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

Memorandum: 05-073

Date: October 24, 2005

To: Fred Gerhart, Chairman, Sequence VIII Surveillance Panel

From: Richard E. Grundza

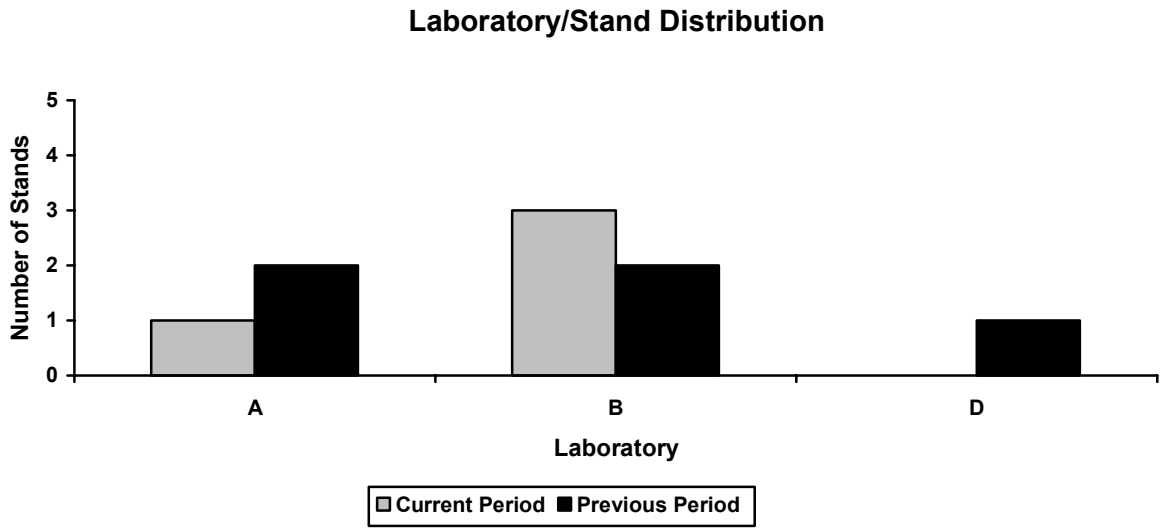
Subject: Sequence VIII Semiannual Report: April 1, 2005 to September 30, 2005

The following is a summary of Sequence VIII reference oil tests that were reported to the Test Monitoring Center during the period from April 1, 2005 to September 30, 2005.

Lab/Stand Distribution

	Reporting Data	Calibrated as of September 30, 2005
Number of Laboratories:	2	2
Number of Stand/Engine Combinations:	4	2

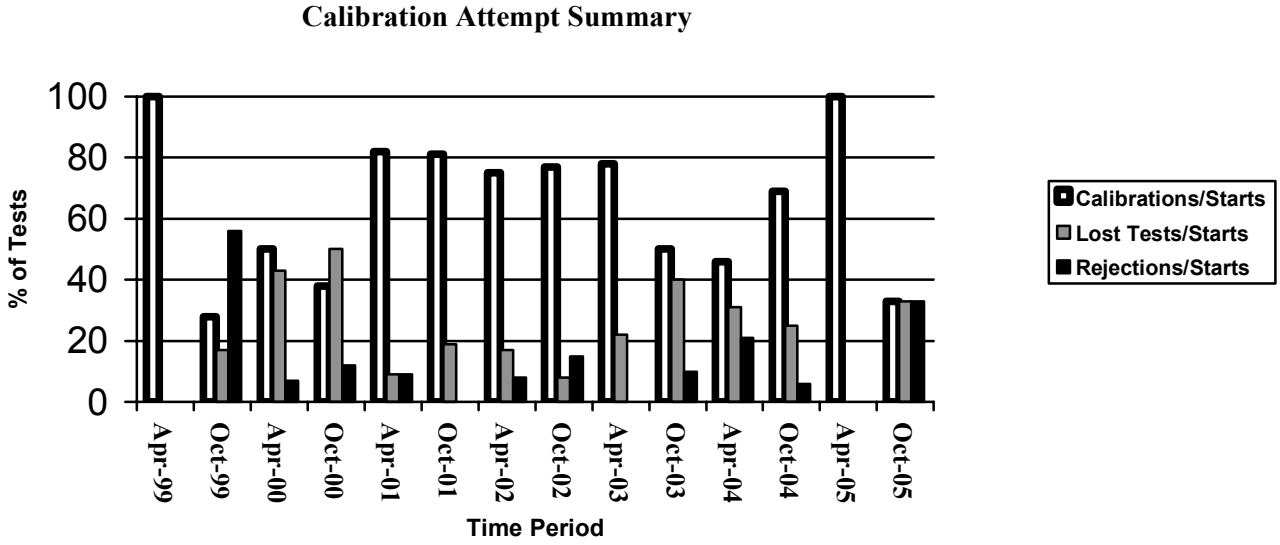
The following chart shows the laboratory/stand distribution:

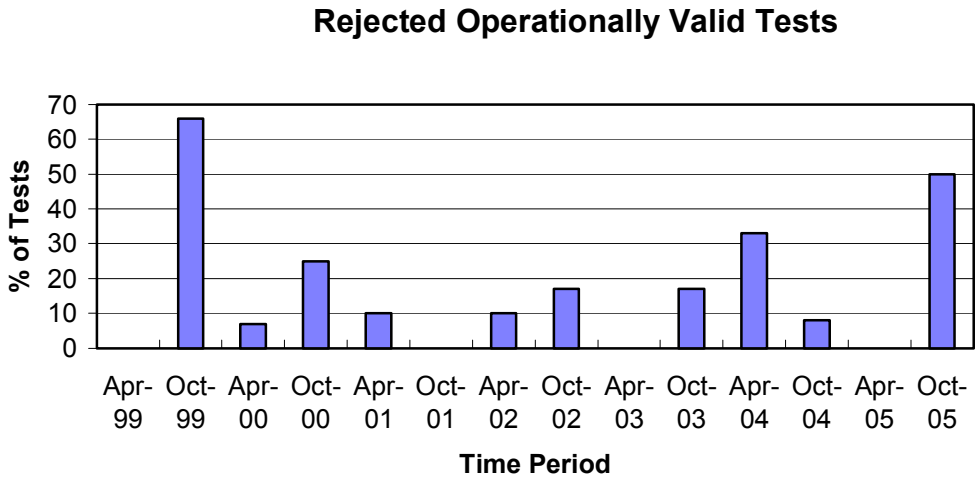


The following summarizes the status of the reference oil tests reported to the TMC:

