Thoughts about the T-8/ T-8 E
Discussing Potential Severity Shift

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05/21/2020

Performance you can rely on.

Outline

- Summary
- Visualization of the proposed industry correction factors (CF)
- *Currently, Severity Adjustments* are being applied to candidate data according to the ltms requirements
- Understanding the changes over time by parameter
- Variability seems to have increased over time. Would the panel consider updating the standard deviation?

What else can I do to help the panel move forward?

Summary

- Proposed correction factors are based on an average change associated to 1005-5 by parameter
  - Note that, 1005-5 data (by parameter) has changed over time
  - Ideally, we would like to identify the root cause for the changes…
  - Variability seems to have increased over time. Would the panel consider updating the standard deviation?

- Proposed correction factors and updated standard deviations

Parameter	Current CF	Target (n=10)	1005-5 Predicted (n=71)**	Proposed CF	Current standard deviation	Updated standard deviation*
VI38	0.4	5.01	4.28	0.73	0.56	0.72
RV48	0.08	1.76	1.75	0.01	0.08	0.17
RV2	0.09	2	1.97	0.03	0.09	0.19

***model: Lab, Stand within Lab, 1005 reblends; 71 tests; same model for all parameters**

**** LSMEANS for 1005-5**

Reminder

- Currently, *Severity Adjustments* are being applied to candidate data according to the ltms requirements. The current *Severity Adjustments* are below. I checked with Sean and these SA's are close to his.

	VI38	RV48	RV2
G 7A	0.01	-0.11	-0.17
G 11	0.53	0.02	0.03
J 6	0.13	-0.03	-0.02
J 18	0.75	0.02	0.04
Level 3 ei alarm			
Level 2 ei alarm			
both			

Surveillance Panels have adopted correction factors when there is a known root cause and also when level 2 alarms in the same direction are present for all entities. This is not the case here.

Proposed correction factors

Parameter	Current CF	Target (n=10)	1005-5 Predicted (n=71)**	Proposed CF	Proposed CF to be applied after current CF
VI38	0.4	5.01	4.28	0.73	0.33
RV48	0.08	1.76	1.75	0.01	-0.07
RV2	0.09	2	1.97	0.03	-0.06

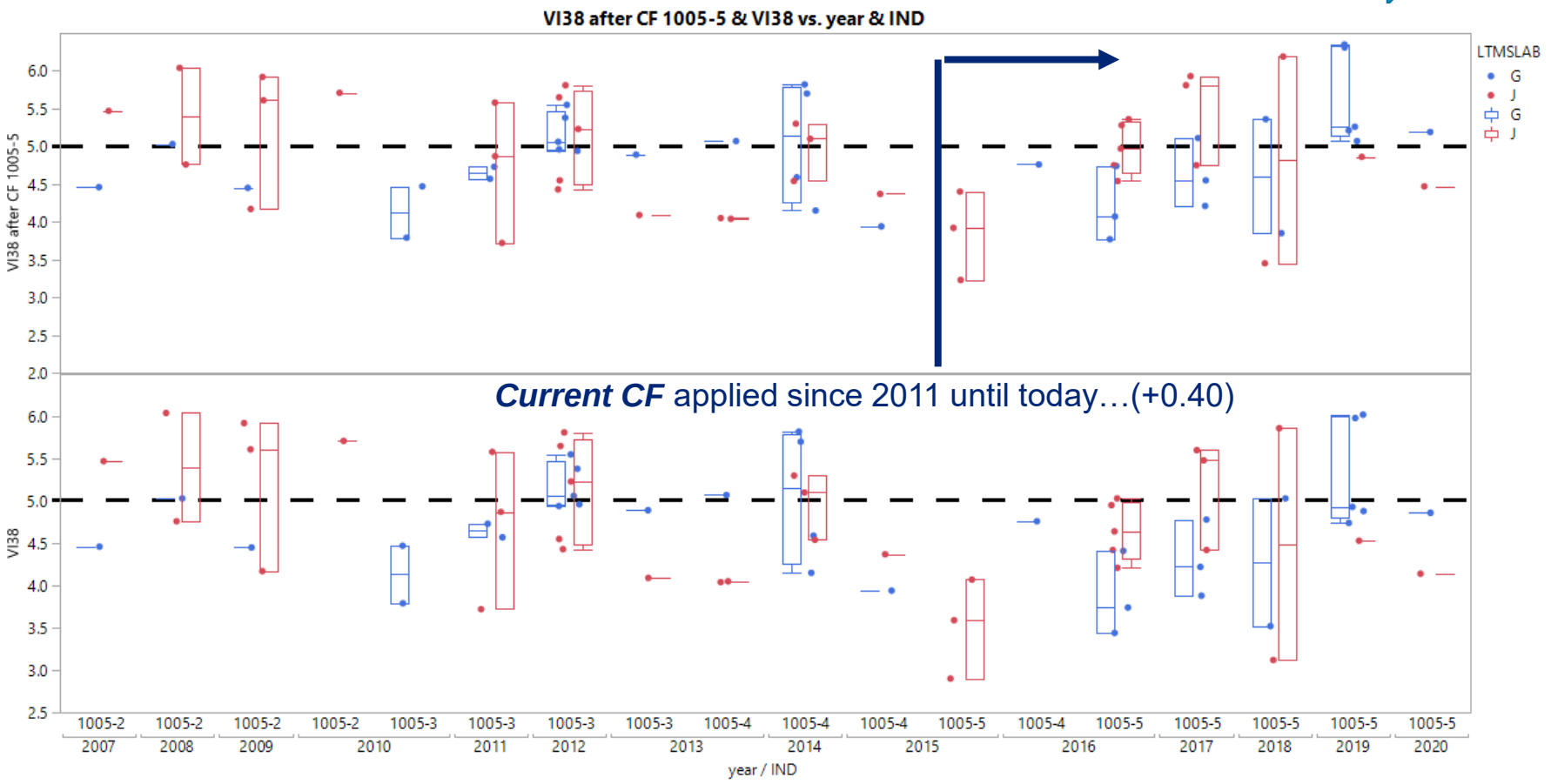
Visualization of the proposed CFs

Nomenclature:

Viscosity increase @ 3.8% soot (cSt)	=> RVISI38 (w/out any CF) & VI38 (with Current CF)
Relative Viscosity @ 4.8 soot 50% DIN Shear loss	=> RRV48 (w/out any CF) & RV48 (with Current CF)
Relative Viscosity @ 4.8 soot 100% DIN Shear loss	=> RRV2 (w/out any CF) & RV2 (with Current CF)

