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Test Monitoring Center

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GM

Reference Test Activity

Reference tests completed 10/1/2023 – 3/31/2024

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Summary of Tests

- GMAER - Aeration continues to trend mild at about the same level since 2019
- GMOD –All parameters in control. Reblend is available for GMOD02. Initial tests have been completed on GMOD01-2.
- GMOEE - Severity trending at or near historic levels
- GMSPI3 – Test activity lower this period with severity near historic levels
- GMTTC – Near target this period (with one test result reported)

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Calibrated Labs and Stands*

Test	Labs	Stands
GMOD	4	4
GMAER	2	3
GMOEE	2	6
GMSP13	1	1
GMTC	1	1

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*As of 3/31/2024

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GMAER

April 2024

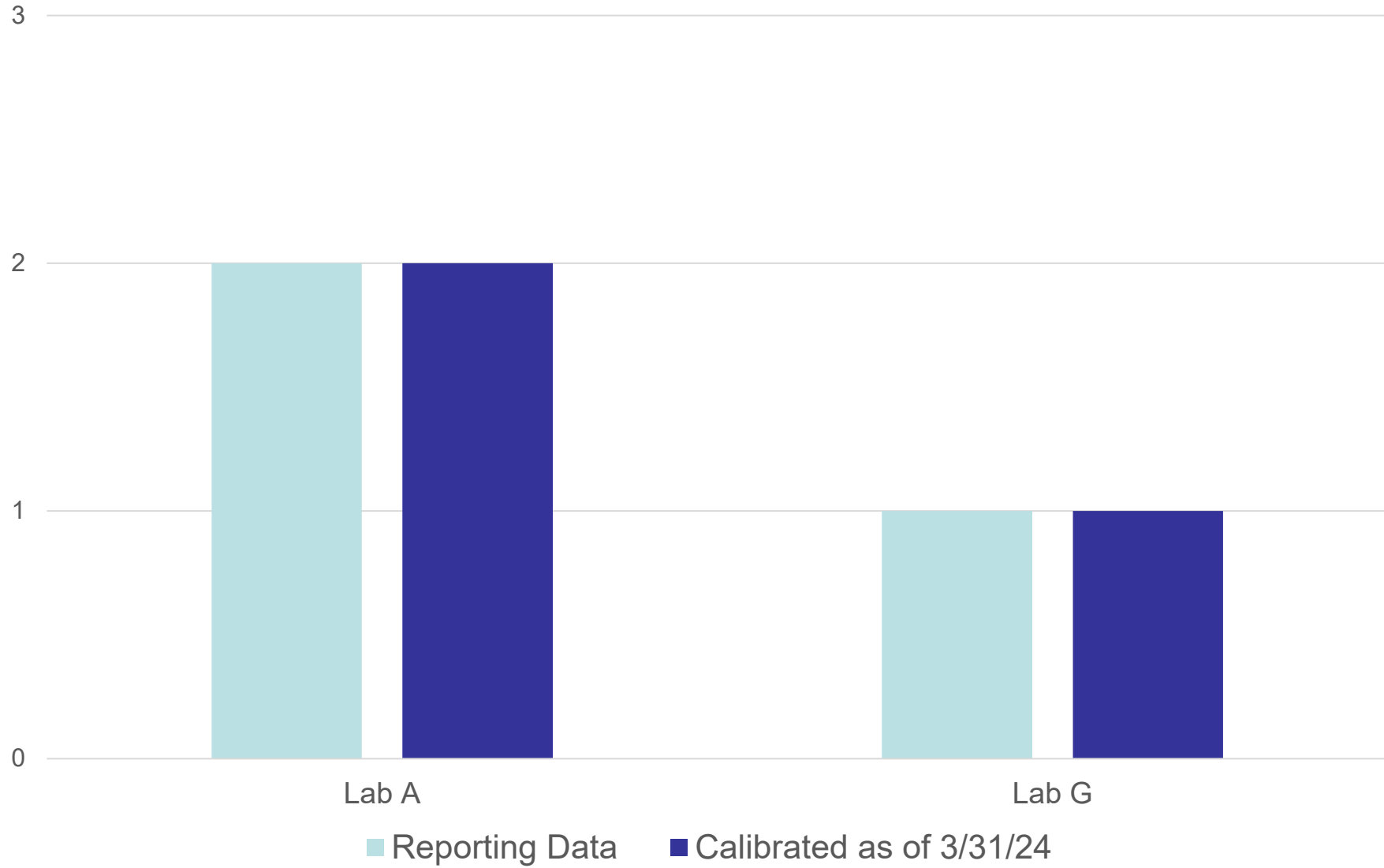
Summary of Activity

- Three calibrated stands in two laboratories
- Aeration continues to trend mild at about the same level since 2019

GMAER Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	4
Operationally Invalid Calibration Test	XC	1
Total		5

Calibrated Labs and Stands



GMAER - Failed Tests

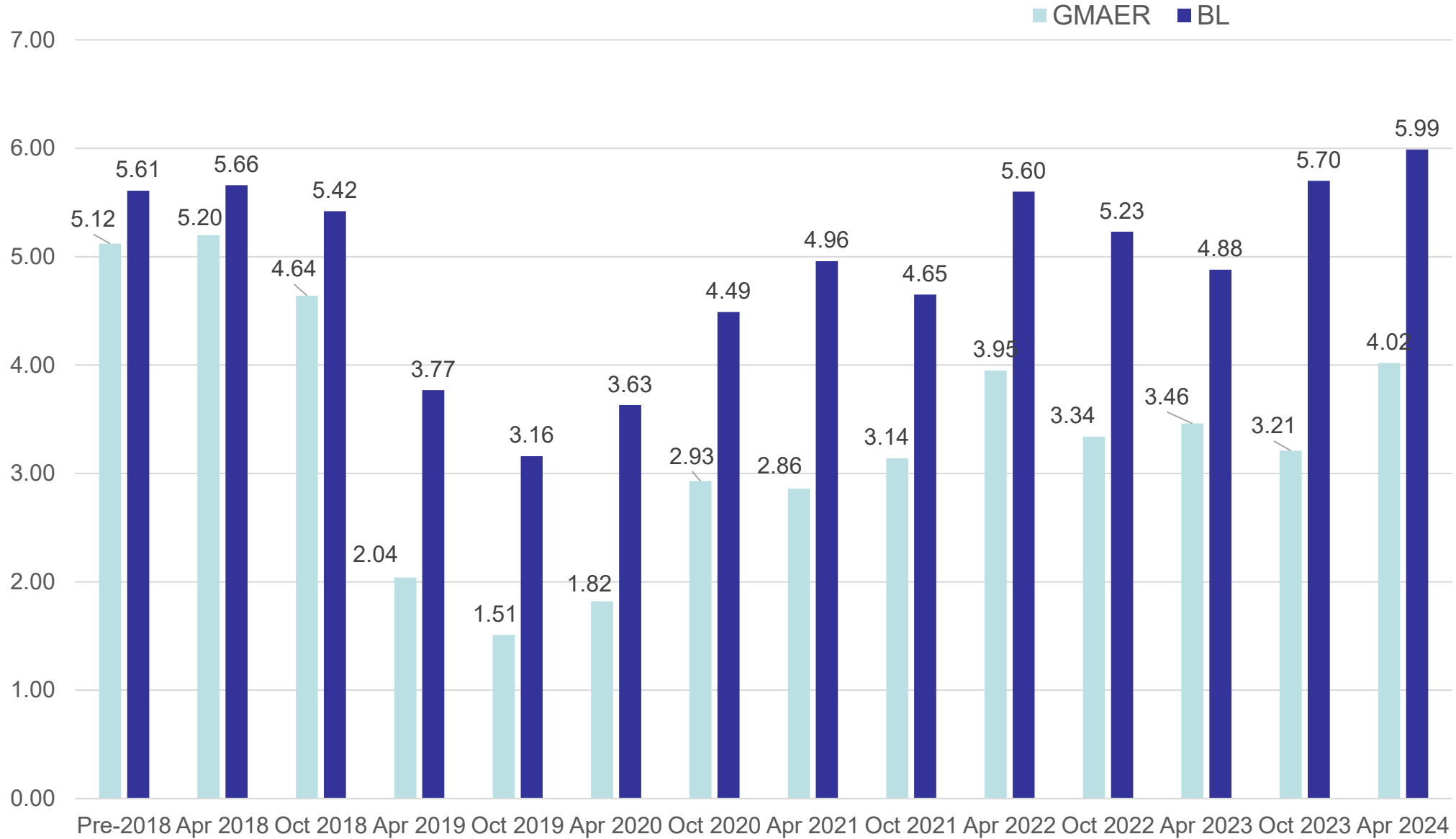
Test Status	#
No failed tests	-
Totals	0

