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Test Monitoring Center

<https://www.astmtmc.org>

ASTM D02.B2 Semi-Annual Report Heavy Duty Reference Oil Testing

Spring 2024

Table of Contents

Section	Topic
Executive Summary	
	Summary Items
	Calibrated Labs and Stands
CAT Tests	
	1K
	1N
	1M-PC
	1P
	1R
	C13
	COAT
Daimler Tests	
	DD13

Table of Contents

Section	Topic
Cummins Tests	
	ISB
	ISM
Light Duty Diesel Tests	
	EOAT
	RFWT
Mack Tests	
	T-8/T-8E
	T-11
	T-12
	T-12A
	T-13

Table of Contents

Section	Topic
Additional Information	
	<u>Information Letters</u>
	<u>Memos</u>
	<u>Reference Oil Inventory</u>
	<u>LTMS Deviations</u>
	<u>Quality Index Deviations</u>
	<u>TMC Laboratory Visits</u>
	<u>Test Area Time Lines</u>
	<u>Rating Workshop Data</u>
	<u>Misc. Information</u>

Heavy Duty Testing

Executive Summary

▶ Test Issues

- COAT
 - COAT to EOAT equivalency process ongoing.
- T13 Oil consumption increase
 - Investigation underway
- ISBVIS test development
- FVTW development work continues

[Return to Table of Contents](#)

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Calibrated Labs and Stands*

Test	Labs	Stands
1K	1	1
1N	3	3
1P	1	1
1R	0	0
C13	3	4
ISB	4	8
ISM	4	5
EOAT	1	1
RFWT	1	1
T-8/E	2	2
T-11	2	3
T-12/T-12A	3/3	3/3
T-13	3	4
COAT	1	1
DD13	2	2

*As of 3/31/2024

[Return to Table of Contents](#)

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SCOTE 1K

»» April 2024

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1 K Test Activity

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

1 K Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

1 K Lost Tests*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		0

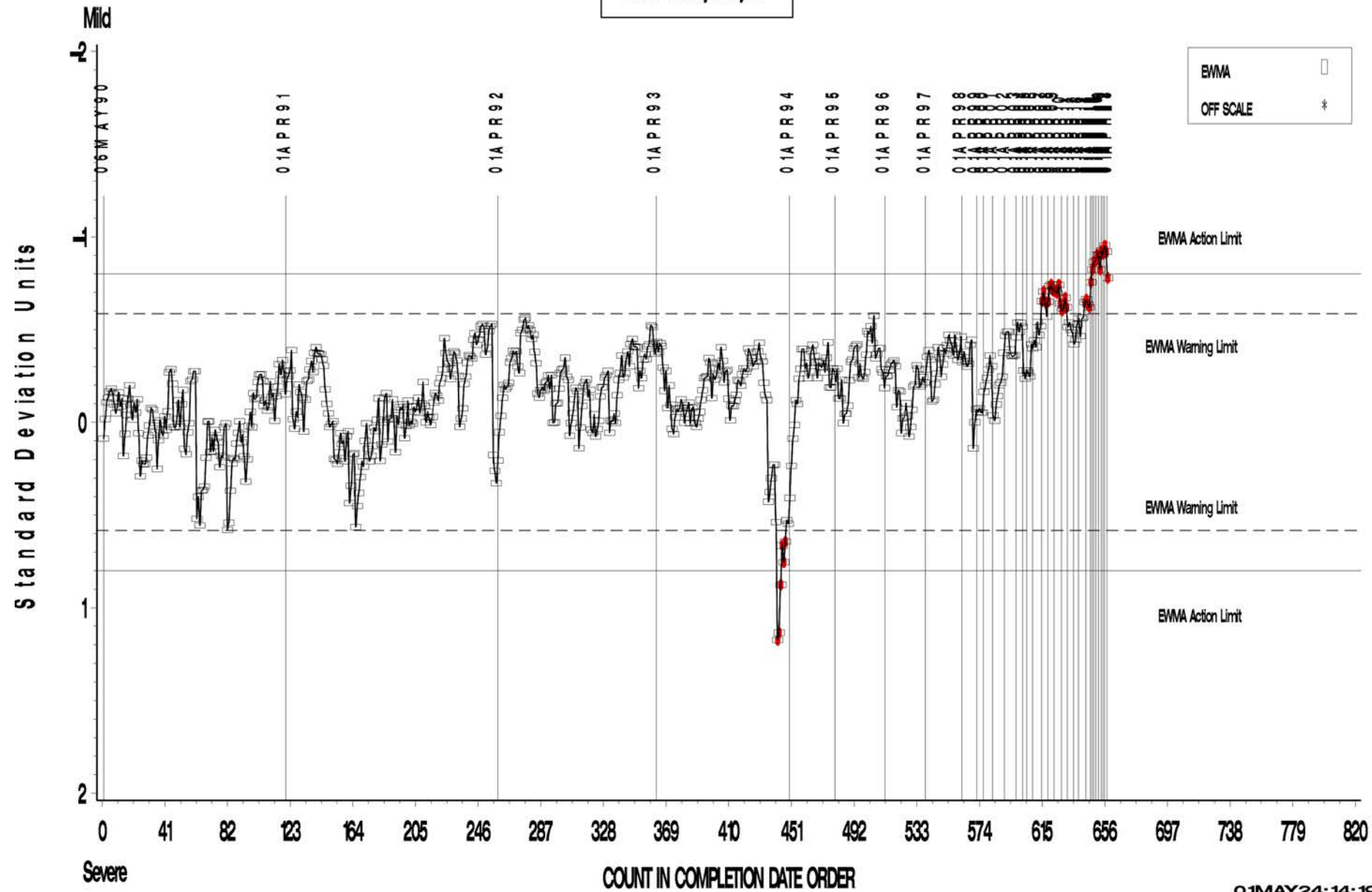
*Invalid and aborted tests

1 K Test Severity

- ▶ TGF and BSOC in severity warning alarm in mild direction
- ▶ All other parameters are in control

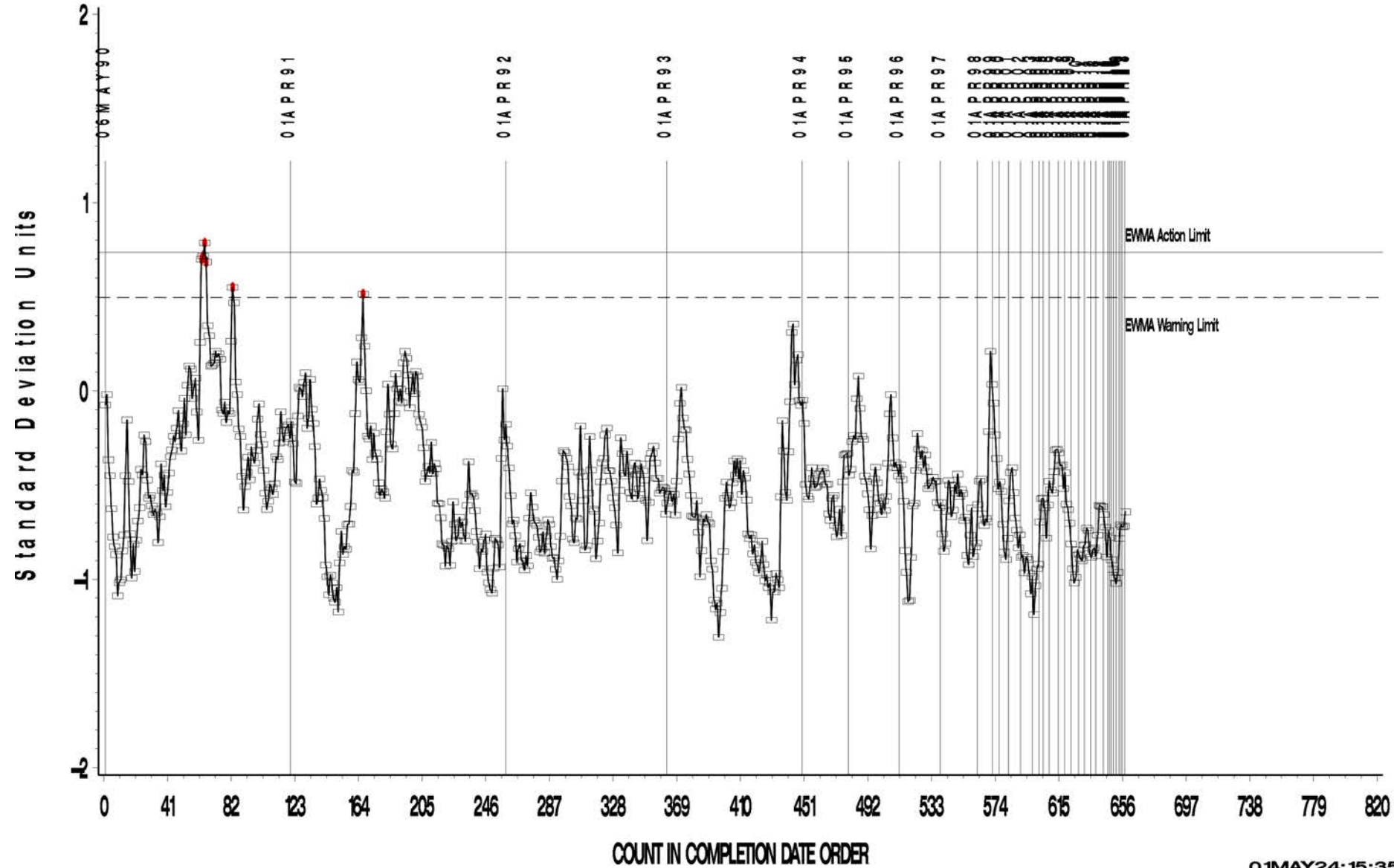
FINAL BSOC

LTMS Severity Analysis



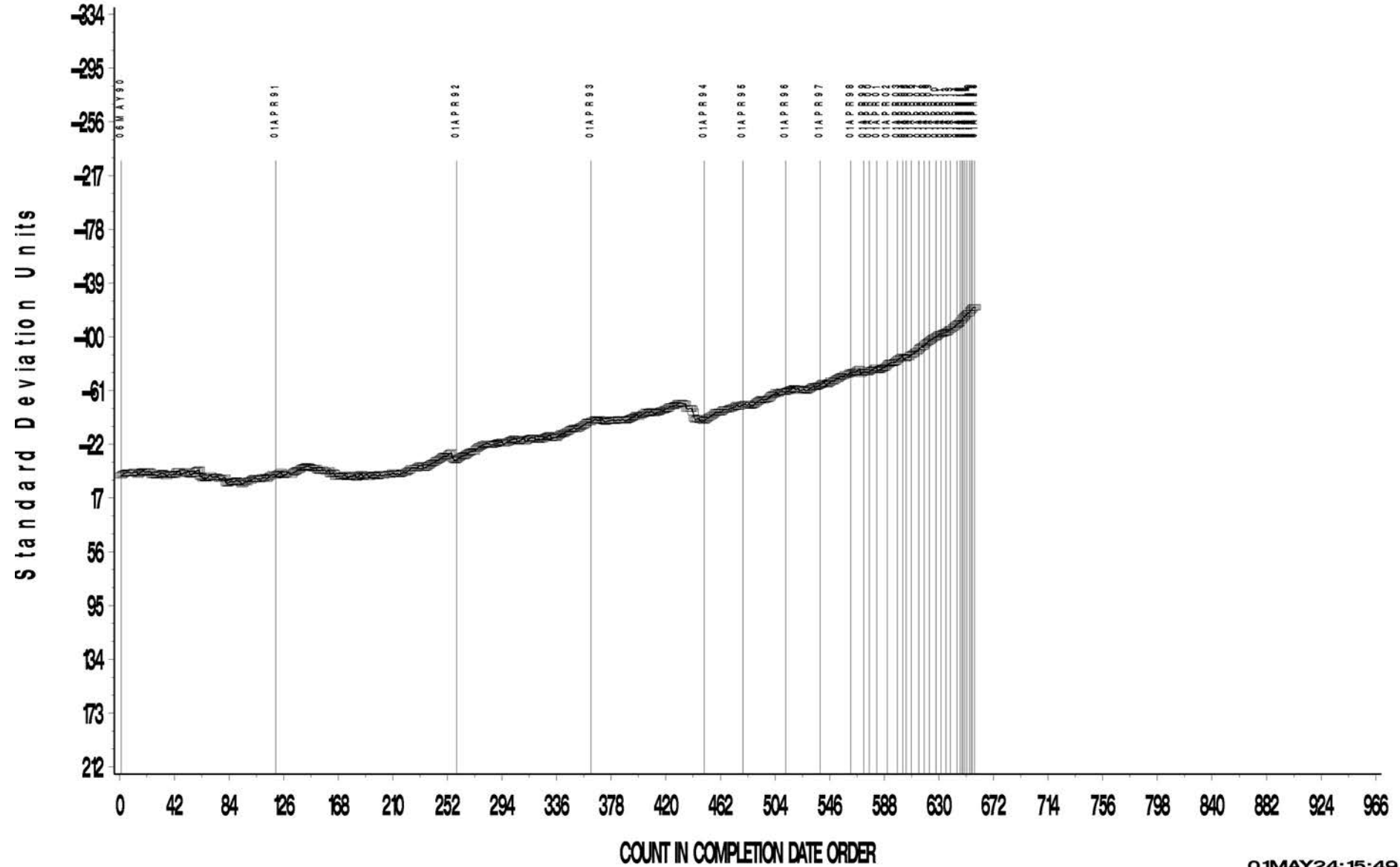
FINAL BSOC

LTMS Precision Analysis



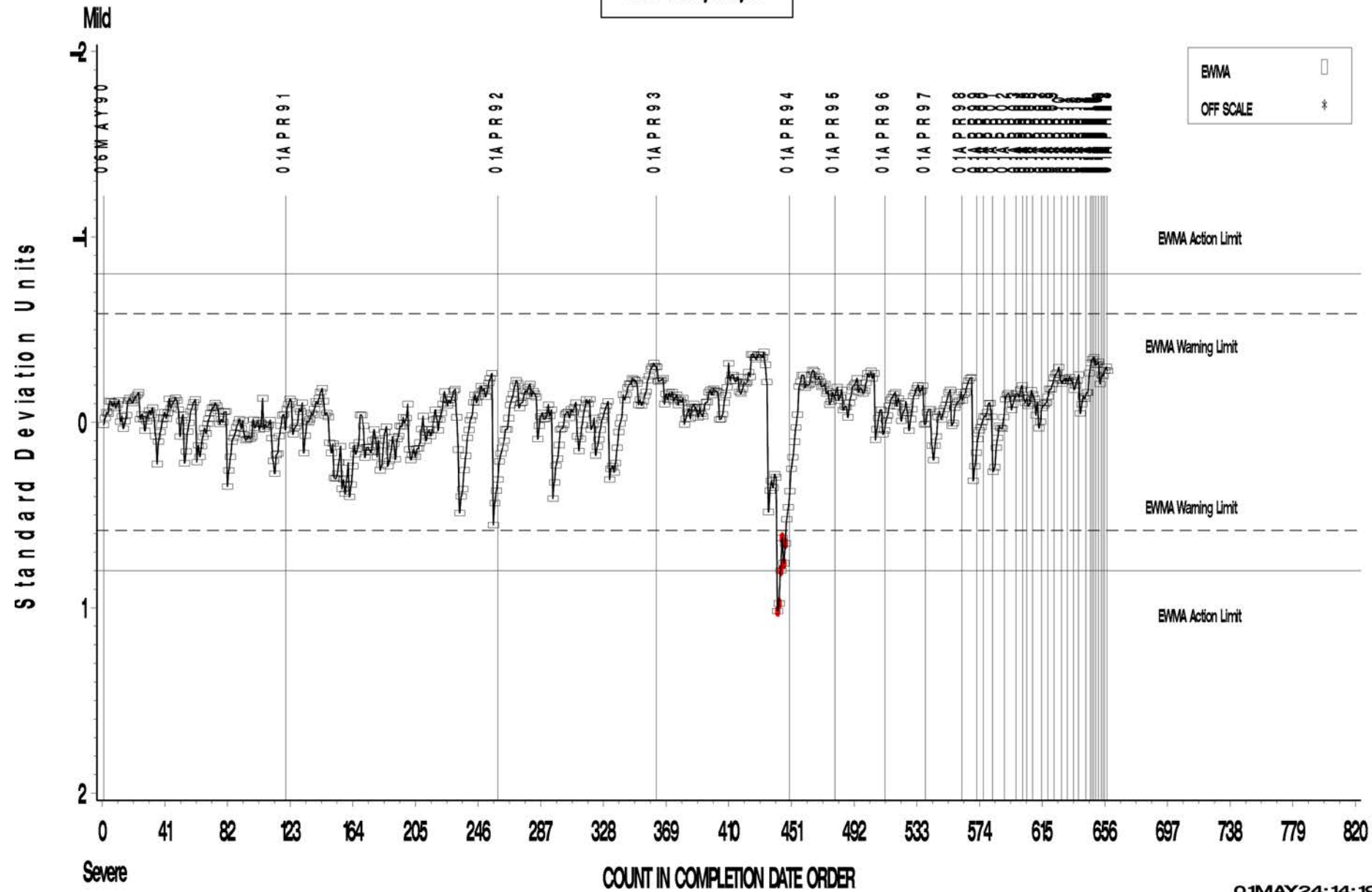
FINAL BSOC

CUSUM Severity Analysis



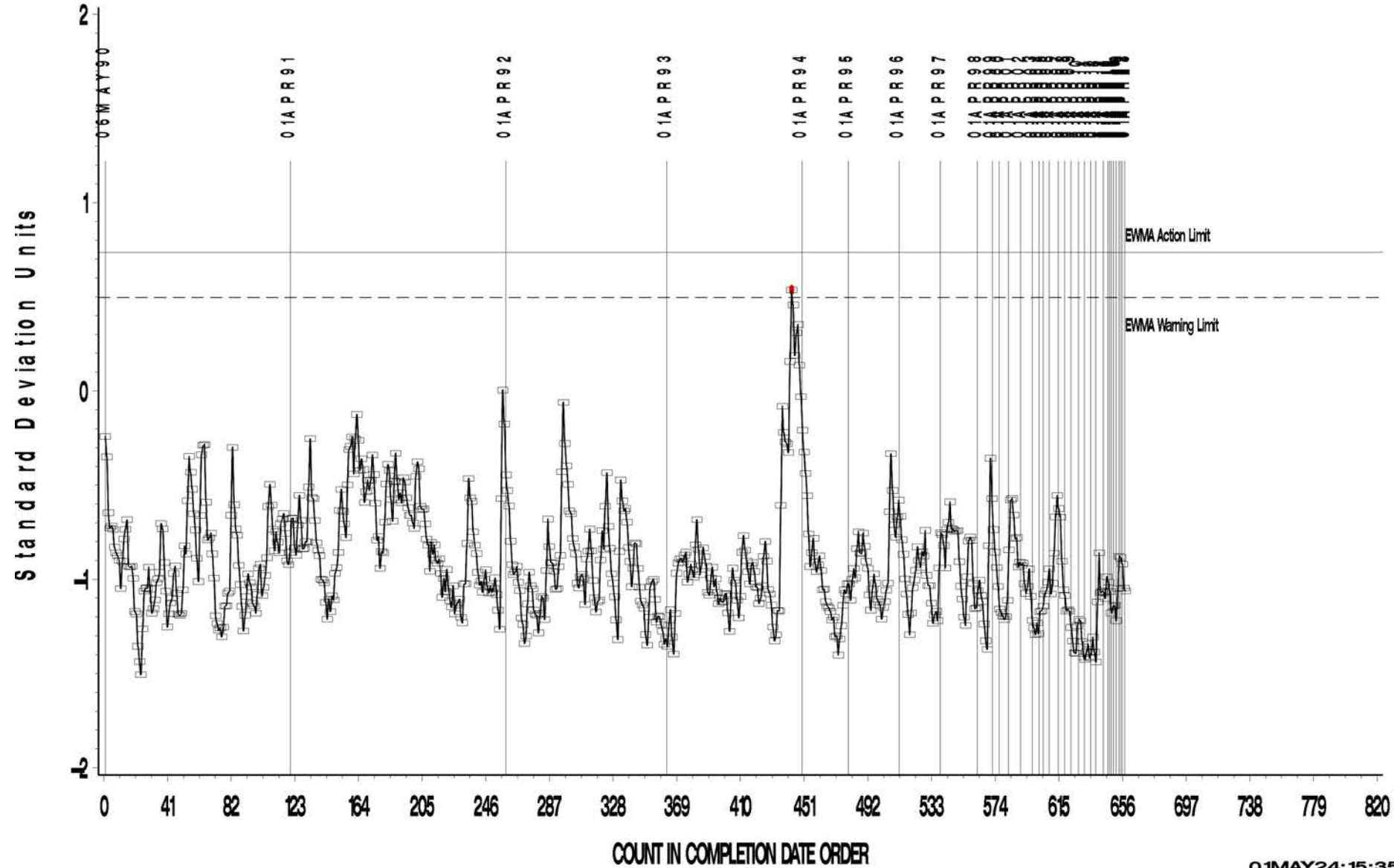
FINAL EOTOC

LTMS Severity Analysis



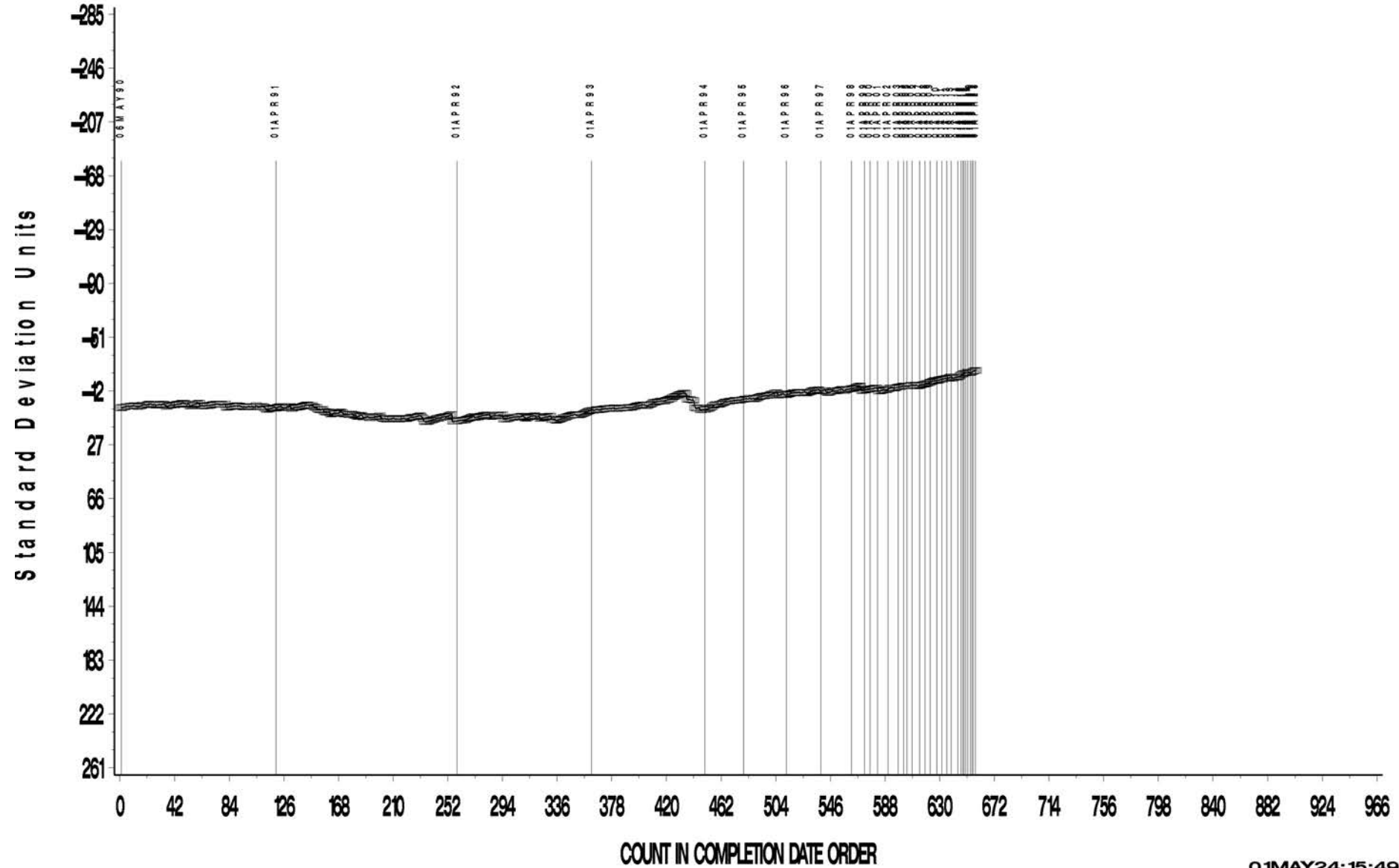
FINAL EOTOC

LTMS Precision Analysis



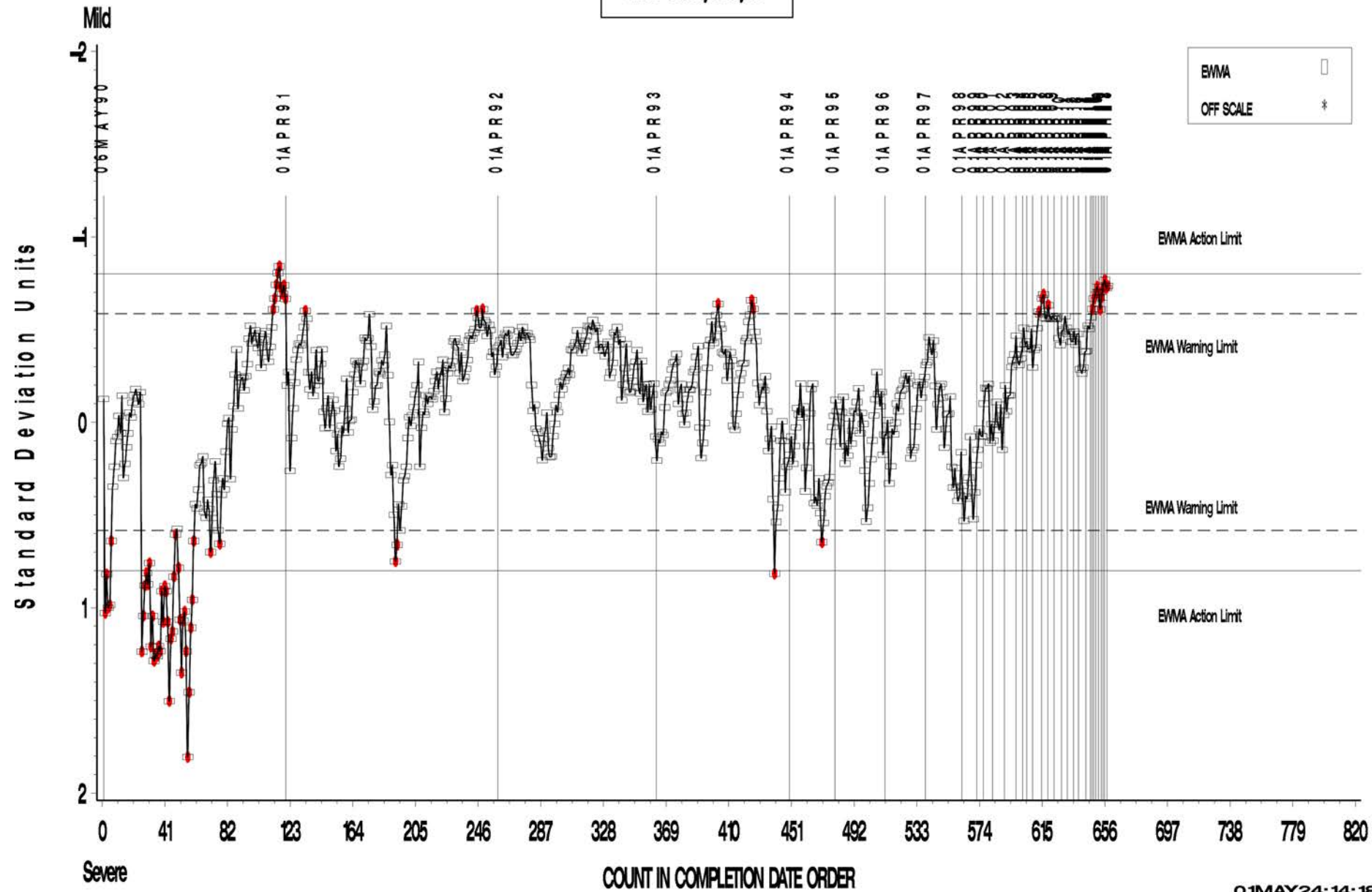
FINAL EOTOC

CUSUM Severity Analysis



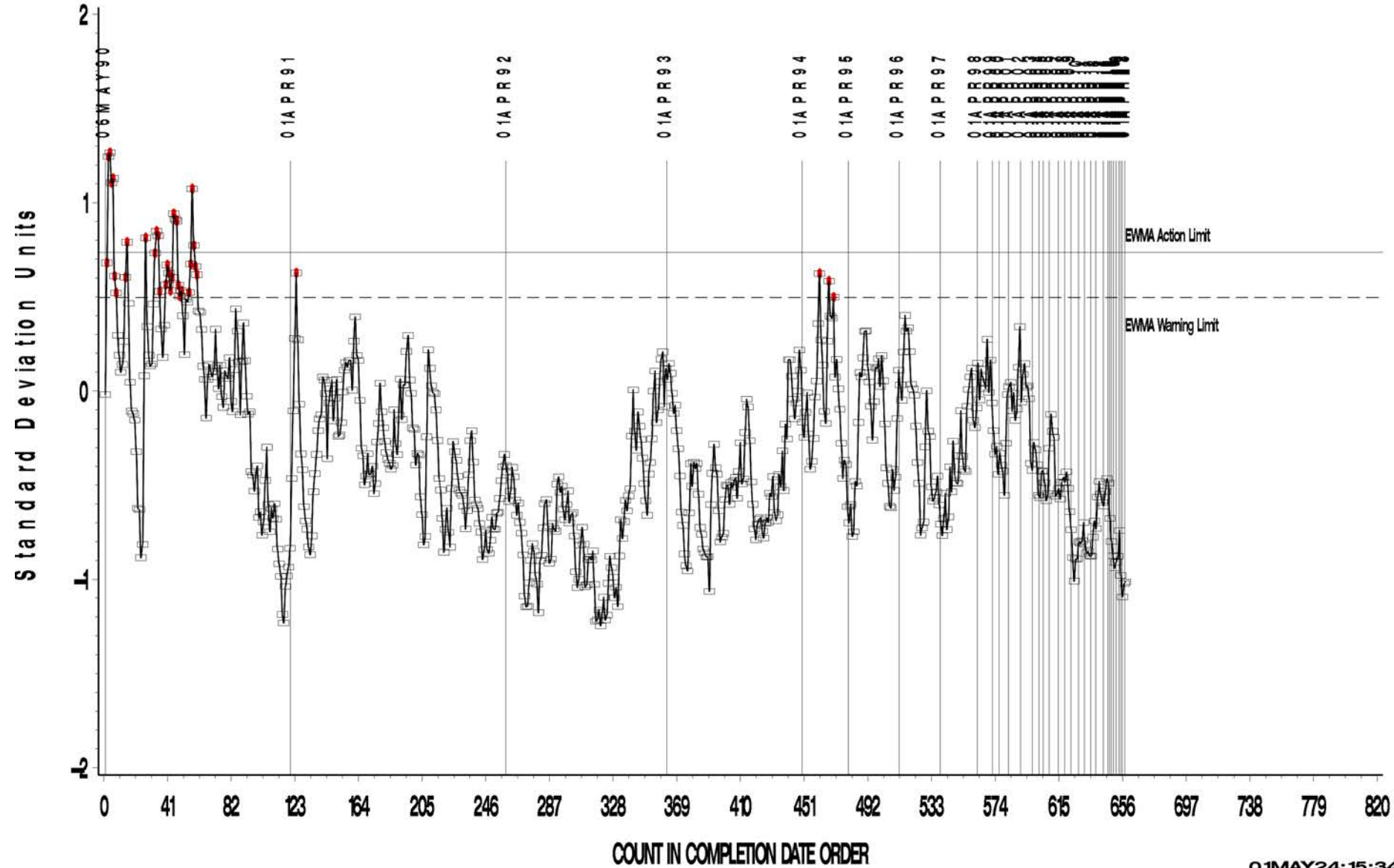
FINAL TGF

LTMS Severity Analysis



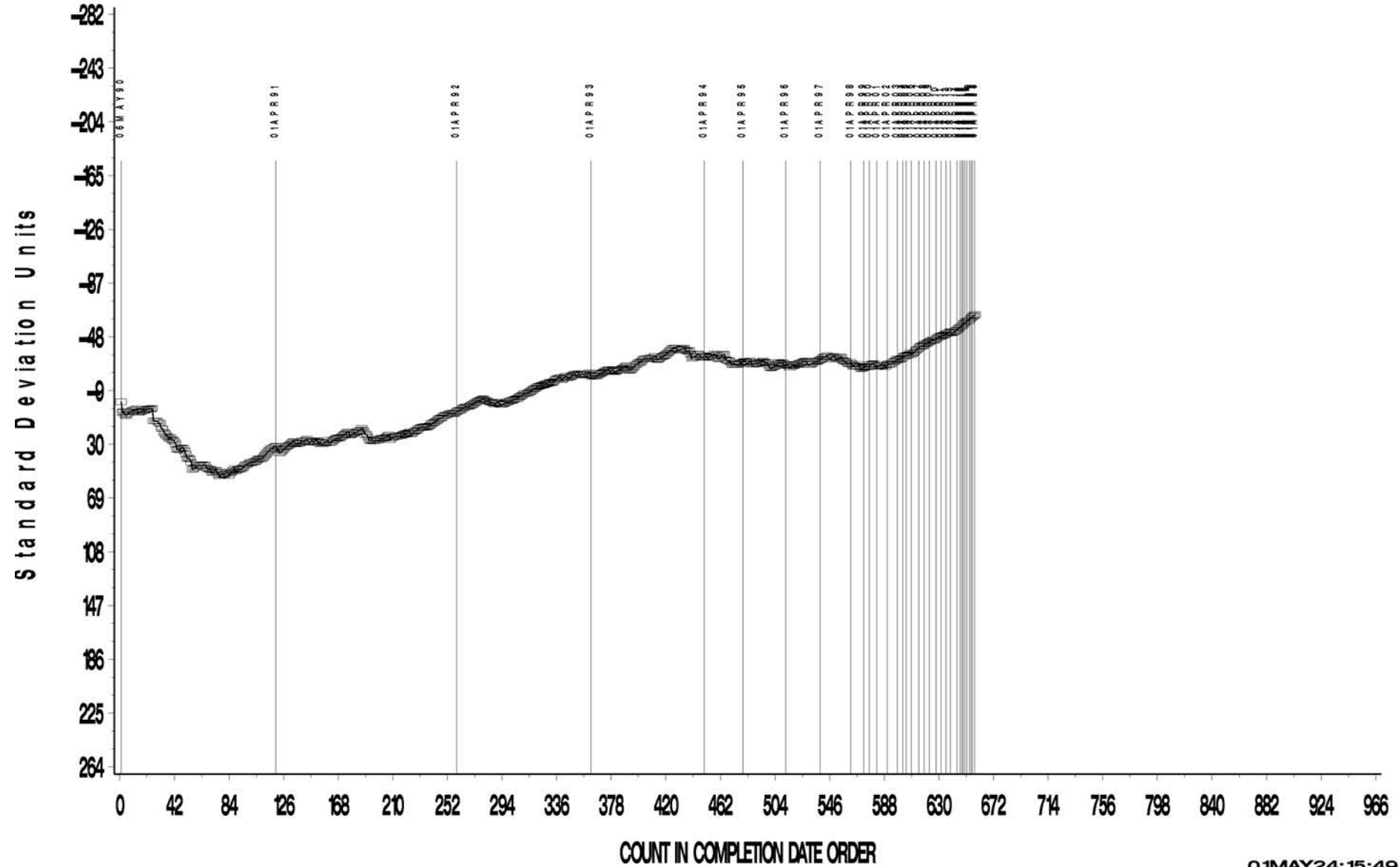
FINAL TGF

LTMS Precision Analysis



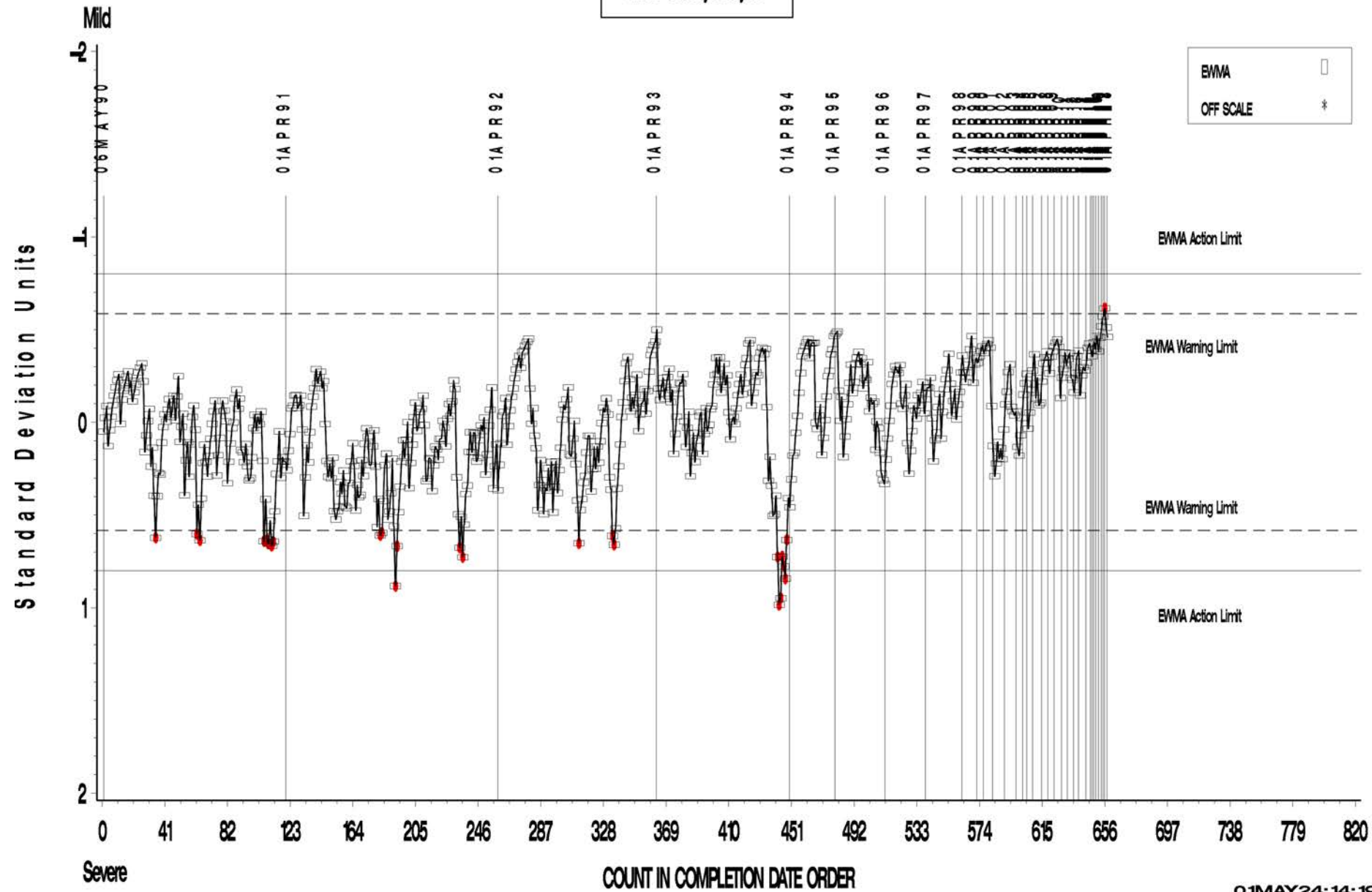
FINAL TGF

CUSUM Severity Analysis



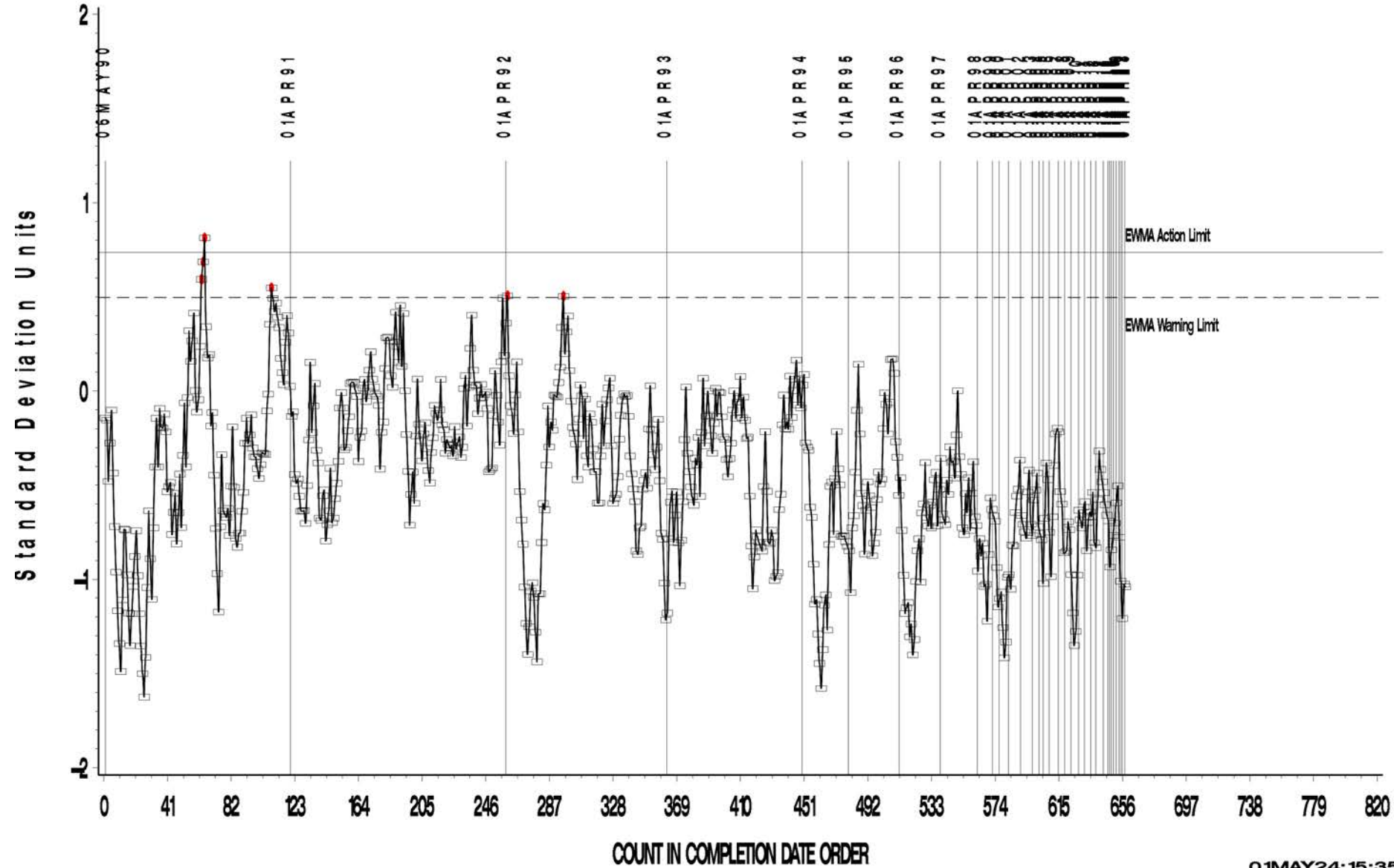
FINAL TLHC

LTMS Severity Analysis



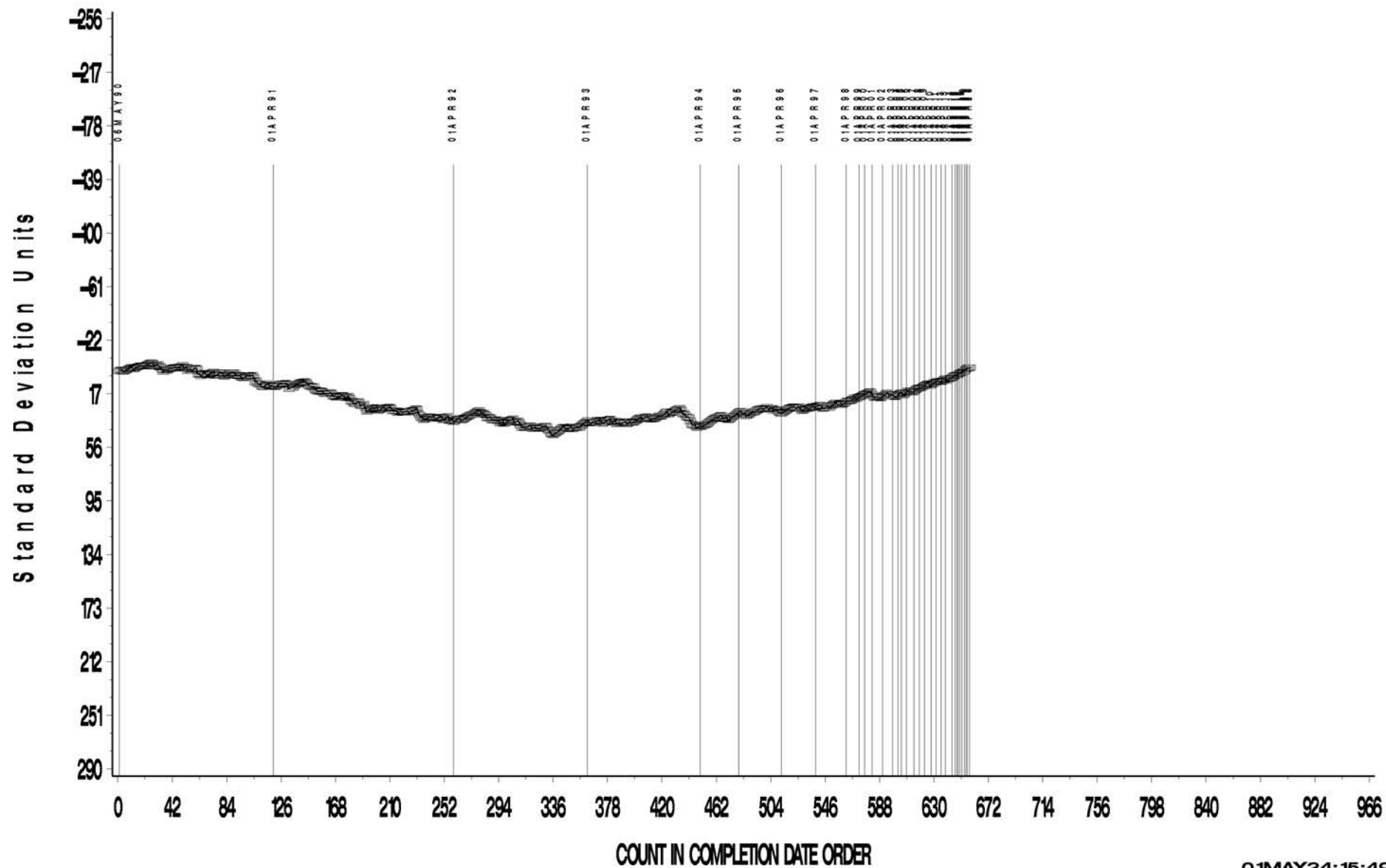
FINAL TLHC

LTMS Precision Analysis



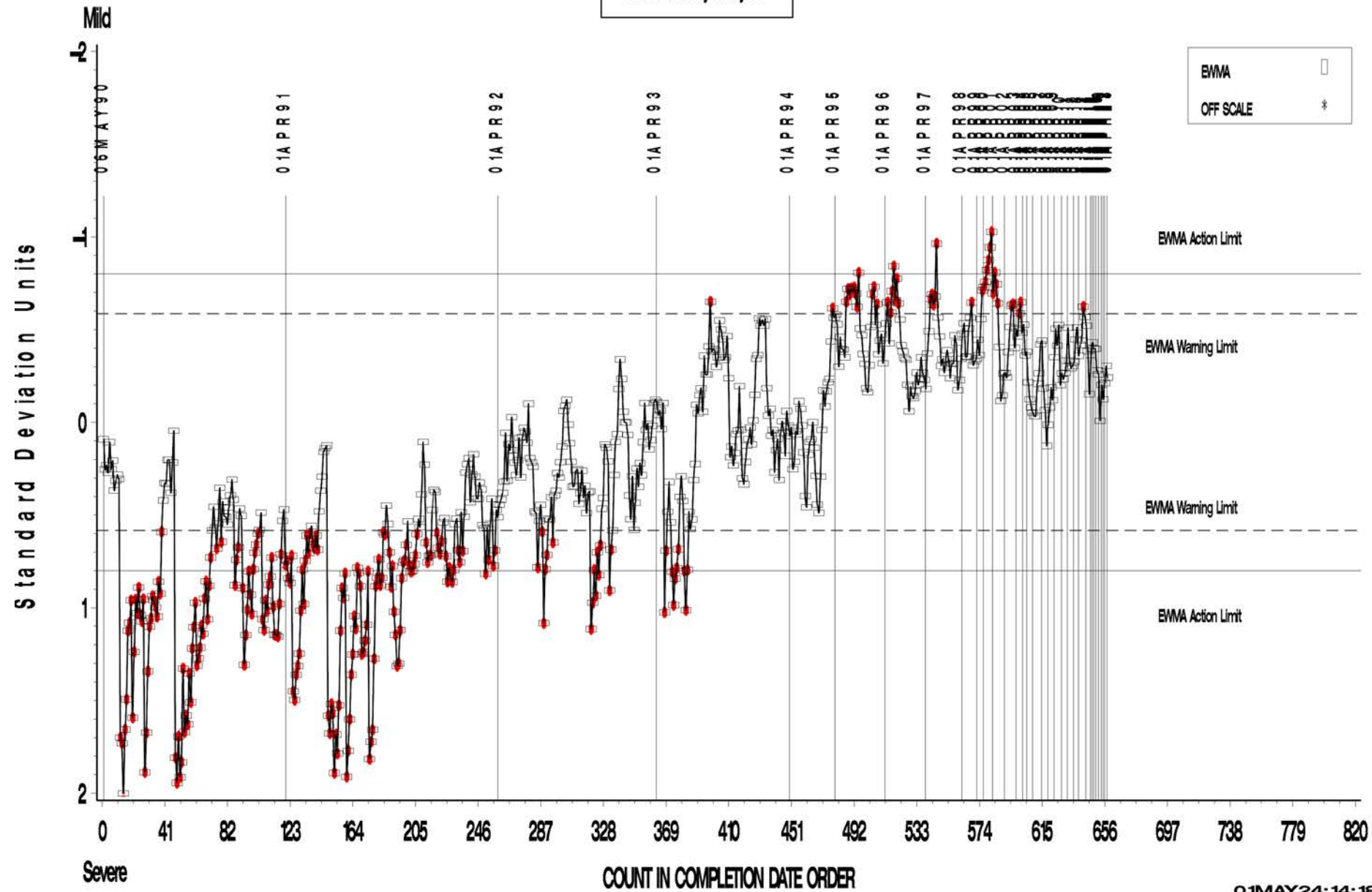
FINAL TLHC

CUSUM Severity Analysis



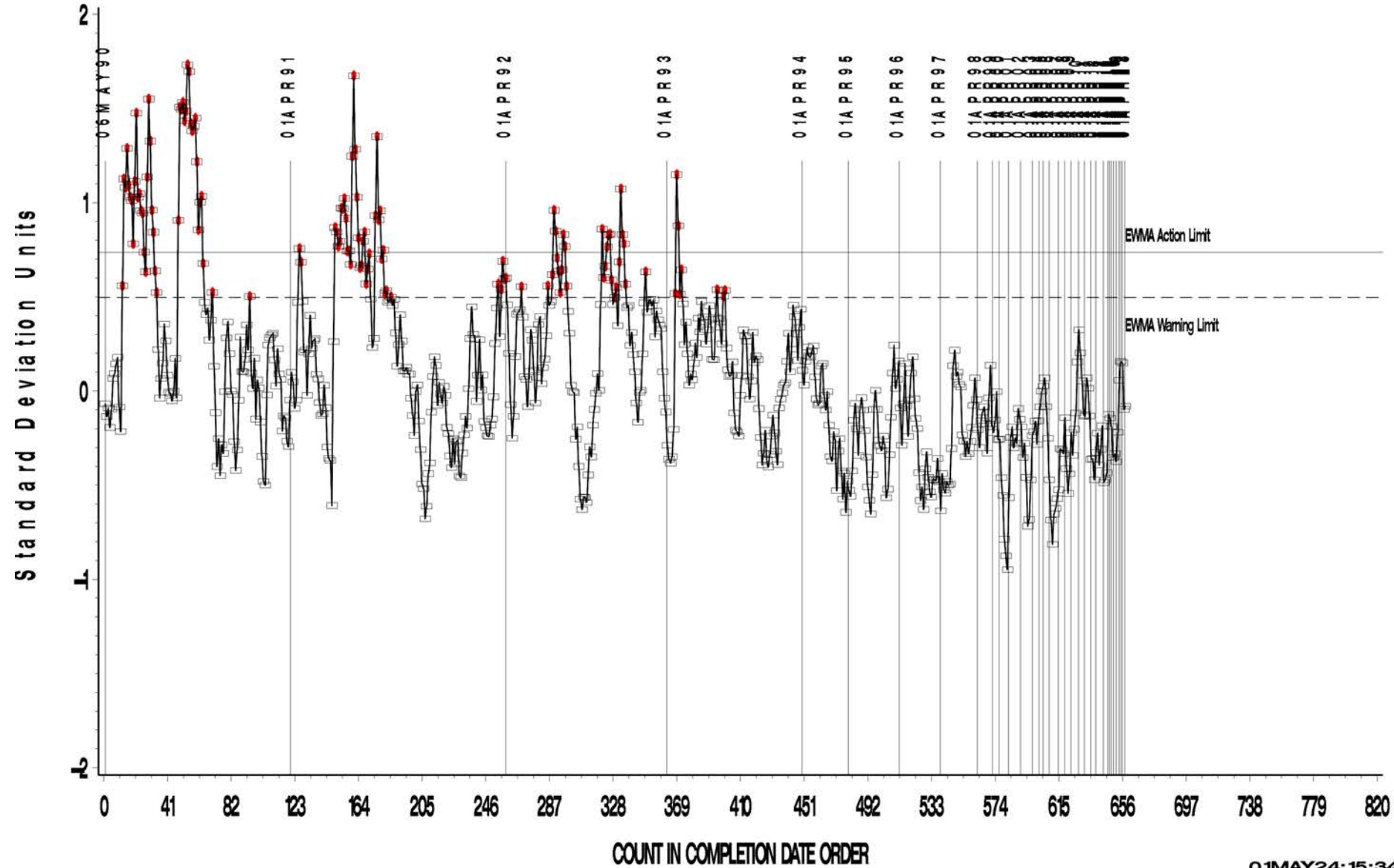
FINAL Weighted Total Demerits

LTMS Severity Analysis



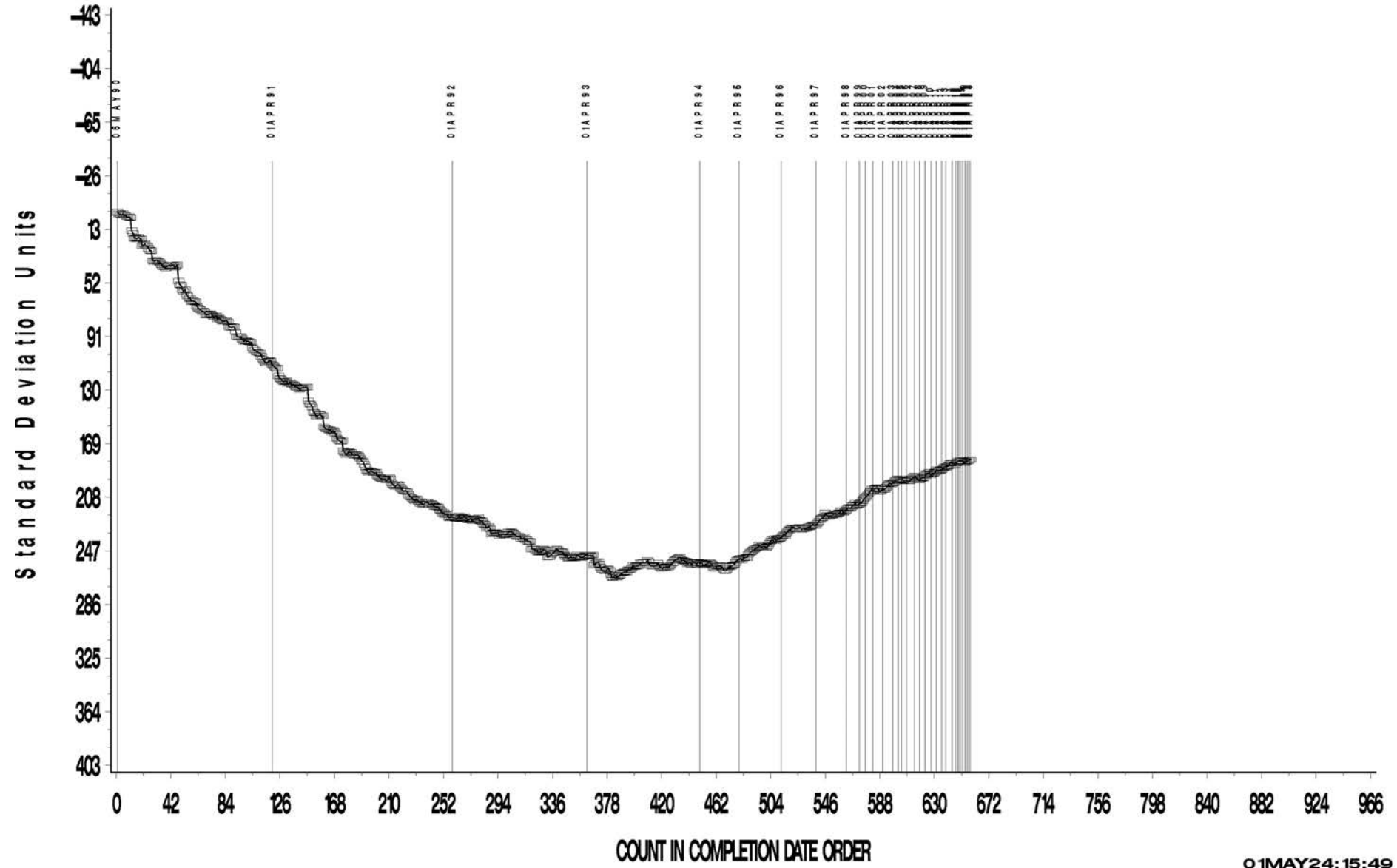
FINAL Weighted Total Demerits

LTMS Precision Analysis

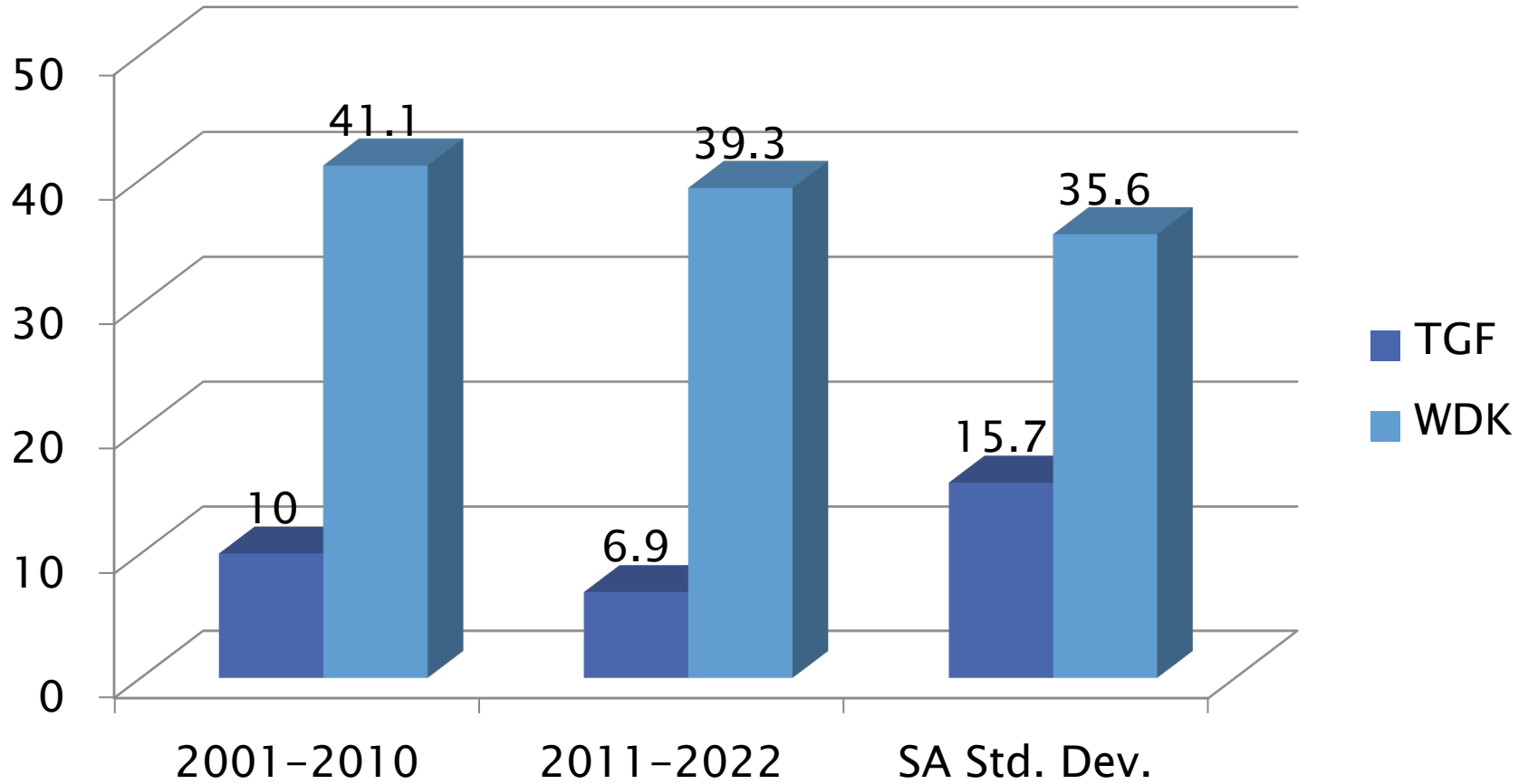


FINAL Weighted Total Demerits

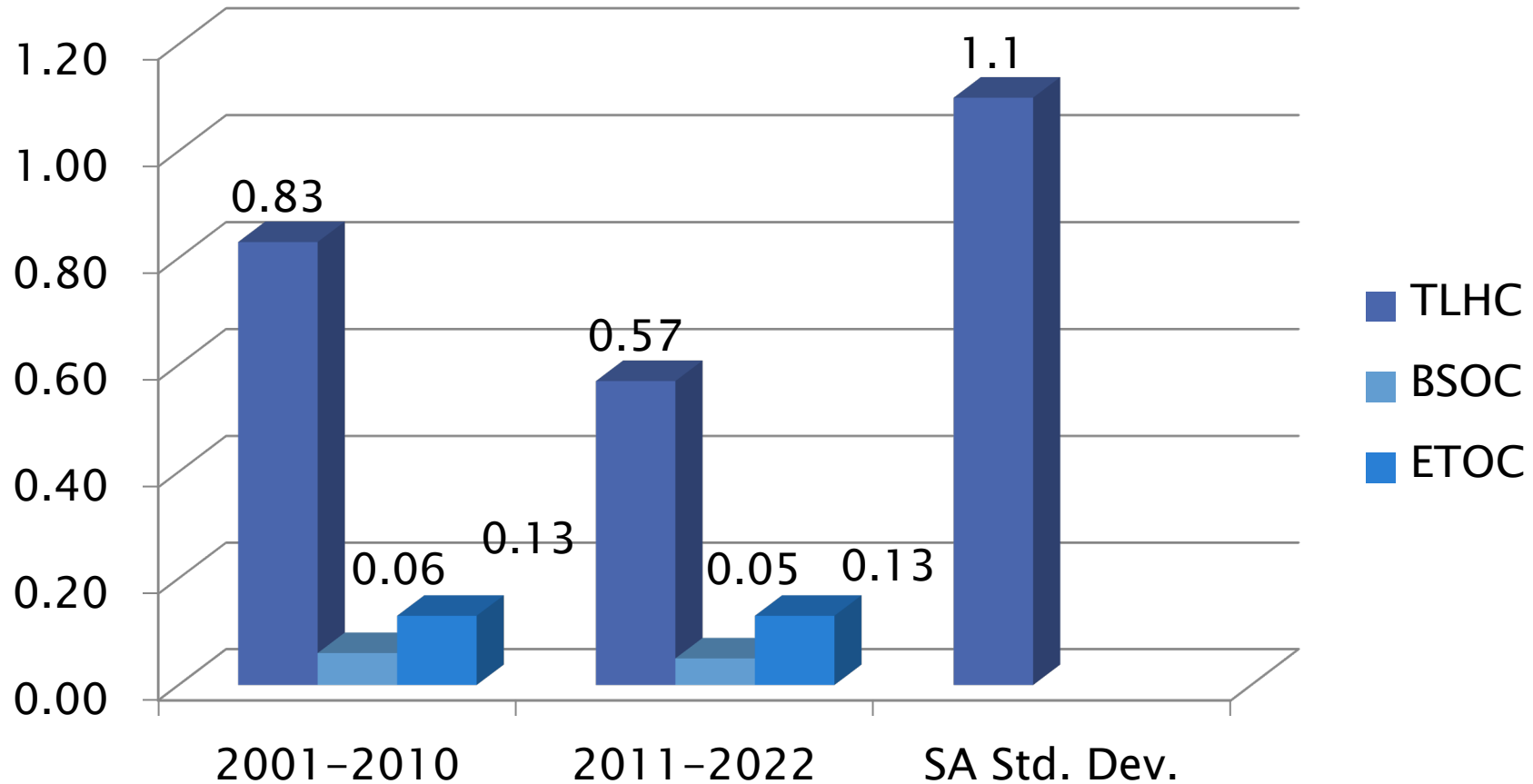
CUSUM Severity Analysis



1 K Precision Estimates



1 K Precision Estimates



[Return to Table of Contents](#)

SCOTE 1N

»» April 2024

1 N Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	1
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	0
Informational	NN	0
Total		1

1 N Failed Tests

Failed Parameter	Number of Tests
No Failed Tests	0
Total	0

1 N Lost Tests*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		0

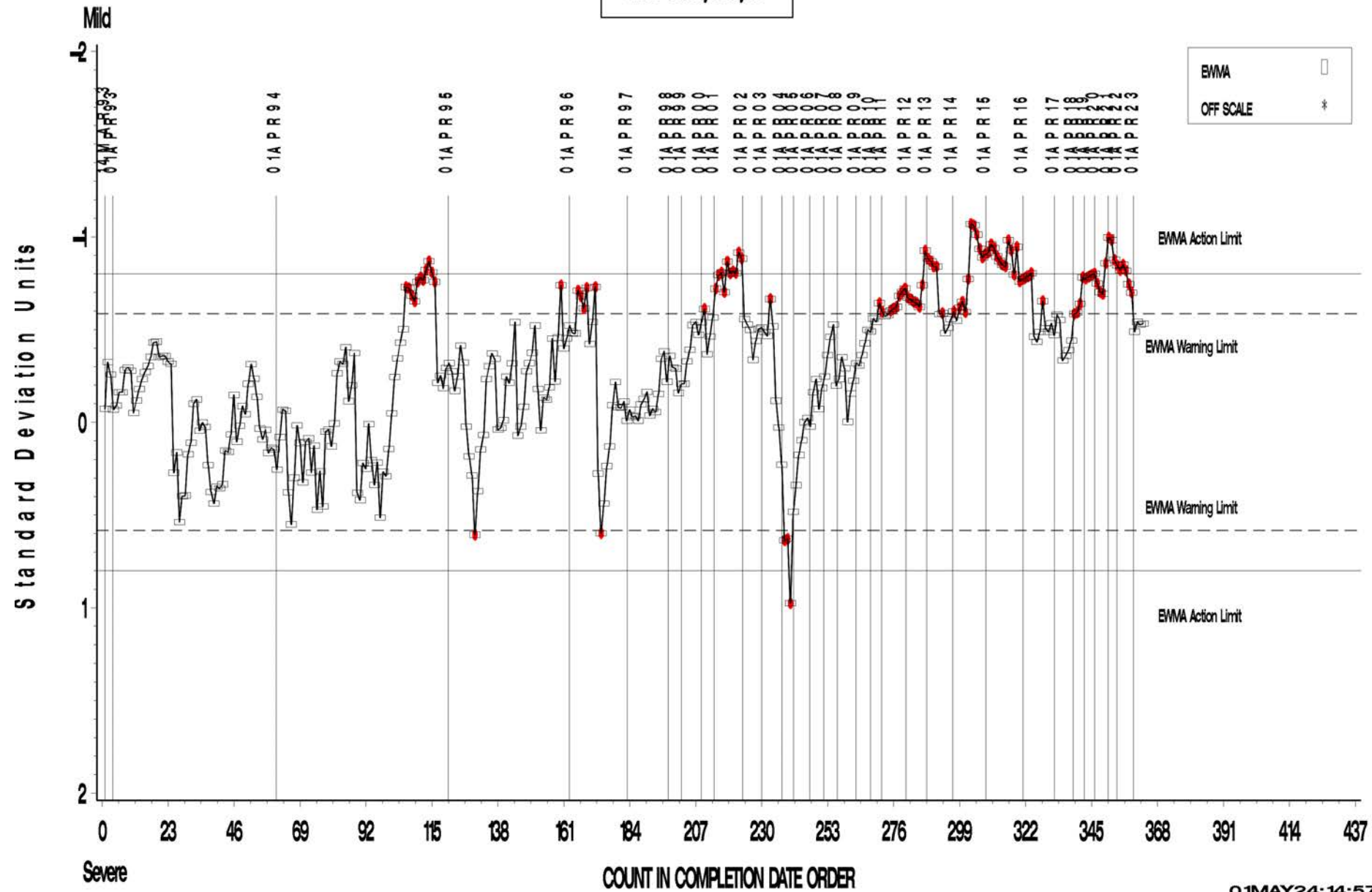
*Invalid and aborted tests

1 N Test Severity

- ▶ TGF is in precision action alarm
- ▶ WDN in severity warning alarm in the mild direction
- ▶ All other parameters are in control

