



Test Monitoring Center

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

MEMORANDUM: 02-053
DATE: May 22, 2002
TO: Warren Totten, Chairman, Cummins Surveillance Panel
FROM: Jeff Clark
SUBJECT: M11EGR Calibration Testing for the April 2002 ASTM Report Period

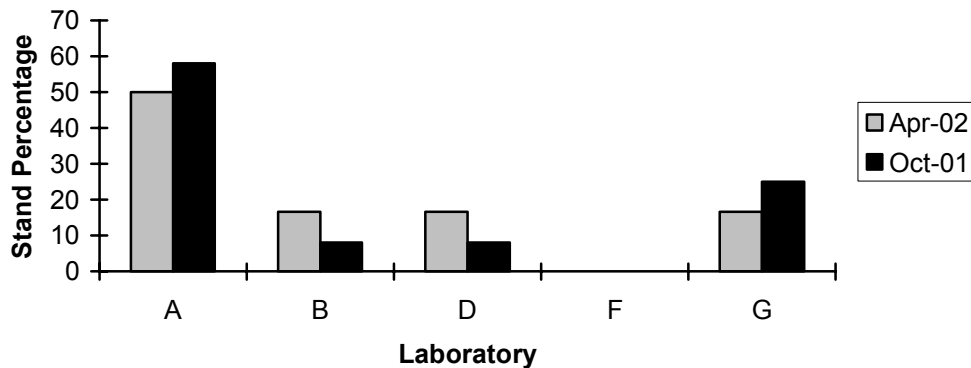
The following is a summary of M11EGR reference oil tests completed during the April 2002 ASTM report period, which began on October 1, 2001 and ended on March 31, 2002.

Lab / Stand Distribution:

	Reporting Data	Calibrated as of 3/31/02
Number of Laboratories	4	3
Number of Stands	6	6

The figure below shows the M11EGR laboratory / stand distribution for tests completed this report period:

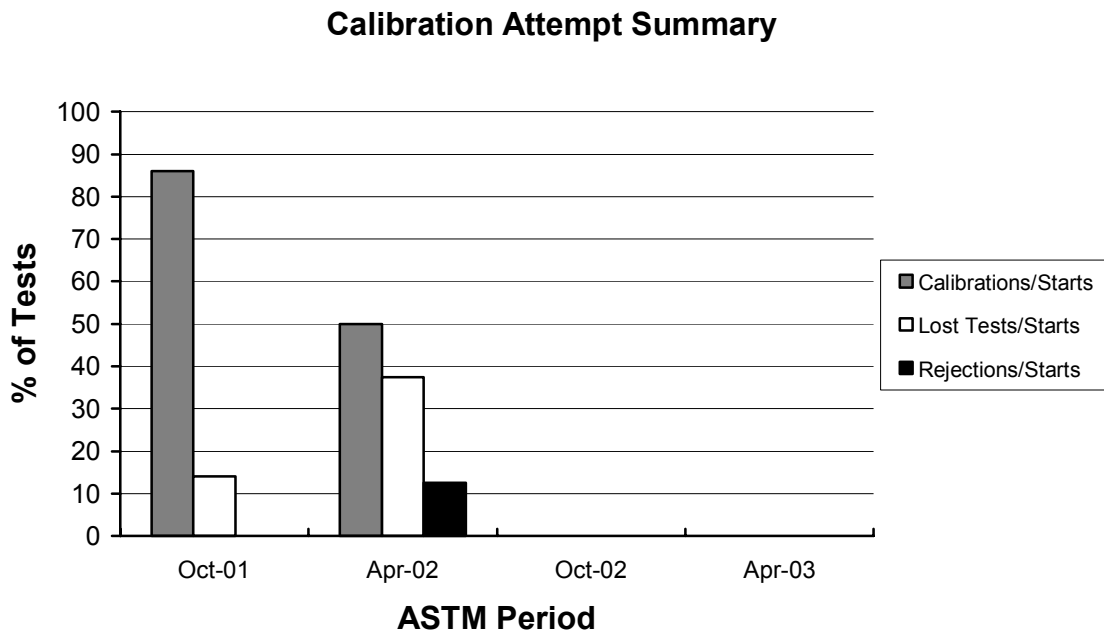
Laboratory / Stand Distribution



The table below summarizes the status of the reference oil tests reported to the TMC this ASTM report period:

Test Status	TMC Validity Code	Number of Tests
Acceptable Calibration Test	AC	4
Failed Calibration Test (LTMS Criteria)	OC	1
Operationally Invalid Calibration Test	LC	1
Aborted Calibration Test	XC	2
Total		8

Calibrations per start, lost tests per start and rejections per start rates are summarized in the figure below:

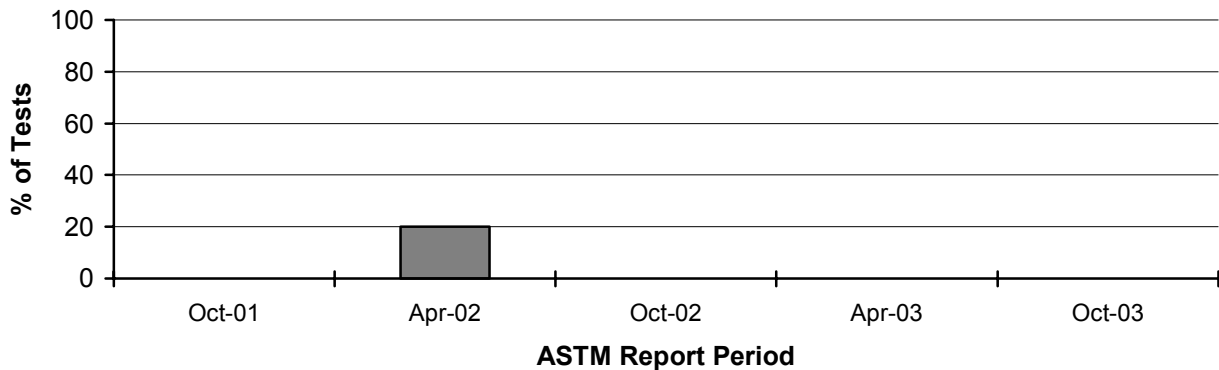


The calibrations per start rate has decreased, while the lost tests and rejections per start rates have increased. A detailed list of reasons tests failed the acceptance criteria (OC validity) is shown in Table 1. Table 2 lists the operationally invalid tests (LC validity) and Table 3 lists the aborted tests (XC validity).

LTMS Acceptance Criteria / Stand Alarms:

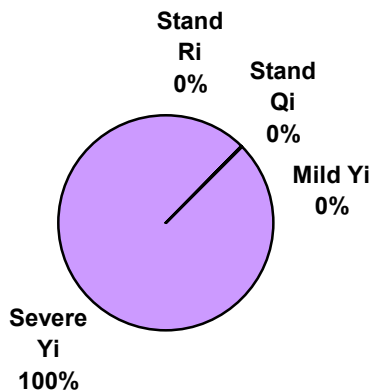
The following figure shows the percentage of operationally valid tests that failed the LTMS acceptance criteria (TMC validity code = OC) for recent ASTM report periods:

Tests Failing LTMS Acceptance Criteria

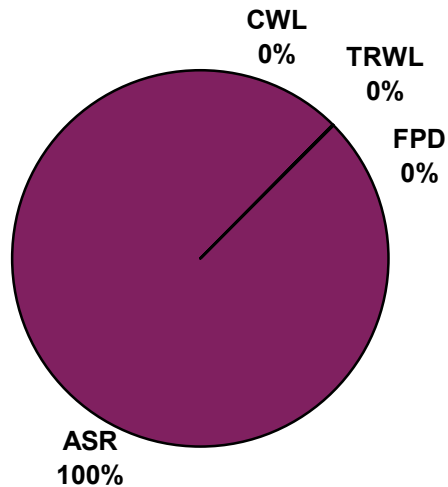


There was one LTMS stand alarm for the current period. The following figures show the alarm and parameter distributions:

Distribution of LTMS Stand Alarms



Distribution of Stand Alarms by Parameter



No LTMS deviations were issued this period. No LTMS deviations have been issued during the history of the M11EGR.

Severity and Precision:

Figure 1 (attached) shows the current industry EWMA severity, EWMA precision, and cusum charts for Crosshead Weight Loss (CWL). CWL is currently in control. For this period, CWL is trending an average of 0.55 Δ/s severe. This is equivalent to 1.71 mg. For a history of CWL industry alarms, refer to the industry alarm log shown in Table 4.

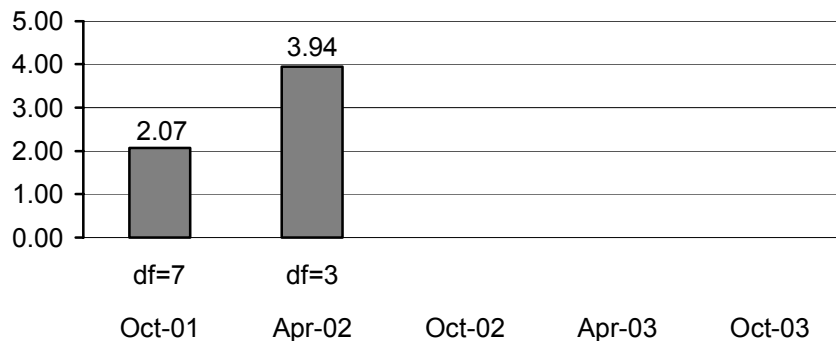
Figure 2 (attached) shows the current industry EWMA severity, EWMA precision, and cusum charts for Average Sludge Rating (ASR). ASR is currently in an industry alarm for both severity and precision. For this period, ASR is trending an average of 1.45 Δ/s severe. This is equivalent to 0.48 merits. For a history of ASR industry alarms, refer to the industry alarm log shown in Table 5. It appears as though these alarms are caused by a single extremely severe result from one test stand that did not successfully calibrate. Without this result, ASR is trending an average of 0.08 Δ/s mild, which is essentially on target.

Figure 3 (attached) shows the current industry EWMA severity, EWMA precision, and cusum charts for Filter Plugging Delta P (FPD). FPD is currently in control. For this period, FPD is trending an average of 0.27 Δ/s mild. This is equivalent to 0.2304 square root units, or 8 kPa at the CI-4 single test limit. For a history of FPD industry alarms, refer to the industry alarm log shown in Table 6.