GMAER - Lost Tests*

Test Status	#
Shutdown due to O ₂ sensor failure	1
Totals	1

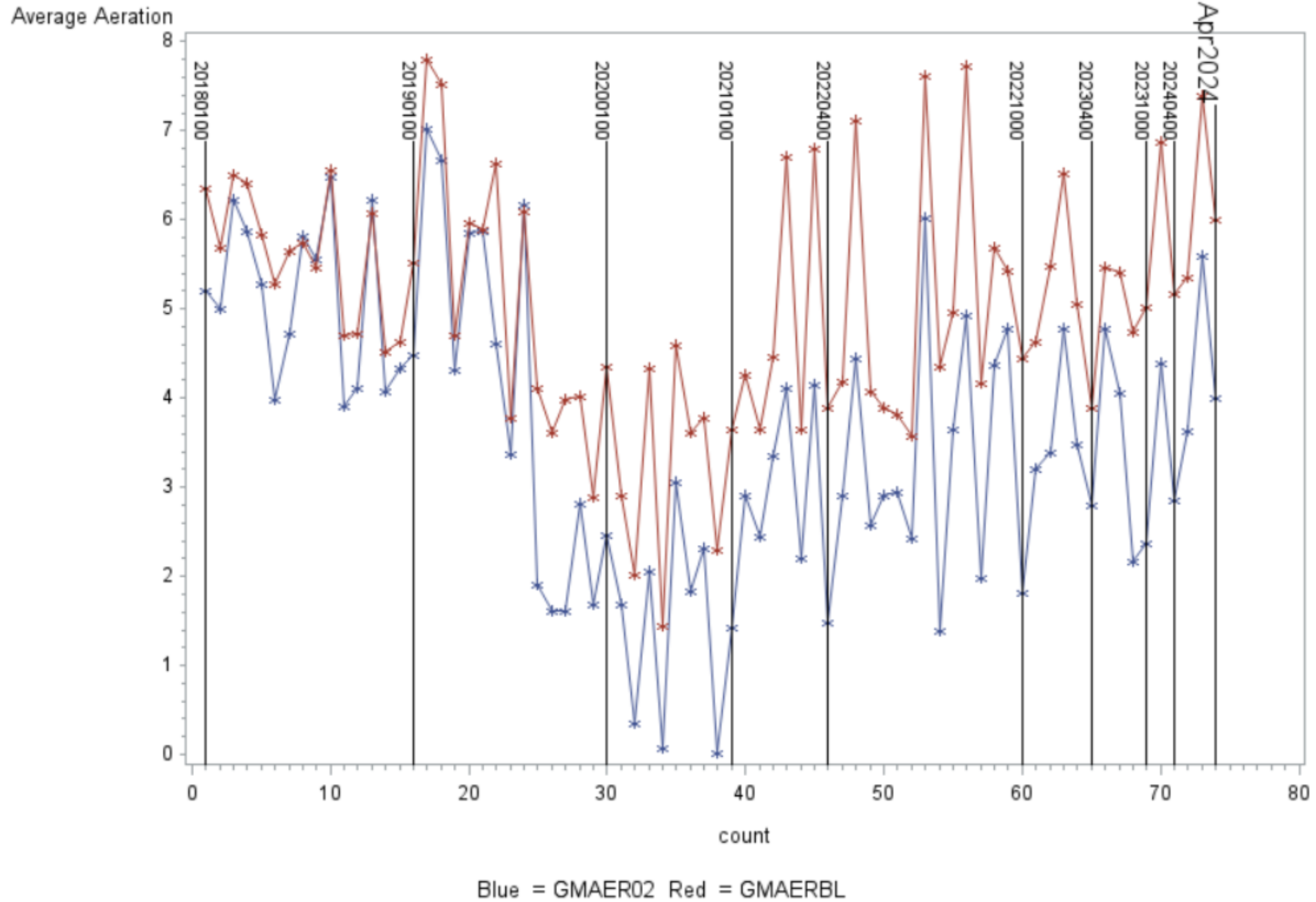
*Invalid and aborted tests

Average Aeration by Report Period

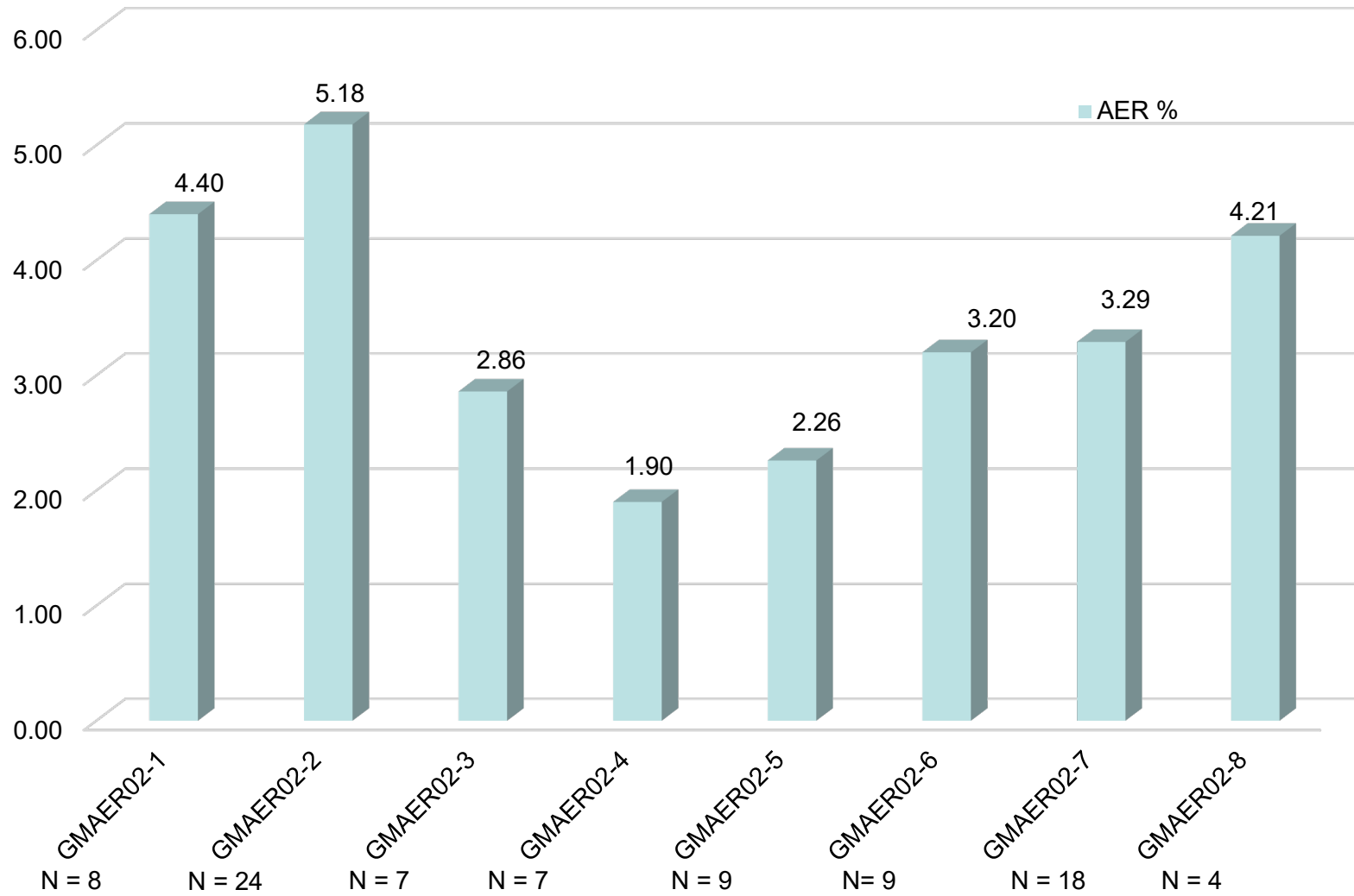


GM Aeration Test

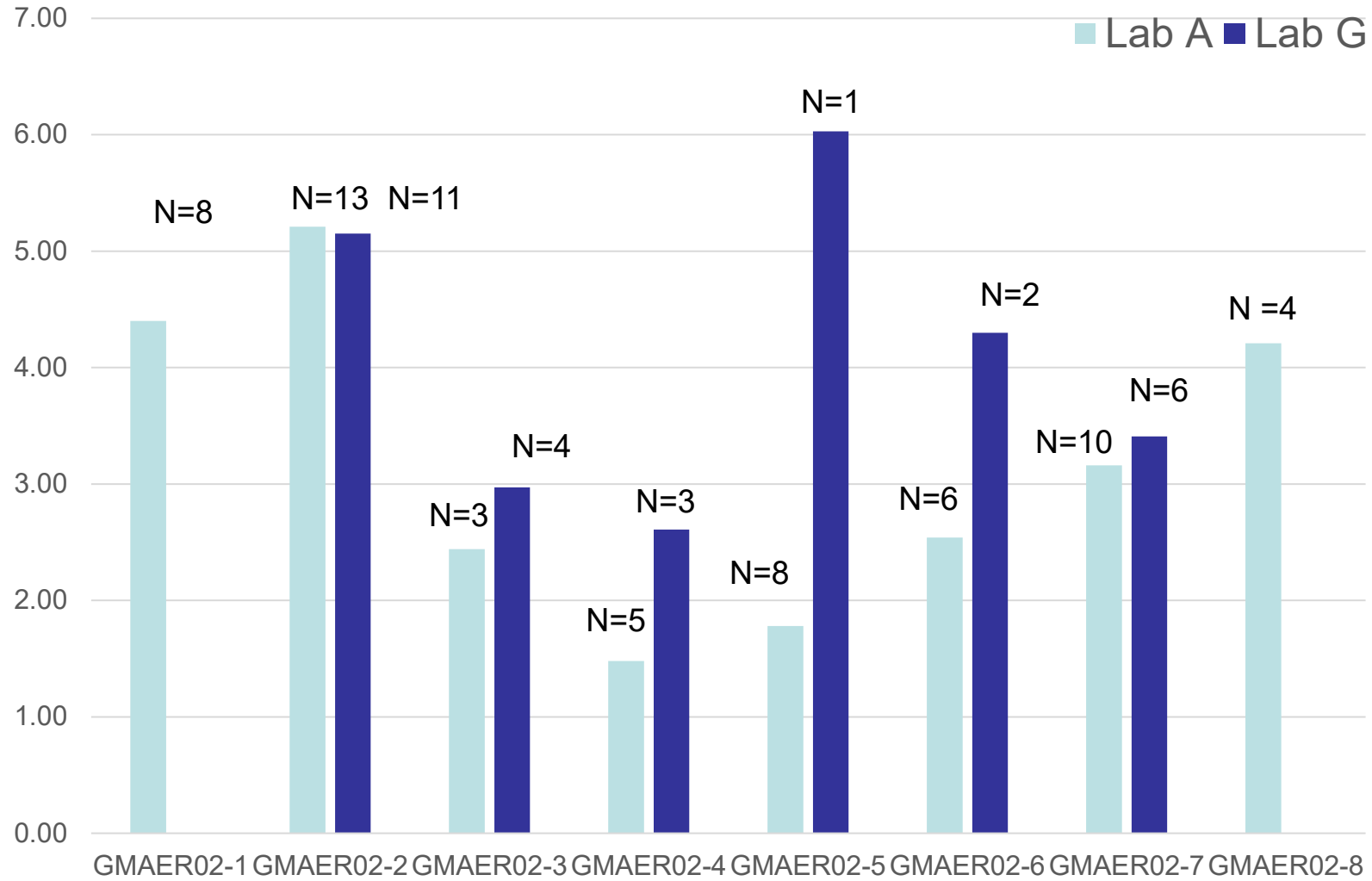
GMAER02 and GMAERBL Reference Test Results



Average AER by Reference Oil Batch



Average Aeration by Lab and Reference Oil Blend



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GMOD

April 2024

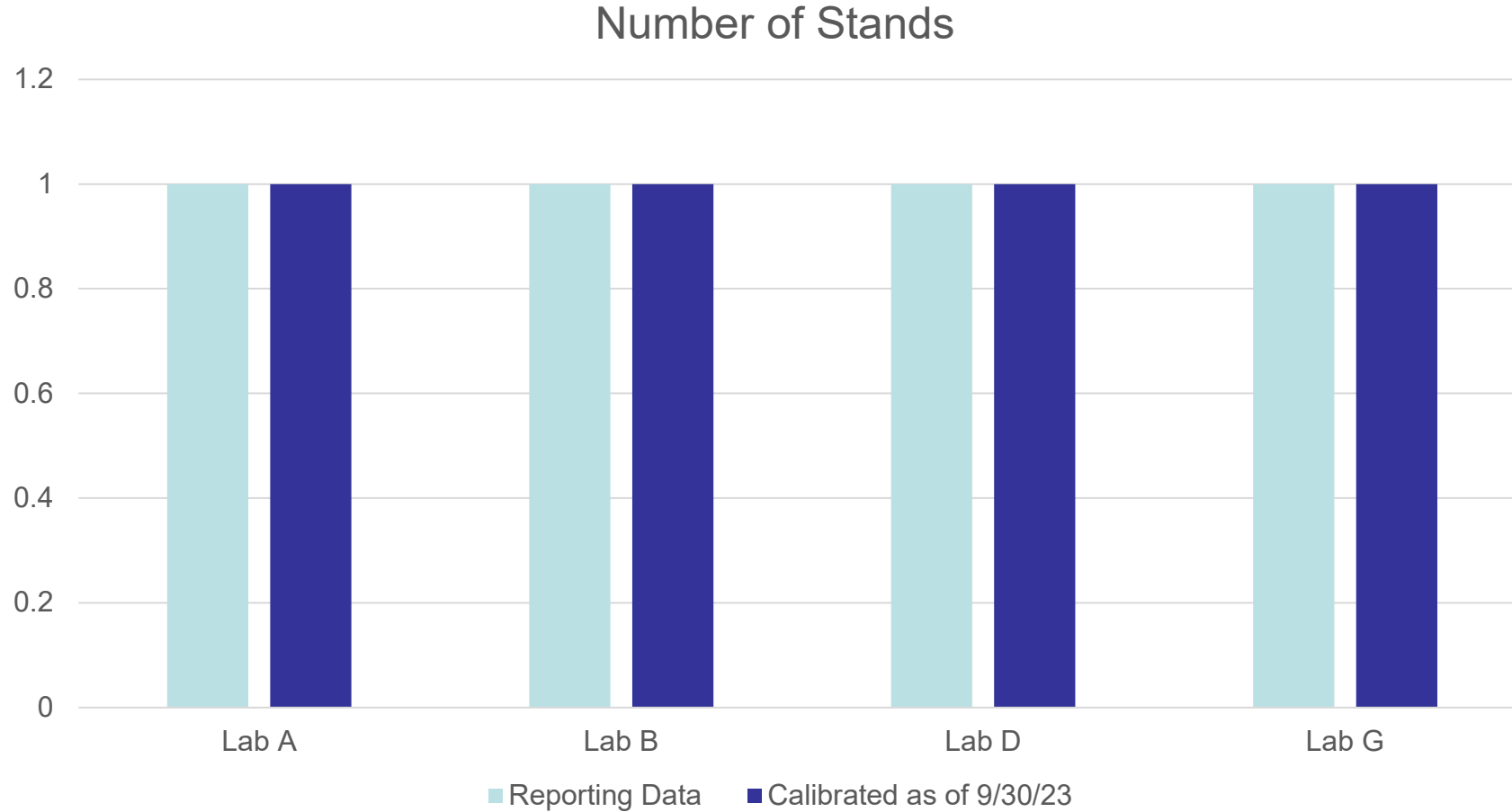
Summary of Activity

- Four calibrated stands in four laboratories
- Reference oils
 - Less than a year supply of GMOD01-1 and approximately a year supply of GMOD02-1 at TMC, reblends of both oils available. 5 GM sponsored tests reported. ASTM statistical group reviewing the results and will make recommendation on targets.
 - RO 434-3 successfully re-introduced.
 - GMOD Test Team agreed to new targets for Reference Oil 434-3. LTMS document updated to allow use with new targets.
- All parameters in control for severity and precision

GMOD Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	6
Terminated Calibration Tests	XC	1
GM Sponsored Test on Reblend	AI	5
Invalid GM Sponsored Tests on Reblend	LI	2
Total		14