Calibration Start Outcomes	TMC Validity Code	No. of Tests
Operationally and Statistically Acceptable	AC	3
Operationally and Statistically Unacceptable	OC	3
Operationally Invalid (laboratory judgement)	LC	3
Total		9

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





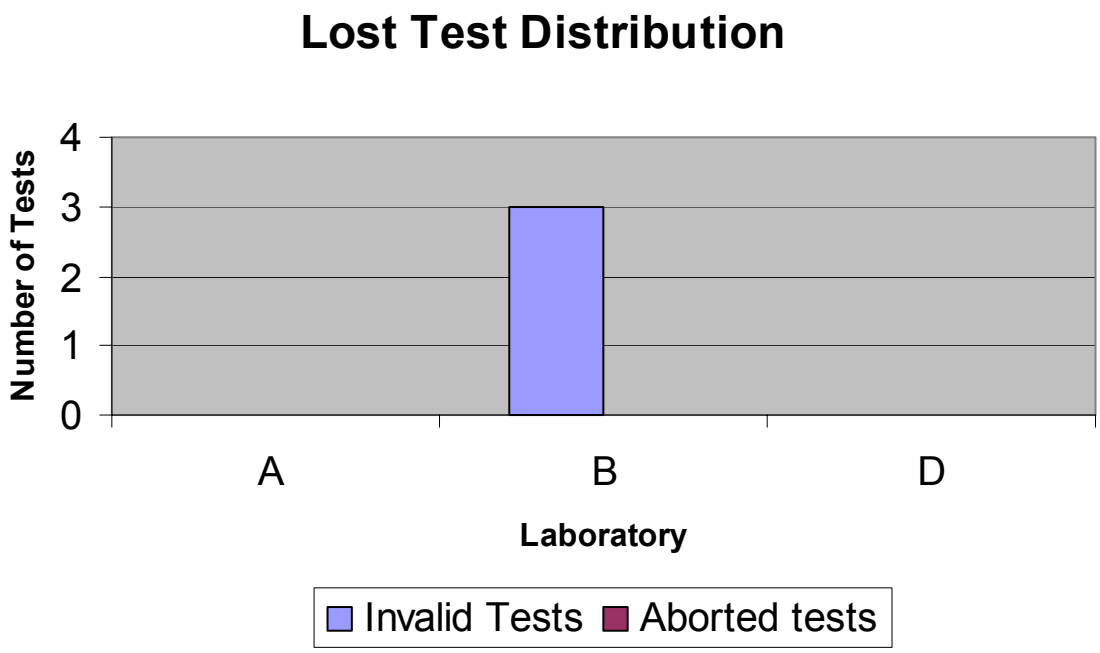
Three tests failed this period. One test failed due to a stand precision EWMA alarm (Qi) for BWL. The remaining two tests failed for mild BWL shewhart severity.

There were three LTMS Deviations this period. Prior to the issuance of these deviations there were no deviations from the LTMS since its introduction in 1999.

Two lab visits were conducted this period.

Lost Test Summary

Three tests were lost this period, two due to mechanical bearing wear and a third due to a failure to conduct stand instrumentation calibrations prior to running the reference test. These tests were conducted on different stand/engine combinations in the same laboratory. Aborts and operationally invalid tests, reported by laboratory, are summarized in the following chart:



Information Letters

Sequence VIII Information Letter 05-1 was issued June 23, 2005. This deleted the Rocker Cover Inlet temperature and pressure sensors and updated the precision statement.

Severity and Precision Analysis

Below is a summary of the average Δ/s, pooled standard deviation, and average Δ in reported units for the tests reported during this period. Also below is a summary of the average Δ/s value for all laboratories reporting data during this period.

Industry Severity Summary			
Parameter	**Average Δ/s**	**Pooled standard deviation (degrees of freedom)**	**Average Δ, in reported units**
BWL	1.403	4.50 (df=5)	6.31 mg
SVIS	0.710	0.10 (df=5)	0.07 cSt

Average Δ/s by Laboratory		
Lab	BWL	SVIS
A	-0.79	-0.90
B	1.84	1.03
D	-	-

Bearing Weight Loss (BWL)

The industry control chart for severity exceeded limits three times during the period. Control charts for precision exceeded control limits for five of the six tests reported this period. Laboratory severity appears to play a major role in the industry alarms (see Figure 1).

The Industry BWL mean Δ/s is 1.403 severe for this report period (see Figure 3). This equates to a shift of 6.31 mg in reported units. The pooled standard deviation for the period is 4.50 mg (see Figure 4), which has degraded with respect to the previous period, but compares well with historical estimates.

Figures 7 and 8 graphically illustrate the lead content, in ppm, versus test severity in delta/s. The highest concentration of lead reported this period was 278 ppm. The lead levels in the bearing storage oil continue to rise.

Stripped Viscosity (SVIS)

The industry control charts for both severity and precision were in control for the period (see Figure 2).

The Industry SVIS mean Δ/s is 0.710 mild for this report period (see Figures 2 & 5). This equates to a shift of 0.07 cSt in reported units. The pooled standard deviation for the period is 0.10 cSt (see Figure 6), which is comparable to historical performance.

Hardware

No hardware changes were made during the period.

