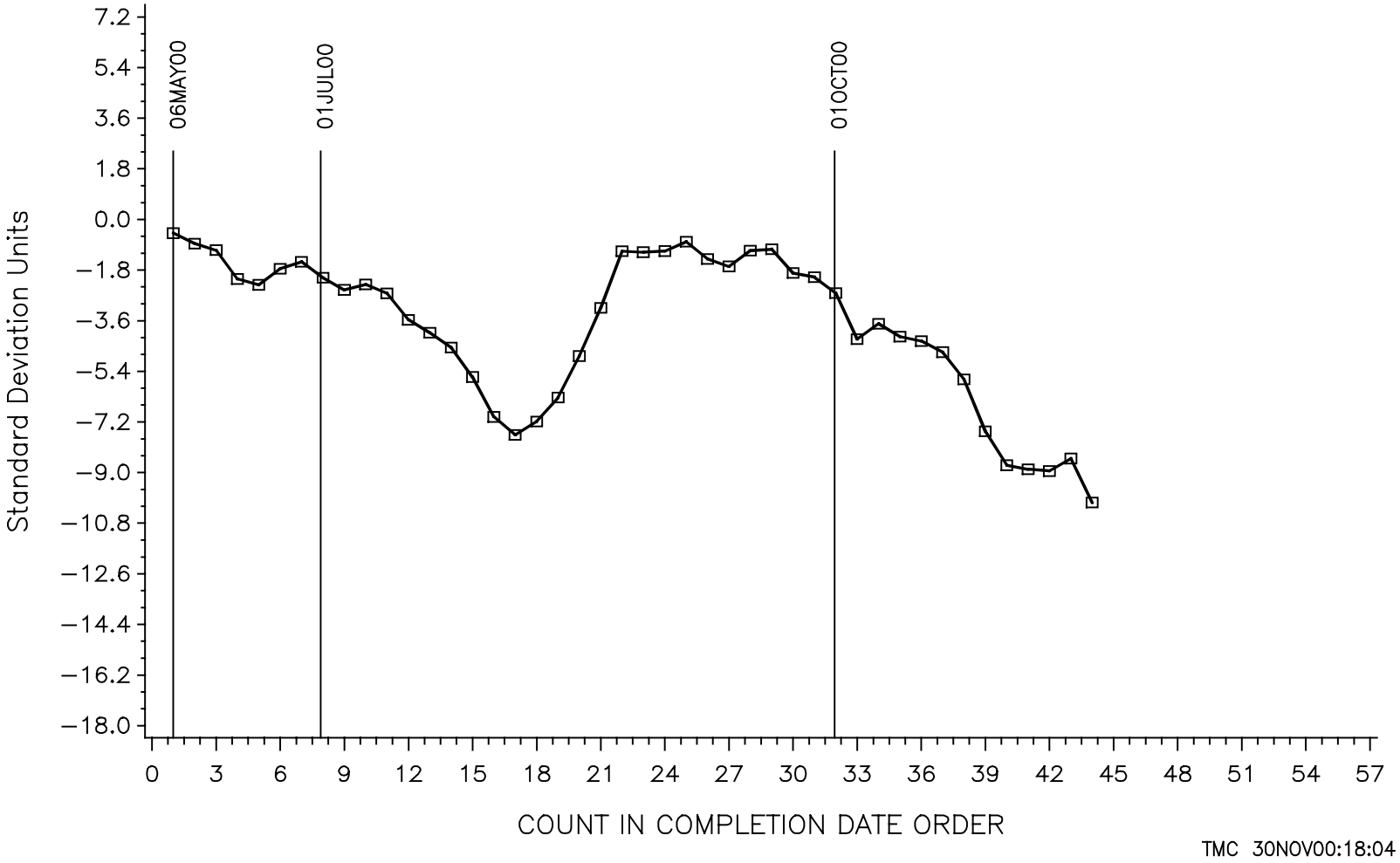
EOWT INDUSTRY OPERATIONALLY VALID DATA

2.0% Water Treatment

TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE (%)

