A Program of ASTM International

Test Monitoring Center

https://www.astmtmc.org

ASTM D02.B1 Semiannual Report
Passenger Car Reference Oil Testing

October 2024

Table of Contents

Table of Contents

Table of Contents

Passenger Car Engine Oil Testing
Executive Summary

- Reblends of oils 224-2, 221-1, API01-1 and API02-1.
  - The Sequence IX panel is currently introducing Oils 224-2, API01-1 and API02-1.
  - A reblend of reference oil 221-1 is available for introduction and is to be introduced during the next report period.
  - The TMC is pursuing a reblend on reference oil 544

Return to Table of Contents

Passenger Car Engine Oil Testing
Executive Summary (cont.)

- IIIH Batch 8 Pistons and PHOS Trend
  - Batch 8 pistons were successfully introduced this report period. PHOS had been encountering several warning alarms during the past two periods, but is now in action alarm. All other parameters are in control.
- Sequence VIE Severity
  - FEI1 severity has trended slightly mild for the past two periods. FEI2 continues to trend severe, but at a much lower level than in the past.

Return to Table of Contents

Passenger Car Engine Oil Testing
Executive Summary (cont.)

- Aged Oil LSPI
  - Re-blends of both reference oils API01 and API02 have been obtained and are being introduced.
- Sequence VH
  - Industry is currently in action alarm for AES and RAC. The panel is actively working on obtaining a new fuel batch and is meeting Bi-weekly to try and address this and other issues.

Return to Table of Contents

Calibrated Labs and Stands*

Test	Labs	Stands
IIIH/A/B	5	14
IVA	1	1
IVB	2	4
VH	3	6
VIE	5	16
VIF	2	5
VIII	2	4
IX	3	5
IXAGED	3	5
X	4	5

Return to Table of Contents

*As of 9/30/2024

Sequence IIIH/A/B

- October 2024

Test Monitoring Center
https://www.astmtmc.org
A Program of ASTM International

Sequence IIIH/A/B Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	22
Unacceptable Calibration Test	OC	4
Operationally Invalid Calibration Test	LC	3
Acceptable Donated Test, BC8 Piston Approval	AG	1
Total		**30**

Sequence IIIH – Failing Tests

Test Status	#
Ei Level 3 Alarm PVIS, Severe Direction	2
Ei Level 3 Alarm PVIS, Mild direction	1
Ei Level 3 Alarm WPD, Mild direction	1
Total	**4**

Sequence IIIH – Lost Tests

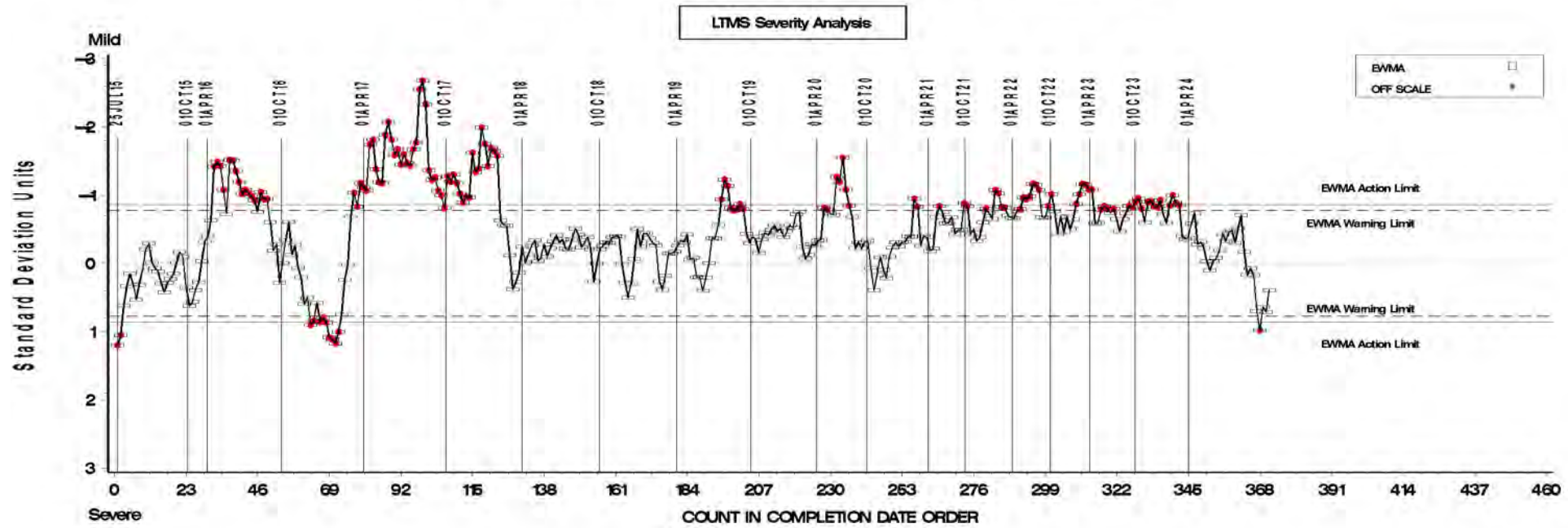
Test Status	Cause	#
Invalid	Coolant Flow Calibration Error	1
Invalid	Oil Loss, Downtime	1
Invalid	Oil Block and Coolant Out Thermocouple issues	1
Totals		**3**

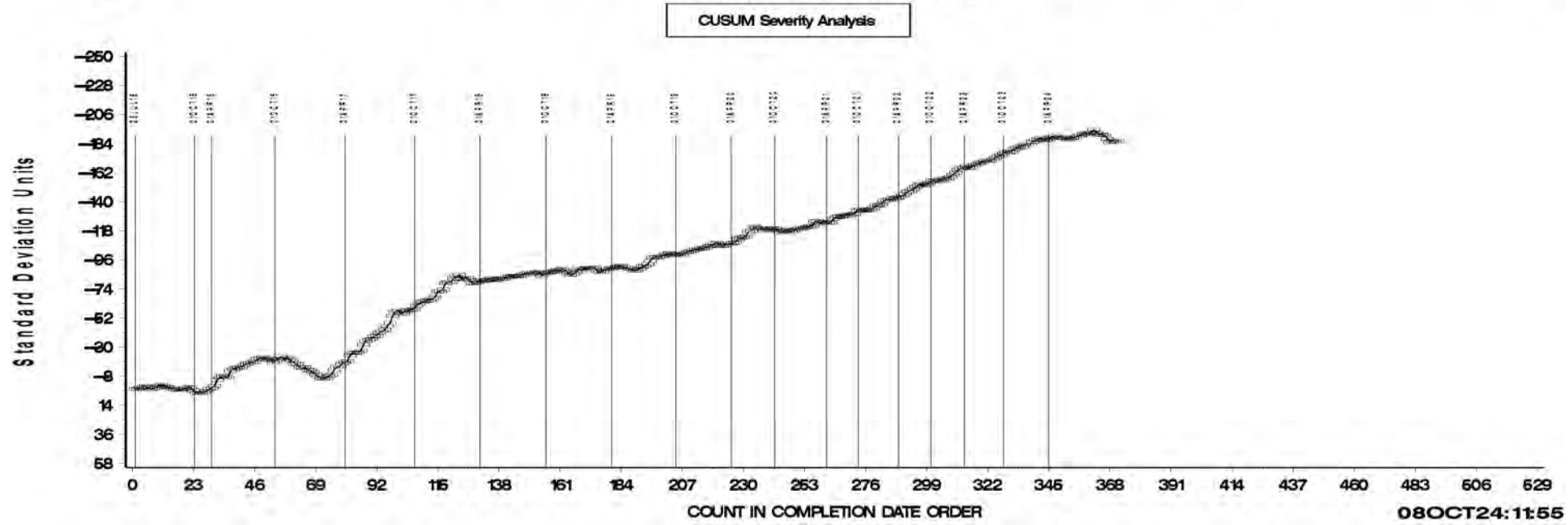
Sequence IIIH Test Severity

- PHOS is in action alarm (mild direction)
- All other parameters are in control.

SEQUENCE IIIH INDUSTRY OPERATIONALLY VALID DATA

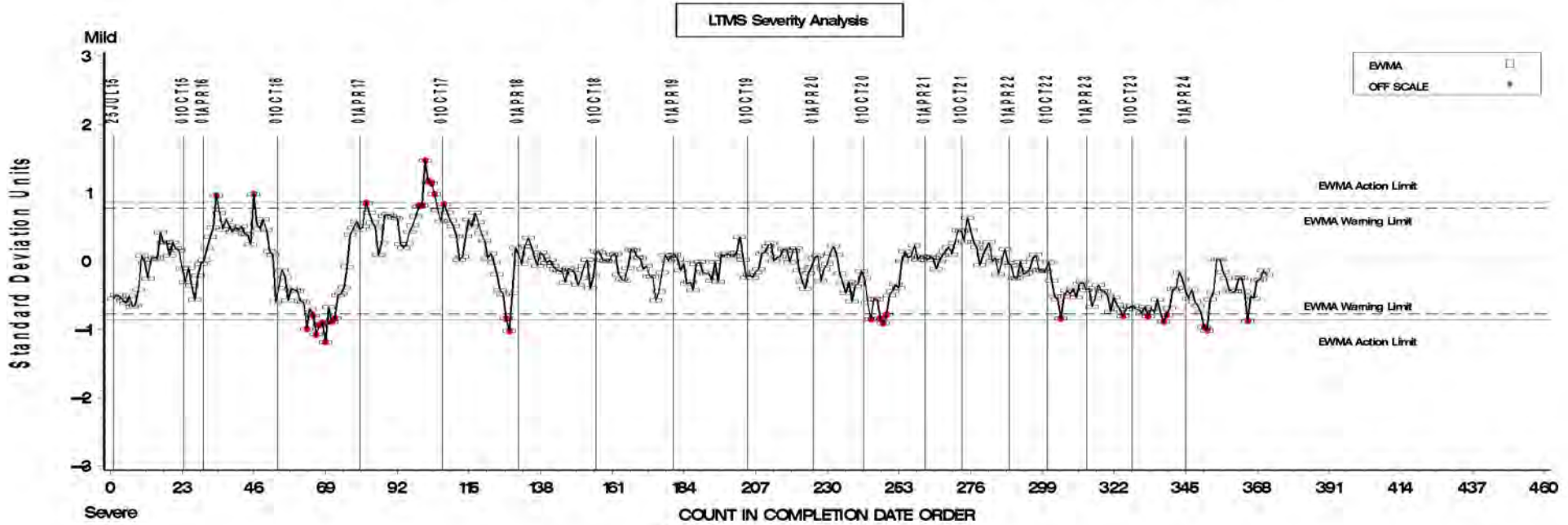
VISCOSITY INCREASE FINAL ORIG UNIT RES

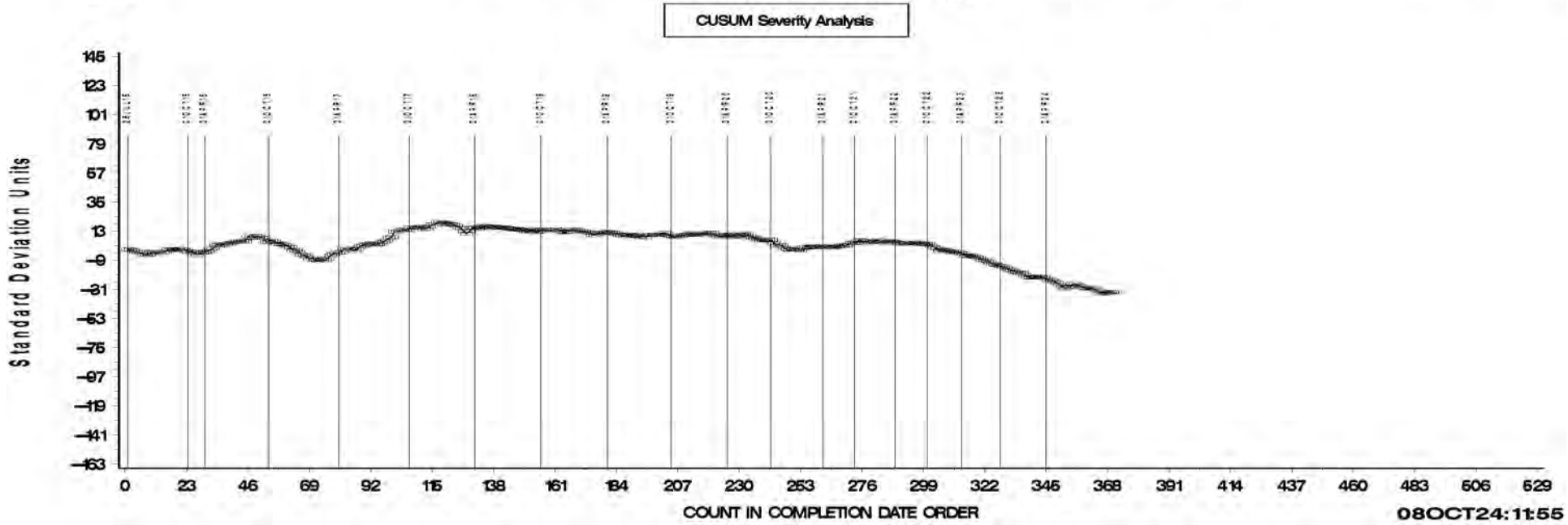




SEQUENCE IIIH INDUSTRY OPERATIONALLY VALID DATA

AVERAGE WEIGHTED PISTON DEPOSITS FNL ORIG U



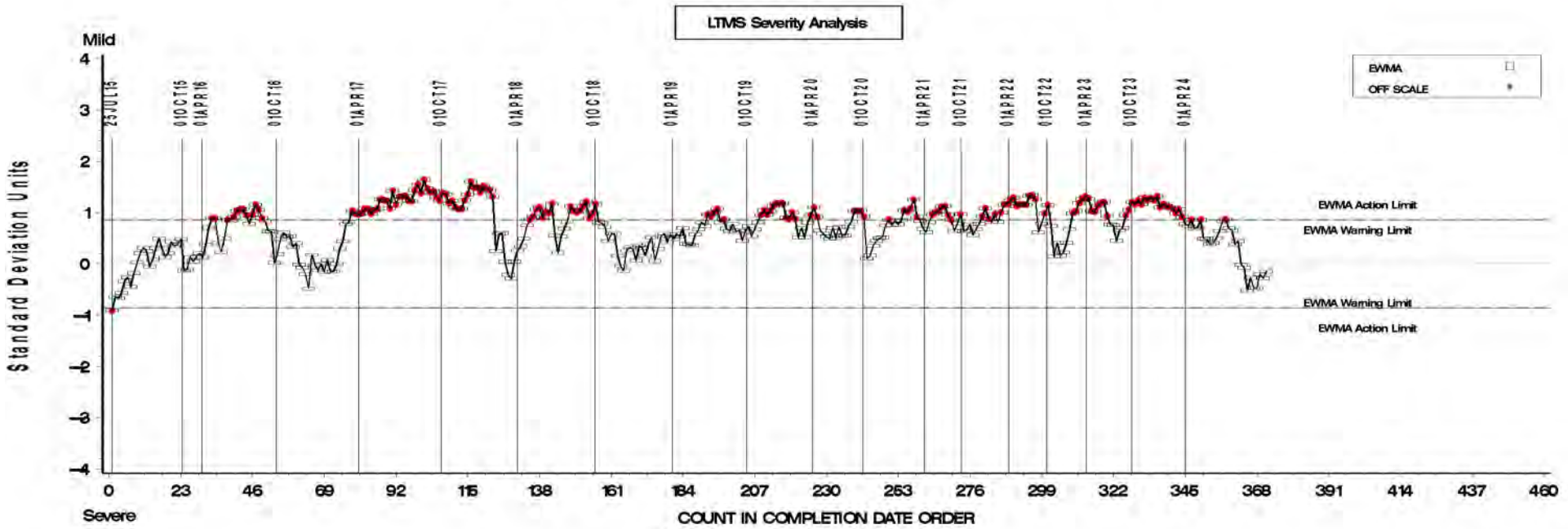


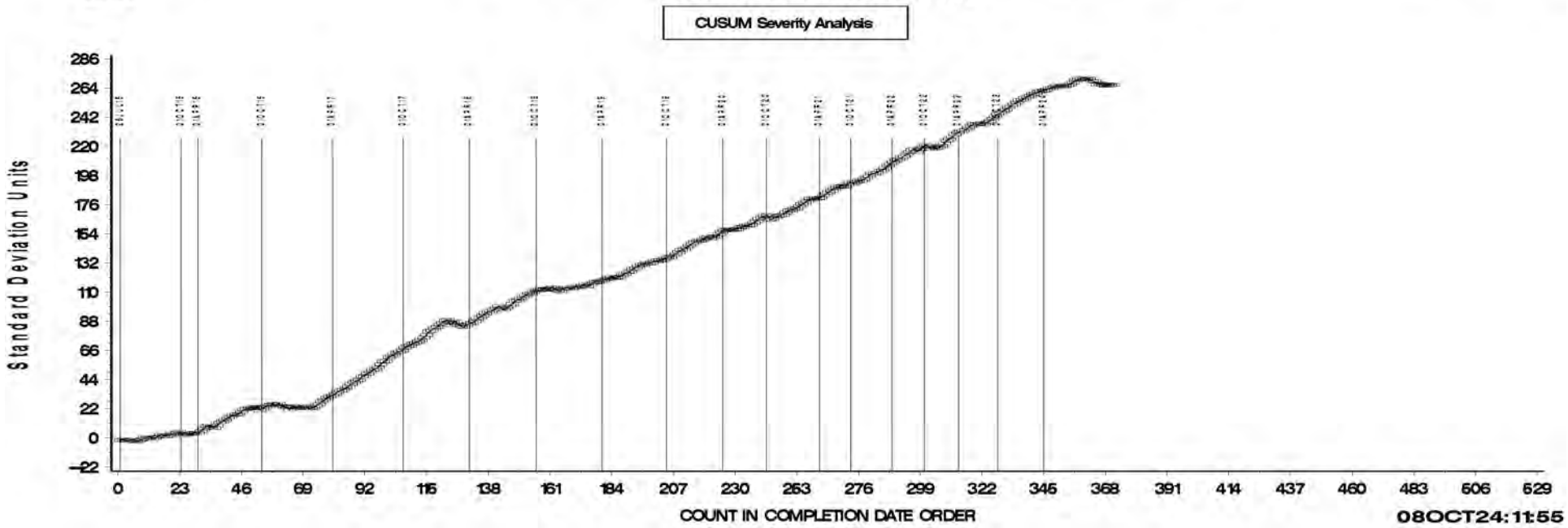
08OCT24:11:55

SEQUENCE IIIH INDUSTRY OPERATIONALLY VALID DATA

A Program of ASTM International

AVERAGE PISTON SKIRT VARNISH

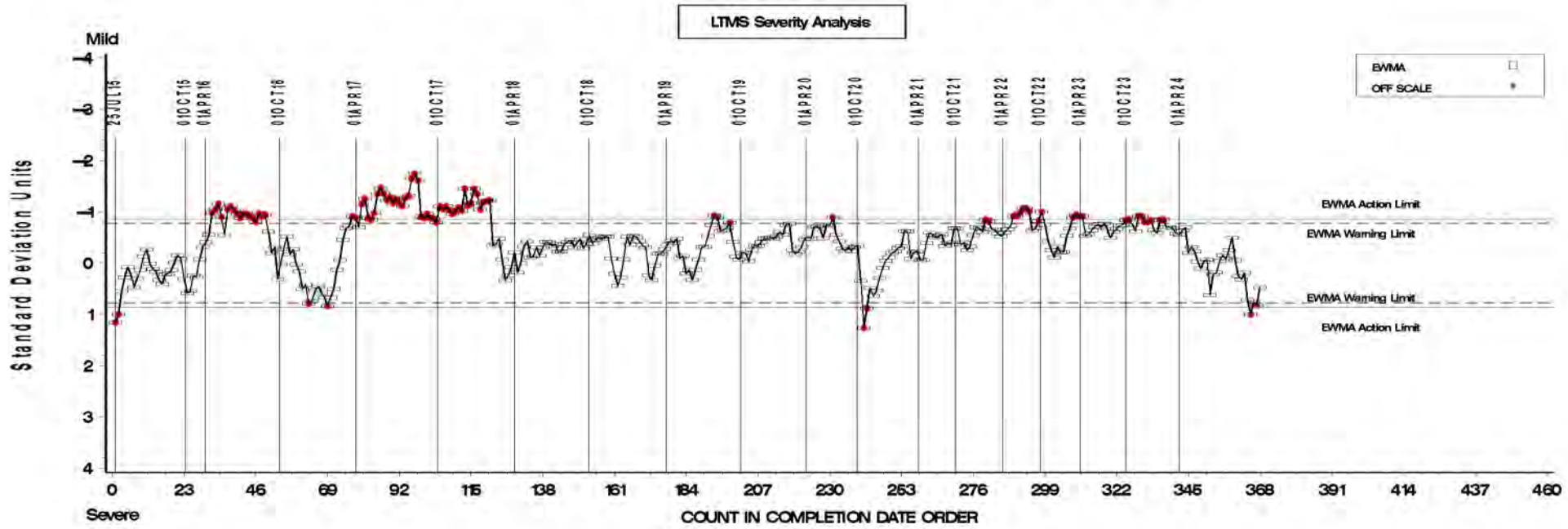


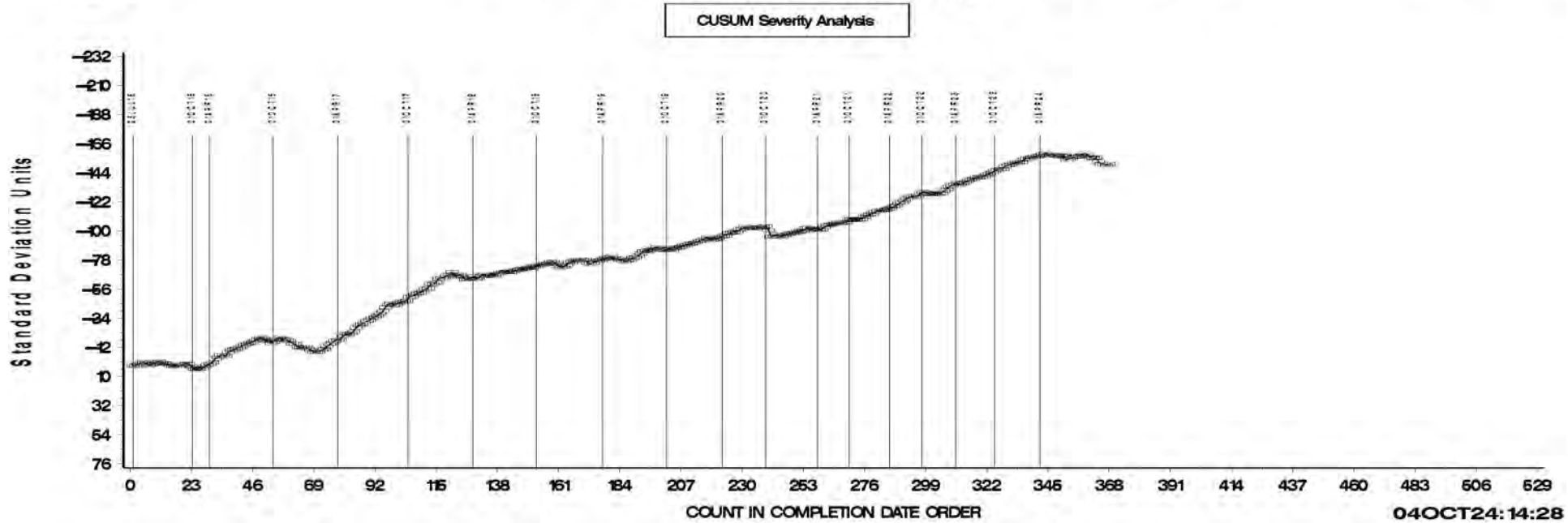


08OCT24:11:55

SEQUENCE IIIHA INDUSTRY OPERATIONALLY VALID DATA

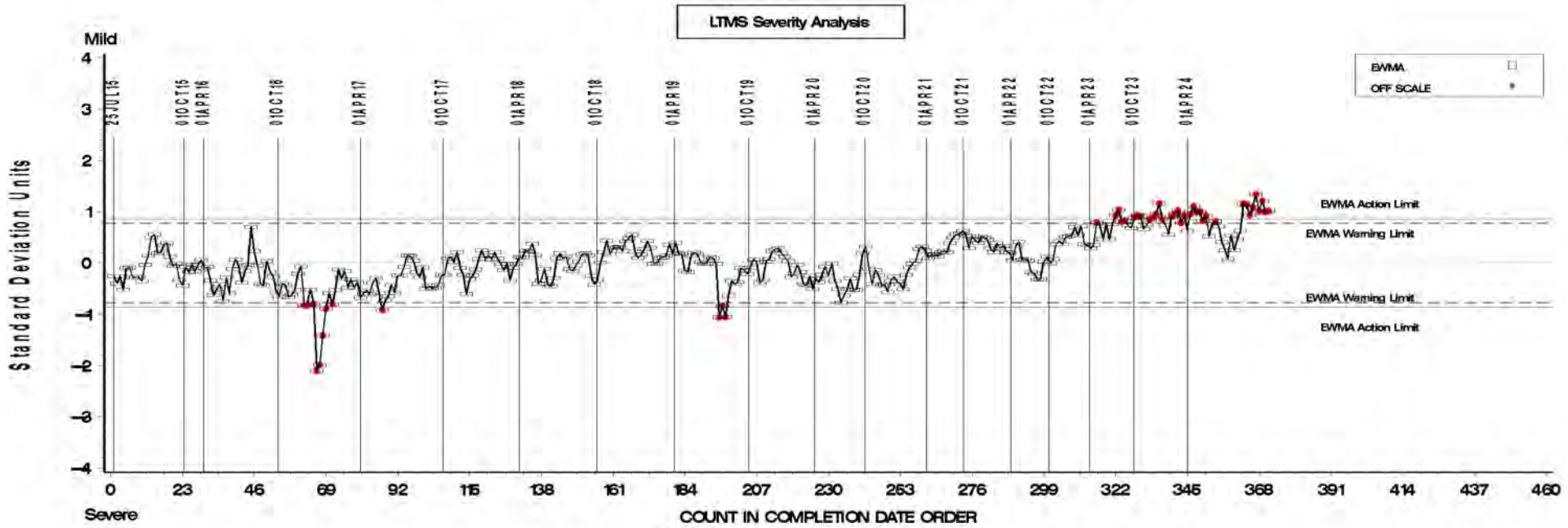
MRV FINAL ORIG UNIT RES [NM, FROZEN, SOLID]

