# MEETING MINUTES

## HEAVY-DUTY ENGINE OIL CLASSIFICATION PANEL
OF
D02.B0.02
December 7, 1999
John Ascuaga's Nugget Hotel – Reno, NV

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## ACTION ITEMS

1. **Complete new tests development and demonstrate discrimination / repeatability – New test Task Forces**

2. **Recommend oxidation protection criteria and test – Oxidation Task Force**

3. **Establish matrix base stock selection criteria – Matrix Design Task Force**

4. **High soot EOT oil samples to Chris May for low temp. rheology study – All**

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## MINUTES

1.0 Call to Order

1.1 Chairman McGeehan called the meeting to order at 1:05 pm on Dec. 7, 1999, in Pavillion B of John Ascuaga's Nugget Hotel in Reno, NV. There were 11 members and approximately 50 guests present. The attendance list is Attachment 2.

2.0 Agenda

2.1 The agenda for the meeting (Attachment 1) was reviewed and John Graham and Glenn Mazzamaro asked to make presentations during the Oxidation Test section.

3.0 Meeting Minutes

3.1 Brian Lawrence requested that the minutes of the Sept. 21, 1999, meeting be revised to show that the T-10 Task Force recommends the use of only one reference oil in the T-10 precision matrix. With that revision, the minutes of that meeting were approved as posted on the TMC website.

3.2 Reports and presentations to the panel **MUST** be given to the secretary via e-mail attachment before the meeting or via floppy disk at the meeting if you want them included in the minutes.

4.0 Membership

4.1 There were no membership changes.

5.0 NCDT Report

5.1 Augie Birke gave the NCDT report for Steve Kennedy (Attachment 3). In addition to the critical issues that Steve raised in his report (decide on oxidation, select matrix base oils & technologies, meet timeline), the issue of ash limit was raised by the panel. An EMA member again stated they would not ask for an ash limit if there were no data to support one. It was then requested that 1N data be made available for pre-matrix oils, followed by an observation that protection of these new engines with EGR was job one. There was desire expressed to have the ash limit issue resolved by the next HDEOCP meeting. During discussion of HTHS, an EMA member indicated there would be a 3.3 cSt minimum for 10W-30 oils.

5.2 Stacy Bond presented the PC-9 timeline status report (Attachment 4) and noted that the 1Q test development was furthest behind, indicating it would be a real challenge to have the 1Q test available for the matrix.

6.0 EGR New Test Status

6.1 Jim McGeehan reported on the 1Q test development for Mike Quinn. CAT has completed one test in-house. Based on what they've seen from that test, they may emphasize control of undercrown deposits and cylinder bore polish. Stacy Bond showed a summary of the CAT data. (Attachment 5).

6.2 John Graham reported on the Cummins M-11 EGR test development (Attachment 6) and noted that they had lengthened the high load wear phase to 50 hours and increased the intake manifold temperature to 150 F. Test length is 300 hours. If more severity is needed, then it would be 400 hours.

6.3 Greg Shank gave a Mack T-10 update (Attachment 7), followed by a report from Brian Lawrence (Attachment 8) on the T-10 Task Force status. A draft test procedure has been issued and discrimination tests are underway. During discussion about CMA template review, Dick Kuhlman noted that concerns about the template should be forwarded to Teri Crosby.

7.0 Oxidation Test

7.1 Rich Lee presented an Oxidation Task Force report (Attachment 9) with membership changes from the floor of Virginia Carrik for Lew Williams and Steve Roby for Chevron.

7.2 Wayne Cave announced a potential relationship between John Deere and Test Engineering, Inc. whereby he would function as a Deere representative for the JDQ-78A test in Deere's absence. Brian Lawrence then raised concern that since the JDQ-78A test does not involve EGR, it would thus give misleading oxidation information.

7.3 Glenn Mazzamaro gave a presentation (Attachment 10) proposing use of the ACEA E5 PDSC bench test for oxidation, except with an EOT oil sample from one of the PC-9 engine tests. Concern was raised from the floor about precision and repeatability when using used oils.

7.4 Stacy Bond presented thoughts on using the Seq. IIIF as a PC-9 oxidation test. (Attachment 11)

7.5 John Graham gave a presentation on Cummins oxidation concerns (Attachment 12) and his analysis of the JDQ-78A data. He recommended formation of a JDQ-78A Task Force and his motion was seconded. Some discussion that this wasn't needed yet, but the motion passed: 7 for, 0 against, 2 abstain. The volunteers / appointees to the task force were: Stacy Bond; a TEI rep.; Aimin Huang; Tom Boschert; John Graham; Don Marn; Mark Cooper; West Alexander and an Infineum rep.. Robert Stockwell reluctantly agreed to serve as temporary chairman of the group.

8.0 PC-9 Fuel

8.1 Pat Fetterman gave the PC-9 Fuel Task Force report (Attachment 13) and noted that they recommended acceptance of the Phillips Petroleum proposal. Even though the fuel task force was formed under B.02, Brian Lawrence moved that the HDEOCP endorse the task force recommendation. This motion passed via voice vote with no negatives or abstentions.

9.0 Test Matrix

9.1 Lowell Norris reported that the EMA chose not to vote on matrix base oil selection in the DEOAP, so the API Lubricants committee recommended the use of one Group I and two Group II basestocks. He noted their recommendation came mainly from commercial issues in that most of the base oils available were from Group I or Group II. With regard to how the two Group II stocks would be selected, he felt that choosing a group II that was almost a Group III would be unacceptable to API.

9.2 Don Marn gave the Matrix Design Task Force report (Attachment 14) and noted that even if the Deere oxidation test were to be included for matrix testing, there were almost enough funds committed to cover the costs. The issue of how to select the two Group II basestocks then came up and prompted a lot of discussion. Jim McGeehan put up a slide (Attachment 15) asking that the extremes of the base oil groups be explored. Frank Zalar proposed reactivating the small group which worked on recommending the DI/VI technologies to be used in the matrix and asking them to recommend the base oil selection criteria. Finally Mark Sztenderowicz moved and John Graham seconded that the Matrix Design Task Force establish the selection criteria for the Group I and Group II basestocks according to their best technical judgement and based on the approved API guidelines. The motion passed: 9 for; 0 against; 0 abstain.

10.0 Elastomers

10.1 Tom Boschert presented the Elastomer Task Force report (Attachment 16) and noted that the task force is in favor of establishing a central parts distributor for the elastomer test materials. They plan to meet and address selection of a CPD in conjunction with another meeting early next year.

11.0 Pumpability

11.1 Chris May gave a report from the Low Temperature Rheology of Used Oils Task Force (Attachment 17). They have support for their work from several groups and specifically need used oil EOT samples from tests with high soot loadings. The EOT samples need to be at least one gallon to allow for distribution. Contact Chris May if you can help.

12.0 Old / New Business

12.1 The next meeting will be held on Feb. 23, 2000, in Chicago at the Holiday Inn – O'Hare from about 8:00 to 1:00.

13.0 Adjournment

13.1 The meeting was adjourned at approximately 4:50 PM, Dec. 7, 1999.

Submitted by:
Jim Wells
Secretary to the HDEOCP

ATTACHMENT 1

# (All Presentations Must be on Disc)

## JOHN ASCUAGA'S NUGGET HOTEL
## TUESDAY DECEMBER 7TH, 1999
## PAVILION B
## 1:00 - 5:00 p.m.

**Chairman/Secretary:** **Jim McGeehan/Jim Wells**
**Topic:** **PC-9**

**Desired Outcome:**
- **Define EGR Tests**
- **Define Oxidation Test**
- **Define BOI Program**
- **Time Line To meet Introduction Date**

| TOPIC | PROCESS | WHO | TIME |
|---|---|---|---|
| Agenda | • Review Agenda & Desired Outcome<br>• Add/Chance | Group | 1:00 - 1:05 |
| Minutes Approval | • September 21st, 1999 Minutes | Group | 1:05 - 1:10 |
| Membership | • Changes | Group | 1:10 - 1:15 |
| NCDT Recommendations | • Tests<br>• Time-Line<br>• Selection Matrix DI/VI Systems | Augie Birke | 1:15 – 1:45 |
| Status EGR Tests | • Cat 1Q<br>• Cummins M-11<br>• Mack T-10 | Mike Quinn<br>John Graham<br>Greg Shank | 1:45-2:30 |
| Oxidation Test | • TEI/Deere: Support<br>• John Deere/IIIF/Bench Tests<br>• Discussion/Selection | Wayne Cave<br>Rich Lee | 2:30 - 3:30 |
| Test Matrix | • API Recommendation on base oils<br>• Base Oils:discussion<br>• Precision/BOI<br>• Discussion and agreement | Augie Birke<br>Don Marn | 3:30 - 4:15 |
| PC-9 Fuel | • Fuel Supplier Selection | Pat Fetterman | 4:15 - 4:30 |
| Elastomers | • Objectives & Update | Tom Boschert | 4:30 - 4:45 |
| Pumpability | • Objects & Tests | Chris May | 4:45 - 5:00 |

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### DECEMBER 7, 1999

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| | J_PABOUCEK@BURMAHCASTROL.COM | |
| Name: | DON BURNETT | TEL: 918-661-7601 |
| Company: | PHILLIPS Chemical Co., | FAX: 918-661-8379 |
| Address: | 892 AB | |
| | Bartlesville, OK 74004 | deburne@ppco.com |
| Name: | Scott Ellis | TEL: 210-522-3399 |
| Company: | SWRI | FAX: 210-684-7530 |
| Address: | 6220 Culebra Road | EMAIL: sellis@swri.org |
| | San Antonio Tx 78228-0510 | |
| Name: | Bernie Kinker | Tel: 215-706-5823 |
| Company: | RohMax USA | Fax: 215-706-5922 |
| Address: | 723 Electronic Drive | BKinker@rohmax.com |
| | Horsham, PA 19044 | |
| Name: | ROBERT STOCKWELL | 210-522-5913 |
| Company: | SwRI | F 210-523-6919 |
| Address: | 6220 CULEBRA | RSTOCKWELL@SWRI.ORG |
| | SA TX 78228 | |

# ASTM

## SECTION D.02.B0.02
## HEAVY DUTY ENGINE OIL CLASSIFICATION PANEL

### ATTENDANCE LIST

### DECEMBER 7, 1999

**GUESTS**

| | | Phone No. / Fax No. / e-mail add. |
|---|---|---|
| **Name:** | Raymond B. Harris III | 717-761-2426 |
| **Company:** | Petroleum Products Corp | FAX 717-761-6051 |
| **Address:** | 245 Green Lane Dr. Camp Hill Pa. 17011 | E-mail HCMGT@aol.com |
| **Name:** | Greg C. Miller | 517 496 2309 |
| **Company:** | Tannas Co. | Fax 3438 |
| **Address:** | 4800 James Savage Rd Midland, Mi 48642 | E-mail GMiller@Savantgroup.com |
| **Name:** | John Baranski | P: 203-573-2354 |
| **Company:** | CK Witco | F: 203 573-2165 |
| **Address:** | 199 Benson Rd. Middlebury CT 06749 | e-mail: ~~[illegible]~~ @ CKWITCO.com John_Baranski |
| **Name:** | ANGELA EDWARDS | 203-573-2308 |
| **Company:** | CK WITCO | (F) 203-573-2165 |
| **Address:** | 199 BENSON RD MIDDLEBURY CT 06749 | angie_edwards @CKWITCO.com |
| **Name:** | Mary Graham | 580-767-4013 |
| **Company:** | Conoco | fax 580-767-4534 |
| **Address:** | 1000 S. Pine Ponca City, OK 74604 | Mary.E.Graham @ 45a.conoco.com |
| **Name:** | VICKY DENTON | (632) 809-4665 |
| **Company:** | Fuels & Lubes Asia Publications Inc. | F (632) 8075 49 |
| **Address:** | POB 151 Ayala Alabang Village Post off. 1780 Muntinlupa City, Philippines | flasia@i-manila.com.ph |
| **Name:** | | |
| **Company:** | | |
| **Address:** | | |
| **Name:** | | |
| **Company:** | | |
| **Address:** | | |

pls notify re minutes

# ASTM

## SECTION D.02.B0.02
## HEAVY DUTY ENGINE OIL CLASSIFICATION PANEL

### ATTENDANCE LIST

### DECEMBER 7, 1999

**GUESTS**

| | Phone No.<br>Fax No.<br>e-mail add. |
|---|---|
| **Name:** VASANT P THAKKAR<br>**Company:** UOP LLC<br>**Address:** 25 E. ALGONQUIN RD.<br>DES PLAINES IL. 60017-5017<br>e-mail: VPTHAKKA@UOP.COM | Tel. 847-391-2523<br>fax 847-391-3737<br>VPTHAKKA@UOP.COM |
| **Name:** BOWEN, RALPH W.<br>**Company:** SOUTHWEST RESEARCH INSTITUTE<br>**Address:** 6220 CULEBRA ROAD<br>SAN ANTONIO, TEXAS 78238 | |
| **Name:** MARK SZTENDEROWICZ<br>**Company:** CHEVRON PRODUCTS CO.<br>**Address:** 100 CHEVRON WAY<br>RICHMOND, CA 94802-0627 | 510-242-5673<br>510-242-3758 (FAX)<br>M.LSZ@CHEVRON.COM |
| **Name:**<br>**Company:**<br>**Address:** | |
| **Name:**<br>**Company:**<br>**Address:** | |
| **Name:**<br>**Company:**<br>**Address:** | |
| **Name:**<br>**Company:**<br>**Address:** | |
| **Name:**<br>**Company:**<br>**Address:** | |

# ASTM

## SECTION D.02.B0.02
## HEAVY DUTY ENGINE OIL CLASSIFICATION PANEL

### ATTENDANCE LIST

### DECEMBER 7, 1999

**GUESTS**

| | Phone No.<br>Fax No.<br>e-mail add. |
|---|---|
| **Name:** Barb Parry | 604-924-2703 |
| **Company:** Mohawk Lubricants Ltd | 604-929-8371 |
| **Address:** 130 Forester St. | bparry@mohawklubes.com |
| North Vancouver BC V7H2M9 | |

**Name:**_____
**Company:**_____
**Address:**_____

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**Company:**_____
**Address:**_____

# PC-9 NCDT Status Report

## ASTM Heavy-Duty Engine Oil Classification Panel

## December 7, 1999

# Status of PC-9

***Background***

- **EMA request change to new HD category plans - 5/20/98**
  - **Due to unanticipated change in emission certification**
  - **NCET formed 5/20/98; team meetings every 6-8 weeks**
- **Proposed Categories:**
  - **PC-7.5 by January 2000**
    - **Interim upgrade to API CH-4; need for improved soot-handling**
    - **Endorsed API LC 7/8/98**
    - **Development terminated 12/98 with API, EMA, CMA agreement**
  - **PC-9 by January 2002**
    - **Moved up from Jan. 2004 implementation**
    - **Higher levels of soot, use of EGR**
    - **API LC buy-in at 11/98 & 3/24 meetings**

# PC-9 Status

## *Progress to Date*

- **NCET work completed, endorsed by DEOAP & LC:**
  - ✔Technical need for category validated
  - ✔Development guidelines established
  - ✔Category language drafted
  - ✔Initial funding proposal in place
  - ✔Preliminary timeline established
- **Good agreement on PC-9 performance parameters:**
  - Several parameters deferred until PC-10
  - Plan for seal compatibility accepted
  - Sulfated ash limit pending validation
  - Final test selection in progress
- **Matrix base stock selection:**
  - DEOAP & LC specify 1-Group I & 2-Group II
  - Final identification of specific base stocks pending
- **Plan to use pre-defined VGRA proposed**
  - Final API & CMA acceptance required

