



Test Monitoring Center

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Memorandum: 02-027

Date: April 25, 2002

To: Zack Bishop, Chairman Emeritus, Sequence VIII Surveillance Panel

From: Michael T. Kasimirsky *Michael T. Kasimirsky*

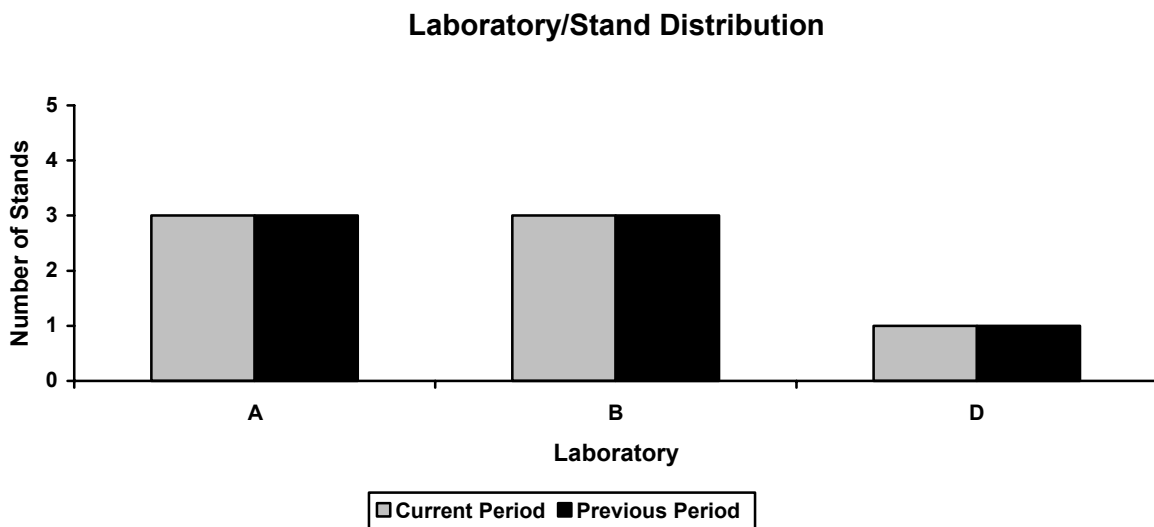
Subject: Sequence VIII Semiannual Report: October 1, 2001 to March 31, 2002

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, 2001 to March 31, 2002.

Lab/Stand Distribution

	Reporting Data	Calibrated as of March 31, 2002
Number of Laboratories:	3	3
Number of Stand/Engine Combinations:	7	7

The following chart shows the laboratory/stand distribution:



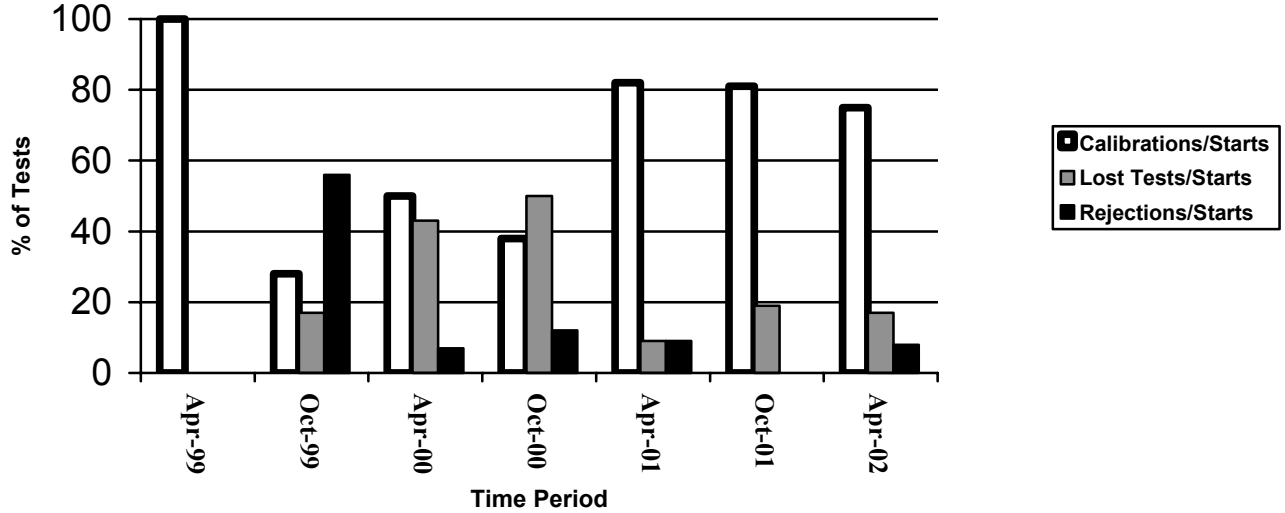
The following summarizes the status of the reference oil tests reported to the TMC:

Calibration Start Outcomes	TMC Validity Code	No. of Tests
Operationally and Statistically Acceptable	AC	9
Failed Acceptance Criteria	OC	1
Stand/Engine failed to successfully calibrate, engine abandoned and data pulled	MC	0
Operationally Invalid (Laboratory Judgment)	LC	2
Operationally Invalid (Laboratory & TMC Judgment)	RC	0
Aborted	XC	0
Total		12

