



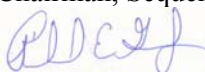
## Test Monitoring Center

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

MEMORANDUM: 07-060

DATE: October 15, 2007

TO: Charlie Leverett, Chairman, Sequence VIB Surveillance Panel

FROM: Richard Grundza 

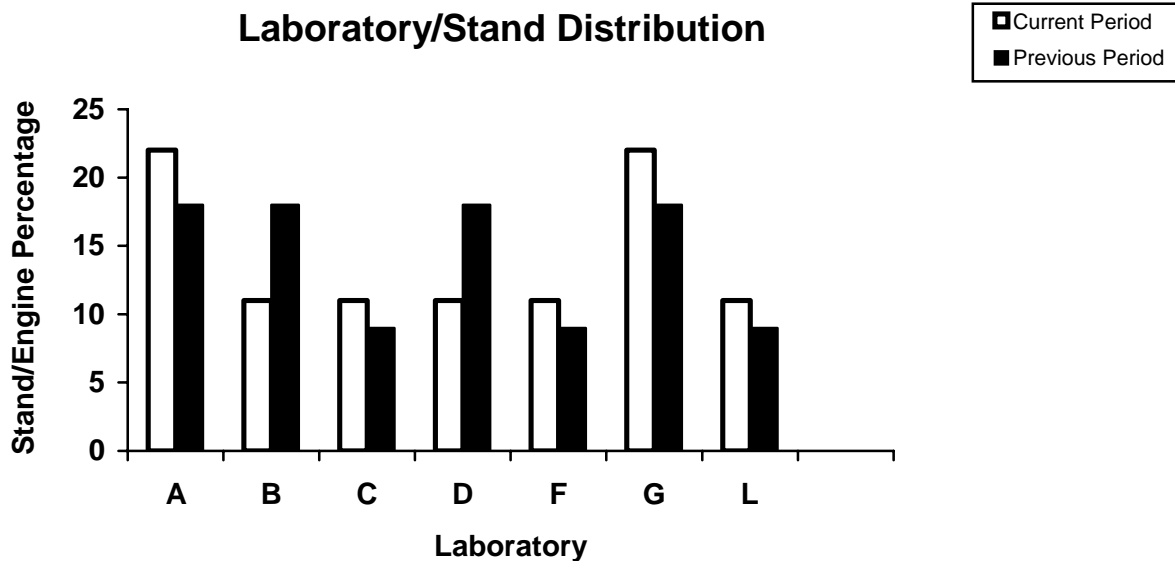
SUBJECT: Sequence VIB Test Results from April 1, 2007 through September 30, 2007

The following is a summary of Sequence VIB reference tests that were reported to the Test Monitoring Center during the period April 1, 2006 through September 30, 2007.

### Lab and Stand Summary

	Reported Data During Period	Calibrated as of 09/30/2007
Laboratories	7	7
Stand/Engine Combinations	19	9

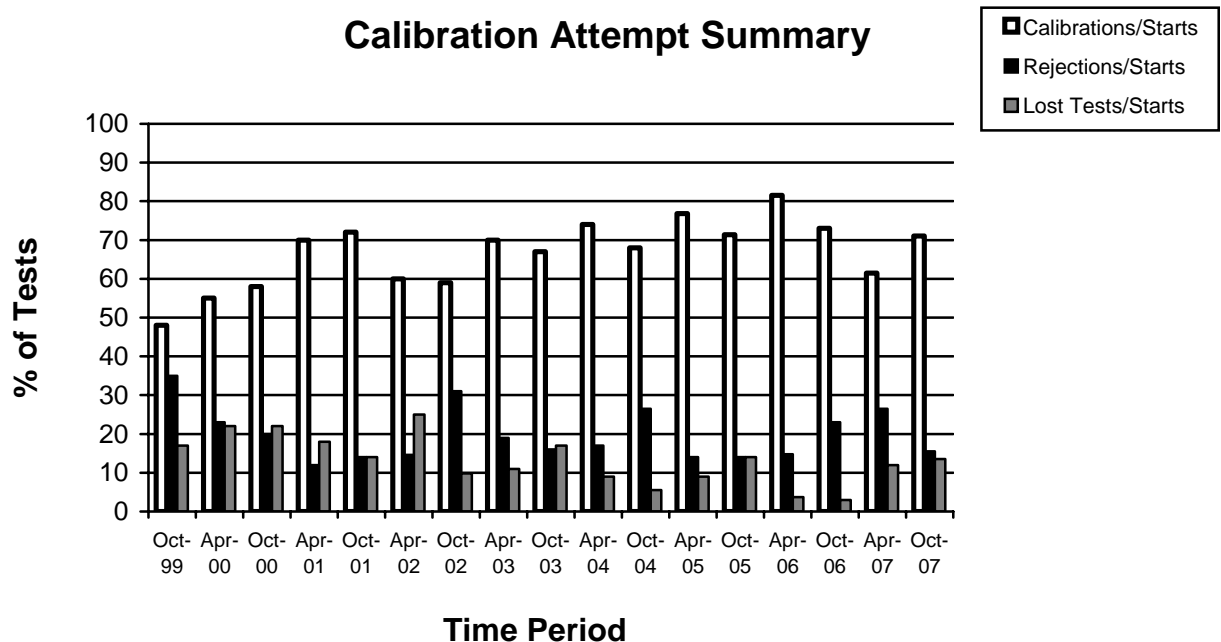
The following chart shows the laboratory stand/engine distribution for data reported during this report period:



The following summarizes the status of the reference oil tests reported to the TMC this report period.

	TMC Validity Codes	No. of Tests
Operationally and Statistically Acceptable	AC	32
Failed Acceptance Criteria	OC	4
Failed Acceptance Criteria (Not in Charts)	OC	2
Aborted	XC	1
Operationally Invalid (laboratory judgment)	LC	5
Operationally Invalid (laboratory and TMC judgment)	RC	1
Total		45

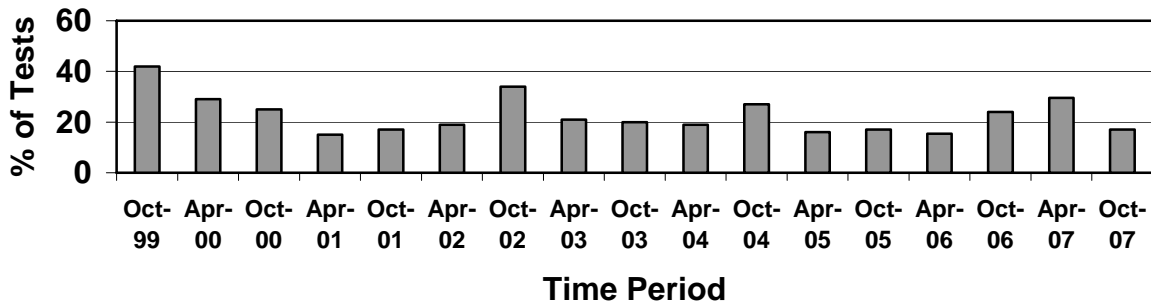
Attempted calibration tests are depicted graphically below by report period:



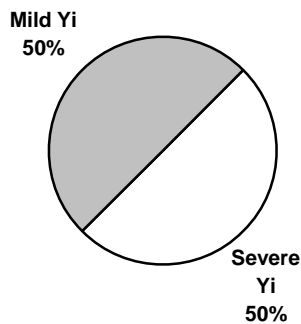
The calibration per start rate has increased with respect to the previous period. The rejected per start rate has decreased with respect to the previous period. The lost test per start rate has increased when compared to the previous period. Rates for all parameters compare well with previous periods.

