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Test Monitoring Center

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

April 2017

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Heavy Duty Testing

Executive Summary

- ▶ Reference Oils
 - 830-3, 831-4
 - ISM and C13/ISB reference oil re-blends secured and ready for testing.
- ▶ Test Issues
 - CAT 1N Test Severity Investigation ongoing by Surveillance Panel
 - COAT test declared unavailable due to flow meter calibration issues. Plan in place and work proceeding to bring test back online.

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Calibrated Labs and Stands*

Test	Labs	Stands
1K	1	1
1N	4	5
1M-PC	1	1
1P	1	1
1R	0	0
C13	4	4
ISB	3	5
ISM	5	5
EOAT	1	1
RFWT	2	2
T-8/E	2	3
T-11	4	5
T-12/T-12A	4/4	6/6
T-13	5	7
COAT	0	0
DD13	3	4

*As of 03/31/2017

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SCOTE 1K

»» April 2017

1 K 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 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

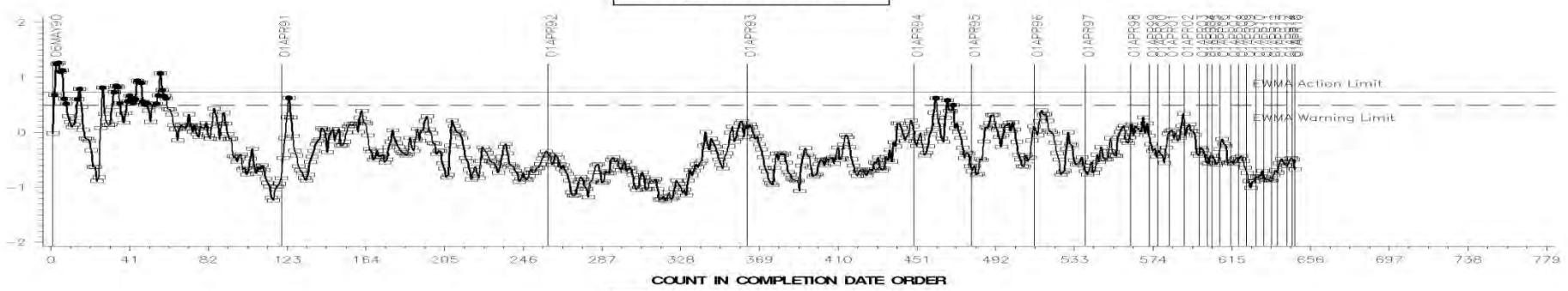
- ▶ As no 1K tests were run during this period no statement about test severity can be made.

FINAL TGF

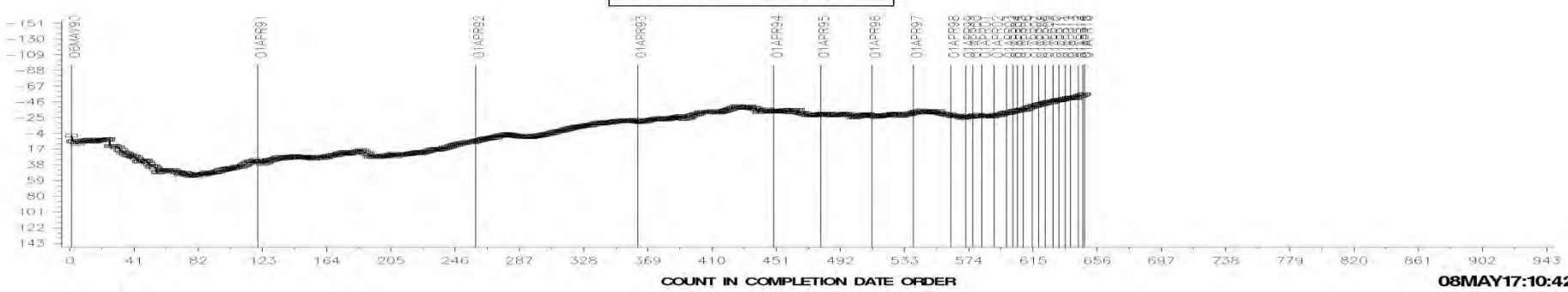
LTMS Severity Analysis



LTMS Precision Analysis



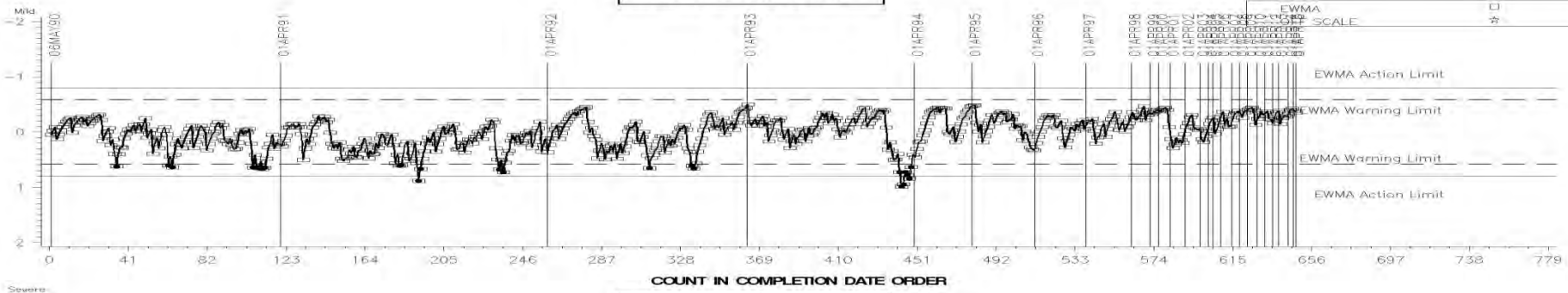
CUSUM Severity Analysis



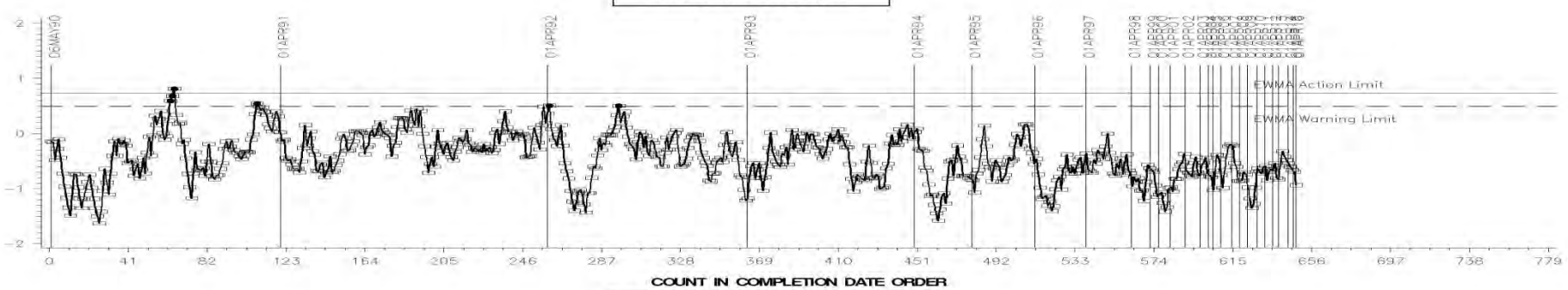
08MAY17:10:42

FINAL TLHC

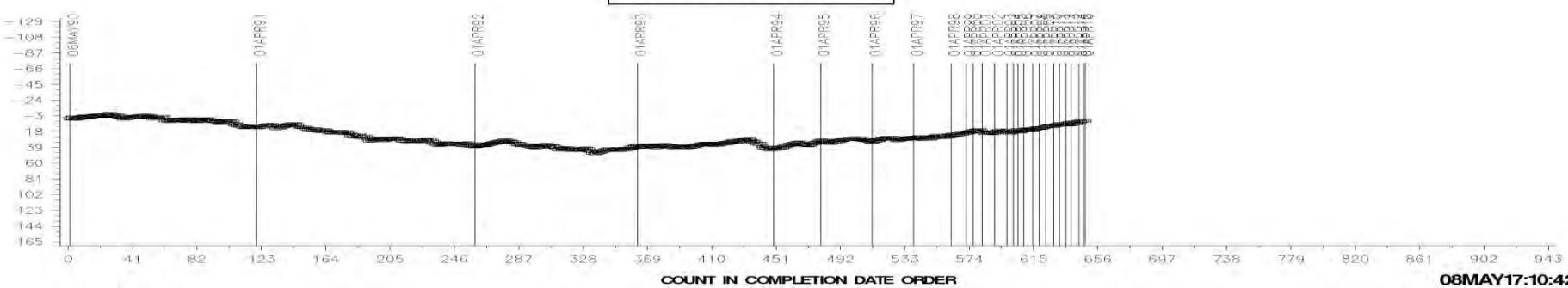
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis



