



Test Monitoring Center

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MEMORANDUM: 03-030
DATE: April 8, 2003
TO: Warren Totten, Chairman, Cummins Surveillance Panel
FROM: Jeff Clark
SUBJECT: M11EGR Calibration Testing for the April 2003 ASTM Report Period

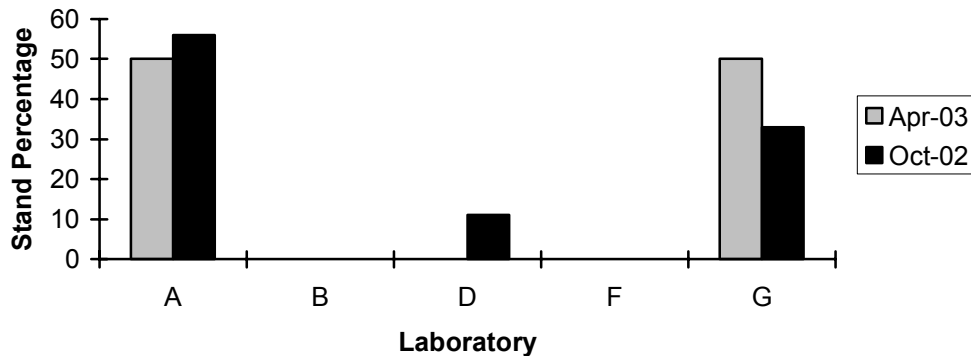
The following is a summary of M11EGR reference oil tests completed during the April 2003 ASTM report period, which began on October 1, 2002 and ended on March 31, 2003.

Lab / Stand Distribution:

	Reporting Data	Calibrated as of 3/31/03
Number of Laboratories	2	2
Number of Stands	4	4

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

Laboratory / Stand Distribution

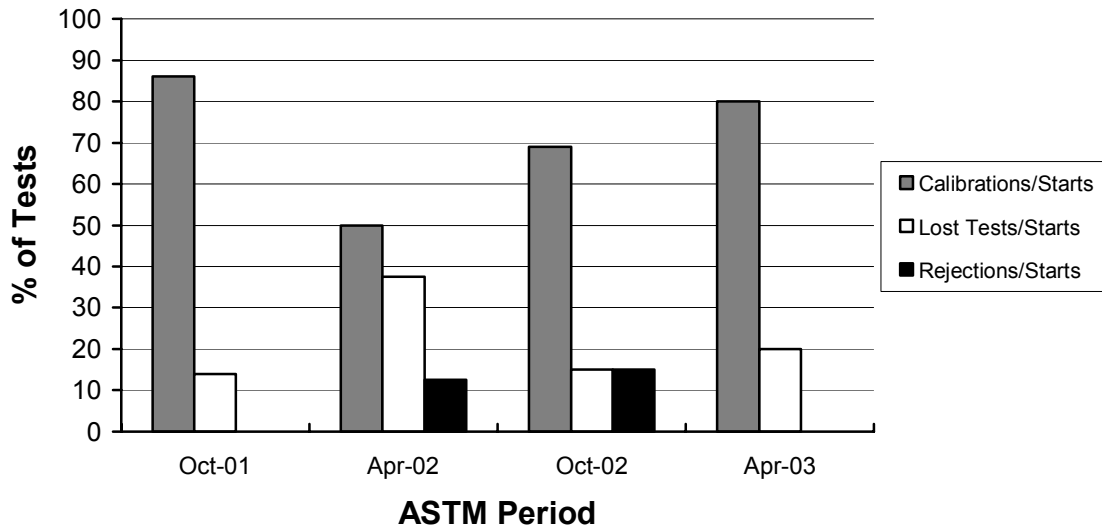


The table below summarizes the status of the reference oil tests reported to the TMC this ASTM report period:

Test Status	TMC Validity Code	Number of Tests
Acceptable Calibration Test	AC	4
Failed Calibration Test (LTMS Criteria)	OC	0
Operationally Invalid Calibration Test	LC	1
Aborted Calibration Test	XC	0
Industry donated test, not for calibration	AG	2
Total		7

The industry donated tests were run on a wire mesh oil filter design. Calibrations per start, lost tests per start and rejections per start rates are summarized in the figure below:

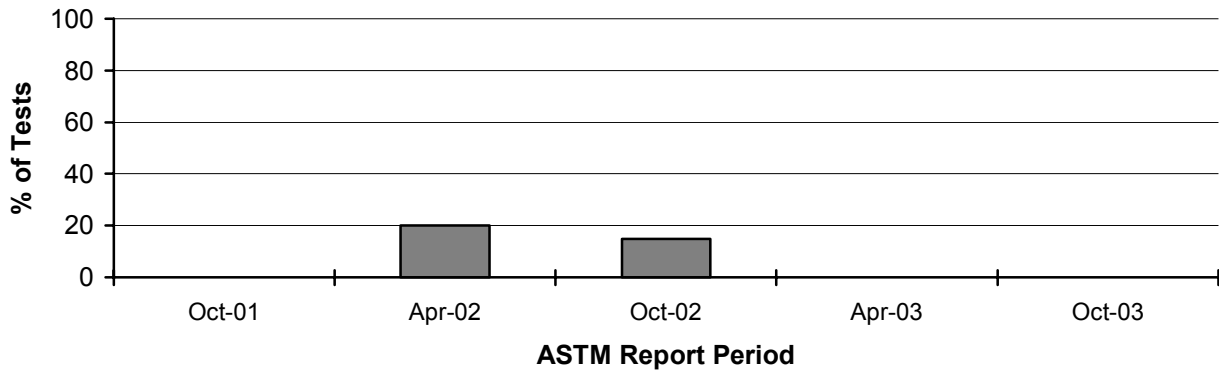
Calibration Attempt Summary



The calibrations per start rate and lost tests per start rate are within historical levels. The rejections per start rate decreased in comparison to the two previous periods. 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 were no LTMS stand alarms this period. 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 0.74 Δ/s severe. This is equivalent to 2.37 mg. For a history of CWL industry alarms, refer to the industry alarm log shown in Table 4.

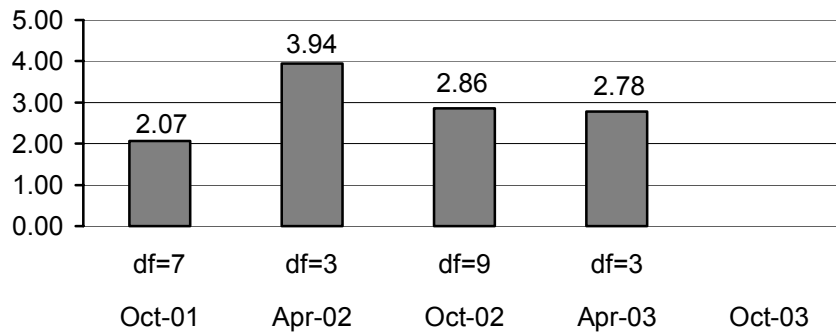
Figure 2 (attached) shows the current industry EWMA severity, EWMA precision, and cusum charts for Average Sludge Rating (ASR). ASR is currently in control. For a history of ASR industry alarms, refer to the industry alarm log shown in Table 5.

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 0.44 Δ/s severe. This is equivalent to 0.46 square root units, or 15 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.

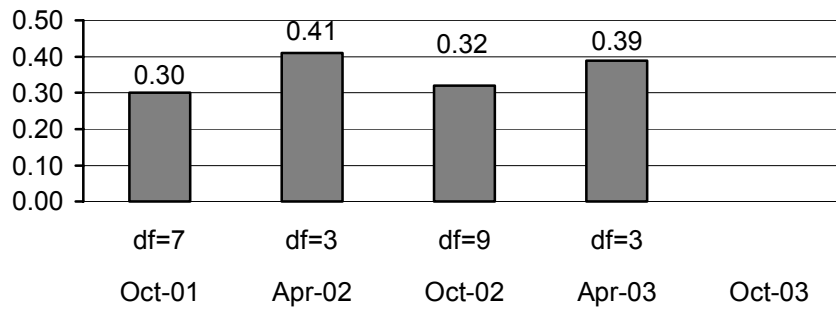
Figure 4 (attached) shows the current industry EWMA severity, EWMA precision, and cusum charts for Top Ring Weight Loss (TRWL). TRWL is currently in control and on target. For a history of TRWL industry alarms, refer to the industry alarm log shown in Table 7.

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.

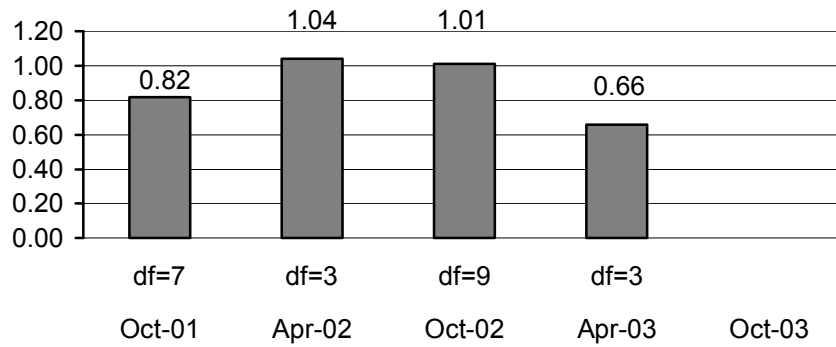
Crosshead Weight Loss Pooled Precision



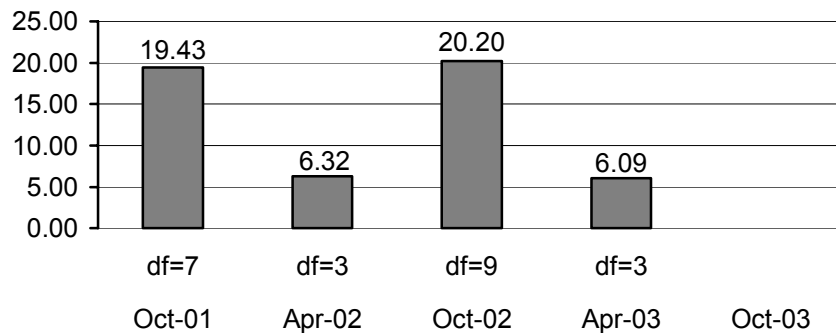
Average Sludge Rating Pooled Precision



Filter Plugging Delta P Pooled Precision



Top Ring Weight Loss Pooled Precision



The precision for CWL and ASR are within historical levels. Compared to the previous period, FPD and TRWL have shown significant improvement in precision. However, this may be a function of low test activity and 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:

The current reference oil test targets are shown below:

Oils	N	Parameter	Mean (cSt)	S
830-2	10	CWL	12.2	3.2
		ASR	8.40	0.36
		FPD	11.9121	1.0554
		TRWL	133.9	19.7

Once 20 tests have been completed on oil 830-2, the TMC will provide a target update for surveillance panel consideration. To date, 11 tests have been completed on oil 830-2.

Information Letters:

No information letters were issued this period.

TMC Laboratory Visits:

Three TMC laboratory visits were conducted this ASTM period. A total of 16 deficiencies were noted and are summarized in the following table.

Deficiency	Number of Labs
Brass fittings used in auxiliary oil system	1
Auxiliary oil system return connection improperly located	1
Temperature calibration tolerance exceeds 0.5°C specification	2
Fuel flow calibration tolerance exceeds 0.2% specification	2
Instrumentation calibration range does not bracket operating range	2
Fuel temperature thermocouple improperly located	1
Controlled shutdowns not conducted according to procedure	1
Incorrect oil addition amount, due to conversion error	1
Incorrect Severity Adjustment applied	1
Precision alarm notification and documentation requirements not followed	1
Improper exhaust temperature thermocouple insertion depth	1
Improper intake air thermocouple insertion depth	1
Oil sump level sight glasses being used***	1

*** The procedure does not address the use of sight glasses. The surveillance panel needs to determine if this practice is acceptable.

In the course of the TMC laboratory visits, several issues with the M11EGR test procedure were uncovered. These are summarized, along with possible resolutions, in the table below. The surveillance panel should address these issues at the next meeting.

Issue	Possible Resolution
Procedure shows oil hx cooled by engine oil	Correct to show oil hx cooled by process water
Intake and Exhaust barrel sizes	Correct to show proper size
Crankcase aspiration line size	Correct to show size as a minimum
Unspecified fuel rail return	To be determined
Lack of pressure calibration specs	To be determined

Quality Index:

Quality Index has not yet been implemented for the M11EGR. The M11EGR O&H group has reviewed industry capability for the M11EGR control parameters. Based on this review, the TMC has submitted a Quality Index proposal to the surveillance panel for consideration. To date, the surveillance panel has not taken action on this proposal.

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/mem03-030.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-04-2003.pdf>