# PC-9 Performance Parameters

| *EMA Proposal* | *EMA Proposed Test* | *Comments* |
|---|---|---|
| Fe Piston Deposits, Oil Con. | *Cat 1Q-EGR (1)* | |
| Al Piston Deposits | Cat 1N (2) | |
| Ring/Liner Wear, Brg Corrosion | *Mack T-10-EGR (3)* | |
| Soot Related VTWT | GM 6.5L (4) | |
| Soot and EGR related VTWT | *Cummins M11-EGR (5)* | |
| Thermal Oxidation | *Deere JDQ (6)* | IIIF & bench test alts. |
| Oil Aeration | Navistar 7.3L (7) | |
| Soot Related Viscometrics | Mack T-8E (8) | |
| Used Oil (Low Temp) Vis | Based on T-8E? | |
| High Temp. Corrosion Bench | CH-4 Bench Test (HTCBT) | |
| Shear Stability | CH-4 Bench Test (Bosch) | |
| Volatility | Bench Test (NOACK) | |
| Foaming | CH-4 Bench Test (D892) | |
| HTHS Viscosity Min | CH-4 Bench Test | Mod. 10W-30 limit |
| Seal Compatibility | Bench - D471 Based | Compare to ref. oil |
| Sulfated Ash Limit | D874 | Pending EMA data |

*Dropped from PC-9:*

| | | |
|---|---|---|
| Soot Related VTWT | *Cummins ISC (9)* | |
| Ring/Liner Wear, Brg Corrosion | Mack T-9 (10) | |
| Closed CC Deposits | *Undefined (11)* | |
| Turbo Coking Deposits | *Undefined (12)* | |
| Catalyst Compatibility | *Undefined (13)* | |

*(X) New Engine Test*

(X) Current Engine Test

# PC-9 Status

## *Critical Issues Pending*

- **Method to determine oxidation stability**
- **Selection of Reference/Matrix technology**
- **Meeting the proposed timeline**

# PC-9 Status

## *Issues Pending -- Oxidation Measurement*

- **Potential Options:**
  - **Deere JDQ-78A Diesel Oxidation Test**
  - **Sequence IIIF (standard or extended-length)**
  - **Oronite Proposal (Seq IIIF + parameters from other PC-9 tests)**
  - **Bench Testing (single or multiple procedures)**
- **Working Group formed to evaluate options**
- **Decision on oxidation needed soon:**
  - **Eliminate potential distractions**
  - **Matrix planning -- size / cost considerations**
  - **NCDT asking for Working Group recommendation by 2/1/2000**

# PC-9 Status

## *Issues Pending -- Matrix Technology Selection*

- **Selection Criteria Identified:**
  - **Demonstrate "CH-4 Plus" & "PC-9 Bench" performance**
  - **Supplemental data from ACEA, JAMA, or field testing will also be considered**
- **Technology selection:**
  - **Letter to potential suppliers outlining process**
  - **Preliminary EMA review candidates based on performance and limited composition details**
  - **More detailed review of promising candidates**
  - **Final selection & incorporation into matrix & reference oils**
- **Target final selection by March 2000:**
  - **Lack of PC-9 test capability makes selection challenging**

# PC-9 Status

## *Issues Pending -- Timeline*

- **June 2002 deadline for licensed PC-9 oils; based on mandated October 2002 NOX reduction**
- **Final ASTM category approval by June 2001 provides API one-year product development period**
- **Revised May-June 2000 matrix start provides adequate time to meet licensing target**

***However . . . .***

- **EGR test developments behind original plan:**
  - **ASTM Validation of "Proof of Concept" by April 2000 very challenging (missed original target for this meeting)**
  - **Matrix start can not slip beyond ~Sept. 2000 to avoid potential delay in category launch**
  - **Further delays will cut into API's one year product approval period**

# PC-9 Status

## *What's Next*

- **Finalize Procedures & Validate New Engine Tests**
- **Resolution of Oxidation Measurement**
- **Complete Pre-Matrix Preparations**

# PC-9 Timeline Notes

Brent Shoffner 12/7/99

- The M11 EGR, 1Q, and T-10 timelines are actively being coordinated with the Surveillance Panels and the Test Developers.

- The individual test timelines are linked to the Summary PC-9 Timeline by two dates:

  ➢ Test procedures adequate for oil development

| | |
|---|---|
| 1Q | 01/25/00 |
| M11 EGR | 12/06/99 |
| T-10 | 12/06/99 |

  ➢ HDEOCP accepts the new engine tests – 4/3/00.

- When the decision is made on an engine test for oxidation, the test will be added to PC-9 timing.

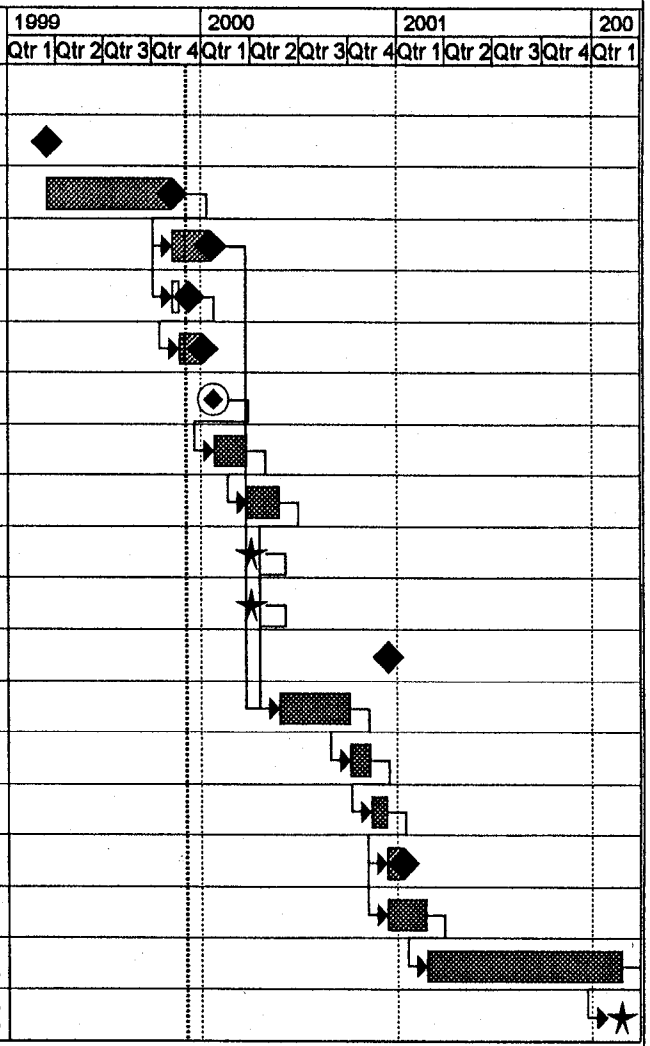
- The “License allowed date” has slipped to 2/26/2002, due to the delay in near term test development.

- Based on my experience with the current ASTM system, the “API License Date” will be later than May 2002.

# Summary of Events Required for PC-9 Licensing

**Brent Shoffner 11/1/99**

| ID | Task Name | Start | Finish |
|---|---|---|---|
| 1 | | | |
| 2 | Define PC-9 Performance Parameters | 3/16/99 | 3/16/99 |
| 3 | Design Prec. Mtx. Appr. API Lubes Comm. | 3/17/99 | 11/8/99 |
| 4 | PC-9 Funding MOU Signed | 11/9/99 | 1/19/00 |
| 5 | Select Base Stock Suppliers for Prec. Mtx. | 11/9/99 | 11/22/99 |
| 6 | Select additive suppliers for Prec. Mtx. | 11/23/99 | 1/3/00 |
| 7 | All test procedures are adequate for oil devel. | 1/25/00 | 1/25/00 |
| 8 | Identify Test Oils (with validation) | 1/26/00 | 3/24/00 |
| 9 | Blend Prec. Mtx. Oil Formulations | 3/27/00 | 5/24/00 |
| 10 | Final Acceptance of New Engine Tests * | 4/3/00 | 4/3/00 |
| 11 | Final Acceptance of Test Parameters | 4/3/00 | 4/3/00 |
| 12 | PC-9 Demonstration Oil is Validated | 12/15/00 | 12/15/00 |
| 13 | PC-9 Precision Matrix Testing | 5/25/00 | 10/4/00 |
| 14 | Precision Matrix Data Analysis | 10/5/00 | 11/10/00 |
| 15 | HDEOCP Post Matrix Test Acceptance | 11/13/00 | 12/12/00 |
| 16 | CMA Registrations Allowed | 12/13/00 | 1/9/01 |
| 17 | Finalize Pass/Fail Criteria (Sub B Mtg) | 12/13/00 | 2/23/01 |
| 18 | New Product Development | 2/26/01 | 2/25/02 |
| 19 | API Licensing Allowed | 2/26/02 | 2/26/02 |

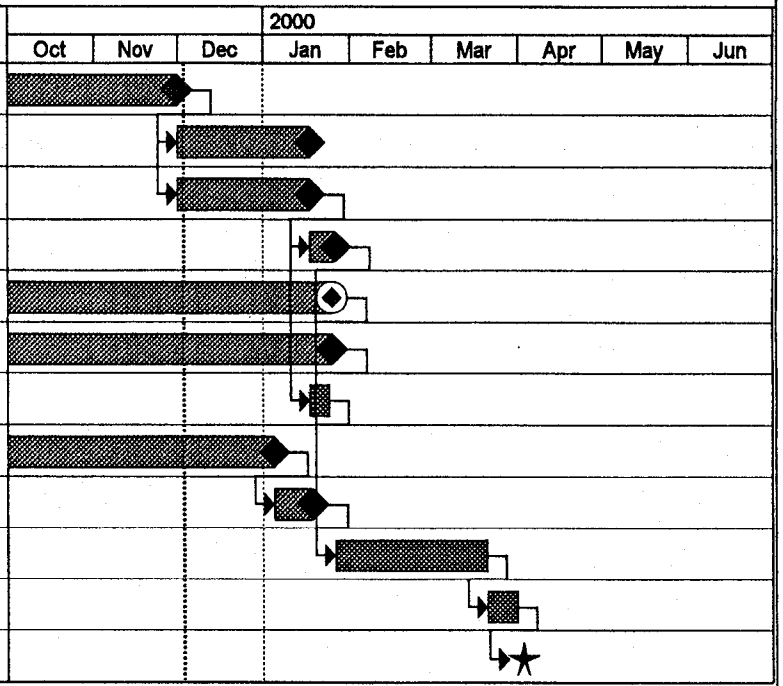



* Acceptance of each engine test (by HDEOCP) for discrimination and preliminary precision prior to starting the precision matrix.

# Time Line for the 1Q Test

Brent Shoffner - 12/3/99

| ID | Task Name | Start | Finish |
|---|---|---|---|
| 1 | Design EGR Hardware | 3/1/99 | 11/30/99 |
| 2 | Produce and ship test kits to labs | 12/1/99 | 1/17/00 |
| 3 | Specify Installation | 12/1/99 | 1/17/00 |
| 4 | Install test kit | 1/18/00 | 1/26/00 |
| 5 | Write procedure (Draft Complete) | 3/1/99 | 1/25/00 |
| 6 | Develop EGR rate measurement | 3/1/99 | 1/25/00 |
| 7 | Lab Visits | 1/18/00 | 1/24/00 |
| 8 | Discrimination Matrix Design Complete | 3/1/99 | 1/4/00 |
| 9 | Discr. Oils Available at the labs | 1/5/00 | 1/18/00 |
| 10 | Run Discrimination Tests | 1/27/00 | 3/20/00 |
| 11 | Data Analysis | 3/21/00 | 3/31/00 |
| 12 | HDEOCP Approves Proof of Concept* | 4/3/00 | 4/3/00 |

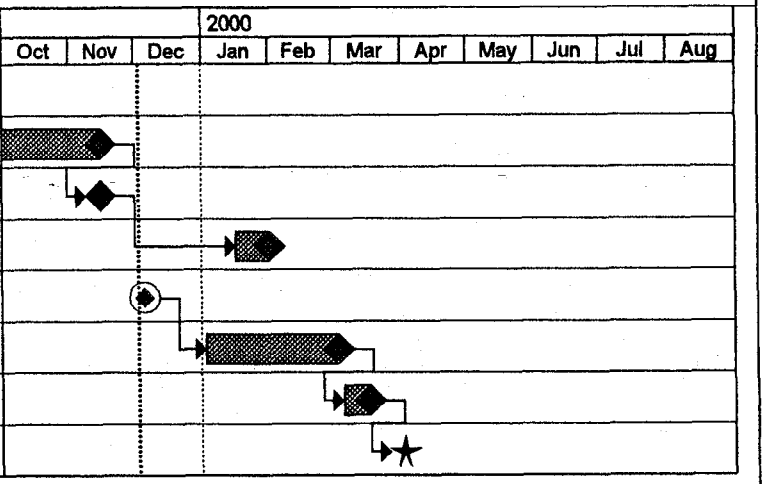



* Contingent on HDEOCP Meeting Date

# Time Line for the T-10 Test

Brent Shoffner - 11/23/99

| ID | Task Name | Start | Finish |
|---|---|---|---|
| 1 | Final Kits/Parts Available (1 per lab) | 7/14/99 | 8/24/99 |
| 2 | Install engines and run shakedown | 8/25/99 | 11/15/99 |
| 3 | Procedure Available | 11/16/99 | 11/16/99 |
| 4 | Lab Visits for Discrimination Matrix | 1/17/00 | 2/1/00 |
| 5 | Procedure Adequate | 12/6/99 | 12/6/99 |
| 6 | Run Preliminary Tests & Report Data** | 1/3/00 | 3/3/00 |
| 7 | Data Analysis | 3/6/00 | 3/17/00 |
| 8 | HDEOCP Approves Proof of Concept* | 4/3/00 | 4/3/00 |

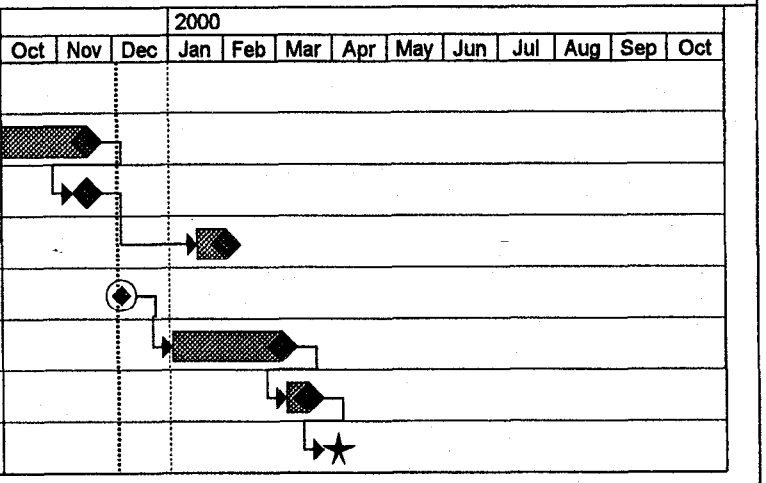



* Contingent on HDEOCP Meeting Date
** Will include TMC 1005-1

# Time Line for the M11 EGR Test

Brent Shoffner - 11/23/99

| ID | Task Name | Start | Finish |
|---|---|---|---|
| 1 | Initial Kits/Parts Available | 4/21/99 | 4/21/99 |
| 2 | Develop Procedure | 4/22/99 | 11/16/99 |
| 3 | Procedure Available | 11/17/99 | 11/17/99 |
| 4 | Lab Visits for Discrimination Matrix | 1/17/00 | 2/1/00 |
| 5 | Procedure Adequate | 12/6/99 | 12/6/99 |
| 6 | Run Preliminary Tests & Report Data** | 1/3/00 | 3/3/00 |
| 7 | Data Analysis | 3/6/00 | 3/17/00 |
| 8 | HDEOCP Approves Proof of Concept* | 4/3/00 | 4/3/00 |




