

From: [Salgueiro, Bob](#)
To: [Ahlborn, Jonathan \(Jonathan.Ahlborn@Lubrizol.com\)](#); [Alessi, Michael \(michael.lalessi@exxonmobil.com\)](#); [Athey, Allison](#); [Bea, Douglas \(DOBE\)](#); [Berman, David \(bermad@cpchem.com\)](#); [Bishop, Zack](#); [Boese, Doyle](#); [Bond, Stacy](#); [Booth, James E.](#); [Budd, Arnel](#); [Buscher, Bill](#); [Campbell, Bob](#); [Carabell, Kevin \(kedc\) \(KCarabell\)](#); [Carter, Brad \(bradley.carter@intertek.com\)](#); [jecarter@jhaltermann.com](#); [Cauley, Chris](#); [Jeff Clark](#); [Conrad, Michael \(Michael.Conrad@Lubrizol.com\)](#); [Conti, Riccardo](#); [Cooper, Mark \(MAWC\)](#); [Devlin, Cathy](#); [Fetterman, Pat](#); [Franklin, Joe \(Intertek\)](#); [Garcia, Luiz \(luiz.garcia@intertek.com\)](#); [Rich Grundza](#); [Gutzwiller, James](#); [Haeglin, John \(Intertek\)](#); [Johnson, Kurt D. \(kurt.johnson@swri.org\)](#); [Jones, Ron](#); [Kennedy, Steve](#); [Kersey, Victor](#); [Kleijwegt, Peter \(pek\)](#); [Lanctot, Dan \(dlanctot@tei-net.com\)](#); [Larch, Bill](#); [Matasic, Jim](#); [McGeehan, James](#); [Menasco, Michael \(ENAS\)](#); [Miiller, Greg](#); [Minotti, Michael](#); [Moritz, Jim \(Intertek\)](#); [Sean A. Moyer](#); [Nann, Norbert](#); [OMalley, Kevin Kevin \(OMalley@lubrizol.com\)](#); [Parsons, Gary](#); [Passut, Charlie](#); [Polley, Kris](#); [Pridemore, Dan](#); [Rajakumar, Allison](#); [Rele, ter, Ruud \(RUUD\)](#); [Ritchie, Andrew](#); [Rutherford, Jim \(JARU\)](#); [Salgueiro, Bob](#); [Santos, Elisa](#); [Schweitzer, Addison](#); [Secue, Nick \(Nicholas.Secue@Lubrizol.com\)](#); [Selby, Keith](#); [Shank, Greg](#); [Sutherland, Mark \(msutherland@tei-net.com\)](#); [Sztenderowicz, Mark](#); [Tallamraju, Ravi \(Ravi.Tallamraju@Lubrizol.com\)](#); [Urbanak, Matt](#); [Van Dam, Wim \(WVDA\)](#); [VanScoyoc, Jonathan \(vanscj@cpchem.com\)](#); [Warden, Robert W. \(robert.warden@swri.org\)](#); [Weber, Ben](#); [Wong, Andrew P.](#); [Booth, James E. \(James.Booth@chevron.com\)](#)
Subject: Mack Surveillance Panel Meeting Minutes - January 13, 2015
Date: Tuesday, January 13, 2015 10:40:07 PM

Good evening everyone,

Please find the unconfirmed minutes below of the January 13th meeting held by the Mack Surveillance Panel.

Please feel free to let me know if there are any changes or revisions needed. Thanks.

Mack Surveillance Panel Meeting

ExxonMobil Research and Engineering, Paulsboro Technical Center, New Jersey

January 13, 2015

Attendees:

Afton – Bob Campbell, Christian Porter

ExxonMobil – Mike Alessi, Riccardo Conti

Intertek – Jim Mortiz, Luiz Garcia

Infineum – Bob Salgueiro (Secretary), Pat Fetterman

Lubrizol – Kevin O'Malley, Jim Matasic (on phone), Ravi Tallamraju, Mike Conrad

Oronite – Mark Cooper (Chairman), Jim Rutherford

SwRI – Bob Warden, Jim McCord (on phone)

TEI – Mark Sutherland

TMC – Sean Moyer

Volvo/Mack – Greg Shank

The meeting was called to order at 1:38PM, by Mark Cooper, Chairman. The agenda topics are bulleted below, with discussions and actions following.