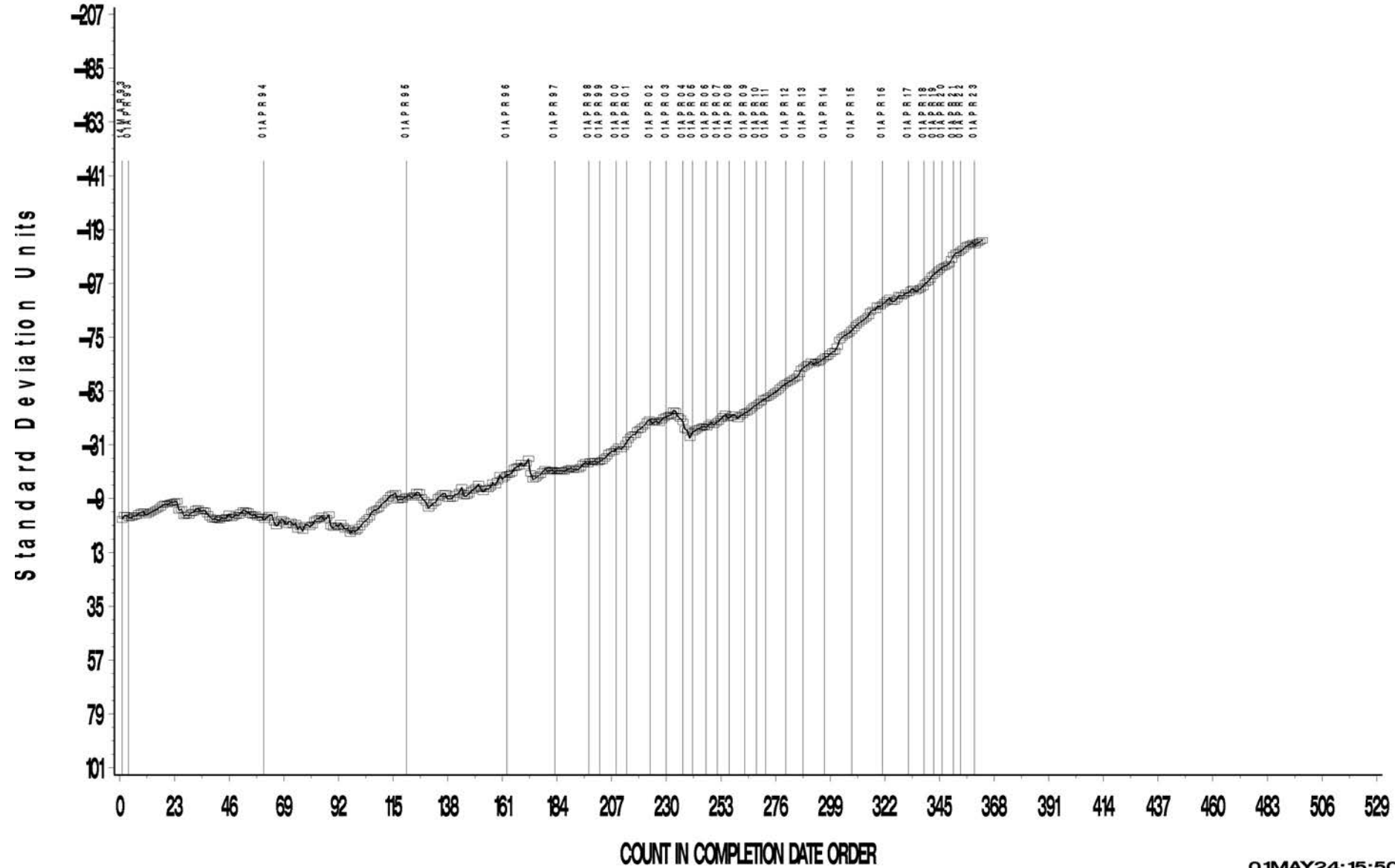
BSOC

LTMS Severity Analysis



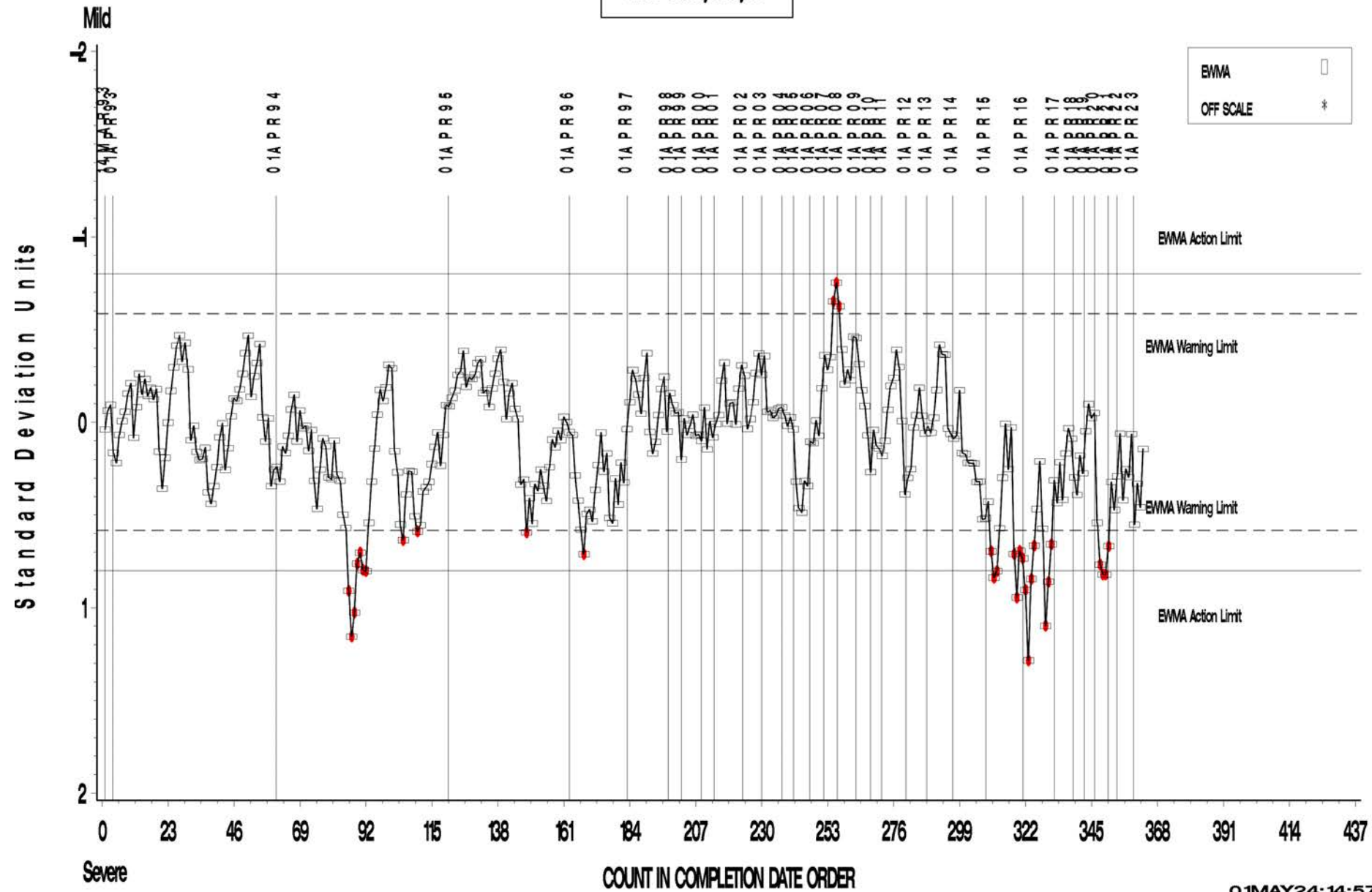
BSOC

CUSUM Severity Analysis



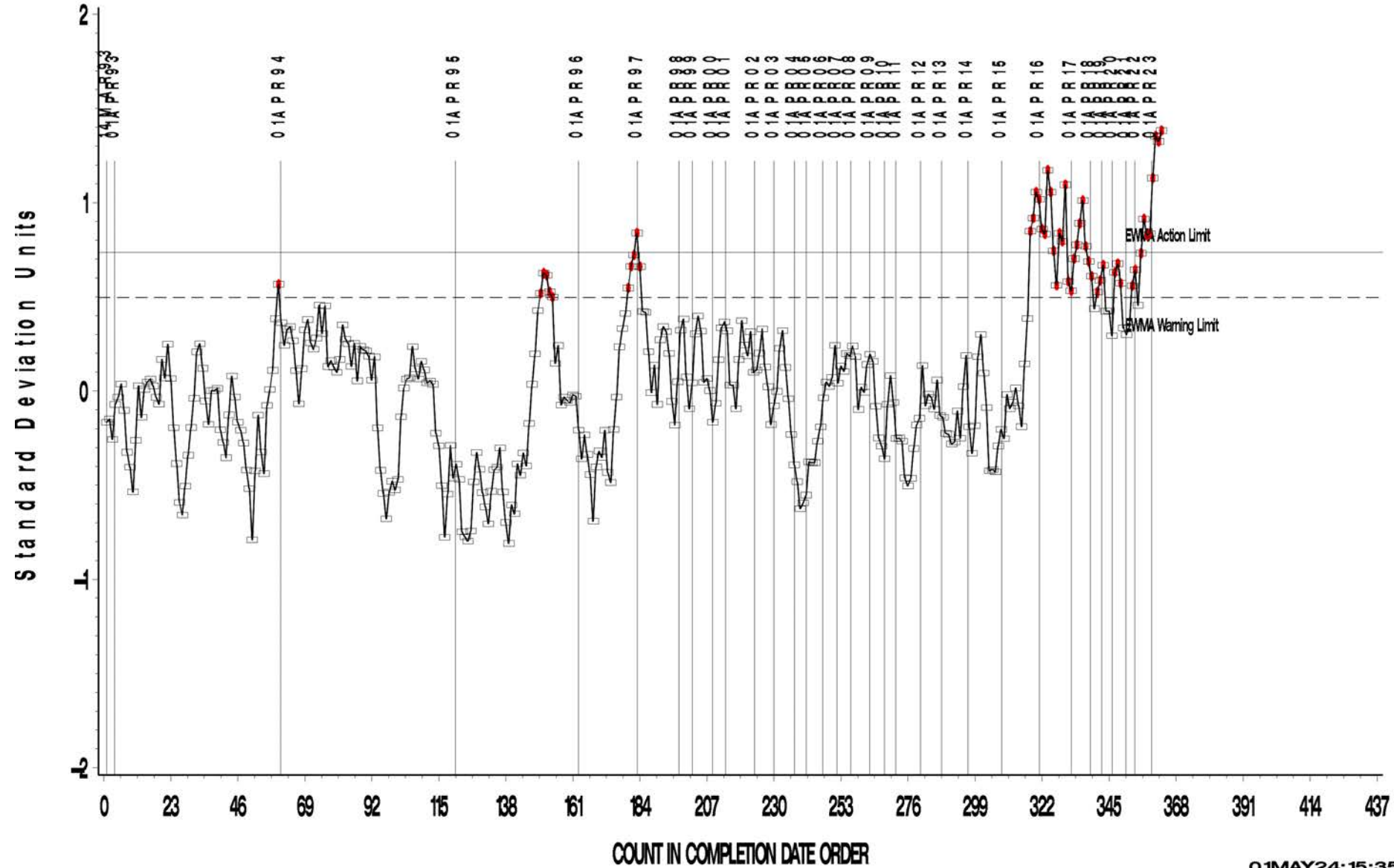
FINAL CORRECTED TGF

LTMS Severity Analysis



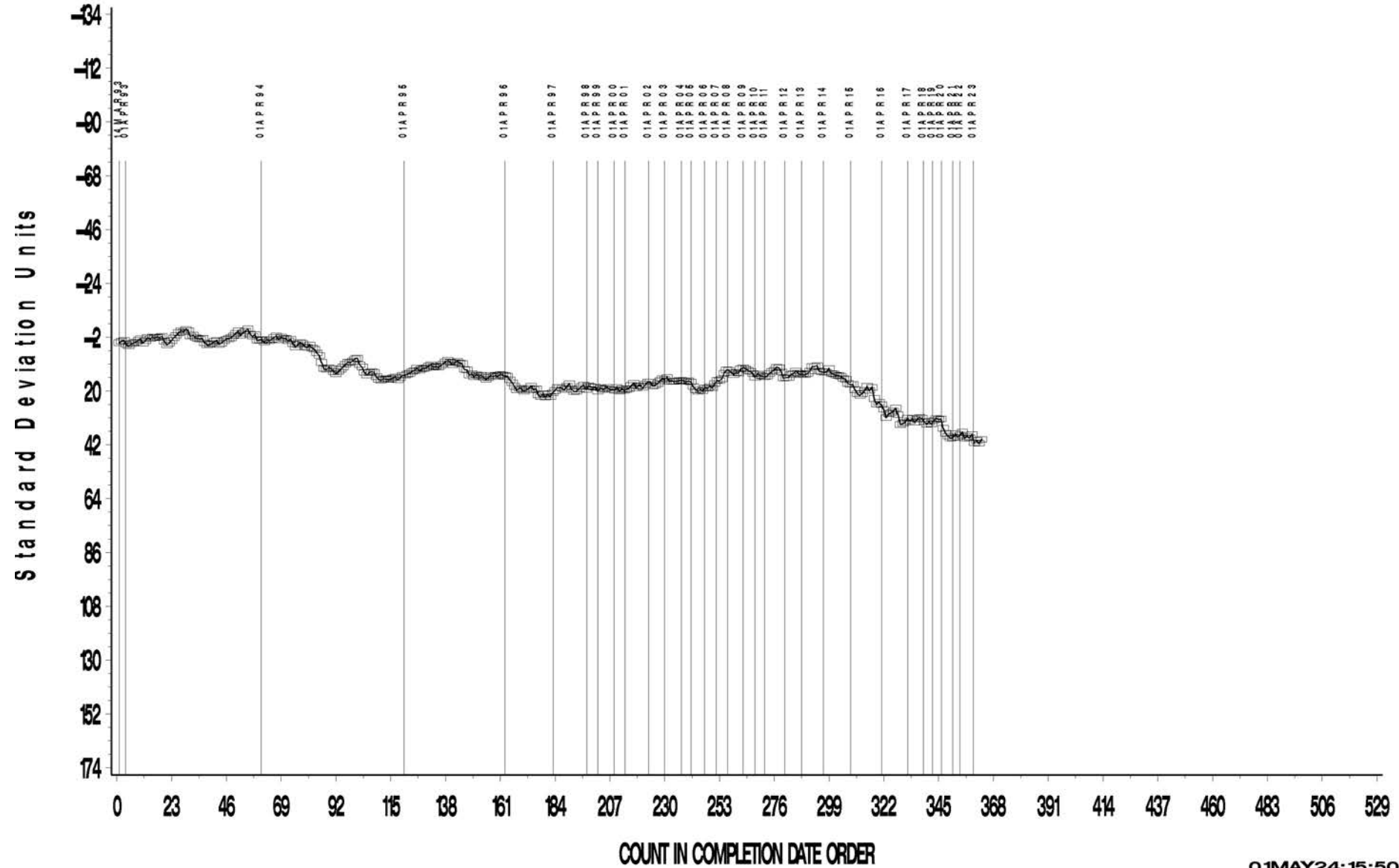
FINAL CORRECTED TGF

LTMS Precision Analysis



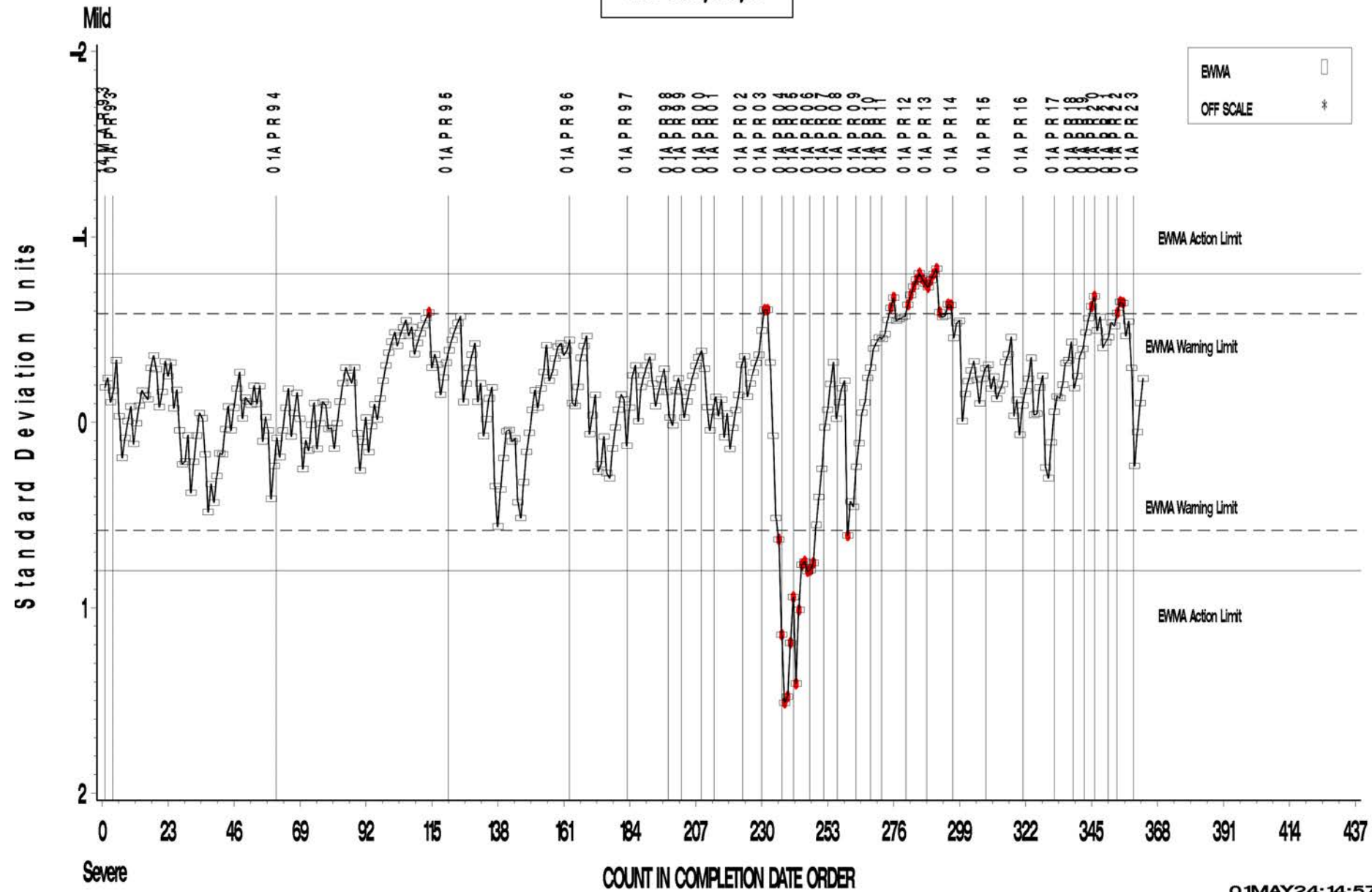
FINAL CORRECTED TGF

CUSUM Severity Analysis



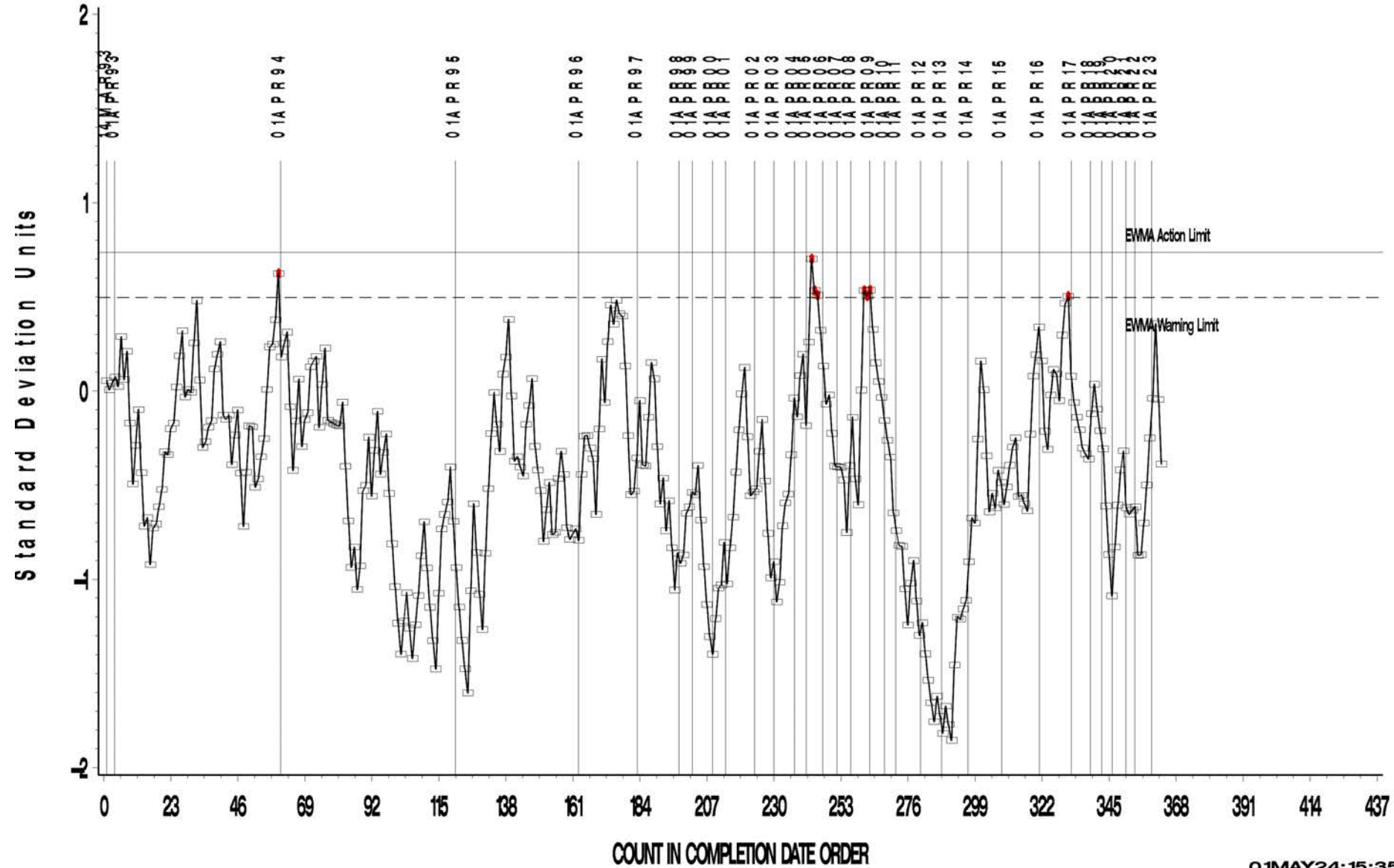
Top Land Heavy Carbon

LTMS Severity Analysis



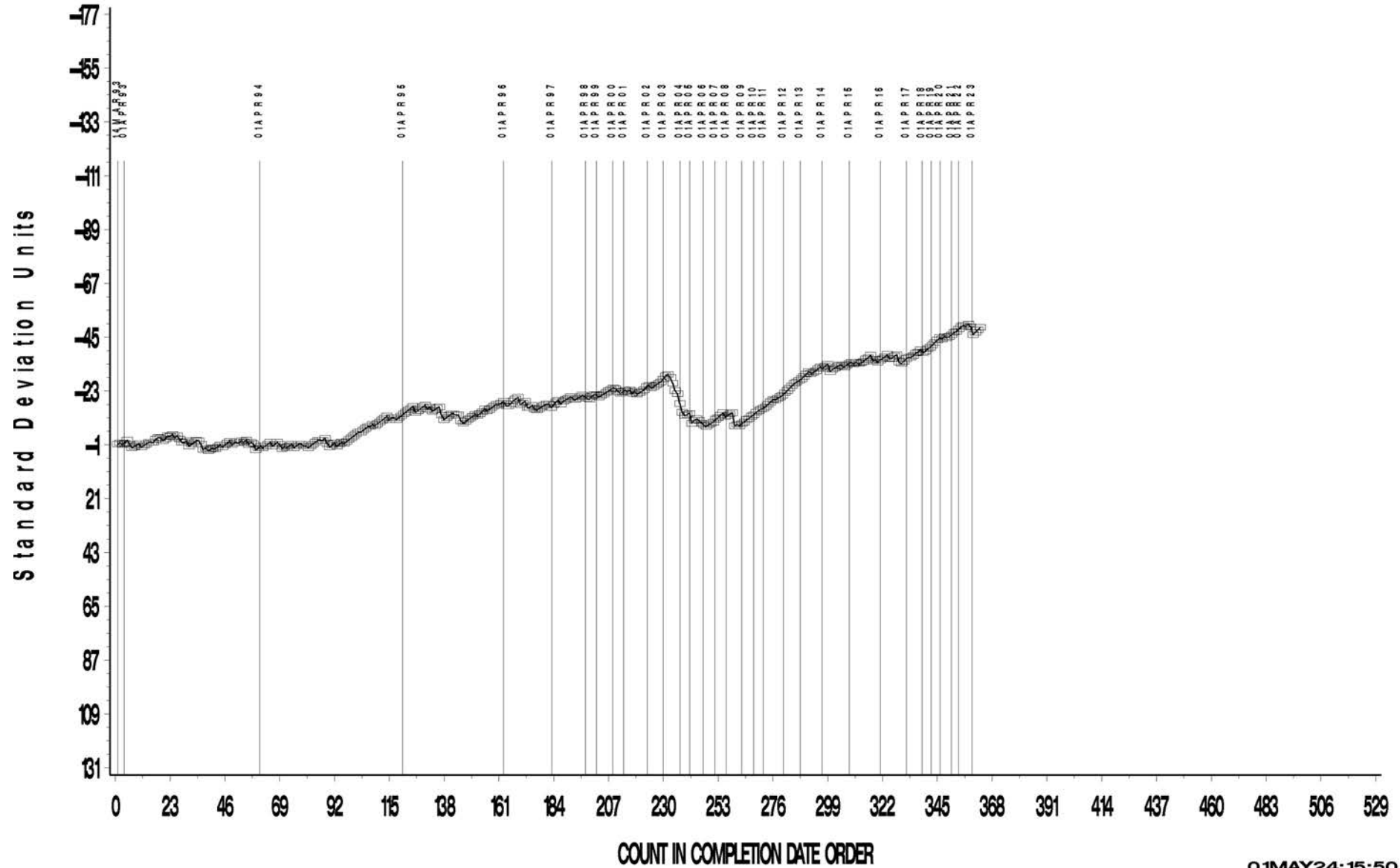
Top Land Heavy Carbon

LTMS Precision Analysis



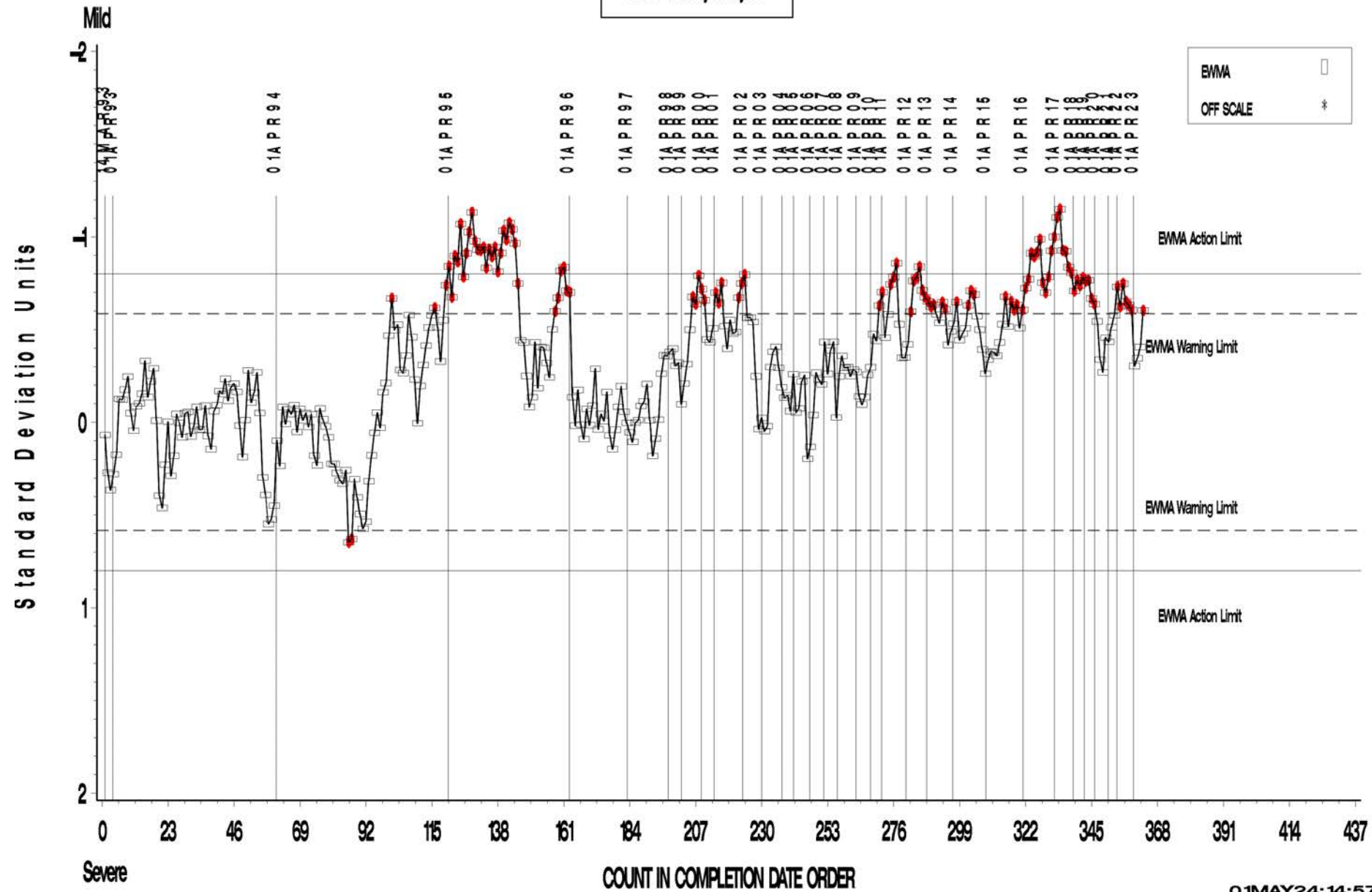
Top Land Heavy Carbon

CUSUM Severity Analysis



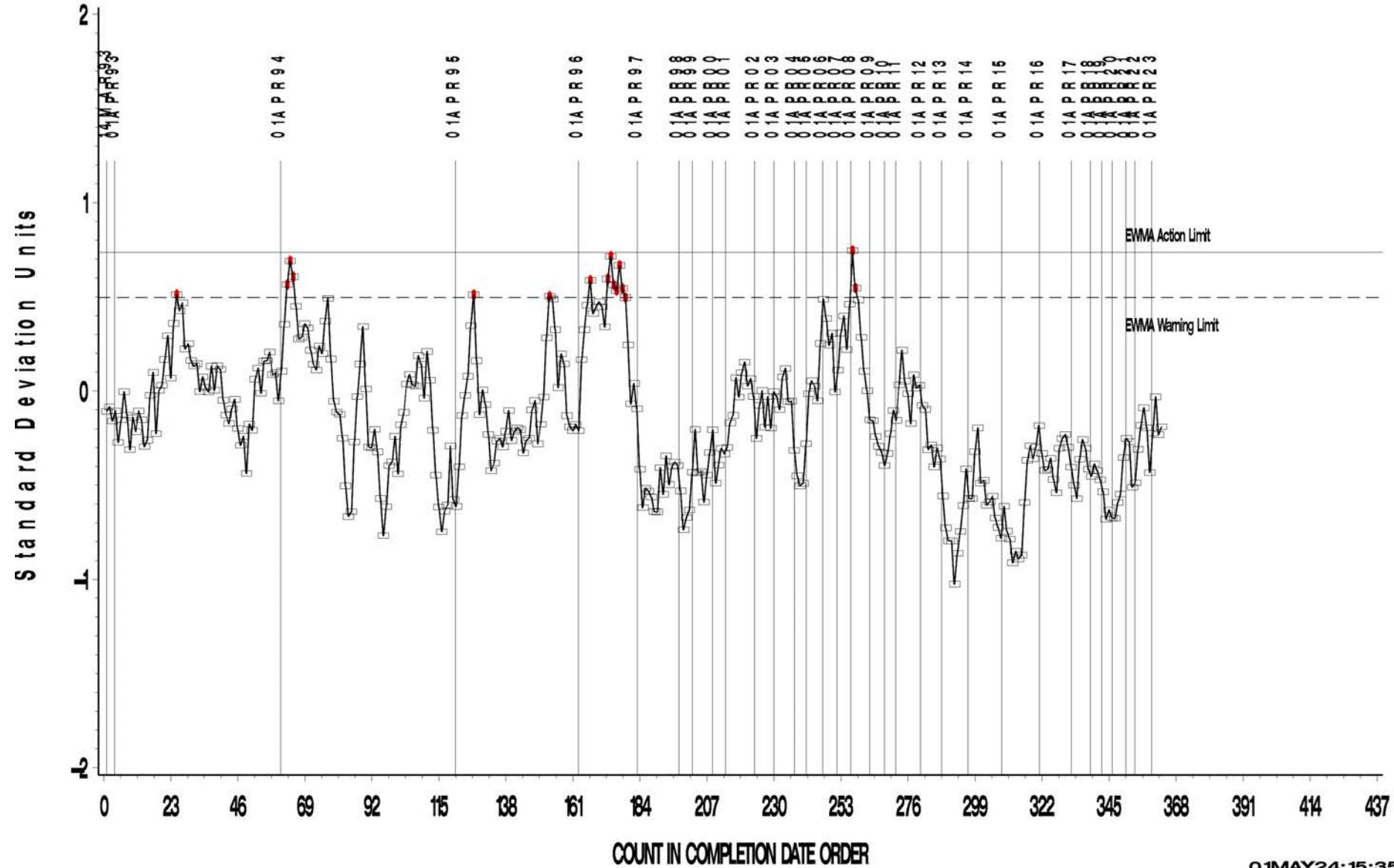
Weighted Total Demerits

LTMS Severity Analysis



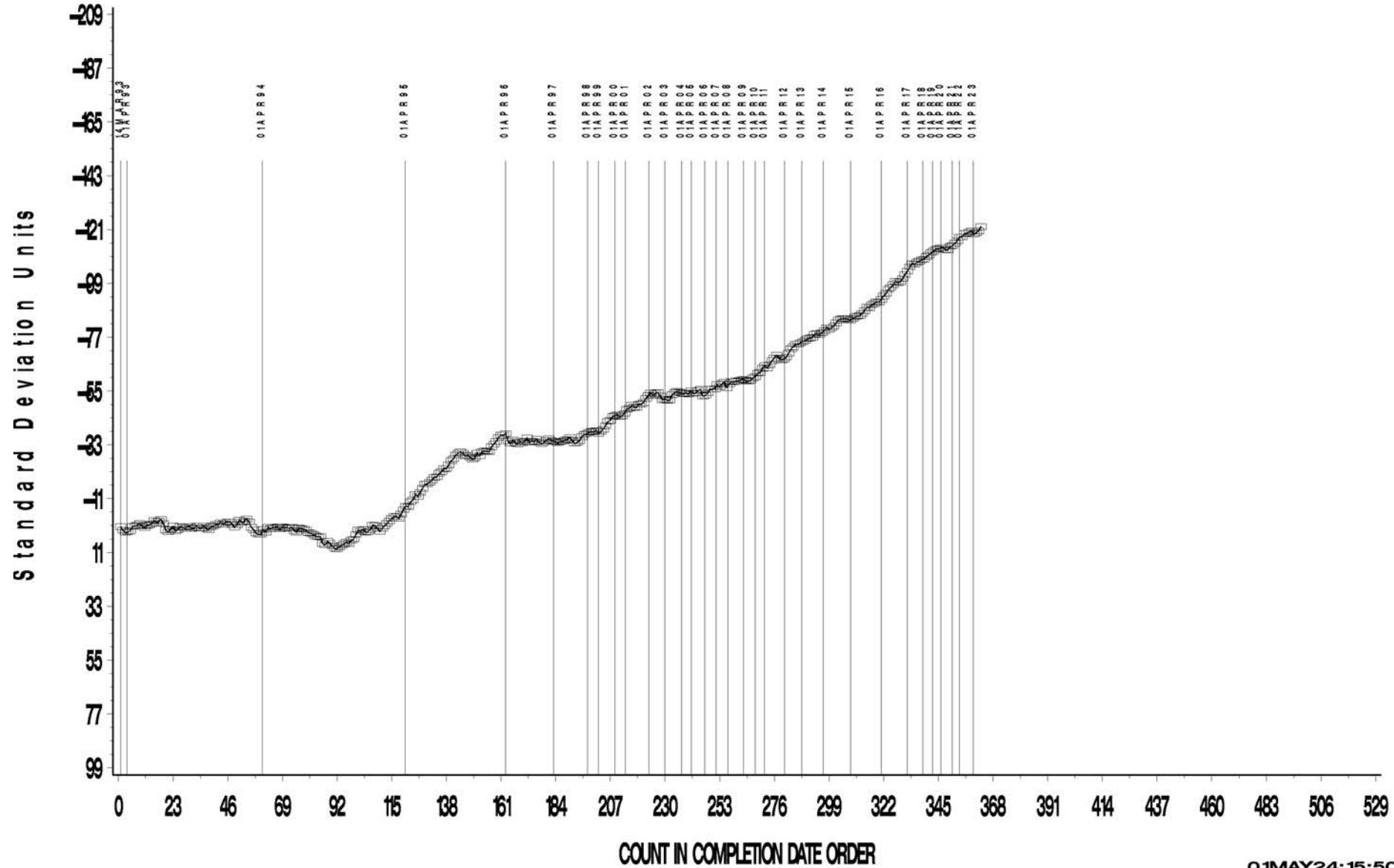
Weighted Total Demerits

LTMS Precision Analysis

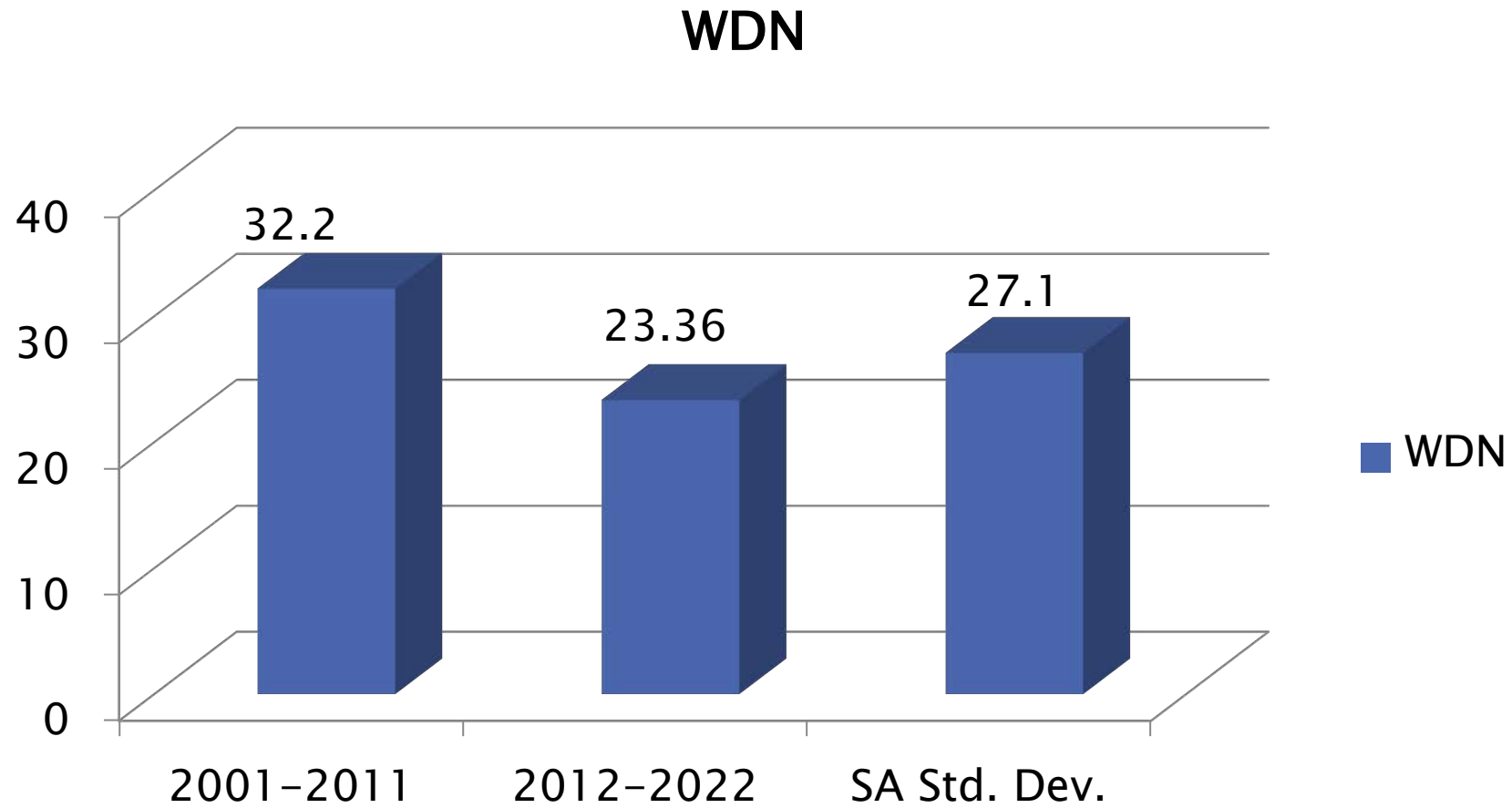


Weighted Total Demerits

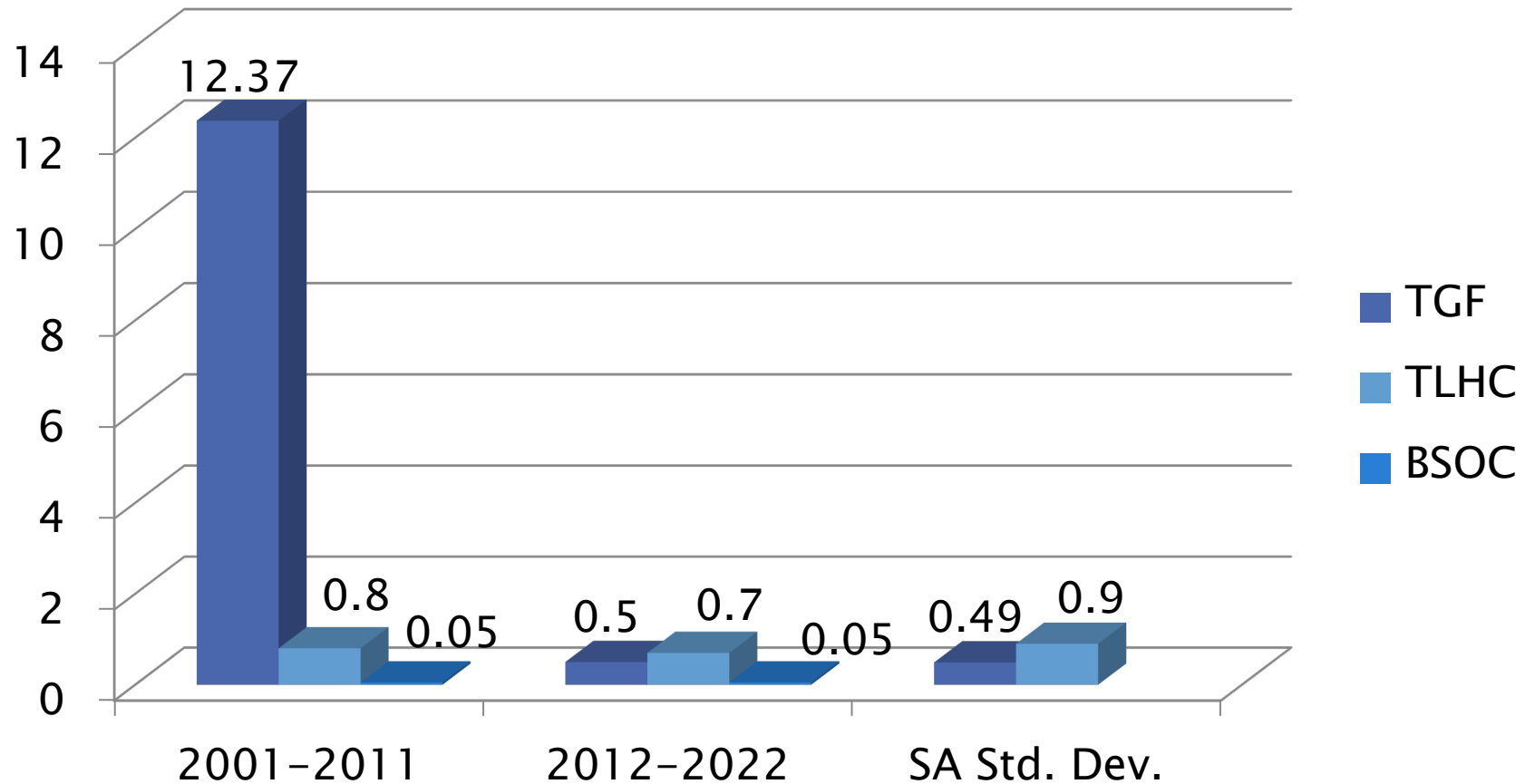
CUSUM Severity Analysis



1 N Precision Estimates



1 N Precision Estimates



[Return to Table of Contents](#)

SCOTE 1P

➤➤ April 2024

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1 P Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	0
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	0
Total		0

1 P Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

1P Lost Tests*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		0

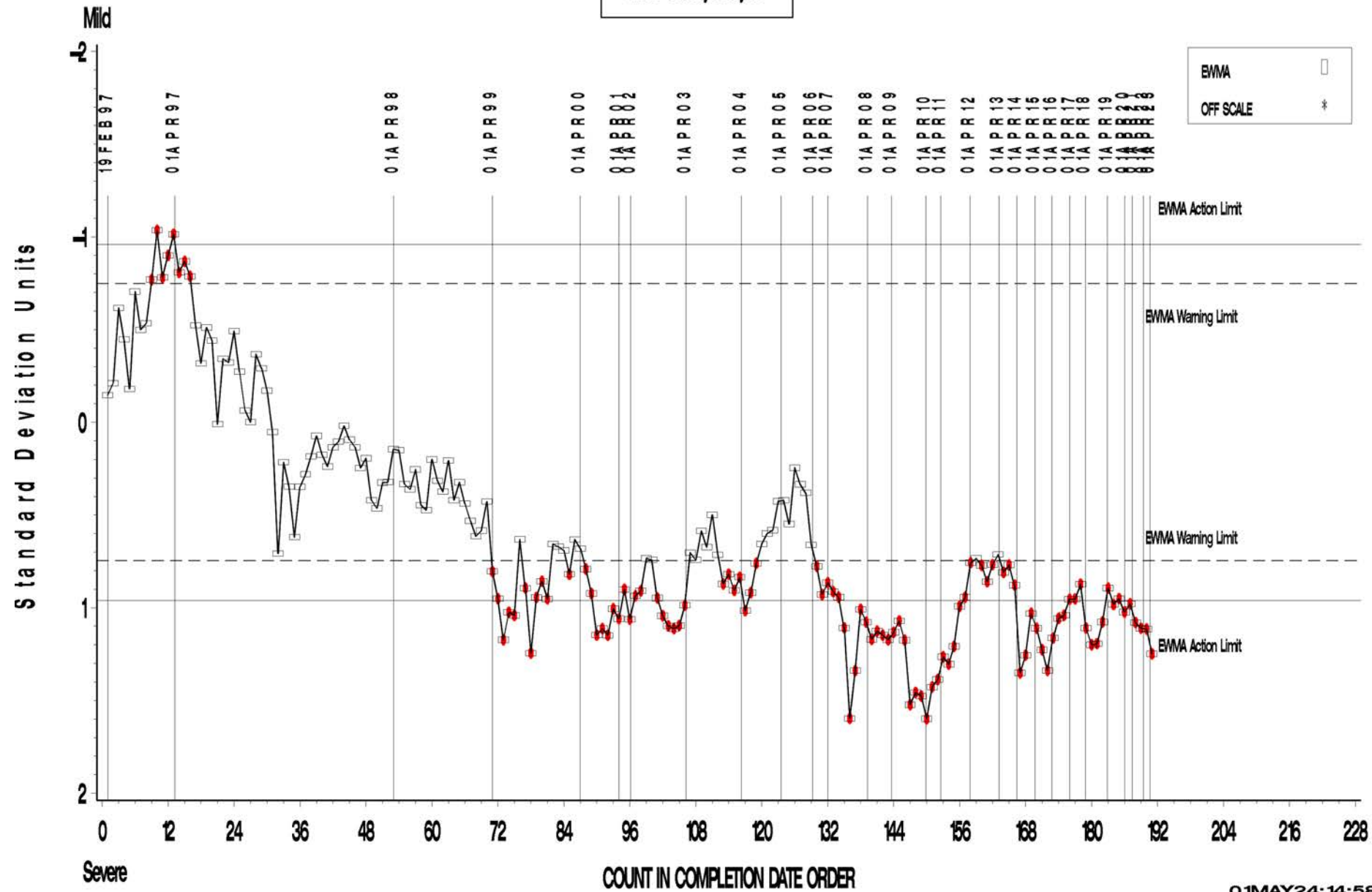
*Invalid and aborted tests

1 P Test Severity

- ▶ As no chartable 1P tests were run during this reporting period, no statement about test severity can be made.