* Contingent on HDEOCP Meeting Date

** Will include TMC 1005-1

# 1Q - EGR SCOTE DATA SUMMARY

| | 1Q -EGR | Pre 1Q-TCL | Pre 1Q-Ind |
|---|---|---|---|
| Oil Type | TMC 1005 | TMC 1005 | TMC 1005 |
| Test Hrs | 504 | 504 | 504 |
| | | | 3 Tests |
| Piston Dep. | | | |
| TLHC | 14 | 8 | |
| T L Carbon | 36 | 31 | 2 - 15 - 21 |
| TGF | 30 | 33 | |
| TG Carbon | 31 | 31 | 25- 31 - 38 |
| 2GF | 18 | 5 | |
| 2G Carbon | 15 | 5 | |
| WD-1P | 388 | 293 | 288-298-306 |
| | | | |
| BSOC g/hr | | | |
| 36 hrs | 12 | 12 | 8 - 10 - 13 |
| 72 hrs | 12 | 12 | 6 - 8 - 12 |
| 216 hrs | 10 | 9 | 8 -9 - 10 |
| 360 hrs | 11 | 9 | 4 - 8 - 10 |
| 504 hrs | 14 | 12 | 6 - 8 - 9 |
| | | | |
| EOT Anal | | | |
| Fe ppm | 74 | 42 | 17-40-145 |
| Al ppm | 2 | 1 | 0 - 1 - 2 |
| Cu ppm | 21 | 154 | 5 - 13 - 18 |
| Cr ppm | 7 | 1 | 0 - 1 - 16 |
| Pb ppm | 9 | 5 | 0 - 2 - 3 |
| TBN EOT | 5.5 | 6.9 | 7 - 6 - 6 |
| TBN Decrease | 2.1 | 0.7 | .1 - 2.2 - 1.8 |
| % Allow | 165 | 67 | |
| % TGA | 1.63 | 0.5 | |
| Visc Incr @ 100c | 5.6 | 3.7 | 3 - 4 - 4 |
| IR O2 | 19 | 13 | |
| | | | |
| Liner Bore Polish % | 5.3 | 1.1 | |
| Liner Wear Step mm | 0.0063 | 0.0014 | |
| Loss Side Clear.mm | | | |
| Top Ring | 0.012 | 0.012 | |
| Inter Ring | 0.033 | 0.043 | |
| Ring Gap Incr mm | | | |
| Top | 0.005 | 0.041 | |
| Inter | 0.032 | 0.007 | |
| Hardware Distress | | | |
| Top Ring | none | none | none |
| Inter Ring | none | none | none |
| Oil Ring | none | none | none |
| Liner | none | none | none |

# M11-EGR Taskforce
# Report to
# HDEOCP

December 7, 1999



ATTACHMENT 6, PAGE 1 OF 6

# M11-EGR Test Objectives

- **Evaluate Heavy Duty Engine Oils Ability to Control Wear, Deposits & Filter Plugging**
  - **Identify & Rate Lubricant Related EGR Risks**
  - **Design Test for Precision**
  - **Minimum Test Duration**
- **Build on M11-HST Experience**
  - **Simple Test Cycle**
  - **Non-Condensing Conditions**



ATTACHMENT 6, PAGE 2 OF 6

# Test Modifications Study Completed

- **Simple Test Cycle for Improved Control**
- **Non-Condensing Conditions to Reduce Variability**
- **Robust Turbocharger Selected**
- **Up-Dated Mechanical Components**
  - **Inserted Rocker Arm**
  - **X Head Inspected for Sub-surface Hardness**
  - **Polyester Oil Filter Media**
  - **Wear Resistant Top Ring**

# Phase III M11 EGR Kit Availability

- **Two M11 EGR Oil Test Engines Running at Cummins with Final Version of Key EGR Parts**
- **Eight EGR Conversion Kits Delivered**
- **All Special Components Available December 15**
  - **Turbochargers**
  - **EGR Coolers**
  - **Rebuild Kits**
- **Parts to Build Ten EGR Engines In-Stock**

# Phase III M11-EGR Test Conditions

- **Soot Loading Phase 50 hr at 330 hp**
  - **Target 9% TGA Soot at 250 hr**
  - **17% EGR**
- **High Load Cycle 50 hr at 430 hp**
  - **10% EGR**
- **Repeat Soot & High Load Phases 3X**
  - **240 F Oil Temperature**
  - **150 F Coolant Out**
  - **150 F Inlet Air Temperature**
- **Test Duration 300 hr**

# Test Validation Plan

- **Test Procedure Ready for Validation Testing**
- **Conduct Tests on Three Oils at Each Lab**
  - **TMC 1005**
  - **PC-9 Prototype A**
  - **PC-9 Prototype B**
- **Matrix Ready April 2000**



ATTACHMENT 6, PAGE 6 OF 6

# Mack T 10 Update

- 8 Engines Delivered to Industry
- Draft Test Procedure Issued 11/16/ 99
- Discrimination Test to Begin Nov / Dec
- First Discrimination Data : January 2000
- Discrimination Data to HDEOCP : Mar / April for Test Acceptance
- Ready for Matrix May / June 2000

ATTACHMENT 7

# Mack T-10 Task Force Report

# To HDEOCP (12/7/99)

- Task Force has convened four times since formation in 1999:
  - June 21, September 9, November 16 & December 6.

- Scope and objectives agreed (last revised on December 6).

- Timeline analysis – Some slippage on Discrimination Matrix.
  - Commenced mid-late 4Q 99.
  - Corrective action taken to ensure Matrix readiness.

- Recommendation to MDTF to focus on single reference oil:
  - Intended to improve LTMS targets.

- Sub-groups activities:
  - O&H SG: Has met three times.
  - Lab Visitation Group activity planned to commence mid-January 2000.
  - Provisional test procedure agreed, except Phase-2 Oil Gallery Temp (decision pending December 6 Task Force meeting).

  - Analytical SG: Has met three times.
  - Making slow progress due to lack of EGR-generated oil samples.

- Future meetings: Mid-late January, 2000.

# Mack T-10 Task Force

# Scope & Objectives

**Revision Date – December 6, 1999**

**Scope:**

This Task Force is responsible for development of the Mack T-10 engine test. It is accountable to the ASTM Heavy Duty Engine Oil Classification Panel and subsequently to ASTM Sub-Committee B0.02.

The Task Force will strive to achieve its objectives via close co-operation and interaction with the test sponsor, participating test laboratories and other ASTM functions (including Task Force Sub-Groups, the Test Monitoring Center and designated Critical Parts Distributor).

| **Objectives:** | **Completed** |
|---|---|
| 1. Evaluate preliminary test configuration and operational conditions and develop accordingly. | |
| 2. Expedite "fit-for-purpose" test/test procedure consistent with PC-9 timeline. | |
| 3. Identify and evaluate key performance criteria. | |
| 4. Demonstrate discrimination with respect to key performance criteria. | |
| 5. Optimize test procedure for maximum test precision and reliability. | |
| 6. Monitor PC-9 Precision/BOI matrix execution. | |
| 7. Monitor/assist statistical evaluation of matrix data. | |
| 8. Review against CMA Template. | |
| 9. Recommend HDEOCP endorsement of T-10 test, key performance criteria and associate limits. | |
| 10. Complete ASTM ballots for test approval/PC-9 inclusion. | |
| 11. Complete ASTM ballots of Mack T-10 Research report. | |

**Specific Activities:**

Develop primary test parameters:

1. Average Ring Weight Loss.
2. Average Cylinder Liner Wear.

Evaluate and compare range of secondary test parameters including:

1. Lead content of EOT lubricant.
2. Lubricant TBN depletion.
3. Lubricant TAN accumulation.
4. TBN/TAN interaction.
5. Oxidation/Nitration assessment via IR or alternative analytical method.
6. Bearing weight loss.
7. Piston deposits.

# ASTM Heavy Duty Engine Oil Classification Panel

## Oxidation Task Force

Dec. 7th 1999

Reno Nevada

# Oxidation Task Force

## Membership

| | | |
|---|---|---|
| Chairman | Rich Lee | Oronite |
| Members | John Graham | Cummins |
| | Steve Kennedy | Mobil |
| | Brian Lawrence | Infineum |
| | Glenn Mazzamaro | Ciba Geigy |
| | Charlie Passut | Ethyl |
| | Greg Shank | Mack |
| | Brent Shoffner | EG&G |
| | Lew Williams | Lubrizol |

# Contents

* Mission statement
* Background
* Oronite presentation
* Additional data supporting Oronite proposal
* Request for additional Caterpillar Pre 1Q data
* PDSC & Panel Coker proposal
* PDSC bench test proposal
* Sequence IIIF update

# Oxidation Task Force

Mission: To review proposals and make recommendations to the HDEOCP regarding measurement techniques to evaluate oxidation performance for lubricants meeting the proposed performance standard API PC-9

# Current Status

* The primary recommendation for a test method from EMA is the John Deere JDQ-78A test.
* The Seq. IIIF was identified as an alternative test method

# John Deere JDQ-78A

* The test method is already developed and the procedure has been shared with the Classification Panel
* Database has been made available by John Deere
* Addition of another expensive multicylinder engine test is the major concern

# Sequence IIIF

* Test procedure is in the process of final approval
* Concern re gasoline vs. diesel fueled engine
* Concern re test severity vs. JDQ-78A
  - » Extended length test?
* Will likely be required anyway for “Universal” products, therefore additional expense minimized

# Oronite Proposal

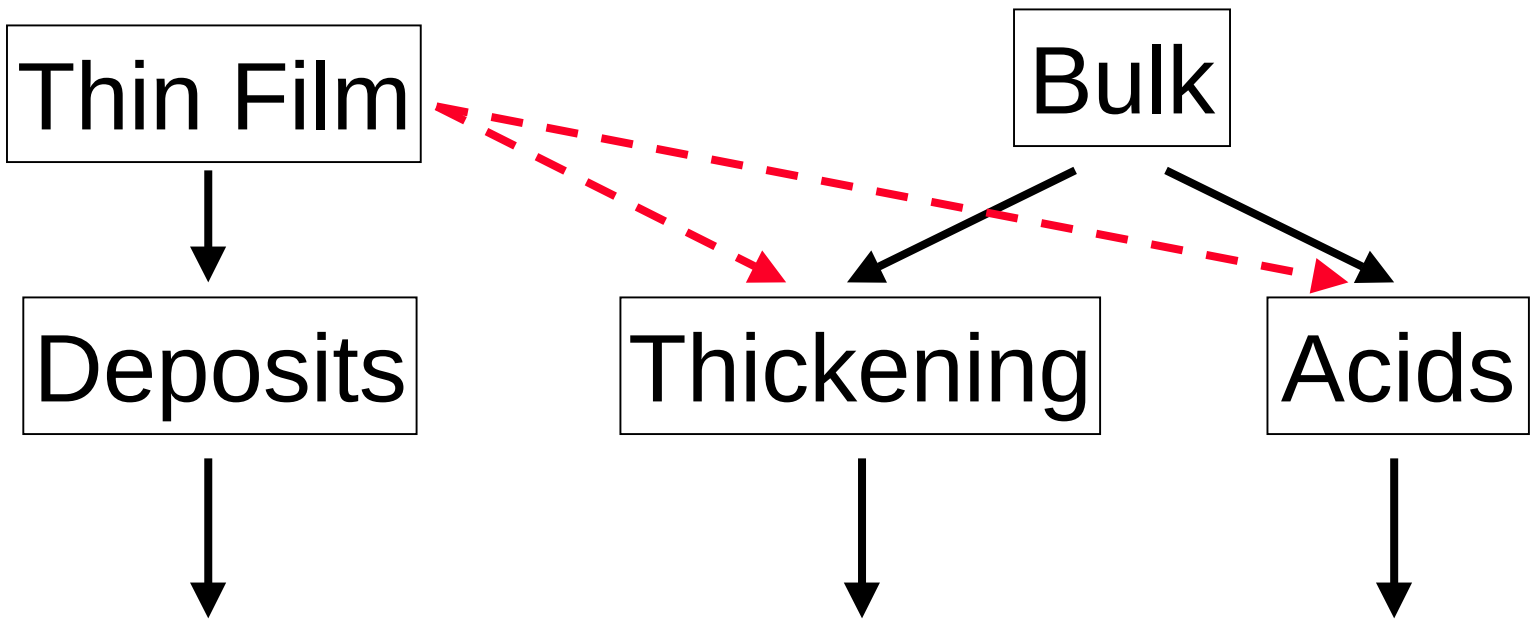
* Presented at NCDT, DEOAP & HDEOCP
* Improved understanding of causes and effects
* More cost effective approach

# Types of Oxidation

* Thin Film
  - Piston zone
  - High Temperature (200°C - 350°C)
  - Short residence time

* Bulk
  - Oil sump
  - Moderate Temperature (120°C - 155°C)
  - Long residence time
  - Catalyzed by wear metals

# Oxidation Impacts



# Summary Recommendations

API PC-9 oxidation performance evaluation:

1) **Caterpillar 1Q** for deposits related to Thin Film Oxidation

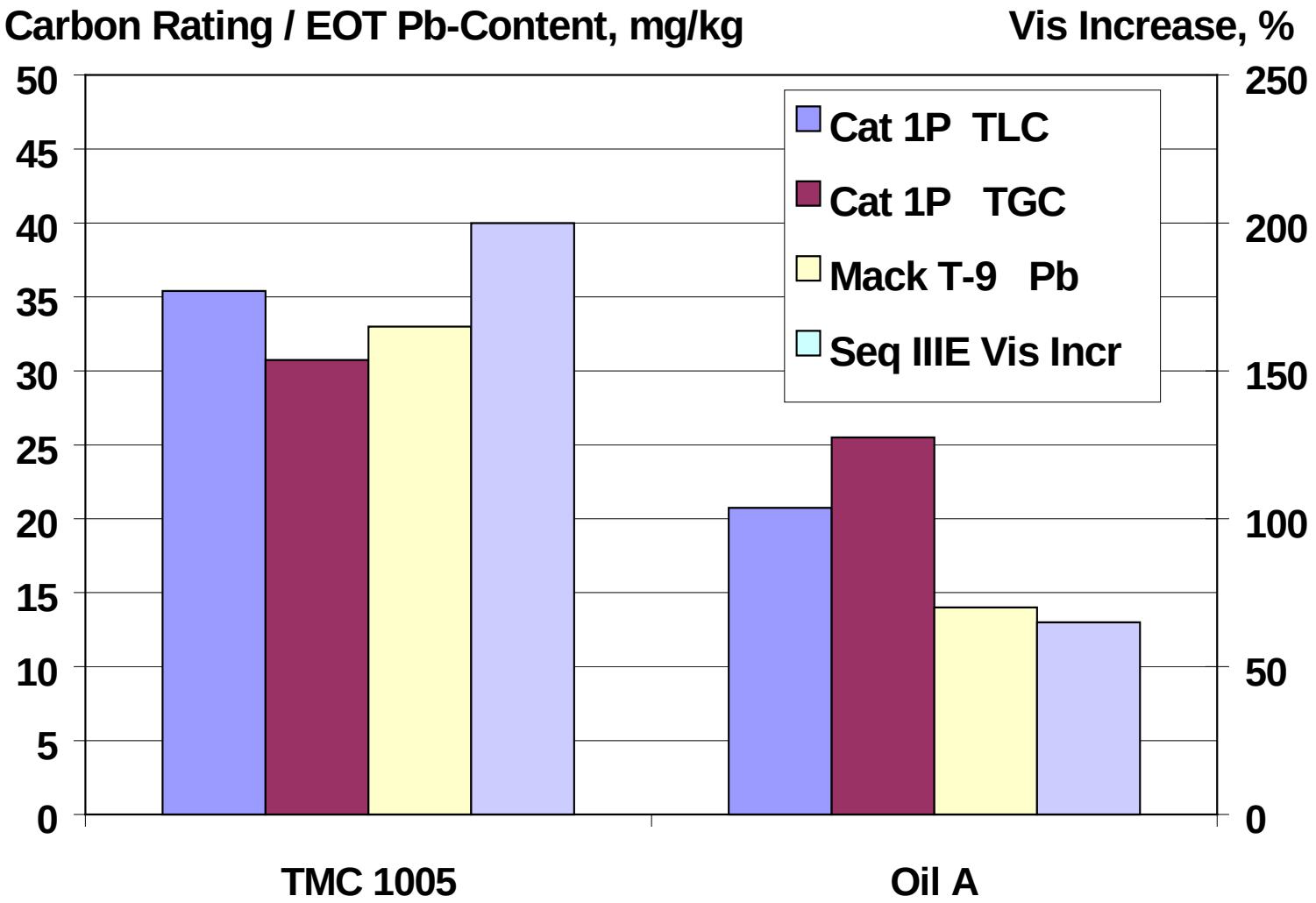
   - Alternative Bench Tests: Panel Coker, PDCS, Others?

