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

Memorandum: 07-007

Date: April 13, 2007

To: Fred Gerhart, Chairman, Sequence VIII Surveillance Panel

From: Richard E. Grundza

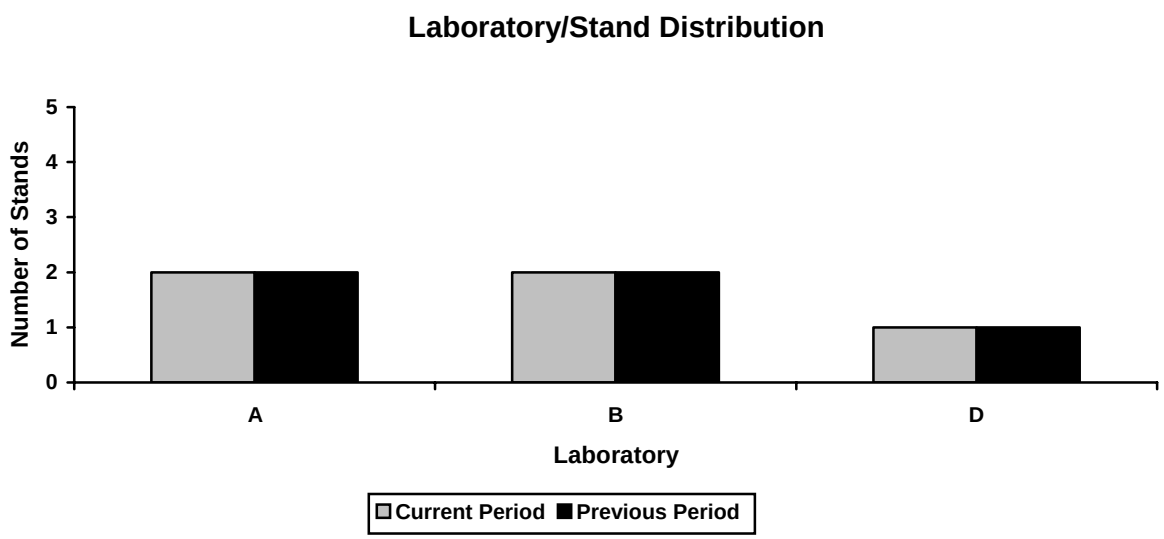
Subject: Sequence VIII Semiannual Report: October 1, 2006 to March 31, 2007

The following is a summary of Sequence VIII reference oil tests that were reported to the Test Monitoring Center during the period from October 1, 2006 to March 31, 2007.

Lab/Stand Distribution

	Reporting Data	Calibrated as of March 31, 2007
Number of Laboratories:	3	2
Number of Stand/Engine Combinations:	5	3

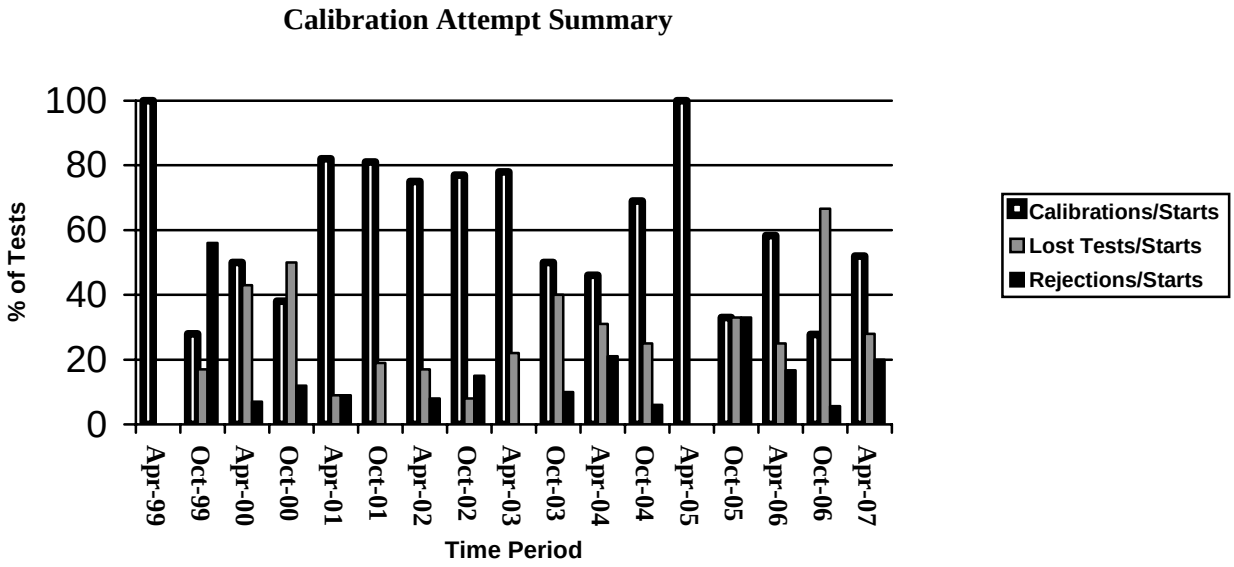
The following chart shows the laboratory/stand distribution:

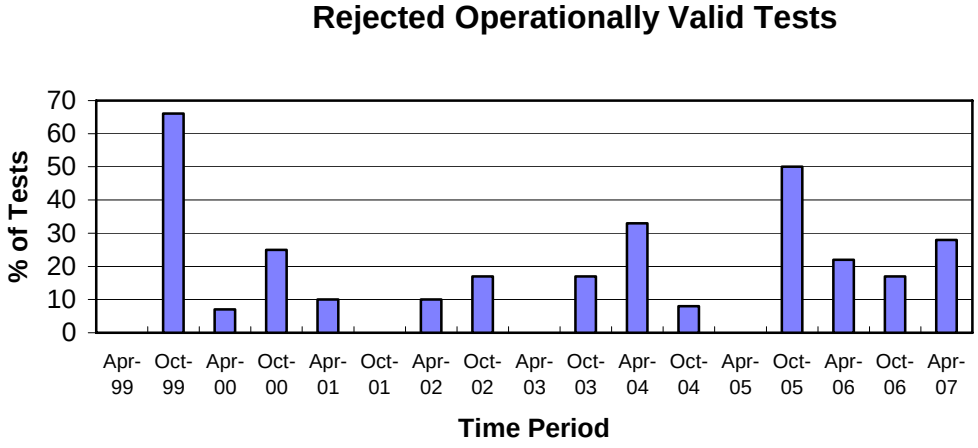


The following summarizes the status of the reference oil tests reported to the TMC:

Calibration Start Outcomes	TMC Validity Code	No. of Tests
Operationally and Statistically Acceptable	AC	13
Operationally Invalid Donated Test	LG	1
Operationally Invalid (laboratory judgment)	LC	6
Aborted	XC	1
Statistically unacceptable Calibration Test	OC	5
Total		26

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





Five tests failed acceptance criteria during the period. Four tests failed for SVIS mild and the remaining test failed for severe BWL.

There were no LTMS Deviations this period. There have been three deviations from the LTMS to date.

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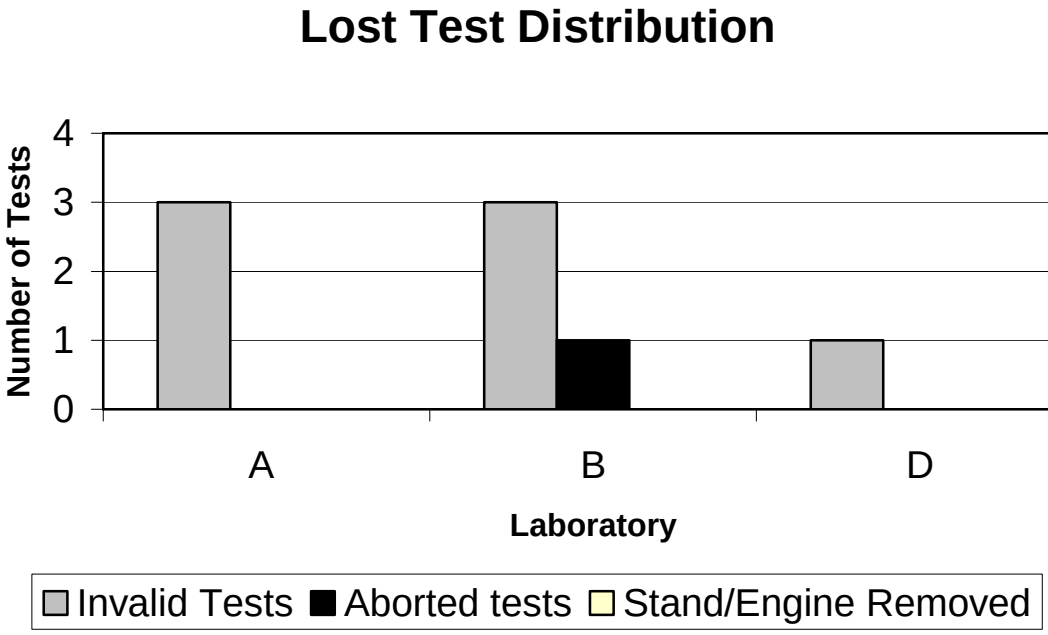
Lost Test Summary

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

Reasons for Lost Test(s)	Number
High mechanical wear	6
Crankshaft damaged	1
High oil consumption	1

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



Information Letters

Information letter 06-1 was issued on October 24, 2006. This letter enhanced the cleaning procedure used to clean bearings.

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 values 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	0.588	3.172 (df=17)	1.87 mg
SVIS	1.157	0.091 (df=17)	0.11 cSt

Average Δ/s by Laboratory		
Lab	BWL	SVIS
A	0.496	1.080
B	0.840	1.883
D	0.431	-1.545

Bearing Weight Loss (BWL)

The industry control charts for severity have exceeded the warning limit seven times during the period. Precision control charts were in control for the period. (see Figure 1).

The Industry BWL mean Δ/s is 0.588 severe for this report period (see Figure 3). This equates to a shift of 1.87 mg in reported units. The pooled standard deviation for the period is 3.172 mg (see Figure 4), which has degraded with respect to the previous period and 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 with the 03-06 batch of bearings was 133 ppm.

Stripped Viscosity (SVIS)

The industry control chart for severity began the period in control, but after the first four tests sounded a severity action alarm (mild), and remained in action alarm for the period. With the exception of three warning alarms, precision was in control for the period (see Figure 2).

The Industry SVIS mean Δ/s is 1.157 mild for this report period (see Figures 2 & 5), and equates to a shift of 0.11 cSt in reported units. The pooled standard deviation for the period is 0.091 cSt (see Figure 6), which is comparable to historical performance.

Hardware

All tests reported during this period were run on the 03-06 Batch bearings.

TMC Memorandum

TMC Memo 07-004 was issued on March 12, 2007 and updated the reference oil targets for reference oil 1006-2.

