



# Volatility Surveillance Panel Update

June 23 2021

Amy Ross

# Meeting Minutes 06/23/2021

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- Review Antitrust Statement
- Membership List Review
- Review and Approve meeting minutes from July 23, 2020
  - Motion by Sheila Thompson, Second by Steve Lazzara
- Summary of annual stats review (slides provided by E. Santos)
  - Question raised by panel member regarding severity of test and concern with pass rate; Tom Schofield noted that severity adjustments are applied on an individual rig basis to account for test variability and that fail rate was 10% this period, overall 5% per Elisa Santos most recent evaluation of D5800 test data; no further questions on this issue were raised
- Review abbreviated slides presented during D02.B0.07 Bench Tests Surveillance Panel meeting on 06/07/2021
- Review of slides containing charts within Executive Summary
  - D6417
  - D5800
- Review of PDSC data provided by SwRI
- Other items?
  - Tom Schofield asked panel members for any objections regarding discardment of the remaining ~2 gallons of VOLD14 QC fluid; no objections brought forth

## Read Antitrust Statement

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# Members List – Updated 20200619

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# Meeting Minutes - 2020723

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- Membership List Review / Role Call
- Reviewed Antitrust Statement
- Reviewed and Approve meeting minutes from November 05, 2019 meeting
  - Motion to approve: Matt Schlaff; Second: Tom Schofield
- Reviewed abbreviated slides presented during D02.B0.07 Bench Tests Surveillance Panel meeting on 06/18/2020
- Full review of slides contained within Executive Summary
  - D6417
  - D5800
- Other items?
  - No other comments or questions from panel members at this time

# Annual Stats Review

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Provided by Elisa Santos



## Summary

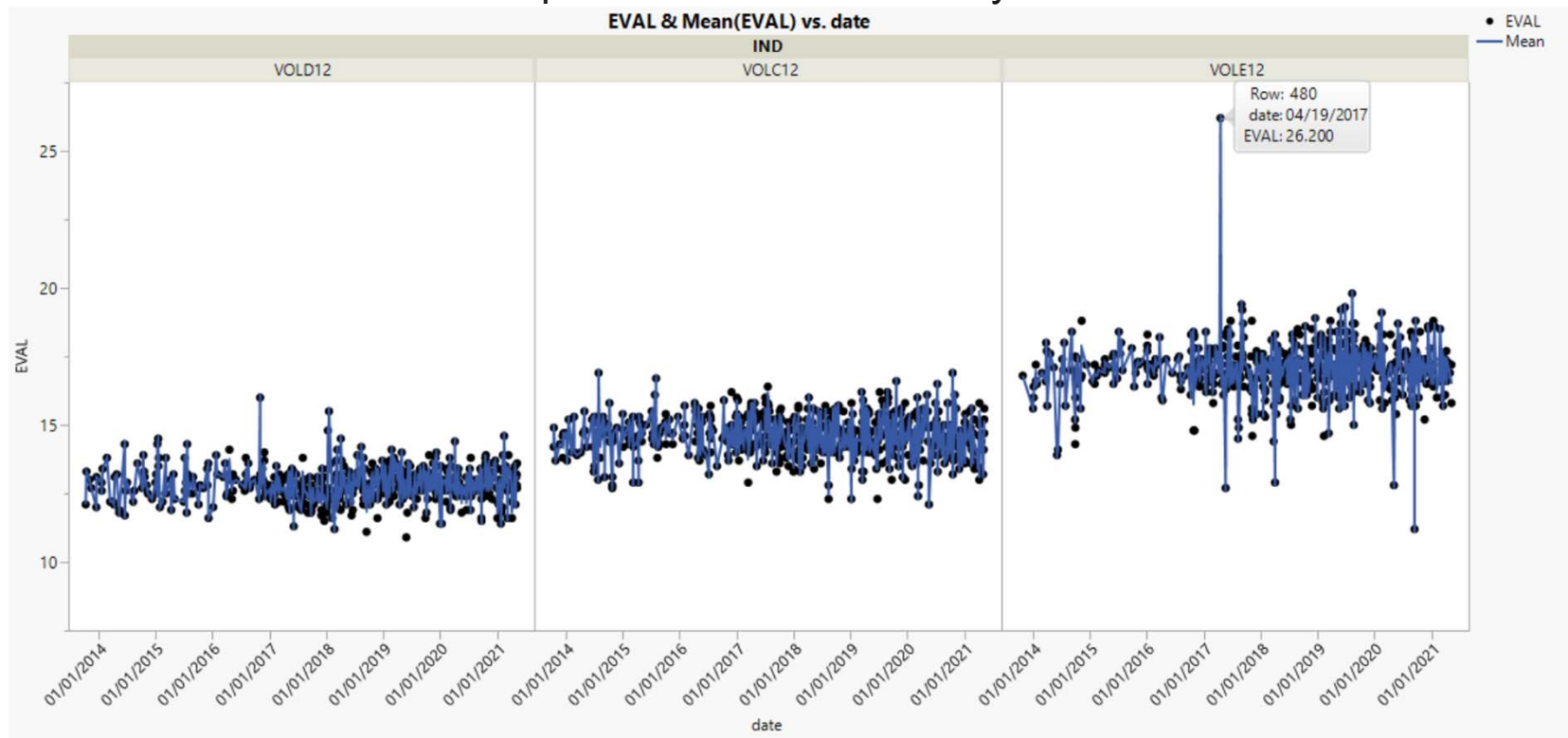
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- After reviewing the most recent data, there is practically no change in the variability
  - After applying the LN transformation, the calculated standard deviation is equal to 0.0464, while the current standard deviation is equal to 0.0465
  - No action is needed
- Rate of tests that did not meet the statistical criteria has declined over time and is now around 5%

# The Data

- 1,660 tests (file 05/12/2021); 10 2013 forward; chart =Yes; excluding test 123872 (highlighted below)
- # of Apparatus = 55

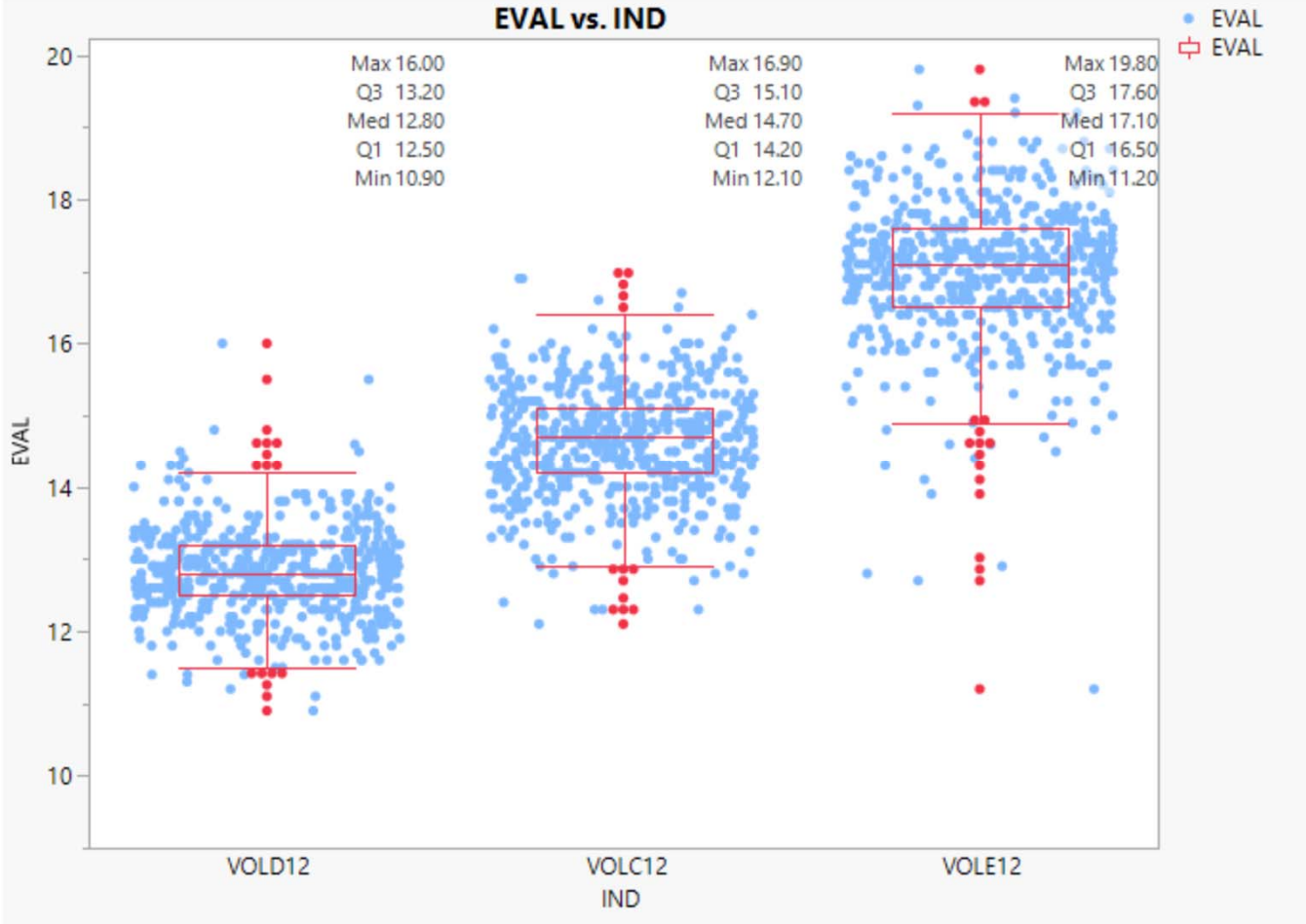
## Evaporation Loss vs. Date by Oil





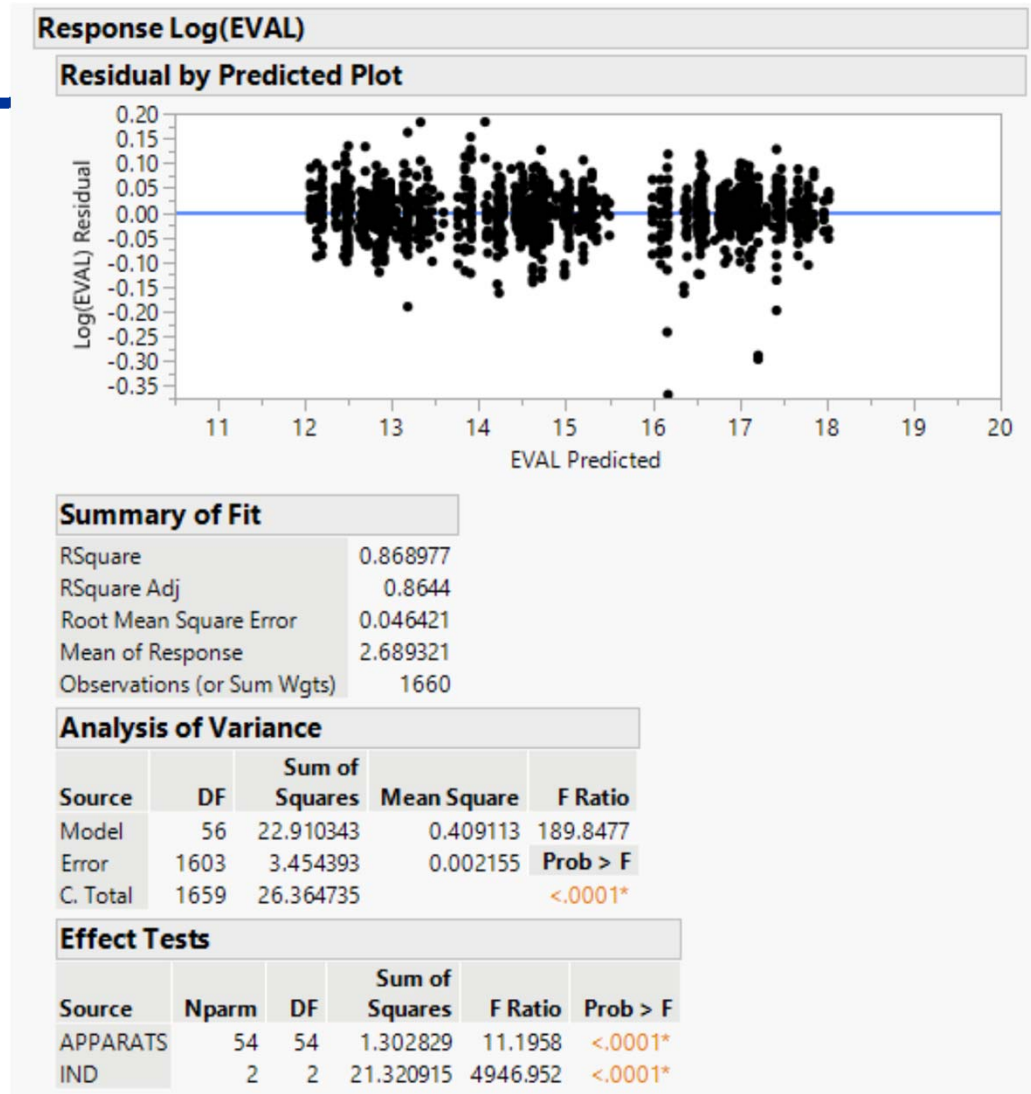
# Evaporation Loss by Oil: another way to visualize the data