2) **Sequence IIIF** for oil thickening related to Bulk Oil Oxidation

3) **Mack T-10** for corrosion related to Bulk Oil Oxidation

4) Set up an **Oxidation Test Task Force** of the HDEOCP

# Additional Oronite Support Data



# Request for Cat. Pre 1Q Data

* Purpose: to evaluate Pre 1Q as a measure of “Thin Film Oxidation”
* A request was sent Nov. 20th to several test engineers who are running Cat. Pre 1Qs asking for:
  - » FTIR
  - » Unweighted deposit
* Scott Parke of TMC agreed to tabulate all data
* Timing: End of Dec. 1999

# ACEA E5 Oxidation Test

* **Several industry proposals**
  - PDSC : Lubrizol
  - Panel Coker : Oronite
  - Hot Tube Tester : Shell
  - TFOUT ASTM D4742 : Ethyl

* **Selection based on the discrimination of 4 reference oils**
  - RL 196 : ACEA E4
  - RL 133 : ACEA E3 / E5
  - RL 134 : low reference
  - Scania field oil giving high Pb corrosion due to oxidation

* **Two tests were pre-selected**
  - PDSC and Panel Coker

# ACEA E5 Oxidation Test

## Terms of Reference / Objectives

***« Select and optimise one of the identified oxidation tests on the basis of correlation with Mack T-9 undercrown deposit formation and identified field performance »***

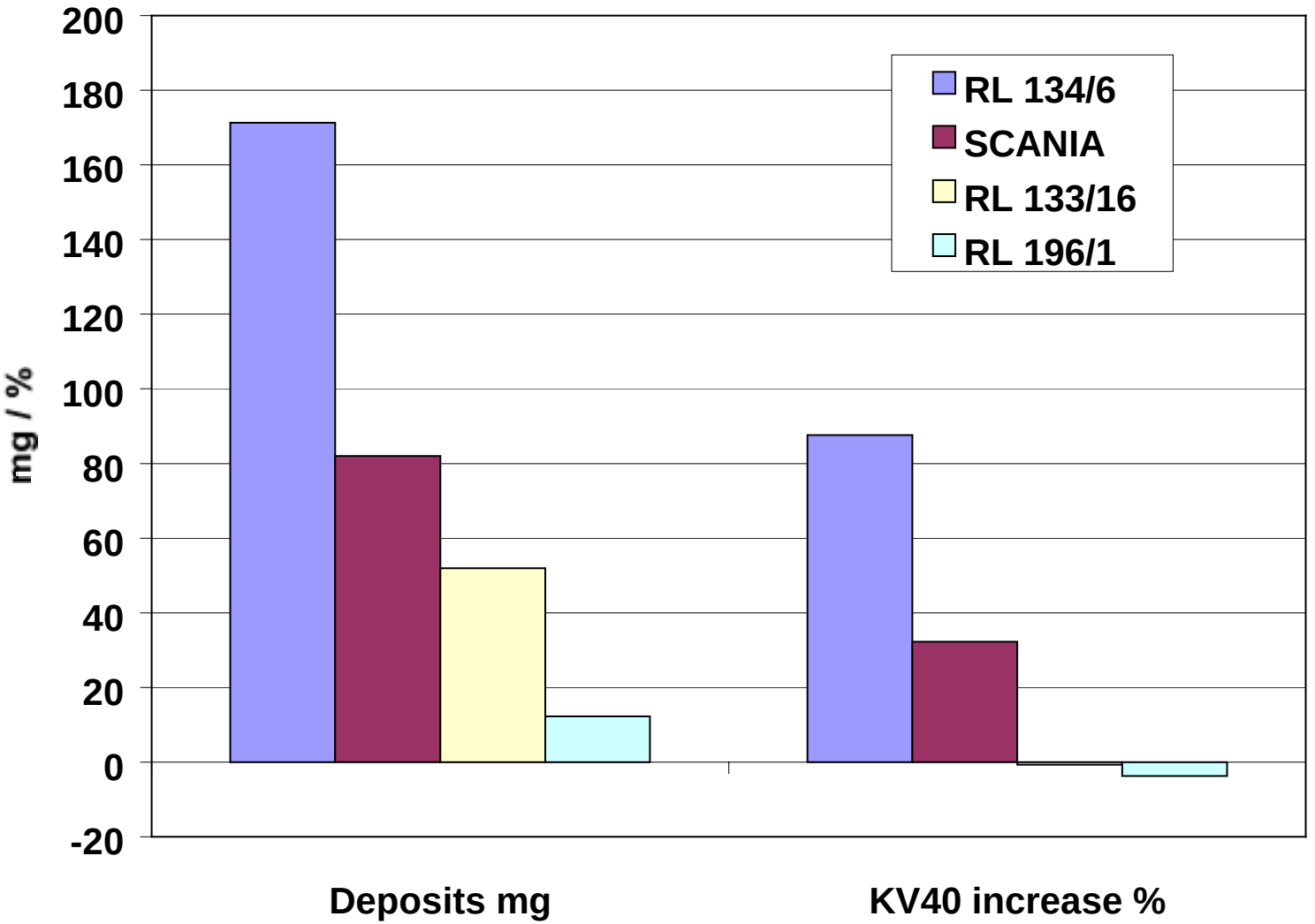
# ACEA E5 Oxidation Test
## Panel Coker Test

**2 methods were proposed : with and w/o pre-aging**

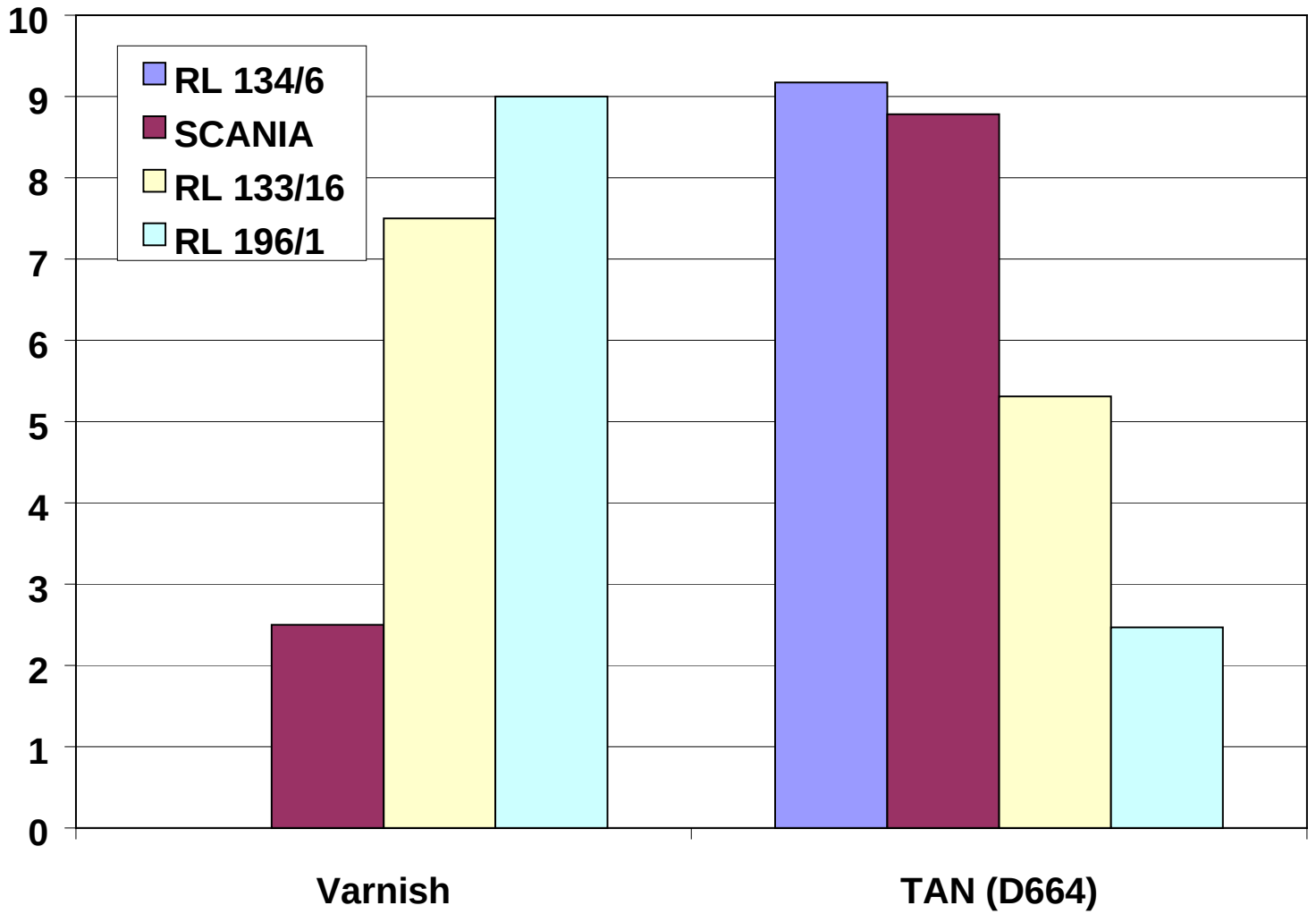
Decision was taken to work on the method w/o pre-aging because it is shorter and should be more repeatable

| | With Pre-aging | No Pre-aging |
|---|---|---|
| Pre-Oxidation Duration | 24 h / 120 h | |
| Oil Quantity | 200 g | 200 g |
| Panel Temperature | 290 °C | 300 °C |
| Oil Temperature | 100 °C | 170 °C |
| Projection / Idle Sequence | 15s / 45s | 15s / 45s |
| Test Duration | From 24 to 120 h | 48 h |
| Air Flow | 15 l/h | 12 l/h |
| Evaluated Parameters | | |
| Deposit Weight | Y | Y |
| Varnish Merit | Y | Y |
| Oxidation | N | Y |

