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Committee D02 on PETROLEUM PRODUCTS AND LUBRICANTS

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May 27, 2005

Please forward any comments to:
Charlie Leverett
PerkinElmer Automotive Research
Email: charlie.leverett@perkinelmer.com

Unconfirmed Minutes from the ASTM Sequence VIII Surveillance Panel Held in Tunkhannock PA May 18, 2005

Call to Order

Chairman Fred Gerhart opened the Surveillance Panel (SP) at 9:00 AM and the agenda was distributed and is shown in Attachment #1.

Select Action Item and Motion Recorder

Bill Busher of Southwest Research Institute, volunteered to be the action item and motion recorder. These are shown in Attachment #2

Charlie Leverett of PerkinElmer recorded the minutes. The sign-in sheet for this meeting is shown in Attachment # 3. Membership changes were:

Rich Grundza replaced Mike K. as the TMC voting member
Andrew Ritchie of Infineum will replace Gordon Farnsworth

This panel would like to acknowledge Gordon's dedication and participation over many..... years and wishes him an enjoyable retirement!

Approval of Minutes
Charlie moved that the previous meeting and Conference Call minutes be approved, all were in favor.

A copy of all VIII SP minutes may be found on the TMC web site:

ftp://ftp.astmtmc.cmu.edu/docs/gas/sequenceviii/

Any questions concerning the access of these documents should be directed to TMC.

TMC Report
Rich Grundza presented a brief summary of the Semiannual Report for this period. A complete copy of this Semiannual Report and all previous reports may be viewed at the following link

ftp://ftp.astmtmc.cmu.edu/docs/gas/sequenceviii/semiannualreports/

Rich then presented data/charts related to the loss of Pb (Lead) in the bearing material. This report is shown in Attachment #4. These charts show the Bearing Weight Loss (BWL) Delta/s vs. Pb PPM in the bearing storage fluid for each of the current reference oils. There was some discussion how accurate this data was for oils 1006, 1006-2 and 1009 due to a theory that targets for these oils were in the process of being set and updated at a time the bearings were showing high Pb in the storage fluid. The concern is that this maybe masking a BWL severity shift

Rich's report was approved.

RSI Report
No report was given at this meeting, the Chairman had sent the latest RSI report to the SP in an Email.

CPD Report
Zack Bishop of TEI gave this report.

A summary of this report is shown below, the full report is shown in Attachment # 5.

- Current inventory of 11-93 bearings by lot
- A review of the TEI Bearing Storage Study
- Recommendation for preserving current bearings
- Details on the possibility of production of a new batch of bearings
- Summary of Annual Parts Order 2005
- List of Seq. VIII Critical Parts

The panel had a lengthy discussion on the current bearings and a proposed new batch, the outcome of this discussion is summarized in the Motions & Action Item List (Attachment #2) items 1-5.

A question was asked regarding the Seq. VIII being included in GF-5, the summary of the response from ILSAC/Oils was the Seq. VIII will be in GF-5. The bench test work by this group did not show a correlation to the Seq. VIII. At this time no one noted any additional work being done on a bench test replacement for the Seq. VIII.

Old Business
The Chairman gave his presentation on "Sequence VIII Bearing Dilemma", this may be found in Attachment #6.

New Business

1.) Frank Farber gave a presentation on Test Precision Calculation Guideline proposal. See Motion and Action Items List (Attachment #2) items 6 & 7.
2.) Continue target updates on 1006-2 and 1009- At the last SP meeting the SP gave TMC approval to update as specified. See Motion and Action Items List (Attachment #2) item 8 for revision.
3.) Expand reporting of Pb in storage oil for candidate tests, no motions were made to accept this suggestion, it is considered optional.

Review of Scope and Objectives
The Sequence VIII Scope and Objectives as revised at the 05/18/05 meeting and are shown in Attachment #7.

The Chairman presented his plan for meetings, this is shown in Attachment #8. Next meeting will be at the call of the chair.

Adjournment
The meeting adjourned at 11:05 AM

Attachment #1

Sequence VIII May 2005 Surveillance Panel Agenda
Tunkhannock, PA
Shadowbrook Resort
May 18, 2005
9AM - 12PM

1. Call to Order - Fred Gerhart
    a. Motion and Action Items Recorder
    b. Membership Changes
    c. Attendance Sign-in

2. TMC – Rich Grundza
    a. BWL Delta/S vs Lead graph for each reference oil
    b. Lead in storage oil versus completion date

3. CPD Report - Zack Bishop
    a. Status of lead in bearing storage oil
    b. Data from oil change experiment
    c. Test bearing inventory by lot

4. Old Business
    a. New bearings or change oil- presentation by SwRI

5. New Business
    a. Frank Farber - test precision calculation guideline proposal
    b. Continue target updates on 1006-2 and 1009?
    c. Expand reporting of lead in storage oil to candidates?

6. Review Scope and Objectives

7. Next Meeting

8. Adjournment

Sequence VIII Surveillance Panel
May 18, 2005
9:00AM – 12:00PM
Shadowbrook Inn
Tunkhannock, PA

Motions and Action Items
As Recorded at the Meeting by Bill Buscher

1. Motion – TEI will develop an actual cost mechanism to the industry for manufacturing a new batch of bearings and develop a plan for storing the new batch of bearings, and distribute it to the Surveillance Panel members.
   Charlie Leverett / Gordon Farnsworth / 7 For 0 Against 3 Waive

2. Action Item – The cost and storage plan for a new batch of bearings will be reviewed and discussed during the November 2005 Surveillance Panel meeting and a decision to move forward will be made at the meeting.

3. Motion – All existing bearings located at both TEI and the laboratories will be removed from their existing EF-411 storage oil and containers and placed in new containers with new EF-411 storage oil. All existing bearings within the industry will be returned to TEI for this task to be performed. This will be completed by 07/01/05.
   Ben Weber / Bill Buscher Jr. / 7 For 0 Against 4 Waive

4. Action Item – TEI will experiment with different storage containers and different storage oils using a sample of existing bearings, to develop a plan for storing a potential new batch of bearings.

5. Action Item – TEI will combine all storage oil from the bearings returned from the laboratories and analyze for lead content and analyze the storage oil from the bearings currently stored at TEI under Argon gas. These analyses will be compared to determine if lead leaching is occurring at different rates between the bearings stored at the laboratories and at TEI.

6. Motion – Approve the concept that the severity adjustments and the test precision calculation should use the same standard deviations.

Charlie Leverett / Dave Glaenzer / Passed with 1 Waive

7. Action Item – Frank Farber to distribute the TGC test precision calculation proposal to the Surveillance Panel members for agreement on oil selection for each parameter.

8. Motion – Reference oil target updates will not be conducted without Surveillance Panel review.
   Charlie Leverett / Mark Sutherland / Passed unanimously

9. Action Item – Sid Clark will review the idea of resurfacing the bearings and resizing the connecting rods to accommodate the resurfaced/resized bearings.

Attachment #3

ASTM L-38 / SEQUENCE VIII SURVEILLANCE PANEL
MEMBERSHIP LIST

Name	Address	Phone/Fax/Email	Attendance
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Brys, Jerrry	Lubrizol Corporation 29400 Lakeland Blvd. Wickliffe, OH 44092	Phone: 440- 347-2C31 Fax: 440- 347-409C jabs@lubrizol.com	
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Todd Dvorak	Afton Chemical 500 Spring Street Richmond, VA 23219	804-788-6367 F. 804-788-6388 Todd.Dvorak@AftonChemical.com	

OVER

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AR.