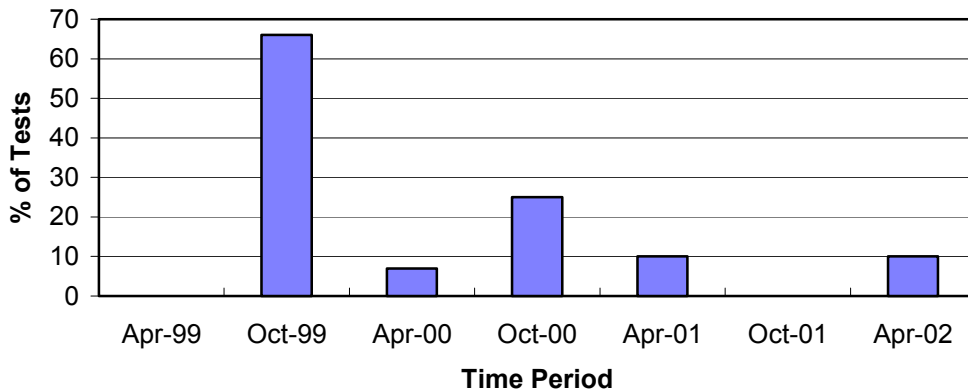
Donated & Industry Support Outcomes	TMC Validity Code	No. of Tests
Shakedown Run	AG	0
Total		0

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

Calibration Attempt Summary



Rejected Operationally Valid Tests



One test failed this period due to mild BWL results.

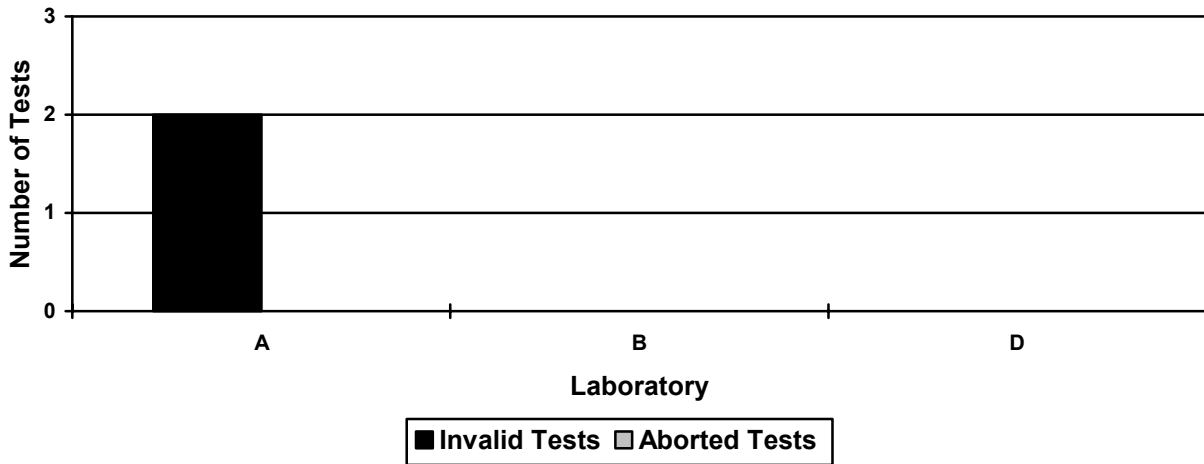
There were no LTMS Deviations this period. There have been no deviations from the LTMS since its introduction in 1999.

During the period, the TMC visited two laboratories. Any discrepancies noted during these visits were identified to the laboratory and corrective action is being taken.

Lost Test Summary

Two tests were lost this period due to mechanical bearing wear. Aborts and Operationally Invalid tests, reported by laboratory, are summarized with the following chart:

Lost Test Distribution



Information Letters

No Information Letters were issued this period.

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	-0.35	2.36 (df=8)	-0.8 mg
SVIS	-0.66	0.070 (df=8)	-0.05 cSt

Average Δ/s by Laboratory		
Lab	BWL	SVIS
A	-0.07	-1.05
B	-0.38	-0.26
D	-1.33	-1.09

Bearing Weight Loss (BWL)

The Industry BWL mean Δ/s is -0.35 mild for this report period (see Figure 3). This equates to a shift of -0.8 mg in reported units. The pooled standard deviation for the period is 2.36 mg (see Figure 4). During the period, the industry experienced a single-point severity alarm and two precision alarms of one and two data points (see Figure 1). The first precision alarm was driven by the failing result on BWL that was reported during the period. Subsequent testing cleared that alarm. The severity alarm and second precision alarm were caused by reference oil tests, run at different laboratories, which were on opposite sides of the test target. Both tests generated passing results and subsequent testing cleared both the severity and precision alarms in the industry. Figures 7 and 8 graphically illustrate the lead content, in ppm, in the bearing storage oil. The highest concentration of lead reported this period was 130 ppm.

Stripped Viscosity (SVIS)

The Industry SVIS mean Δ/s is -0.66 severe for this report period (see Figure 5). This equates to a shift of -0.05 in reported units. The pooled standard deviation for the period is 0.070 cSt (see Figure 6). The industry has been within limits for both severity and precision for the period (see Figure 2).

Hardware

There were no hardware changes for the period.

Reference Oils

Oil	TMC Inventory, In gallons	TMC Inventory, In tests	Laboratory Inventory, in tests	Estimated Life
704-1	471	235	9	10+ years ¹
1006	46	23	4	3 months ¹
1006-2	5,246	2,623	10	3+ years ¹

¹ Multiple test area reference oil; total TMC inventory shown

Reference oil 1006-2 was introduced into the Sequence VIII test at the November meeting of the Sequence VIII Surveillance Panel. The panel approved a motion to introduce this reference oil using the existing test targets for reference oil 1006 until five data points have been generated on this new reference oil. At that time, the TMC was tasked with generating test targets based upon these five data points and then

circulating them to the industry for review and subsequent approval. The panel would then decide if it wanted to use these targets or wait for 10 data points to become available and generate targets at that time. The targets would be automatically updated at 10, 20, and 30 data points as usual. However, reference oil 1006-2 had been performing differently than the original blend of 1006 in other test areas so the TMC, after consultation with the Surveillance Panel Chairman, had held off on assigning 1006-2 until some investigation could be done on this oil to assure that it would perform similarly to the previous blend in the Sequence VIII test. Consultation with the oil suppliers confirmed that they were not surprised by the performance of that oil in other test areas and that they did not expect it to behave differently in the Sequence VIII test. As such, after consultation with the Surveillance Panel Chairman, the TMC has resumed implementation of the introduction plan for this reference oil and will begin assigning it on Sequence VIII reference oil tests in the very near future. The targets for this oil will be established according to the guidelines approved by the Surveillance Panel in November 2001.