As before, variability increases with the mean of Evaporation loss, confirming the need of a transformation for Evaporation loss



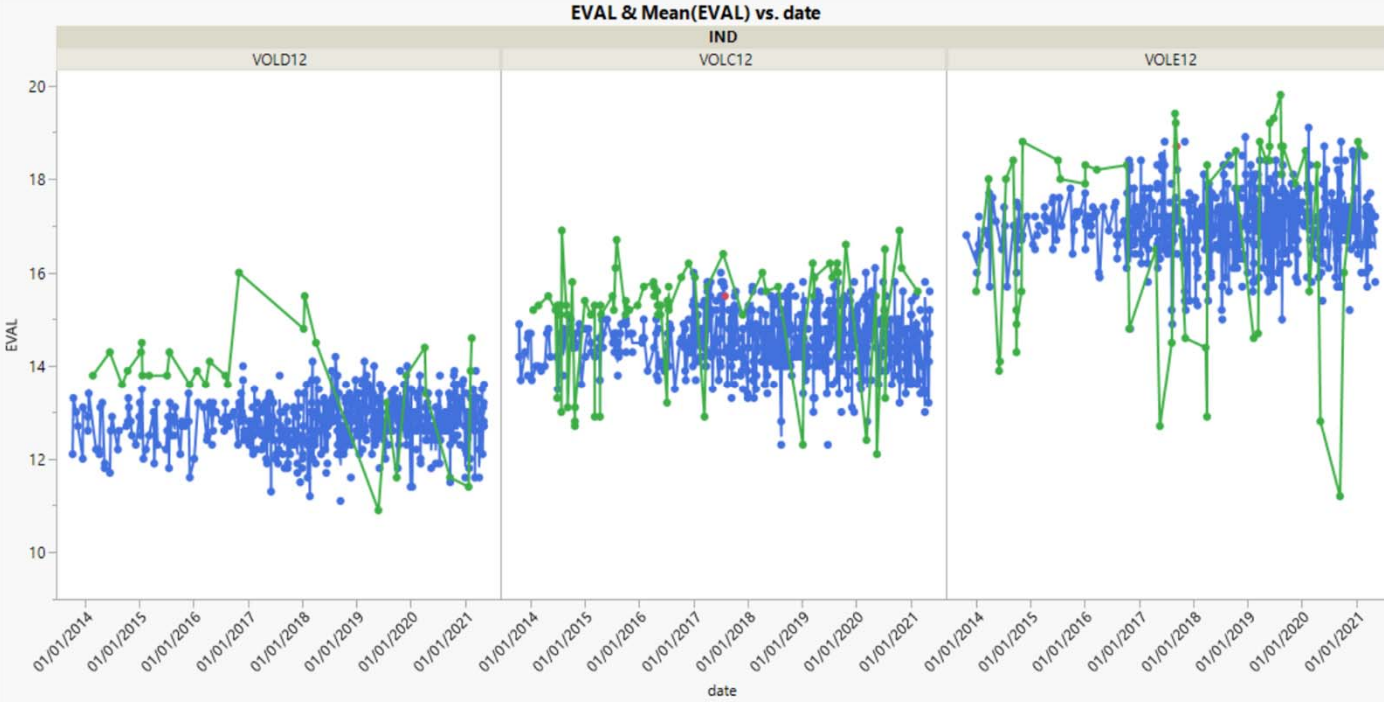
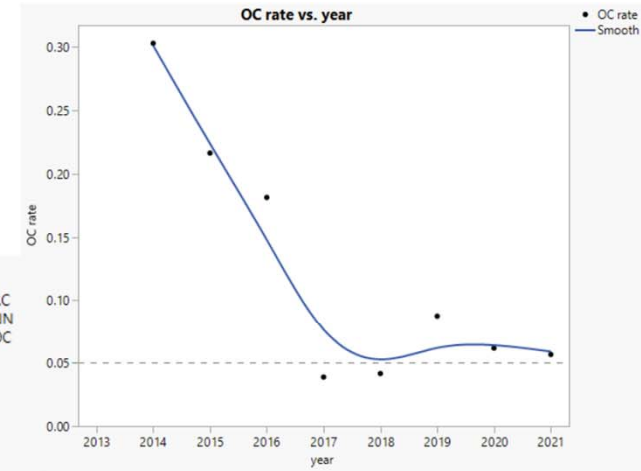
# Calculations

Standard deviation calculation:  
Including Apparatus and Oil in the  
model



# Additional Thoughts

Rate of tests that did not meet the statistical criteria has declined over time and is now around 5%










# ASTM D02.B0.07 Summary

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## Abbreviated Summaries










## Volatility Surveillance Panel Summary – D6417

Precision and Severity	  	<ul style="list-style-type: none"> <li>• Pooled s (0.47) less precise than target (0.39); slightly worse than last period; incremental increase over the past 2 years; This period, primarily due to rigs, D5* and D6; Pooled s 0.37 without suspect results which is comparable to target and last period*</li> <li>• Performance mild this period (-0.81s / -0.43*); CUSUM leveling off but slight mild trend developing last period with sharp increase this period; 5 of 7 labs performing mild to some extent; slightly severe performance APR '18 thru APR '20, nearly on target</li> </ul>
Test Status	  	<ul style="list-style-type: none"> <li>• 10% fail rate (12% last period)</li> <li>• 7 labs with 9 calibrated rigs; 21 cal attempts, 19AC results; 2OC (mild) results; no invalidated results</li> </ul>
Lab/Apparatus	  	<ul style="list-style-type: none"> <li>• Lab D furthest from target performance (-2.18s; others &lt;1.0s)</li> <li>• Last period, Rig D5 had 2OC results, changed column between; failed the 2-test cal this period (one -3.8s) with subsequent pass</li> <li>• Rig D6 reported -5s result</li> </ul>






## Volatility Surveillance Panel Summary – D6417

Calibration Oils	<ul style="list-style-type: none"> <li style="text-align: center;"></li> <li style="text-align: center;"></li> <li style="text-align: center;"></li> <li style="text-align: center;"></li> <li style="text-align: center;"></li> </ul>	<ul style="list-style-type: none"> <li>• Mean values for all oils comparable to target values; precision is comparable but slightly worse than target for Oils 55 and 58; Oil 52 furthest from target precision (0.47 vs 0.31)</li> <li>• Oil 52 performance (-1.77s) significant change from last period (OCT20= -0.87; APR20=0.02)</li> <li>• Oil 55 performance comparable magnitude from target as last period but mild (-0.16)</li> <li>• Oil 58 performance comparable magnitude from target as last period but severe (0.24)</li> <li>• Healthy supply of all fluids</li> </ul>
Method and LTMS Updates		<ul style="list-style-type: none"> <li>• No updates this term</li> <li>• D6417 calibration requirement updates are issued as LTMS document updates</li> <li>• Upcoming SP meeting on June 23rd at 11am</li> </ul>

## Volatility Surveillance Panel Summary – D5800










Precision and Severity	  	<ul style="list-style-type: none"> <li>• Pooled s (0.0495) less precise than updated target (0.0465); more precise than last two periods; Proc B rigs are less precise than target while Proc D rigs are more precise</li> <li>• CUSUM shows continued overall severe trend (0.53s this period, priors 0.35s, 0.54s), attributed to Procedure B units</li> </ul>
Test Status	      	<ul style="list-style-type: none"> <li>• 10 labs with 25 calibrated rigs (comparable to last period); 11 labs reporting data; -20% cal attempts in 2020 (176 to 140)</li> <li>• 143 results reported; Fail rate 6%; 9 OC (4 labs/5 rigs); 2 LC/XC, 1 RC; 0 shakedown runs</li> <li>• 3-Ei L3 alarms (2 mild, 1 severe); 7-Zi L2 alarms (all severe)</li> <li>• 2 tests exceeded 3s range, compared to 5 last period (+3.8s rig G6, +3.3 rig J7)</li> <li>• 3 invalid runs due to vacuum leak (RC), failing QC (LC) and spilled sample (XC)</li> </ul>

## Volatility Surveillance Panel Summary – D5800

Lab/Apparatus	 	<ul style="list-style-type: none"> <li>• Rig G6 had two consecutive Zi L2 (severe) alarms before clearing on third attempt, repeated later in report period (4 OC fails total); Same pattern on rig G8 from same lab last period and into this period</li> <li>• Labs AY, G* and J* all saw more off-target performance (severe) than others (<math>\geq 1.0s</math>)</li> </ul>
Precision and Severity by Procedure	  	<ul style="list-style-type: none"> <li>• 1 NCK2 rig; 19 NCK25G rigs; 7 NS2 rigs; comparable breakdown as last period</li> <li>• Proc B precision (0.0477) slightly worse than target and severe perf (0.77s); NCK2 precision 0.0042, severe perf (0.71); NCK25G precision 0.0490, severe perf (0.77s)</li> <li>• Proc D precision (0.0376) better than target and last term (0.07) with continued mild performance, nearly on target (-0.15s)</li> </ul>



## Volatility Surveillance Panel Summary – D5800

<p>Calibration Oils</p>	<p>                 </p>	<ul style="list-style-type: none"> <li>• All oils (VOLC12, D12 and E12) were greater than target mean</li> <li>• VOLC12 and VOLD12 precision were worse than the target while VOLE12 was slightly better (0.0519, 0.0510, 0.0454, resp)</li> <li>• VOLC12 (0.46s) performance was less severe than last term</li> <li>• VOLD12 performance (0.67s ) was much more severe than last period (0.37s)</li> <li>• VOLE12 performance (0.46s) was much more severe than last period (0.04s)</li> <li>• Supply is good for VOL C12, D12, E12 and D18; VOLD14 QC oil will be disposed of this period (2.3gal); PDSC QC analyses donated by SwRI confirmed little to no change in oxidation of fluids (will be reviewed in SP meeting)</li> </ul>
<p>Method and LTMS Updates</p>	<p>        </p>	<ul style="list-style-type: none"> <li>• No D5800 technical memos were issued by the TMC this period</li> <li>• Calibration requirements will be issued as LTMS updates</li> <li>• Annual stats team evaluation review, performed by Elisa Santos, showed no significant changes in precision and that Ln scale is still appropriate</li> </ul>



ASTM D02.B0.07

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## Full Executive Summary

# D6417: Estimation of Engine Oil Volatility by Capillary GC

Test Status	Validity Code	No. Tests
Acceptable Calibration Test	AC	19
Failed Calibration Test	OC	2
Operationally Invalidated by Lab	LC, XC	0
Operationally Invalidated After Initially Reported as Valid	RC	0
<b>Total</b>		<b>21</b>