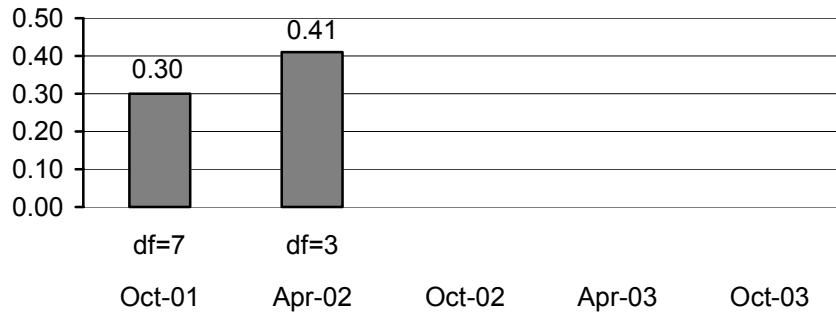
Figure 4 (attached) shows the current industry EWMA severity, EWMA precision, and cusum charts for Top Ring Weight Loss (TRWL). TRWL is currently in control and on target. For a history of TRWL industry alarms, refer to the industry alarm log shown in Table 7.

Precision, as estimated by the pooled standard deviation, is shown in the following figures. For comparison purposes, the TMC will continue to report precision by ASTM period.

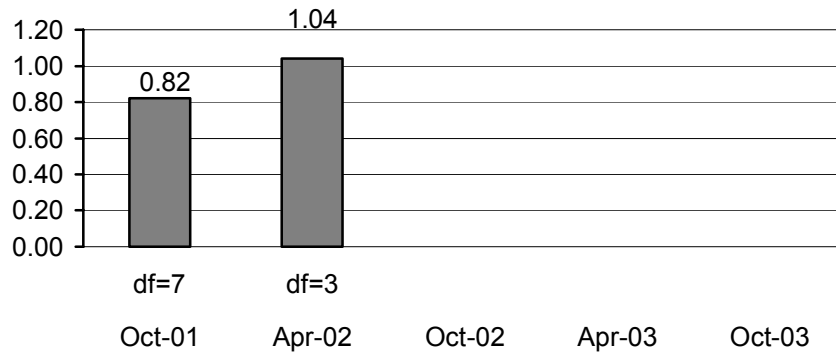
Crosshead Weight Loss Pooled Precision



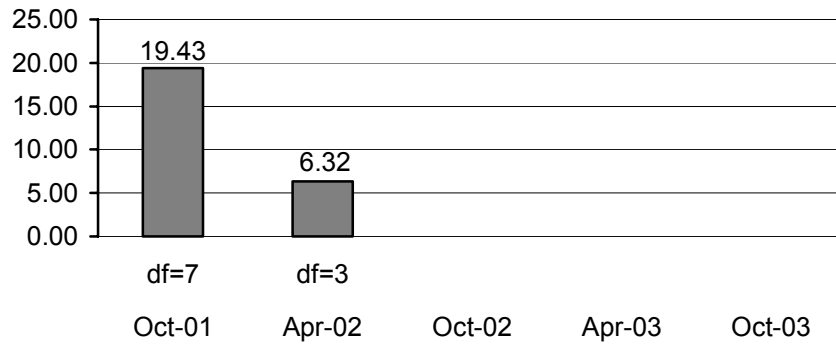
Average Sludge Rating Pooled Precision



Filter Plugging Delta P Pooled Precision



Top Ring Weight Loss Pooled Precision



Compared to the previous period, CWL, ASR, and FPD have shown degradation in precision while TRWL shows a significant improvement in precision. However, the small degrees of freedom make it difficult to draw any meaningful conclusions regarding the impact or causes of these apparent changes in precision. Please note, that the degrees of freedom (df) equals $\Sigma(n \text{ observations per oil} - 1)$.

Reference Oils:

Supplies of oils PC-9E (830) and 830-1 have been exhausted. Oil 830-2 is now at the labs and available for reference testing. To date, no tests have been completed on oil 830-2. The current reference oil test targets are shown below:

Oils	N*	Parameter	Mean (cSt)	S
830-2	-	CWL	17.3	3.7
		ASR	8.50	0.38
		FPD	11.7164	2.7000
		TRWL	131.7	22.9

* Targets based on PC-9E 12 test targets.

Information Letters:

Information Letter 02-01 was issued March 22, 2002. Topics included a correction factor for FPD and controlling EGR rate by intake CO₂.

TMC Laboratory Visits:

No TMC laboratory visits were conducted this ASTM period.

Quality Index:

Quality Index has not yet been implemented for the M11EGR. The TMC will be conducting an industry capability study shortly, after which a QI proposal will be brought to the panel for consideration.

Additional Information:

Table 8 contains the M11EGR Timeline, which details changes to the test since its inception.

The M11EGR database can be accessed on the TMC's homepage. If you have any questions on how to access this information, contact the TMC.

JAC/jac/mem02-053.jac.doc

Attachments

c: J.L. Zalar, TMC

F.M. Farber, TMC

Cummins Surveillance Panel

<ftp://ftp.astmtmc.cmu.edu/docs/diesel/cummins/semiannualreports/M11EGR-04-2002.pdf>