Reference Oils

Oil	TMC Inventory, In gallons	TMC Inventory, In tests	Laboratory Inventory, in tests	Estimated Life
704-1	353	176	3	5+ years
1006	43	21	1	3 months[1]
1006-2	4,610	2,305	3	3+ years[1]
1009	715	357	5	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-04-2007.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

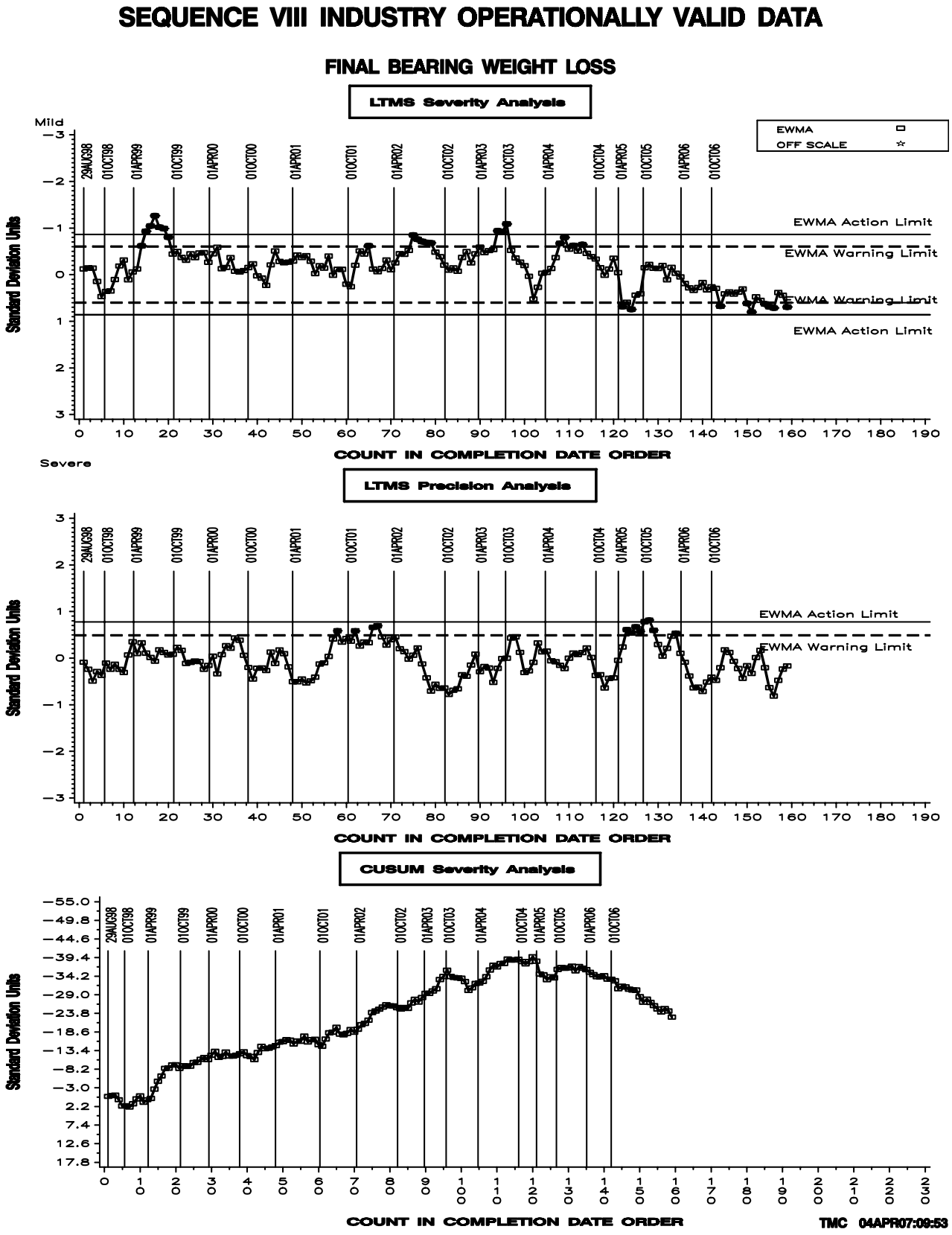

SEQUENCE VIII INDUSTRY OPERATIONALLY VALID DATA
FINAL BEARING WEIGHT LOSS
LTMS Severity Analysis
Mild
Severe
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
Standard Deviation Units
29AUG98
01OCT98
01APR99
01OCT99
01APR00
01OCT00
01APR01
01OCT01
01APR02
01OCT02
01APR03
01OCT03
01APR04
01OCT04
01APR05
01OCT05
01APR06
01OCT06
COUNT IN COMPLETION DATE ORDER
LTMS Precision Analysis
EWMA Action Limit
EWMA Warning Limit
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
CUSUM Severity Analysis
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
TMC 04APR07:09:53