GMOD Test Stands



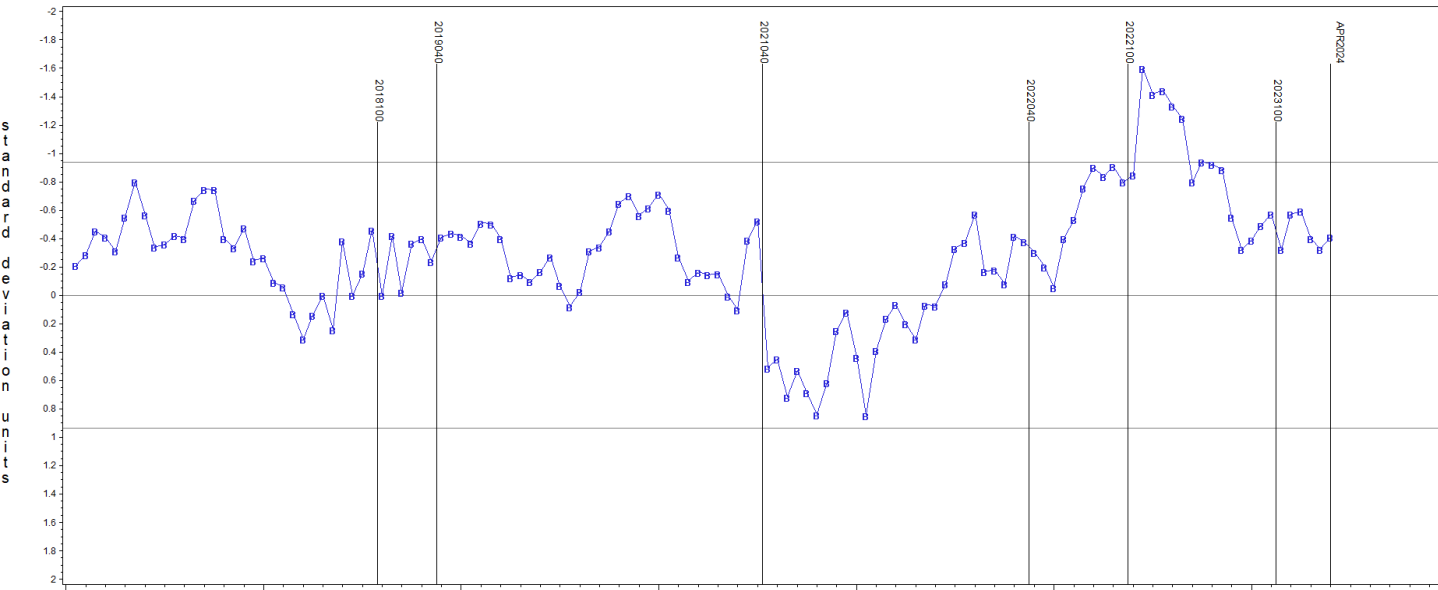
GMOD - Failed Tests

Test Status	#
No failed tests this report period	0
Total	0

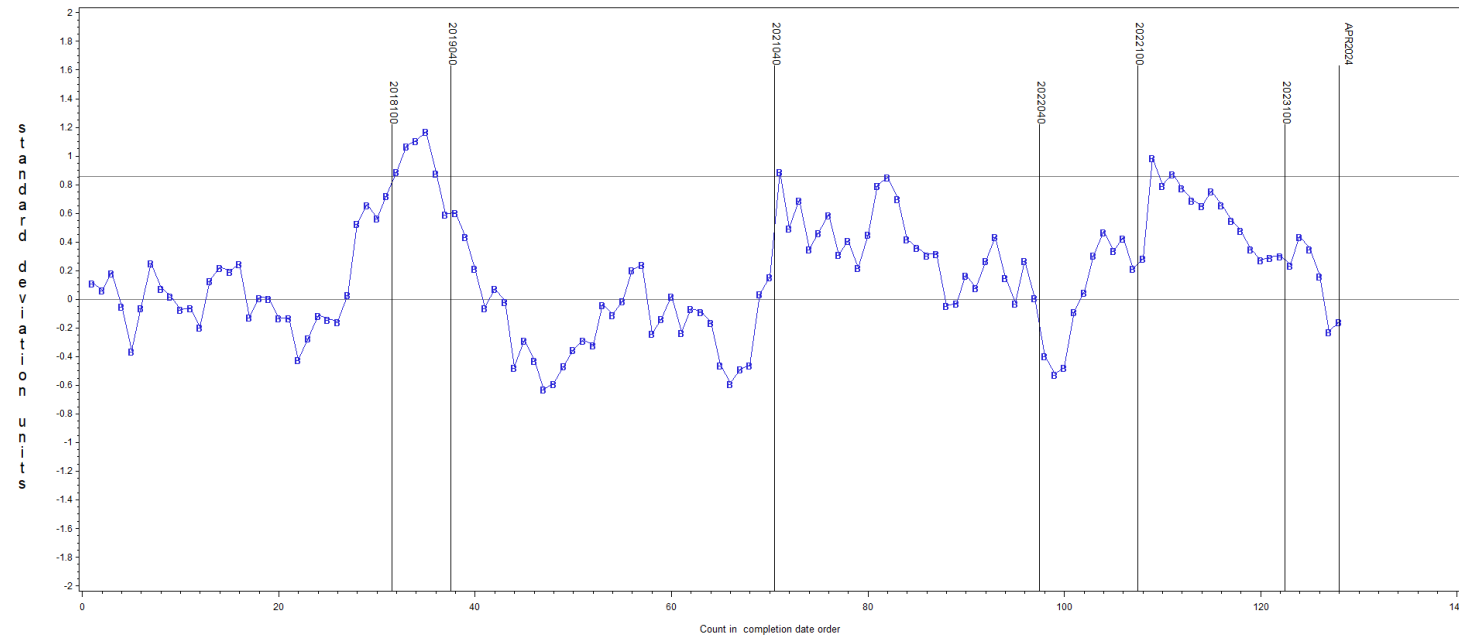
GMOD – Lost Tests

Test Status	Validity	#
Terminated Calibration Test, coolant temperature control issues	XC	1
Invalid GM Sponsored Test, high oil consumption	LI	1
Invalid GM Sponsored Test, oil pressure control issues	LI	1
Total		3

GM Oxidation and Deposit Test
PVIS LTMS Severity Analysis



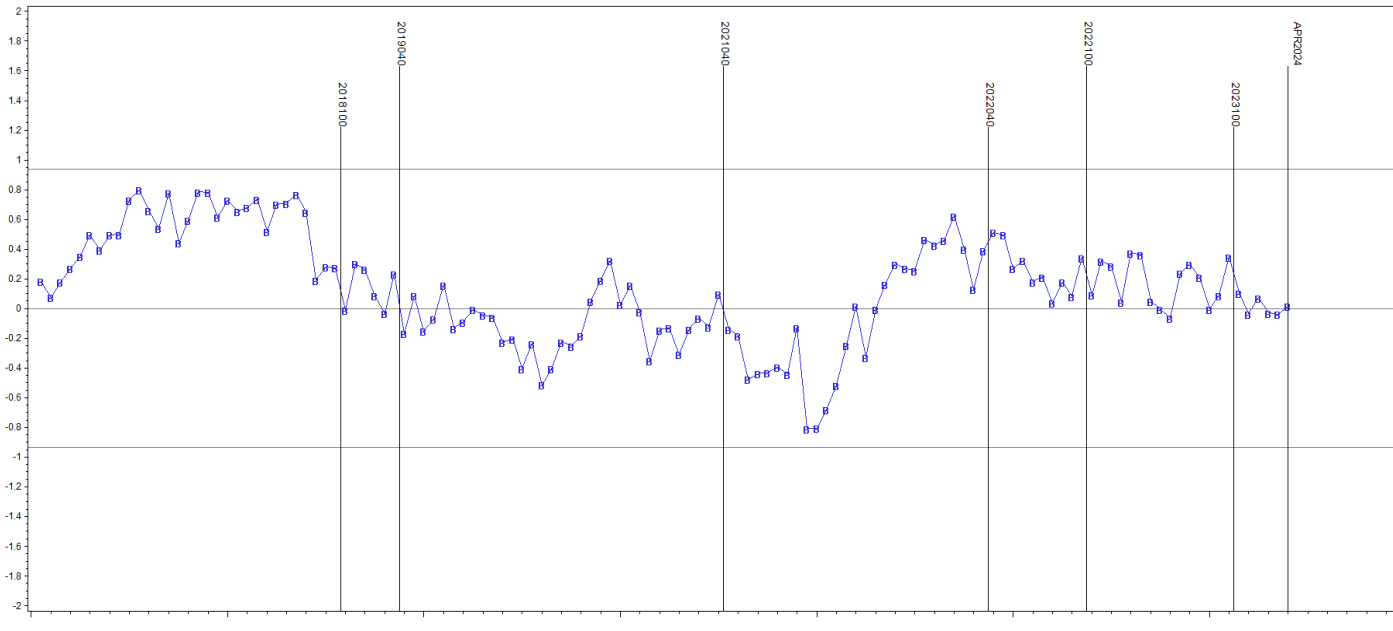
GM Oxidation and Deposit Test
PVIS LTMS Precision Analysis



PVIS Severity / Precision

- PVIS was in control for both severity and precision
- Severity is trending mild relative to precision matrix targets

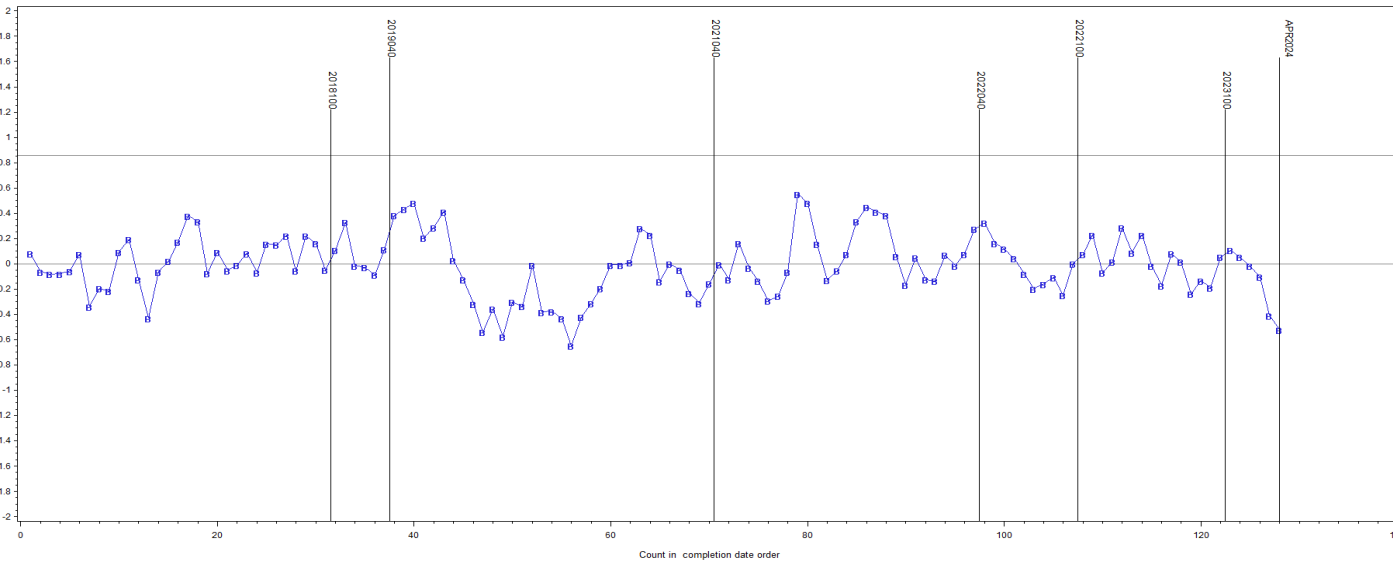
GM Oxidation and Deposit Test
WPD LTMS Severity Analysis