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ASTM L-38 / SEQUENCE VIII SURVEILLANCE PANEL
Guests

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ASTM L-38 / SEQUENCE VIII SURVEILLANCE PANEL
Guests

Name	Address	Phone/Fax/Email	Attendance
Zach Bishop	TEI	ZBISHOP@TEI-NET.COM	

Sequence VIII Meeting

May 18,2005

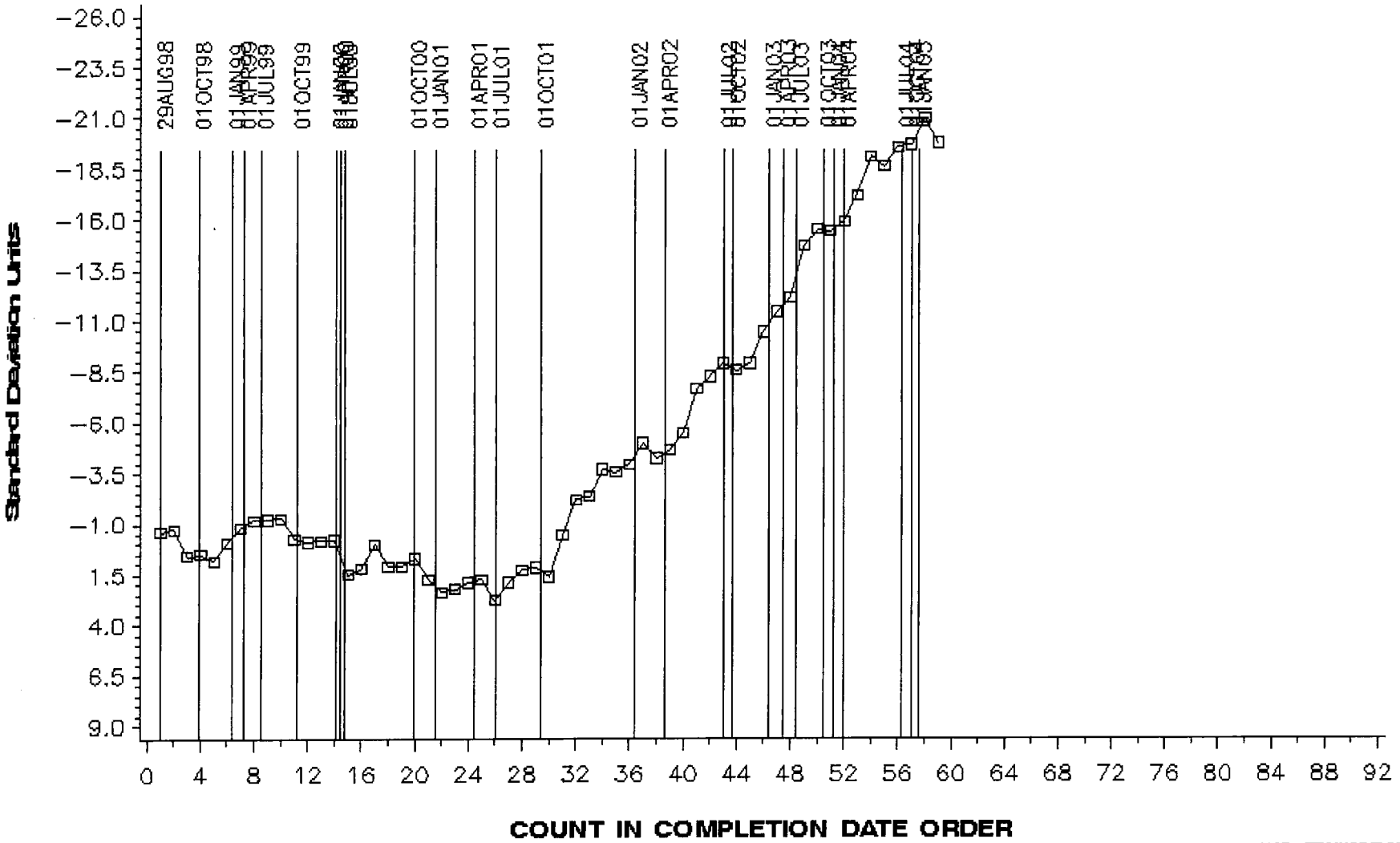
Attachment #1

SEQUENCE VIII INDUSTRY OPERATIONALLY VALID DATA

Reference Oil 704—1 Only

FINAL BEARING WEIGHT LOSS

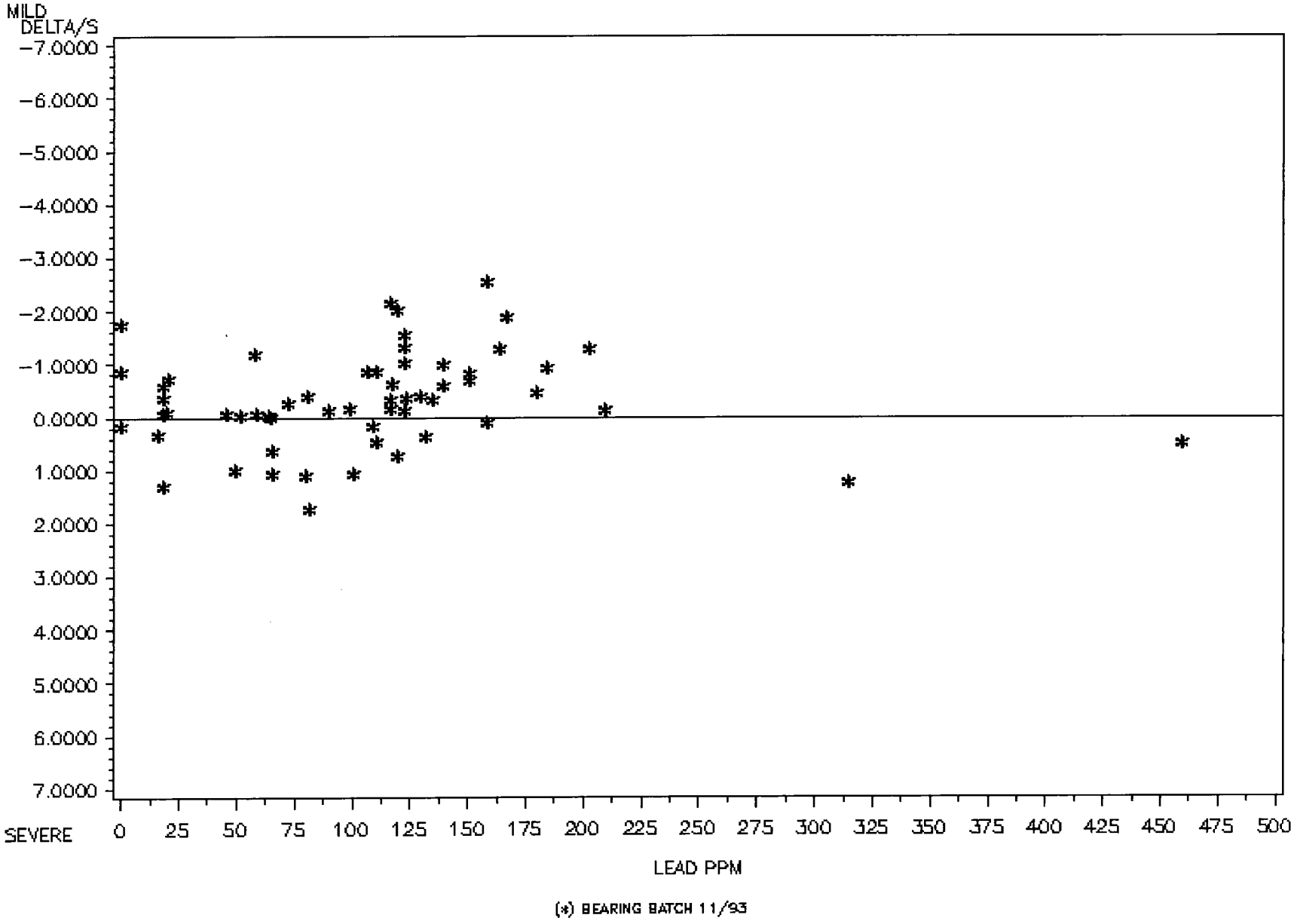
CUSUM Severity Analysis



TMO 18MAY05:TE03

SEQUENCE VIII BWL DELTA/S vs LEAD PPM

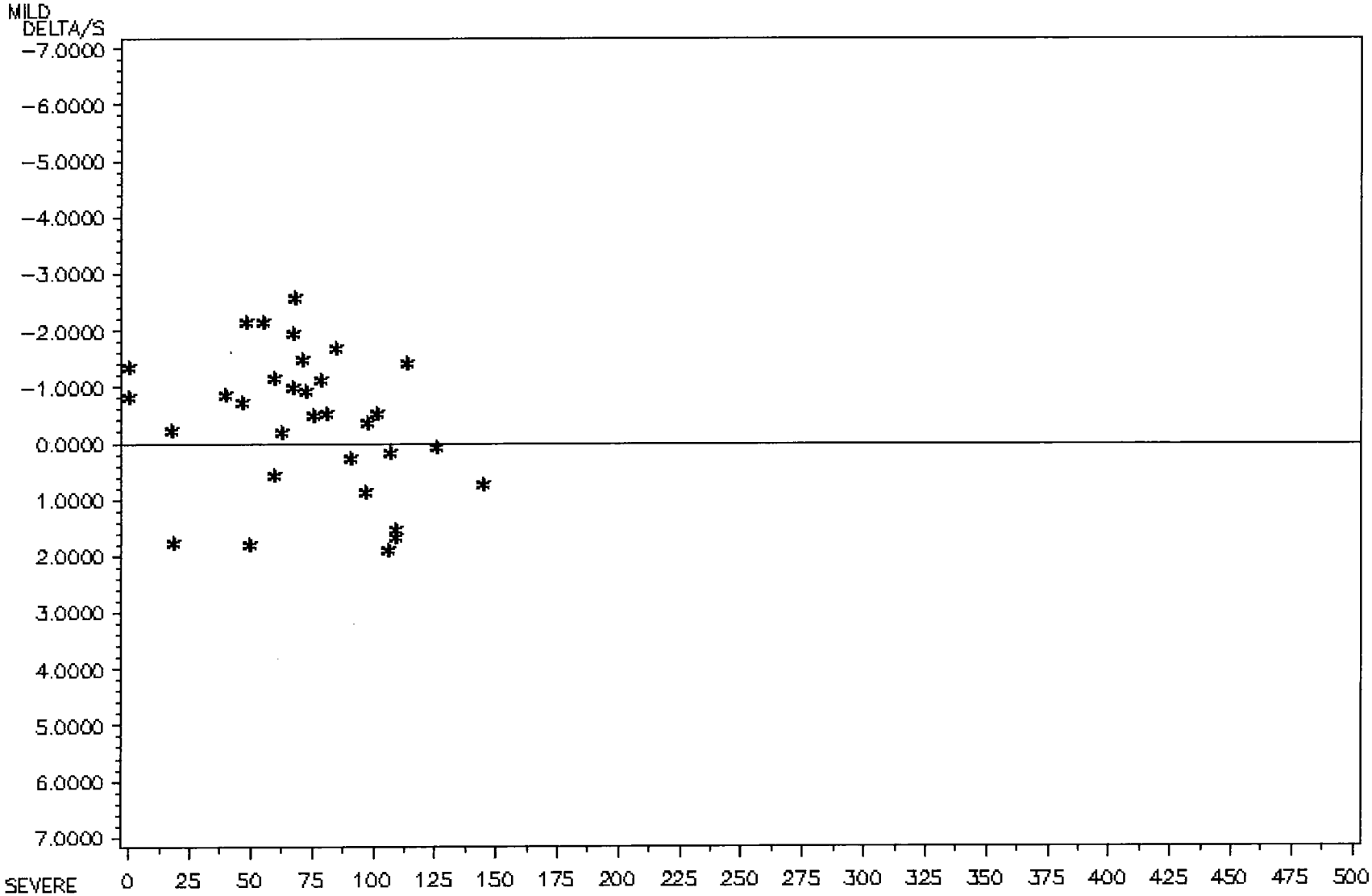
Reference oil 704-1 Only



(*) BEARING BATCH 11/93

SEQUENCE VIII BWL DELTA/S vs LEAD PPM