Distribution: Email

Table 1
Summary of Reasons for Rejected Tests

	No. of Tests
No rejected tests	-

Table 2
Summary of Reasons for Invalid Tests

	No. of Tests
Low soot, Stage B CO ₂ out of spec	1

Table 3
Summary of Reasons for Aborted Tests

	No. of Tests
No aborted tests	-

FIGURE 1 M11EGR INDUSTRY OPERATIONALLY VALID DATA

CROSSHEAD WEIGHT LOSS

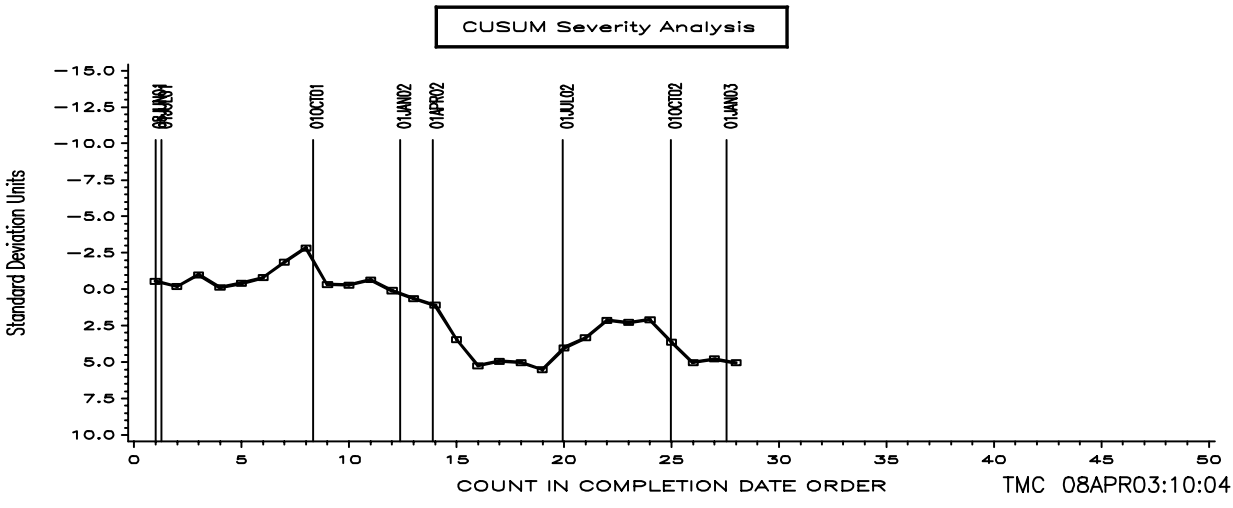
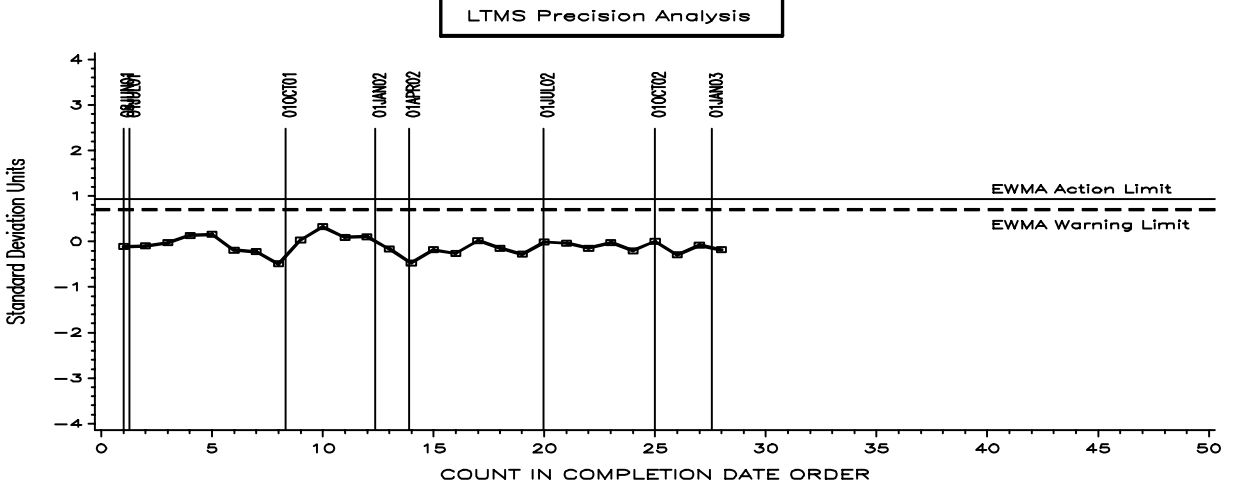
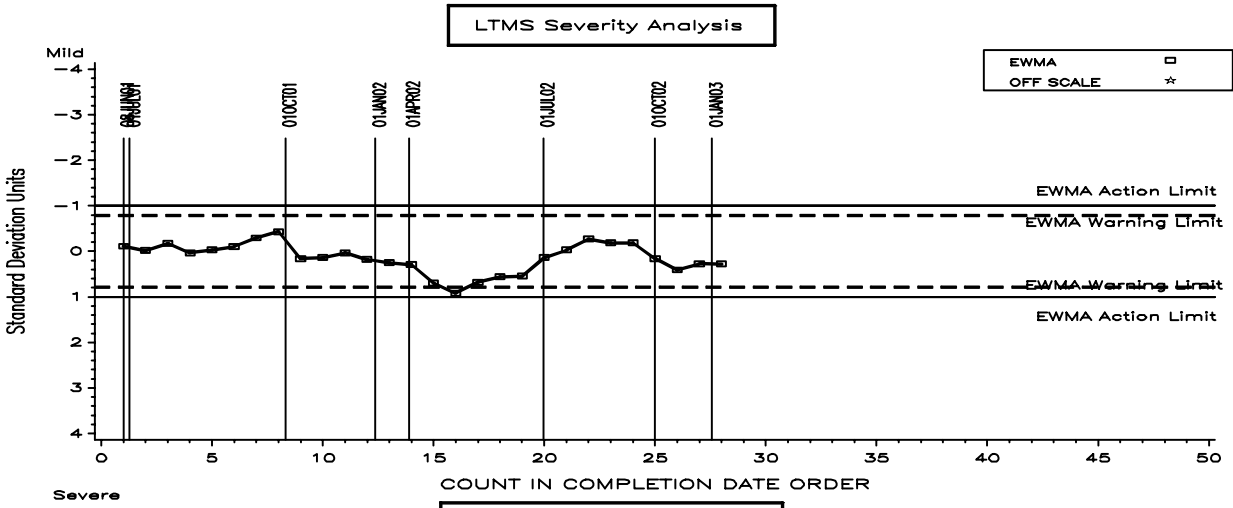


TABLE 4

CROSSHEAD WEIGHT LOSS INDUSTRY ALARM LOG

April 20, 2002 to May 2, 2002 (Severity Warning, severe direction)

A one-test excursion occurs. No industry related problem.