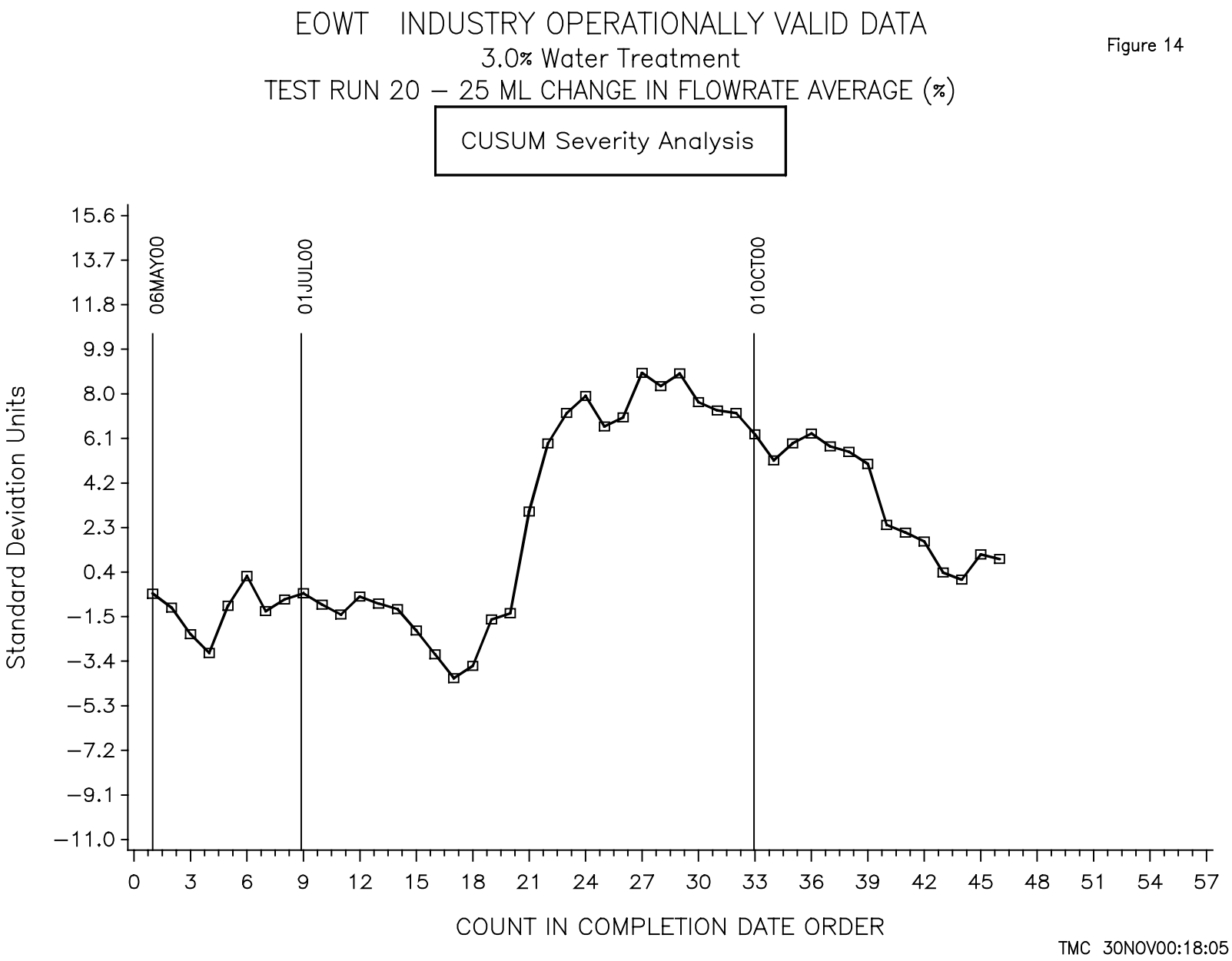
CUSUM Severity Analysis

Figure 13



TMC 30NOV00:18:04

Figure 14


EOWT INDUSTRY OPERATIONALLY VALID DATA
3.0% Water Treatment
TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE (%)
CUSUM Severity Analysis
06MAY00
01JUL00
01OCT00
Standard Deviation Units
15.6
13.7
11.8
9.9
8.0
6.1
4.2
2.3
0.4
−1.5
−3.4
−5.3
−7.2
−9.1
−11.0
0 3 6 9 12 15 18 21 24 27 30 33 36 39 42 45 48 51 54 57
COUNT IN COMPLETION DATE ORDER
TMC 30NOV00:18:05

