



# Test Monitoring Center

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

MEMORANDUM: 01-172

DATE: December 3, 2001

TO: Mike Zaiontz,  
Chairman, Single Cylinder Diesel Surveillance Panel

FROM: Scott Parke

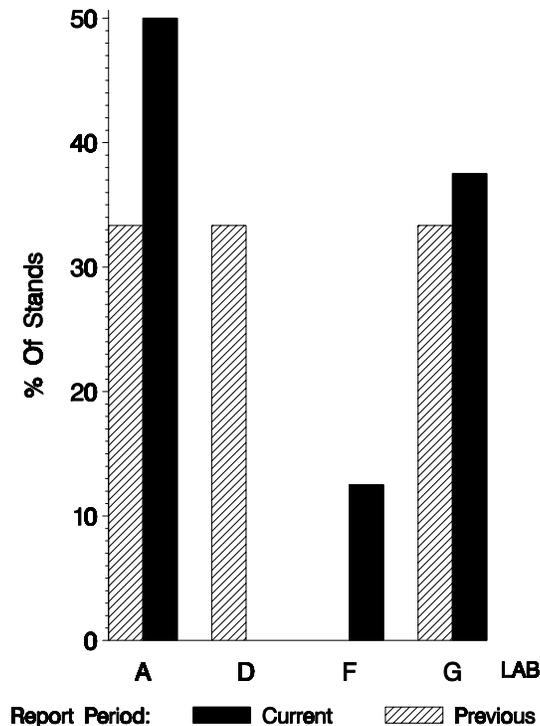
SUBJECT: 1N Testing from April 1, 2001 through September 30, 2001

Ten calibration tests were reported to the Test Monitoring Center during the period from April 1, 2001 through September 30, 2001. The data from these tests is shown on page 9. Following is a summary of testing activity this period.

|                  | Reporting Data | Calibrated on 9-30-01 |
|------------------|----------------|-----------------------|
| Number of Labs   | 3              | 3                     |
| Number of Stands | 8              | 9                     |

Stands reporting data this period were distributed as shown below:

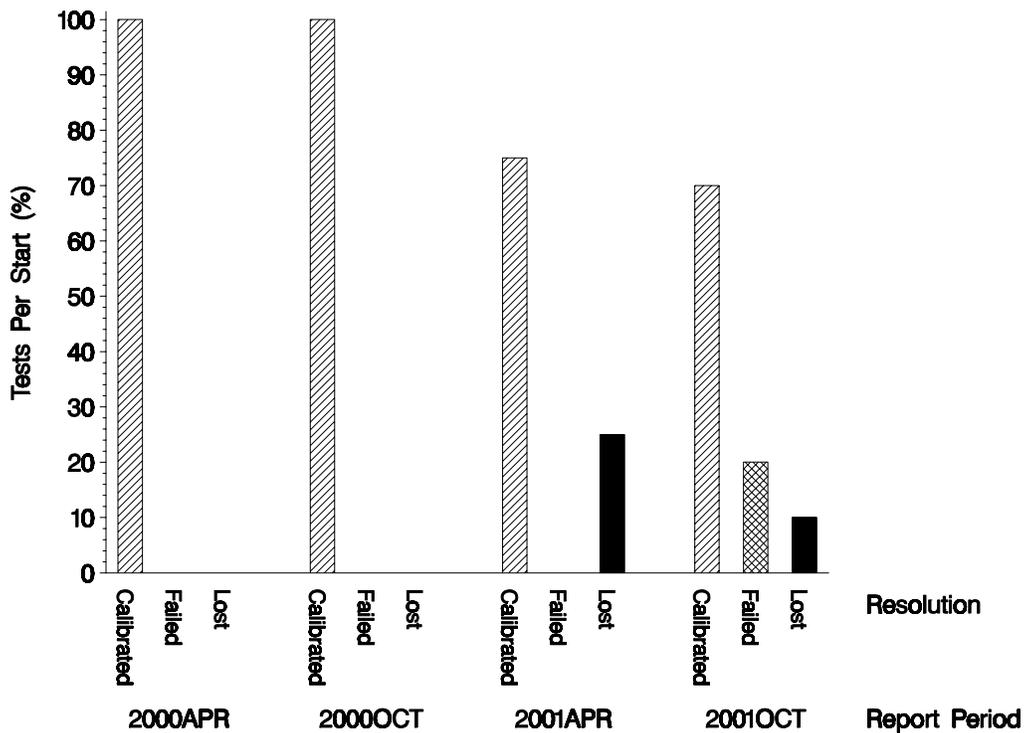
### 1N LABORATORY / STAND DISTRIBUTION



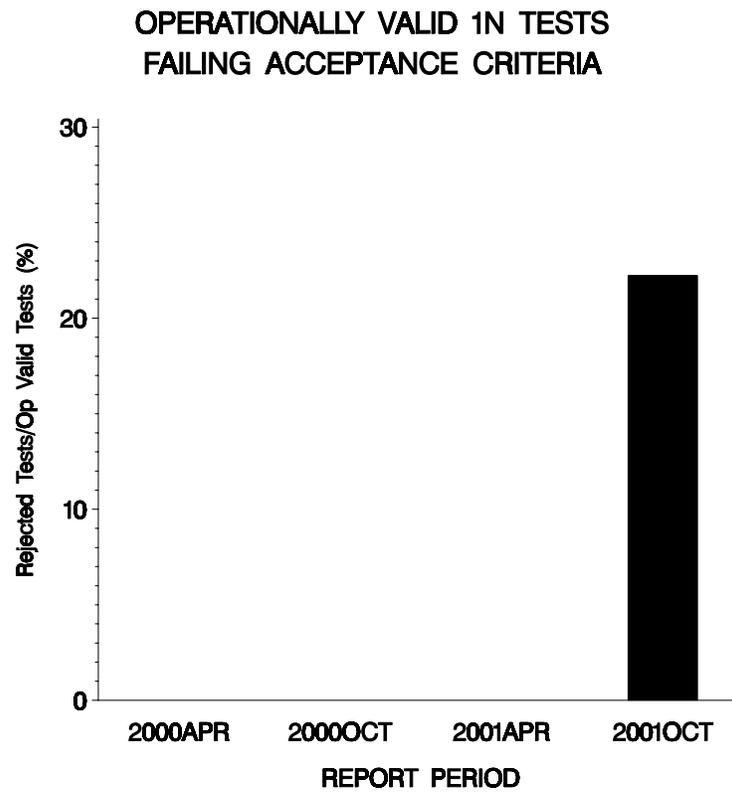
**Test Distribution by Oil and Validity**