Distribution: Email

Table 1
Summary of Reasons for Rejected Tests

	No. of Tests
Average Sludge Rating, Severe	1

Table 2
Summary of Reasons for Invalid Tests

	No. of Tests
Missed soot window, low	1

Table 3
Summary of Reasons for Aborted Tests

	No. of Tests
Improperly installed piston rings	1
Wrong oil filter	1

FIGURE 1
M11EGR INDUSTRY OPERATIONALLY VALID DATA

CROSSHEAD WEIGHT LOSS

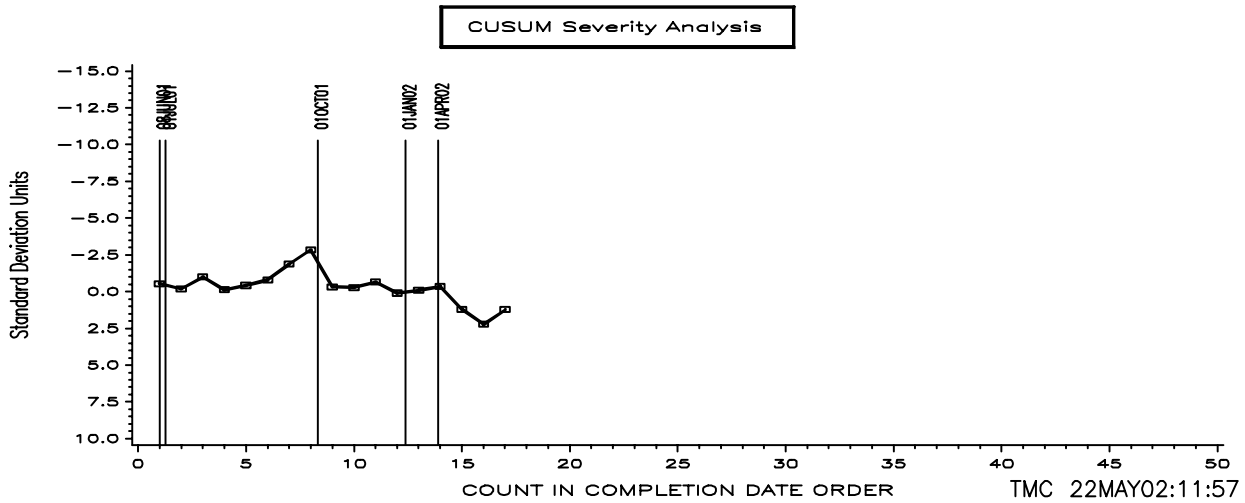
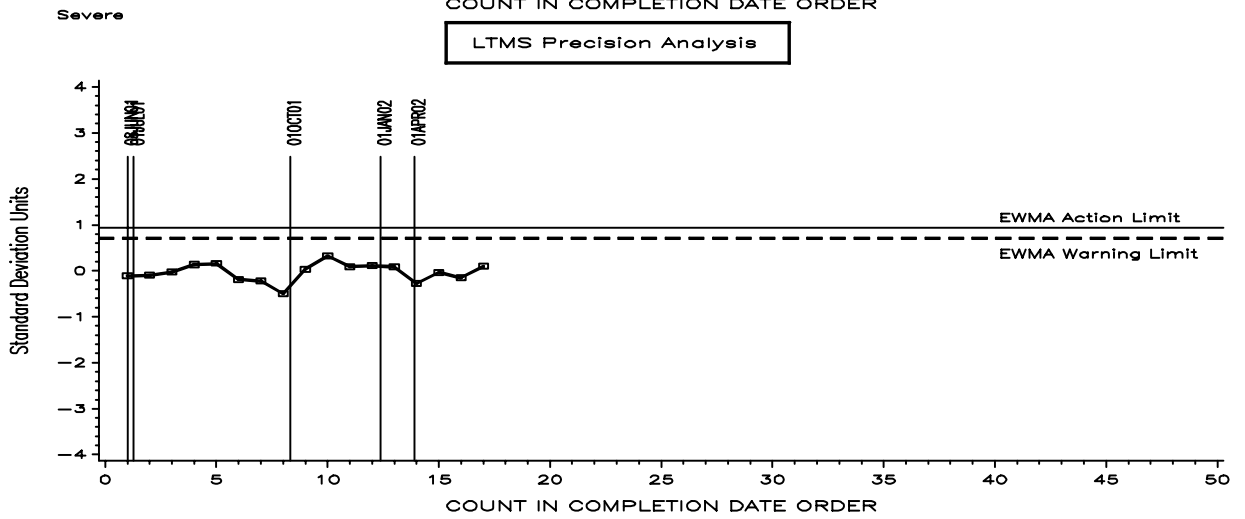
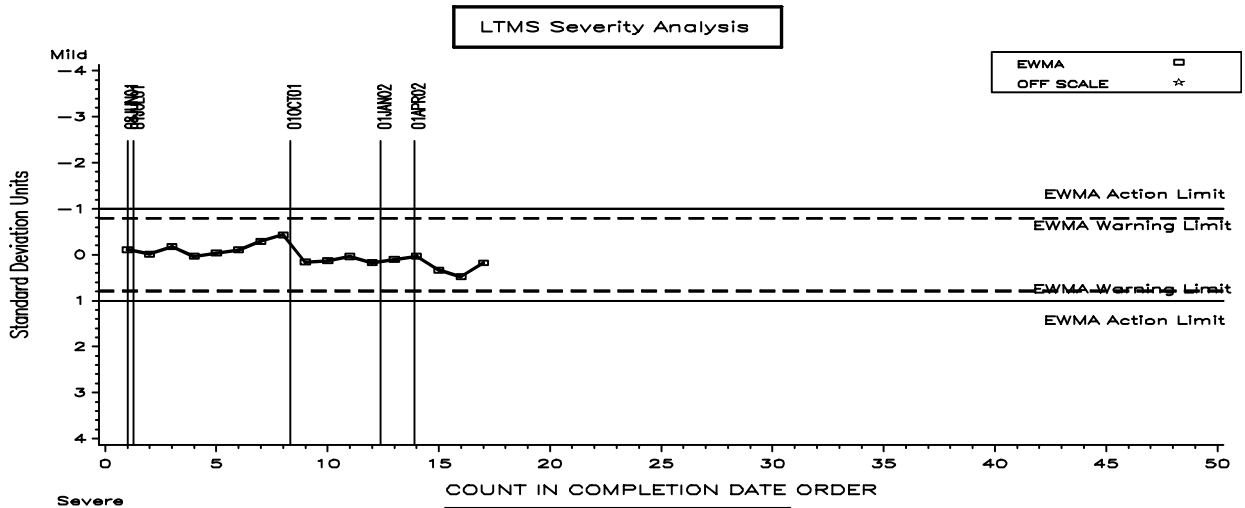