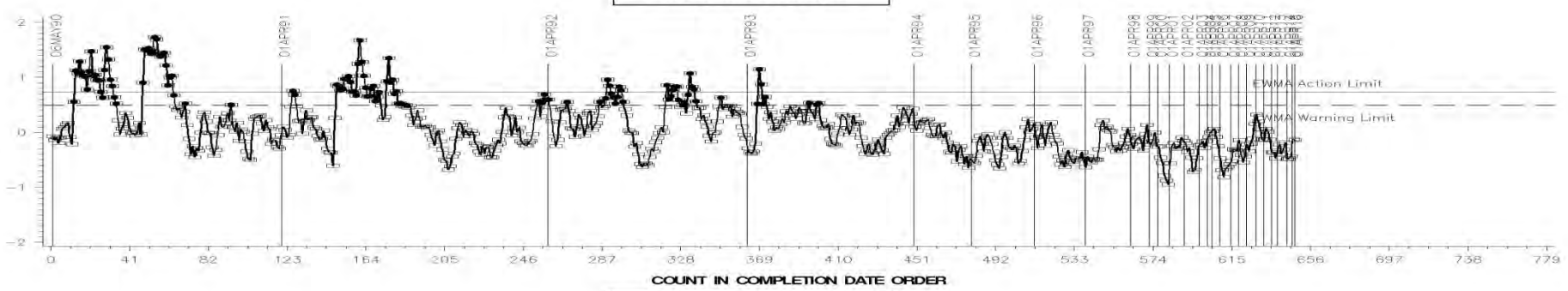
08MAY17:10:42

FINAL Weighted Total Demerits

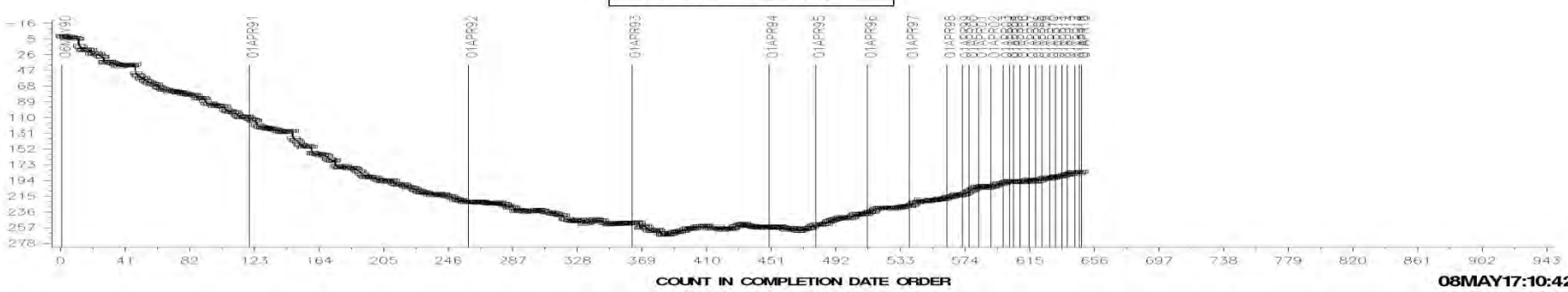
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis



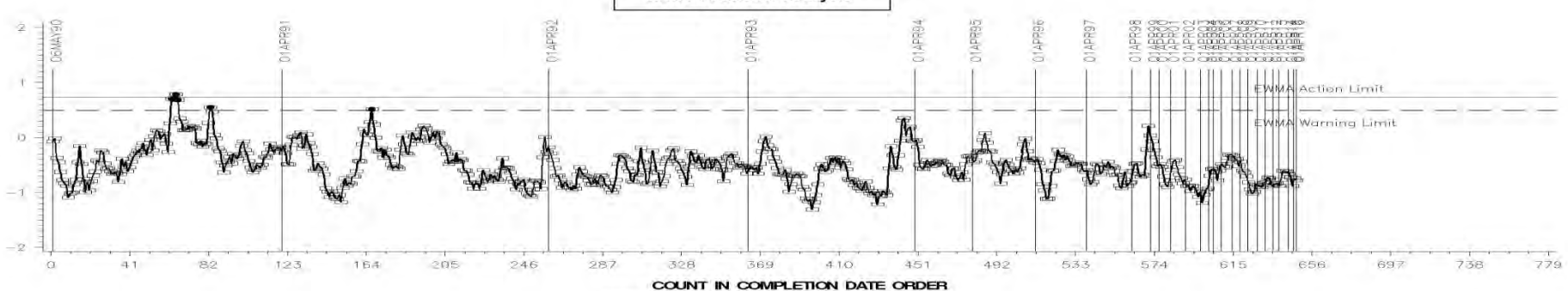
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FINAL BSOC