The GF-3 Category Reference Oil, reference oil 1009, has arrived at the TMC and work is continuing on getting this reference oil ready to ship out to the industry for introduction into the LTMS. It should be available for shipment in approximately six weeks.

Stripped Viscosity Measurement Investigation

During lab visits, the TMC has been conducting an investigation into the procedures used at the calibrated test labs to determine the stripped viscosity of the 10-h used oil sample as required by the Sequence VIII Test Method. This activity was performed in conjunction with the Stripped Viscosity Round Robin activities that have been conducted recently and was completed during the last period.

To summarize, all three calibrated test labs were found to use a fairly similar apparatus and test procedure to perform this measurement. However, some slight differences in the apparatus and test procedures were found. Only one of the three labs uses a mechanical stirrer in the stripping apparatus as required in Section A14.1.1 of the Sequence VIII Test Method (D6709). The other two laboratories rely on the nitrogen sparge to stir the oil sample during the stripping procedure, rather than some mechanical stirring method.

Another difference noted was that one of the three test laboratories uses a 1 μm filter pad instead of the 0.5 μm filter pad required in section A14.1.3 of the Test Method.

The only other difference of note is in the timing of the stripping procedure. The Test Method defines the stripping procedure as heating the sample at $120 \pm 5^\circ\text{C}$ for one hour in a vacuum of 100 mmHg, etc. One laboratory begins the one-hour clock at 115°C while the others begin the one-hour time clock when the sample reaches 120°C . The procedure listed in the Test Method is not clear as to which interpretation is correct.

Of the differences noted above, only the mechanical stirring and filter media differences are considered significant. The laboratories that did not conform to the requirements listed in the Test Method on these two items have been made aware of the deficiencies and are working to correct those deficiencies in their procedures.

The Surveillance Panel will need to decide if the Stripped Viscosity Round Robin activity that has taken place in the past should be continued in the future. If so, the specifics of when, how, and the repercussions of failing to perform this activity or generate acceptable results will need to be addressed by the Surveillance Panel before the process can be formally put in place.

MTK/mtk

Attachments

c: F. M. Farber, TMC
Sequence VIII Surveillance Panel
<ftp://ftp.astmtmc.cmu.edu/docs/gas/sequenceviii/semiannualreports/VIII-04-2002.pdf>