Reference Oils

Oil	TMC Inventory, In gallons	TMC Inventory, In tests	Laboratory Inventory, in tests	Estimated Life
704-1	407	203	6	5+ years
1006	43	21	3	3 months[1]
1006-2	4,774	2,387	4	3+ years[1]
1009	834	417	1	3+ years[1]

[1] Multiple test area reference oil; total TMC inventory shown

REG/reg

Attachments

c: F. M. Farber, TMC
Sequence VIII Surveillance Panel
ftp://ftp.astmtmc.cmu.edu/docs/gas/sequenceviii/semiannualreports/VIII-10-2005.pdf

Distribution: Electronic Mail

List of Figures

- Figure 1 graphically presents the Industry control charts for BWL and also the CUSUM delta/s plot (by count in completion date order) of bearing weight loss for operationally valid tests.

- Figure 2 graphically presents the Industry control charts for SVIS and also the CUSUM delta/s plot (by count in completion date order) of bearing weight loss for operationally valid tests.

- Figure 3 graphically presents a historic perspective for BWL mean delta/s by report period.

- Figure 4 graphically presents a historic perspective for BWL pooled standard deviations by report period.

- Figure 5 graphically presents a historic perspective for SVIS mean delta/s by report period.

- Figure 6 graphically presents a historic perspective for SVIS pooled standard deviations by report period.

- Figure 7 graphically presents a comparison of Total Bearing Weight Loss (Delta/s) vs. the amount of lead content, in ppm, in the bearing storage oil.

- Figure 8 graphically presents the amount of lead content, in ppm, in the bearing storage oil by completion date order (Sequence VIII and L-38 data combined).

- Figure 9 is the Sequence VIII Timeline, created to track changes in test hardware and operations.

Figure 1

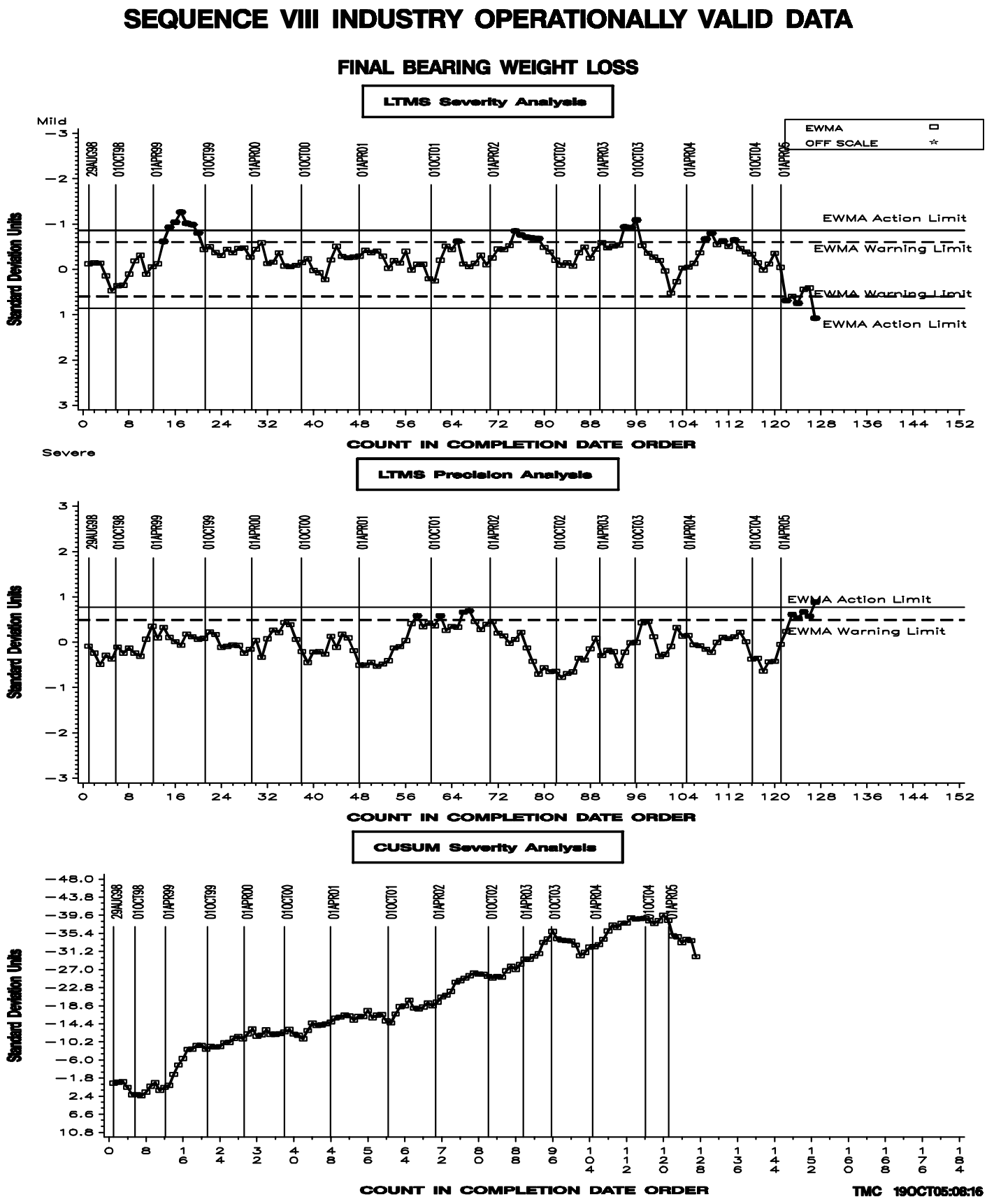

SEQUENCE VIII INDUSTRY OPERATIONALLY VALID DATA
FINAL BEARING WEIGHT LOSS
LTMS Severity Analysis
Mild
Severe
Standard Deviation Units
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
29AUG98
01OCT98
01APR99
01OCT99
01APR00
01OCT00
01APR01
01OCT01
01APR02
01OCT02
01APR03
01OCT03
01APR04
01OCT04
01APR05
COUNT IN COMPLETION DATE ORDER
LTMS Precision Analysis
EWMA Action Limit
EWMA Warning Limit
COUNT IN COMPLETION DATE ORDER
CUSUM Severity Analysis
COUNT IN COMPLETION DATE ORDER
TMC 19OCT05:08:16