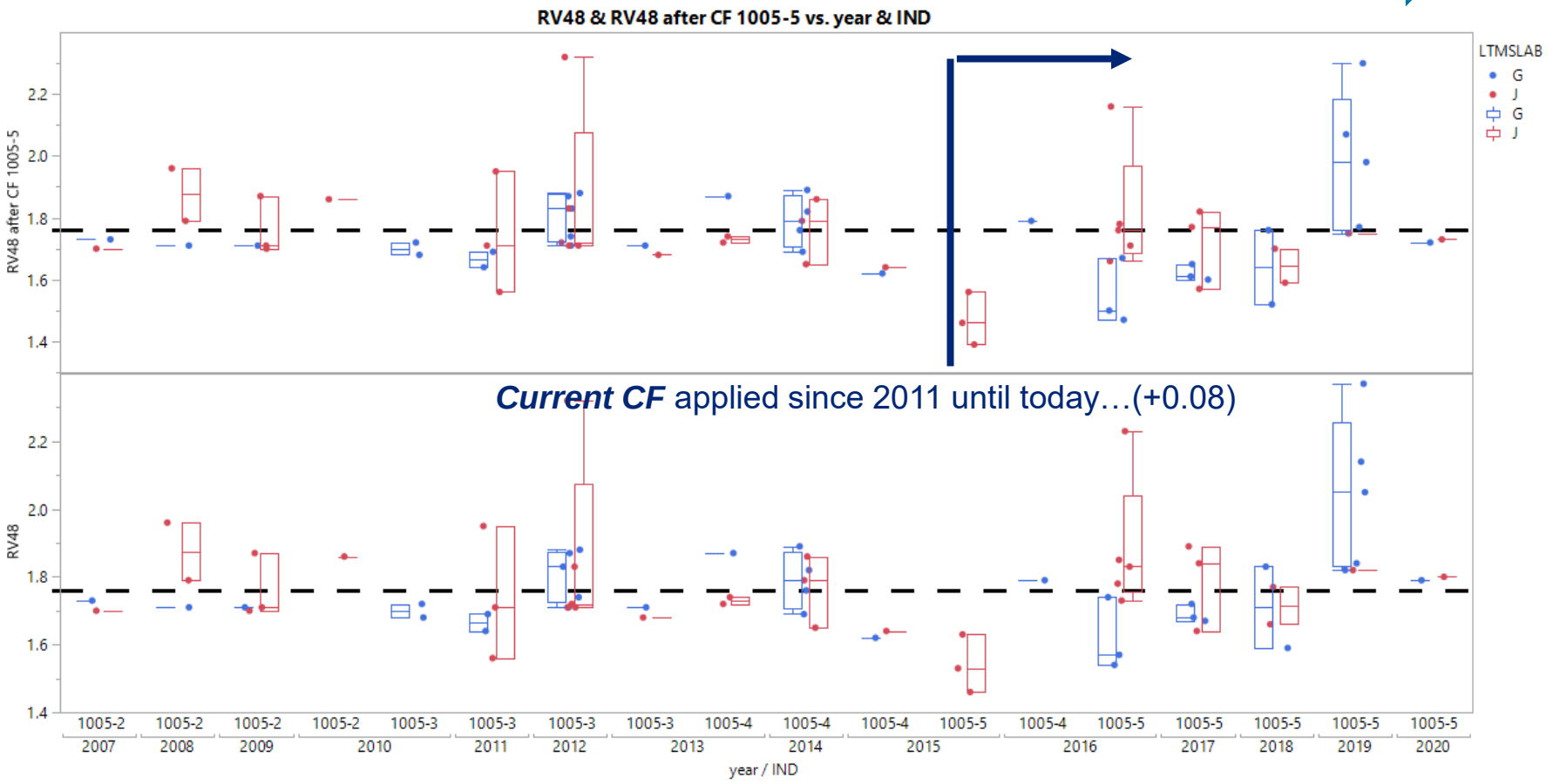
VI38 before and after proposed CF - applied to 1005-5 reference test results

proposed CF applied to 1005-5 data



RV48 before and after proposed CF - applied to 1005-5 reference test results

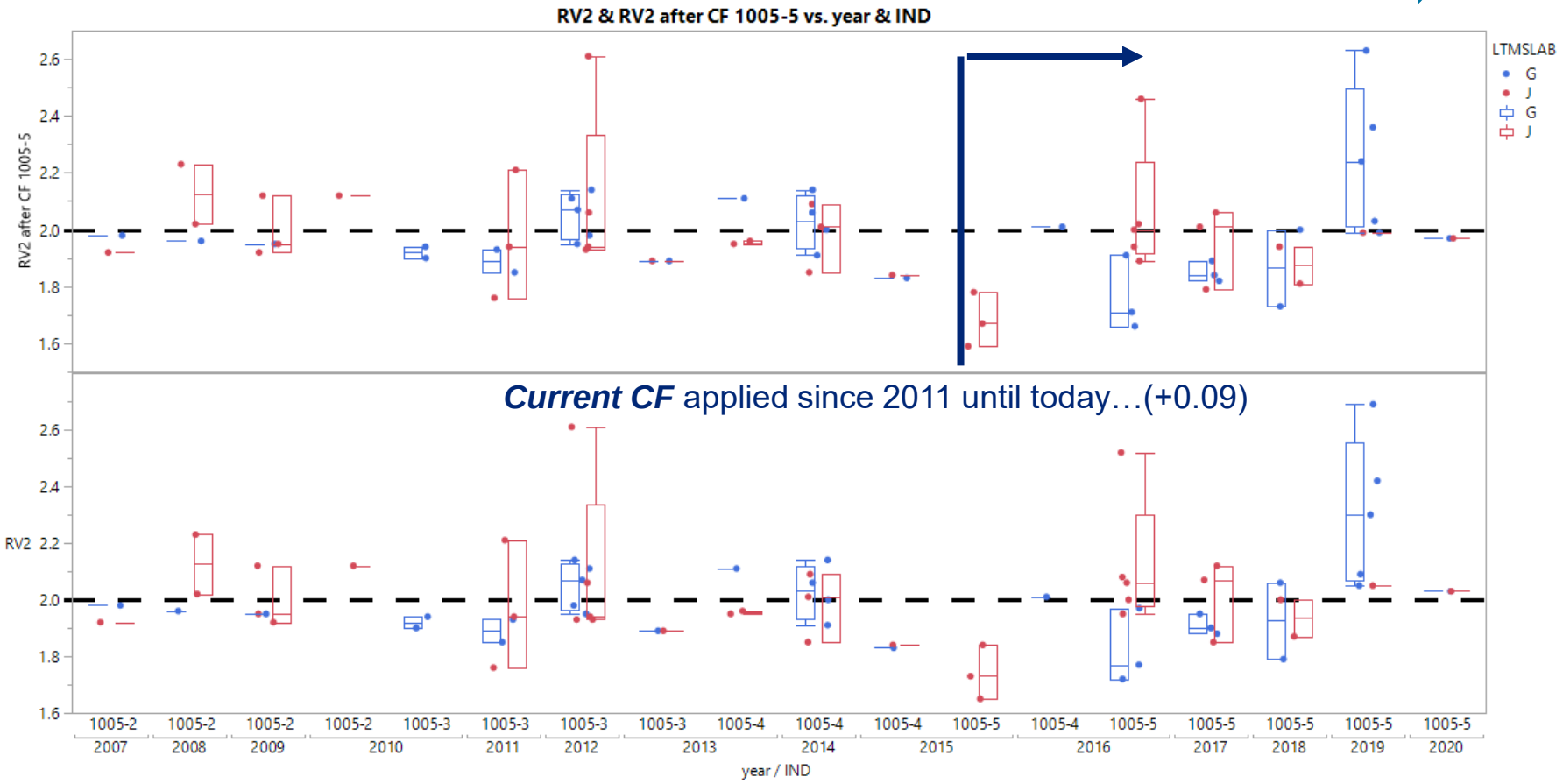
proposed CF applied to 1005-5 data



Current CF applied since 2011 until today…(+0.08)