Number of Labs Reporting Data: 7  
Fail Rate of Operationally Valid Tests: 10%

# D6417: Estimation of Engine Oil Volatility by Capillary GC

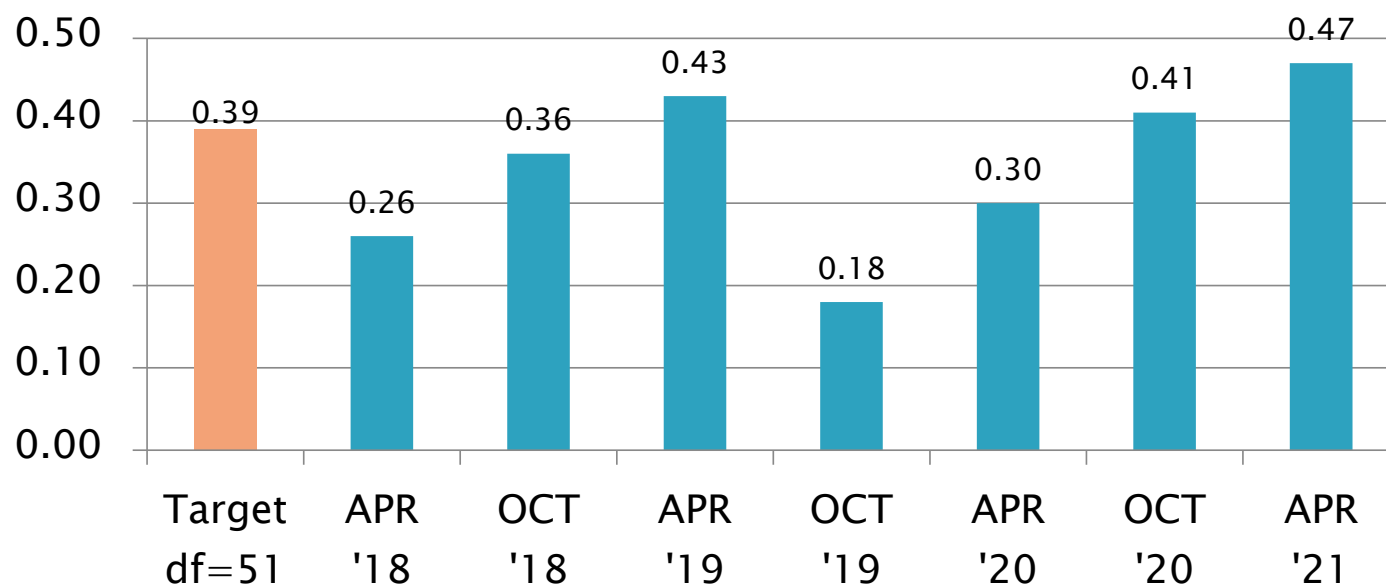
Period Precision and Severity Estimates

Area % Volatized @ 371°C	n	df	Pooled s	Mean $\Delta/s$
Initial Selected Oils from RR	54	51	0.39	-----
4/1/18 through 9/30/18	16	13	0.36	0.15
10/1/18 through 3/31/19	19	16	0.43	0.35
4/1/19 through 9/30/19	19	16	0.18	0.10
10/1/19 through 3/31/20	17	14	0.30	0.09
4/1/20 through 9/30/20*	16	13	0.41	-0.34
4/1/20 through 9/30/20*	14	11	0.31	0.01
10/1/20 through 3/31/21*	21	18	0.47	-0.81
10/1/20 through 3/31/21*	19	16	0.37	-0.43

\*Period statistics with two mild results from rigs D5/D6 included and excluded (operational problem suspected but lab never confirmed)

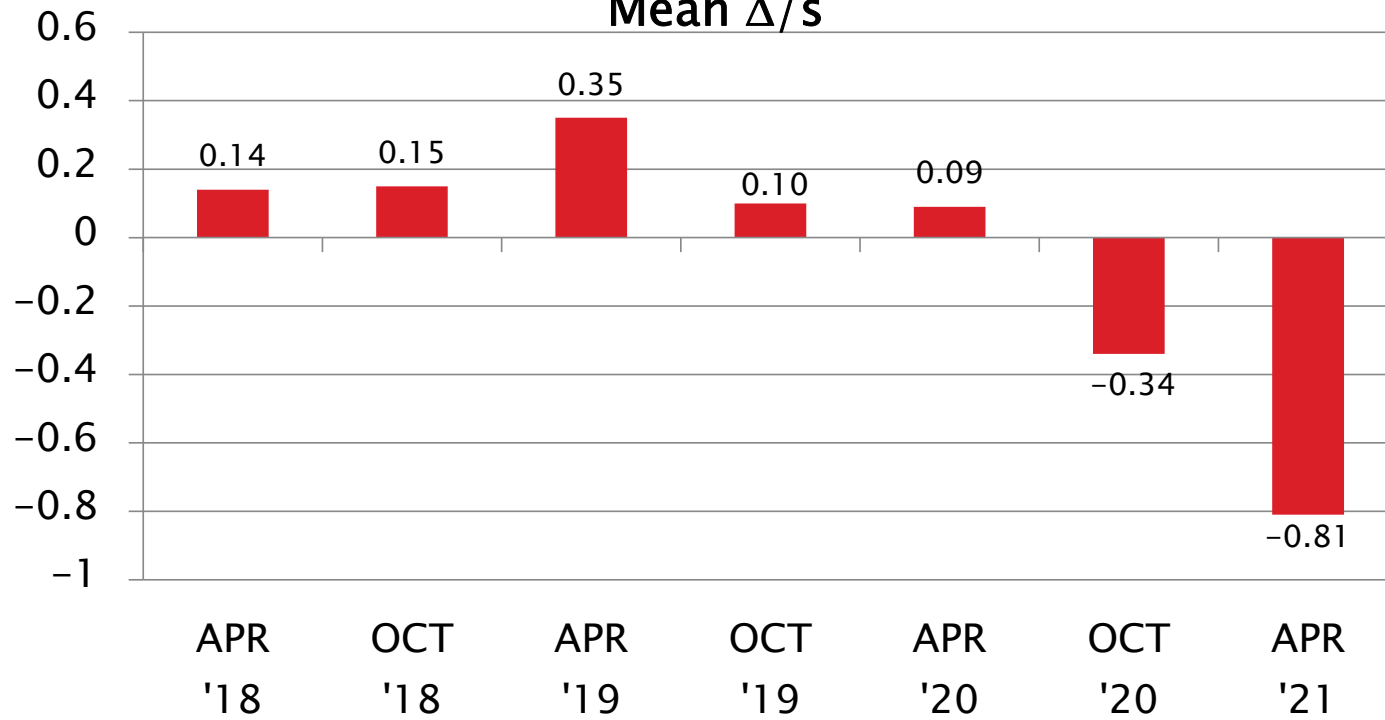
# D6417 Precision Estimates

Area % Volatized @ 371°C  
Pooled s



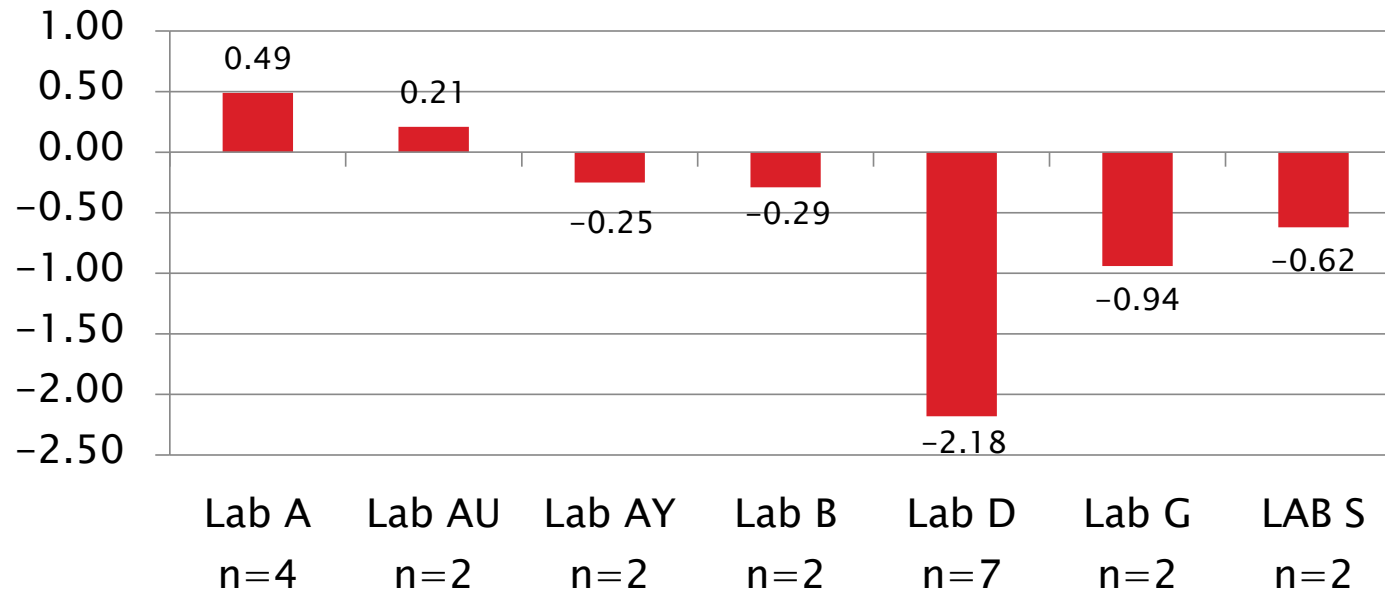
# D6417 Severity Estimates

Area % Volatized @  
371°C  
Mean  $\Delta/s$



# D6417 Lab Severity Estimates

Area % Volatized @ 371°C  
Mean  $\Delta/s$



Test Monitoring Center  
<http://astmtmc.cmu.edu>



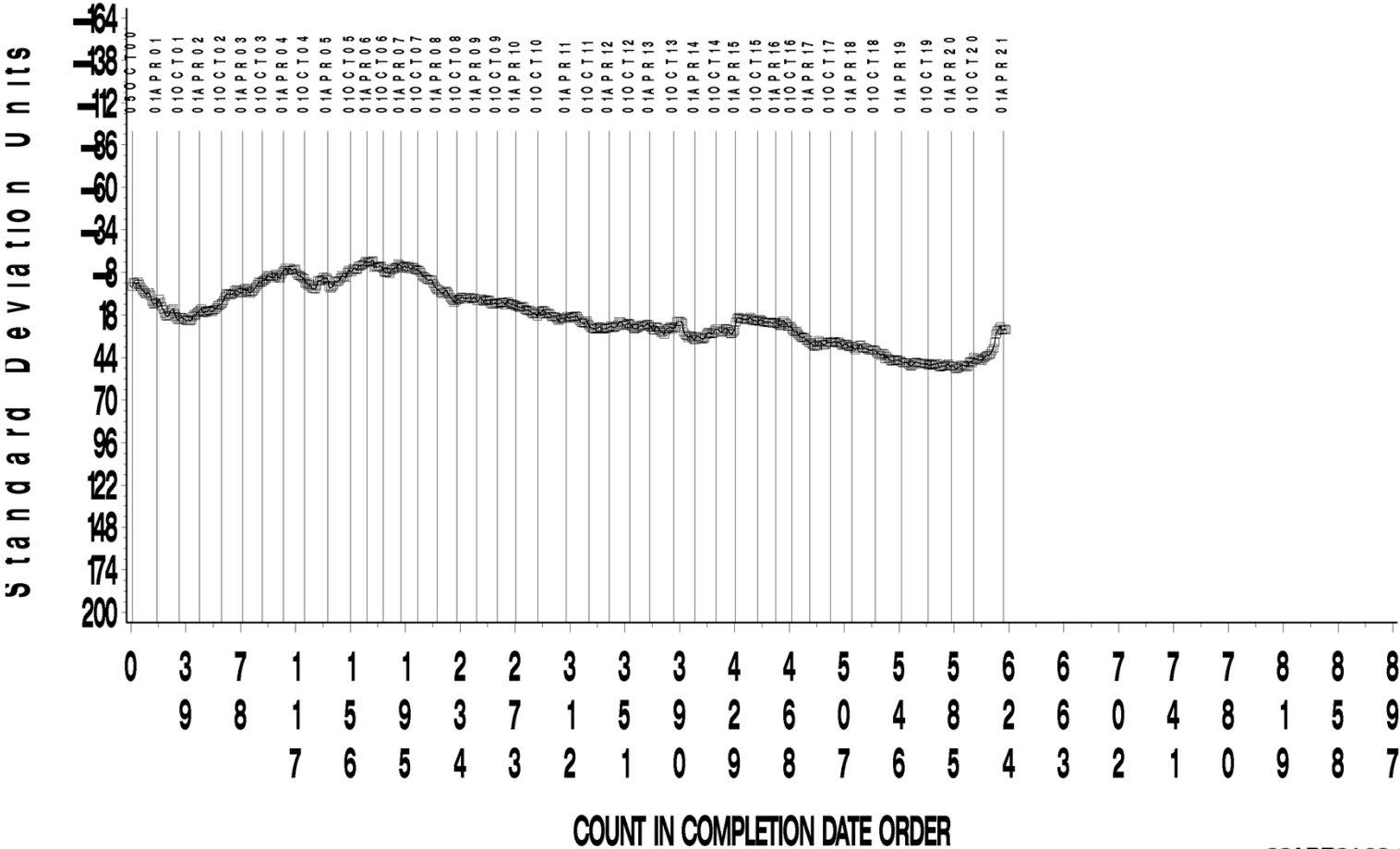
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D64-17 VOLATILITY BY GC INDUSTRY OPERATIONALLY VALID DATA



