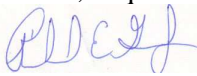




# Test Monitoring Center

Carnegie Mellon University  
6555 Penn Avenue, Pittsburgh, PA 15206, USA

<http://astmtmc.cmu.edu>  
412-365-1000

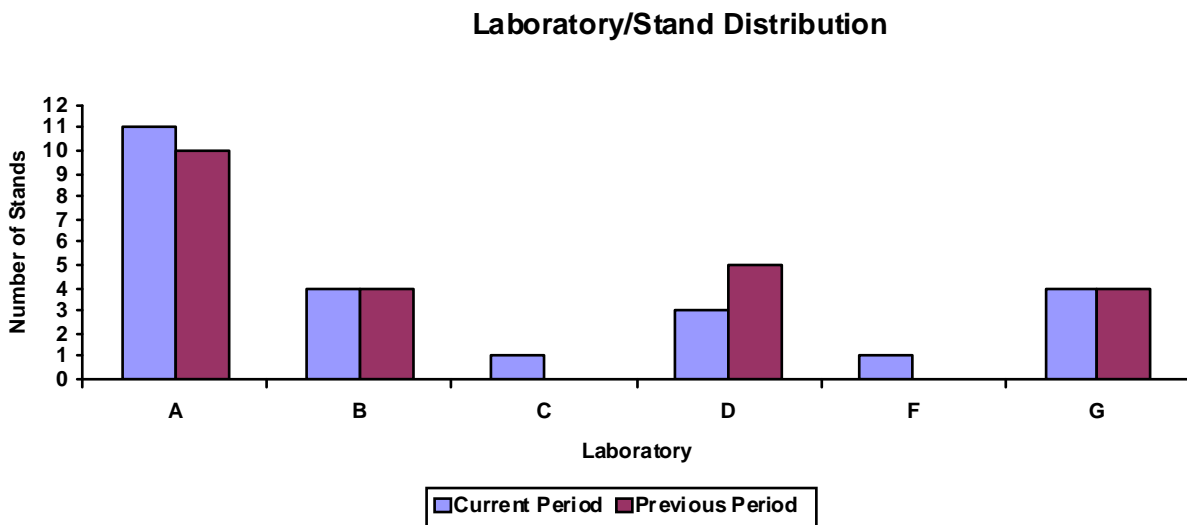
Memorandum: 11-009  
 Date: May 11, 2011  
 To: Charlie Leverett, Chairman, Sequence VI Surveillance Panel  
 From: Richard E. Grundza   
 Subject: Sequence VID Semiannual Report: October 1, 2010 through March 31, 2011

The following is a summary of Sequence VID reference tests that were reported to the Test Monitoring Center during the period October 1, 2010 through March 31, 2011.

### Lab/Stand Distribution

	Reporting Data	Calibrated as of March 31, 2011
Number of Laboratories:	6	4
Number of Test Stand/Engines:	24	10

The following chart shows the laboratory/stand distribution:

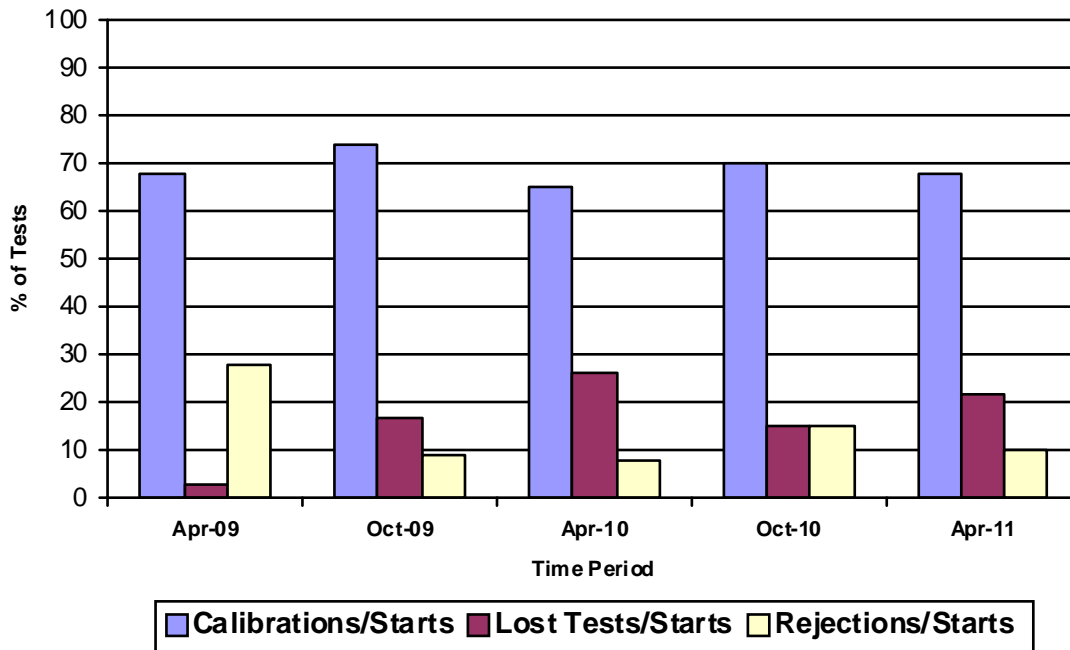


The following summarizes the status of the reference oil tests reported to the TMC:

Calibration Start Outcomes	TMC Validity Codes	No. of Tests
Operationally and Statistically Acceptable	AC	34
Operationally Valid Donated Test	AG	1
Operationally Valid, Statistically Unacceptable	OC	5
Operationally Invalid, Laboratory Judgment	LC	3
Operationally Invalid, Laboratory and TMC Judgment	RC	2
Aborted Calibration Attempt	XC	1
Engine Abandoned	MC	3
Total		49

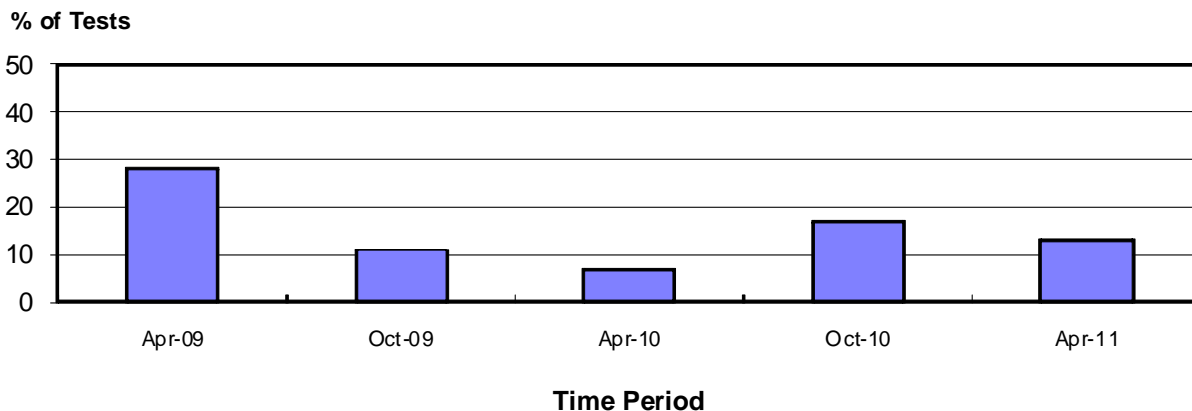
Calibrations per start, lost tests per start and rejection per start rates are summarized below:

### Calibration Attempt Summary



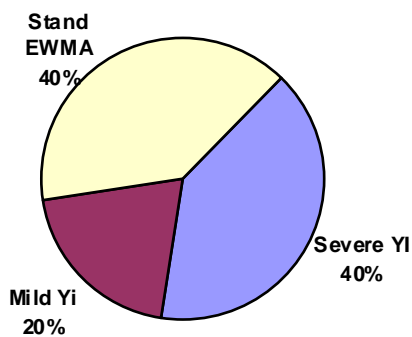
The calibration per start rate is essentially unchanged since last period. The lost test per start rate has increased since last period. The rejected test per start rate has decreased this period.

### Rejected Test Rate for Operationally Valid Tests

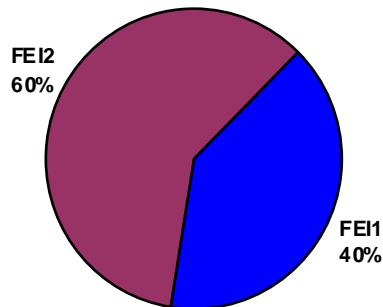


Five tests failed acceptance criteria. The following charts summarize the reasons and breakdown by parameter for the failed tests:

**Distribution of LTMS Stand Alarms**



**Distribution of Stand Alarms by Parameter**



Of the five tests, one failed for FEI1 in the severe direction, one test failed for FEI1 in the mild direction and one failed for FEI2 in the severe direction. The remaining two tests failed for FEI2 EWMA precision alarms.

There were no LTMS Deviations written this period. There has been one deviation written to date.