|                                 |    |          |          |          |          |          | Totals      |             |
|---------------------------------|----|----------|----------|----------|----------|----------|-------------|-------------|
|                                 |    | 1004-1   | 1004-3   | 809-1    | 810-2    | 811-1    | Last Period | This Period |
| Accepted for Calibration        | AC | 0        | 4        | 1        | 0        | 2        | 3           | 7           |
| Rejected Mild                   | OC | 0        | 0        | 0        | 0        | 1        | 0           | 1           |
| Rejected Severe                 | OC | 1        | 0        | 0        | 0        | 0        | 0           | 1           |
| Rejected for EWMA Precision     | OC | 0        | 0        | 0        | 0        | 0        | 0           | 0           |
| Rejected for Shewhart Precision | OC | 0        | 0        | 0        | 0        | 0        | 0           | 0           |
| Operationally Invalid (lab)     | LC | 0        | 0        | 0        | 0        | 0        | 0           | 0           |
| Operationally Invalid (lab/TMC) | RC | 0        | 0        | 0        | 0        | 0        | 1           | 0           |
| Aborted Calibration             | XC | 0        | 0        | 0        | 0        | 1        | 0           | 1           |
| <b>Total</b>                    |    | <b>1</b> | <b>4</b> | <b>1</b> | <b>0</b> | <b>4</b> | <b>4</b>    | <b>10</b>   |

**1N CALIBRATION ATTEMPT SUMMARY**



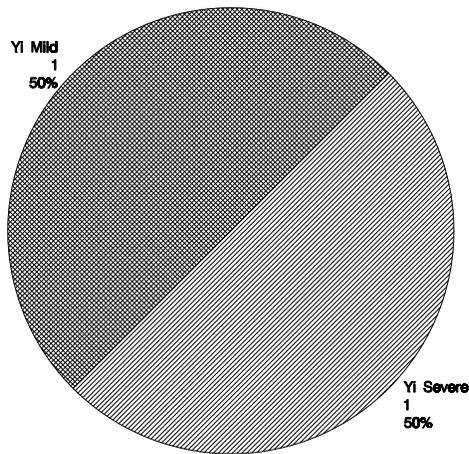
The seeming increase in the number of lost/failed tests is a reflection of the overall increase in 1N testing this period.



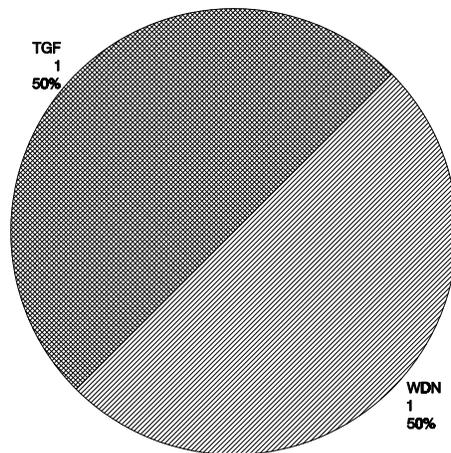
No LTMS deviations were written this period (none have ever been written for this test).

Shown below is the distribution by type and parameter of the alarms causing the failures for this period.

**DISTRIBUTION OF 1N  
LTMS STAND ALARMS  
(By Alarm Type)**



**DISTRIBUTION OF 1N  
LTMS STAND ALARMS  
(By Test Parameter)**

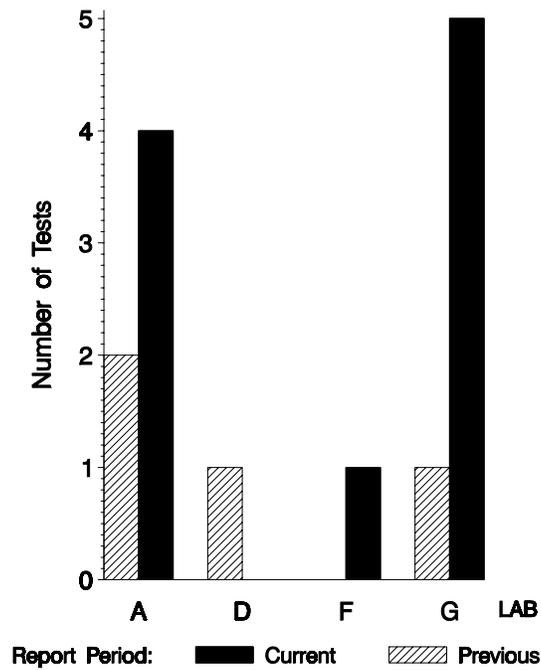


Two tests failed this period; one was mild on WDN, one was severe on TGF.

By lab, the tests run this report period were distributed as shown below:

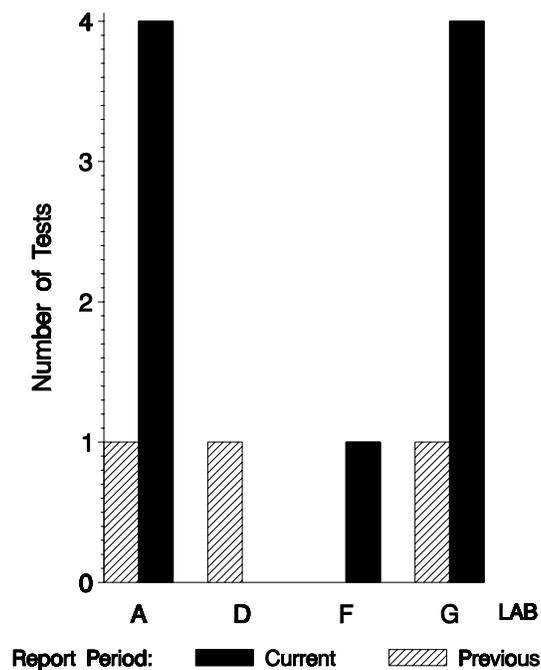
**NUMBER OF 1N TESTS REPORTED  
BY LAB AND REPORT PERIOD**

(All Test Starts – Both Valid & Invalid)