Distribution: Electronic Mail

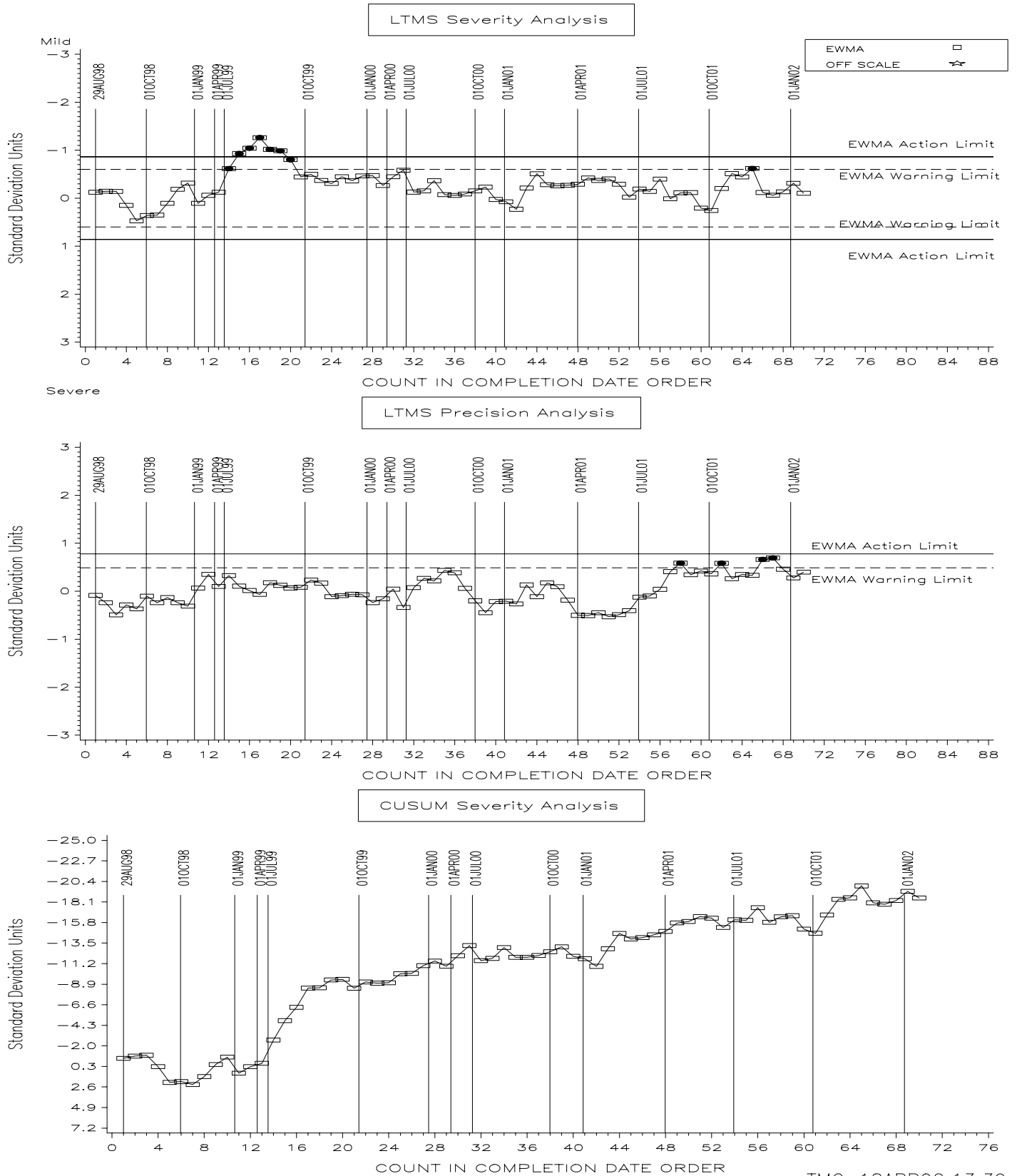
List of Figures

- 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.