The percentage of tests failing the acceptance criteria for operationally valid tests has increased when compared to the previous period. The percentages are depicted graphically below.

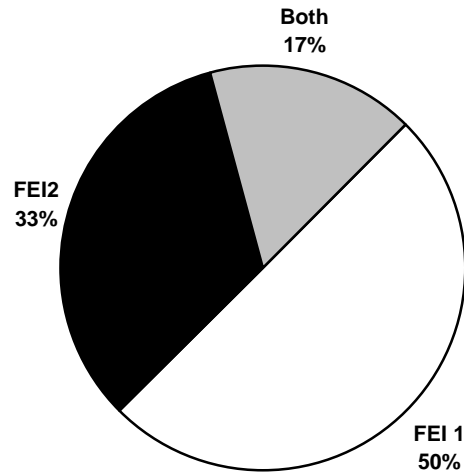
### Rejected Operationally Valid Tests



### Distribution of LTMS Stand Alarms

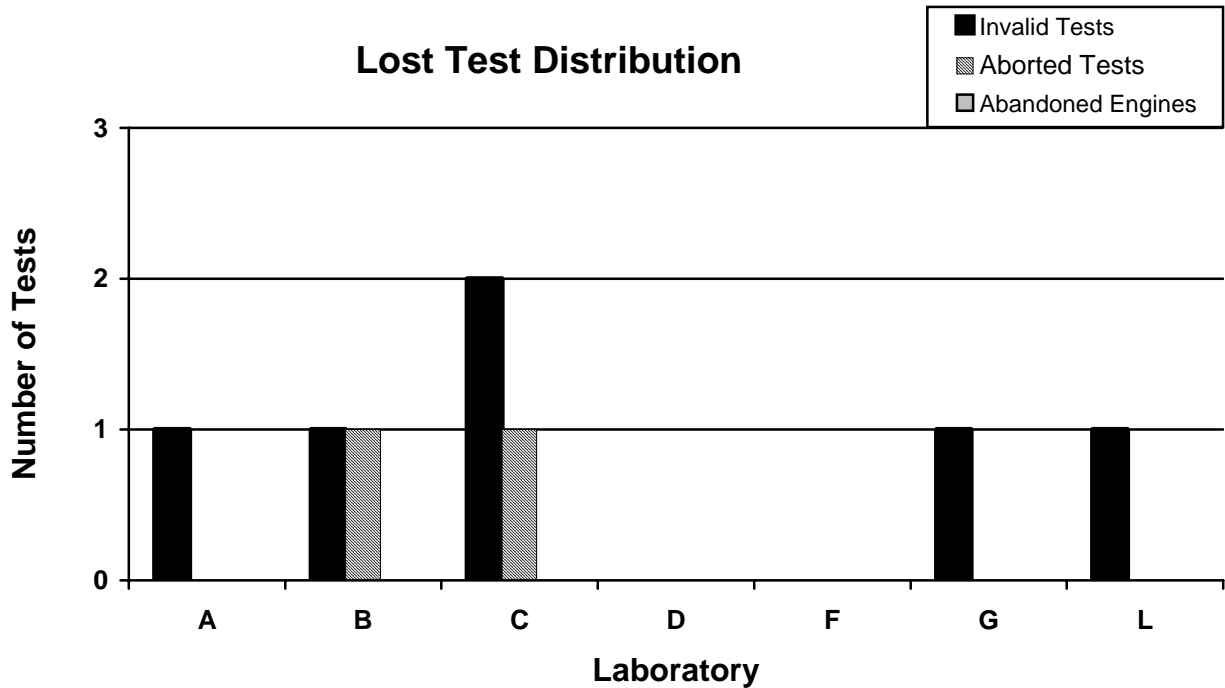


### Distribution of Stand Alarms by Parameter

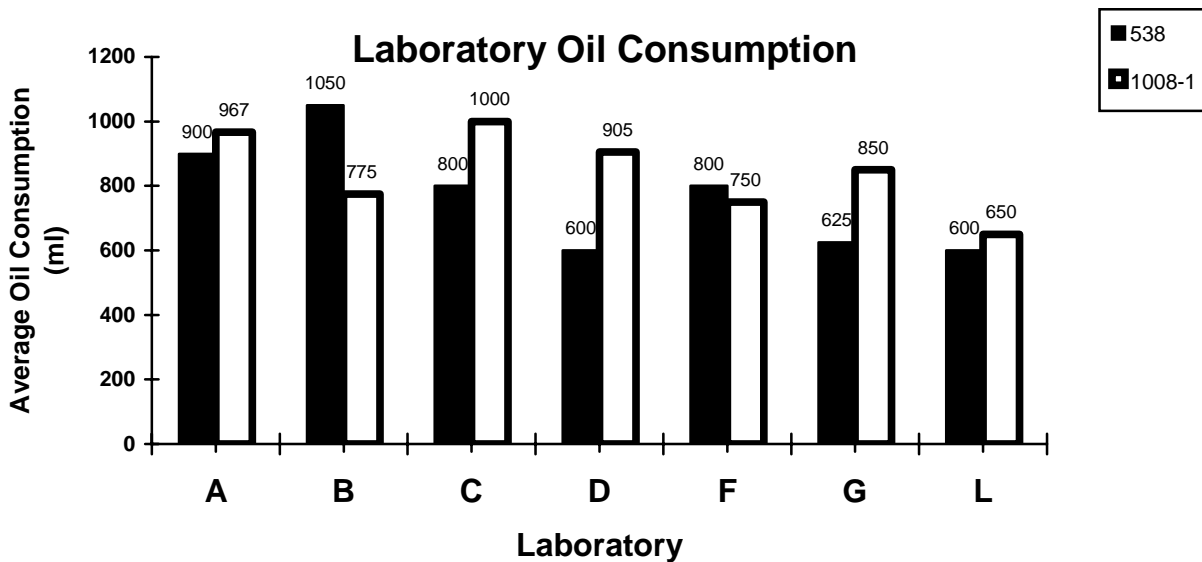


There were three tests rejected for FEI Shewhart (Yi) severe and three tests rejected for FEI Shewhart (Yi) mild. Two of the tests run for calibration that failed for Shewhart severe were not charted. One of the two non-charted tests failed for FEI1 severe, while the other failed for both FEI1 and FEI2 severe. The not-charted failing tests were the first tests on a new stand/engine that failed Shewhart limits and were not charted so as not to unduly influence the severity adjustment calculation. There has not been an LTMS deviation written for Sequence VIB to date.