Figure 2

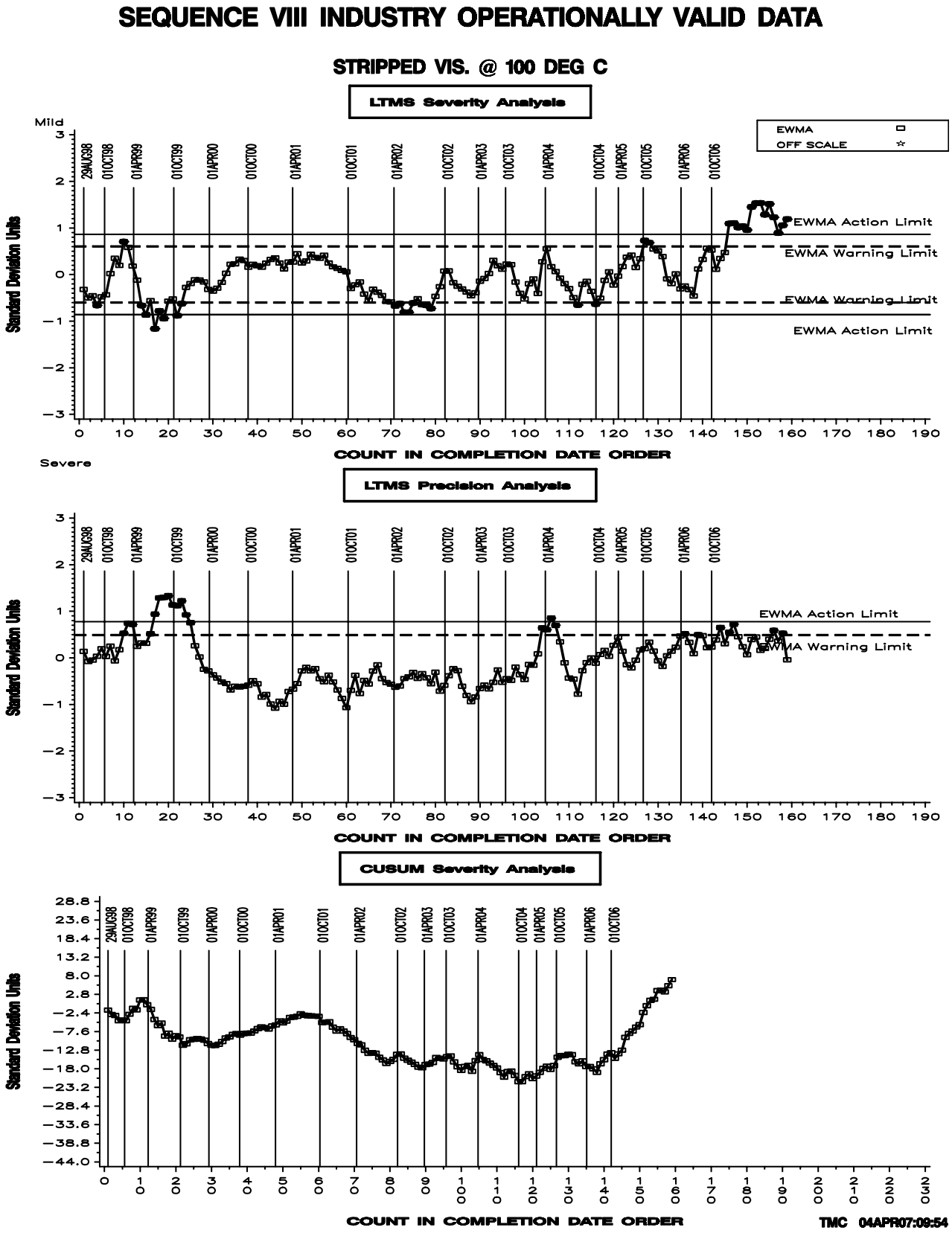

SEQUENCE VIII INDUSTRY OPERATIONALLY VALID DATA
STRIPPED VIS. @ 100 DEG C
LTMS Severity Analysis
Mild
Severe
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
Standard Deviation Units
29AUG98
01OCT98
01APR99
01OCT99
01APR00
01OCT00
01APR01
01OCT01
01APR02
01OCT02
01APR03
01OCT03
01APR04
01OCT04
01APR05
01OCT05
01APR06
01OCT06
COUNT IN COMPLETION DATE ORDER
LTMS Precision Analysis
EWMA Action Limit
EWMA Warning Limit
CUSUM Severity Analysis
TMC 04APR07:09:54