RV2 before and after proposed CF - applied to 1005-5 reference test results

proposed CF applied to 1005-5 data



Current CF applied since 2011 until today…(+0.09)

More plots that may help understanding of changes over time…

Nomenclature:

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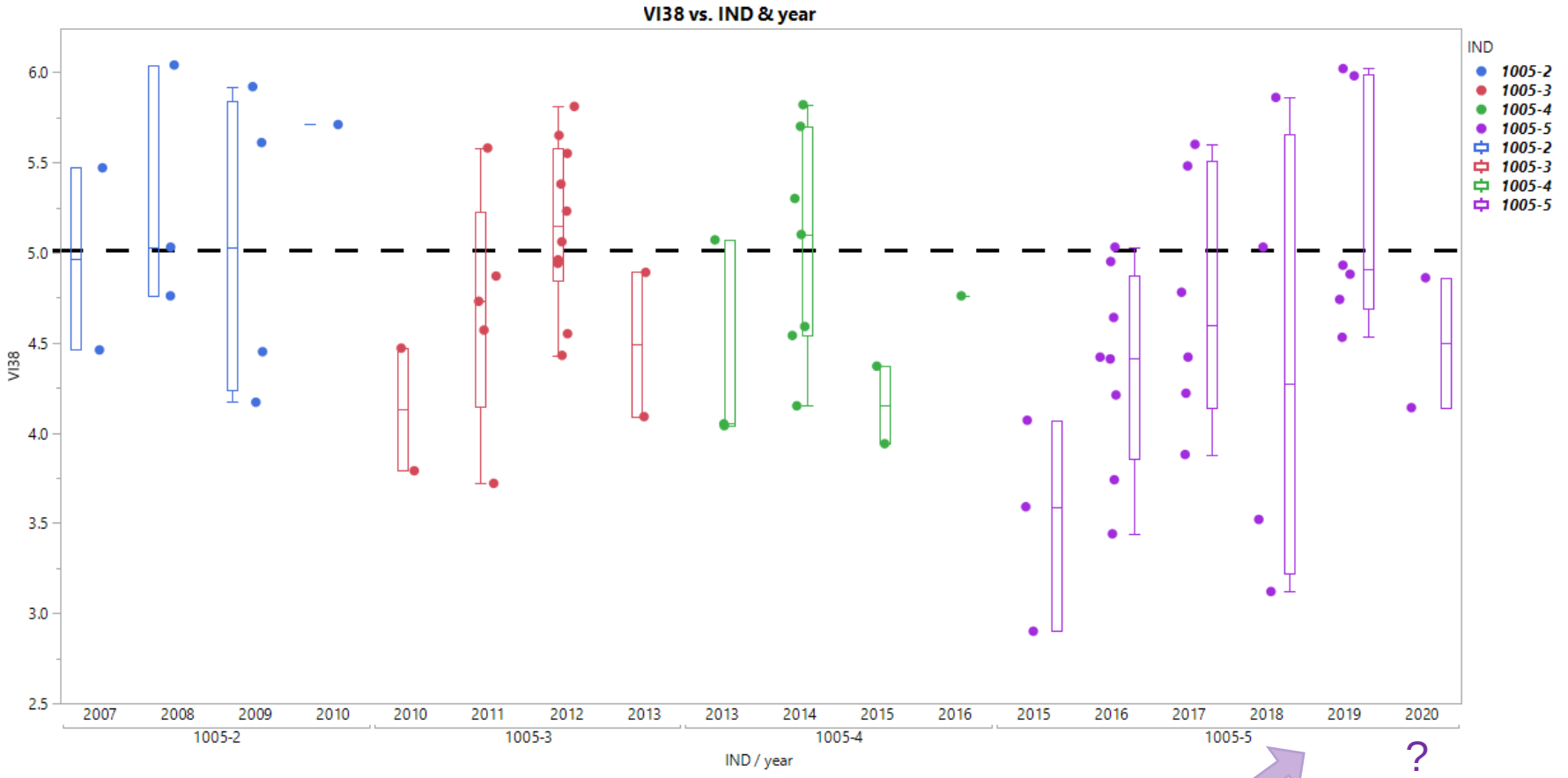
Relative Viscosity @ 4.8 soot 100% DIN Shear loss	=> RRV2 (w/out any CF) & RV2 (with Current CF)