The laboratory distribution of lost tests is shown below. A detailed list of reasons for tests declared operationally invalid, aborted or lost due to abandoned engines is shown in Table 2 (See Attachment).

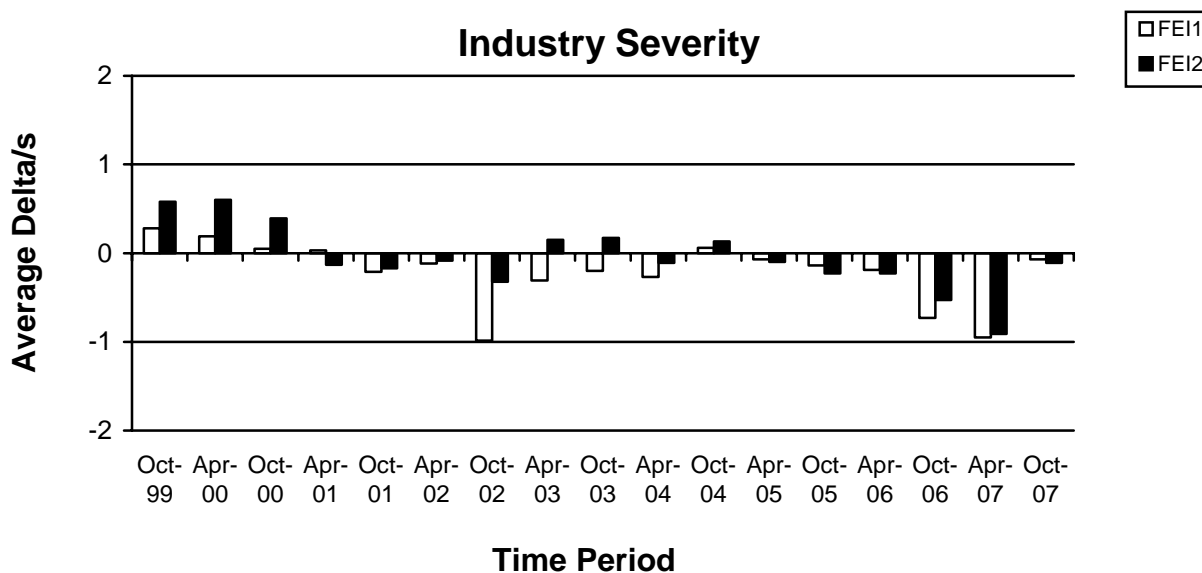


The average oil consumption by oil and laboratory are depicted graphically below

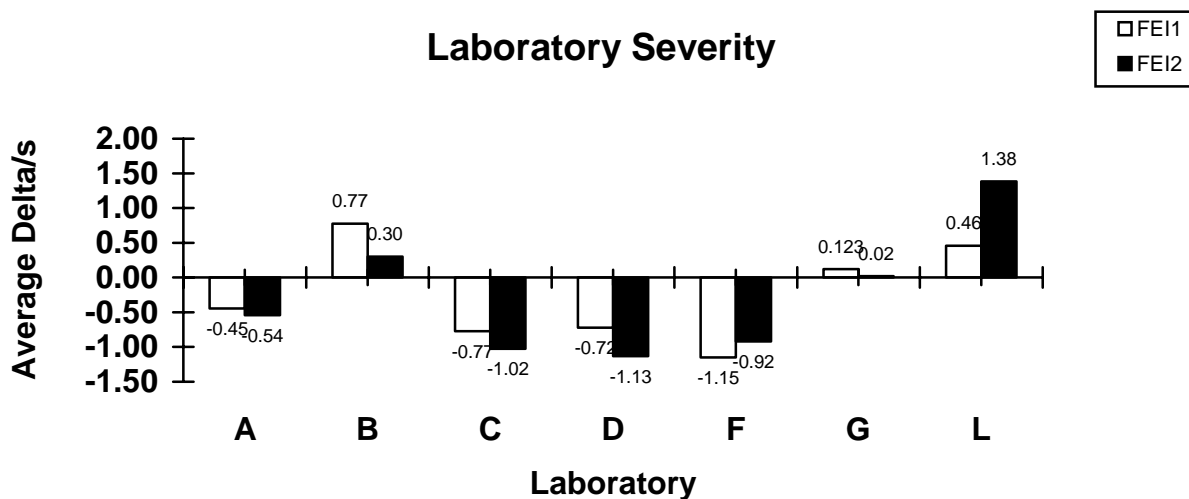


TEST SEVERITY AND PRECISION

The industry mean  $\Delta$ /s for FEI1 and FEI2, for this report period are -0.07 and -0.11, respectively. FEI1 was on or near target, while severity for FEI2 was slightly severe of target for the period.

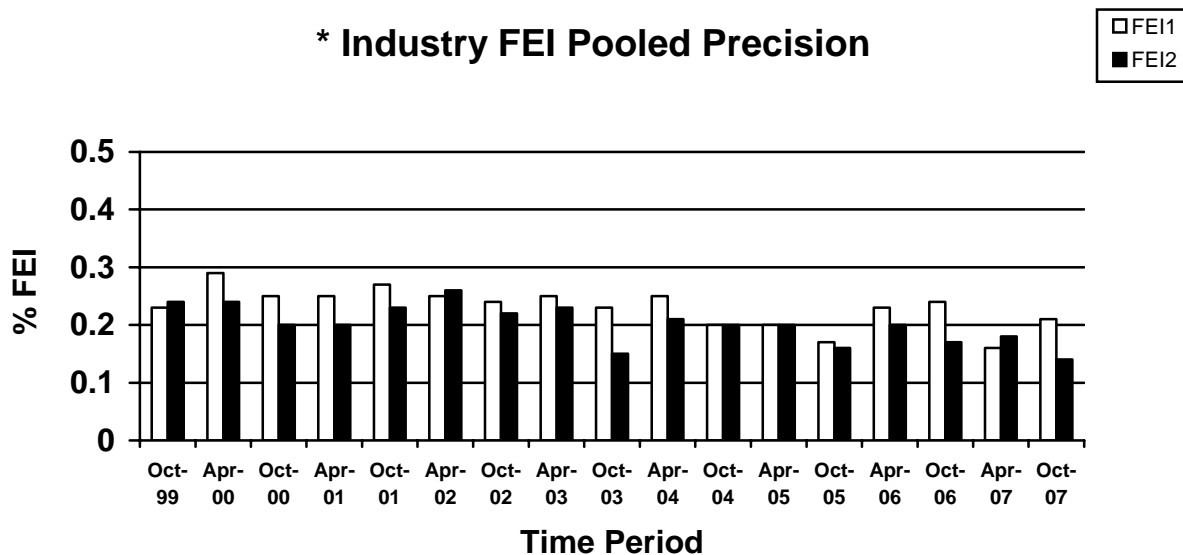


Shown below is a summary of the average FEI  $\Delta$ /s for all laboratories reporting data this report period.



The industry precision estimates for FEI1 and FEI2 for this report period are 0.21 and 0.14 (pooled s), respectively. Precision for FEI1 has degraded when compared to the previous period, while precision for FEI2 has improved. Precision for both parameters compares favorably with historical estimates.