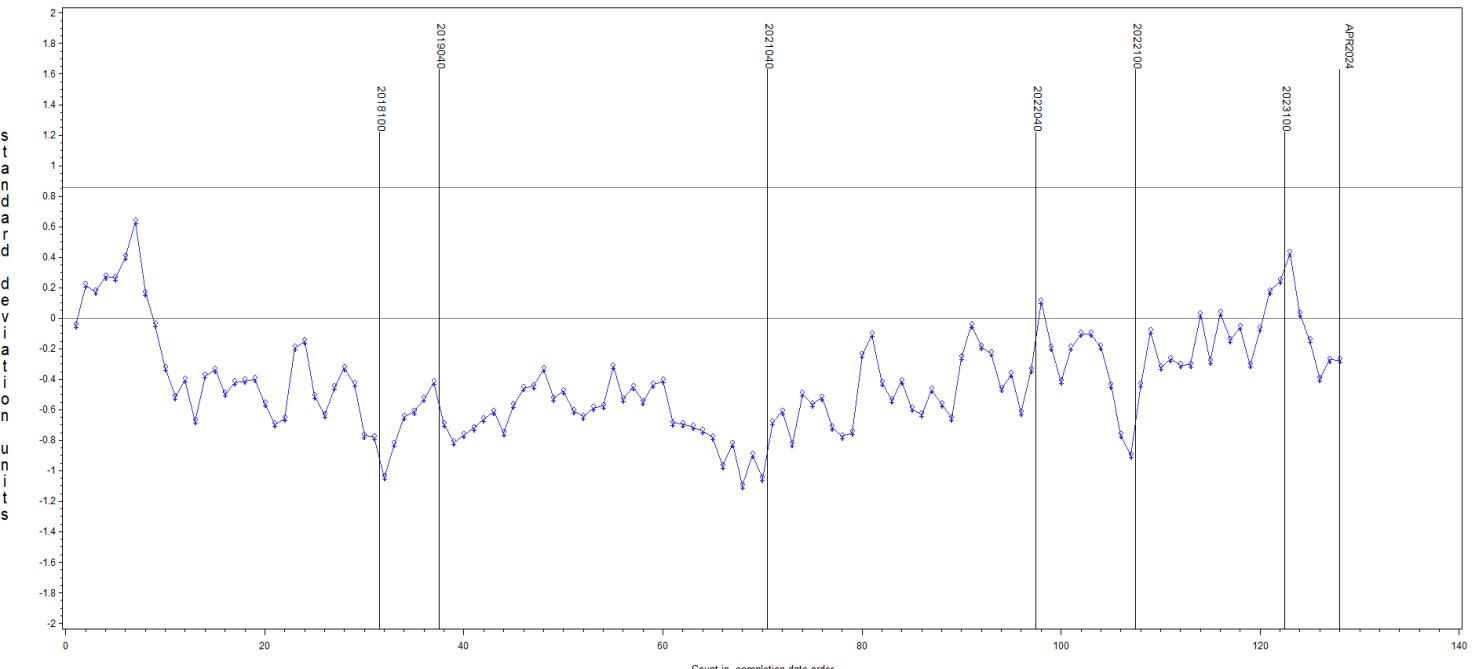
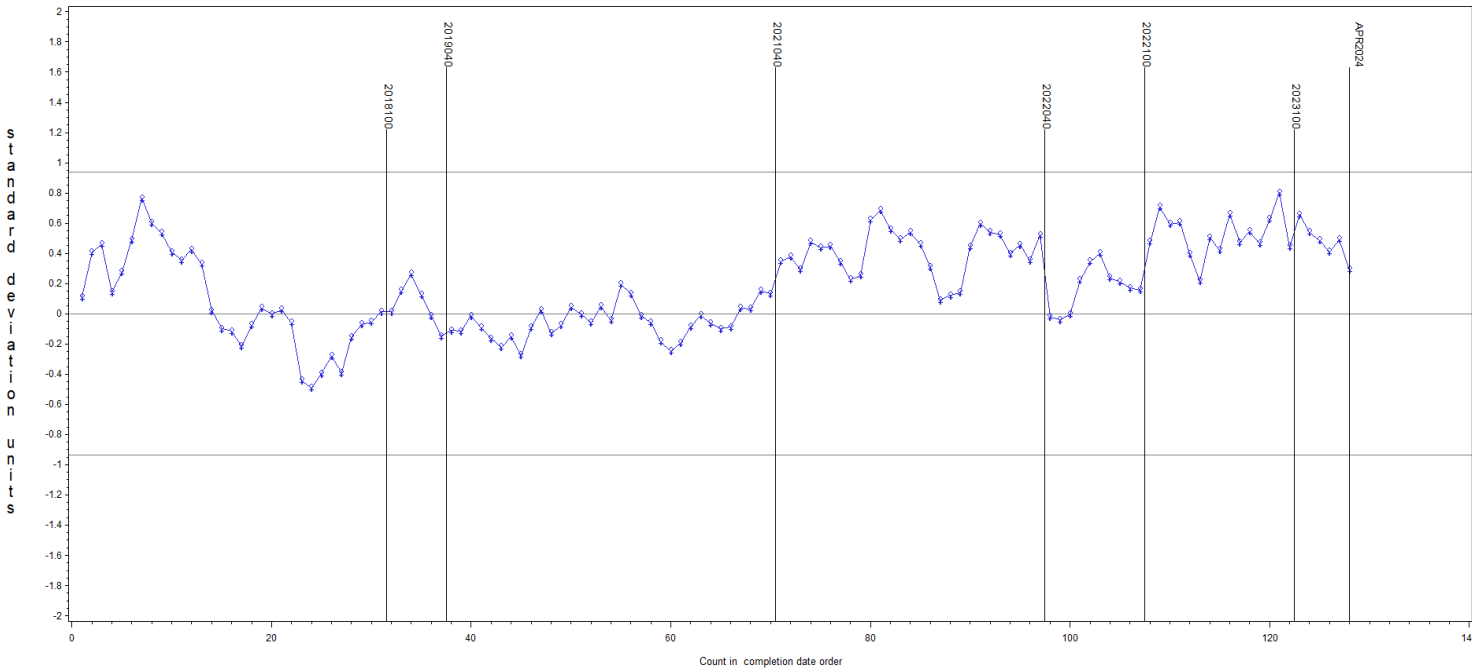
WPD Severity / Precision

- WPD is in control for severity and precision
- Severity is on or near target

GM Oxidation and Deposit Test
WPD LTMS Precision Analysis



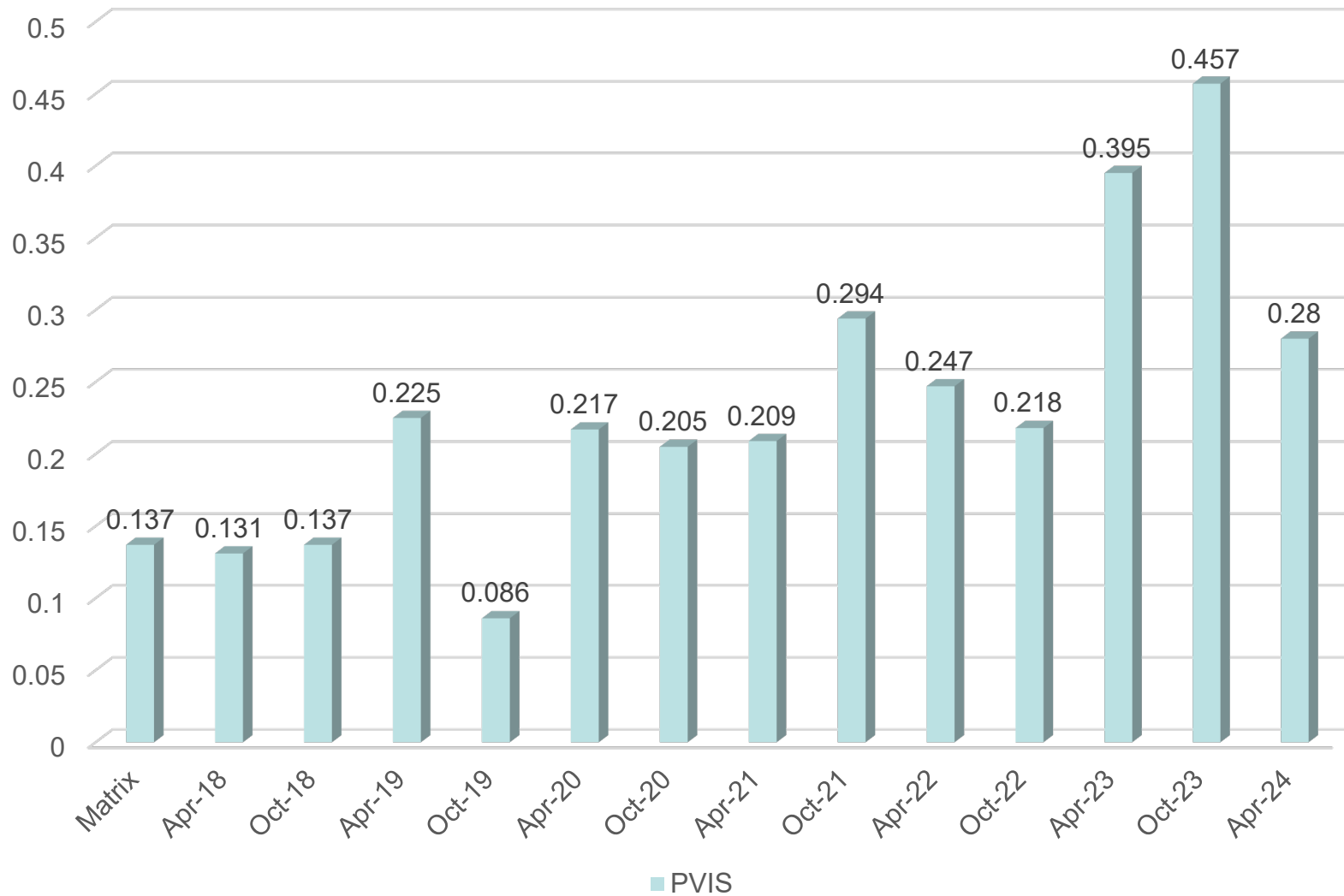
GM Oxidation and Deposit Test
PHOS LTMS Severity Analysis



PHOS Severity / Precision

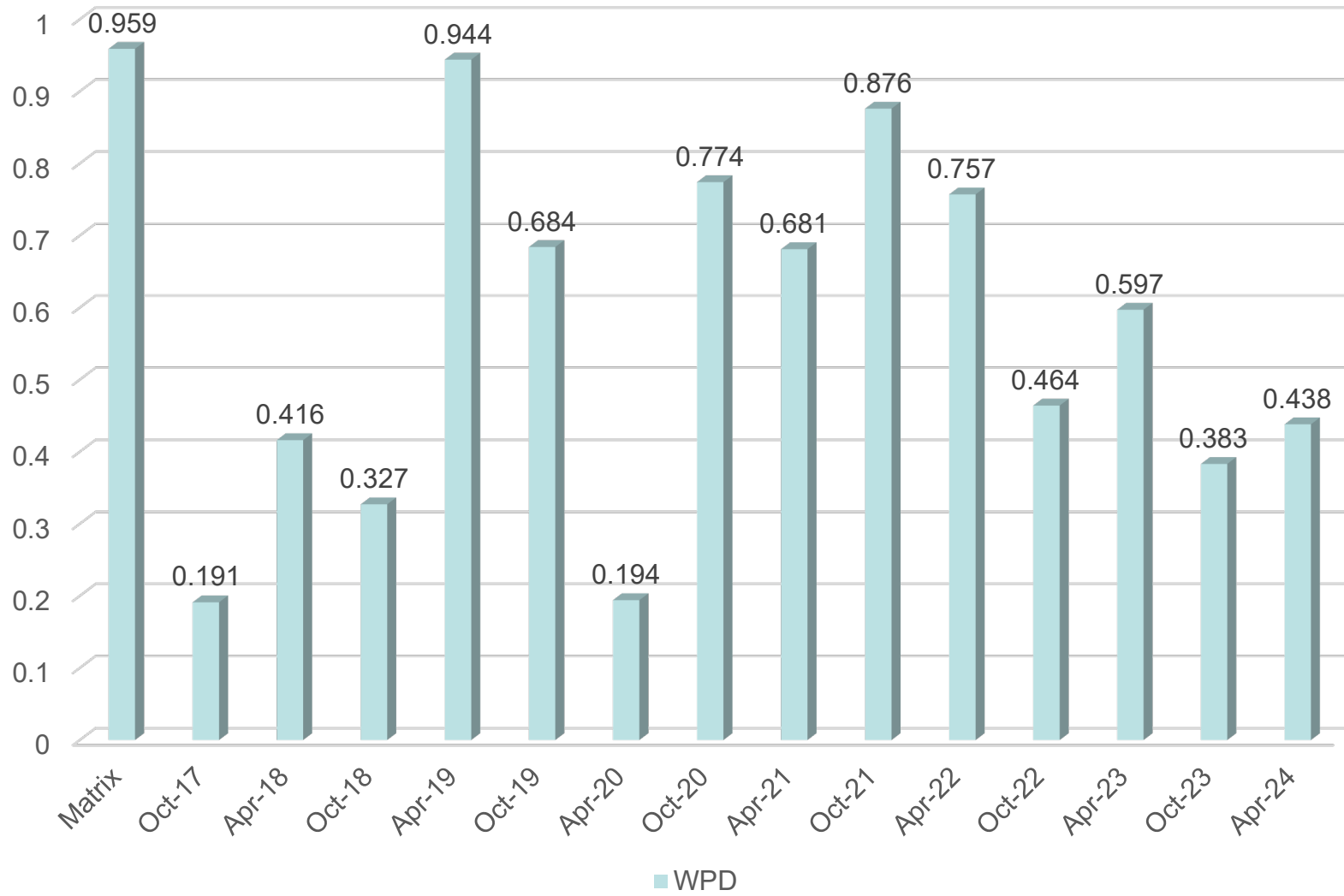
- PHOS is in control for severity and precision
- Appears to be trending mild relative to precision matrix targets (not a calibration criteria)