TABLE 4

CROSSHEAD WEIGHT LOSS INDUSTRY ALARM LOG

No alarms have occurred.

Updated 5/22/02

FIGURE 2
M11EGR INDUSTRY OPERATIONALLY VALID DATA
AVG SLUDGE RATING

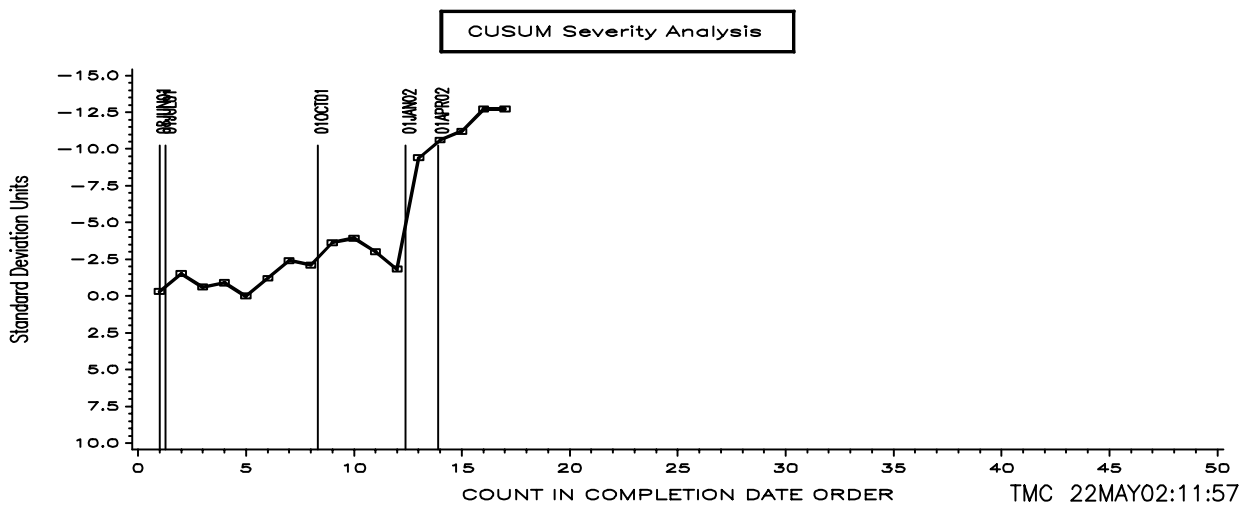
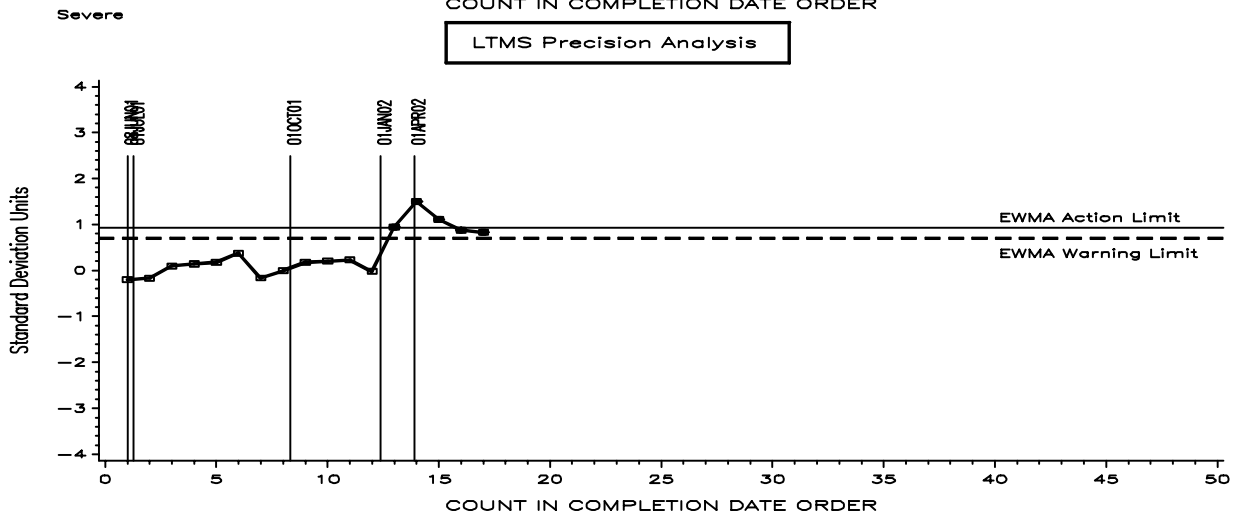
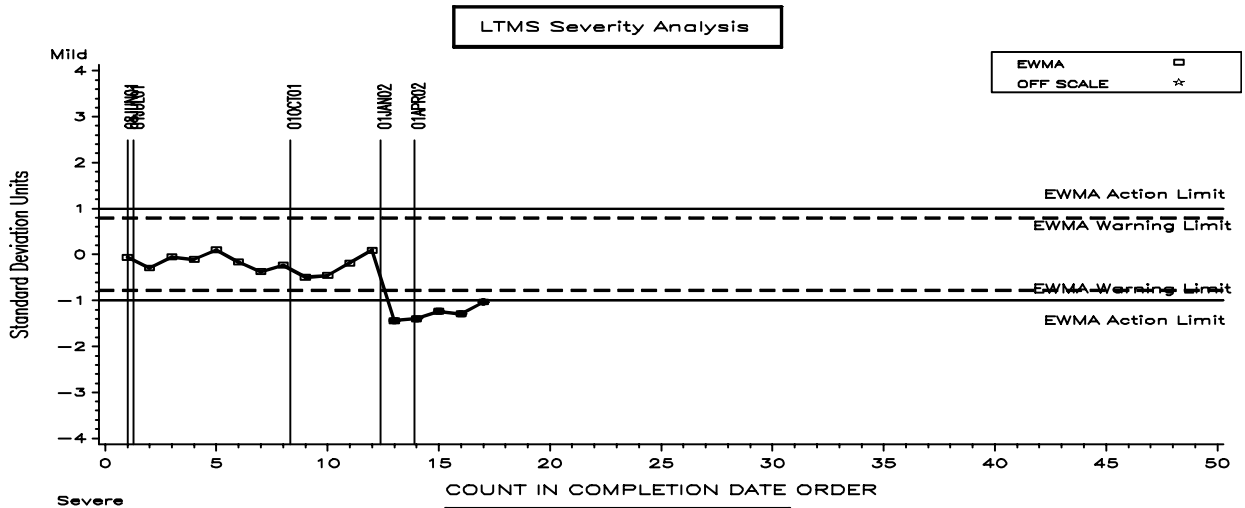