Figure 2

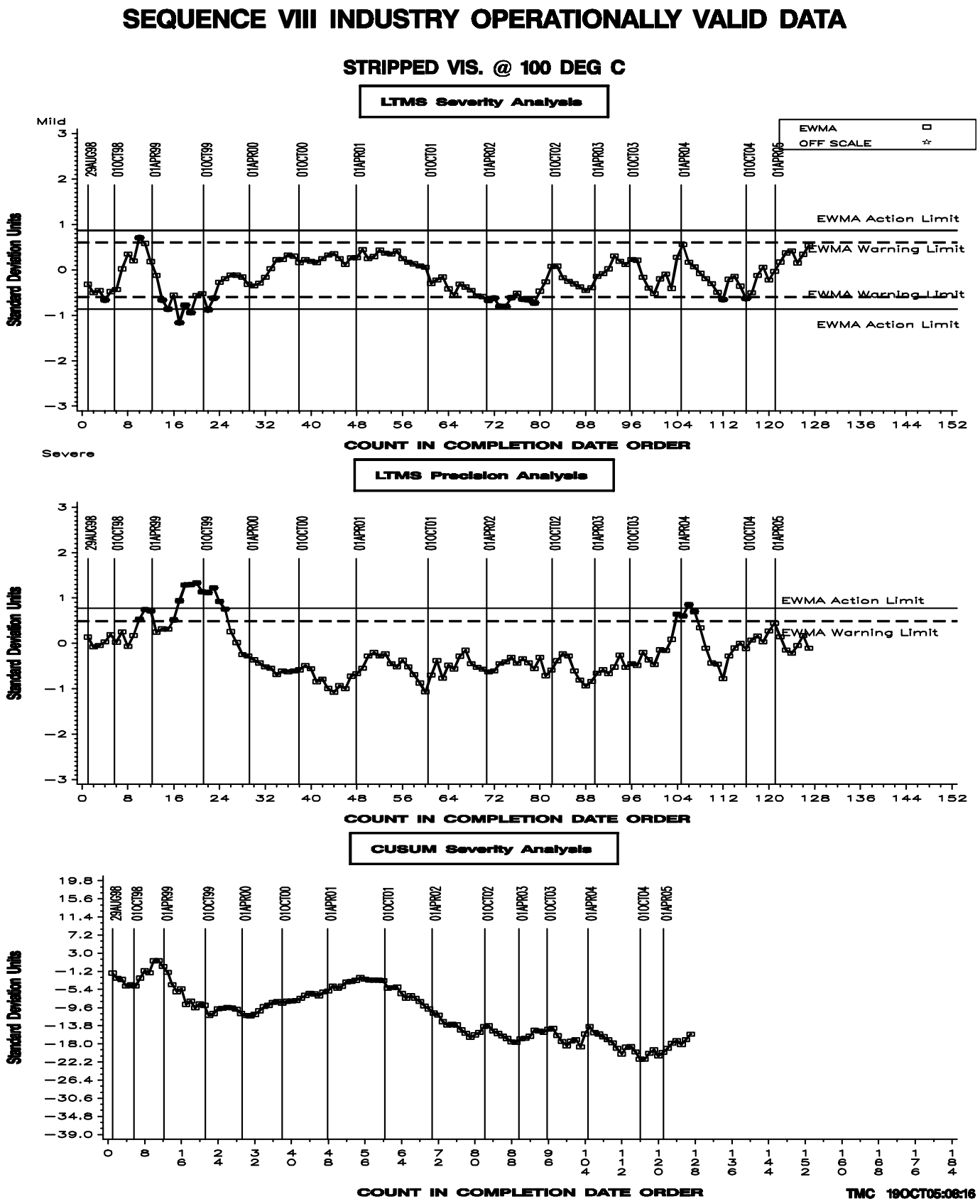

SEQUENCE VIII INDUSTRY OPERATIONALLY VALID DATA
STRIPPED VIS. @ 100 DEG C
LTMS Severity Analysis
Mild
Severe
Standard Deviation Units
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
29AUG98
01OCT98
01APR99
01OCT99
01APR00
01OCT00
01APR01
01OCT01
01APR02
01OCT02
01APR03
01OCT03
01APR04
01OCT04
01APR05
COUNT IN COMPLETION DATE ORDER
LTMS Precision Analysis
EWMA Action Limit
EWMA Warning Limit
COUNT IN COMPLETION DATE ORDER
CUSUM Severity Analysis
COUNT IN COMPLETION DATE ORDER
TMC 19OCT05:06:16