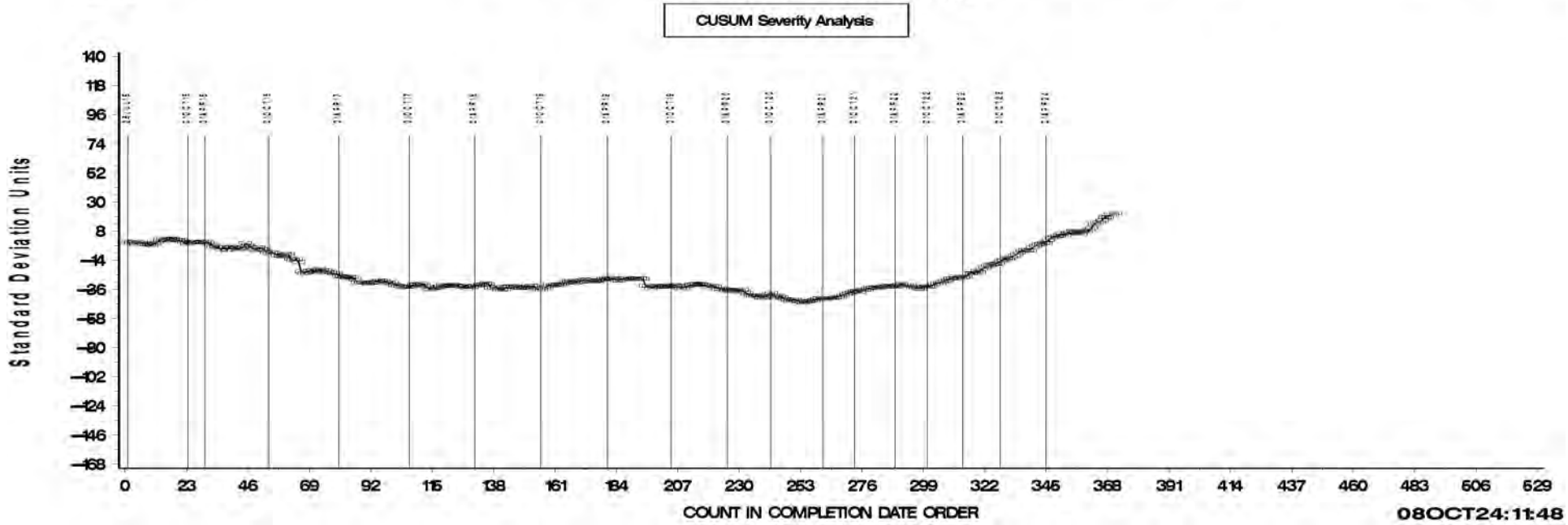




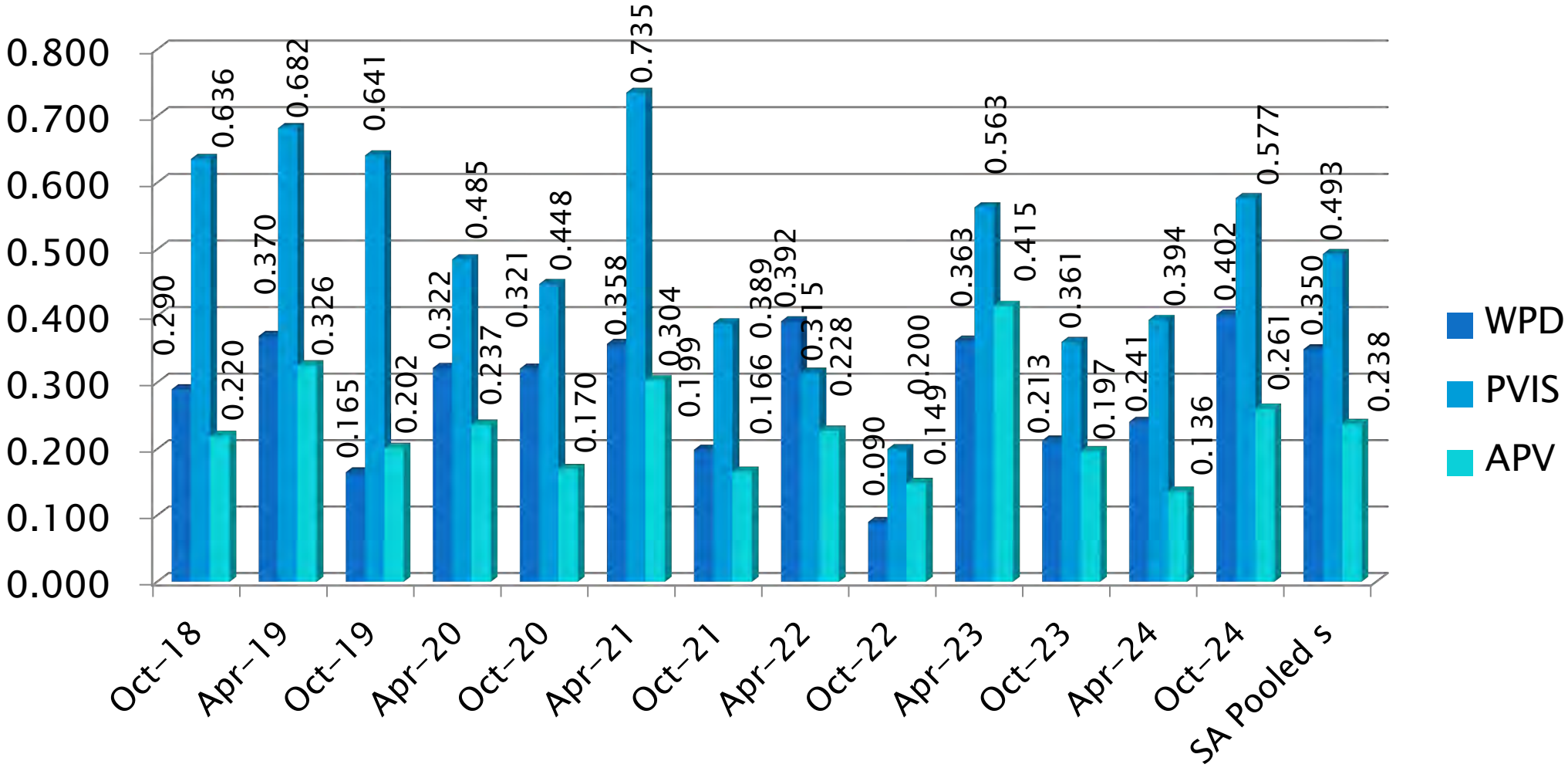
SEQUENCE IIIHB INDUSTRY OPERATIONALLY VALID DATA

PHOSPHORUS RETENTION, FINAL RESULT



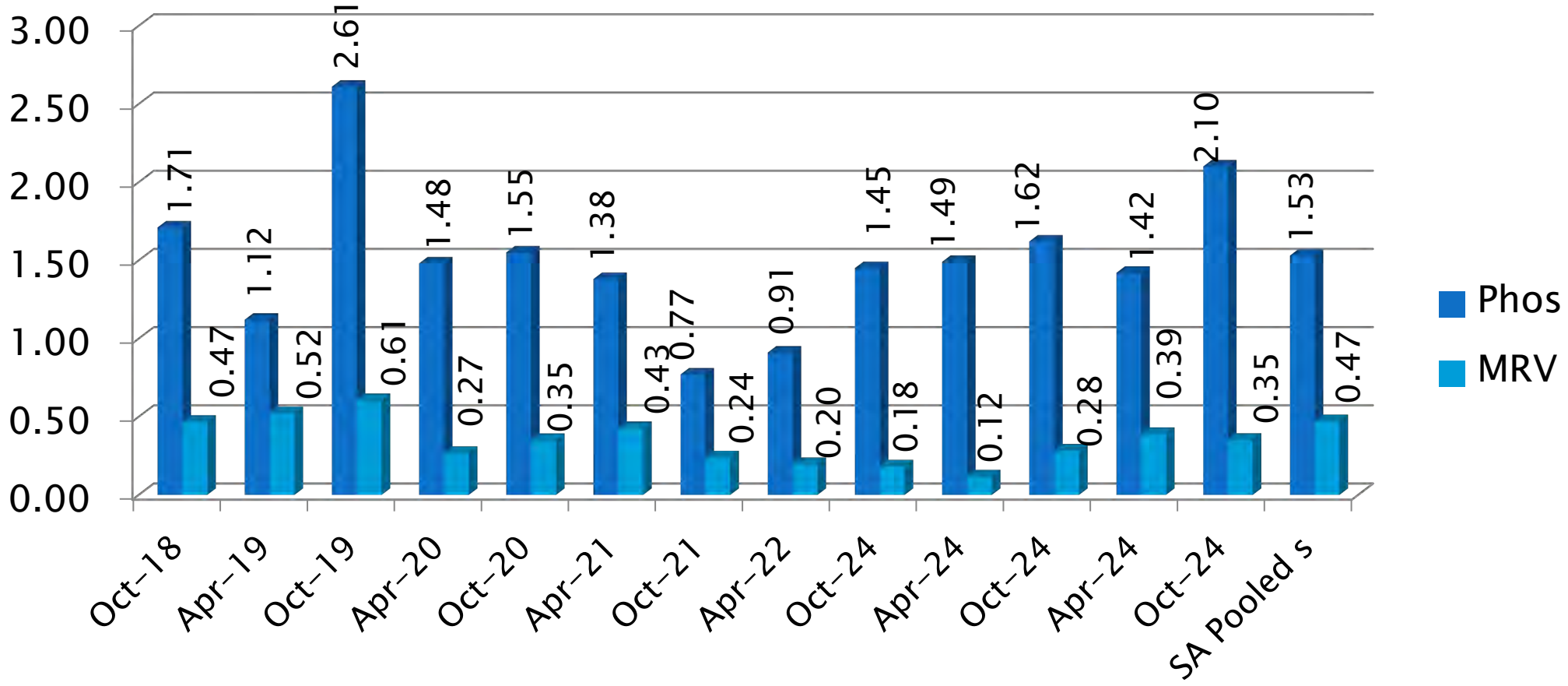


IIIH Precision Estimates



Test Monitoring Center
https://www.astmtmc.org
A Program of ASTM International

Sequence IIIHA/B Precision Estimates



Return to Table of Contents

Sequence IVA

- October 2024

Test Monitoring Center
https://www.astmtmc.org
A Program of ASTM International

Sequence IVA Activity

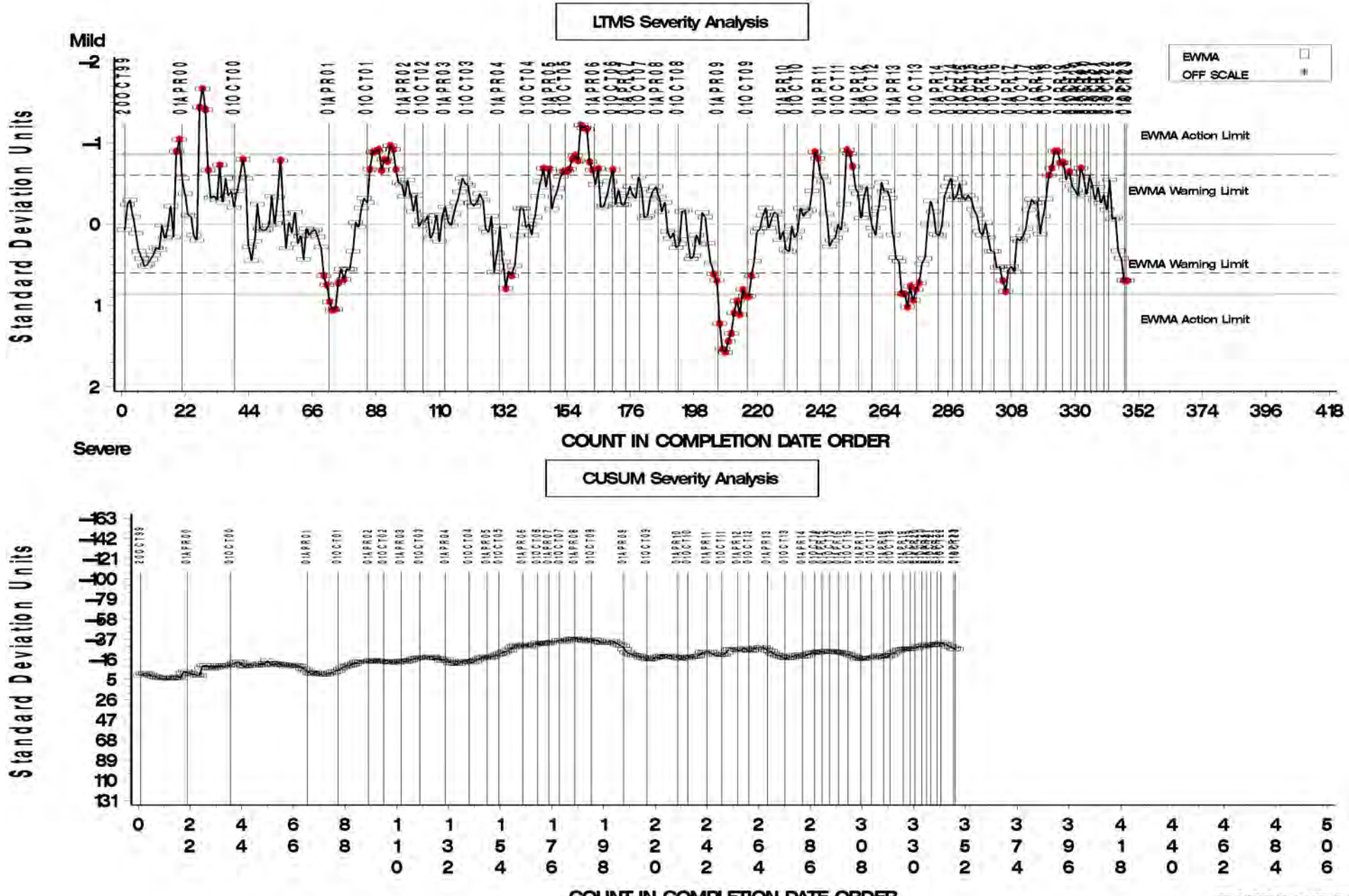
Test Status	Validity Code	#
No tests this report period	AC	0
Total		**0**

Sequence IVA Test Severity

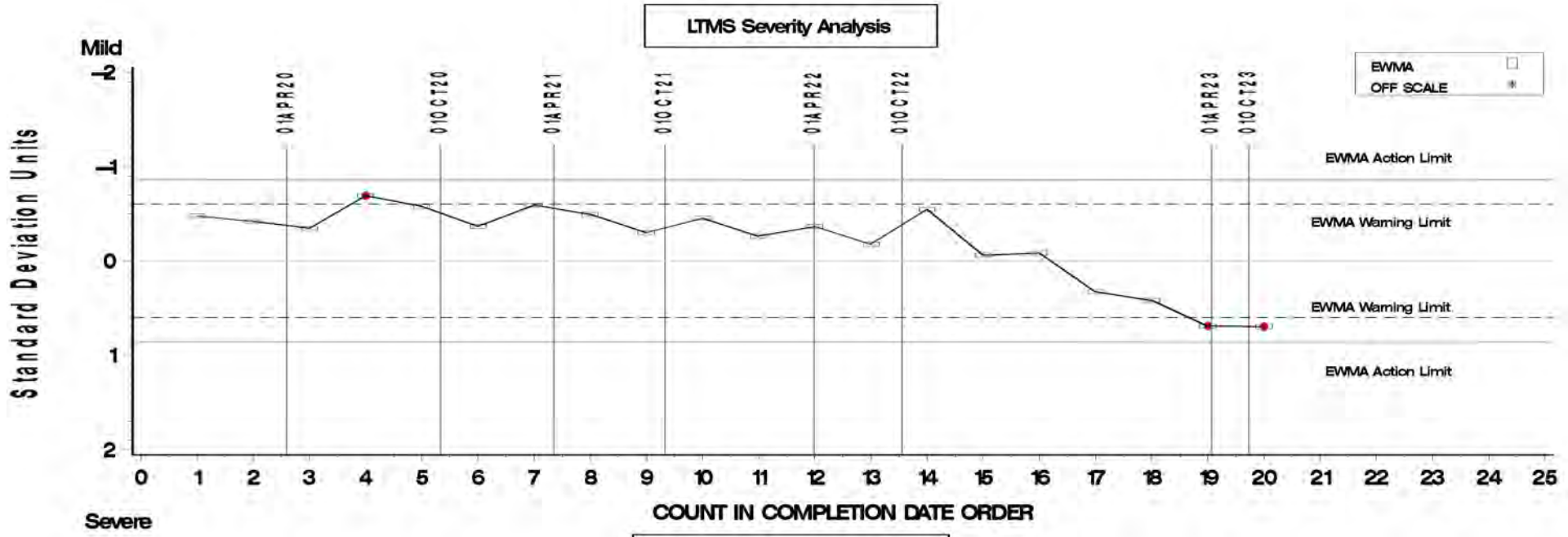
- Severity and precision are in warning alarm.

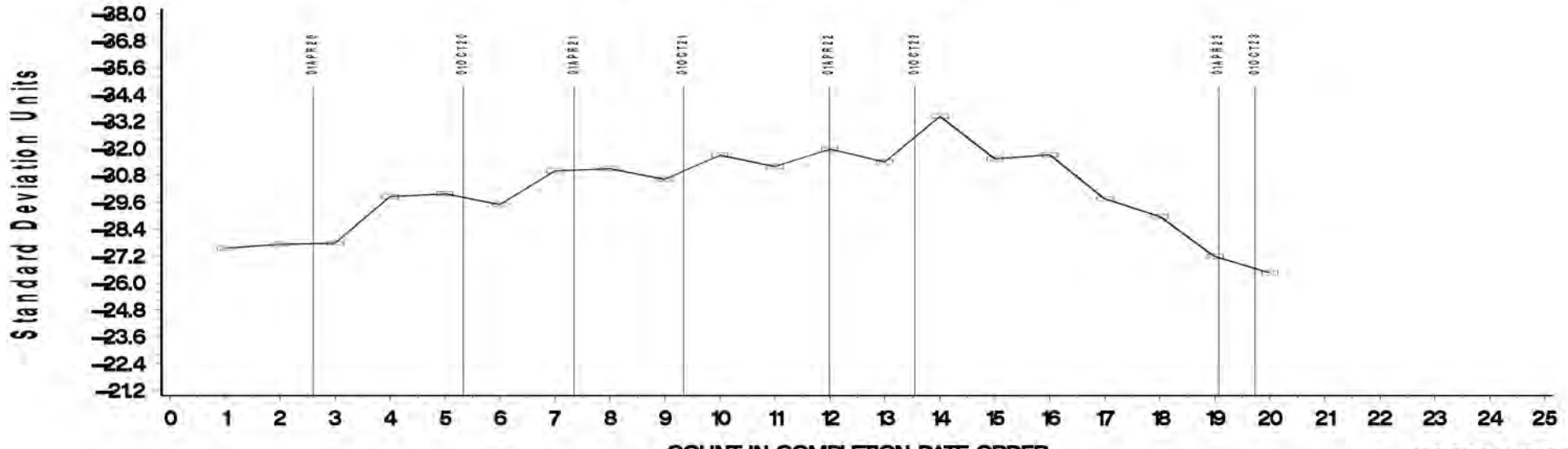
SEQUENCE IVA INDUSTRY OPERATIONALLY VALID DATA

AVERAGE CAM WEAR



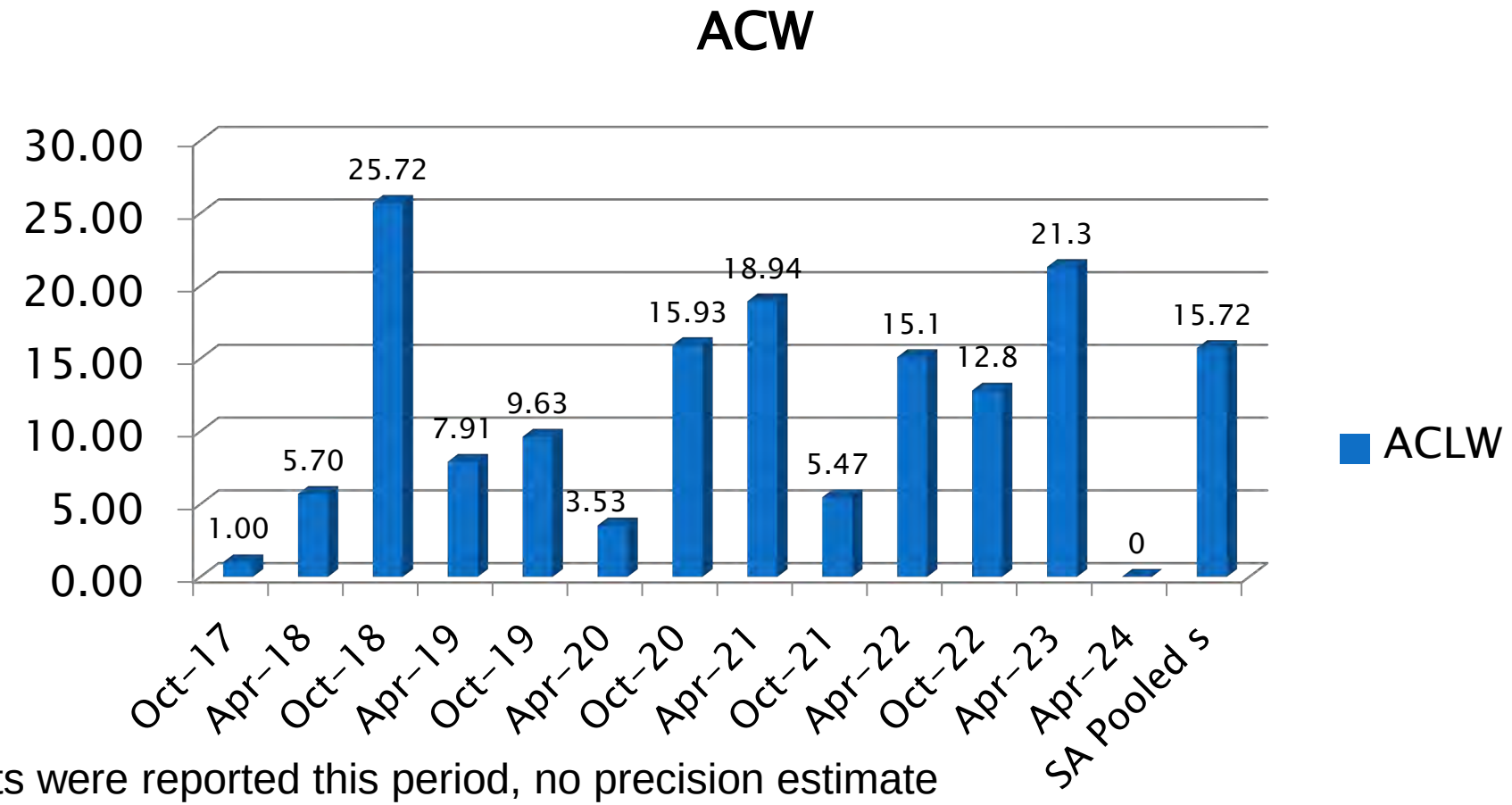
SEQUENCE IVA INDUSTRY OPERATIONALLY VALID DATA
Last 20 Tests
AVERAGE CAM WEAR