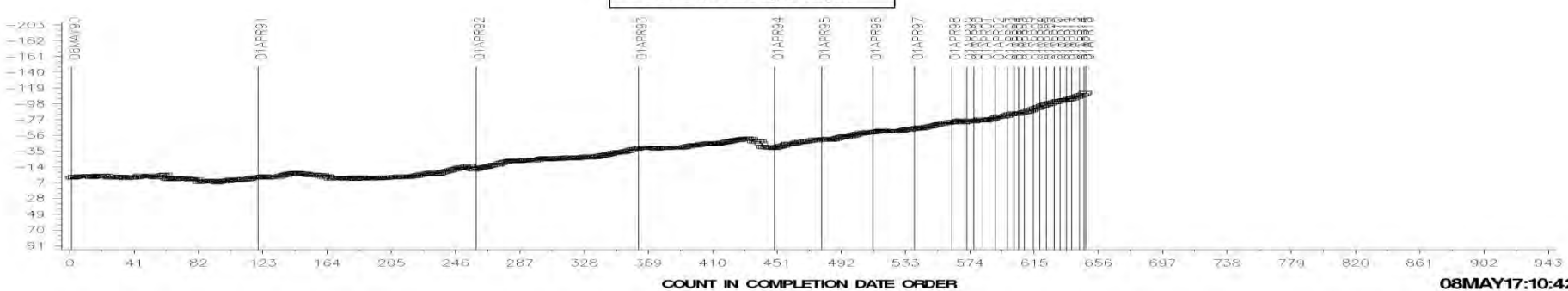
LTMS Severity Analysis



LTMS Precision Analysis



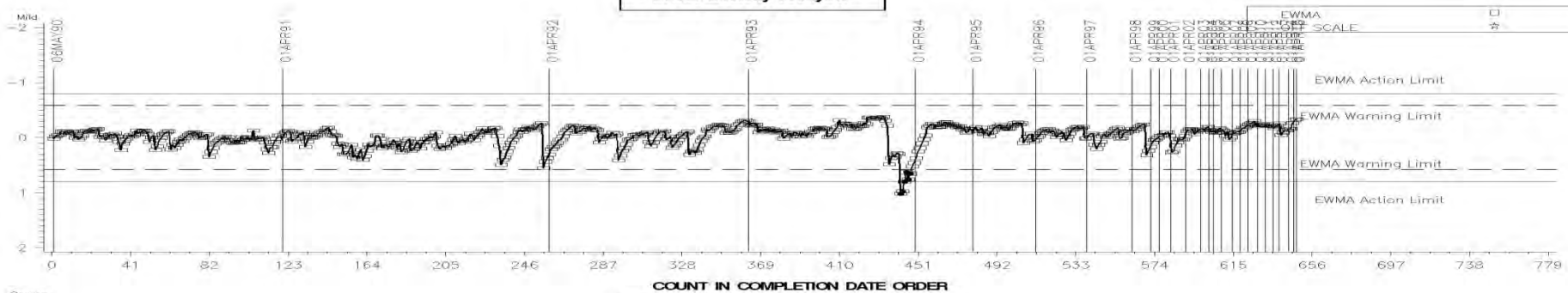
CUSUM Severity Analysis



08MAY17:10:42

FINAL EOTC

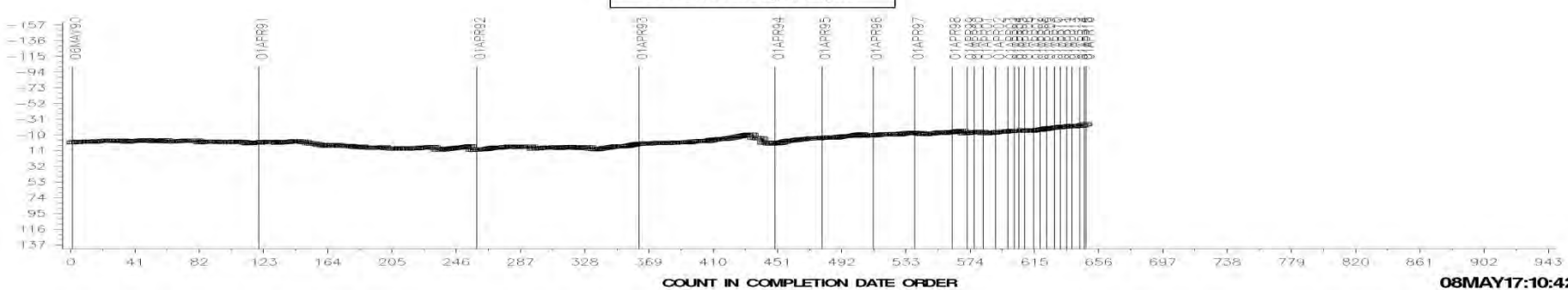
LTMS Severity Analysis



LTMS Precision Analysis

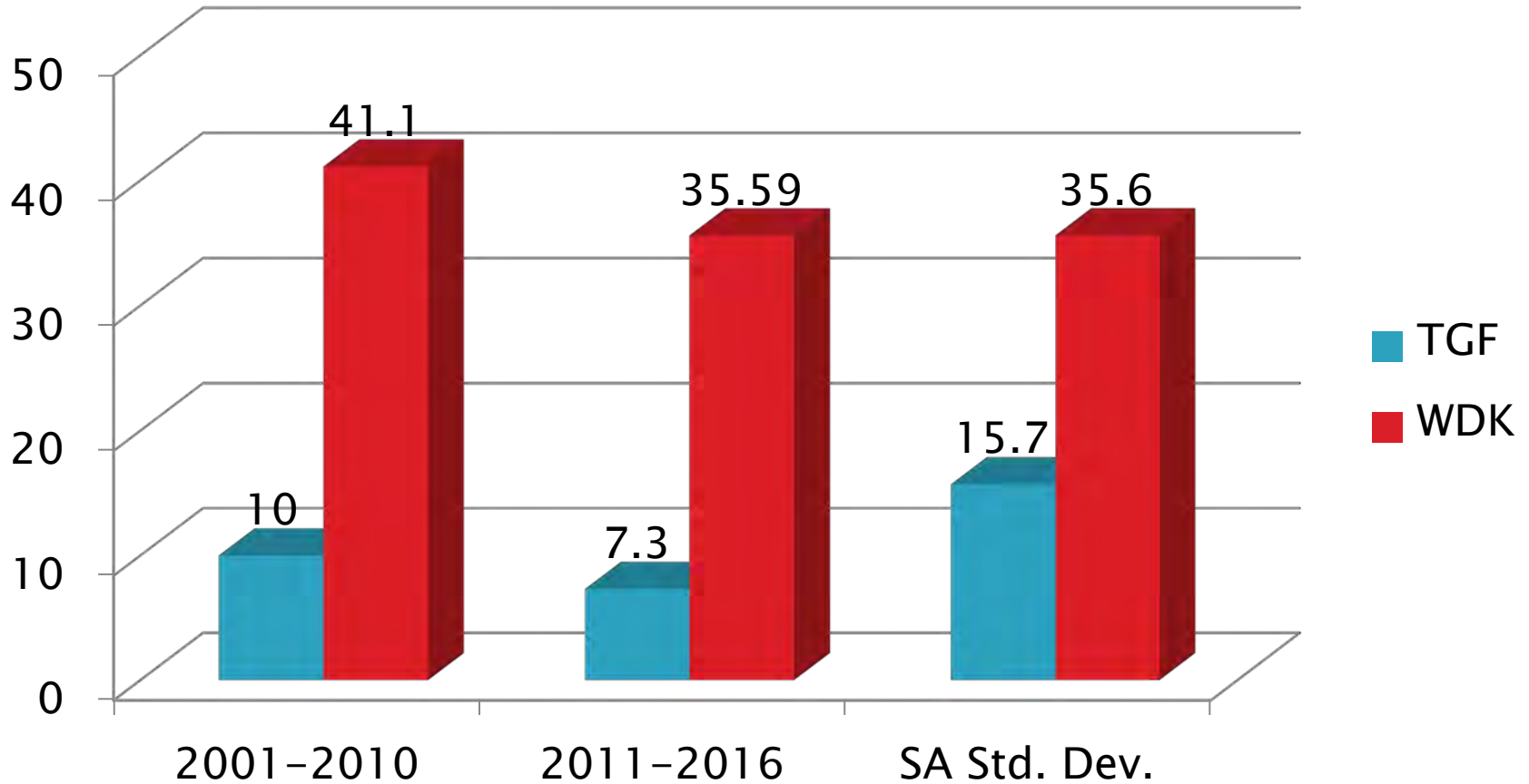


CUSUM Severity Analysis

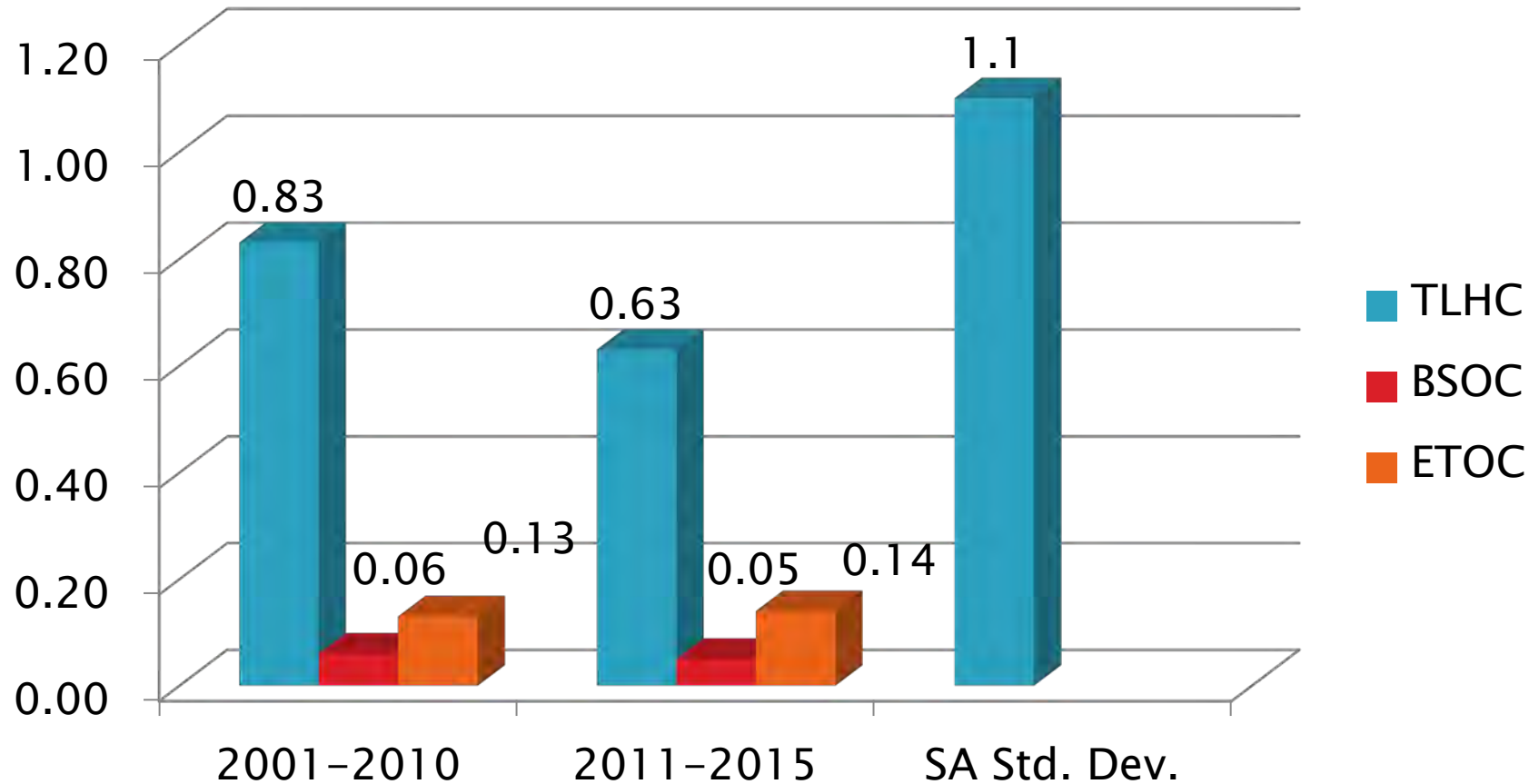


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1 K Precision Estimates



1K Precision Estimates



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SCOTE 1N

»» April 2017

1 N Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	4
Failed Calibration Test	OC	2
Operationally Invalid	LC	0
Aborted	XC	1
Informational	NN	1
Total		8

1 N Failed Tests

Failed Parameter	Number of Tests
Severe Top Groove Fill, Top Land Heavy Carbon	1
Severe Top Groove Fill	1
Total	2

1 N Lost Tests*

Status	Cause	#
Invalid	No invalid tests	0
Aborted	Spun rod bearing during break-in	1
Total		1