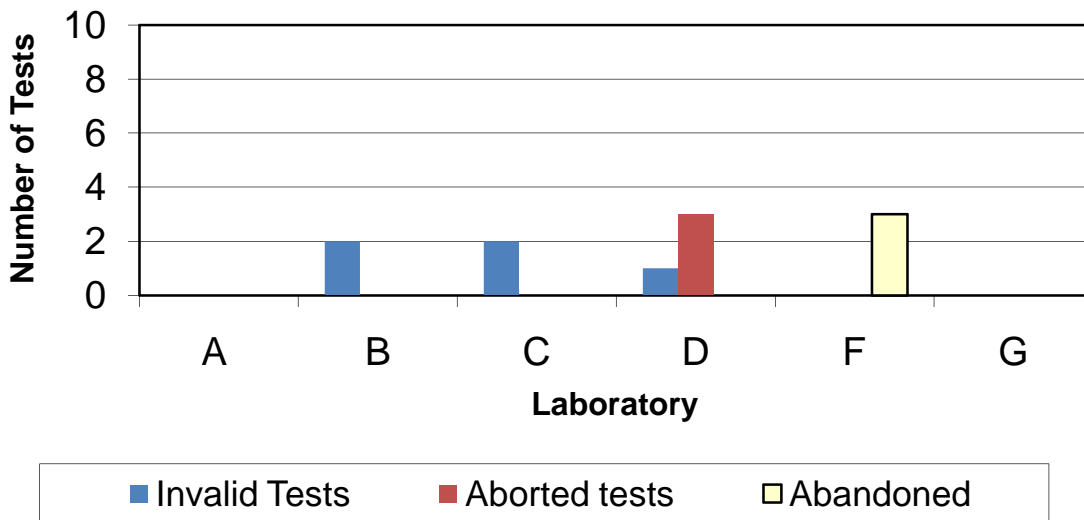
Lost Test Summary

Eleven tests were lost this period. The reasons for the lost tests are tabulated below:

Reasons for Lost Test(s)	Number
Exhaust Leak, Believed to Cause Erratic AFR Readings	1
Coolant Temperature Control	1
Downtime >18 hours	1
Fuel Temperature Control, BL After Stage 2 Oil Temp. Out of Spec.	1
Speed Control	2
Oil Contamination	1
Engine Mechanical Failure	1
Abandon Engine	3

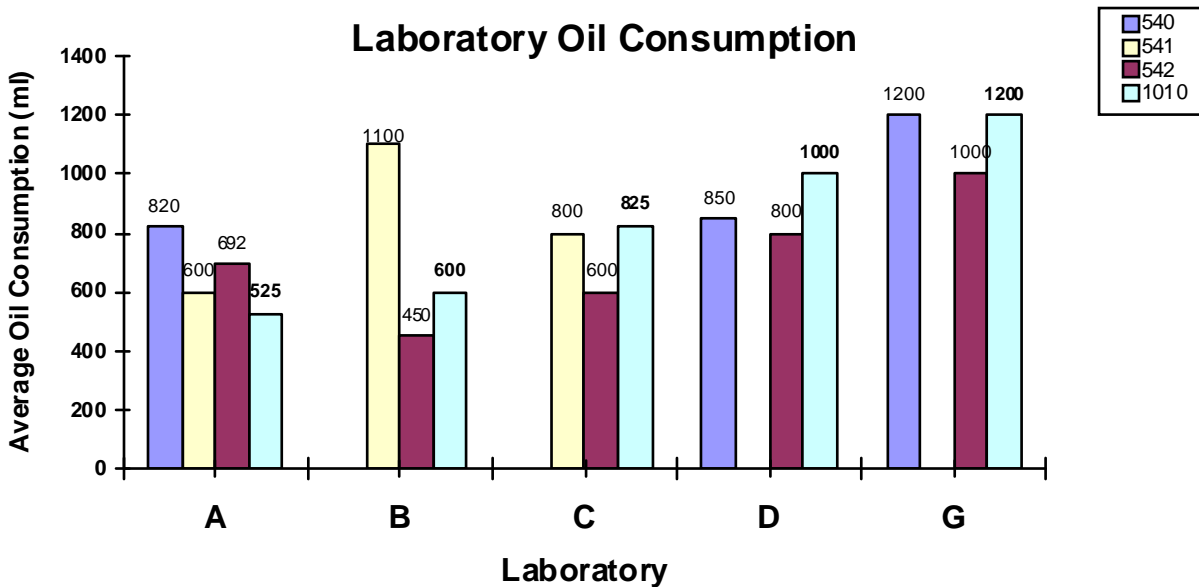
Aborts and operationally invalid tests, reported by laboratory, are summarized in the following chart:

**Lost Test Distribution**



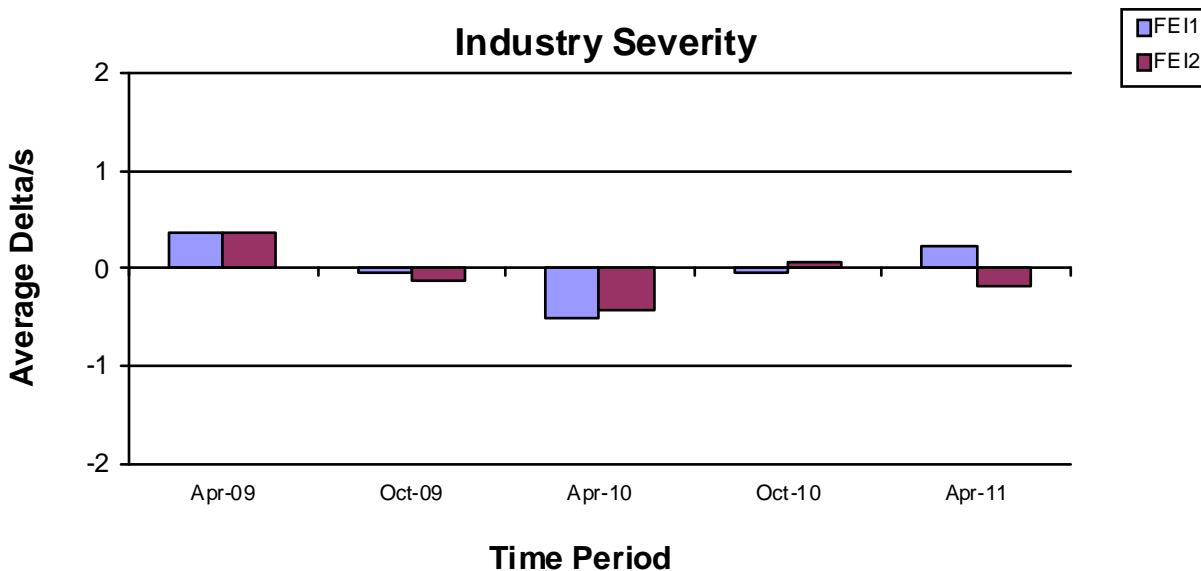
Tests listed as engine abandoned were calibration attempts on engines which did not calibrate and were removed from the LTMS without ever having been calibrated. A total of three results from one lab, representing one engine were removed this period.

The average oil consumption values by oil and laboratory are depicted graphically below

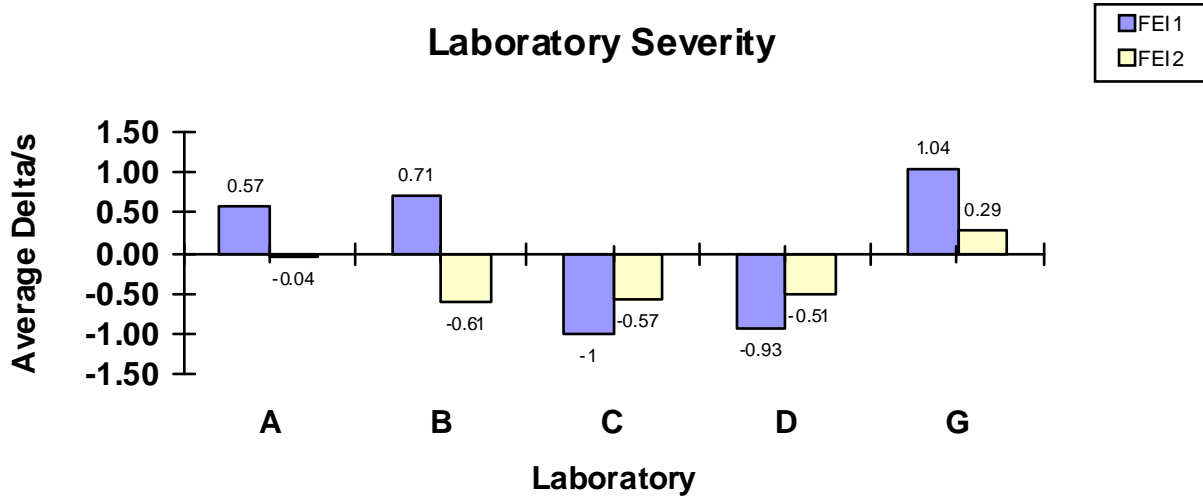


Severity and Precision Analysis

The industry mean  $\Delta/s$  for FEI1 and FEI2, for this report period is 0.24 and -0.19, respectively. FEI1 was slightly mild, while FEI2 was slightly severe this report period.