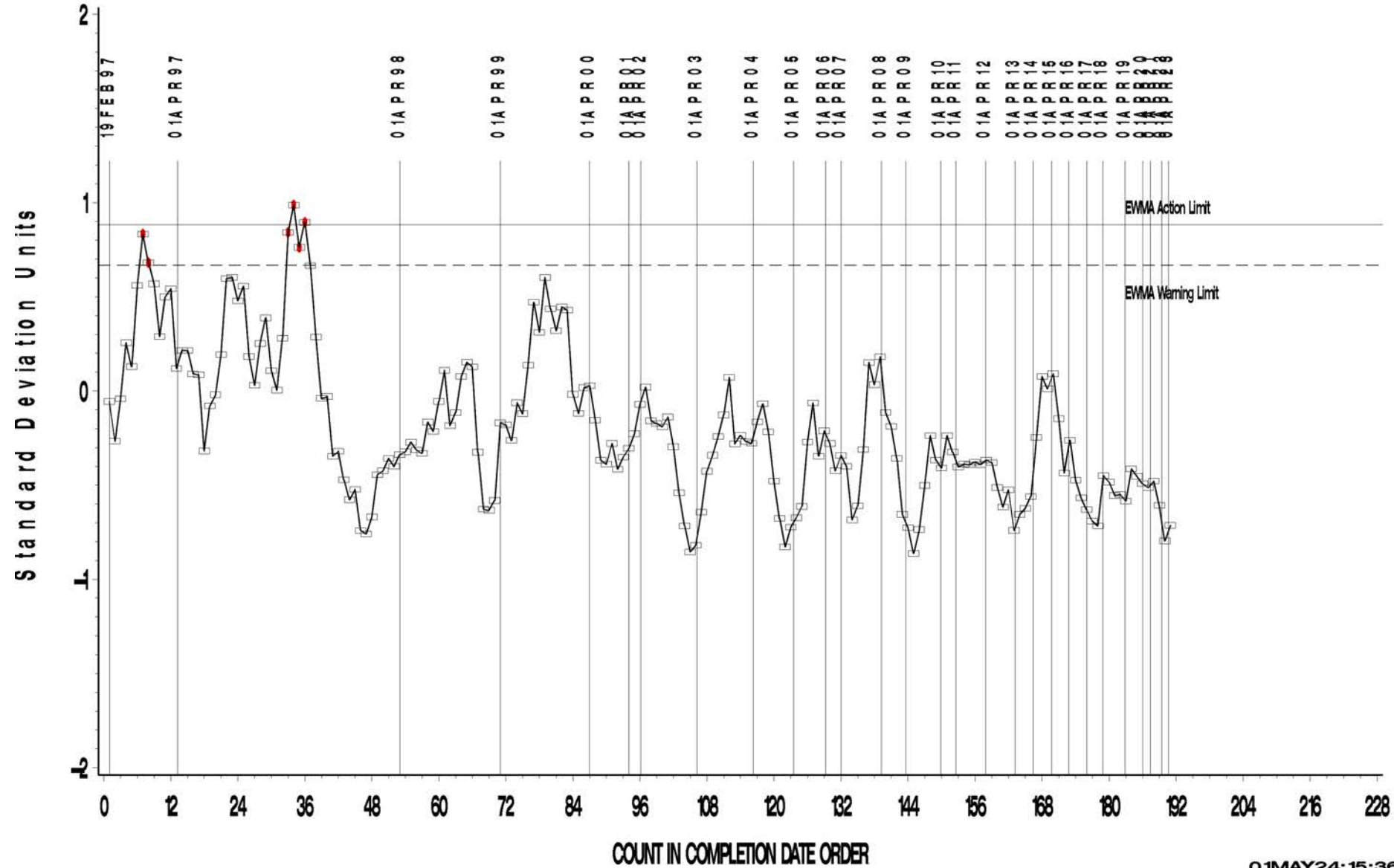
EOTOC

LTMS Severity Analysis



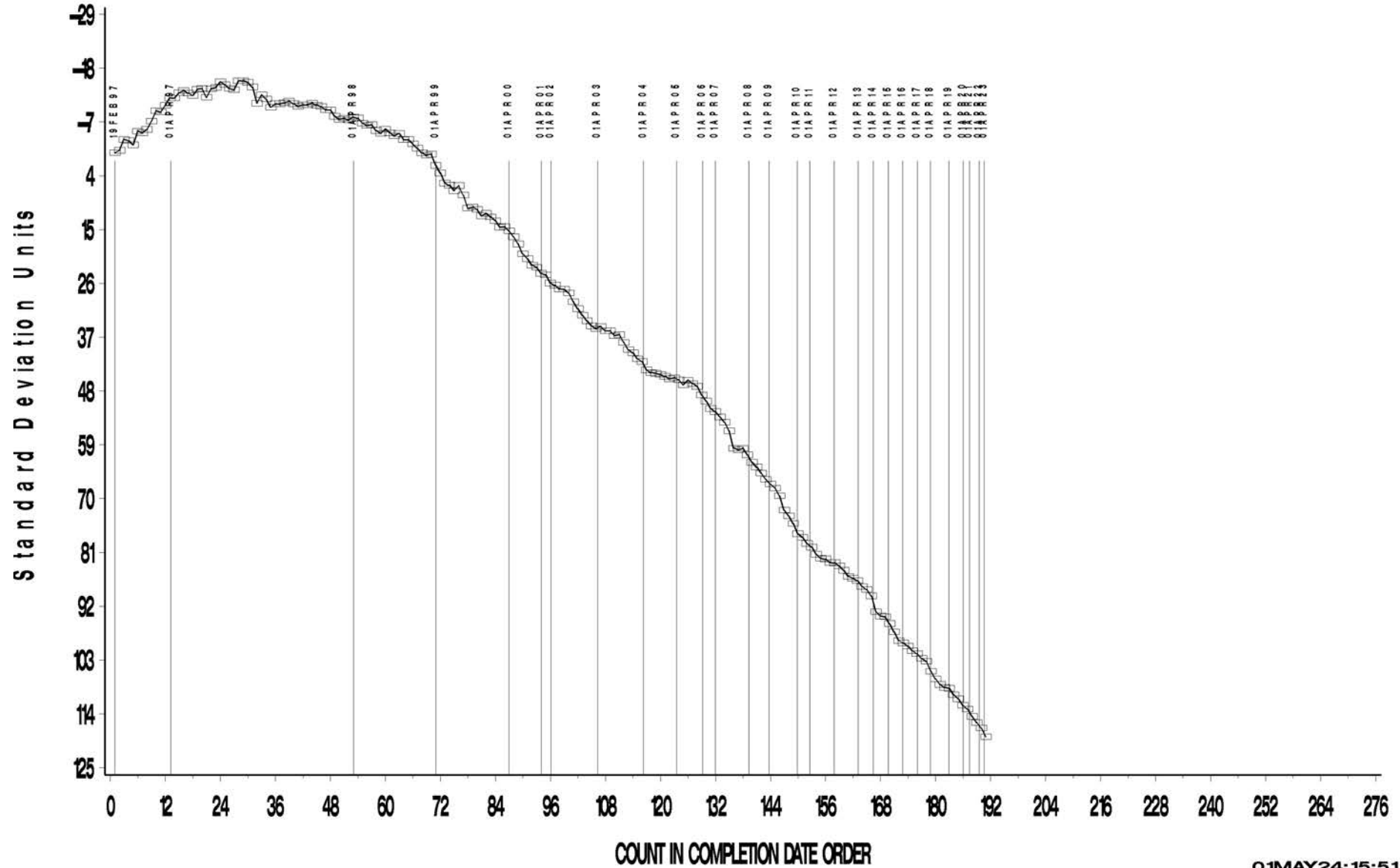
EOTOC

LTMS Precision Analysis



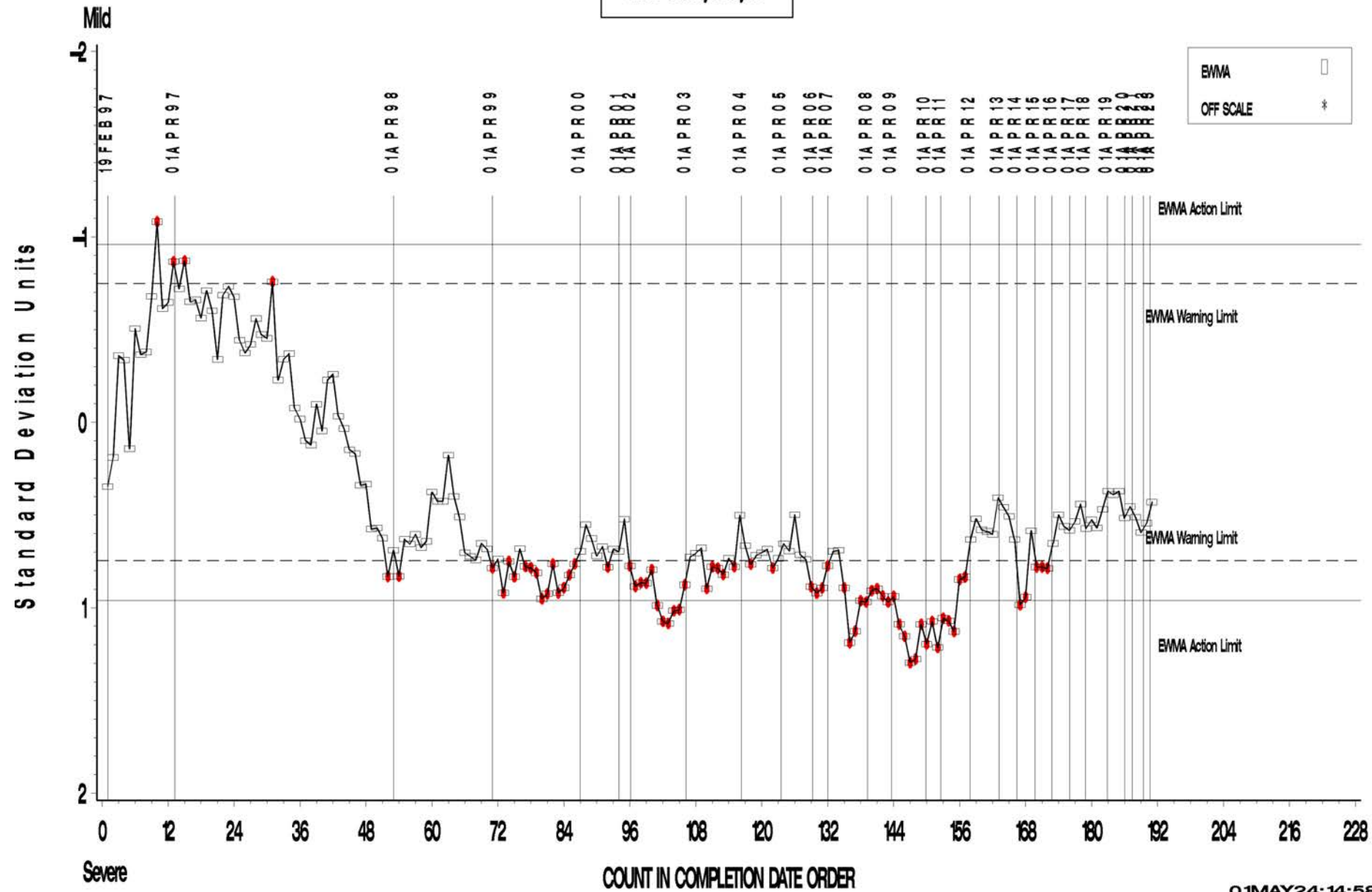
EOTOC

CUSUM Severity Analysis



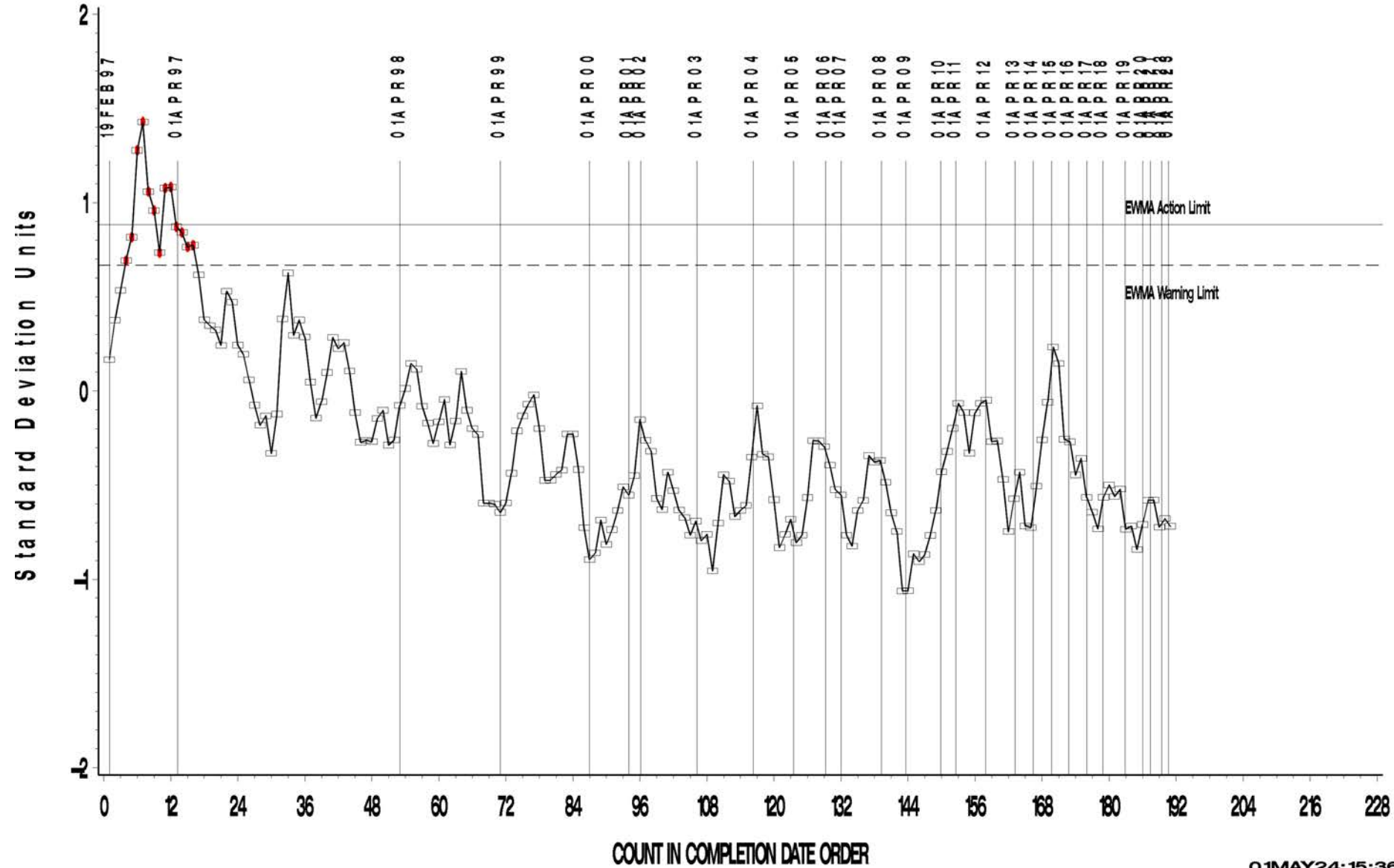
OIL CONSUMPTION

LTMS Severity Analysis



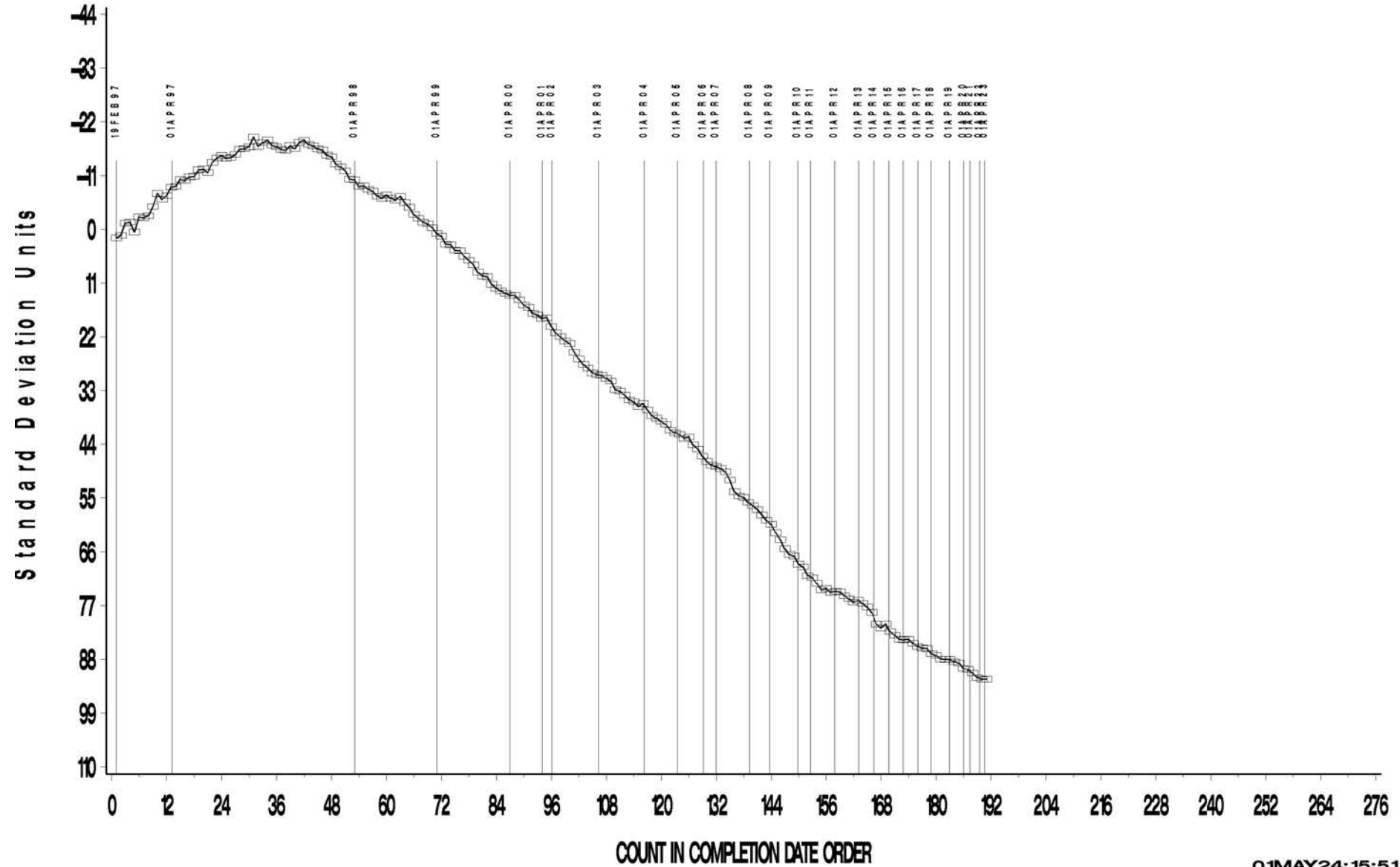
OIL CONSUMPTION

LTMS Precision Analysis



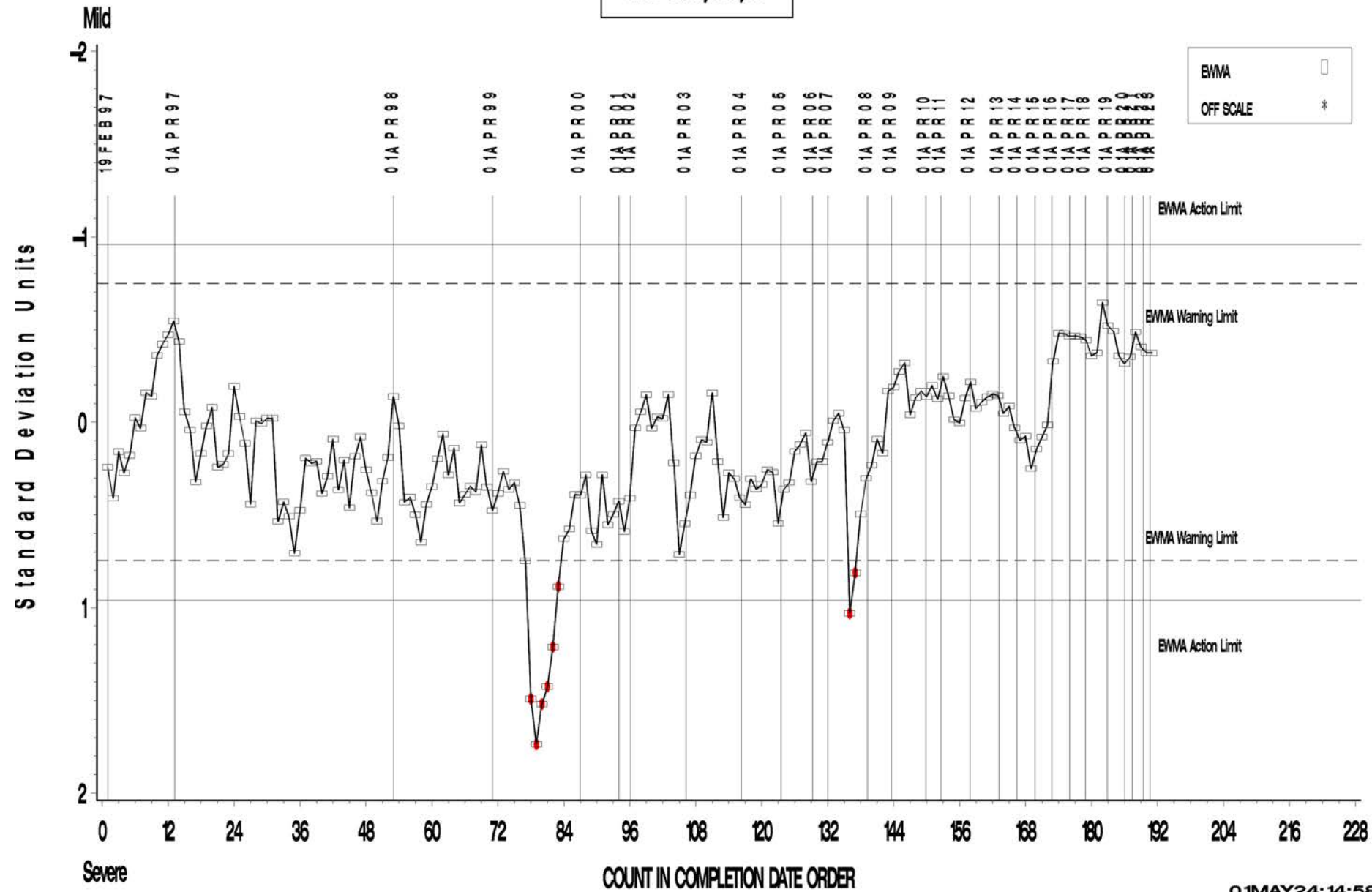
OIL CONSUMPTION

CUSUM Severity Analysis



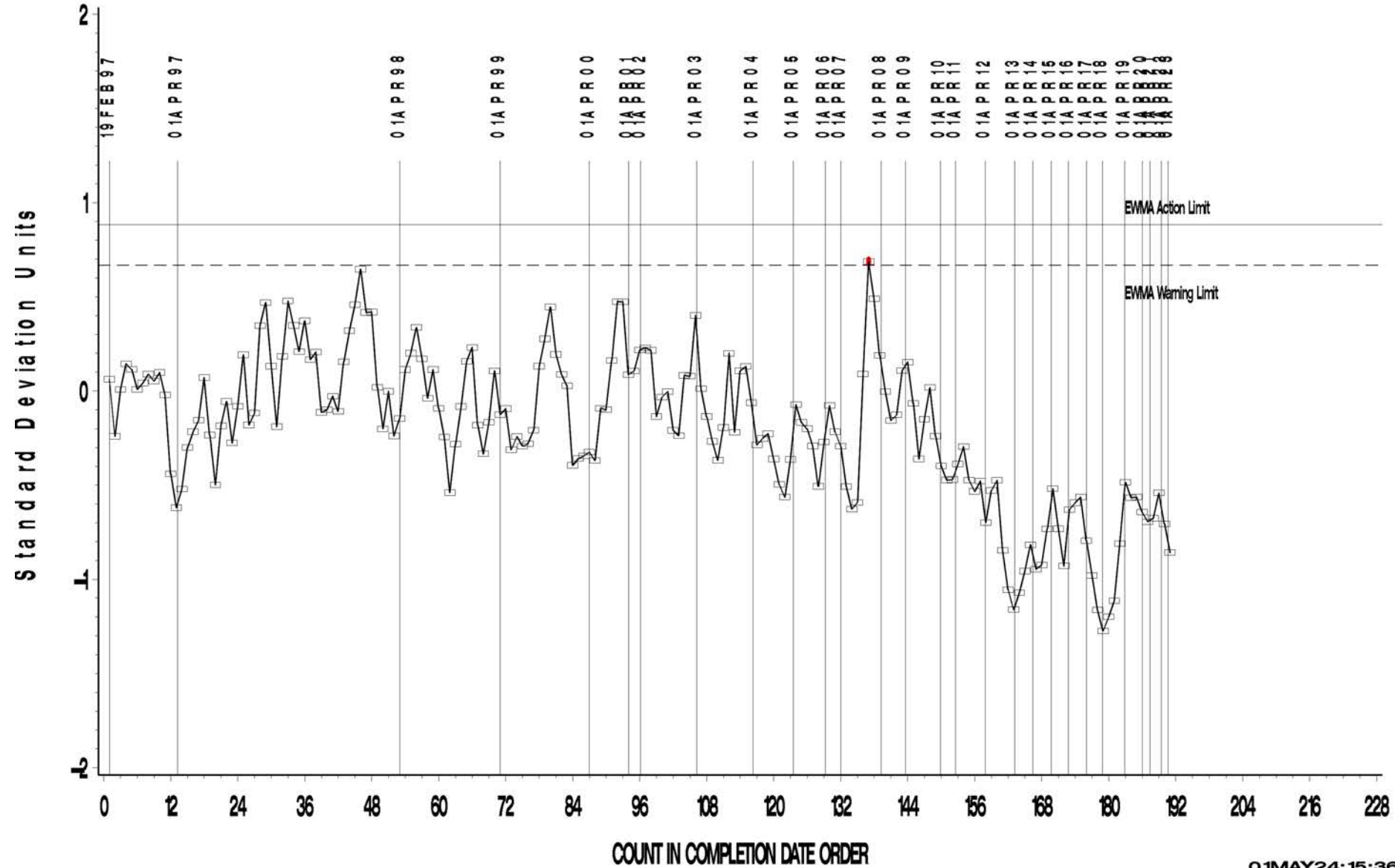
TOP GROOVE CARBON

LTMS Severity Analysis



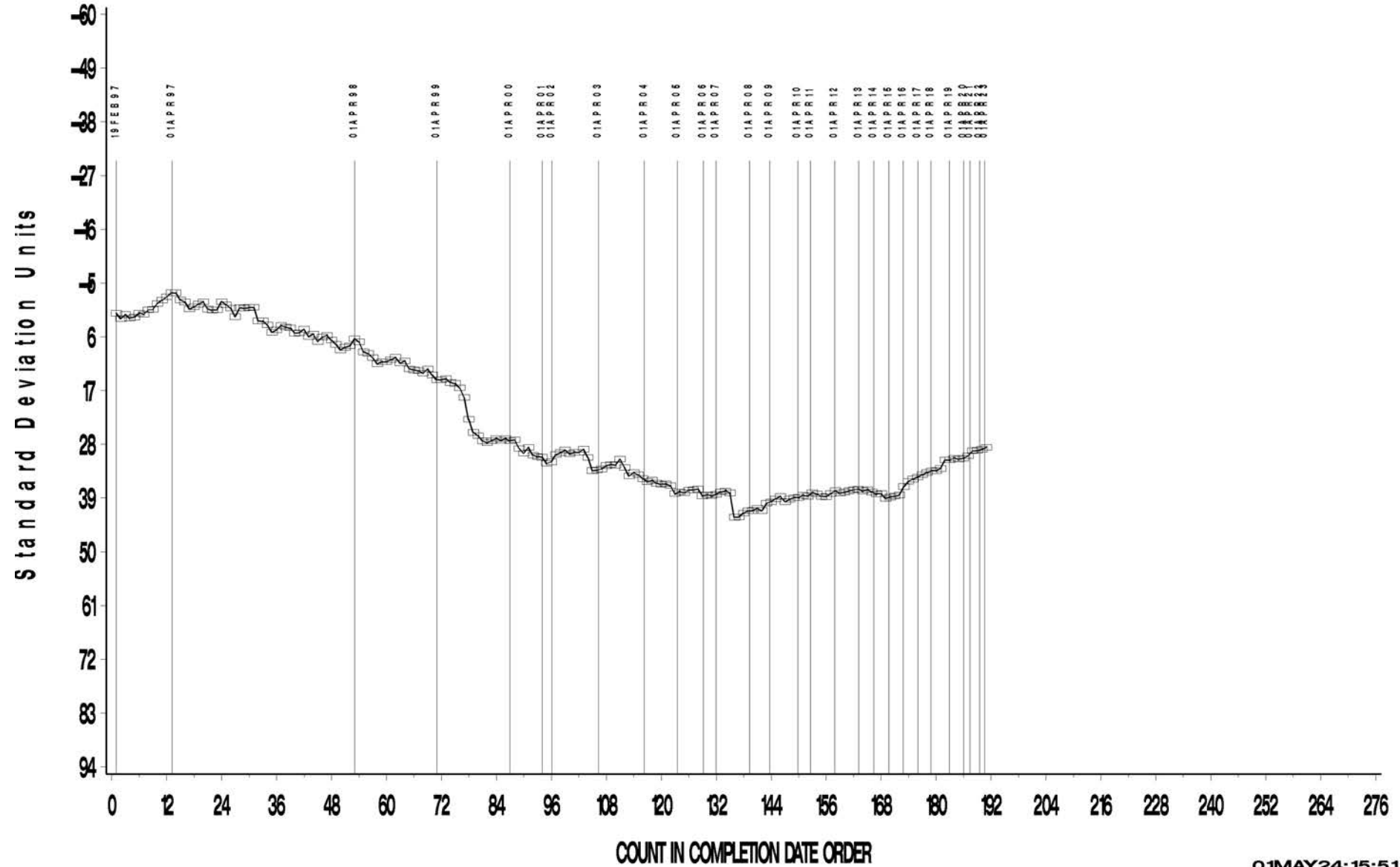
TOP GROOVE CARBON

LTMS Precision Analysis



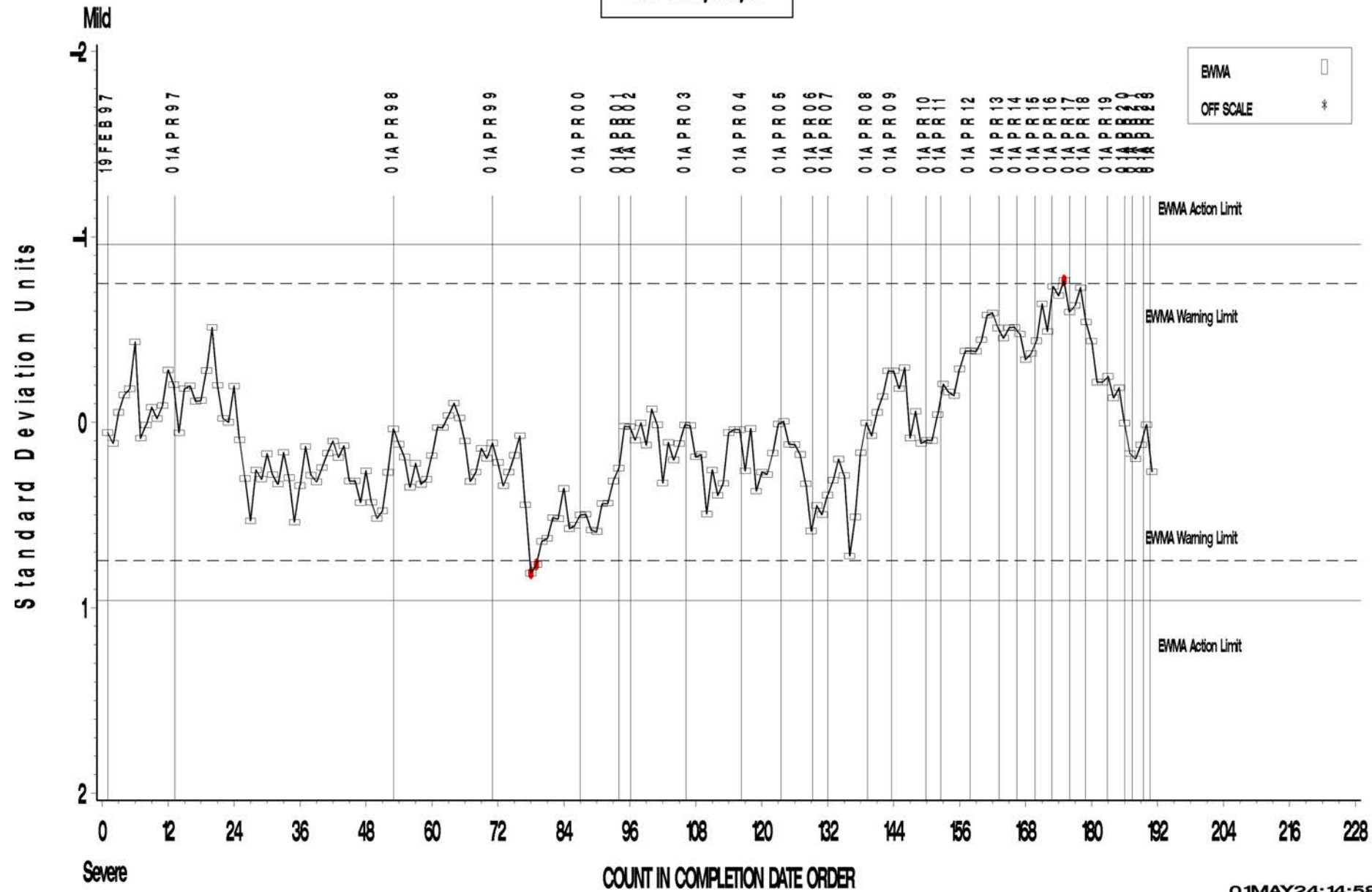
TOP GROOVE CARBON

CUSUM Severity Analysis



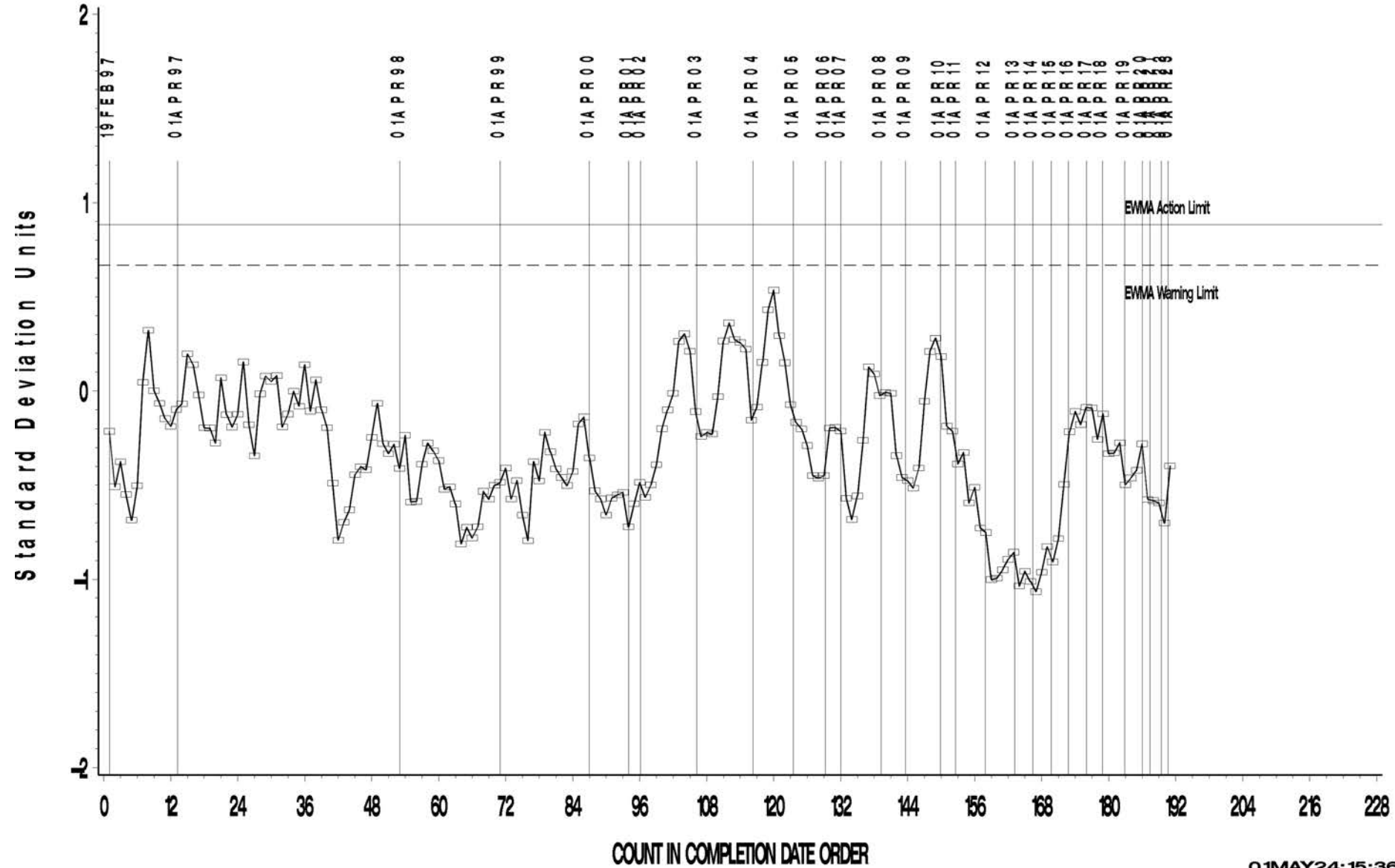
TOP LAND CARBON

LTMS Severity Analysis



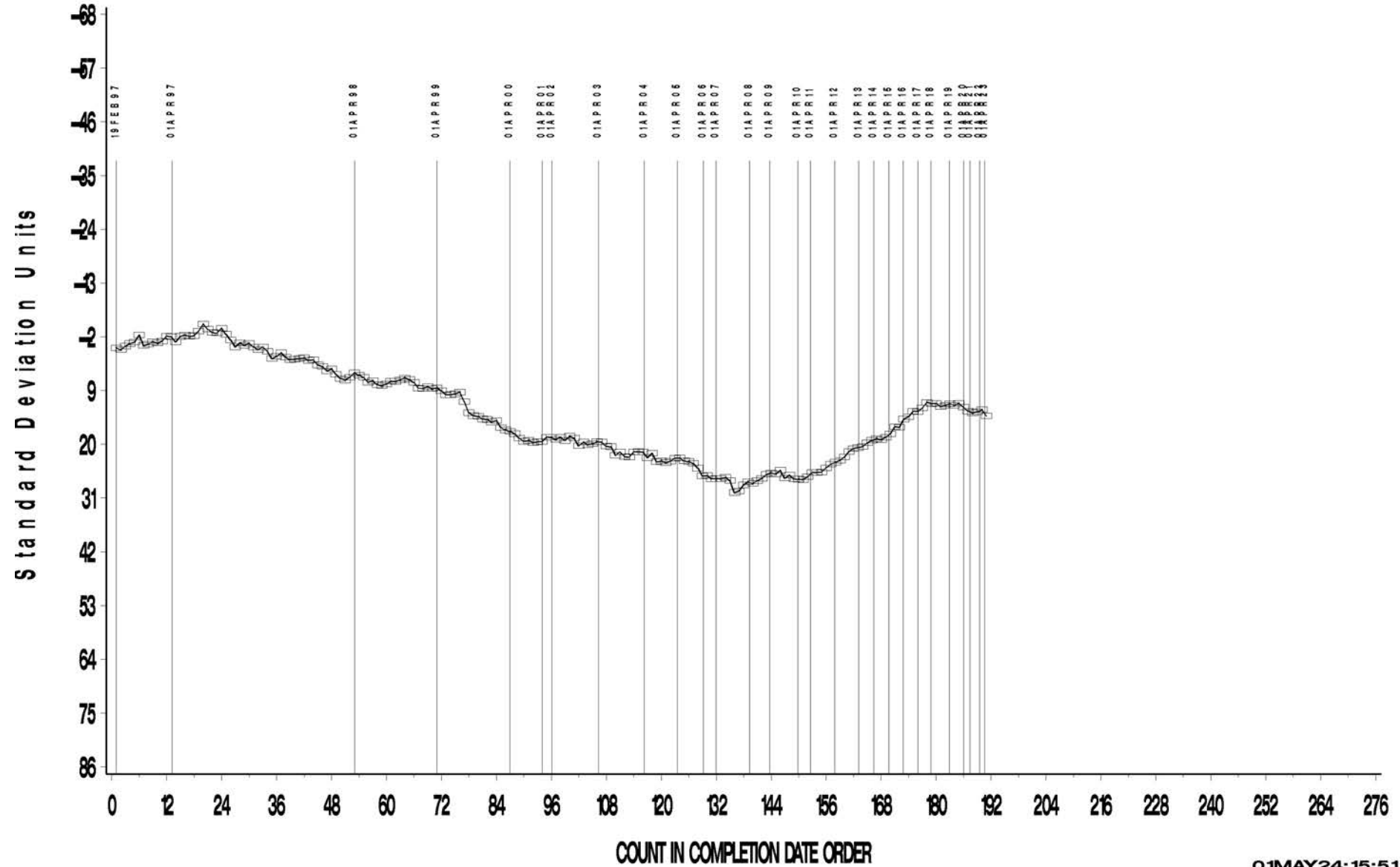
TOP LAND CARBON

LTMS Precision Analysis



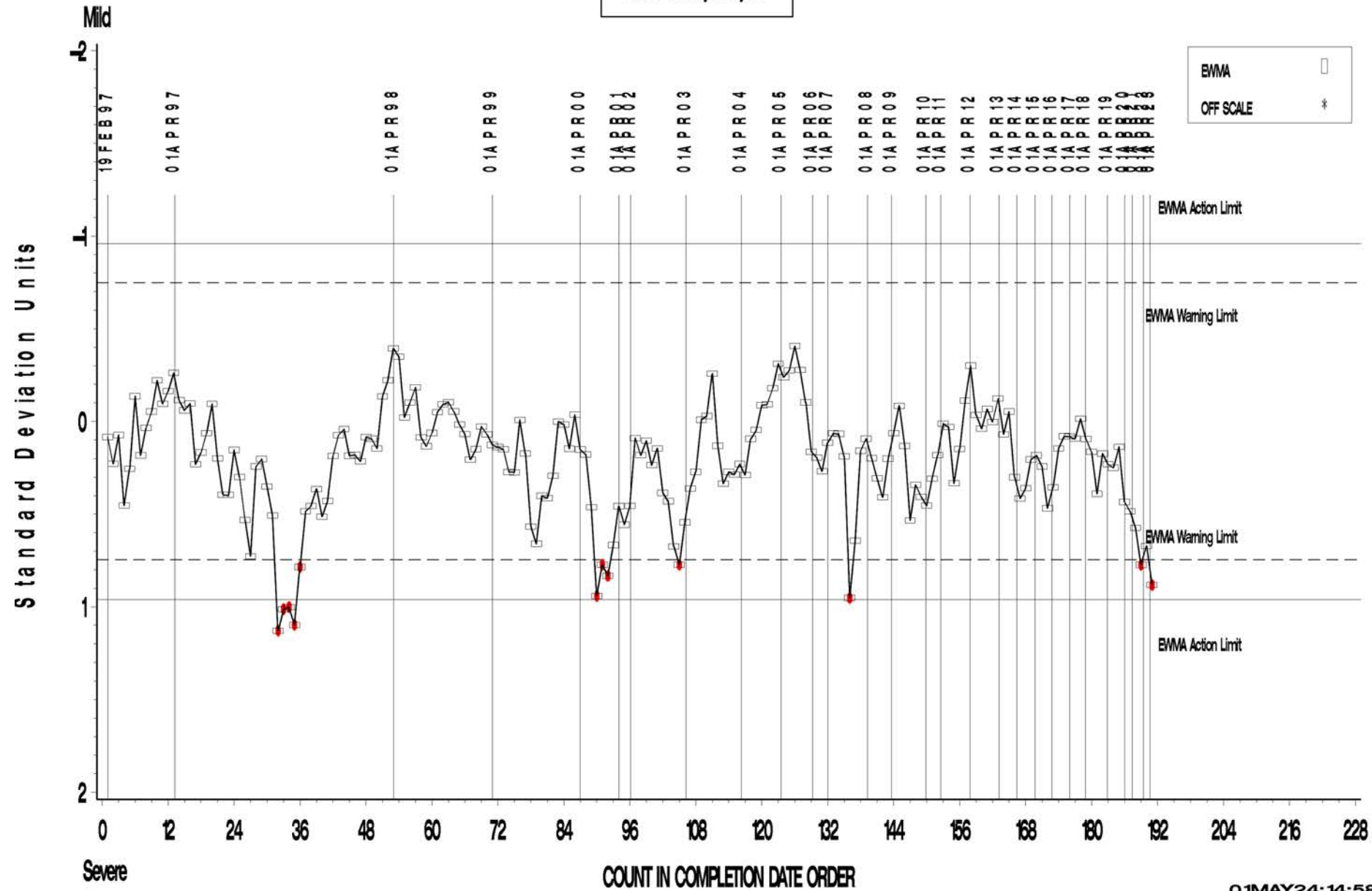
TOP LAND CARBON

CUSUM Severity Analysis



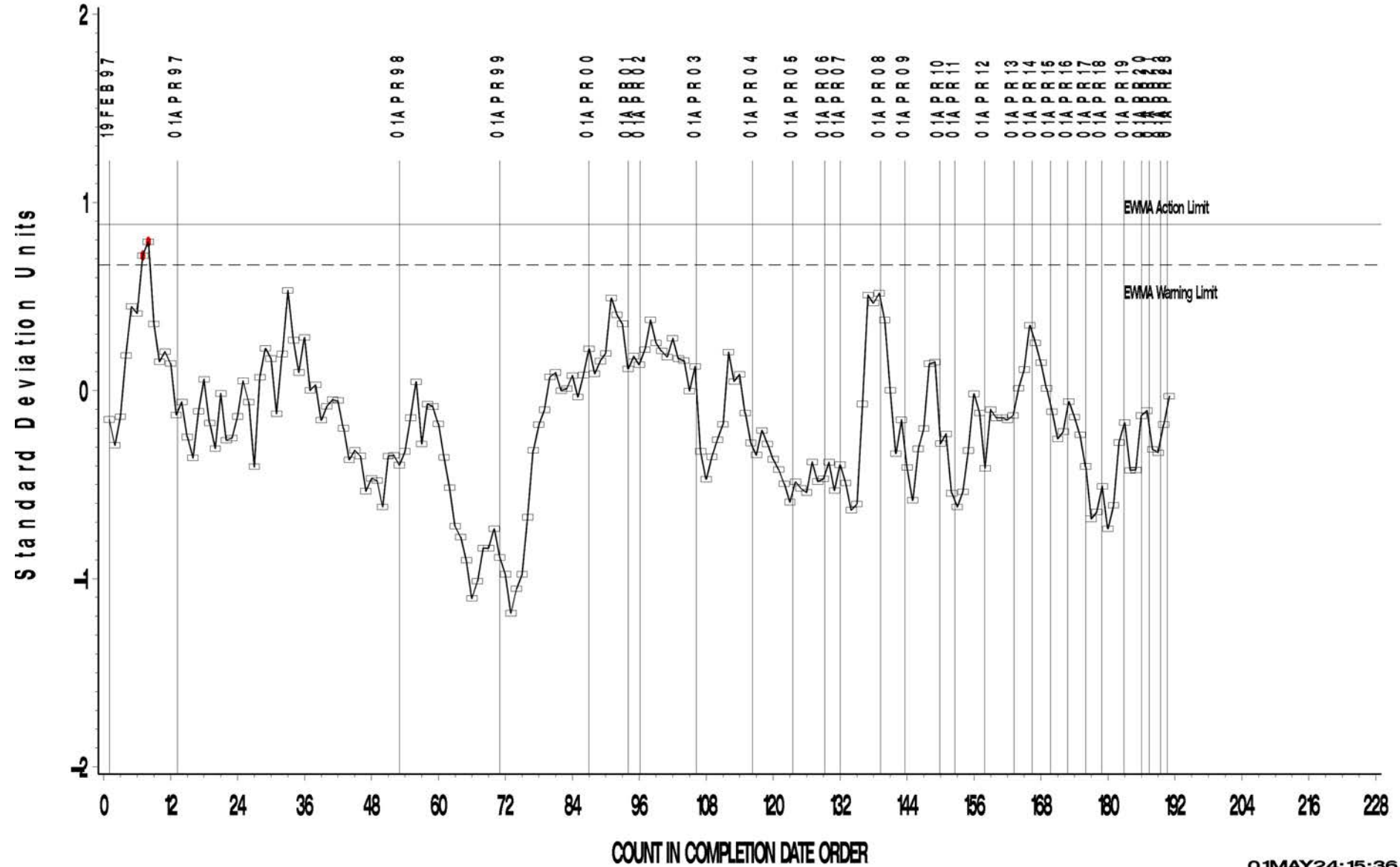
WEIGHTED TOTAL DEMERITS

LTMS Severity Analysis



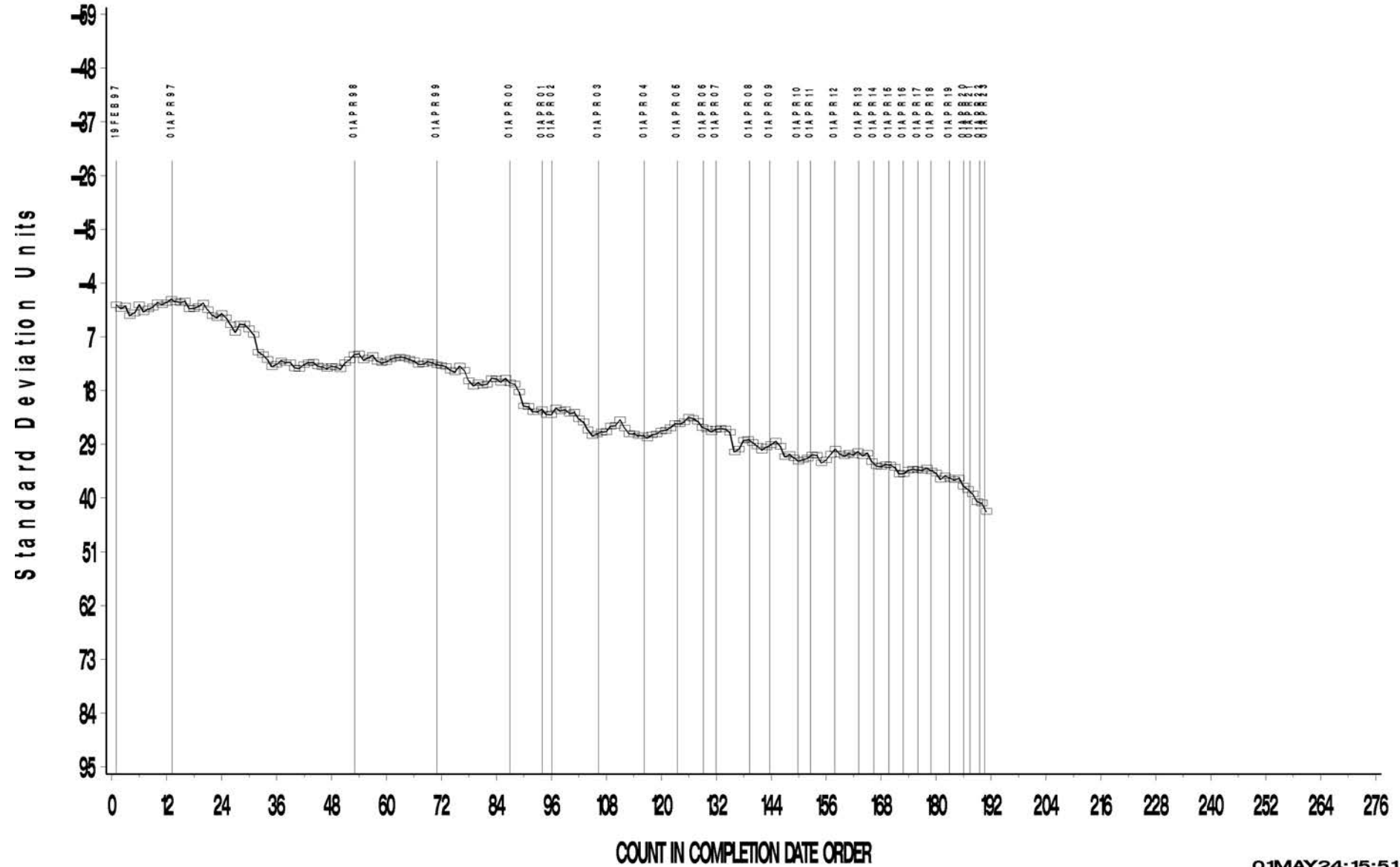
WEIGHTED TOTAL DEMERITS

LTMS Precision Analysis

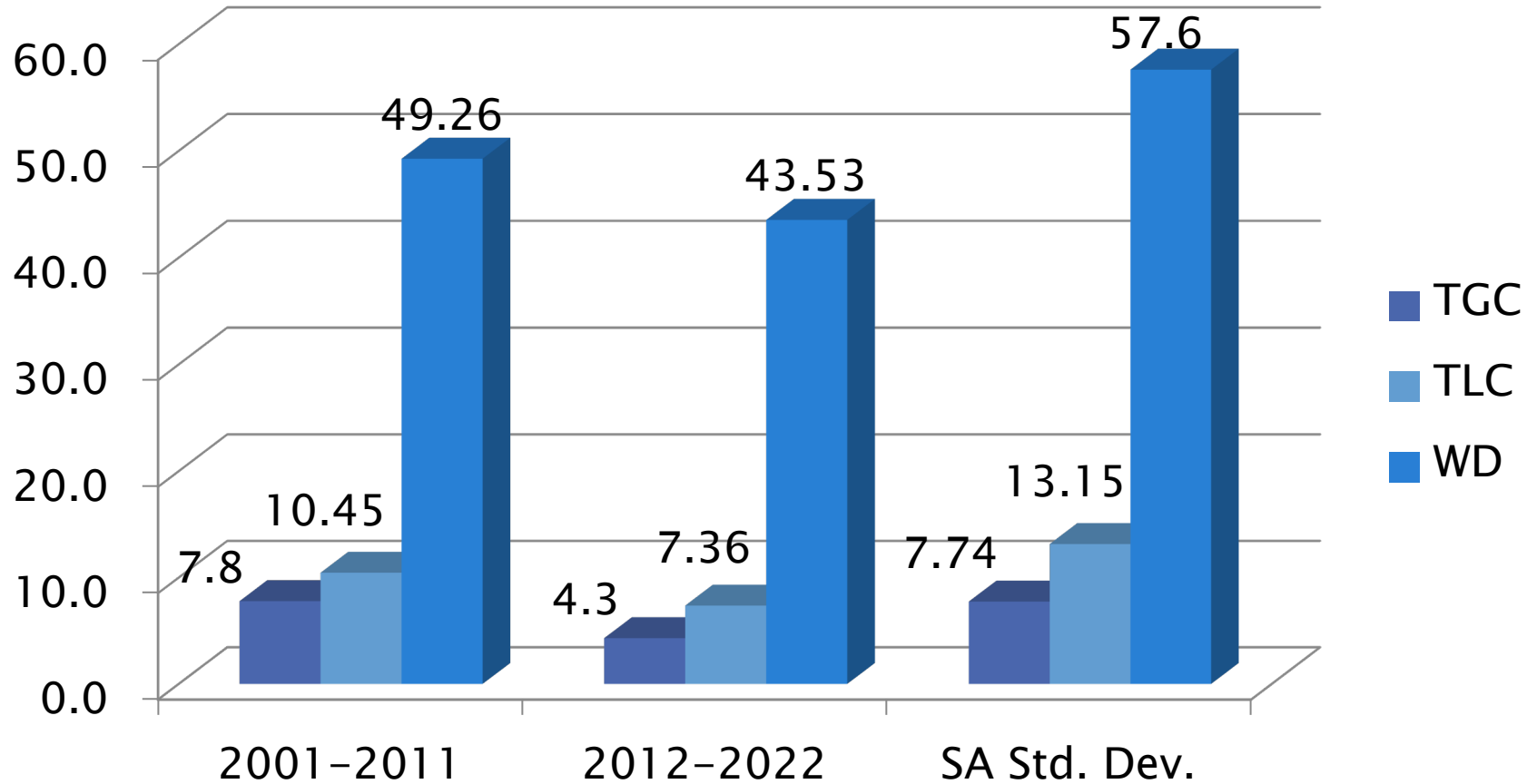


WEIGHTED TOTAL DEMERITS

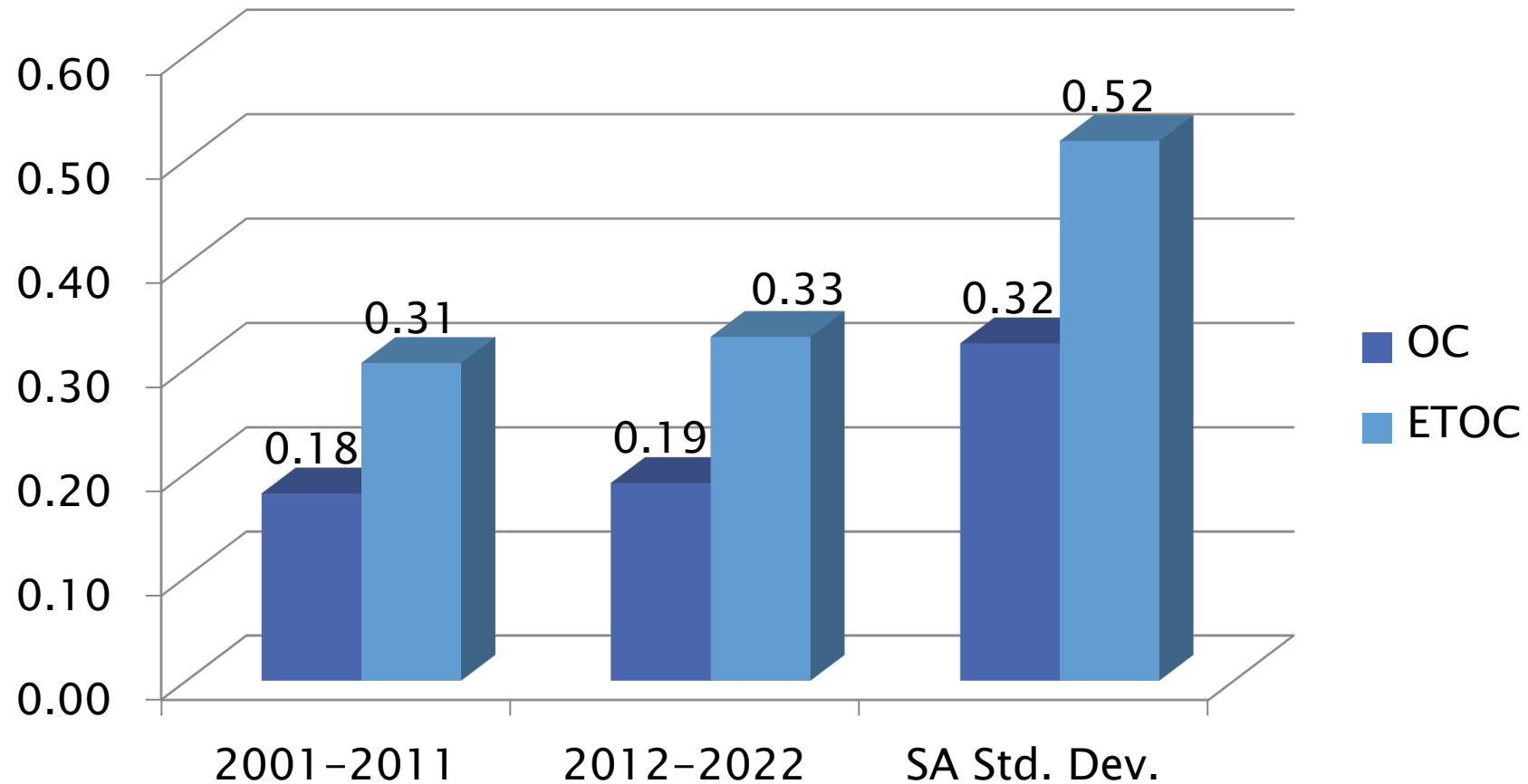
CUSUM Severity Analysis



1 P Precision Estimates



1 P Precision Estimates



[Return to Table of Contents](#)

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SCOTE 1 R

»» April 2024

1 R Test Activity

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

1 R Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

1 R Lost Tests*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	Broken exhaust valve	1
Total		1

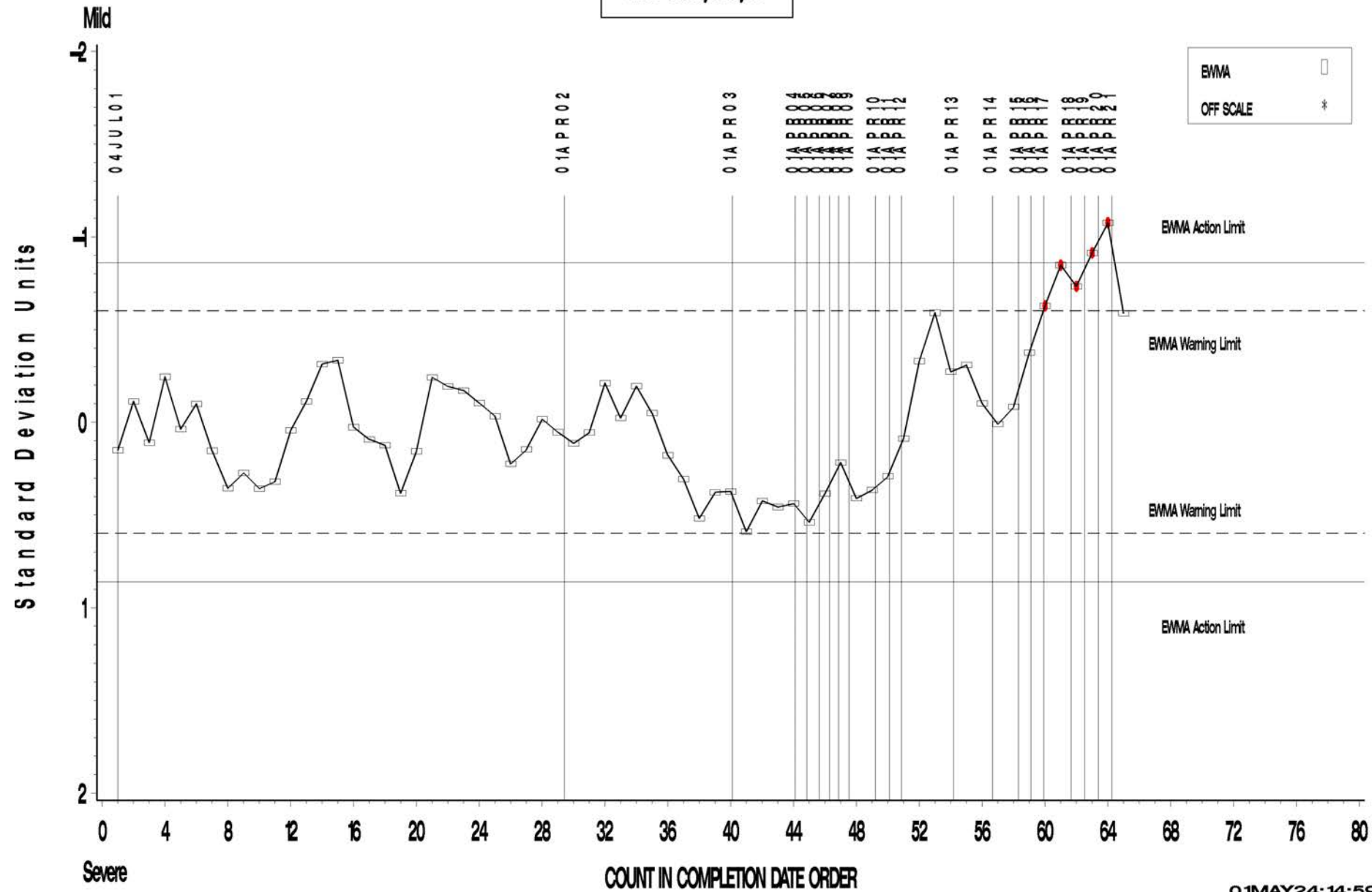
*Invalid and aborted tests

1 R Test Severity

- ▶ As no chartable 1R tests were run during this reporting period, no statement on test severity can be made.

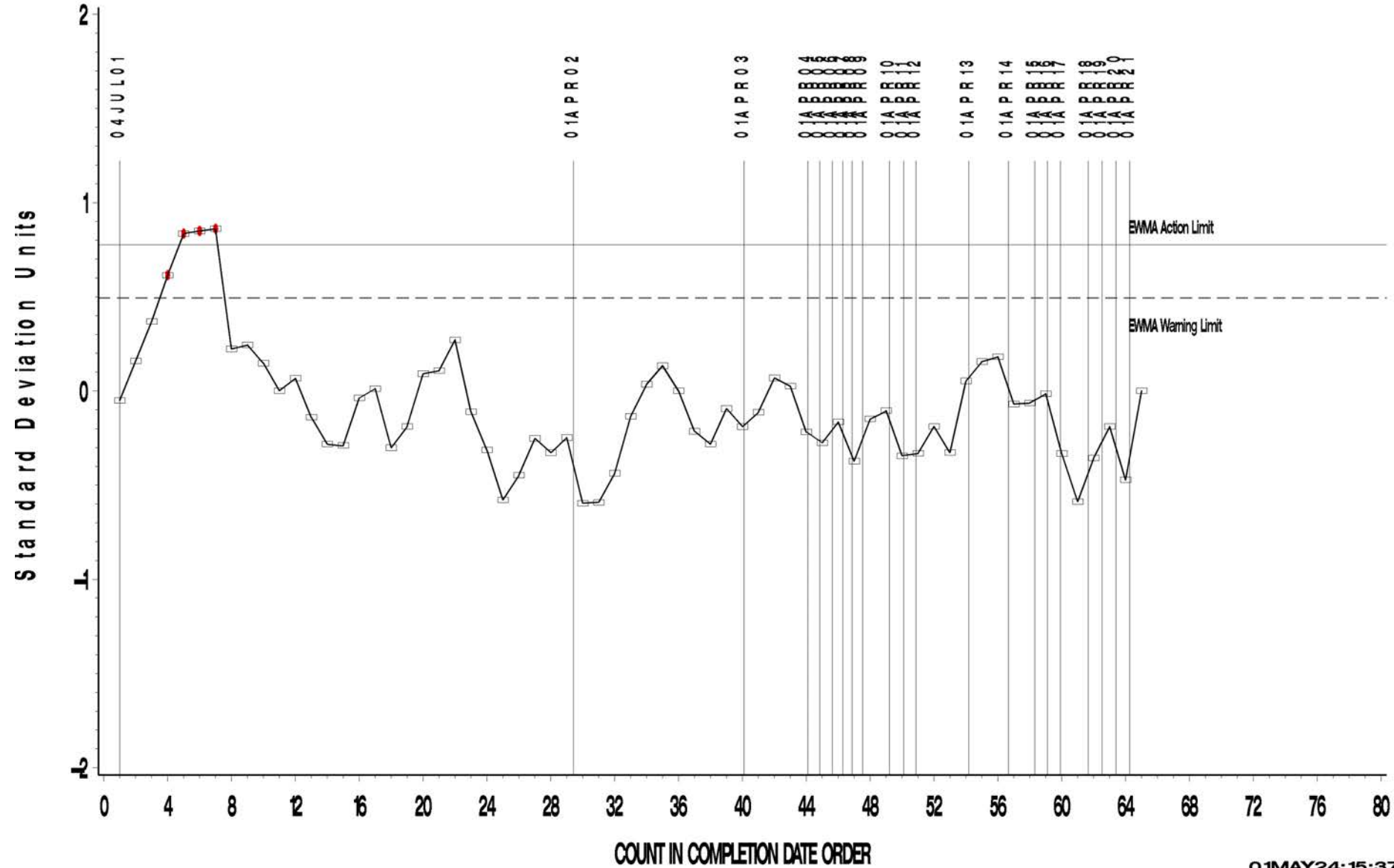
FINAL BOTOC

LTMS Severity Analysis



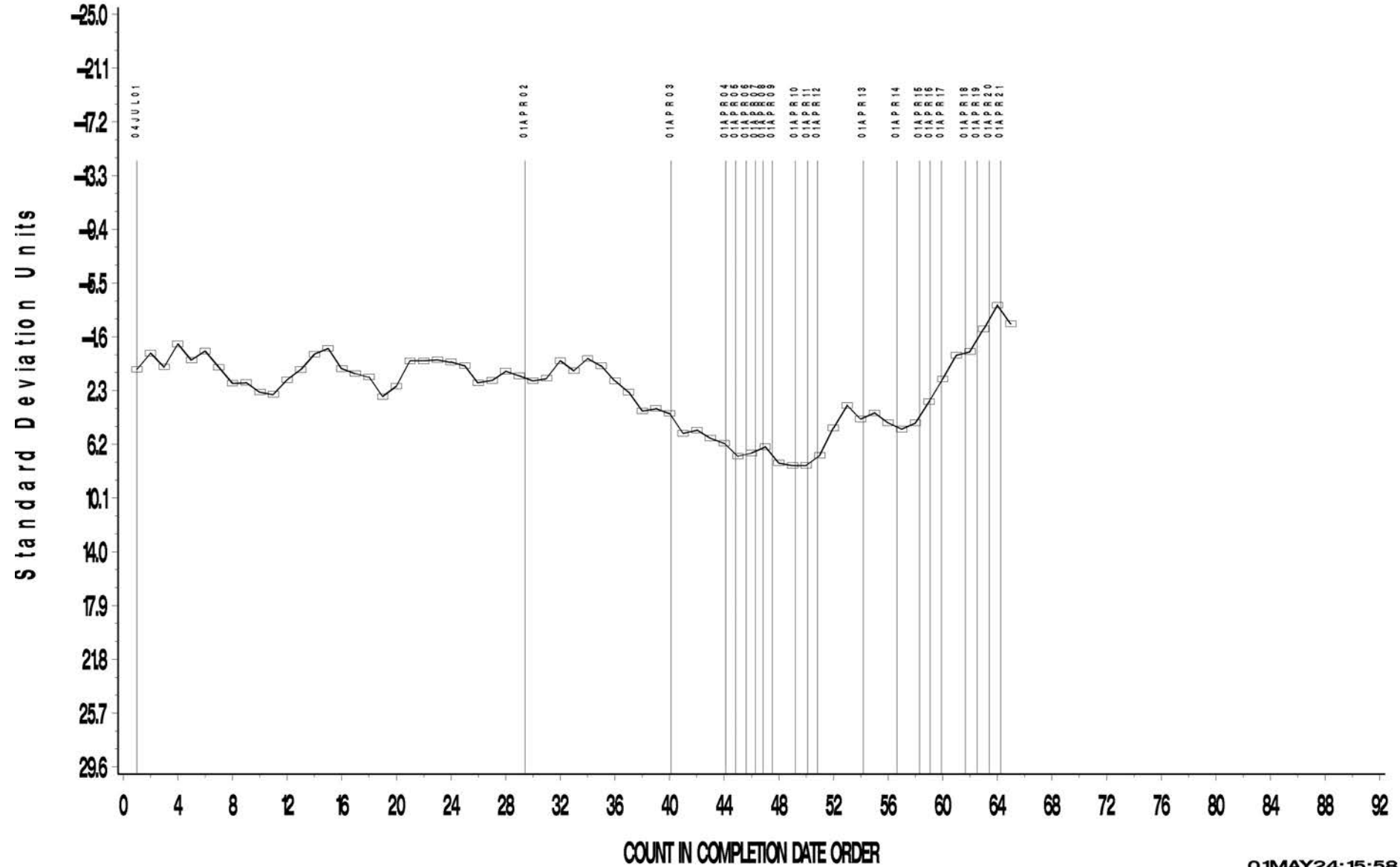
FINAL BOTOC

LTMS Precision Analysis



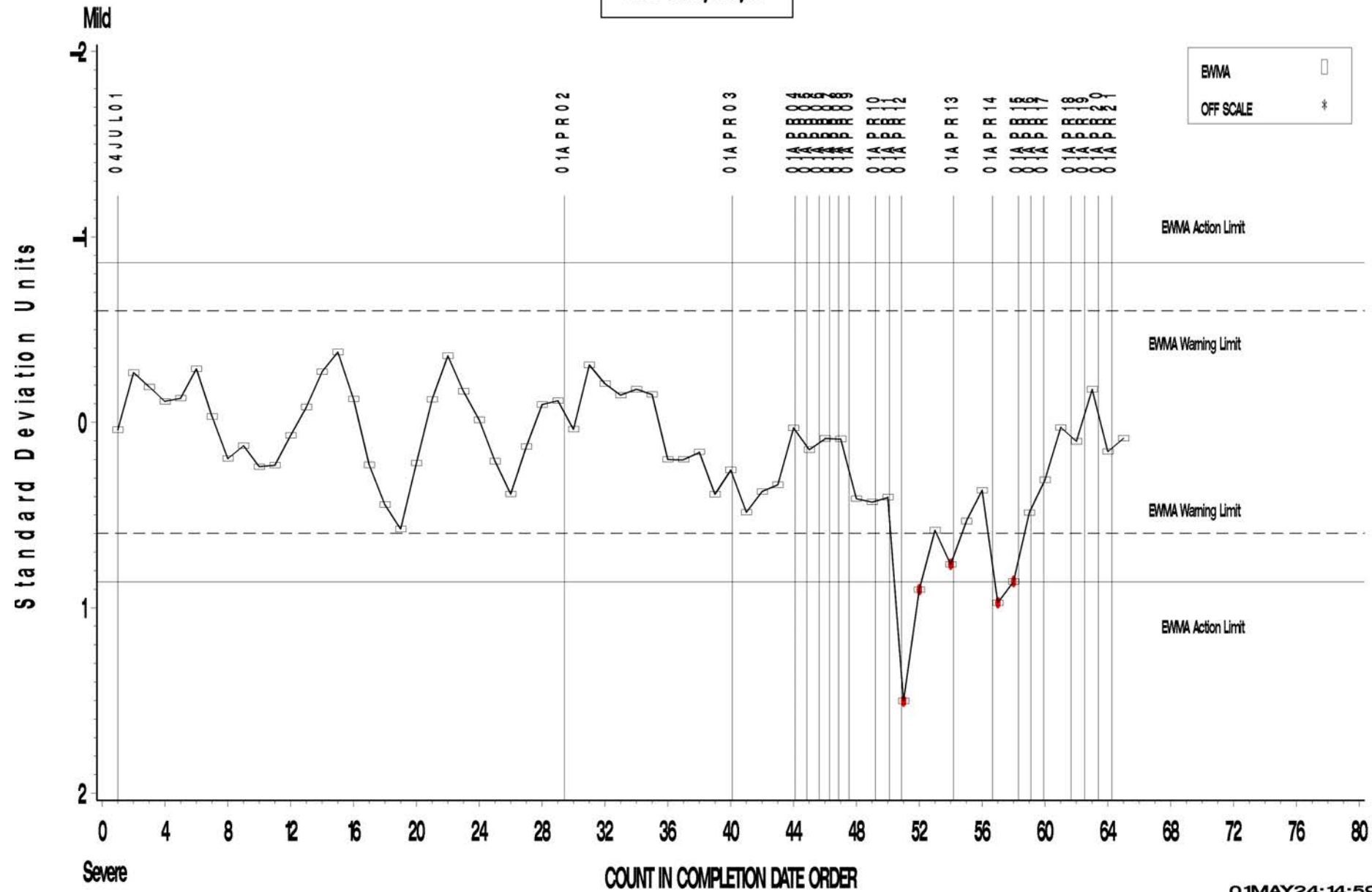
FINAL BOTOC

CUSUM Severity Analysis



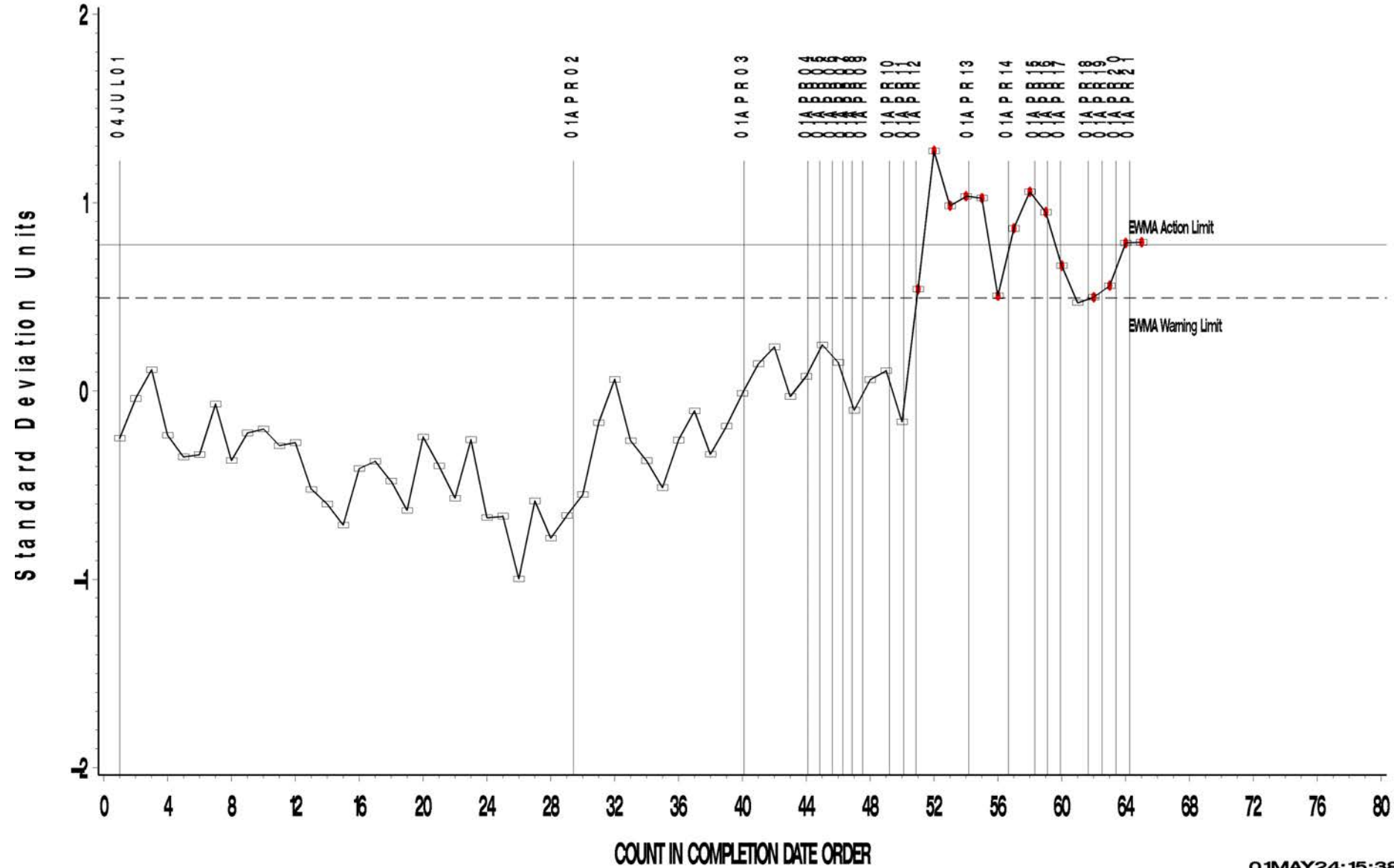
FINAL EOTOC (g/h)

LTMS Severity Analysis



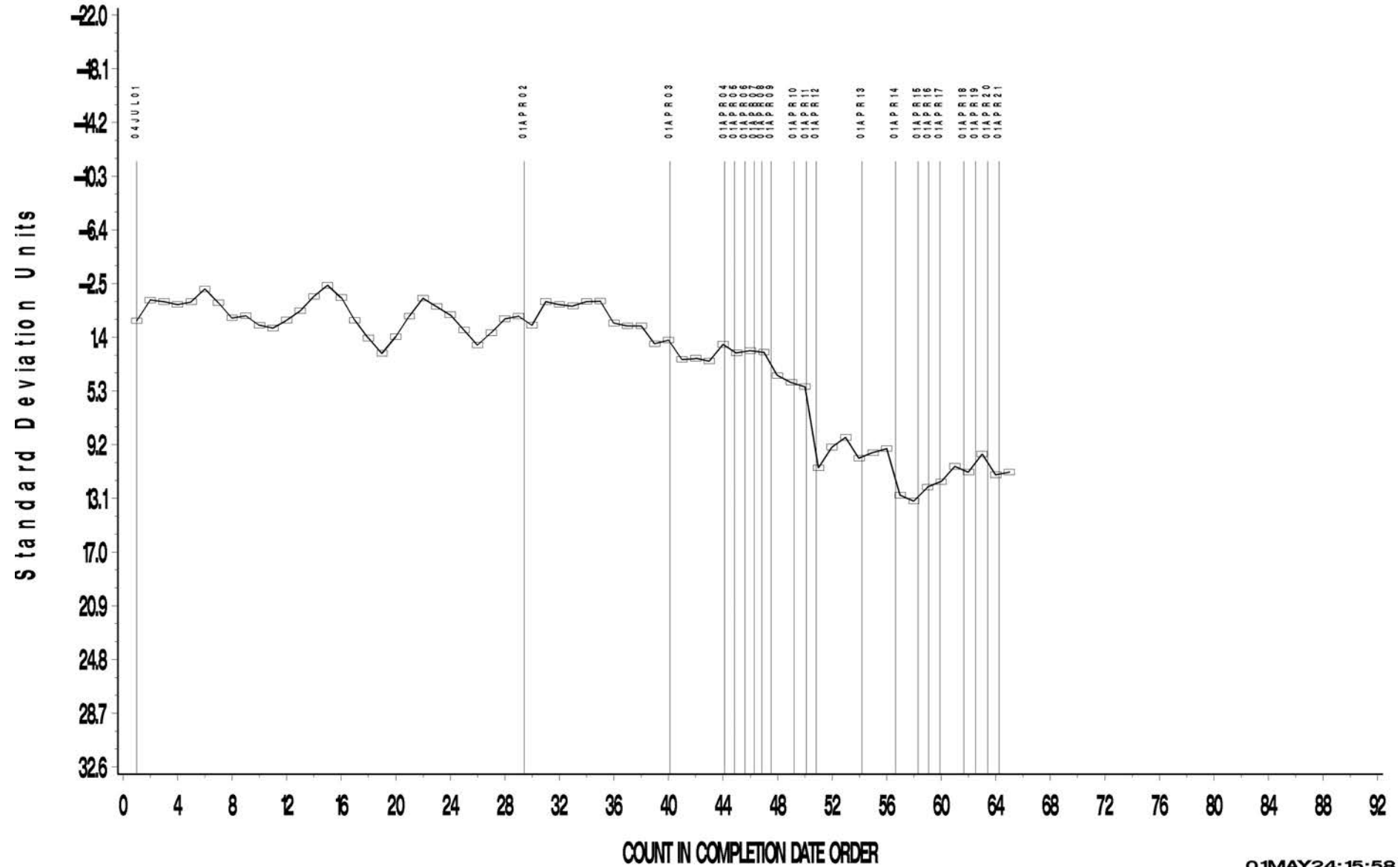
FINAL EOTOC (g/h)

LTMS Precision Analysis



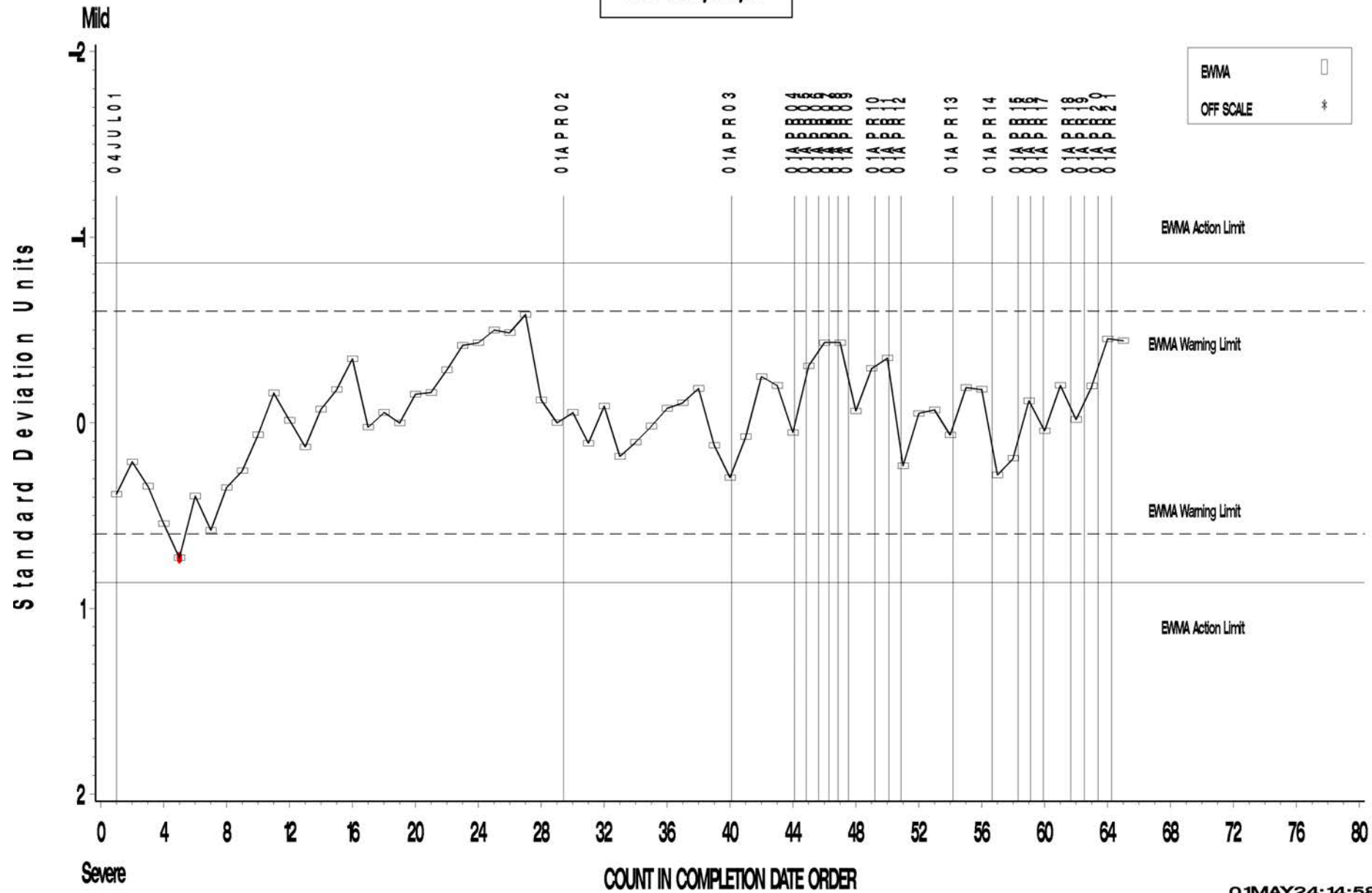
FINAL EOTOC (g/h)

CUSUM Severity Analysis



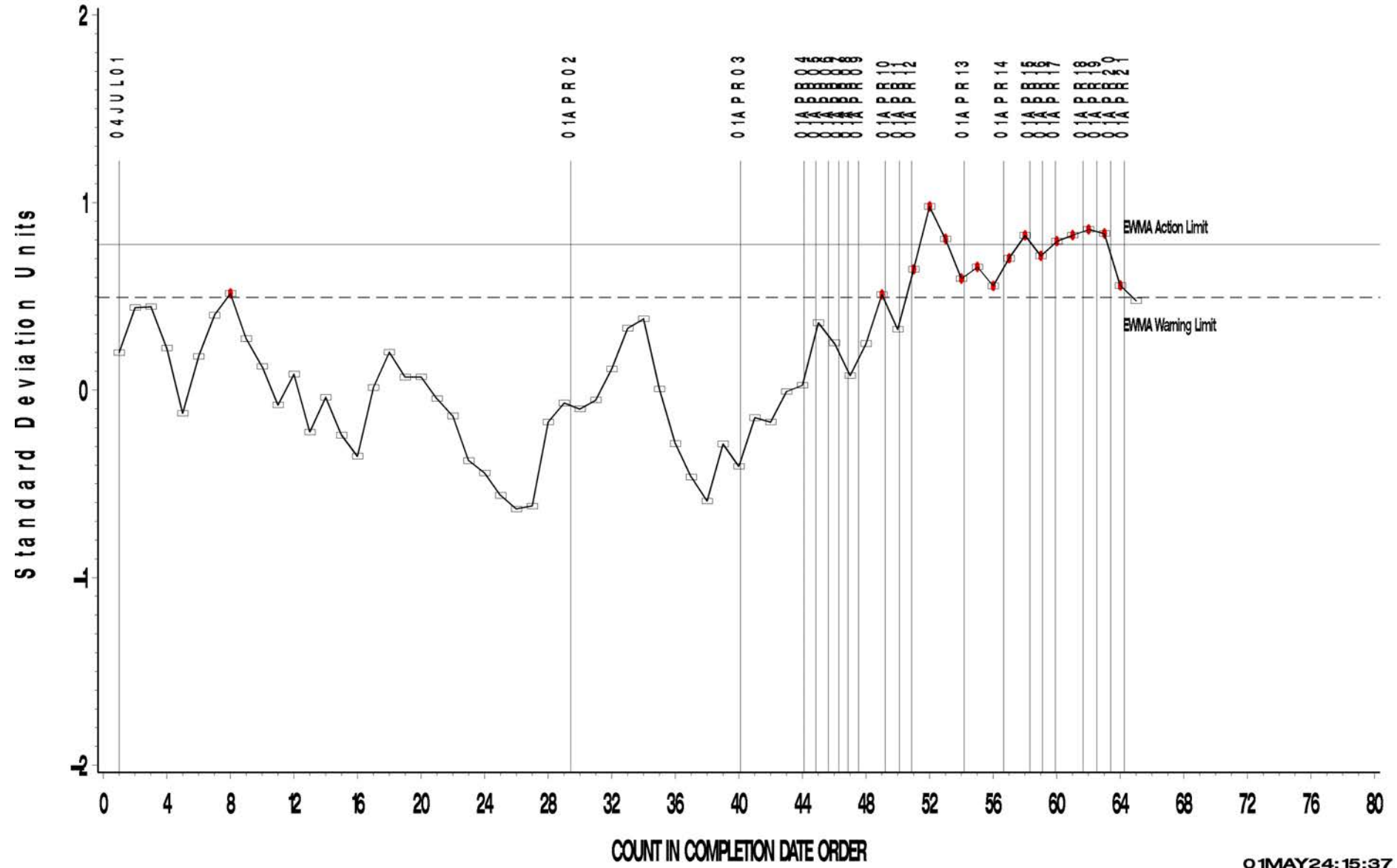
FINAL TOP GROOVE CARBON (DEMERITS)

LTMS Severity Analysis



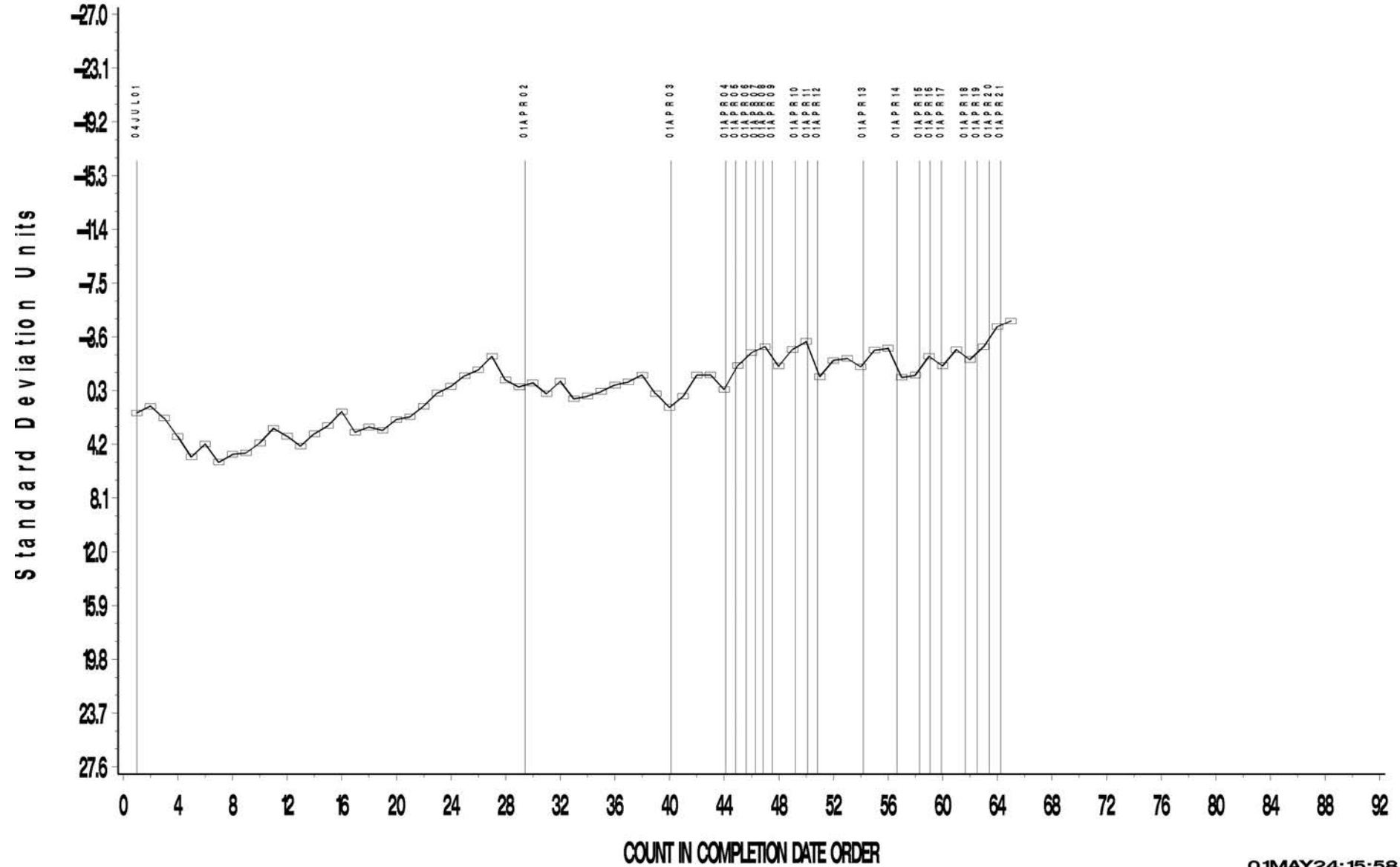
FINAL TOP GROOVE CARBON (DEMERITS)

LTMS Precision Analysis



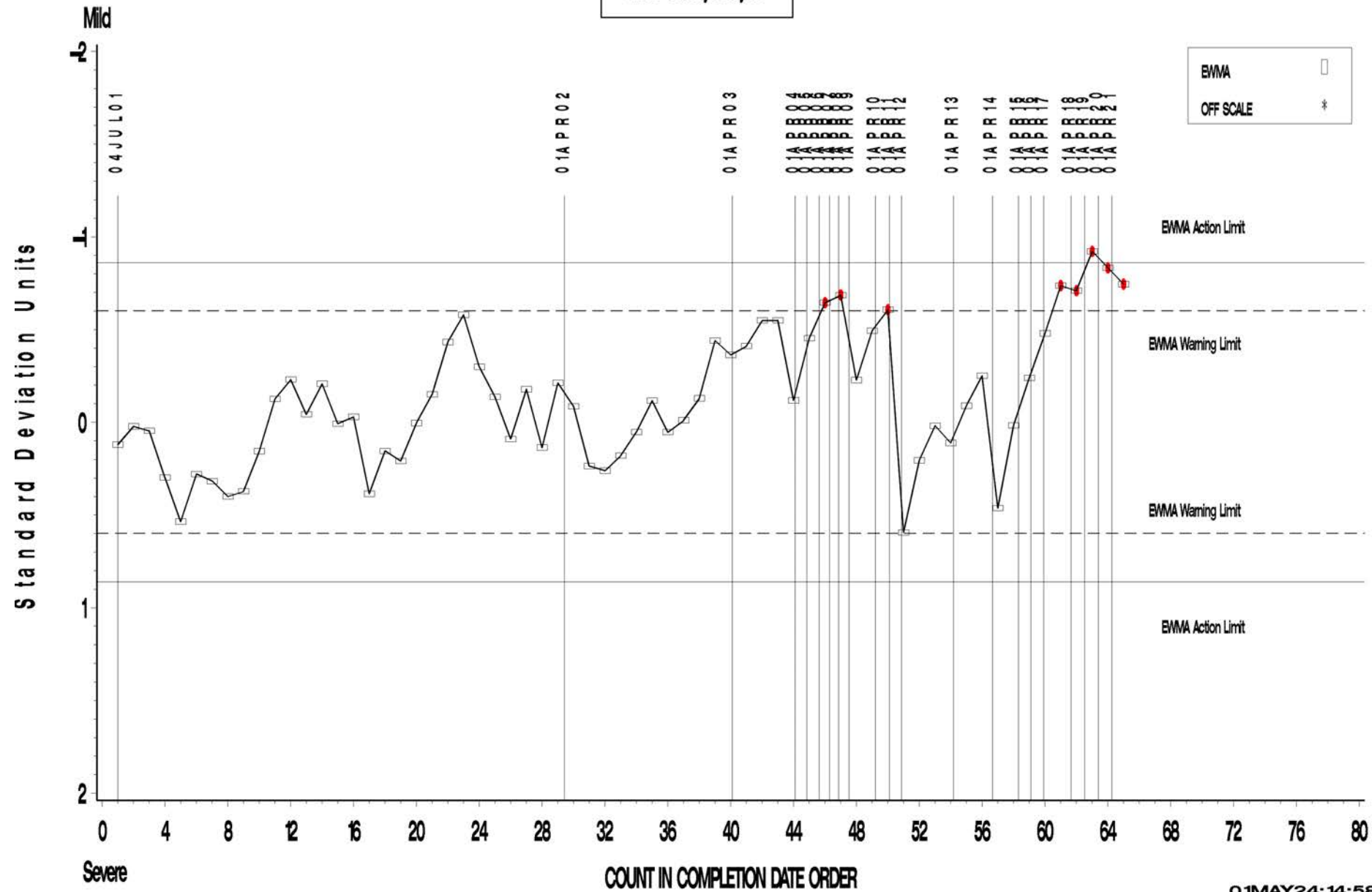
FINAL TOP GROOVE CARBON (DEMERITS)

CUSUM Severity Analysis



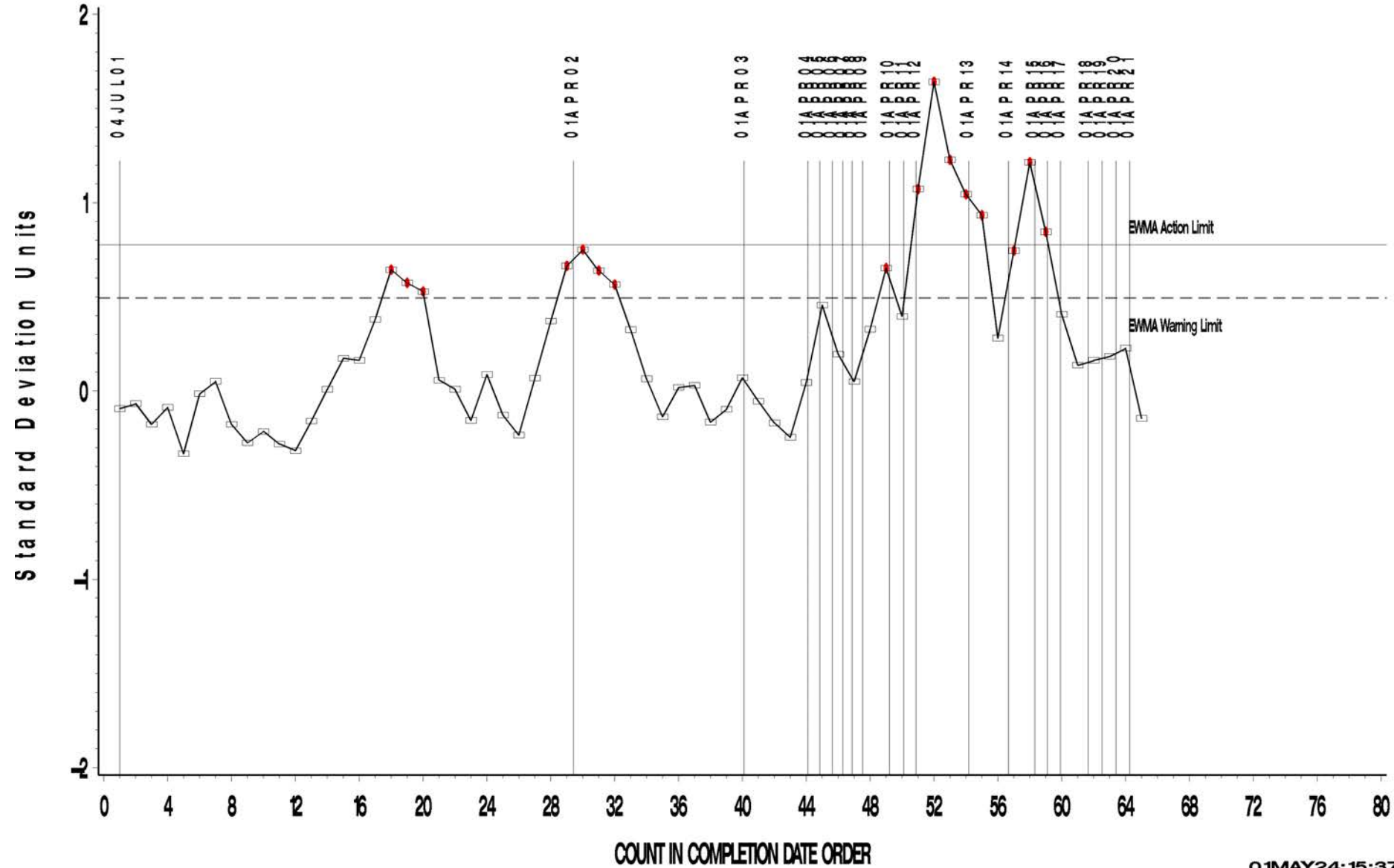
FINAL TOP LAND CARBON (DEMERITS)