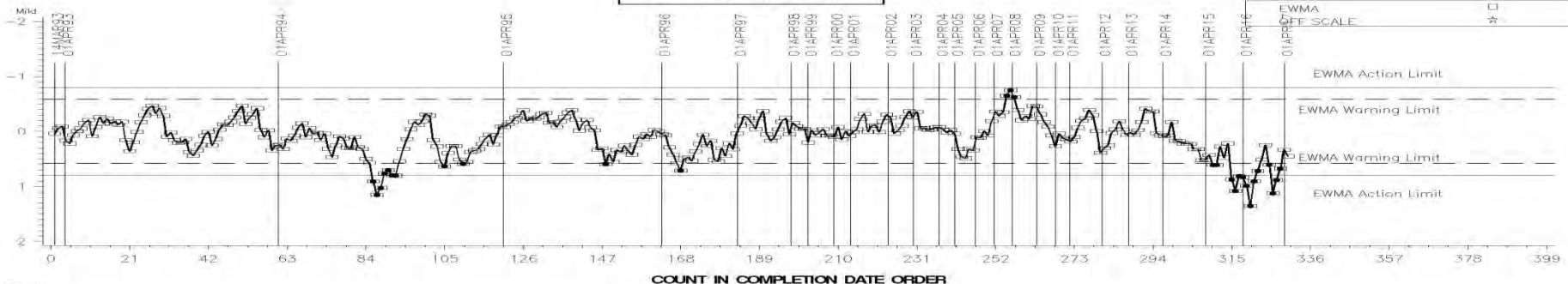
*Invalid and aborted tests

1 N Test Severity

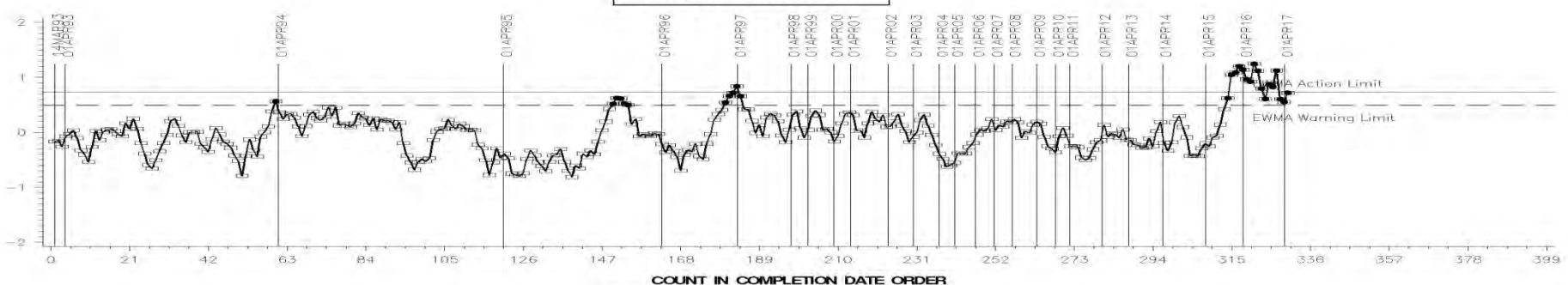
- ▶ WDN in severity action alarm mild direction.
- ▶ TGF in precision warning alarm.
- ▶ TLHC and BSOC in control
- ▶ Severity trends are being evaluated by surveillance panel

FINAL CORRECTED TGF

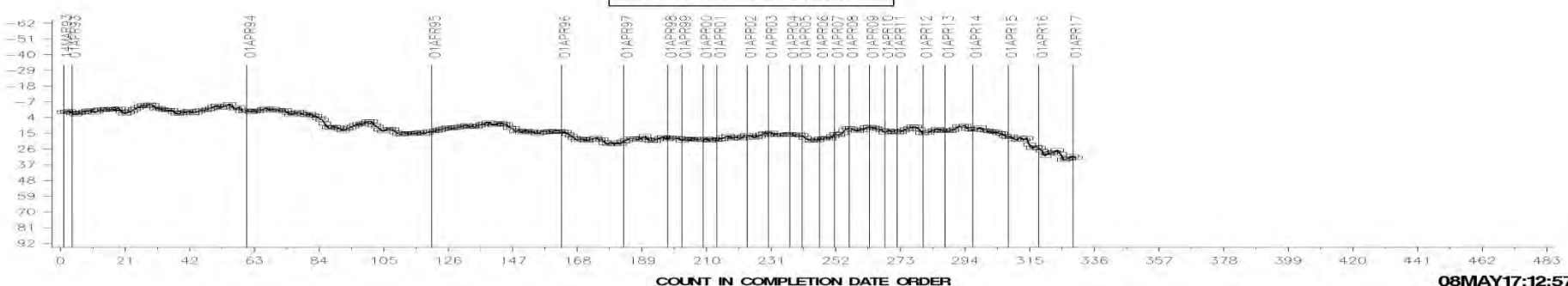
LTMS Severity Analysis



LTMS Precision Analysis



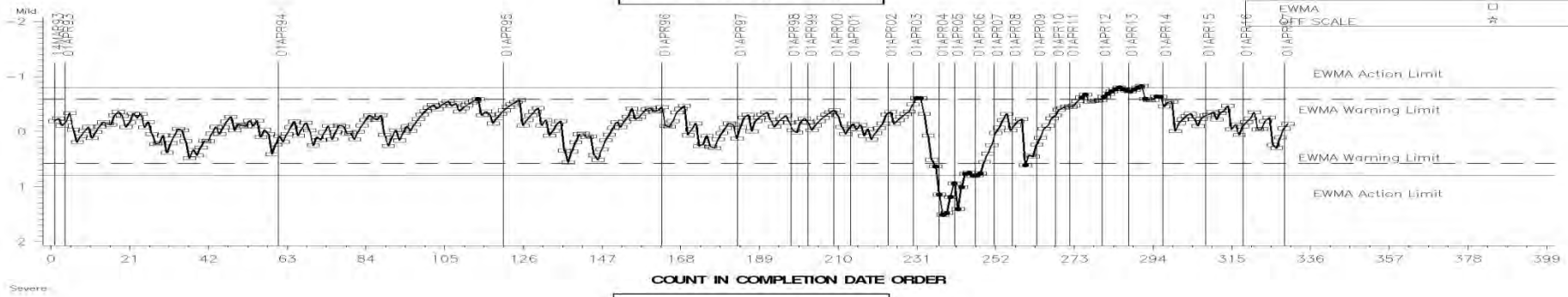
CUSUM Severity Analysis



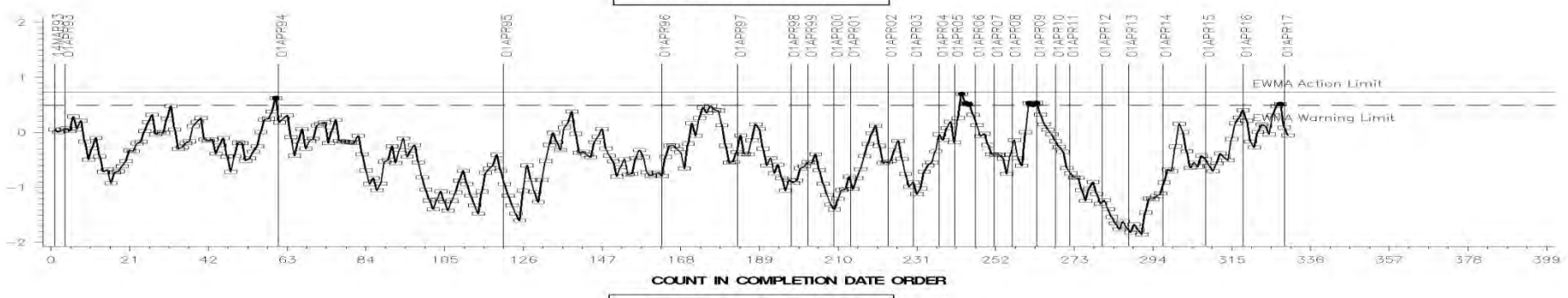
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Top Land Heavy Carbon

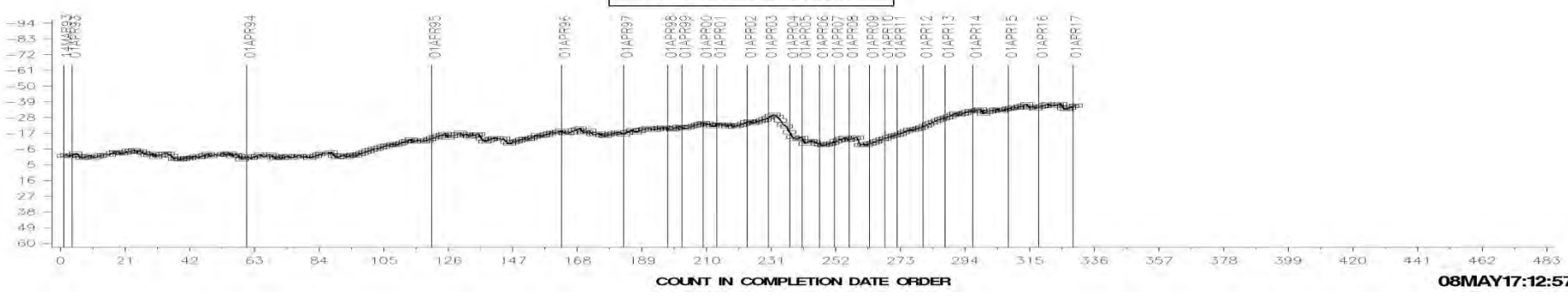
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis



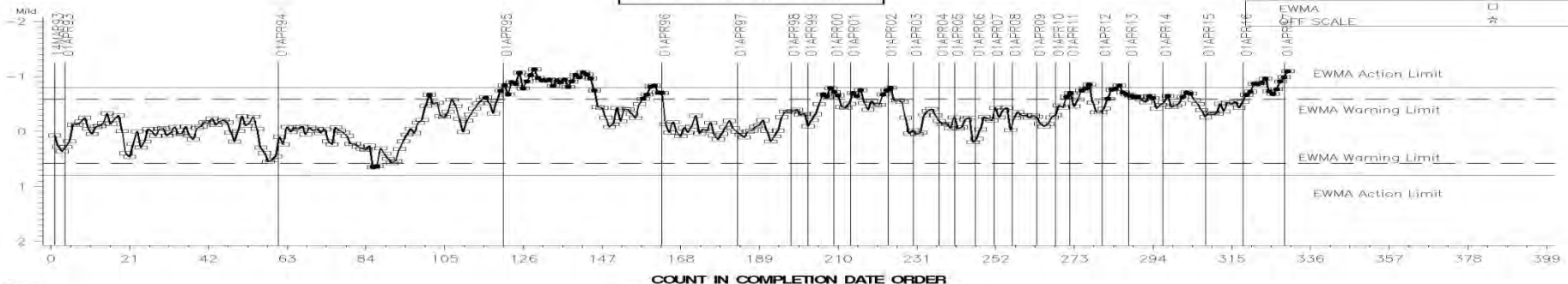
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CATERPILLAR 1N INDUSTRY OPERATIONAL VALID DATA

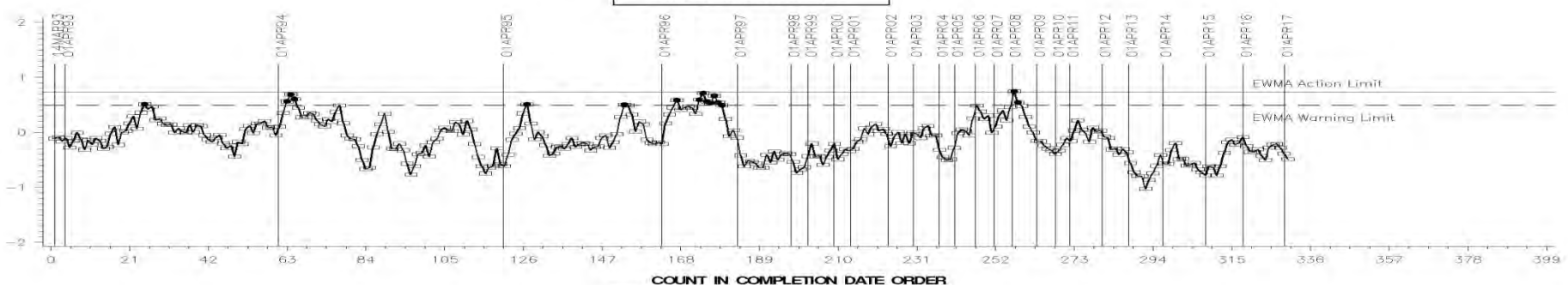


Weighted Total Demerits

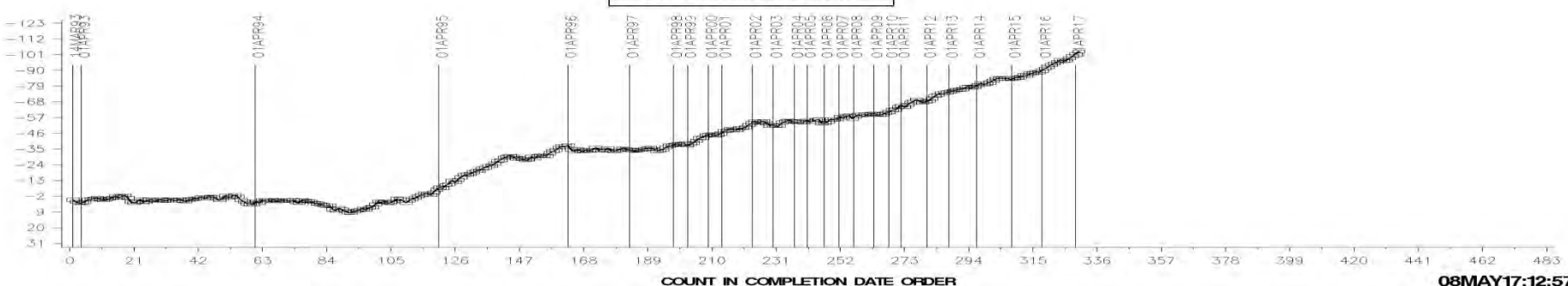
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

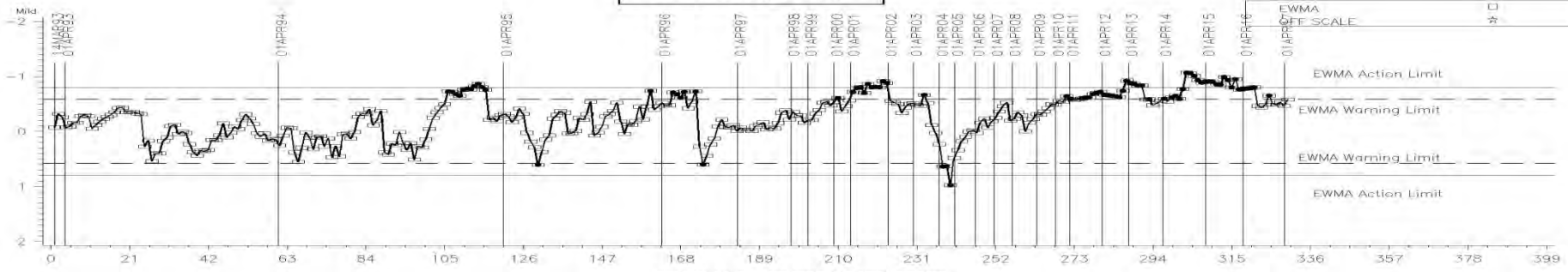


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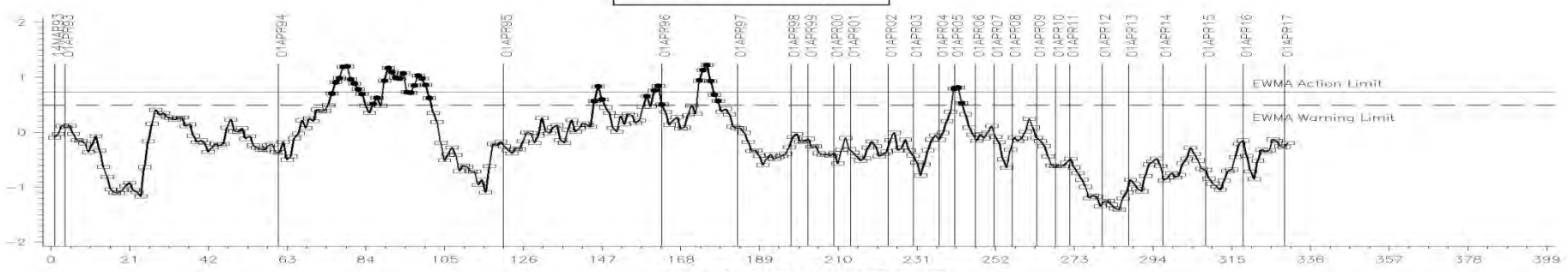
BSOC