• CPD Report

Mark Sutherland

- **“T” Liners** – TEI has about 2500 “T” batch liners. The majority will mostly be disposed, but a few will be kept for use in Mack T-8 tests. McCord (SWRI) said that the latest reference tests on the new tighter tolerance liners were really not any better than the “T” liners. Campbell (AFTN) suggested that we take a statistical look at the data. But due to the quantity of the current “V” batch of liners, we wouldn't be able to begin using the “T” batch for 4-5 years. After a discussion about why the Surveillance Panel had rejected the “T” batch of liners previously, the Surveillance Panel decided to dump the “T” batch liners but keep a few for Mack T-8 testing.
- **Piston crowns** – The second batch “B”, of tight tolerance piston crowns, are in

process. Piston forgings were delayed. They are being machined now and will start to arrive at TEI in early February. TEI is down to 6 kits of the current batch of crowns. TEI will dump the old production crowns. Campbell (AFTN) asked about the screening of pistons that the Surveillance Panel had asked TEI to do, to select pistons while the tighter tolerance pistons were being made. TEI were to select pistons which had valve cutout chamfer and smooth bowl entry. Sutherland (TEI) confirmed that the pistons which had the smooth bowl entry and chamfer around the valve cutout, were also the tallest pistons (as measured from the wrist pin). The question remained could these tall pistons be contributing to the “valve fracturing” that has been occurring.

- **Piston skirts** – 1000 were rejected by TEI due to pitting. TEI is down to 245. Another 1000 have been ordered. Supplier says they are in stock, so obtaining more should not be an issue.

- **Update on next generation Federal-Mogul Rings**

Group

- Update on the top rings – “V” rings made by Federal-Mogul using a proprietary coating process, but the “V” rings had very mild liner wear in recent reference testing. Federal-Mogul had been sent T and U batch rings (made by Mahle) that had both low and high oil consumption. They profiled them but couldn’t see any difference in face, side profiles, and unit loading. Oil consumption was around 90. Federal-Mogul asked the Surveillance Panel what we wanted changed. Federal-Mogul’s process is electro-coating which gives very consistent results batch to batch. It was the “S” ring that performed in the 60’s on oil consumption. Campbell (AFTN) asked because the hardware has changed so much over the last decade, do we really need the Mack T-12 in PC-11? Shank (VLVO) pointed out even if we did not include the T-12 in PC-11, the T-12 would still be there for API CJ-4 and past categories. Shank (VLVO) mentioned the possibility of using a combination of the Mack T-13 and T-12 for older categories. The Surveillance Panel decided that we did want to continue to work with Federal-Mogul on generating rings which would return the test to where it was originally. Sutherland (TEI) will setup meeting with Federal-Mogul to discuss their ideas and get back to the Surveillance Panel. Campbell (AFTN) felt that for oil candidates that don’t flat line Pb in the T-12, the correction factor is not correcting enough for oil consumption.

- **Connecting Rod / Bearing Issues**

Group

- Sutherland (TEI) reported that the bad rods have been screened out for bad small end bushing, offset rod/bearing caps, rust, twist and bending. Volvo/Mack had a meeting with the supplier to discuss the issues.

- **Valve Issues and Aftermarket Valves**

Group

- TEI found an aftermarket supplier for valves. SwRI apparently had found the same supplier and had run 10 sets of valves. The supplier can make up to 4000 valves currently with the same ingot. They said they would send us the microstructure on every 100th valve. The new Supplier believed the nodules (inclusions) in the base material of the previous supplier’s valves contributed to the valve neck fracture failures (The previous supplier didn’t think they contributed to the failures). Campbell (AFTN) reported that their lab just had a valve failure this morning on one of these new aftermarket valves. Intertek and Lubrizol hadn’t yet run any of the new valves. TEI reported the turnaround time

would be 8 weeks if we need to order valves. To get by, the labs have been reusing valves that meet specification. Lubrizol wondered if the other labs might be doing something differently which is why they've only had 1 failure, a while ago. It was noted we have a different supplier with different material and we still have valve failures. McCord (SWRI) suggested Afton look at the piston valve reliefs clearance and see if there was rubbing that might have caused a side loading on the valve which would have contributed to its failure. Shank (VLVO) asked to look at the piston crown valve relief specs. Matasic (LZ) confirmed they use production guides and ream them out. Campbell (AFTN) noted that the production guides were very tight, but the remanufactured guides were easier to ream. Campbell shared a photo of the other valve from the same failed cylinder and there was a crack in the valve neck, which appeared to be the same location as the failed valve. Campbell (AFTN) will send the failed and cracked valves to TEI who will send it on to Federal-Mogul for analysis. Federal-Mogul use a 2 step forging process vs MAHLE which uses a 1 step process. TEI will report back on what Federal-Mogul say about the failed and cracked valves.

- **Clarification of Procedural Changes to T-8 Injection Timing** **Group**
 - There was question as to whether the timing changes in the T-8 applied to just references or both references and candidates? Campbell (AFTN) was worried that if we controlled injection timing it might move the test into a different regime that where it was in the past. The labs recollection was that the change was only to apply to references. Moyer (TMC) agreed they will edit the procedure to note that the changes only apply to references.

- **Engine Build Life of T-8 and T-11** **Group**
 - Moritz (IAR) reported they are only getting 2 to 3 runs out of a T-11 build before losing it to high oil consumption. SwRI thought the last hardware that made it out to 10 runs before needing a rebuild was SSWN. Intertek asked about using the "V" batch of rings in the T-11. Some labs had noted observing more piston deposits. Shank (VLVO) thought that the observed oil consumption profile was different between wearing out and loss of control due to deposits. Fetterman (INF) described that in the NCT400, the oil consumption would be steady until the deposits would build up at the base of the top land until it grew circumferentially until the deposits rubbed the liner after which oil consumption would then take off. Intertek and Lubrizol will rate the pistons on their latest references and report the results. TMC said they could adjust a calibration period to allow a lab to run a reference with the "V" rings. Intertek and Lubrizol will inquire if they'd be willing run a reference with the "V" rings.