SEQUENCE VIII INDUSTRY OPERATIONALLY VALID DATA

FINAL BEARING WEIGHT LOSS

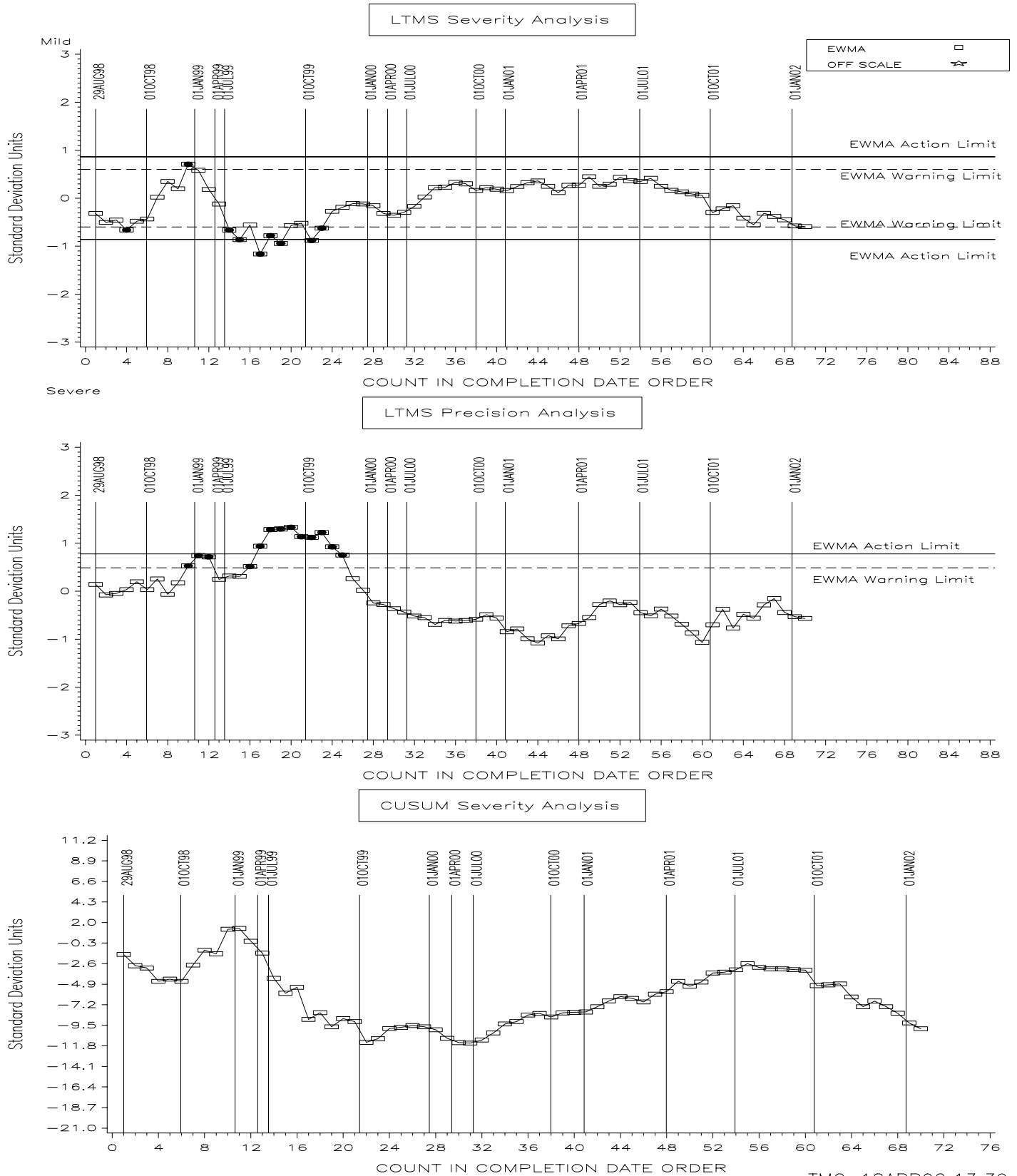
Figure 1



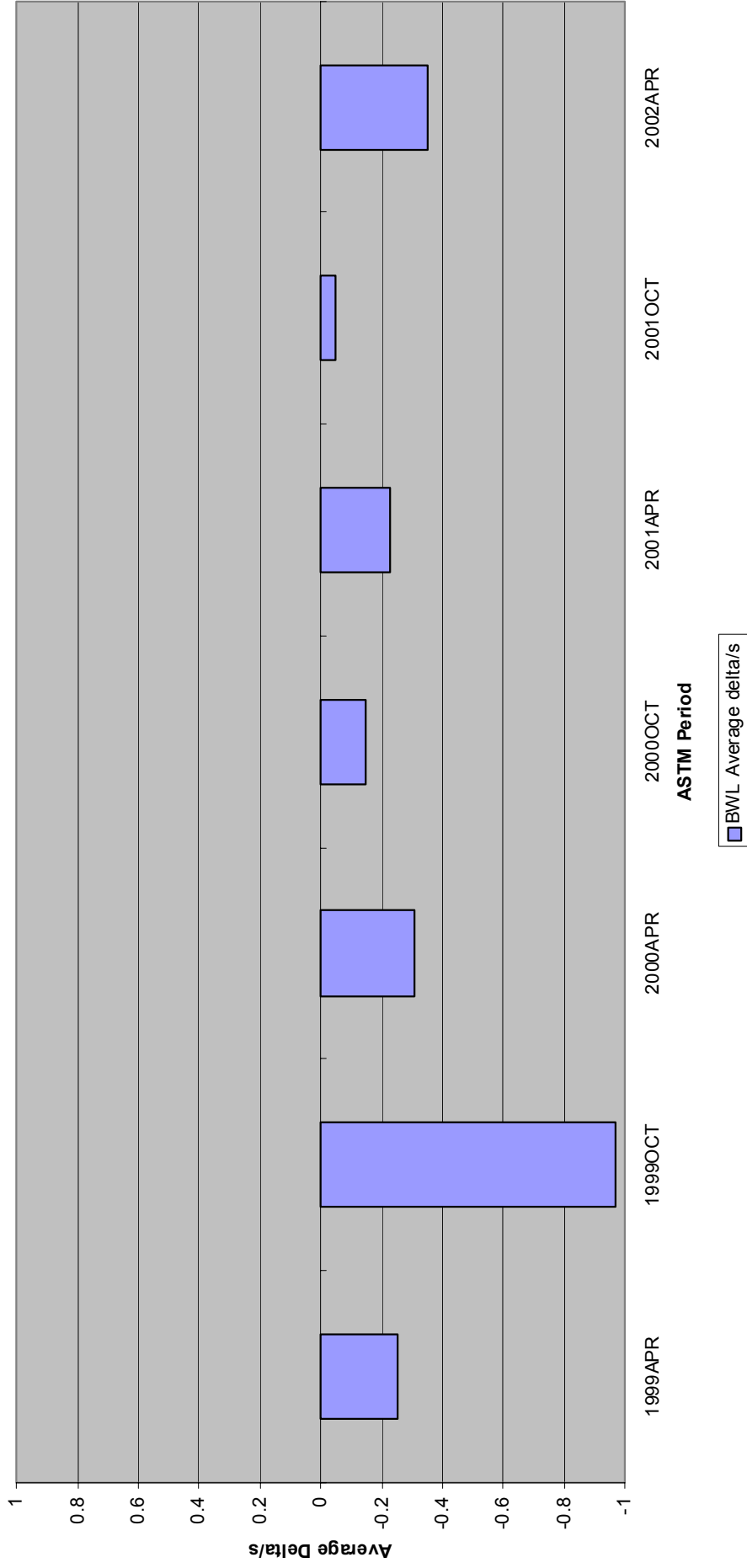
SEQUENCE VIII INDUSTRY OPERATIONALLY VALID DATA