LTMS Severity Analysis



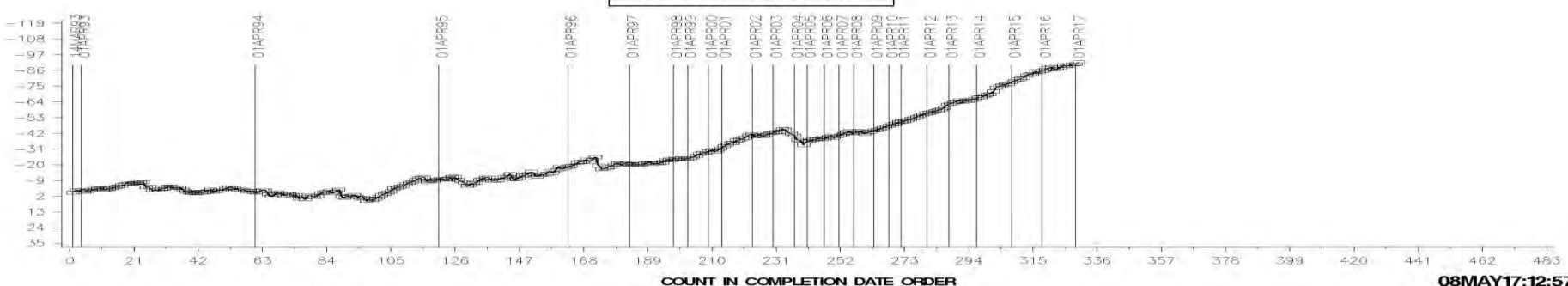
COUNT IN COMPLETION DATE ORDER

LTMS Precision Analysis



COUNT IN COMPLETION DATE ORDER

CUSUM Severity Analysis

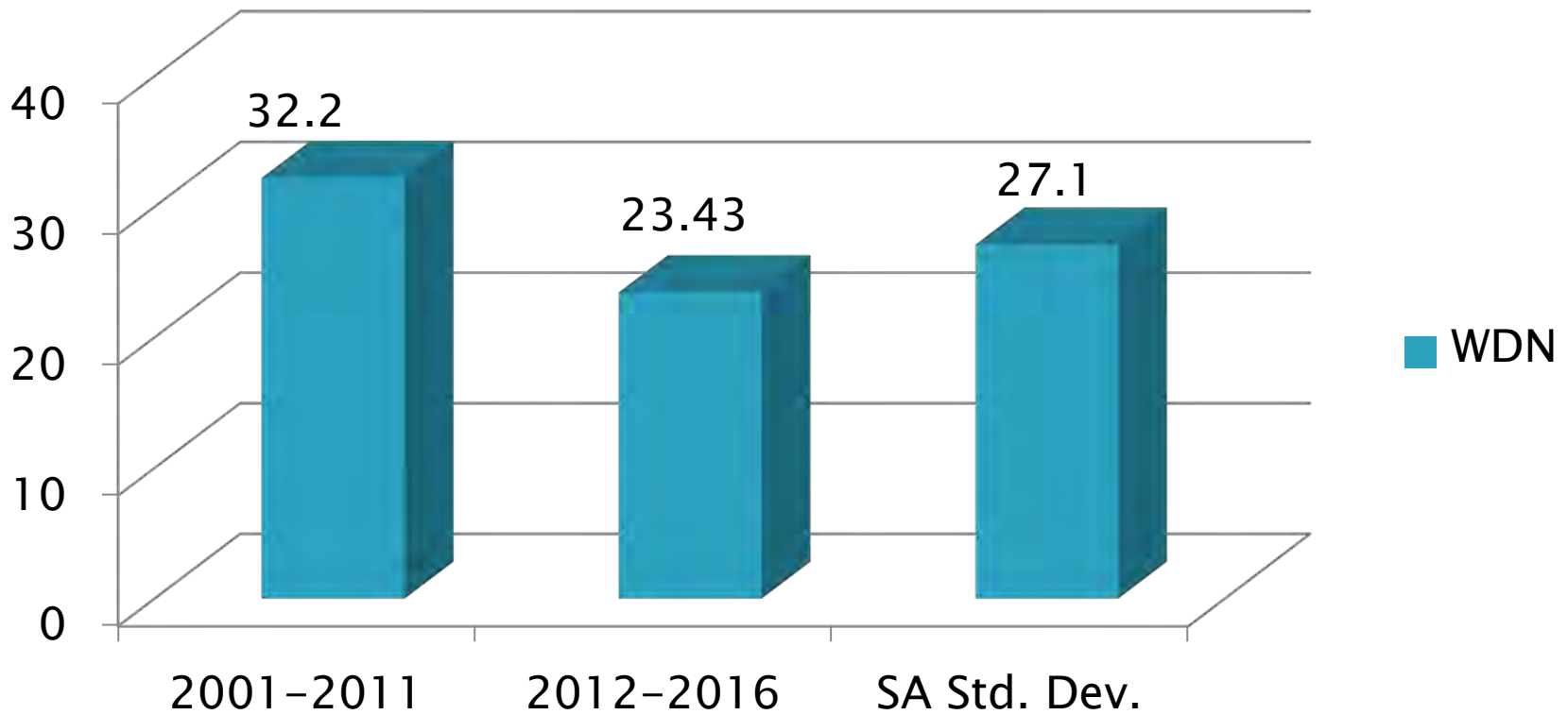


COUNT IN COMPLETION DATE ORDER

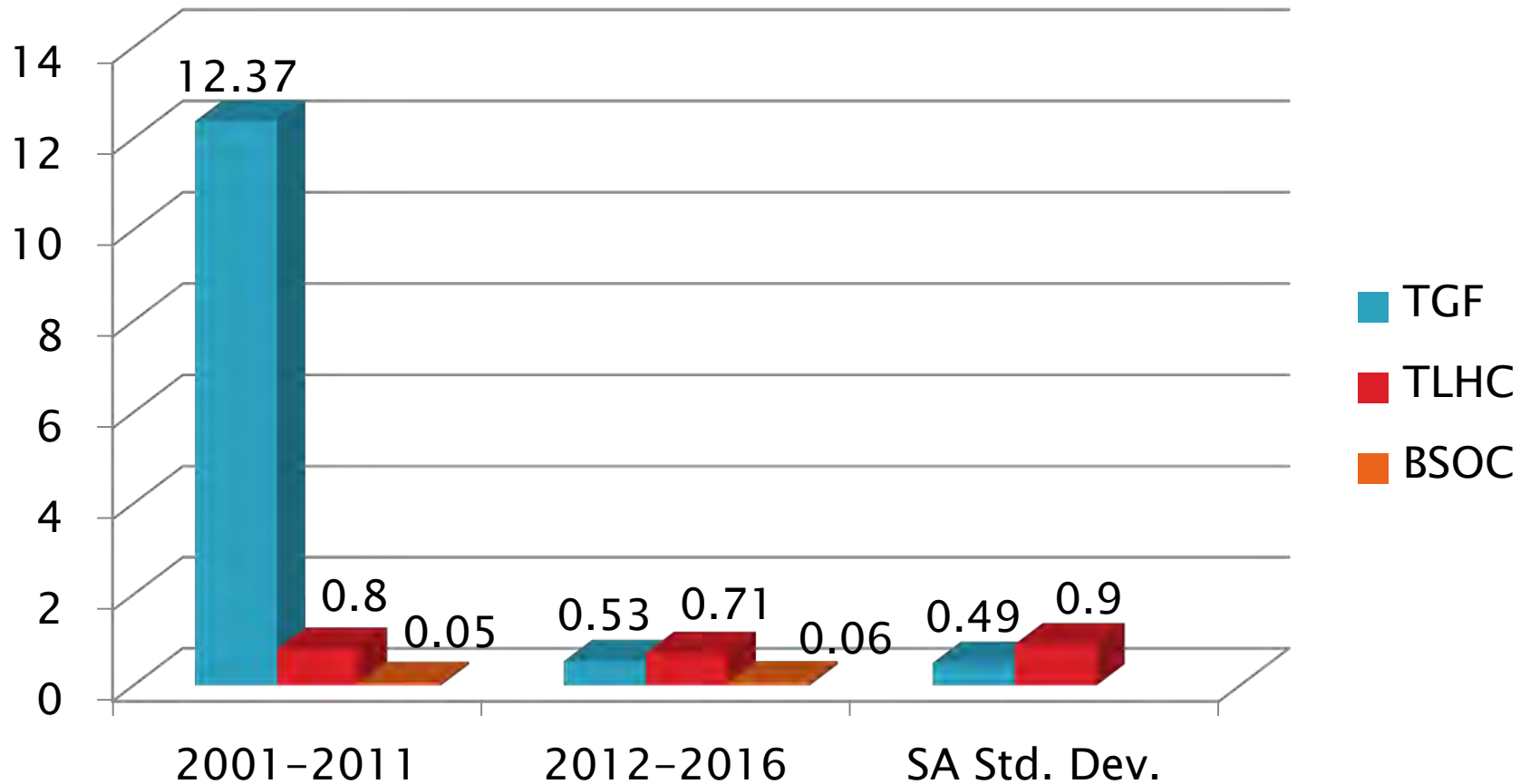
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1 N Precision Estimates