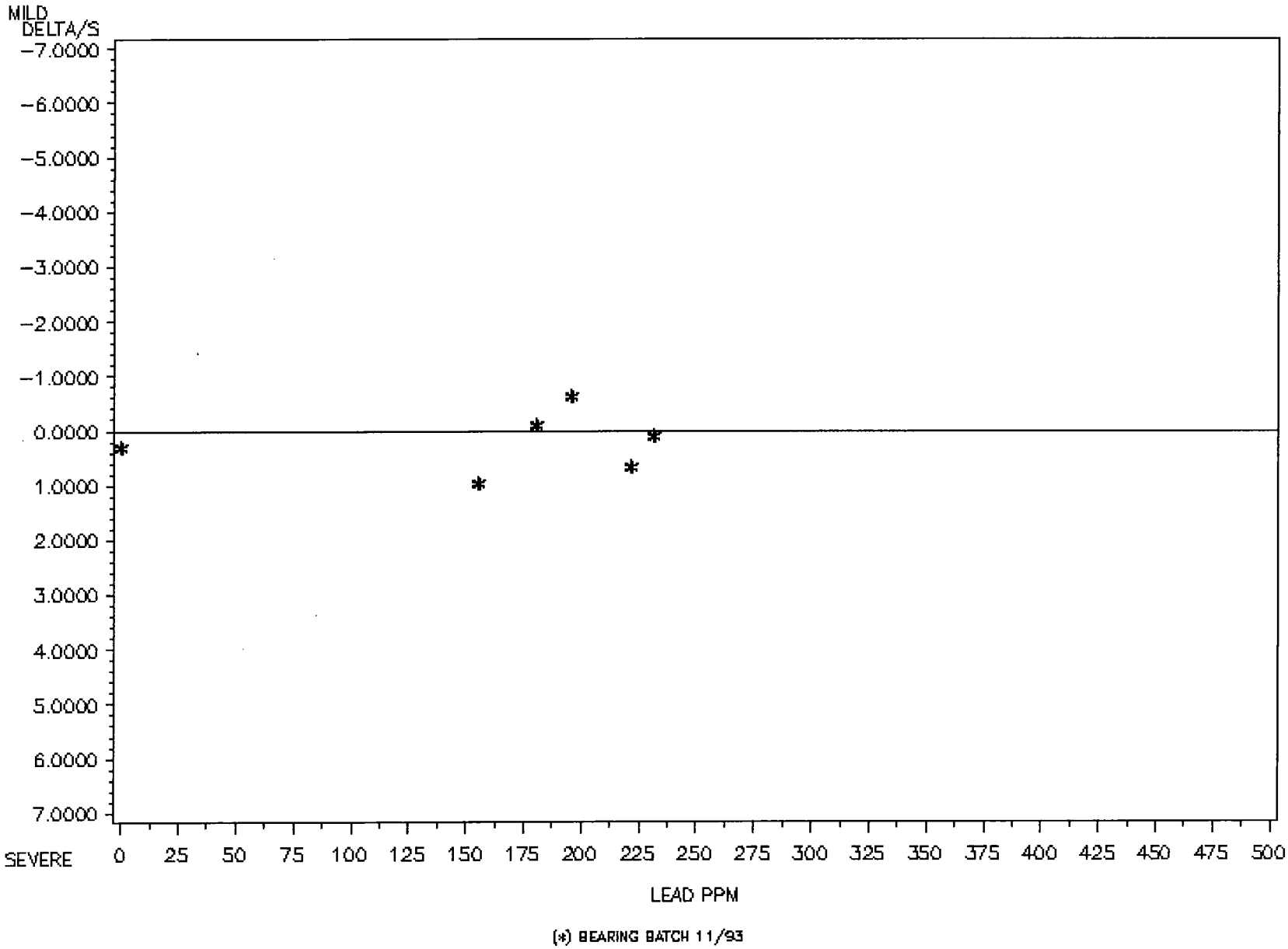
Reference oil 1006 Only



(*) BEARING BATCH 11/93

SEQUENCE VIII BWL DELTA/S vs LEAD PPM

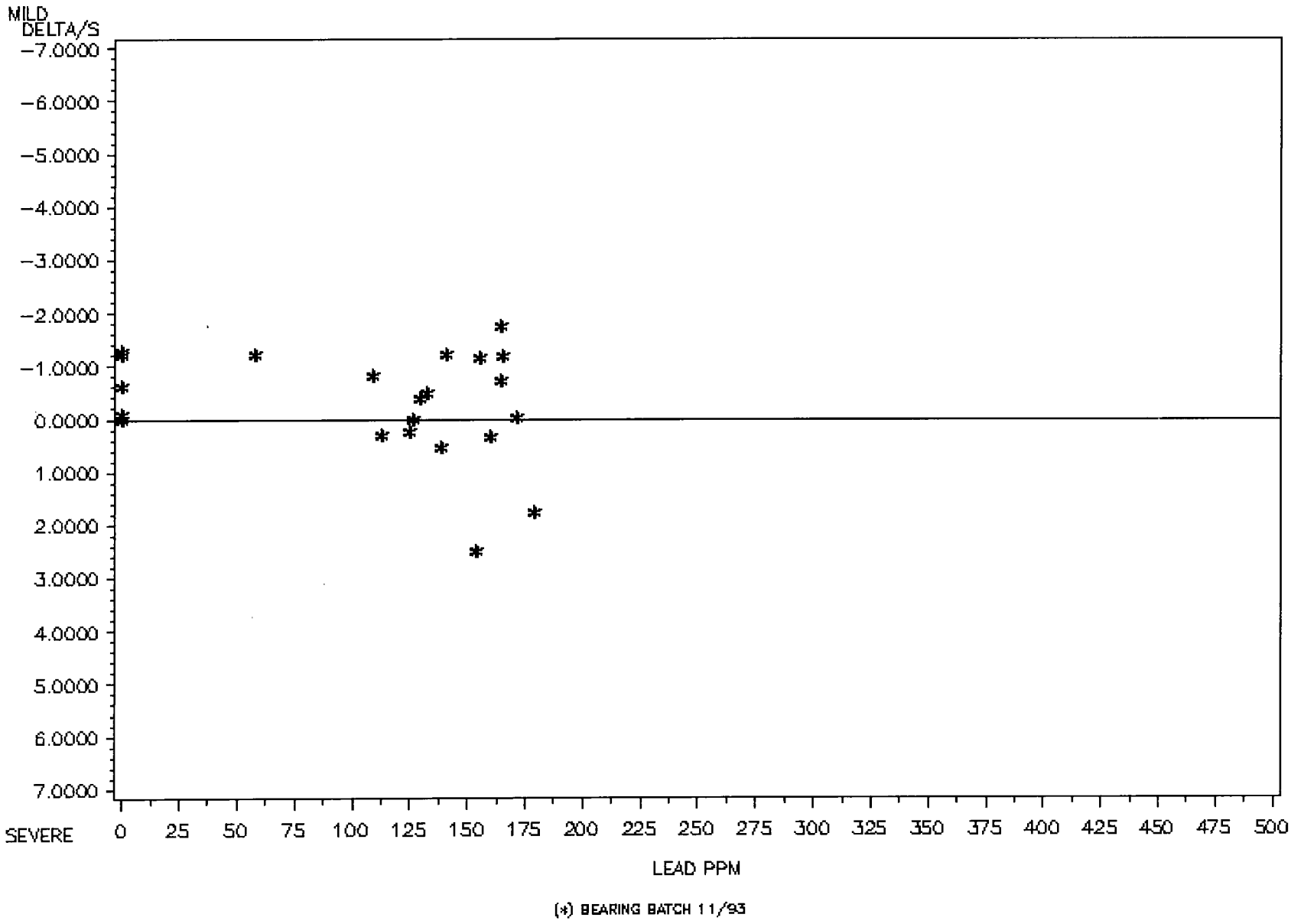
Reference oil 1009 Only



(*) BEARING BATCH 11/93

SEQUENCE VIII BWL DELTA/S vs LEAD PPM

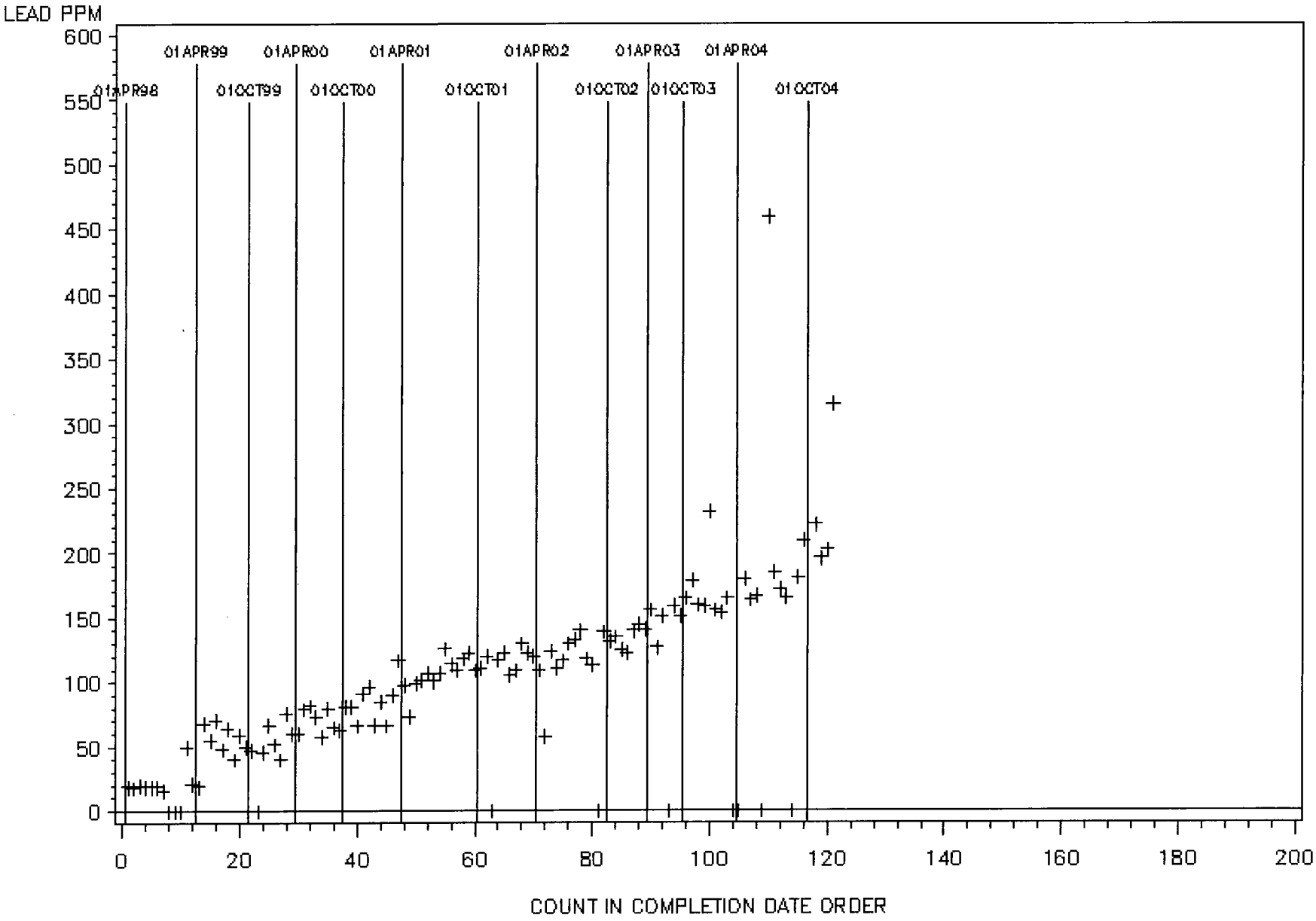
Reference oil 1006-2 Only



(*) BEARING BATCH 11/93

BEARING OIL STORAGE LEAD PPM vs COMPLETION DATE

SEQUENCE VIII LMTS DATA ONLY



CPD Report to Sequence VIII Surveillance Panel May 18, 2005

- 11-93 Rod Bearing Batches
  - –Lot Codes 11, 12, 13, 14 and 15 are all in argon storage
  - –Currently issuing Lot Code 11
  - –Inventory (as of 05/18/2005)
    - Lot 11 = 150 sets
    - Lot 12 = 427 sets
    - Lot 13 = 425 sets
    - Lot 14 = 400 sets
    - Lot 15 = 170 sets

  - •Total in storage at TEI = 1572 sets (12 to 15 year supply)

TEST ENGINEERING, INC.

Attachment #5

CPD Report to Sequence VIII Surveillance Panel May 18, 2005

- 11-93 Batch Rod Bearing Storage Study (see table next slide)
  - –Bearings stored in Argon since March 2002
  - –One set (Set "A") was not stored in Argon
  - –Set "A" was washed in Pentane on 9/3/2004 and re-packaged in fresh EF-411 (Lot Codes 10, 11, 13, 14 and 15) and placed in Argon storage. Lot Code 12 was washed in Pentane, re-packaged in fresh EF-411 but not placed in Argon storage.
  - –Periodic analysis will continue and the data will be made available to the industry as part of TEI's reports to the Surveillance Panel.

