

May 9, 2017

Caterpillar Surveillance Panel Teleconference Minutes

Teleconference Attendees:

Jim Gutzwiller (Chairman), Elisa Santos, Bob Salgueiro, Gang Hu – Infineum

Jim McCord, Jim Carroll, Travis Kostan (Secretary) – SwRI

Hind Abi-Akar – Caterpillar

Alex Ebner – Lubrizol

Tim Griffin, Jim Moritz, Martin Chadwick – Intertek

Sean Moyer - TMC

Christian Porter – Afton

Jim Rutherford, Mark Cooper – Chevron-Oronite

Dan Lanctot – TEI

Barb Goodrich – John Deere

Todd?

Agenda: Discuss COAT reference data with Batch A filters.

Elisa Santos presented her analysis (see attached)

All the statisticians had a meeting on 5/8/15.

They do not have agreement on how to move forward.

She gave three CF (correction factor) options with continuation of SAs for each lab, and a fourth option to recalculate standard deviations and apply them to LTMS statistics.

Options	Predicted	Target	ICF	
1- based on 833 & 832	10.88	11.305	1.039	Under-corrects 833 and over-corrects 832
2- based on oil 833	11.37	11.94	1.05	Over-corrects 832
3-based on oil 832	10.39	10.67	1.027	Under-corrects 833

Reference oil 832 (low aeration) needs half the correction factor that oil 833 (high aeration) needs.

Variability increased for the low aeration oil 832

Elisa showed multiple graphic analyses of all Matrix and reference tests.

Labs differ in major trends and shape of test results over time.

Pages 17-21, and page 22 show correction factors applied to each lab's results. 1.027, 1.039, 1.05, and Jim Rutherford's CF.

Comment: These corrections are for the 9 new references plus earlier data.

McCord: Both oils should have shifted together.

Elisa: Yes, but there are periods between 832 oil tests where we don't have much data.

Elisa showed Model 1 in her the presentation's appendix to get her CFs.

Elisa: There are unknown profile filters that are not included in the graphs. She added them back in during the conference.

McCord: We had a step change on a returned, recalibrated MM from Emerson last year.

Comment. The labs are still different.

Elisa: We thought the changes in hardware and procedures we made would bring the labs together. She is surprised it did not.

Option 4 – Adjust standard deviations.

A new standard deviation (0.357 SD) was calculated and she applied them to the LTMS to recalculate statistics. Then there were no alarms.

And she added back in a calculated SA per each lab.

Hind thanked Elisa.

The Webex ball was passed to Jim Rutherford to give his presentation (see attached)

The industry has all set a Level 2 alarm.

We have to reset the LTMS

Which means change the SD and restart each labs chart.

Hind: there have been two major changes 1. Filters 2. Calibration.

Jim R: Start with the new data and figure out how to get back to the original targets.

Here is his correction:

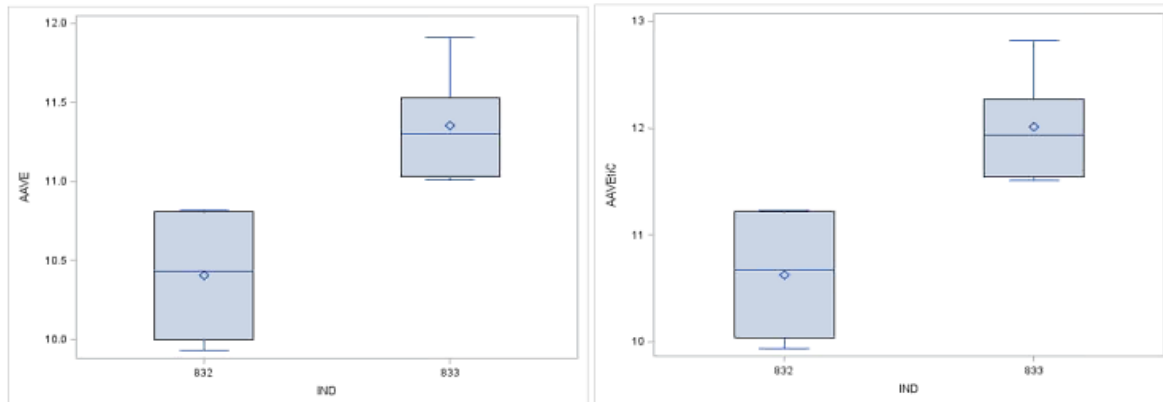
LTMS Current Calibration and Filters



$$\text{AAVEtiC} = 9.92 + 1.458x(\text{AAVE} - 9.92)$$

IND	N Obs	Variable	Mean	Std Dev
832	4	AAVE	10.41	0.471
		AAVEtiC	10.63	0.687
833	5	AAVE	11.36	0.376
		AAVEtiC	12.01	0.549

Although not a recommendation, we can calculate a best ICF.



McCord: If we restart candidate testing now do we have just 2 candidates?

Rutherford: Not sure.

Hind: Elisa what was changed in our direction

Elisa: Nothing we are trying to get back to original targets

McCord: Do we have to wait 2 weeks

Sean: I don't believe so.

Tim: CF seems biased by the low levels from Lab A.

Answer: the model takes care of this.

McCord: Is lab and engine the same? These could cause differences between labs.

Sean: Lab and engine are synonymous.

McCord: What is today's goal?

Hind: Are we at the stage to decide? What is the level of comfort to make this decision?

Jim R and Elisa do you have a recommendation?

Comment: Not comfortable going forward with any CFs discussed. But, changing the standard deviation and re-calculating the LTMS seem to be a good idea for a short term approach. And, we need to collect more data to get a CF.

Hind: What do we need to agree? Do we need more data?

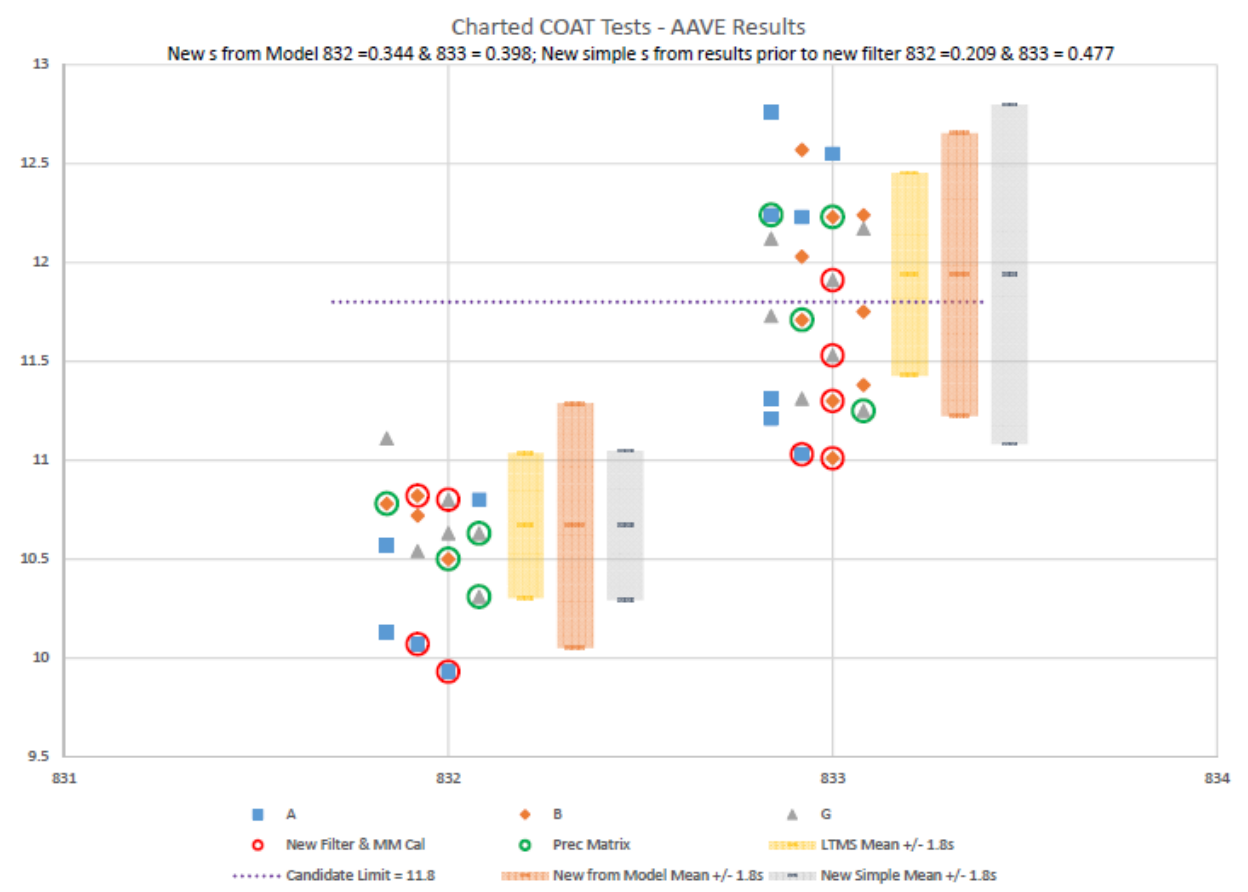
Elisa: Updating the SD would be a good option. And starting the whole test over or using previous data going forward are two options. There is still discrimination between the oils.