STRIPPED VIS. @ 100 DEG C

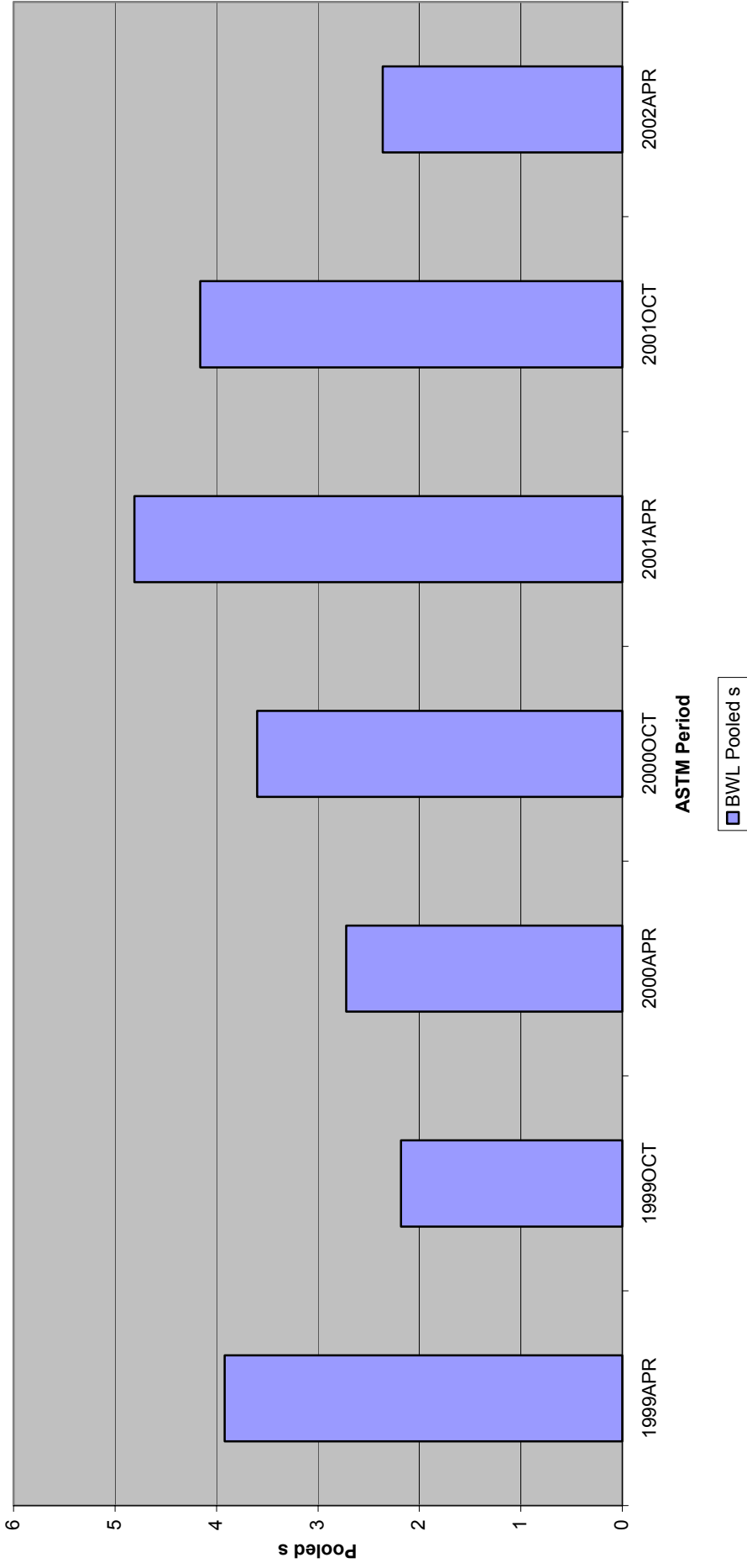
Figure 2



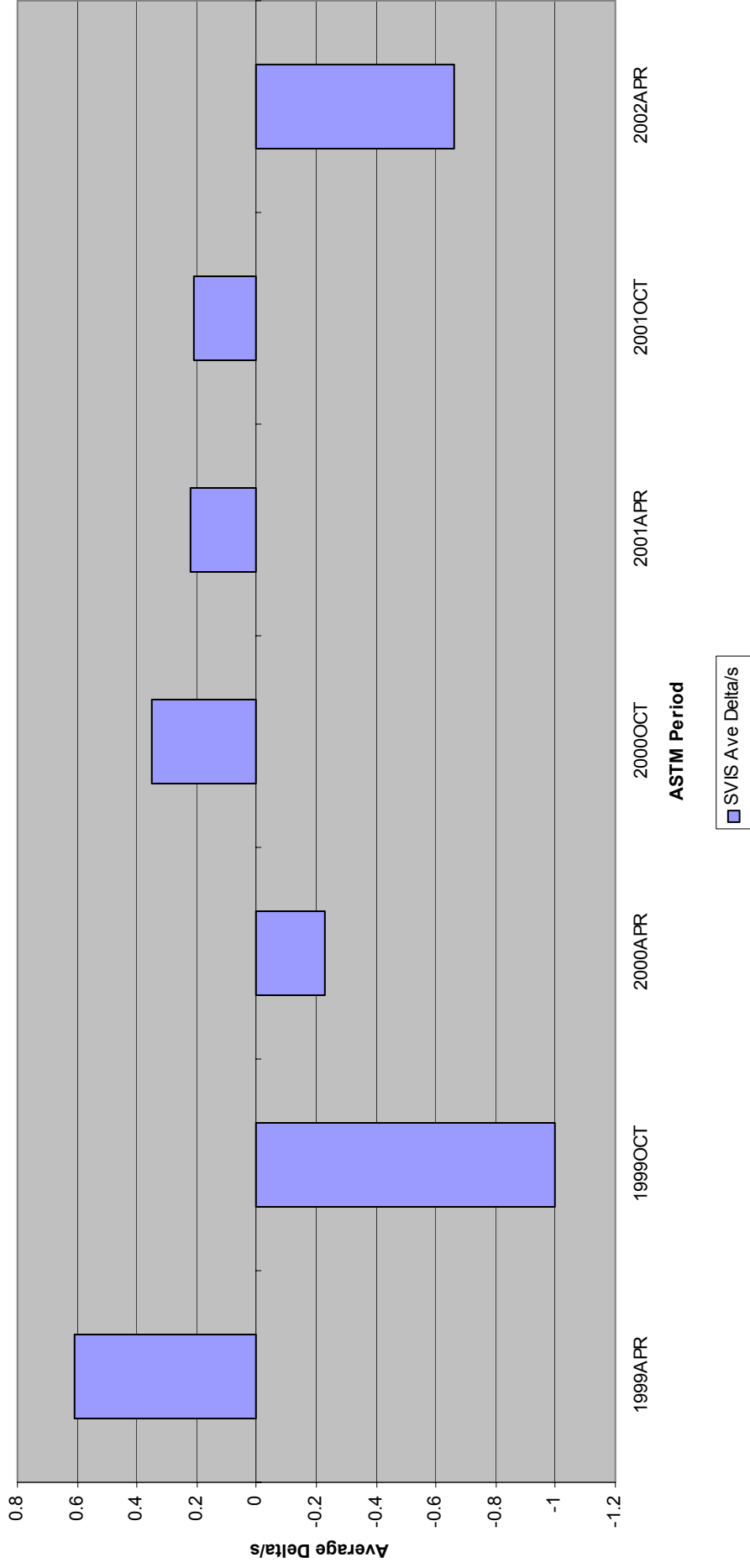
**Figure 3 - Sequence VIII Reference Oil Data
Bearing Weight Loss**