TEST ENGINEERING, INC.

CPD Report to Sequence VIII Surveillance Panel May 18, 2005

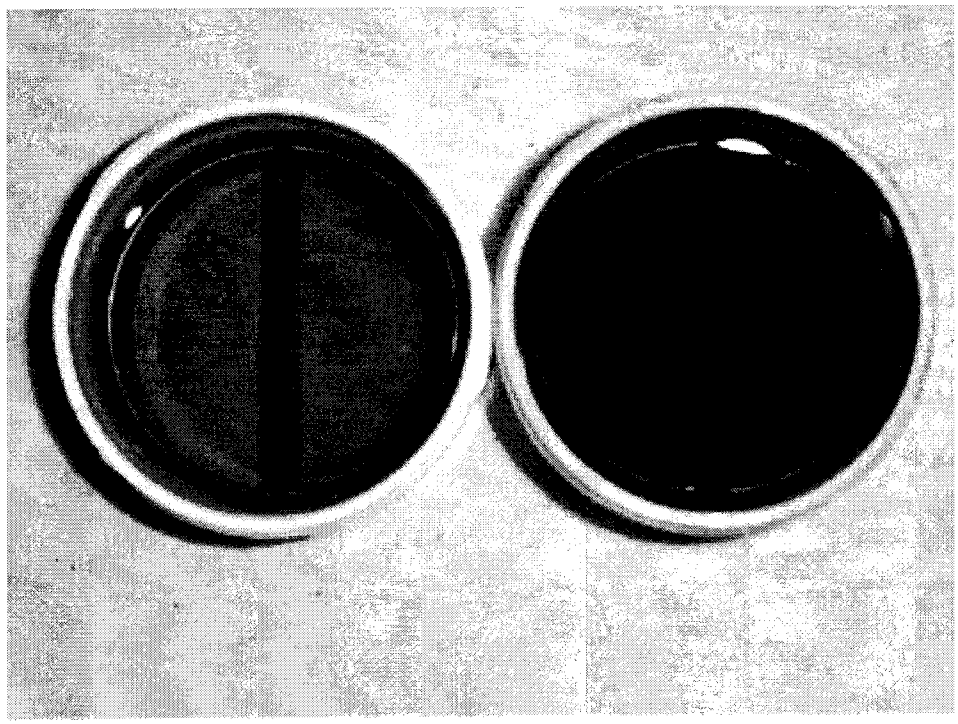
Analysis of Rod Bearing Storage Oil

Lead (ppm)

Lot Code	No Argon	No Argon	Argon	No Argon	Argon	Argon Washed "A" New EF411	No Argon Washed "A" New EF411	Argon Washed "A" New EF411	Argon Washed "A" New EF411
	Set "A"	Set "A"	Set "B"	Set "A"	Set "B"	Set "A"	Set "A"	Set "A"	Set "A"
	12/4/2001	3/28/2002	3/8/2002	9/2/2004	9/2/2004	10/28/2004	10/28/2004	3/11/2005	5/10/2005
	A-N-12-01	A-N-04-02	B-A-04-02	A-N-09-04	B-A-09-04	A-W-A-10-04	A-W-N-10-04	A-W-A-10-04	A-W-A-10-04
10	140	142	123	752	153	4		7	8
11	145	145	135	354	188	4		6	8
12	149	150	156	683	158		190	9	11
13	146	146	152	788	176	7		7	7
14	135	138	140	366	173	4		7	4
15	83	86	77	147	132	2		4	6

TEST ENGINEERING, INC.

CPD Report to Sequence VIII Surveillance Panel May 18, 2005



New EF-411 vs. Aged EF-411

TEST ENGINEERING, INC.

CPD Report to Sequence VIII Surveillance Panel May 18, 2005

- 11-93 Rod Bearing Storage Recommendation (in the event that the industry continues using this current bearing batch):

  –Wash all remaining bearing sets in Pentane and re-package in fresh EF-411 or a "White Oil" (this item open for discussion). Store re-packaged bearing sets in Argon. Perform periodic oil analysis from a sampling of the bearing lot codes that remain in Argon storage.

TEST ENGINEERING, INC.

CPD Report to Sequence VIII Surveillance Panel May 18, 2005

- Should a new batch of bearings be manufactured to replace the 11-93 supply? Factors to consider:
  - –Cost to have 2500 bearing sets manufactured, inspected, placed in containers with preservative oil and stored in Argon is estimated to be approximately $300,000.00.
  - –Cost to industry to discard current bearing supply will be approximately $200,000.00.
  - –How will the industry bear the burden of this expense?
    - •TEI would provide the initial funding for this endeavor but would ask for industry to share in a portion of the expense by purchasing a one year supply of the new batch of bearings when they become available.

TEST ENGINEERING, INC.

CPD Report to Sequence VIII Surveillance Panel May 18, 2005

- Annual Parts Order
  - –Letter was mailed to labs soliciting Sequence VIII parts requirements for calendar year 2005. The letter included a listing of parts currently in TEI inventory which are frequently ordered. Labs placed their orders and TEI was able to procure all items required to meet Sequence VIII testing needs for calendar year 2005.
  - –This process will be repeated again for calendar year 2006. A letter will be mailed to labs during the latter part of the 4th quarter of 2005.
  - –TEI will continue to procure vendors to manufacture required parts to meet the industry GF-5 needs for the Sequence VIII test.

TEST ENGINEERING, INC.

Sequence VIII Critical Parts List (page 1)	
Part No.	**Item Description**
100002-2	SeqVIII/-38 WIRING HARNESS
100003-1	ELECTRIC DISTRIBUTOR ASSEMBLY
100003-2	NON-ELECTRIC DISTRIBUTOR ASSEMBLY
100009	VALVE, EXHAUST
100027-1	WASHER, LOCK, CAM, CRANK
100028-1	FILTER ELEMENT KIT
100034-1	BEARING, CONNECTING ROD
100037-1	GASKET KIT
100038-1	SeqVIII/L-38 CRANKSHAFT
100043-1	FILTER ELEMENT KIT
100091-1	VALVE, EXHAUST
100099-1	PISTON ASSEMBLY
122183-1	SLEEVE, CYLINDER, UNHONED
2405	PISTON ASSEMBLY
2405-1	PISTON ASSEMBLY NT
2434-S	CONNECTING ROD SUB ASSEMBLY
30337	METALLIC O-RING
3129	SPARK PLUG, 14MM
3189	INSULATION, OIL HEATER
3190	THERMOCOUPLE CONNECTOR
3224	CERRO BASE METAL
4000	PIPE PLUG, SOCKET HEAD
4001	PIPE PLUG, SOCKET HEAD, STEEL
4872	NUT, HEX, LOCK, KLINCHER
4880	SCREW, SHOULDER
4924	RETAINER, VALVE SPRING, EXHAUST
4925	RETAINER, VALVE SPRING, INTAKE

Sequence VIII Critical Parts List (page 2)	
Part No.	**Item Description**
8202	TAPPET, ASSEMBLY VALVE
8211	CAMSHAFT, CLR TEST ENGINE
8231-Standard	BEARING, CAMSHAFT
8231-Undersize	BEARING, CAMSHAFT
8252-Standard	BEARING, MAIN
8252-Undersize	BEARING, MAIN
8292	WASHER, THRUST, BABBITT
8301	BUSHING, PISTON PIN
8355	GUIDE, EXHAUST VALVE
8363	BUSHING, PISTON PIN, D.I. DIES
8365	GUIDE, INTAKE VALVE
8371	FRET RING, CYLINDER SLEEVE
8381	BOLT, CYLINDER BARREL
8571	HOUSING, OIL PRESSURE REG.
8575	VALVE, OIL PRESSURE REGULATOR
8692-1	BOLT, CONNECTING ROD
8692-2	BOLT, CONNECTING ROD
8871-A	VALVE, INTAKE
8892	ROCKER ARM, EXHAUST VALVE
8911-A	VALVE SEAT INSERT, EXHAUST
8983	VALVE SEAT INSERT INTAKE
9081	DRIVESHAFT, ACCESSORY
9181	GASKET, COUNTER
9450-1	HEATER ELEMENT
9652	GASKET, CARBURETOR FLANGE
9729	GASKET, CRANKCASE BREATHER
9730	SPRING, CRANKCASE BREATHER
9851	SCREEN, OIL PUMP