LTMS Severity Analysis



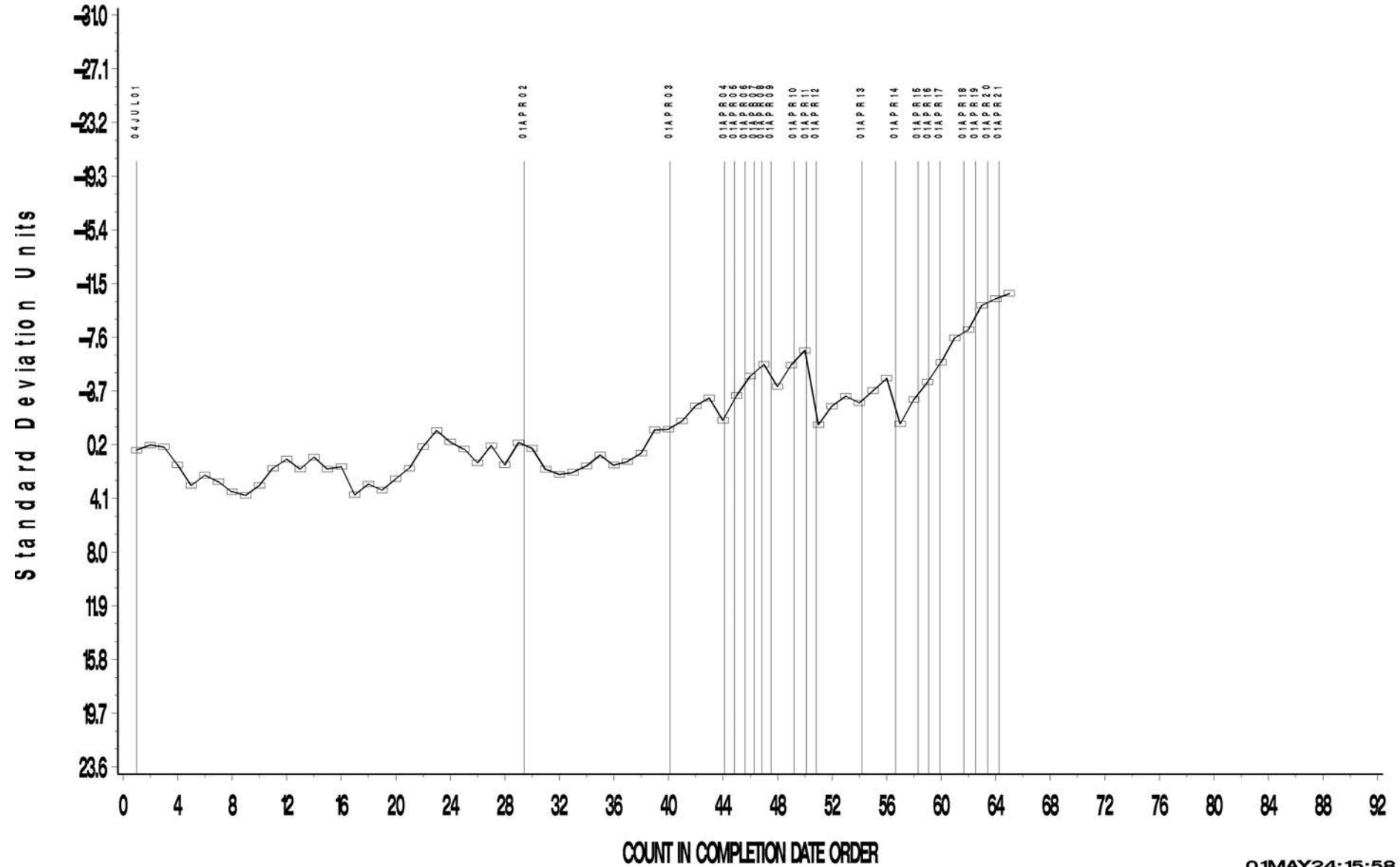
FINAL TOP LAND CARBON (DEMERITS)

LTMS Precision Analysis



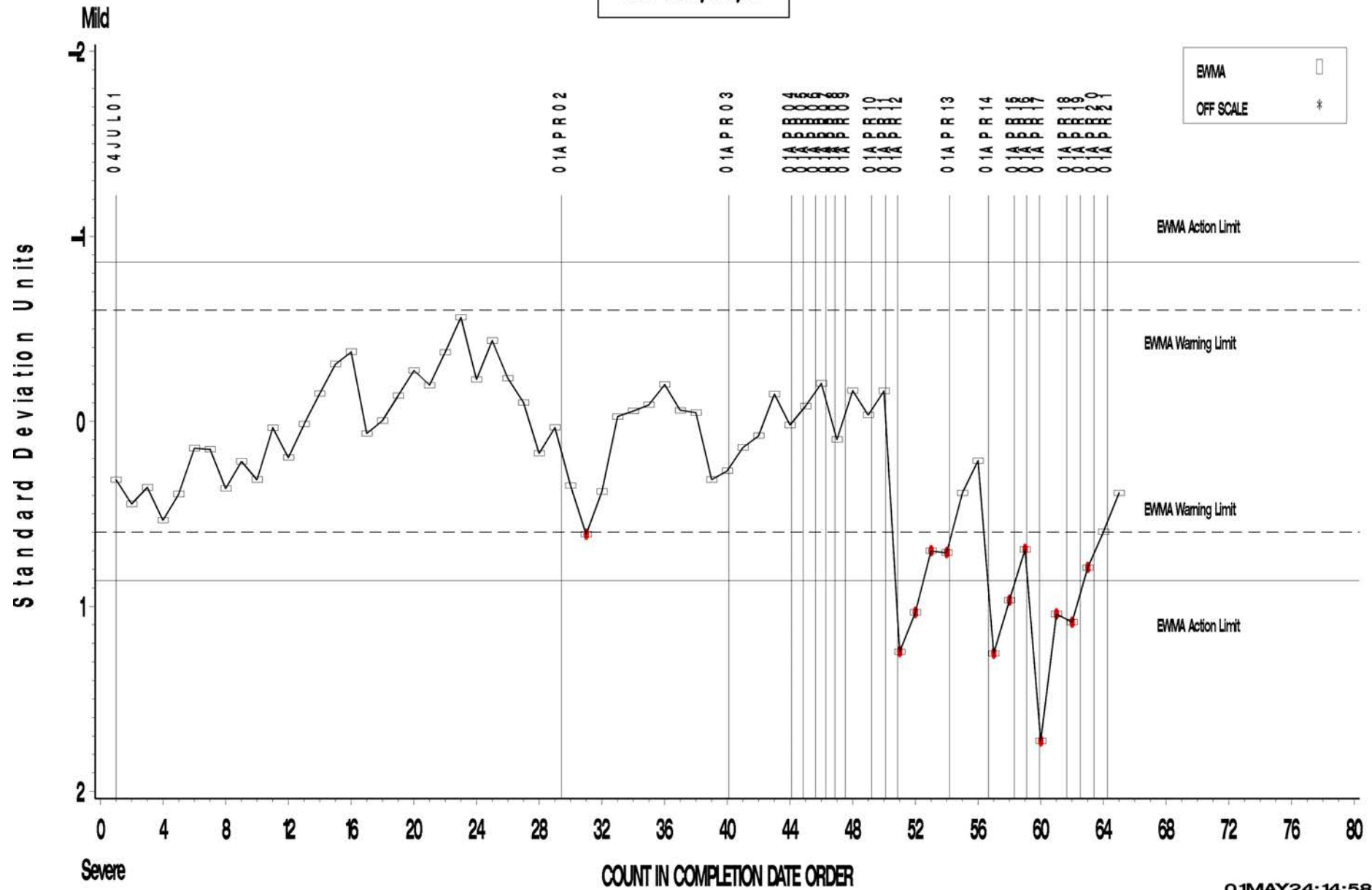
FINAL TOP LAND CARBON (DEMERITS)

CUSUM Severity Analysis



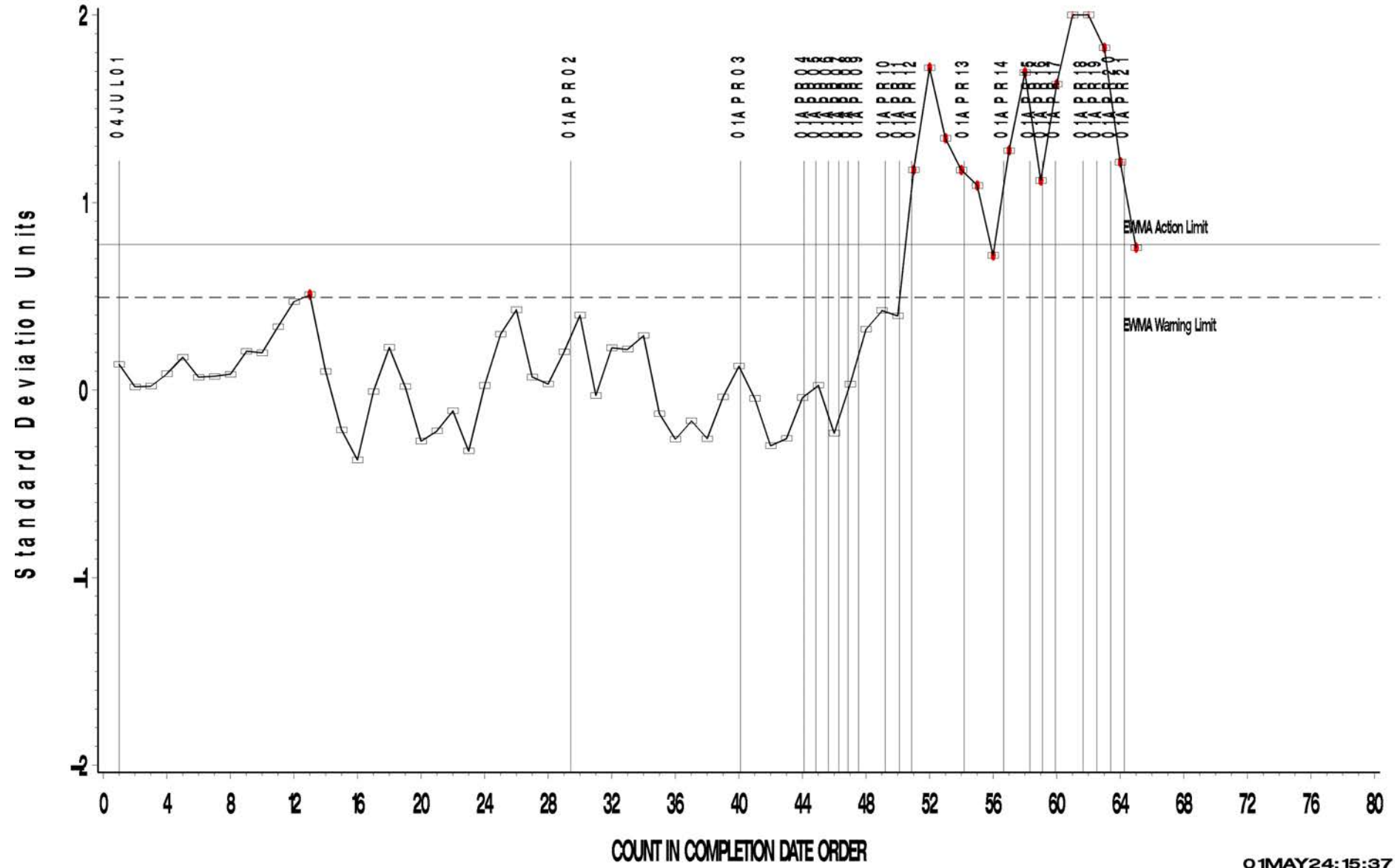
FINAL WEIGHTED TOTAL DEMERITS (DEMERITS)

LTMS Severity Analysis



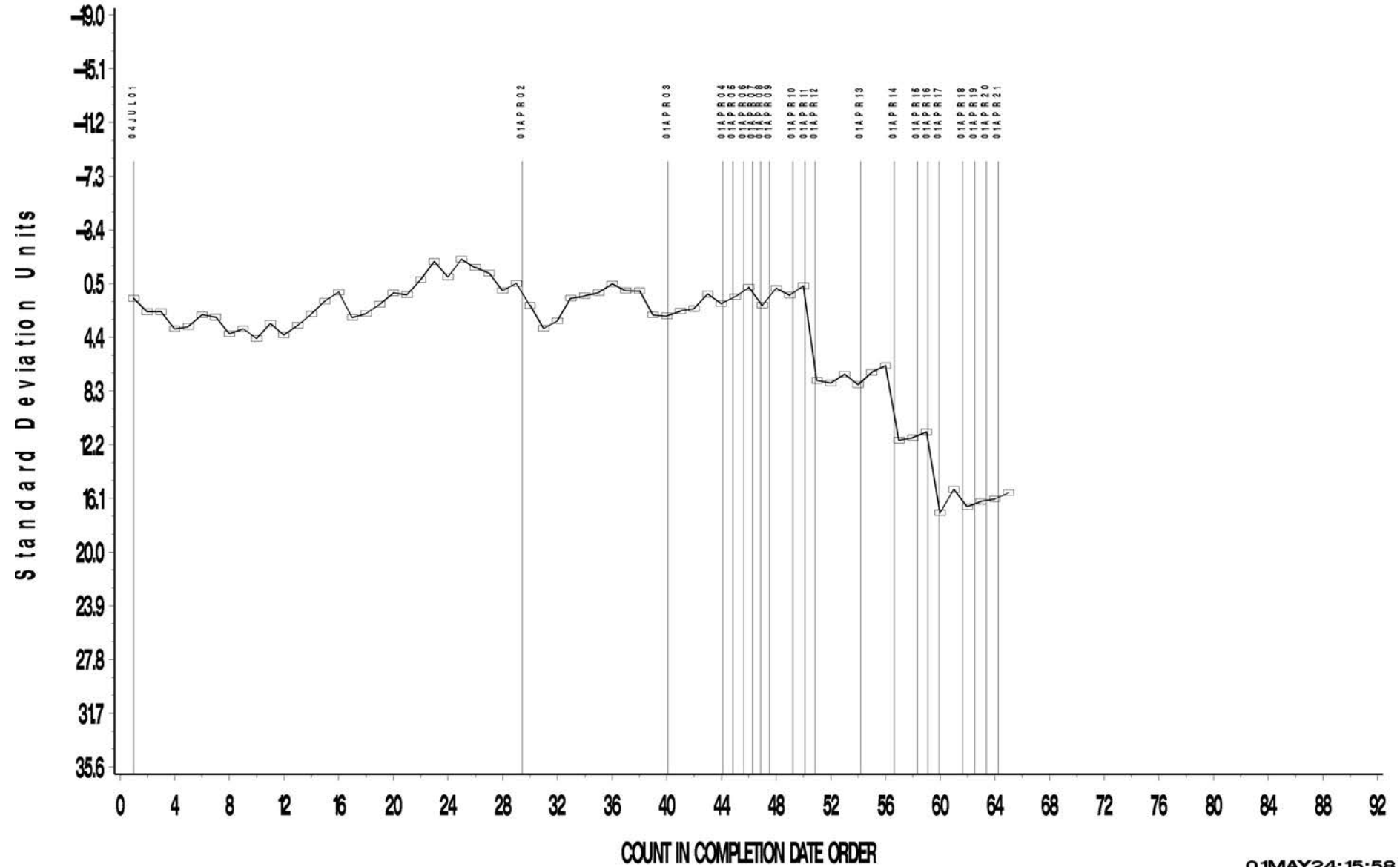
FINAL WEIGHTED TOTAL DEMERITS (DEMERITS)

LTMS Precision Analysis

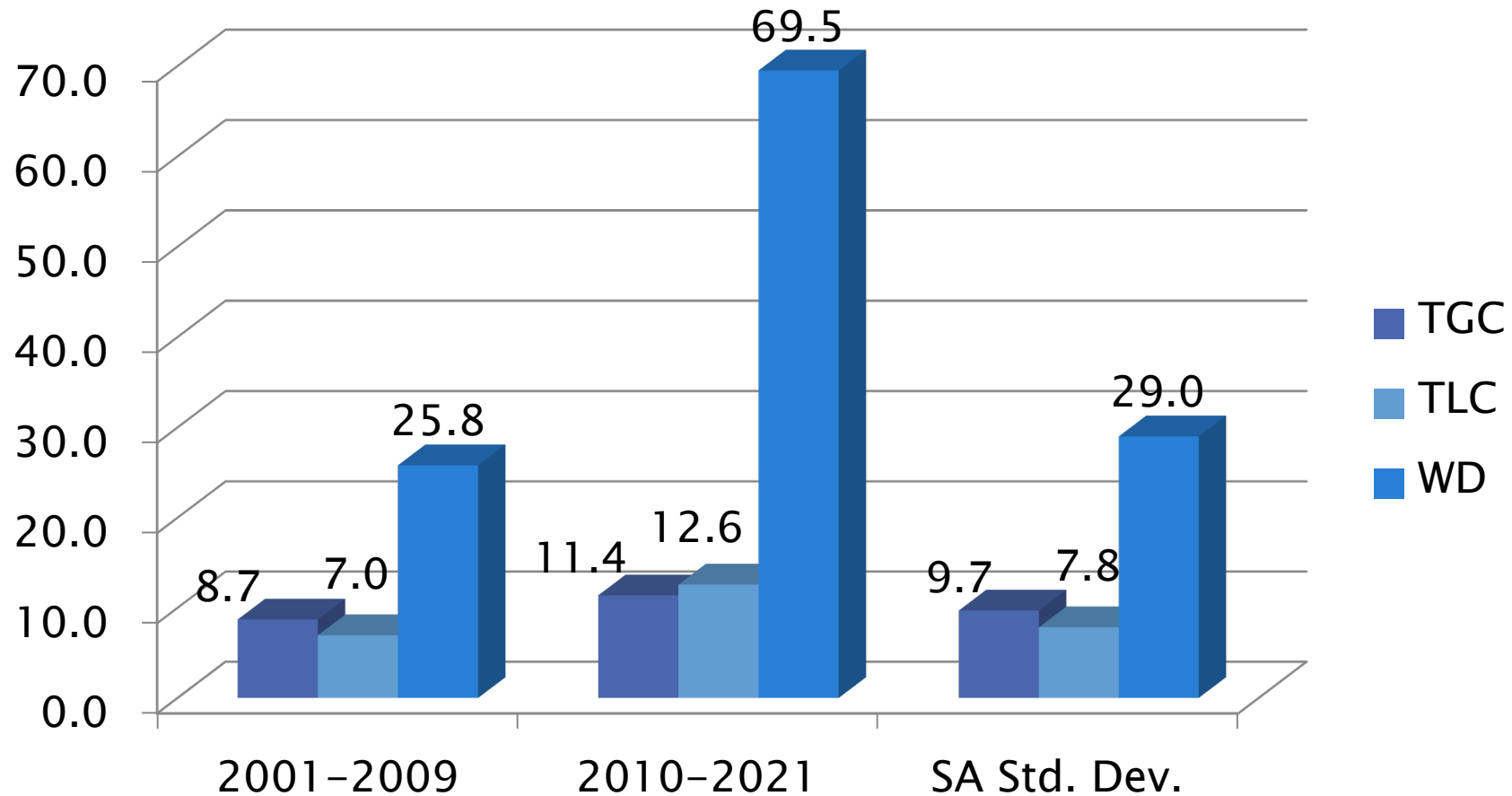


FINAL WEIGHTED TOTAL DEMERITS (DEMERITS)

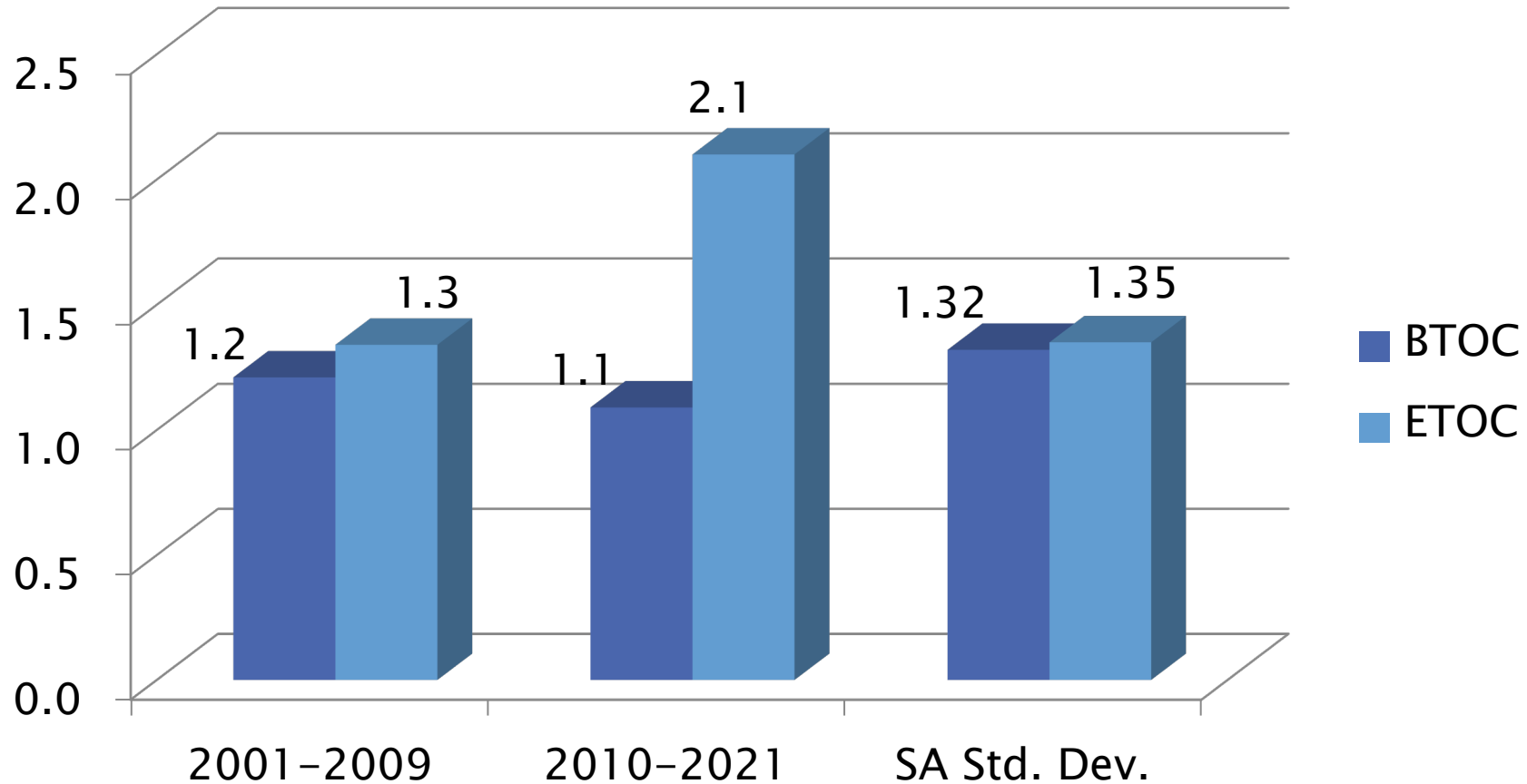
CUSUM Severity Analysis



1 R Precision Estimates



1 R Precision Estimates



[Return to Table of Contents](#)

Test Monitoring Center
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CAT C13

»» April 2024

Test Monitoring Center
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C13 Test Activity

Test Status	Validity Code	C13
Acceptable Calibration Test	AC	2
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	0
Total		2

C13 Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

C13 Lost Tests*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		0

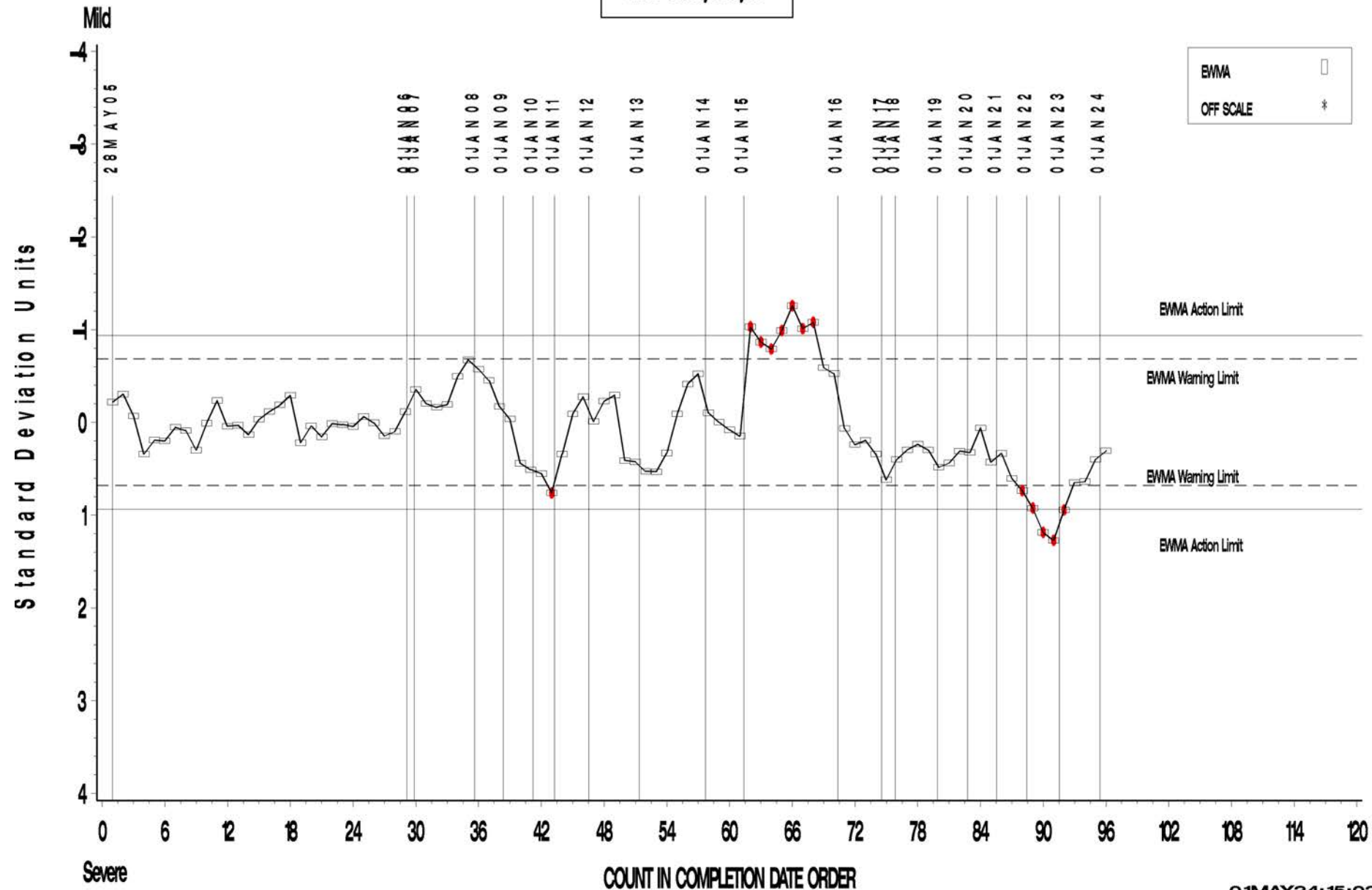
*Invalid and aborted tests

C13 Test Severity

- ▶ TLC is in severity warning alarm in the mild direction. Near action alarm.
- ▶ All other parameters are in control
- ▶ 2RTC is near severity warning alarm in severe direction. 2RTC is also near precision warning alarm.

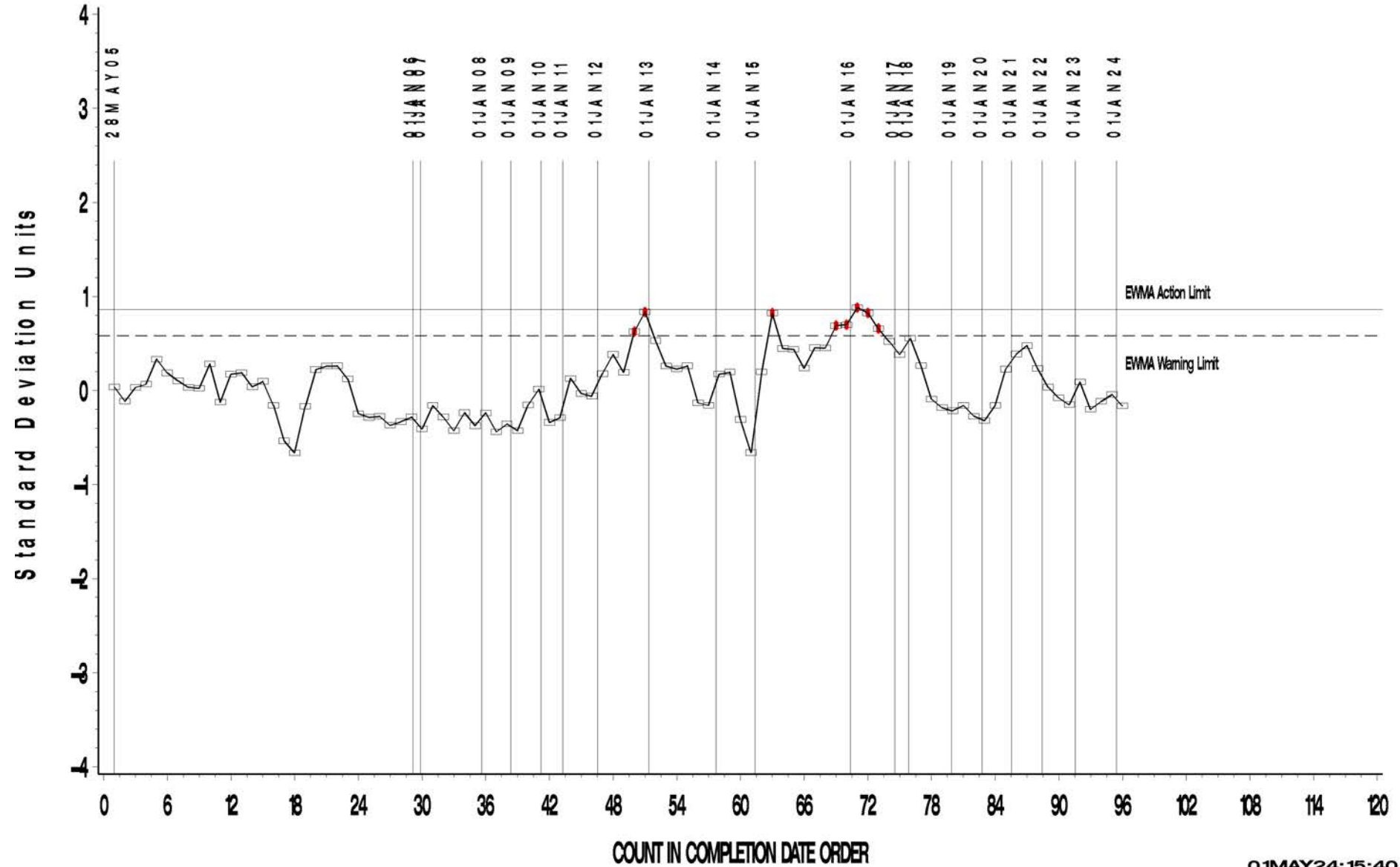
OIL CONS. DELTA — FINAL RESULT

LTMS Severity Analysis



OIL CONS. DELTA — FINAL RESULT

LTMS Precision Analysis

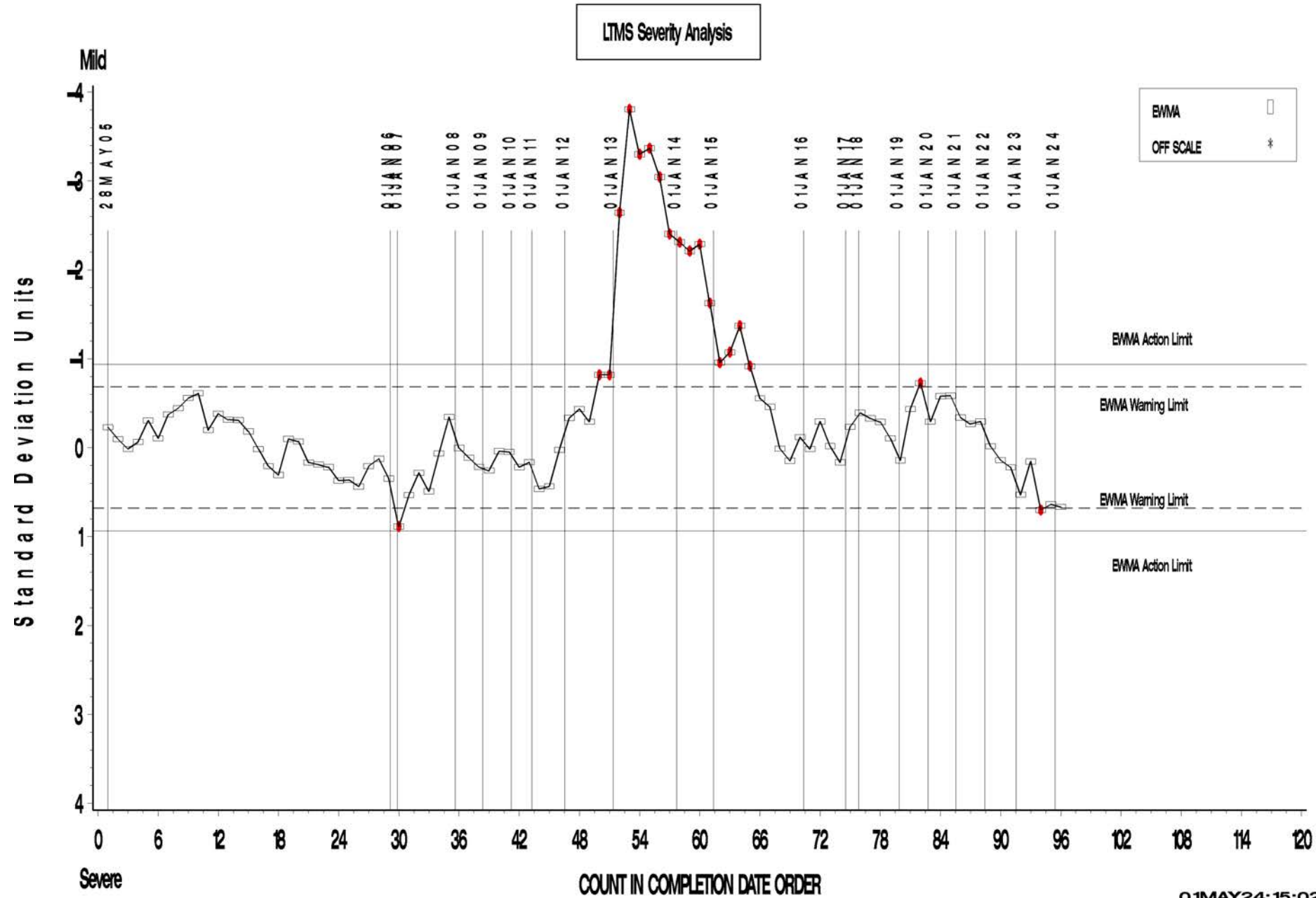


OIL CONS. DELTA — FINAL RESULT

CUSUM Severity Analysis

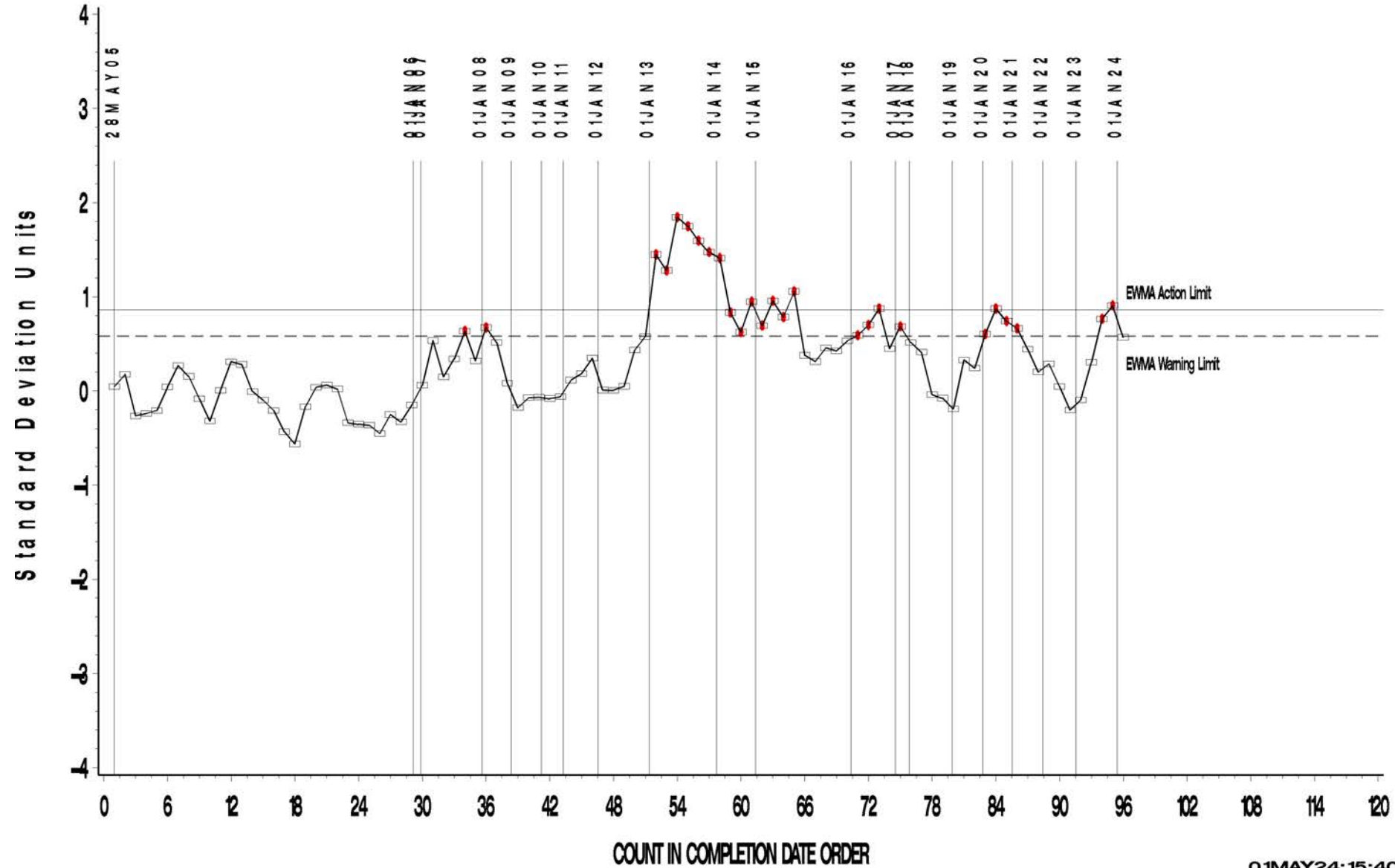


2ND RING TOP CARBON AVG. — FINAL RESULT



2ND RING TOP CARBON AVG. — FINAL RESULT

LTMS Precision Analysis



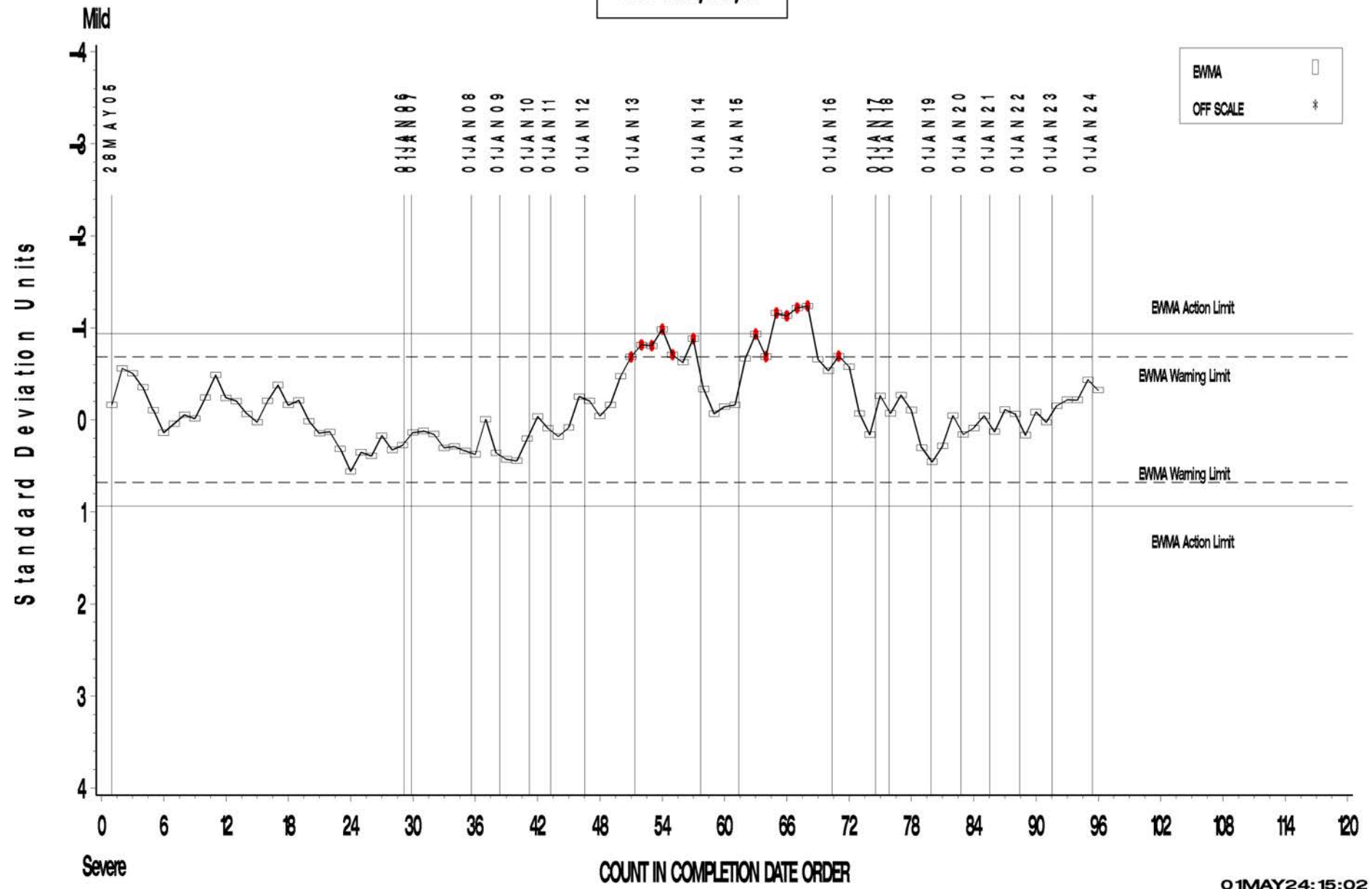
2ND RING TOP CARBON AVG. — FINAL RESULT

CUSUM Severity Analysis



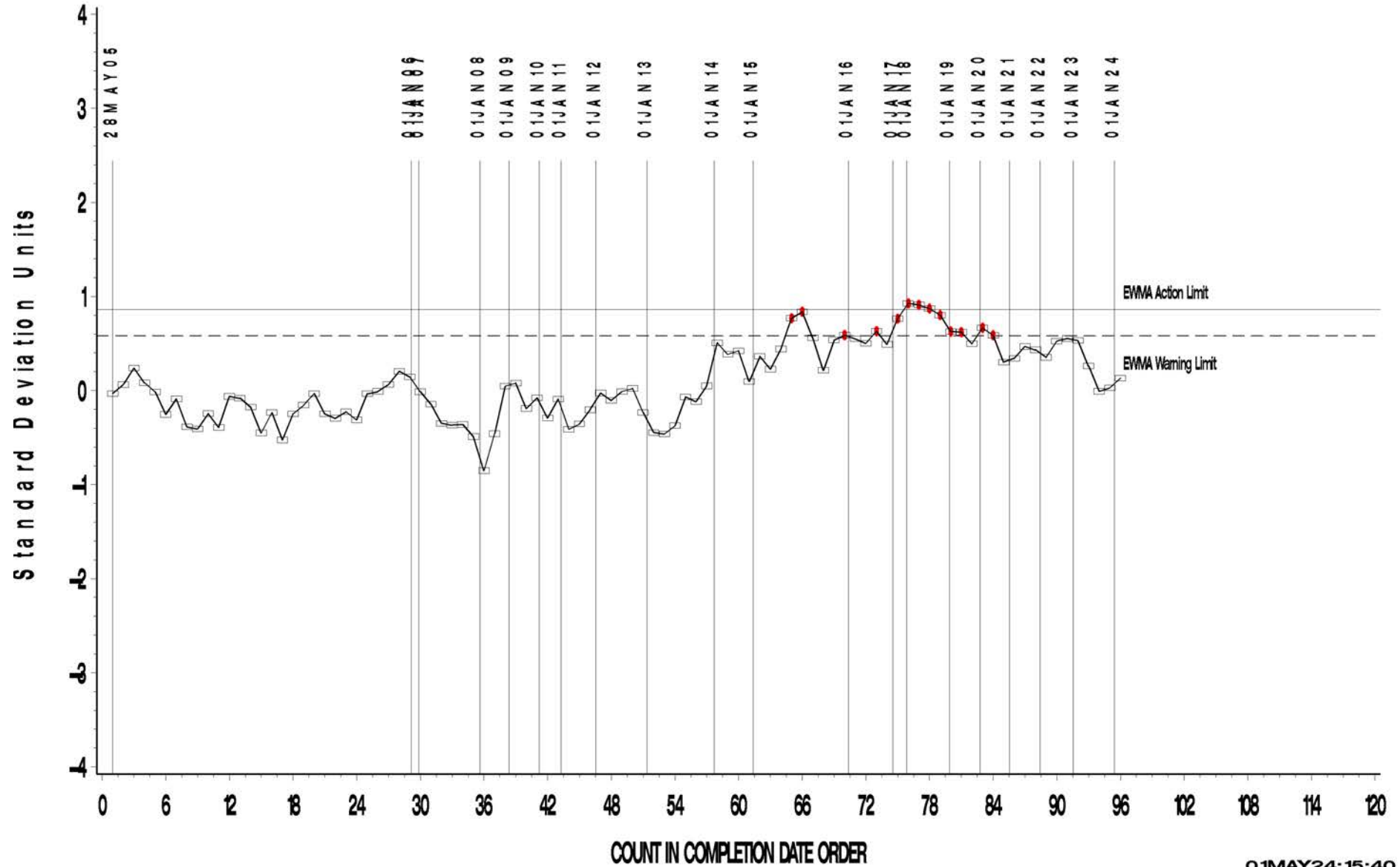
TOP GROOVE CARBON AVG — FINAL RESULT

LTMS Severity Analysis



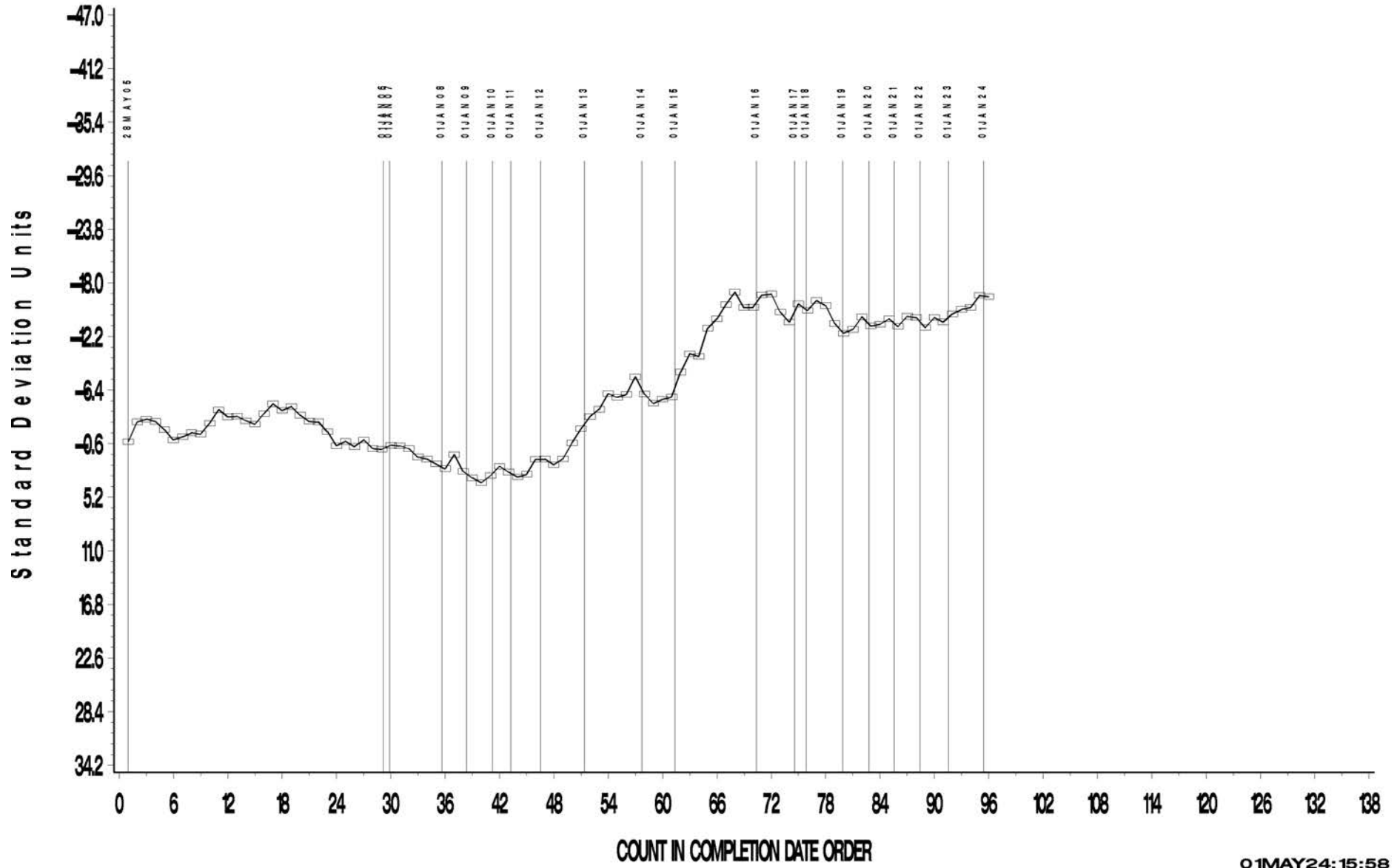
TOP GROOVE CARBON AVG — FINAL RESULT

LTMS Precision Analysis



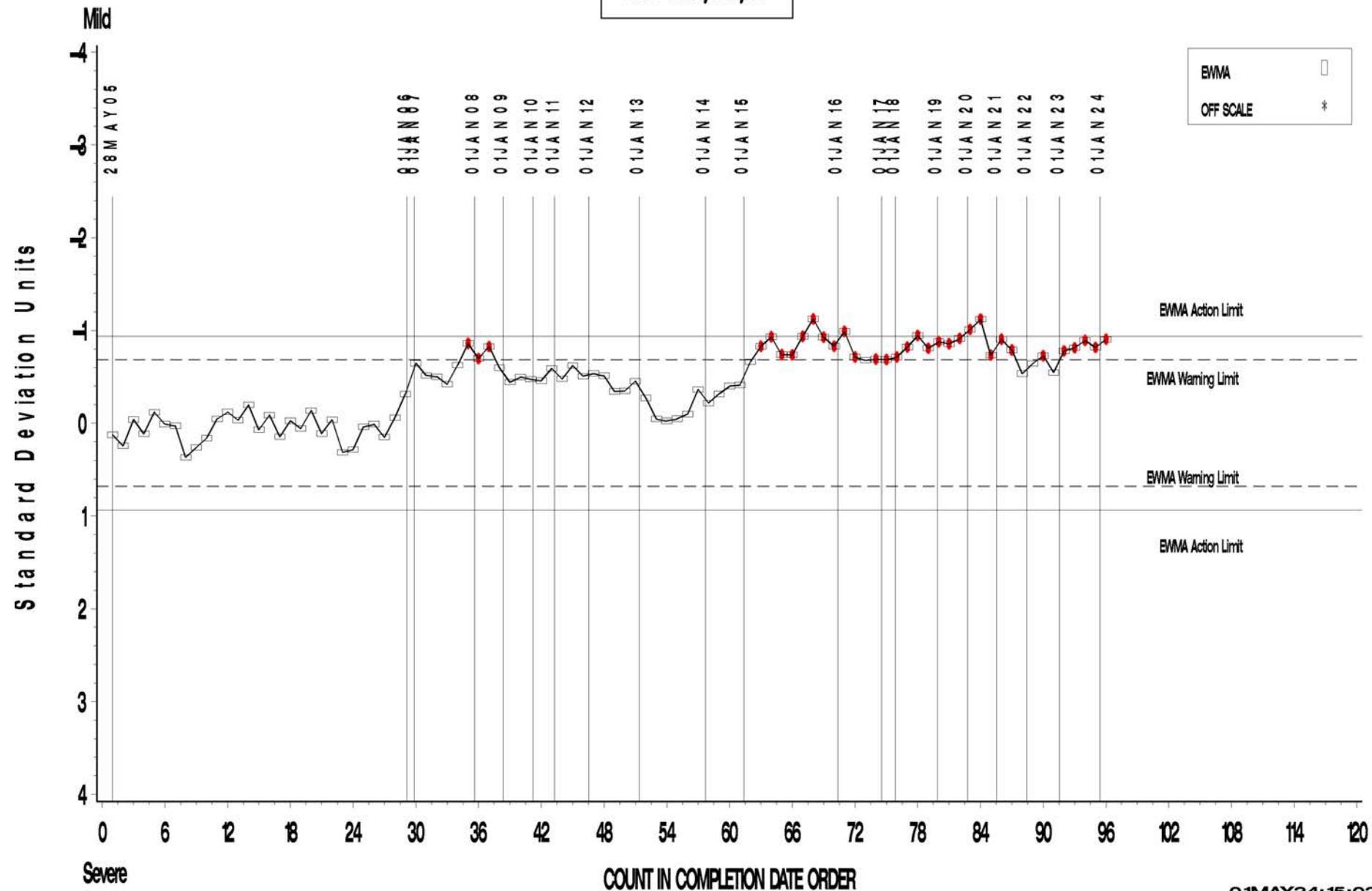
TOP GROOVE CARBON AVG — FINAL RESULT

CUSUM Severity Analysis



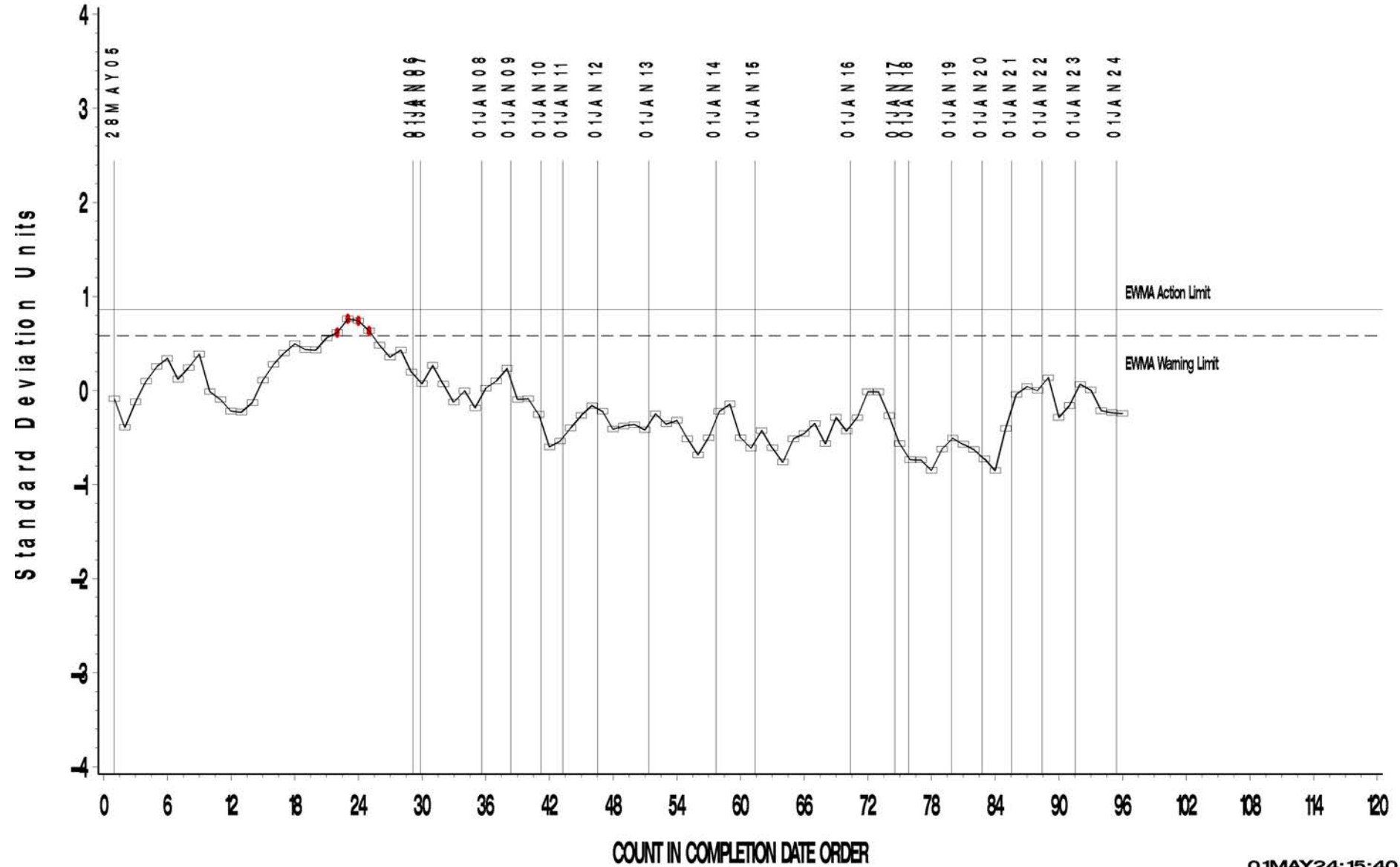
TOP LAND CARBON AVG. — FINAL RESULT

LTMS Severity Analysis



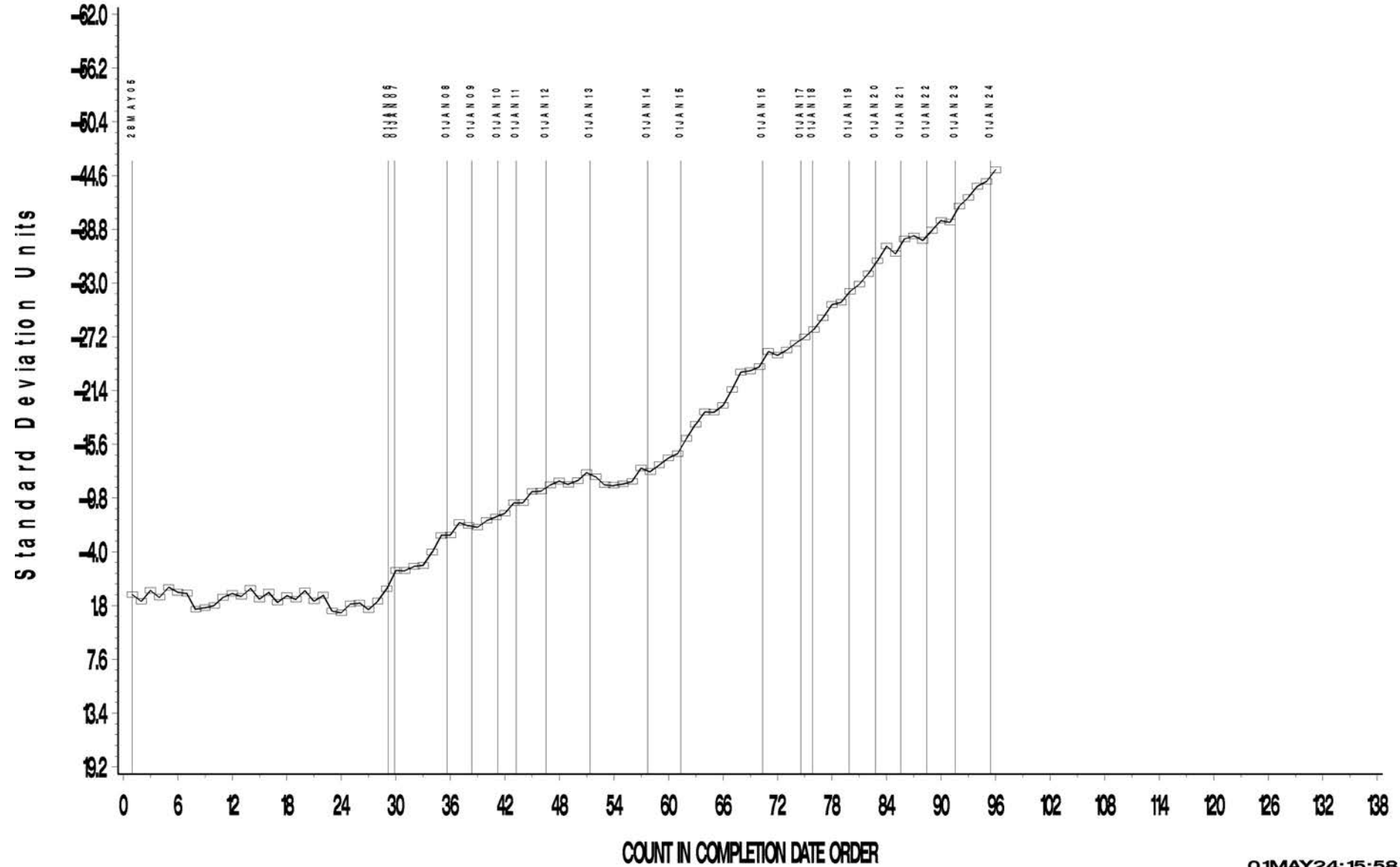
TOP LAND CARBON AVG. — FINAL RESULT

LTMS Precision Analysis

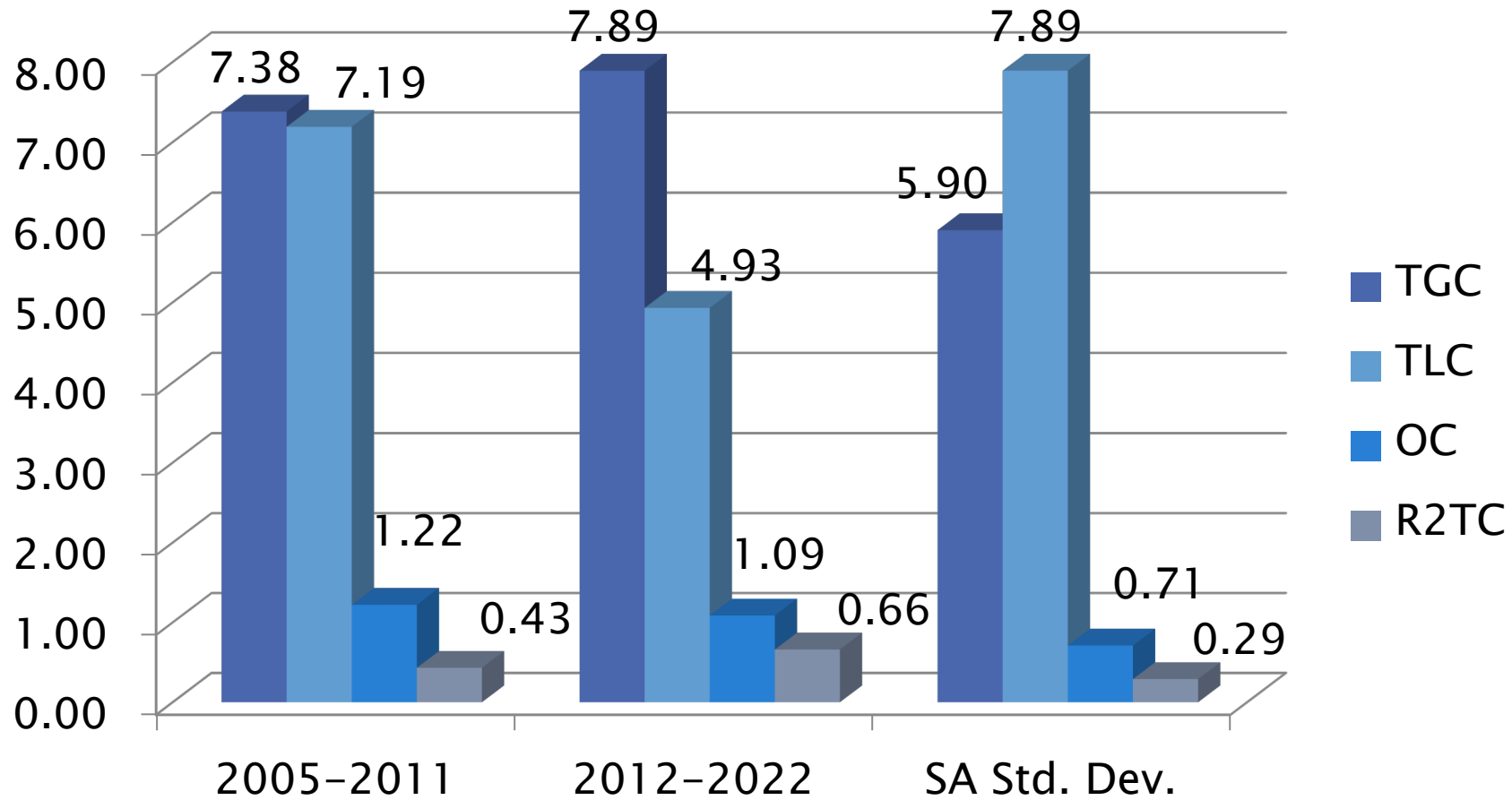


TOP LAND CARBON AVG. — FINAL RESULT

CUSUM Severity Analysis



C13 Precision Estimates



[Return to Table of Contents](#)

Test Monitoring Center
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C13 Oil Aeration (COAT)

»» April 2024

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



A Program of ASTM International

COAT Test Activity

Test Status	Validity Code	COAT
Acceptable Calibration Test	AC	1
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	0
Informational	NN	5
Total		6

COAT Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

COAT Lost Tests*

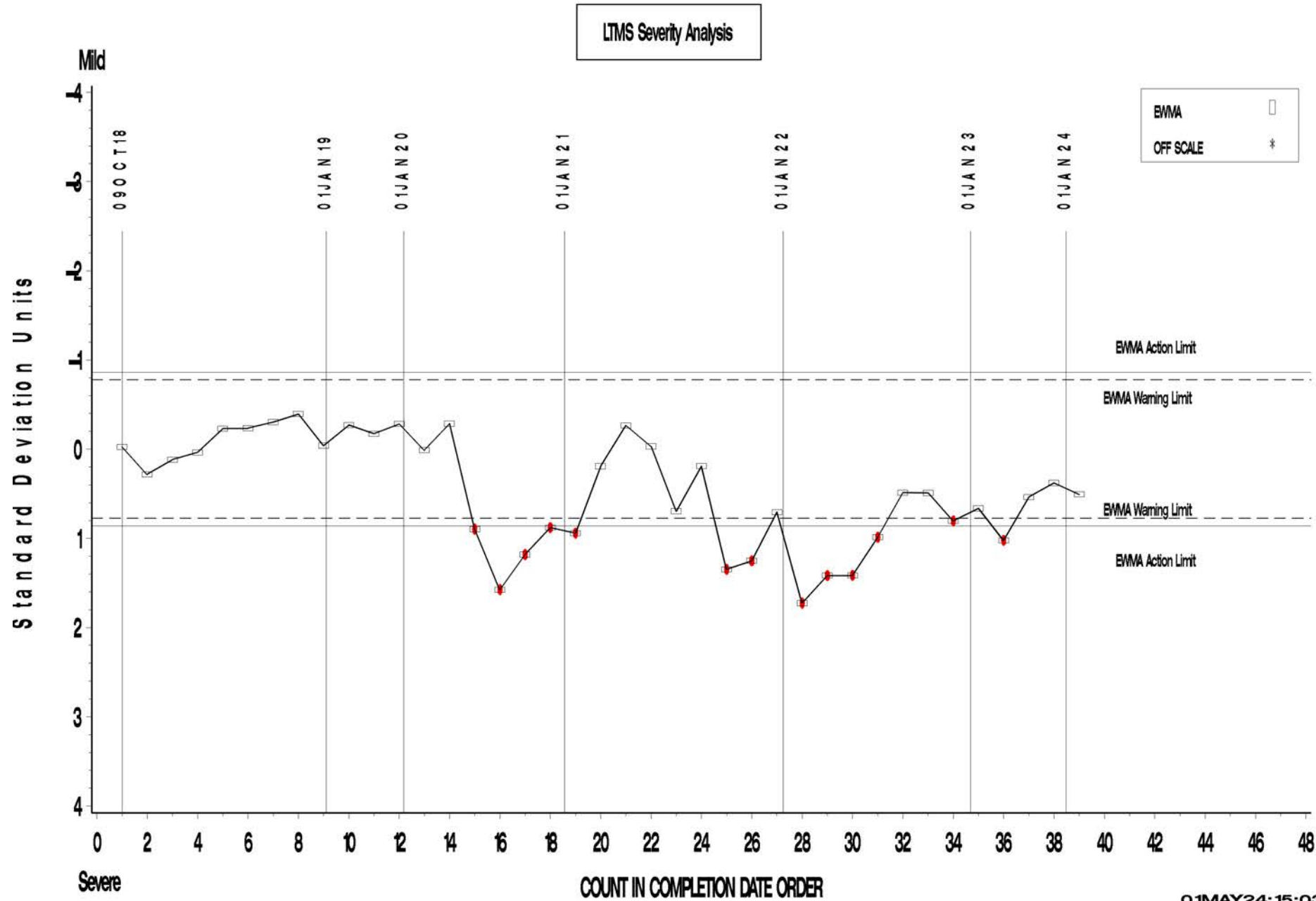
Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		0

*Invalid and aborted tests

COAT Test Severity

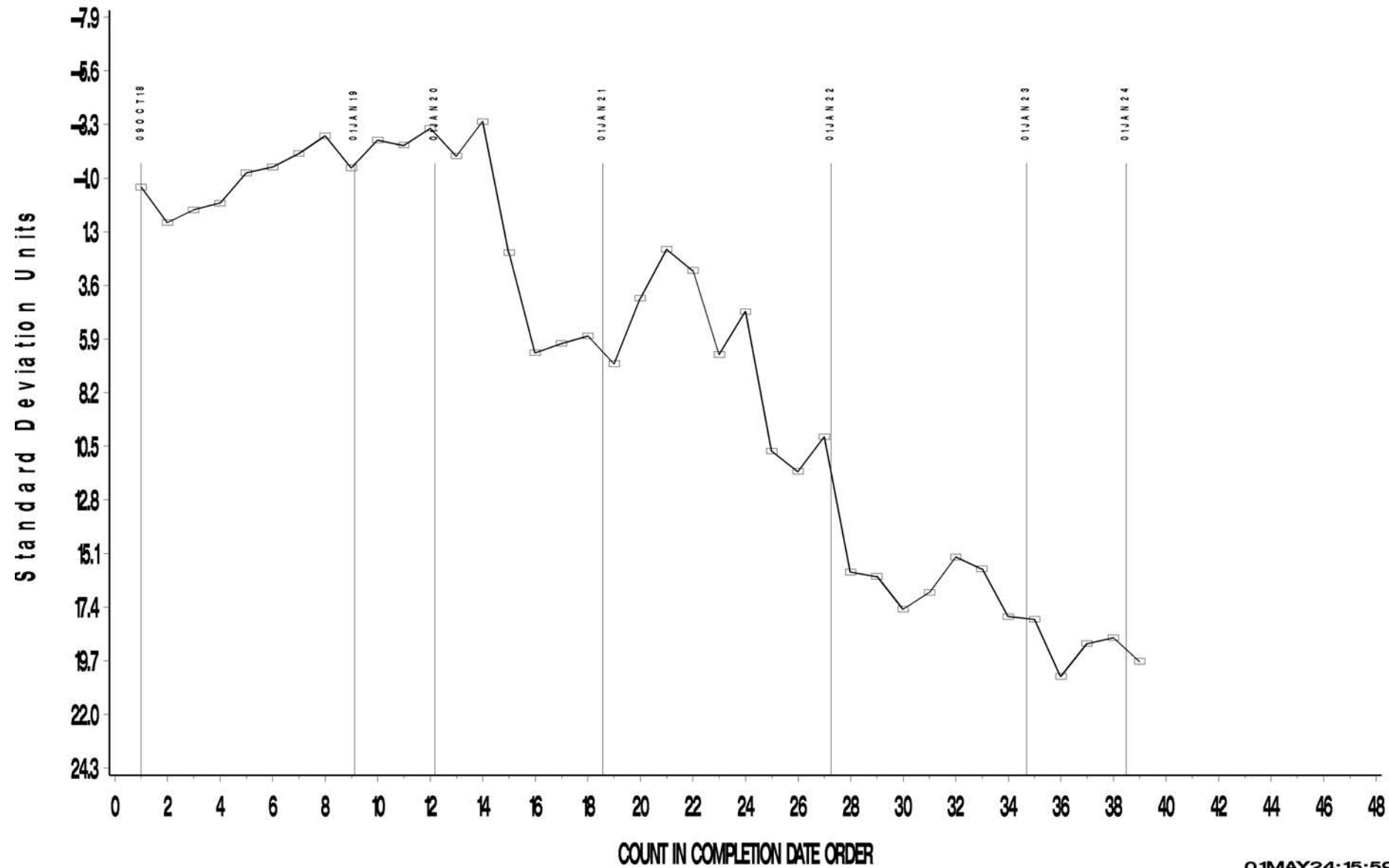
- ▶ AAVE is in control

CORRECTED AVERAGE OIL AERATION OVER TEST HOURS 40 — 50



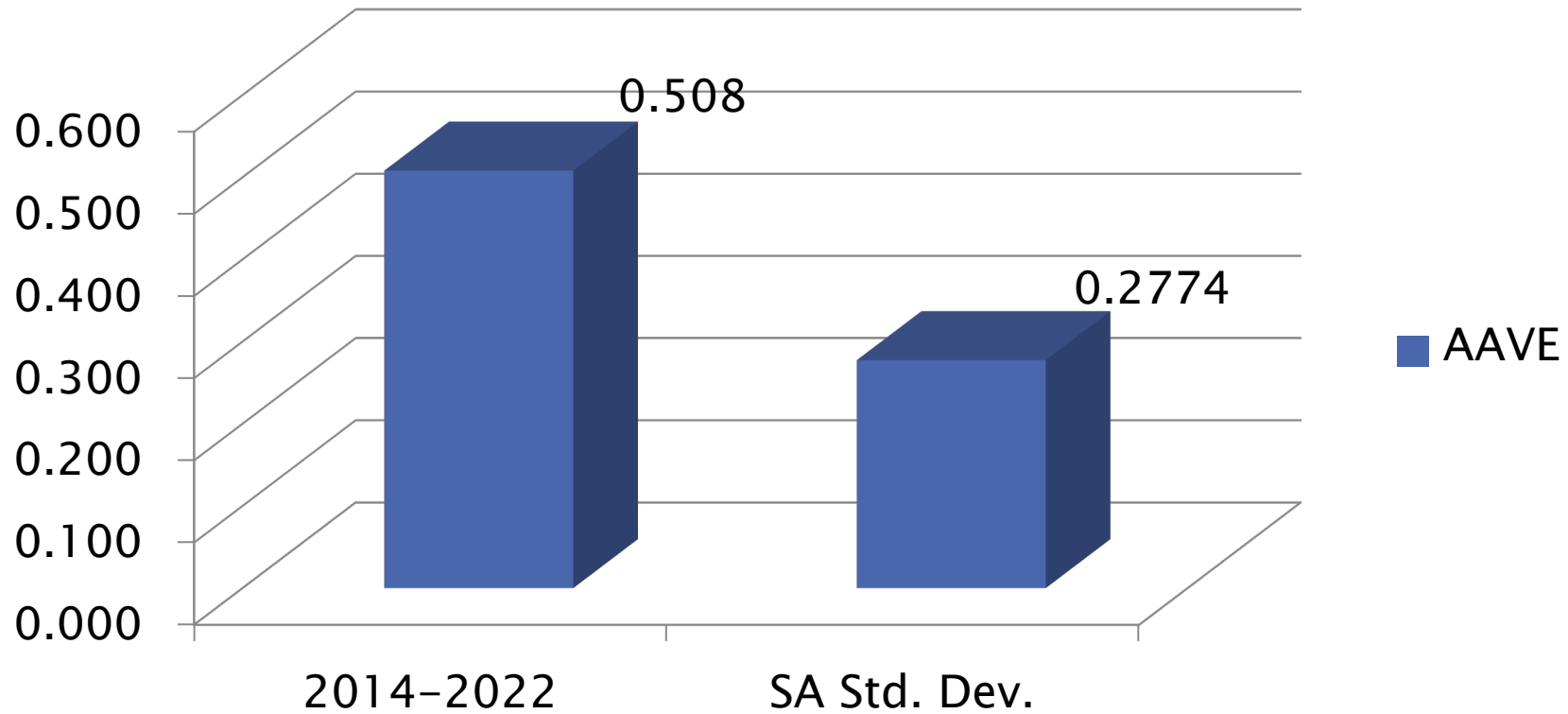
CORRECTED AVERAGE OIL AERATION OVER TEST HOURS 40 — 50

CUSUM Severity Analysis



COAT Precision Estimates

AAVE



[Return to Table of Contents](#)