# ACEA E5 Oxidation Test
## Panel Coker Test

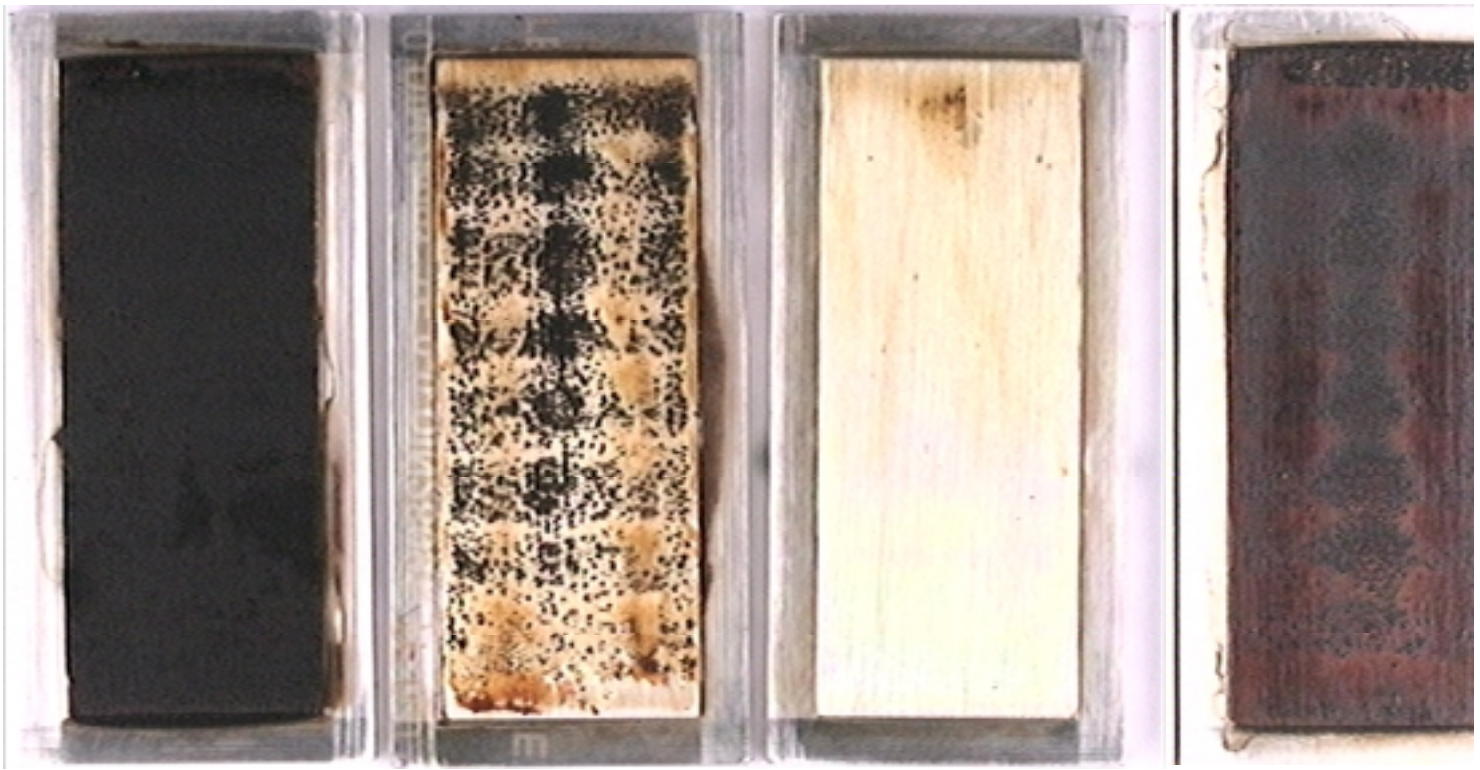


# ACEA E5 Oxidation Test
## Panel Coker Test



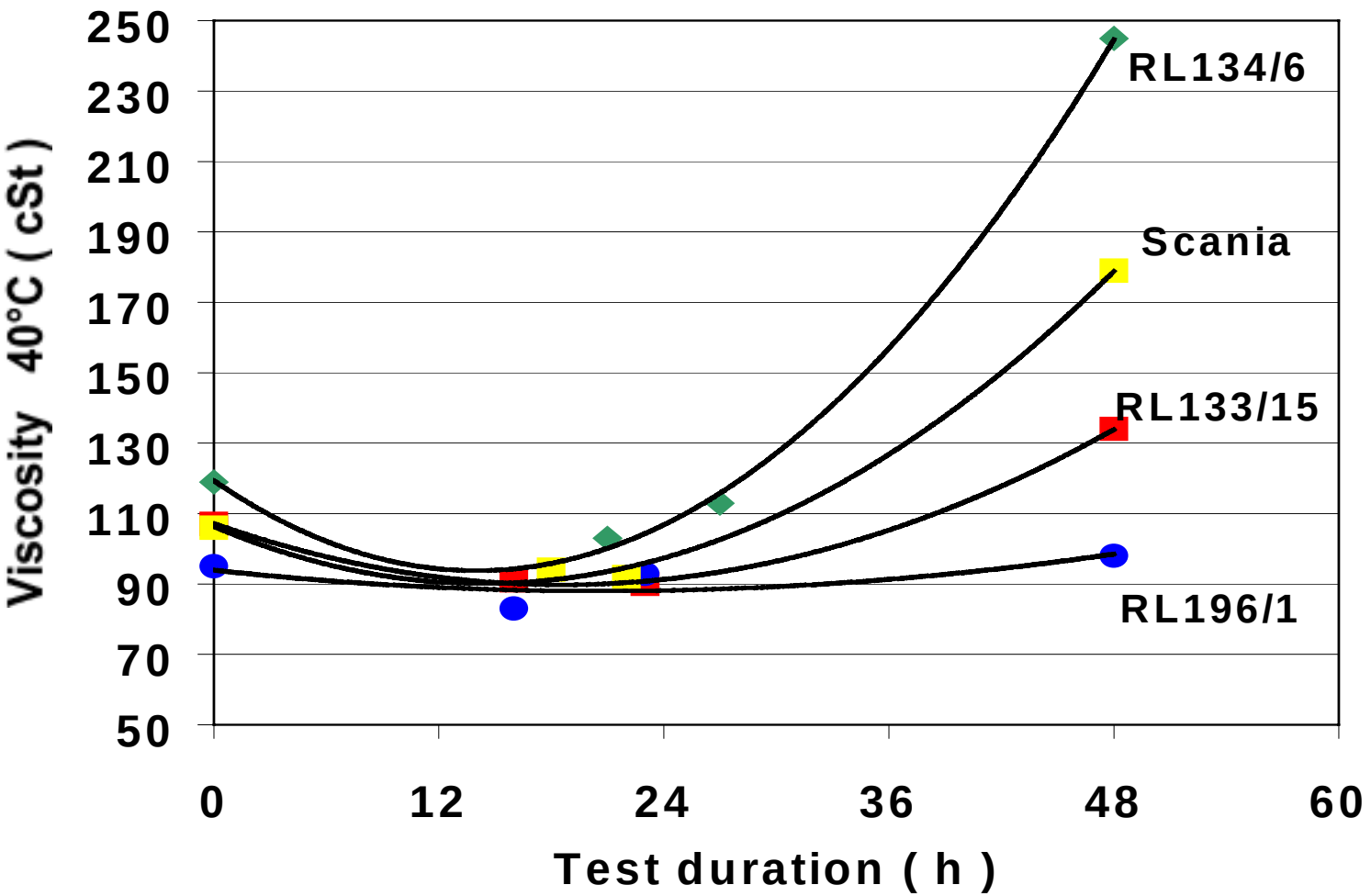
# ACEA E5 Oxidation Test
## Panel Coker Test

RL 134/6 | RL 133/15 | RL 196/1 | SCANIA oil



# ACEA E5 Oxidation Test

## Panel Coker Test



# ACEA E5 Oxidation Test
## Panel coker Test - Conclusions

* All test parameters provide a good ranking of the 4 selected reference oils

* This test is able to simulate 2 oxidation phenomena
  - » Bulk oxidation : low temperature (170°C), contributes to viscosity increase and corrosion (TAN)
  - » Thin film oxidation : high temperature (300°C), contributes to deposit formation

* Rating the amount of deposits and the varnish on the metallic plates gives a good indication of engine piston cleanliness

# ACEA E5 Oxidation Test
## PDSC Test

* **Scope of the method**
  - » Determine the oxidative stability of fully formulated engine oils
  - » The effectiveness of anti-oxidants may also be determined by PDSC
* **Evaluated parameter**
  - » Oxidative Induction Time (OIT) : time to reach the onset of the exothermic reaction
* **Proposed operating procedures**
  - » With or w/o catalyst
  - » With oxygen or air
  - » Different temperatures (between 175°C and 210°C)
  - » Different pressures (between 100 psi and 500 psi)

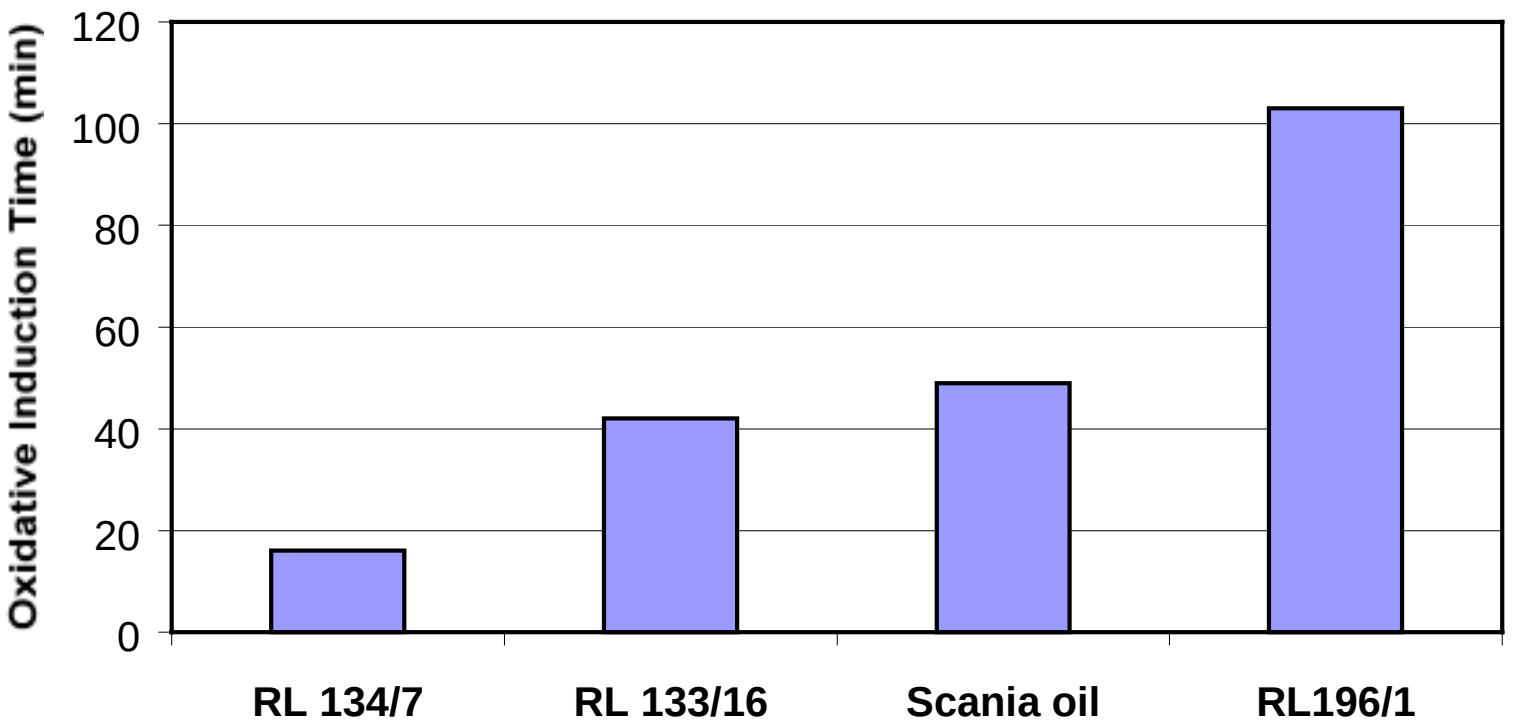
# ACEA E5 Oxidation Test
## PDSC Test

* All operating conditions correctly rank RL 134, RL 133 and RL 196

* None of the operating conditions discriminates between RL 133 (good reference) and the Scania field oil (low reference)

* Operating conditions selected according to the reproducibility between participating labs
  - » T = 210°C
  - » P = 100 psi of air
  - » No flow
  - » No catalyst
  - » Ramp temperature from 50°C to 210°C : 40°C/min

# ACEA E5 Oxidation Test
## PDSC Results



# ACEA E5 Oxidation Test
## PDSC vs Panel Coker

| | Oil A | Oil B |
|---|---|---|
| T-9 Liner Wear | 28.4 | 22.8 |
| T-9 EOT Pb-Content | 48 | 84 |
| PDSC @ 195°C | 84 | 99/103 |
| PDSC @ 210°C | 20 | 20 |
| TGA, °C | 286/288 | 297/299 |
| MAO 73 Deposit Weight, mg | 12/14 | 26/19 |
| MAO 73 KV40 Increase, % | 12/16 | 29/24 |
| MAO 73 IR Oxidation | 203/202 | 342/277 |
| MAO 73 Merit CEC M02-A78 | 5 | 1.9 |

# ACEA E5 Oxidation Test
## PDSC vs Panel Coker

* **PDSC**
  - » Is easy to run and very quick
  - » Needs very little oil
  - » Is repeatable and reproducible
  - » Does not discriminate between RL 133 (high reference) and Scania field oil (low reference)
  - » Does not correlate with Mack T-9 results (Pb corrosion)

* **Panel Coker**
  - » Equipment is not common (in-house test)
  - » Is repeatable but work needed to improve reproducibility between labs
  - » Correctly discriminates **ALL** reference oils
  - » Ranks the 2 T-9 oils correctly according to Pb corrosion
  - » Seems more suitable to simulate high temperature deposits due to oxidation

# The Sequence IIIF as an option for PC-9 Oxidation

Brent Shoffner

11/3/99

# Disclaimer

* This presentation should be regarded as information.
* The choice of an oxidation test for PC-9 should be a “data based” decision.

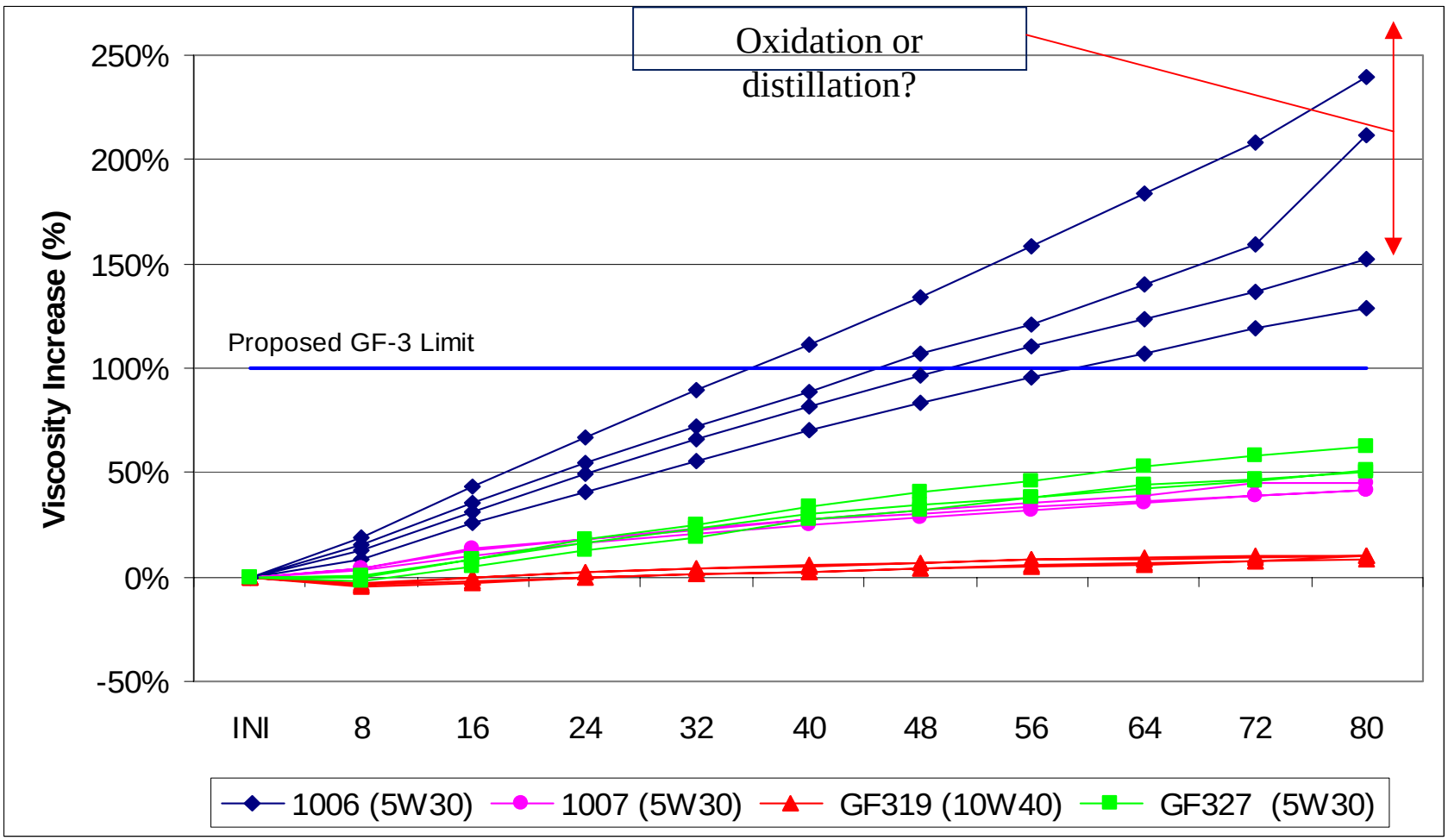
# Current IIIF Status

* The IIIF Precision Matrix (19 tests) is complete.
* The Statistical Analysis Team has studied the results and will publish their findings.
* Test oils include three additive technologies and two viscosity grades (5W-30 and 10W-40).

# Test Length

* The question is: “Will the IIIF test discriminate a borderline failing PC-9 oil?”
* If not, “The IIIF would have to be extended length.”
* It is my understanding that GM would not oppose development of an extended IIIF test?
* The IIIF Surveillance Panel would have the responsibility for developing and monitoring an extended IIIF test.

# IIIF Viscosity Increase vs. Test Hours



# Double Length Example

* Two Options
  - » Inspection at 80 hours
    - – First half is a valid CMA standard IIIF test
    - – As I understand it, Ford has accepted a double length IIIE with inspection for their factory fill specification.
  - » Run the test continuously for 160 hours.