Sequence VIII Bearing Dilemma

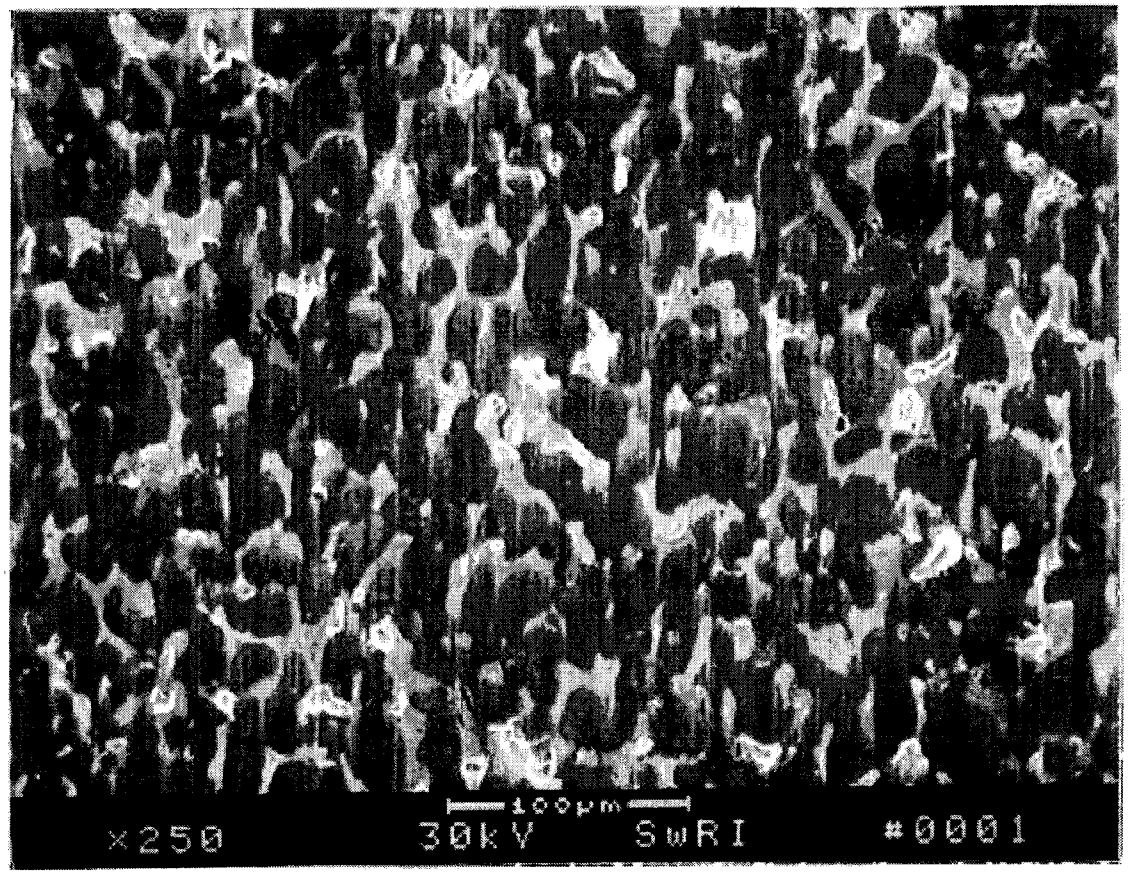
Summary by Sequence VIII Chair

May 18, 2005

Attachment #6

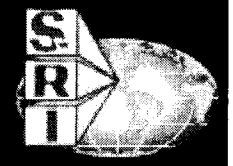
Sequence VIII Copper-Lead Test Bearing

- SAE H24 Cu-Pb alloy – 76% Cu 24% Pb

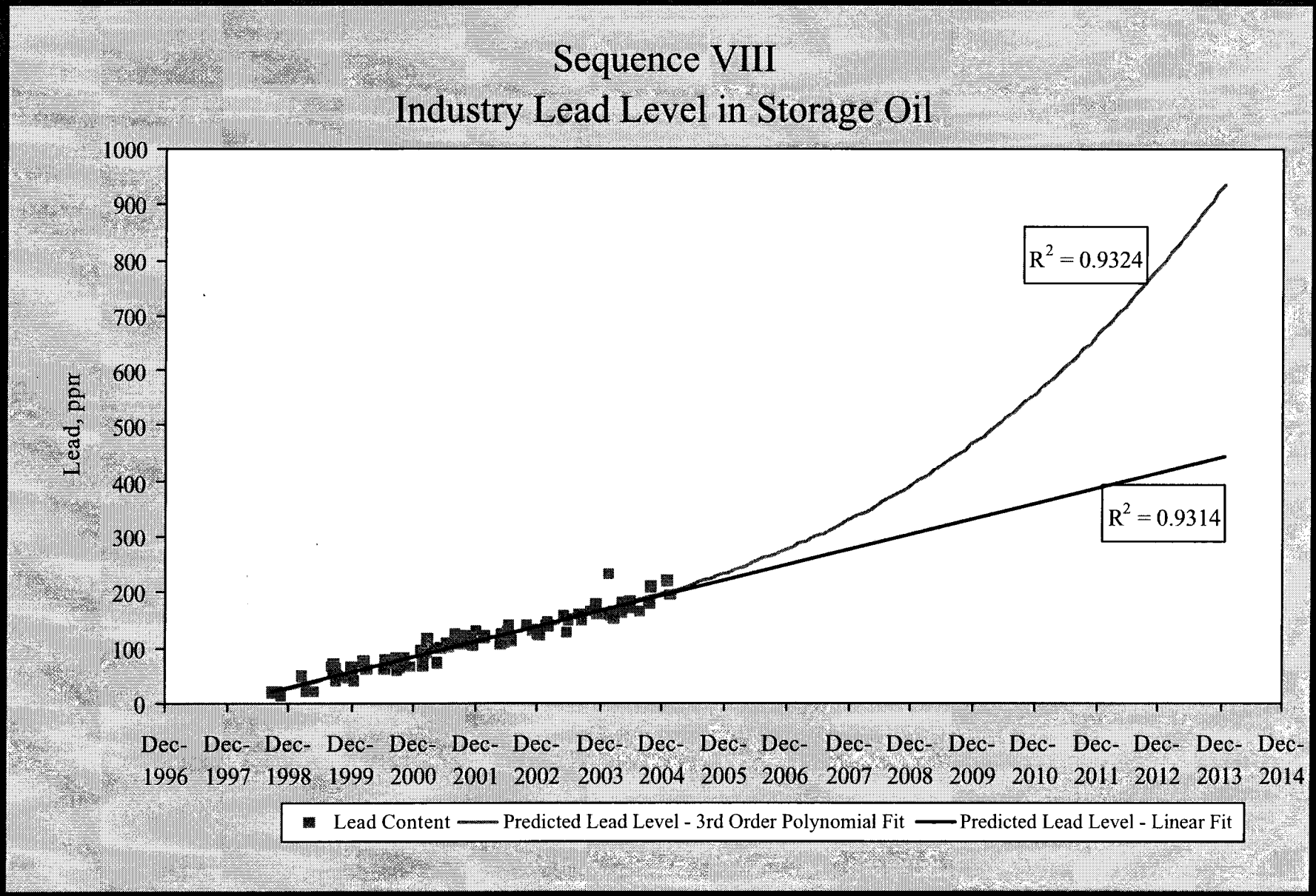


Test Bearing Issues

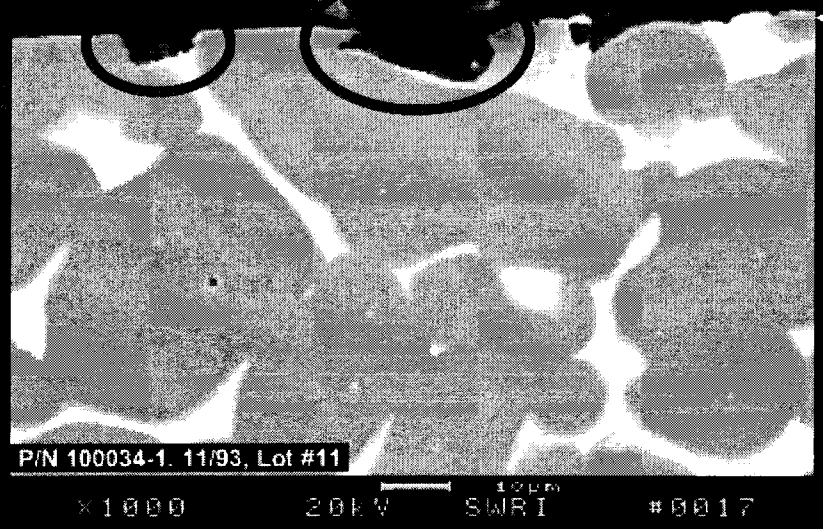
- Test criteria is bearing weight loss, which is dominated by lead loss
- Test bearings are stored in plastic containers filled with EF-411 oil. All bearings were produced in Nov. 1993
  - We currently have approximately 1,400 bearing sets
- Over time lead has been leaching into the storage oil, but all laboratories can still meet calibration and the industry currently does not have a severity adjustment. However….