Figure 3 - Sequence VIII Reference Oil Data
Bearing Weight Loss

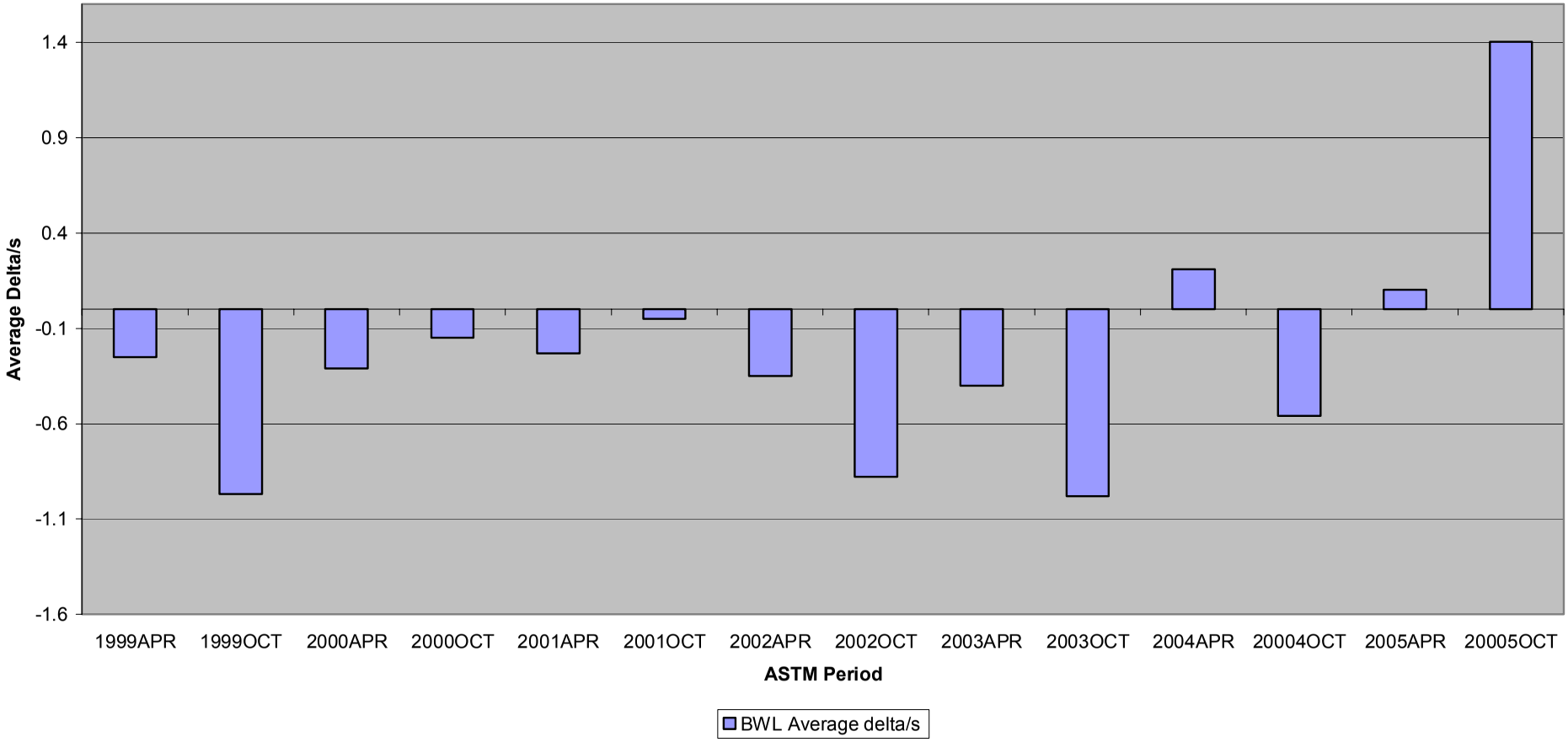


Figure 4 - Sequence VIII Reference Oil Data
Bearing Weight Loss

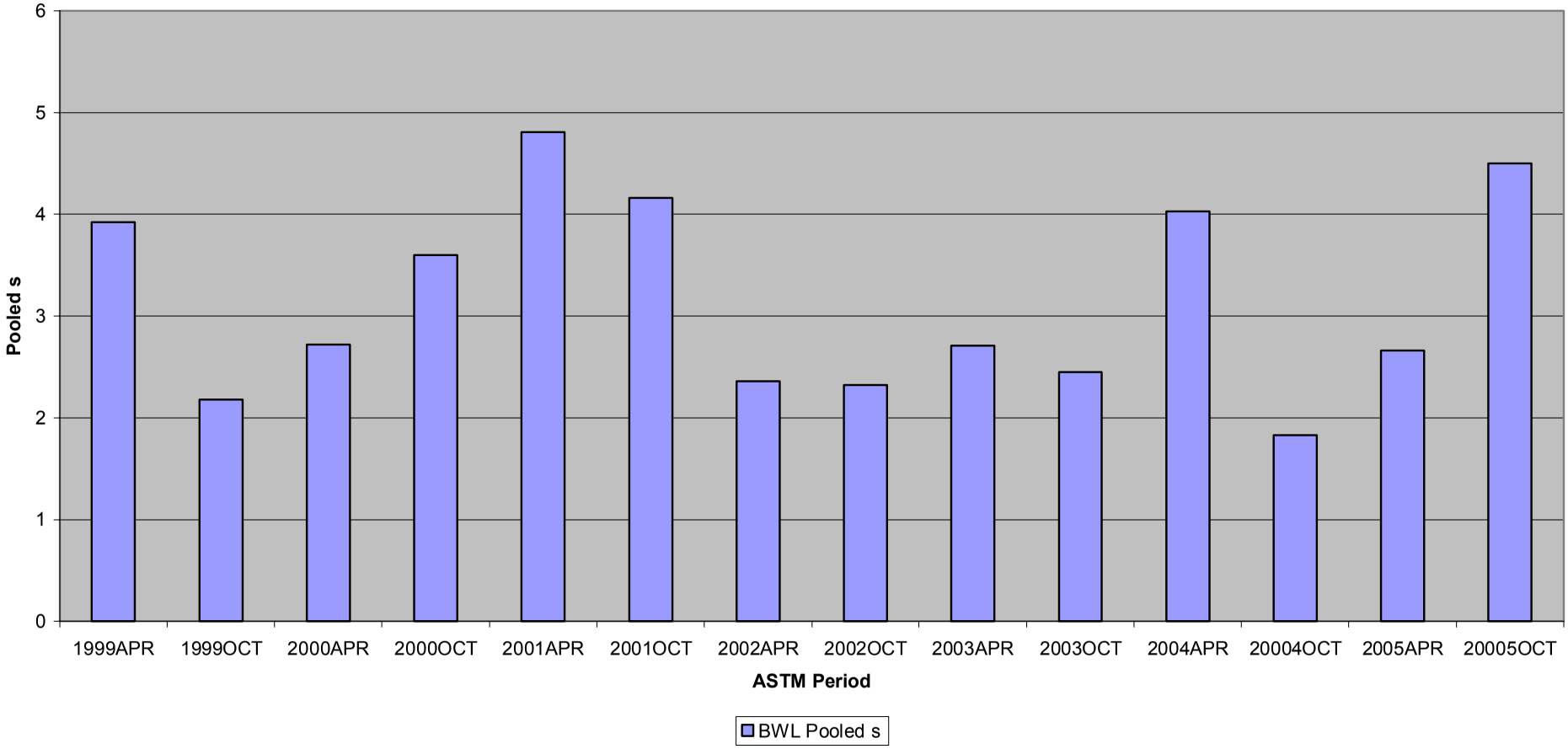


Figure 5 - Sequence VIII Reference Oil Data