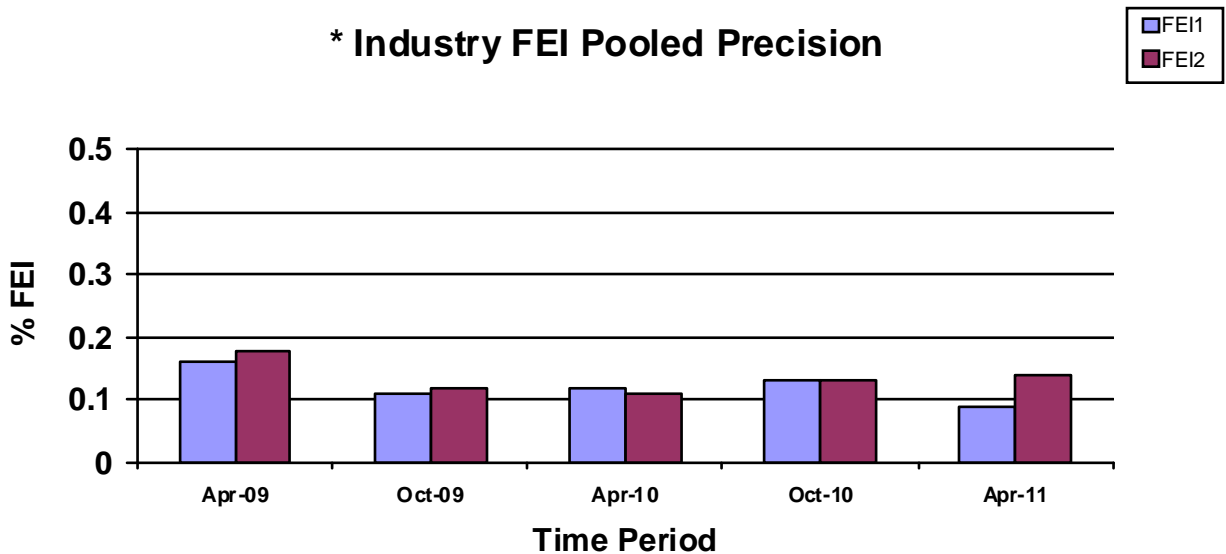


Shown below is a summary of the average FEI  $\Delta/s$  for all laboratories reporting data this report period.



Precision estimates for FEI1 and FEI2 are 0.09 and 0.14. Precision for FEI1 has improved slightly and FEI2 precision has changed little when compared to the previous period.

### \* Industry FEI Pooled Precision



\*Precision estimates are calculated by pooling oil and stand/engine combination.

#### FEI1

Figure 1 shows the industry control charts. With the exception of three mild warning and one mild action alarms, severity was in control during the report period. Precision began the period in control, but sounded a series of alarms midway through the period which clear and with the chart ending the period in warning alarm. The summation delta/s plot, with an average delta/s of 0.24, shows industry trending mild for the period.

*FEI2*

Figure 2 shows the industry control charts. With the exception of three severe warning alarms, severity was in control for the period. The precision chart began the period action and warning alarm and ended the period with a warning and action alarm, but was in control for the remainder of the period. The summation delta/s plot, with an average delta/s of -0.19, shows industry trending severe for the period.

Lab Visits

No lab visits were conducted this period.

Information Letters

No information letters were issued this period.

Reference Oils

<b>Oil</b>	<b>Original Blend, in gallons</b>	<b>TMC Inventory, in gallons</b>	<b>Quantity Used past six months</b>	<b>TMC Inventory, in tests</b>	<b>Laboratory Inventory, in tests</b>	<b>Estimated life</b>
540	1100	514	26	102	11	3+ years
541	550	66	75	13	8	1 year
541-1	550	550	0	0	0	3+ years
542	1100	476	115	95	9	2+ years
1010	1100	840	260	168	10	3+ years <sup>1</sup>

<sup>1</sup> Multiple test area reference oil; total TMC inventory shown.

One donated test was reported during this period. This test was run to generate targets for reference oil 1010. Initial targets for reference oil 1010 were effective December 1, 2010 (see Figure 3). A reblend of oil 541 has been obtained, designated 541-1 and is awaiting analytical results before being shipped to laboratories for introduction.

REG/reg

Attachments

c: F. M. Farber, TMC  
 J. A. Clark, TMC  
 Sequence VID Surveillance Panel  
<ftp://astmtmc.cmu.edu/docs/gas/sequenceiv/semiannualreports/VID-04-2011.pdf>

Distribution: Electronic Mail

List of Figures

- Figure 1 graphically presents the Industry control charts for FEI1 and also the CUSUM delta/s plot (by count in completion date order) of FEI1 for operationally valid tests.
- Figure 2 graphically presents Industry control charts for FEI2 and also the CUSUM delta/s plot (by count in completion date order) of FEI2 for operationally valid tests.
- Figure 3 is the Sequence VID Timeline, created to track changes in test hardware and operations.