VI38: within 1005-5 tests there seems to be an overall trend towards the target

Thinking about an average behavior along time, ignoring Lab

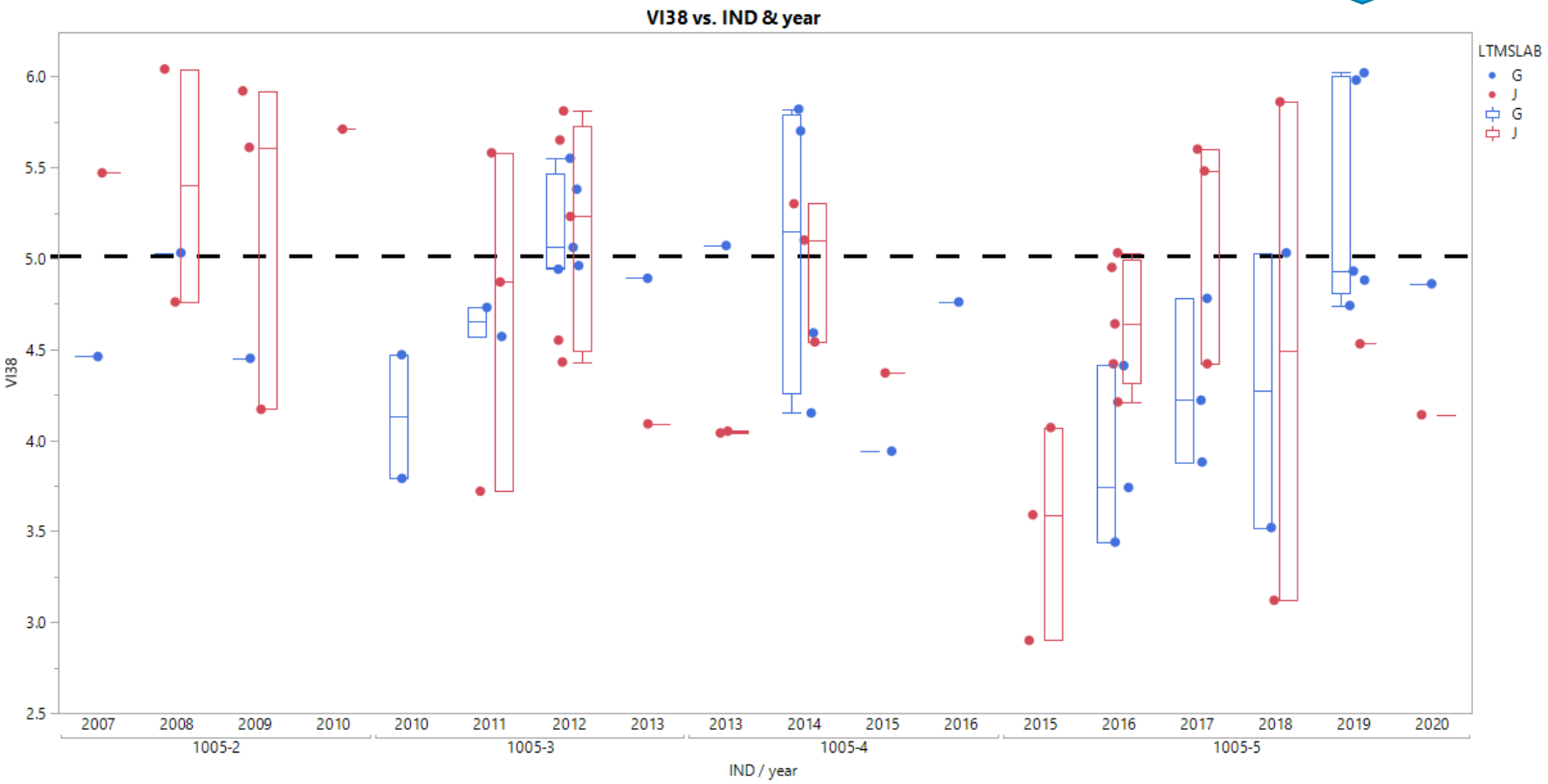


Next slide adds Lab to the picture

1005-5: 2015 to 2019

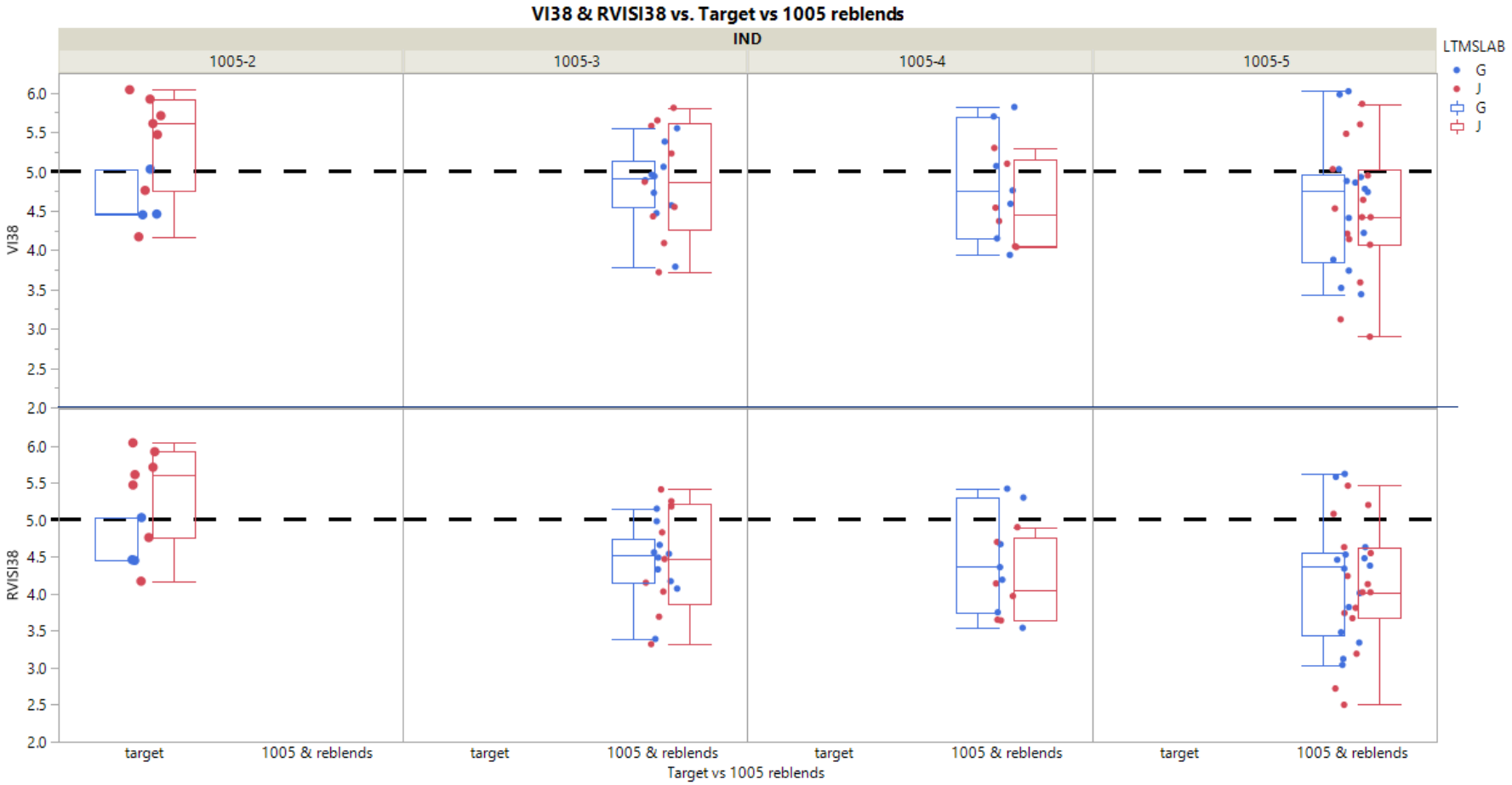
VI38: labs depicted side by side by oil and year

2019: 2 out of 5 tests from lab G are close to 6. There is only one test from lab J
2020: two new tests… one from each lab