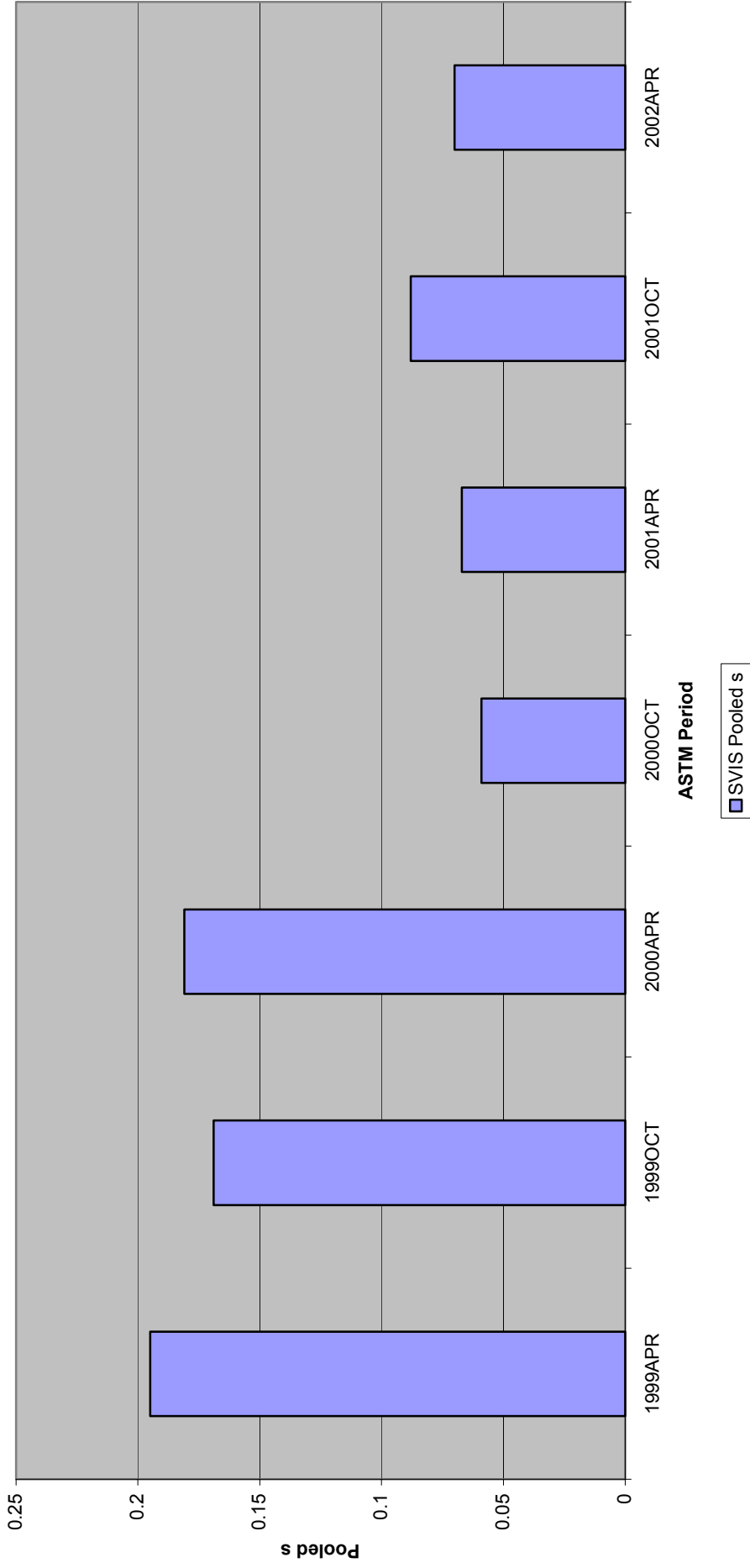
**Figure 4 - Sequence VIII Reference Oil Data
Bearing Weight Loss**



**Figure 5 - Sequence VIII Reference Oil Data
Stripped Viscosity**



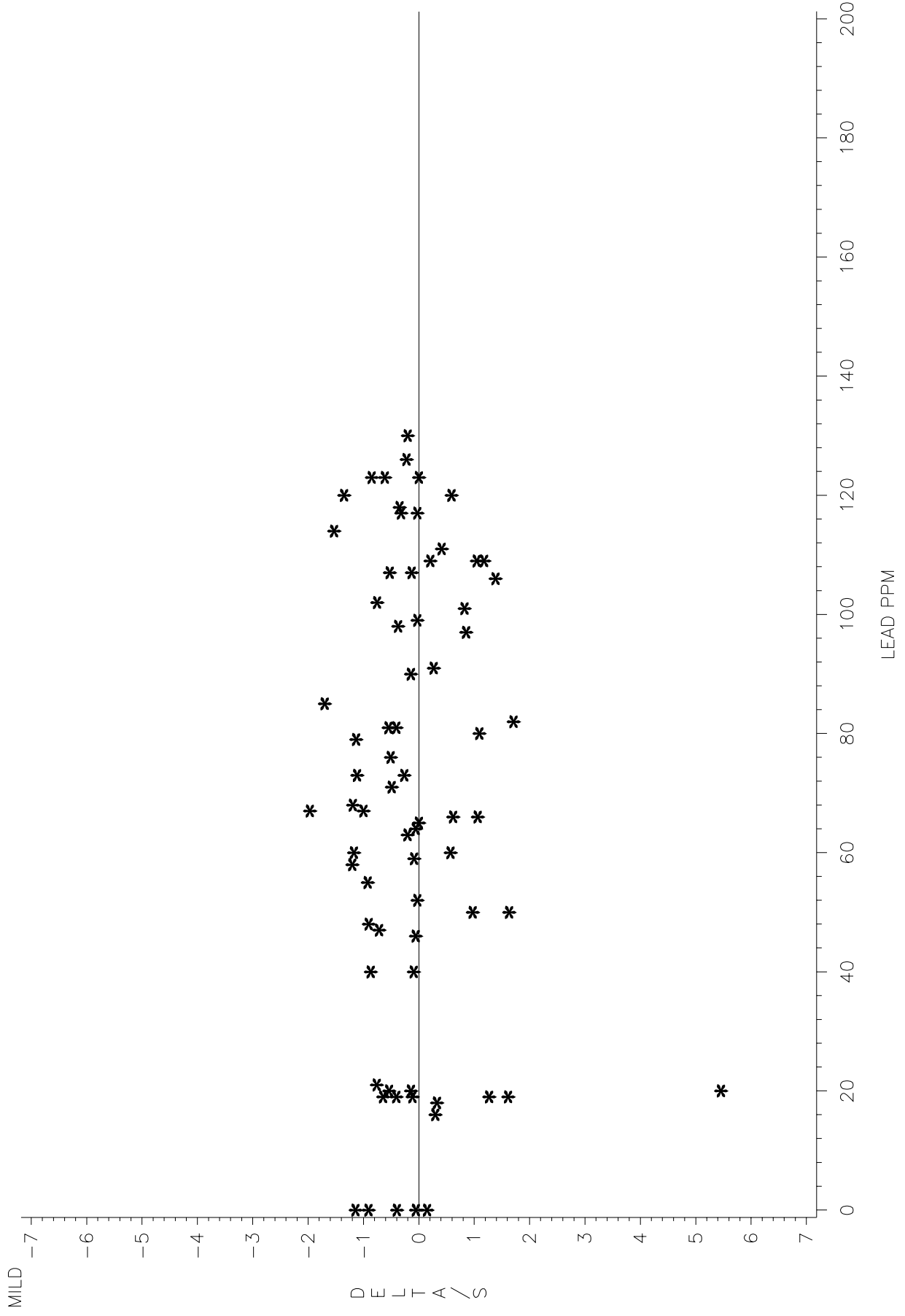
**Figure 6 - Sequence VIII Reference Oil Data
Stripped Viscosity**