Lead Leaching Rate Over Time



Lead Leaching Photo



Voids on surface are actual voids produced by the lead leaching into the EF411

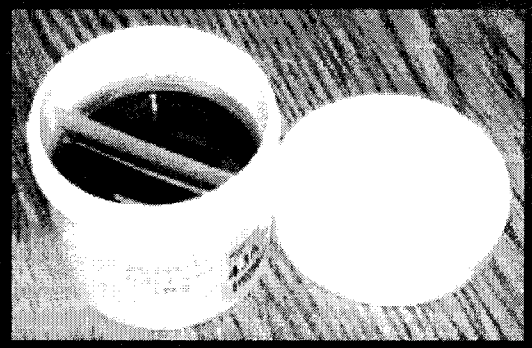
Cross Section Photograph of H24 test bearing. (SEM – x 1000).

Lighter material is lead.

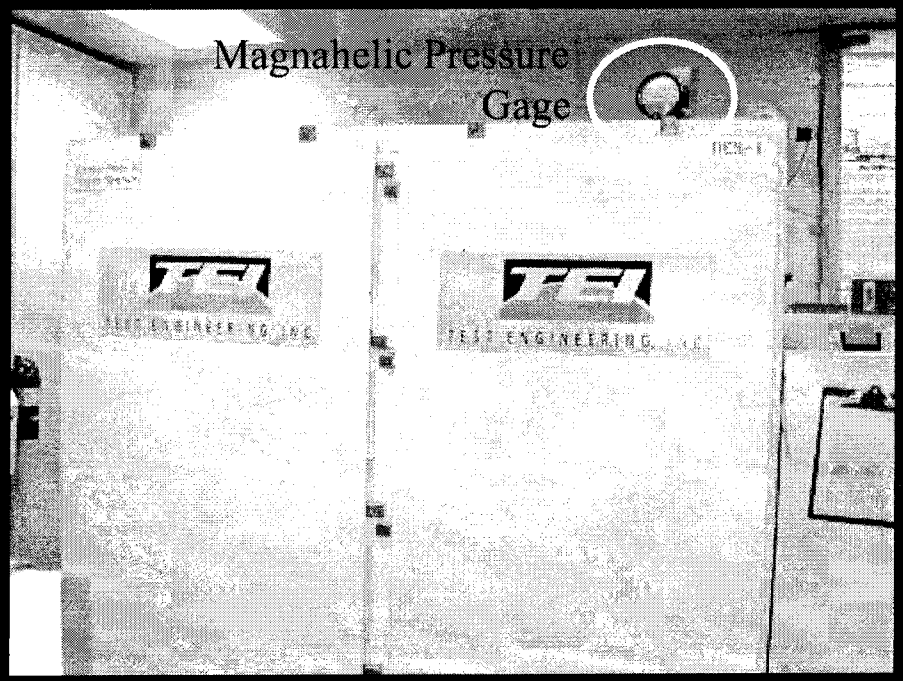
Recent SEM EDS (Energy Dispersive Spectrometer) data reports that 50% of the lead on the surface is gone. However, EDS penetration is only 1 micron deep. However, current lead leaching depth is ~ 5 to 10 microns.

Bearing Storage Details at TEI

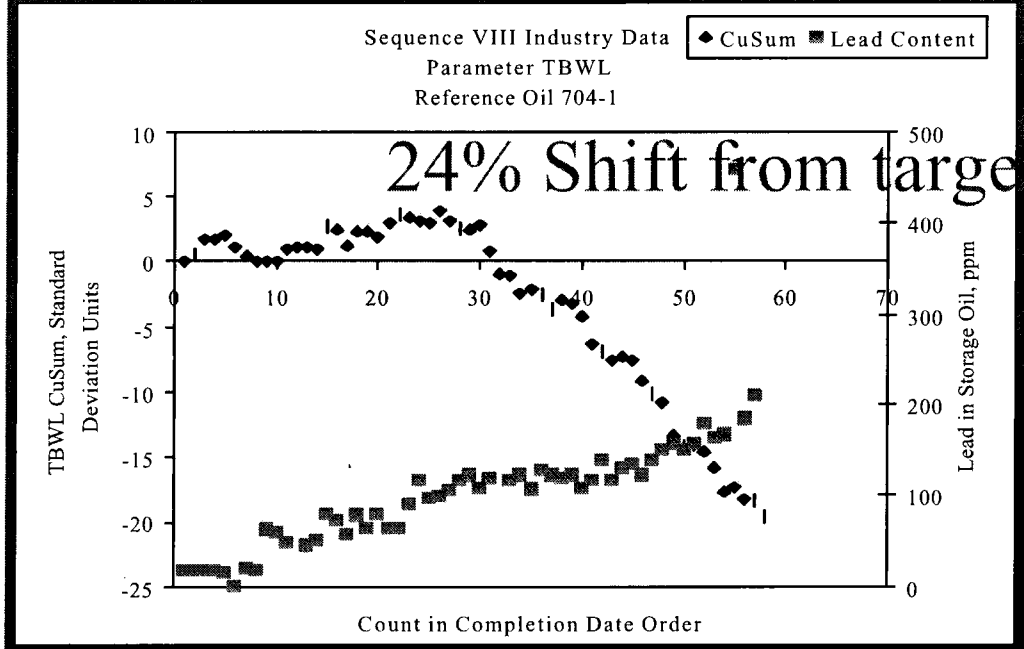
- Cabinet is checked daily to ensure magnahelic is showing a positive pressure
- Cabinet is filled with Argon
- TEI uses an oxygen sensor to ensure that oxygen inside is < 0.05%