TABLE 5

AVERAGE SLUDGE RATING INDUSTRY ALARM LOG

February 3, 2002 to date (Severity, severe direction; Precision)

Five consecutive tests exceed severity and precision limits. These alarms appear to be caused by one extremely severe result on a stand that did not successfully calibrate. No indication yet that any action is necessary by the surveillance panel.

Updated 5/22/02

FIGURE 3
M11EGR INDUSTRY OPERATIONALLY VALID DATA

FILTER PLUGGING DELTA P

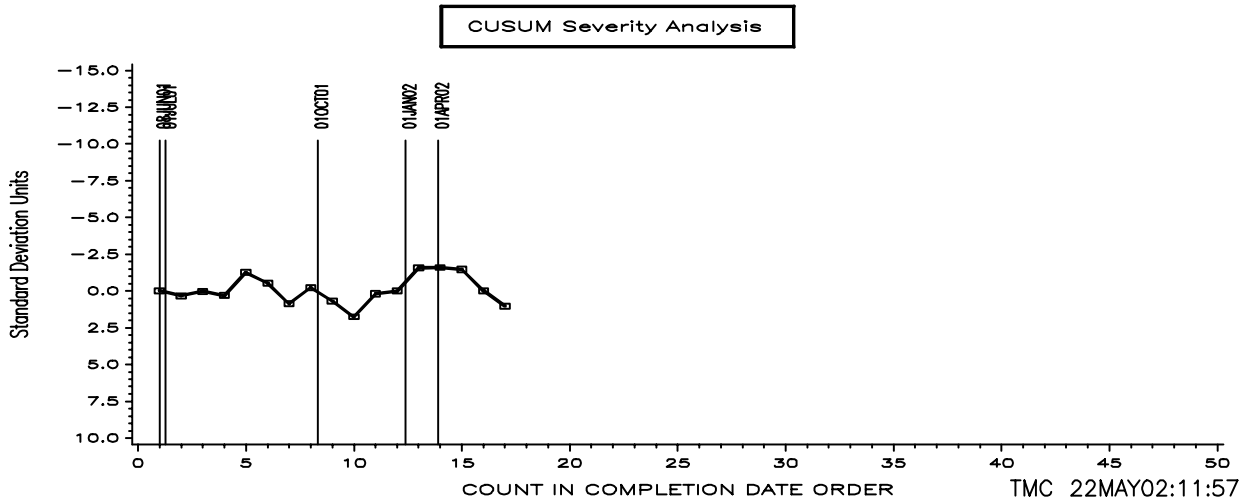
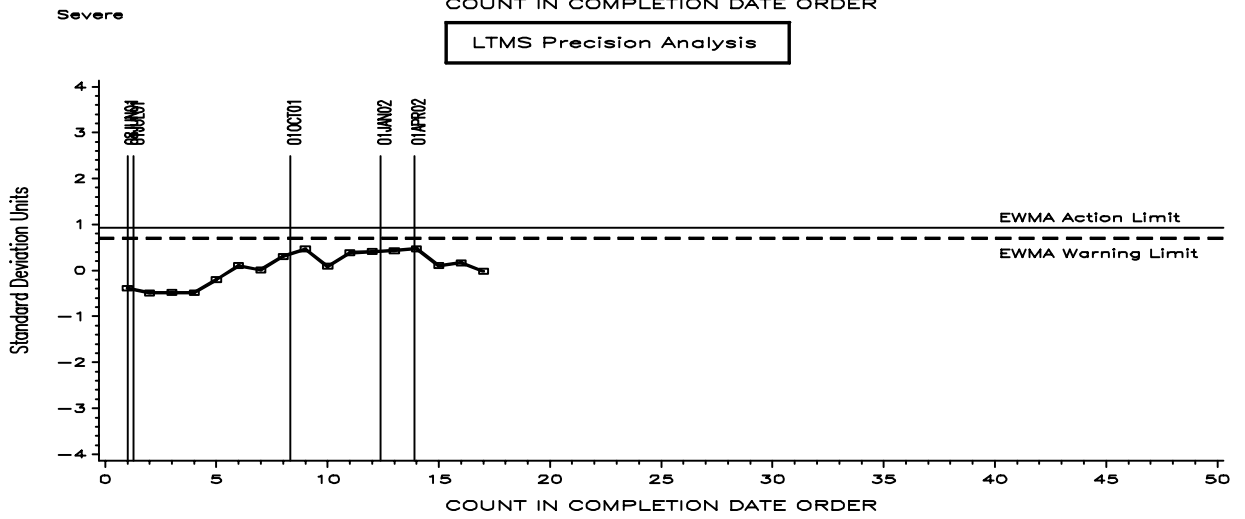
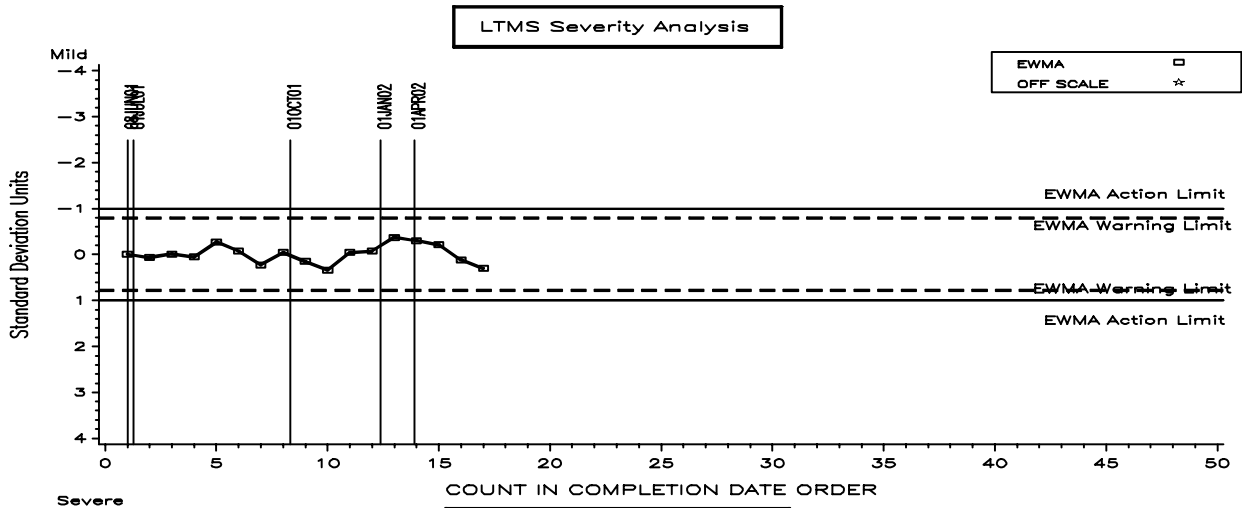


TABLE 6

FILTER PLUGGING DELTA P INDUSTRY ALARM LOG

No alarms have occurred.