**Figure 1**  
**SEQUENCE VID INDUSTRY OPERATIONALLY VALID DATA**



FEI FINAL RESULT PHASE I

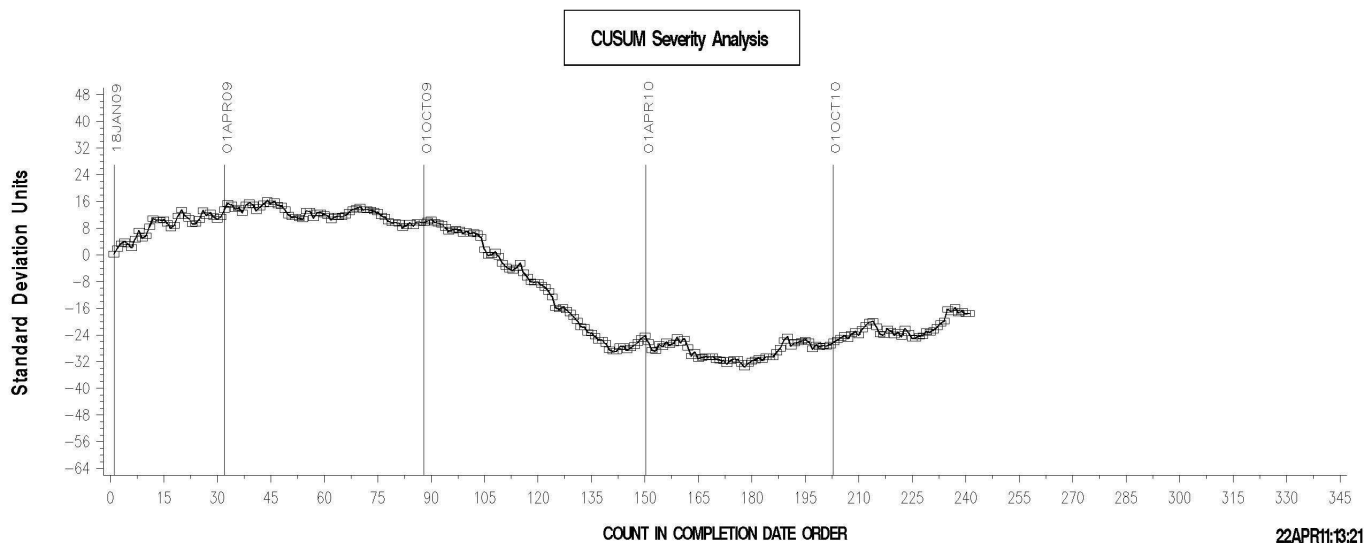
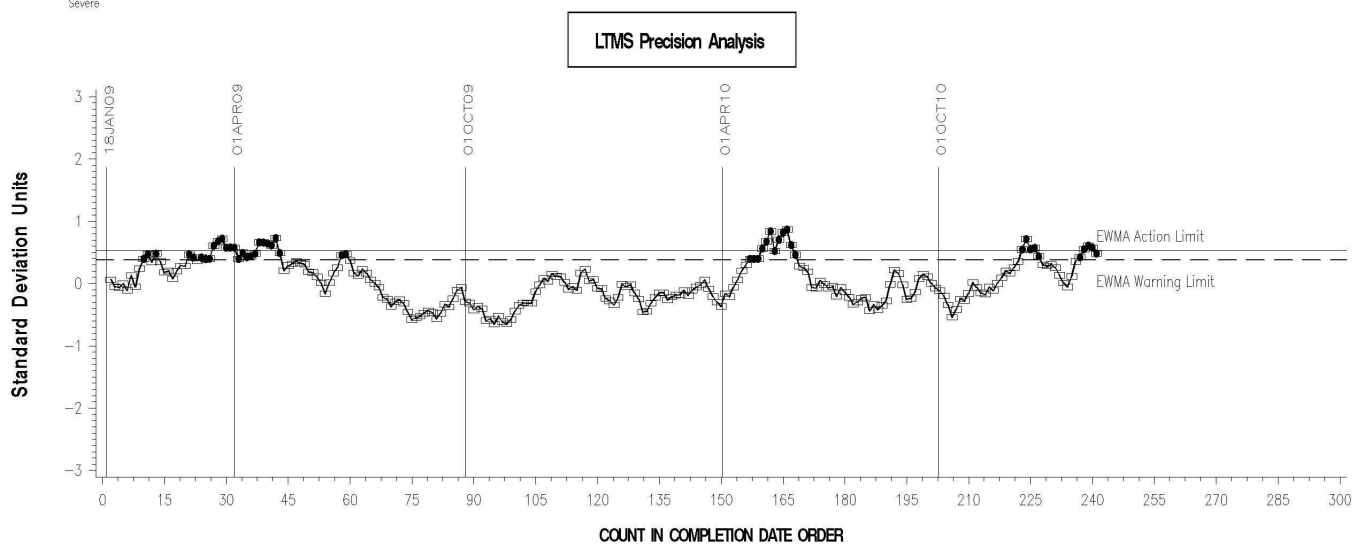
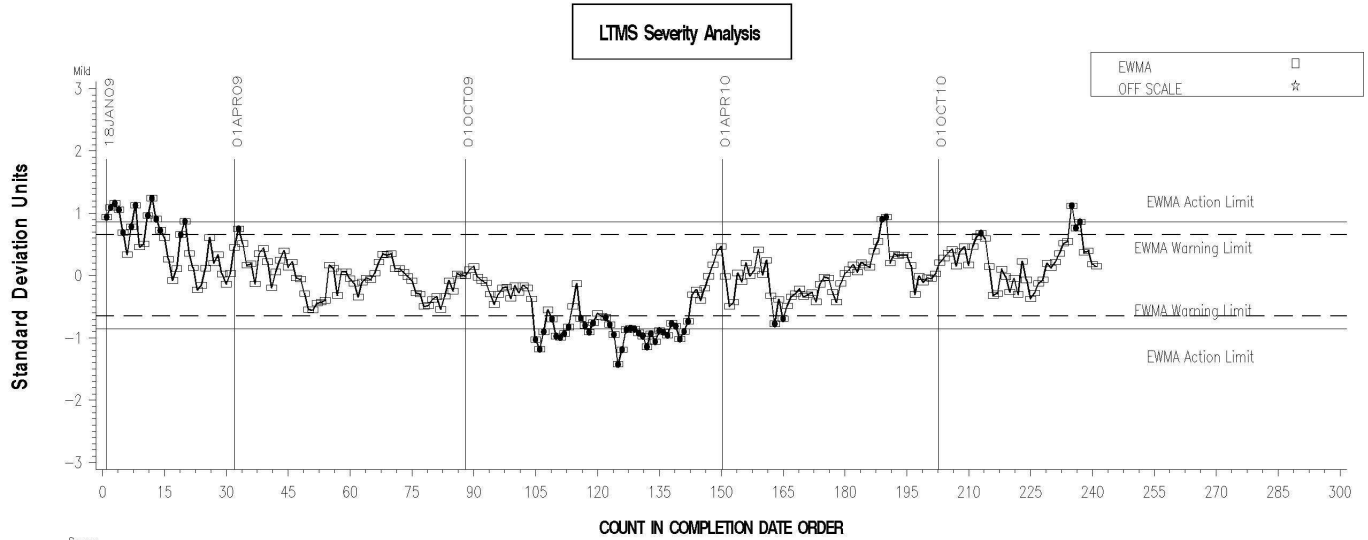