PVIS – Pooled s Values by Report Period

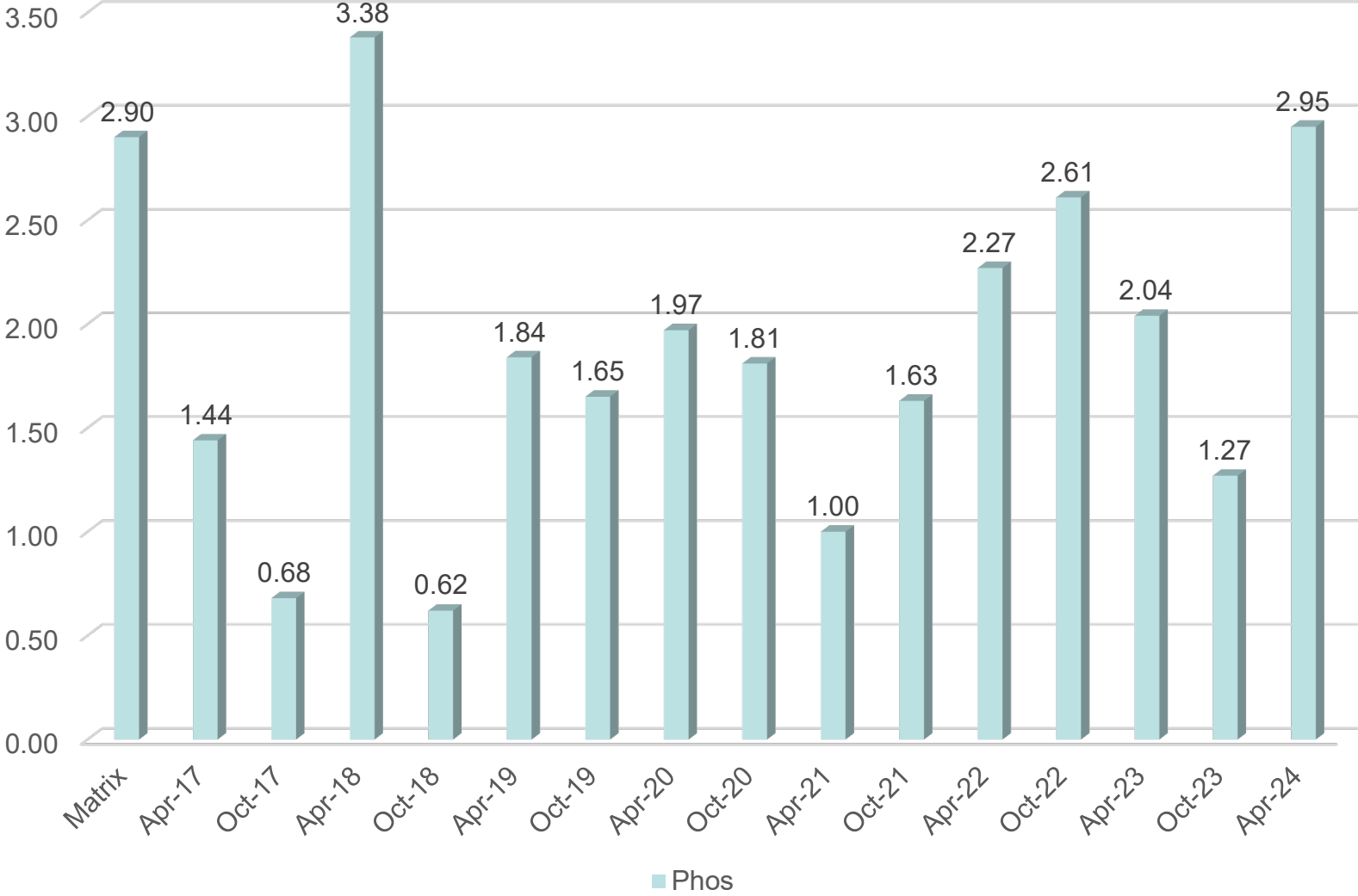


PVIS estimates calculated in transformed units

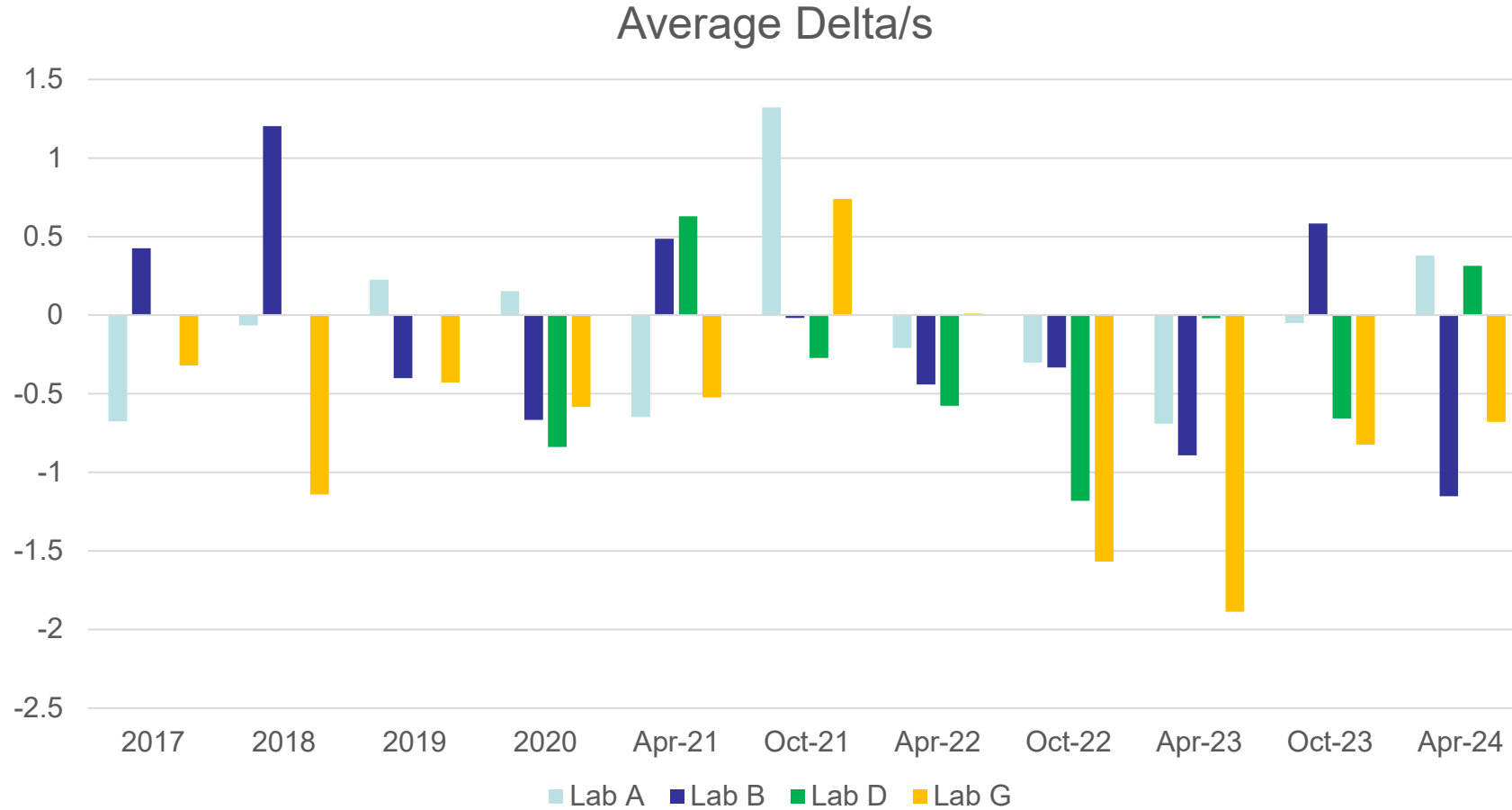
WPD – Pooled s Values by Report Period



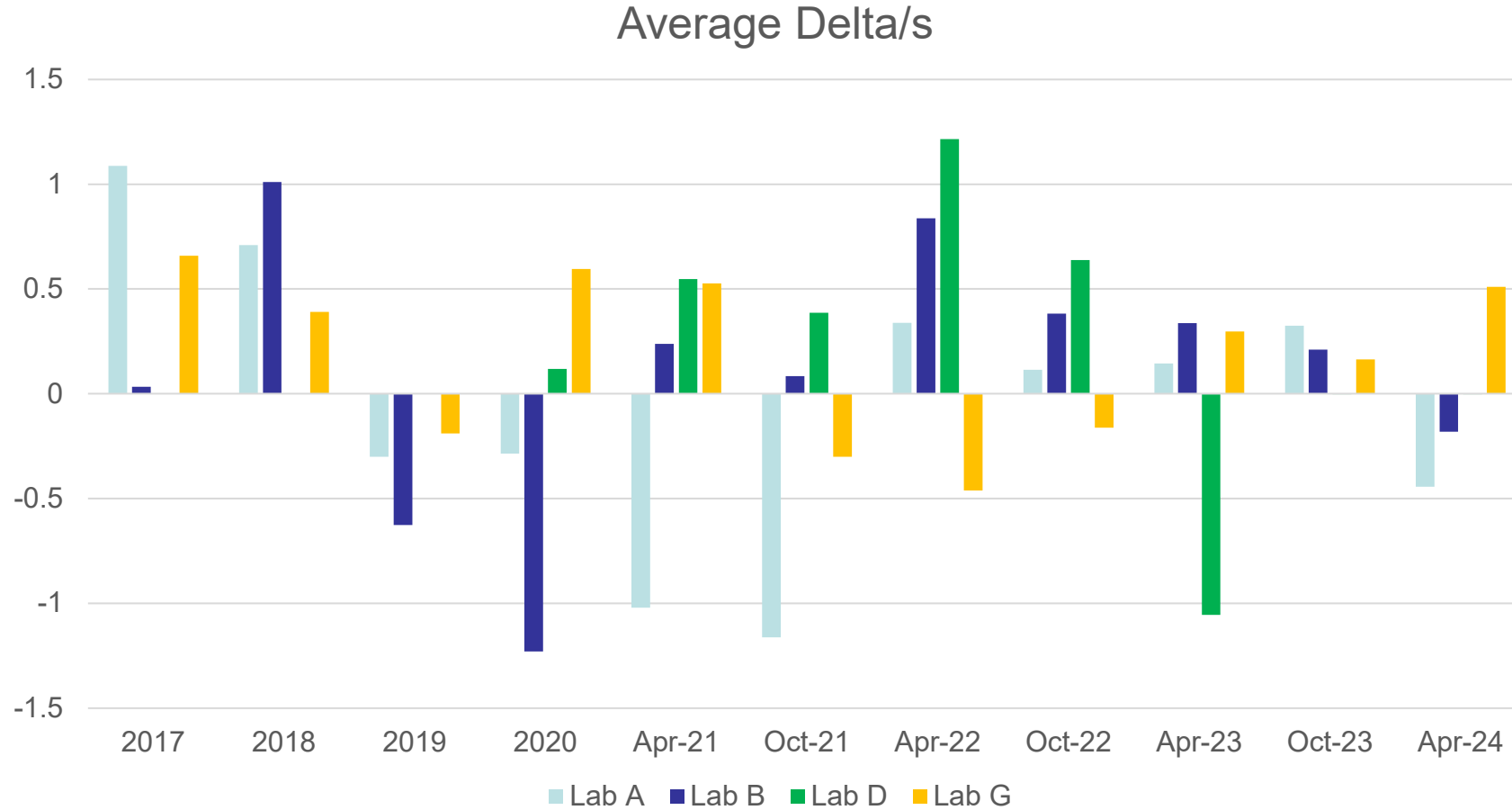
PHOS – Pooled s Values by Report Period



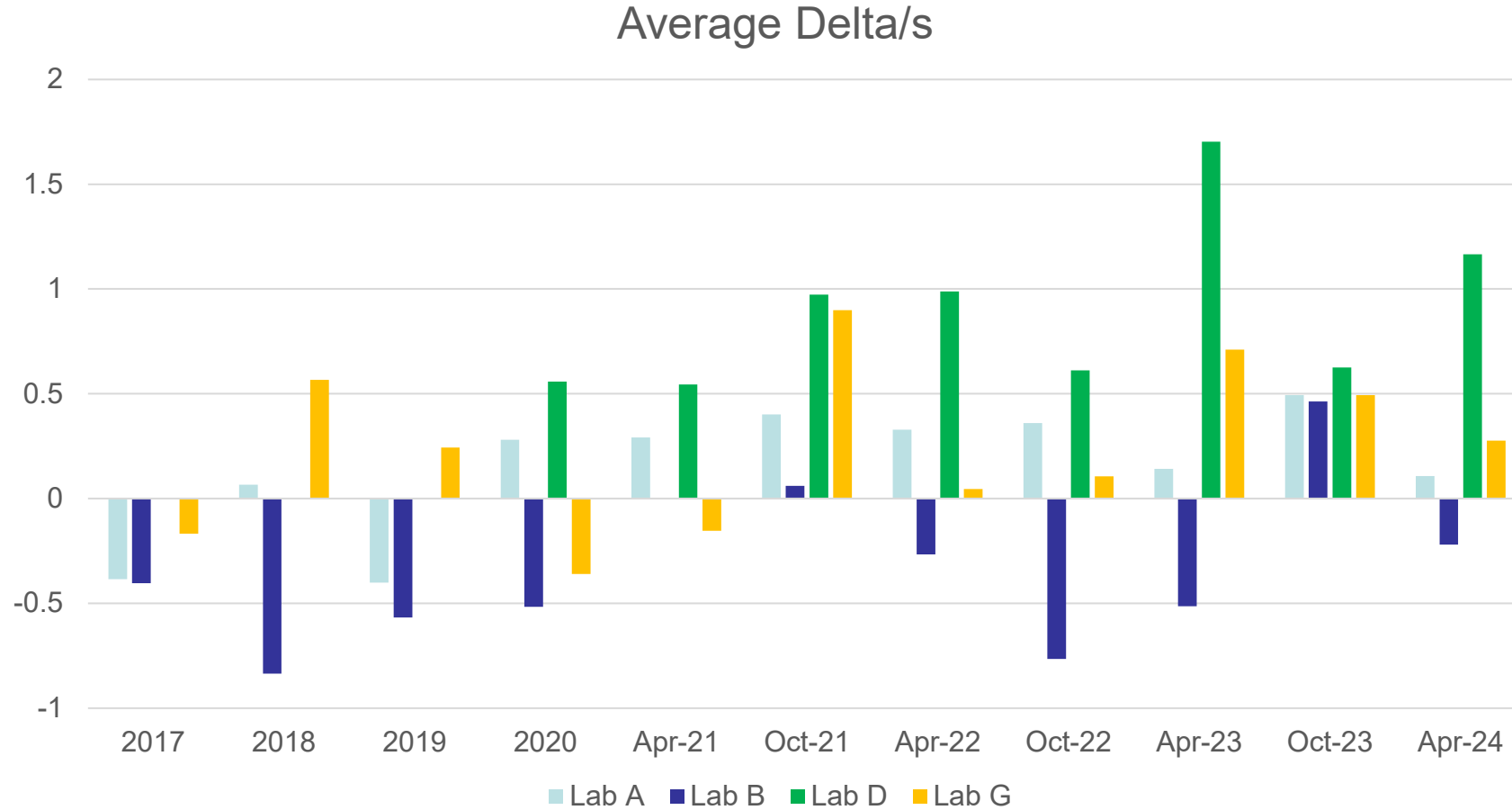
Average delta/s by Lab % Viscosity Increase



Average delta/s by Lab Weighted Piston Deposits



Average delta/s by Lab % Phosphorus Retention



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GMOEE

April 2024

Summary of Activity

- 3 calibrated stands in 2 laboratories
- Severity has been severe when compared to previous periods.

GMOEE Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	3
Statistically Unacceptable Calibration Test	OC	1
Aborted Calibration Test	XC	1
Total		5

Calibrated Labs and Stands