Figure 3 - Sequence VIII Reference Oil Data
Bearing Weight Loss

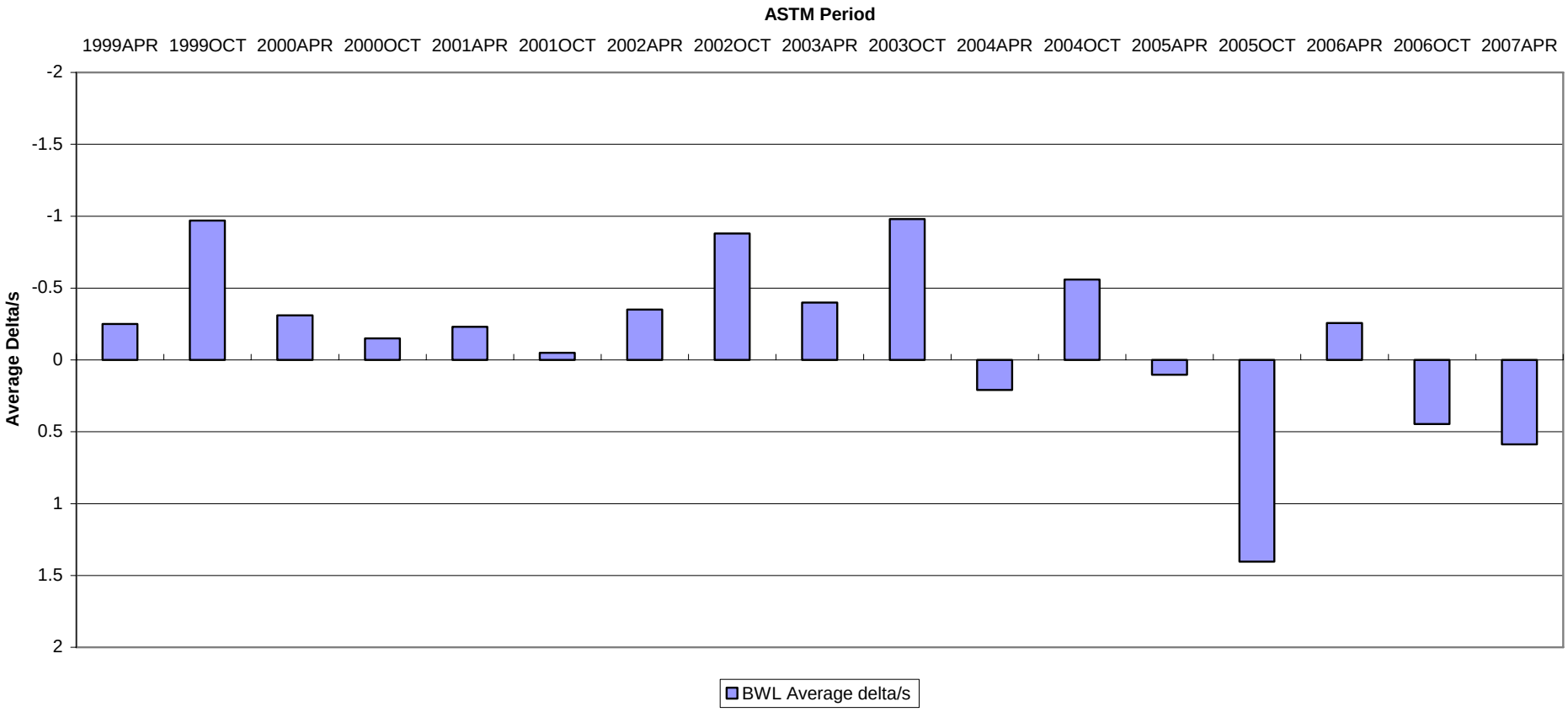


Figure 4 - Sequence VIII Reference Oil Data
Bearing Weight Loss

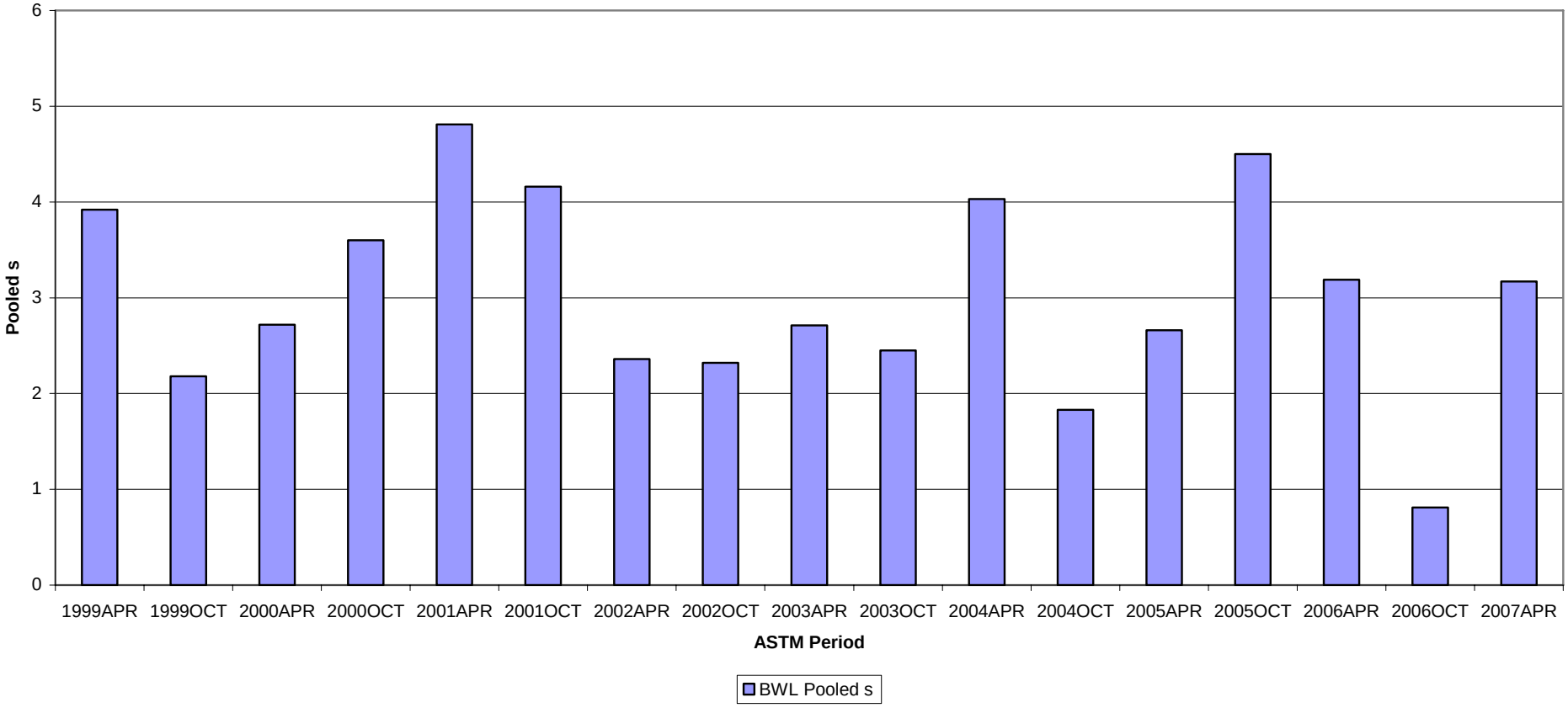


Figure 5 - Sequence VIII Reference Oil Data
Stripped Viscosity

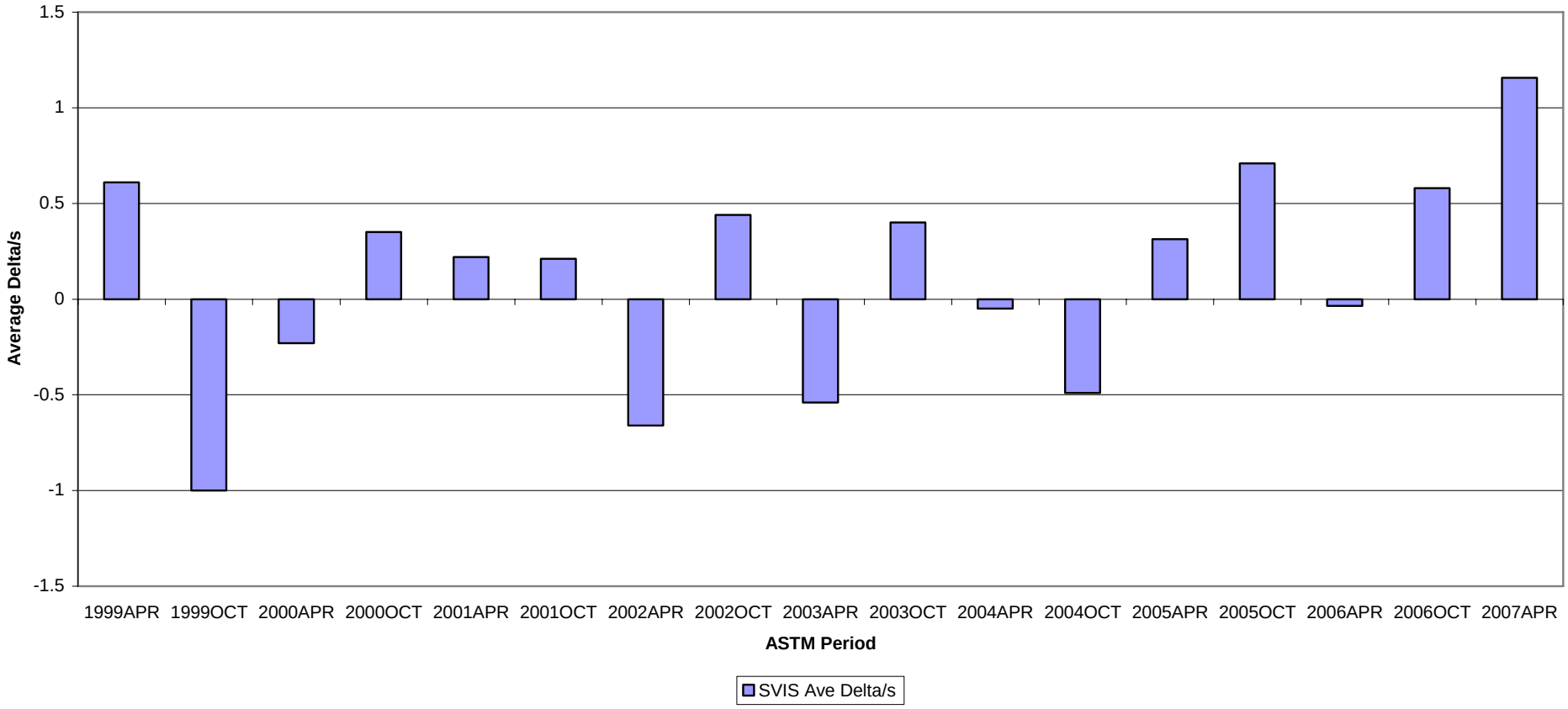