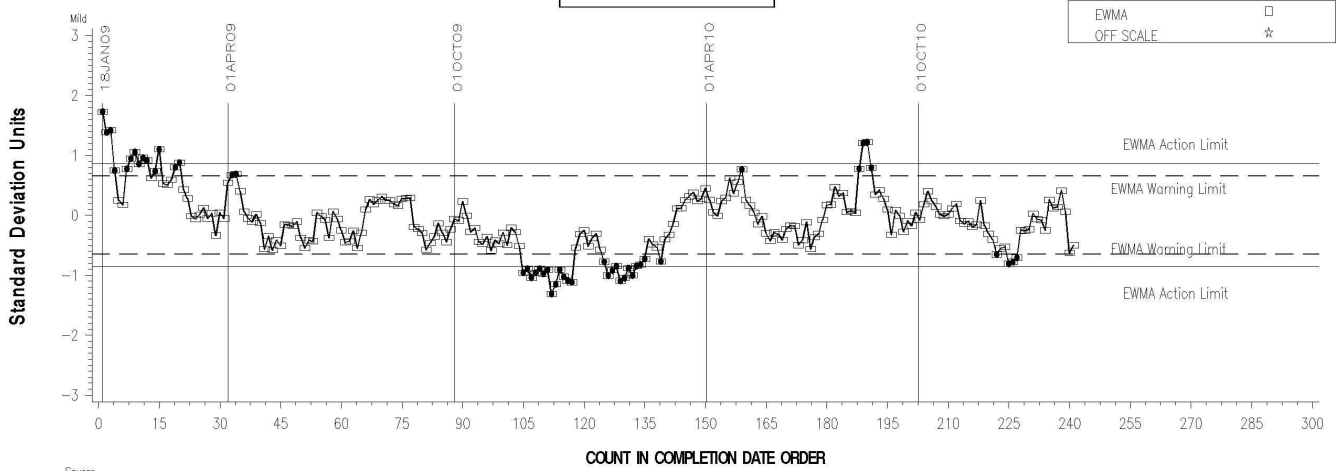
Figure 2

SEQUENCE VID INDUSTRY OPERATIONALLY VALID DATA

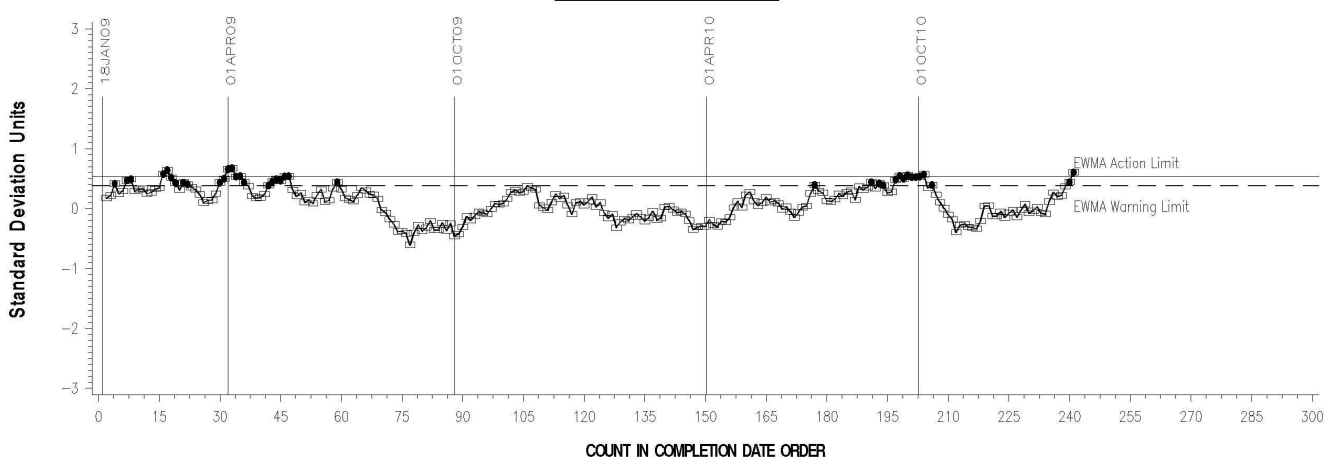
FEI FINAL RESULT PHASE II



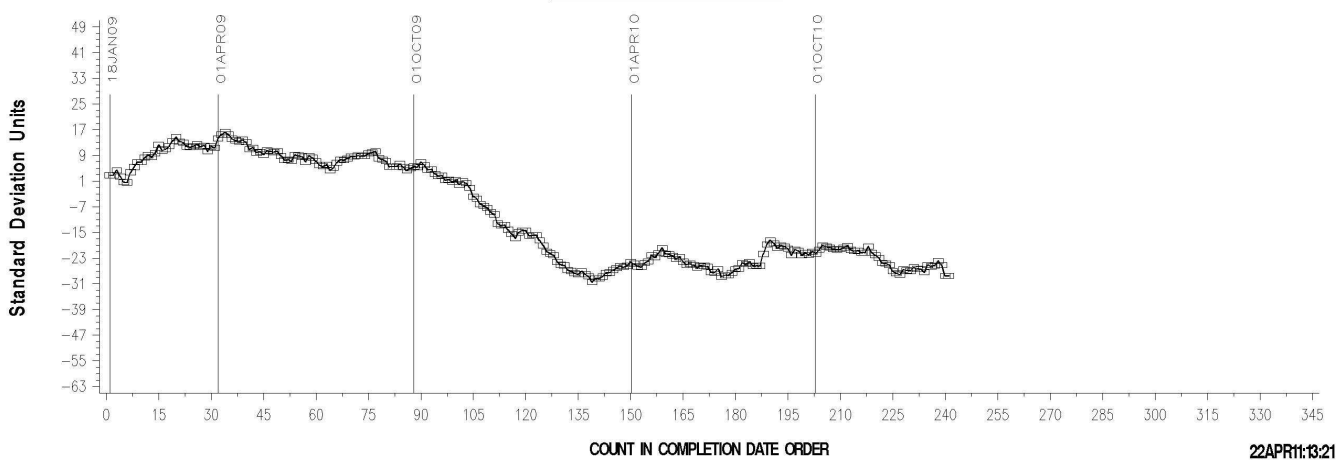
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis



<b>Figure 3 - Sequence VID Timeline</b>		
<b>Date</b>	<b>Topic</b>	<b>Information Letter</b>
20090112	START OF MATRIX TESTING	
20090412	COMPLETION OF MATRIX TESTING	
20090422	SURVEILLANCE PANEL RECOMMENDS TEST ACCEPTABLE TO CLASSIFICATION PANEL, REFERENCE OIL TARGETS ACCEPTED.	
20090513	SEQUENCE VID TEST LTMS ESTABLISHED BY SURVEILLANCE PANEL	
20090527	REVISED STAND ENGINE CALIBRATION REQUIREMENTS	09-1
20090527	ADDED ENGINE HOUR ADJUSTMENT	09-1
20090527	ADDED PRECISION STATEMENT TO TEST PROCEDURE	09-1
20090603	CALIBRATION STATUS GRANTED TO STAND/ENGINE COMBINATIONS	
20091203	UPDATED STANDARD DEVIATIONS FOR CHARTING AND SA'S	