Updated 4/8/03

FIGURE 2
M11EGR INDUSTRY OPERATIONALLY VALID DATA

AVG SLUDGE RATING

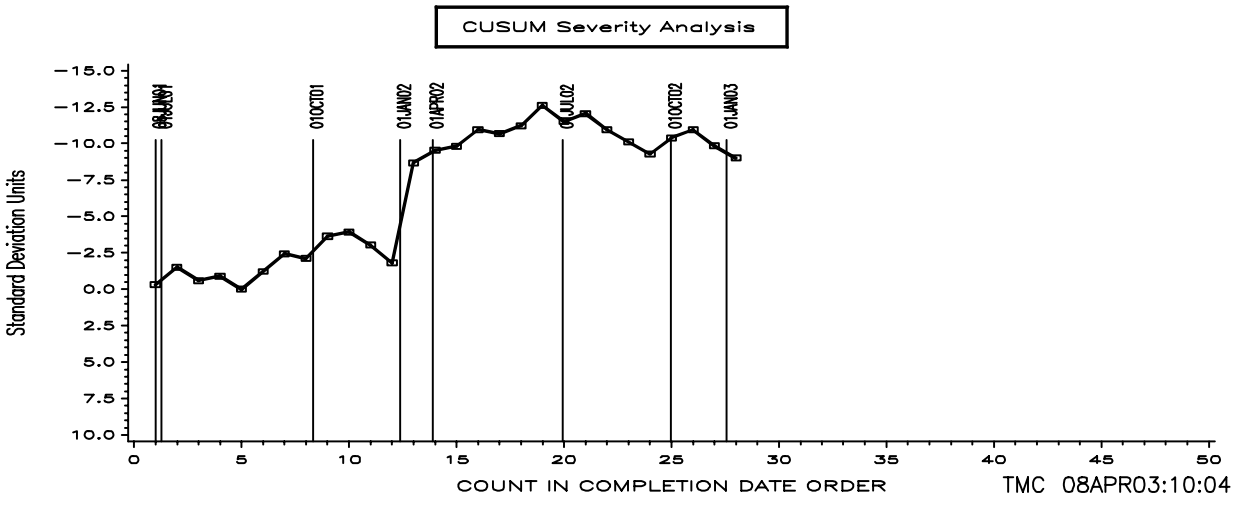
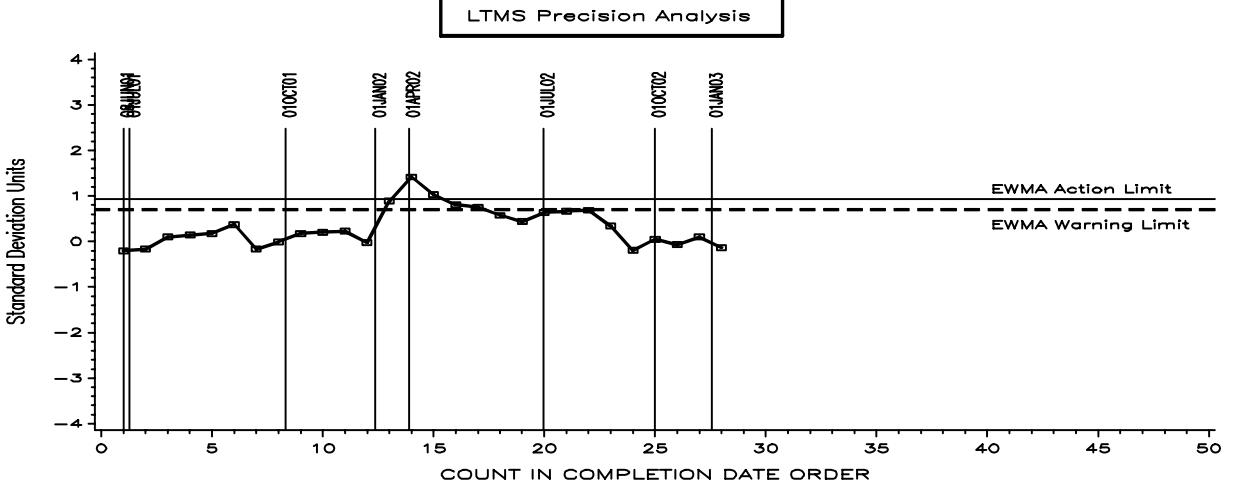
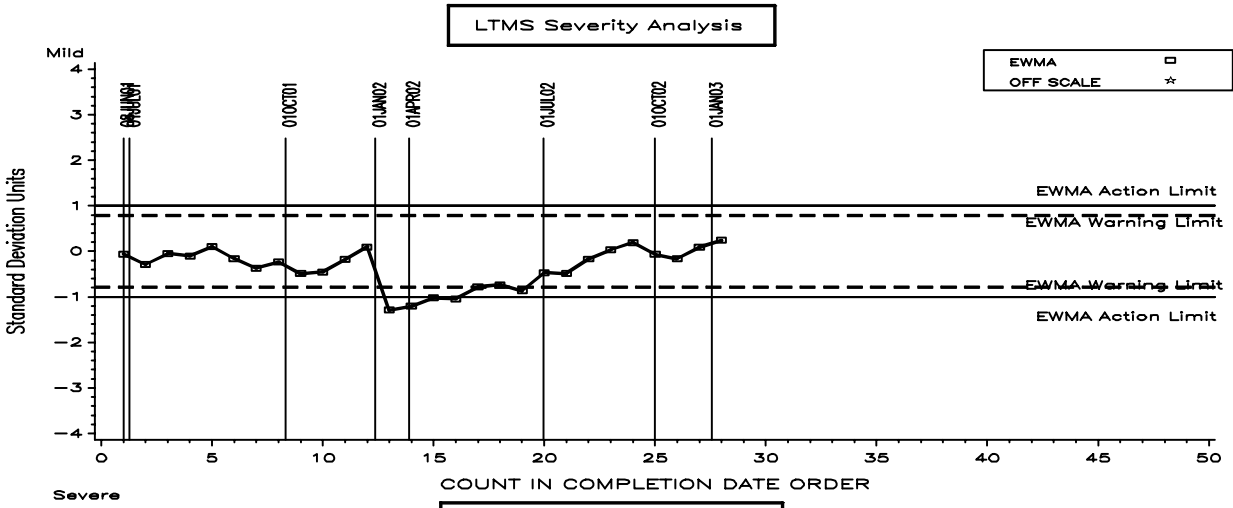