Figure 6 - Sequence VIII Reference Oil Data
Stripped Viscosity

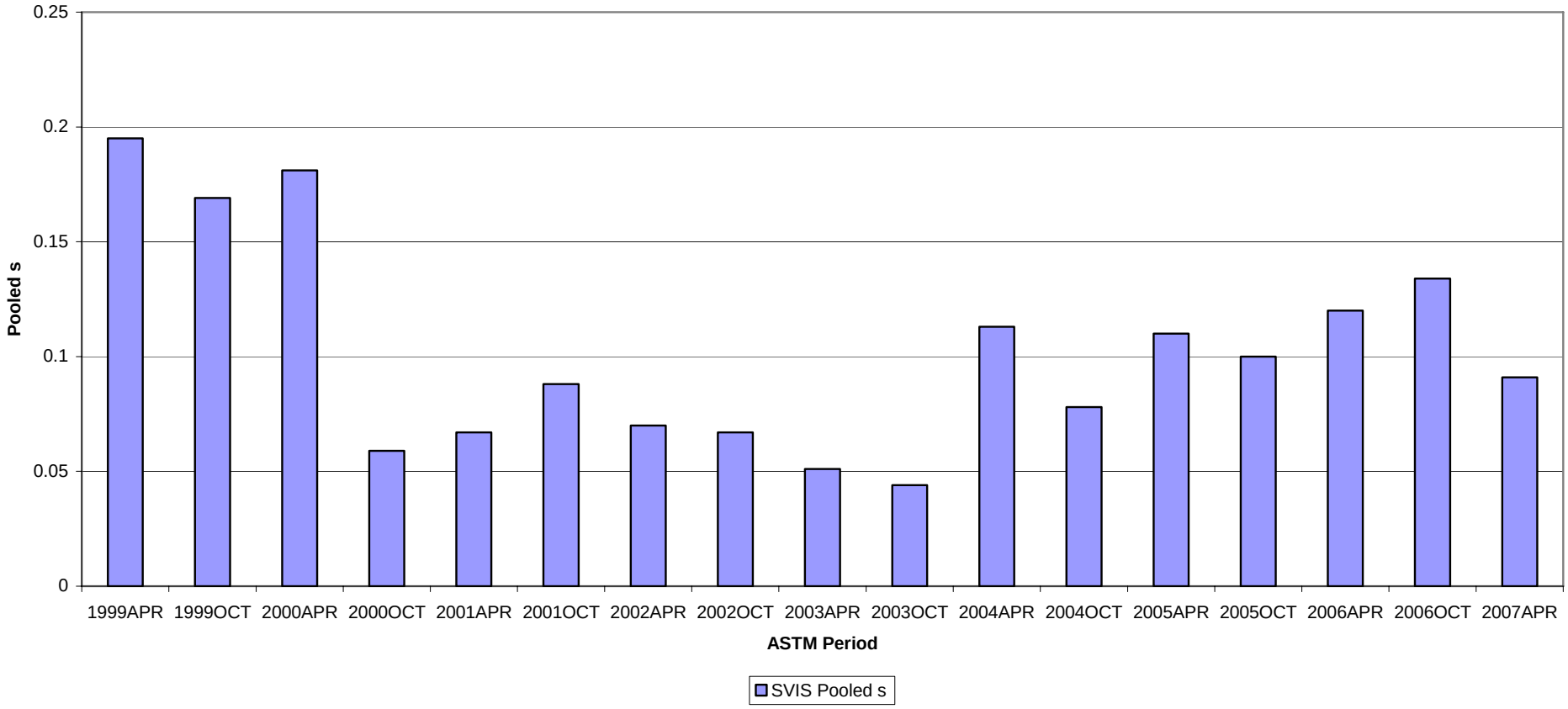


Figure 7

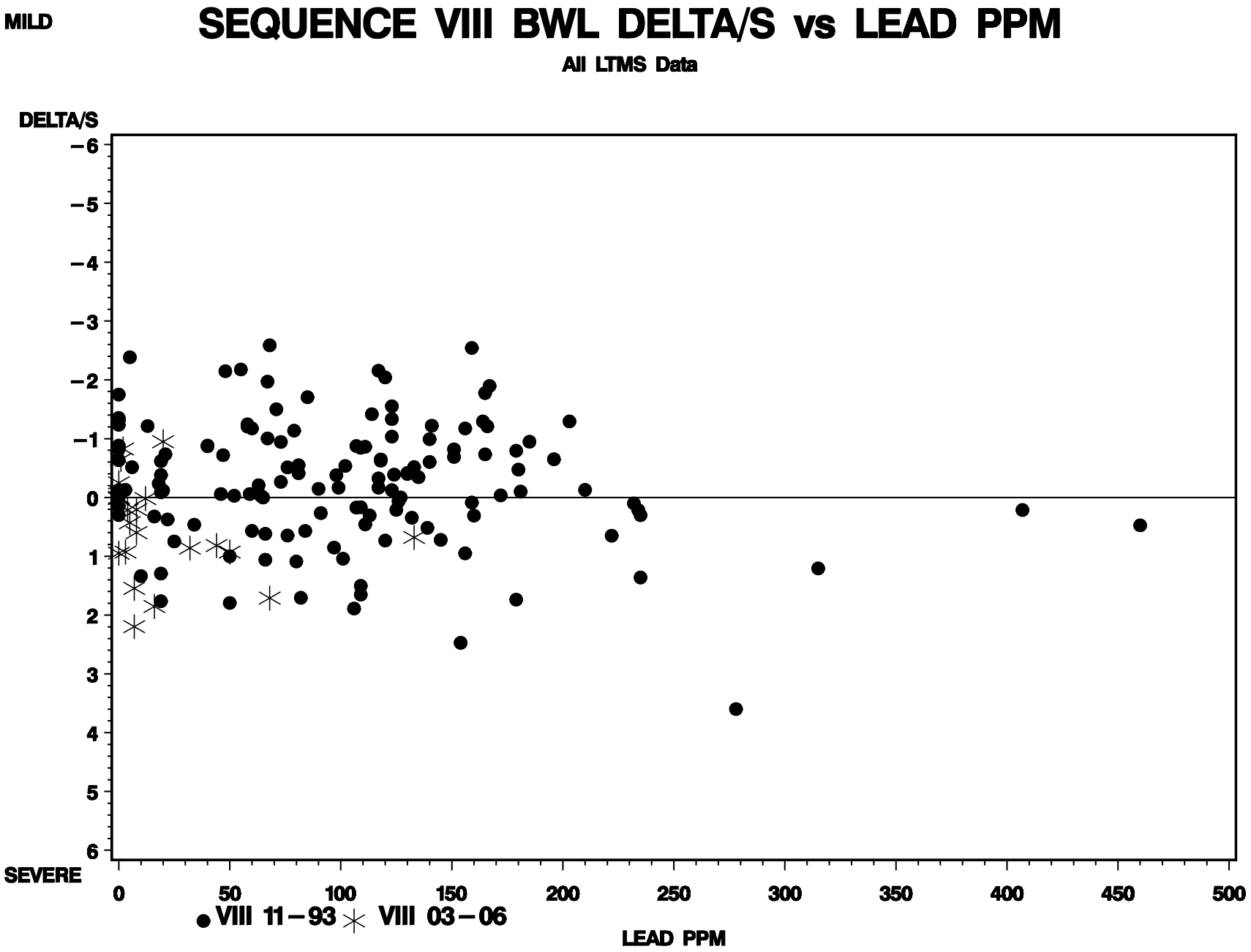

MILD
SEQUENCE VIII BWL DELTA/S vs LEAD PPM
All LTMS Data
DELTA/S
−6
−5
−4
−3
−2
−1
0
1
2
3
4
5
6
SEVERE
0
50
100
150
200
250
300
350
400
450