Stripped Viscosity

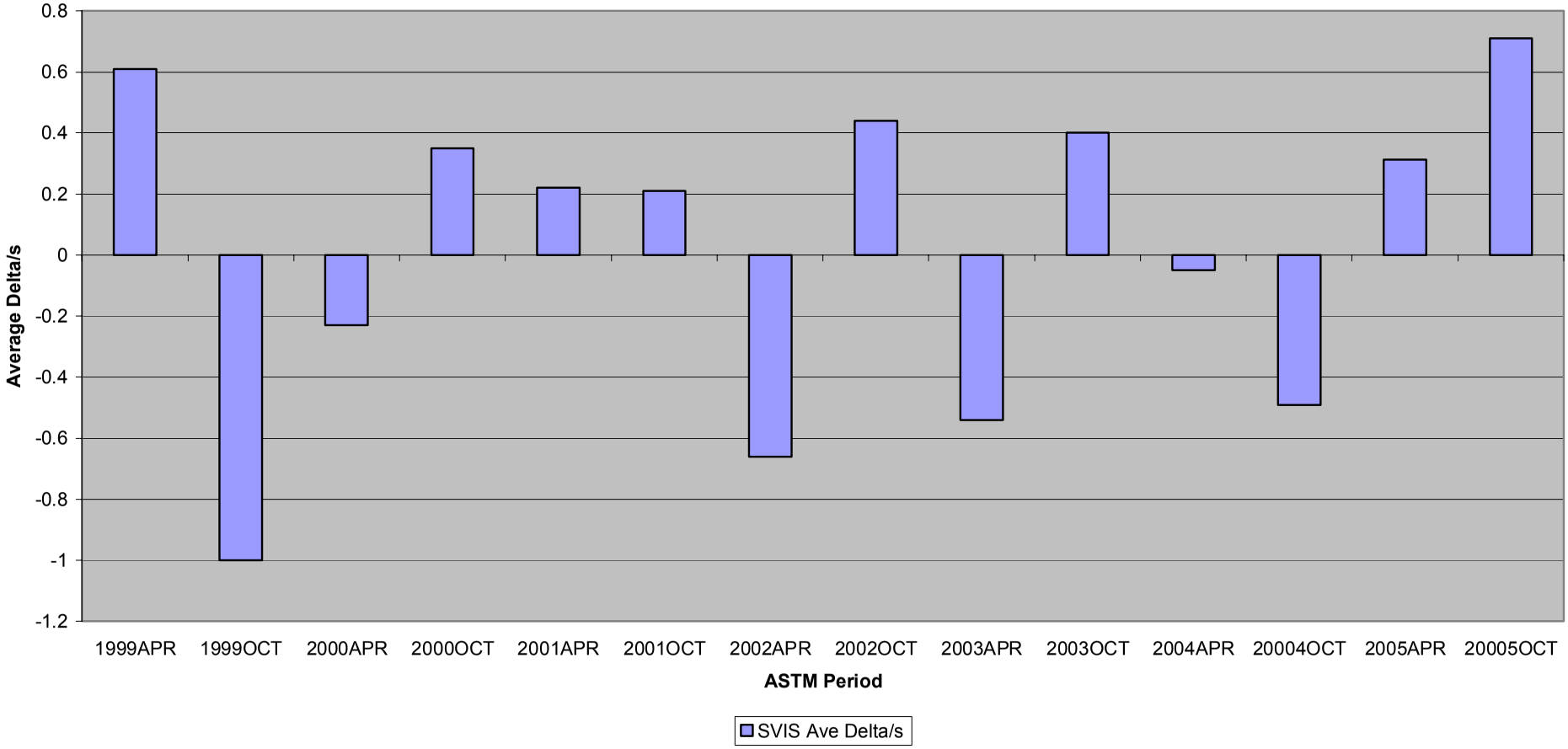


Figure 6 - Sequence VIII Reference Oil Data
Stripped Viscosity

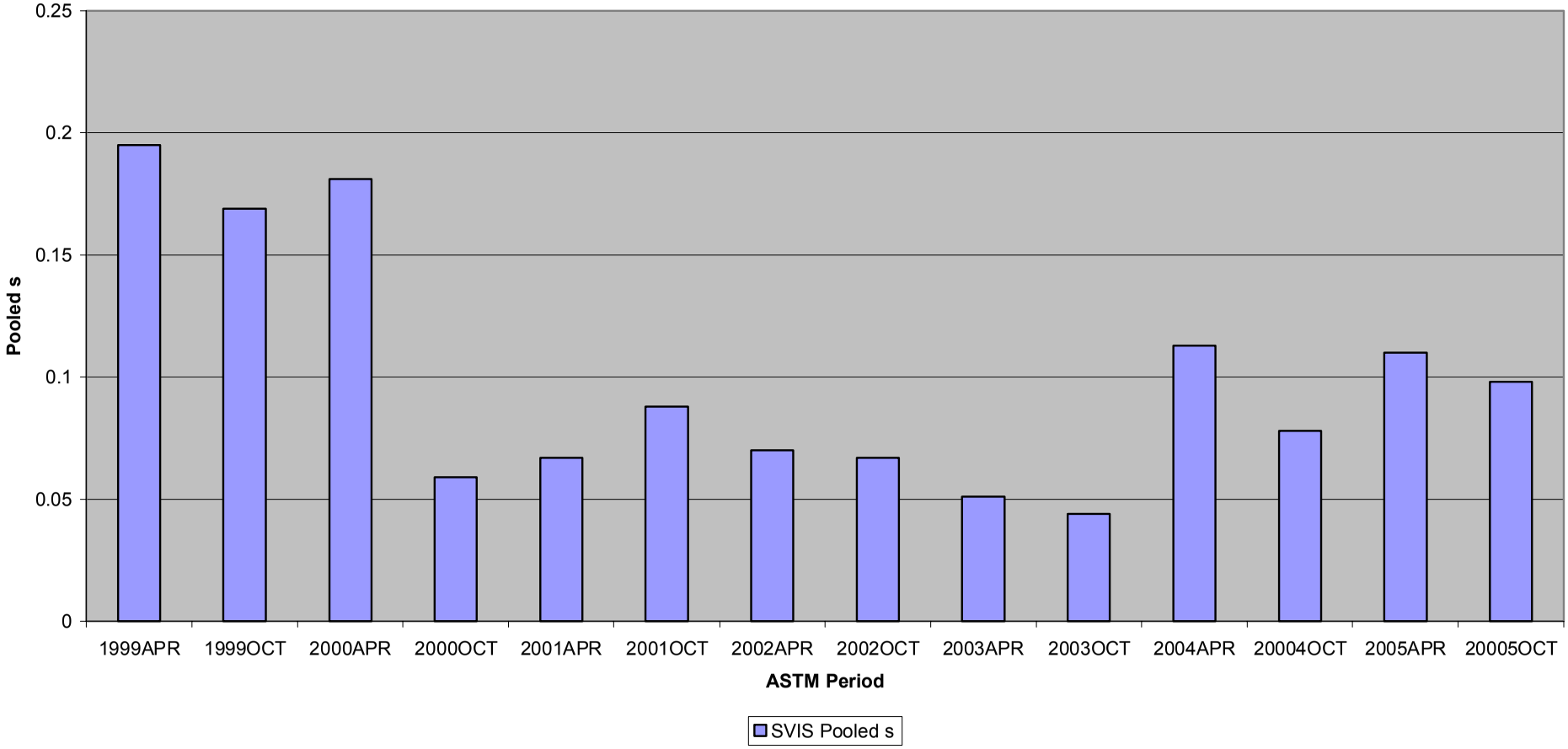


Figure 7

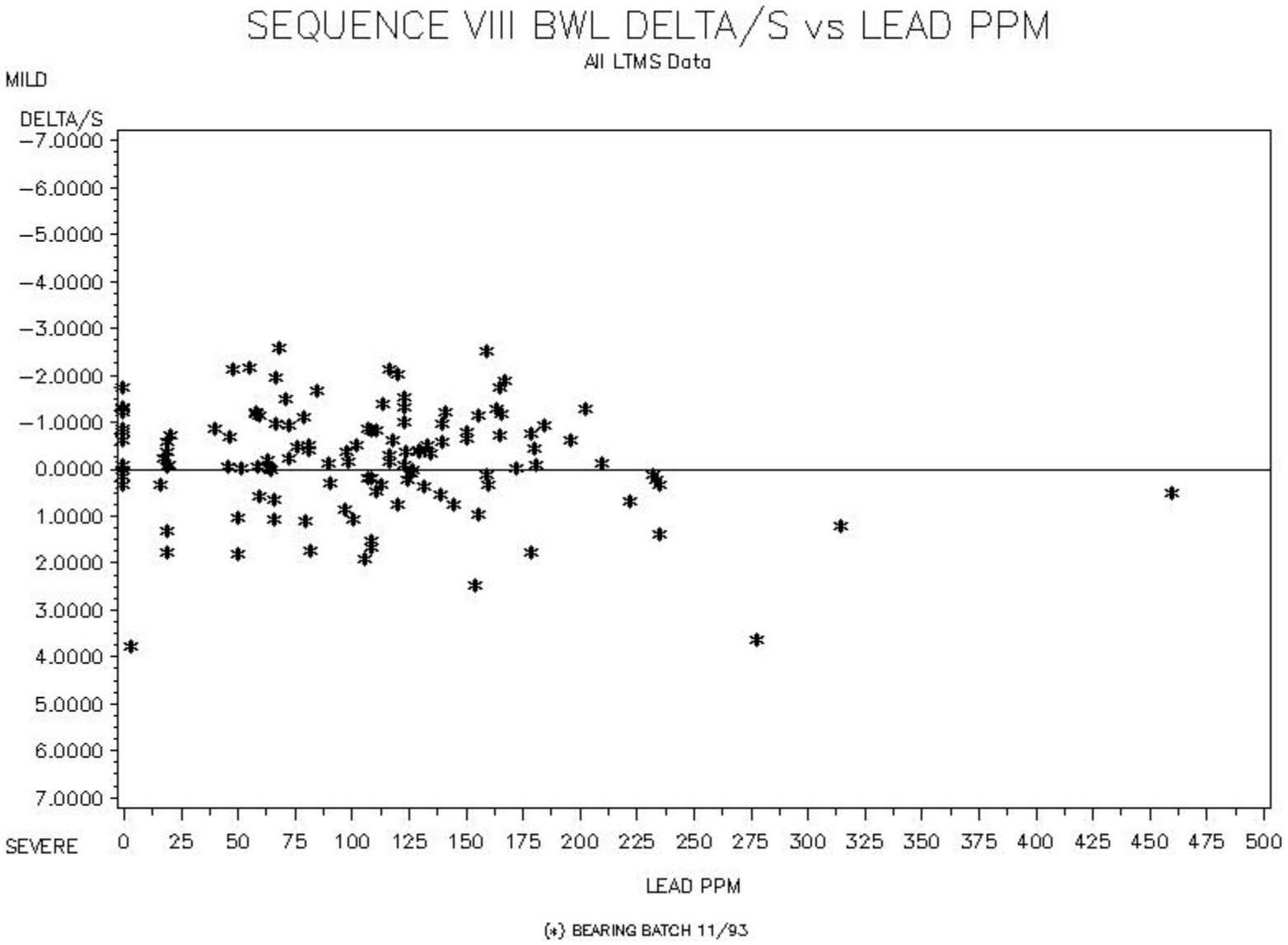

SEQUENCE VIII BWL DELTA/S vs LEAD PPM
All LTMS Data
MILD
DELTA/S
−7.0000
−6.0000
−5.0000
−4.0000
−3.0000
−2.0000
−1.0000
0.0000
1.0000
2.0000
3.0000
4.0000
5.0000
6.0000
7.0000
SEVERE
0 25 50 75 100 125 150 175 200 225 250 275 300 325 350 375 400 425 450 475 500
LEAD PPM
(*) BEARING BATCH 11/93