SAMPLE AREA % VOLATIZED

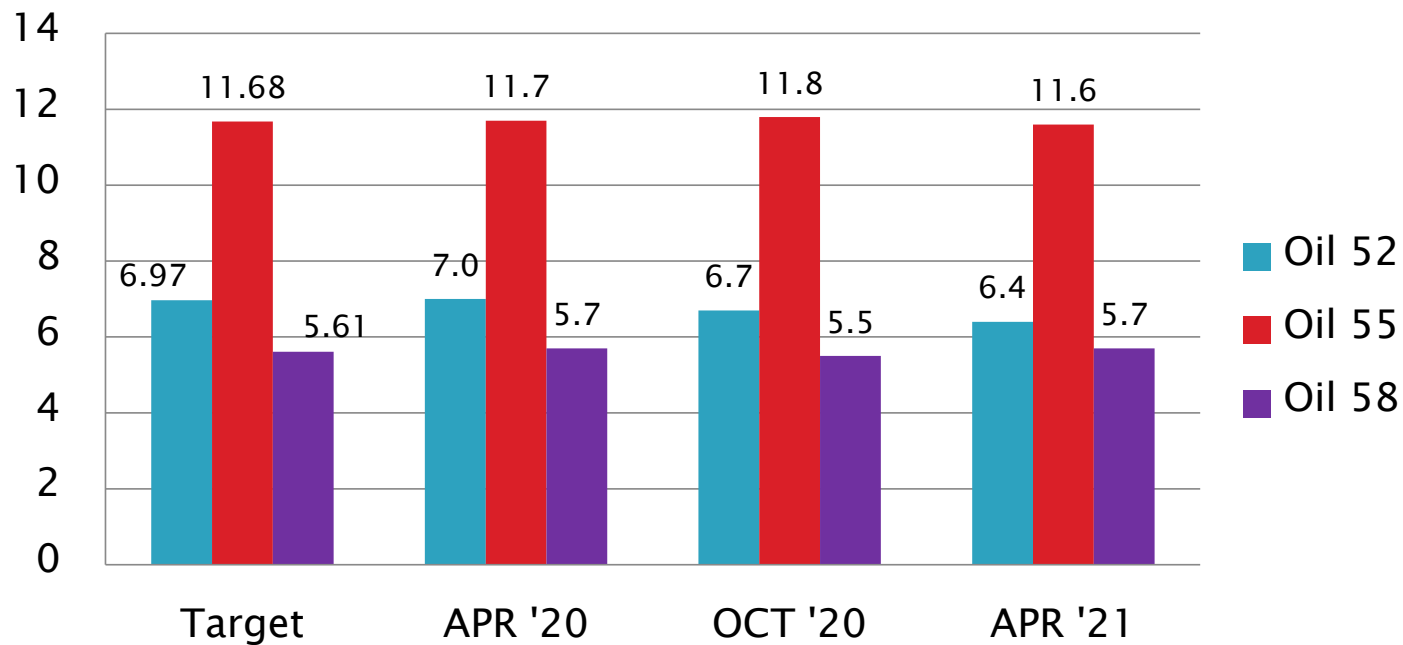
CUSUM Severity Analysis





# D6417 Performance by Oil

Area % Volatized @ 371°C  
Mean



Test Monitoring Center  
<http://astmtmc.cmu.edu>

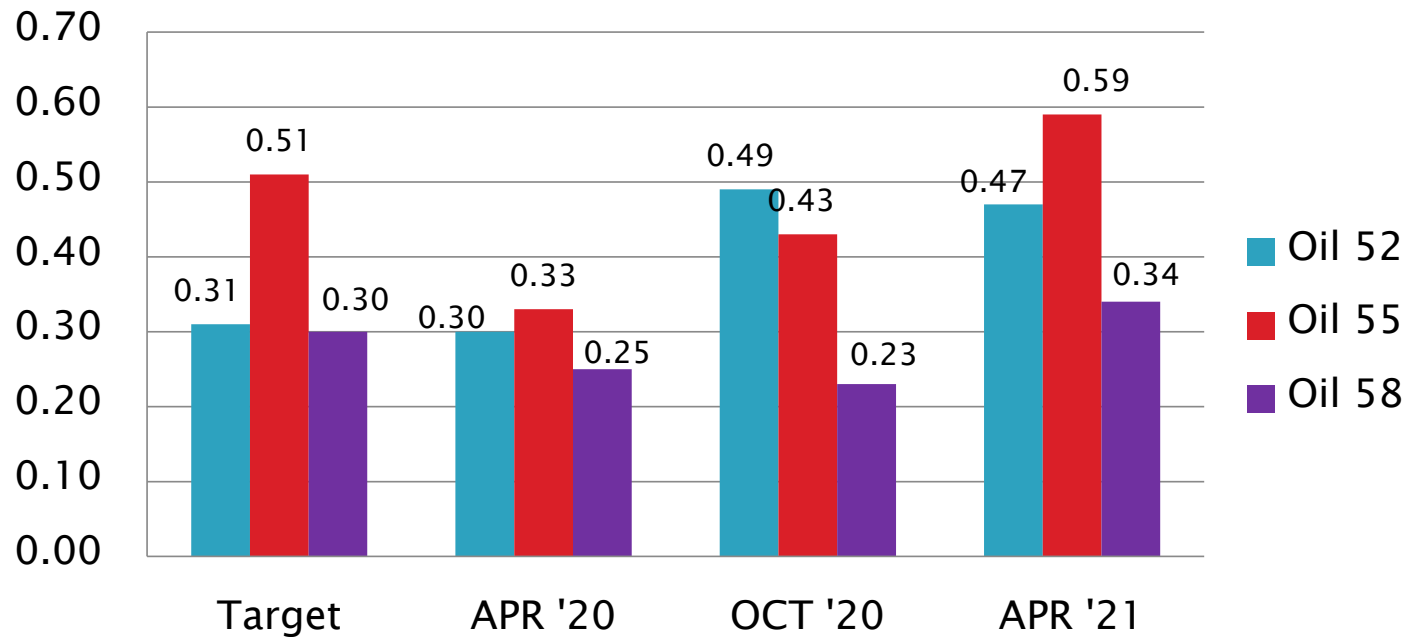


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# D6417 Performance by Oil

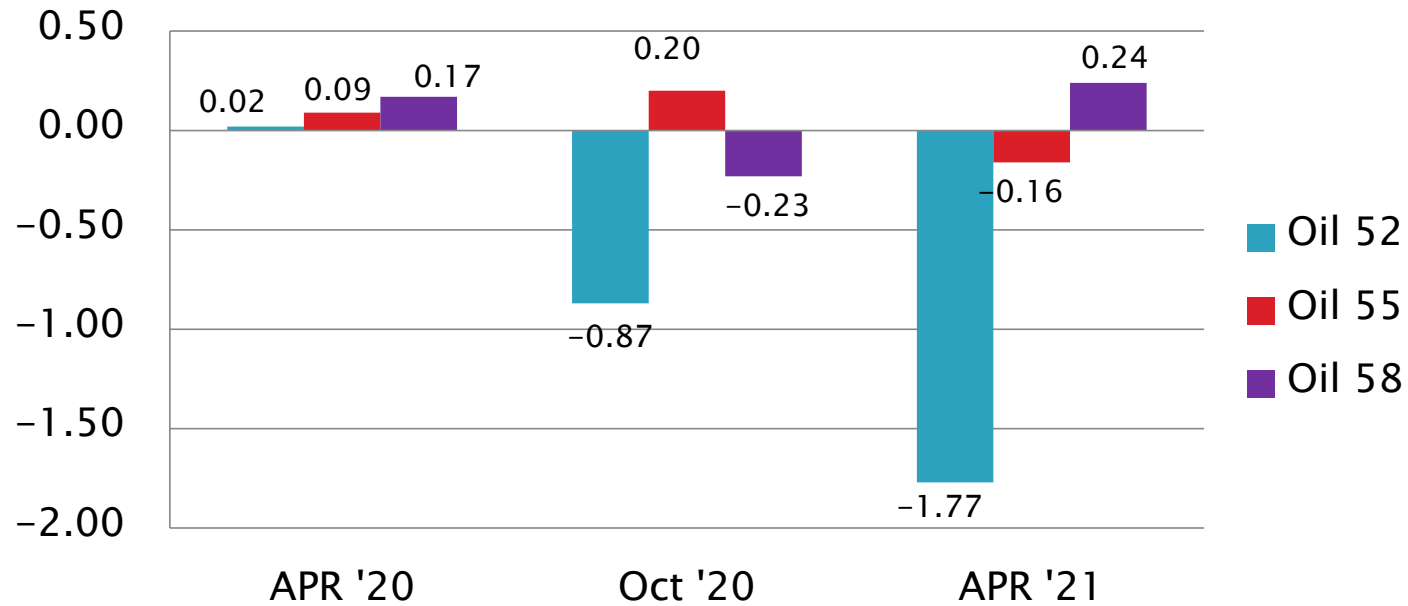
Area % Volatized @ 371°C

$S_R$



# D6417 Performance by Oil

Area % Volatized @ 371°C  
Mean  $\Delta/s$



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# D5800: Evaporation Loss of Lubricating Oil by Noack Method

Test Status	Validity Code	No. Tests
Acceptable Calibration Test	AC	131
Failed Calibration Test	OC	9
Operationally Invalidated by Lab	LC, XC	2
Operationally Invalidated After Initially Reported as Valid	RC	1
<b>Total</b>		<b>143</b>

Number of Labs Reporting Data: 11  
Fail Rate of Operationally Valid Tests: 6%

*Test Monitoring Center*  
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# D5800: Evaporation Loss of Lubricating Oil by Noack Method

## Period Precision and Severity Estimates

Sample Evaporation Loss, mass %	n	df	Pooled s	Mean $\Delta/s$
Targets Effective 02/07/20 <sup>1</sup>	78	75	0.0465	-----
4/1/18 through 9/30/18 <sup>2</sup>	149	146	0.82	0.40
4/1/18 through 9/30/18 <sup>2</sup>	148	145	0.76	0.44
10/1/18 through 3/31/19	151	148	0.81	0.51
4/1/19 through 9/30/19	164	161	0.81	0.65
10/1/19 through 3/31/20 <sup>1</sup>	146	143	0.0503	0.54
4/1/20 through 9/30/20 <sup>1</sup>	136	133	0.0659	0.35
10/1/20 through 3/31/21 <sup>1</sup>	140	137	0.0495	0.53

<sup>1</sup>Began monitoring natural log transformed test results on 20200207 making logarithmic scale changes for target and period precision estimates starting April 2020 report period.

<sup>2</sup>Extreme OC result included and excluded

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# D5800: Evaporation Loss of Lubricating Oil by Noack Method

## Performance Comparison by Procedure & Model Sample Evaporation Loss, Mass %

Procedure	n	df	Pooled s	Mean $\Delta/s$
Procedure B	104	101	0.0477	0.77
Procedure C	No Procedure C tests reported this period.			
Procedure D	36	33	0.0376	-0.15
Model	n	df	Pooled s	Mean $\Delta/s$
NCK2	6	3	0.0042	0.71
NCK25G	98	95	0.0490	0.77
NS2	36	33	0.0376	-0.15