# Double Length IIIF with Inspection

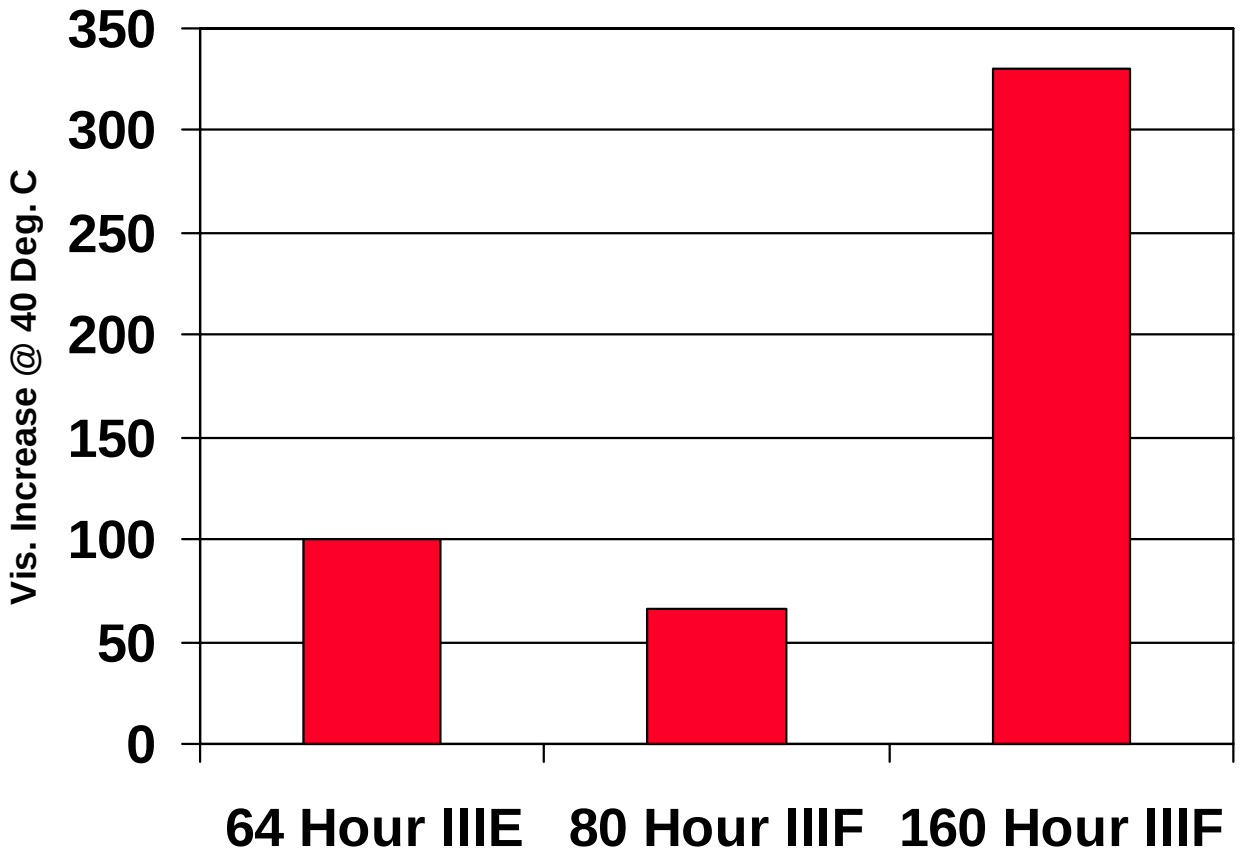
* Advantages
  - The extended length IIIF LTMS could piggy back on the IIIF LTMS.
  - New lifters could be installed at the mid-test point to alleviate the chance for cam and lifter wear.
  - Universal oils could be validated with one double length test.

# Double Length IIIF with Inspection

* Disadvantages
  - » Inspection time may affect oxidation result precision.
  - » Errors in disassembly/reassembly could affect the result.

# Double Length Seq. IIIF Oxidation

## SAE 5W-30 API SJ Technology in Group 1 Base Stock



# Suggested Next Meeting

* Week of February 15th 2000?
* Chicago?

# Proposal for PC-9 Oxidation Test

*Ciba Specialty Chemicals*

*December 7, 1999*

*ASTM HDEOCP Meeting*

*Reno, NV*



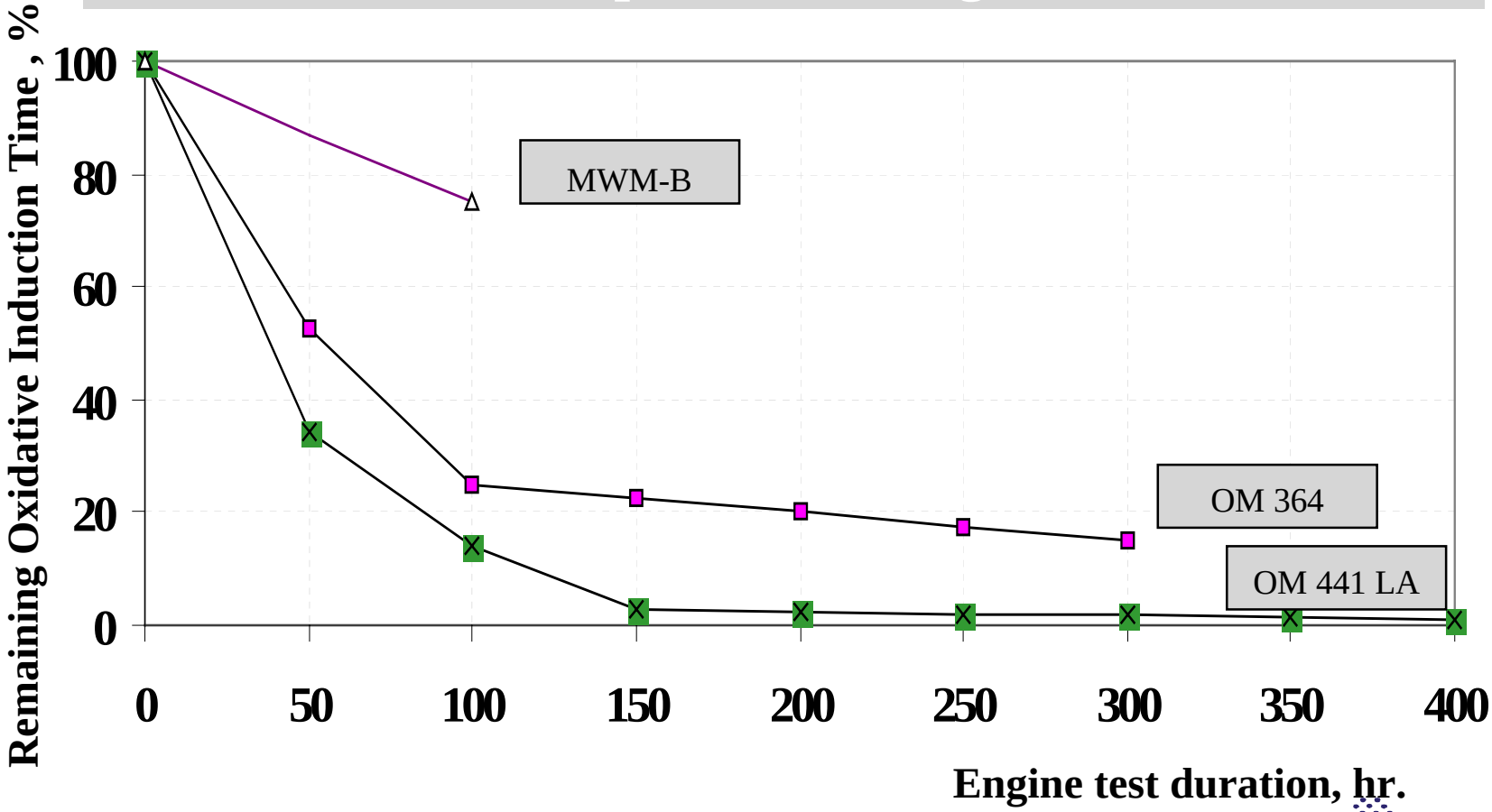
Ciba

# Ciba Proposal

## To assess oxidation performance of PC-9 oils, use PDSC analysis of EOT oil from most oxidatively severe PC-9 engine test.

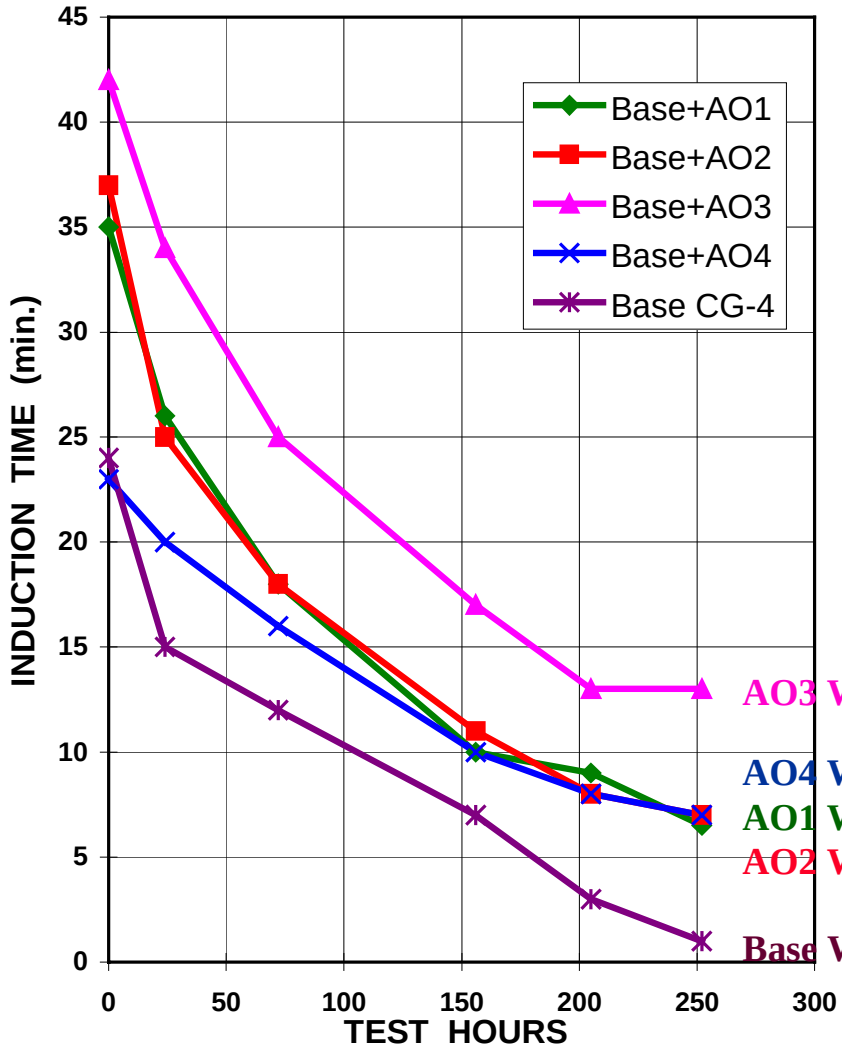
- Current ACEA E5-99 category requires measurement of PDSC oxidative induction time (CEC-L-85-T-99) of fresh oil (limit: $\geq$ 35 min.) as oxidation test
- Oronite oxidation data presented at 9/21/99 HDEOCP meeting indicates Mack T9 is the most severe diesel engine test in API CH-4
- Using EOT oil more accurately reflects remaining "performance reserve"

# PDSC shows relative stability of 3 generations of European diesel engines




Above data based on reference oil RL 133

# PDSC EVALUATION OF CAT 1N ENGINE OILS




- Baseline represents CG-4 marginal pass oil less ashless antioxidant
- PDSC analysis of fresh oils ranks them differently than PDSC analysis of EOT oils
- EOT PDSC more accurately reflects actual piston ratings than fresh oil PDSC

**AO3 WTD: 219**

**AO4 WTD: 239**
**AO1 WTD: 244**
**AO2 WTD: 286 (marginal pass)**

**Base WTD: 396**

Lubricant Additives

Ciba

ATTACHMENT 10, PAGE 4 OF 8

# Summary: PDSC for PC-9 Oxidation

**Benefits:**

- PDSC is a highly accepted and accessible measurement tool for oxidation performance, with good precision
- CEC L-85 PDSC method has achieved “T” status in Nov/98 after only 5 months of Task Force work
- Consistant with movement towards global harmonization of engine oil approval testing (e.g. ACEA E5-99)
- An additional, expensive engine test from PC-9 category can be eliminated (i.e. JDQ or ext. IIIF), saving the industry up to $14 million over the life of the category.

**Risks:**

- Link to bulk oil viscosity increase has not been fully investigated



# Background Slides: PDSC Methods



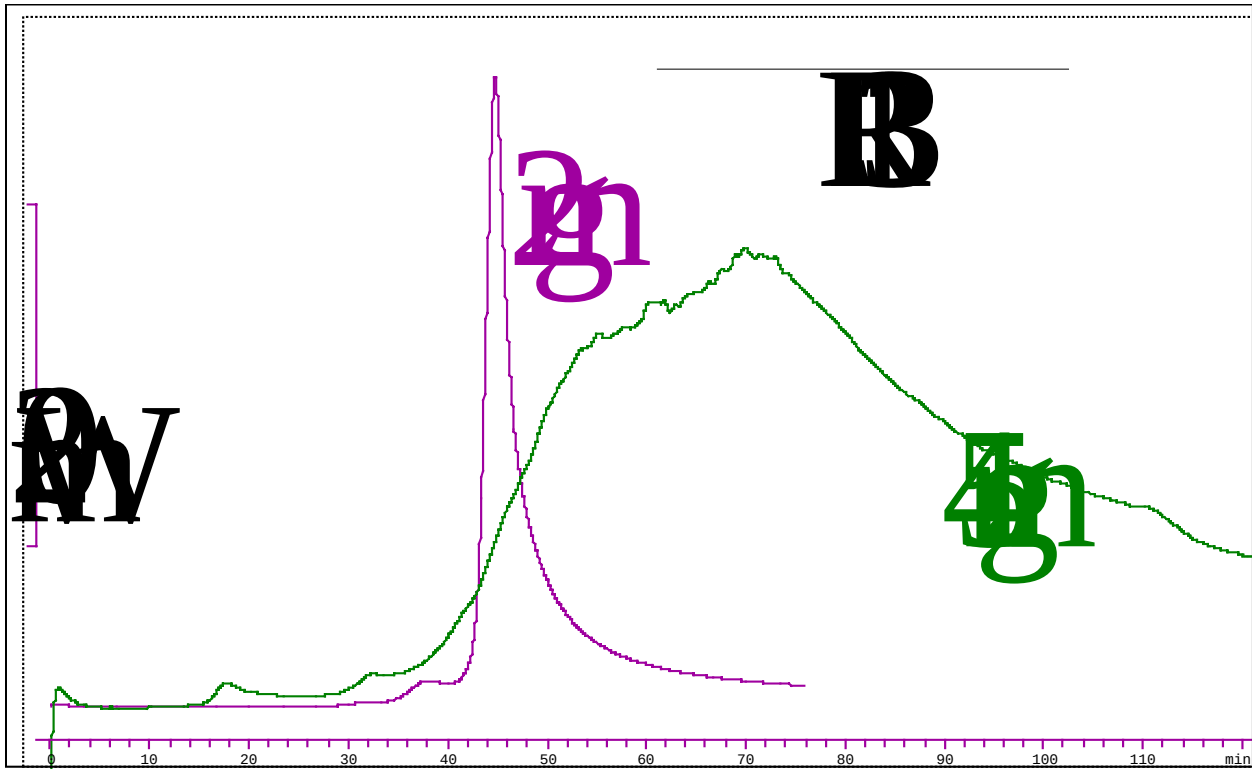
Ciba

# Comparison of PDSC Test Conditions

| | OM Tests | CAT Tests | CEC L-85 |
|---|---|---|---|
| **Isothermal** | 200°C | 200°C | 210°C |
| **Temp. Ramp** | 50°C/min. | 20°C/min | 40°C/min |
| **Pans** | steel | steel | aluminum |
| **Gas** | 10 bar $O_2$ | 10 bar $O_2$ | 100 psi Air |
| **Sample size** | 45 mg | 2 mg | 2.75 mg |
| **Apparatus** | Mettler 27HP | TA 910 | ----- |

ATTACHMENT 10, PAGE 7 OF 8

# PDSC Trace for Reference Oil RL 133




Remark: This demonstrates the sample size influence on the peakshape. One cannot compare OIT because the pans were cleaned with two different methods. A preconditionning step (pans placed in a 300°C oven for 1 hour) is also used now after the normal cleaning with solvents.