Figure 8

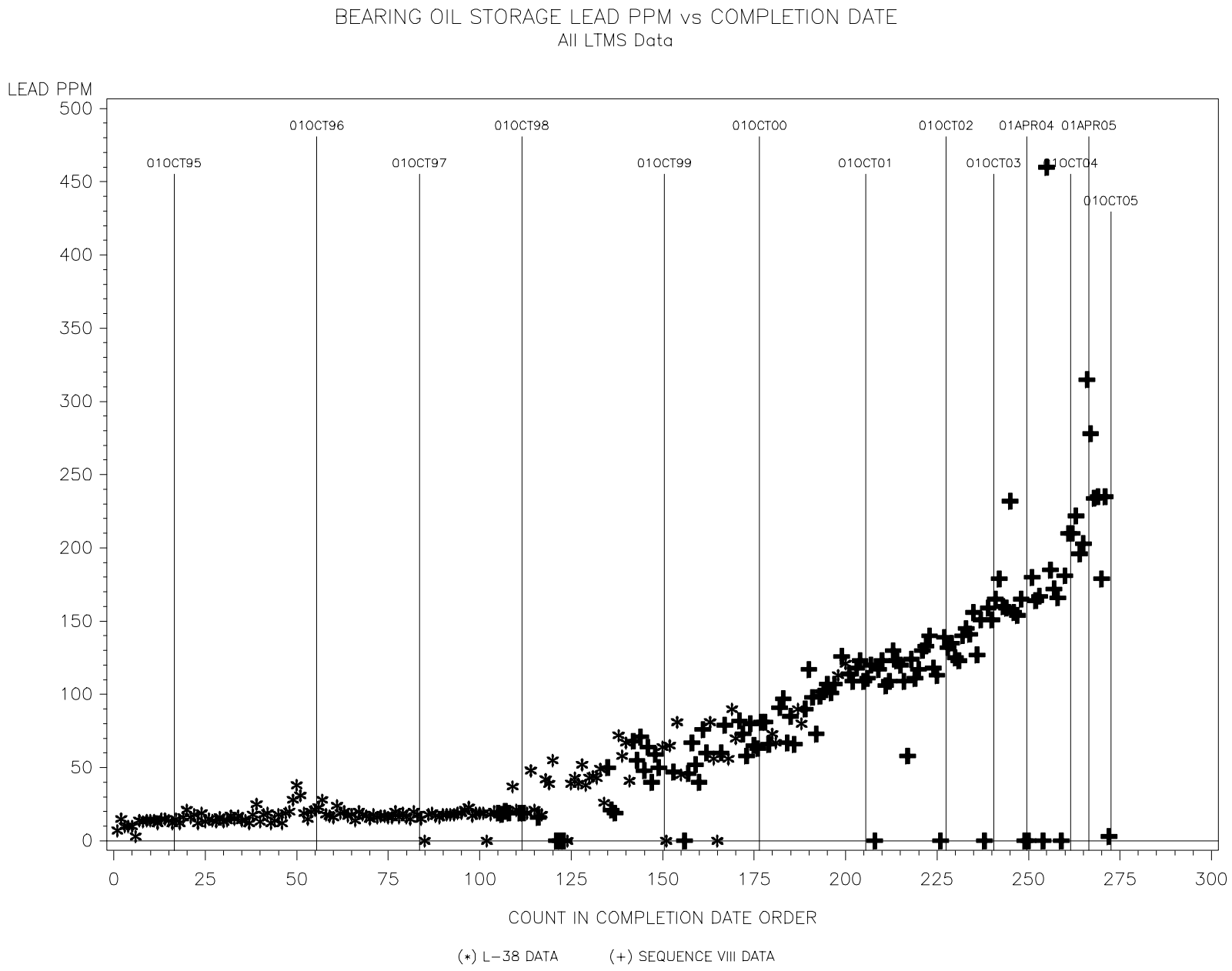

BEARING OIL STORAGE LEAD PPM vs COMPLETION DATE
All LTMS Data
LEAD PPM
500
450
400
350
300
250
200
150
100
50
0
01OCT95
01OCT96
01OCT97
01OCT98
01OCT99
01OCT00
01OCT01
01OCT02
01OCT03
01OCT04
01OCT05
01APR04
01APR05
0
25
50
75
100
125
150
175
200
225
250
275
300
COUNT IN COMPLETION DATE ORDER
(*) L-38 DATA
(+) SEQUENCE VIII DATA

Figure 9 - Sequence VIII Timeline		
Date	**Topic**	**Information Letter**
2/10/1999	NEW PISTON RING BATCH APPROVED FOR USE IN SEQUENCE VIII TESTING	00-1
4/16/1999	DRAFT 3.1 OF THE SEQUENCE VIII TEST PROCEDURE ISSUED	99-1
5/19/1999	REMOVAL OF RING BATCH REPORTING REQUIREMENTS	00-1
5/19/1999	NEW OIL FILTER (RAYCOR LFS-62) IMPLEMENTED INTO TESTING	00-1
11/16/1999	TEST ENGINEERING INC. NEW TEST PARTS SUPPLIER	00-1
1/28/2000	PISTON CLEANING PROCEDURE FOR REUSING PISTONS IN SEQUENCE VIII TESTING	00-1
6/15/2002	REVISED STAY-IN-GRADE PROCEDURE IMPLEMENTED	02-1
11/18/2002	EDITORIAL REVISIONS TO D6709-01	02-2
1/1/2004	New MINIERAL SPIRITIS SPECIFICATION	03-1
1/26/04	BILLET CRANKSHAFT APPROVED FOR USE IN SEQUENCE VIII TESTING	
12/9/2004	CLARIFIED SOLVENT SPECIFICATION	04-1
12/9/2004	REVISED FUEL FLOW SPECIFICATION	04-1
12/9/2004	REQUIREMENTS FOR BUILDS WITH OVERSIZE PISTONS	04-1
6/23/05	DELETED ROCKER COVER INLET TEMPERATURE AND PRESSURE SENSORS, UPDATED PRECISION STATEMENT	05-1