### \* Industry FEI Pooled Precision



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

## INDUSTRY CONTROL CHARTS

### FEI1

Figure 1(last 75 test results) shows FEI1 severity began the period with a series of six action and one warning alarm. After this series of alarms, the severity charts remained in control for the period. FEI1 precision was in control for most of the report period, with a series of five warning and one action alarms occurring at the end of the period. The severity alarms at the beginning of the period appear to be the result of several new stand/engine combinations being introduced. The precision alarms appear to be the result of a result failing mild ( $2.909\Delta/s$  from target) followed by more severe result from a new stand/engine. The re-run after the failing mild result was also mild ( $1.727\Delta/s$  from target) and was also followed by a more severe result from a new stand/engine. Figure 2 shows the entire industry chart.

### FEI2

Figure 3 (the last 75 test results) shows that, similar to FEI1, severity began the period in severity alarm, with a series of three warning and an action alarm, before returning in control limits for the remainder of the period. As with FEI1, new engines appear to be the primary cause of the severity alarm event. Precision was in control for the entire period. Figure 4 shows the entire industry chart.

REFERENCE OILS

The following table quantifies reference oils by the number of tests remaining at the TMC and each laboratory. Sequence VIB reference oils are shipped in quantities of 5 gallons per test.

LAB	538	538-1	539	1006	1007	1008	1008-1
A	1	2	1	0	0	0	2
B	2	1	1	0	1	0	2
C	0	1	1	0	0	0	0
D	2	1	0	0	0	0	2
F	1	1	1	0	3	0	0
G	1	0	2	0	0	0	1
L	1	1	1	0	5	0	3
TMC	0	510	250	0	*	**	***

\* 411 gallons (Multiple test area usage)

\*\* 29 gallons (Multiple test area usage)

\*\*\* 1140 gallons (Multiple test area usage)

A reblend of oil 538, designated 538-1, has been obtained and has been placed in inventory at the Test Monitoring Center. Seven donated tests on reference oil 538-1 were completed during this report period. Due to downtime, which exceeded the procedural limit of ten hours, one of the donated tests had to be re-run. Once this test is completed, the panel will review the results of these tests and set targets.

INFORMATION LETTERS

Information letter 07-1 was issued on August 5, 2007. This information letter added spark plug SP432 to the test method.

LAB VISITS

A total of seven lab visits were conducted by the Test Monitoring Center this report period.

SUMMARY

Severity for FEI1 trended on or near target this report period.

Severity for FEI2 trended slightly severe this period.

FEI2 precision has degraded when compared to the last report period.

FEI2 precision has improved compared to the last period

The percentage of calibrations per starts has increased this report period.

The percentage of lost tests per starts has increased this report period.

The percentage of statistically rejected tests per starts decreased this report period.

The percentage of operationally valid tests rejected statistically has decreased this report period.

REG/reg

#### Attachments

c: Sequence VIB Surveillance Panel

Sequence VIB Test Engineers

<ftp://ftp.astmtmc.cmu.edu/docs/gas/sequencevi/semiannualreports/vib-10-2007.pdf>



Sequence VIB Semiannual Report  
List of Attachments

- Table 1 is a historic statistical summary for reference oils through September 30, 2007.
- Table 1A is a statistical summary for reference oils for the current report period.
- Table 2 is a summary of lost tests due to operationally invalid, aborted, abandoned engines or lost due to BC shift exceeding the test limits.
- Table 3 is the Sequence VIB Timeline.
- Figure 1 graphically present the Industry control charts for FEI1 for the last 75 test results.
- Figure 2 graphically present the Industry control charts for FEI1.
- Figure 3 graphically present the Industry control charts for FEI2 for the last 75 test results.
- Figure 4 graphically present the Industry control charts for FEI2.

TABLE 1

SEQUENCE VIB  
 OPERATIONALLY VALID DATA SET  
 DATA PRIOR TO 10/01/07

OIL CODE 1006				
N	TEST PARAMETER	MEAN	s	REPORTED RANGE
236	FEI1	1.40	0.29	0.61 - 2.50
236	FEI2	0.52	0.27	-.36 - 1.23
OIL CODE 1007				
N	TEST PARAMETER	MEAN	s	REPORTED RANGE
92	FEI1	0.75	0.30	0.24 - 2.11
92	FEI2	0.45	0.27	-.55 - 1.25
OIL CODE 1008				
N	TEST PARAMETER	MEAN	s	REPORTED RANGE
245	FEI1	1.82	0.24	1.18 - 2.47
245	FEI2	1.24	0.21	0.58 - 1.74
OIL CODE 1008-1				
N	TEST PARAMETER	MEAN	s	REPORTED RANGE
221	FEI1	1.90	0.25	1.24 - 2.68
221	FEI2	1.25	0.22	0.46 - 1.95
OIL CODE 538				
N	TEST PARAMETER	MEAN	s	REPORTED RANGE
258	FEI1	1.83	0.31	0.86 - 2.67
258	FEI2	1.55	0.25	0.68 - 2.32

1052 TOTAL

TABLE 1A

SEQUENCE VIB  
 OPERATIONALLY VALID DATA SET  
 DATA FROM 04/01/07 THRU 09/30/07

OIL CODE 1008-1

N	TEST PARAMETER	MEAN	s	REPORTED RANGE
17	FEI1	2.06	0.23	1.70 - 2.60
17	FEI2	1.22	0.17	0.99 - 1.60

OIL CODE 538

N	TEST PARAMETER	MEAN	s	REPORTED RANGE
21	FEI1	1.74	0.26	1.33 - 2.27
21	FEI2	1.54	0.27	0.98 - 1.99

38 TOTAL

Table 2

### Lost Tests Summary

Tests declared operationally invalid, aborted or lost due to abandoned engines are summarized below by laboratory, reason, number of lost tests, and percent of lost tests:

LAB	REASON	Tests Lost	% of Tests Lost
A	Wrong BC Batch	1	12.5%
B	Downtime < 10 hours	1	25%
	High oil consumption	1	
C	Downtime < 10 hours	2	37.5%
	Fuel pressure regulator failed	1	
G	Spark plug wire failure	1	12.5%
L	Fuel leak	1	12.5%