GMOEE - Failed Tests

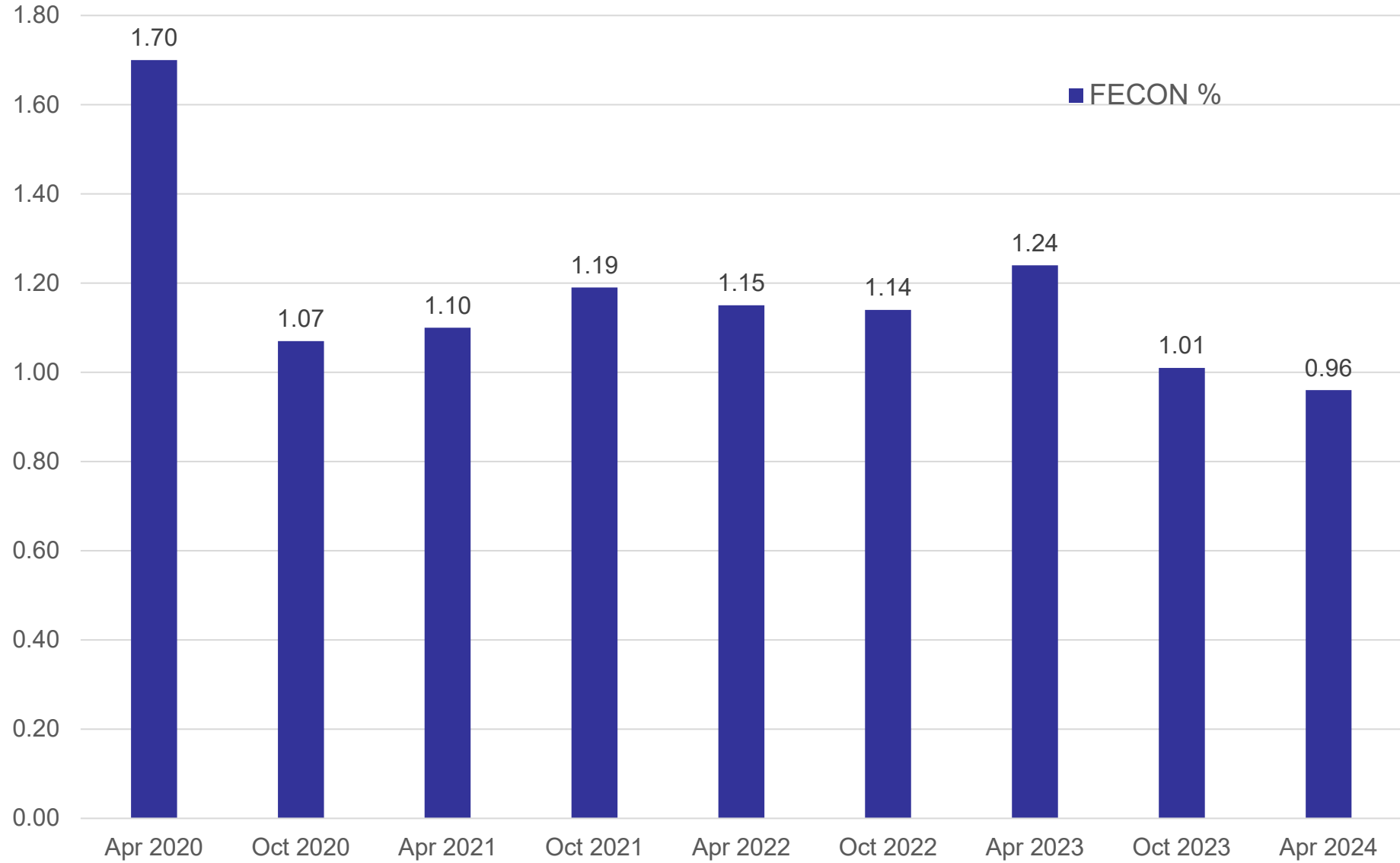
Test Status	#
%FECON Severe	1
Totals	0

GMOEE - Lost Tests*

Test Status	#
No Lost Tests	0
Totals	0

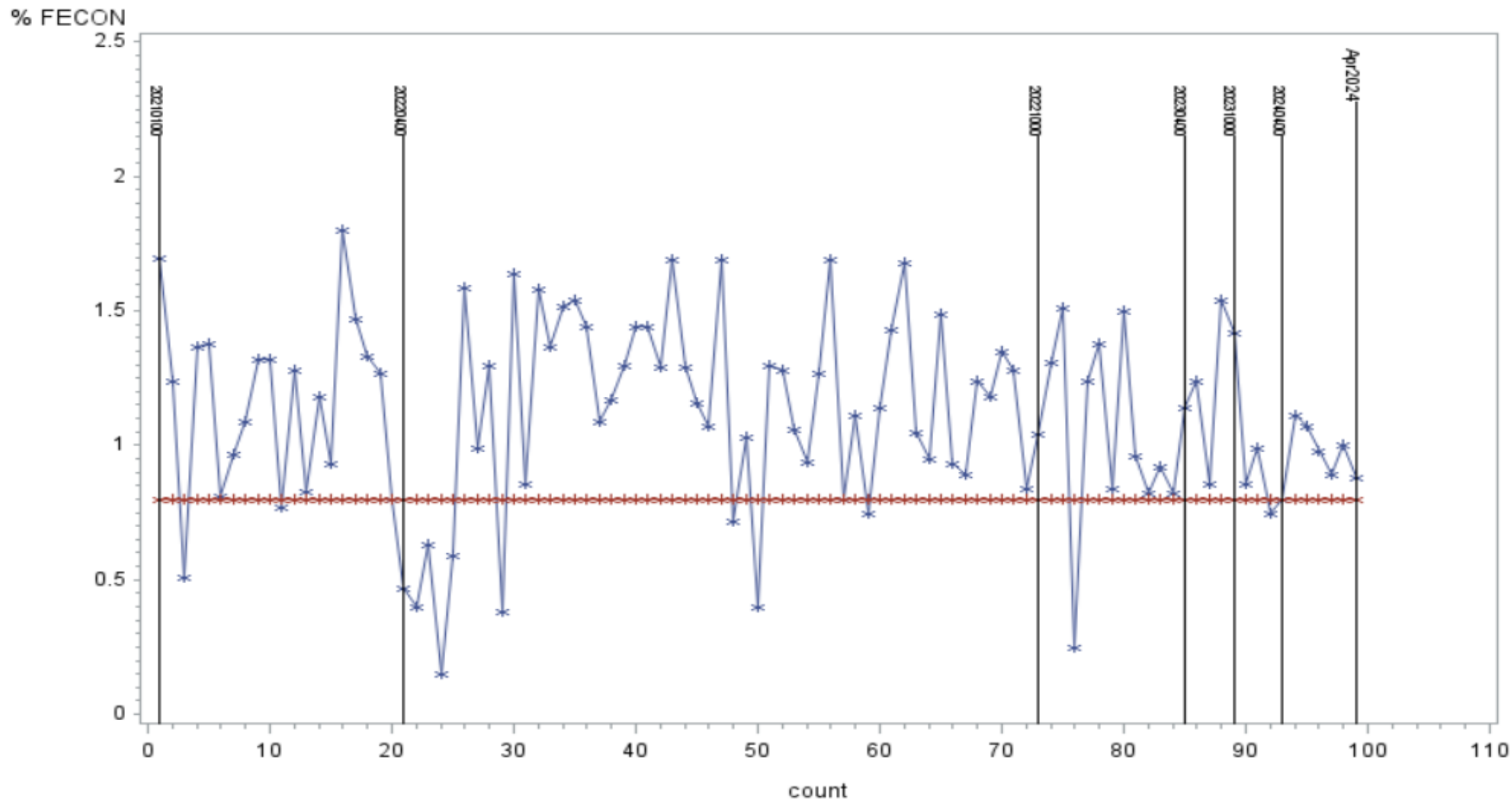
*Invalid and aborted calibration tests

Average AVFECON (%) by Report Period



GM Fuel Economy Test

% FECON Versus Minimum FECON Reference Test Results



Blue = % FECON Red = Minimum FECON



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GMSP13

April 2024

Summary of Activity

- With 19 tests reported this period, reference test activity was about the same this period compared to the previous period.
- Severity and precision levels have been steady since 2022, the exception being the poor oil, which appeared to be more severe for the period of October 2023.
- There were three lost tests and six failing tests this report period.

