

VH Operational Data Review | MINUTES

Revision Date 5/14/2017 8:22:00 PM

Relevant Test:	Sequence VH
Note Taker:	Chris Mileti
Meeting Date:	05-09-2017
Lubrizol Attendees:	Chris Mileti
Comments:	2 nd review of Sequence VH Precision Matrix operational data. Reference presentation " VH Precision Matrix Update 051117 2.pptx " distributed by Ron Romano on 05-09-2017 at 11:38AM EST.

1. REVIEW OF R. ROMANO PRESENTATION:

a) Slide #2:

Summary

- Sludge (AES, RAC and OSCR) demonstrates good visual oil discrimination at least for Oils 940 and 1011.
- Visual Varnish discrimination is weak.
- Sludge demonstrates statistical discrimination of oils at least between Oils 940 and 1011.
- Though visual discrimination of Varnish is weak, AEV50 and APV50 statistically discriminate Oils 940 and 1011.
- AEV50 and APV50 appears to discriminate slightly better than their full rating counterparts.
- Lab is at least borderline statistically significant for Varnish terms.

- i) Sludge discrimination is good (especially between REO940 and REO1011).
- ii) Varnish discrimination is weak.

b) Slide #3:

Matrix

Run Order	Afton	Ashland	IAR Stand 1	IAR Stand 2	SWRI 1	SWRI 2
1	1011	1009	940	940	1009	1011
2	1011	940	940	1011	1009	1009
3	940	1011	1009	1009	1011	940
4	1009	1011	1011	1009	940	940
Complete						
In progress						
Invalid						

- Data is as of May 8, 2017
- 21 valid tests have completed and reported to TMC.
- Valvoline's 2nd test was found to be operationally invalid.
- Valvoline will continue running but recommended not to wait for their remaining tests to run statistical analysis.
- Statistician's group says completed tests are enough to run analysis. 6 tests on each oil

- i) Twenty-two tests have been completed.
 - (1) These tests are highlighted in green.
- ii) Ashland's first REO1011 test is running and is highlighted in yellow.
 - (1) They do not plan to run their second REO1011 test.
 - (2) Ashland had to invalidate both of their REO940 tests.
 - (a) The first REO940 test was invalidated for a negative rocker arm cover temperature QI coefficient.
 - (b) The second REO940 test was invalidated for a lack of fuel dilution.
- iii) **Comments from Boese:**
 - (1) There is statistical value in adding two valid tests from Ashland.
 - (a) There would not have been statistical value in adding data from Ashland if it only had one valid test.
- iv) The group decided to include the valid Ashland results in the final Precision Matrix statistical analysis.
 - (1) The TMC confirmed that both valid Ashland tests have been posted to the TMC website.
 - (2) The QI calculations have been reviewed.
- v) **Reference Oil Targets (Boese):**
 - (1) Reference oil targets will be set using the Precision Matrix data only.
 - (2) The targets are "fixed in stone" and cannot be updated.
 - (3) The standard deviations can be modified.
 - (4) Correction factors [for the fuel batch] will be implemented as needed.

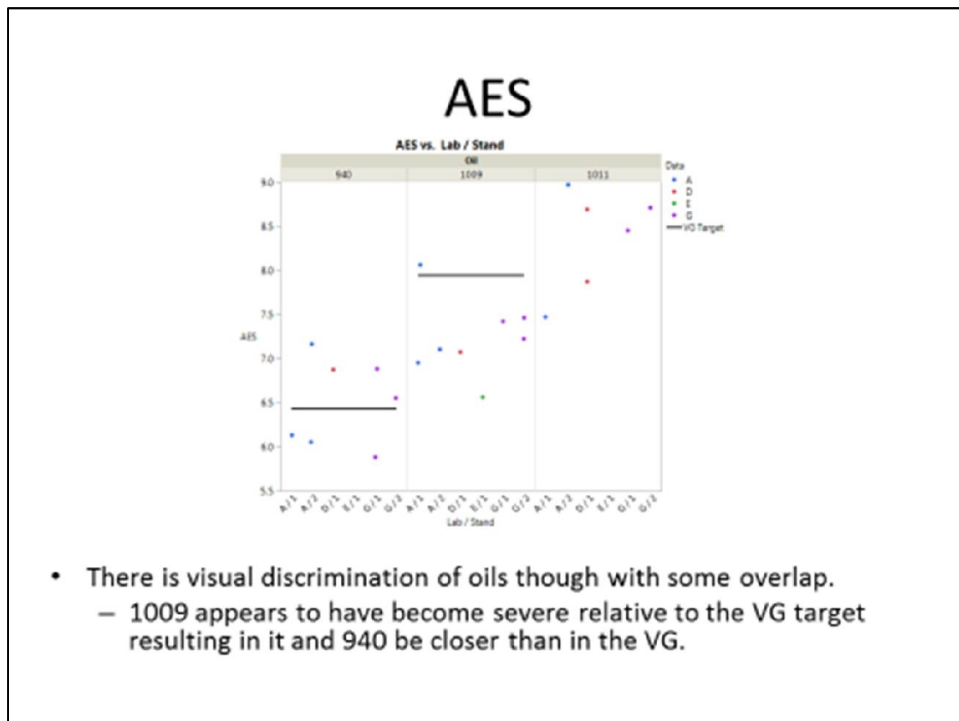
c) Slide #4:

Next steps

- May 9, 2017 operational data review for remaining tests, 2 Afton, 2 Intertek, 7 SWRI
- May 16 2017 Surveillance Panel review of tests to date to kick off stats analysis.
- June 14 2017 Surveillance Panel review and approve Statistician's analysis and LTMS and approve test is ready to become an ASTM method and inclusion into GF-6
- Send approved Statistician's analysis to AOAP and PCEOCP
- Vote at AOAP/PCEOCP during week of June 26 on Sequence VH for inclusion into GF-6 and ready to become an ASTM method.

- i) The engineers will need to review the results of the statistical analysis before these results are presented to the full Surveillance Panel on June 14th.

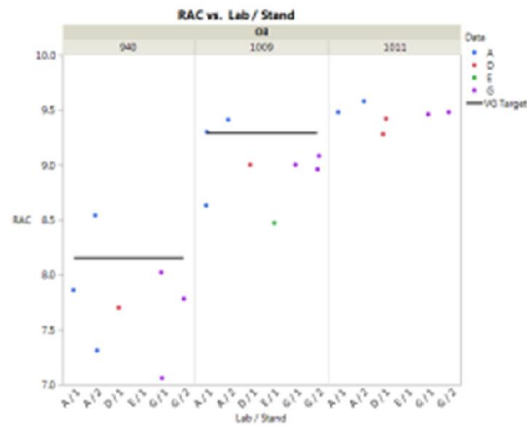
d) Slide #8:



- i) There is a good trend in AES across the three reference oils.
 ii) There is some overlap between REO940 and REO1009.

e) Slide #9:

RAC

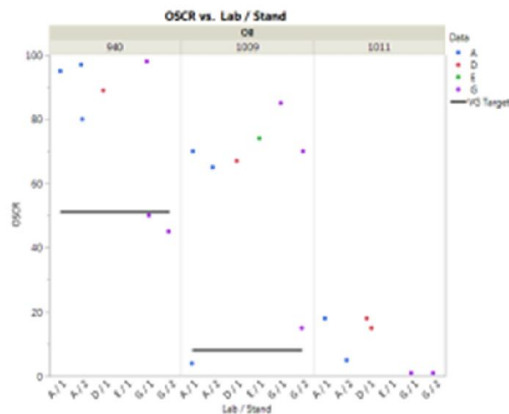


- There is good separation between 940 and 1009 with both being, on average, severe relative to the VG target.

i) Ford intends to keep Rocker Arm Cover sludge as a pass/fail parameter for the Sequence VH.

f) Slide #10:

OSCR



- There is good separation between ROs 940 and 1011.
- The 1009 data appears to be bi-modal. The SP has discussed the potential that the apparent severity may change with the amount of time from test end to rating evaluation with the severity decreasing with increasing time.

i) There were two low OSC ratings with REO940.

ii) There were two extremely low OSC ratings with REO1009.

iii) Ashland Comments:

(1) More explicit instructions for rating the oil screen need to be added to the Sequence VH procedure.

(a) The engineers will need to solicit feedback from the Raters.