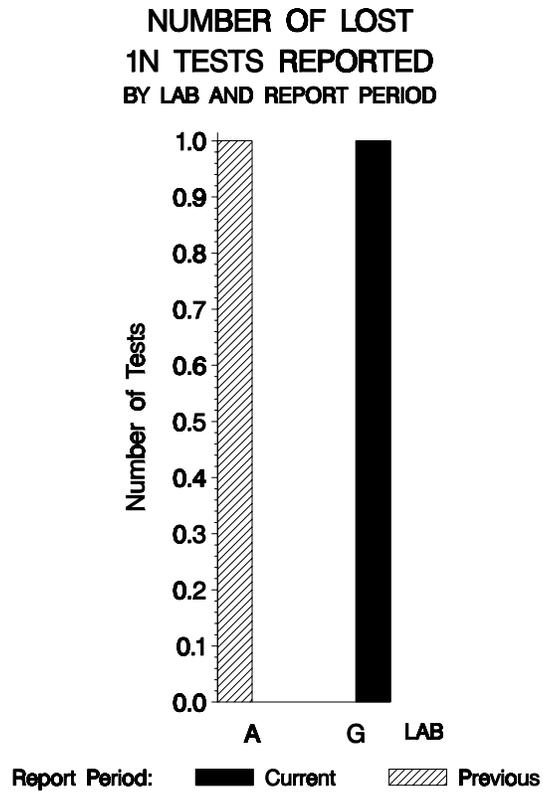


With all operationally invalid tests removed, the distribution looks like this:

**NUMBER OF OPERATIONALLY VALID  
1N TESTS REPORTED  
BY LAB AND REPORT PERIOD**



And the by-lab distribution of lost tests:



One test was lost in each of the past two periods.

Lost Tests per Start by Oil and Lab

| Lab   | 1004-1 |        |   | 1004-3 |        |   | 809-1 |        |   | 810-2 |        |   | 811-1 |        |    | Total |        |    |
|-------|--------|--------|---|--------|--------|---|-------|--------|---|-------|--------|---|-------|--------|----|-------|--------|----|
|       | Lost   | Starts | % | Lost   | Starts | % | Lost  | Starts | % | Lost  | Starts | % | Lost  | Starts | %  | Lost  | Starts | %  |
| A     |        |        |   | 0      | 3      | 0 | 0     | 1      | 0 |       |        |   |       |        |    | 0     | 4      | 0  |
| F     | 0      | 1      | 0 |        |        |   |       |        |   |       |        |   |       |        |    | 0     | 1      | 0  |
| G     |        |        |   | 0      | 1      | 0 |       |        |   |       |        |   | 1     | 4      | 25 | 1     | 5      | 20 |
| Total | 0      | 1      | 0 | 0      | 4      | 0 | 0     | 1      | 0 |       |        |   | 1     | 4      | 25 | 1     | 10     | 10 |

Lost tests are those that were either aborted, rejected by lab, or operationally invalid.

Causes for Lost Tests

| Lab | Cause                             | Oil    |        |       |       |       |    | Validity |    |      | Loss Rate |   |   |   |     |
|-----|-----------------------------------|--------|--------|-------|-------|-------|----|----------|----|------|-----------|---|---|---|-----|
|     |                                   | 1004-1 | 1004-3 | 809-1 | 810-2 | 811-1 | LC | RC       | XC | Lost | Starts    | % |   |   |     |
| G   | Scuff on break-in. Unknown cause. |        |        |       |       | ●     |    |          |    |      |           |   | 1 | 5 | 20% |
|     | Lost                              | 0      | 0      | 0     | 0     | 1     | 0  | 0        | 0  | 1    |           |   |   |   |     |
|     | Starts                            | 1      | 4      | 1     | 0     | 4     | 10 | 10       | 10 | 10   |           |   |   |   |     |
|     | %                                 | 0%     | 0%     | 0%    | 0%    | 25%   | 0% | 0%       | 0% | 0%   |           |   |   |   |     |

| Average $\Delta$ /s by Lab |   |        |        |        |        |
|----------------------------|---|--------|--------|--------|--------|
| Lab                        | n | TGF    | WDN    | TTLHC* | BSOC   |
| A                          | 4 | -0.400 | -0.290 | -0.151 | -0.654 |
| F                          | 1 | 1.870  | 0.292  | -0.770 | -1.800 |
| G                          | 4 | -0.678 | -1.319 | 0.137  | -1.199 |
| Industry                   | 9 | -0.271 | -0.683 | -0.092 | -1.023 |

\* Transformed TLHC

DATA FROM ALL OPERATIONALLY VALID TESTS REPORTED THIS PERIOD:

**LTMS**

| DATE     | LAB | STAND | OIL    | TG | WD    | TL | OC   | TGYI   | WDYI   | TLYI   | OCYI   |
|----------|-----|-------|--------|----|-------|----|------|--------|--------|--------|--------|
| 20010625 | G   | 8     | 811-1  | 16 | 214.6 | 0  | 0.14 | -0.403 | -1.789 | -0.610 | -1.596 |
| 20010710 | G   | 8     | 811-1  | 18 | 268.9 | 1  | 0.16 | -0.310 | -0.337 | 0.545  | -1.212 |
| 20010723 | A   | 3     | 1004-3 | 9  | 169.1 | 0  | 0.14 | -1.274 | -1.358 | -0.609 | -0.880 |
| 20010814 | A   | 1     | 809-1  | 16 | 224.6 | 14 | 0.3  | -0.873 | 0.801  | 1.223  | -0.108 |
| 20010826 | F   | 5     | 1004-1 | 52 | 220.3 | 0  | 0.12 | 1.870  | 0.292  | -0.770 | -1.800 |
| 20010909 | G   | 18    | 811-1  | 9  | 228.0 | 2  | 0.2  | -0.727 | -1.430 | 1.221  | -0.442 |
| 20010922 | A   | 11    | 1004-3 | 28 | 202.2 | 0  | 0.14 | -0.143 | -0.070 | -0.609 | -0.880 |
| 20010926 | A   | 4     | 1004-3 | 42 | 190.3 | 0  | 0.15 | 0.690  | -0.533 | -0.609 | -0.747 |
| 20010929 | G   | 5     | 1004-3 | 9  | 159.8 | 0  | 0.09 | -1.274 | -1.720 | -0.609 | -1.547 |