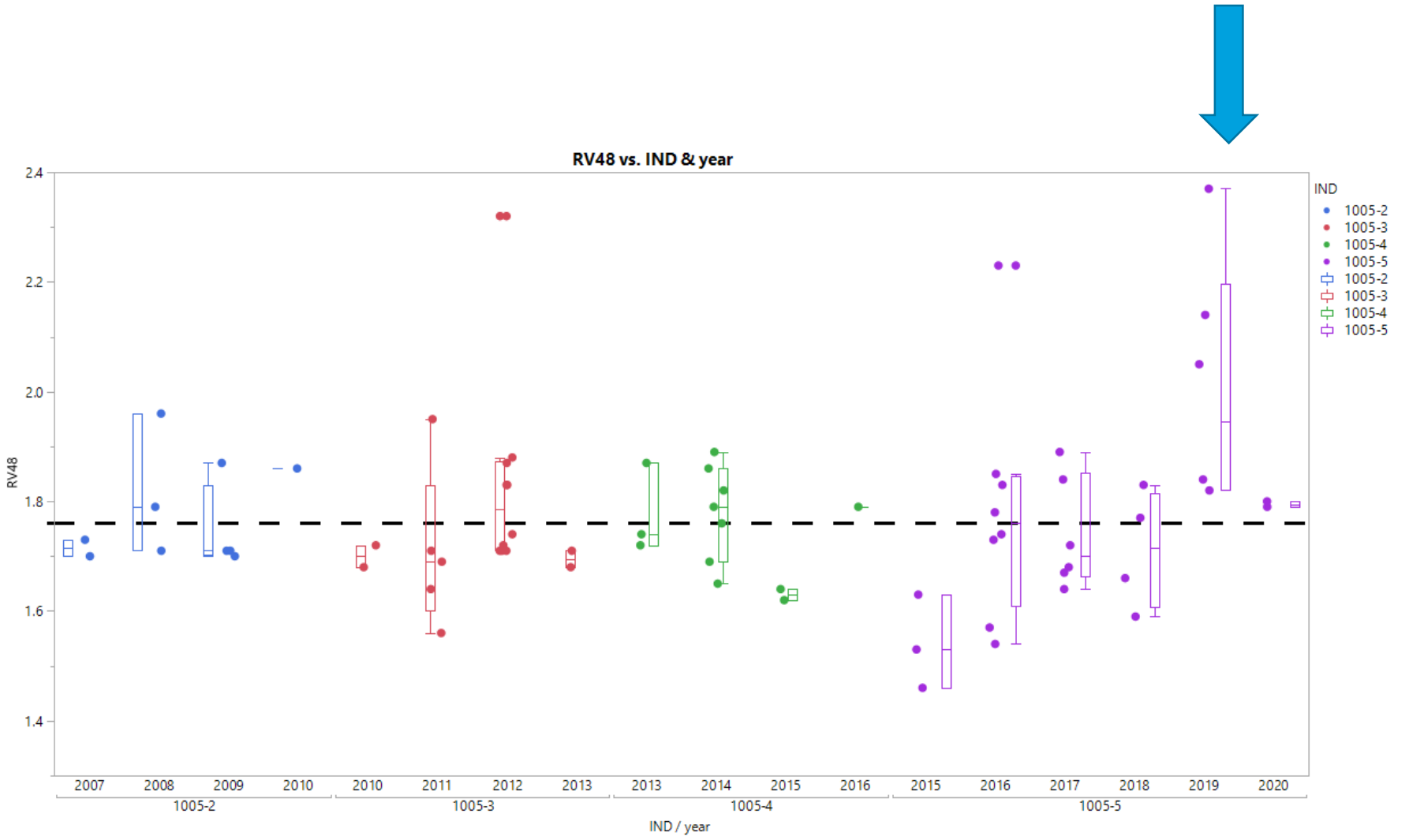


VI38 Variability seems to have increased over time

Target (10 tests) 1005 re-blends (61 tests)

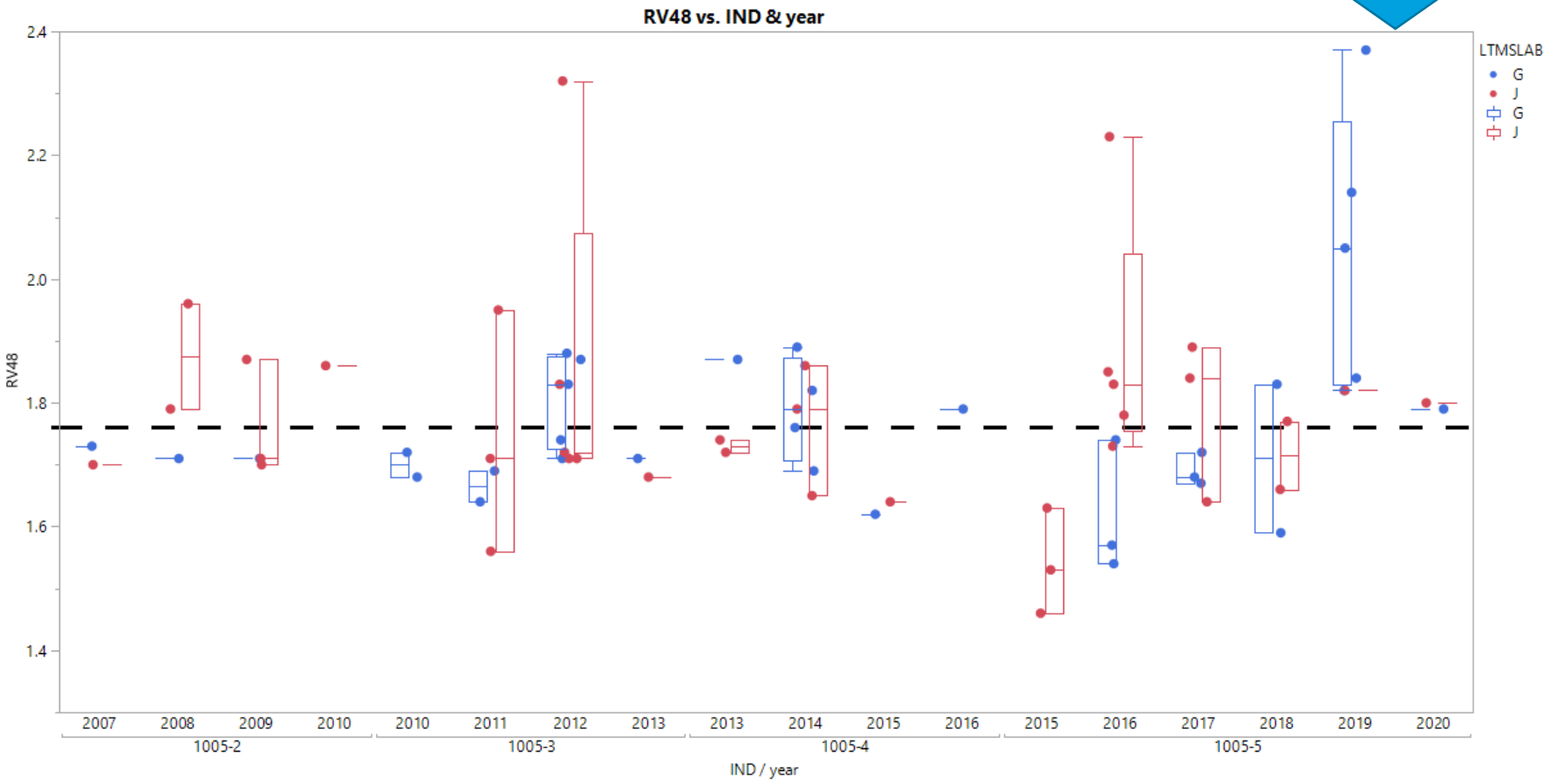


RV48: 2019 data after current CF is all above the target 2020 tests (two) are back on target



RV48: labs depicted side by side by oil and year

2019: high test results have happened twice in the past. 3 out of 5 tests from lab G are 2.05 or higher after applying current CF. There is only one test from lab J.
2020: tests (two) are back on target, one on each lab