**Sequence VIB Timeline**

Date	Item Changed	Information Letter
19990809	Reference oil 1006 targets updated	
19990809	Reference oil 1007 targets updated	
19990809	Reference oil 1008 targets updated	
19990924	Calibration requirements	99-1
19990924	Alternative Cooling system	99-1
19990924	Fuel injection flow procedure	99-1
19990924	Requirement for use of maintenance log	99-1
19990924	Coolant flow measurement device calibration revision	99-1
19990924	Preparation procedure for oil charge	99-1
19990924	Recording compression pressures	99-1
19990924	Ignition timing checks	99-1
19990924	Valve stem seal replacements	99-1
19990924	Alternative Racor oil filter (LFS-62) use approved	99-1
19990924	Engine serial number added to report	99-1
19991015	Invalid test BC shift limits of -0.5 to 0.8% added	99-2
19991015	Tests terminated due to an FEI result are not permitted	99-2
19991015	Section 11.5.17.3 deleted – Manual data logging no longer required	99-2
19991015	Exhaust back pressure calibration prior to calibration test added	99-2
19991015	Instrumentation calibration requirements	99-2
19991015	Use of Eaton 37KW (50hp) dry gap dynamometer approved	99-2
19991015	New flush oil (BCFHD) and flush oil procedure	99-2
19991015	Micro motion model CMF010 mass flow meter approved	99-2
19991015	Kinematic viscosity measurements on new reference oils permitted	99-2
19991015	Report form editorial change for LABVALID made	99-2
19990924	Valve stem seal revised part number	99-3
20000207	Oil sight glass calibration	00-1
20000207	Revised Figure A2.22 – Oil Level Marker Ruler	00-1
20000207	Revised flush effectiveness procedure	00-1
20000207	Coolant flush procedure	00-1
20000207	Oil consumption validity interpretation	00-1
20000207	Load cell temperature specification	00-1
20000410	Valve Spring Replacement	00-2
20000524	Eliminate Baseline Shift Criteria	00-3
20000601	Maximum Allowable Oil Consumption Test Limit	00-3
20000601	Oil Sample Location Defined	00-3
20000601	Revised Blow-by and Crankcase Ventilation System	00-3
20000807	Fuel Injector Calibration Flow Rate Specification Added	00-3
20000807	Dynamometer Replacement During a test is not permitted	00-3
20000807	Engine Break-in Stand Requirements	00-3
20000807	Removal of Ford Wiring Harness Diagram	00-3
20000807	Addition of Alternative Injector Wiring Harness Part Numbers	00-3
20000807	Addition of Alternative HEGO Sensor Part Numbers	00-3
20000807	Addition of Alternative Throttle Body Adapter Part Number	00-3
20000807	Visteon EEC Control Module	00-3
20000901	Barometric Pressure added to report packet as record only	00-3

**Sequence VIB Timeline**

Date	Item Changed	Information Letter
20000801	A Task Force Was Appointed by the VIB Surveillance Panel to Address Lab To Lab Differences with Oil Consumption and FEI Severity. Information Letter 00-4 was a result of the Lab Visit Discrepancies.	
20000915	Increase Oil Charge to 6.0 Liters	00-4
20000915	Revise Oil Level/Sight Glass Calibration Procedure	00-4
20000915	Oil Pan Oil Level Requirement	00-4
20001116	Reduced Calibration Frequency	01-1
20001117	Validity Interpretation During BSFC Measurement Cycle	01-1
20001117	Reporting Stage Restarts or Any Test Time Deviations	01-1
20001117	Alternate HEGO Sensor Part Number	01-1
20001117	Revisions to New Engine Cyclic Break-in	01-1
20010301	Revisions to Test Length Calculation and Reporting Format	01-1
20010301	Additional Oil Analysis Requirements	01-1
20010822	Allowed Timing Chain Tensioner with Subsequent Reference Oil Test	01-2
20010822	Defined Maximum Total Test Length as 150 h	01-2
20010822	Defined Off Test Time and Allows No More Than 2 h of Off Time During Phase I and II Aging	01-2
20010822	Added Reference to Ford 543 Engine Assembly Manual	01-2
20010822	Refined Oil Analysis Procedure for HTHS, CCS Viscosity, Friction Coefficient by HFRR, Fuel Dilution and Infrared for Oxidation & Nitration	01-2
20010822	Correction of Company Suppliers in X1.3 and X1.19	01-2
20011005	Pressurization of Engine Coolant System to 69±13.8 kPa	01-3
20011005	Deleted Requirement to Measure Blowby	01-3
20011005	Revised Load Cell Temperature Delta for 3°C to 6°C in 6.4.2.3	01-3
20011005	Corrected Fuel Supplier Name and Address in Section 7.2 and Footnote 15	01-3
20011129	Added Provisions for VIBSJ Test	01-4
20011207	Revised AFR limits from 14.25:1 - 15.25:1 to 14.00:1 – 15.00:1	01-5
20020405	Allowed Replacement of Timing Chain as Part of Tensioner Assembly	02-1
20020405	Revised Procedure to Require Viscosity Measurements for Both Reference and Non Reference Oils	02-1
20020712	Reference oil 538 targets updated (n=20)	
20021016	Reference oil 538 targets updated (n=30)	
20021114	Reference oil 1008-1 initial targets generated (n=10)	
20030327	Updated Test Method D6837 to incorporate info letter 02-1 and remove remedial statements	03-1
20030521	Reference oil 1008-1 initial targets generated (n=20)	
20030618	Dropped requirements to monitor HTHS, CCS, FC by HFRR and INI and INO	03-2
20030703	Reference oil 1008-1 initial targets generated (n=30)	
20040101	Added reference to fuel spec, replaced Aliphatic Naphtha with Type II Class C solvent	03-3
20040130	Added addition micromotion transducers to test method, revised calibration requirements for oil heat exchanger thermocouple and made editorial changes relating to precision statements.	04-1
20040802	Added MotorCraft AGSF32FM to test method	04-2