12APR24:16:02

Sequence IVA Precision Estimates



No tests were reported this period, no precision estimate is available

Return to Table of Contents

Sequence IVB

- October 2024

Test Monitoring Center
https://www.astmtmc.org
A Program of ASTM International

Sequence IVB Activity

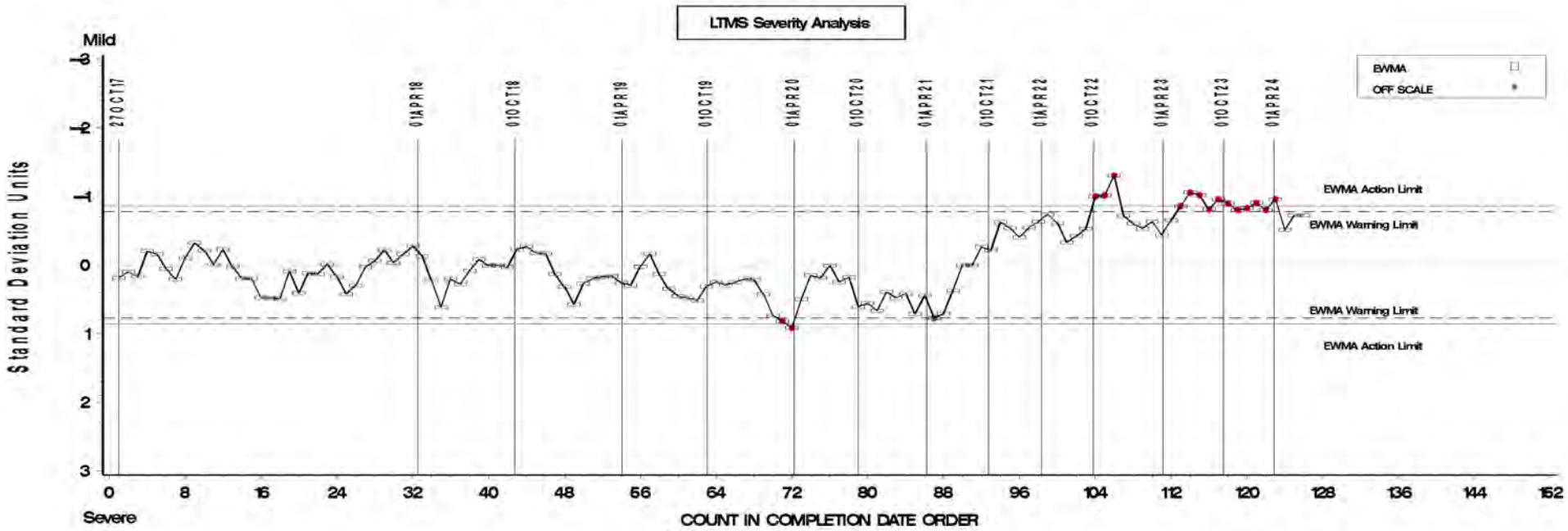
Test Status	Validity Code	#
Acceptable Calibration Test	AC	4
Total		**4**

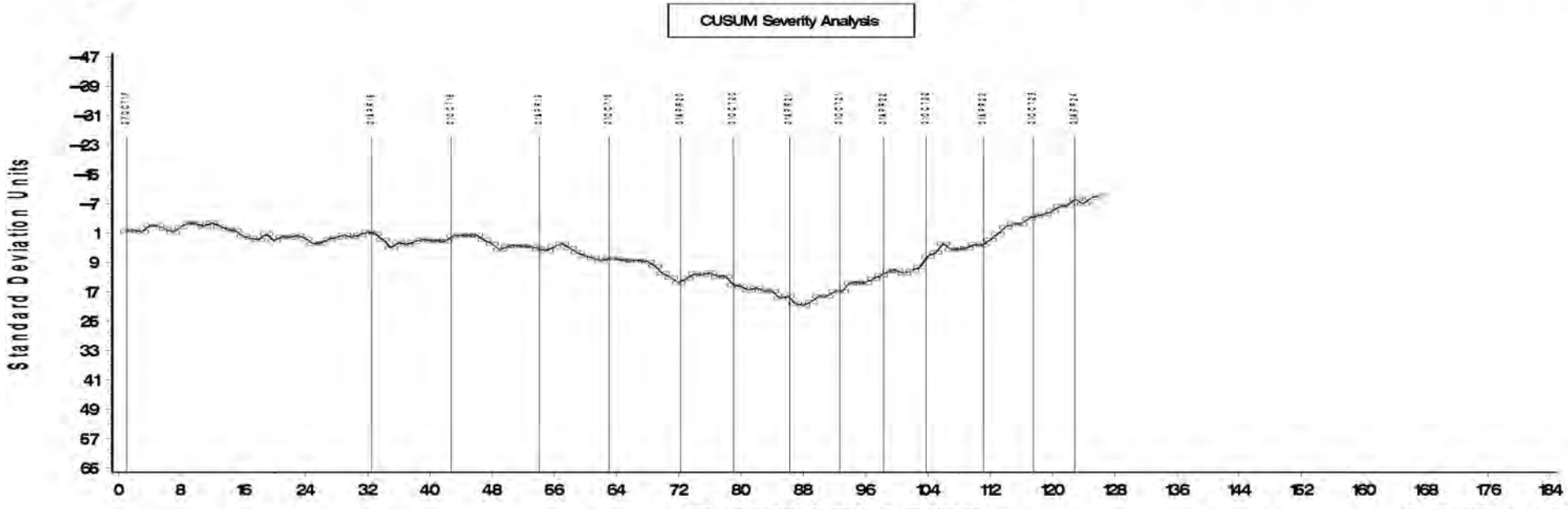
Sequence IVB Test Severity

- AVLI and FE are in control, though both parameters are trending mild.

SEQUENCE IVB INDUSTRY OPERATIONALLY VALID DATA

AVERAGE VOLUME LOSS BY KEYENCE INTAKE Final

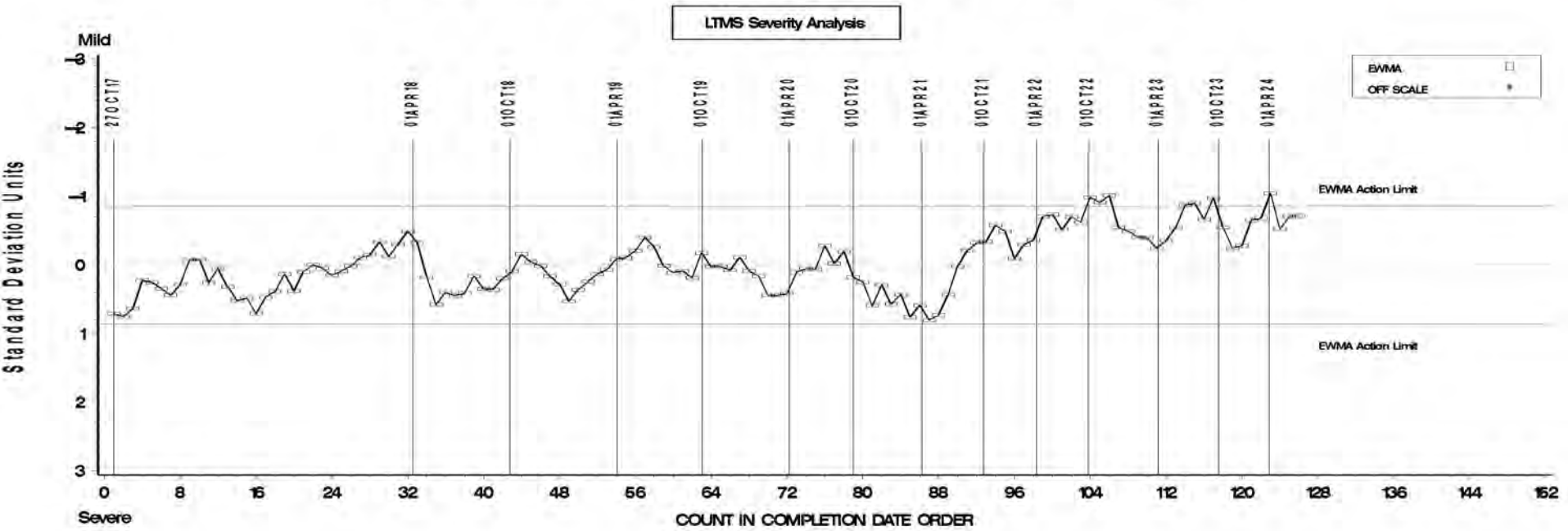


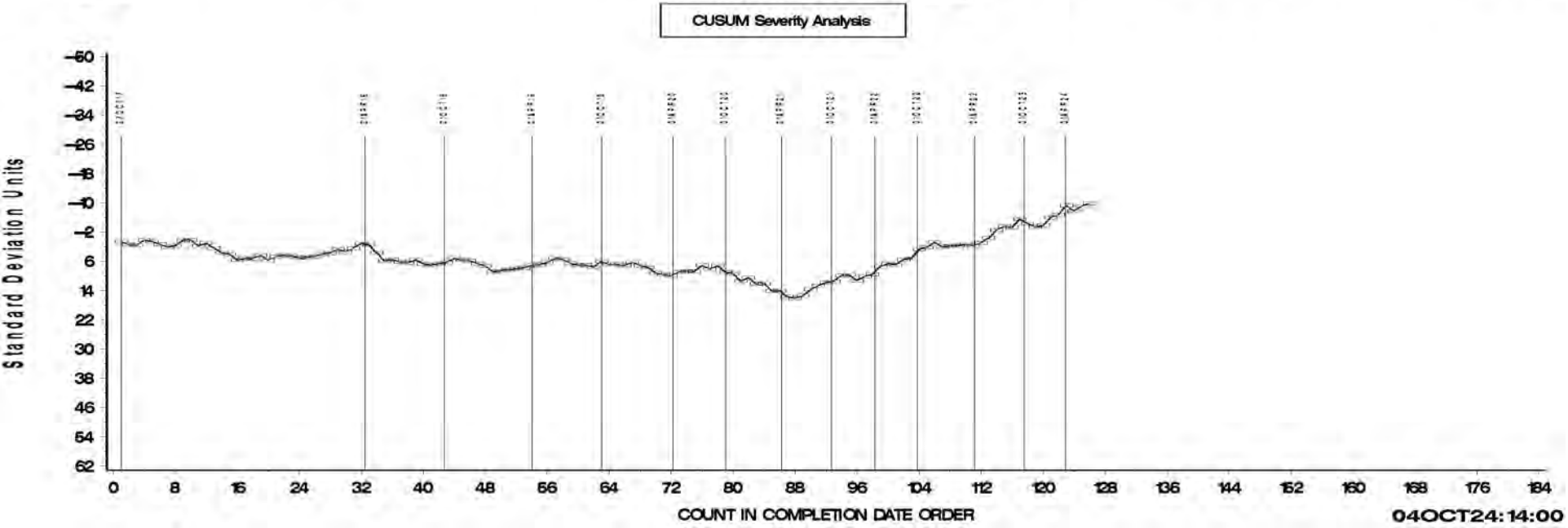


04OCT24:14:00

SEQUENCE IVB INDUSTRY OPERATIONALLY VALID DATA

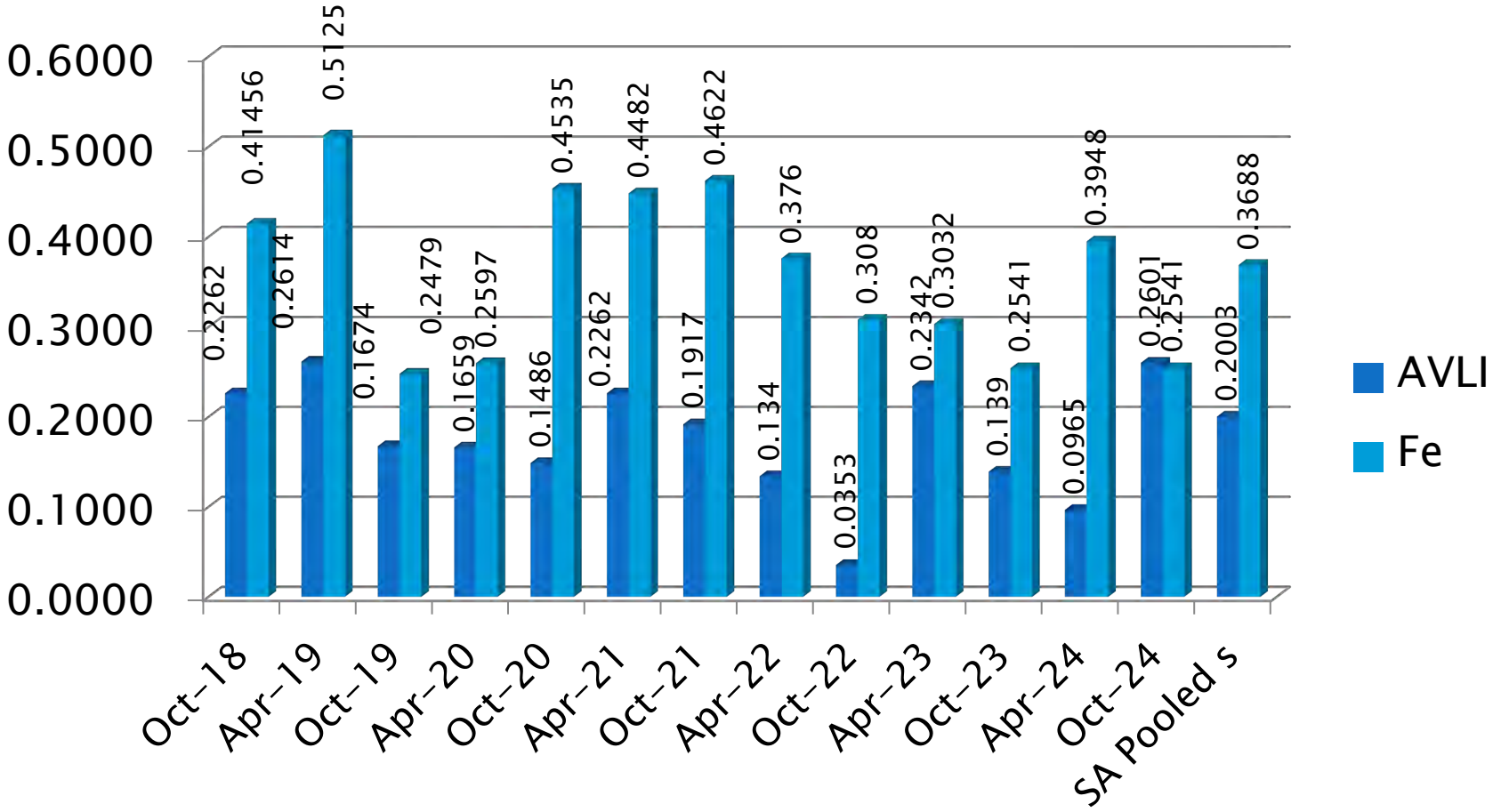
END OF TEST FE FINAL Severity Adjusted RESULT





04OCT24:14:00

Sequence IVB Precision Estimates



Return to Table of Contents

Sequence VH

- October 2024

Test Monitoring Center
https://www.astmtmc.org
A Program of ASTM International

Sequence VH Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	6
Statistically Unacceptable Calibration Test	OC	3
Operationally Invalid Calibration Test	LC	1
Terminated Early Calibration Test	XC	1
Total		**11**

Sequence VH – Failing Tests

Test Status	#
Ei Level 3 Alarm AES, Severe direction	1
Ei Level 3 Alarm AES and RAC, Severe direction	1
Ei Level 3 Alarm AES, RAC and AE50, Severe direction	1
Total	**3**

Sequence VH – Lost Tests

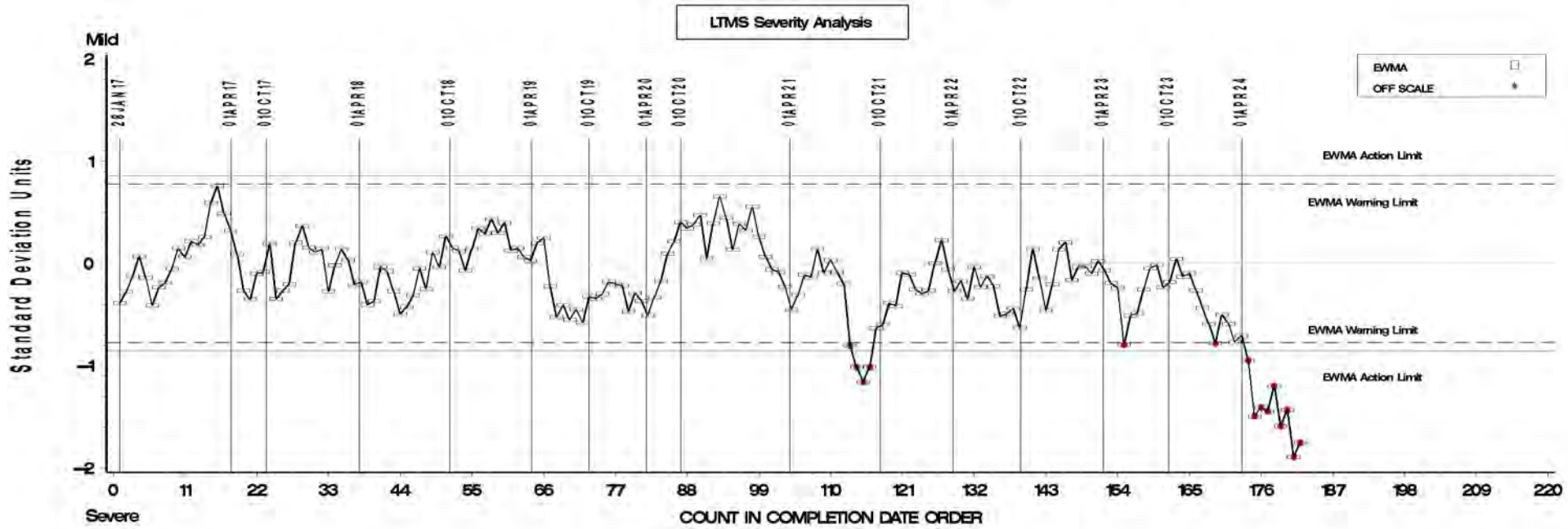
Test Status	Cause	#
Invalid	Excessive Fuel Dilution	1
Aborted	Excessive Fuel Dilution	1
Totals		**2**

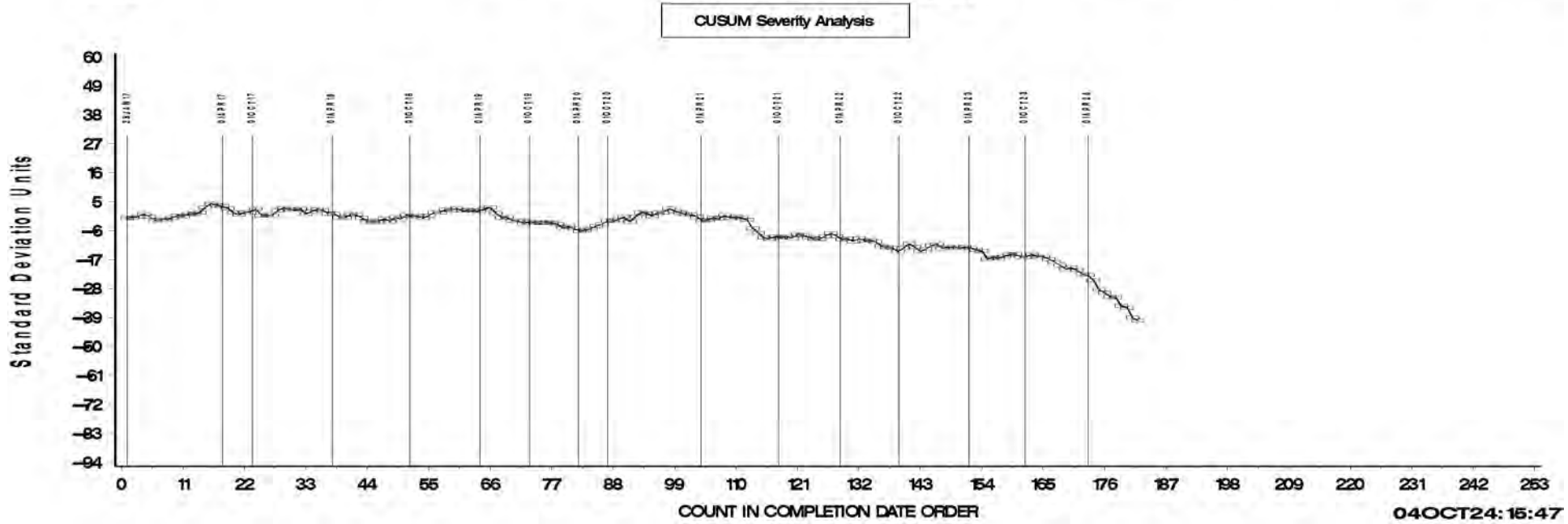
Sequence VH Test Severity

- AES, AE50 and RAC parameters are all in action alarm (severe direction)
- AP50 is in control