WDN



1N Precision Estimates



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SCOTE 1M-PC

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1 M-PC Test Activity

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

1 M-PC Failed Tests

Failed Parameter	Number of Tests
No Failed Test	0
Total	0

1 M-PC Lost Tests*

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

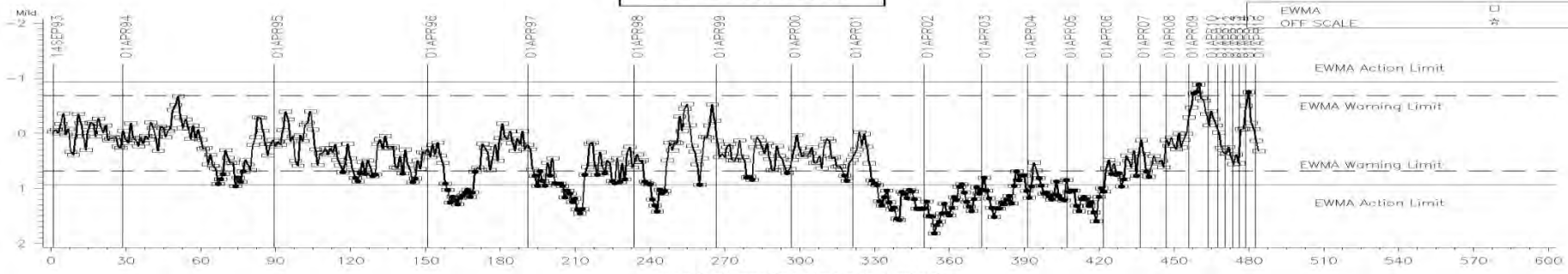
*Invalid and aborted tests

1 M-PC Test Severity

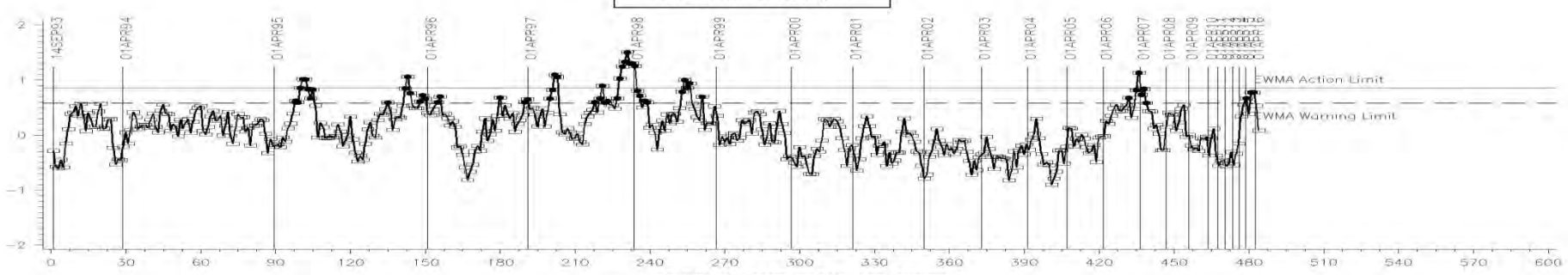
- ▶ WTD and TGF are in control.

FINAL TOP GROOVE FILLING

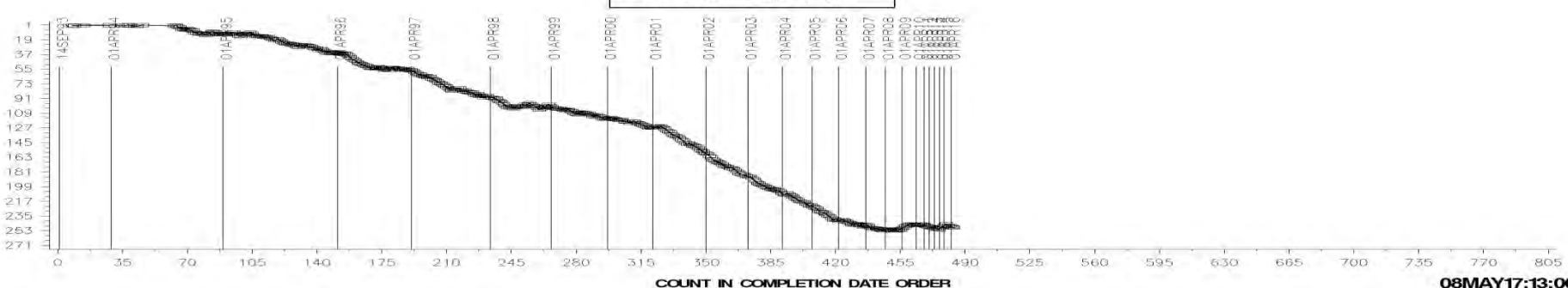
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis



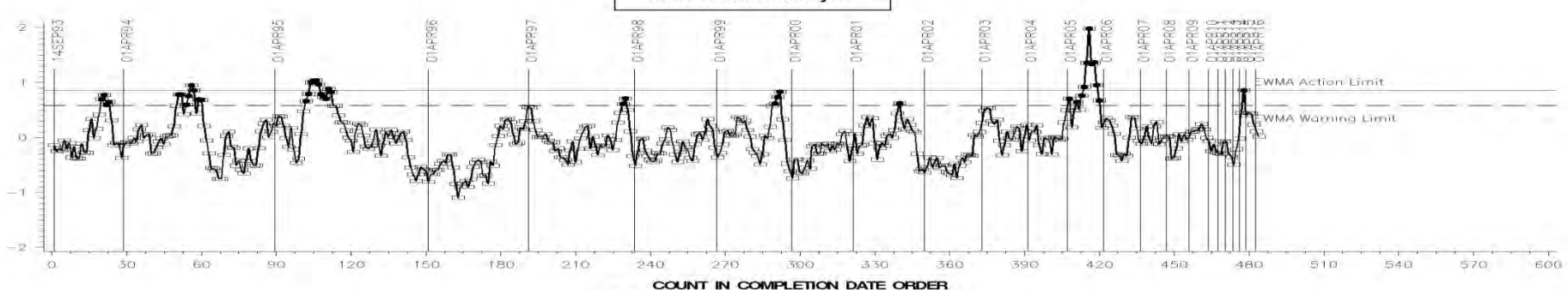
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Weighted Total Demerits