- **Alternatives to Modine Intercoolers** **Group**
 - T-12 procedure calls out a particulate part number for a Modine Intercooler but some labs desired flexibility to use alternates as long as they meet the same specs so could we specify engineering principles in the procedure vs using specific part numbers.
MOTION: Bob Warden motioned to add flexibility to the T-12 procedure for specifying the intercooler, by making it "Modine or equivalent". Campbell (AFTN) seconded the motion. The motion passed with no objection. The motion was then extended to cover the T-8 and T-11 as

well. There was again no objection by the Surveillance Panel and the motion extension passed.

- **Parts Batch IDs for older T-12 reference tests in LTMS** **Group**
 - Moyer (TMC) reported they still need labs historical batch data (liners, rings, rods, mains, piston) to populate the database. Labs agreed to report to TMC by end of February.

- **Oil Filter / Centrifuge Housing Alternative** **Group**
 - Afton confirmed they haven't had the chance to measure centrifuge speed with the other filter to make sure it was still the same, but they will. Agreement is still needed on thermocouple location in new housing. TEI confirmed that no labs have asked for new housings yet. Moritz (IAR) will work on the thermocouple location and report back to the Surveillance Panel.

- **Guidelines for 'Compromised' Oil Samples** **Group**
 - TMC reported that for a recent reference, a 250 hour sample for the T-12, used for determining the "Delta Pb 250 to 300 hr" parameter, had fresh oil added to the engine before the sample was taken. Campbell (AFTN) did not believe you could interpolate the data as the merit calculations are very sensitive to Delta Pb. He suggested you could separate the sample into (2) 2 oz samples. Moyer (TMC) asked if there was anything to add to the procedure to address compromised samples. Campbell (AFTN) felt the procedure pretty clearly spells out what is supposed to be done. The Surveillance Panel decided that there wasn't a need to add a note about not interpolating, because the procedure says take a sample and measure it and adding what should NOT be done to the procedure could create confusion later.

- **Replacement of SLBOCLE with HFRR for T-12 fuel analysis** **Group**
 - Chevron Phillips are measuring HFRR with an internal spec of 400 max, but not currently reporting on the Certificate of Analysis. Cooper (ORO) will request that they start reporting it. Shank (VLVO) shared that the max limit for most OEMs in Europe is 460.
MOTION: Shank (VLVO) motioned and Fetterman (INF) seconded, to replace the SLBOCLE with the HFRR. With no opposition from the Surveillance Panel, the motion passed. Moyer (TMC) will update the data dictionary.
The latest batch of PC-10 fuel had viscosity of 2.9cP but limit is 2.6 cP. The CofA from Chevron Phillips reports 2 to 3 as the acceptable range. Chevron Phillips needs to lower their limit from 3 to 2.6 cP max. Cooper (ORO) will follow up with Chevron Phillips.

- **Old Business / New Business** **Group**
 - **Sulfur measurement method change** – Chevron Phillips wanted to change the method of measuring Sulfur from D5453 to D2622. No objections were raised. Mark Cooper will advise Chevron Phillips the Mack Surveillance Panel is OK with the proposed change.
 - **Change Merit system for PC-11 T-12** – Shank (VLVO) believed the only two parameters that would remain of the T-12 for PC-11 would be Top Ring Weight Loss and Cylinder Liner Wear. The Pb (oxidation) and oil consumption

parameters would both move to the T-13. Shank (VLVO) asked Rutherford (ORO), do we go back to Pass/Fail limits on those 2 parameters? Alessi (XOM) brought up that it didn't seem like it was a statistical question. So would we go back to tiered limits on Top Ring Weight Loss and Cylinder Liner Wear? What would the limits be, Anchor or Max? In the Merit system it was assumed that you could live with any 1 parameter at the max as long as one of the other parameters were exceptionally good. Rutherford suggested a merit rating across the T-12 and T-13 might be needed to keep the same level of performance. No decision was made, but Greg asked that the SP start thinking about how to handle the two parameters and we should have a good idea by mid-year 2015. Shank (VLVO) will talk to EMA about using the 2 wear parameters at the max limits.

- **Next Meeting**

Mark Cooper

- To be determined and send out by e-mail.

The meeting was adjourned at 4:45 PM.

Very Best Regards,

Bob Salgueiro

Industry Liaison Advisor

Infineum USA L.P. 1900 East Linden Avenue Linden NJ 07036 USA

Office: 908-474-2492 Fax: 908-474-3637 Mobile: 908-358-8742 E-mail: Bob.Salgueiro@Infineum.com



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