Updated 5/22/02

FIGURE 4
M11EGR INDUSTRY OPERATIONALLY VALID DATA

TOP RING WEIGHT LOSS

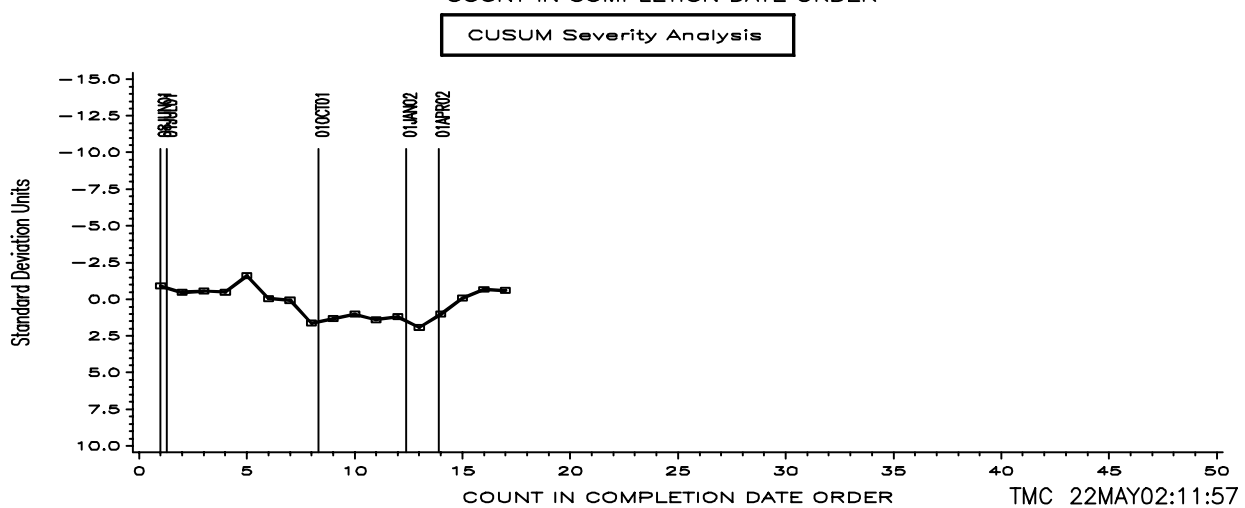
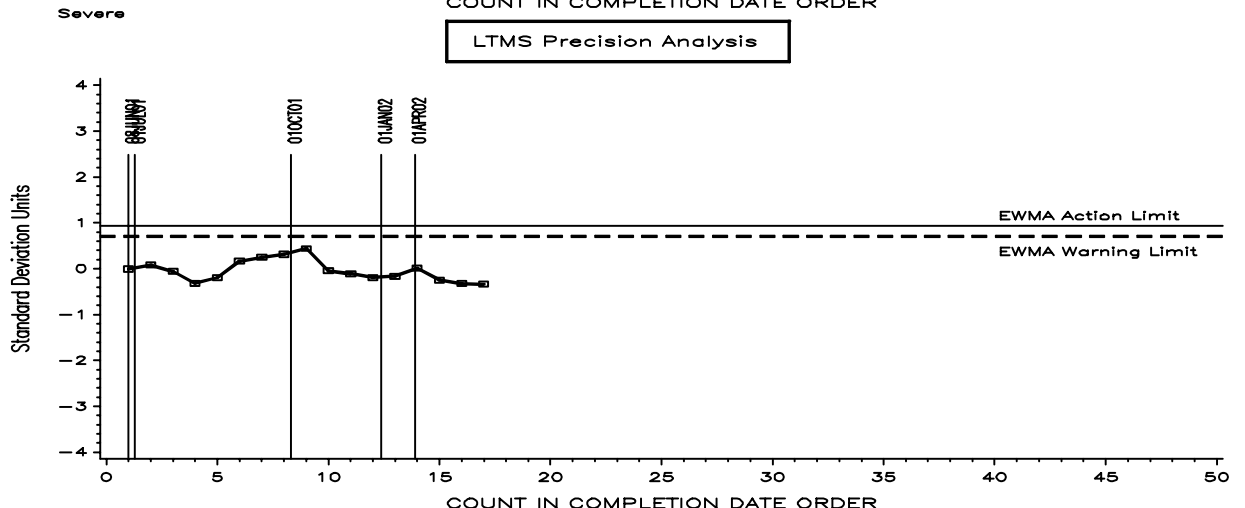
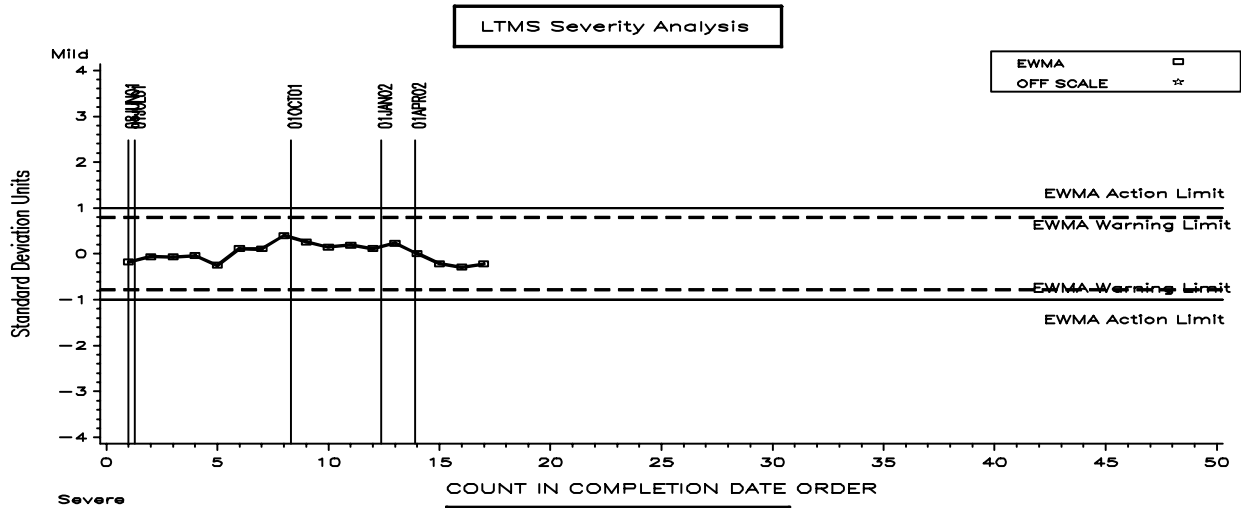


TABLE 7

TOP RING WEIGHT LOSS INDUSTRY ALARM LOG

No alarms have occurred.

Updated 5/22/02

TABLE 8
M11EGR TIMELINE

DATE	I. L.	TOPIC
20001207,		BEGINNING OF PC-9 MATRIX
20010618,		INTRODUCTION OF OIL FILTERS WITH HOT MELT BEAD
20010623,		COMPLETION OF PC-9 MATRIX
20010820,		LTMS IMPLEMENTED
20020121,		OIL 830-1 INTRODUCED
20020221, 02-01		BEADED OIL FILTER CORRECTION FACTOR OF +3.15 (TRANSFORMED UNITS) IMPLEMENTED FOR OIL FILTER
		PLUGGING
20020221, 02-01		EGR RATE CONTROLLED BY INTAKE CO2
20020521,		REPORT FORMS AND DATA DICTIONARY VERSION 20020301