TABLE 5

AVERAGE SLUDGE RATING INDUSTRY ALARM LOG

February 3, 2002 to June 16, 2002 (Severity, severe direction; Precision)

Five consecutive tests exceed severity and precision limits. These alarms appear to have been caused by one extremely severe result on a stand that did not successfully calibrate. The alarms cleared with no action taken.

Updated 4/8/03

FIGURE 3
M11EGR INDUSTRY OPERATIONALLY VALID DATA

FILTER PLUGGING DELTA P

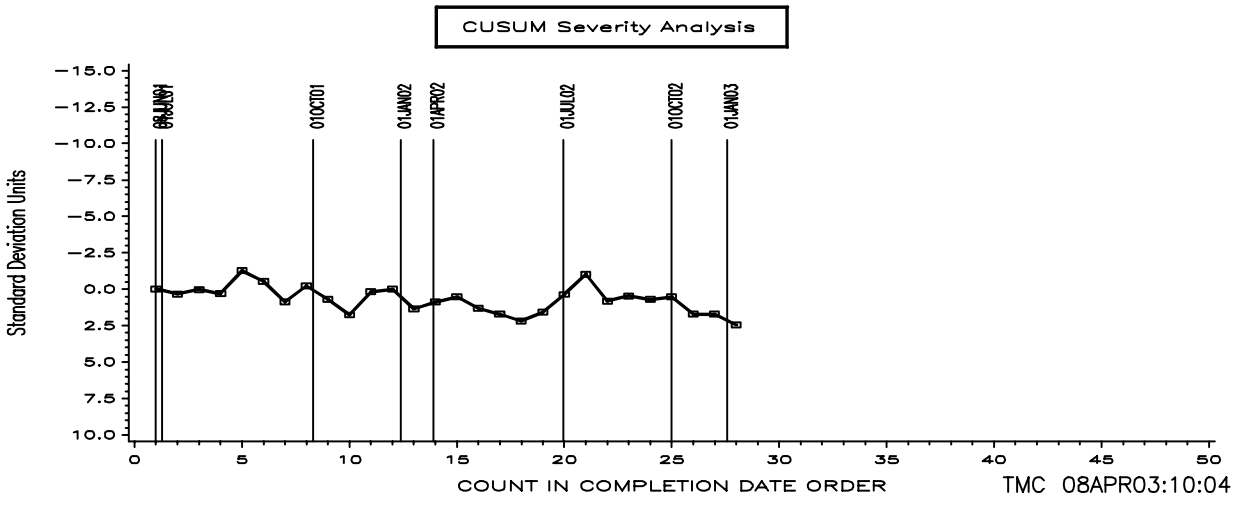
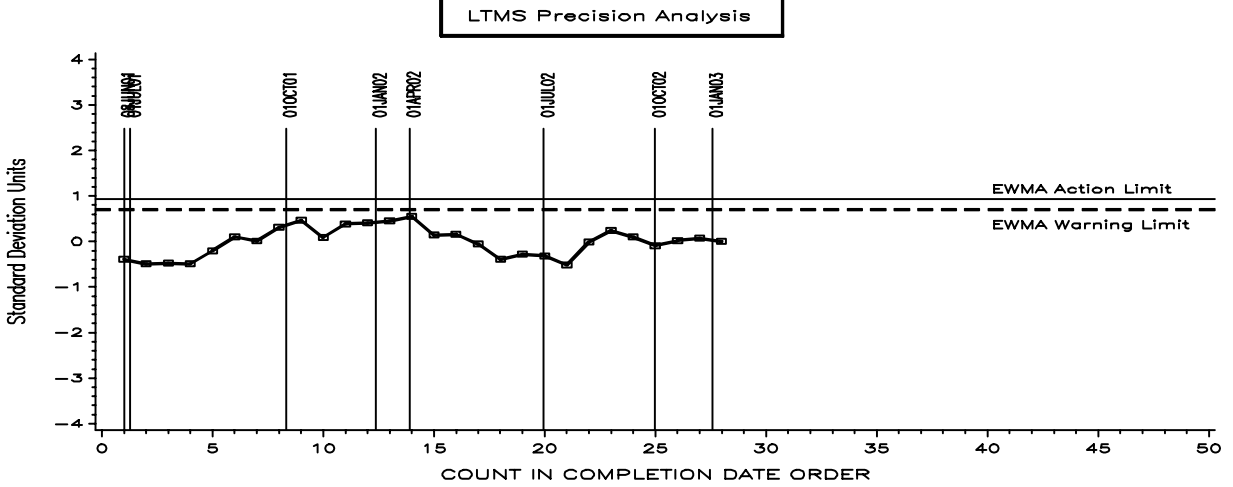
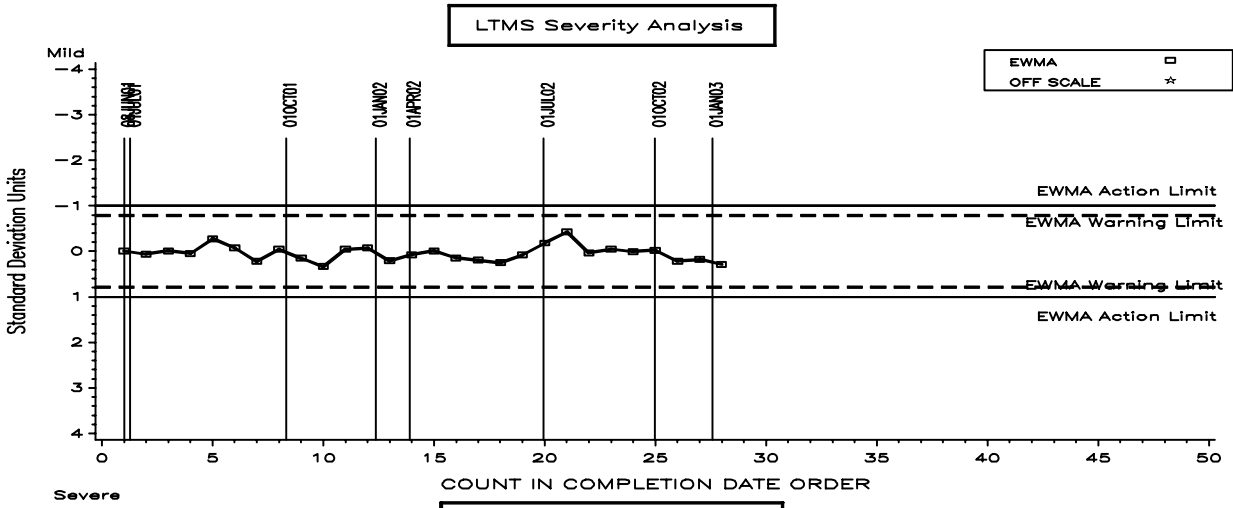