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



Daimler DD13 Scuffing Test

»» April 2024

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



A Program of ASTM International

DD13 Test Activity

Test Status	Validity Code	COAT
Acceptable Calibration Test	AC	0
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	0
Total		0

DD13 Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

DD13 Lost Tests*

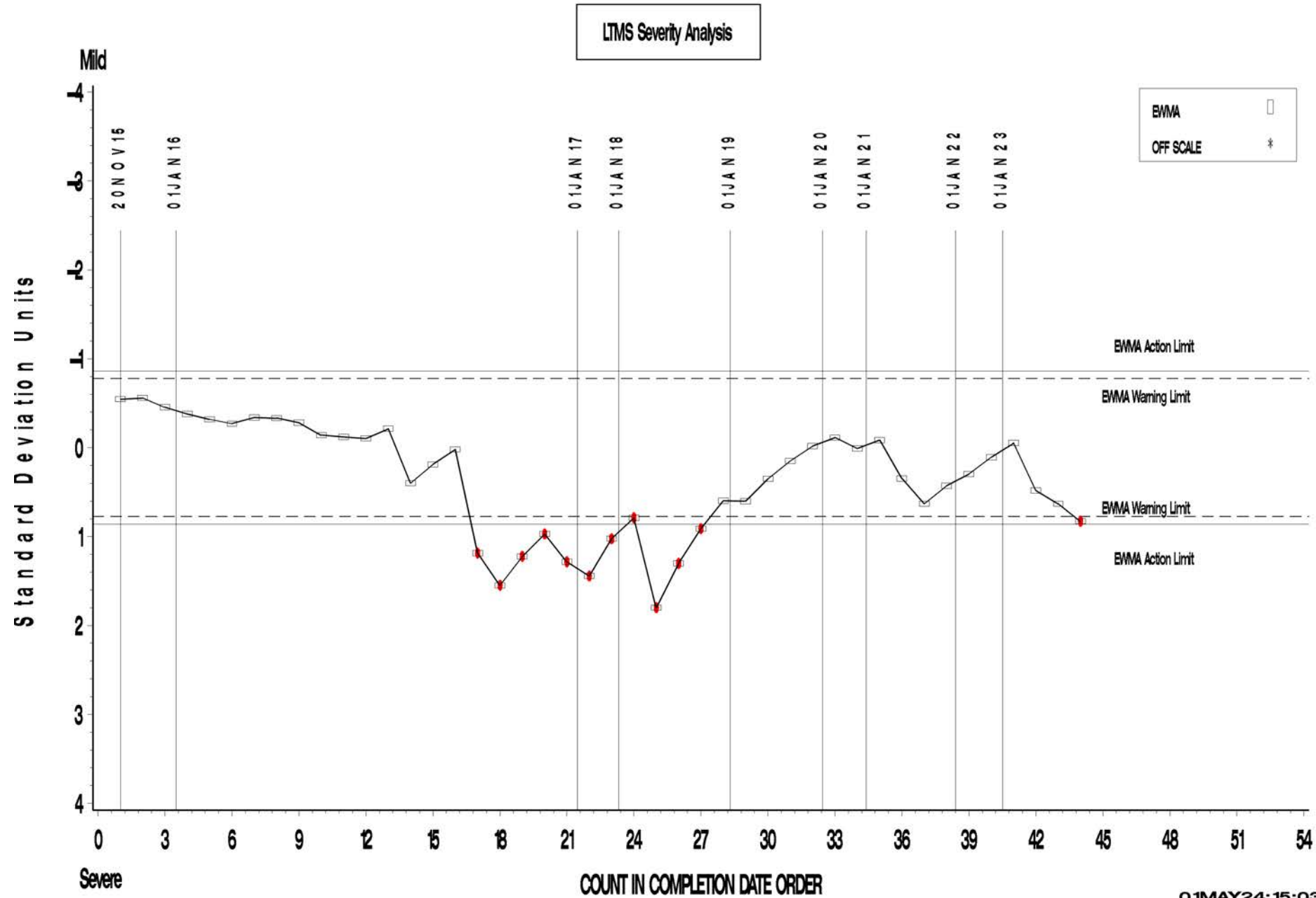
Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		0

*Invalid and aborted tests

DD13 Test Severity

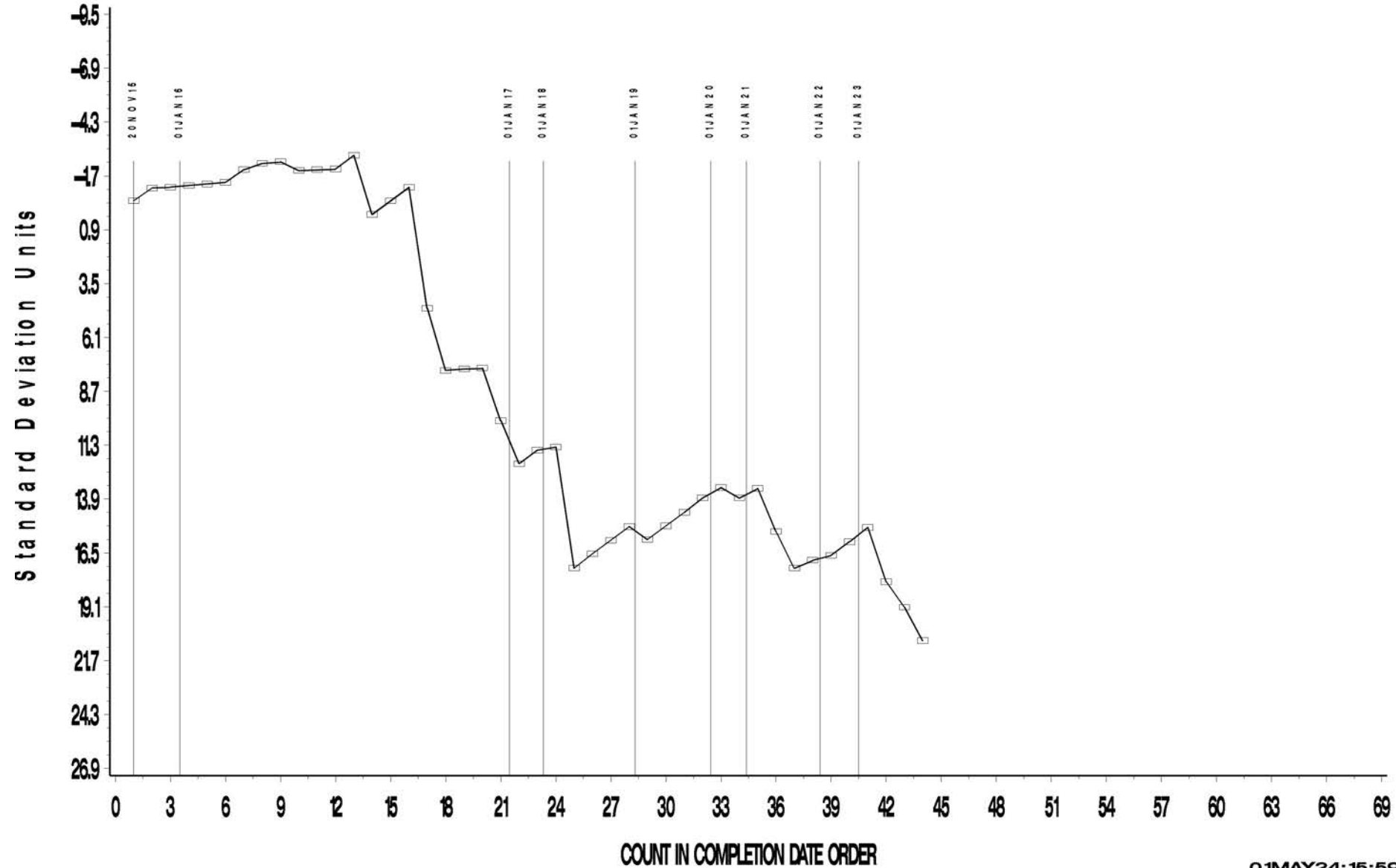
- ▶ As no chartable DD13 tests were run during this reporting period, no statement about test severity can be made.

FNL. ORIG. UNIT HOURS TO SCUFF



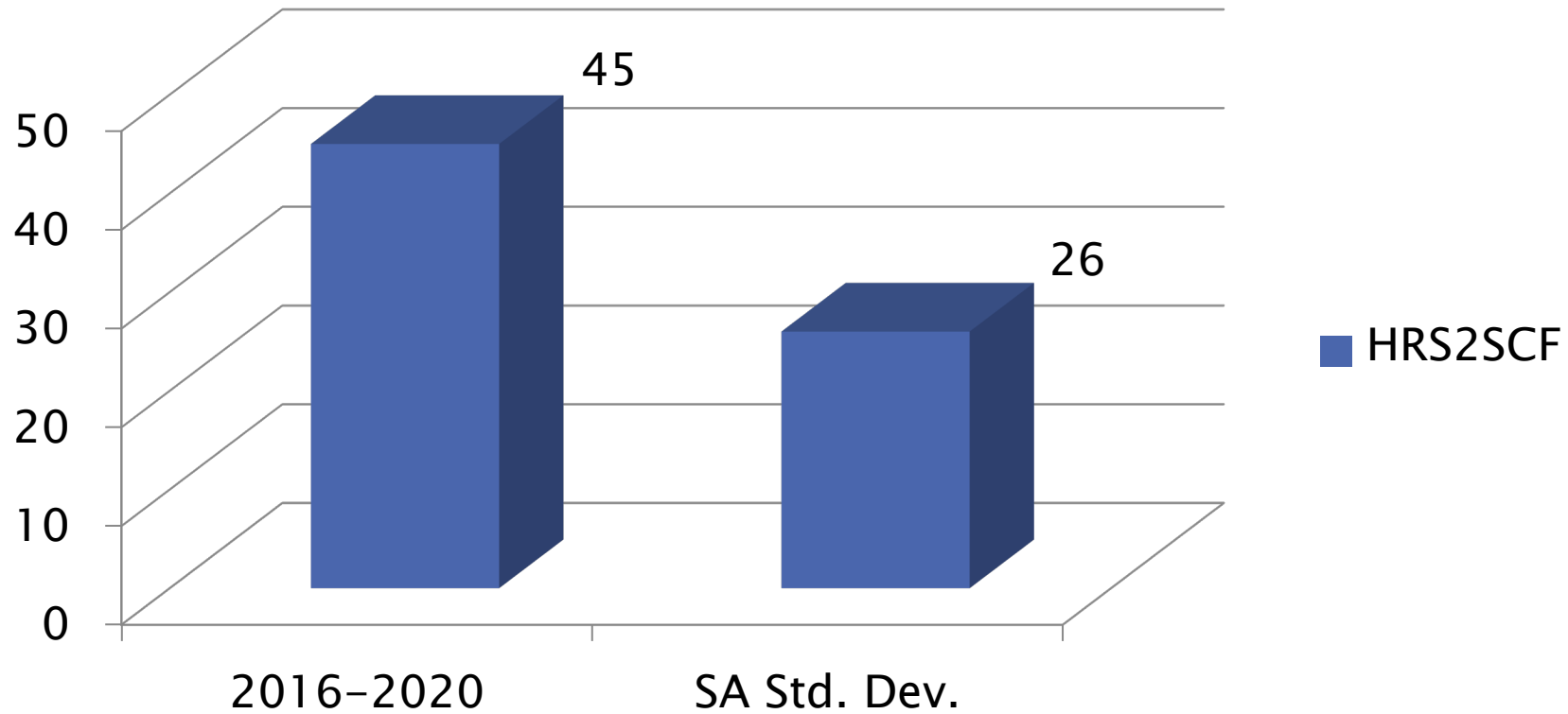
FNL. ORIG. UNIT HOURS TO SCUFF

CUSUM Severity Analysis



DD13 Precision Estimates

HRS2SCF



[Return to Table of Contents](#)

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



EOAT

»» April 2024

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



A Program of ASTM International

EOAT Test Activity

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

EOAT Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

EOAT Lost Tests*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		0

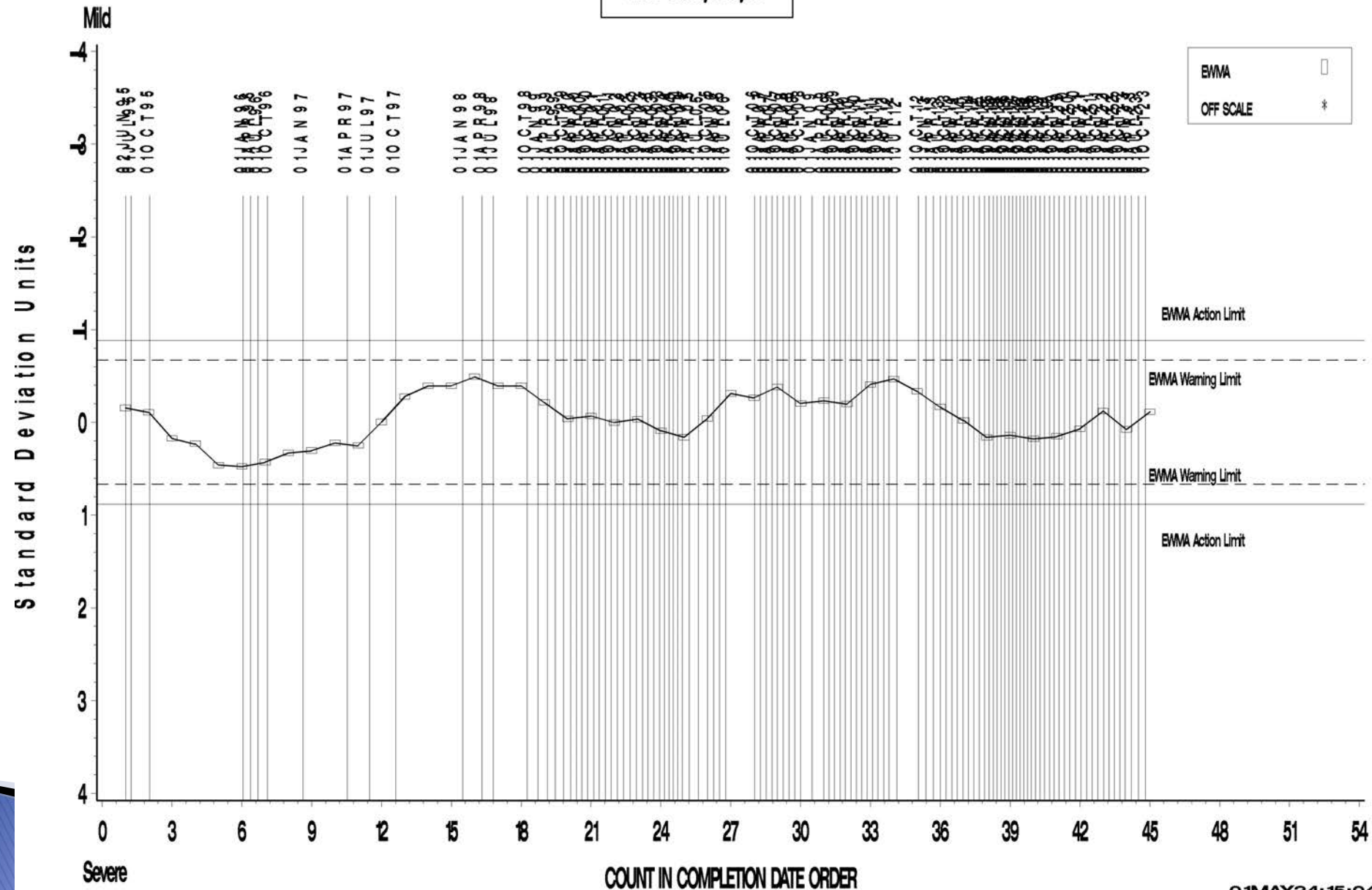
*Invalid and aborted tests

EOAT Test Severity

- ▶ AEOA is in control.

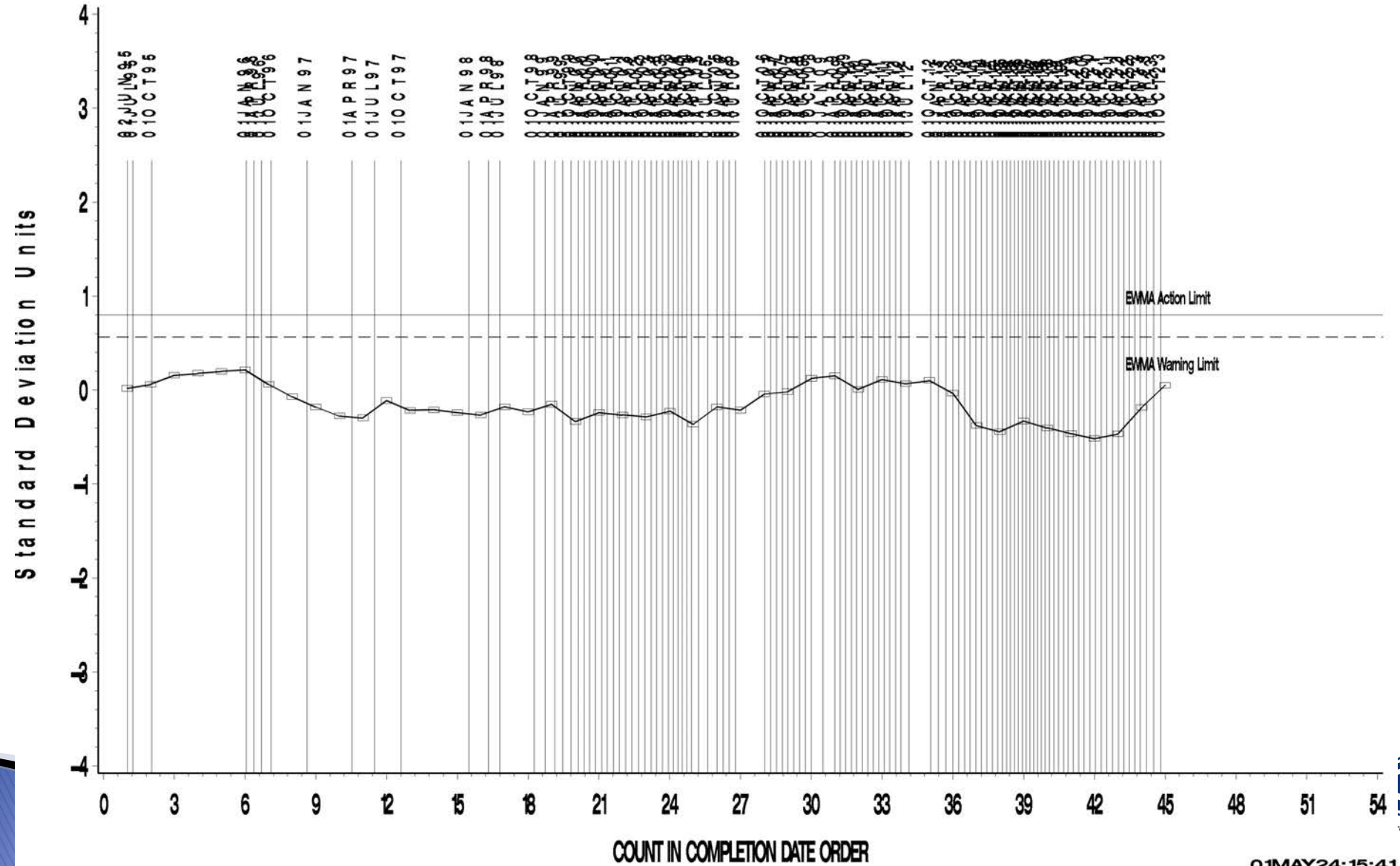
ENGINE OIL AERATION

LTMS Severity Analysis



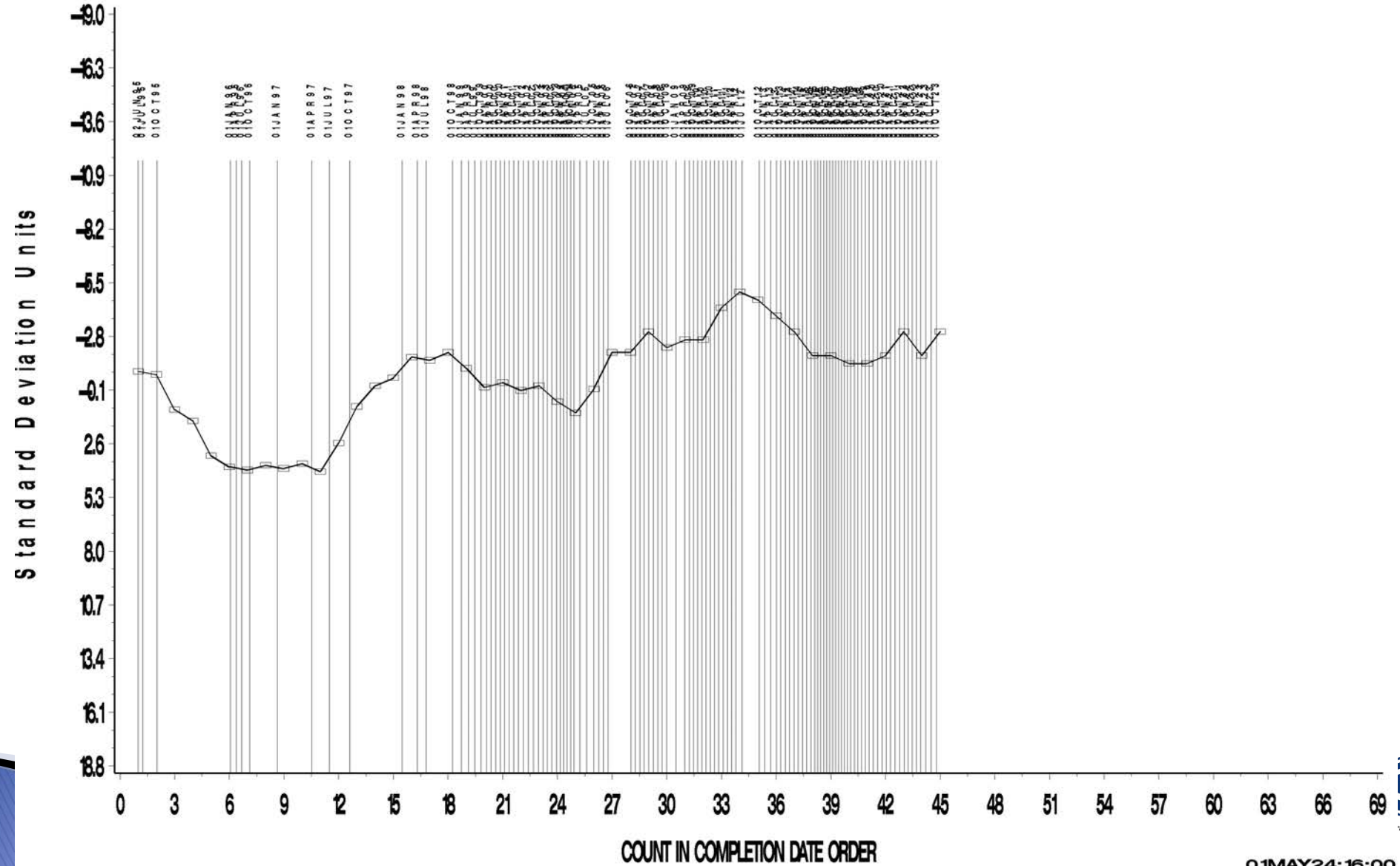
ENGINE OIL AERATION

LTMS Precision Analysis



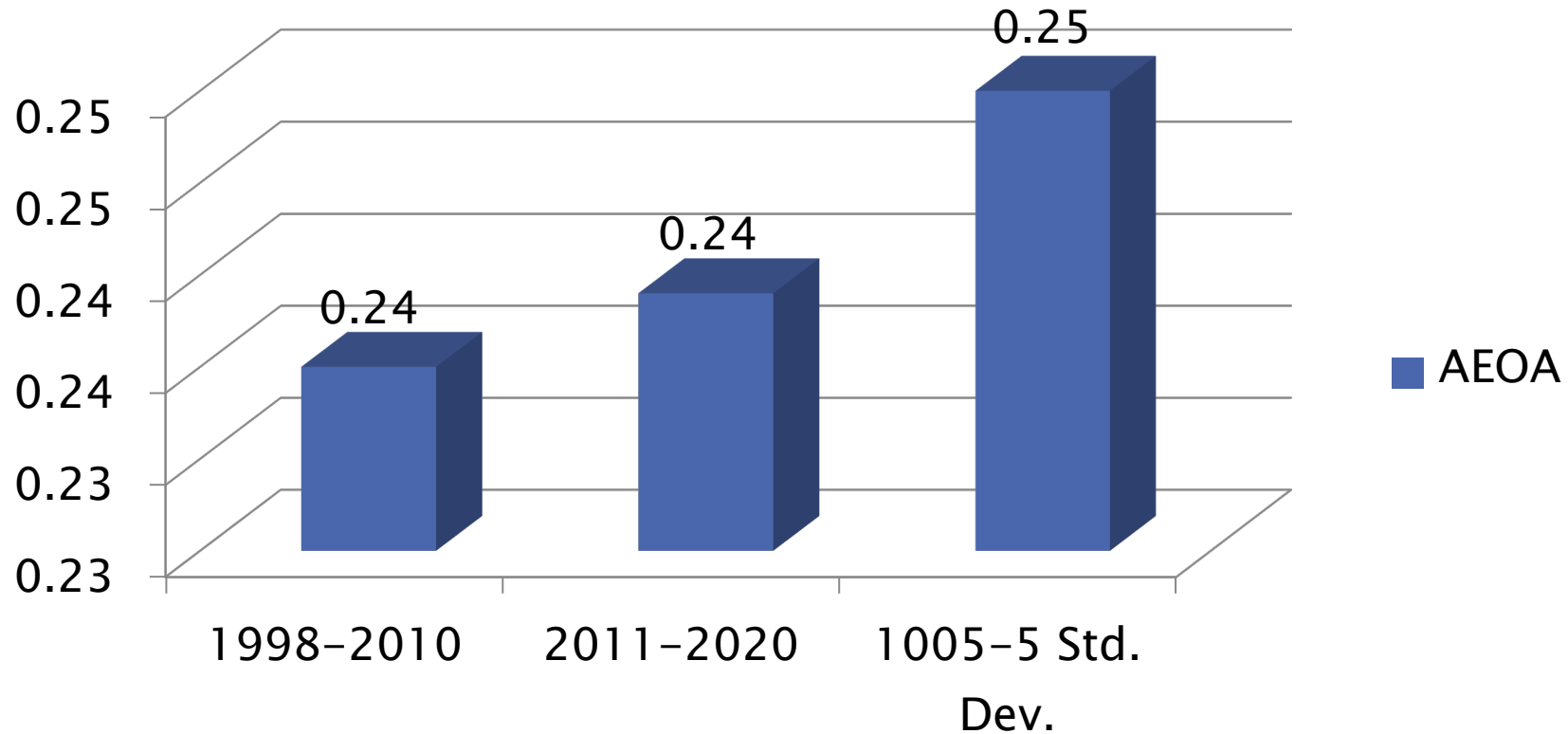
ENGINE OIL AERATION

CUSUM Severity Analysis



EOAT Precision Estimates

AEOA



[Return to Table of Contents](#)

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



Cummins ISB

»» April 2024

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



A Program of ASTM International

ISB Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	1
Failed Calibration Test	OC	1
Operationally Invalid	LC	0
Aborted	XC	0
Total		2

ISB Failed Tests

Failed Parameter	Number of Tests
ATWL Level 3 Ei	1
Total	1

ISB Lost Tests*

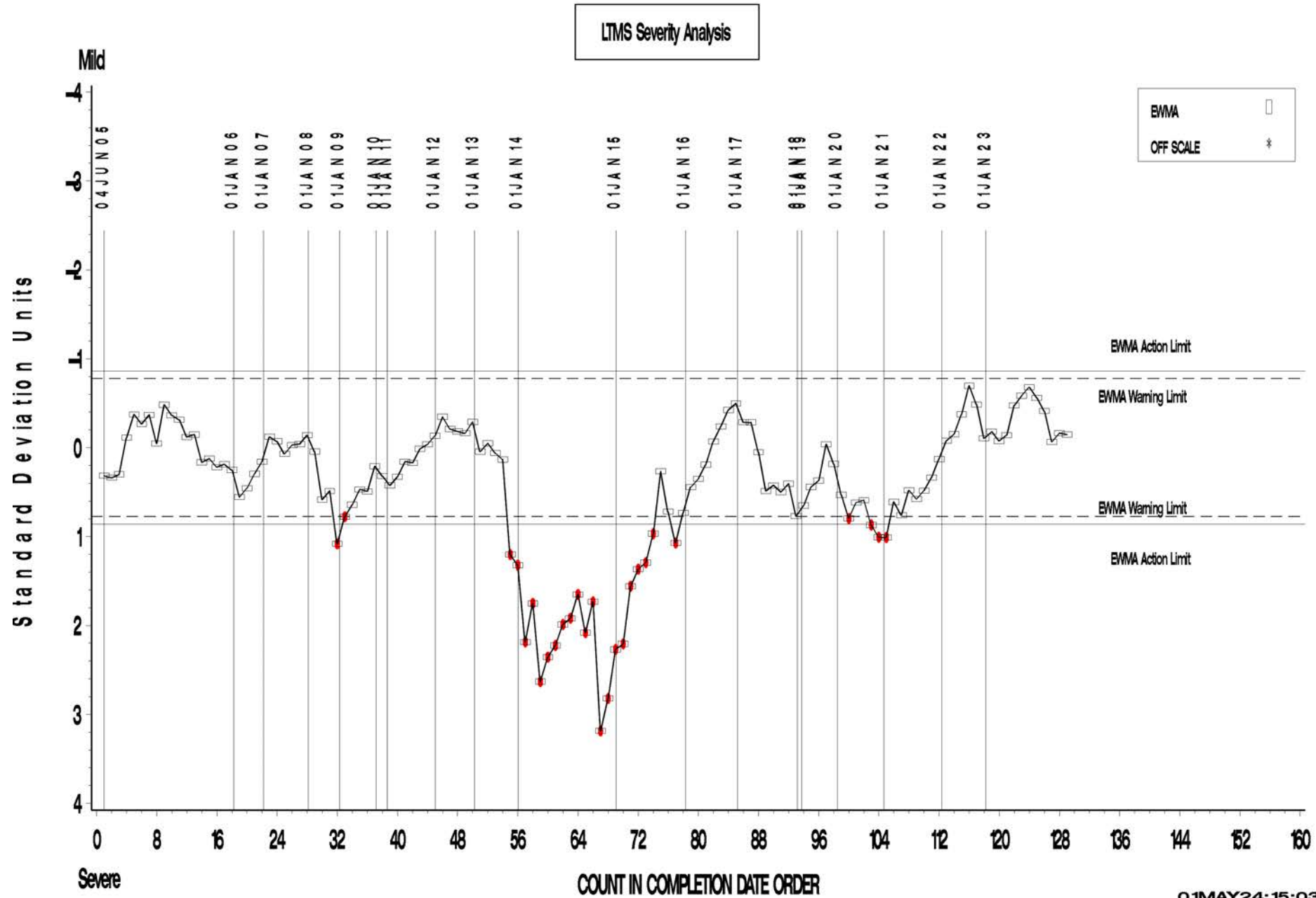
Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		0

*Invalid and aborted tests

ISB Test Severity

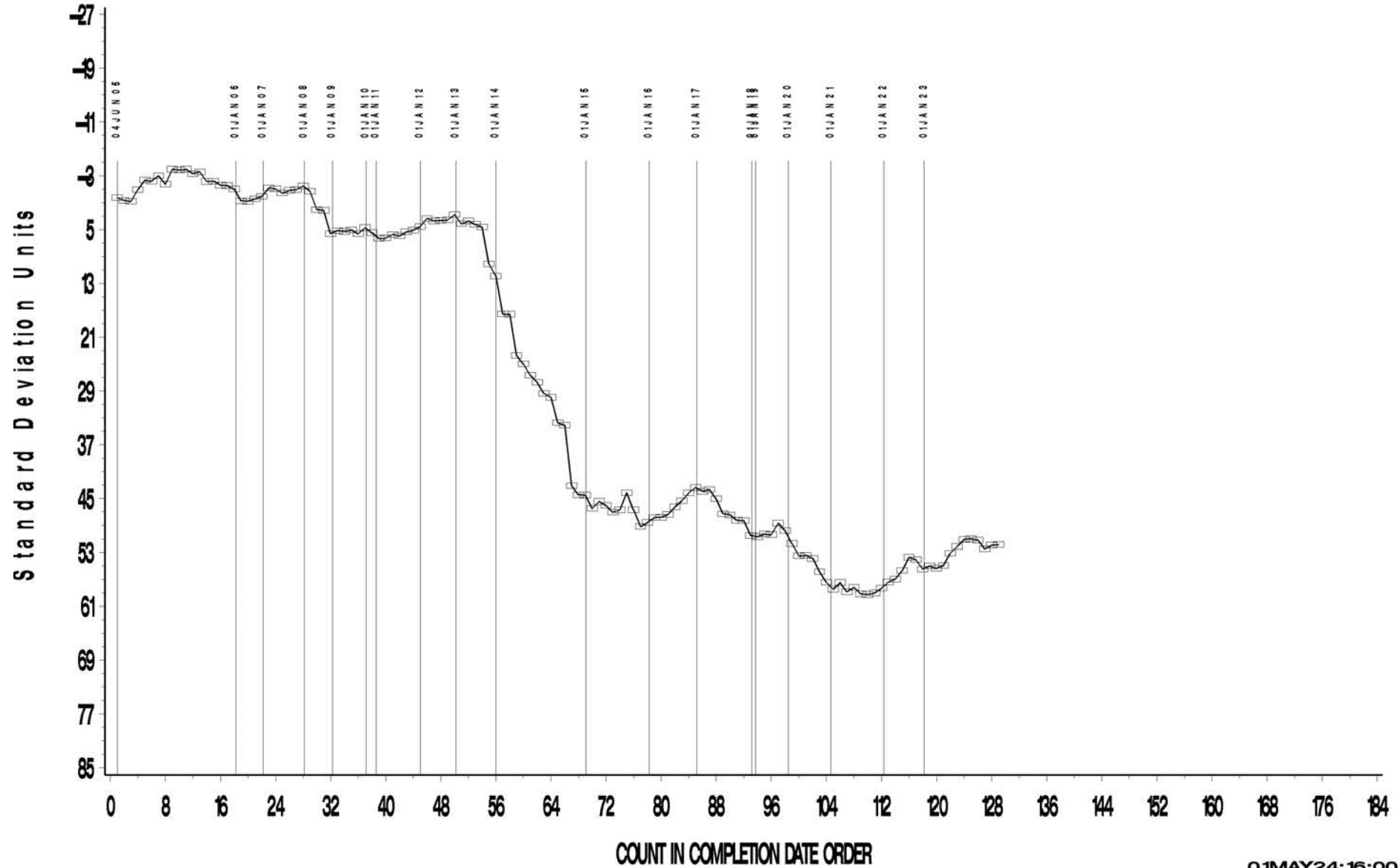
- ▶ ACSW and ATWL are in control.

AVERAGE CAMSHAFT WEAR

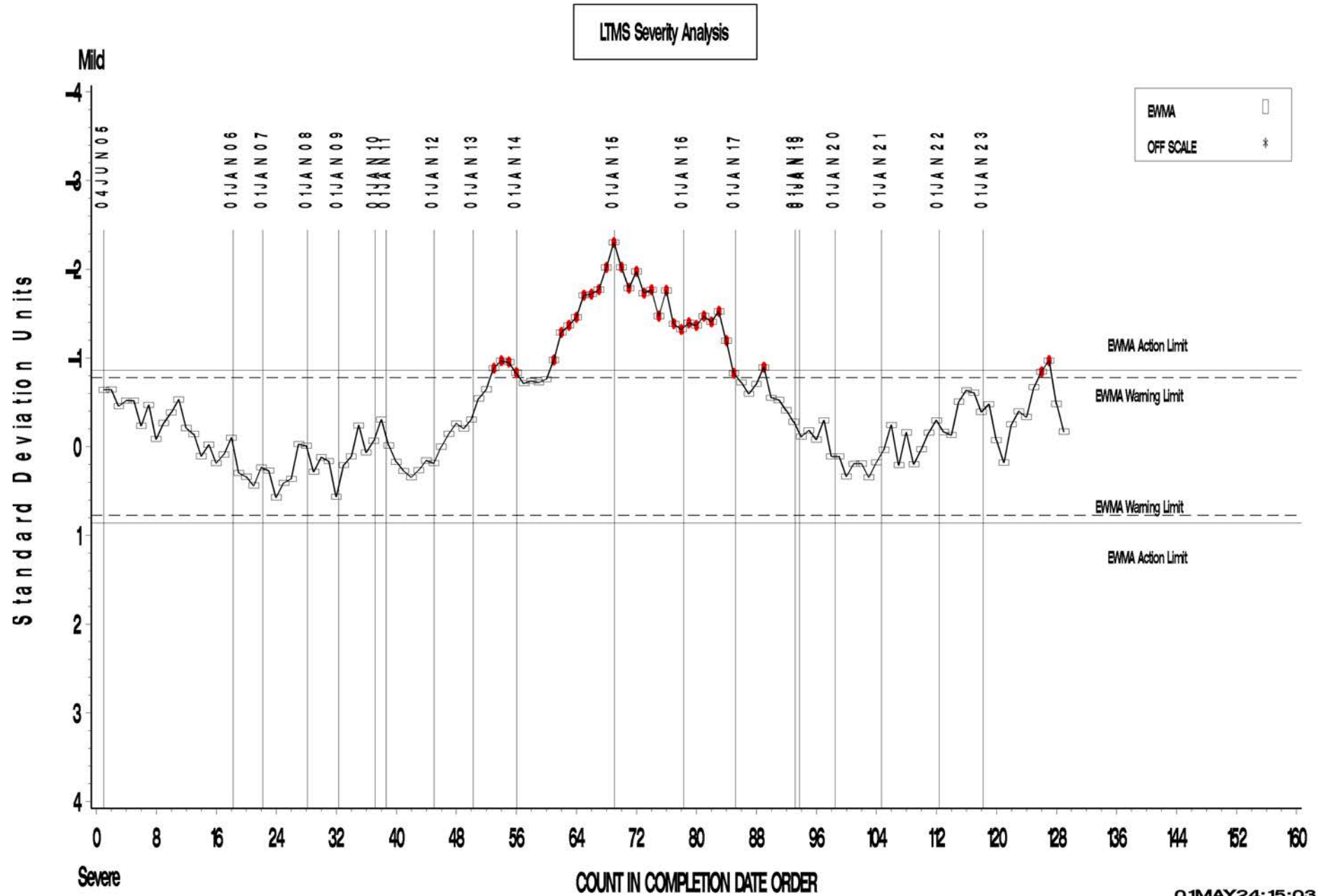


AVERAGE CAMSHAFT WEAR

CUSUM Severity Analysis

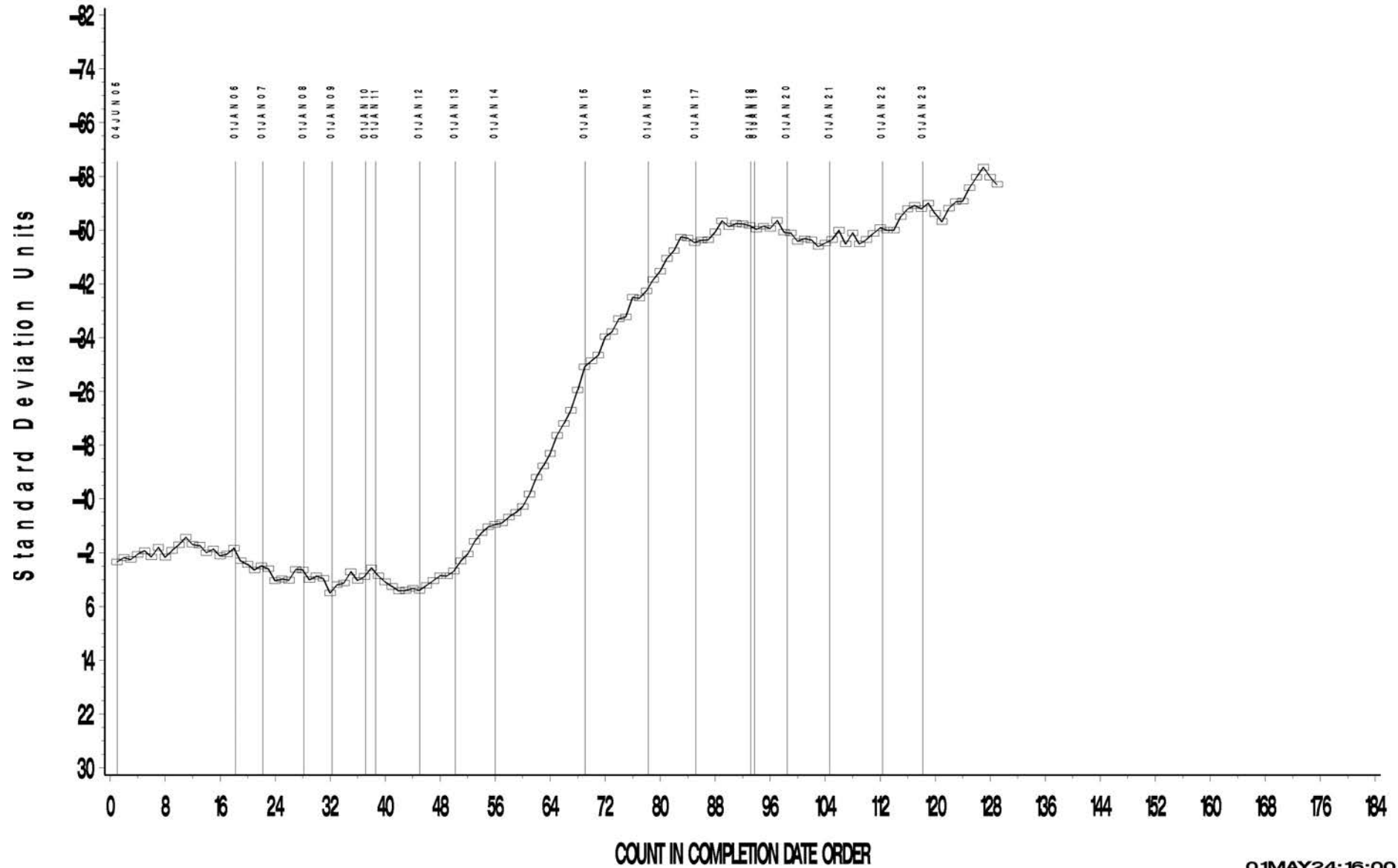


AVERAGE TAPPET WEIGHT LOSS

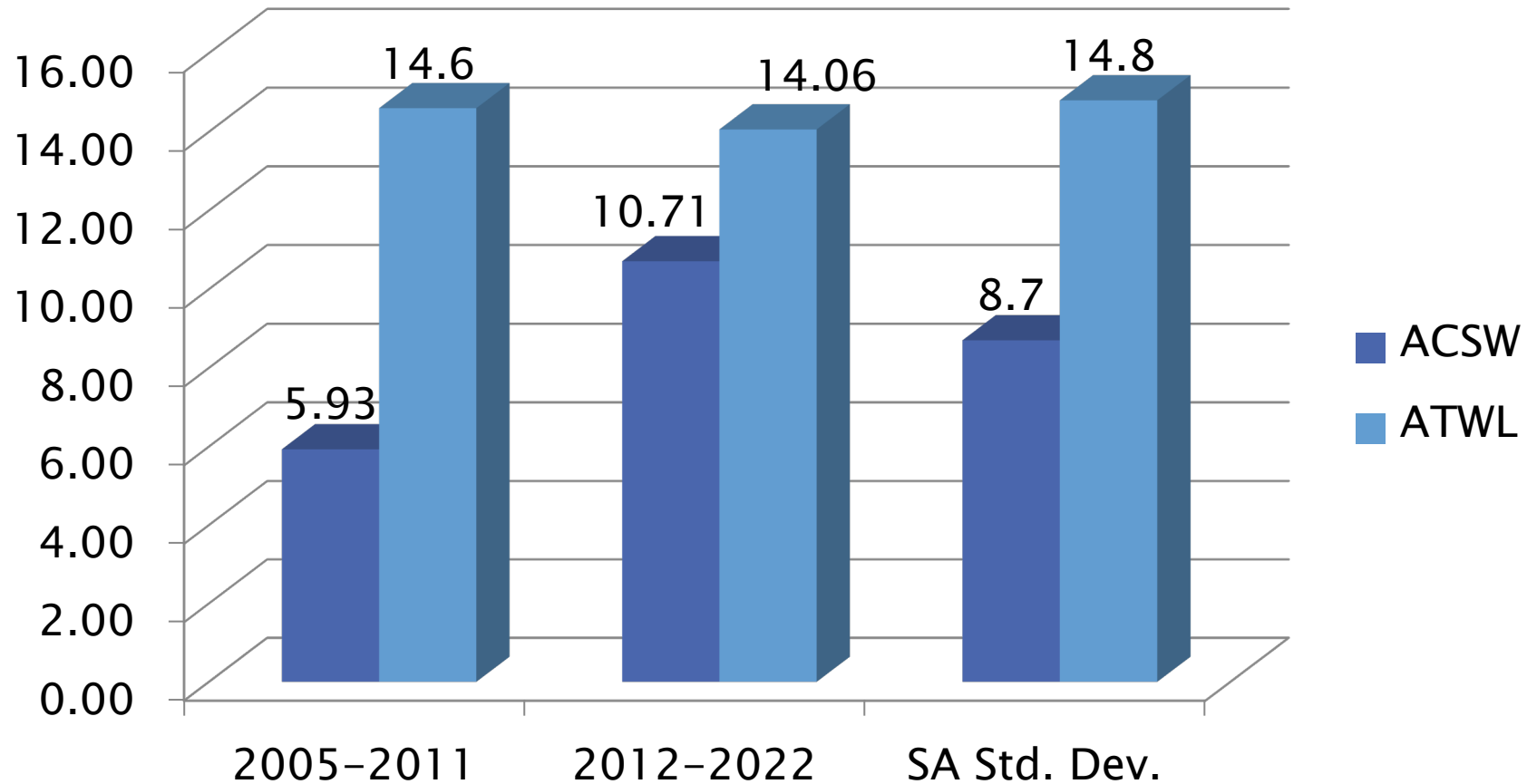


AVERAGE TAPPET WEIGHT LOSS

CUSUM Severity Analysis



ISB Precision Estimates



[Return to Table of Contents](#)

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



Cummins ISM

»» April 2024

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



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ISM Test Activity

Test Status	Validity Code	#
Acceptable Calibration	AC	0
Failed Calibration	OC	0
Operationally Invalid	LC	0
Aborted	XC	0
Total		0

ISM Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

ISM Lost Tests*

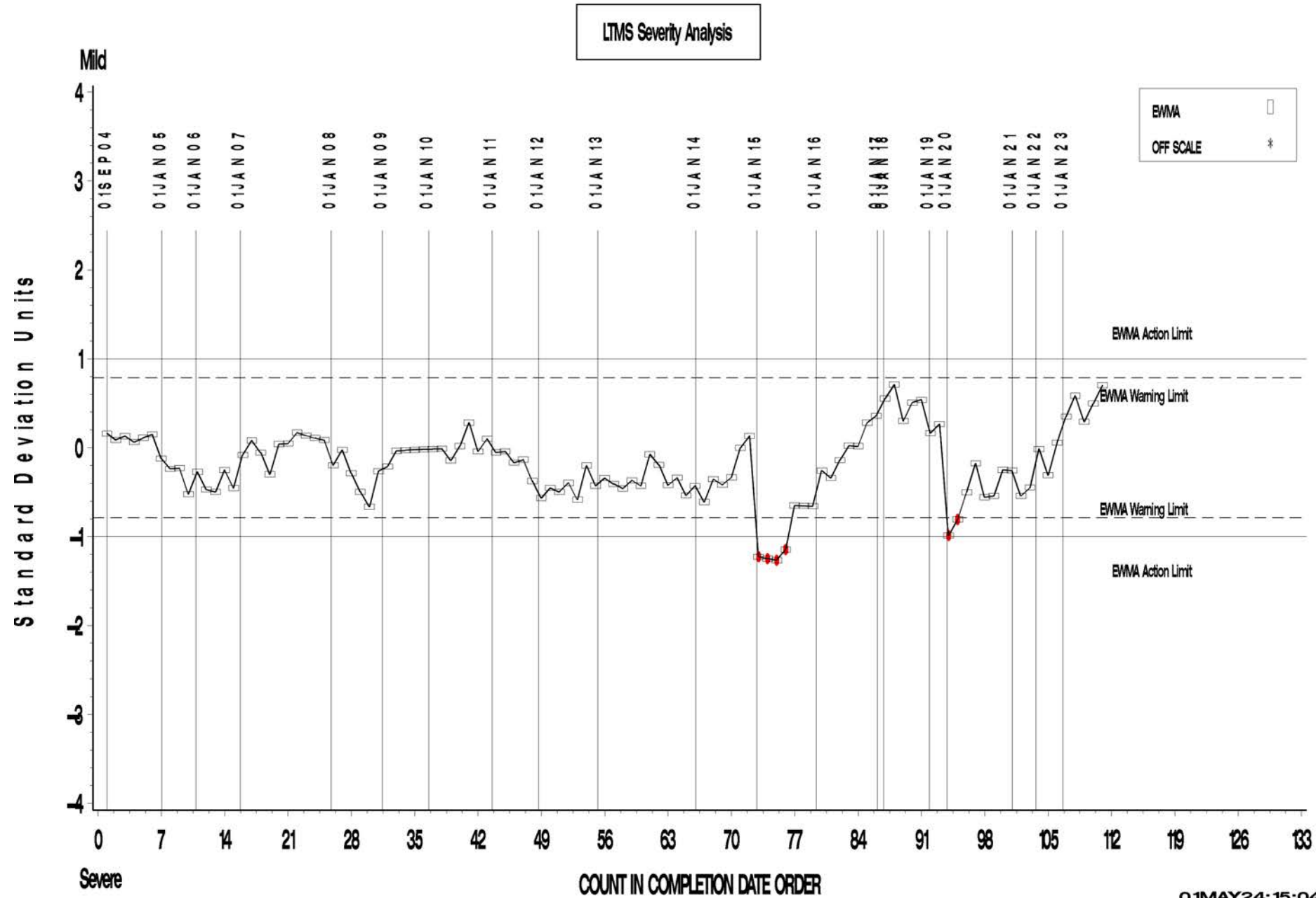
Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		0

*Invalid and aborted tests

ISM Test Severity

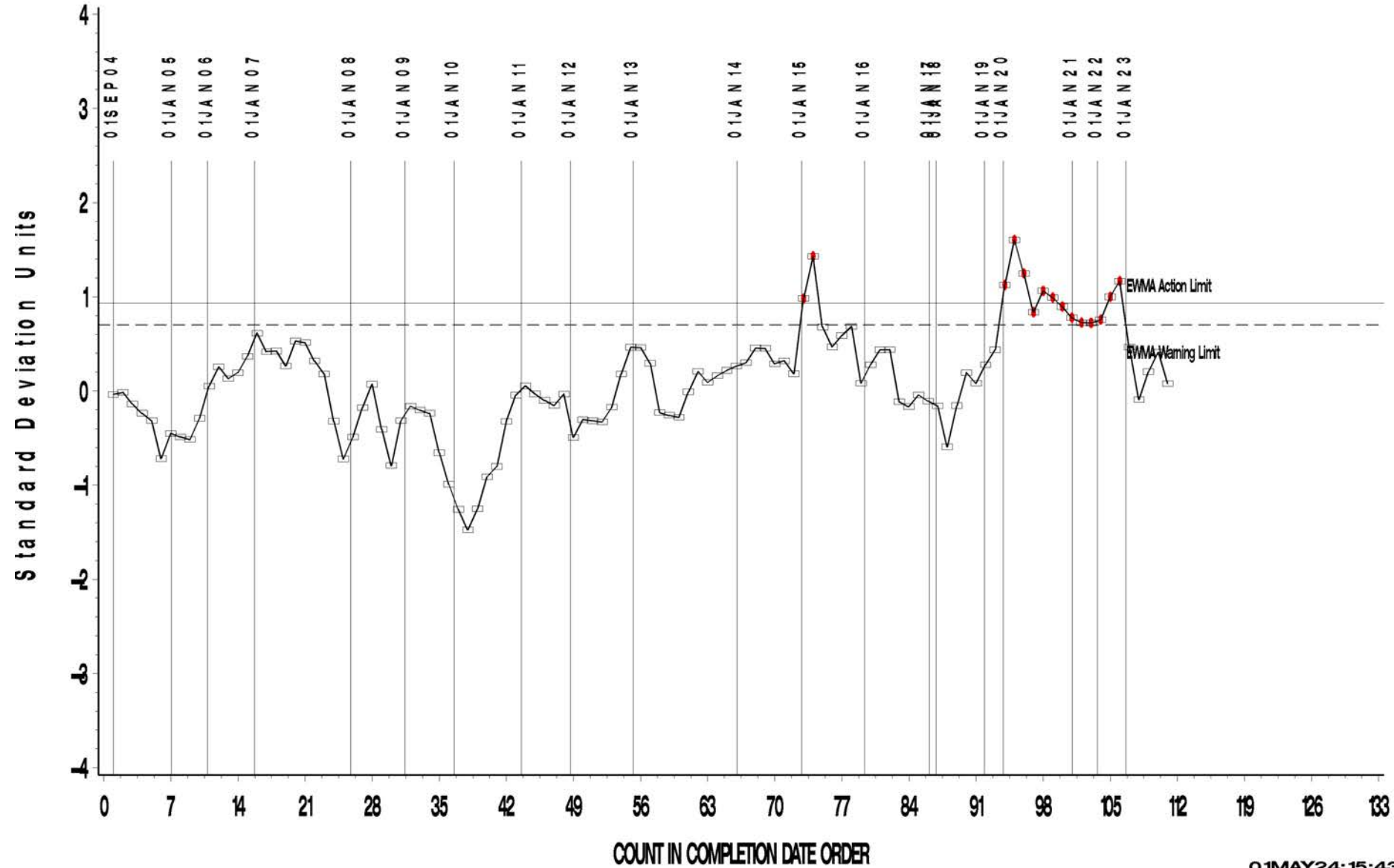
- ▶ As no chartable ISM tests were run during this reporting period, no statement about test severity can be made.

AVERAGE SLUDGE RATING



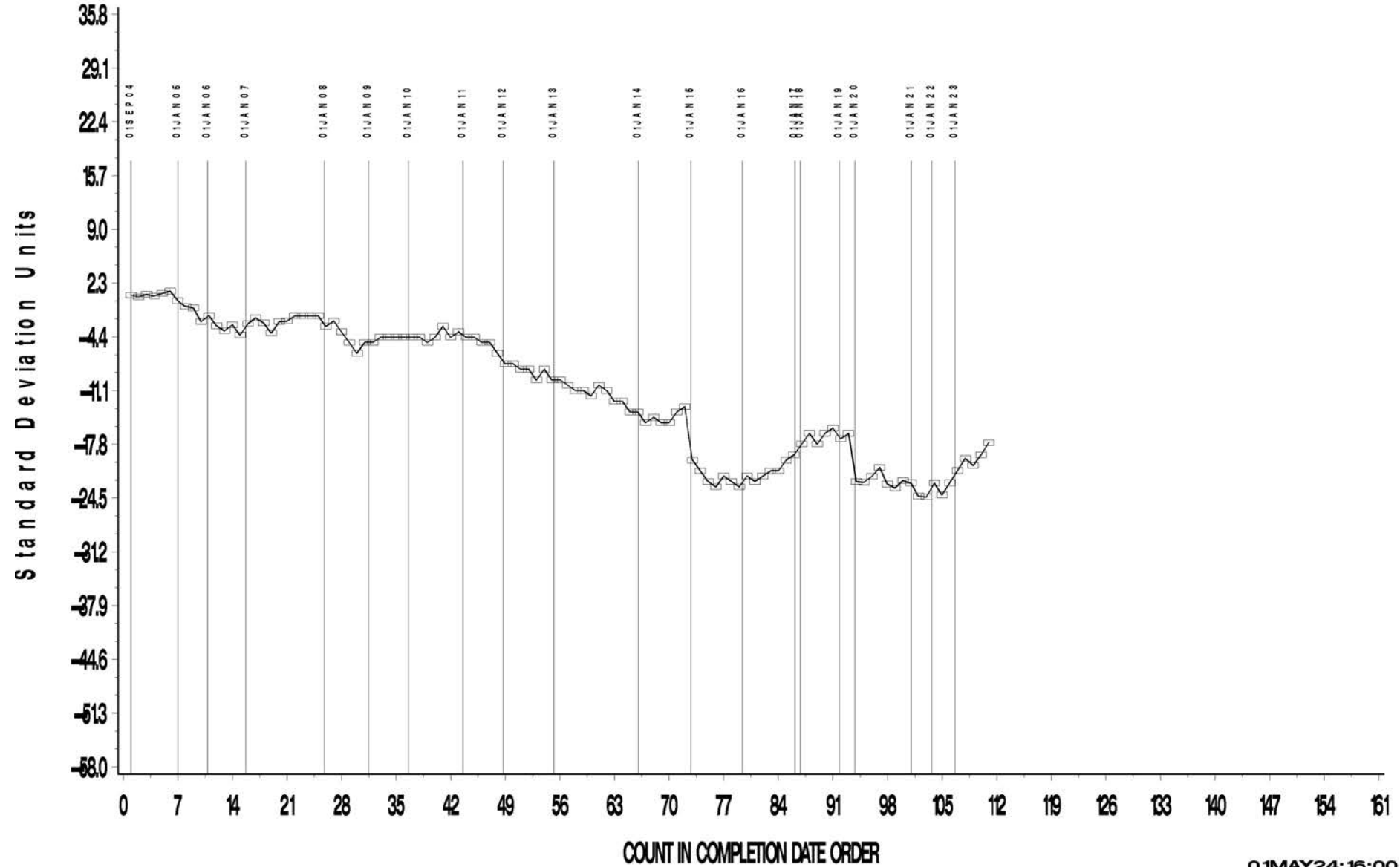
AVERAGE SLUDGE RATING

LTMS Precision Analysis



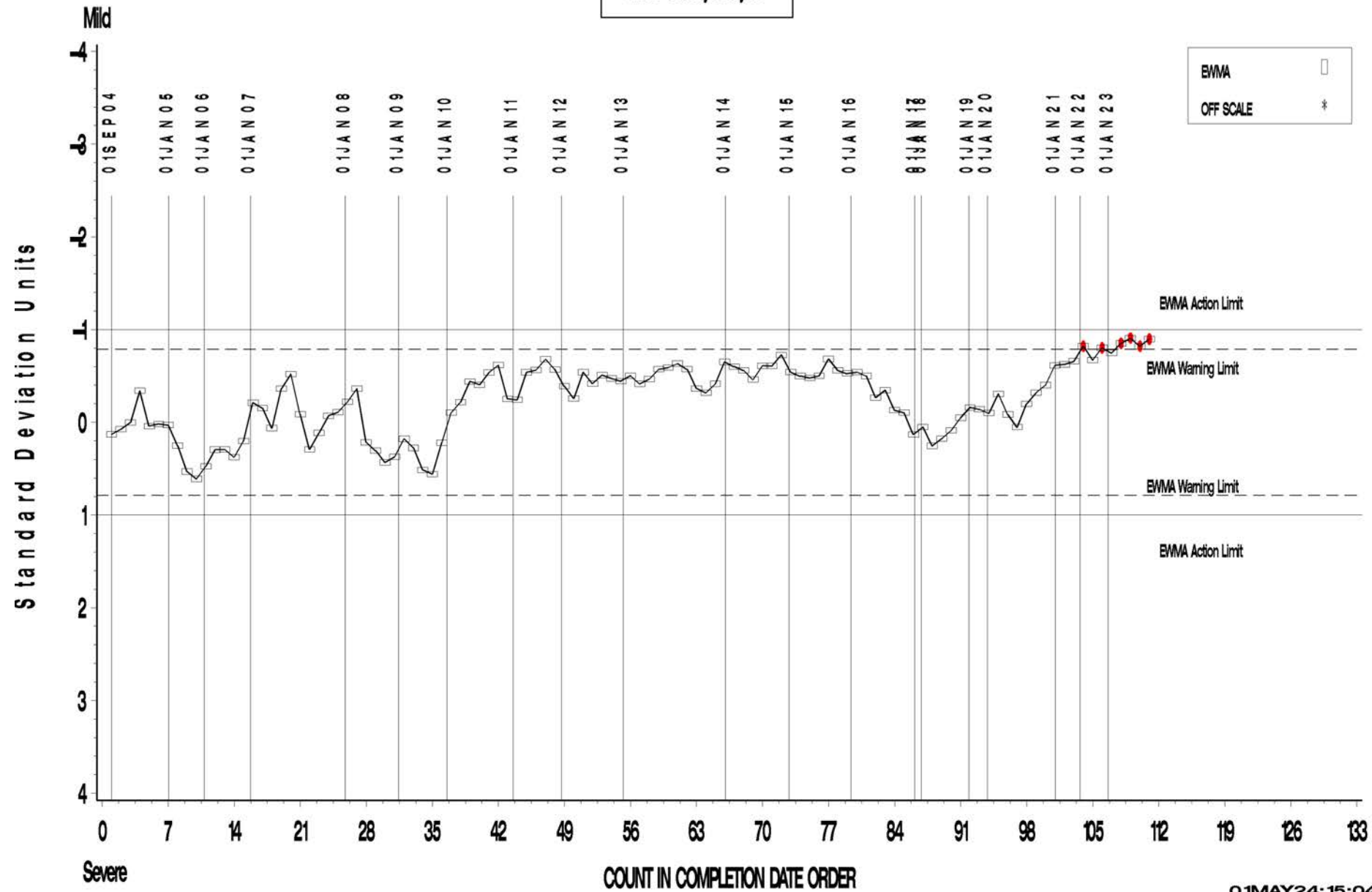
AVERAGE SLUDGE RATING

CUSUM Severity Analysis



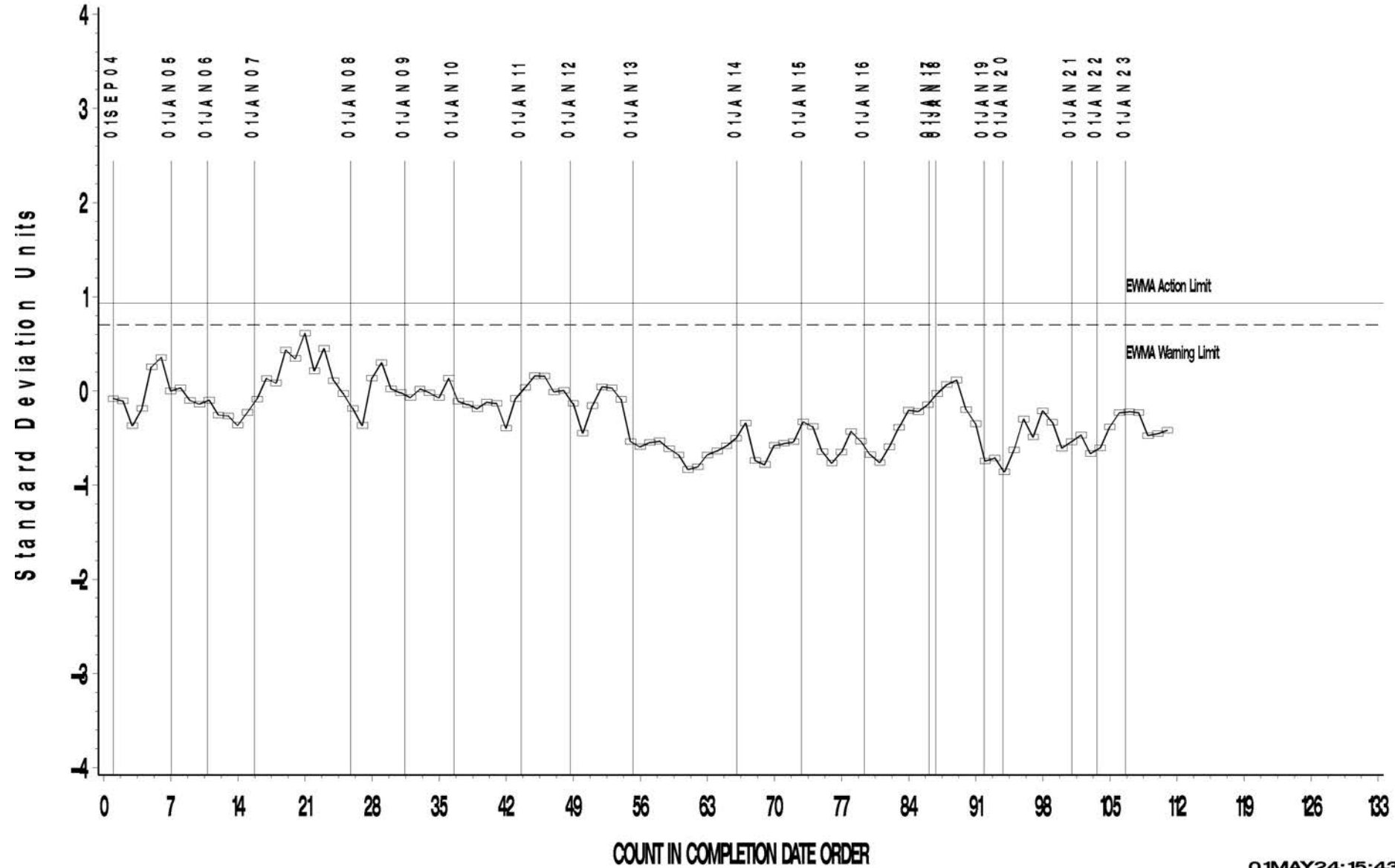
CROSSHEAD WEIGHT LOSS ADJUSTED TO 3.9 % SOOT

LTMS Severity Analysis



CROSSHEAD WEIGHT LOSS ADJUSTED TO 3.9 % SOOT

LTMS Precision Analysis



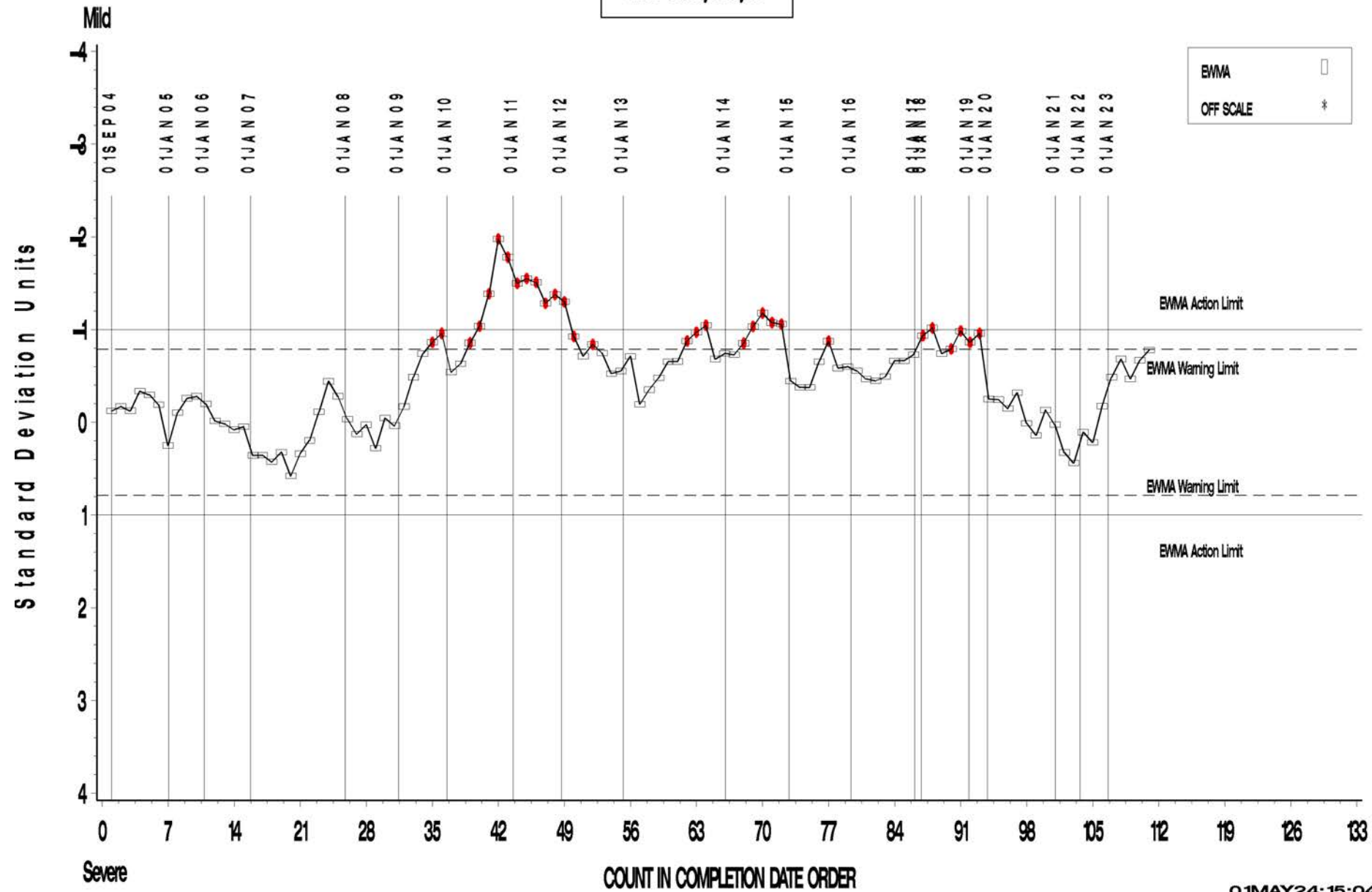
CROSSHEAD WEIGHT LOSS ADJUSTED TO 3.9 % SOOT