SEQUENCE VIII TBWL DELTA/S vs LEAD PPM

September 1, 1998 through March 31, 2002

FIGURE 7



(*) BEARING BATCH 11/93

SFVFRF

BEARING OIL STORAGE LEAD PPM vs COMPLETION DATE
 September 1, 1994 through March 31, 2002

FIGURE 8

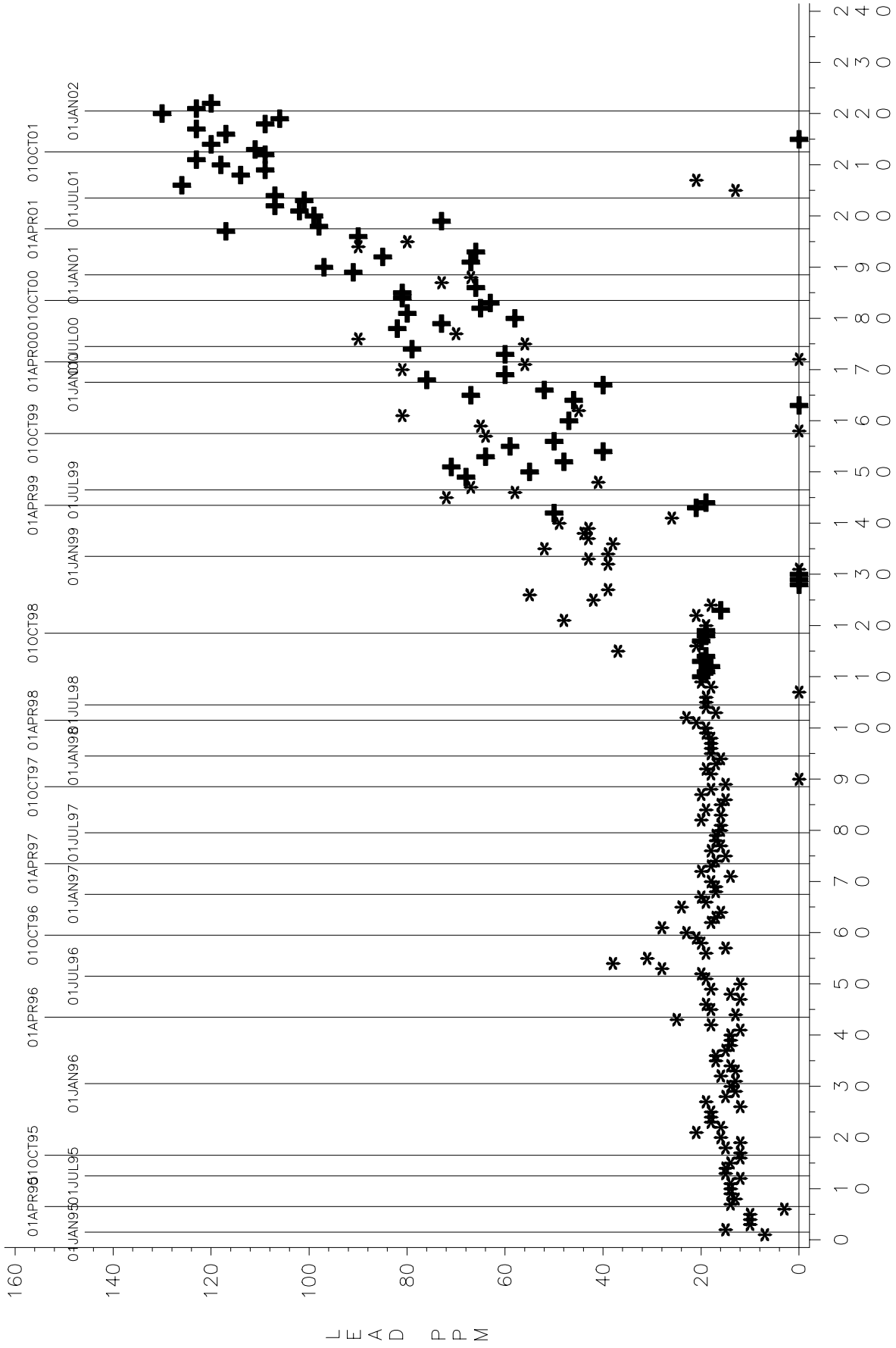


Figure 9 - Sequence VIII Timeline

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