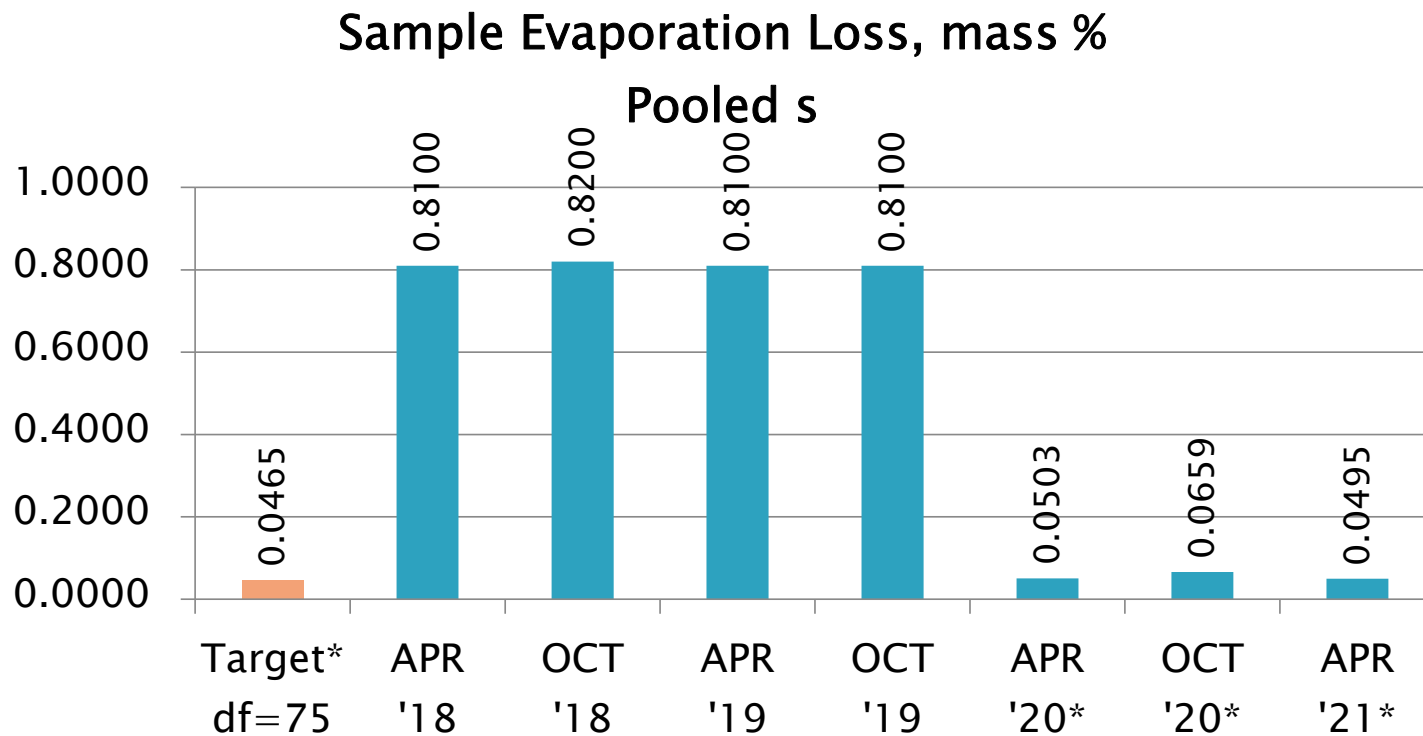
1 Procedure B NCK2 Rig  
19 Procedure B NCK25G Rigs  
7 Procedure D NS2 Rigs

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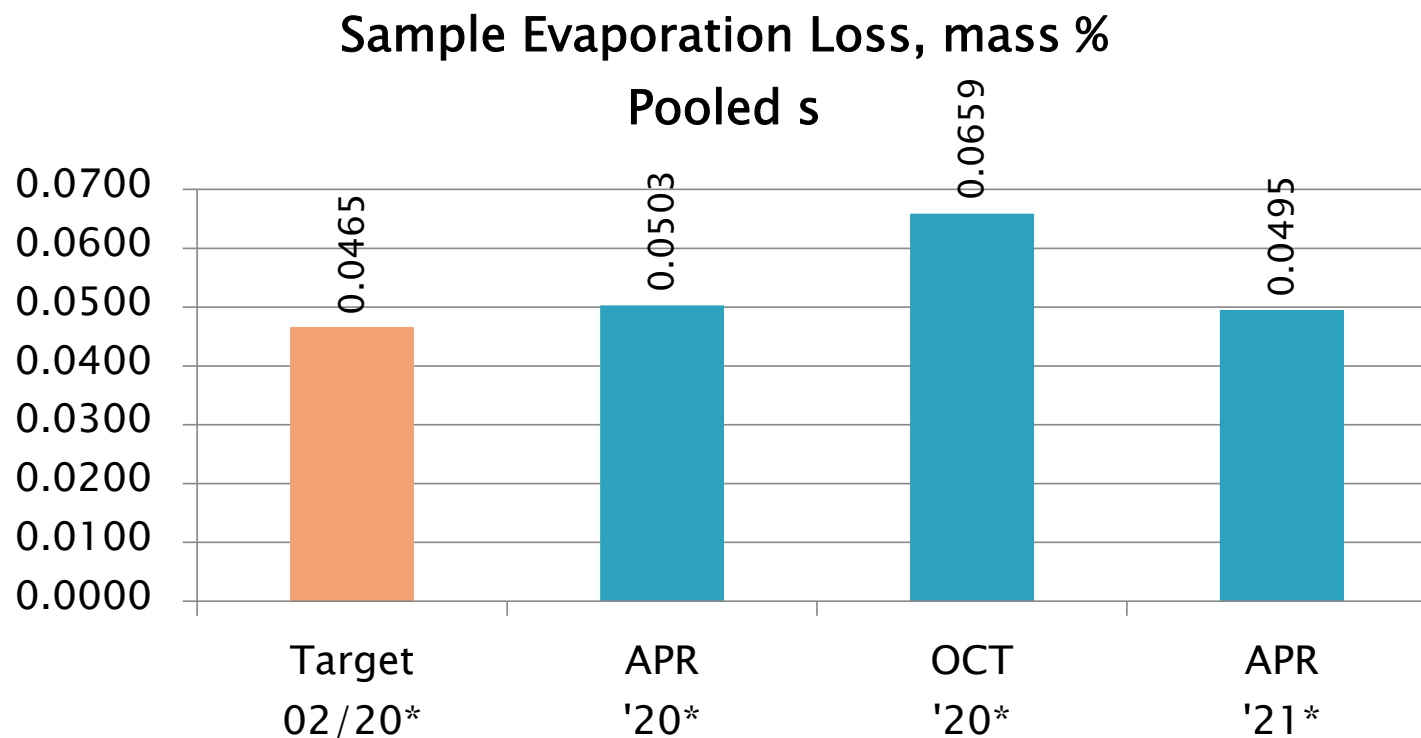
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# D5800 Precision Estimates



\*Began monitoring natural log transformed test results on 20200207 making logarithmic scale changes for target and period precision estimates starting April 2020 report period.

# D5800 Precision Estimates

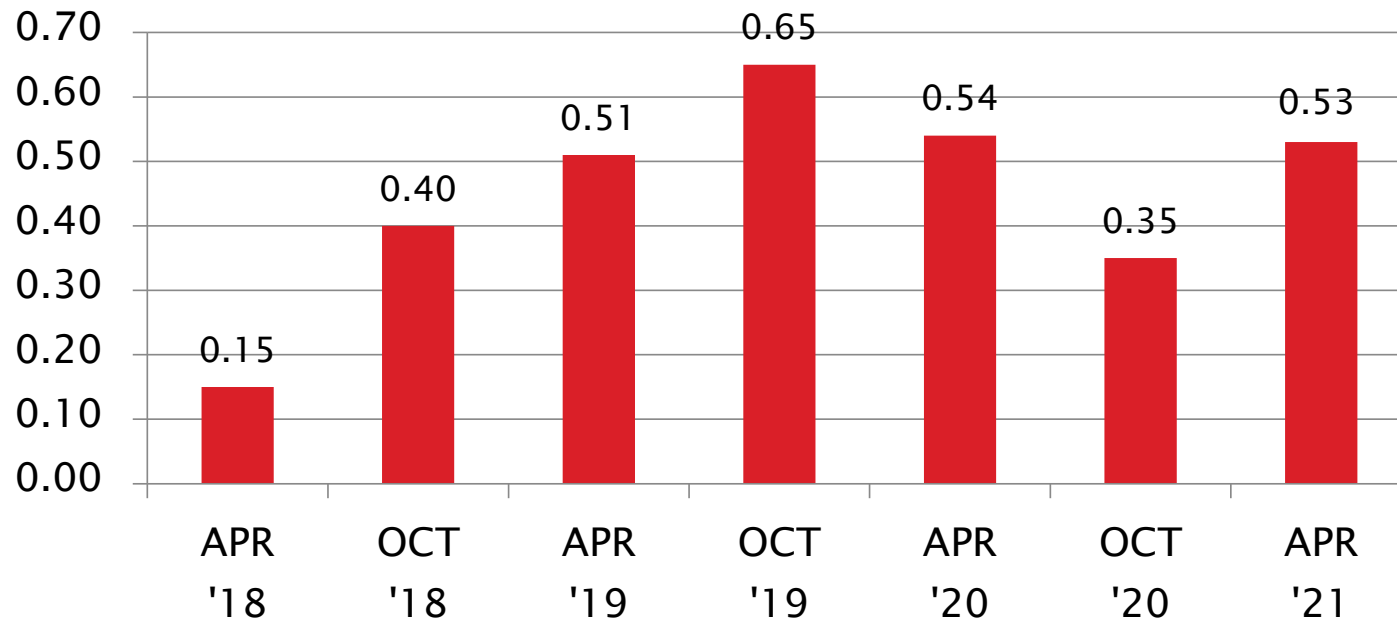


\*Began monitoring natural log transformed test results on 20200207 making logarithmic scale changes for target and period precision estimates starting April 2020 report period.



# D5800 Severity Estimates

Sample Evaporation Loss, mass %  
Mean  $\Delta/s$



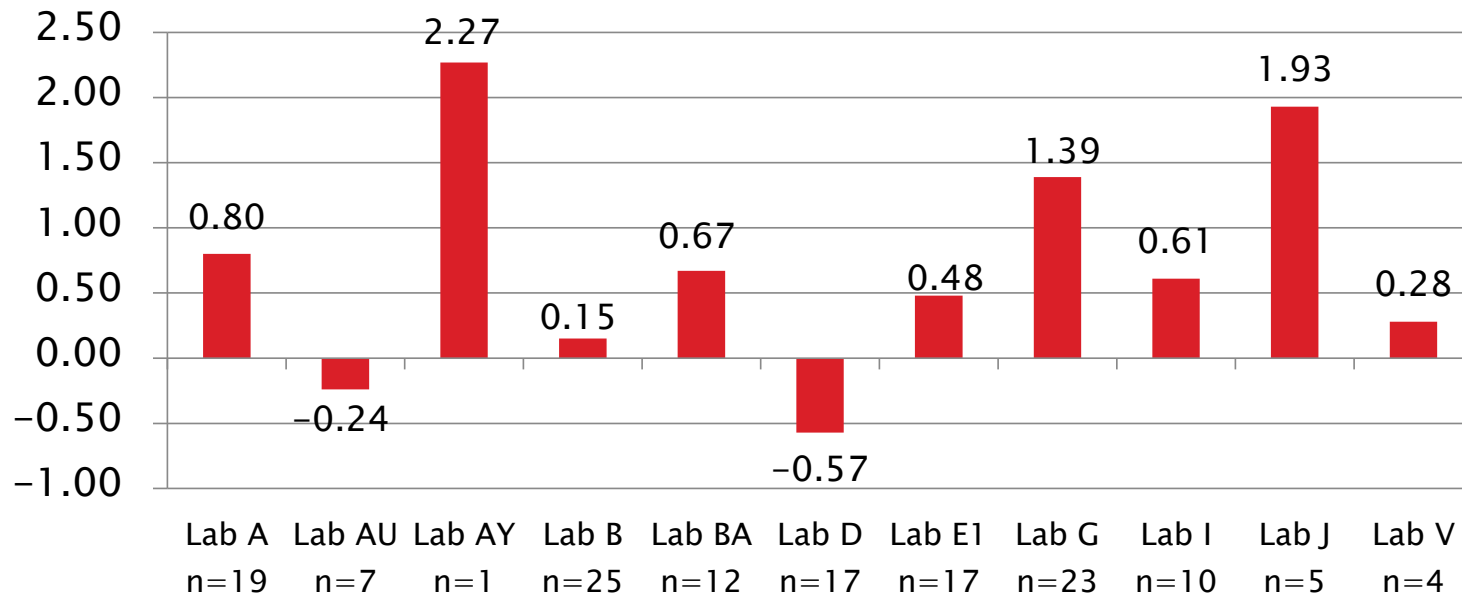
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# D5800 Lab Severity Estimates