# The Sequence IIIF as an option for PC-9 Oxidation

Brent Shoffner

12/7/99

# Disclaimer

- This presentation should be regarded as information.
- The choice of an oxidation test for PC-9 should be a “data based” decision.

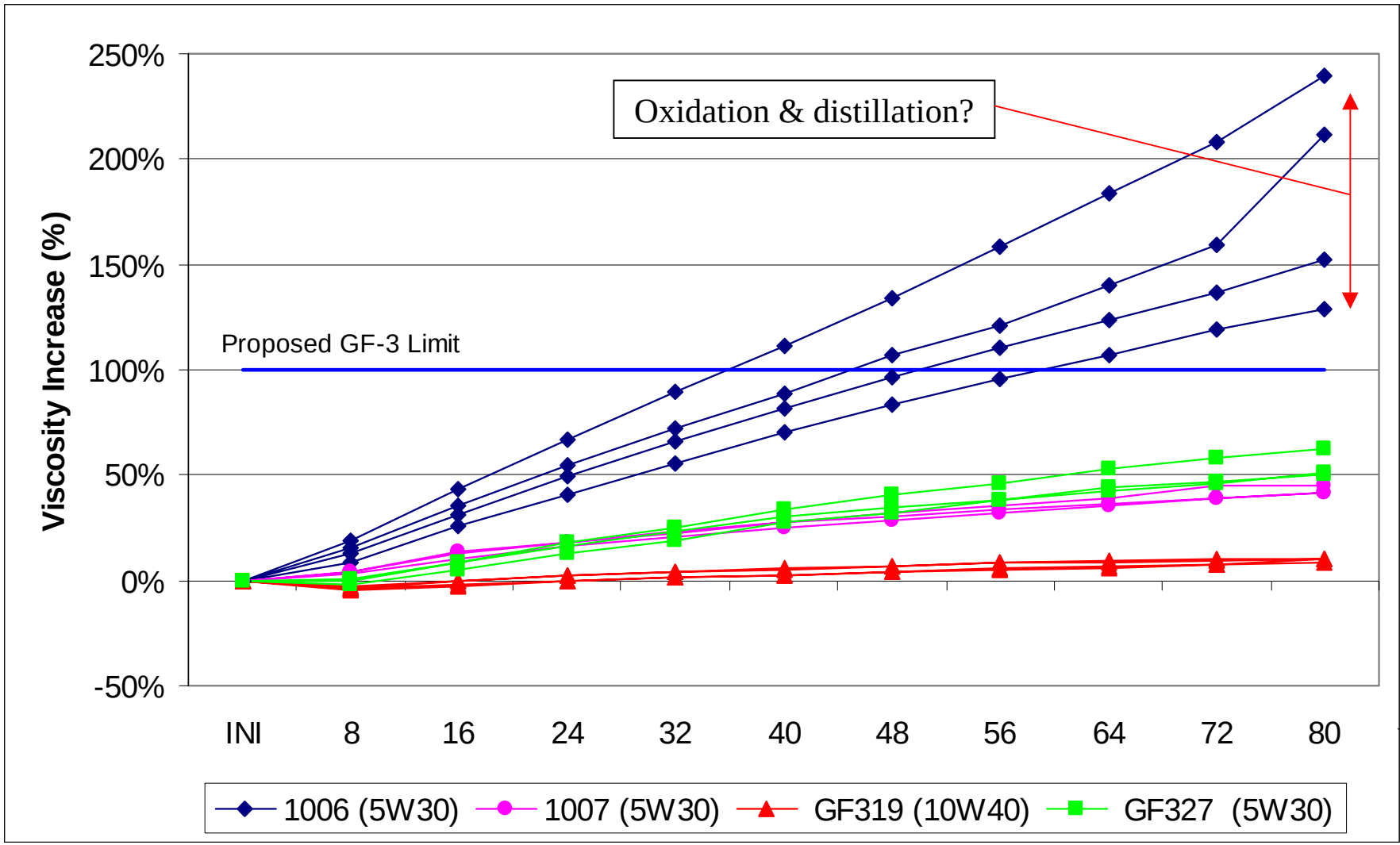
# Current IIIF Status

- The IIIF Precision Matrix (19 tests) is complete.
  - Test oils include three additive technologies and two viscosity grades (5W-30 and 10W-40).
- “Given the Precision Matrix data, the IIIF Surveillance Panel recommends that the IIIF is a viable test.”

# Test Length

- The question is: “Will the IIIF test discriminate a borderline failing PC-9 oil?”
- If not, “The IIIF would have to be extended length.”
- The IIIF Surveillance Panel (including GM) would have the responsibility for developing and monitoring an extended IIIF test.

# IIIF Viscosity Increase vs. Test Hours



# Double Length Example

- Two Options
  - Inspection at 80 hours
    - First half is a valid CMA standard IIIF test
    - As I understand it, Ford has accepted a double length IIIE with inspection for their factory fill specification.
  - Run the test continuously for 160 hours.

# Double Length IIIF *With vs. Without* Inspection

- Advantages ***With Inspection***
  - The extended length IIIF LTMS could piggy back on the IIIF LTMS.
  - Universal oils could be validated with one double length test.
- Disadvantages
  - Inspection time may affect oxidation result precision.
  - Errors in disassembly/reassembly could affect the result.

# High Temperature Oil Degradation Issues

December 7, 1999

# Oil Degradation Issues

- EGR Engines Will Reject 25-35% More Heat to Coolant
- Vehicle Design Constrains Cooling System Capacity Increases
- Oil & Coolant Temperatures Will Increase

# High Temperature Data

Standard ISM engine

1600 RPM

| Coolant | Rifle | Sump |
|---|---|---|
| 214 | 232 | 253 |
| 216 | 235 | 256 |
| 218 | 242 | 262 |

1800 RPM

| Coolant | Rifle | Sump |
|---|---|---|
| 213 | 248 | 265 |
| 217 | 249 | 266 |
| 220 | 250 | 268 |

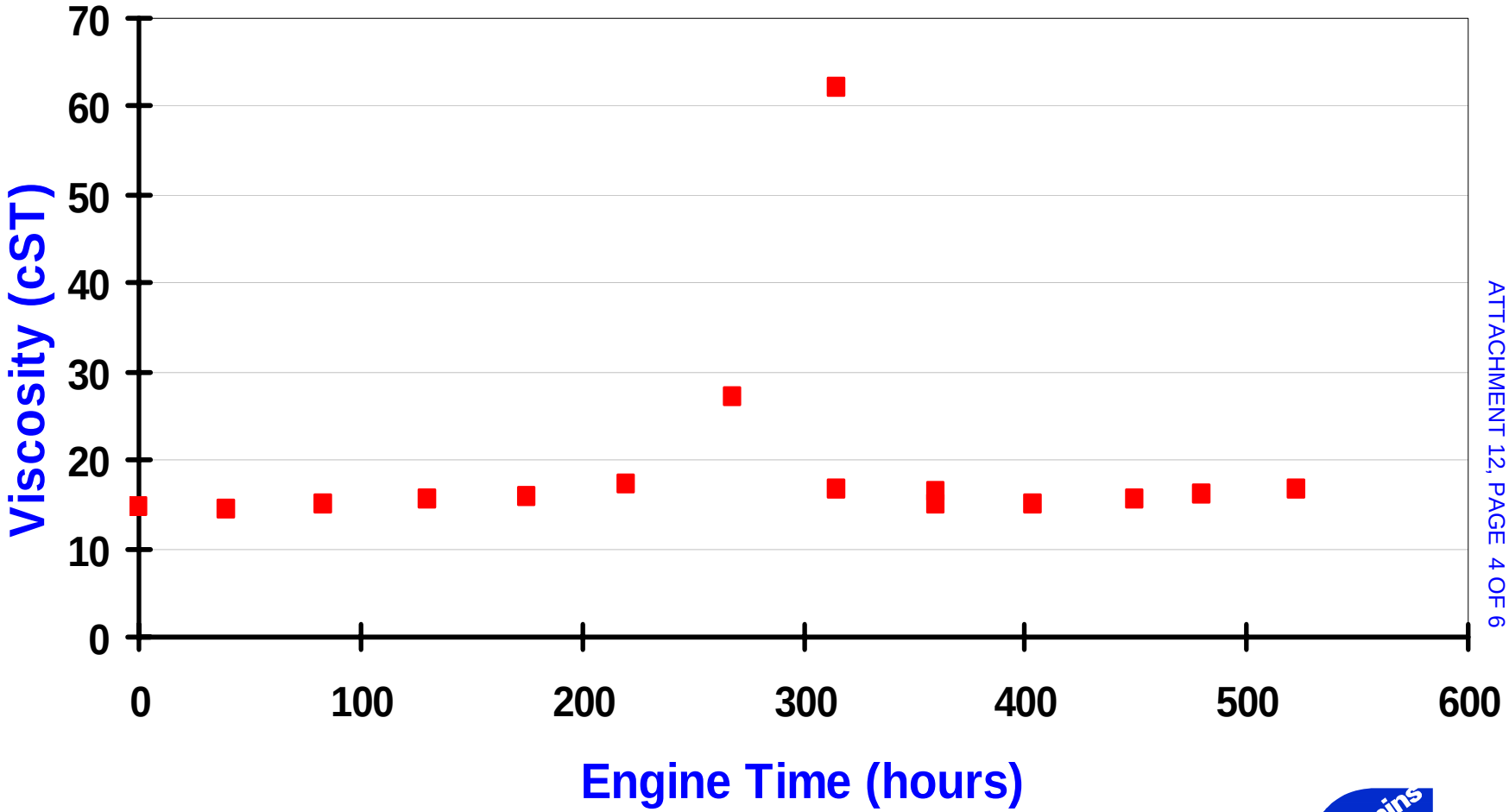
1600 RPM

| Coolant | Rifle | Sump |
|---|---|---|
| 230 | 250 | 268 |

1800 RPM

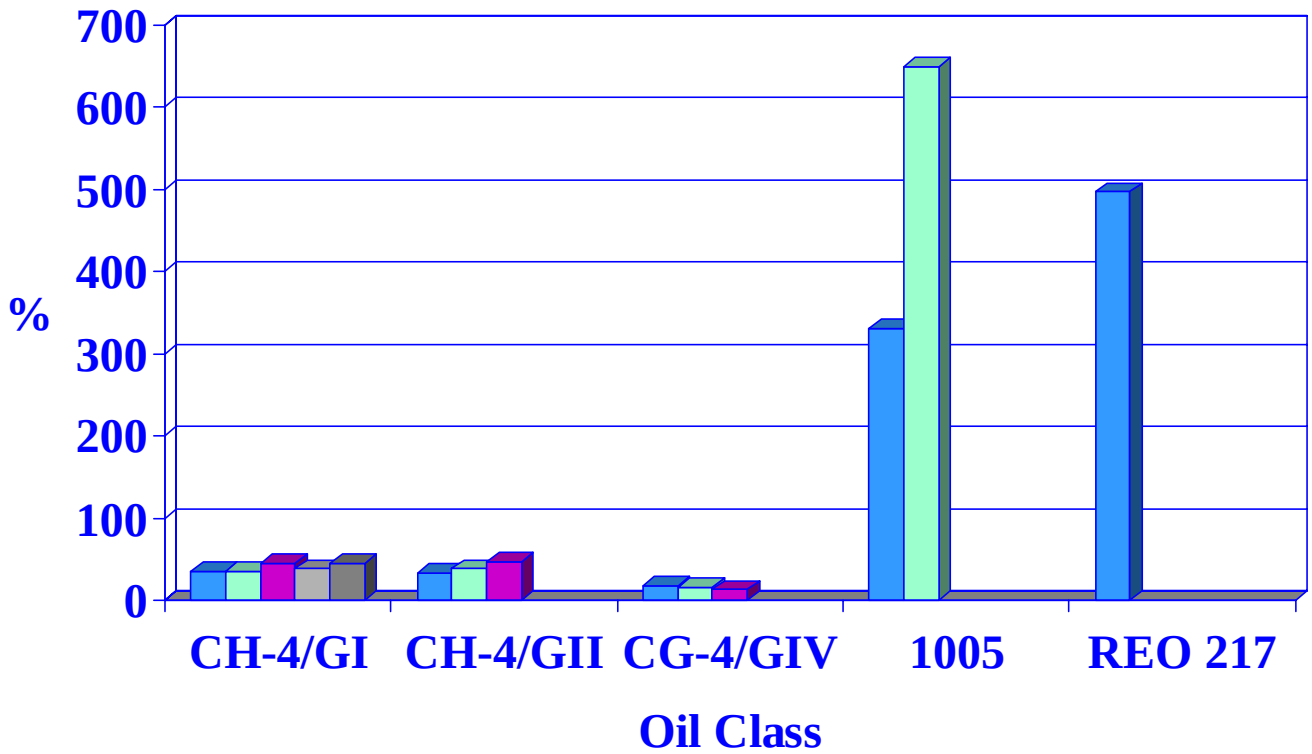
| Coolant | Rifle | Sump |
|---|---|---|
| 230 | 257 | 275 |

# M11 HSM
# 275 F Oil Sump




HSM

# Preliminary Look at 400 hr JDQ Viscosity Increase at 100 C



# Recommendations

- Form Task Force to Develop JDQ 78 to ASTM Standards
- Evaluate Ability of PC-9 EGR Tests, IIIF & Bench Tests to Cover High Temperature Oil Degradation of EGR Diesels
- Select High Temperature Oil Degradation Test(s) for PC-9

# Future HD Category Diesel Fuel Task Force Report to the HDEOCP

December 7, 1999

Reno, NV

# Future HD Category Diesel Test Fuel Task Force Report to B.2

December 8, 1999

Reno, NV

# Task Force Members

| | |
|---|---|
| Pat Fetterman (chairman) | Infineum |
| Frank Bondarowicz | Navistar |
| Augie Burke | Equilon |
| Jerry Keller | ALI |
| Ken Murphy (Greg Shank) | Mack Trucks |
| Brent Shoffner | EG&G |
| Jim Wells | SwRI |
| Lew Williams | Lubrizol |

# Task Force Fuel Supplier Members

| | |
|---|---|
| Don Burnett | Phillips Chemical Co. |
| Gil Clark | Specified: Fuels & Chemicals |

# Task Force Activities Since September Report

- Contact CH-4 test surveillance panels to assess possibility of using PC-9 fuel
  - Endorsed by Caterpillar and Mack panels
  - Agreed in concept by Cummins, RFWT, and EOAT panel chairs; but not endorsed by panels
- Issued new RFP letter to Phillips and Specified on September 22 with close date of September 30
- Both suppliers responded

# Supplier Responses

- Both suppliers offered pricing on the supply of PC-9 test fuel per the specification developed by this task force.
- Phillips proposal base is $1.00/gal ex Borger,Tx plus $0.185/gal transportation to San Antonio
- Specified proposal base is $1.19/gal ex Channelview, Tx plus $0.09/gal transportation
- Both suppliers also sent letters of commitment to supply this business long term
- Specified also offered a discount on LSRD-4