SEQUENCE VH INDUSTRY OPERATIONALLY VALID DATA

AVERAGE ENGINE SLUDGE FINAL RESULT



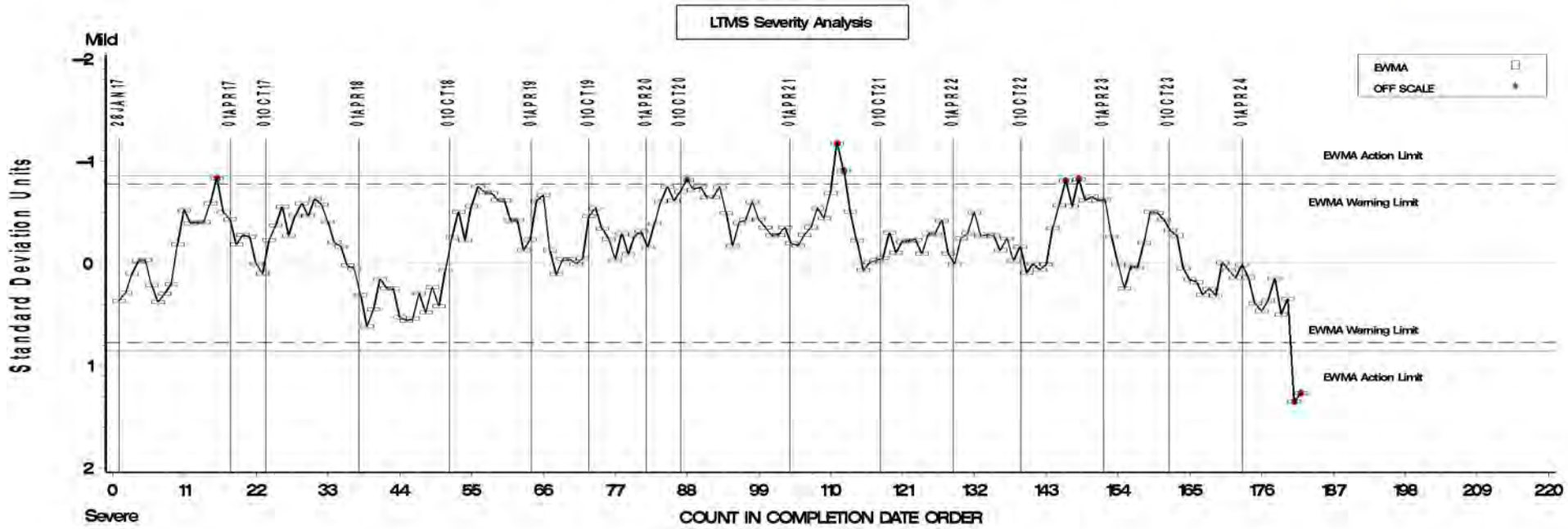


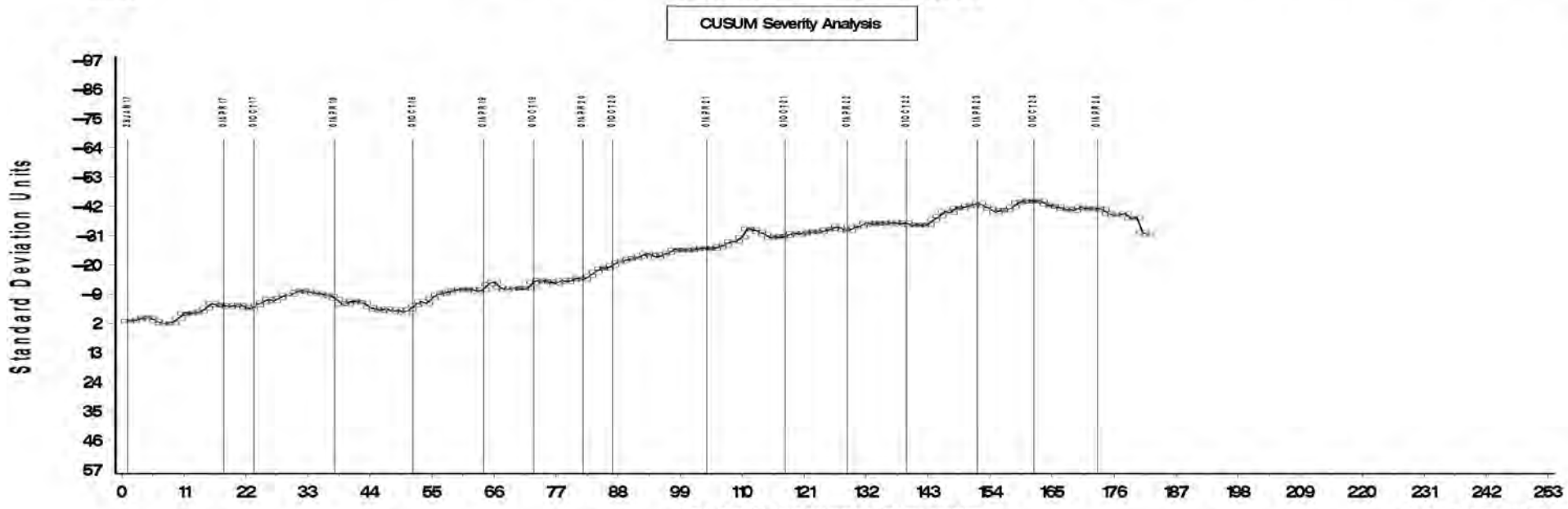
04OCT24:15:47

SEQUENCE VH INDUSTRY OPERATIONALLY VALID DATA

A Program of ASTM International

AVERAGE ROCKER COVER SLUDGE

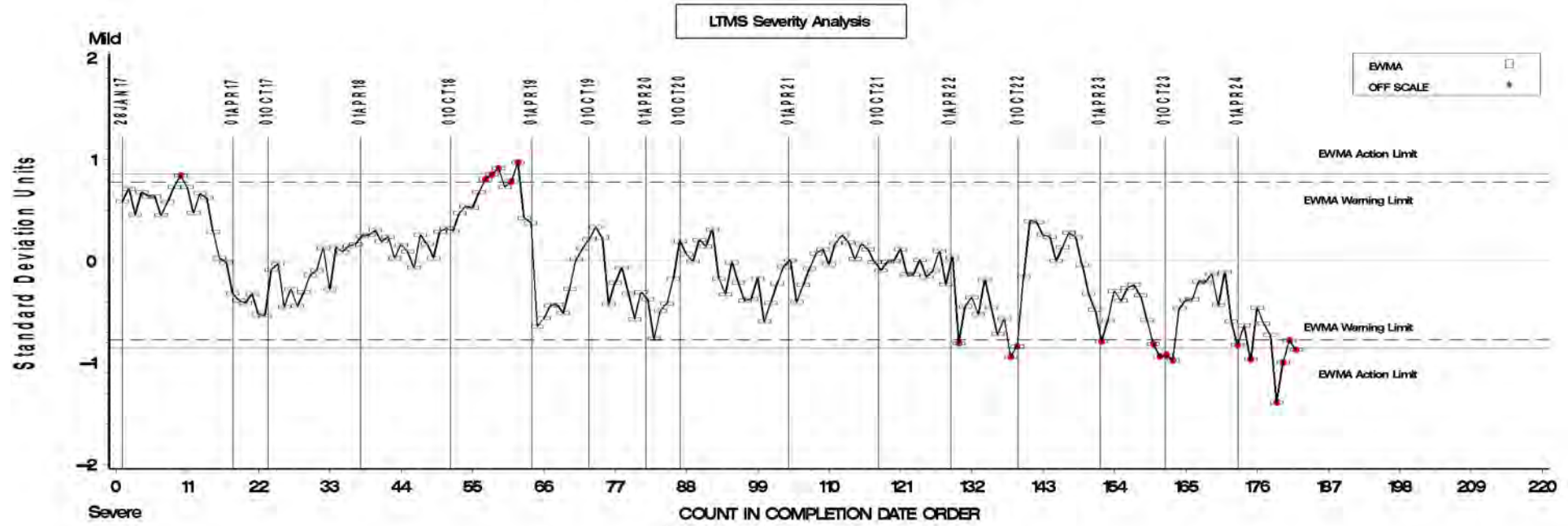


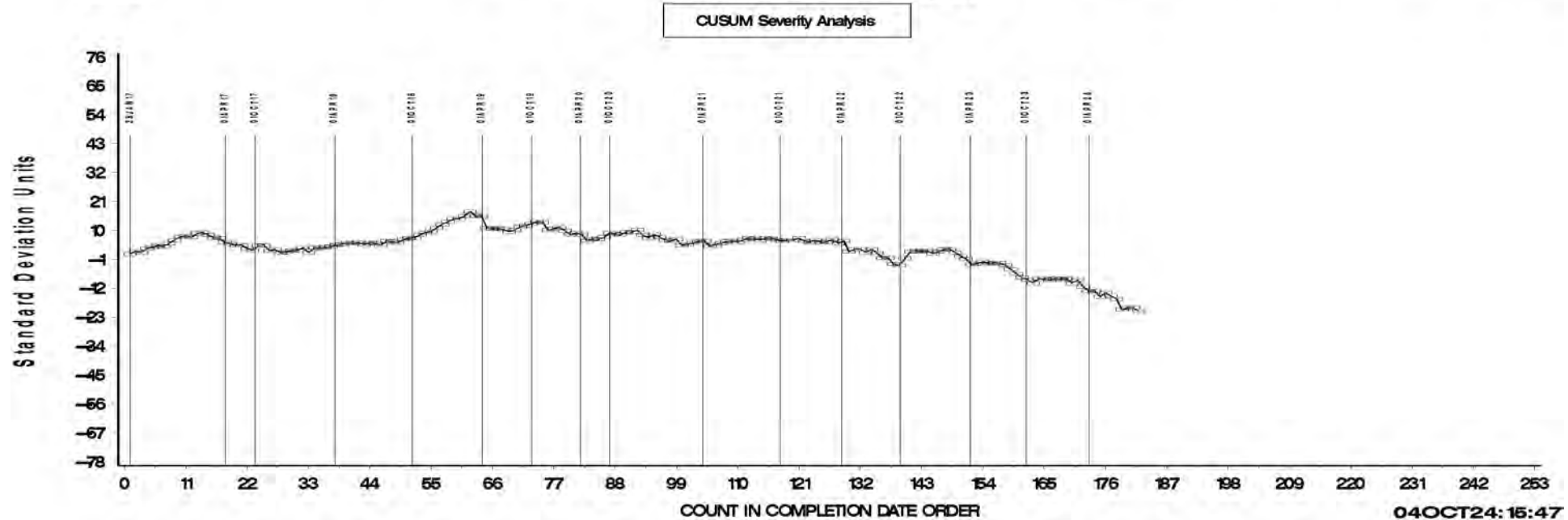


04OCT24:15:47

SEQUENCE VH INDUSTRY OPERATIONALLY VALID DATA

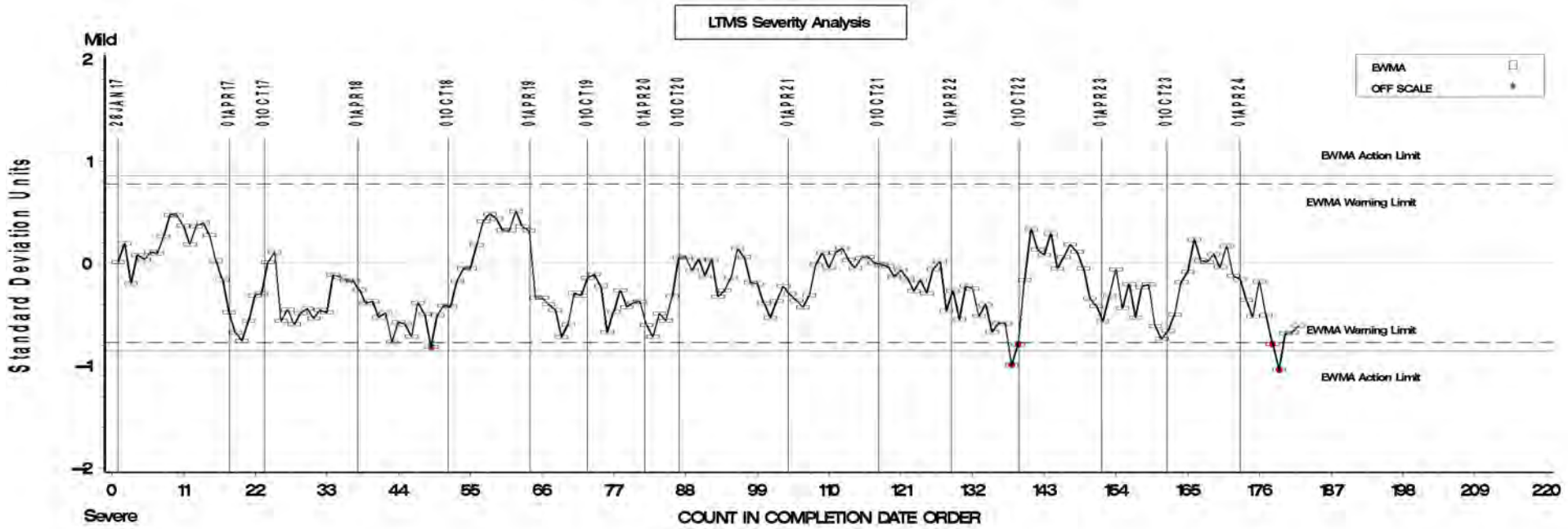
AVG. ENG. VARN. 50% RATING

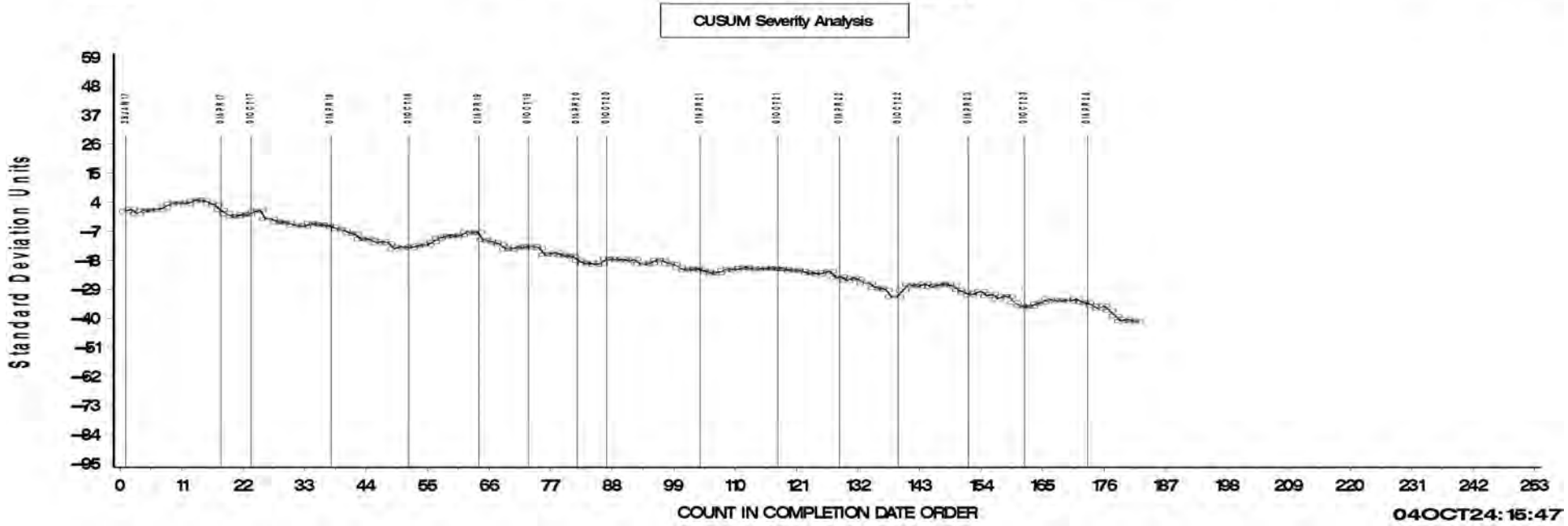




SEQUENCE VH INDUSTRY OPERATIONALLY VALID DATA

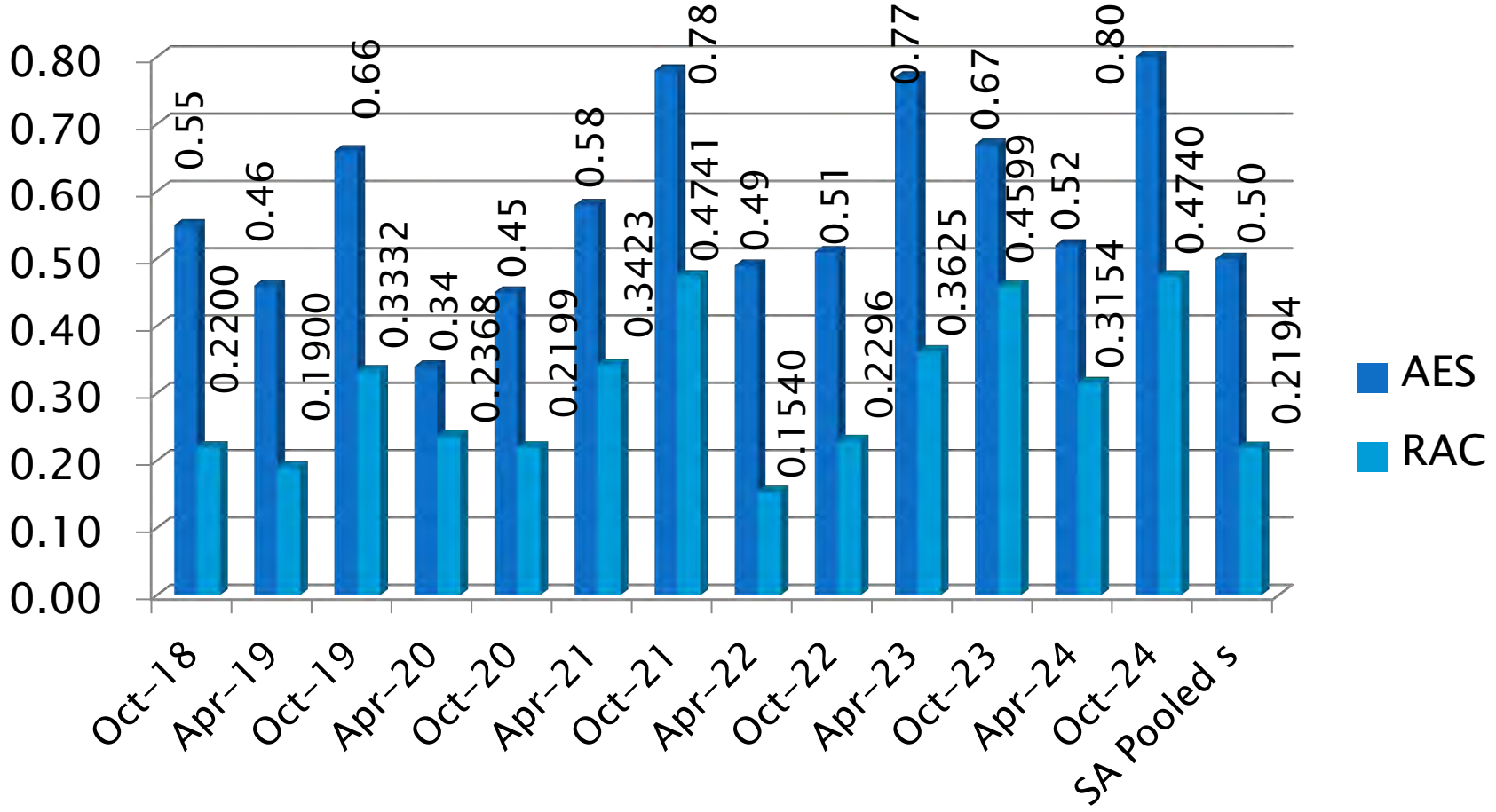
AVG PISTON SKIRT 50% RATING





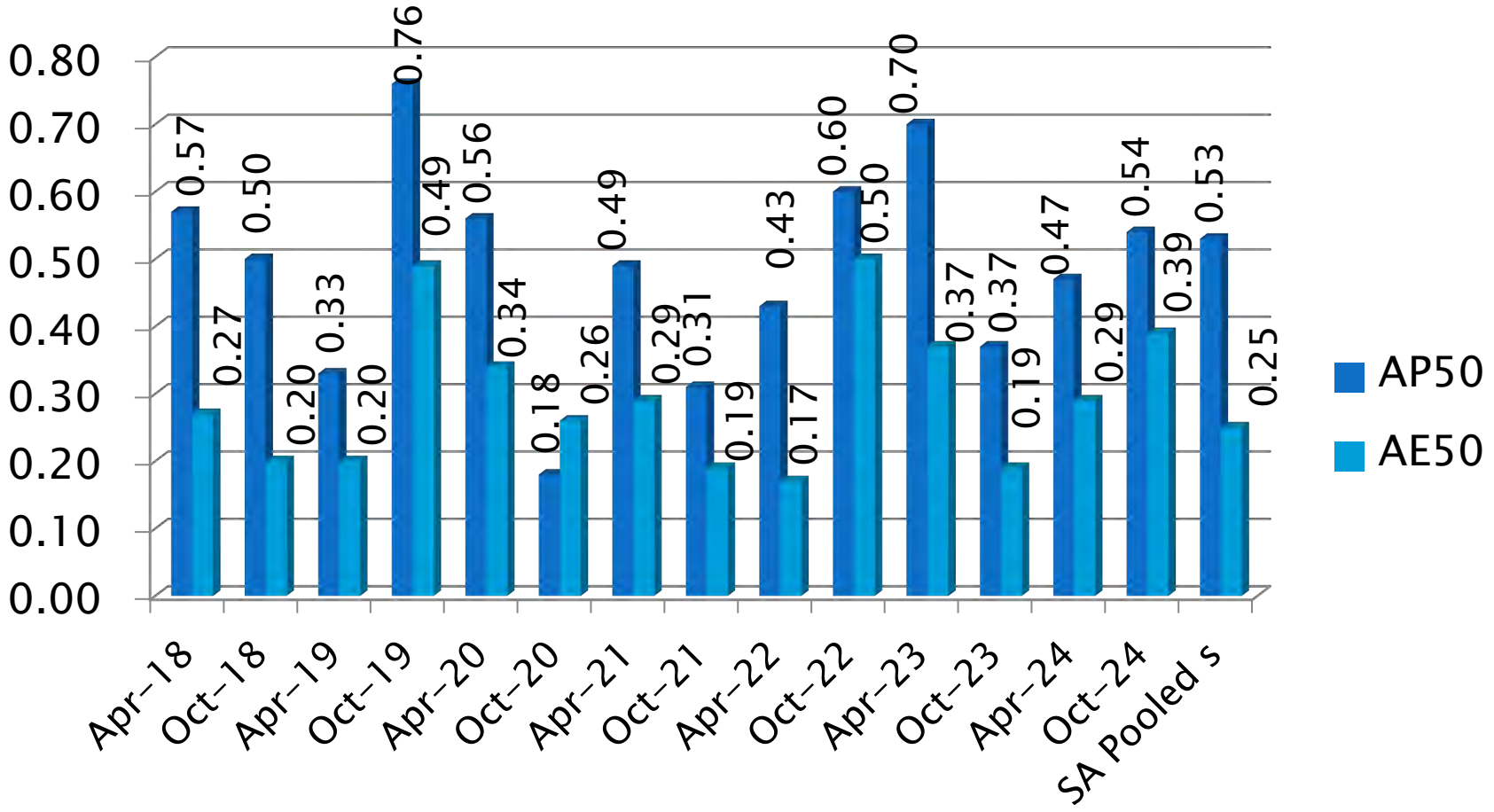
04OCT24:15:47

Sequence VH Precision Estimates



Test Monitoring Center
https://www.astmtmc.org
A Program of ASTM International

Sequence VH Precision Estimates



Return to Table of Contents

Sequence VIE

- October 2024

Test Monitoring Center
https://www.astmtmc.org
A Program of ASTM International

Sequence VIE Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	37
Engine Abandoned	MC	1
Engine Ran Additional Breakin after Failing Reference	MC	1
Statistically Unacceptable Calibration Test	OC	1
Aborted Calibration Test	XC	2
Total		**42**

Sequence VIF – Failing Tests

Test Status	#
FEI2 Shewhart Alarm, severe direction	1
Total	**1**

Sequence VIE – Lost Tests*

Test Status	Cause	#
Aborted	Downtime exceeded 24 hours	1
Aborted	Low oil pressure	1
Totals		**2**

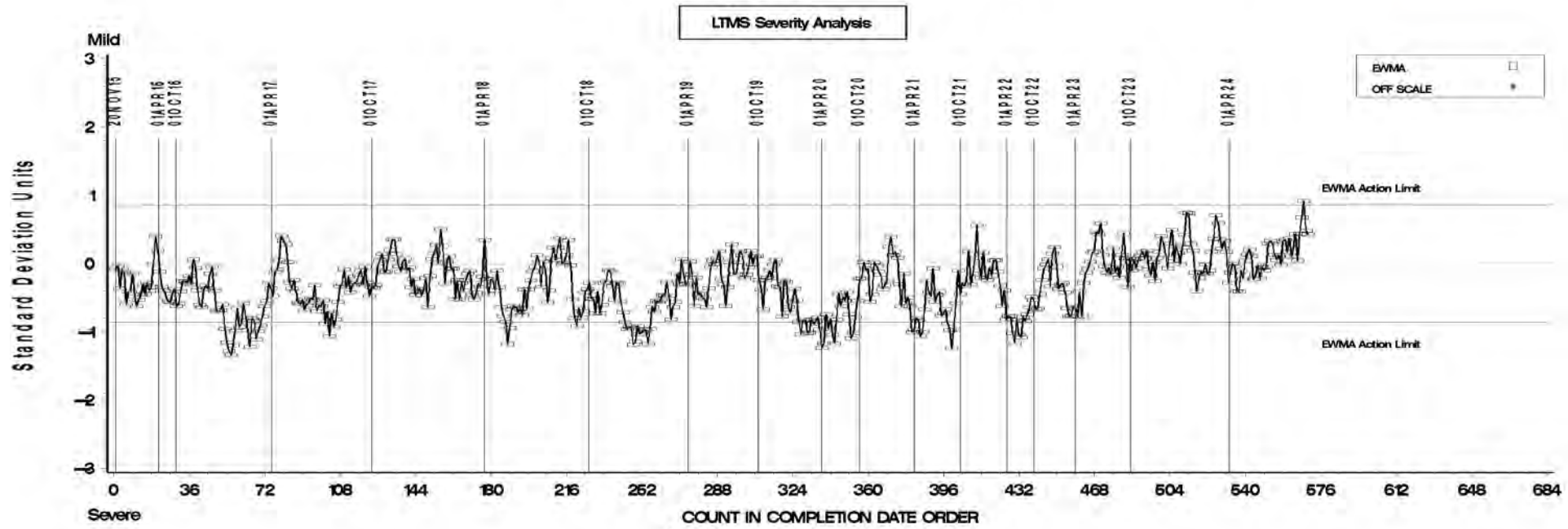
*Invalid and aborted tests

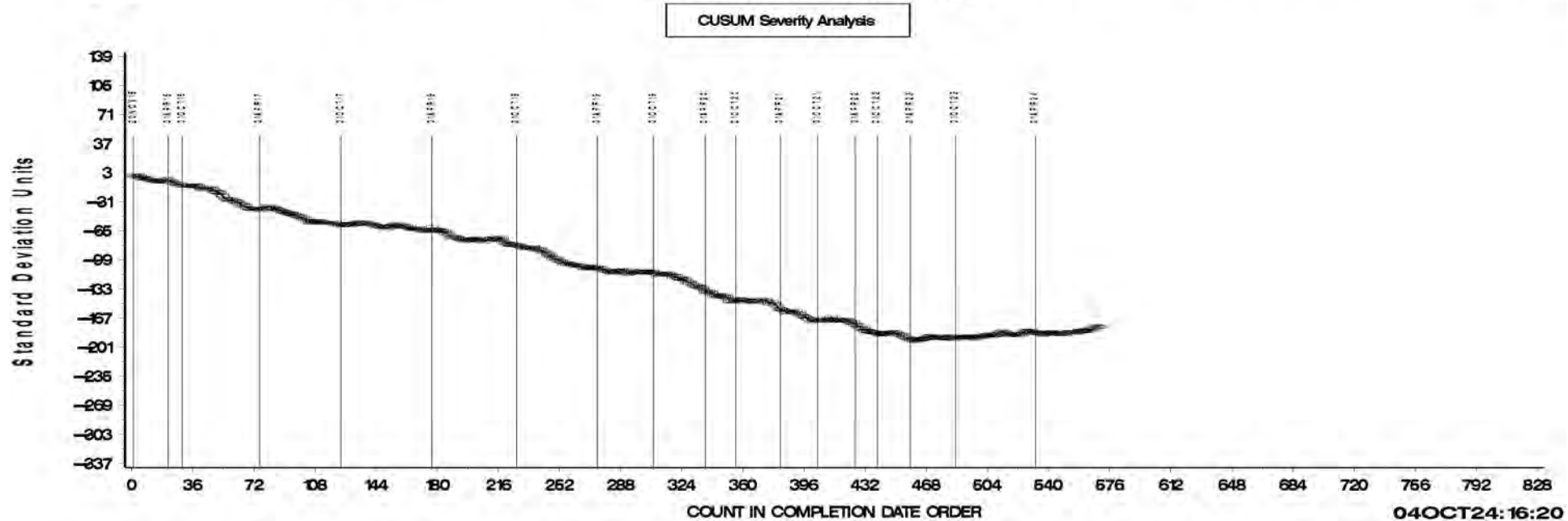
Sequence VIE Test Severity

- FEI1 and FEI2 are in control and have shown near target trends in the Cusum and EWMA charts for the past two report periods.