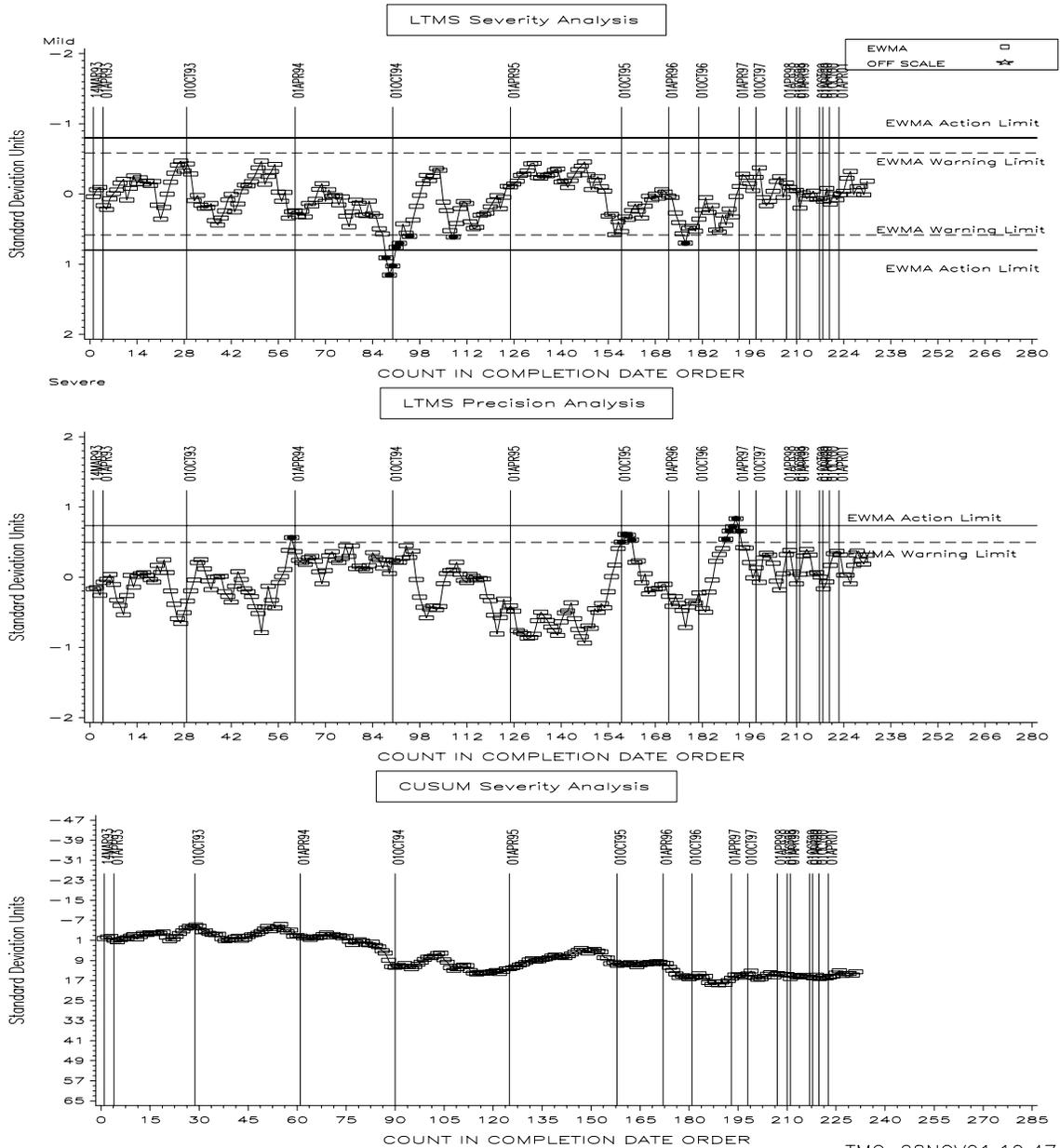
DISCUSSION OF INDUSTRY PERFORMANCE OVER THIS PERIOD

TGF:

The industry average TGF  $Y_i$  this period (shown in the table on the previous page) was  $-0.271$  mild. Using 1004-1's test target standard deviation of 14.6 to compute an average  $\Delta$  yields 4% TGF.

CATERPILLAR 1N INDUSTRY OPERATIONALLY VALID DATA

Top Groove Fill



The LTMS/Cusum plot for TGF (shown above) is unremarkable for this period.