# Evaluation of Responses

- Using an assumed consumption profile of:

| | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|
| LSRD-4 | 167 KG | 167 KG | 0 | 0 |
| PC-9 | 0 | 1.75 MG | 2.5 MG | 2.0 MG |

  and looking at a 12% discounted cash flow, the Phillips proposal has a net present value of $310K favorable versus the Specified proposal.
- Based on this analysis, the TF recommends the acceptance of the Phillips proposal

# Summary

- The new fuel TF has developed a specification for a new test fuel for the PC-9 tests
- All of the CH-4 test surveillance panels are also looking at using this fuel
- The panel recommends acceptance of the Phillips propasal to supply at $1.00/gal ex Borger, Tx
- Assuming the consumption of 6.25 MG of fuel over the next three years, this results in savings of over $5,400,000 versus the use of LSRD-4

# PC-9 Matrix Design Task Force

## Status Report

**To**

## Heavy Duty Engine Oil Classification Panel

**Tuesday December 7, 1999**

**John Ascuaga's Nugget Hotel**

**Pavilion B**

**Reno, Nevada**

# PC-9 Matrix Design Task Force

## Task Force Scope:

- **Design a FORMULATIONS MATRIX Incorporating a Range of Technology and Base Oils (and Viscosity Grades) For Use During Matrix Testing for the PC-9 Test Procedures Currently Under Development.**

- **Design a TESTING MATRIX for Each New PC-9 Procedure to Enable Determination of Precision, Reference Oil LTMS Data, and Base Oil Interchange (and Viscosity Grade Read Across) Guidelines.**



ATTACHMENT 14, PAGE 2 OF 12

# PC-9 Matrix Design Task Force

## Task Force Decisions (October 7th Meeting)

- **Primary Formulations Matrix (9 Test Oils)**
  - **Base Oils (Three)**
    - **Three Individual Base Stocks**
      - **Selected From Group I, Group II, Group III and Group IV**
      - **Unique Base Oil Preferred, As Opposed to Mixes of Two Groups**
  - **Viscosity Grade (One)**
    - **SAE 15W-40**
  - **Technologies (Three)**
    - **Three DI + VM Combinations**
    - **Selection Criteria Established by NCDT**
    - **Selection to Be Made by EMA**
- **API LC (November 3rd Meeting) and DEOAP (October 7th Meeting)**
  - **Recommended: 1 from Group I and 2 From Group II**

# PC-9 Matrix Design Task Force

## Task Force Position

**Proposed Formulations Matrix:**

| Base Oil ⟶ | 1 - I | 1 - II | 1 - II* |
|---|---|---|---|
| **Technology** | | | |
| A | X | X | X |
| B | X | X | X |
| C | X | X | X |

| Component Key | | | |
|---|---|---|---|
| Technology | A | B | C |
| Base Oil | I | II | II* |
| Viscosity Grade | 1 | ~~2~~ | |

# PC-9 Matrix Design Task Force

## Task Force Decisions (October 7th Meeting)

- **PC-9 Test Matrices:**
  - **Statistical Matrix Designed for Each Test:**

    **M11/EGR, T-10/EGR, 1-Q/EGR**
  - **Designed to Provide:**
    - **Precision/BOI along with Reference Oil/LTMS Data**
    - **Designs are essentially finalized**
  - **Number of Tests:**
    - **M11/EGR = 28**
    - **T-10/EGR = 28**
    - **1-Q/EGR = 28**
  - **For Each Proposed Statistical Test Matrix**
    - **Cost Estimates Developed**
    - **Project Timeline Developed**



ATTACHMENT 14, PAGE 5 OF 12

# PC-9 Matrix Design Task Force

## Task Force Decisions (October 7th Meeting)

- **PC-9 Test Matrix (Supplemental):**
  - **Statistical Matrix Designed for JDQ-78A**
  - **Designed to Provide:**
    - **Precision/BOI along with Reference Oil/LTMS Data**
    - **Designs is essentially finalized**
  - **Number of Tests:**
    - **JDQ-78A = 20**
  - **For this Proposed Statistical Test Matrix**
    - **Cost Estimates Developed**
    - **Project Timeline developed**



ATTACHMENT 14, PAGE 6 OF 12

# PC-9 Matrix Design Task Force

## PC-9 Test Matrix Project Costs Summary

| | | |
|---|---|---|
| Test Prices Used | M-11/EGR | $85,000 |
| For Matrix Project | 1Q/EGR | $60,000 |
| Cost Estimates | T-10/EGR | $65,000 |
| | JDQ-78A | $60,000 |



ATTACHMENT 14, PAGE 7 OF 12

# PC-9 Matrix Design Task Force

## 3 Test Matrix For Precision Only

| PC-9 Test: | M-11/EGR | | 1-Q/EGR | | T-10/EGR | | Total Cost | |
|---|---|---|---|---|---|---|---|---|
| | # Tests | $ | # Tests | $ | # Tests | $ | # Tests | $ |
| Number of Tests: | 24 | 2.040 | 24 | 1.440 | 24 | 1.560 | 72 | 5.040 |
| **Project Cost (Funding Group)** | **6** | **0.510** | **6** | **0.360** | **6** | **0.390** | **18** | **1.260** |



ATTACHMENT 14, PAGE 8 OF 12

# PC-9 Matrix Design Task Force

## 3 Test Matrix Design For Precision and BOI

### Using SAE 15W-40 Grade Formulations Matrix (9 Oils)

| PC-9 Test: | M-11/EGR | | 1-Q/EGR | | T-10/EGR | | Total Cost | |
|---|---|---|---|---|---|---|---|---|
| | # Tests | $ | # Tests | $ | # Tests | $ | # Tests | $ |
| Number of Tests: | 28 | 2.380 | 28 | 1.680 | 28 | 1.820 | 84 | 5.880 |
| **Project Cost (Funding Group)** | **8** | **0.680** | **8** | **0.480** | **8** | **0.520** | **24** | **1.680** |



ATTACHMENT 14, PAGE 9 OF 12

# PC-9 Matrix Design Task Force

## 4 Test Matrix For Precision Only

| PC-9 Test: | M-11/EGR | | 1-Q/EGR | | T-10/EGR | | JDQ-78A | | Total Cost | |
|---|---|---|---|---|---|---|---|---|---|---|
| | # Tests | $ | # Tests | $ | # Tests | $ | # Tests | $ | # Tests | $ |
| Number of Tests: | 24 | 2.040 | 24 | 1.440 | 24 | 1.560 | 20 | 1.200 | 92 | 6.240 |
| **Project Cost (Funding Group)** | **6** | **0.510** | **6** | **0.360** | **6** | **0.390** | **7** | **0.420** | **25** | **1.680** |



ATTACHMENT 14, PAGE 10 OF 12

# PC-9 Matrix Design Task Force

## 4 Test Matrix Design For Precision and BOI

### Using SAE 15W-40 Grade Formulations Matrix (9 Oils)

| PC-9 Test: | M-11/EGR | | 1-Q/EGR | | T-10/EGR | | JDQ-78A | | Total Cost | |
|---|---|---|---|---|---|---|---|---|---|---|
| | # Tests | $ | # Tests | $ | # Tests | $ | # Tests | $ | # Tests | $ |
| Number of Tests: | 28 | 2.380 | 28 | 1.680 | 28 | 1.820 | 20 | 1.200 | 104 | 7.080 |
| **Project Cost (Funding Group)** | **8** | **0.680** | **8** | **0.480** | **8** | **0.520** | **7** | **0.420** | **31** | **2.100** |



ATTACHMENT 14, PAGE 11 OF 12

# PC-9 Matrix Design Task Force

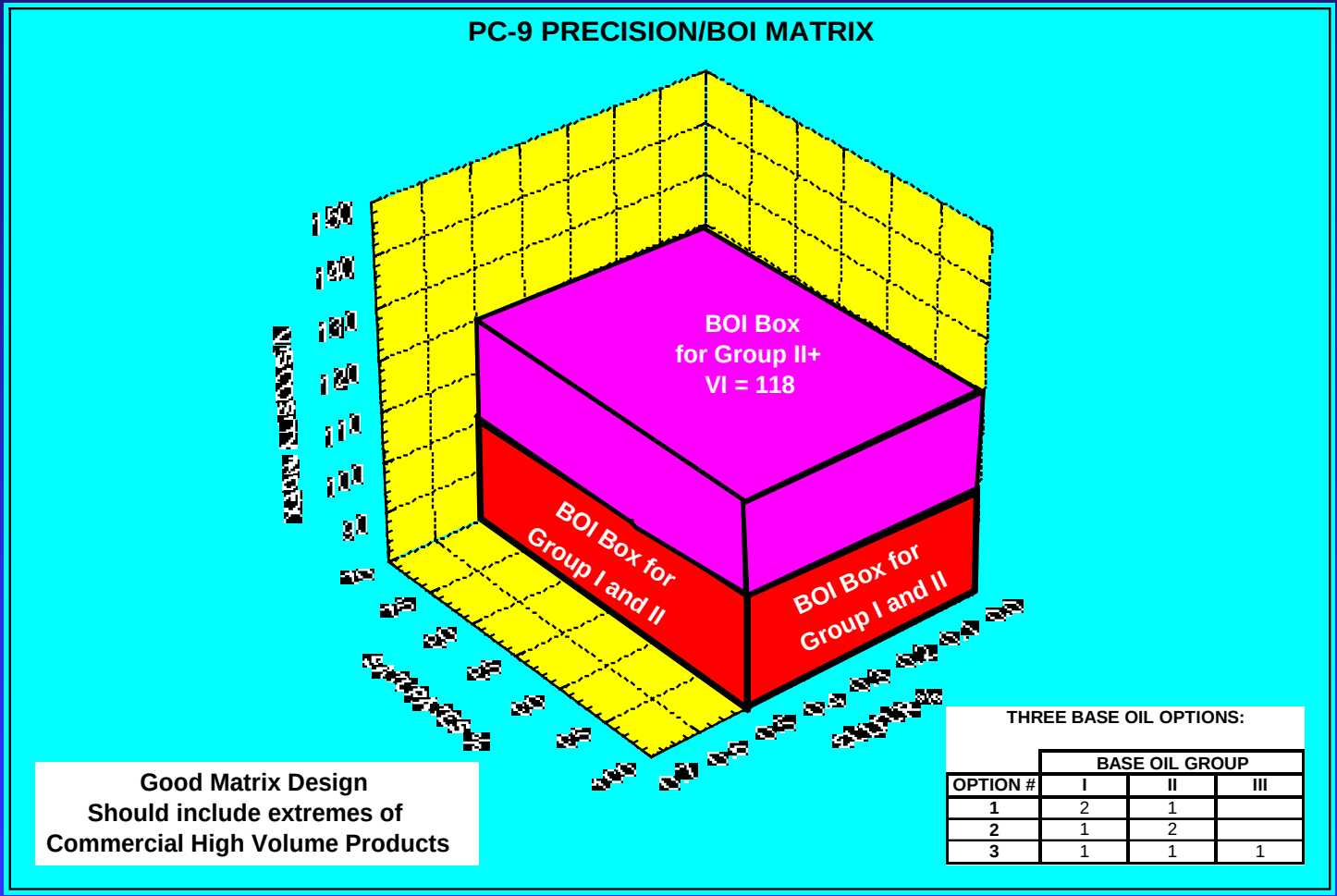
## Proposed Timeline:

- **Formulations Matrix**
  - **Base Oils Available** *February 1, 2000*
  - **Technologies Available** *January 25, 2000*
  - **Blends Prepared** *March 31, 2000*

- **Matrix Testing**

  **(If the PC-9 Tests are Ready at the December ASTM Meeting)**
  - **Matrix Start** **May 25, 2000**
  - **Matrix Completion** **October 4, 2000**
  - **Data Evaluation Completed** **November 10, 2000**

# Maximize BOI in PC-9 Matrix




Good Matrix Design
Should include extremes of
Commercial High Volume Products

THREE BASE OIL OPTIONS:

| | BASE OIL GROUP | | |
|---|---|---|---|
| OPTION # | I | II | III |
| 1 | 2 | 1 | |
| 2 | 1 | 2 | |
| 3 | 1 | 1 | 1 |

ATTACHMENT 15

# ASTM B0.02 HDEOCP
# Elastomer Task Force Objectives
# Dec. 7, 1999

The Elastomer Task force was formed at the Request of the HDEOCP following an elastomer proposal presented at the May NCDT meeting. We proposed that PC-9 mimic what was done with GF-3. The objectives of the Task Force are:

- Survey the industry for oils that represent technology that has had satisfactory field performance and may be particularly aggressive to one or more of the seals used in the ASTM D471 test. (PC-7 seals test)
- Choose one or more oils based on D-471 testing plus any other information offered with that oil. Oils must be submitted prior to limit setting by the HDEOCP. The PC-9 Matrix oils will also be run in the D-471 tests. Selection will be based on the task force reasoning that the oil represents a minimum baseline performance for acceptability.
- Contact ASTM D11.15 to make known the inclusion of HDD elastomer oil(s) in the PC-9 profile.
- Make recommendations to the HDEOCP. The intentions are that due to the repeatability of the elastomer test and variation between and within seal batches and age, the oil(s) selected represent a minimum performance level - That all-new formulations should be less antagonistic toward seals then the recommended reference oils. Also, that all new elastomers which are developed be compatible with these oils.
- Request that the EMA make a service fluid and elastomer recommendation similar to the ILSAC GF-3 recommendation.

Oil requirements:

- D-471 test results (PC-7 materials and conditions) must accompany the oil
- The company must be willing to blend the oil in large quantities for distribution by ASTM/TMC. Potential of several thousand gallons or more is possible.
- The oil must represent technology of a type that has given satisfactory performance in the field.

# ASTM B0.02 HDEOCP
# Elastomer Task Force Report
# Dec. 7, 1999

- There have been no new meetings since the last Task Force Report of September 21, 1999.

- Task Force membership and mailing list have increased and are shown in the accompanying attachment

- Task Force members have been polled electronically as to the need for a Central Parts Distributor (CPD) to store and distribute key elastomer materials. Those responding have been unanimously in favor of a CPD.

- The next Task Force meeting will be scheduled to be held immediately before or after the NCDT or DEOAP or HDEOCP meeting (Take your pick – whichever comes first)

# ASTM HDEOCP PC-9 Elastomer Task Force Membership

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# Low Temperature Rheology of Used Oils Task Force

## Scope & Objectives

## Scope & Objectives Statement (revised):

***"To determine the suitability of current rheological methods in measuring low temperature properties of used oils from fired engines (relating to cold cranking and pumpability), provide recommendations for any modifications to those methods, and determine the precision of those modified or unmodified methods."***

# LOTRUO CONTACTS MADE WITH RELEVANT ASTM GROUPS

## Section B1 (PCEO)

- F. Fernandez (PCEOCP) - strong endorsement
- W. Nahumck (IIIE/F surveillance panel) - supports our efforts, will work to obtain samples

## Section B2 (HDEO)

- M. Quinn (B2) - strong endorsement
- J. McGeehan (HDEOCP) - requested LOTRUO presentation at Dec. 7th meeting
- C. Passut (T8/T8E surveillance panel) - supports our efforts, will advise panel and work to obtain samples
- J. Graham (M11/M11 EGR) - LOTRUO waiting for word back

- Have also made request to J. Zalar (TMC) re. opportunities to obtain used reference oils from relevant tests for analysis by the LOTRUO group - will be raised at surveillance panel meeting