500
VIII 11−93
VIII 03−06
LEAD PPM

Figure 8

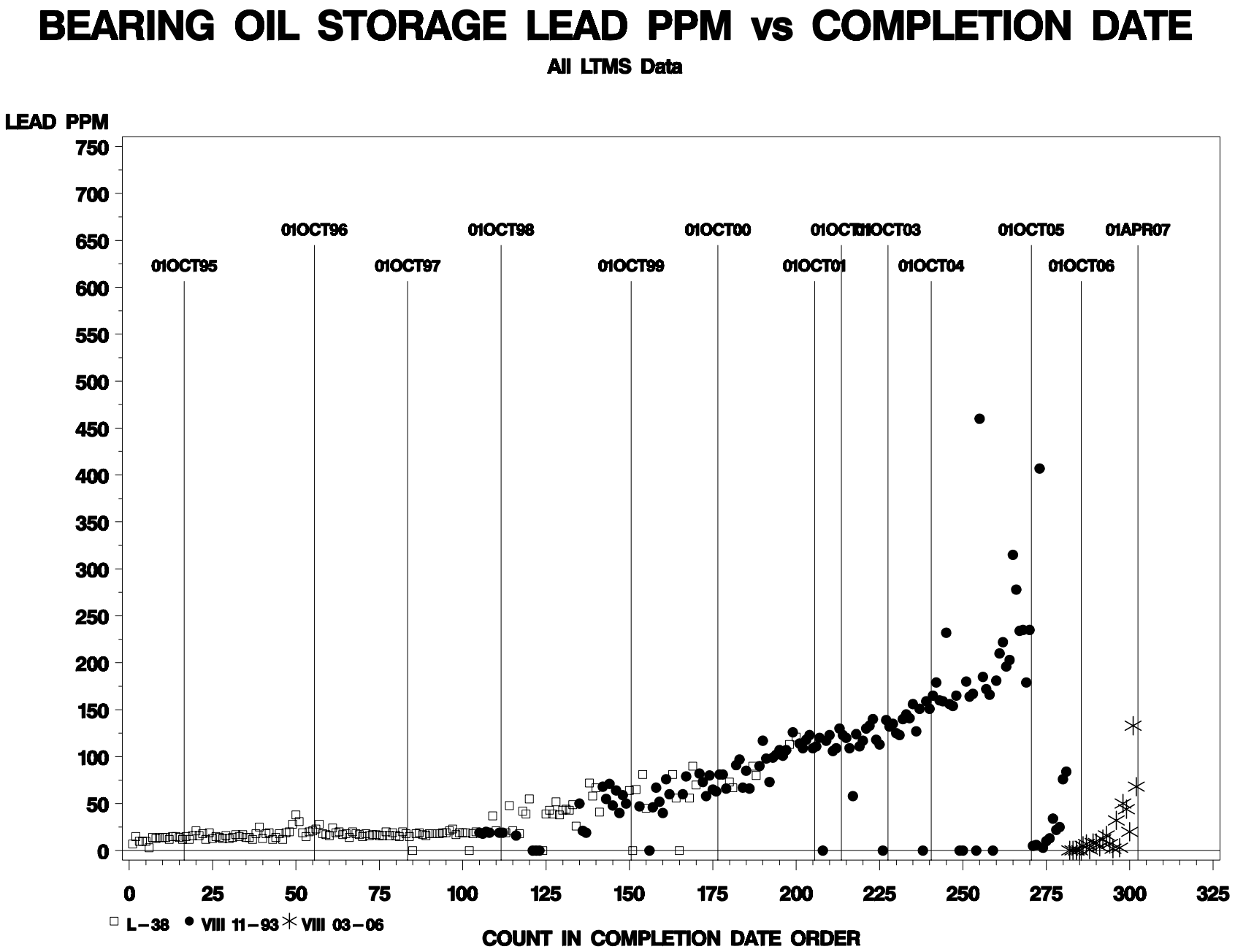

BEARING OIL STORAGE LEAD PPM vs COMPLETION DATE
All LTMS Data
LEAD PPM
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
01OCT95
01OCT96
01OCT97
01OCT98
01OCT99
01OCT00
01OCT01
01OCT03
01OCT04
01OCT05
01OCT06
01APR07
0
25
50
75
100
125
150
175
200
225
250
275
300
325
L-38
VIII 11-93
VIII 03-06
COUNT IN COMPLETION DATE ORDER

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	NEWINERAL SPIRITS 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
9/20/06	FIRST TEST ON 03-06 BEARINGS	
3/12/07	TARGET UPDATE, REFERENCE OIL 1006-2	