PCEOCP Bench Tests – Reference Test Targets and Acceptance Bands

Test	Oil Code	Parameter	n	Mean	sR	Acceptance Bands * 95% Lower	Acceptance Bands * 95% Upper
VGC by	RO #1 (51)	area % volatility loss	48	13.07	0.66	11.8	14.4
D2887	RO #2 (52)	area % volatility loss	48	6.88	0.43	6.0	7.7
Extended	RO #3 (53)	area % volatility loss	48	17.92	0.76	16.4	19.4
	RO #4 (54)	area % volatility loss	48	19.16	0.87	17.5	20.9
	RO #5 (55)	area % volatility loss	48	11.56	0.71	10.2	13.0
D6417	52	area % volatility loss	18	6.97	0.31	6.4	7.6
	55	area % volatility loss	18	11.68	0.51	10.7	12.7
	58	area % volatility loss	18	5.61	0.30	5.0	6.2
VGC by	RO #1 (51)	mass % volatility loss	10	11.85	0.47	10.9	12.8
D5480	RO #2 (52)	mass % volatility loss	11	6.22	0.23	5.8	6.7
(New Targets	RO #3 (53)	mass % volatility loss	10	16.74	0.66	15.4	18.0
Effective	RO #4 (54)	mass % volatility loss	10	17.89	0.68	16.6	19.2
12/7/1999)	RO #5 (55)	mass % volatility loss	11	10.71	0.29	10.1	11.3
D5800	52	mass % volatility loss	59	13.61	0.49	12.6	14.6
New Targets	55	mass % volatility loss	60	16.39	0.66	15.1	17.7
10/2/00	58	mass % volatility loss	59	14.46	0.52	13.4	15.5
TEOST by	AROP 124 (71)	Total Deposit wt. (mg)	27	51.79	4.79	42.4	61.2
D6335	AROP 125 (72)	Total Deposit wt. (mg)	27	26.72	3.46	19.9	33.5
MTEOS by	74	Total Deposit wt. (mg)	7	15.60	5.50	4.8	26.4
Draft 17 00.08.11	432	Total Deposit wt. (mg)	7	50.51	5.50	39.7	61.3
(preliminary	433	Total Deposit wt. (mg)	7	52.56	5.50	41.8	63.3
targets & bands)	1006	Total Deposit wt. (mg)	7	34.94	5.50	24.2	45.7
GI by	VSO #1 (51)	Gelation Index	35	63.3	12.0	39.8	86.8
D5133	VSO #2 (52)	Gelation Index	35	4.5	0.2	4.0	5.0
	VSO #3 (53)	Gelation Index	37	44.7	4.6	35.6	53.8
	VSO #5 (55)	Gelation Index	36	22.3	4.8	12.8	31.8
	AROP 111 (62)	Gelation Index	35	17.0	3.9	9.4	24.6
D6082	HTFF (1002)	Tendency (ml)	32	410.63	58.78	295	526
(HT FOAM)	HTFF (1002)	Stability (ml)	32	37.81	45.41	0	127
D6082	HTFF (1007)	Tendency (ml)	28	65.71	19.28	28	103
(HT FOAM)	HTFF (1007)	Stability (ml)	28	0.00	0.00	0	0
BRT by	81	Average AGV	12	112	14.00	85	140
D02-1483	1006	Average AGV	12	128	7.21	114	142
(D6557)	5A-3	Average AGV	12	76	6.47	63	89
EOFT by	77	Δ Flowrate (%)	12	-45.55	4.36	-54.10	-37.00
(Draft 6)	78	Δ Flowrate (%)	12	15.74	6.87	2.27	29.21
EOWT by	77	0.6% H20 Δ Flowrate (%)	12	-24.90	5.68	-36.03	-13.77
(Draft 5)	77	1.0% H20 Δ Flowrate (%)	12	-17.94	5.45	-28.62	-7.26
	77	2.0% H20 Δ Flowrate (%)	12	-17.96	8.47	-34.56	-1.36
	77	3.0% H20 Δ Flowrate (%)	12	-18.23	6.83	-31.62	-4.84
EOWT by	78	0.6% H20 Δ Flowrate (%)	12	10.87	6.16	-1.20	22.94
(Draft 5)	78	1.0% H20 Δ Flowrate (%)	12	7.54	6.15	-4.51	19.59
	78	2.0% H20 Δ Flowrate (%)	12	5.17	5.33	-5.27	15.62
	78	3.0% H20 Δ Flowrate (%)	12	-0.54	4.52	-9.40	8.32