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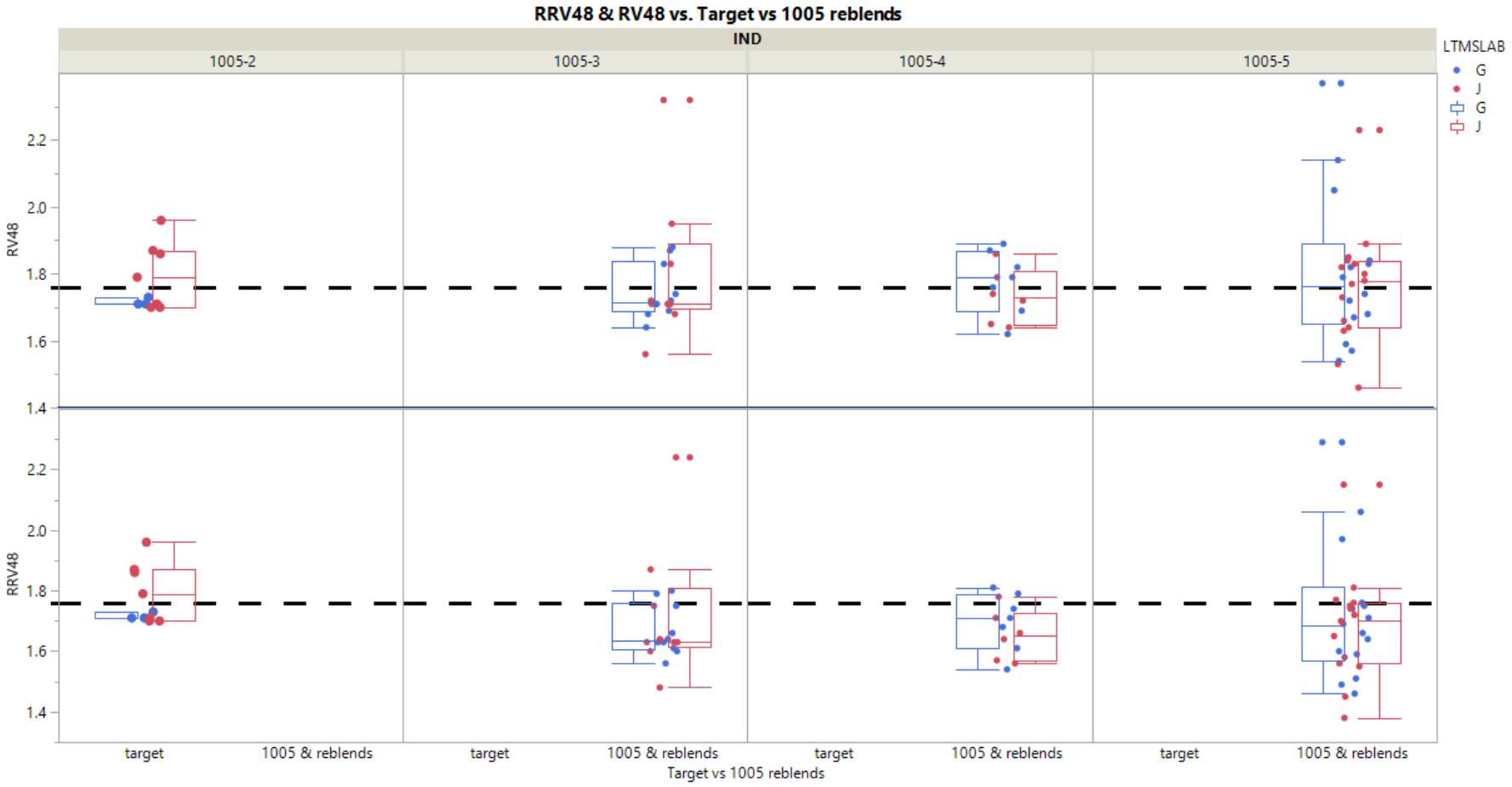
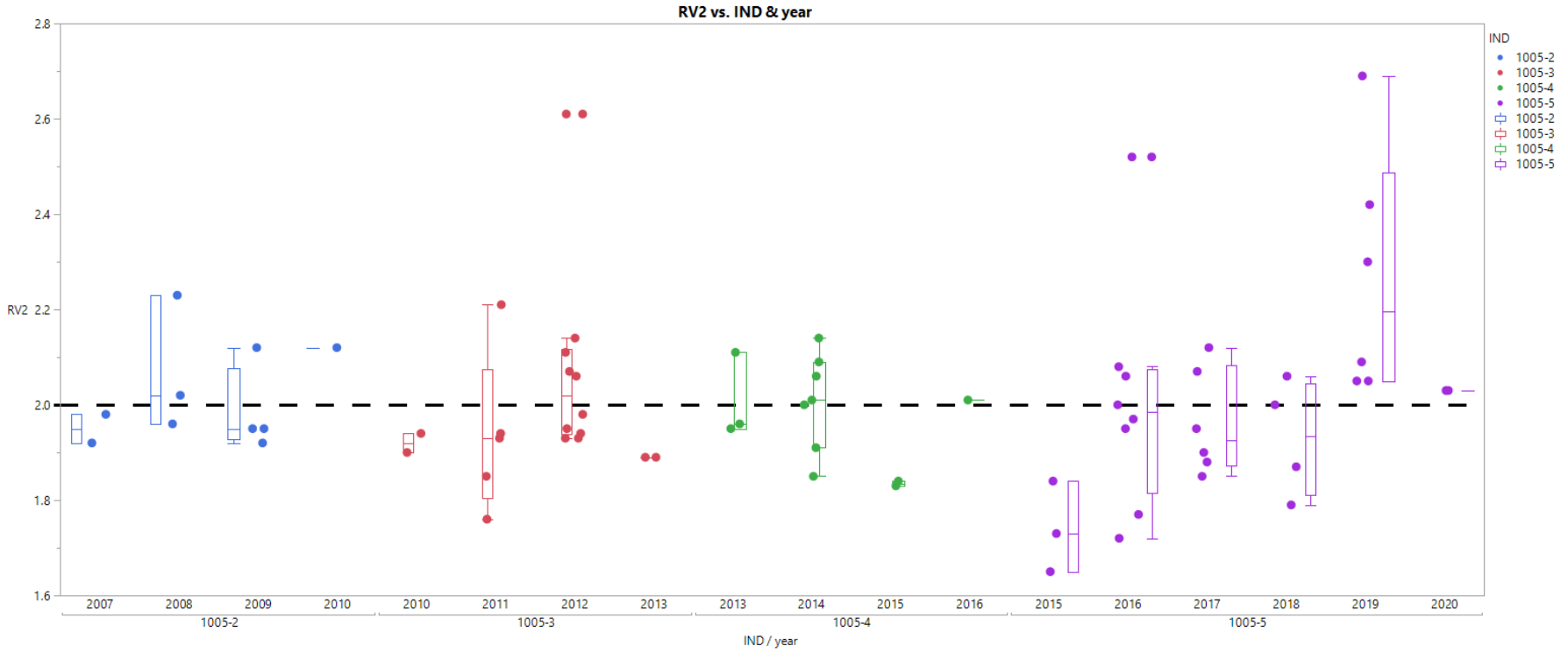
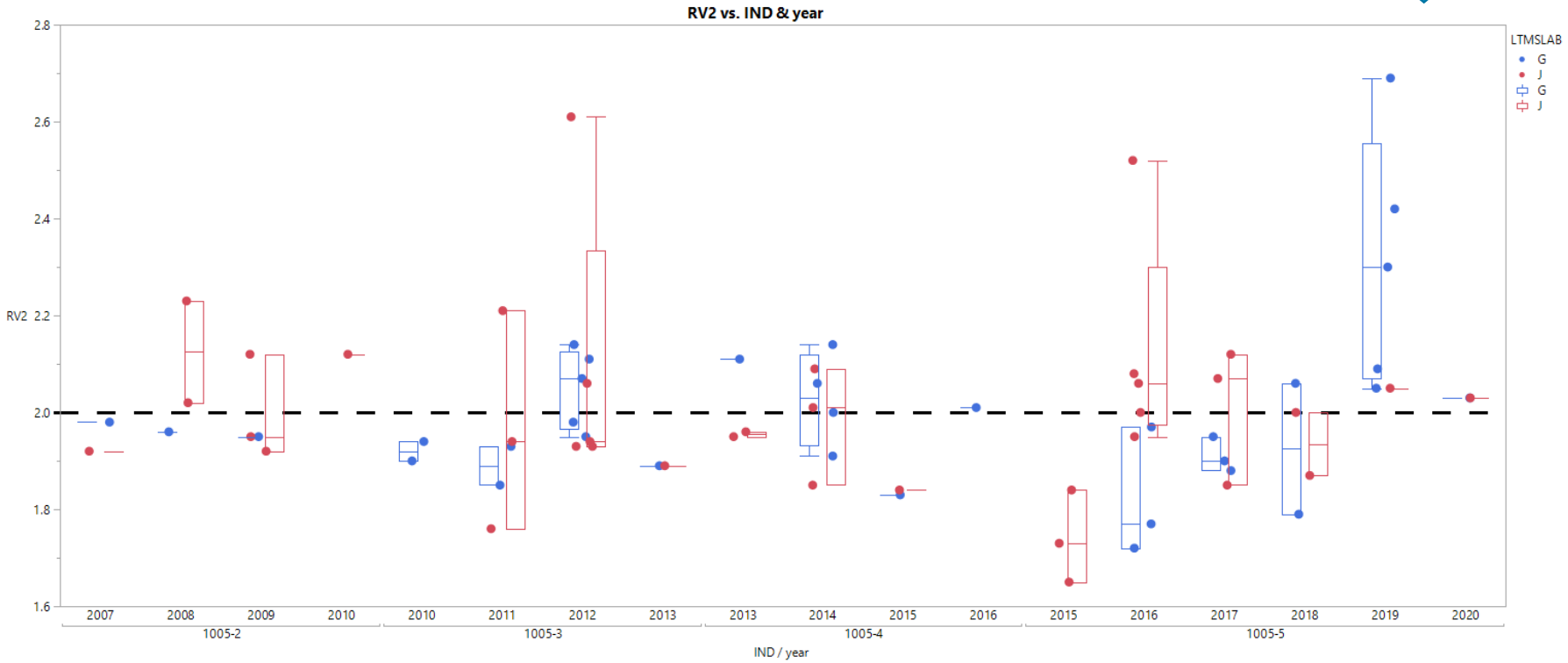