Martin: Still concerned that the data from before is biasing the CFs and SDs.

Rutherford: This is where we are now. If there is a major difference between labs that is carrying over.

Martin: That is my concern.

Martin received the Webex ball. He showed an analysis using Elisa's Std. Deviations.



McCord: Lab A's last 6 tests were shallow.

McCord: Old data had old sensors and other differences.

Comment: We don't have any way to know if and how much the engine affects any trends.

McCord: Early on everyone had to restart with new engines. Best we could do is to measure all the same with the hardware and calibration procedure. We had discussions to use old filters, but they were not available.

Hind: All tests met Qis, but we should expect differences between engines. Are we missing something?

Moritz: Should we do a deep data review of all engine information? We may have missed something within an engine that affects results.

Sean: There may be an uncontrolled parameter.

Gutzwiller: There were two engines that had different results. Maybe we should look at all the data.

Martin: I have no problem with moving forward with new StDev. But I am not sure any CF is appropriate at this time.

Comment: It doesn't look like our lab changes have affected the lab to lab differences

Tim: What are the new slope and offsets at each lab? Can we recalculate without the new offsets?

Sean: We have not gotten closer. There may be another difference we may have missed. Maybe we should go as a group to each lab and look for differences.

Hind: My concern is the timeframe.

Sean: Throwing on a CF would not help.

Moritz: We need to strike a balance with due diligence to come up with the path forward.

Martin's plots show that discrimination is still good.

Martin: We could adopt Option 4 (adjusting the stand deviation) with shortened calibration periods. And, collect more data.

Hind: What are the SAs we are talking about?

Pages 41-47 in Elisa's Appendix.

Lab A: Stdev. = 0.398 and SA = 0.654

Lab B: Stdev. = 0.141 and SA = 0.424

Lab G Stdev. = 0.141 and SA = 0.050

Comment: Personally I think we should use the Stdev. from oil 832 to get the SAs
And we would get larger adjustments.

Q: What is the logic of using just one oil's Stdev?

Sean: Because we did this with original set of data. I am not sure why.

Hind: Sean, do you have a preference.

Sean: We should not rush to get the test back on line. We should do our due diligence.
This option of changing the StDev seem reasonable.

Moritz: I guess the variability has increased so this is not out of left field.

Sean: I am not ready to vote today.

Hind: We must review the data.

Comment: We could temporarily lower the Zi limit to 2.

Next meeting Thursday, May 11 at 2pm EDT

Elisa, Rutherford, and Martin are to send out their presentations.