*95% Bands = Mean +/- (1.960 x sR)

PCEOCP Bench tests – Individual Reference Oil Statistics

(Operationally Valid Tests Only)

Test	Oil Code	Parameter	Targets			10/1/96 - 9/30/97			10/1/97 - 9/30/98			10/1/98 - 9/30/99			10/1/99 - 9/30/00		
			n	Mean	sR	n	Mean	sR	n	Mean	sR	n	Mean	sR	n	Mean	sR
VGC by	51	% volatility loss	48	13.07	0.66	9	13.0	0.73	10	12.9	0.61	7	13.2	0.59	9	13.4	0.80
D2887	52	% volatility loss	48	6.88	0.43	8	6.9	0.51	7	6.8	0.44	5	7.1	0.62	7	7.0	0.35
Ext.	53	% volatility loss	48	17.92	0.76	8	18.2	0.88	5	18.0	0.72	5	17.9	1.10	8	18.1	1.26
	54	% volatility loss	48	19.16	0.87	4	18.7	0.57	7	18.7	0.97	9	19.3	1.10	4	19.2	0.98
	55	% volatility loss	48	11.56	0.71	5	11.0	0.52	9	11.3	0.47	8	11.5	0.68	4	11.9	1.14
D6417	52	% volatility loss	18	6.97	0.31	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----
	55	% volatility loss	18	11.68	0.51	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----
	58	% volatility loss	18	5.61	0.30	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----
VGC by	51	% volatility loss	10	11.85	0.47	3	12.0	0.32	3	11.7	0.38	3	11.8	0.85	1	11.2	----
D5480	52	% volatility loss	11	6.22	0.23	4	6.4	0.18	2	6.1	0.28	4	6.1	0.28	3	6.0	0.36
*	53	% volatility loss	10	16.74	0.66	3	16.9	0.40	3/2	15.6/17.5	3.28/0.67	3	16.1	0.55	1	16.4	----
	54	% volatility loss	10	17.89	0.68	1	18.0	-----	3	18.0	0.11	2	17.8	0.14	1	18.4	----
	55	% volatility loss	11	10.71	0.29	4	10.8	0.39	4	10.7	0.18	1	10.5	-----	1	10.8	0.31
D5800	51	% volatility loss	36	18.13	0.42	6	17.7	0.49	4	18.5	0.46	5	18.5	0.19	5	18.3	0.28
**	52	% volatility loss	36	13.39	0.40	6	13.6	0.51	4	13.6	0.56	3	14.1	0.46	9	13.8	0.42
	53	% volatility loss	36	22.30	0.55	6	22.5	0.41	4	22.4	0.64	7	22.5	0.48	2	22.6	0.35
	54	% volatility loss	36	23.54	0.67	6	24.3	1.22	5	24.1	1.04	9	24.3	0.57	6	24.5	0.45
	55	% volatility loss	36	16.21	0.48	3	16.6	0.41	5	16.4	0.60	8	16.4	0.39	8	16.8	0.32
TEOST	71	Deposit wt. (mg)	27	51.79	4.79	24	48.8	4.69	20	49.0	6.85	15	47.6	5.78	14	52.1	10.30
(D6335)	72	Deposit wt. (mg)	27	26.72	3.46	18	27.3	4.73	19	27.8	3.60	16	28.3	3.78	12	29.4	5.33
MTEOS	1006	Deposit wt. (mg)				----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	432	Deposit wt. (mg)				----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	433	Deposit wt. (mg)				----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	74	Deposit wt. (mg)				----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