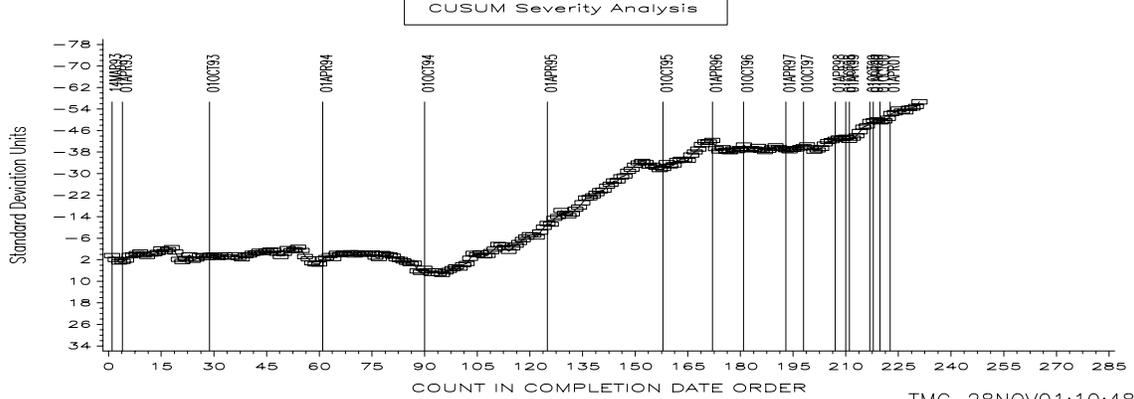
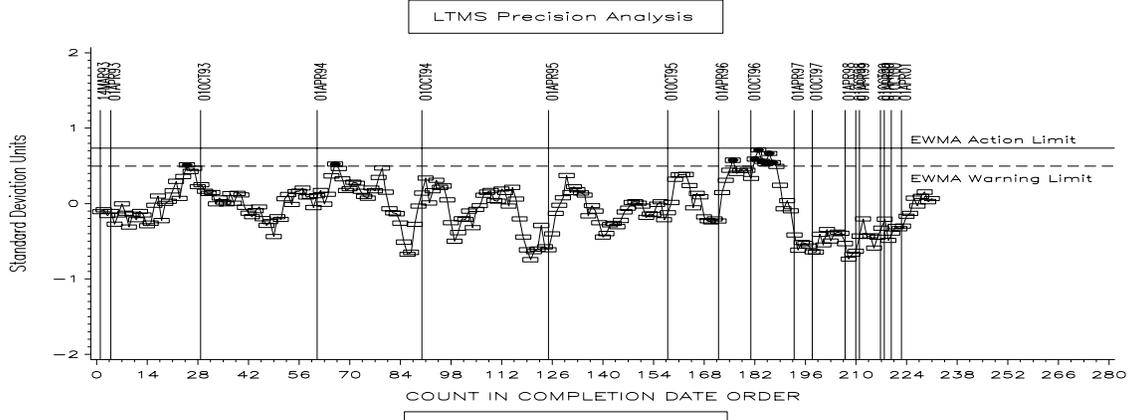
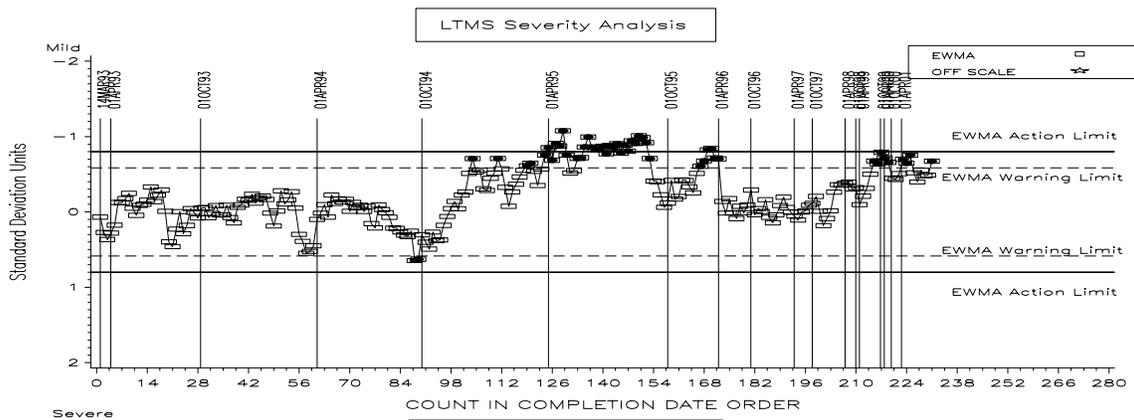
WDN:

The WDN average  $Y_i$  reported this period was  $-0.683$  (see table on page 9). This translates to 18.5 demerits when multiplied by the target standard deviation for 1004-1 (27.1). WDN results have tended to be mild since the April 1999 report period.

The LTMS/Cusum plot is shown below.

CATERPILLAR 1N INDUSTRY OPERATIONALLY VALID DATA

Weighted Total Demerits

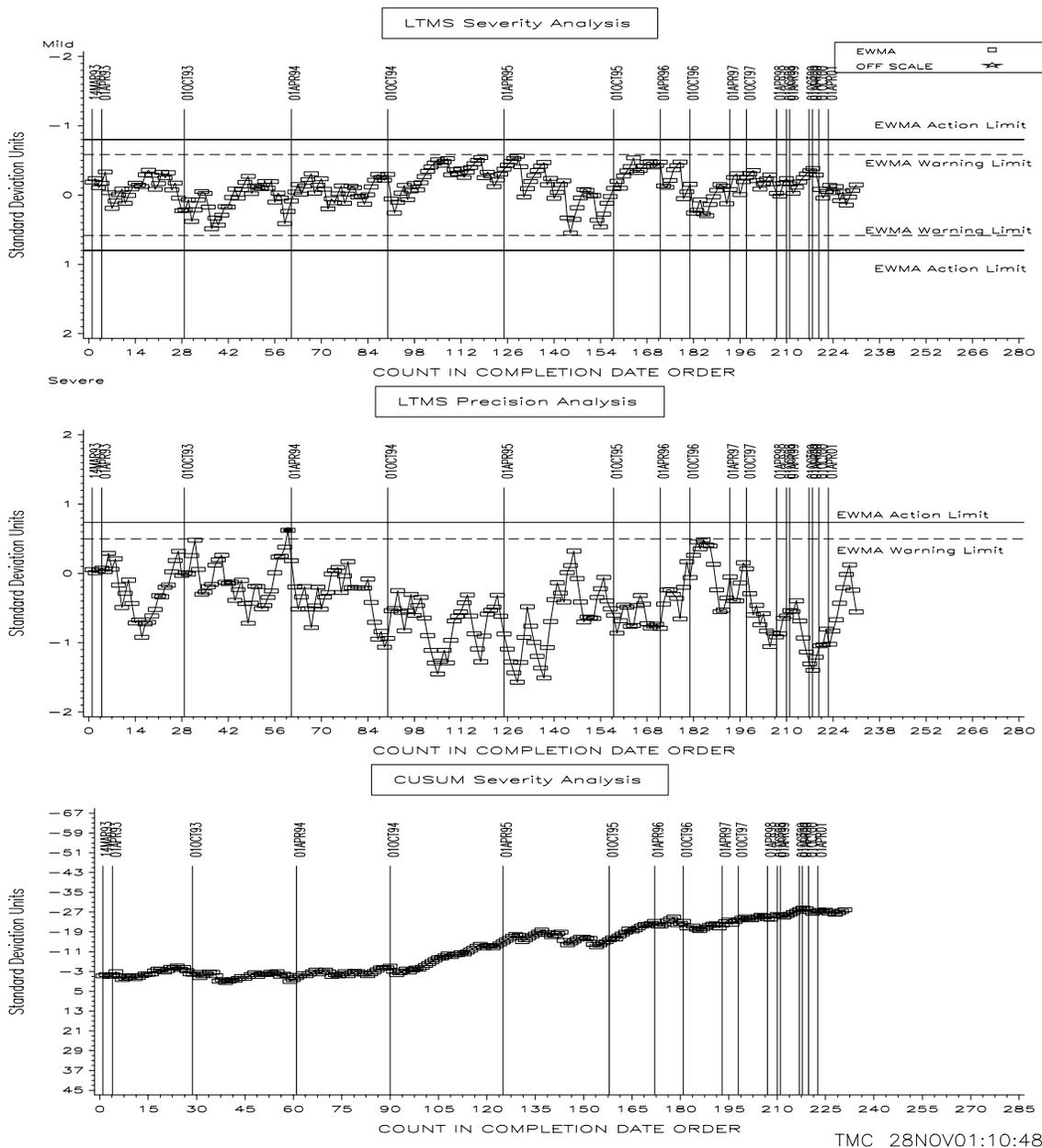


TLHC:

The average TLHC  $Y_i$  reported this period was -0.092 (see table on page 9). Using the test target standard deviation of 0.9 from oil 1004-1 to compute an average transformed delta yields 0.083. Back-transforming this value gives less than 1% TLHC.

CATERPILLAR 1N INDUSTRY OPERATIONALLY VALID DATA

Top Land Heavy Carbon



TMC 28NOV01:10:48

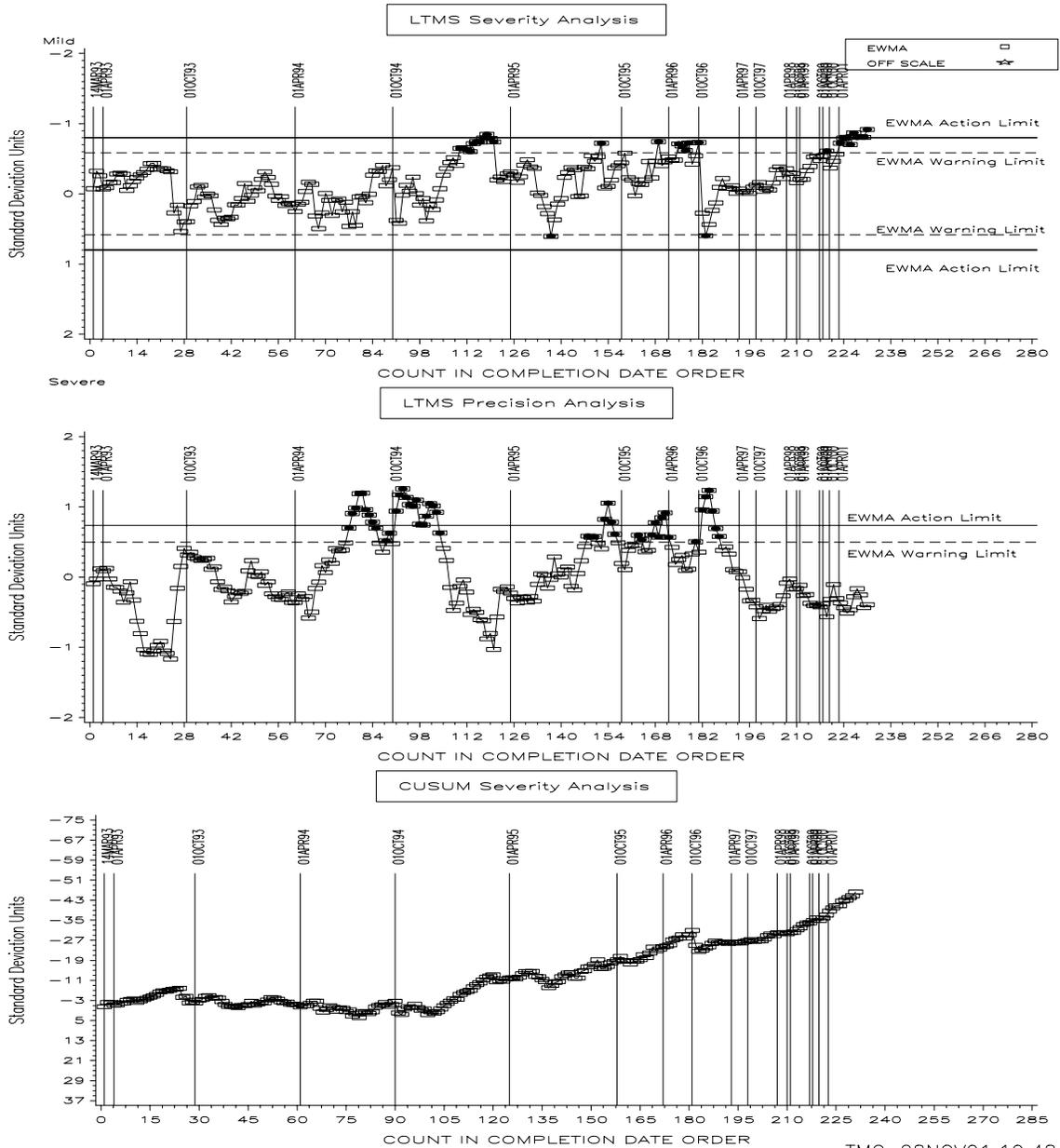
The LTMS/Cusum plot for transformed TLHC is shown above. Precision and severity were both within limits throughout this report period.

**BSOC:**

The average BSOC Yi reported this period was -1.023 or, computing an average delta using the test target standard deviation of 0.045 for oil 1004-1 gives 0.046g/kWh mild. The LTMS/Cusum plot for BSOC is shown below. This parameter is currently exceeding the EWMA action limit (mild).