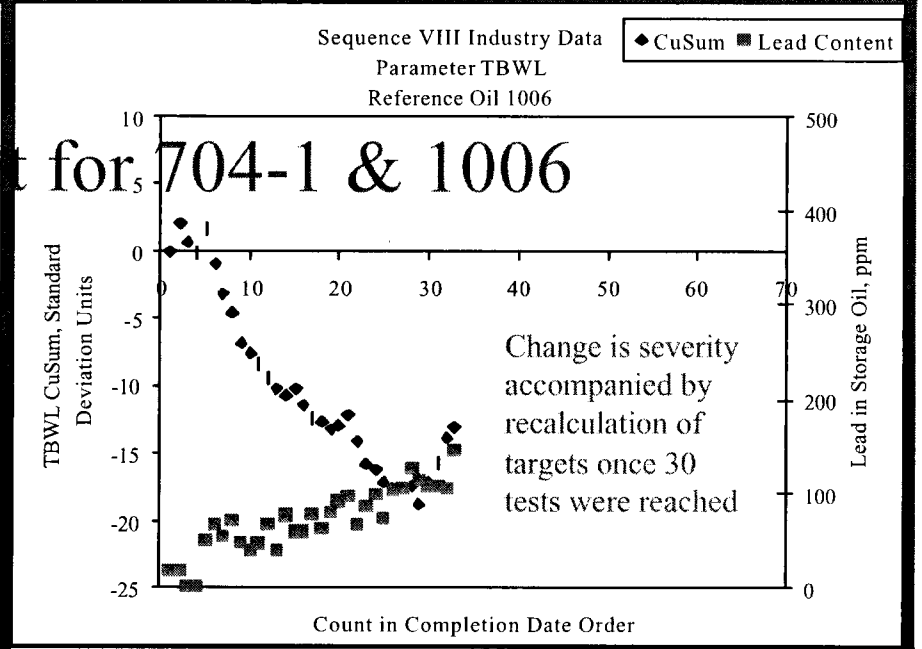
Storage Container

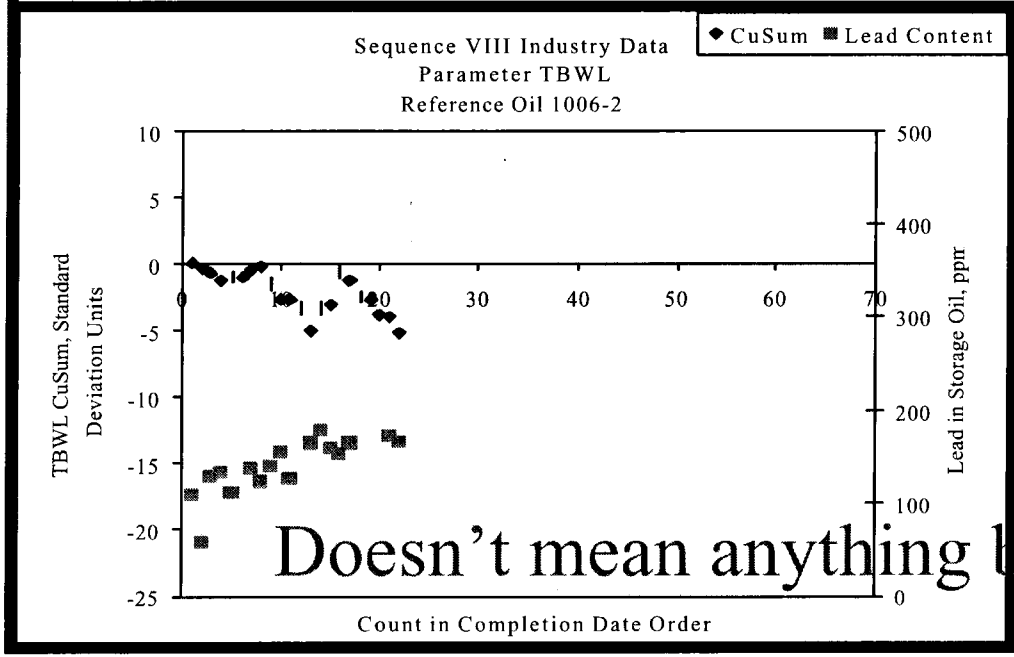


Sequence VIII Severity Shift by Reference Oil

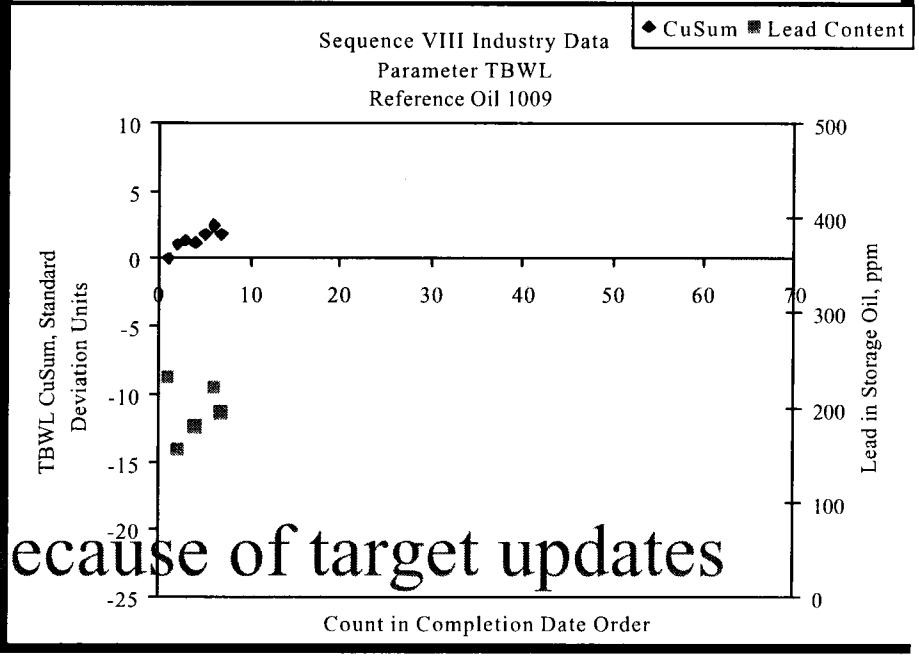


24% Shift from target for 704-1 & 1006





Doesn't mean anything because of target updates

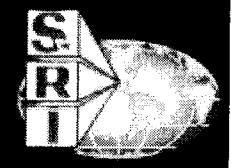


Sequence VIII Surveillance Panel Historical Actions

- February 4th 2005, SP submitted an e-ballot to change out the EF-411 storage oil with fresh EF-411 on Lots 10 & 11 only
  - Ballot failed because some questioned whether the leaching rate would increase with fresh EF-411, and the fear that this was not a permanent solution
- On March 8th, SP held a conference call to discuss the possibility of procuring new bearings at the request of ILSAC
  - CPD determine that it is feasible at a cost of ~$300,000 for 1,875 sets with 25% rejection rate, but <u>not</u> including scraping of existing bearings
    - Scraping cost is ~$200,000 ($125 x ~1,600 [includes lab stock])
    - Prove-out testing can be accomplished with stand calibrations
    - Total for new bearings = $500000/1200 tests (10 tests/month) = ~$420
    - Actual Test Price Increase = $295 ($420 - $125)
  - However, Act SOON rather than LATER. Federal Mogul has started the process of switching all production to Al bearings for environmental concerns.
    - Actual deadline = mid 2006 (Decision really needed year-end 2005)

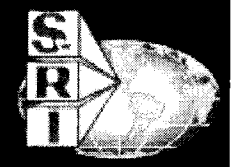
PAO Experiment Results

- 11-93 lot 11 bearing set washed in pentane and placed into glass container
- PAO added to cover bearings.
- Heated in oven at 160 f
- Every 24 hrs sample pulled for D5185
- Through 168 hrs –
  - Lead < 1 ppm
  - Copper < 1 ppm
  - Tin < 1 ppm



What are our Options?

1. Bottom line – There <u>are</u> plenty of bearings available for GF5 **<u>IF</u>** the bearings can be protected against further leaching.
   - Best proposed solution to date is to change the high sulfur EF-411 oil to a PAO, and store under Argon
   - Will this permanently fix the problem?
   - Industry correction factor needed?
2. Procure new bearings
   - Must do before mid-2006 because of environmental concerns
   - We have already proven that if we don't change anything in our current storage practice, that we can live without lead leaching effects for at least 7-8 years
     - However, hope is to improve this further by storing them in PAO
3. Others?



Future Sequence VIII S.P. Meetings

The Sequence VIII test method is stable and is in maintenance mode. Most of this S.P. panel's business has been conducted using e-ballots.

However, due to some industry concerns the Sequence VIII Surveillance Panel will meet at a minimum of once per year.

November 18, 2004

Attachment #9

Sequence VIII S.P. Scope

The Sequence VIII Surveillance Panel is responsible for the surveillance of the Sequence VIII test procedure (ASTM D 6709-01). This panel works in conjunction with Test Engineering Inc. (TEI) who supplies the test hardware. Improvements in the test operation, test monitoring, and test validation will be accomplished through continual communications with the test hardware supplier, the ASTM Test Monitoring Center, the Technical Guidance Committee, and the ACC Monitoring Agency.

The panel will maintain an up-to-date evaluation of the precision of the VIII reference oils and will report this precision and test severity levels to D02.BO.01 Oil Classification Panel and section.

These combined efforts will help to assure that the Sequence VIII test method will continue to provide the industry with a precise method for evaluating a lubricant's ability to protect against copper-lead bearing weight loss and to evaluate the viscosity stability of multi-viscosity-grade oils.

November 18, 2004

Attachment # 7

Sequence VIII S.P. Objectives

Objective	Target Date for Completion
Continual monitoring of lead content in storage oil.	On Going
New bearing batch decision	November 2005