Sample Evaporation Loss, mass %  
Mean  $\Delta/s$



Test Monitoring Center  
<http://astmtmc.cmu.edu>



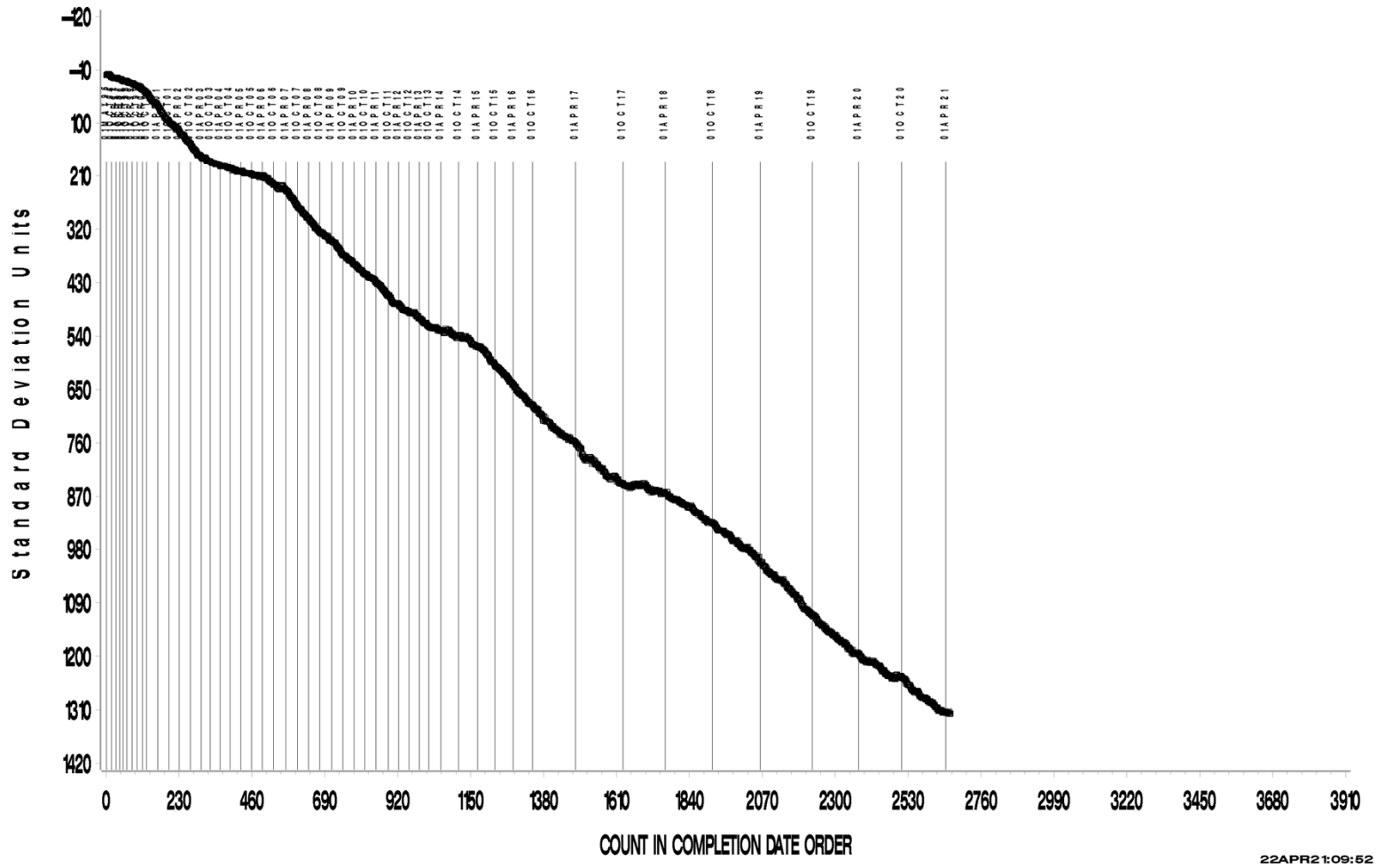
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D5800 VOLATILITY BY NOACK INDUSTRY OPERATIONALLY VALID DATA