CUSUM Severity Analysis



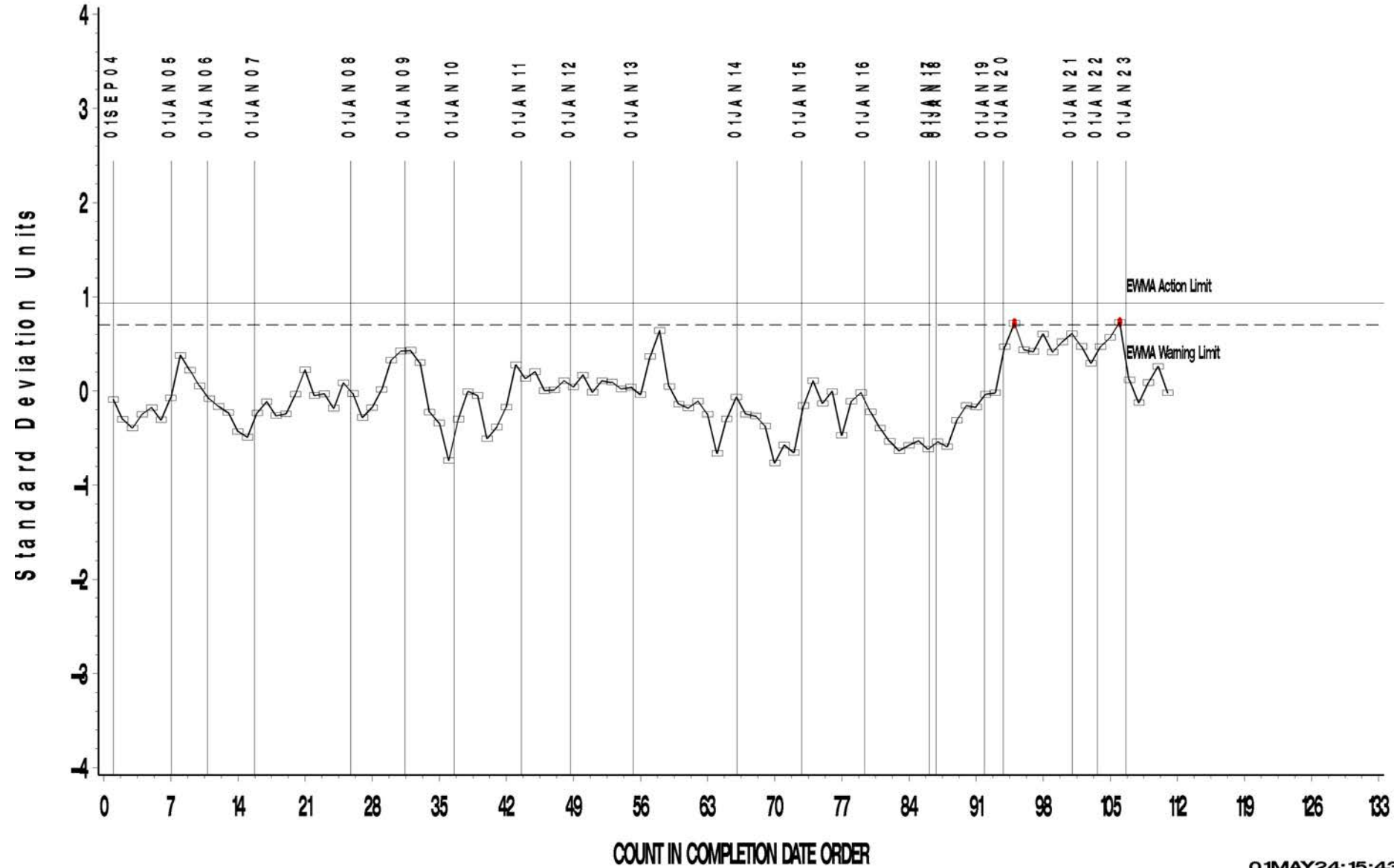
OIL FILTER DELTA PRESSURE

LTMS Severity Analysis



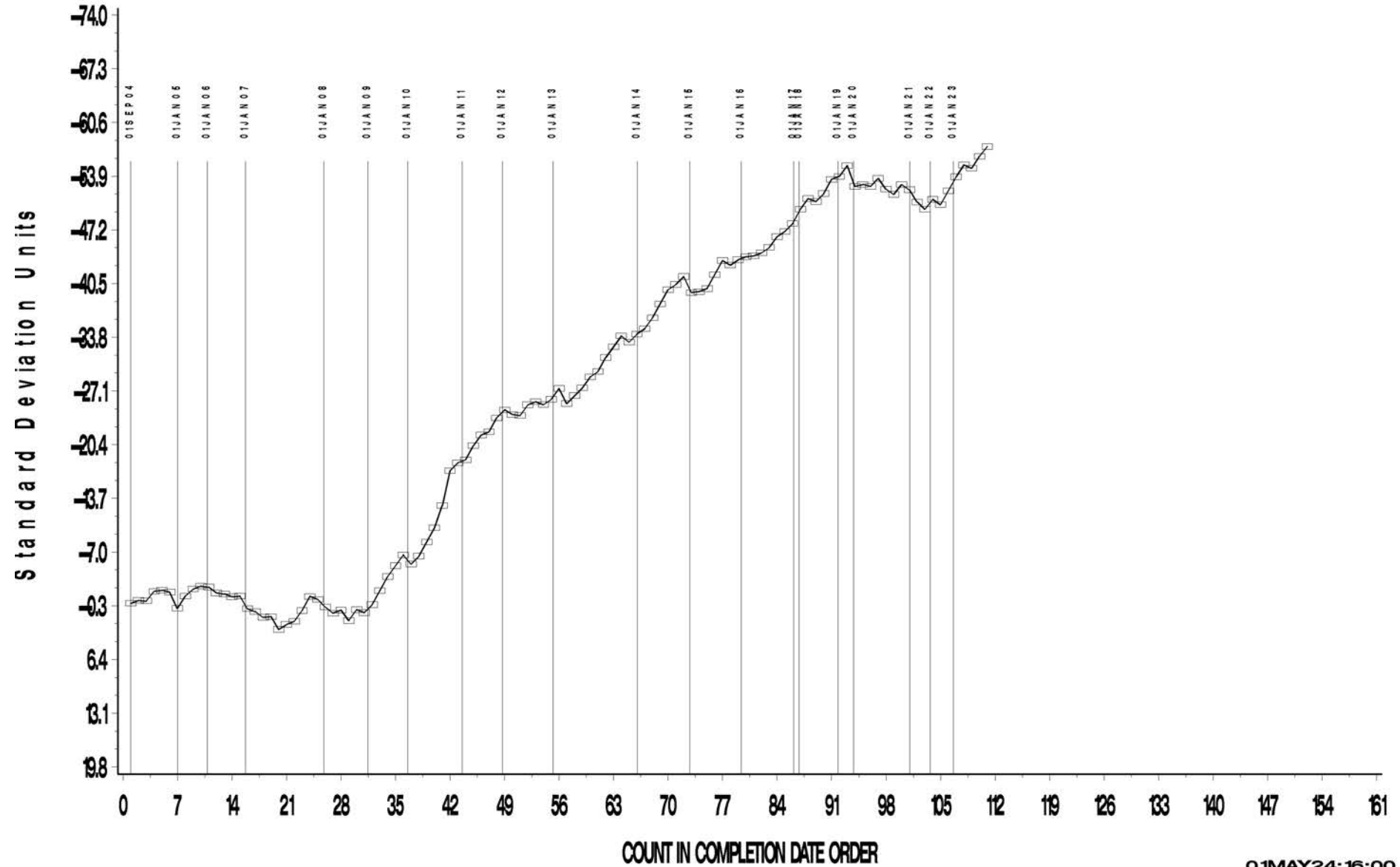
OIL FILTER DELTA PRESSURE

LTMS Precision Analysis



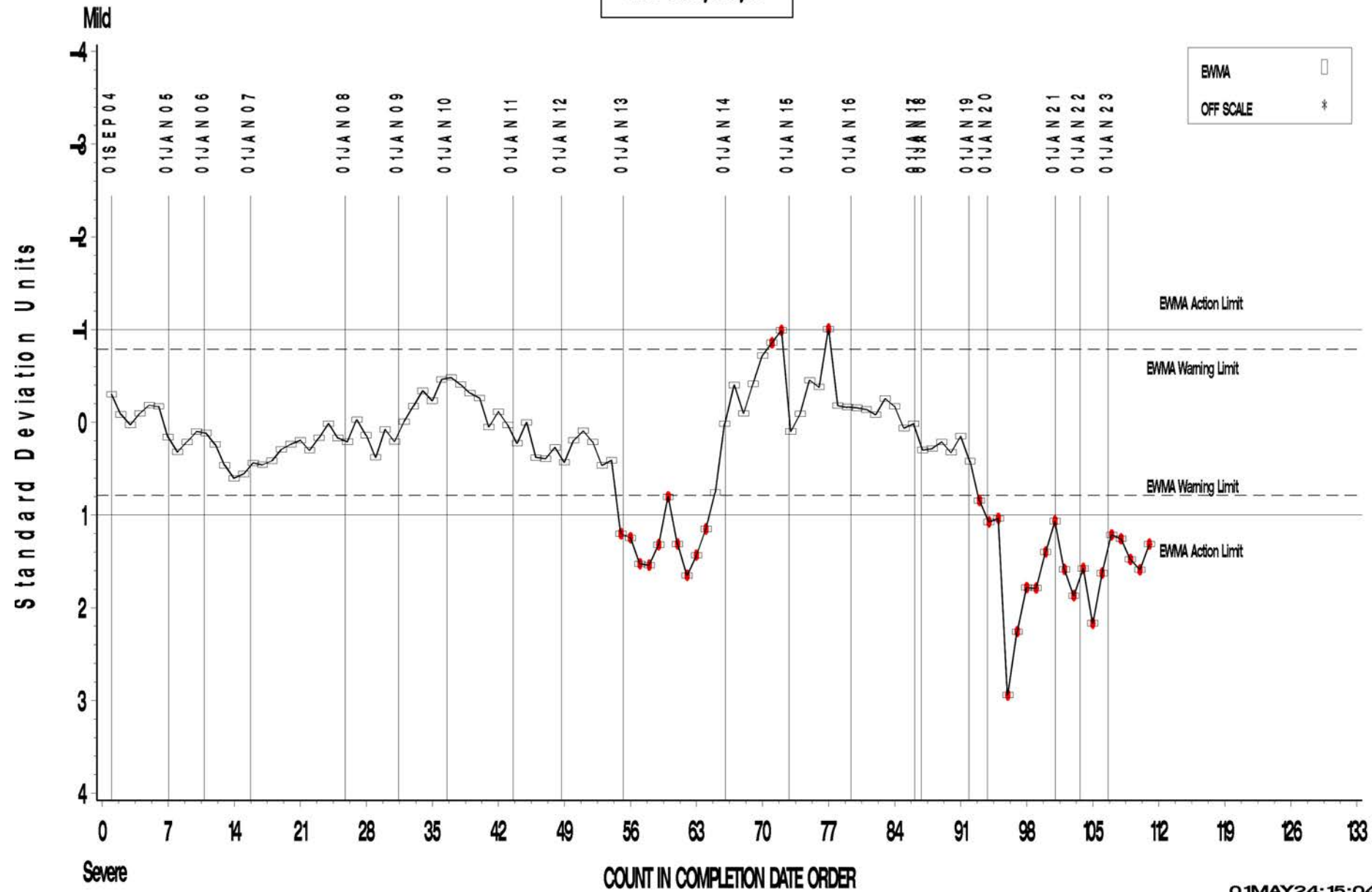
OIL FILTER DELTA PRESSURE

CUSUM Severity Analysis



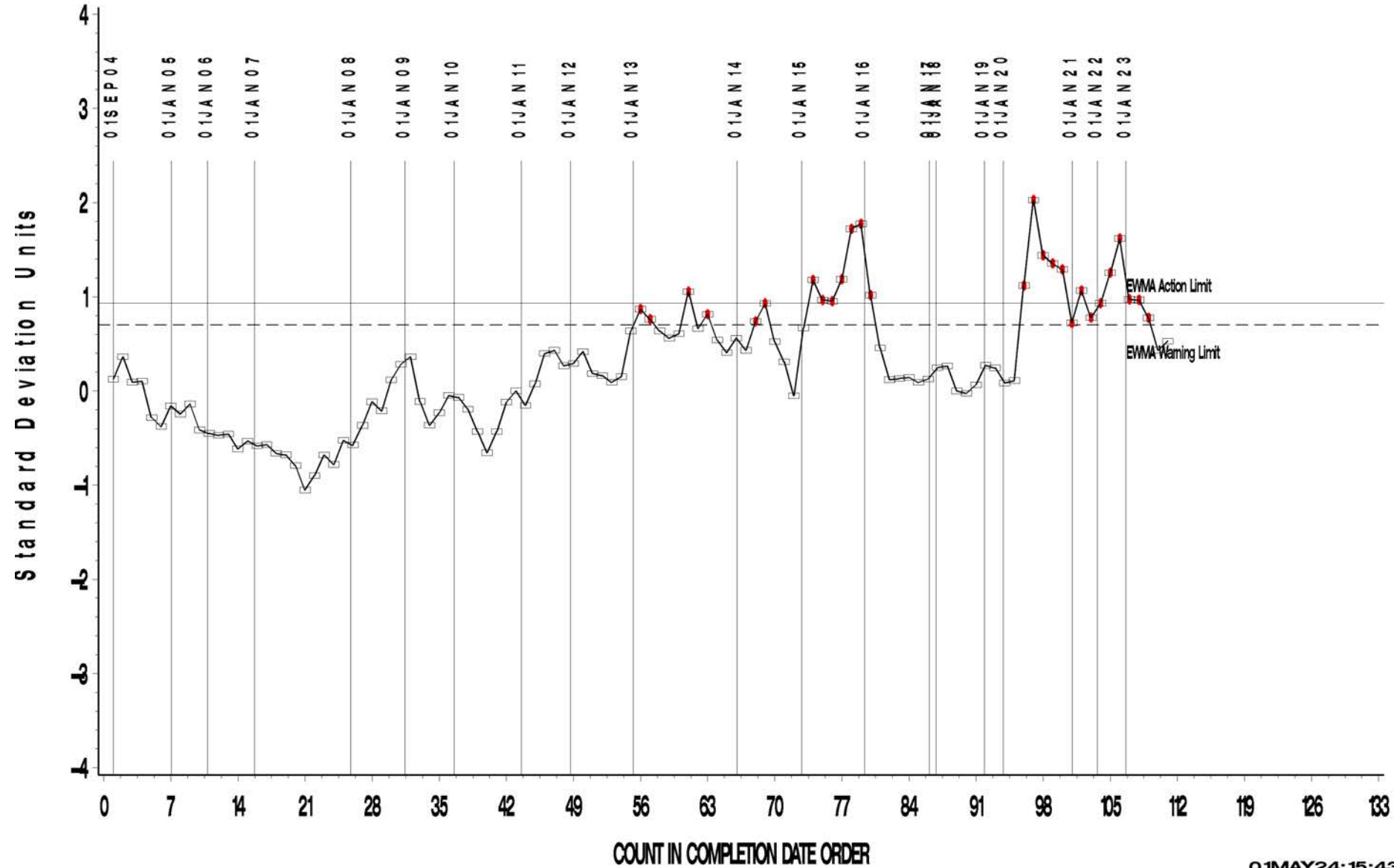
INJECTOR SCREW WEIGHT LOSS ADJUSTED TO 3.9% SOOT

LTMS Severity Analysis



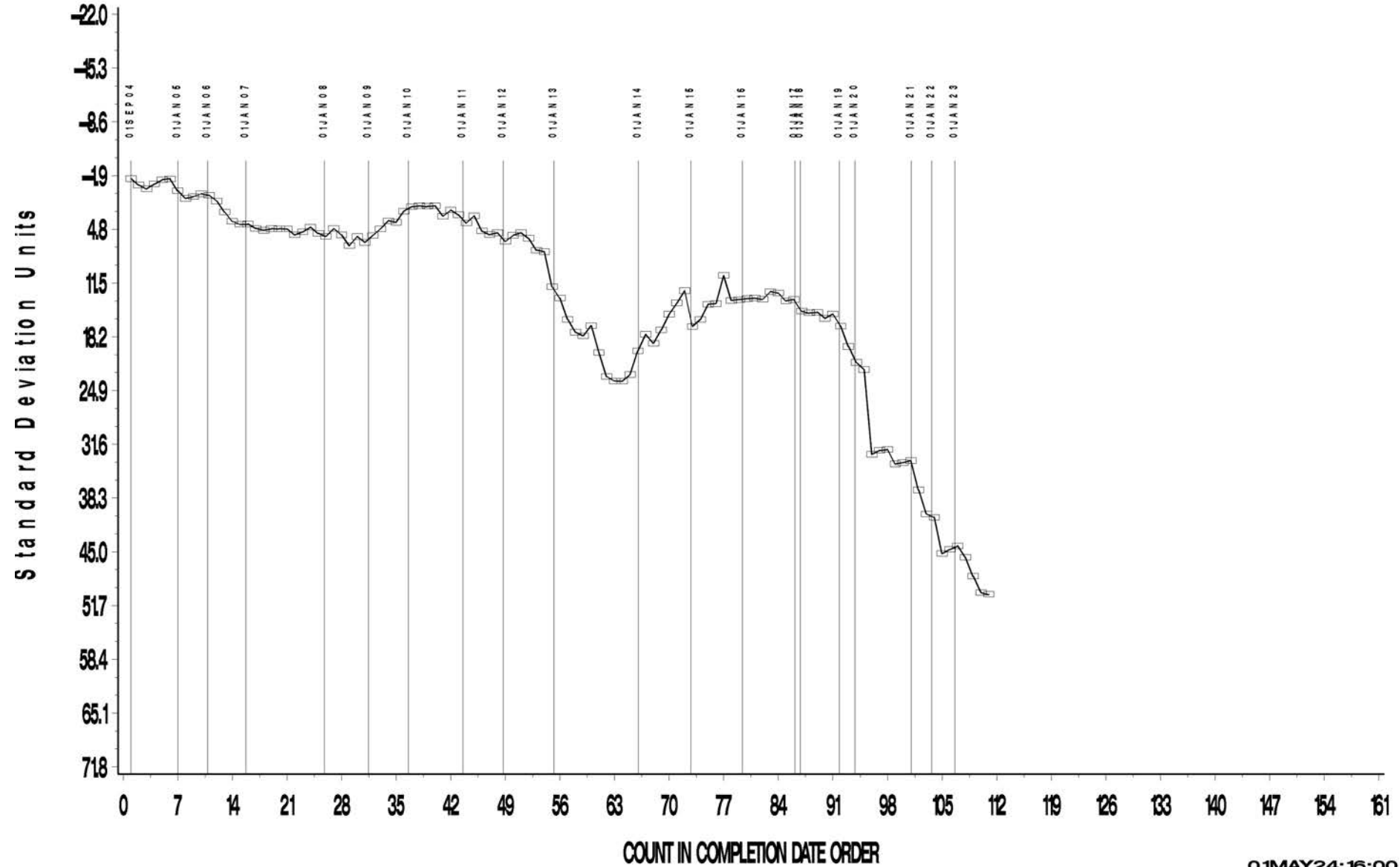
INJECTOR SCREW WEIGHT LOSS ADJUSTED TO 3.9% SOOT

LTMS Precision Analysis

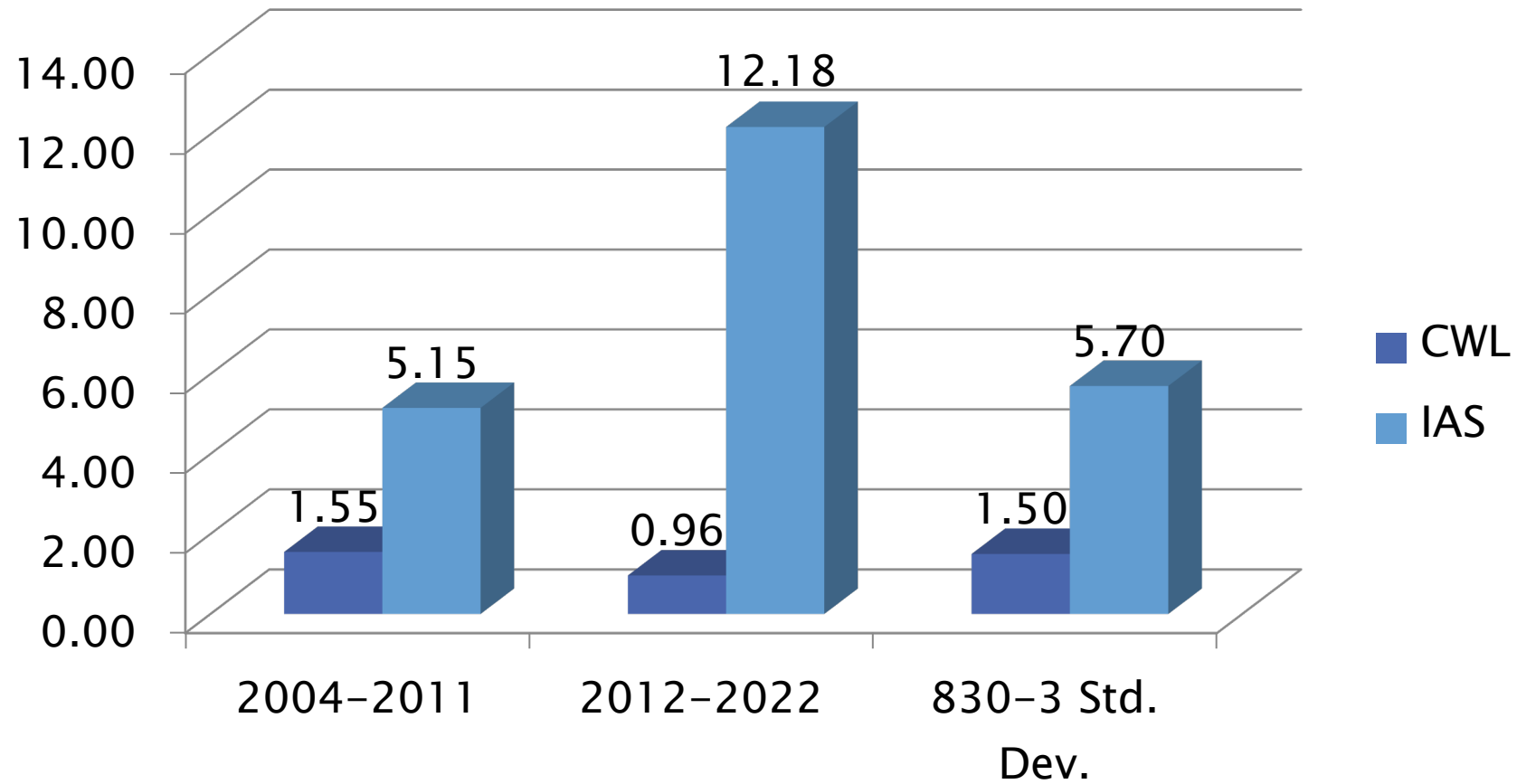


INJECTOR SCREW WEIGHT LOSS ADJUSTED TO 3.9% SOOT

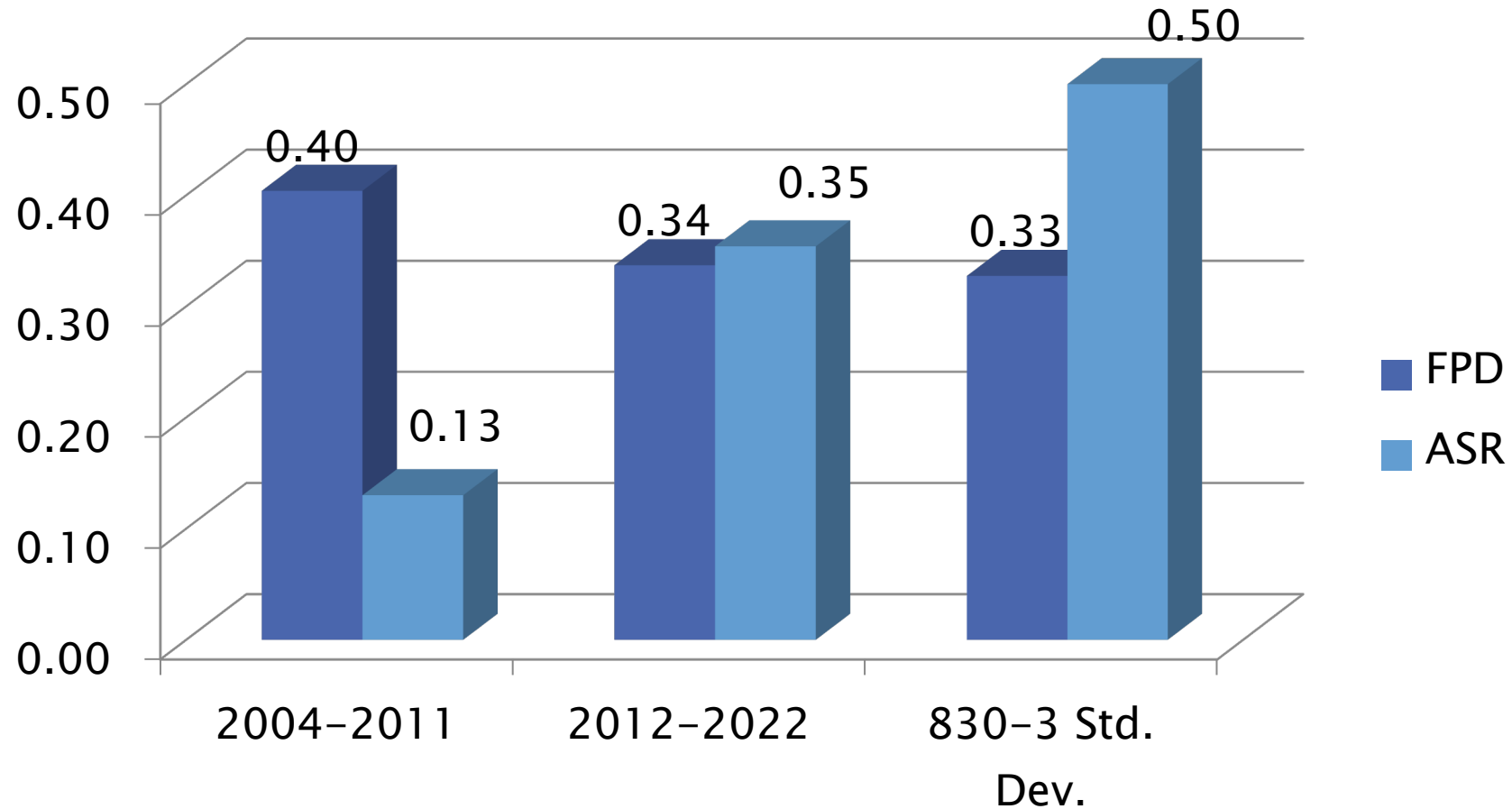
CUSUM Severity Analysis



ISM Precision Estimates



ISM Precision Estimates



[Return to Table of Contents](#)

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



RFWT

»» April 2024

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



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RFWT Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	0
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	0
Total		0

RFWT Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

RFWT Lost Tests*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		0

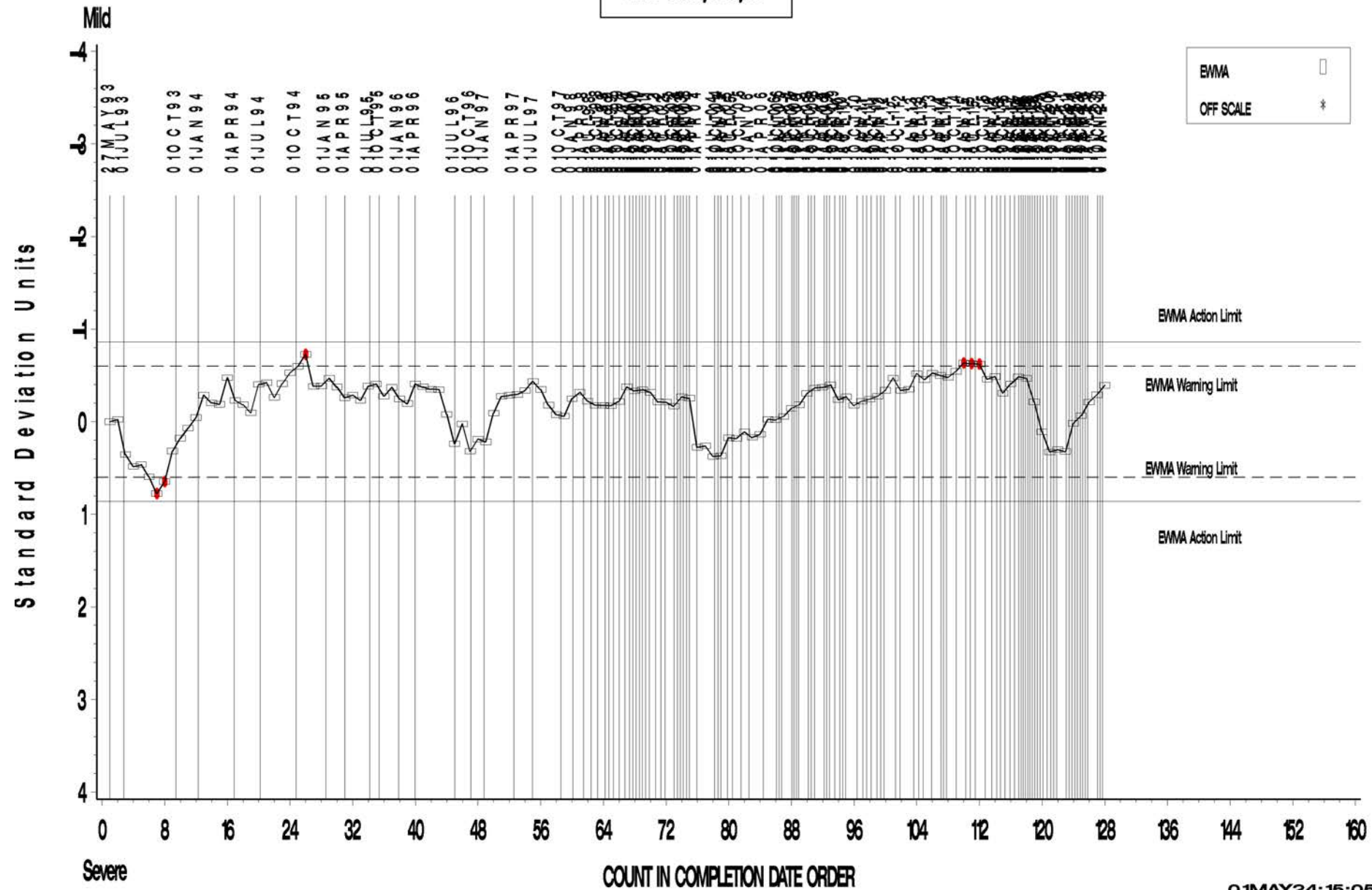
*Invalid and aborted tests

RFWT Test Severity

- ▶ As no chartable RFWT tests were run during this reporting period, no statement about test severity can be made.

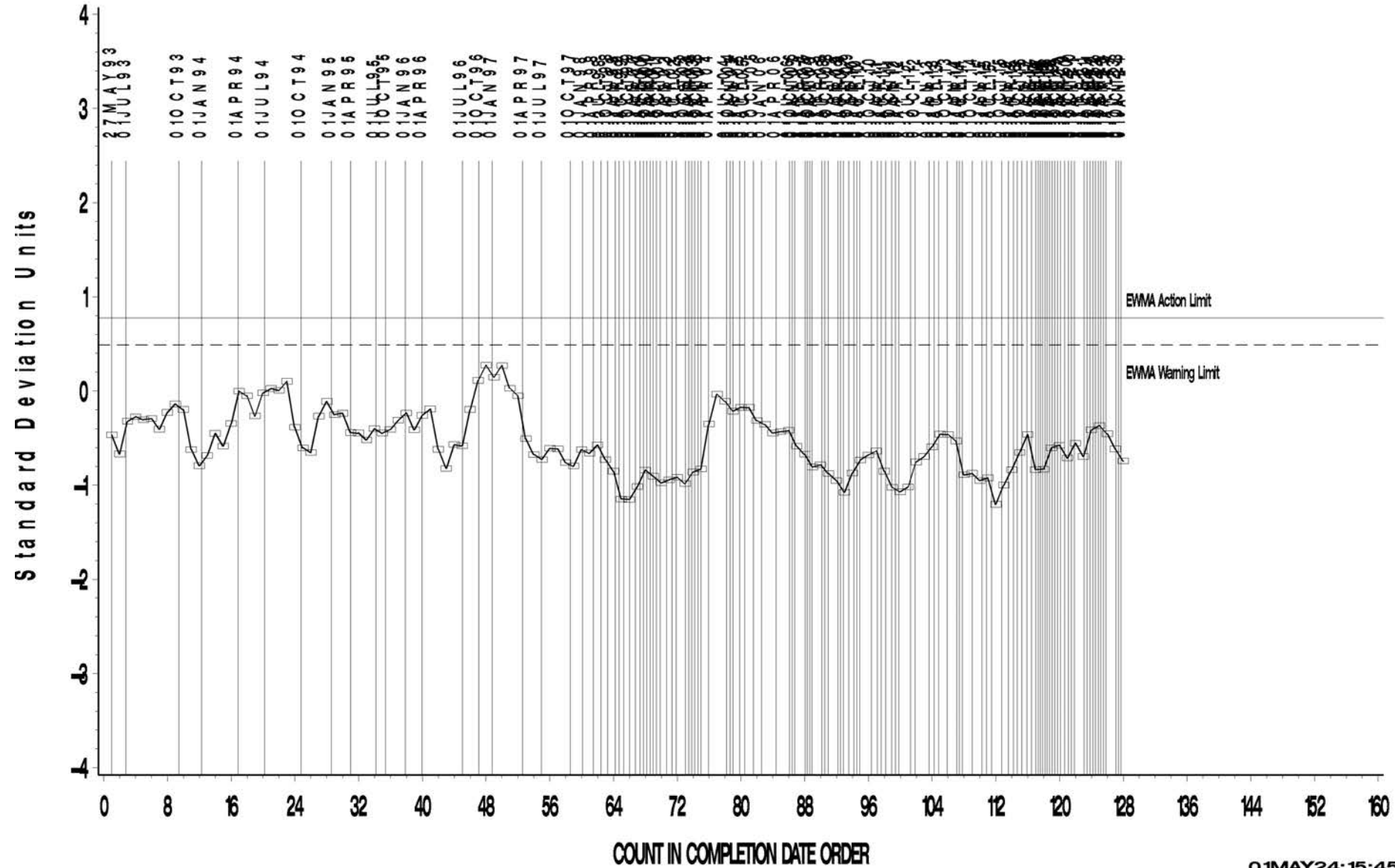
Average Follower Wear

LTMS Severity Analysis



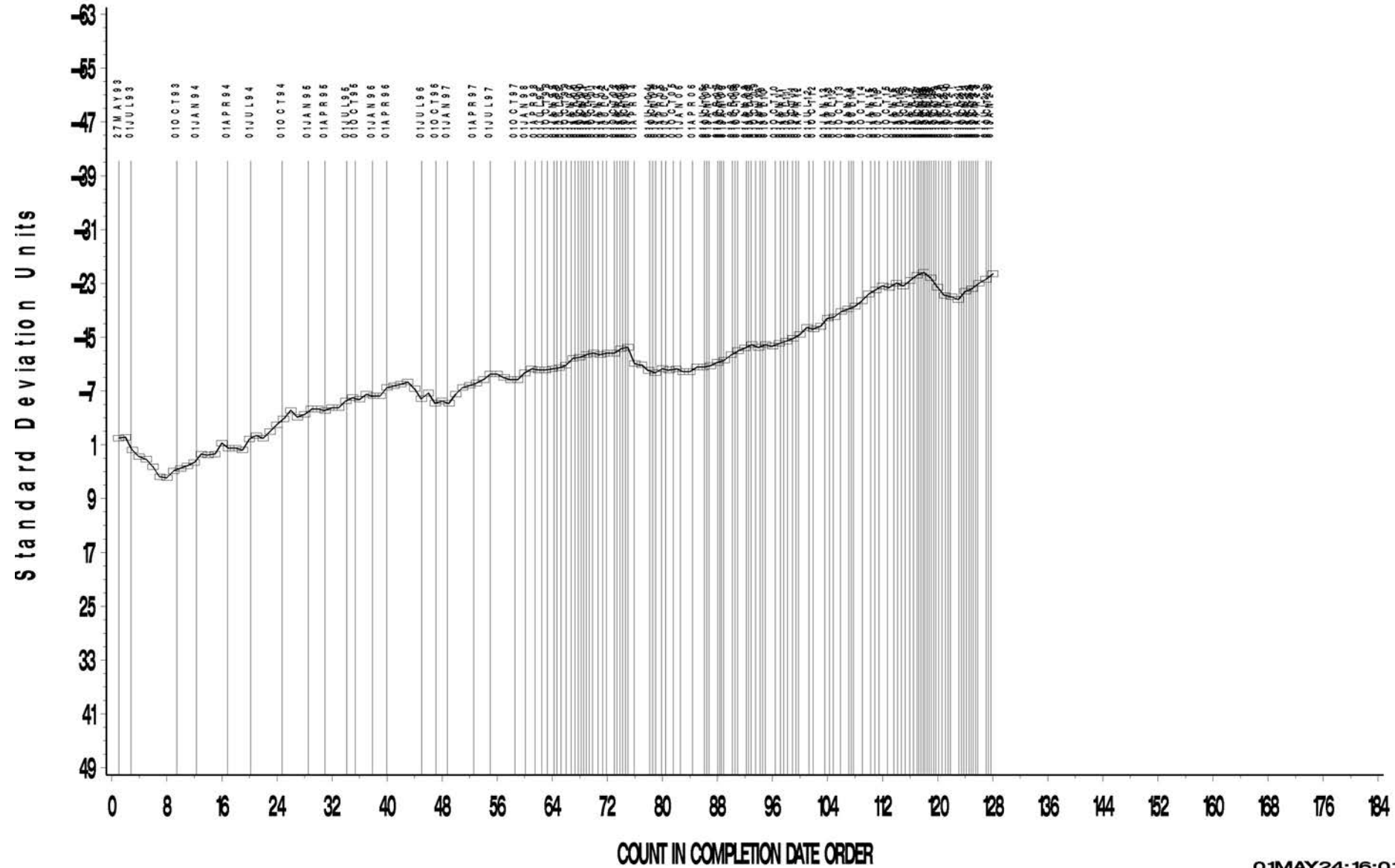
Average Follower Wear

LTMS Precision Analysis



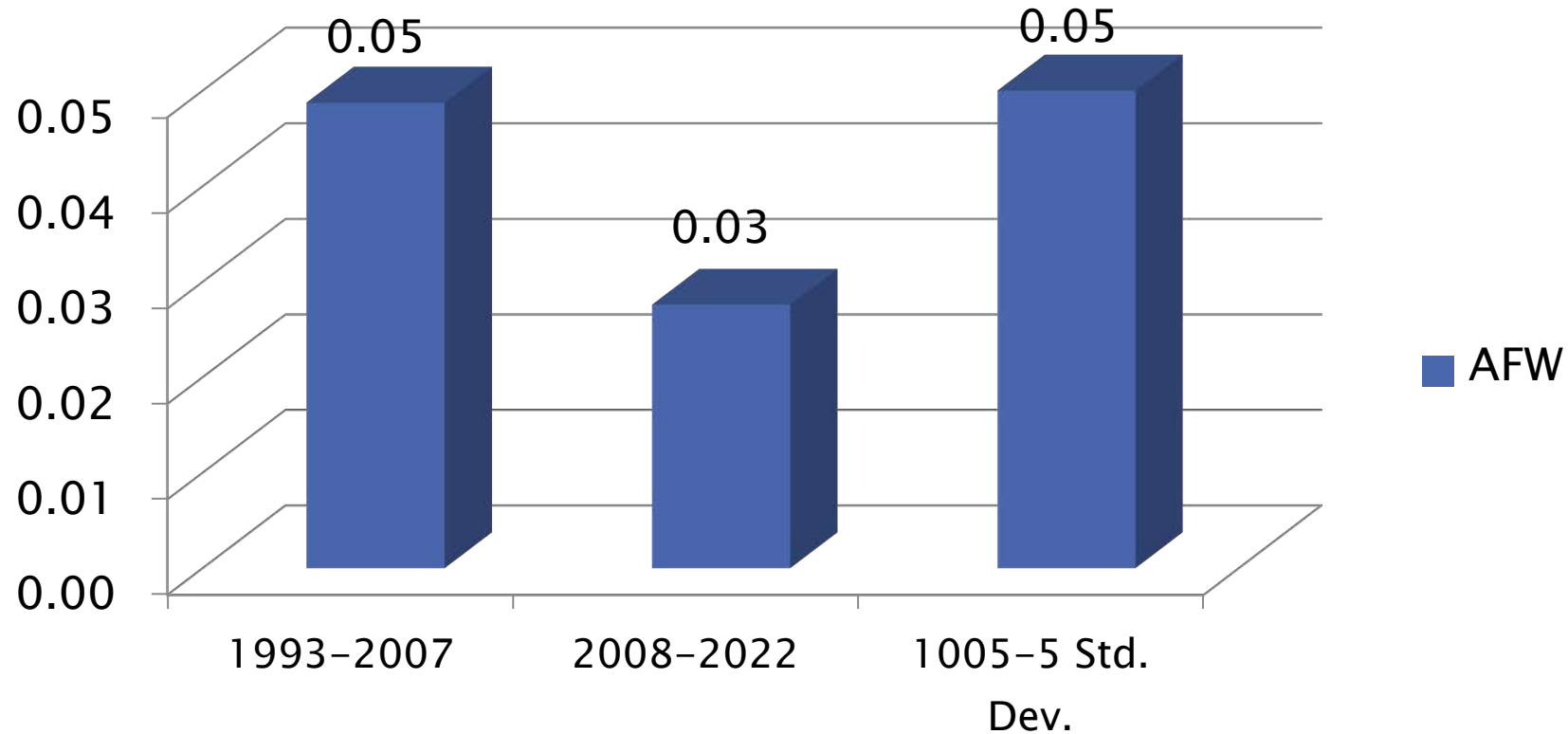
Average Follower Wear

CUSUM Severity Analysis



RFWT Precision Estimates

AFW



[Return to Table of Contents](#)

Test Monitoring Center
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Mack T-8/T-8E

»» April 2024

Test Monitoring Center
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T-8/T-8E Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	2
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	0
Total		2

T-8/T8-E Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

T-8/T8-E Lost Tests*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		0

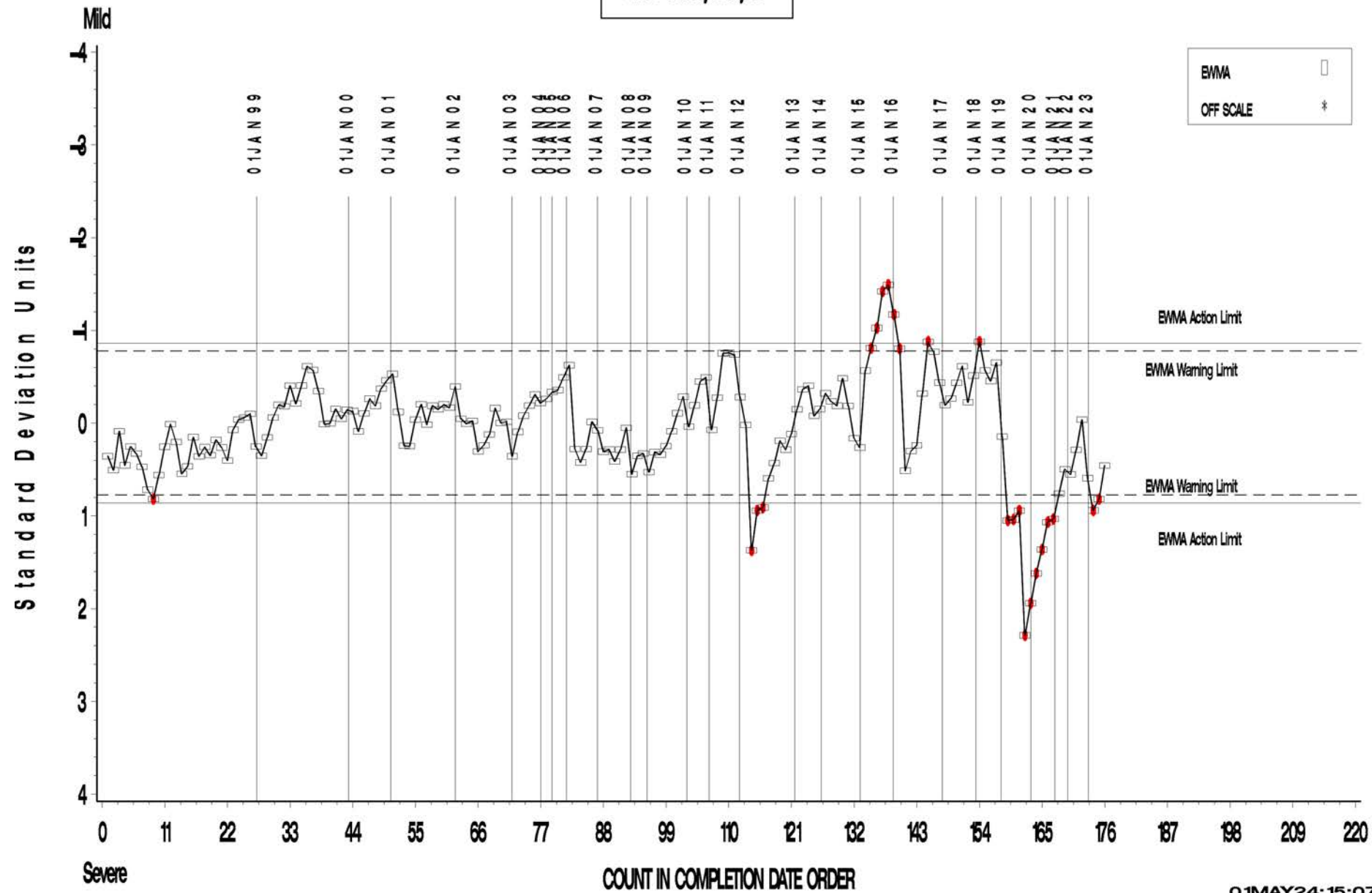
*Invalid and aborted tests

T-8/T-8E Test Severity

- ▶ VI38 is in level 2 Zi alarm in mild direction.
- ▶ RV2 and RV48 are in control.

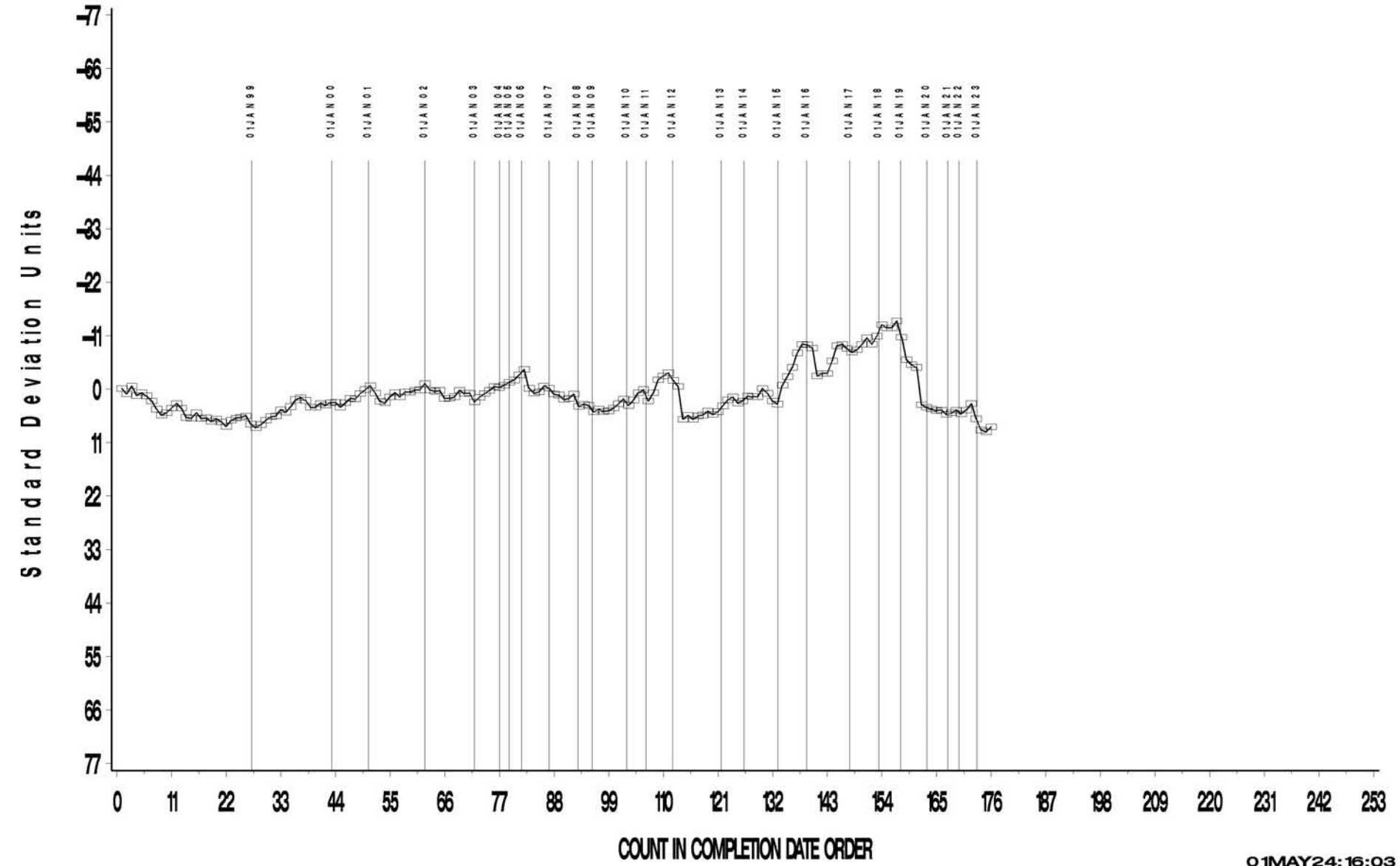
RELATIVE VISCOSITY @ 4.8% (100% LOSS)

LTMS Severity Analysis



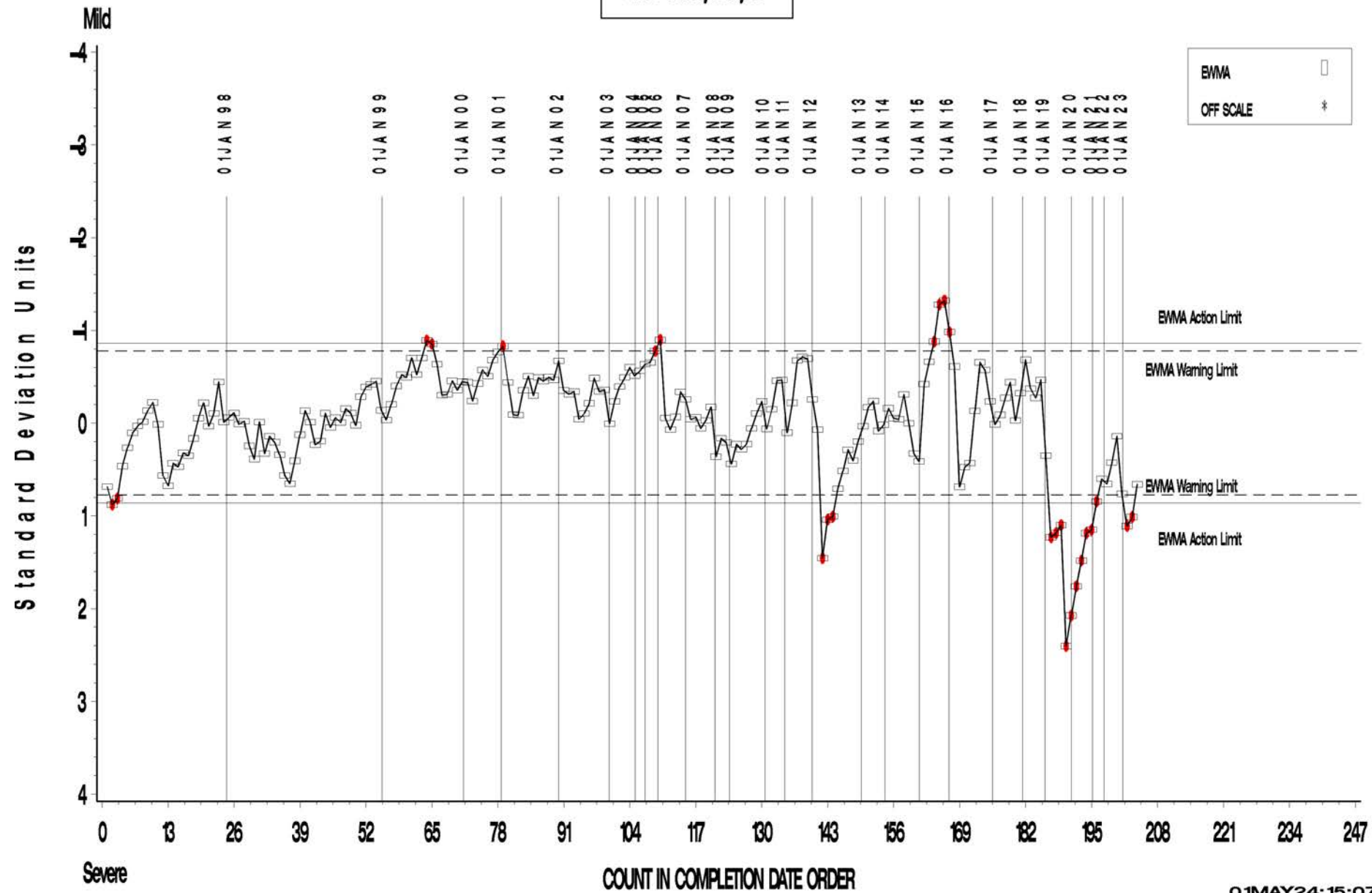
RELATIVE VISCOSITY @ 4.8% (100% LOSS)

CUSUM Severity Analysis



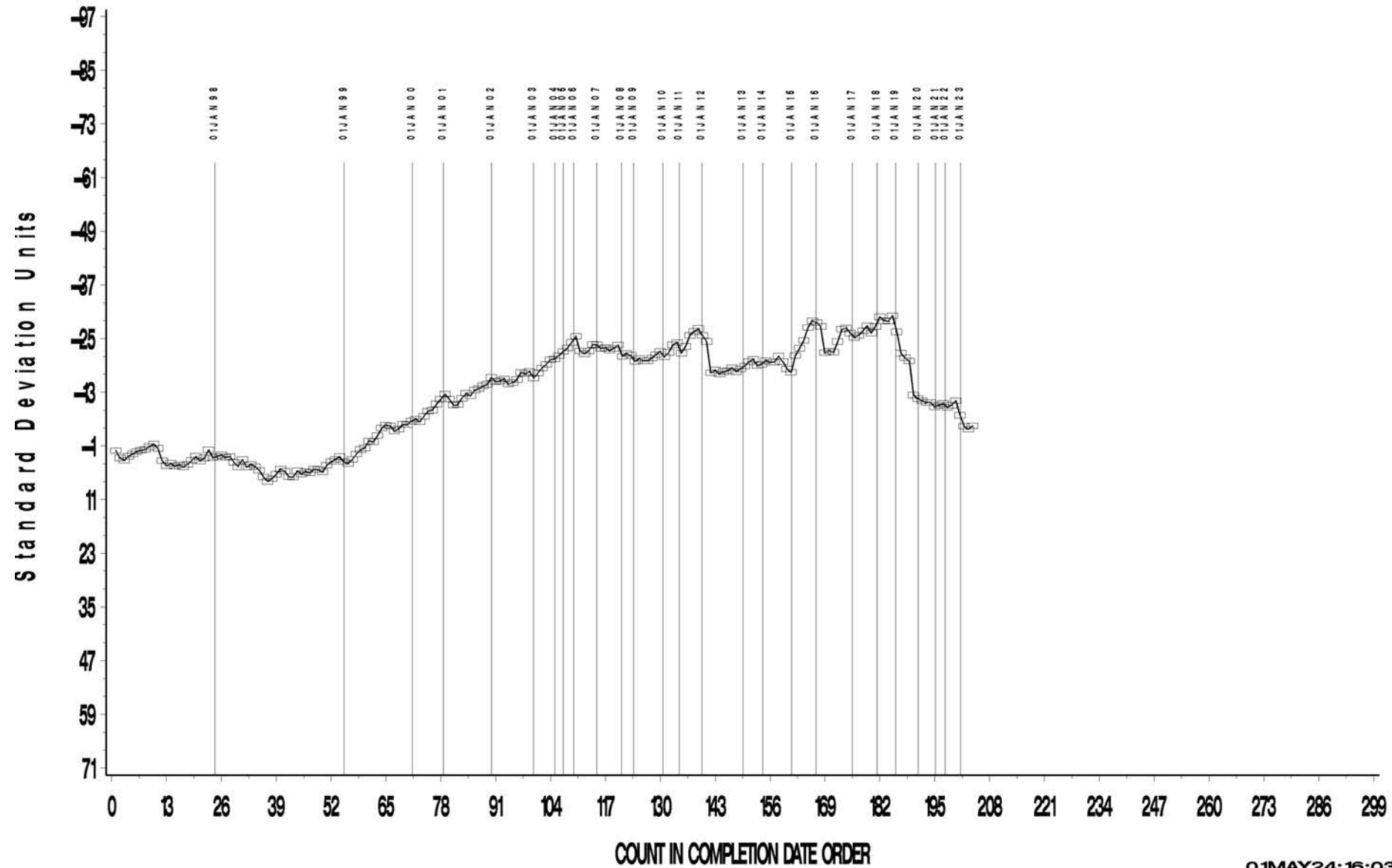
RELATIVE VISCOSITY @ 4.8% (50% LOSS)

LTMS Severity Analysis



RELATIVE VISCOSITY @ 4.8% (50% LOSS)

CUSUM Severity Analysis

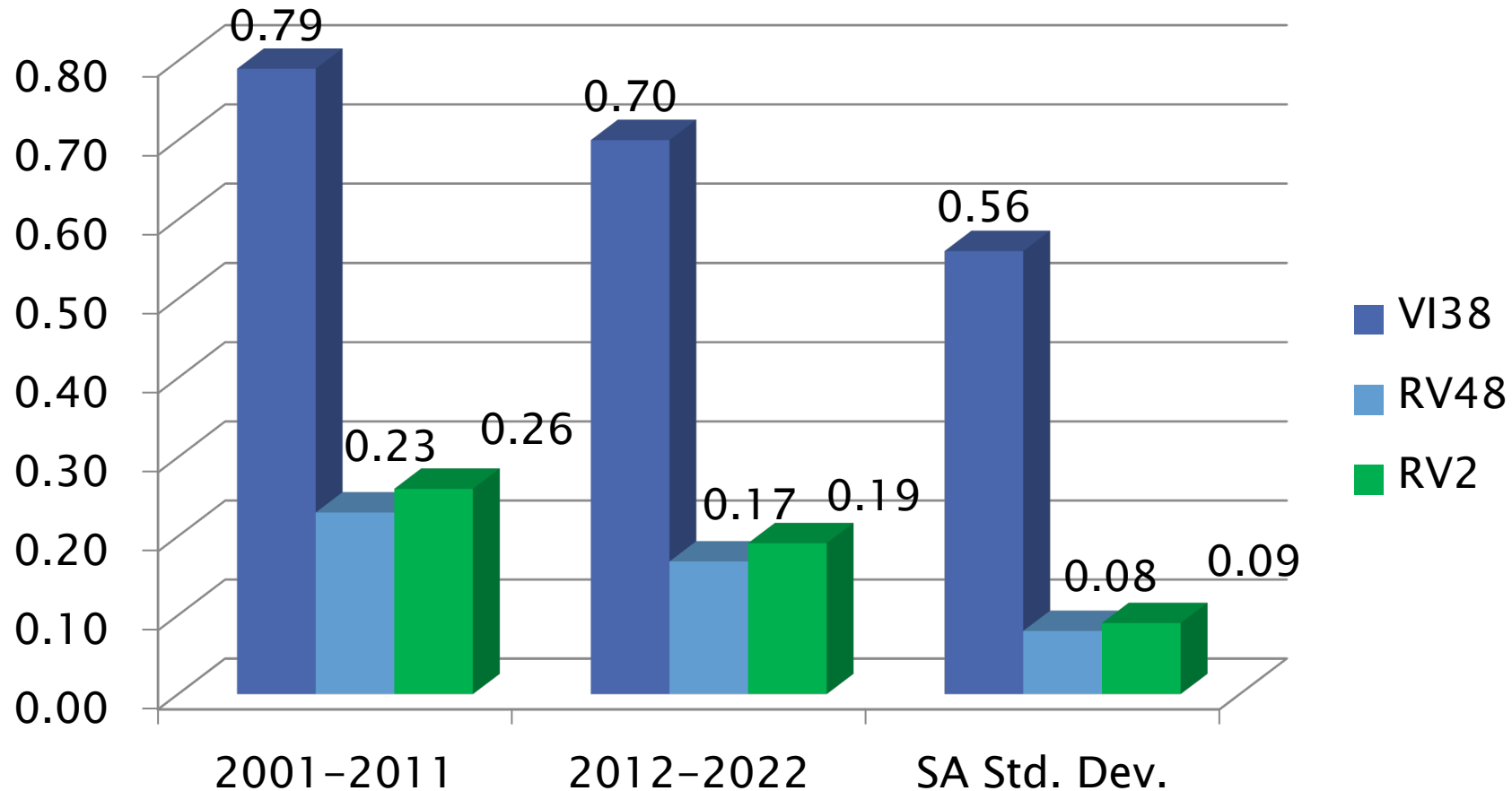


VISCOSITY INCR @ 3.8% SOOT

CUSUM Severity Analysis



T-8/E Precision Estimates



[Return to Table of Contents](#)

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



Mack T-11

»» April 2024

T-11 Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	2
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	0
Total		2

T-11 Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

T-11 Lost Tests*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		0

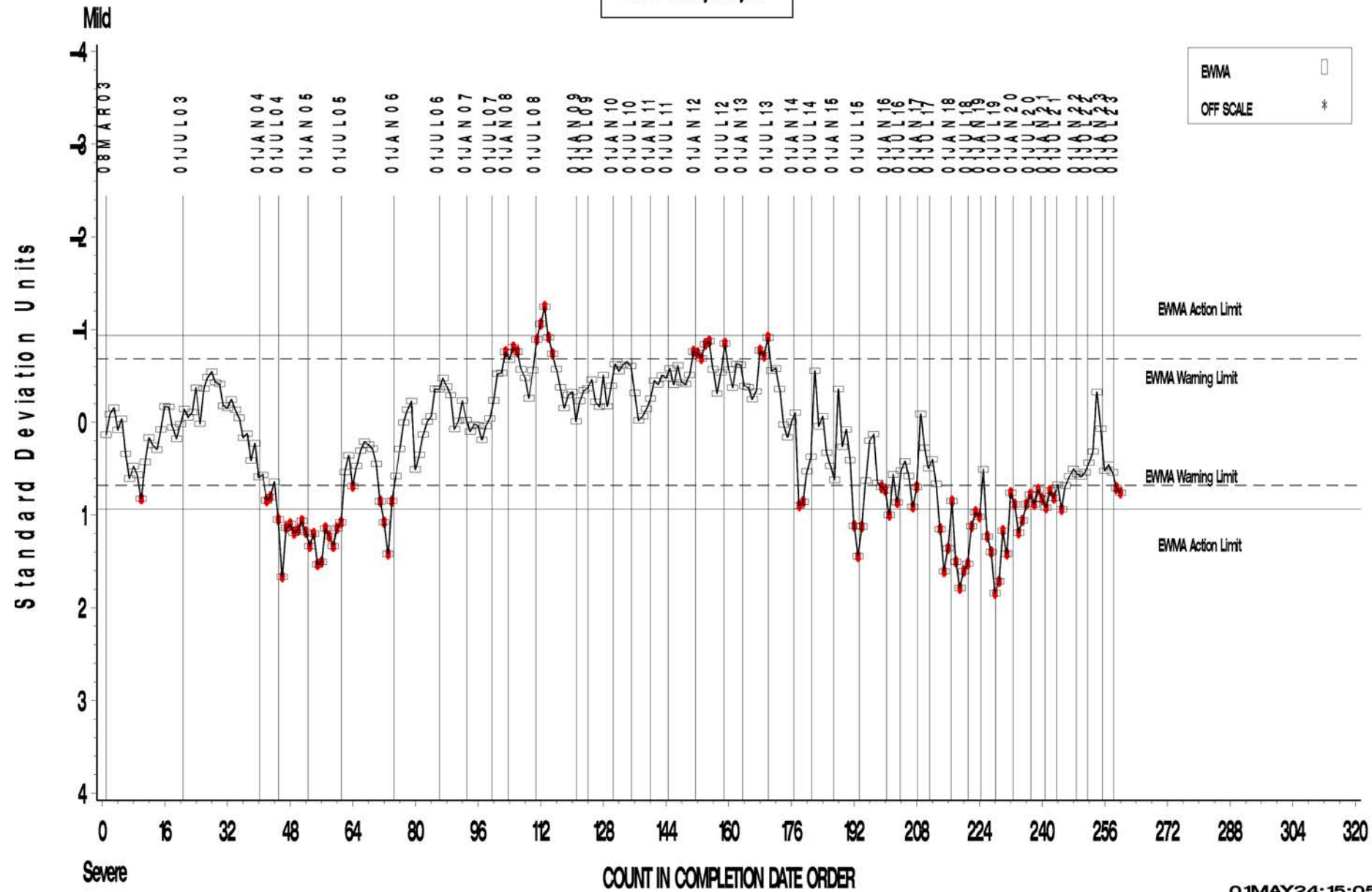
*Invalid and aborted tests

T-11 Test Severity

- ▶ SOOT and SOOT5 are in control.
- ▶ SOOT4 is in severity action alarm in the severe direction. SOOT4 also in precision action alarm.
- ▶ MRV is in severity warning alarm in the severe direction.