RV2: 2019 data after current CF is all above the target
2020 tests (two) are back on target



RV2: labs depicted side by side by oil and year

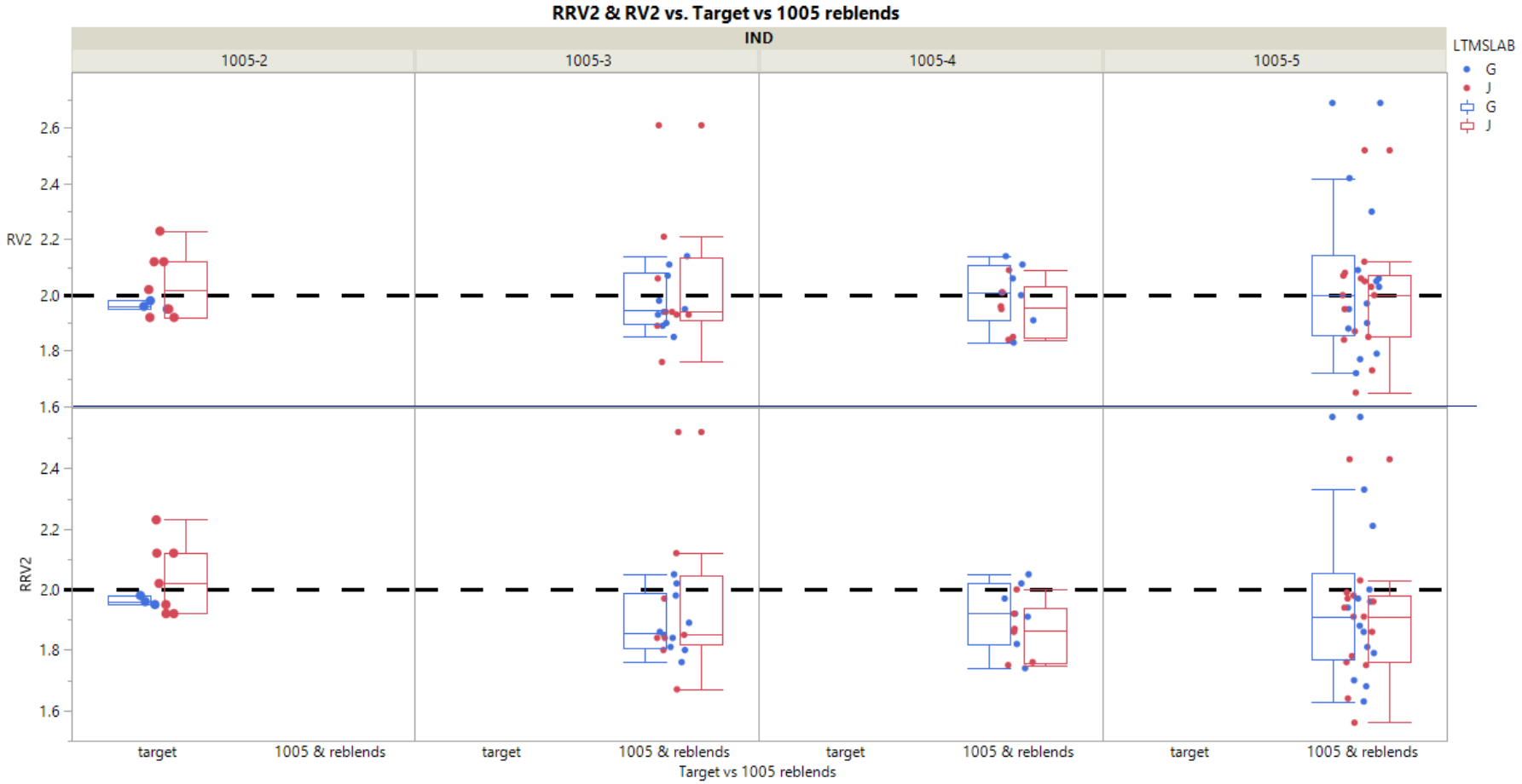
2019: high test results have happened twice in the past. 3 out of 5 tests from lab G are 2.3 or higher after applying current CF. There is only one test from lab J.
2020: tests (two) are back on target, one on each lab