(2) This parameter should measure the physical clogging of the oil screen (and not just liquid oil that fills in the mesh).

iv) Intertek Comments:

- (1) The OSC rating with the VG test does not typically change after the screen is blown out.
- (2) The sludge of the Sequence VH test is thinner than that of the Sequence VG test.
 - (a) As a result, the OSC rating can change after the oil screen is blown out.
- (3) In fact, Intertek had an OSC rating change from 65% to 1% after the oil screen was allowed to sit over a weekend.

v) Afton Comments:

- (1) Afton has also seen the Sequence VH OSC rating change over time.
- (2) However, they have seen the oil screen become more clogged.
 - (a) It is almost as if the oil can fill in the grid if given enough time.

vi) Lubrizol Comments:

- (1) The OSC parameter is very sensitive to fuel batch.
- (2) This is illustrated by the vastly different correction factor adjustments applied to different fuel batches.
- (3) This needs to be a "rate and report" parameter.

vii) Infinium Comments:

- (1) The OSC parameter has always had a lot of variability.
- (2) The AES results for REO1009 are fairly consistent, yet the OSC results for REO1009 have a lot of variability.

viii) Ford Comments:

- (1) Ford is willing to change OSC to a "rate and report" parameter until these issues can be resolved.
 - (a) So OSC will no longer be a critical parameter for test stand calibration.

ix) A. Ritchie and Intertek:

- (1) The Surveillance Panel has to find a better way to measure this parameter.
- (2) This should be an action item after the Precision Matrix is complete.

g) Slides 12 through 14:

- i) There is a lot of overlap between reference oils with the APV, AEV, APV50 and AEV50 parameters.

2. OPERATIONAL DATA REVIEW:

a) Opening Comments:

- i) TMC noted that the all of the QI's for the valid tests are high (>0.5).
- ii) Any operational data review should focus on uncontrolled parameters and not controlled parameters.
 - (1) The controlled parameters are already monitored by the QI calculations.

b) Uncontrolled Parameters:

- i) ***During the meeting, Afton issued a list of uncontrolled parameters that they would like to review:***
 - (1) Fuel Flow
 - (2) R Lambda
 - (3) L Lambda
 - (4) Coolant Inlet
 - (5) Crankcase Pressure

- (6) Fuel Pressure
- (7) Oil Pump Pressure
- (8) Left Head Pressure
- (9) Right Head Pressure
- (10) Oil Out Temp
- (11) Torque

- ii) Lubrizol's data template should include most or all of these (11) parameters.
- iii) The uncontrolled parameter review should include all (54) cycles.
- iv) The test hours should be reported in decimal format.

c) Stage 3→1 Ramp:

i) TMC Comments:

- (1) The TMC noted that the data has improved since the first operational data review.
- (2) The intent of these transition/ramp reviews is not to continually chase the data.
- (3) Instead, the intent is to prove that a lab can achieve each ramp in the required amount of time.

ii) Oil Temperature:

- (1) SWRI Stand 7 seems to be more susceptible to small variations in oil performance than Stand 9.
 - (a) These small variations did not affect the validity of the SWRI data.

d) Stage 1→2 Ramp:

- i) A few of the laboratories have parameters that "skirt the window", but there are no validity concerns.

e) Stage 2→3 Ramp:

i) Power:

- (1) Some of the Intertek data falls below the 3kW level prior to the 5-second threshold.
- (2) Lubrizol reviewed the minutes from the original operational data review, and the intent of the discussion was that power should fall below 3kW prior to a 20-second threshold.
- (3) The group agreed to reword the procedure to state that the power should fall below 3kW prior to 20-seconds.
- (4) *Discrepancy with Power:*
 - (a) The current end of the window for power is 20-seconds.
 - (b) However, the group decided during the first operational data review (12-19-2016) to set the end of window at 30-seconds.

ii) Speed and Power:

- (1) SWRI noted that it is not ideal to control both speed and torque/power at the same time.
 - (a) This makes the system to susceptible to lab-to-lab variations in driveshaft stiffness, flex plate mass, etc.
- (2) Ashland noted that controlling to MAP instead of torque/power will probably present the same problem.
- (3) Afton noted that all of the labs need to control Stage 3 AFR in the same way before there is any review of speed and power control.

Action Items	Person responsible	Completion Date

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Follow-up Notes/Updates:	Initials	Date Added