SEQUNCE VIE INDUSTRY OPERATIONALLY VALID DATA

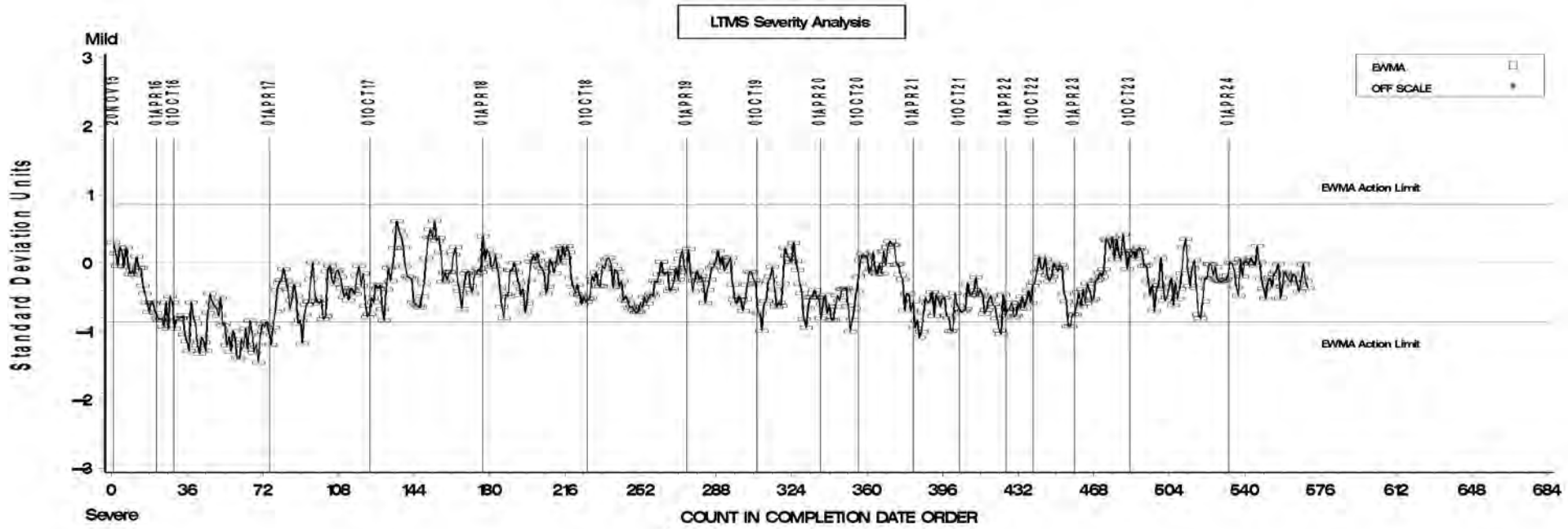
FEI FINAL RESULT PHASE I

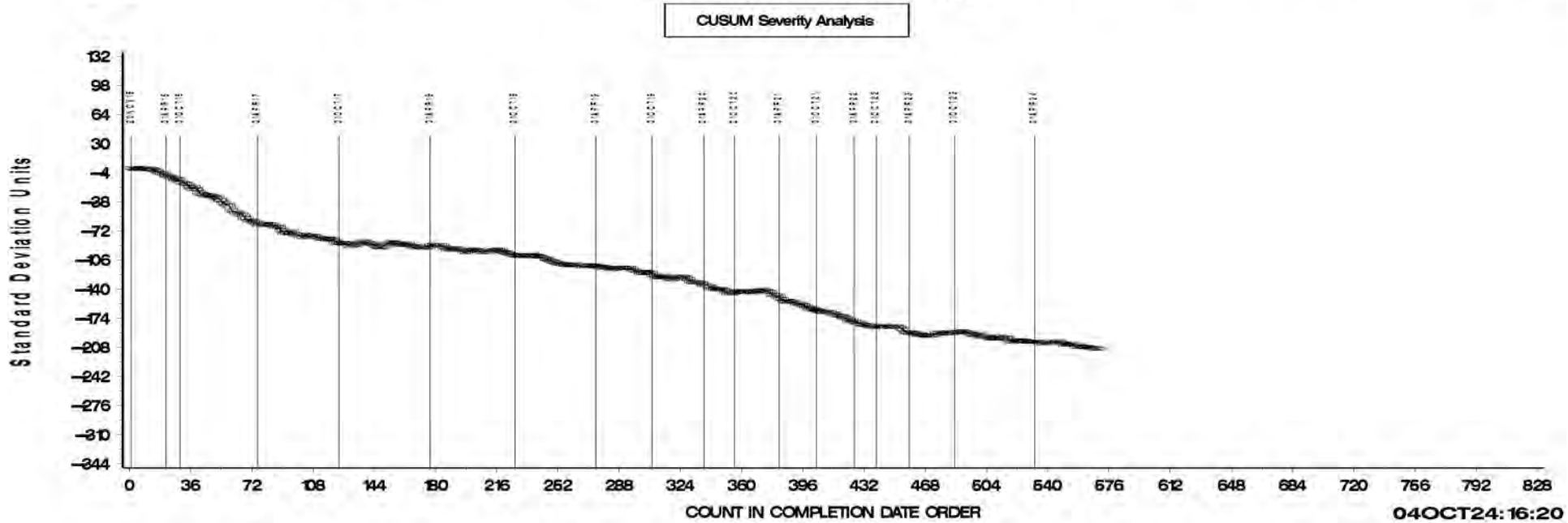




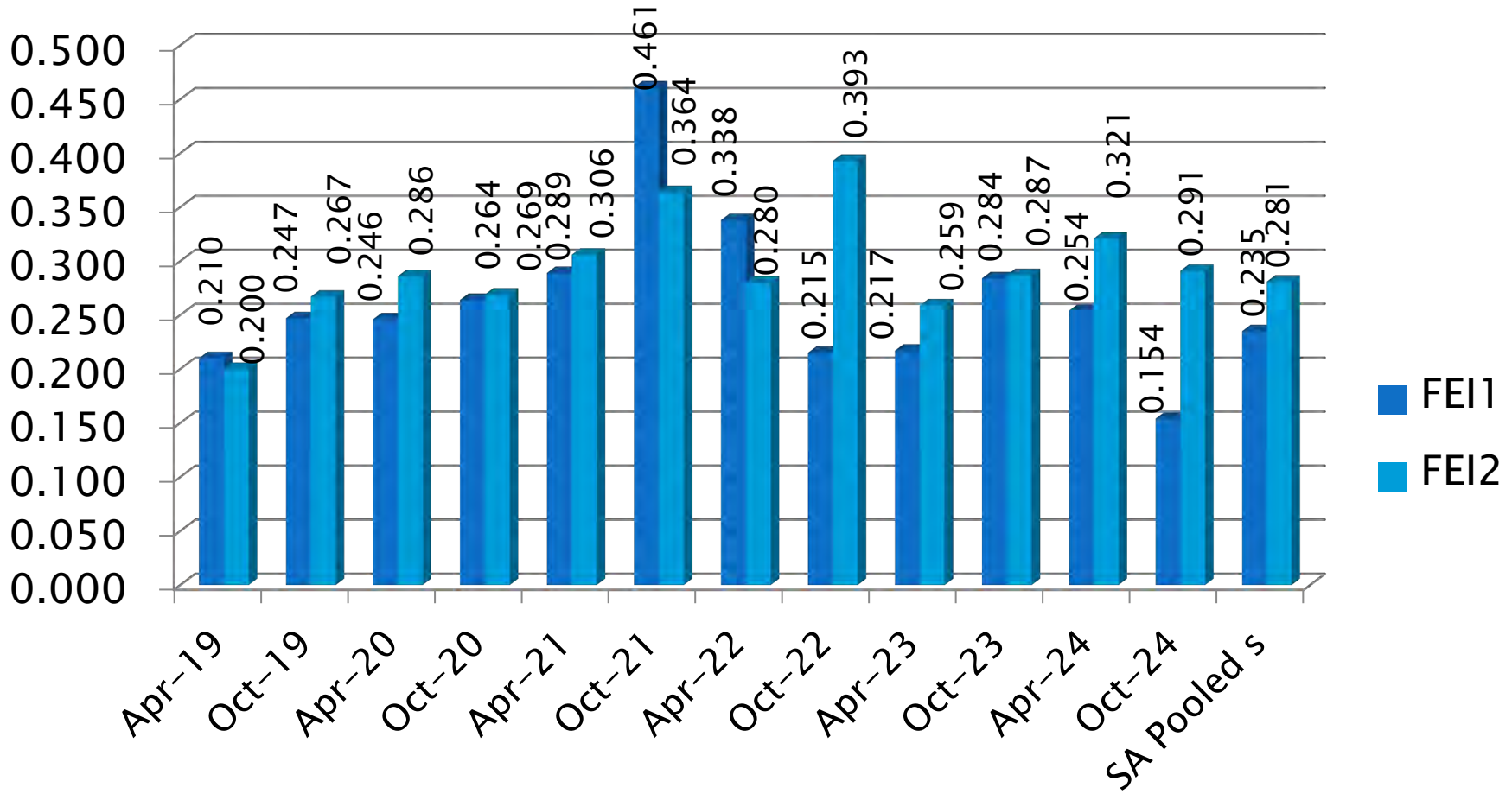
SEQUNCE VIE INDUSTRY OPERATIONALLY VALID DATA

FEI FINAL RESULT PHASE II





Sequence VIE Precision Estimates



Return to Table of Contents

Sequence VIF

- October 2024

Test Monitoring Center
https://www.astmtmc.org
A Program of ASTM International

Sequence VIF Activity

Awaiting 1 test from SwRI

Test Status	Validity Code	#
Acceptable Calibration Test	AC	24
Engine Abandoned	MC	5
Operationally Invalid Calibration Test	LC	2
Statistically Unacceptable Calibration Test	OC	2
Aborted Calibration Test	XC	1
Total		**34**

Sequence VIF – Failing Tests

Test Status	#
FEI1 Wi Alarm, mild direction*	2
Total	**2**

* Failing tests were the first of 2 required for calibration, stand subsequently met calibration criteria with the second test.

Sequence VIF – Lost Tests*

Test Status	Cause	#
Aborted	Oil loss	1
Invalid	BL Shift between BL1 and BL2 >0.40% with no BLB3 run.	1
Invalid	Oil Contaminated	1
Totals		**3**

*Invalid and aborted tests

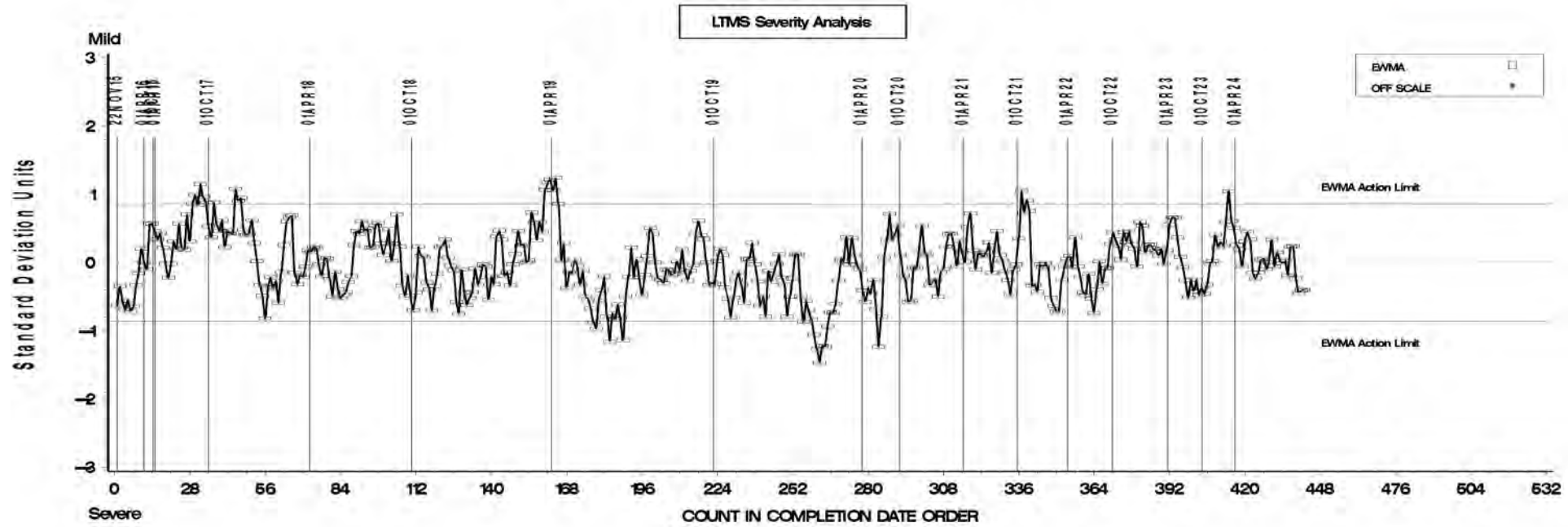
Sequence VIF Test Severity

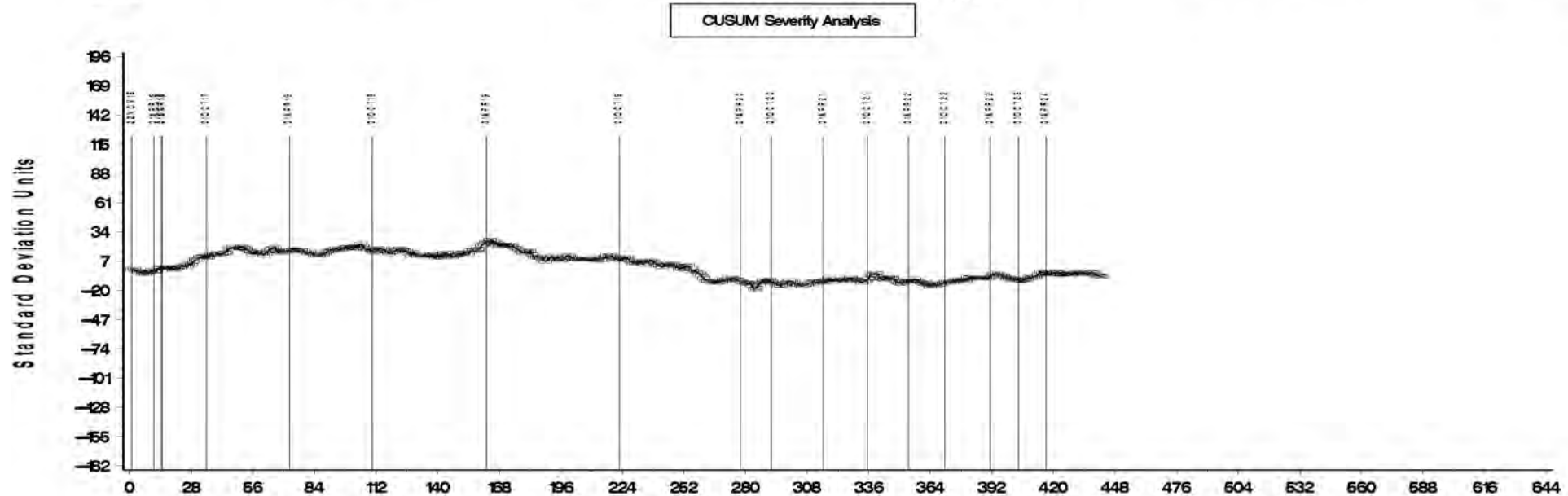
- FEI1 is in control
- FEI2 is in control

SEQUNCE VIF INDUSTRY OPERATIONALLY VALID DATA

A Program of ASTM International

FEI FINAL RESULT PHASE I





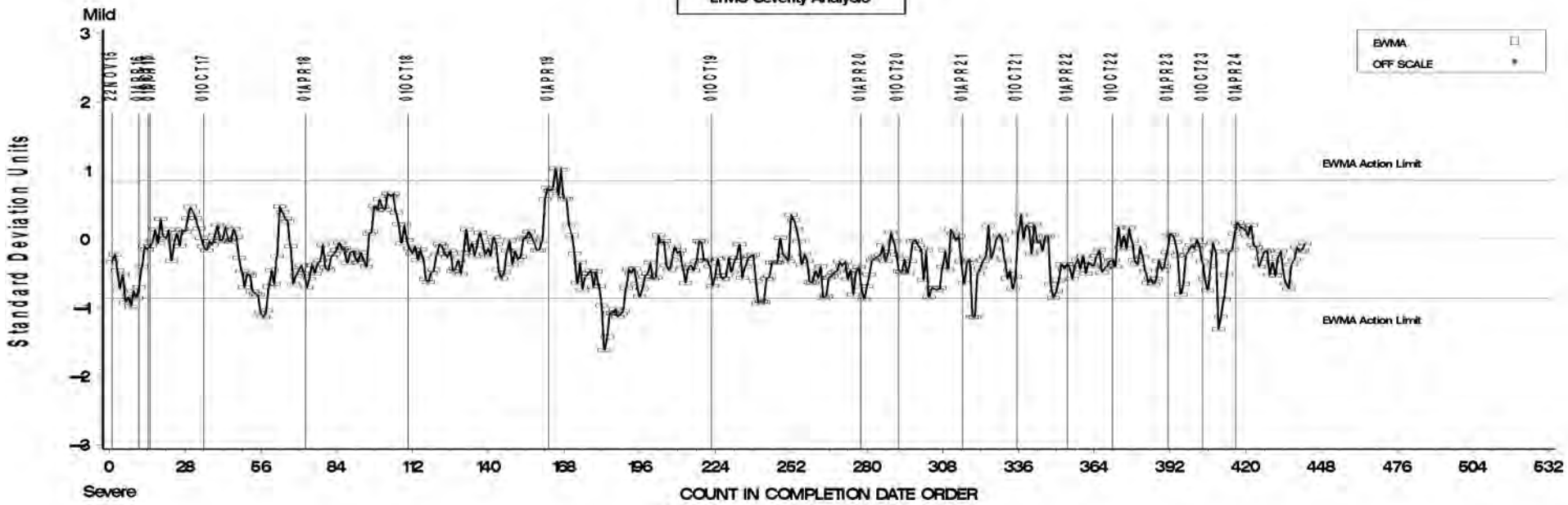
07OCT24:11:38

SEQUNCE VIF INDUSTRY OPERATIONALLY VALID DATA

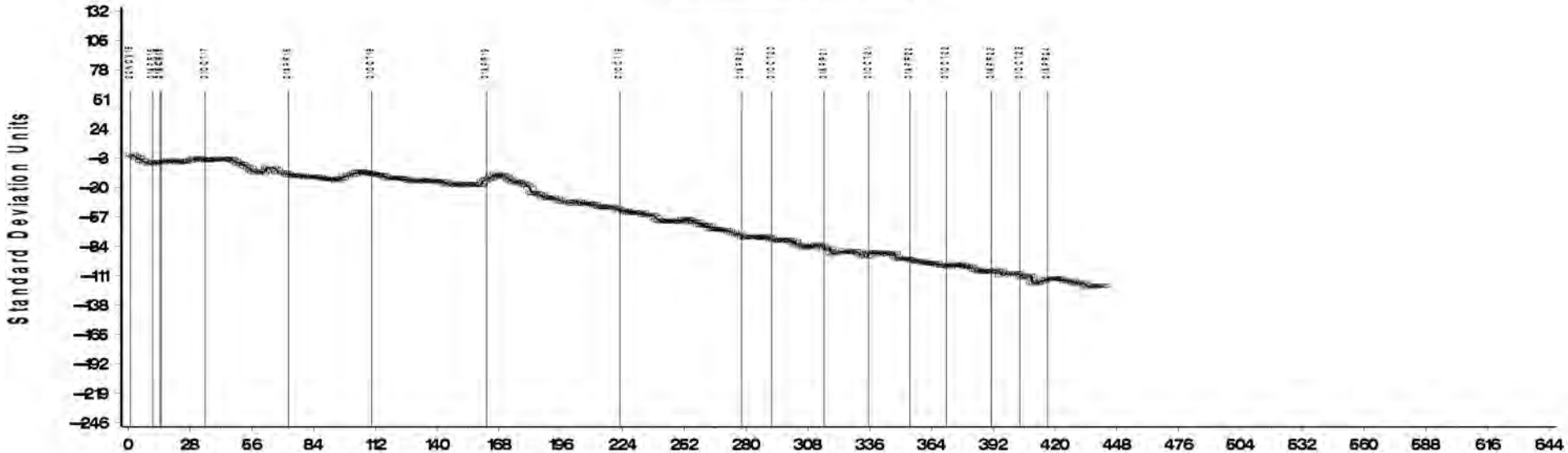
A Program of ASTM International

FEI FINAL RESULT PHASE II

LTMS Severity Analysis

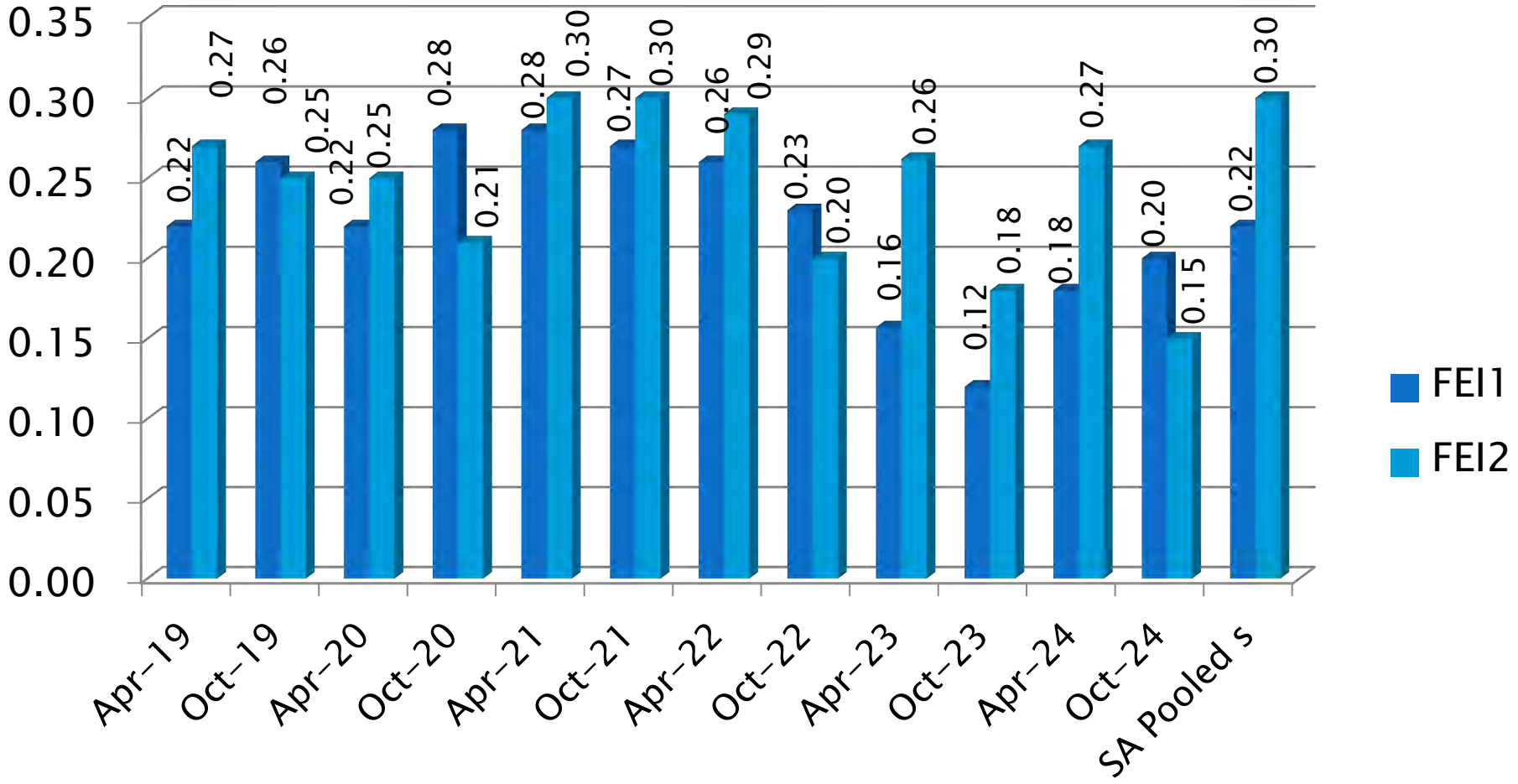


CUSUM Severity Analysis



07OCT24:11:38

Sequence VIF Precision Estimates



Return to Table of Contents

Sequence VIII

- October 2024

Test Monitoring Center
https://www.astmtmc.org
A Program of ASTM International

Sequence VIII Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	5
Failed Calibration Test	OC	1
Operationally Invalid Calibration Test (High Mechanical Wear)	LC	2
Aborted	XC	2
Total		10

Sequence VIII – Lost Tests*

Test Status	Cause	#
Invalid	High Mechanical Wear	2
Aborted	High Dyno Coolant Temperature	1
Aborted	Load Control Issues Related to Dyno	1
Totals		**4**

*Invalid and aborted tests

Sequence VIII– Failed Tests

Test Status	#
Stand Precision Shewhart Alarm, Stripped Viscosity	1
Total	**1**

Sequence VIII Test Severity

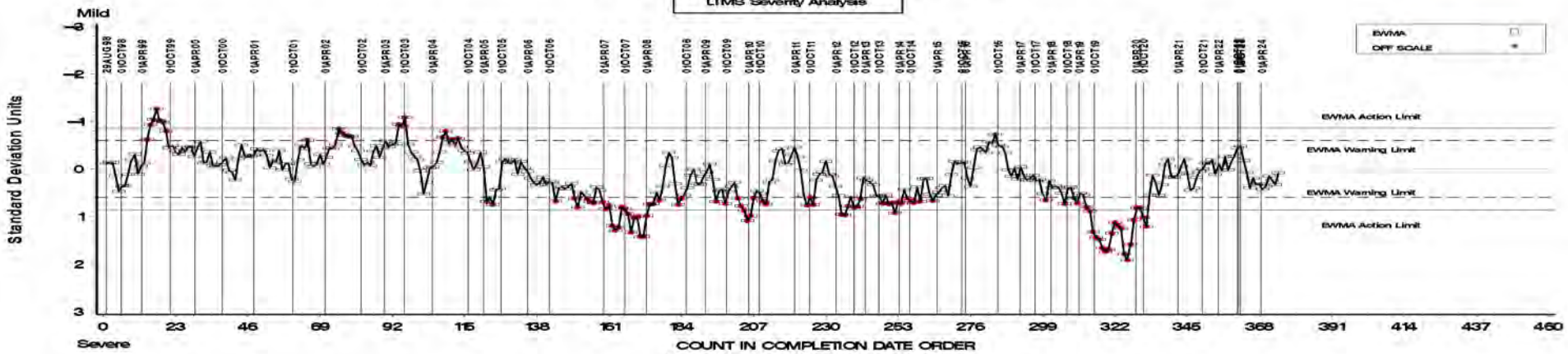
- BWLS is in control
- SVIS is in control (trending mild)