20091214	ADJUSTED CALIBRATION PERIODS	09-2
20091214	CORRECTED/REVISED VALVE IDENTIFICATION	09-2
20091214	ADDRESSED HOW TO DOCUMENT FUEL BATCH WHEN MORE THAN ONE BATCH IS IN THE TANK USED FOR TESTING	09-2
20100119	INCREASE ALLOWABLE DOWNTIME TO 18 HOURS	10-1
20100521	CHANGE IN COOLANT FLOW PRESSURE TRANSDUCER	10-2
20100521	ALLOW USE OF SMALL (<35 L/s) FANS TO COOL KNOCK AND O <sub>2</sub> SENSORS	10-2
20100521	ADD MANIFOLD ABSOLUTE PRESSURE (MAP) to BREAK IN TRACES	10-2
20100521	UPDATED LOAD CELL SUPPLIER INFO In APPENDIX X1	10-2
20100720	ADJUSTED CALIBRATION PERIODS	10-3
20100720	CORRECTED/REVISED VALVE IDENTIFICATION FOR SOLENOID VALVES IN OIL SYSTEM	10-3
20100818	REVISED LOCATION OF FUEL TO FUEL RAIL THERMOCOUPLE	10-4
20100818	ADDED TEMPERATURE DRIFT SPEC FOR LOAD CELL POWER SUPPLY	10-4
20100818	CORRECTED AMOUNT OF BL OIL USED FOR A TYPICAL TEST	10-4
20101201	INITIAL TARGETS FOR REFERENCE OIL 1010 (N=5)	