RV2: Variability seems to have increased over time

Target (10 tests)

1005 re-blends (61 tests)



Proposed Correction Factors and Updated Standard Deviations

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VI38	0.4	5.01	4.28	0.73	0.56	0.72
RV48	0.08	1.76	1.75	0.01	0.08	0.17
RV2	0.09	2	1.97	0.03	0.09	0.19
***model: Lab, Stand within Lab, 1005 reblends; 71 tests; same model for all parameters**						
****** LSMEANS for 1005-5**						

Exclusions: 3 tests in Lab E1 – run last in 2009

Appendices

If SP asks for means and standard deviations

Target (reblends)	# of tests	Mean(RVISI38)	Std Dev(RVISI38)	Mean(RRV48)	Std Dev(RRV48)	Mean(RRV2)	Std Dev(RRV2)
target LTMS	10	**5.01**	**0.56**	**1.76**	**0.08**	**2.00**	**0.09**
1005-3	19	4.46	0.60	1.69	0.16	1.91	0.18
1005-4	13	4.33	0.63	1.68	0.09	1.89	0.10
1005-5	29	**4.13**	**0.82**	**1.71**	**0.20**	**1.92**	**0.23**
target - 1005-5		0.88		0.05		0.08	
Current CF		0.4		0.08		0.09	

Number of tests by Lab/Stand and re-blend

Lab/Stand	re-blend	# of tests
G/7	1005-2	1
G/9	1005-2	2
G/9	1005-3	6
G/10	1005-4	2
G/11	1005-5	4
G/ 7A	1005-3	4
G/ 7A	1005-4	5
G/ 7A	1005-5	10
J/6	1005-3	1
J/6	1005-4	4
J/6	1005-5	8
J/15	1005-2	3
J/15	1005-3	4
J/16	1005-2	4
J/17	1005-3	3
J/18	1005-3	1
J/18	1005-4	2
J/18	1005-5	7

Excerpt from LTMS T-8 and T-8E

The following are the specific T-8 and T-8E calibration test requirements.

A. Reference Oils and Parameters

The critical parameters are Viscosity Increase at 3.8% Soot (T-8 and T-8E) and Relative Viscosity at 4.8% Soot, 50% DIN Shear Loss (T-8E only). Relative Viscosity at 4.8% Soot, 100% DIN Shear Loss is a non-critical parameter (T-8E only). The reference oils required for test stand and test laboratory calibration are reference oils accepted by the ASTM Mack Test Surveillance Panel. The mean and standard deviation for the current reference oils for each critical and non-critical parameter are presented below.

VISCOSITY INCREASE @ 3.8% SOOT
Unit of Measure: cSt
NON-CRITICAL PARAMETER

Reference Oil	Mean	Standard Deviation
1005-3	5.01	0.56
1005-4	5.01	0.56
1005-5	5.01	0.56

RELATIVE VISCOSITY @ 4.8% SOOT
50% DIN Shear Loss
Unit of Measure: unitless
NON-CRITICAL PARAMETER

Reference Oil	Mean	Standard Deviation
1005-3	1.76	0.08
1005-4	1.76	0.08
1005-5	1.76	0.08

RELATIVE VISCOSITY @ 4.8% SOOT
100% DIN Shear Loss
Unit of Measure: unitless
CRITICAL PARAMETER

Reference Oil	Mean	Standard Deviation
1005-3	2.00	0.09
1005-4	2.00	0.09
1005-5	2.00	0.09

Mark Cooper's email: September 14, 2011

Background:
Reference oil data indicates the T-8 test has experienced a mild shift / trend over time. Analysis was performed by Doyle Boese and Jim Rutherford to evaluate options to deal with the severity issues. The analyses were discussed by the Mack Surveillance Panel during a teleconference on September 12. Due to time constraints, the surveillance panel decided to ballot this motion through e-mail.

Motion:
Jim Moritz (Intertek) made the following motion that was seconded by Greg Shank (Volvo Mack): Update the targets and standard deviations for Oil 1005-3 using the values shown the table below. Utilize the Industry Correction Factors shown in the table below. In addition, re-implement the lab severity adjustment system for T-8 (previously suspended with the introduction of 1005 until sufficient data was collected). Details on how to restart LTMS charts are shown below the table.

1005-3	Estimate	VI38	RV48	RV2
	Target	5.01	1.76	2.00
	Standard Deviation	0.56	0.08	0.09
	Industry Correction Factor	0.397	0.076	0.087

Chart Details
-Add ICF to 1005-3 results
-Rerun charts by using the targets/standard deviations for all 1005 runs (using appropriate 1005-2 and 1005-3 targets/standard deviations).
-Implement lab SAs using the original threshold limit approach with the target standard deviations to calculate SA's. Use SA's for candidate tests going forward.
-The most recent test on any stand in the system will be re-evaluated for pass/fail and calibration status. Any changes in calibration status would be implemented moving forward (no retroactive action/impacts).

Note the last item could cause existing calibrated stands to lose calibration status. If any stand is re-evaluated, all stands will be re-evaluated. If the surveillance panel finds this unacceptable, then stands would not be re-evaluated, and any uncalibrated stands would require an acceptable calibration test to calibrate.

History of Industry Correction Factors
Appendix B

Test Area	Effective From	Effective To	Condition	Description
ISM	June 28, 2007	***	All Tests	Add +1.7 to Crosshead Wear At 3.9% Soot Add +19.1 to Injector Adjusting Screw Wear At 3.9% Soot
	March 4, 2010	***	All Tests	Add +1.3 to Crosshead Wear At 3.9% Soot
	April 30, 2011	***	All Tests	Add +2.5 to Crosshead Wear At 3.9% Soot
	November 19, 2013	***	All Tests	Add -0.200 to ln(SAIAS)
	October 1, 2014	***	All Tests	Add 4 kPa to Oil Filter Delta Pressure
			All tests using batch C injector push rods, batch D injector adjusting screws and batch F crossheads	Add + 0.410 to ln(SAIAS)
T-8	September 17, 2011	***	All Tests	Add +0.40 to Viscosity Increase at 3.8% Soot
T-8E	September 17,2011	***	All Tests	Add +0.08 to Relative Viscosity at 4.8% Soot (50% DIN Shear Loss) Add +0.09 to relative Viscosity at 4.8% Soot (100% DIN Shear Loss)
T-11	September 14, 2005	***	All Tests	Add -0.39% to Soot @ 12cSt Vis. Inc., Add 1274 cP to MRV Vis
	December 6, 2005	***	All Tests	Add -0.36% to Soot @ 12cSt Vis. Inc., Add 713 cP to MRV Vis.
	March 24, 2006	***	All Tests	Add -0.35% to Soot @ 12cSt Vis. Inc., Add 956 cP to MRV Vis.
				Multiply Average Cylinder Liner Wear by 0.946
				$\Delta Lead_{Final} = \exp[(\ln(\Delta Lead) \times 0.923)]$
				$\Delta Lead\ (250\text{-}300)_{Final} = \exp[(\ln(\Delta Lead\ 250\text{-}300) \times 0.956)]$
				$OC = \exp[(\ln(OC_{100\text{-}300}) \times 0.961)]$

Permissions