GMSPi3 Activity

Test Status	Validity Code	#
Acceptable Calibration Test*	AC	10
Statistically Unacceptable Calibration Test	OC	6
Invalid Calibration Test	LC	2
Terminated Early Calibration Test	XC	1
Total		19

GMSP13 - Failed Tests

Test Status	#
Mild direction GMPI01 reference oil	6
Totals	0

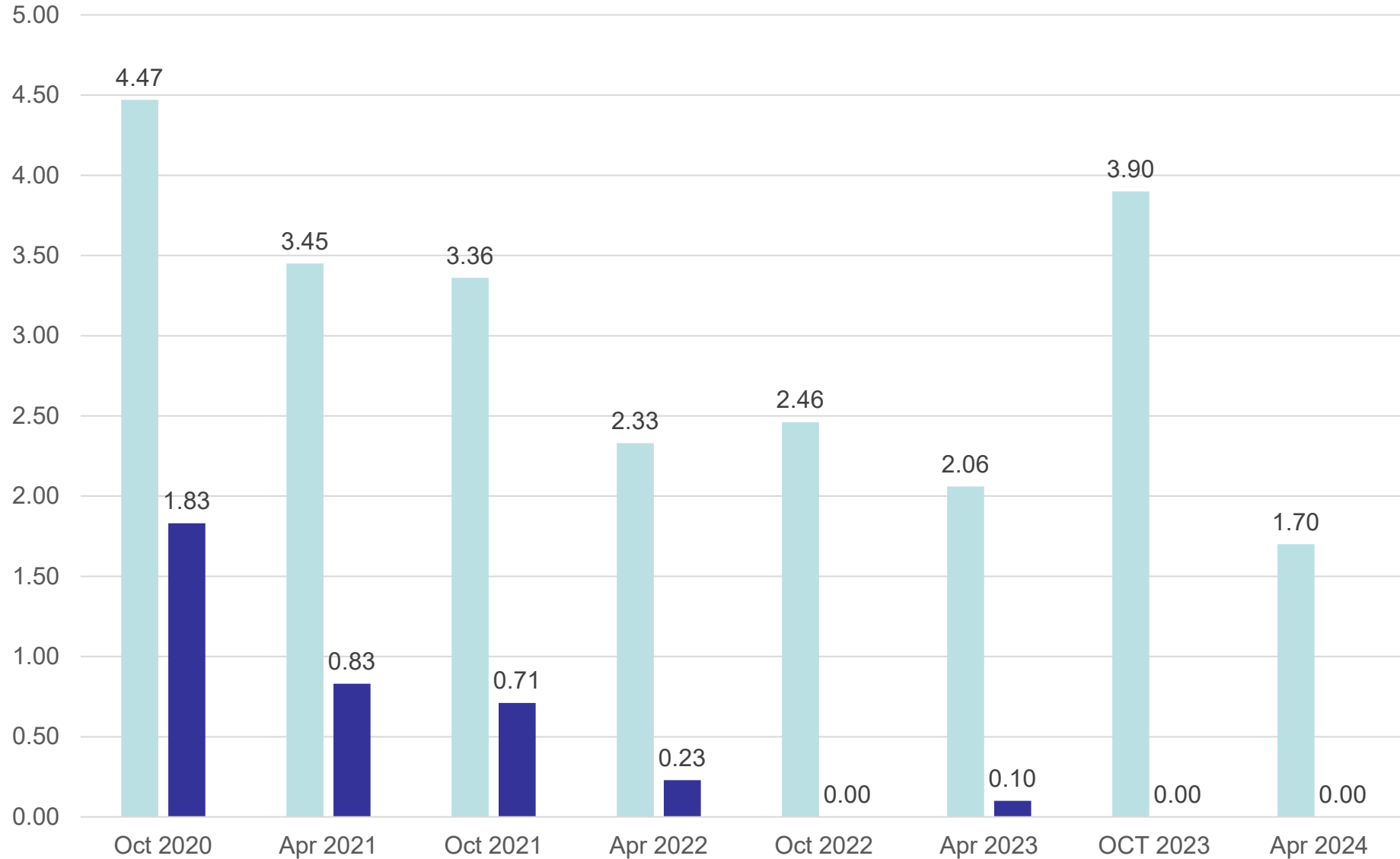
GMSPi3 - Lost Tests*

Test Status	#
Humidity Control (aborted)	1
Exhaust Backpressure valve issues (Invalid By Lab)	2
Totals	3

*Invalid and aborted tests

Average TPICBEVT by Report Period

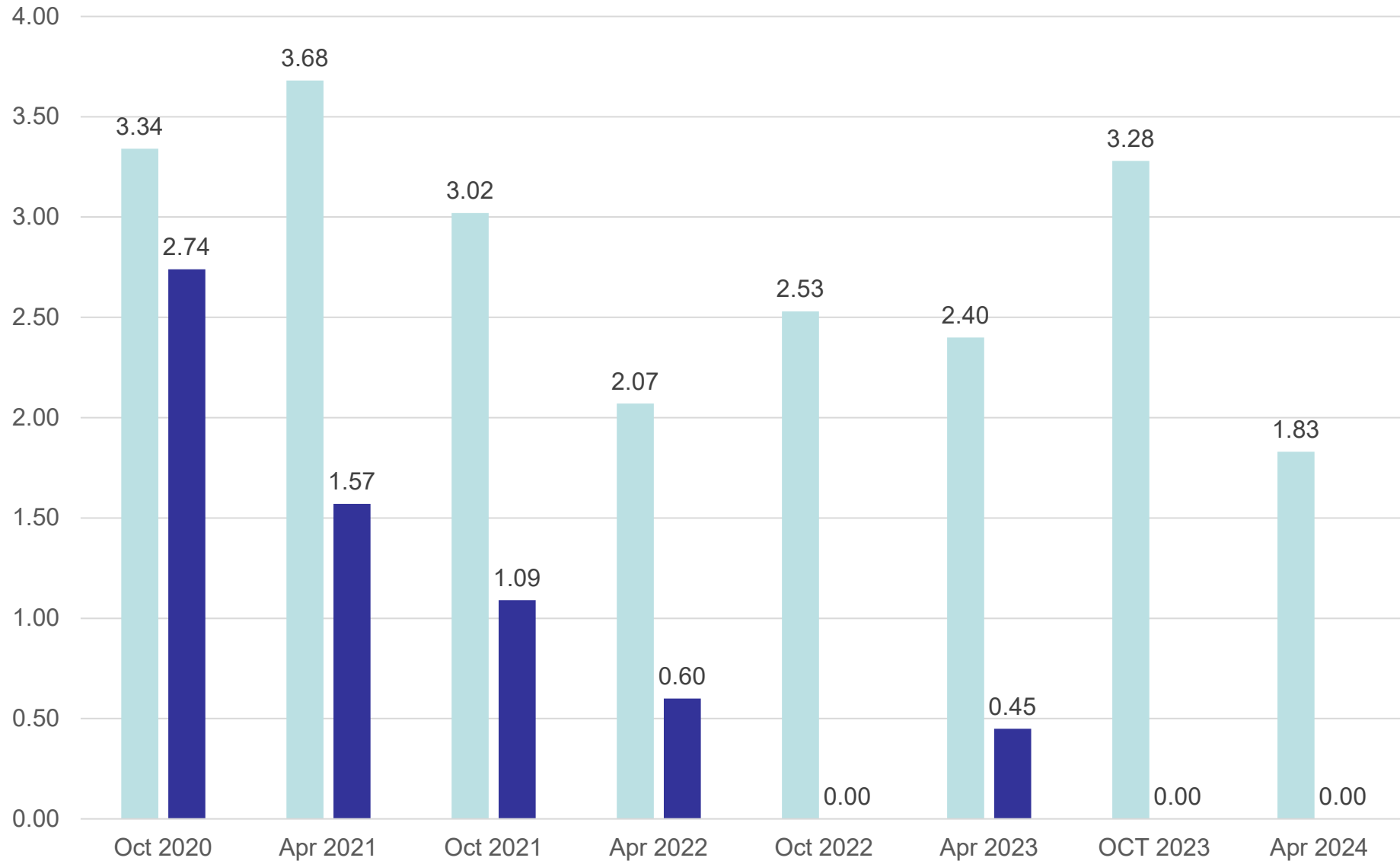
GMPI01 GMPI02



Oct 2020 averages include non-blind development tests

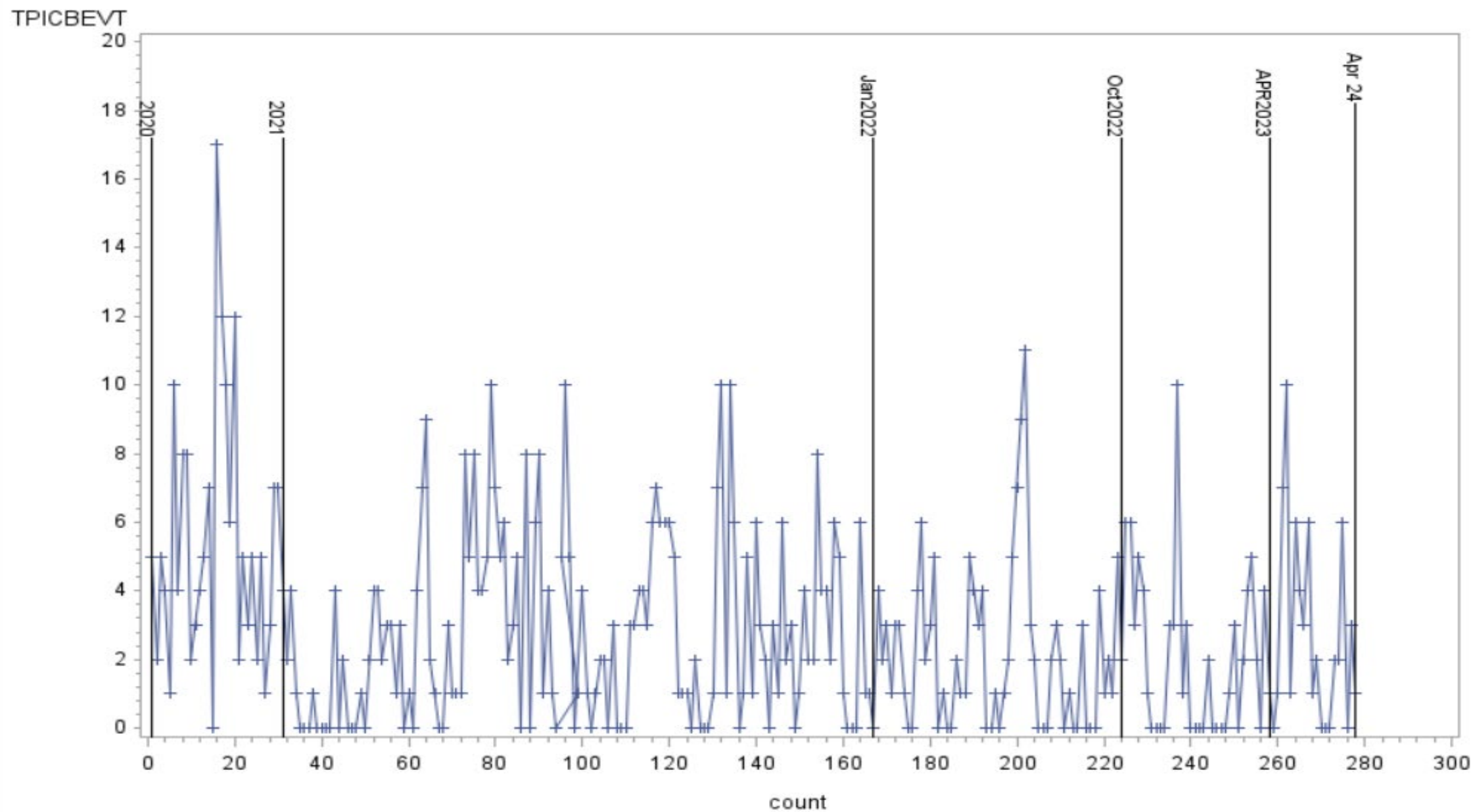
Standard Deviation of TPICBEVT by Report Period