MRV VISCOSITY

LTMS Severity Analysis

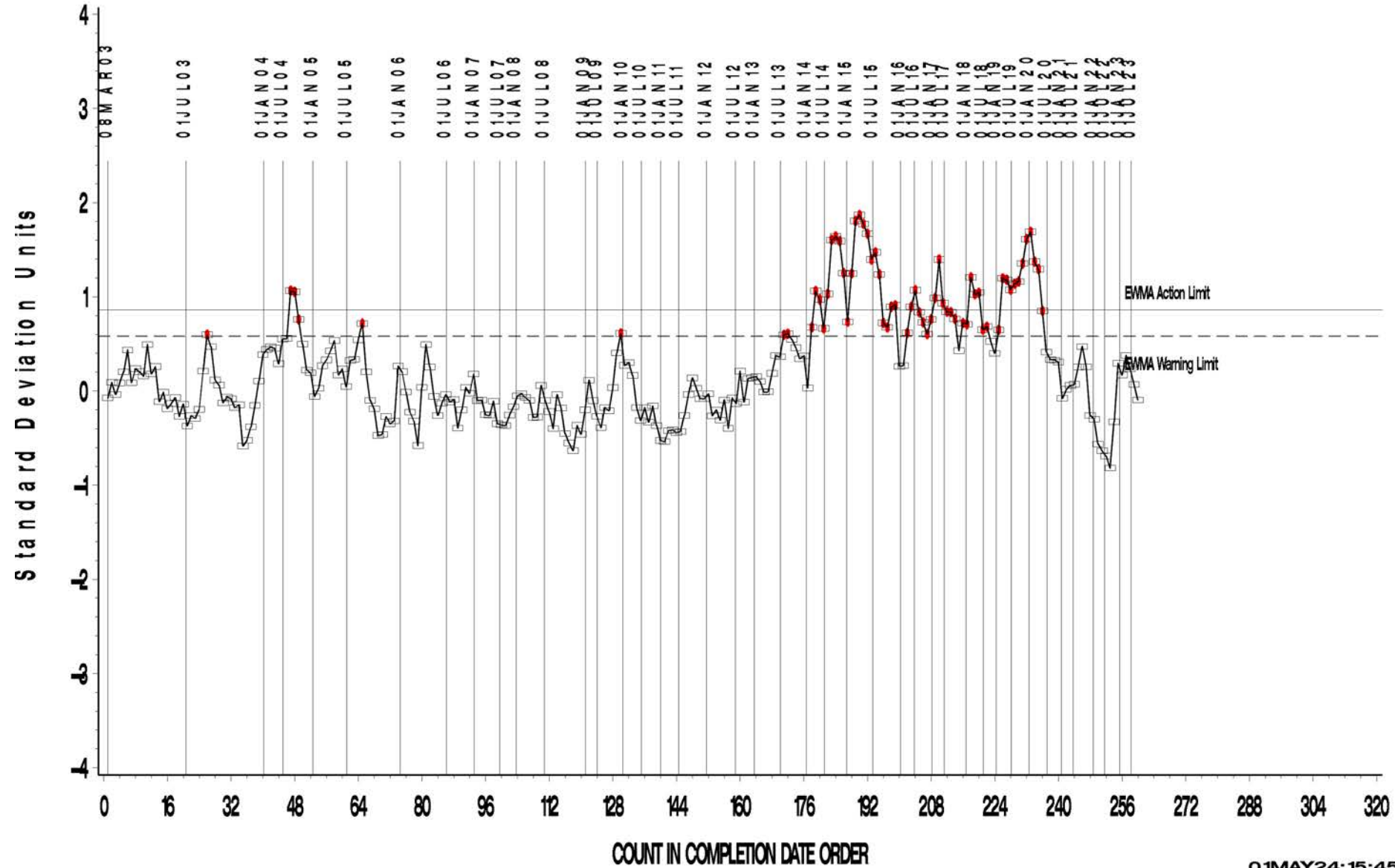


EWMA □
OFF SCALE *

EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit

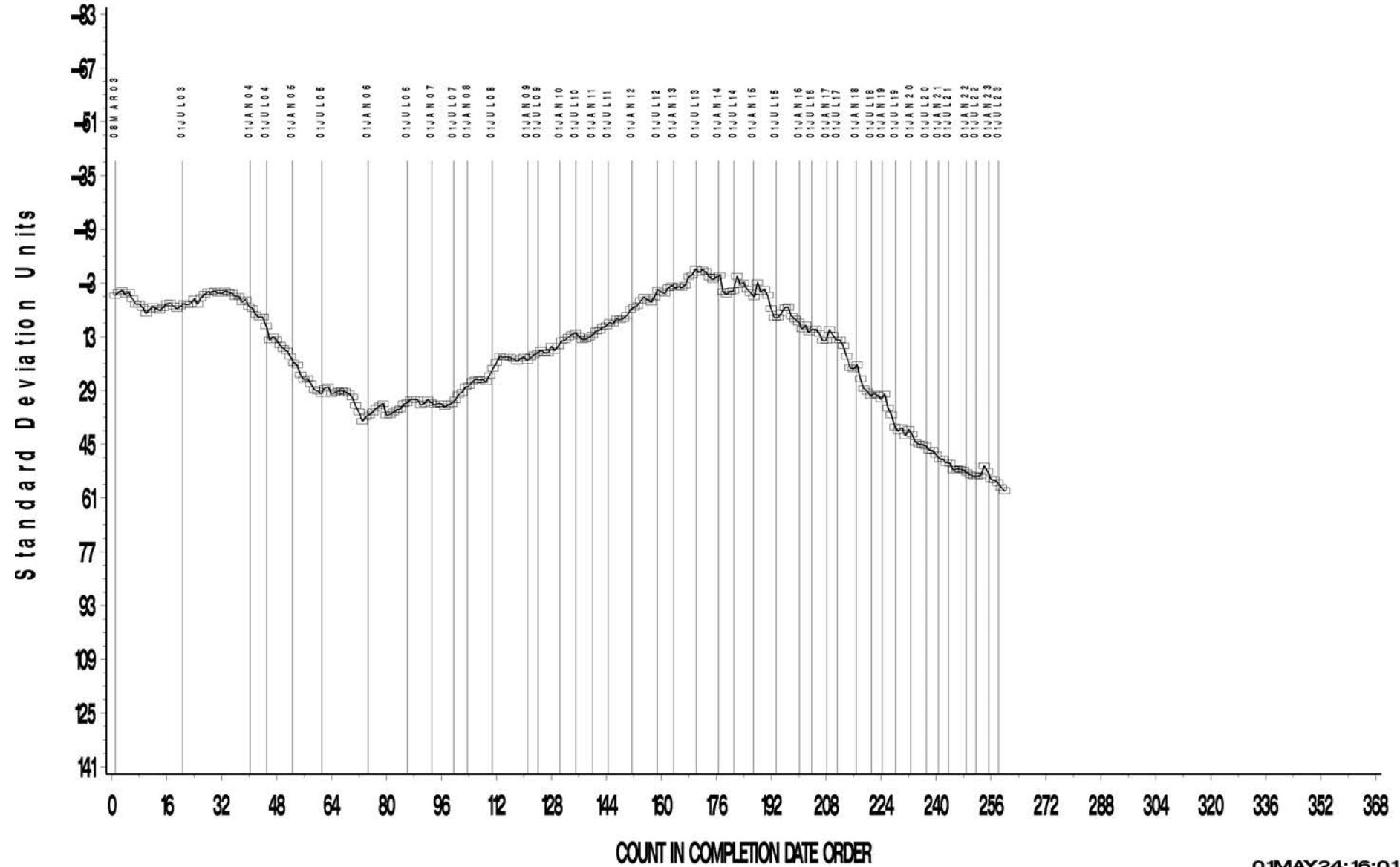
MRV VISCOSITY

LTMS Precision Analysis



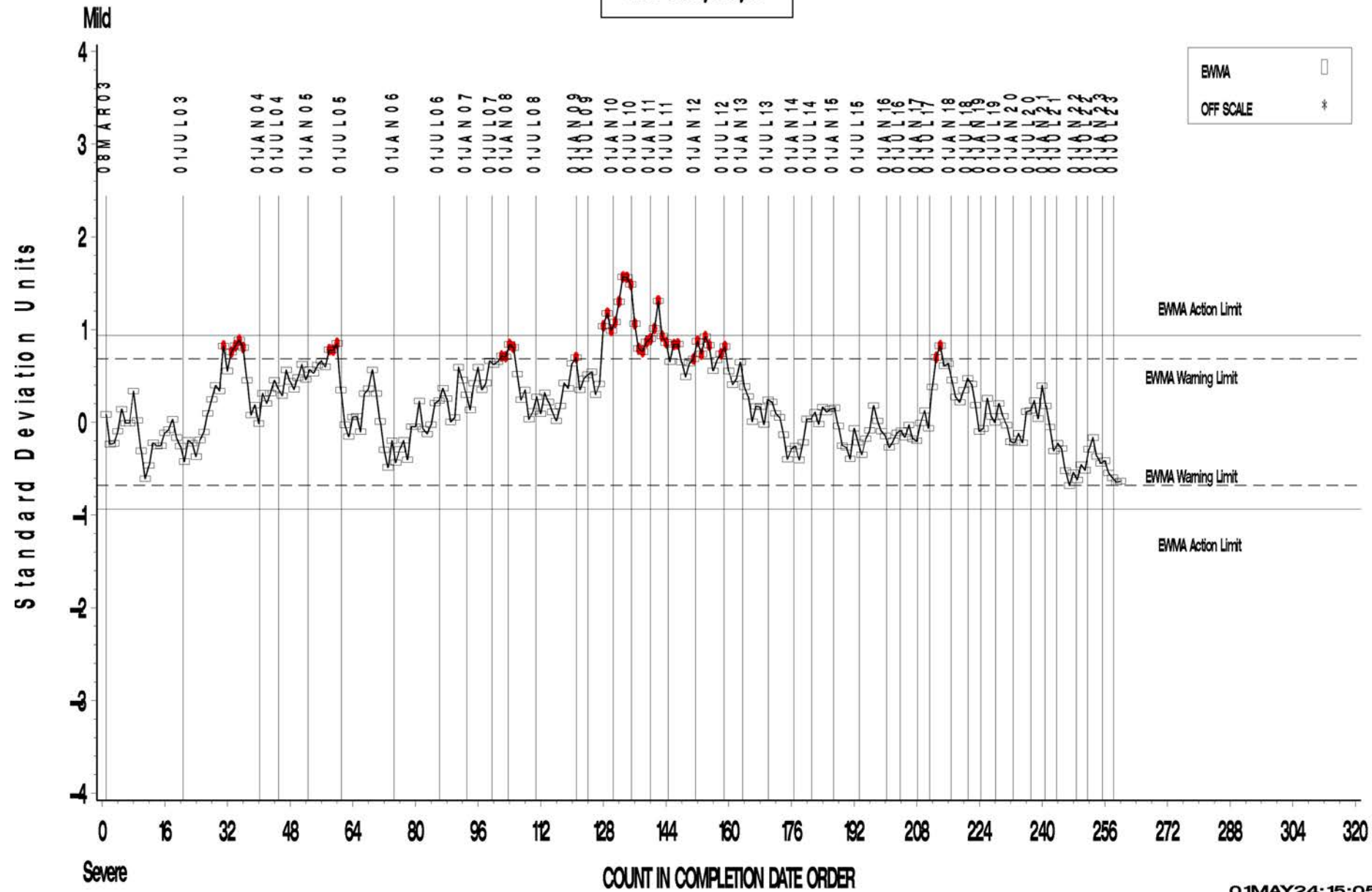
MRV VISCOSITY

CUSUM Severity Analysis



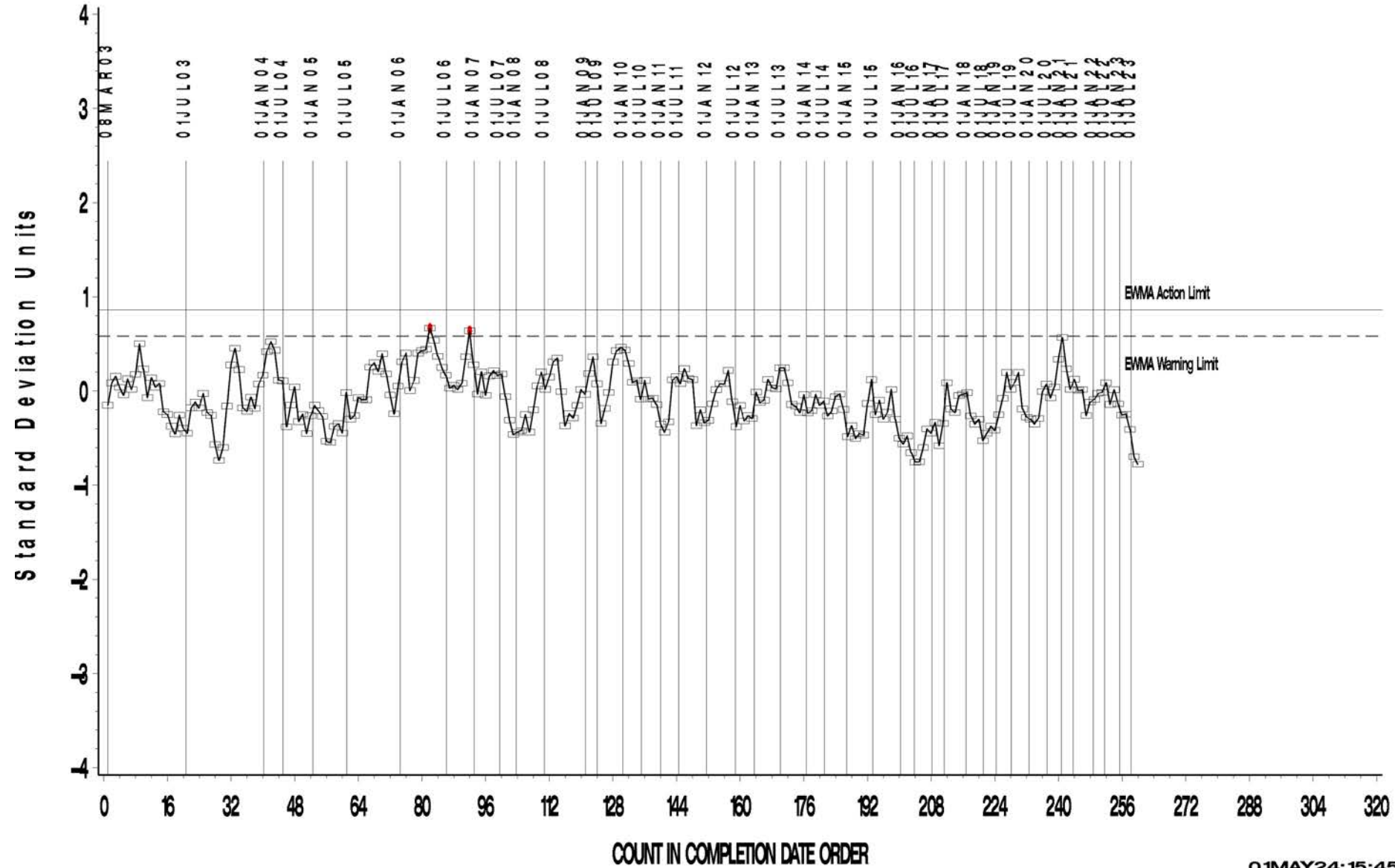
SOOT AT 12 cSt

LTMS Severity Analysis



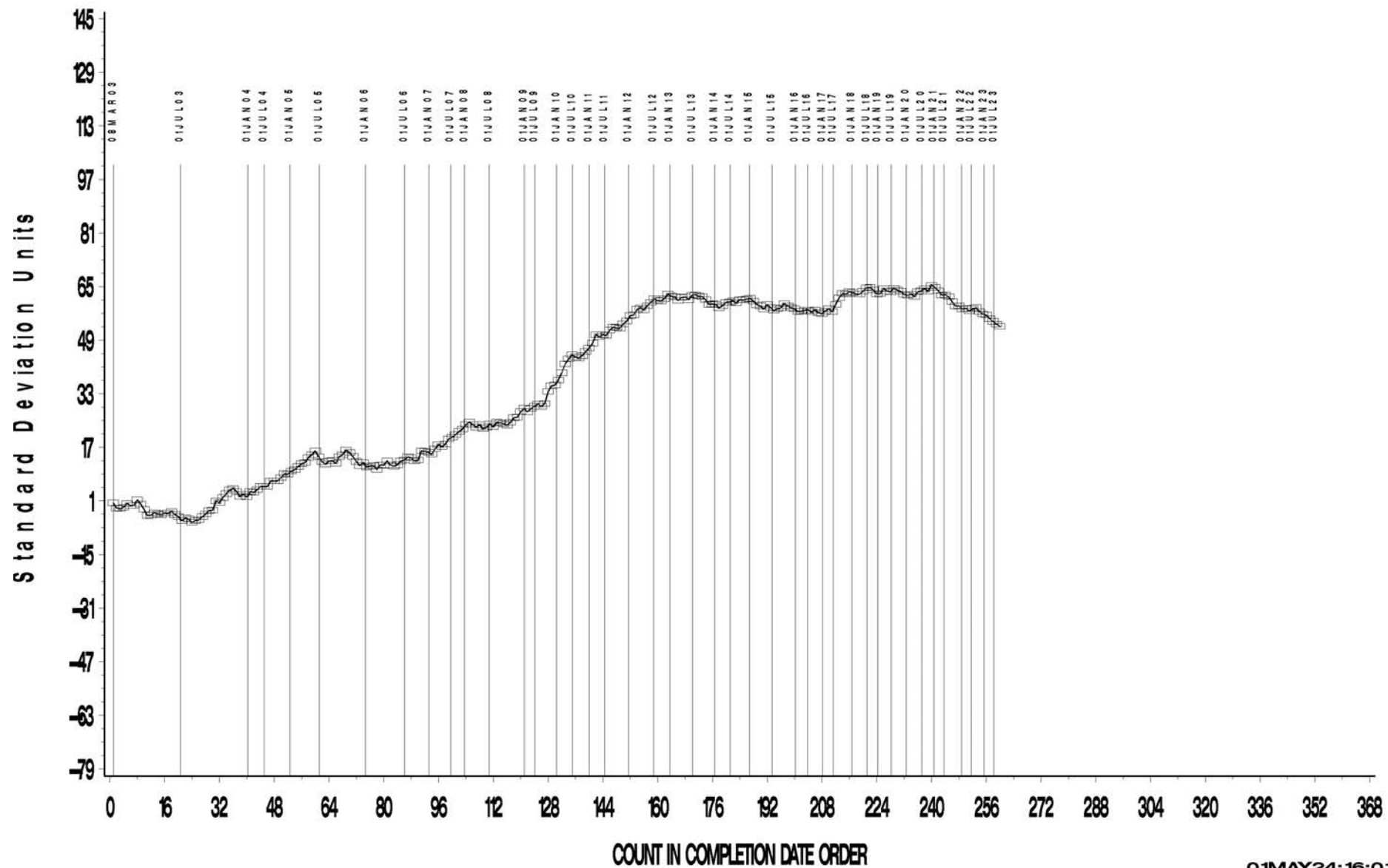
SOOT AT 12 cSt

LTMS Precision Analysis



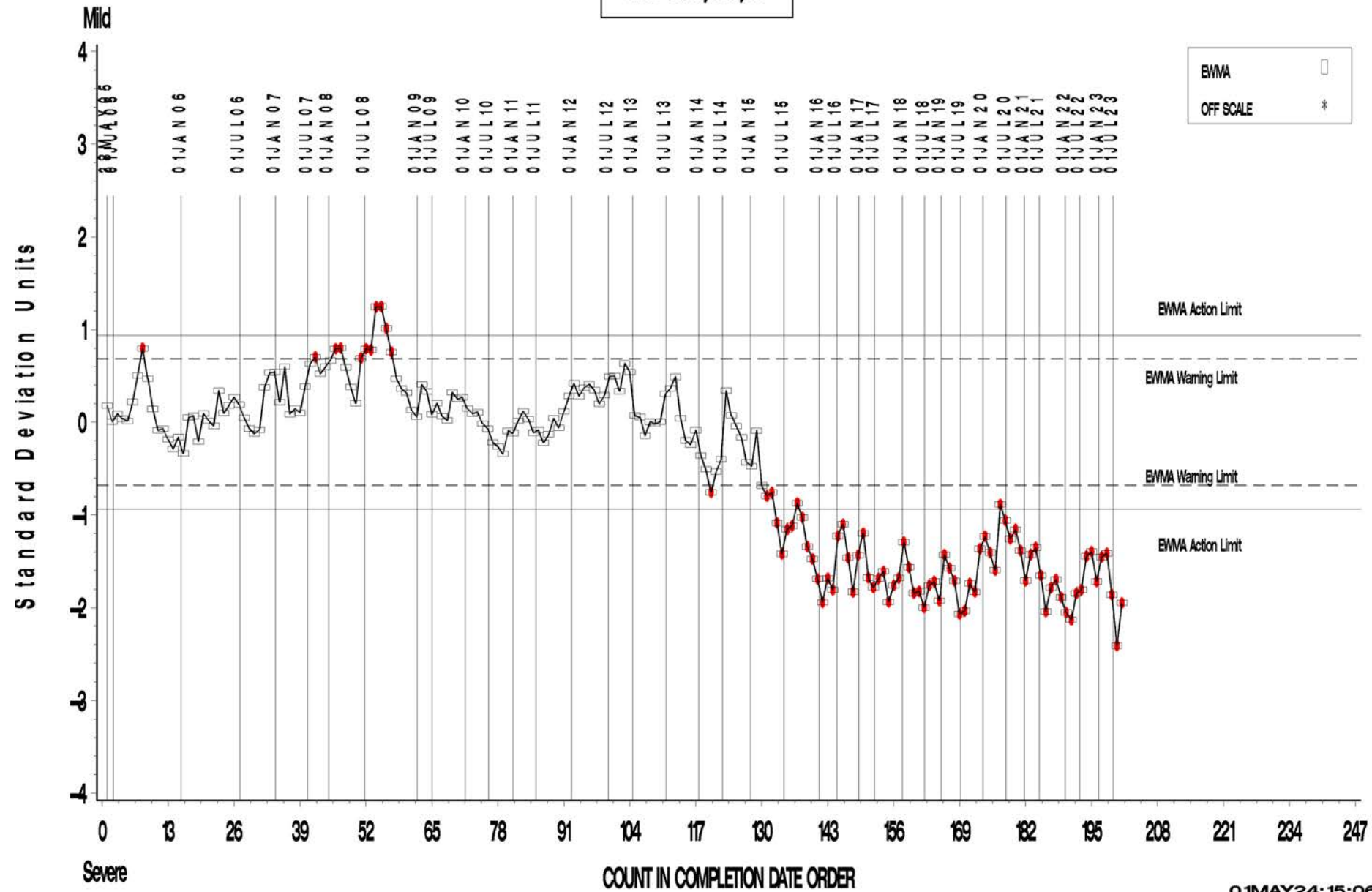
SOOT AT 12 cSt

CUSUM Severity Analysis



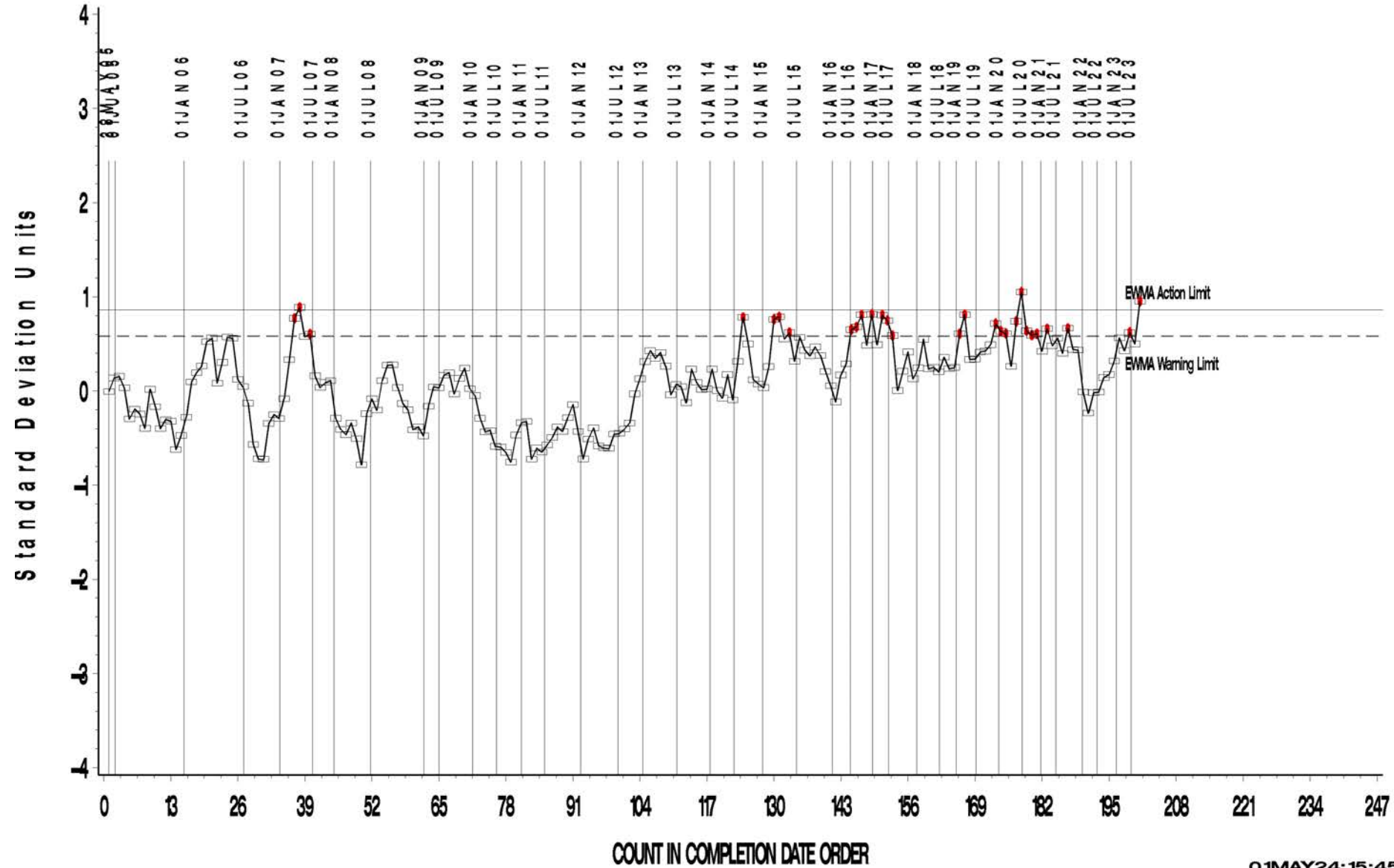
SOOT @ 4 cSt — FINAL RESULT

LTMS Severity Analysis



SOOT @ 4 cSt — FINAL RESULT

LTMS Precision Analysis



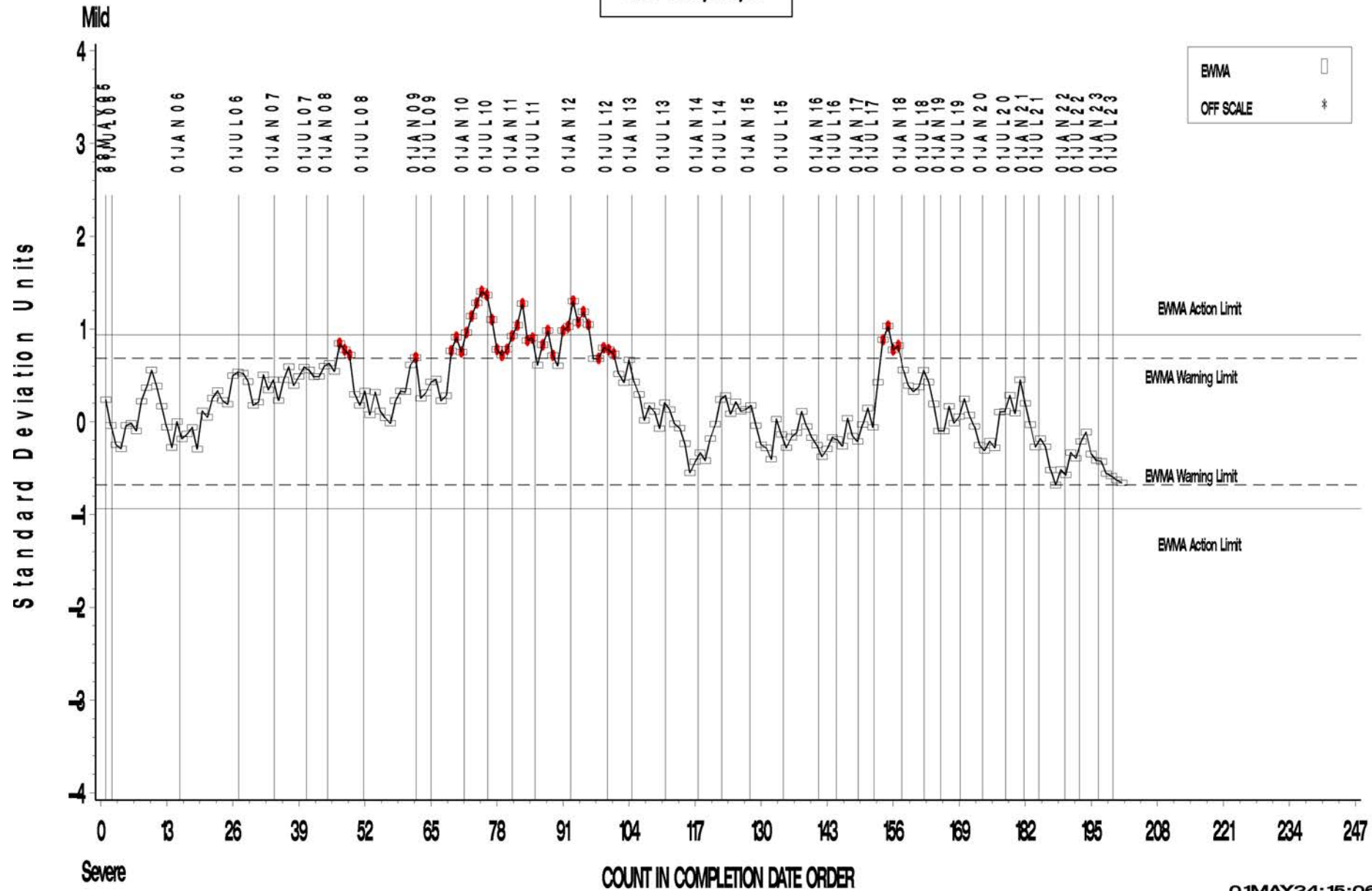
SOOT @ 4 cSt — FINAL RESULT

CUSUM Severity Analysis



SOOT @ 15 cSt — FINAL RESULT

LTMS Severity Analysis

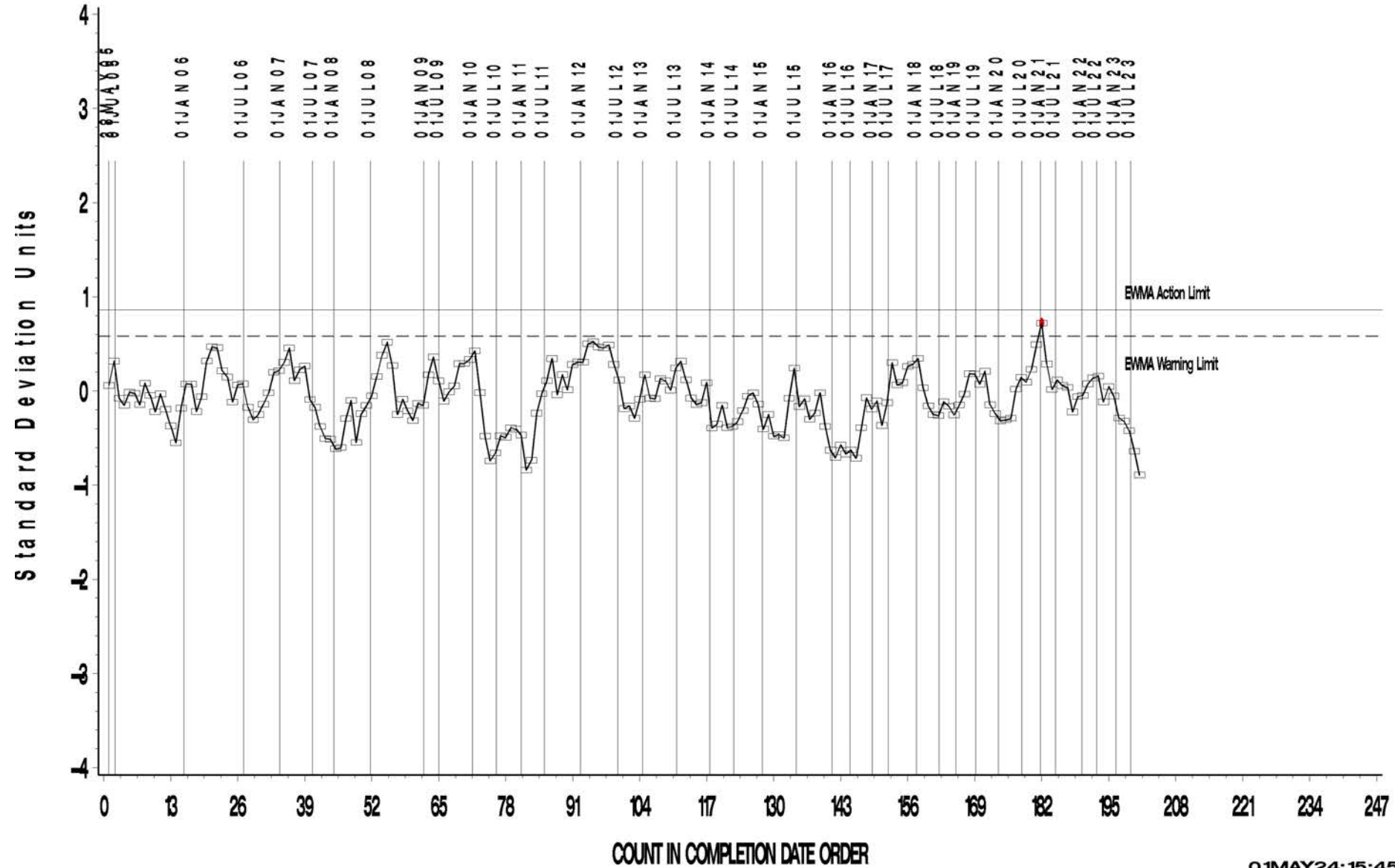


EWMA □
OFF SCALE *

EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit

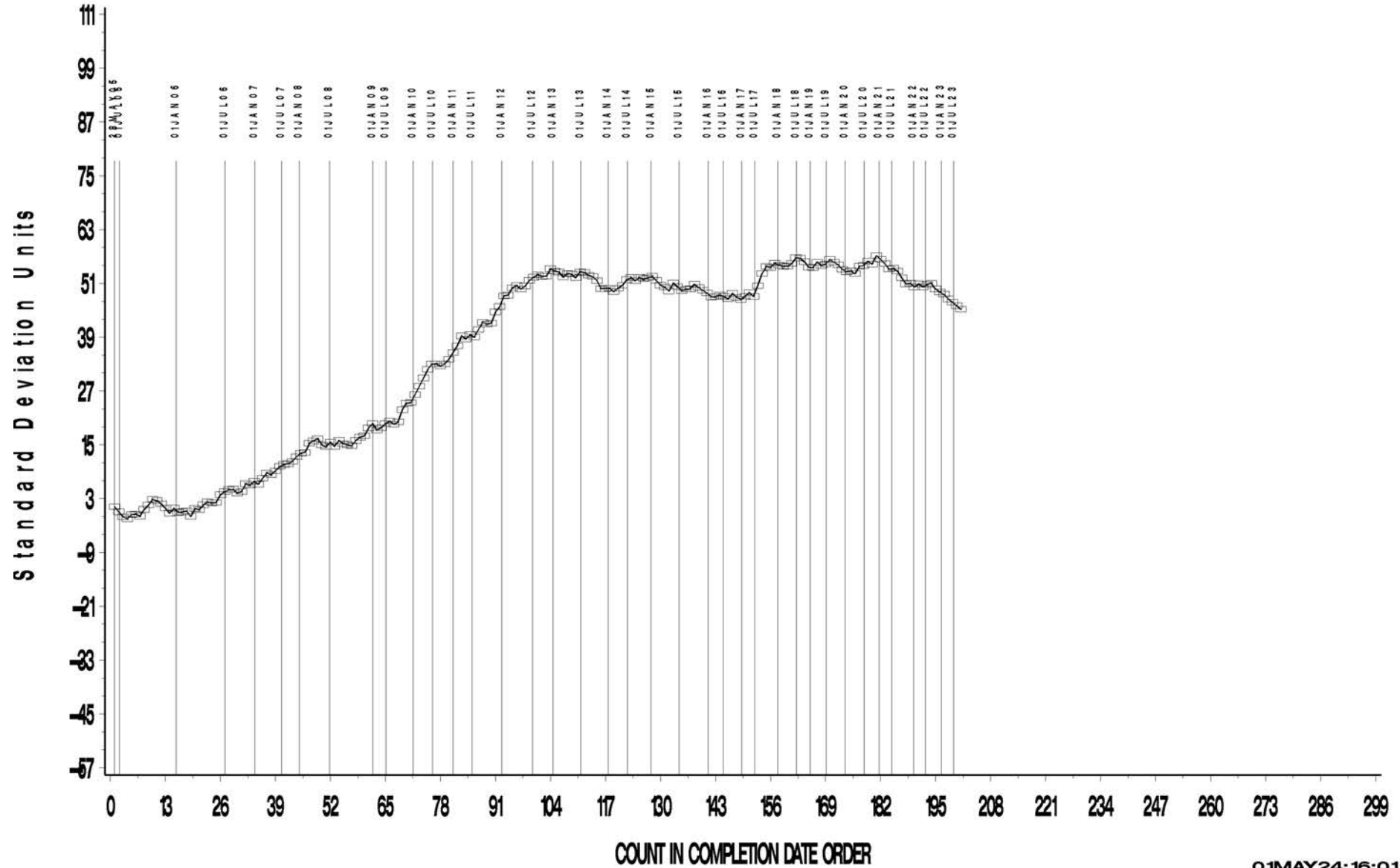
SOOT @ 15 cSt — FINAL RESULT

LTMS Precision Analysis

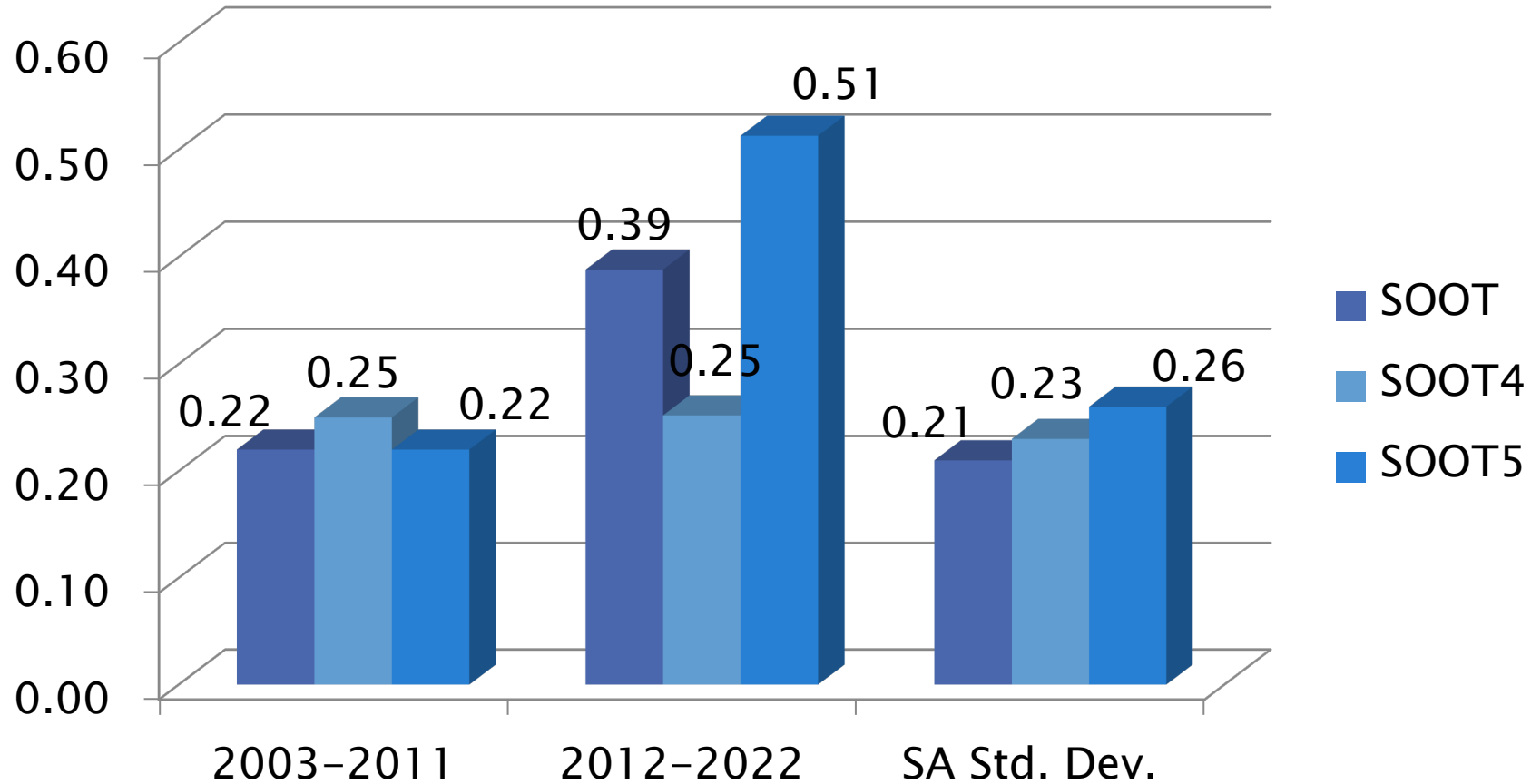


SOOT @ 15 cSt — FINAL RESULT

CUSUM Severity Analysis

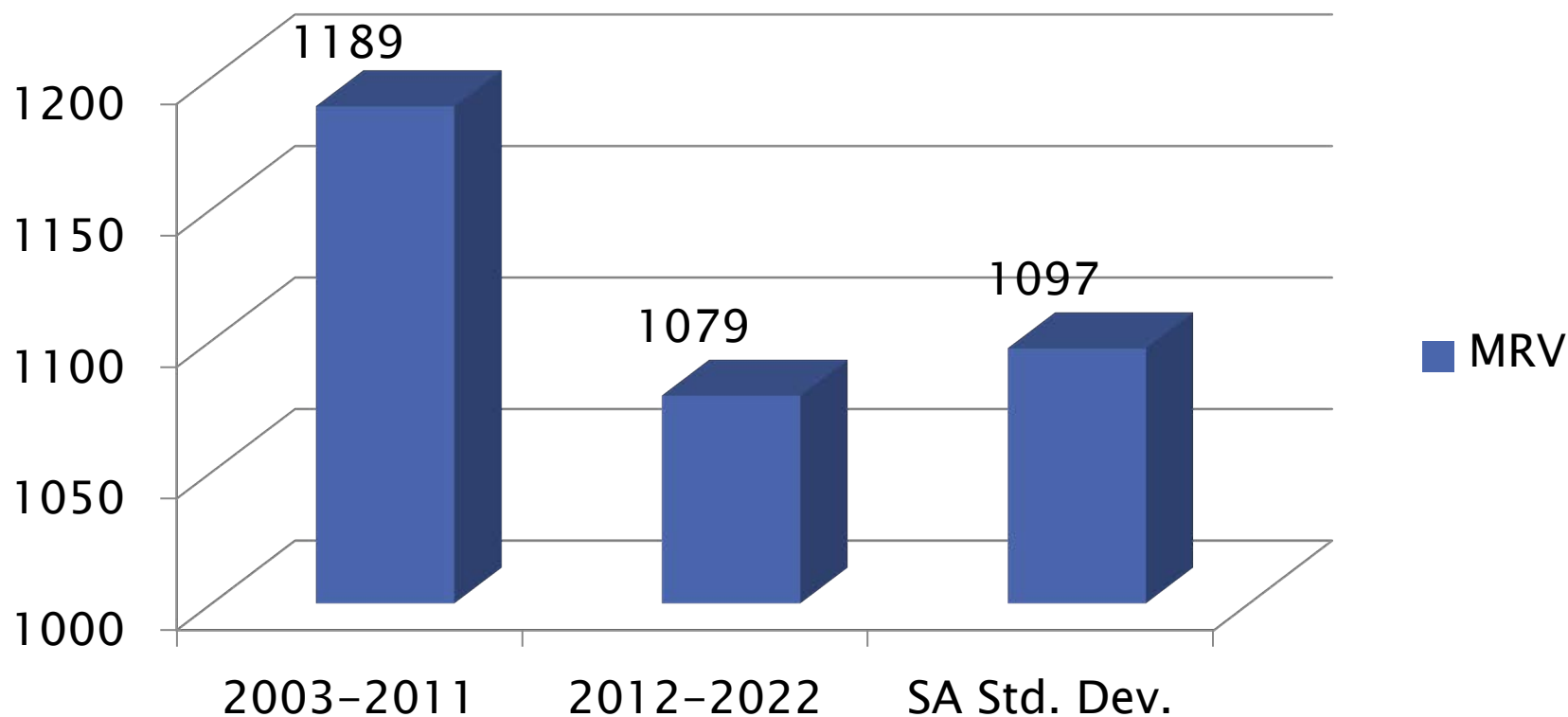


T-11 Precision Estimates



T-11 Precision Estimates

MRV



[Return to Table of Contents](#)

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<https://www.astmtmc.org>



Mack T-12

»» April 2024

T-12 Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	0
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	0
Total		0

T-12 Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

T-12 Lost Tests*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		0

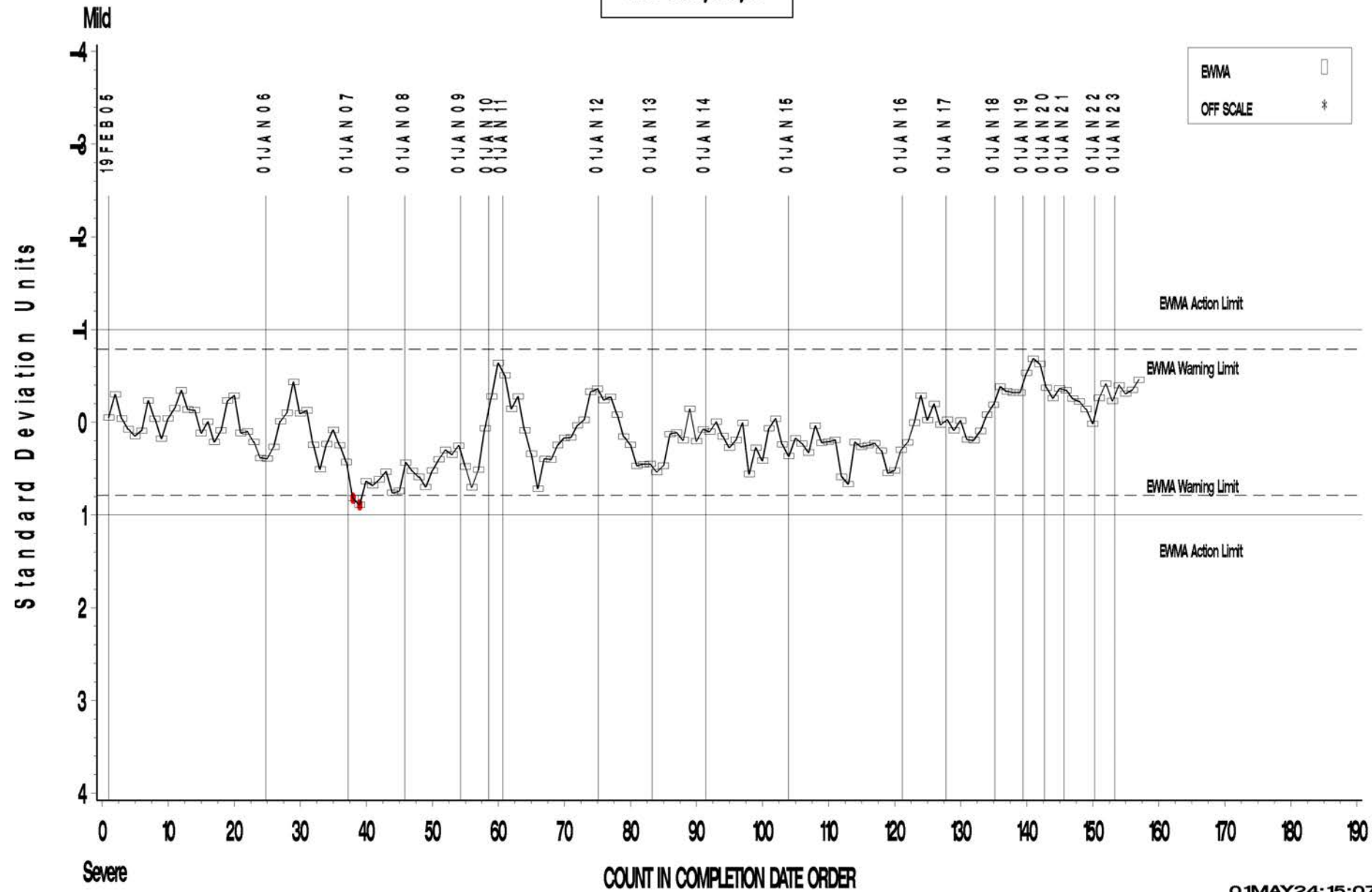
*Invalid and aborted tests

T-12 Test Severity

- ▶ As no chartable T12 tests were run during this reporting period, no statement about test severity can be made.

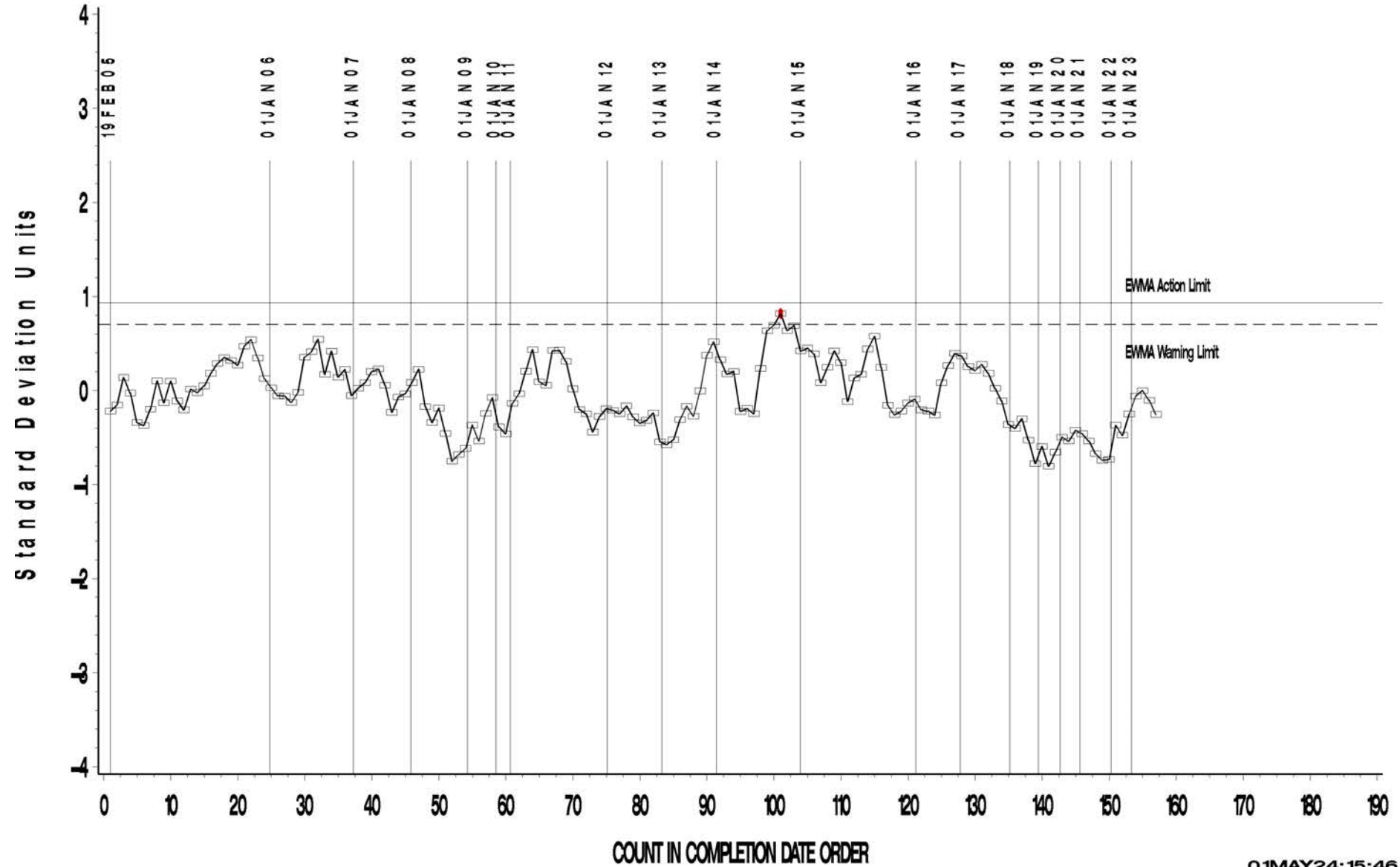
AVG. CYLINDER LINER WEAR (CLW)

LTMS Severity Analysis



AVG. CYLINDER LINER WEAR (CLW)

LTMS Precision Analysis



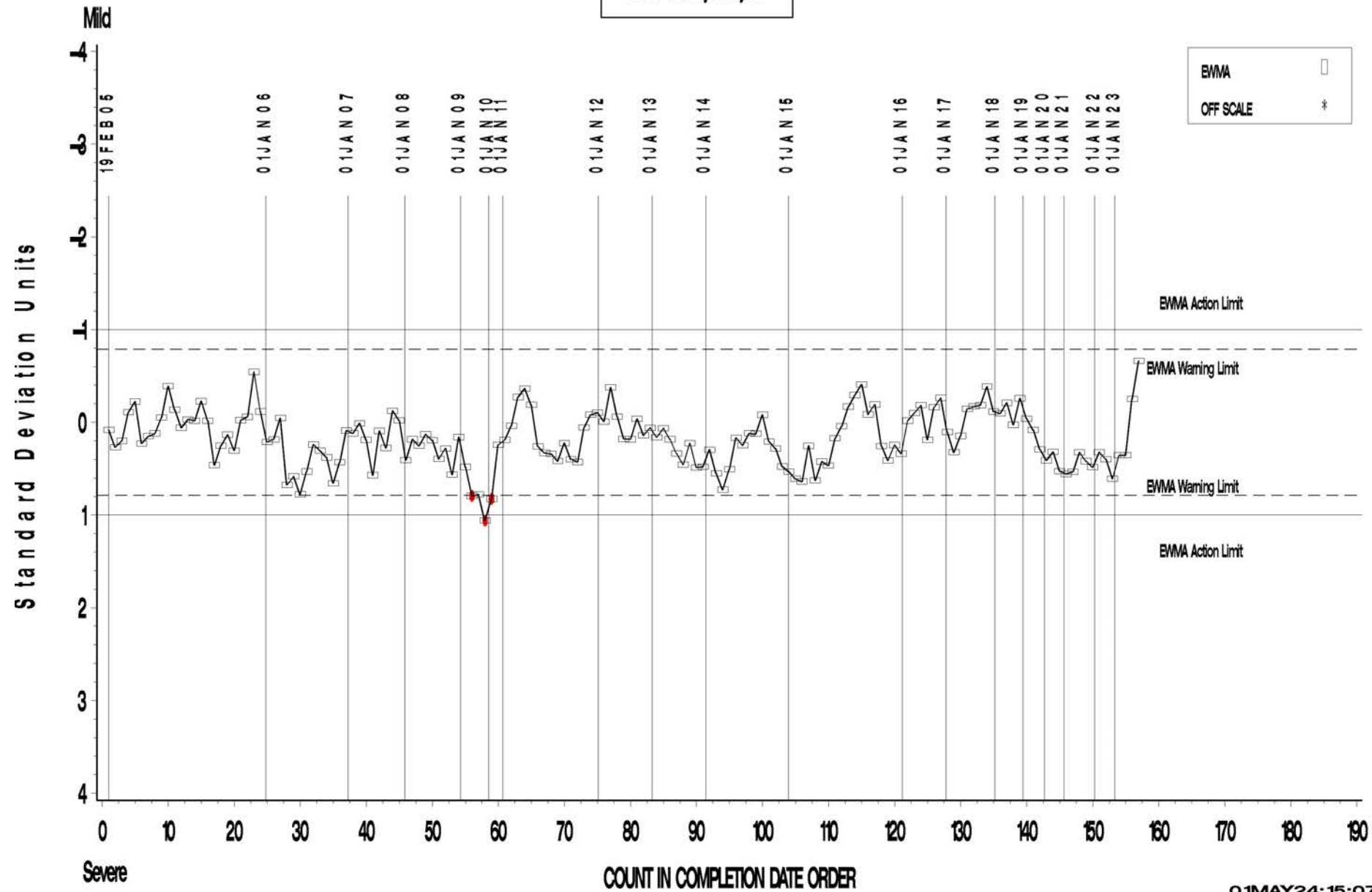
AVG. CYLINDER LINER WEAR (CLW)