EVAPORATION LOSS, MASS%



CUSUM Severity Analysis

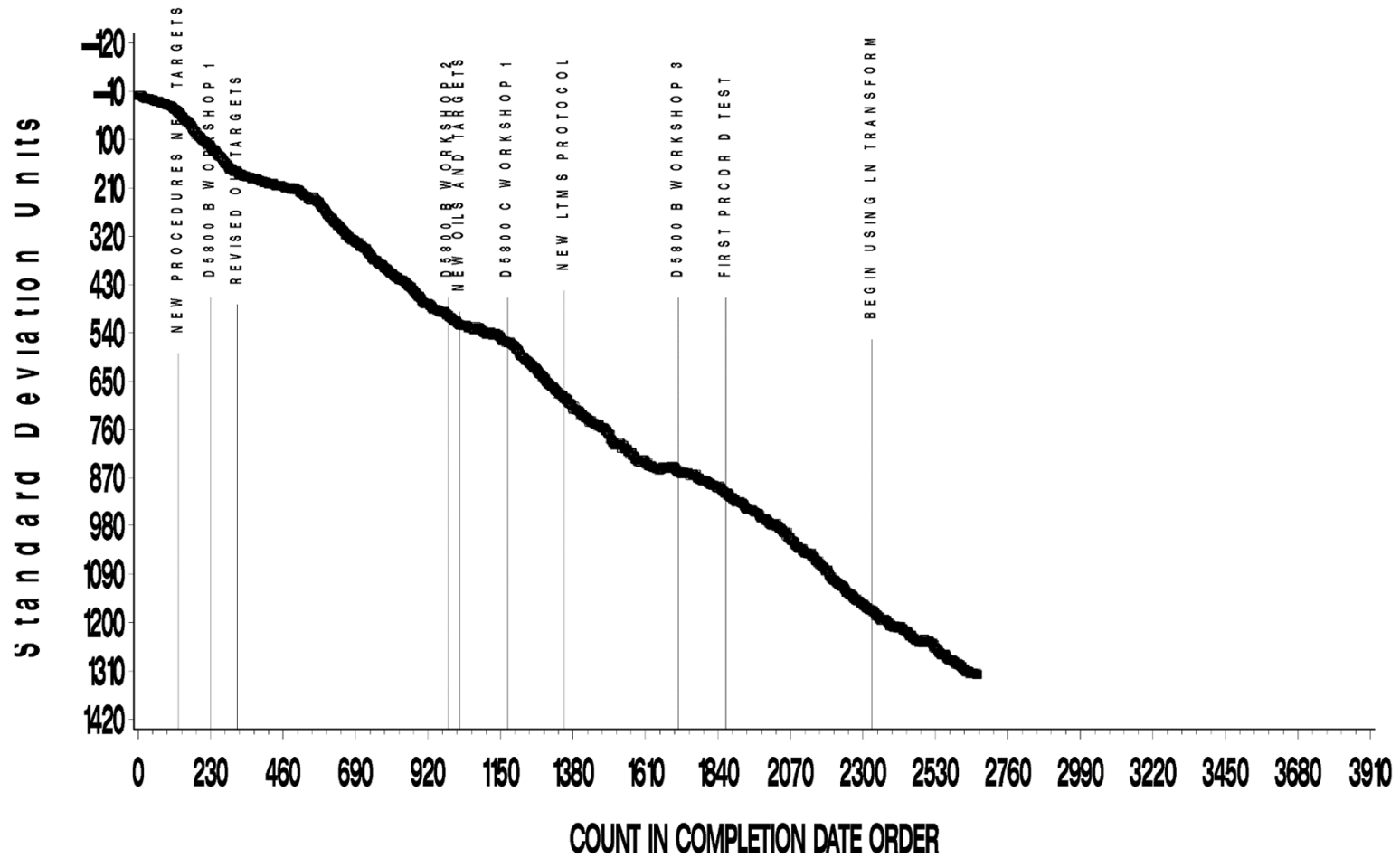


D5800 VOLATILITY BY NOACK INDUSTRY OPERATIONALLY VALID DATA

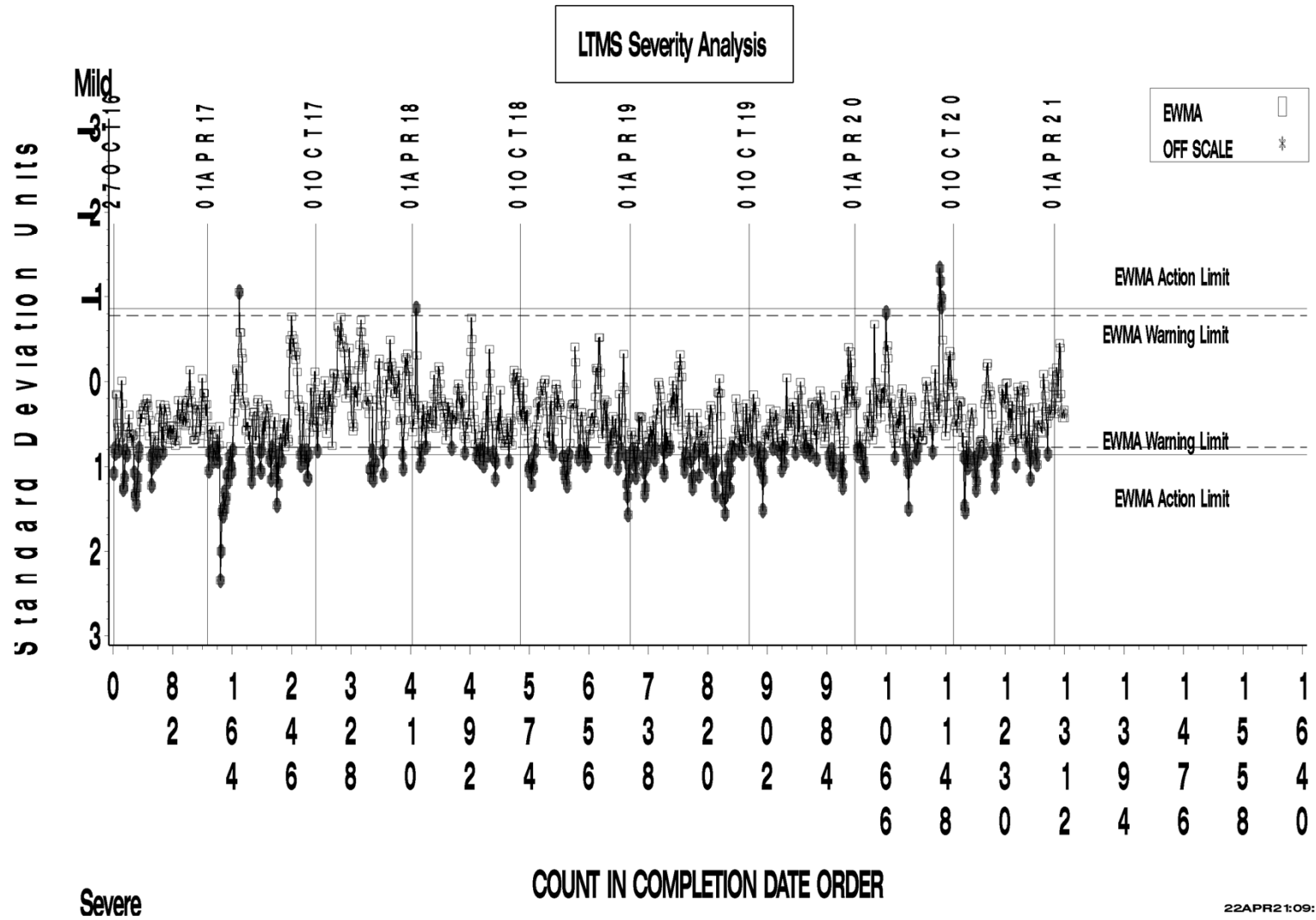


EVAPORATION LOSS, MASS%

CUSUM Severity Analysis



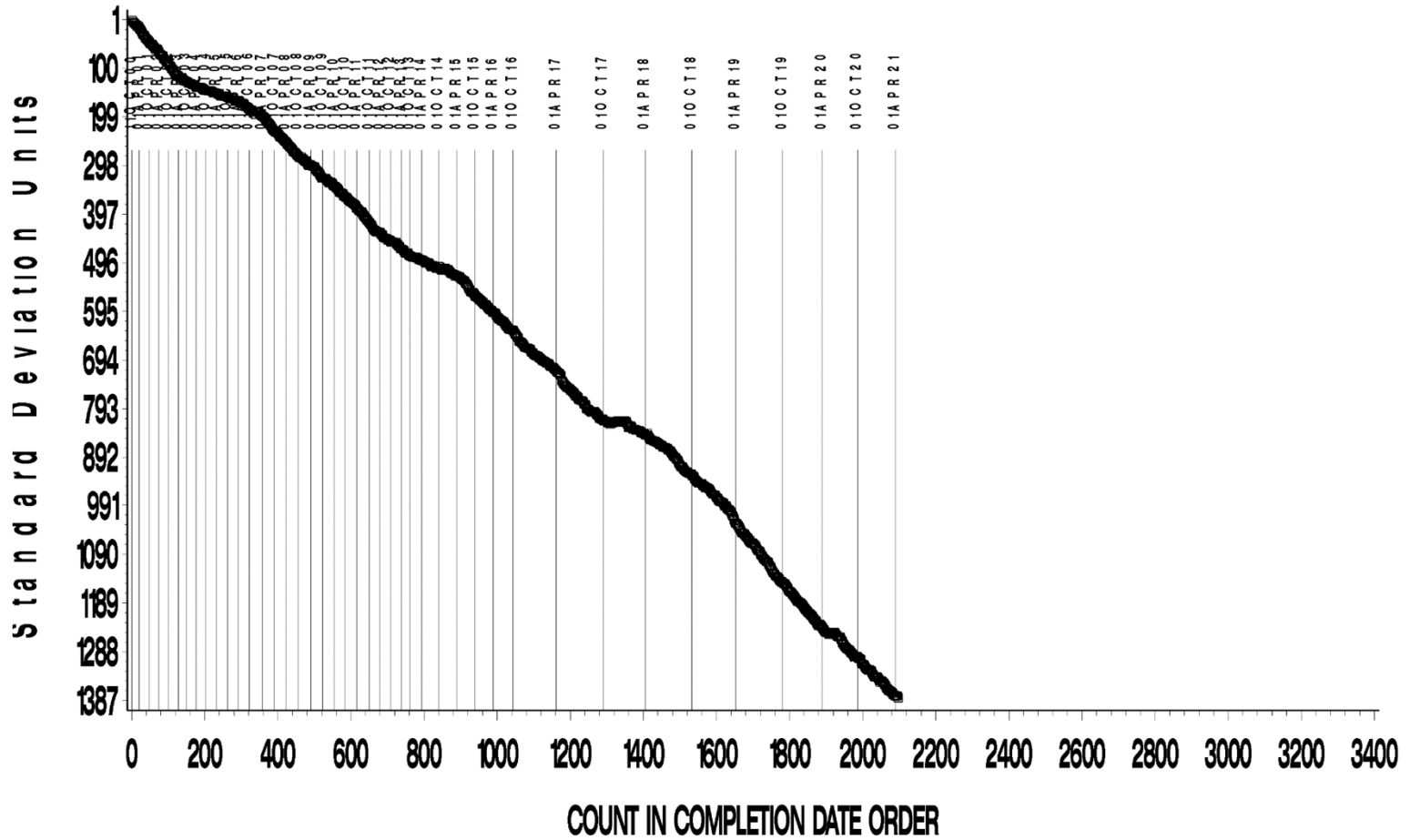
D5800 VOLATILITY BY NOACK INDUSTRY OPERATIONALLY VALID DATA  
 DTCOMP> = '20161019'  
 EVAPORATION LOSS, MASS%