GI	51	Gelation Index	35	63.3	12.01	11	59.1	9.50	16	54.7	13.03	12	65.2	10.52	15	60.6	7.40
(D5133)	52	Gelation Index	35	4.5	0.24	11	4.4	0.28	16	4.5	0.20	12	4.4	0.22	10	4.3	0.13
	53	Gelation Index	37	44.7	4.64	17	43.1	6.06	11	46.7	2.44	12	47.0	3.91	12	47.9	6.68
	55	Gelation Index	36	22.3	4.84	13	22.0	3.19	14	24.6	3.10	13	24.2	4.02	9	23.7	4.58
	62	Gelation Index	35	17.0	3.90	14	16.8	4.82	14	17.4	2.93	12	16.6	4.82	12	17.8	3.94
D6082	1002	Tendency (ml)	32	410.63	58.78	32	414.6	97.29	29	390.7	67.30	16	391.9	76.53	14	450.7	106.44
	1002	Stability (ml)	32	37.81	45.41	32	53.6	91.23	29	16.9	34.55	16	26.9	60.85	14	76.4	114.13
D6082	1007	Tendency (ml)	28	65.71	19.28	----	---	---	----	---	----	8	66.2	15.06	16	67.8	17.22
	1007	Stability (ml)	28	0.00	0.00	----	---	---	----	---	----	8	0.0	0.00	16	0.0	0.00
BRT	1006	Average AGV	12	112	14.00	----	-----	-----	-----	-----	-----	-----	-----	-----	7	123.1	5.30
	5A-3	Average AGV	12	128	7.21	----	-----	-----	-----	-----	-----	-----	-----	-----	7	82.0	12.03
	81	Average AGV	12	76	6.47	----	-----	-----	-----	-----	-----	-----	-----	-----	14	121.0	11.50
EOFT	77	Avg. % CF	12	-45.55	4.36	----	----	---	----	---	----	----	----	----	26	-32.4	8.56
	78	Avg. % CF	12	15.74	6.87	----	---	---	----	---	----	----	----	----	27	17.9	6.24
EOWT	77	0.6 H2O Avg. %CF	12	-24.90	5.68	----	----	---	----	---	----	----	----	----	18	-25.6	6.19
	77	1.0 H2O Avg. %CF	12	-17.94	5.45	----	---	---	----	---	----	----	----	----	15	-17.4	6.72
	77	2.0 H2O Avg. %CF	12	-17.96	8.47	----	---	---	----	---	----	----	----	----	17	-18.1	6.26
	77	3.0 H2O Avg. %CF	12	-18.23	6.83	----	---	---	----	---	----	----	----	----	16	-21.7	4.96
EOWT	78	0.6 H2O Avg. %CF	12	10.87	6.16	----	----	---	----	---	----	----	----	----	16	11.2	6.32
	78	1.0 H2O Avg. %CF	12	7.54	6.15	----	---	---	----	---	----	----	----	----	17	8.4	7.21
	78	2.0 H2O Avg. %CF	12	5.17	5.33	----	---	---	----	---	----	----	----	----	14	4.5	4.74
	78	3.0 H2O Avg. %CF	12	-0.54	4.52	----	---	---	----	---	----	----	----	----	16	3.8	6.37

* D5480 Targets Adjusted 12/7/99 per direction of the Volatility Surveillance Panel

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

*D5480 Targets Adjusted 12/7/99 per direction of the EOV surveillance Panel

**D5800 Targets Adjusted 10/2/2000; new oils selected; new procedures approved