CATERPILLAR 1N INDUSTRY OPERATIONALLY VALID DATA

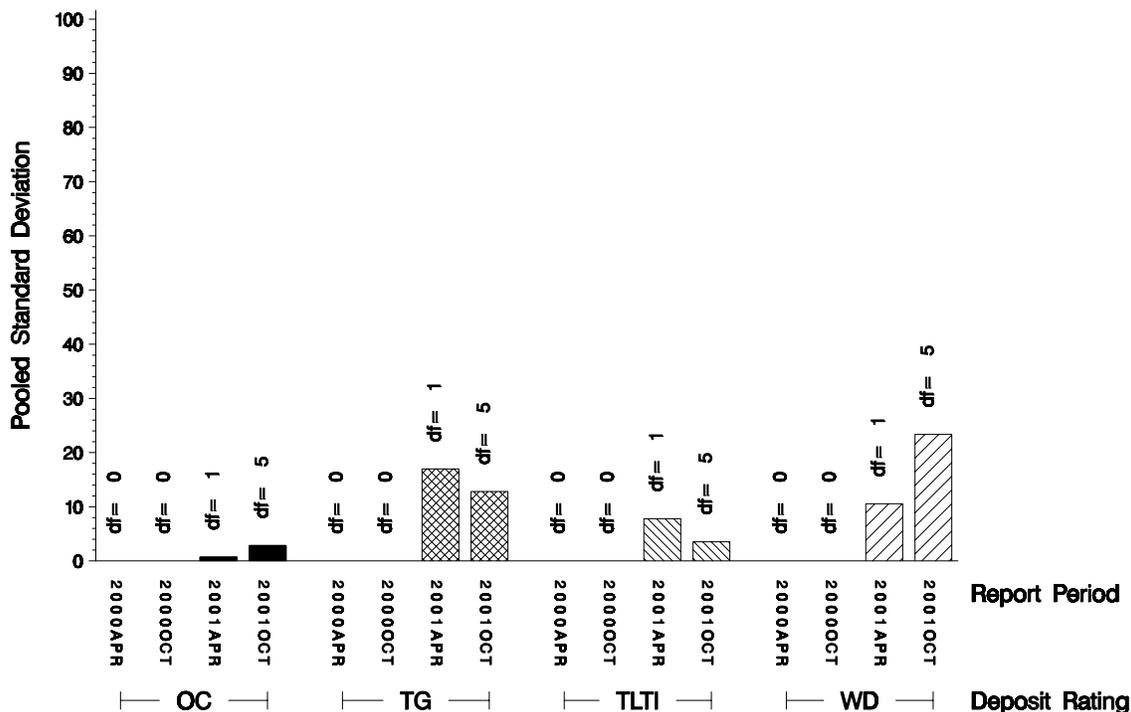
BSOC (g/Kw-h)



POOLED S:

Shown below is a bar chart comparing the pooled s values for the 1N test parameters over the last four report periods. Please note that the values for TLHC have been multiplied by 10 and the values for BSOC have been multiplied by 100 to allow these parameters to be shown on the same plot as the other parameters.

**1N REFERENCE TEST PRECISION**  
 POOLED STANDARD DEVIATION BY SIX-MONTH ASTM REPORT PERIOD



Transformed TLHC (TLTI) is scaled by 10 for display on the common y-axis  
 BSOC (OC) is scaled by 100 for display on the common y-axis

STATUS OF REFERENCE OIL SUPPLY:

At the end of this report period, the testing oil supply stood as summarized in the following table:

| Oil          | Cans @ Labs | @ TMC       |              |
|--------------|-------------|-------------|--------------|
|              |             | Cans        | Gallons      |
| 809-1        | 16          | 305         | 3059         |
| 810-2        | 3           | 360         | 3605         |
| 811-1        | 16          | 1           | 19           |
| 811-2        | 0           | 170         | 1702         |
| 1004-1       | 6           | 0           | 0            |
| 1004-2       | 9           | 4           | 40           |
| 1004-3       | 6           | 250         | 2505         |
| <b>Total</b> | <b>56</b>   | <b>1090</b> | <b>10930</b> |

\* Future reblends of oils marked with an asterisk are *not* obtainable by TMC.

Be aware that this table presumes that *all* of each of these oils is dedicated to the 1N test area. This is *not* true. 809-1 is used in several other test areas; 810-2 and 811-x are used in the 1K test area; and 1004-x is used in most of the other diesel test areas.

TIMELINE OF SIGNIFICANT EVENTS IN THE LIFE OF THE 1N TEST:

| Effective Date | Info Letter |   |
|----------------|-------------|---|
| 19910710       | 2           | INDUSTRY CORRECTION FACTORS FOR CANDIDATE TESTING                       |
| 19910927       | 1           | INFORMATION LETTER 1 - REWRITTEN PROCEDURE                              |
| 19911015       | 3           | COOLING SYSTEM MODIFICATION   |
| 19911015       | 3           | COOLANT BYPASS VALVE  |
| 19911015       | 3           | CYLINDER LINER WEAR MEASUREMENT DEVICE                                  |
| 19911015       | 3           | TEST FUEL NAME CHANGE   |
| 19911015       | 3           | REPORT FORMS  |
| 19920601       | 4           | CLOSED COOLING SYSTEM   |
| 19920601       | 4           | PISTON PACKAGING FOR REFEREE RATING                                     |
| 19920601       | 4           | MINERAL FREE WATER - DEFINITION   |
| 19920601       | 5           | FLUSHING CART FLOW DIAGRAM  |
| 19920731       | 6           | TEMPERATURE PRESSURE AND SPEED STANDARD CALIBRATION TRACEABILITY        |
| 19920731       | 6           | HUMIDITY MONITORING SYSTEM  |
| 19921015       | 7           | FUEL INJECTION PUMP TIMING USING THE BUBBLE METHOD                      |
| 19921015       | 7           | PISTON RATER CALIBRATION  |
| 19921015       | 7           | OIL SAMPLING FREQUENCY FOR USED OIL ANALYSIS                            |
| 19930324       | 8           | INTERNAL ENGINE PAINT AND SUPPLIER                                      |
| 19930629       |             | FIRST USE OF 1004   |
| 19930702       | 9           | CATERPILLAR BRAND COOLANT   |
| 19930708       | 10          | PROCEDURE DISCLAIMER  |
| 19930708       | 10          | CYLINDER HEAD COOLANT PASSAGE CLEANING                                  |
| 19930708       | 10          | CRANKCASE PRESSURE INCREASE DURING BLOWBY MEASUREMENT                   |
| 19930708       | 10          | ACCEPTABLE CYLINDER HEAD/JUG ASSEMBLIES                                 |
| 19930708       | 10          | RING GAP MEASUREMENT - FEELER GAUGES/TAPER GAUGE                        |
| 19930708       | 10          | PISTON POSITION DURING DOWNTIME   |
| 19930708       | 10          | OIL CONSUMPTION CALCULATIONS  |
| 19930708       | 10          | OIL CONSUMPTION CALCULATION AFTER SHUTDOWN                              |
| 19930708       | 10          | MISSING OR BAD TEST DATA  |
| 19930708       | 10          | TYPOGRAPHICAL ERROR IN TABLE A12  |
| 19940101       |             | 1Y3555 DEADLINE   |
| 19940101       | 11          | TEST RUN NUMBERING  |
| 19940101       | 11          | PISTON PHOTOGRAPHS  |
| 19940101       | 11          | USE OF AN ALIGNMENT FIXTURE IN P-TUBE AIMING                            |
| 19940101       | 11          | LOCATION OF LINER SURFACE FINISH MEASUREMENTS                           |
| 19940101       | 11          | LOCATION OF LINER BORE DIAMETER MEASUREMENTS                            |
| 19940101       | 11          | ENGINE ROTATION SPEED DURING FLUSHING                                   |
| 19940101       | 11          | ACCEPTABLE CYLINDER LINER PART NUMBERS                                  |
| 19940101       | 11          | CALIBRATION FREQUENCY   |
| 19940102       |             | CATERPILLAR COOLANT DEADLINE  |
| 19940129       |             | START OF EXCLUSIVE USE OF 1004-X OILS                                   |
| 19940205       |             | FIRST USE OF 1004-1   |
| 19940226       |             | LAST USE OF 1004  |
| 19940301       | 12          | OUTLIERS AS A TEST VALIDITY CRITERIA                                    |
| 19940301       | 12          | INSTRUMENTATION CALIBRATION TOLERANCES AND TIME CONSTANTS               |
| 19940316       | 13          | FUEL DILUTION AS AN OPERATIONAL VALIDITY CRITERION                      |
| 19950401       |             | FIRST LTMS TEST   |
| 19950605       |             | 811-1 RETURN TO SYSTEM  |
| 19950811       |             | FIRST USE OF 1004-2   |
| 19950918       |             | 809-1 RETURN TO SYSTEM  |
| 19960510       | 96-1        | 1K/1N DATA DICTIONARY AND REPORT FORMS (VERSION=19960304)               |
| 19960913       | 96-2        | BETA TESTED 1K/1N DATA DICTIONARY AND REPORT FORMS (VERSION=19960913)   |
| 19961025       |             | FIRST 810-X DISCRIMINATION RUN  |
| 19970320       | 97-1        | USE OF LOW SULFUR FUEL FOR THE 1N TEST                                  |
| 19970320       | 97-1        | ADDITION OF END OF TEST OIL CONSUMPTION (EOTOC) AS A REPORTED PARAMETER |
| 19970320       | 97-1        | ENGINE PARTS WARRANTY CLAIM PROCEDURE CHANGE                            |
| 19970320       | 97-1        | LTMS REQUIREMENTS FOR CALIBRATION                                       |
| 19970320       | 97-1        | CLARIFICATION OF SPECIFICATION FOR HUMIDITY CALIBRATION                 |
| 19970320       | 97-1        | CLARIFICATION OF WHEN REFEREE RATINGS ARE REQUIRED                      |
| 19970320       | 97-1        | ADDITION OF DATA DICTIONARY AND REPORT FORMS TO THE PROCEDURE           |
| 19970320       | 97-1        | TEST REPORTING DEADLINES  |
| 19970320       | 97-1        | EXAMPLES FOR SEVERAL OF THE REPORT FORMS                                |
| 19980101       | 98-1        | FUEL SUPPLIER NAME CHANGE   |
| 19980101       | 98-1        | FUEL SAMPLING REQUIREMENTS  |
| 19980101       | 98-1        | REVISED ENGINE PARTS WARRANTY PROCEDURE & FORM                          |
| 19980101       | 98-1        | 810-2 DISCRIMINATION RUNS RETURNED TO LTMS/CAL RUNS CAL PD = 1YR        |
| 19980828       | 98-2        | RATING WORKSHEET ADDED TO TEST REPORT AS FORM 4A                        |
| 19981111       | 98-3        | ADDED AREAS FOR CLEAN TO RATING SHEETS 5 & 5A                           |
| 19990419       | 99-1        | TEST STAND INSTRUMENTATION CALIBRATION REQUIREMENTS                     |
| 19990419       | 99-1        | COOLANT SYSTEM FLUSHING REQUIREMENTS                                    |
| 19990419       | 99-1        | UPDATED INTAKE AIR FILTER REQUIREMENTS                                  |
| 19990419       | 99-1        | VISUAL INSPECTION OF INTAKE AIR BARRELS                                 |
| 19990419       | 99-1        | RE-CALIBRATION REQUIREMENTS WHEN CRANK IS REMOVED                       |
| 19990419       | 99-1        | USE OF MOBIL EF-411 AS BUILD-UP/FLUSHING OIL                            |
| 19990419       | 99-1        | TIME ZONE FOR USE IN EOT REPORTING                                      |
| 19990419       | 99-1        | EDITORIAL   |
| 20000101       | 00-1        | 810-X RUNS WILL OCCUR VOLUNTARILY ONCE PER YEAR                         |

RATING:

During this report period, no 1N tests required re-rating. The table below summarizes the re-rates for this report period:

| <b>Rating Re-rate Summary</b>                    |          |
|--|----------|
| Total number of re-rates requested               | <u>0</u> |
| Number of tests where lab rating was changed     | 0        |
| Number of tests where referee rating was changed | 0        |
| Number of tests where no changes were made       | 0        |

LAB VISITS:

No 1N lab visits were completed during this period.

INFORMATION LETTERS:

No information letters were issued this period.

FUEL BATCH APPROVAL:

During this period, the following fuel batches were approved for testing: 0104281, 0107479, and 0109663.

SUMMARY

- Severity for TGF, WDN, and TLHC remained within the action limits for the duration of this period though WDN results tended to be mild of target. BSOC severity is currently exceeding the mild EWMA action limit.
- Precision for all parameters remained within limits throughout this report period.

SDP/sdp/astm1001.doc/m01-172.sdp.doc

c: J. L. Zalar

F. M. Farber

A. C. Hahn

Single Cylinder Diesel Surveillance Panel

<ftp://tmc.astm.cmri.cmu.edu/docs/diesel/scote/semiannualreports/1n-10-2001.pdf>

distribution: Email