CUSUM Severity Analysis



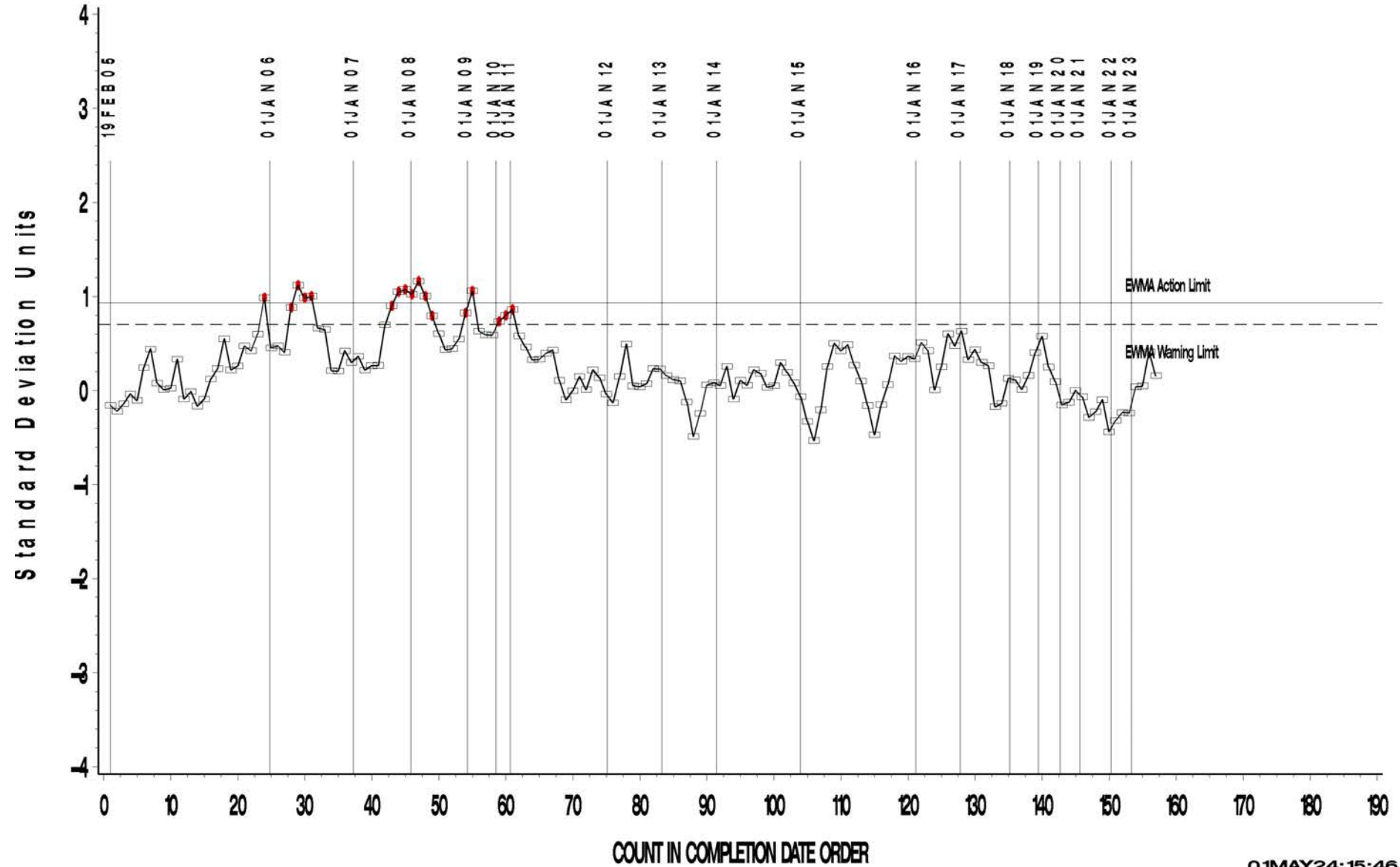
FINAL TRANS. RES. OIL CONSUMPTION

LTMS Severity Analysis



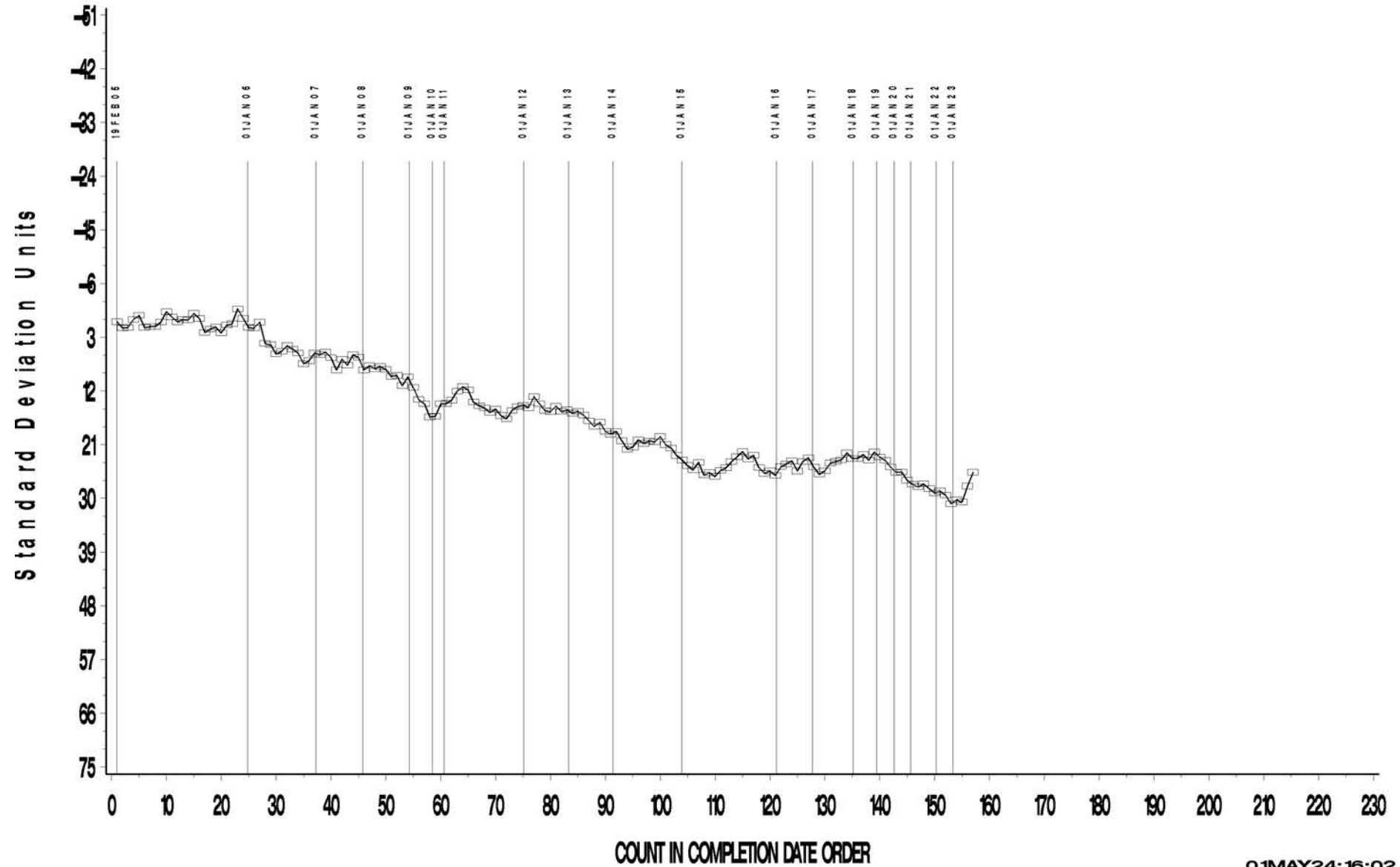
FINAL TRANS. RES. OIL CONSUMPTION

LTMS Precision Analysis



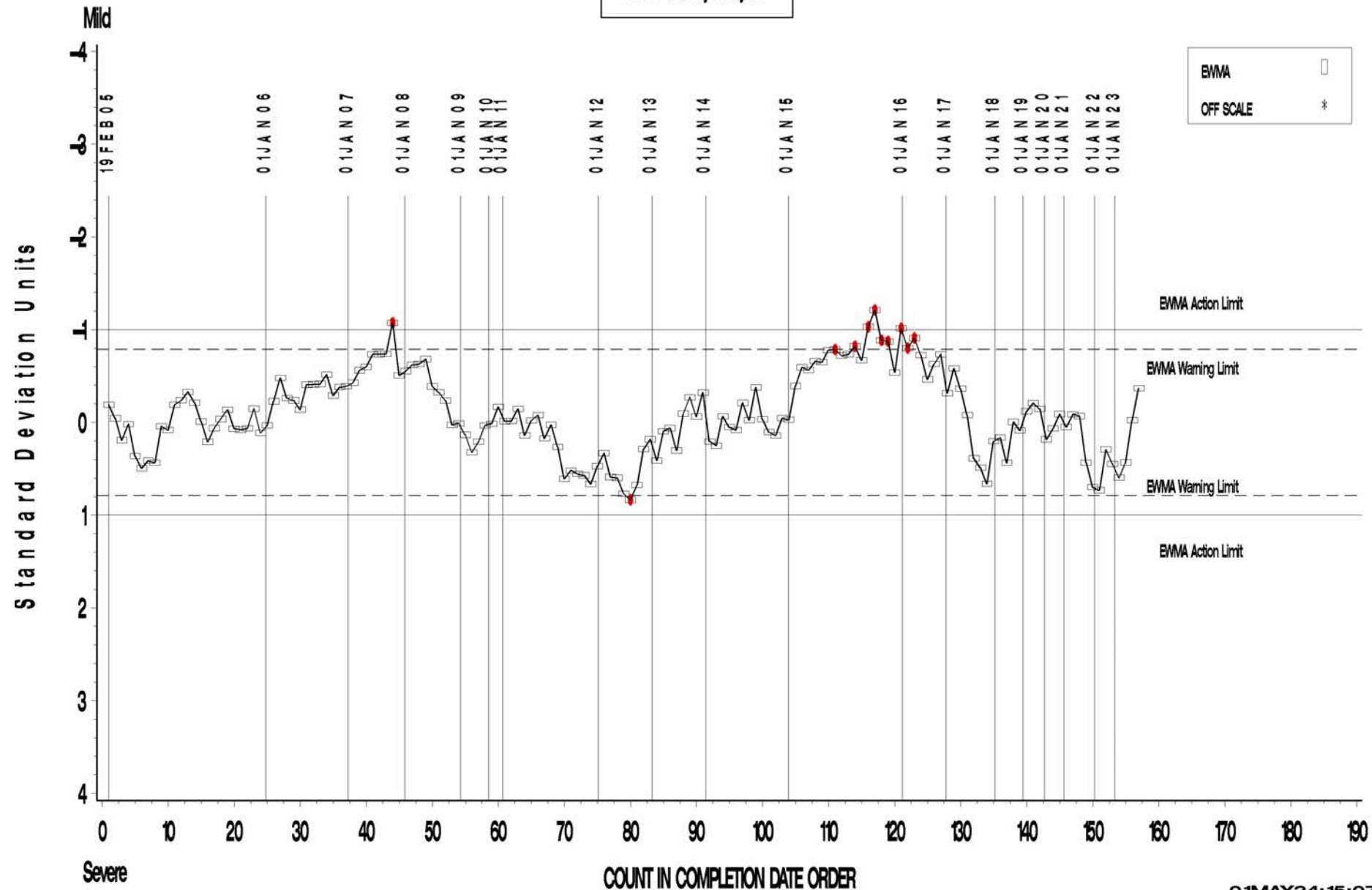
FINAL TRANS. RES. OIL CONSUMPTION

CUSUM Severity Analysis



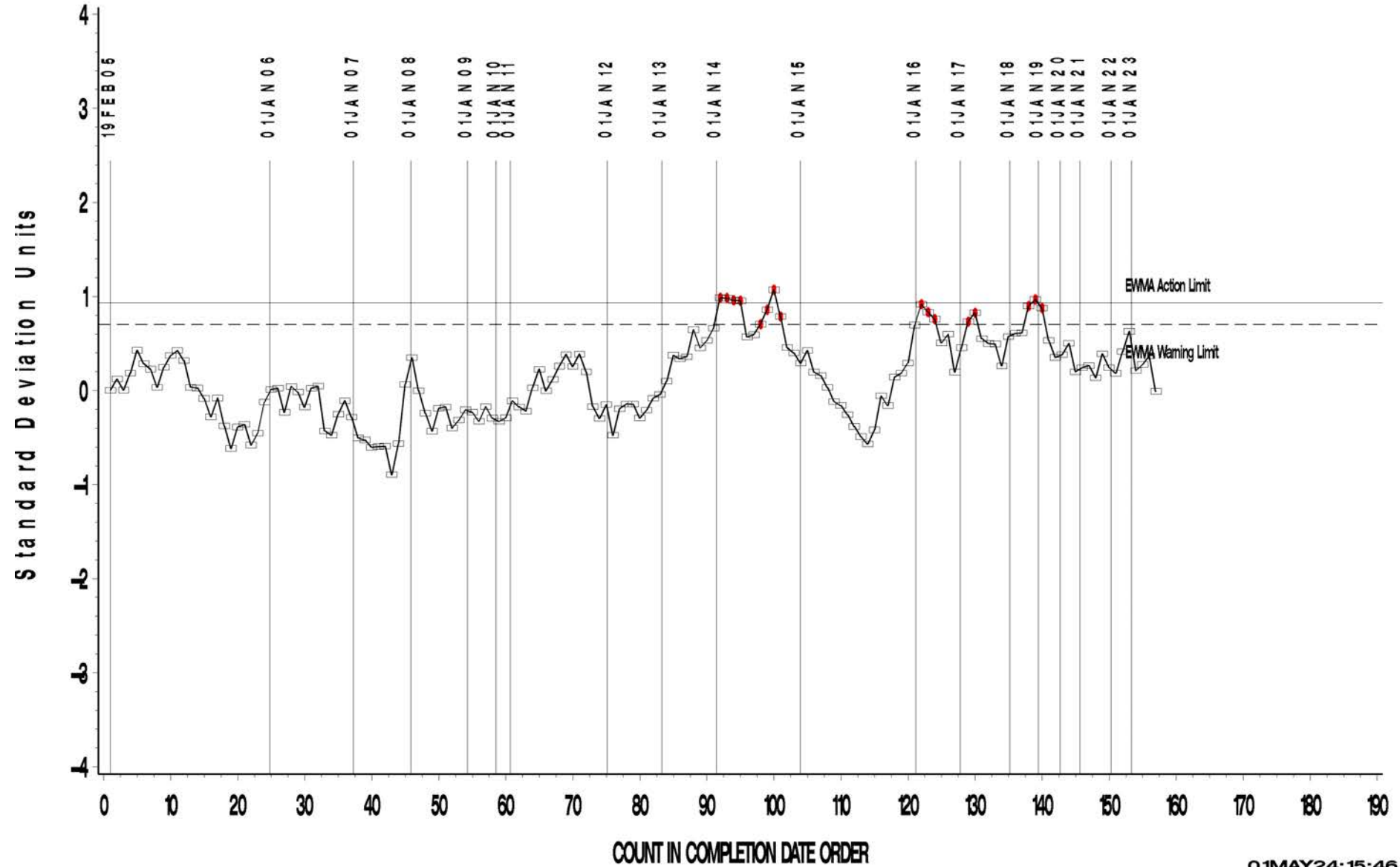
FINAL TRANS. RES. DELTA PB @ EOT

LTMS Severity Analysis



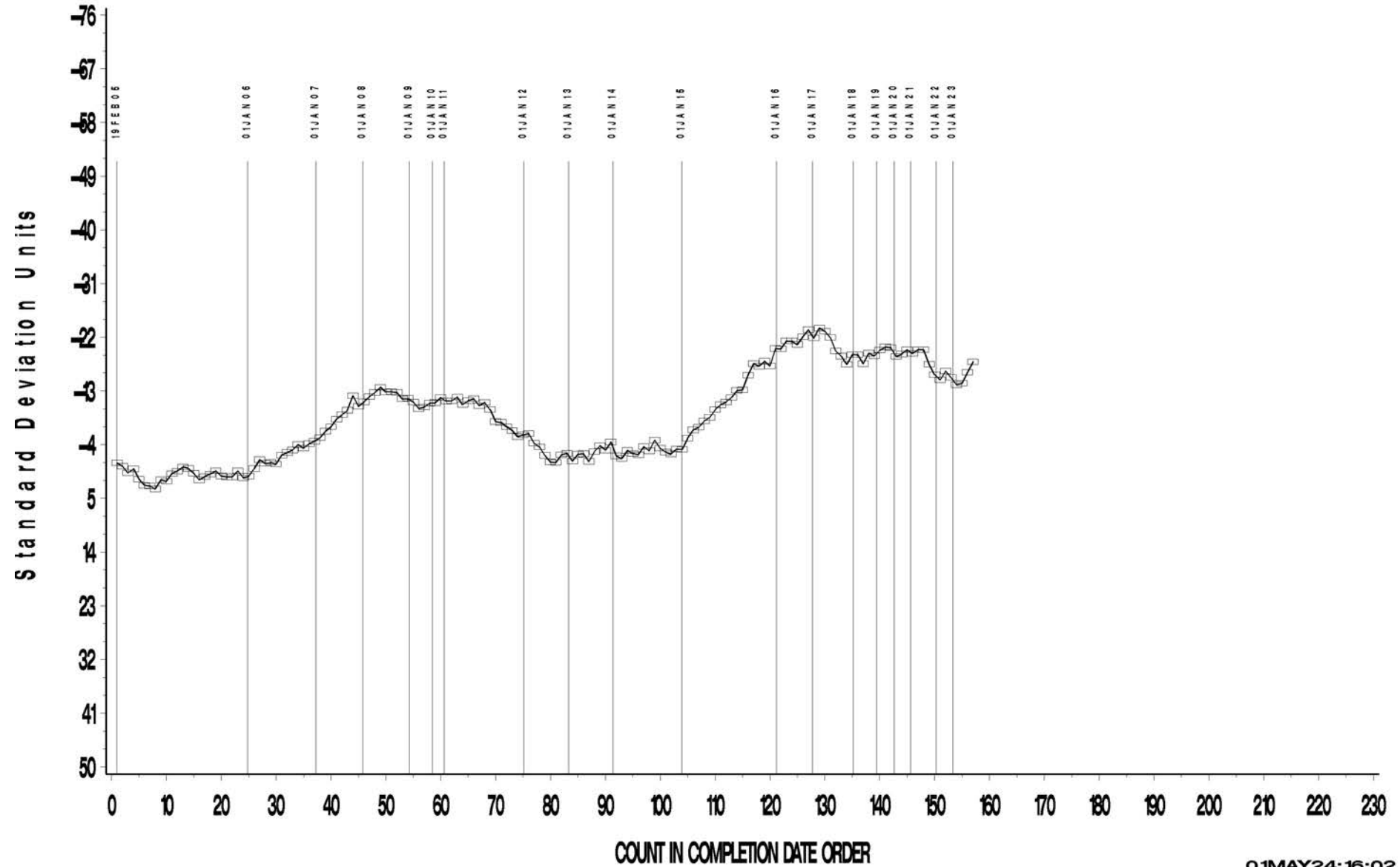
FINAL TRANS. RES. DELTA PB @ EOT

LTMS Precision Analysis



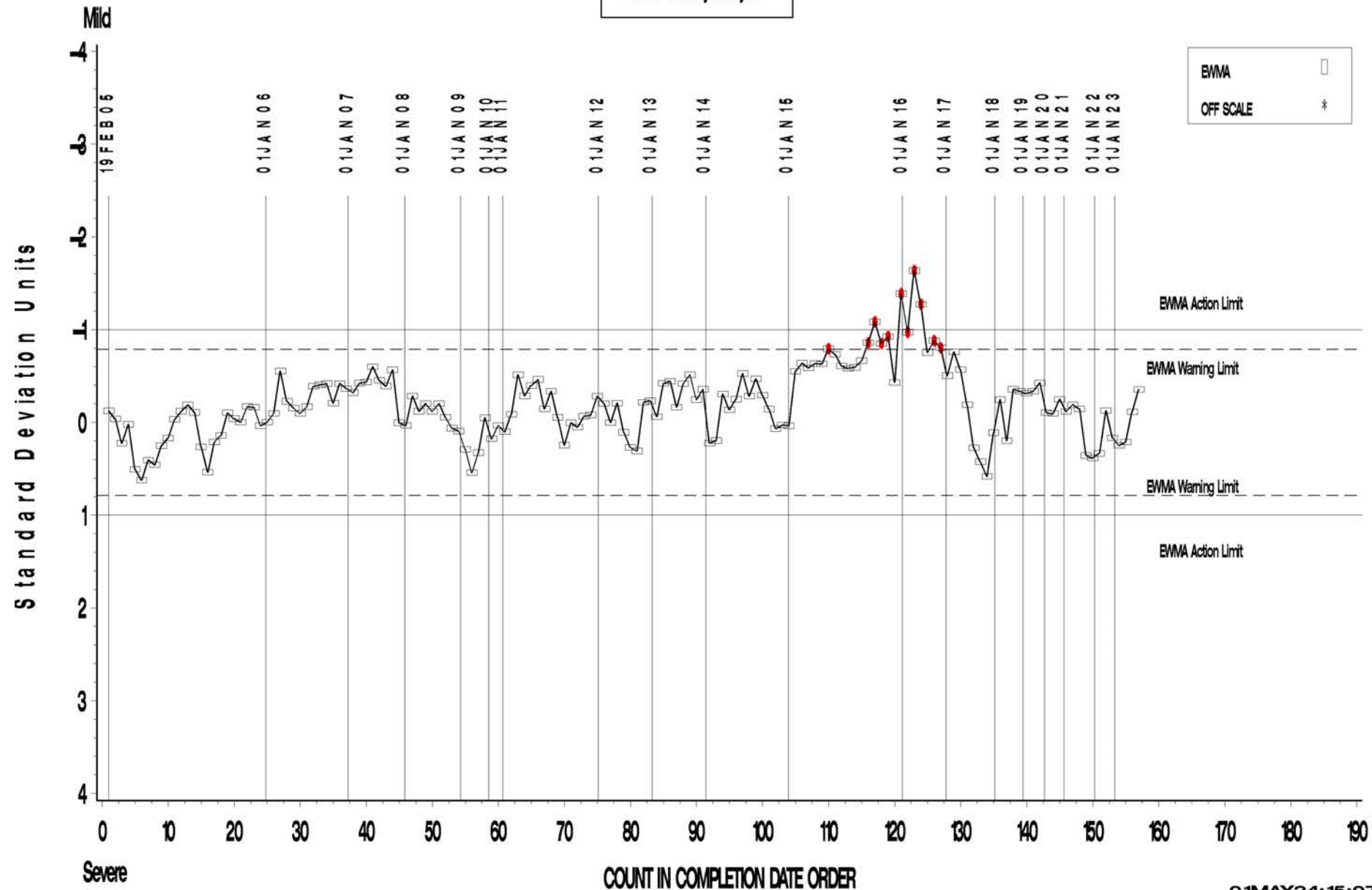
FINAL TRANS. RES. DELTA PB @ EOT

CUSUM Severity Analysis



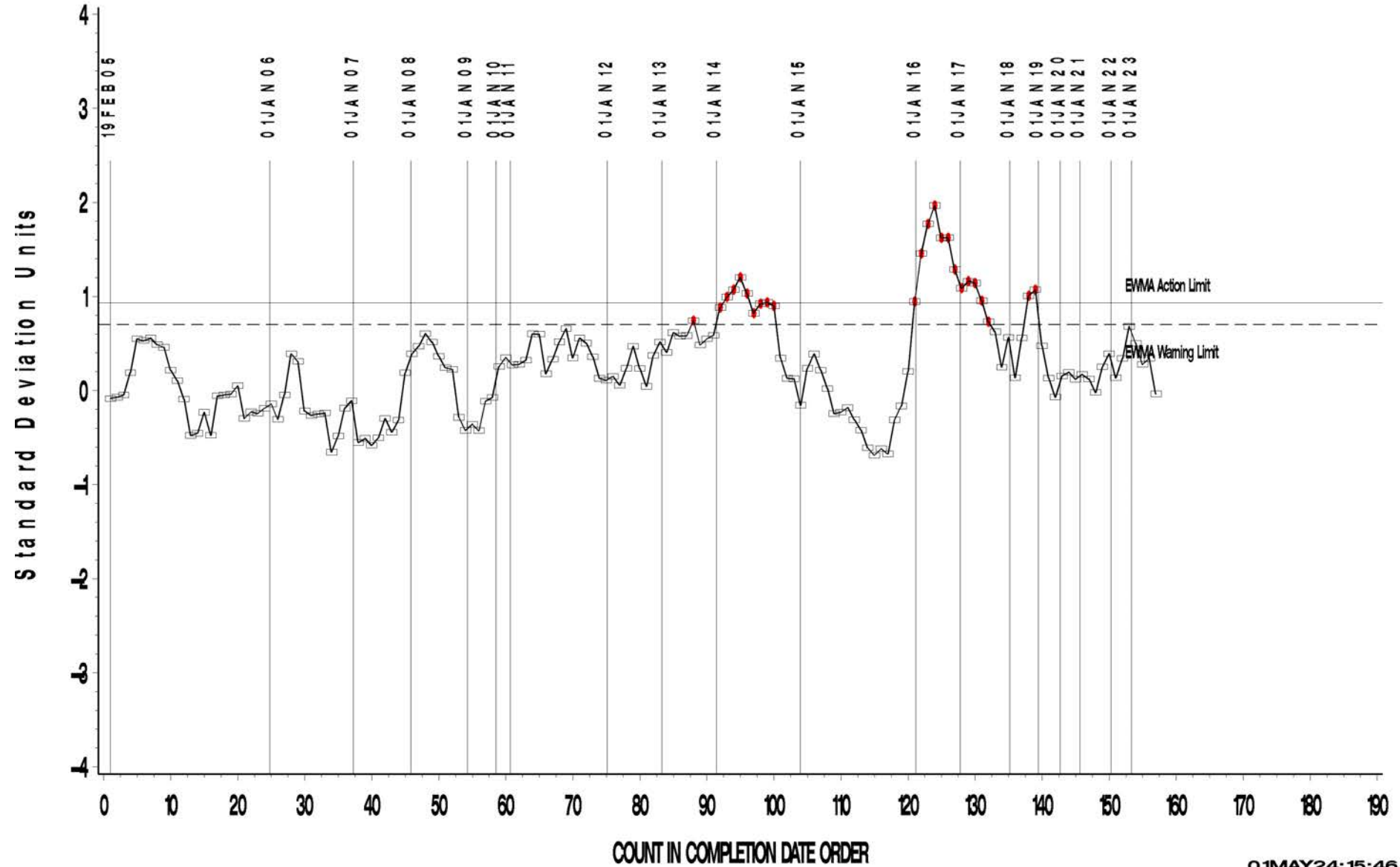
FINAL TRANS. RES. DELTA PB 250-300H

LTMS Severity Analysis



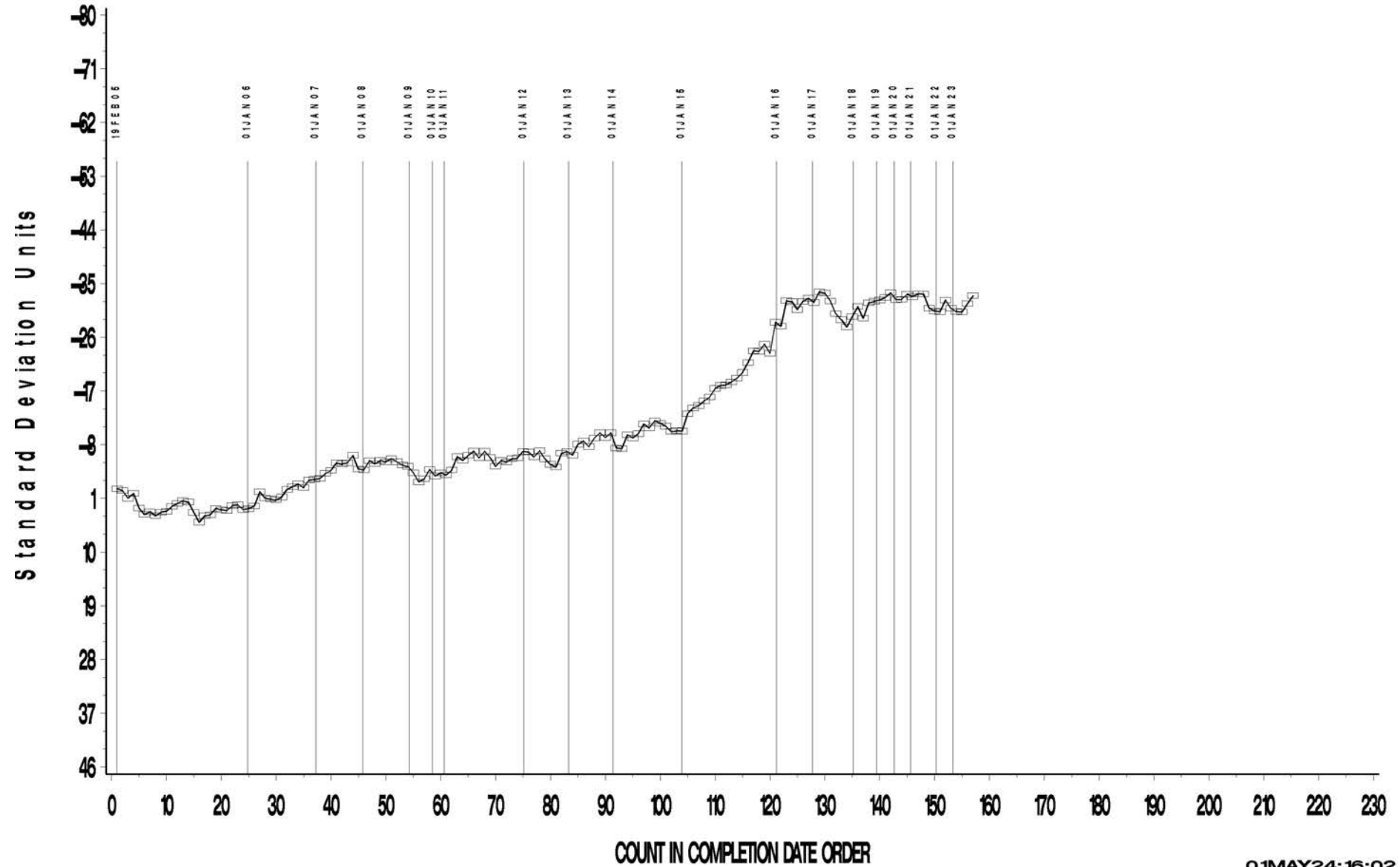
FINAL TRANS. RES. DELTA PB 250-300H

LTMS Precision Analysis

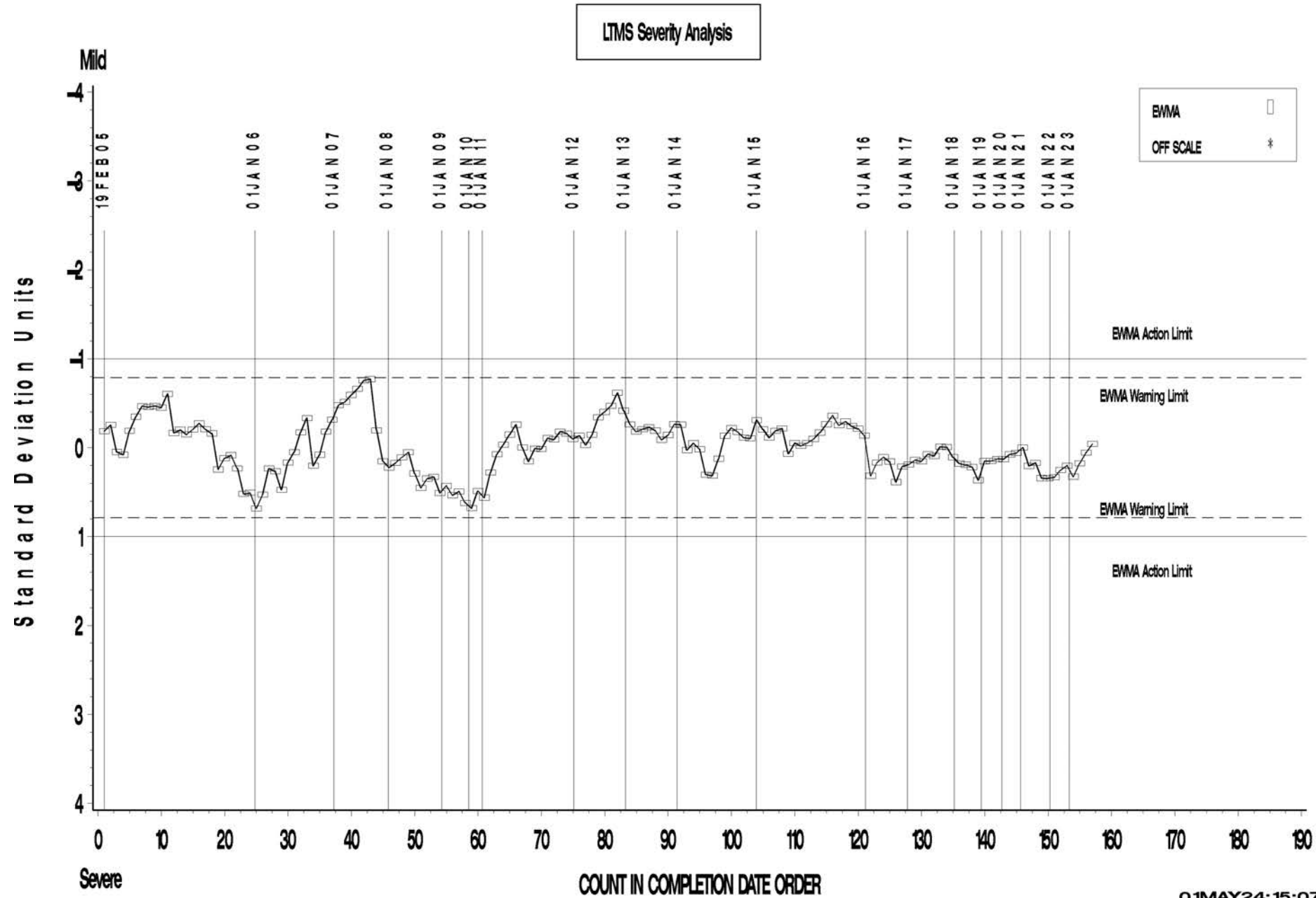


FINAL TRANS. RES. DELTA PB 250-300H

CUSUM Severity Analysis

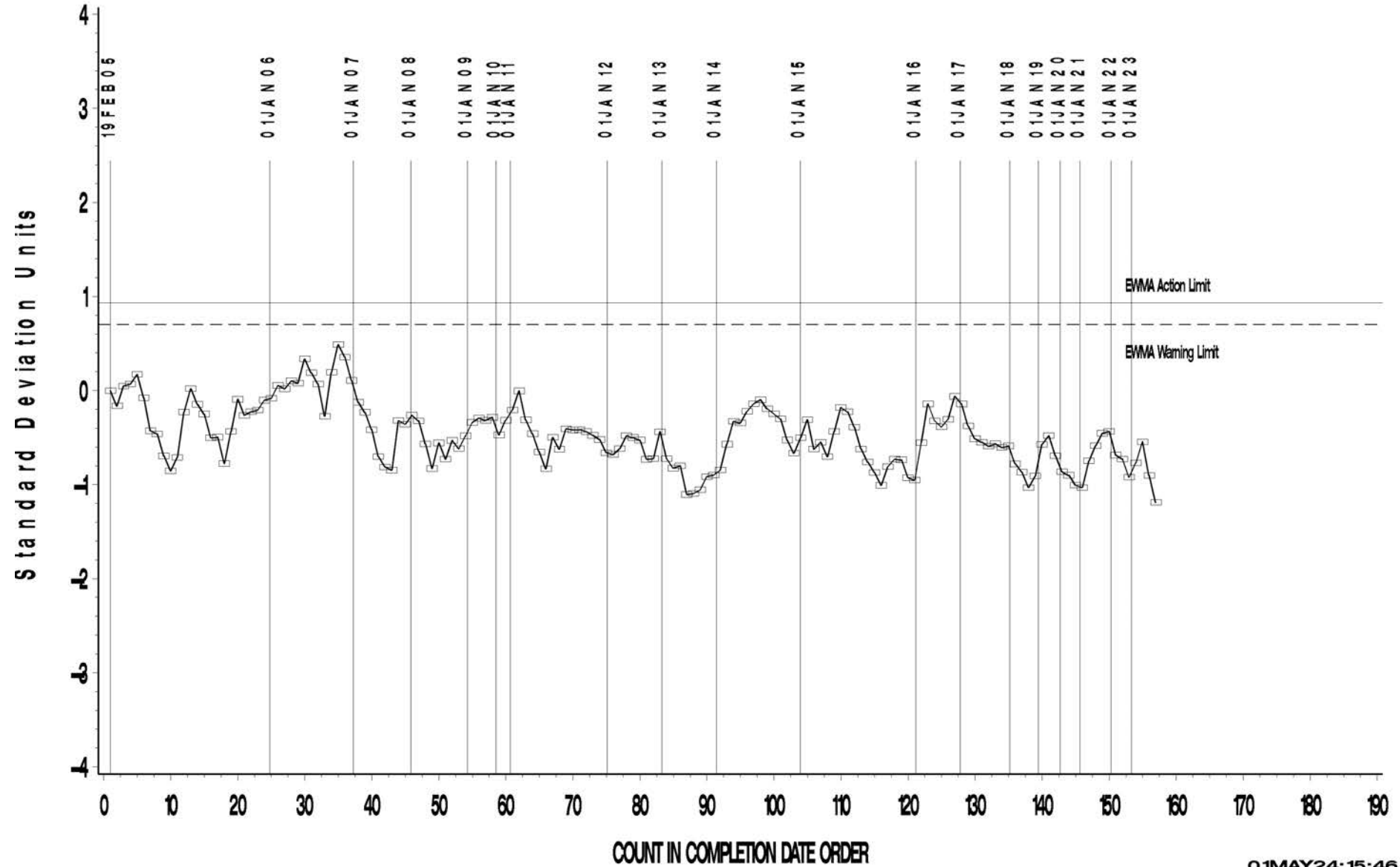


AVG. TOP RING WEIGHT LOSS (TRWL)



AVG. TOP RING WEIGHT LOSS (TRWL)

LTMS Precision Analysis

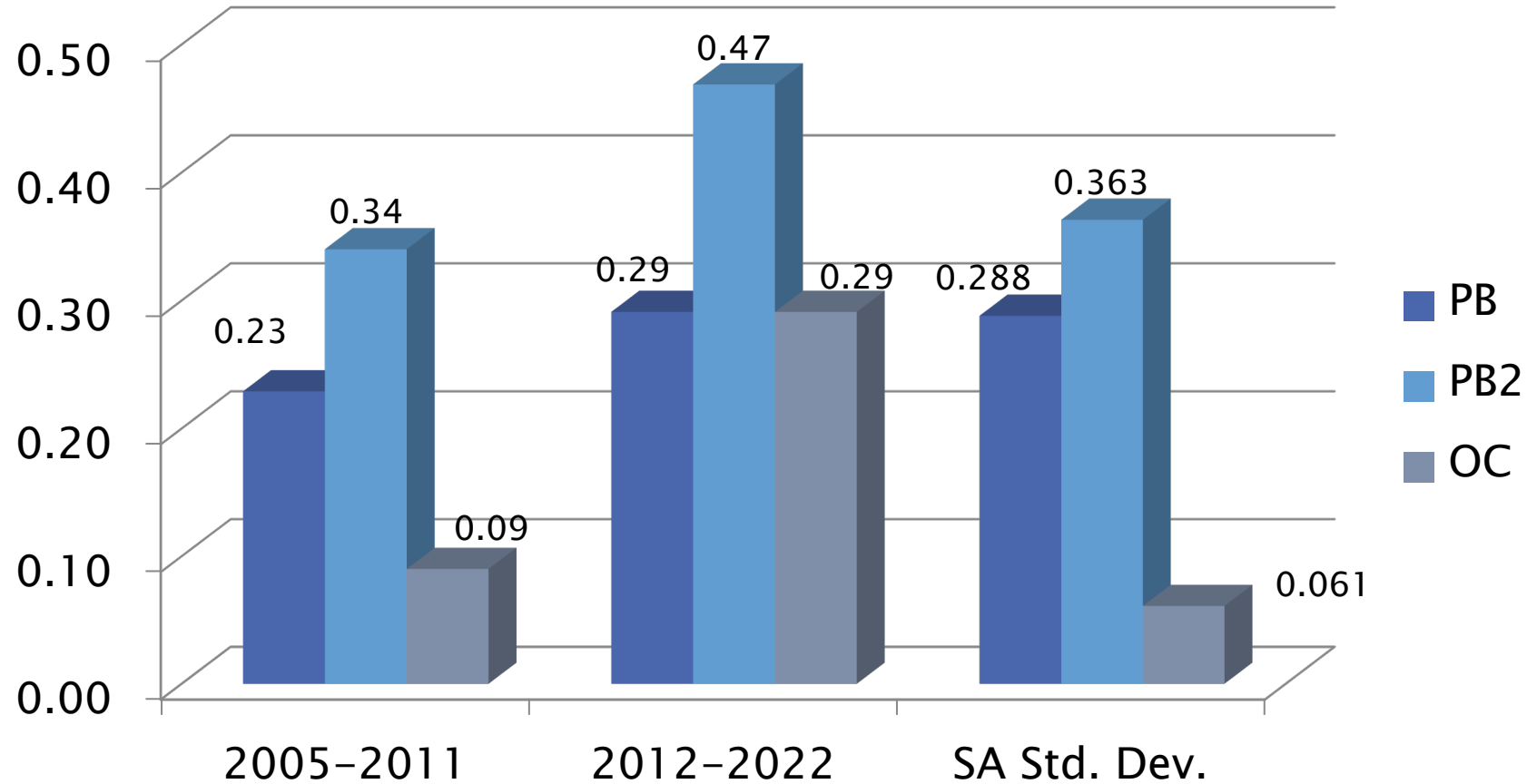


AVG. TOP RING WEIGHT LOSS (TRWL)

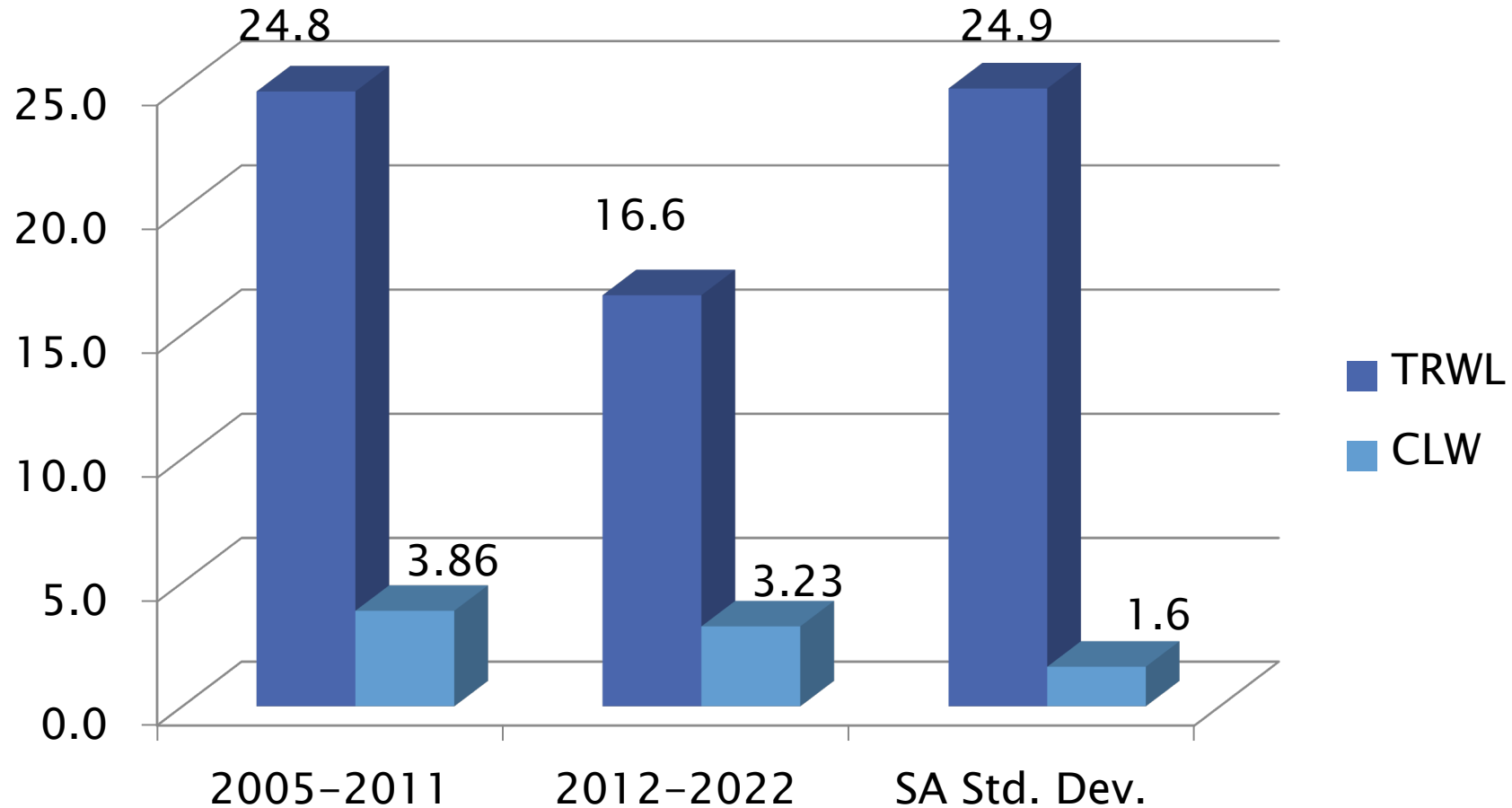
CUSUM Severity Analysis



T-12 Precision Estimates



T-12 Precision Estimates



[Return to Table of Contents](#)

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Mack T-12A

»» April 2024

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T-12A Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	1
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Total		1

T-12A Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

T-12A Lost Tests*

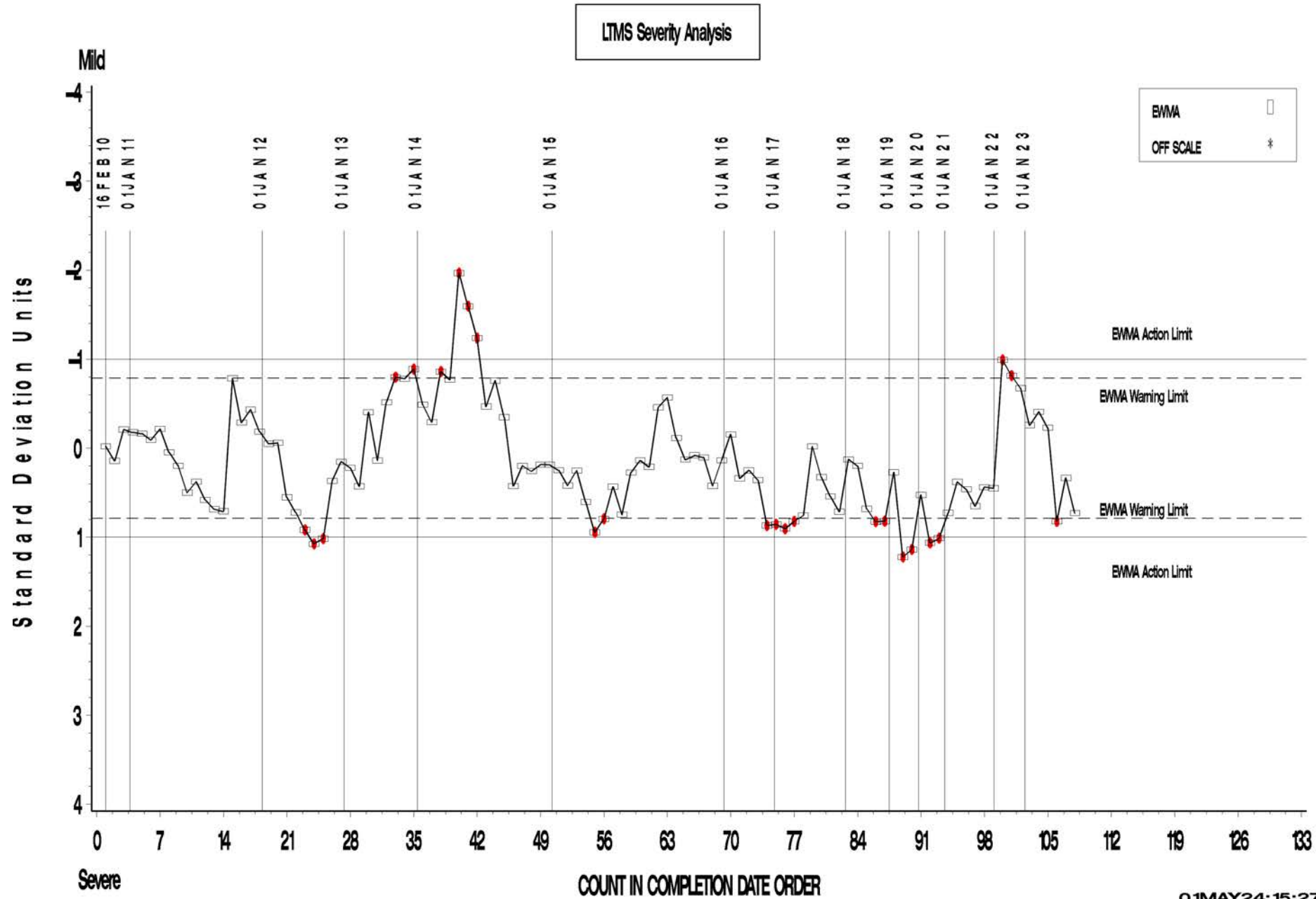
Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		0

*Invalid and aborted tests

T-12A Test Severity

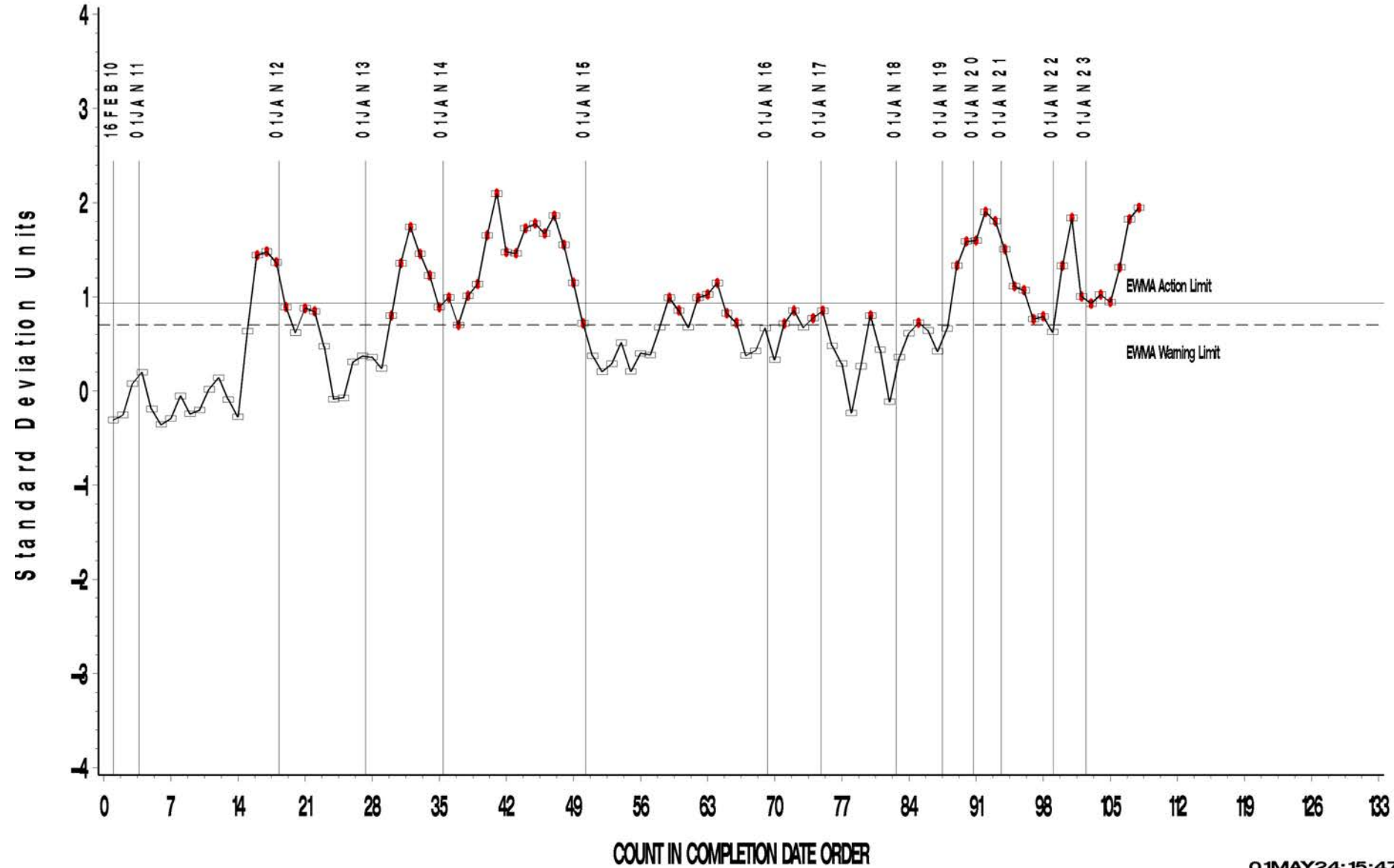
- ▶ MRV is in precision action alarm

FINAL ORIGINAL UNIT MRV VISCOSITY [NM, SOLID, FROZEN, <, >]



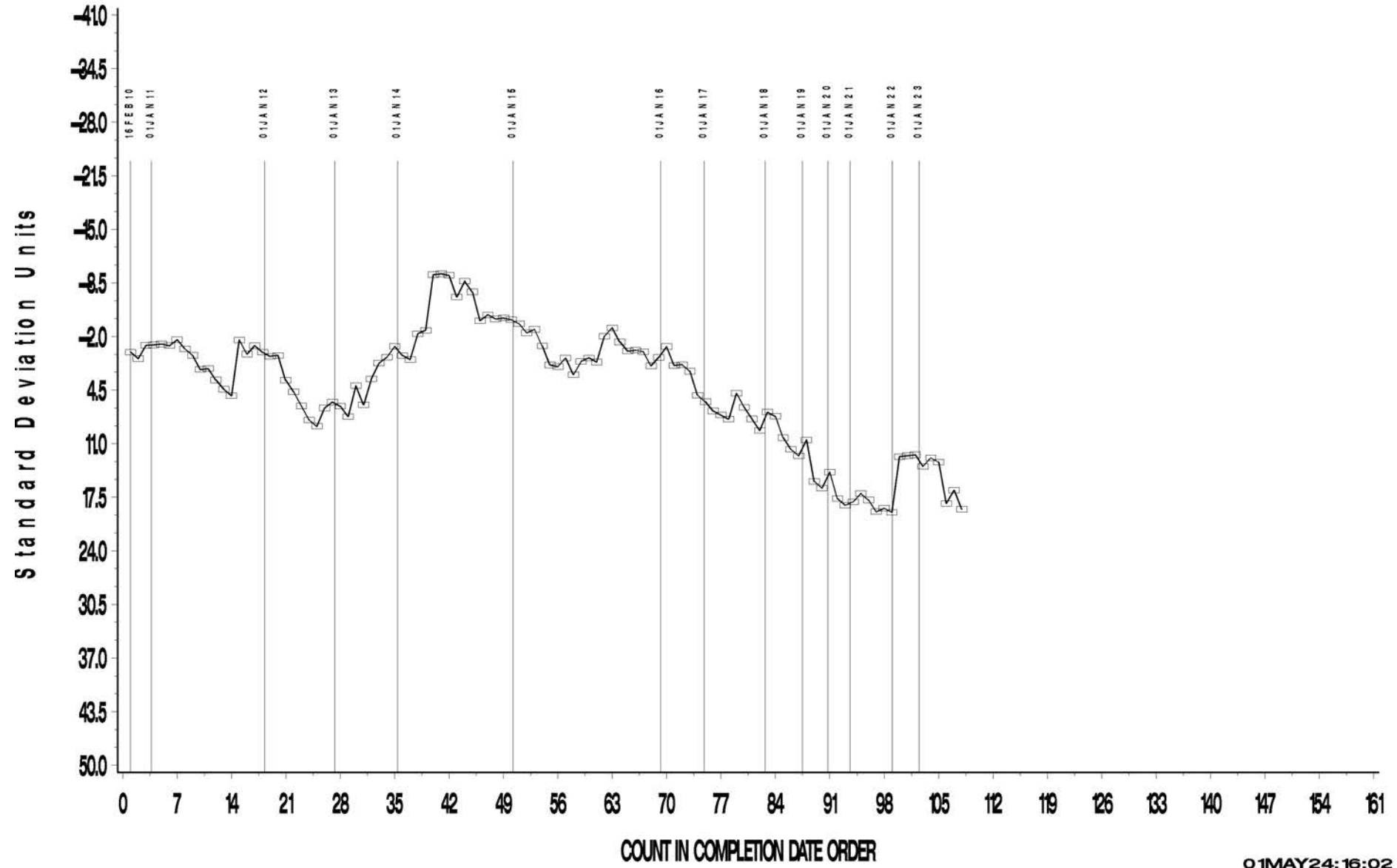
FINAL ORIGINAL UNIT MRV VISCOSITY [NM, SOLID, FROZEN, <, >]

LTMS Precision Analysis



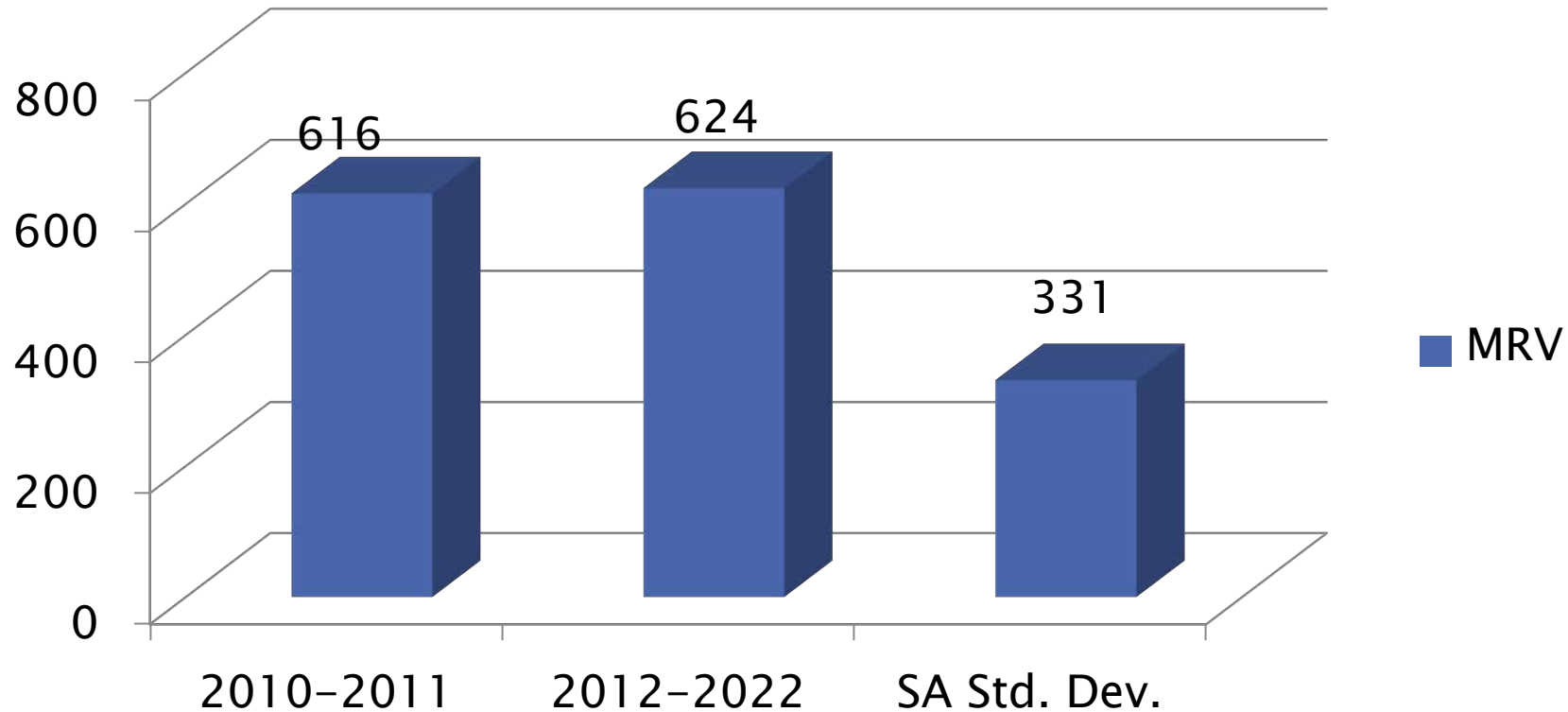
FINAL ORIGINAL UNIT MRV VISCOSITY [NM, SOLID, FROZEN, <, >]

CUSUM Severity Analysis



T-12A Precision Estimates

MRV



[Return to Table of Contents](#)

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Mack T-13

»» April 2024

T-13 Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	2
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	2
Informational	NN	1
Total		5

T-13 Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

T-13 Lost Tests*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	Oil gallery and oil jet thermocouple issues	1
Aborted	High crankcase pressure due to build issue	1
Total		2

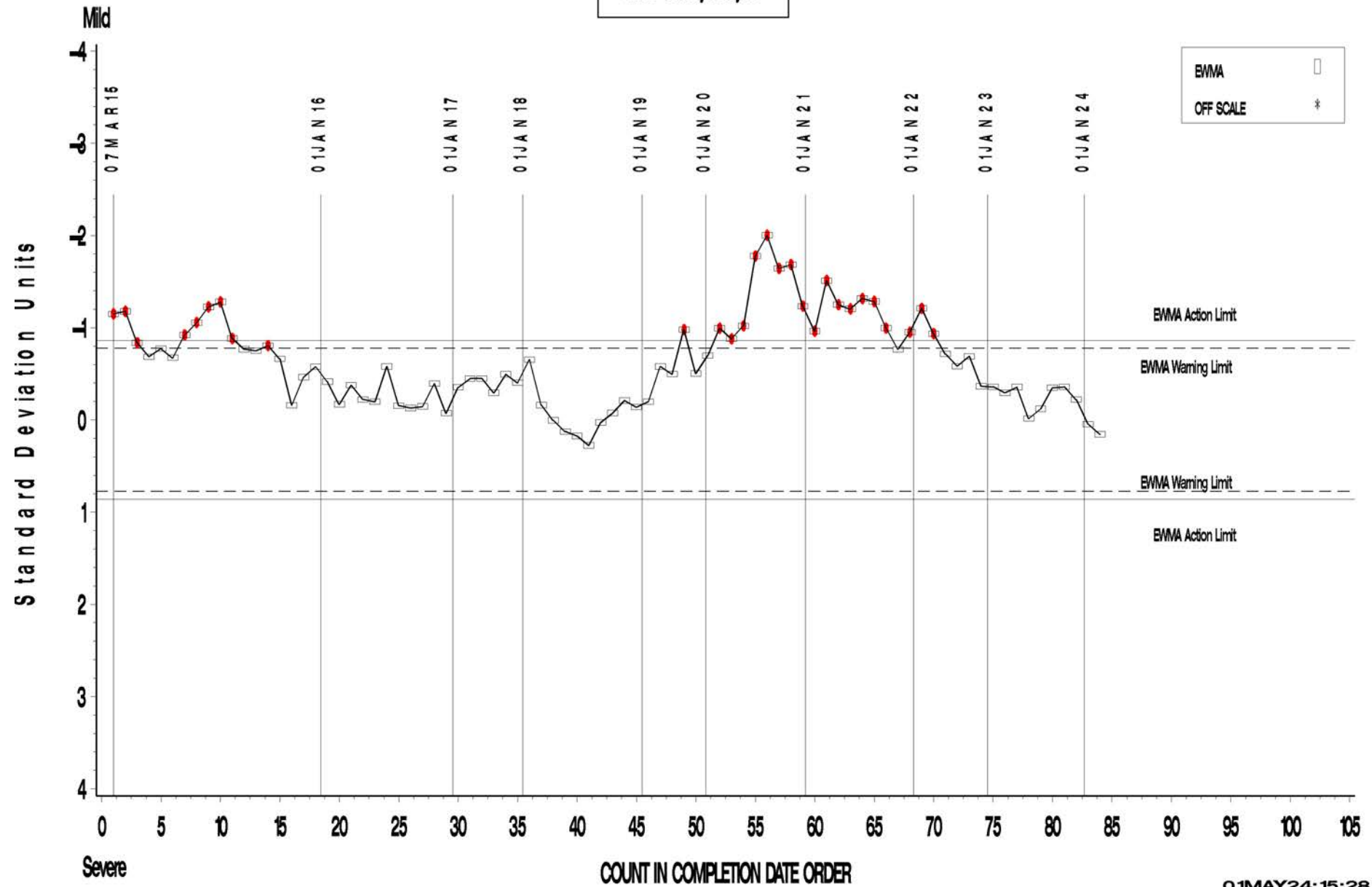
*Invalid and aborted tests

T-13 Test Severity

- ▶ IRPH and KV40 are in control

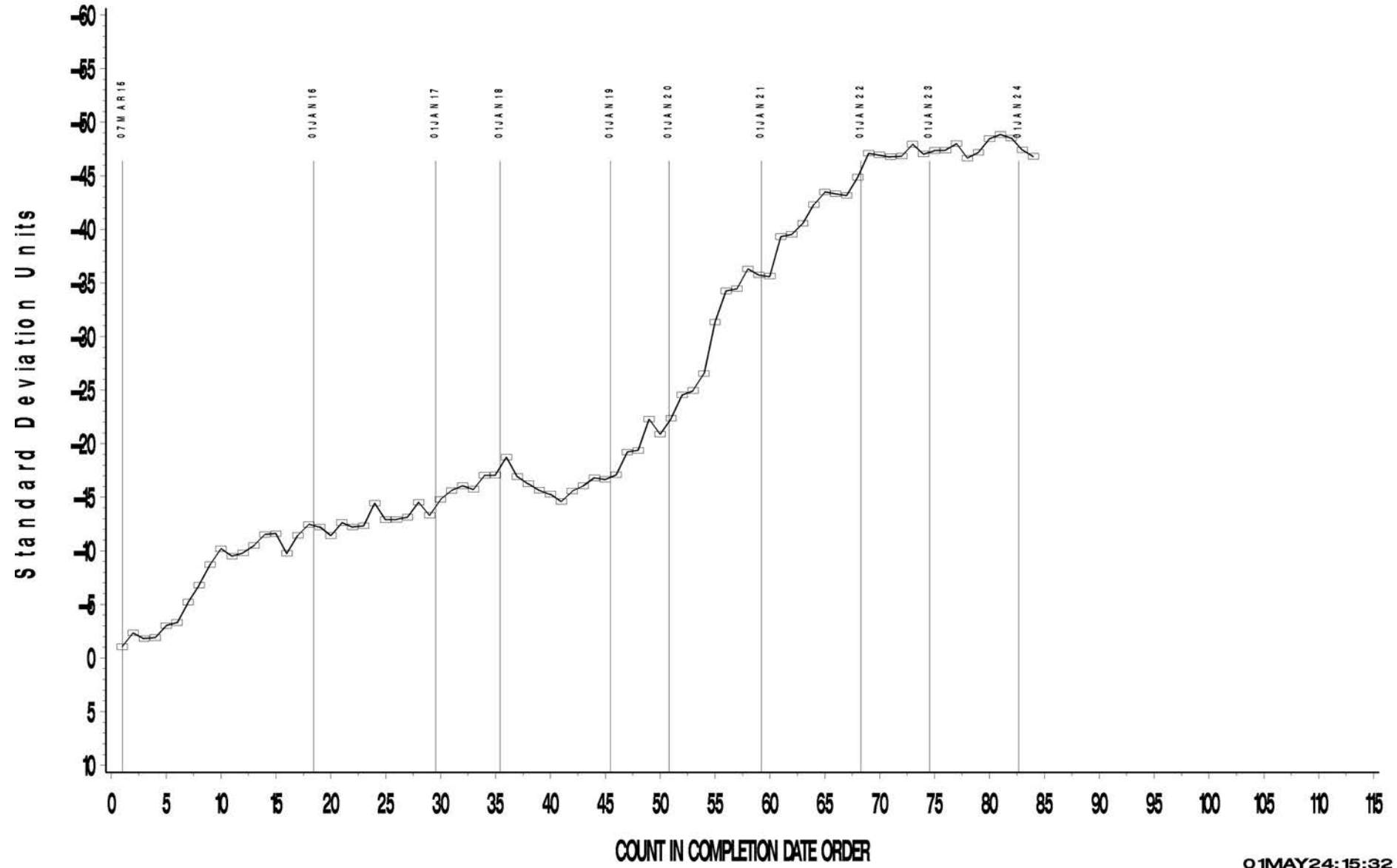
FINAL ORIGINAL PEAK HEIGHT IR AT EOT

LTMS Severity Analysis



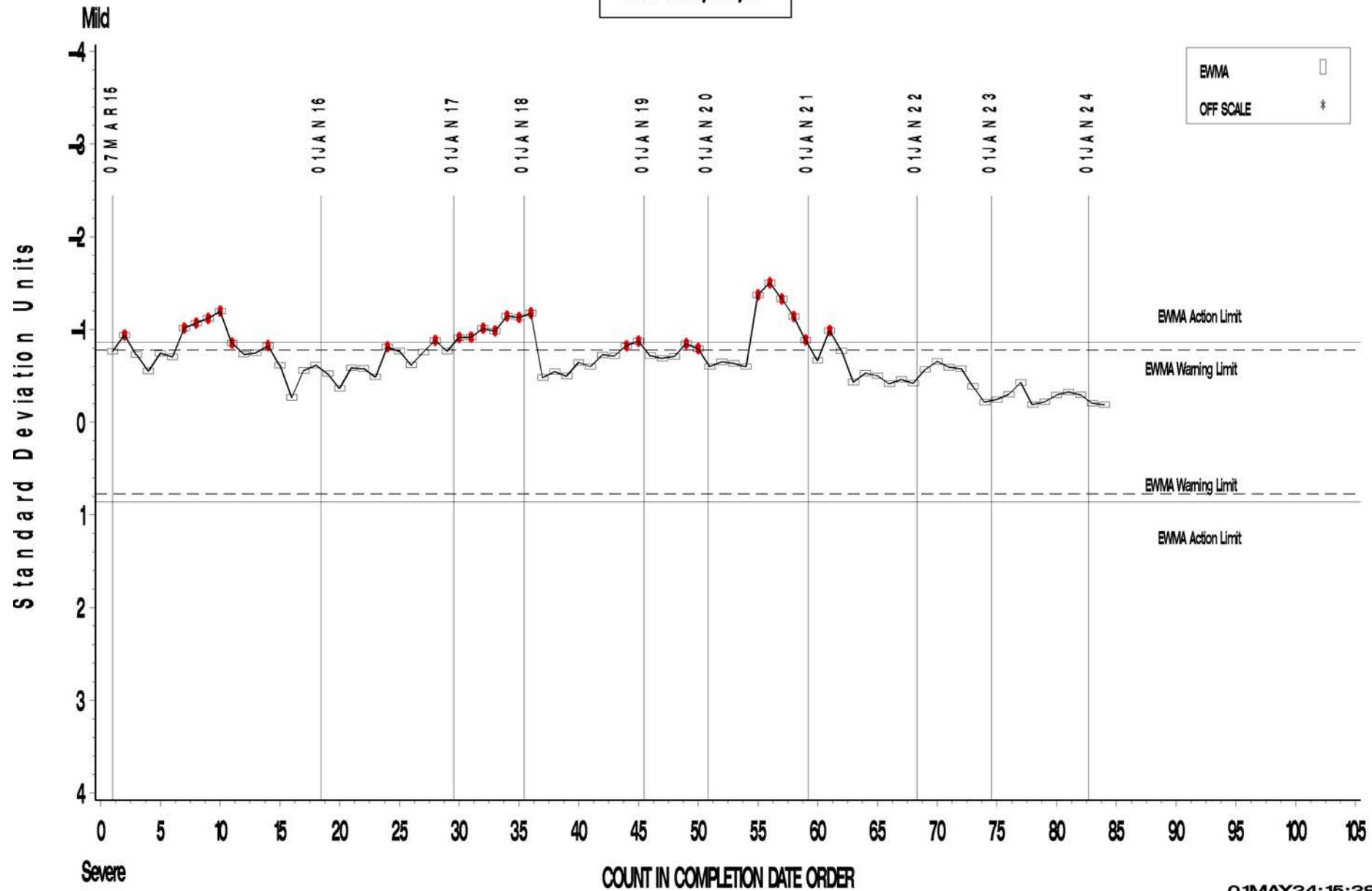
FINAL ORIGINAL PEAK HEIGHT IR AT EOT

CUSUM Severity Analysis



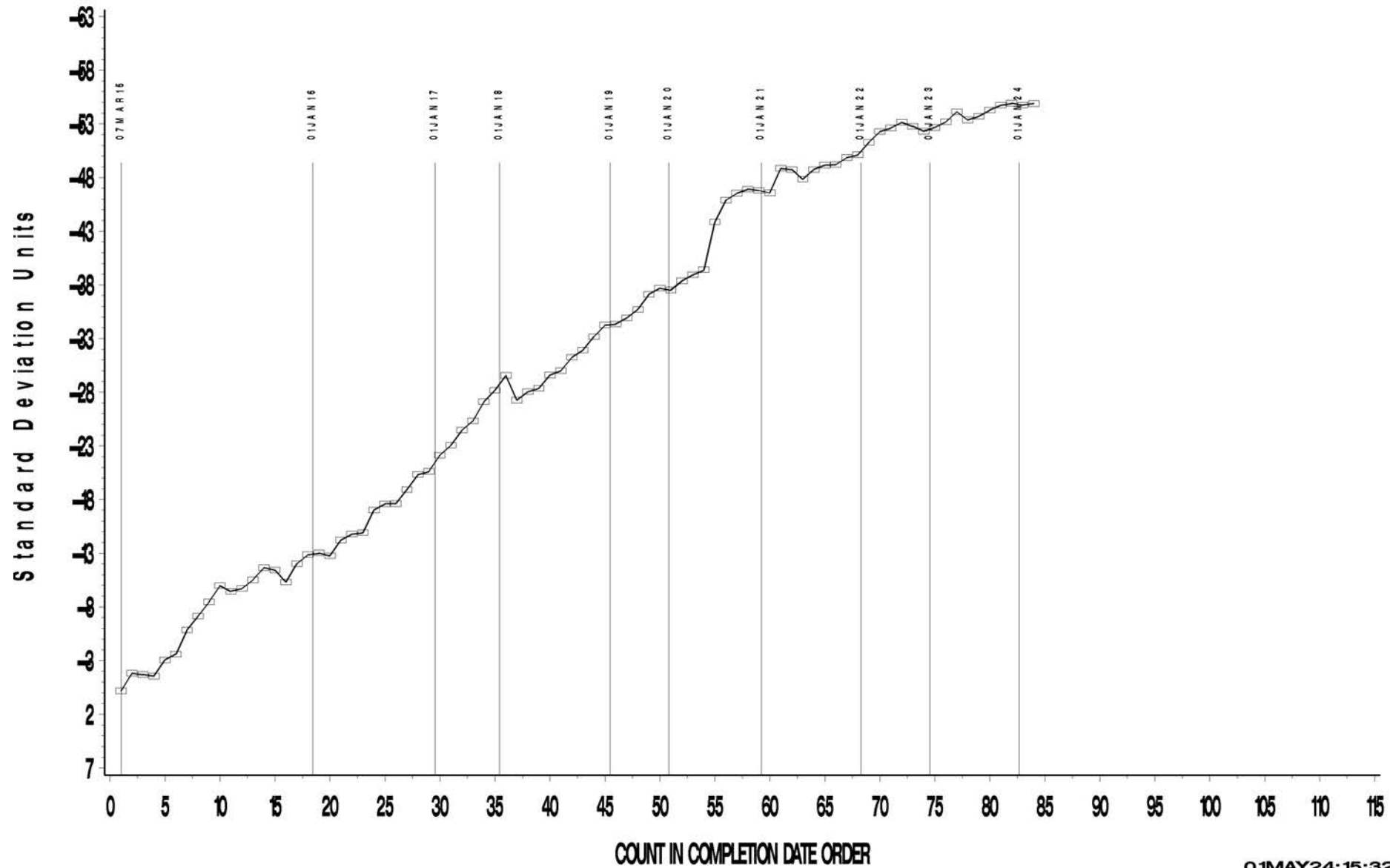
FNL. ORIG. UNIT KINEMATIC VISCOSITY AT 40 DEG C % CHANGE 300-360 HRS

LTMS Severity Analysis

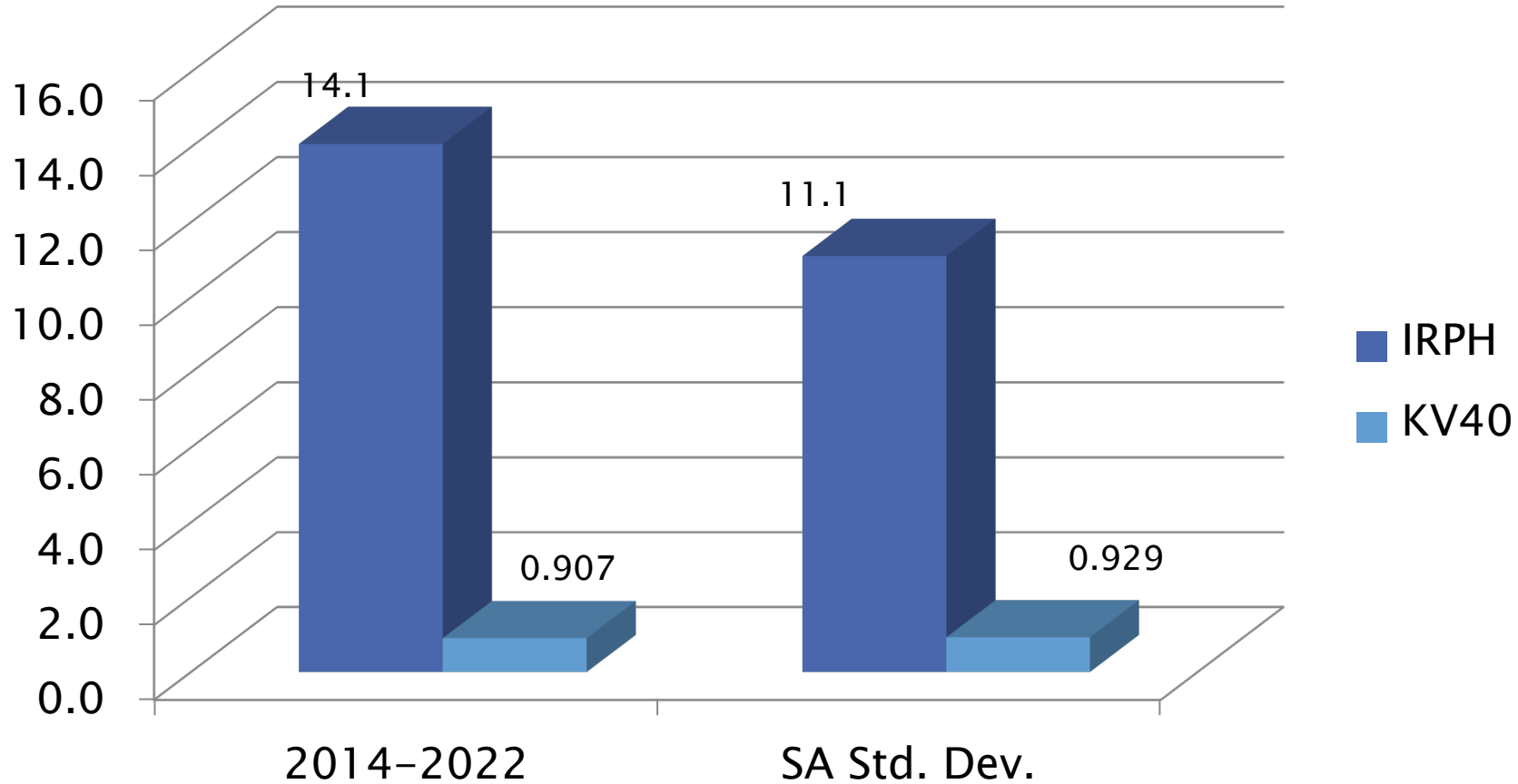


FNL. ORIG. UNIT KINEMATIC VISCOSITY AT 40 DEG C % CHANGE 300-360 HRS

CUSUM Severity Analysis



T-13 Precision Estimates



[Return to Table of Contents](#)

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Information Letters

➤➤ October 1, 2023–March 31, 2024

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Information Letters*

Test	Date	IL	Topic
T12	10/13/23	23-1	Hardware Correction Factor Updates
T13	10/13/23	23-1	Industry Correction Factor for Kinematic Viscosity Parameter
T11	11/2/23	23-1	Additional Coolant Option

*Available from TMC Website

[Return to Table of Contents](#)

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Memos

➤➤ October 1, 2023–March 31, 2024

Memos*

Date	Number	Topic
N/A	N/A	No memos were issued during the period

*Available from TMC Website

[Return to Table of Contents](#)

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



Reference Oil Inventory



Actions, Re-blends, Inventories
and Estimated Life

Reference Oil Reblends

- ▶ Re-blend of 831 (831-5) received. Introduction has not yet occurred.

Reference Oil Inventory Estimated Life

Oil	Tests	Year	Blend Quantity	TMC Inventory	Estimated Life
809-1	1K, 1N	1991	9134	1876	> 5
811-2	1K, 1N	1995	1732	760	> 5
821-4	T-12	2013	4495	2198	> 5
822-2	1R, T-11	2013	4386	1664	> 5
823-1	T-13	2021	1421	1282	> 5
830-3	ISM	2016	2891	2360	> 5
832-1	COAT	2018	1951	1214	> 5
833-2	COAT	2022	1078	1078	> 5
834	ISB Soot	2023	764	728	3
864-1	DD13	2016	1576	440	3
864-2	DD13	2023	1475	1475	> 5
1005-5	1P, 1R, EOAT, RFWT, T-8E	2015	3826	702	2
831-4	C13, ISB	2017	1699	498	2.5
832-2	COAT	2022	734	513.5	> 5
1005-6	EOAT, COAT	2021	480	294	2
824	T-13	2024	881	724	> 5
831-5	C13, ISB	2024	1884	1871	> 5
FVTW1	FVTW	2021	1020	692	>5
FVTW2	FVTW	2021	1020	693	>5
FVTW3	FVTW	2022	396	276	3.5

LTMS Deviations

»» October 1, 2023–March 31, 2024

LTMS Deviations

- No LTMS Deviations in Current Period

Historical Count of HD LTMS Deviations

Test	LTMS Deviations
1M-PC	2
1N	2
T-8/E	2
T-10A	1
T-12	1

[Return to Table of Contents](#)

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Quality Index Deviations

»» October 1, 2023–March 31, 2024

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Quality Index Deviations

- ▶ No Qi deviations were issued this period

Quality Index Deviations

Historical Count of HD Quality Index Deviations

Test	Qi Deviations
1P	15
1R	1
ISM	3
C13	2
T-10A	1
T-11	3
T-12	8
T-13	3
COAT	5

[Return to Table of Contents](#)

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TMC Laboratory Visits

➤➤ October 1, 2023–March 31, 2024

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TMC Lab Visits

- ▶ No HD lab visits were conducted during this reporting period.

[Return to Table of Contents](#)

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Test Area Timelines

➤➤ October 1, 2023–March 31, 2024

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Test Area Timeline Additions*

Test	Date	IL/Memo	Topic
T11	11/2/23	23-1	Additional Coolant Option
T12	10/13/23	23-1	Hardware Correction Factor Updates
T13	10/13/23	23-1	Industry Correction Factor for Kinematic Viscosity Parameter

[Return to Table of Contents](#)

*As of 3/31/24

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



Rating Workshop Data



2023 Standardized Testing Deposit
Rating Workshop

Rating Workshop Data

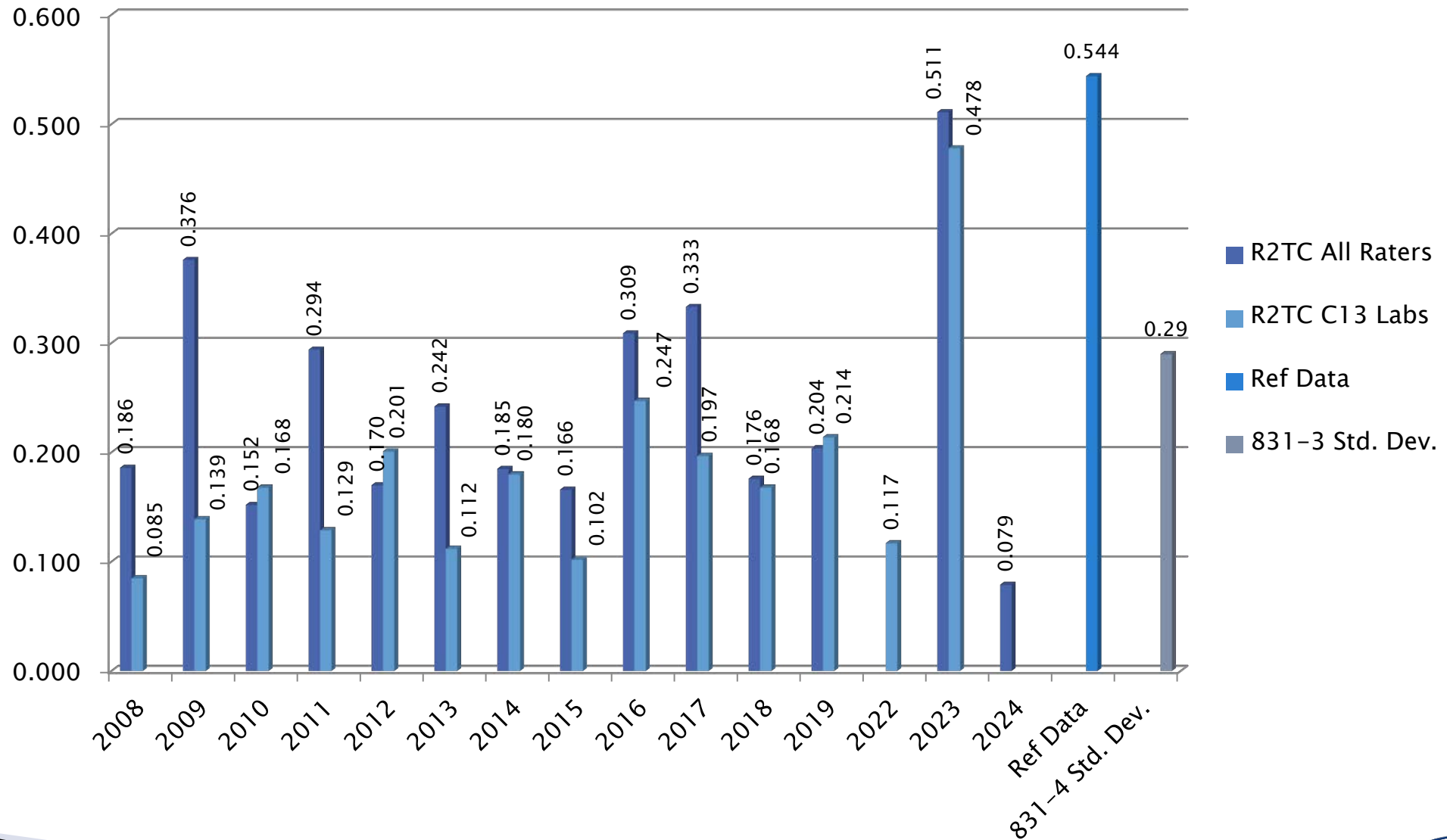
- ▶ The 2024 Standardized Testing Deposit Rating Workshop was held in March 2024 in San Antonio. The heavy-duty rating data is presented here.

[Return to Table of Contents](#)

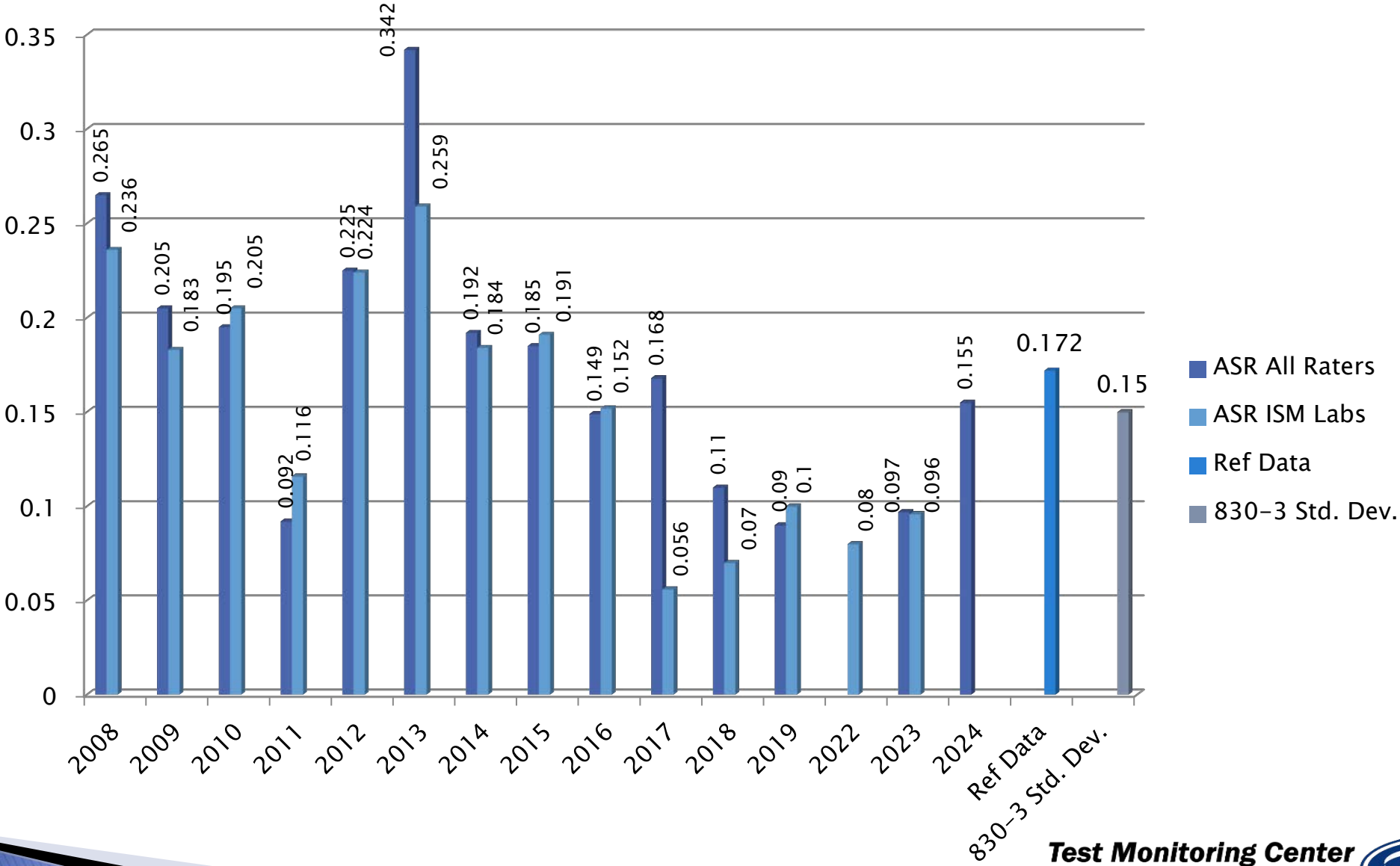
Test Monitoring Center
<https://www.astmtmc.org>



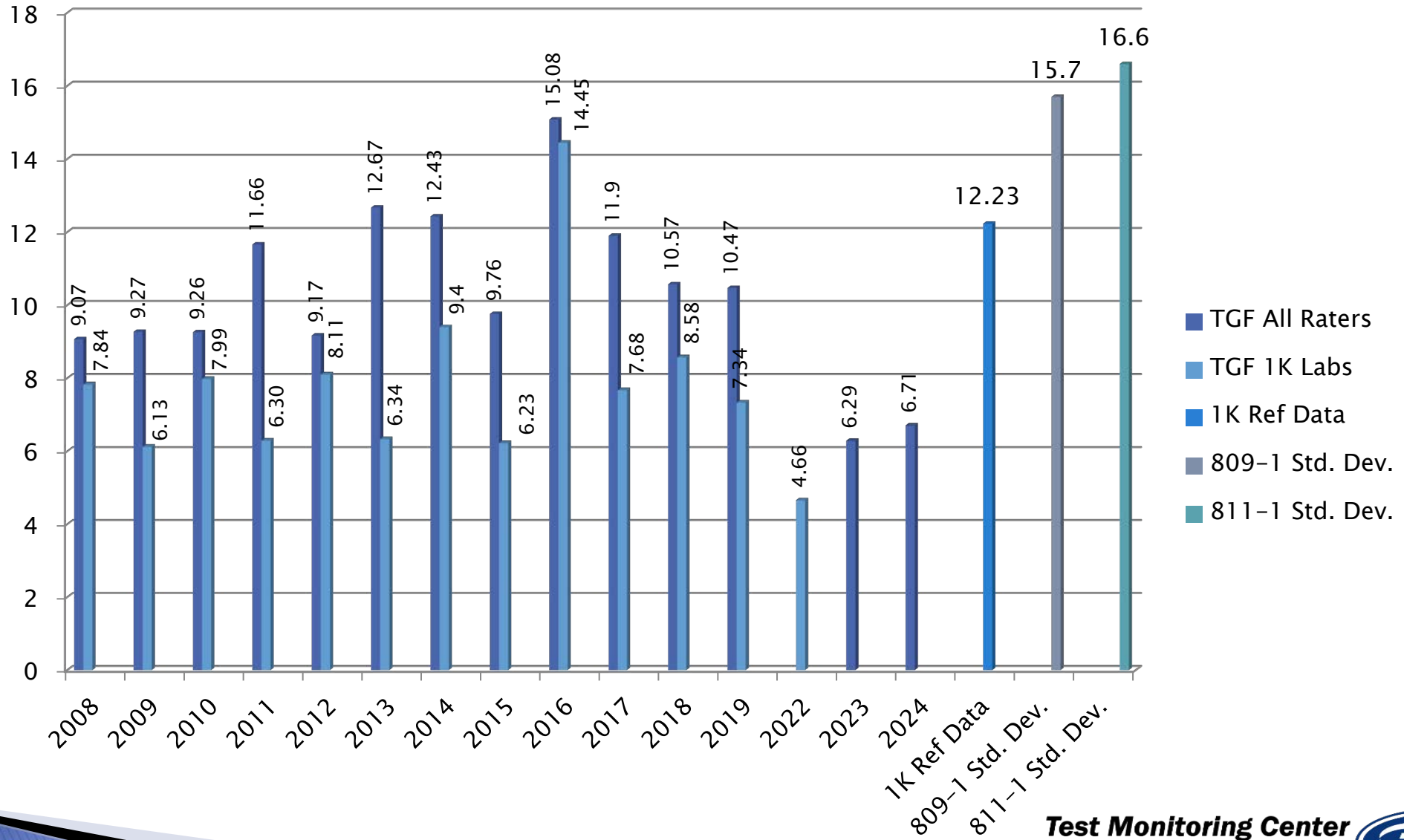
C13 2nd Ring Carbon Precision – Rating Workshop Data



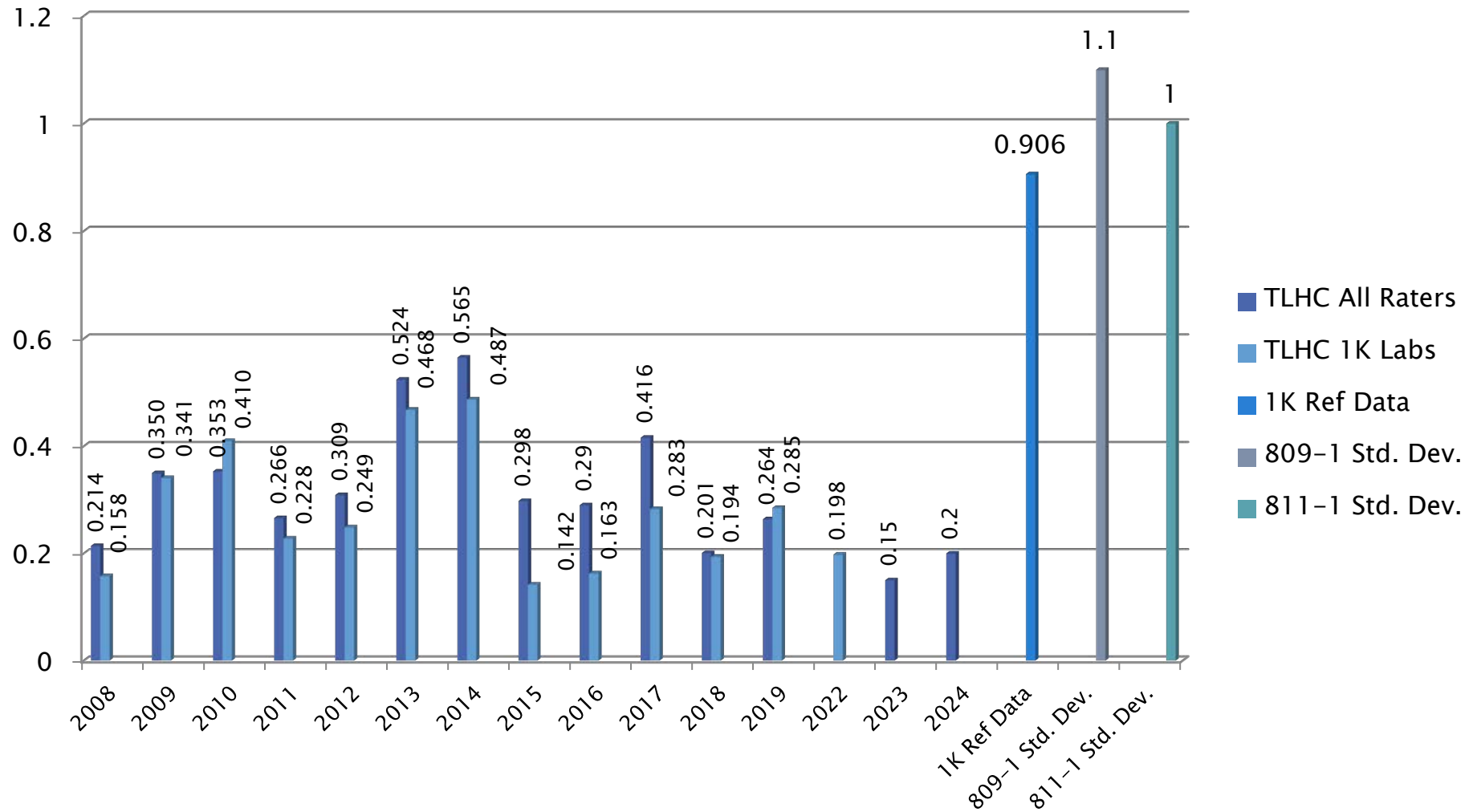
ISM Sludge Rating Precision - Rating Workshop Data



Deposit Rating Precision - Rating Workshop Data



Deposit Rating Precision – Rating Workshop Data



[Return to Table of Contents](#)

Miscellaneous Information

- ▶ Available on TMC Website:
 - Oil Assignment Request and Test File Upload
 - 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](#)

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