SEQUENCE VIII INDUSTRY OPERATIONALLY VALID DATA

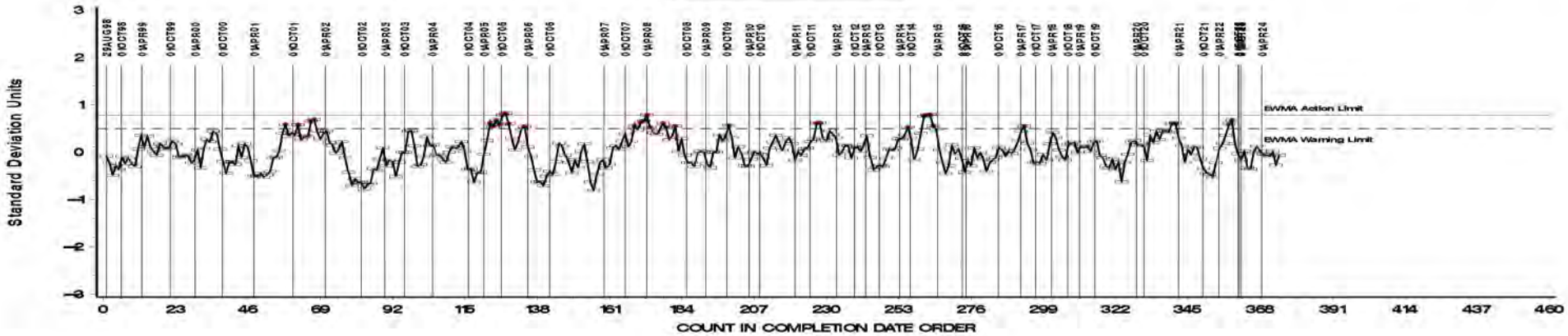
A Program of ASTM International

FINAL BEARING WEIGHT LOSS

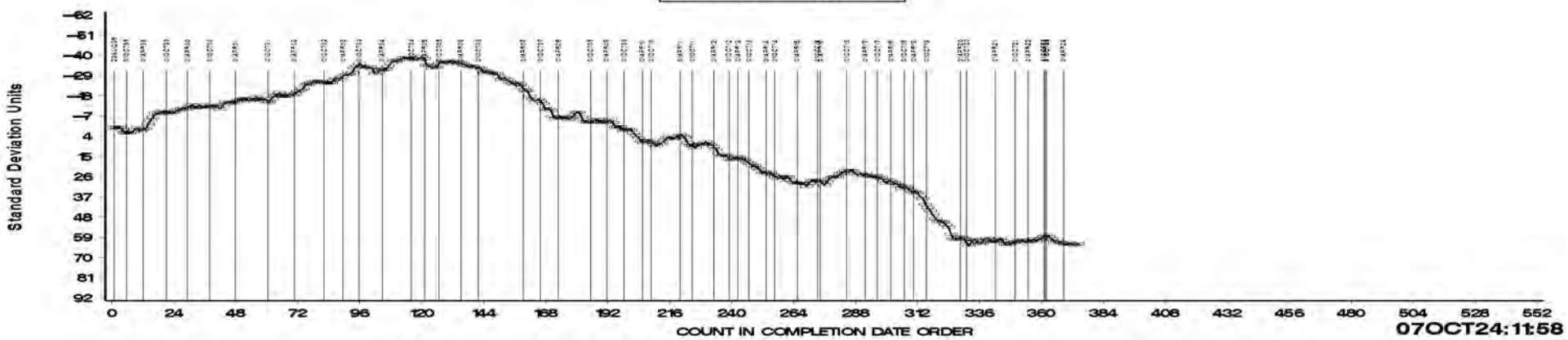
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis



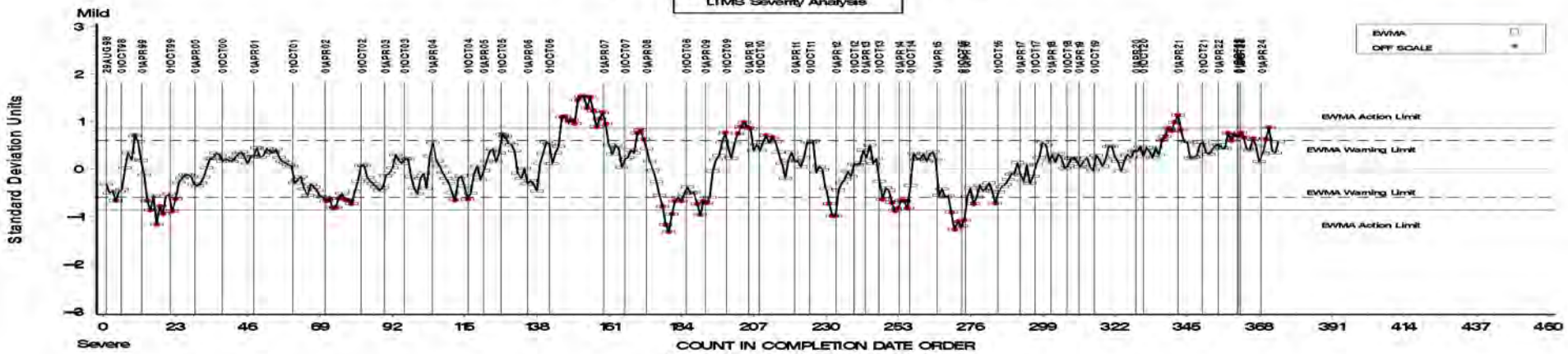
07OCT24:11:58

SEQUENCE VIII INDUSTRY OPERATIONALLY VALID DATA

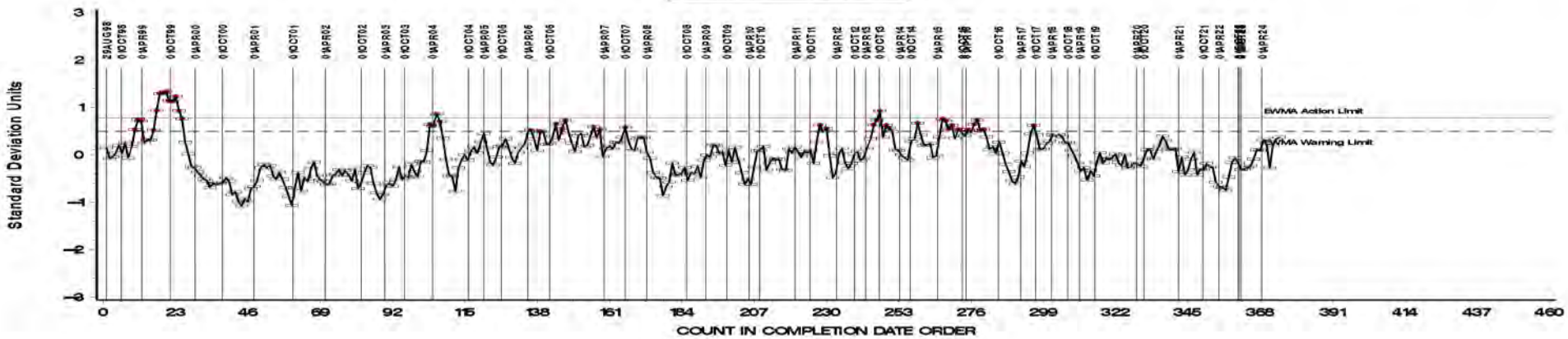
A Program of ASTM International

STRIPPED VIS. @ 100 DEG C

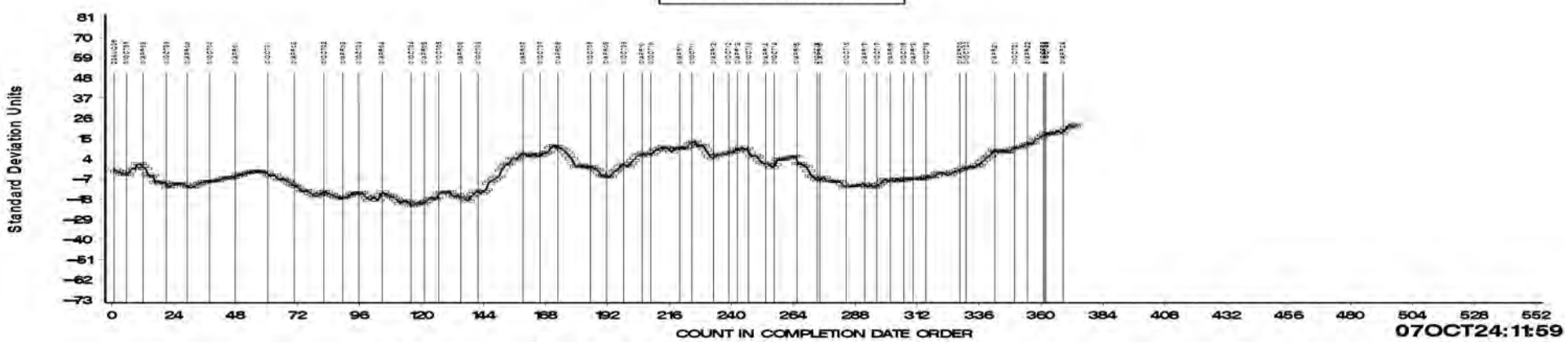
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis



07OCT24:11:59

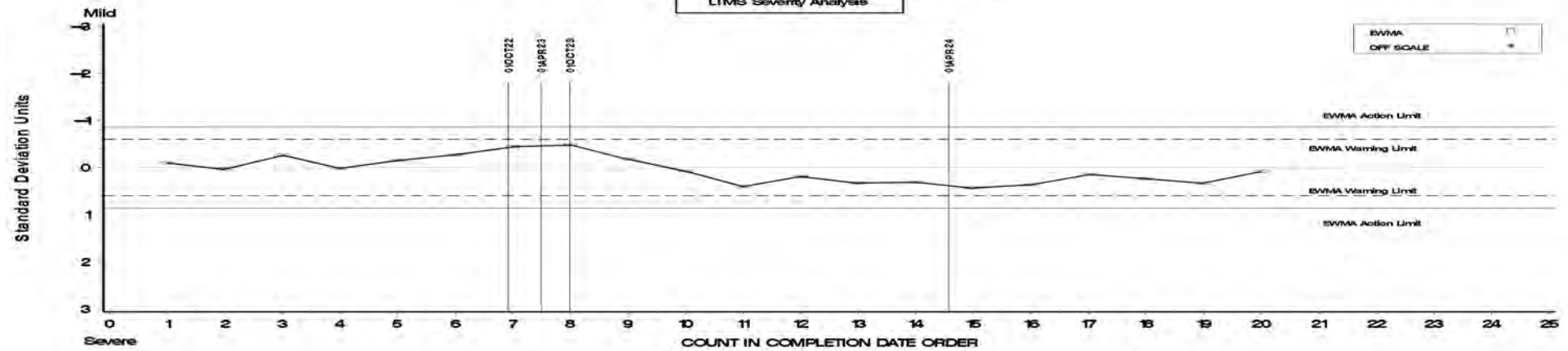
SEQUENCE VIII INDUSTRY OPERATIONALLY VALID DATA

Last 20 tests

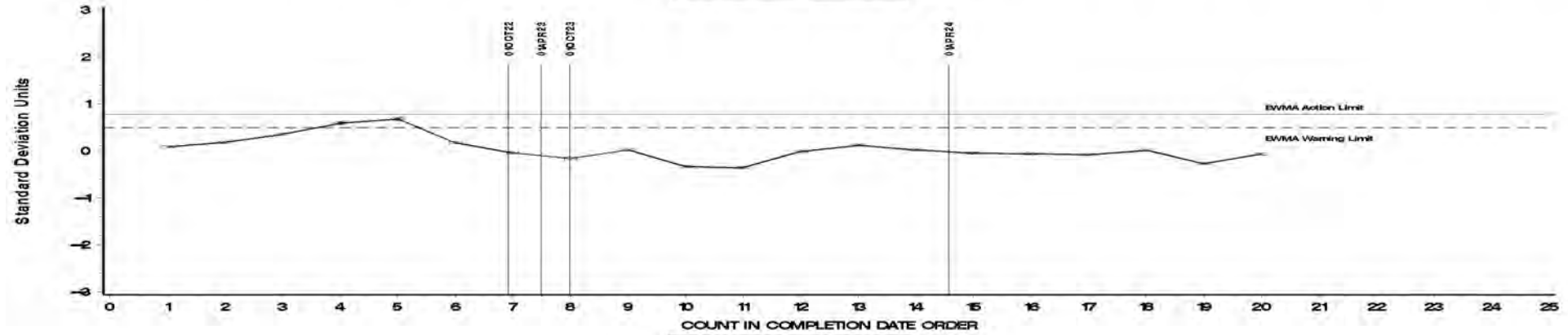
FINAL BEARING WEIGHT LOSS

A Program of ASTM International

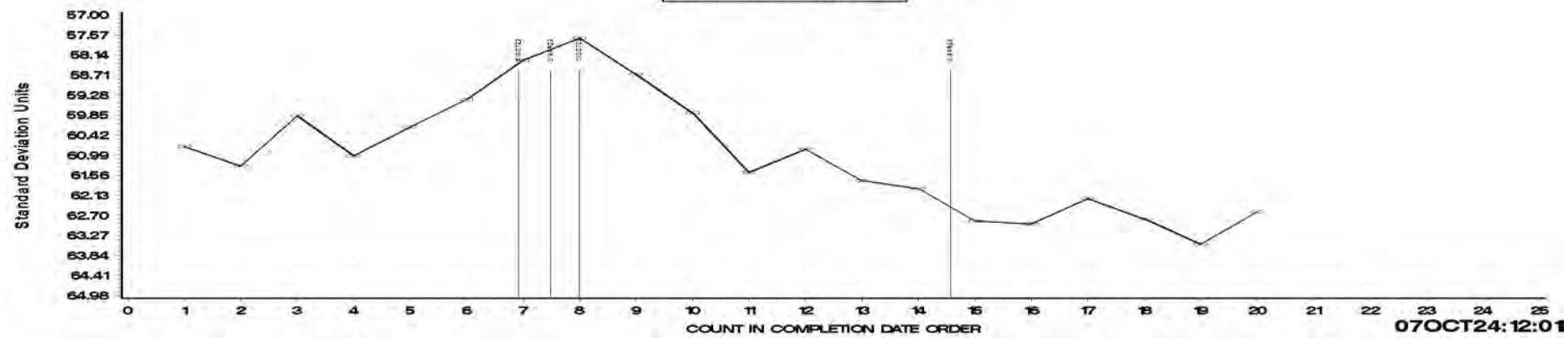
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis



07OCT24:12:01

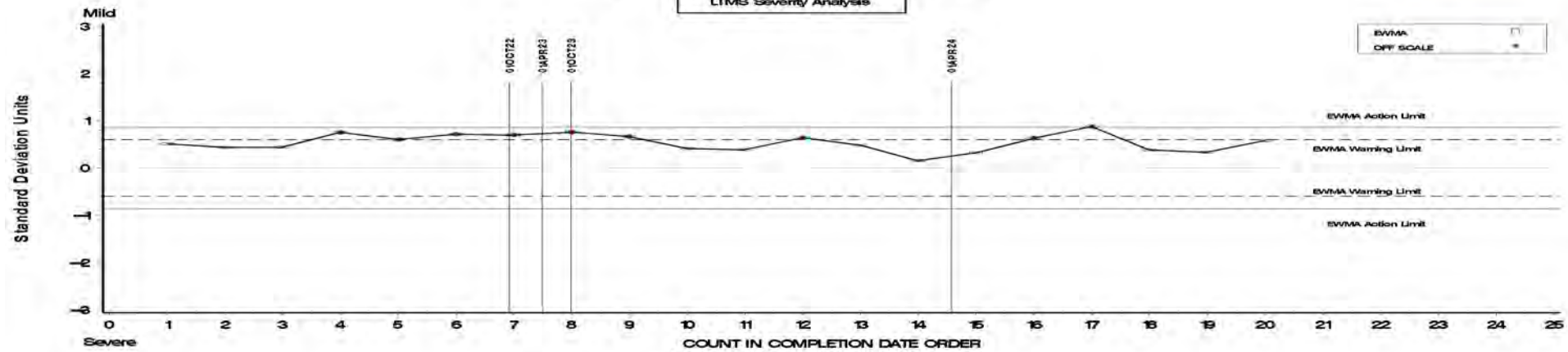
SEQUENCE VIII INDUSTRY OPERATIONALLY VALID DATA

Last 20 tests

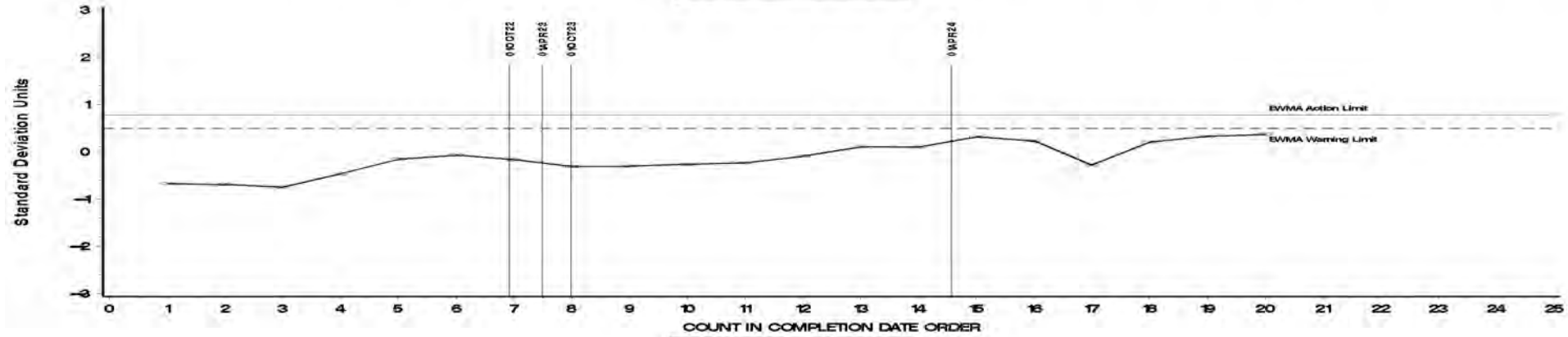
STRIPPED VIS. @ 100 DEG C

A Program of ASTM International

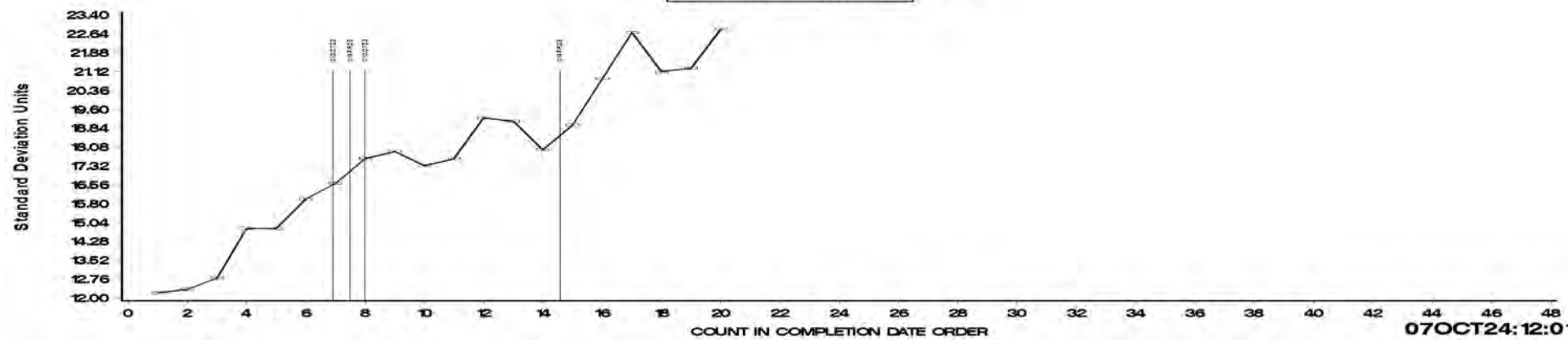
LTMS Severity Analysis



LTMS Precision Analysis

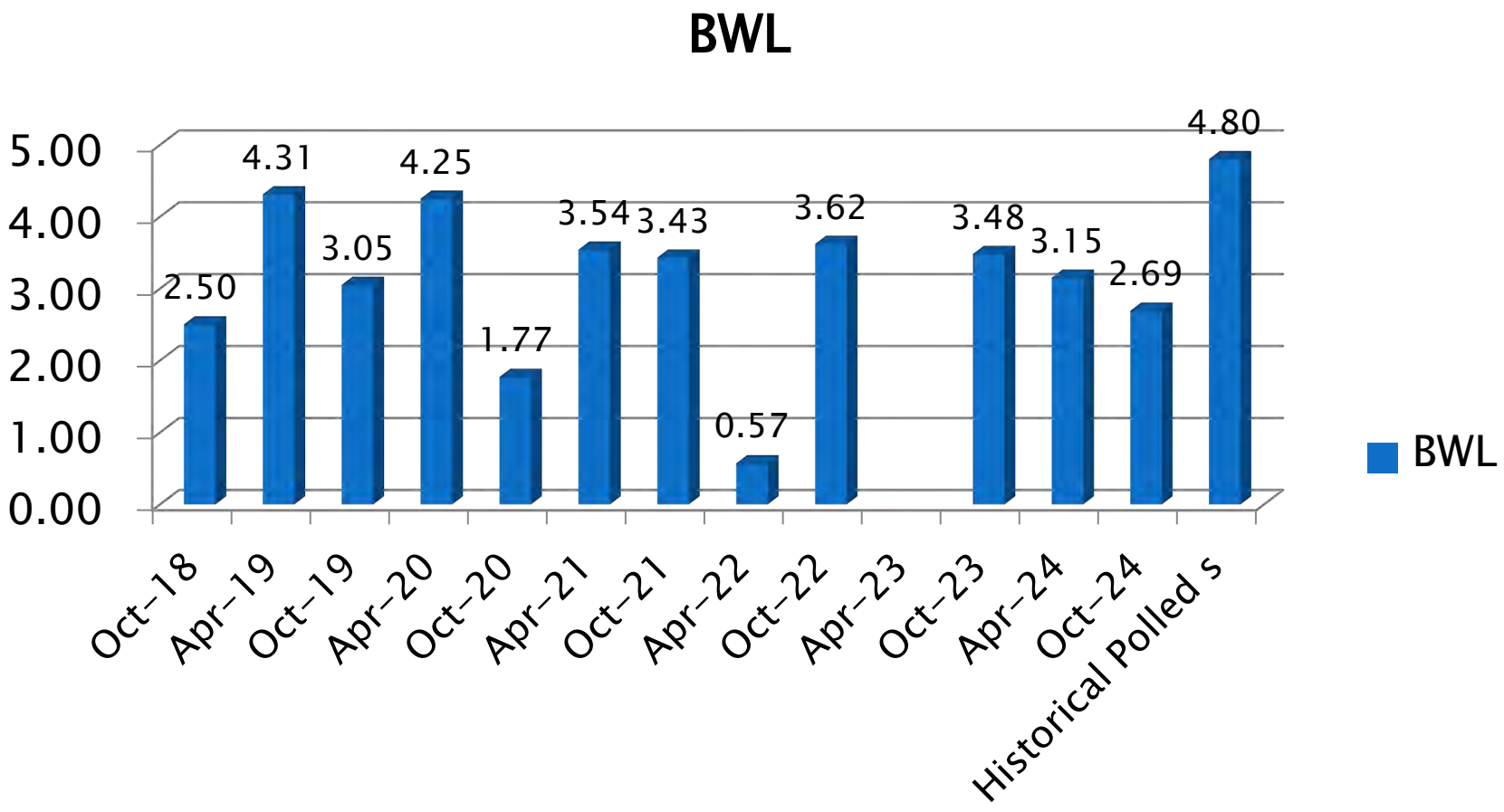


CUSUM Severity Analysis

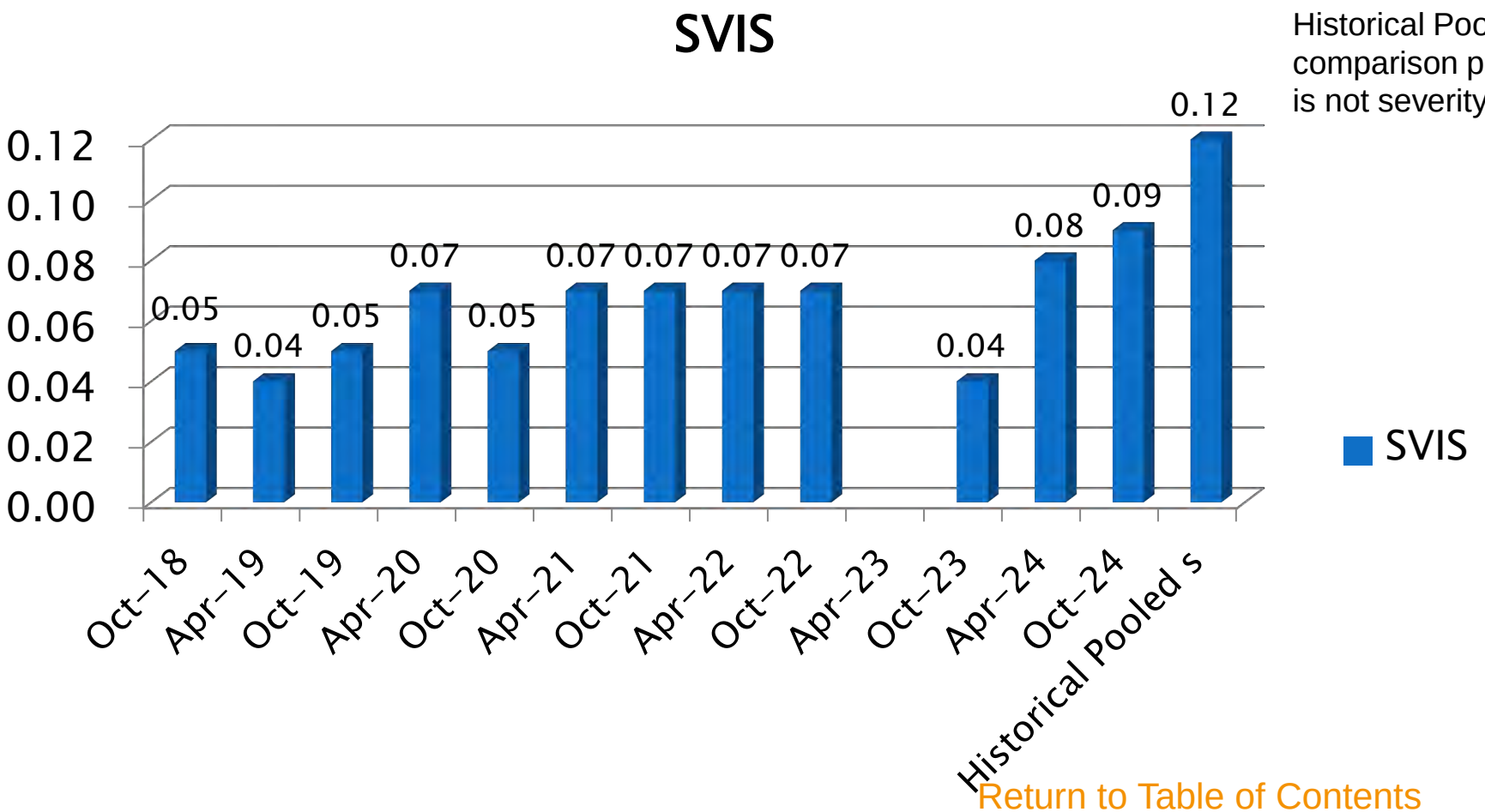


07OCT24:12:01

Sequence VIII Precision Estimates



Sequence VIII Precision Estimates



Historical Pooled s used for comparison purposes, parameter is not severity adjusted.