GMPI01 GMPI02



Oct 2020 standard deviations include non-blind development tests

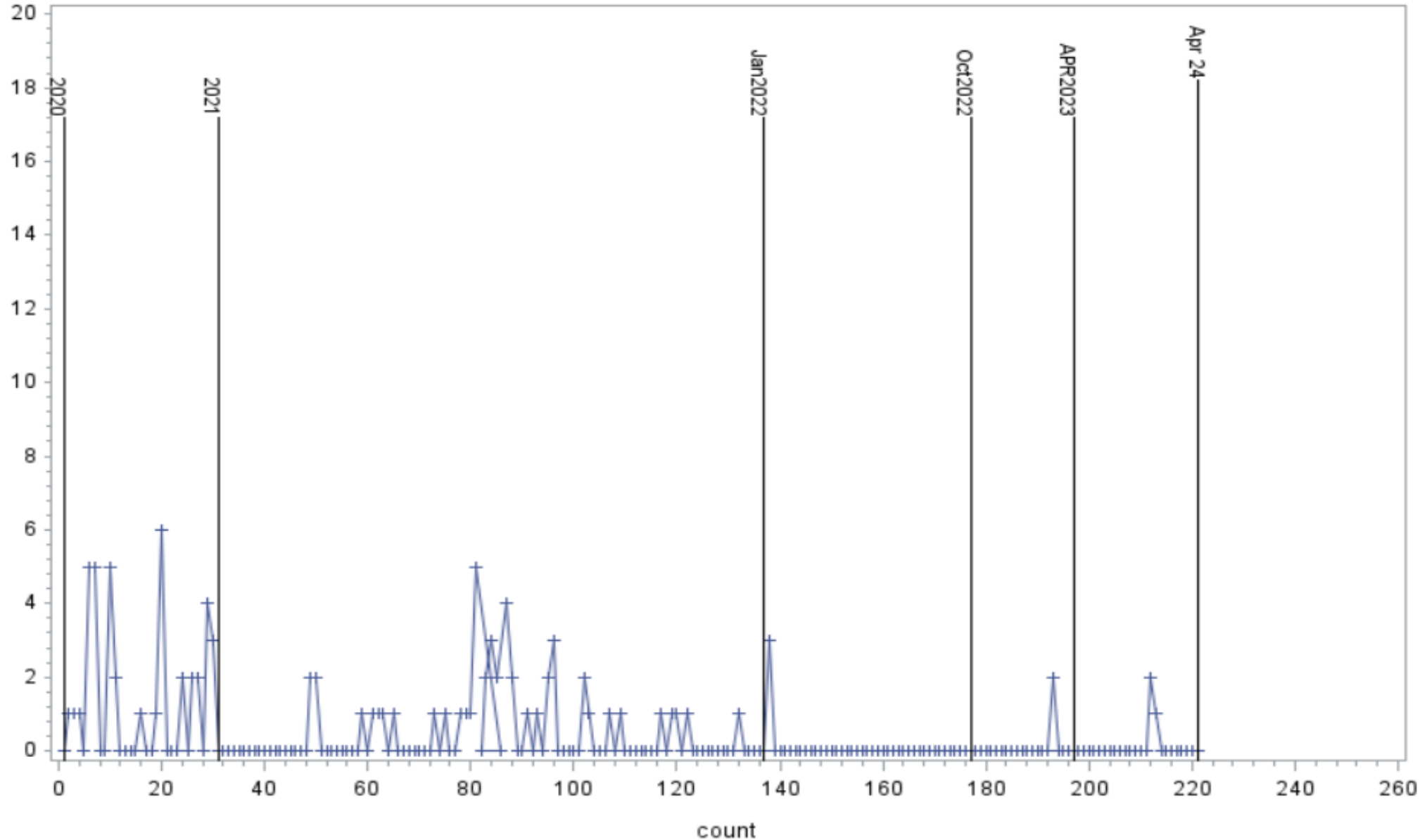
GMPI01 Reference Test Results



Blue = % FECON Red = Minimum FECON

GMPI02 Reference Test Results

TPICBEVT



Blue = % FECON Red = Minimum FECON



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GMTC

April 2024

Summary of Activity

- One reference test reported this period
 - Resulted in test stand calibration
 - With one result on reference oil TC01-1, TCOC1800 was slightly mild this period

GMTC Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	1
Statistically Unacceptable Calibration Test	OC	0
Aborted Calibration Test	XC	0
Invalid Calibration Test	LC	0
Total		1

GMTC - Failed Tests

Test Status	#
No failed tests	-
Totals	0

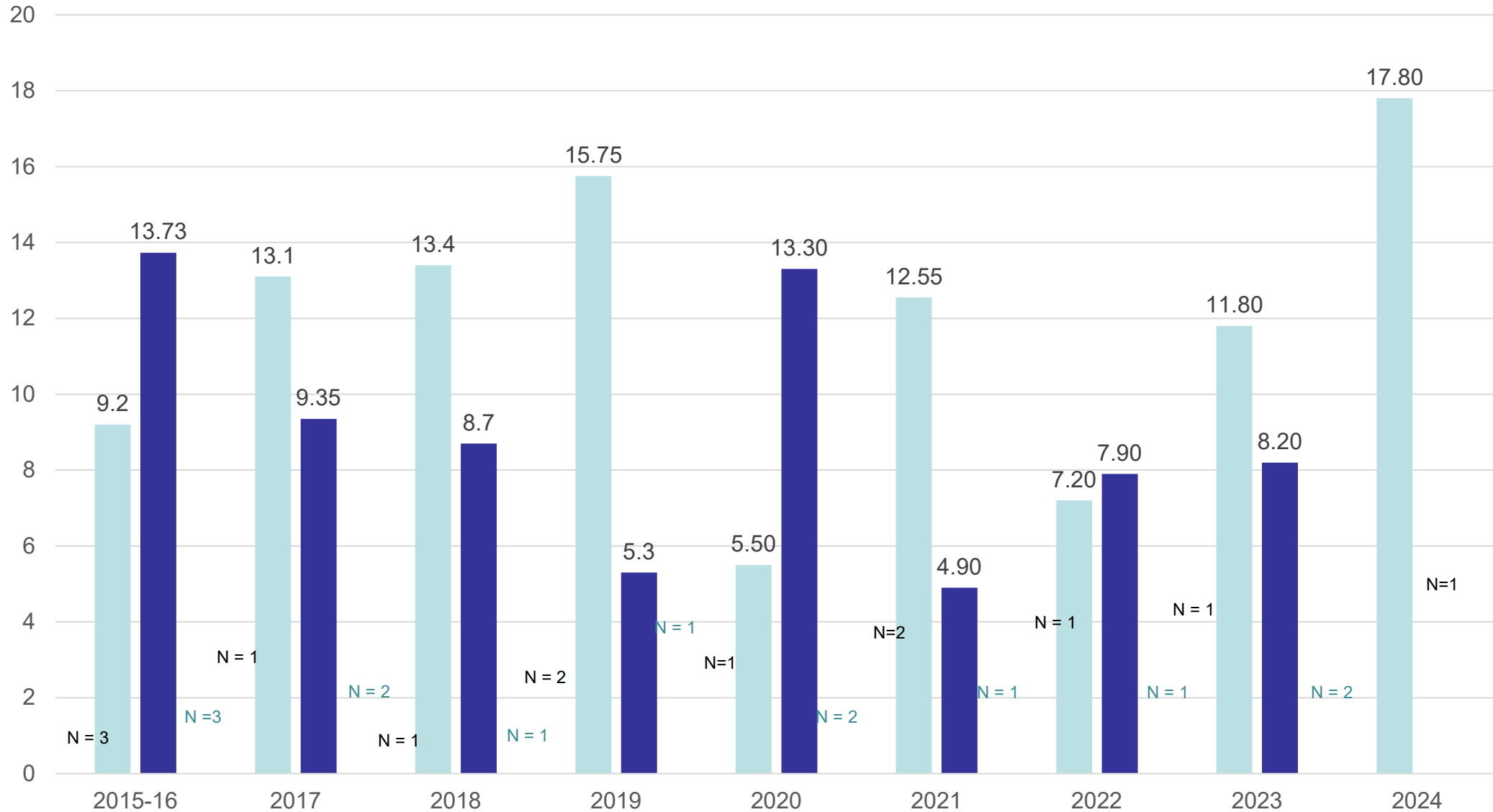
GMTC - Lost Tests*

Test Status	#
No lost tests	-
Totals	0

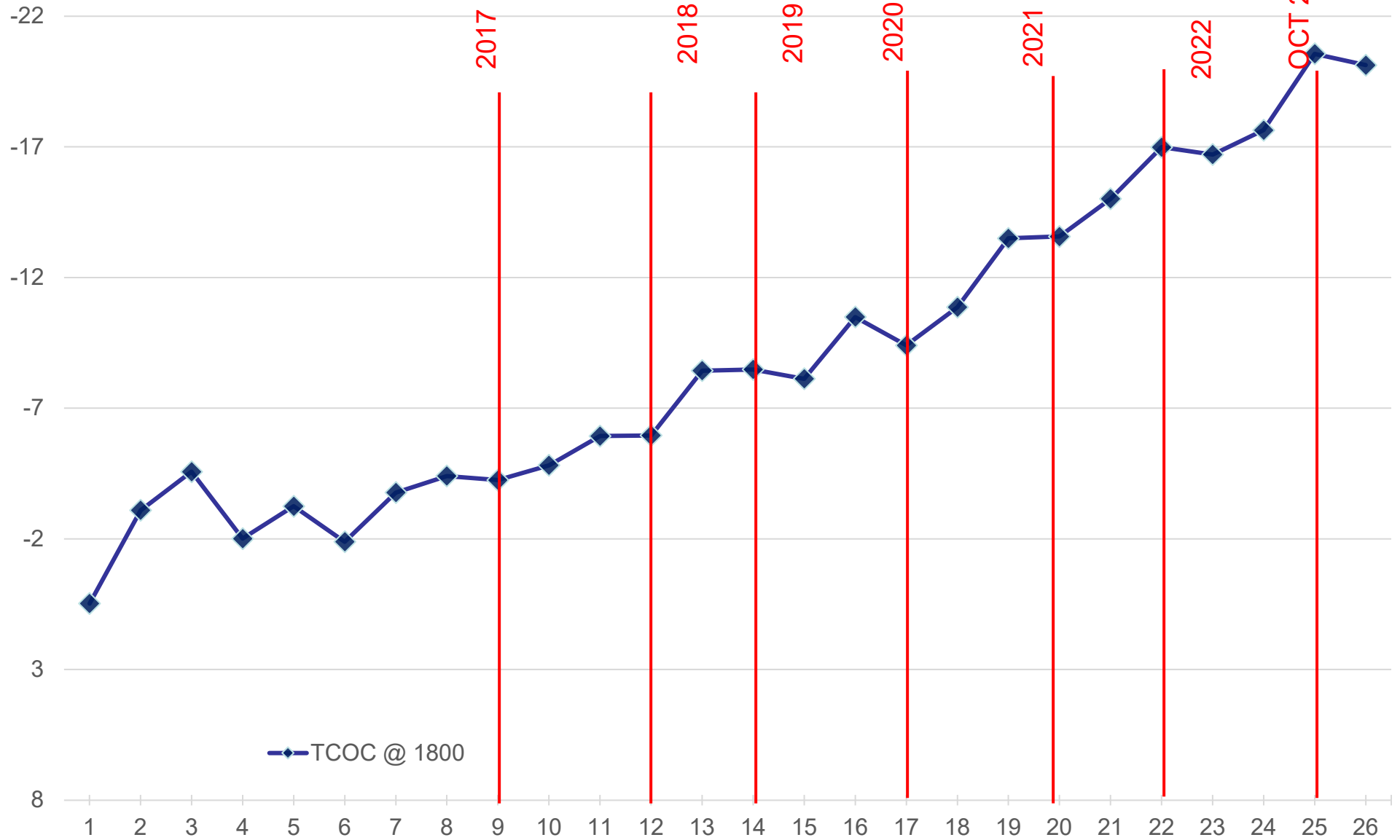
*Invalid and aborted tests

Average TCOC1800 by Report Period

GMTC01 GMTC02



TCOC1800 Reference Test Results – CuSum Chart



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Lab Visits

April 2024

TMC/GM Lab Visits

Test	Number of Labs Visited
GMAER	0
GMOD	1
GMOEE	0
GMSPi3	0
GMTc	0

Only one GMOD visit was conducted this period due to travel restrictions.

Lab Visit Issues

No significant items identified this period

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Oil Inventory

April 2024

Reference Oil Inventory Estimated Life

<u>Original Blend</u>	<u>Oil</u>	<u>Tests</u>	<u>Year</u>	<u>Blend Quantity</u>	<u>TMC Inventory</u>	<u>Estimated Life</u>
434	434-3	IIIH, GMOD	2017	980	586	> 5
GMAER02	GMAER02-8	GMAER	2023	160	151	1
GMAERBL	GMAERBL-9	GMAER	2022	532	158	0.5
GMOD01	GMOD01-2	GMOD	2023	302	263	5
GMOD02	GMOD02-1	GMOD	2015	320	30	1.5
GMPI01	GMPI01-4	GMSPi3	2021	530	369	5
GMPI02	GMPI02-3	GMSPi3	2020	530	76	1.5
GMPI02	GMPI02-4	GMSPi3	2022	584	584	> 5
GMTC01	GMTC01-1	GMTC	2014	110	20	5
GMTC02	GMTC02-1	GMTC	2015	144	62	5
GMVFEBL02	GMVFEBL02-2	GMOEE	2021	3402	1196	1
GMVFEHR01	GMVFEHR01-2	GMOEE	2022	2120	1839	> 5

* The inventory of 434-3 should last considerably longer as IIH has decreased quantity shipped from 4 gallons to 2.5 gallons.

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