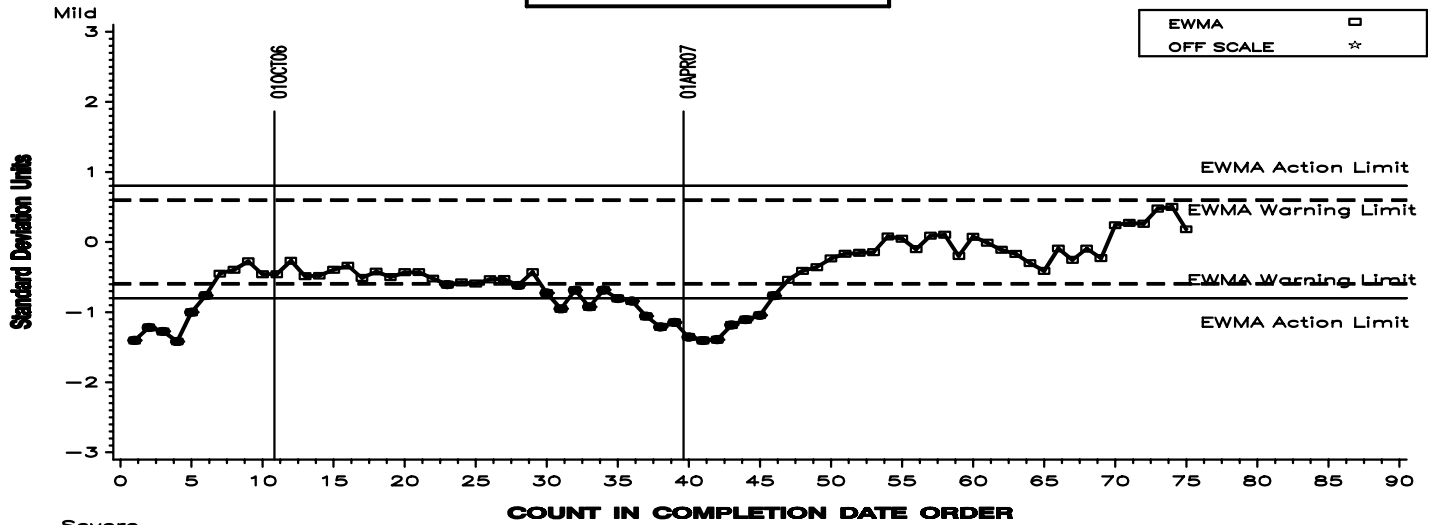
**Sequence VIB Timeline**

Date	Item Changed	Information Letter
20040802	Added rear crankshaft seal to parts allowed to be replaced on engine	04-2
20040802	Made editorial changes to precision statement	04-2
20040921	Changed $Z_0$ calculation to be the average of first shewhart acceptable through and including second acceptable reference test to initialize stand charts. Also excluded any unacceptable shewhart results, prior to the first acceptable result on a new stand/engine from control charts.	
20041001	Revised stand/engine calibration requirements to include engine test hours	04-3
20041001	Change calibration frequency for fuel flow, speed, AFR and EBP to prior to a reference sequence.	04-3
20041001	Decreased calibration frequency for coolant flow, thermocouple & temperature measurement systems and other instrumentation to every six months	04-3
20041115	Added provisions for external coolant flush cart	04-4
20041214	Clarified Requirement for solvent meeting ASTM D235, Type II, Class C to meet Type II, Class C requirements for Aromatic content, Color and Flash point only.	04-5
20050719	Added Throttle body F3PZ-9E926NA to test method	05-1
20070805	Added Spark Plug SP432	07-1

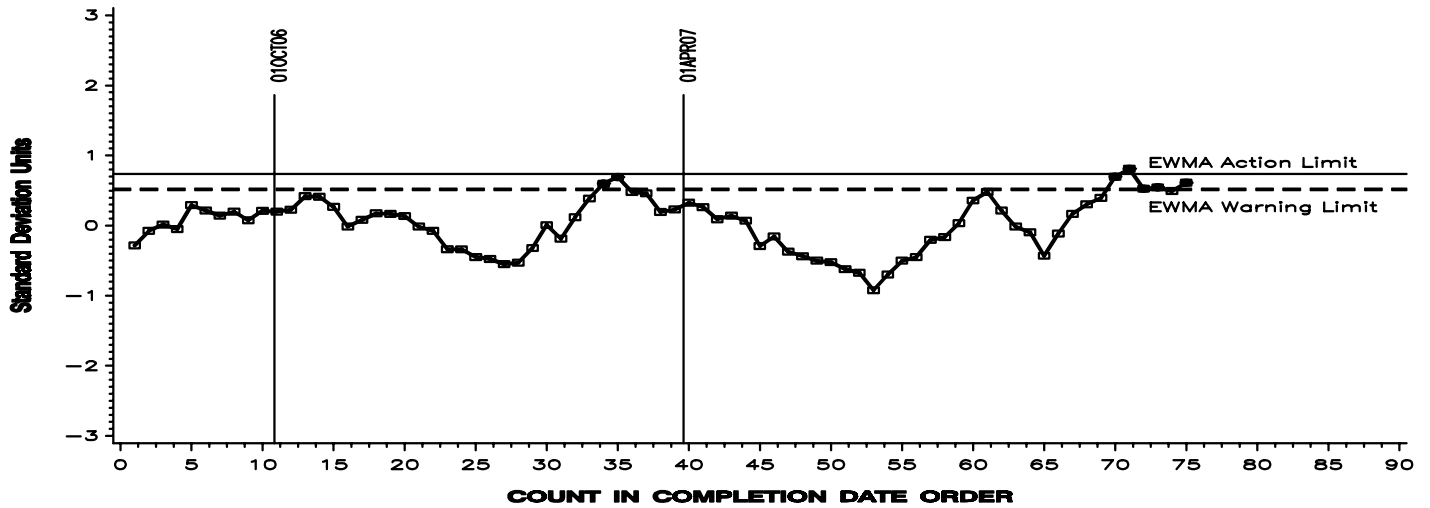
# SEQUENCE VIB INDUSTRY OPERATIONALLY VALID DATA

Last 75 Data points Only  
FEI FINAL RESULT PHASE I (%)