D5800 VOLATILITY BY NOACK INDUSTRY OPERATIONALLY VALID DATA  
 PRCDR='B'  
 EVAPORATION LOSS, MASS%



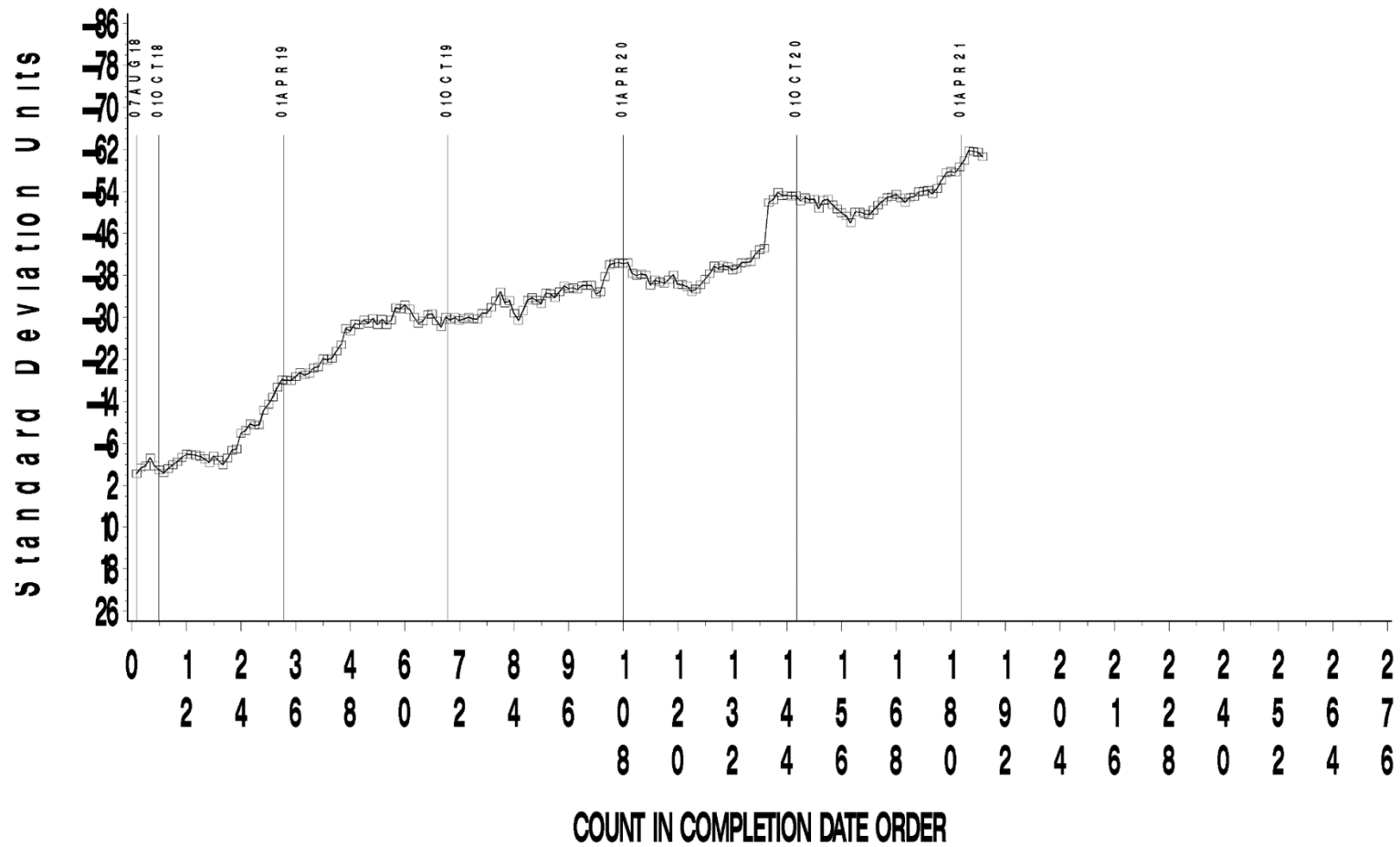
CUSUM Severity Analysis



D5800 VOLATILITY BY NOACK INDUSTRY OPERATIONALLY VALID DATA  
 PRCDR='D'  
 EVAPORATION LOSS, MASS%



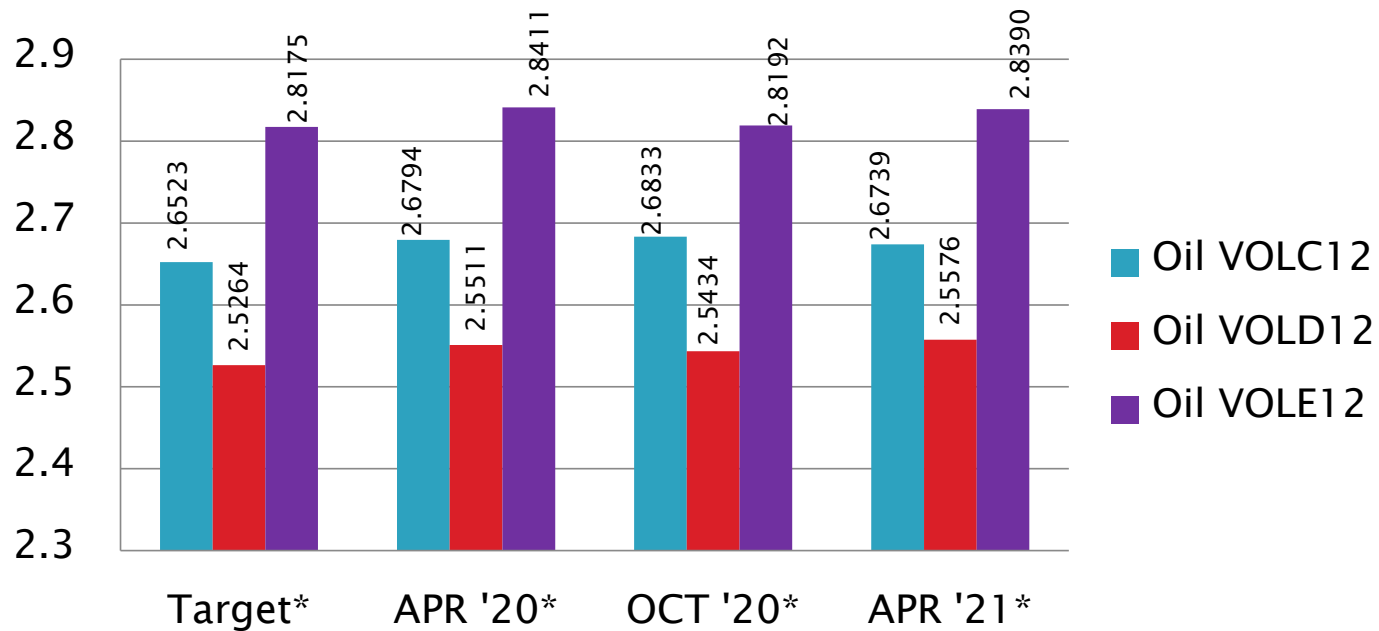
CUSUM Severity Analysis



# D5800 Performance by Oil

Sample Evaporation Loss, mass %

Mean

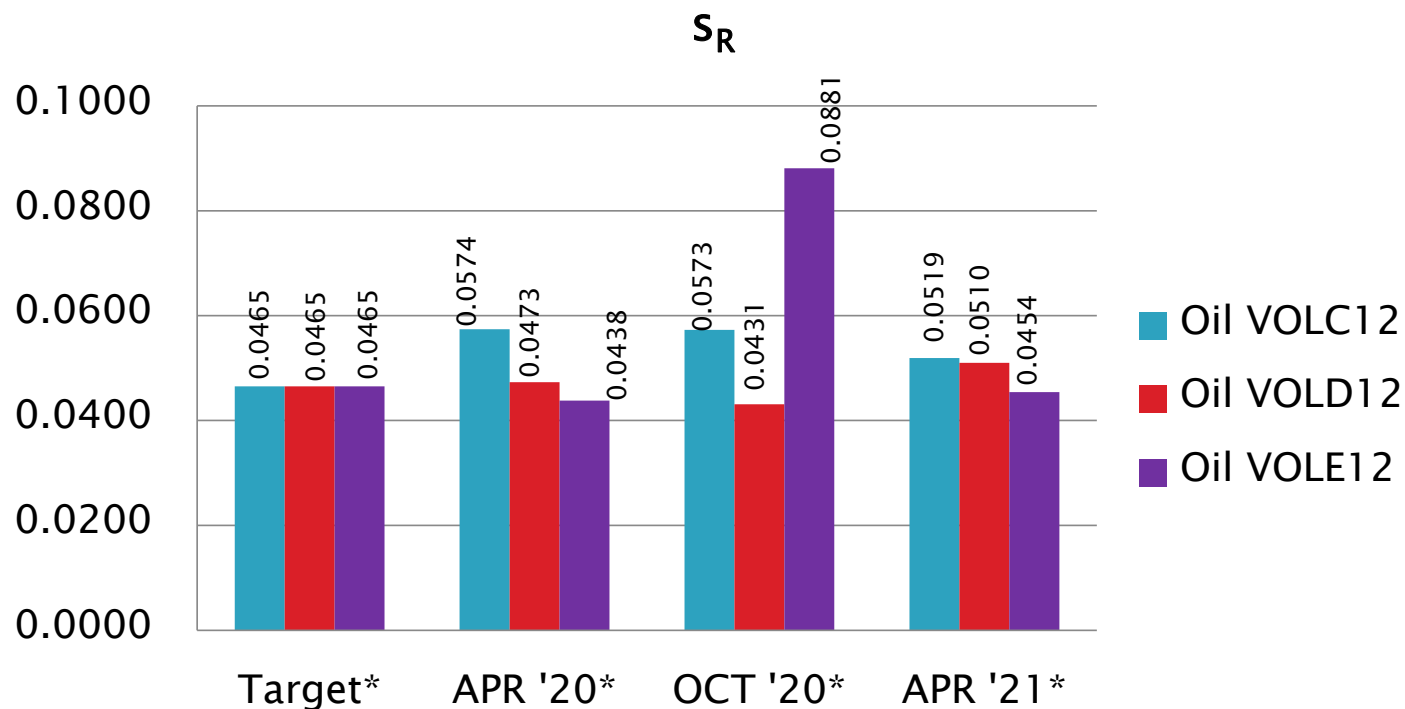


\*Results transformed to natural log per updated LTMS 20200207



# D5800 Performance by Oil

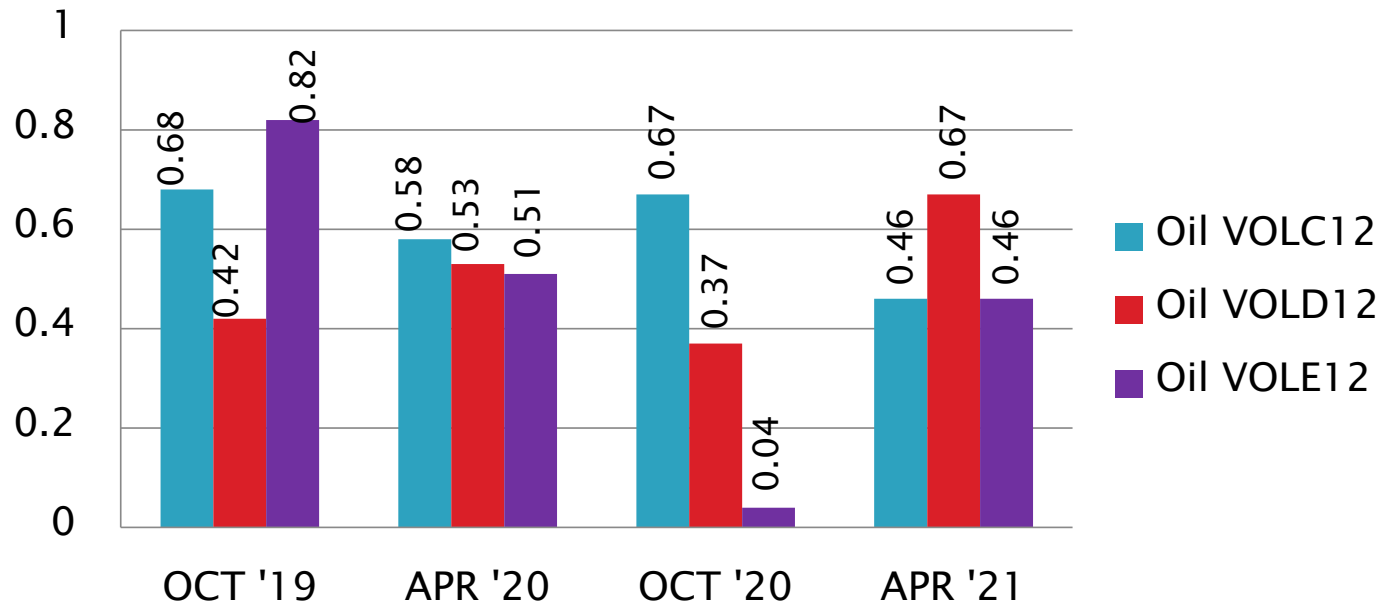
Sample Evaporation Loss, mass %



\*Results transformed to natural log per updated LTMS 20200207

# D5800 Performance by Oil

Sample Evaporation Loss, mass %  
Mean  $\Delta/s$



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# Reference Oil Inventory

»» As of 3/31/2021

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# Reference Oil Inventory

## D5800

Oil	Year Rec'd By TMC <sup>A</sup>	Tests	TMC Inventory, gallons	Gallons Shipped last 12 months
VOLC12	2013	D5800	28.9	1.4
VOLD12	2013	D5800	27.3	1.3
VOLE12	2013	D5800	25.0	1.4
VOLD18	2018	D5800QC	851	116

<sup>A</sup>The integrity of TMC reference oils is confirmed annually by analytical QC testing of chemical and physical properties.

# Reference Oil Inventory

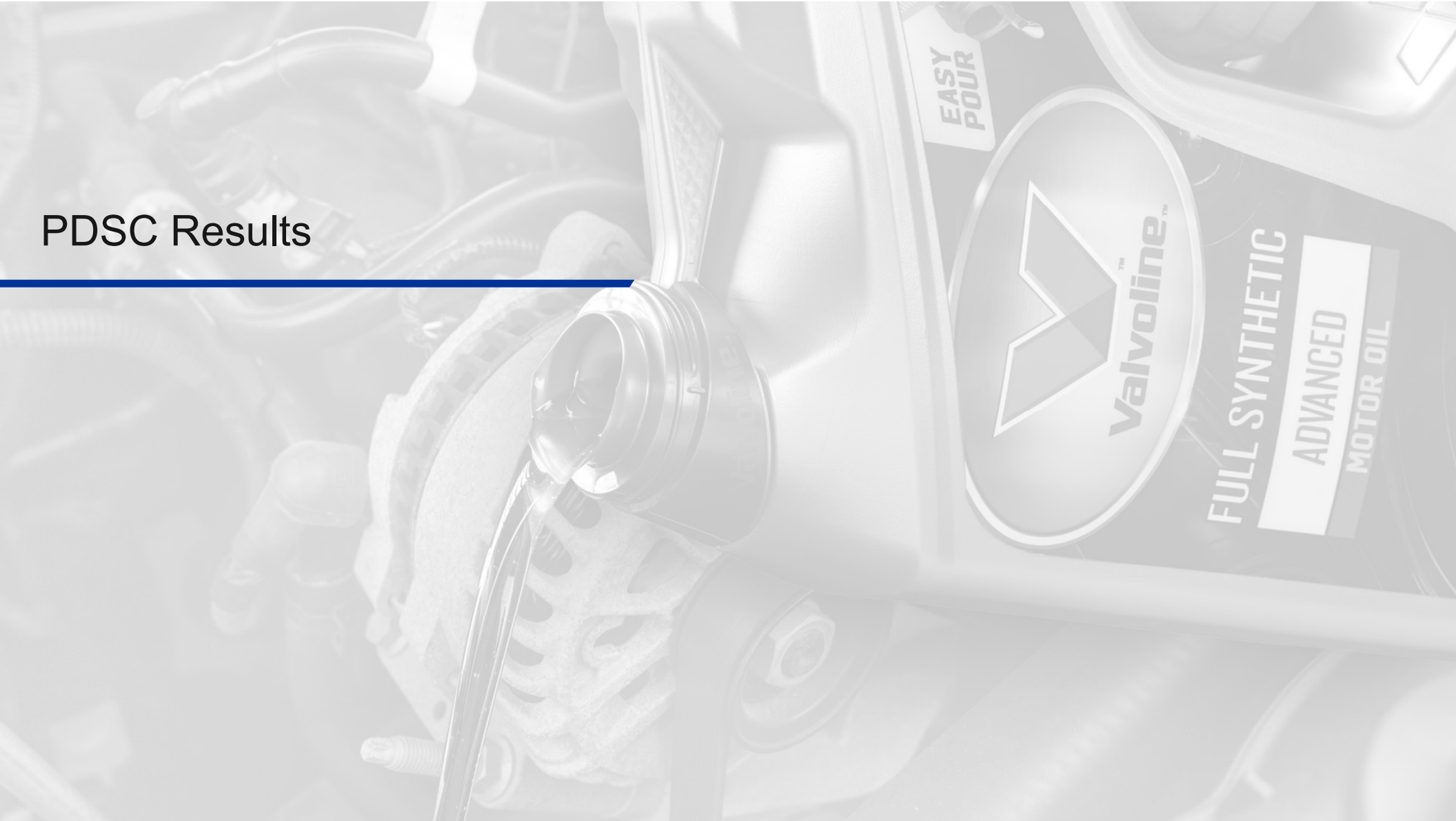
## D6417, GI

Oil	Year Rec'd By TMC <sup>A</sup>	Tests	TMC Inventory, gallons	Gallons Shipped last 12 months
52	1995	D6417	59.4	0.01
55	1995	D6417	66.0	0.01
58	1998	D6417, D6417QC, GI	113.9	1.3
GIA17	2017	GI	8.5	1.3
1009	2002	GI	36.8	0.9

<sup>A</sup> The integrity of TMC reference oils is confirmed annually by analytical QC testing of chemical and physical properties.

# PDSC Results

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## PDSC Results

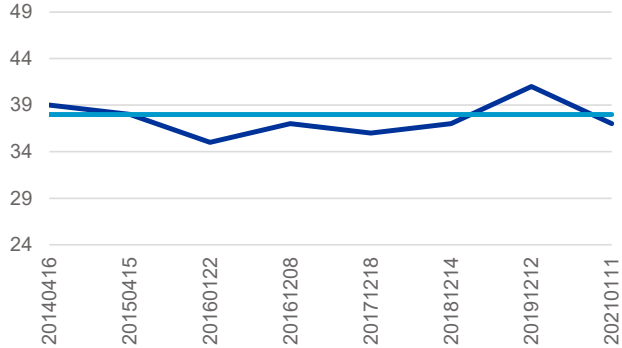
- D5800 Reference Oils Supplemental QC: ASTM D6186 Oxidation Induction time and temp, run until oil 'breaks'

	VOLC12		VOLD12		VOLE12		VOLD14		VOLD18	
Report Date	minutes	Deg C	minutes	Deg C	minutes	Deg C	minutes	Deg C	minutes	Deg C
20140416	39	210	26	210	27	210	----	----	----	----
20150415	38	210	25	210	24	210	21	210	----	----
20160122	35	210	24	210	24	210	23	210	----	----
20161208	37	210	25	210	24	210	24	210	----	----
20171218	36	210	26	210	24	210	24	210	----	----
20181214	37	210	25	210	26	210	26	210	23	210
20191212	41	210	25	210	25	210	----	----	24	210
20210111	37	210	26	210	27	210	----	----	24	210
average	38		25		25				24	
SD	2		1		1				1	
2021 Diff	-1		1		2				0	

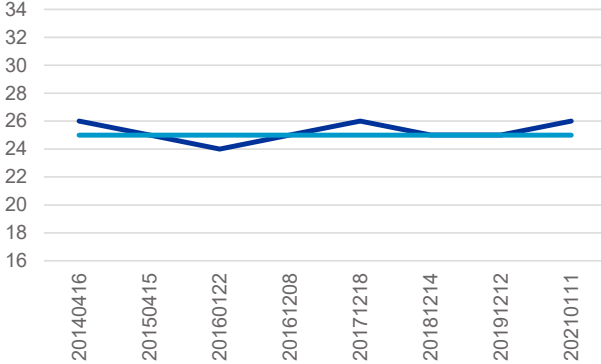
*Thank you to SwRI for donating this data!*

# PDSC Results

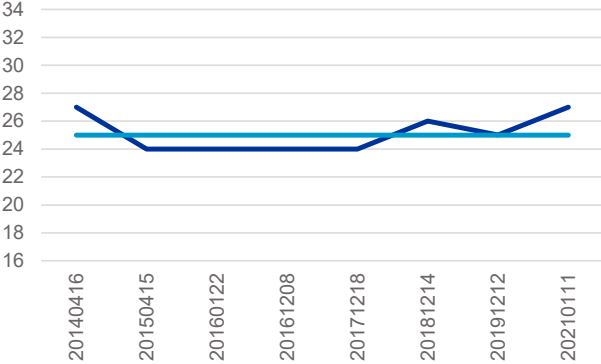
VOLC12



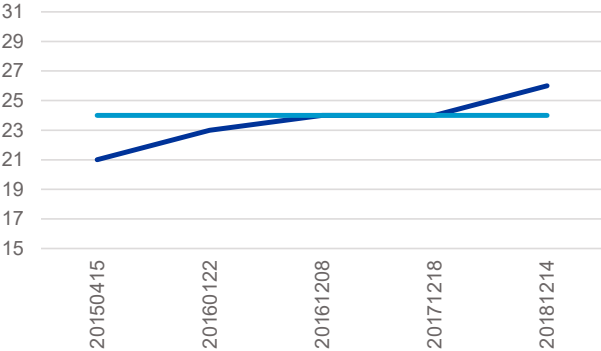
VOLD12



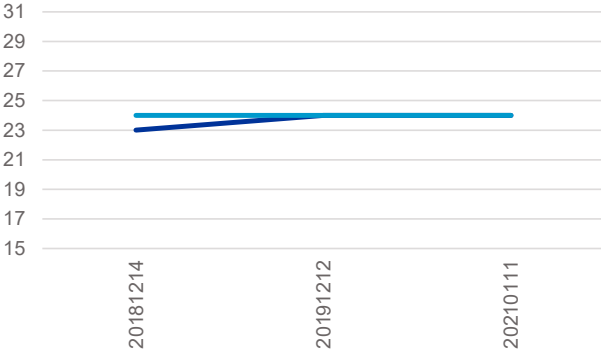
VOLE12



VOLD14



VOLD18







Other Items?

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