Return to Table of Contents

Sequence IX

- October 2024

Test Monitoring Center
https://www.astmtmc.org
A Program of ASTM International

Sequence IX Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	29
Statistically Unacceptable Calibration Test	OC	5
Operationally Invalid Calibration Test (lab judgement)	LC	2
IMTS Piston Evaluation	NI	3
Engine Abandoned	MC	3
Acceptable Donated Test, Reference Oil 224-2 Introduction	AG	3
Total		**45**

Sequence IX – Failed Tests

Test Status	Number of Tests
Ei Level 3 alarm (mild direction)	4
Ei Level 3 alarm (severe direction)	1
Total	**5**

Sequence IX – Lost Tests*

Test Status	Cause	#
Invalid	Did not obtain 4 valid iterations	1
Invalid	Voltage Issues	1
Totals		**2**

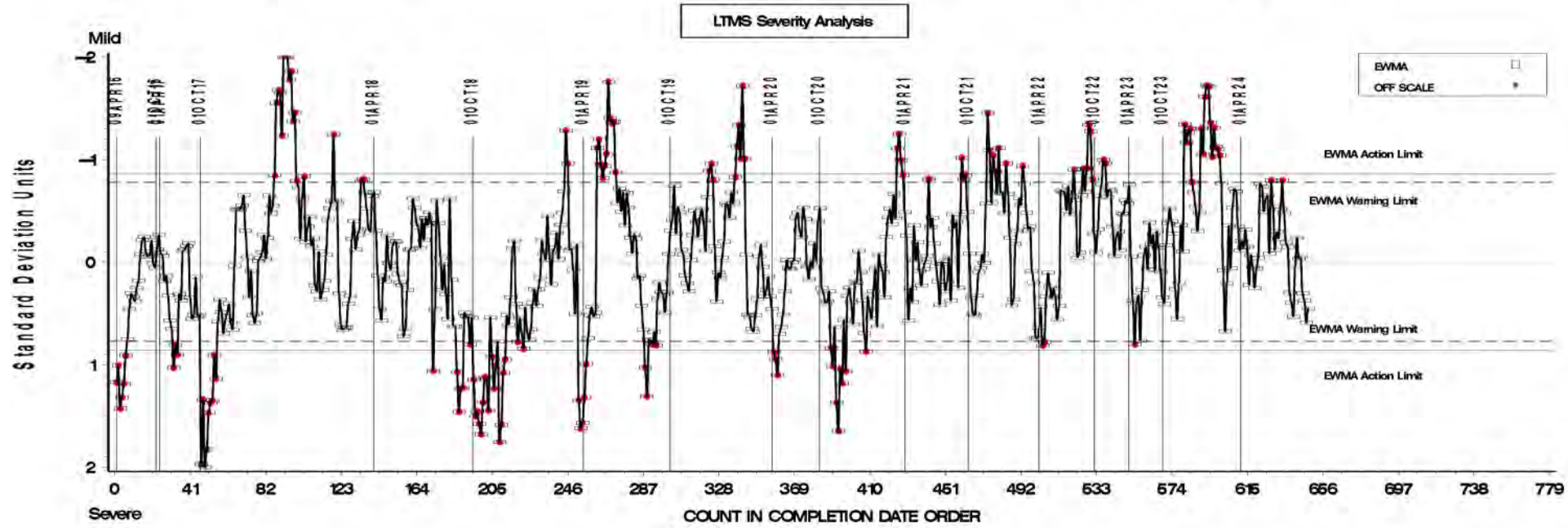
*Invalid and aborted tests

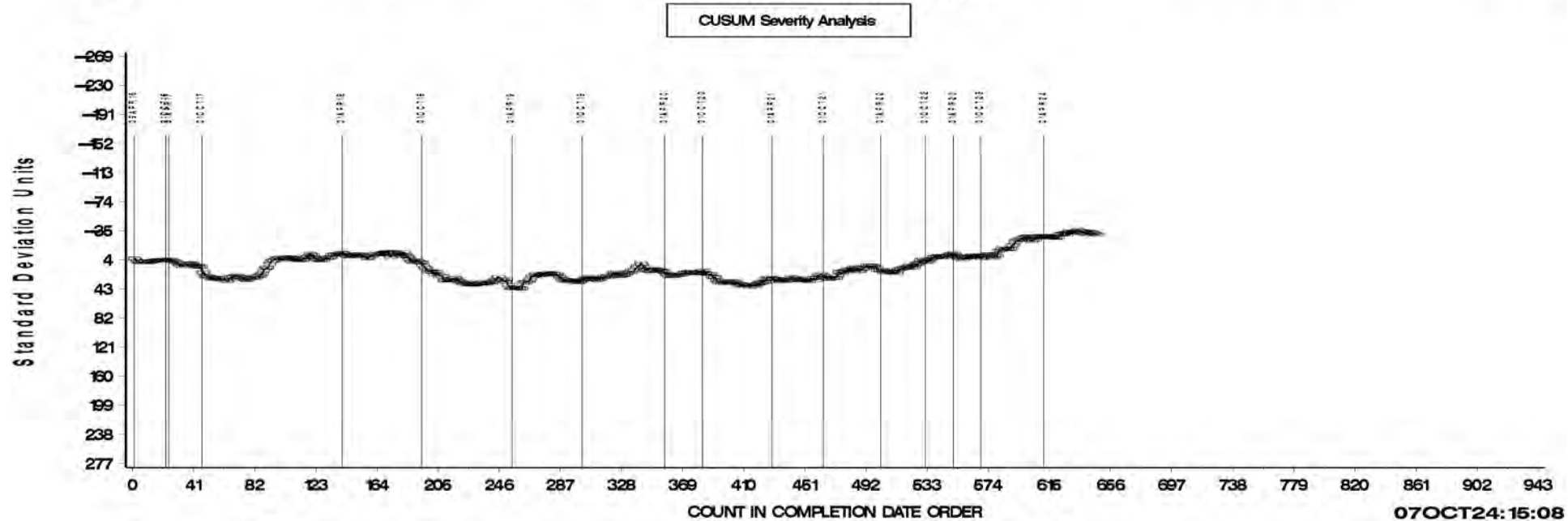
Sequence IX Test Severity

- Average number of Pre-ignitions in control.

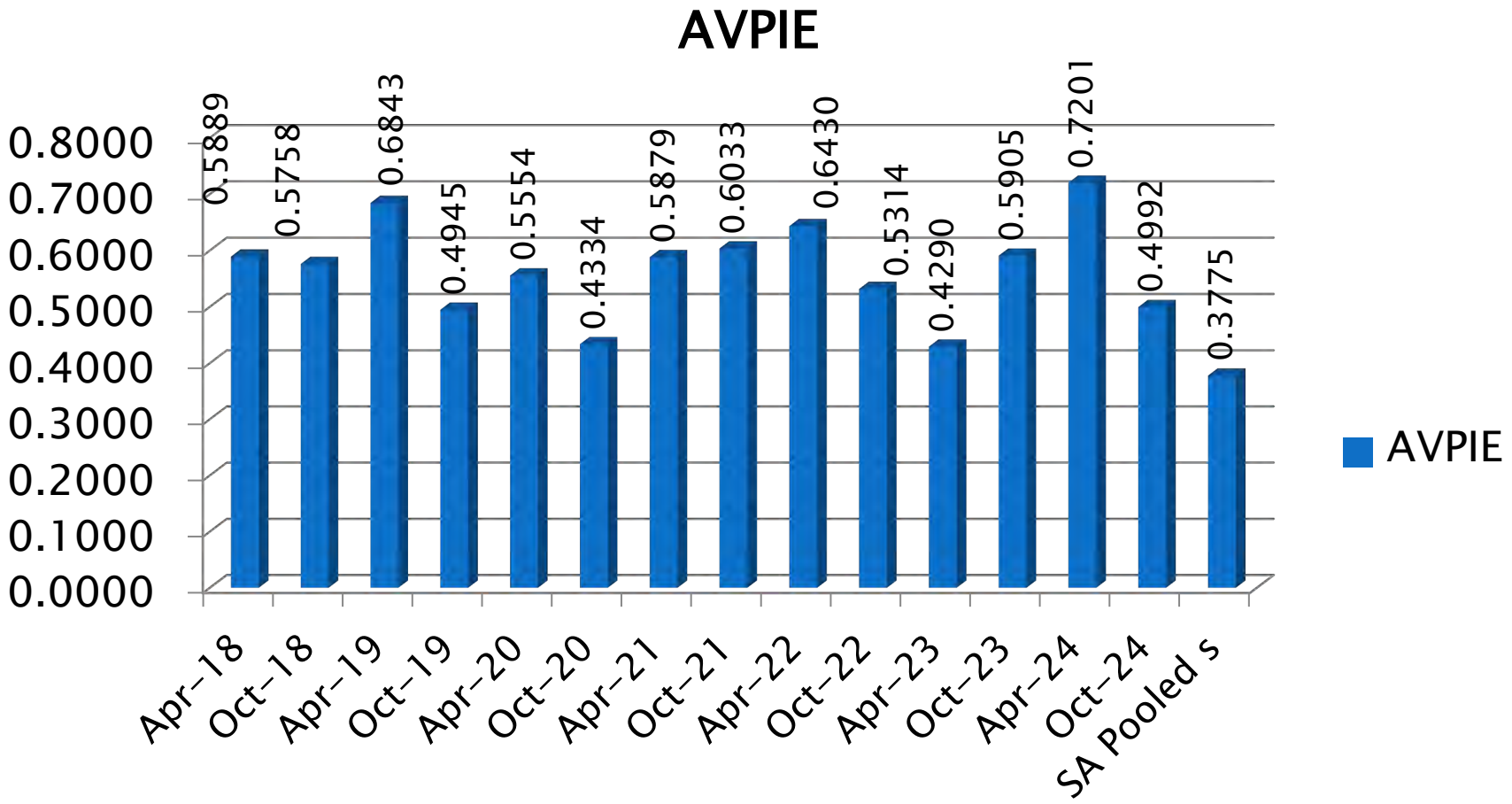
SEQUENCE IX INDUSTRY OPERATIONALLY VALID DATA

AVERAGE NUMBER OF PREIGNITIONS FROM VALID ITERATIONS





Sequence IX Precision Estimates



Return to Table of Contents

Sequence IXAGED

- October 2024

Test Monitoring Center
https://www.astmtmc.org
A Program of ASTM International

Sequence IXAGED Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	6
Unacceptable Calibration test	OC	2
Aborted Calibration Test (lab judgement)	XC	1
Engine Abandoned	MC	1
Total		**10**

Sequence IX – Failed Tests

Test Status	Number of Tests
Zi Level 2 alarm (severe direction)	2
Total	**2**

Sequence IXAGED – Invalid Tests

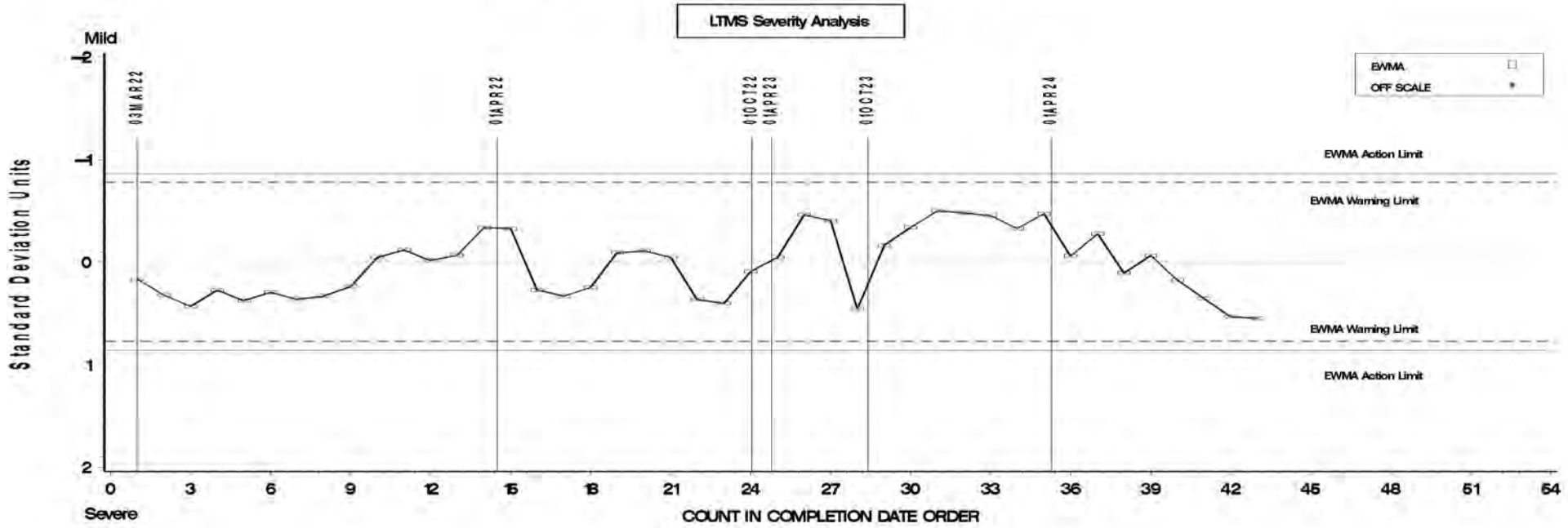
Test Status	Cause	#
Aborted	Blowby Control	1
Totals		**1**

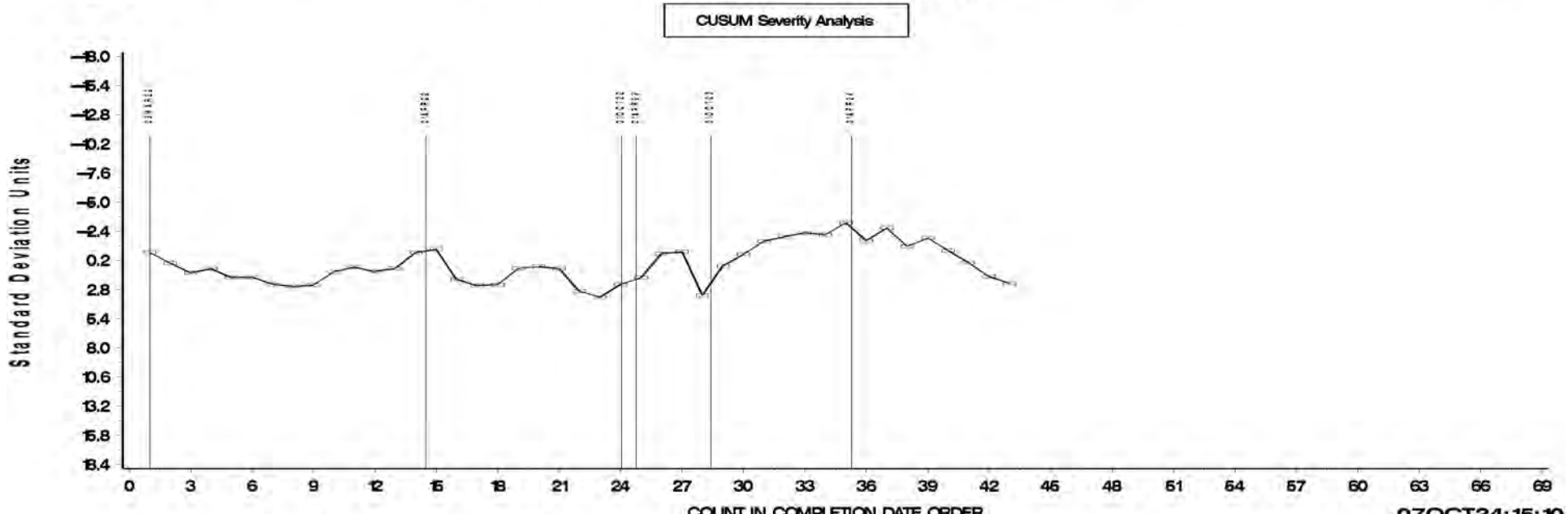
Sequence IXAGED Test Severity

- Average number of Pre-ignitions in control.

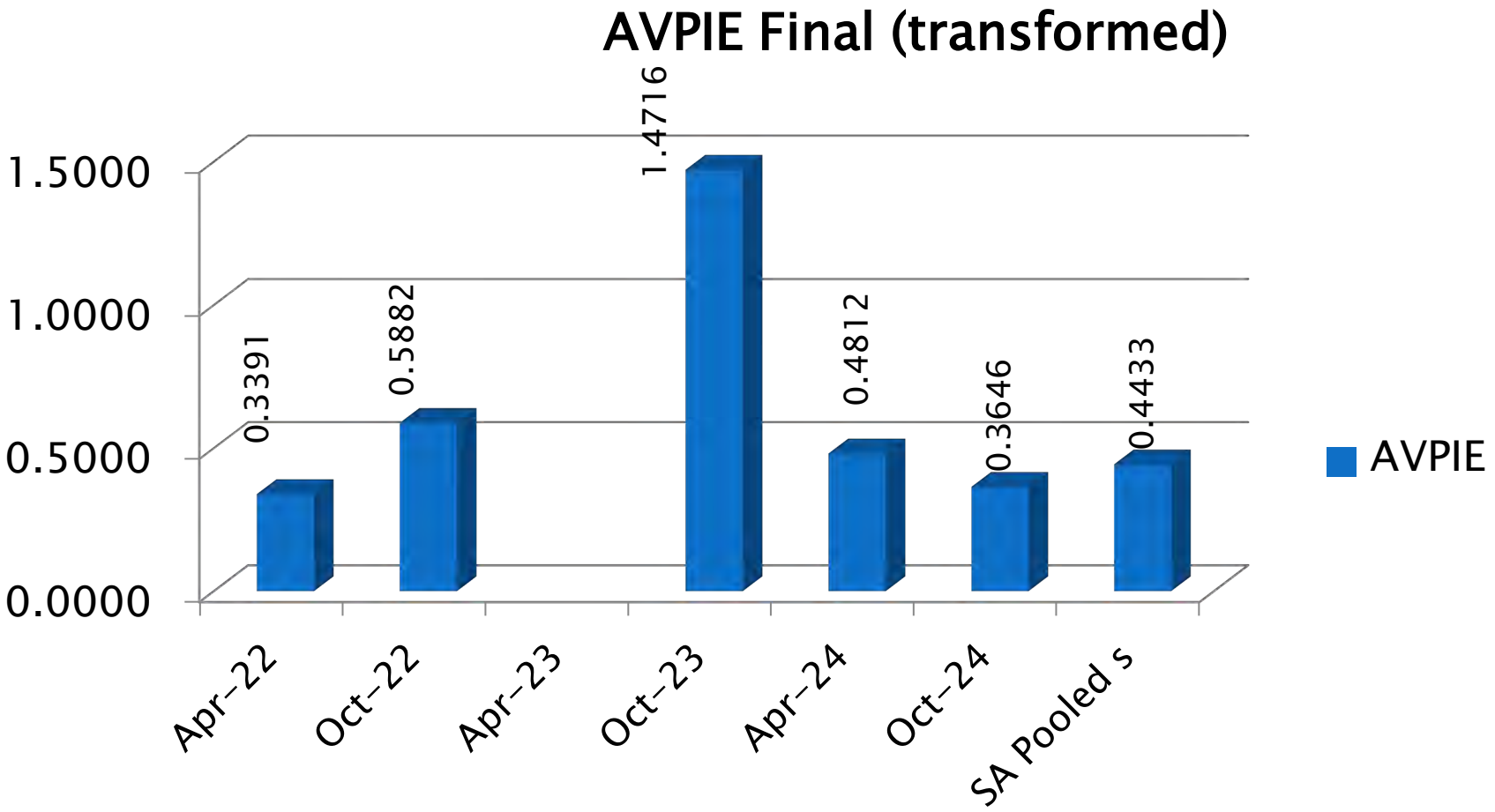
SEQUENCE IX AGED INDUSTRY OPERATIONALLY VALID DATA

AVG # of Preignitions, original units





Sequence IX Precision Estimates



Return to Table of Contents

Sequence X

October 2024

Test Monitoring Center
https://www.astmtmc.org

A Program of ASTM International

Sequence X Activity

Test Status	Validity Code	#
Acceptable reference test	AC	6
Acceptable discrimination test	AS	5
Operationally invalid test (Lab judgement)	LC	1
Total Number of Tests		12

Sequence IXAGED – Invalid Tests

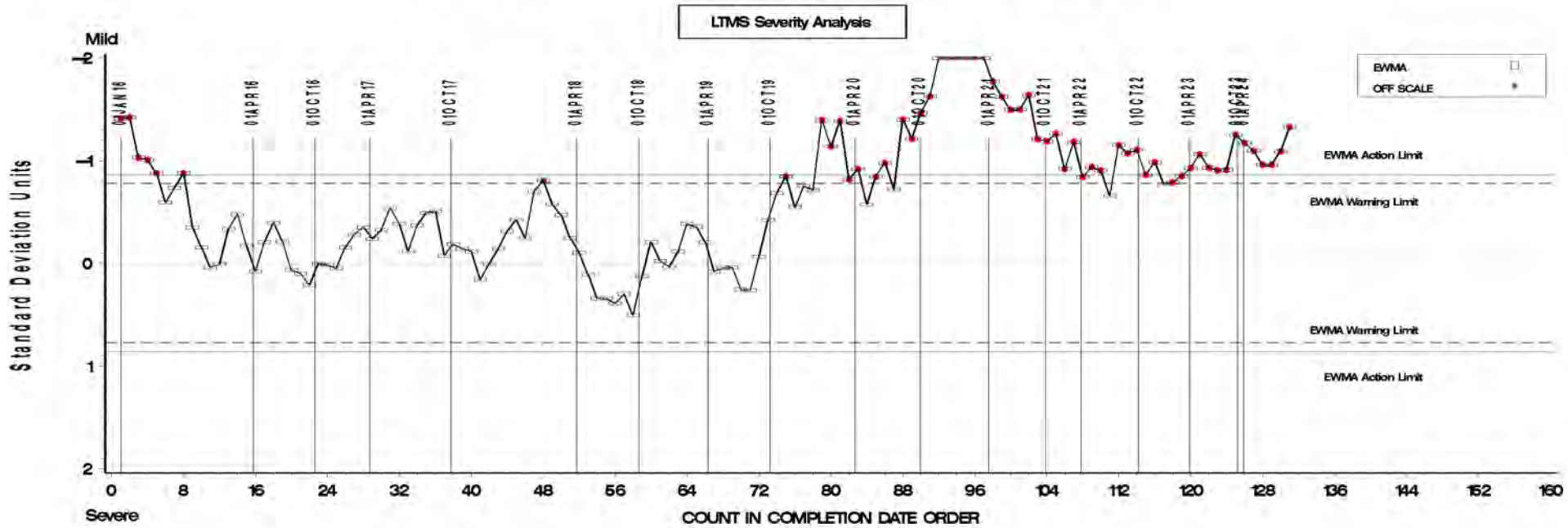
Test Status	Number of Tests
Oil temperature ramp out of spec	1
Total	**1**

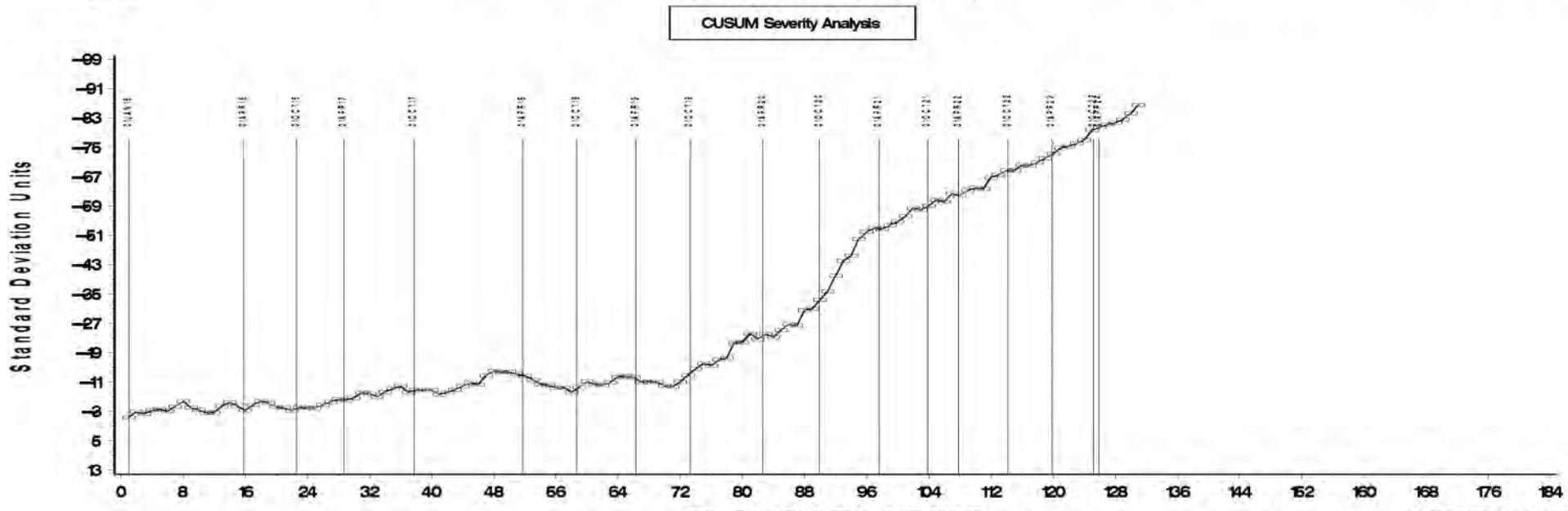
Sequence X Test Severity

- End of test chain wear is in action alarm (mild direction).