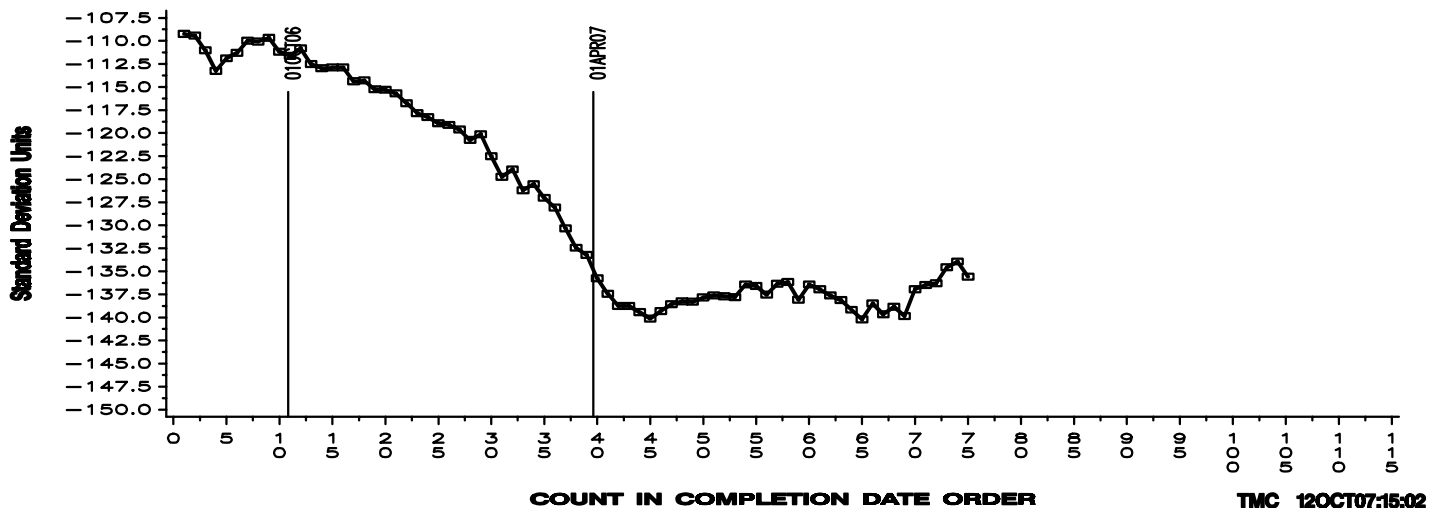
## LTMS Severity Analysis



## LTMS Precision Analysis



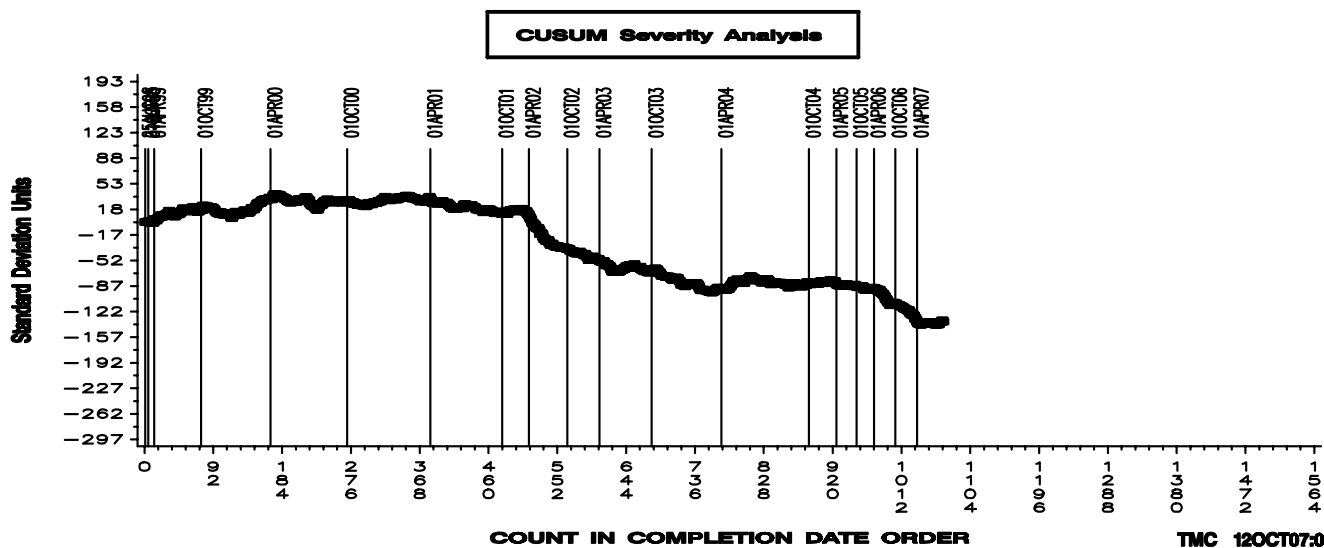
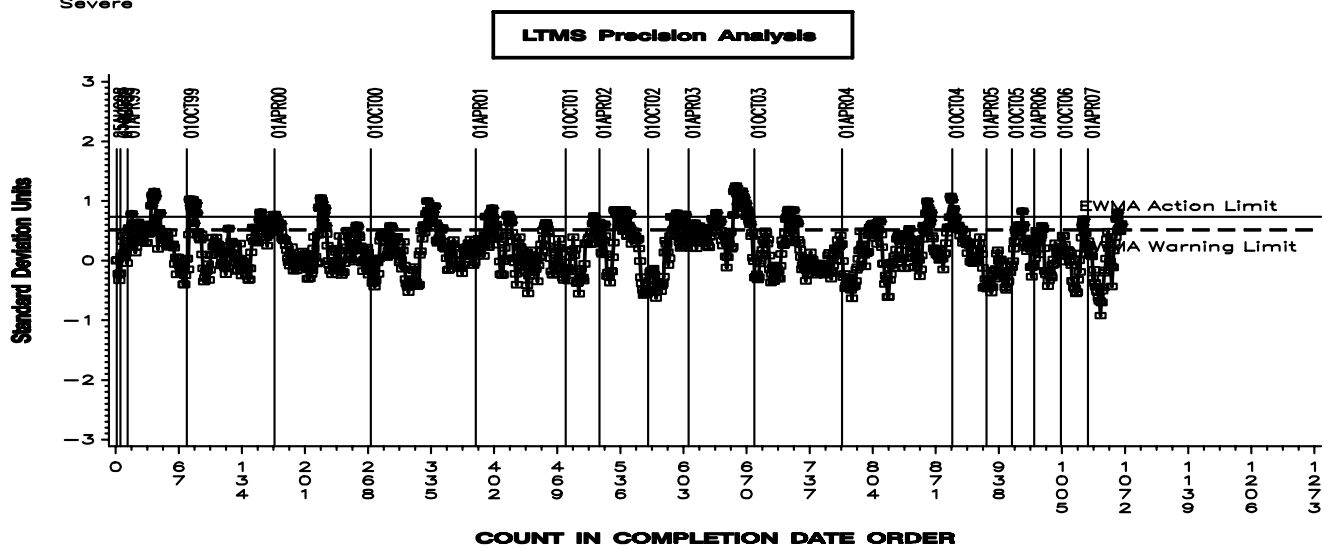
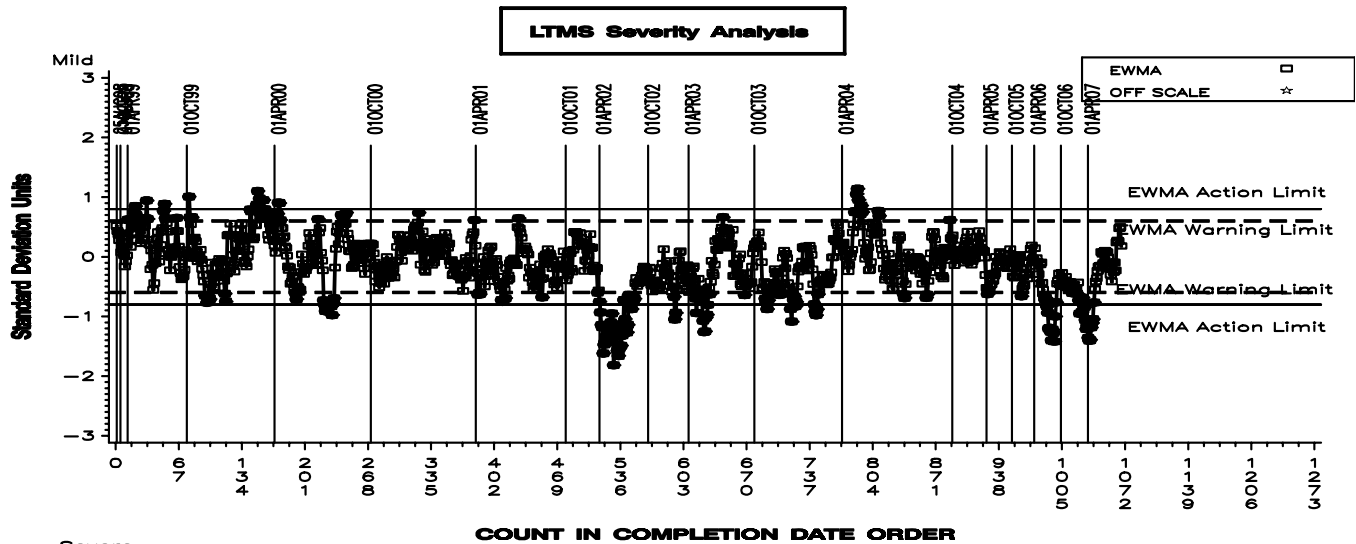
## CUSUM Severity Analysis