TABLE 6

FILTER PLUGGING DELTA P INDUSTRY ALARM LOG

No alarms have occurred.

Updated 4/8/03

FIGURE 4
M11EGR INDUSTRY OPERATIONALLY VALID DATA

TOP RING WEIGHT LOSS

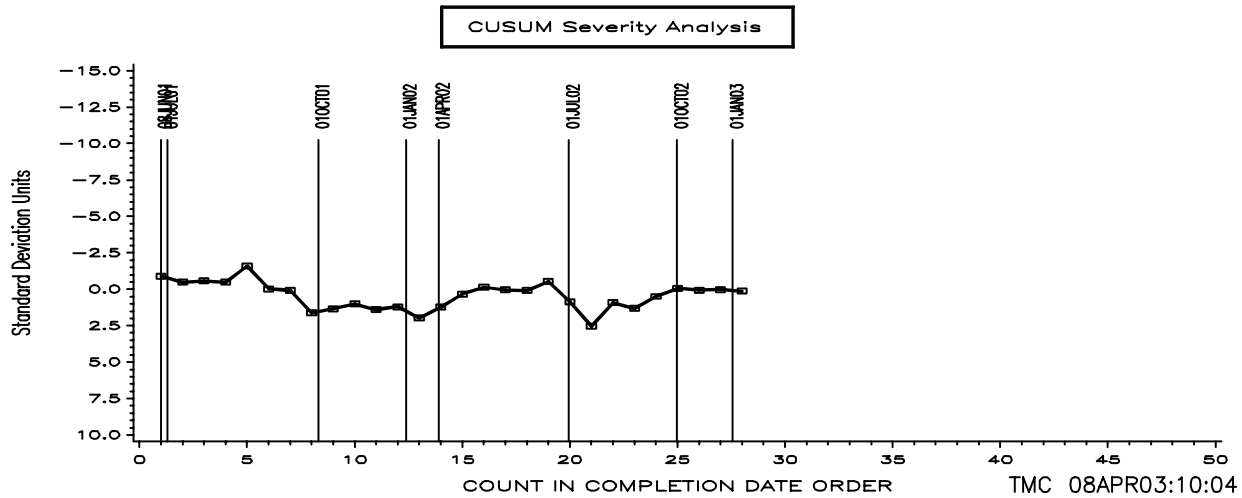
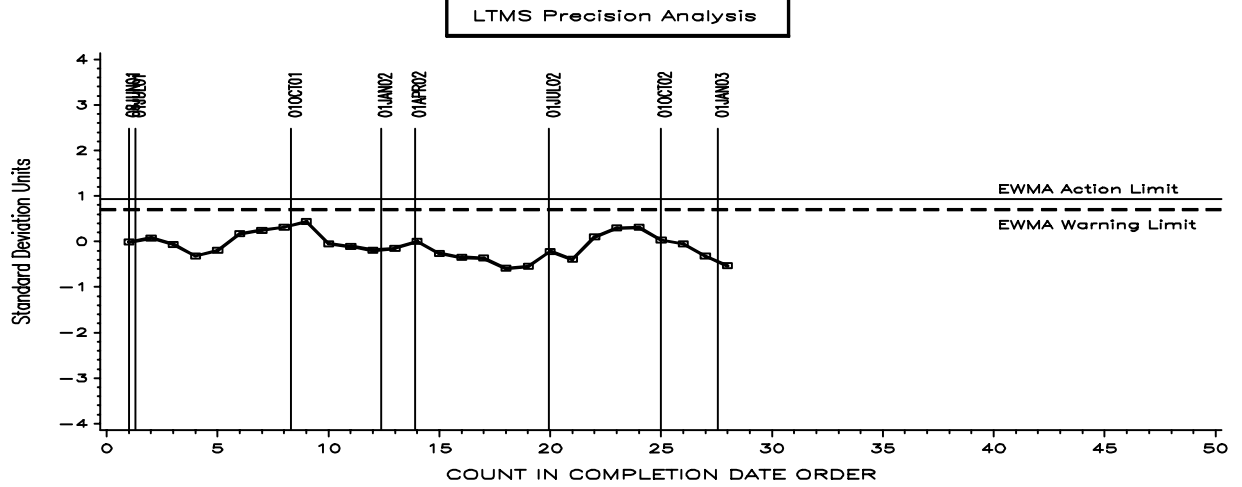
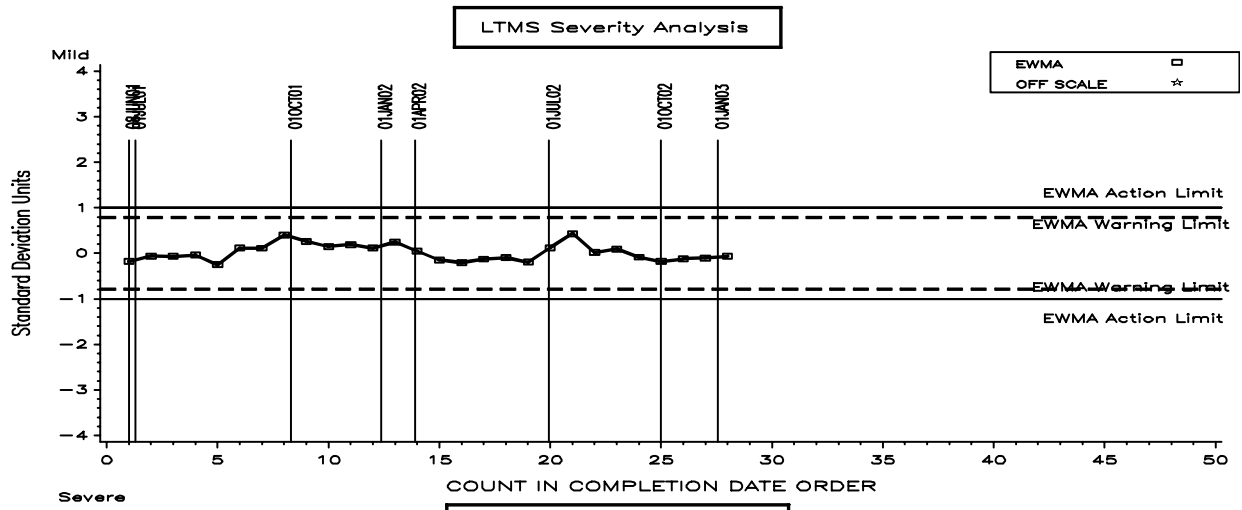


TABLE 7

TOP RING WEIGHT LOSS INDUSTRY ALARM LOG

No alarms have occurred.

Updated 4/8/03

TABLE 8
M11EGR TIMELINE

Date	Info. Letter	Event
20001207		BEGINNING OF PC-9 MATRIX
20010618		INTRODUCTION OF OIL FILTERS WITH HOT MELT BEAD
20010623		COMPLETION OF PC-9 MATRIX
20010820		LTMS IMPLEMENTED
20020203		REFERENCE OIL 830-1 INTRODUCED
20020221	02-01	BEADED OIL FILTER CORRECTION FACTOR OF +3.15 (TRANSFORMED UNITS) IMPLEMENTED FOR OIL FILTER PLUGGING
20020308		PROCEDURE DRAFT 5 ISSUED
20020616		REFERENCE OIL 830-2 INTRODUCED
20020830		TEST TARGETS UPDATED FOR OIL 830-2, BASED ON DATA FROM BOTH 830-1 AND 830-2
20030206		TEN TEST TARGETS FOR OIL 830-2