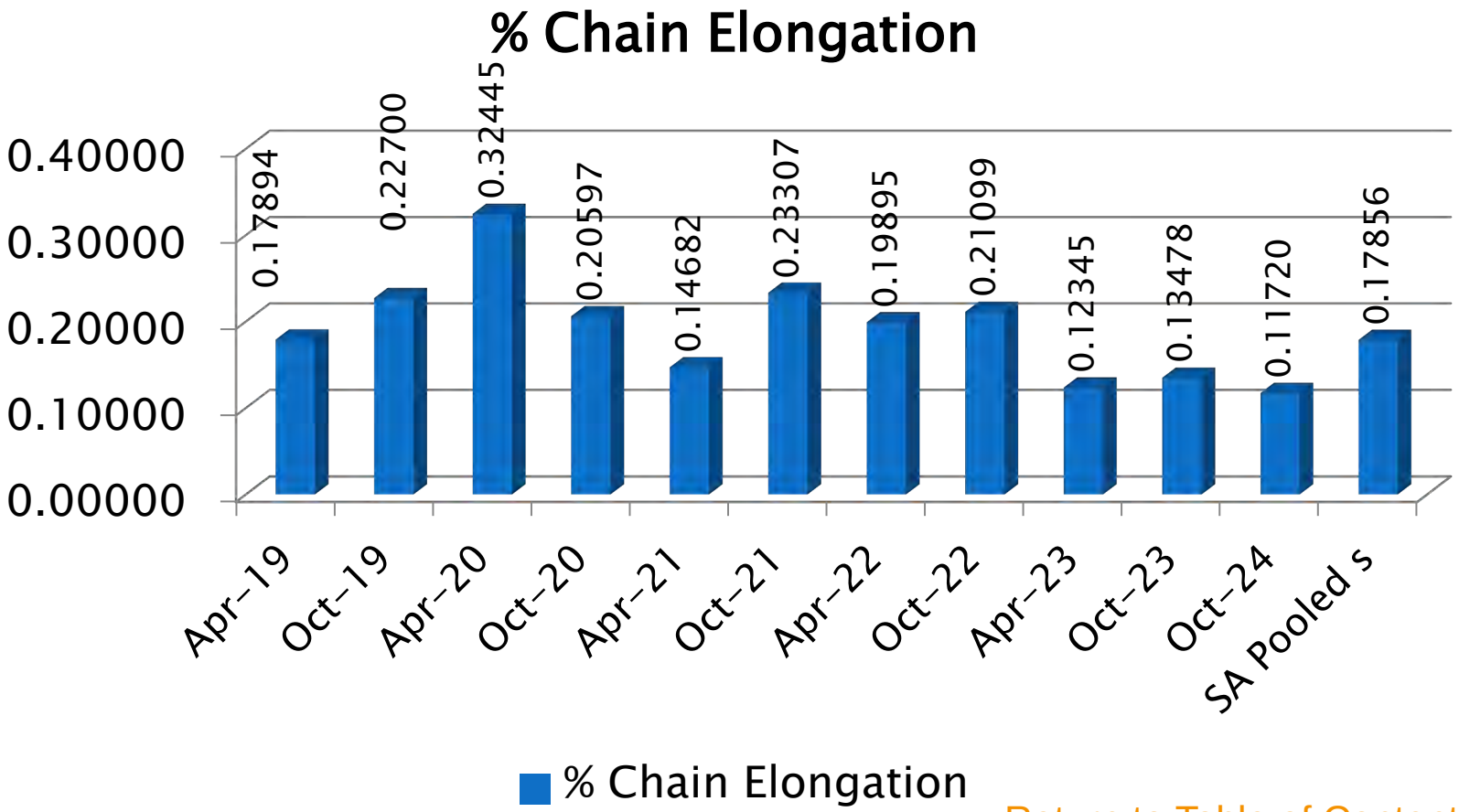
SEQUENCE X INDUSTRY OPERATIONALLY VALID DATA

END OF TEST CHAIN WEAR FINAL RESULT





Sequence X Precision Estimates



Return to Table of Contents

Information Letters

October 2024

Test Monitoring Center
https://www.astmtmc.org

A Program of ASTM International

Information Letters*

Test	Date	IL	Topic
IVB	20240813	24-1	Corrected missing reference to breakin oil SL107 and reporting negative wear results as 0.
IX	20240729	24-2	Updated Section 8.10.1 to require 4 iterations with RO220 after break in cycle to confirm engine health
VH	20240507	24-3	A number of build practice changes as recommended by the O and H Subpanel
VH	20240912	24-4	Updated part numbers for ring grinder burr and honing brushes, required SJ-410 surface finish analyzer, reporting of adjusted sludge results > 10 as 10 and added fuel rail temperature to test report.
X	20240719	24-2	Added Annex A11 which defines requirements for approval of an alternate fuel supplier.

*Available from TMC Website

Return to Table of Contents

Reference Oil Inventory

- Actions, Re-blends, Inventories and Estimated Life

Test Monitoring Center
https://www.astmtmc.org
A Program of ASTM International

Reference Oil Re-blends

TMC 220 and 224

- A reblend for reference oil 220 has been received and is currently being introduced. Reference oil 224-2 was introduced this reference period, with nine results reported from three labs. No target updates for this oil are planned at this time, a further review of results is planned when twelve tests are reported.

TMC 940

- A limited quantity remains of reference oil 940. A reblend of this oil, 940-1 has been obtained by the TMC. The panel agreed to suspend the use of this oil until additional results on the other two oils with the new fuel batch could be evaluated.

Reference Oil Re-blends

TMC API01 and API02

- Reblends for both IXAGED reference oils are being introduced. Four tests have been reported with reference oil API01-1 and three have been reported on reference oil API02-1.

TMC 1006-2

- Less than 12 gallons remain at TMC. The Sequence VIII has dropped this oil because of age concerns and replaced it with 1009-1. The Sequence IVA will continue to use this oil for the foreseeable future.

TMC 544

- Less than 24 gallons remain at TMC and TMC is contacting supplier for a re-blend. This oil is used for referencing 20% of the time.

Reference Oil Inventory Estimated Life

Oil	Tests	Year	Blend Quantity	TMC Inventory	Estimated Life	Comment
220-1	IX	2022	1060	969	>5	Break-In oil only
221-1	IX	2015	996	952	>5	
224-2	IX	2022	780	660	>5	
270	X	2015	1100	476	5	
271	X	2015	980	587	5	
300-1	IVB	2017	378	176	3	
434-3	IIIH, GMOD	2017	980	528	>5	
436	IIIH	2014	1100	545	>5	
438-2	IIIH	2017	540	360	5	
542-5	VIE, VIF	2021	1060	557	2	
543-1	VIF	2020	1000	860	>5	
544	VIE	2015	1003	24	<1	
931	VH	2020	912	722	>5	
940-1	VH	2018	485	485	>5	
1006-2	IVA, VIII	2000	5500	12	3	Beyond useful life
1009-1	VIII	2017	1000	835	>5	
1010-2	VIE	2022	555	199	1.5	
1011-1	IVB, VH, VF, X	2019	1395	824	4	
1012	IVB	2017	2145	1024	>5	
API01-1	IXAGED	2021	480	400	>5	
API02-1	IXAGED	2021	473	401	>5	

LTMS Deviations

April 1, 2024–September 30, 2024

Test Monitoring Center
https://www.astmtmc.org

A Program of ASTM International

LTMS Deviations

- No LTMS Deviations this period

LTMS Deviations

Historical Count of PCEO LTMS Deviations

Test	LTMS Deviations
IIIH	0
IVA	7
IVB	0
VH	0
VIE	0
VIF	0
VIII	3
IX	0
X	0

Return to Table of Contents

Quality Index Deviations

April 1, 2024–September 30, 2024

Test Monitoring Center
https://www.astmtmc.org

A Program of ASTM International

Quality Index Deviations

- Three deviations were issued this period:
  - Sequence IIIH – Deviation for exhaust backpressure due to a failing actuator.
  - Sequence IIIH – Deviation for oil block temperature due to an intermittent thermocouple connection.
  - Sequence VH – Speed, MAP and coolant flow due to excessive cell temperatures causing intermittent controller issues.

Quality Index Deviations

Historical Count of PCEO Quality Index Deviations

Test	Quality Index Deviations
IIIH	10
IVA	33
IVB	2
VH	12
IX	3
X	3

Return to Table of Contents

TMC Laboratory Visits

April 1, 2024–September 30, 2024

Test Monitoring Center
https://www.astmtmc.org

A Program of ASTM International

TMC Lab Visits

Test	Number of Labs Visited
IIIH	0
IVB	0
IX	0
VH	1
VIE/VIF	1
VIII	0
X	0

Lab Visit Issues

- Sequence VH
  - Oil heat exchanger not properly located.

Test Area Timelines

- April 1, 2024–September 30, 2024

Test Monitoring Center
https://www.astmtmc.org
A Program of ASTM International

Test Area Timeline Additions*

Test	Date	Topic	IL
IIIH	20240513	BC8 Pistons Introduced	
IVB	20240813	Corrected missing reference to breakin oil SL107 and reporting negative wear results as 0.	24-1
IX	20240315	First Occurrence of reference oil 224-2	
IX	20240729	Updated Section 8.10.1 to require 4 iterations with RO220 after break in cycle to confirm engine health	24-2
IXAGED	20240608	First occurrence of reference oil API02-1	

*As of 09/30/2024

Test Area Timeline Additions*

Test	Date	13opic	IL
IXAGED	20240827	First occurrence of reference oil API01-1	
VH	20240507	Procedure changes resulting from build workshop	24-3
VH	20240912	Updated ring grinder burr and honing stone p/ns, Specified SJ-410 analyzer and modified mounting bracket, addressed reporting of sludge when corrected results exceed 10 and added fuel rail temperature to test report.	24-3
X	20240713	Added Annex A11 which defines steps for approving an alternate fuel	24-2

*As of 09/30/2024

Rating Workshop Data

2024 ASTM Deposit Rating Workshop

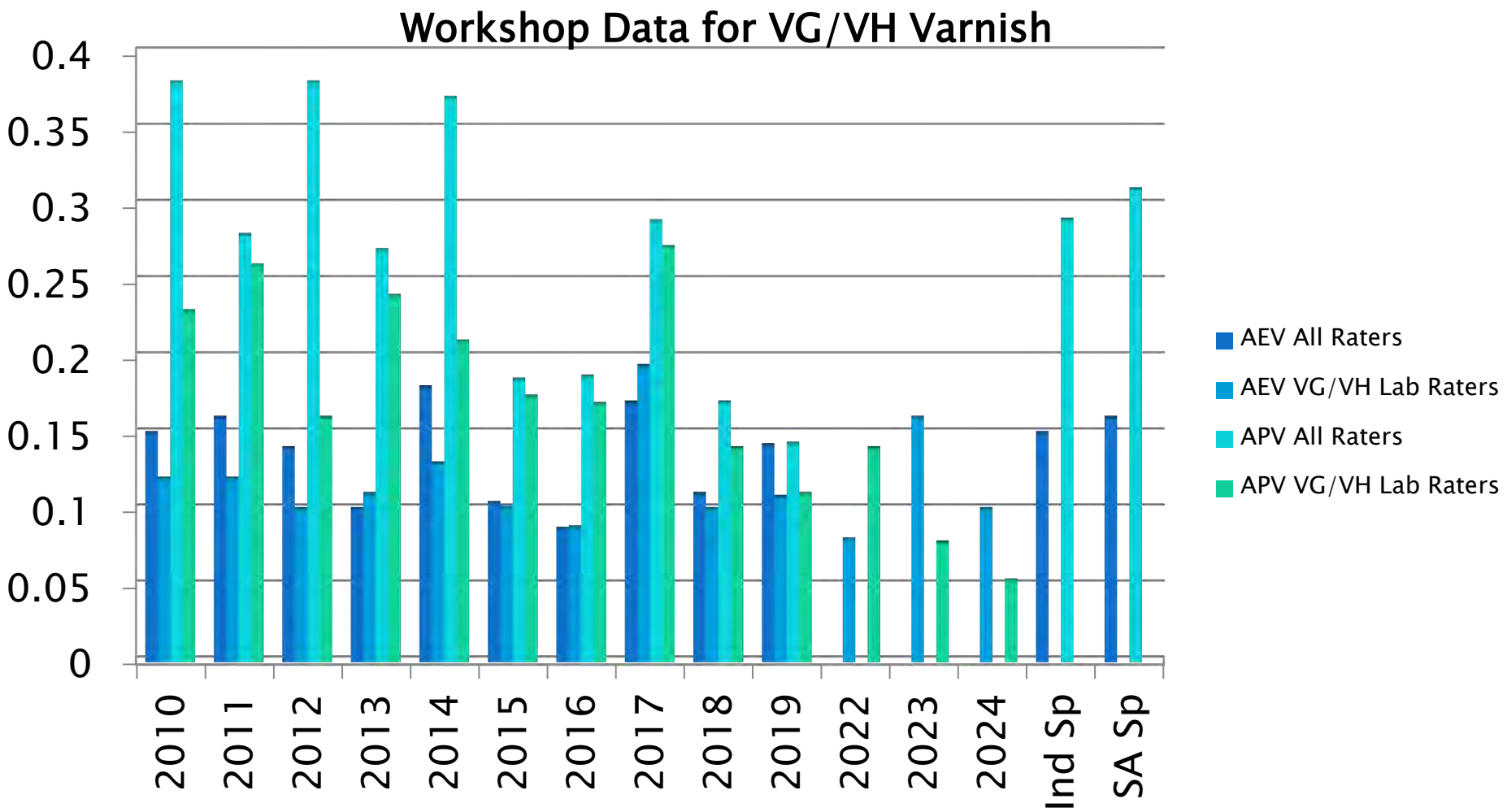
Test Monitoring Center
https://www.astmtmc.org

A Program of ASTM International

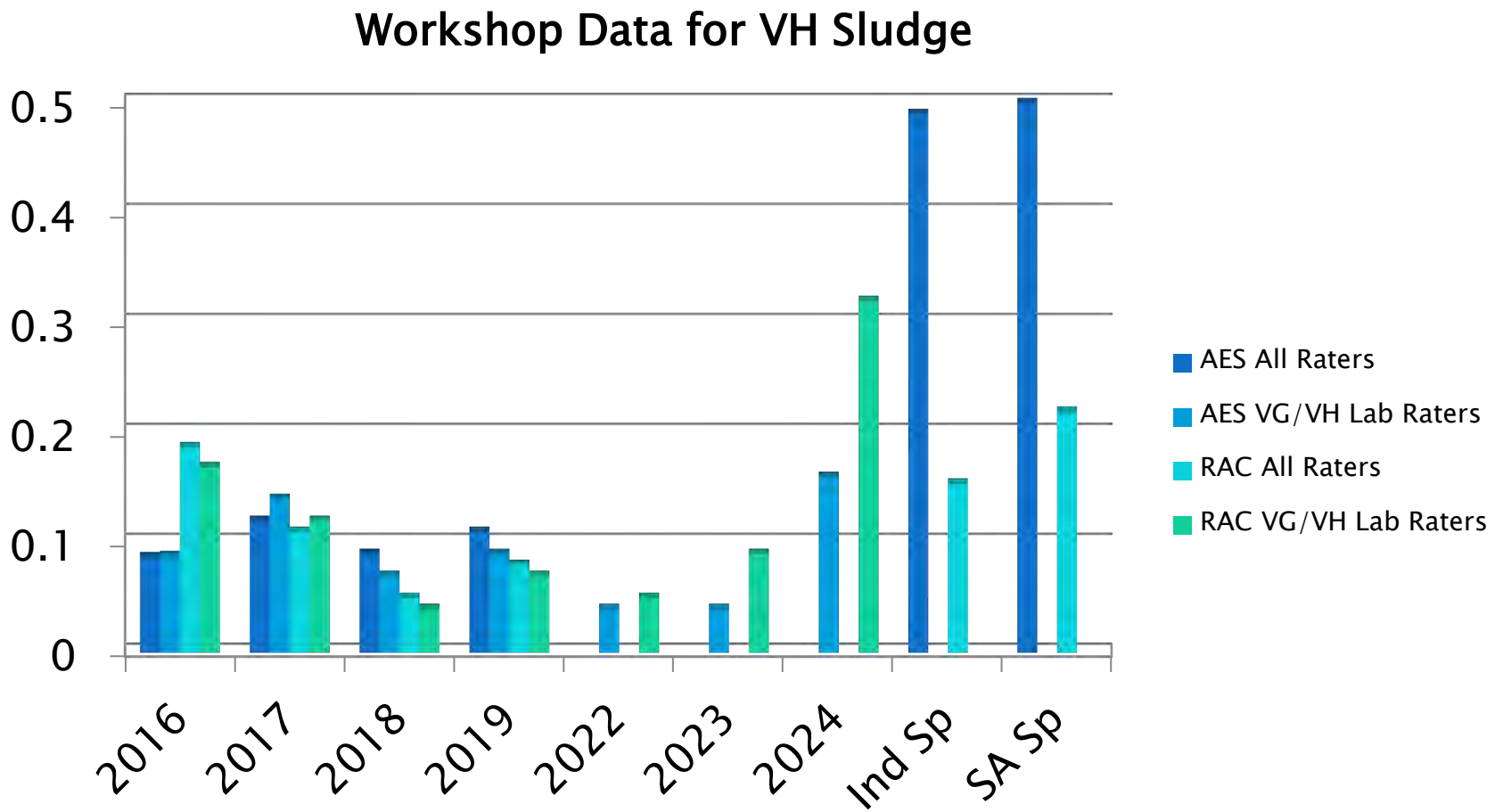
Rating Workshop Data

- Summary of Precision Data From Light Duty Rating workshops:
  - VH Average Piston, Average Engine Varnish.
  - VH Sludge added for this workshop as calibration requirement
  - IIIH WPD
  - The 2022 and subsequent workshops only includes raters from calibrated labs.

Sequence VG/VH Precision-Rating Workshop Data

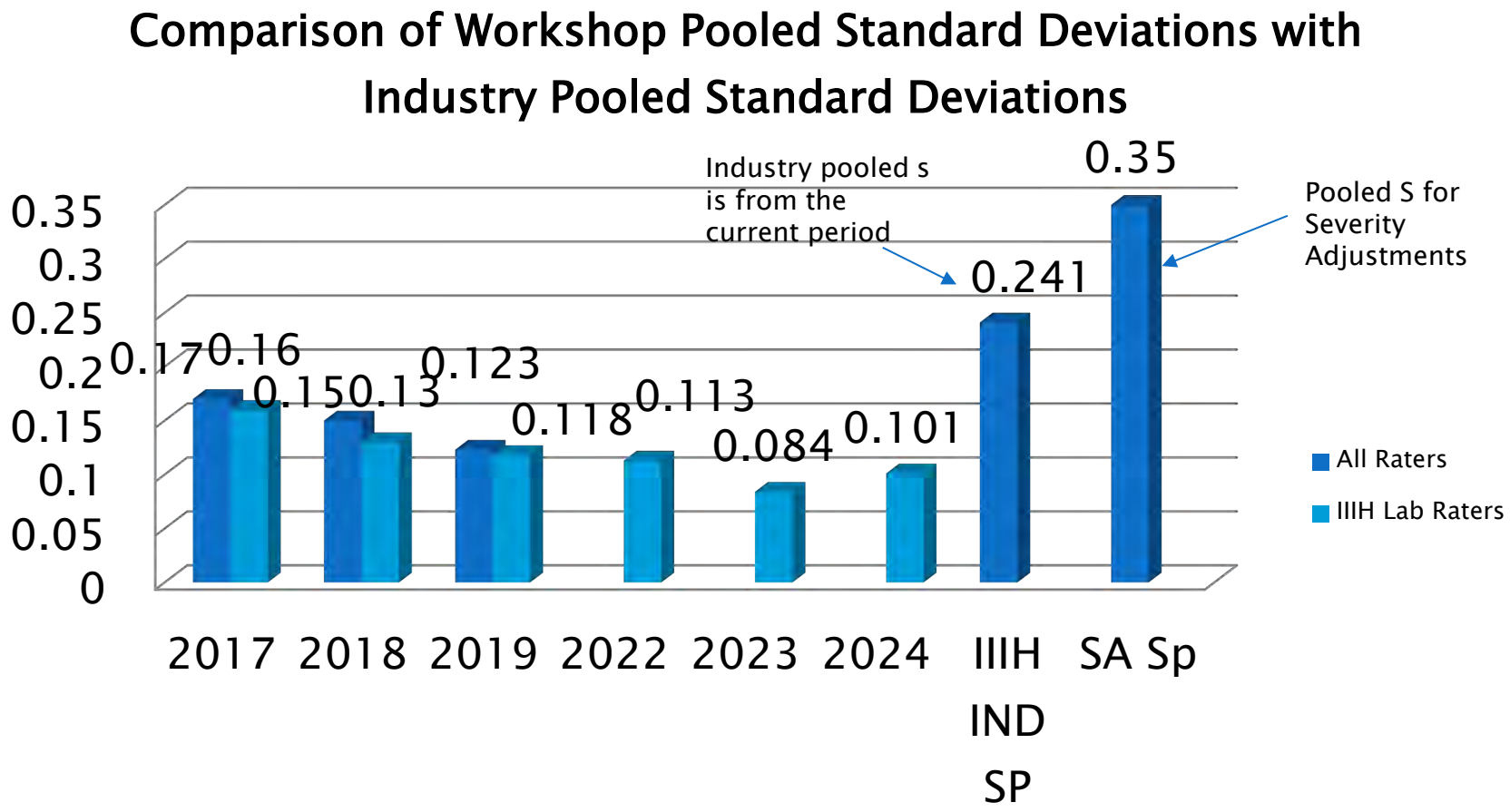


Sequence VH Precision-Rating Workshop Data



Sludge parameters were added for rater calibration in 2019

Sequence IIIH Precision – Rating Workshop Data



Return to Table of Contents

Miscellaneous Information

- Available on TMC Website:
  - Live Reference Test Data Bases
  - Surveillance Panel Meeting Minutes
  - Test Area Alarm Logs
  - Complete Test Area Timelines
  - LTMS Manual

- https://www.astmtmc.org

Return to Table of Contents

A Program of ASTM International