# SEQUENCE VIB INDUSTRY OPERATIONALLY VALID DATA

Figure 2

## FEI FINAL RESULT PHASE I (%)



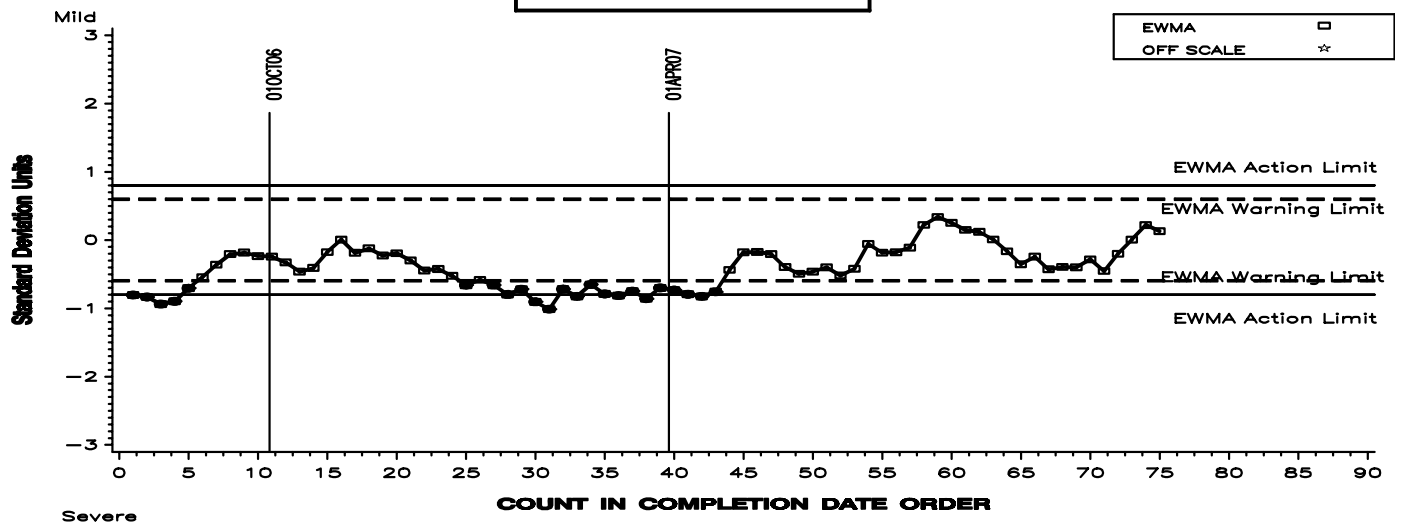


# SEQUENCE VIB INDUSTRY OPERATIONALLY VALID DATA

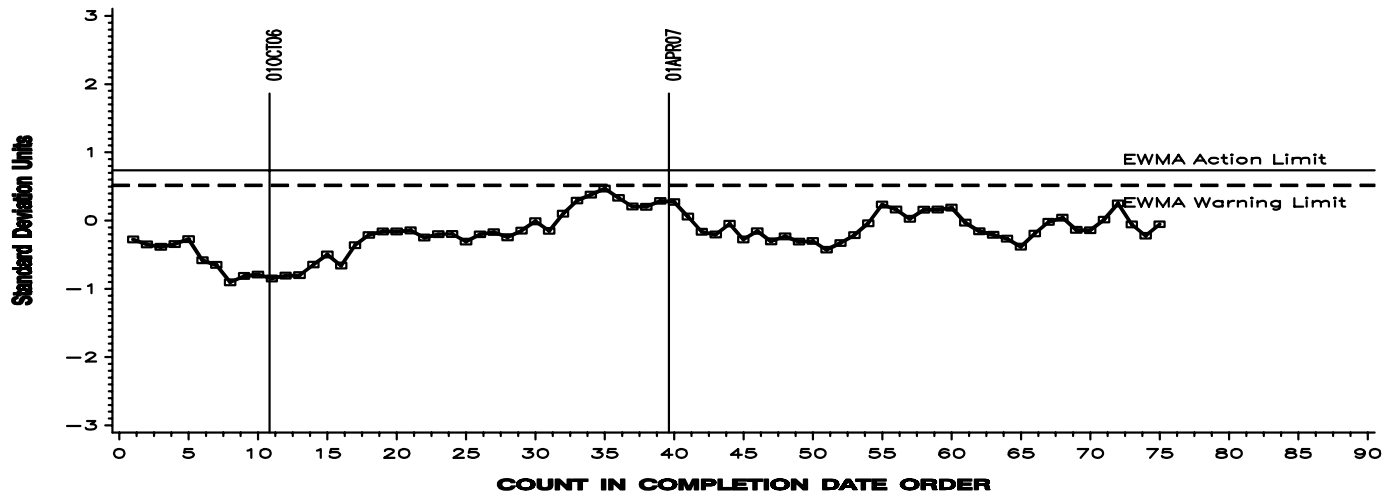
Figure 3

Last 75 Data points Only  
FEI FINAL RESULT PHASE II (%)

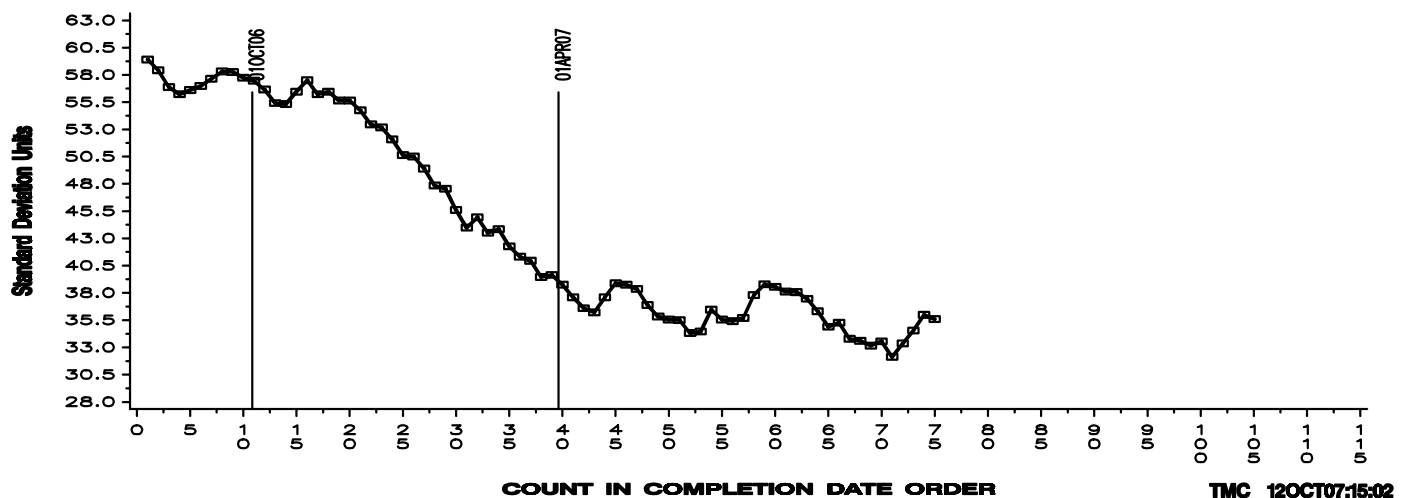
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis



TMC 12OCT07:15:02

## SEQUENCE VIB INDUSTRY OPERATIONALLY VALID DATA