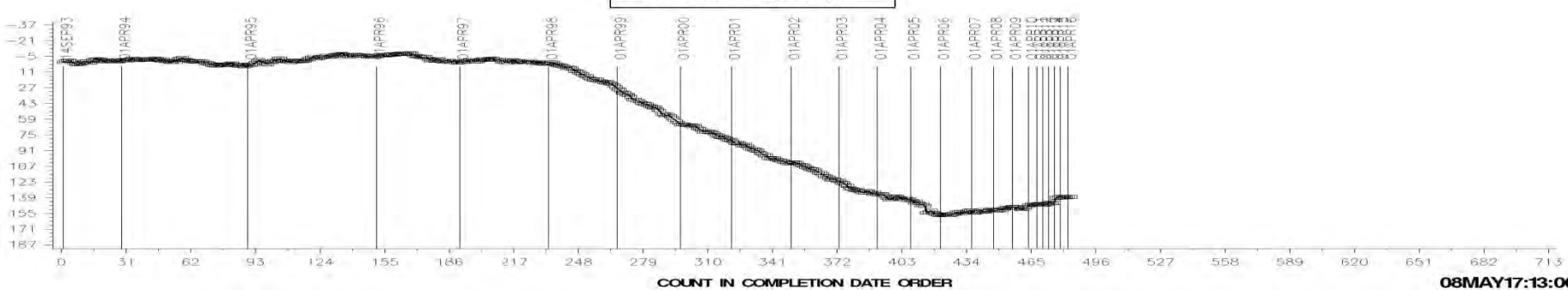
LTMS Severity Analysis



LTMS Precision Analysis

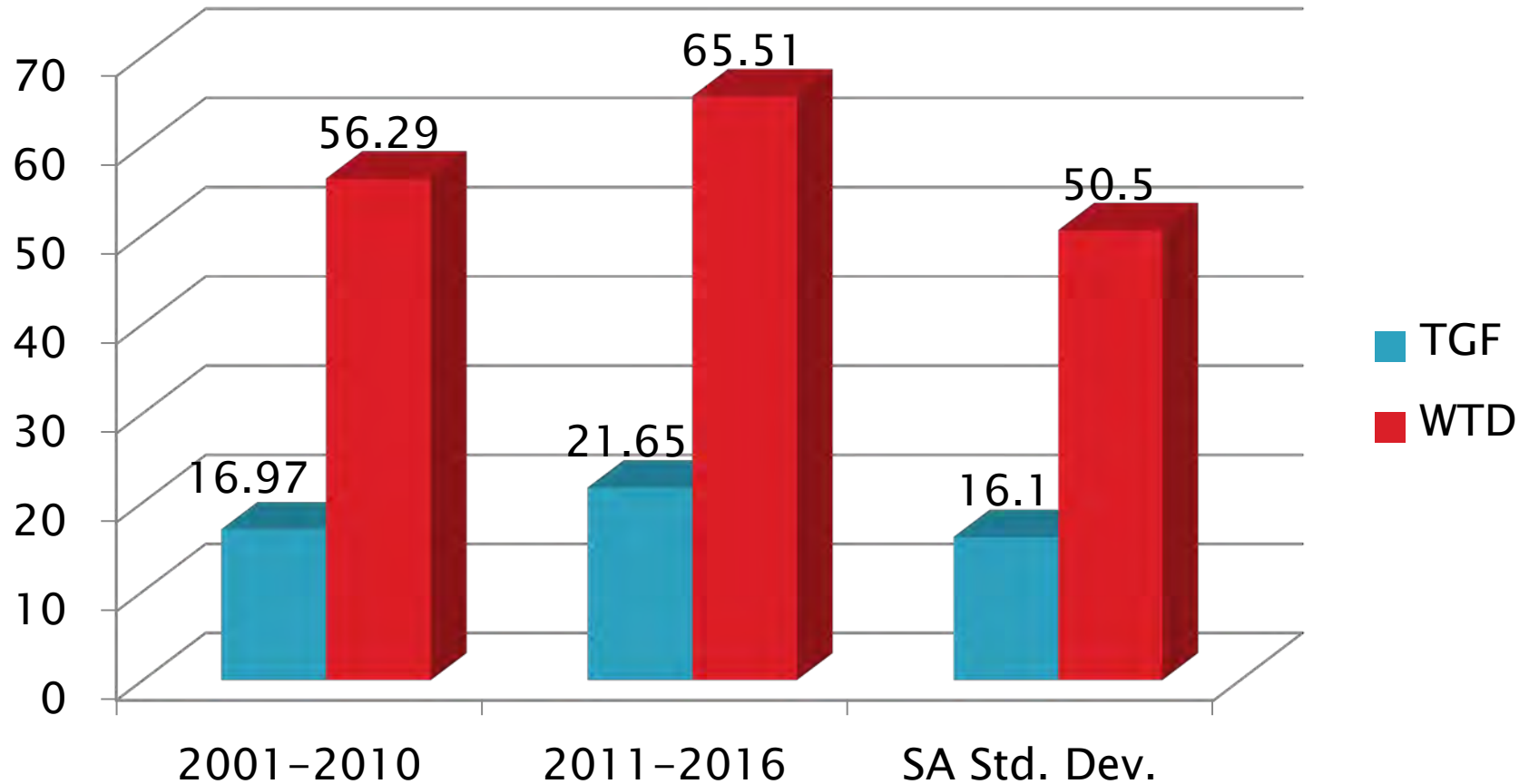


CUSUM Severity Analysis



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1 MPC Precision Estimates



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1 P Test Activity

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

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

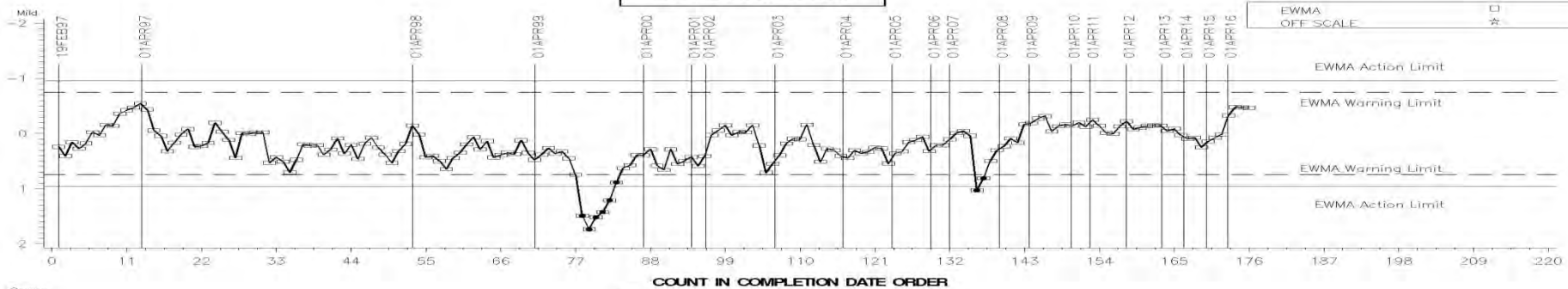
*Invalid and aborted tests

1 P Test Severity

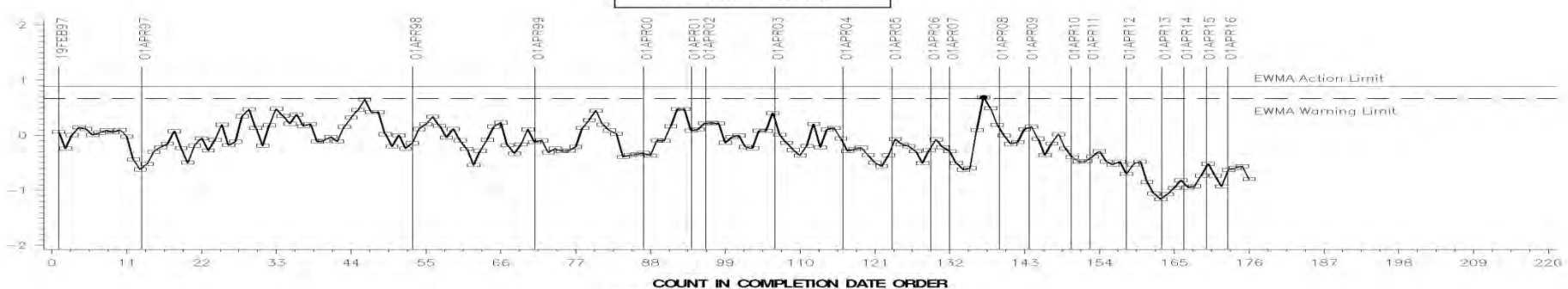
- ▶ EOTOC is in warning alarm severe direction.
- ▶ TGC, TLC, OC and WD are in control.

TOP GROOVE CARBON

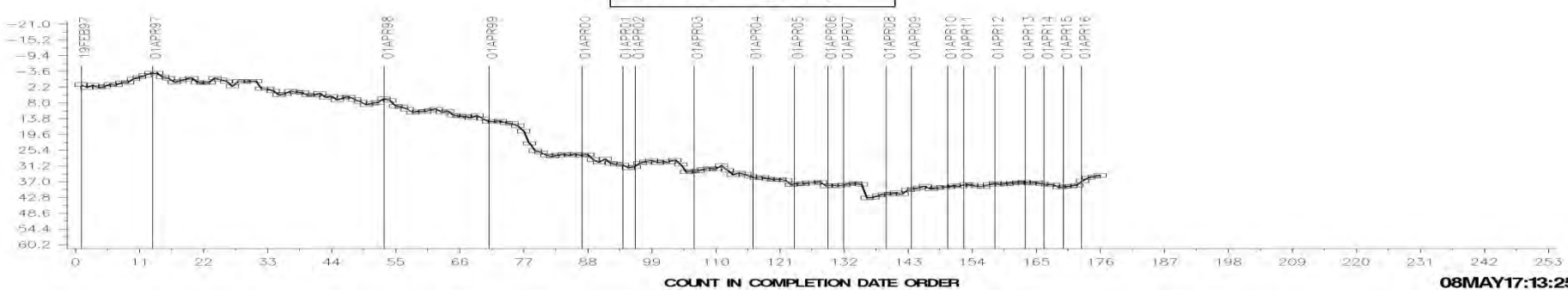
LTMS Severity Analysis



LTMS Precision Analysis



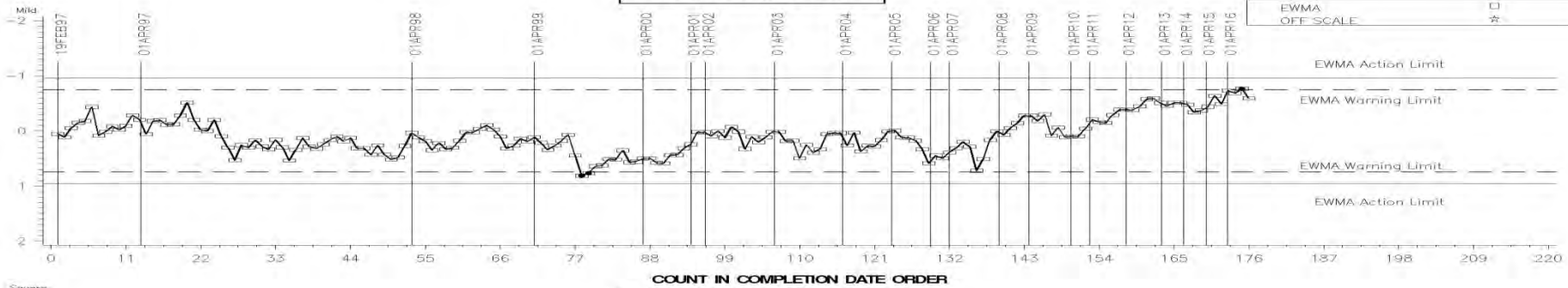
CUSUM Severity Analysis



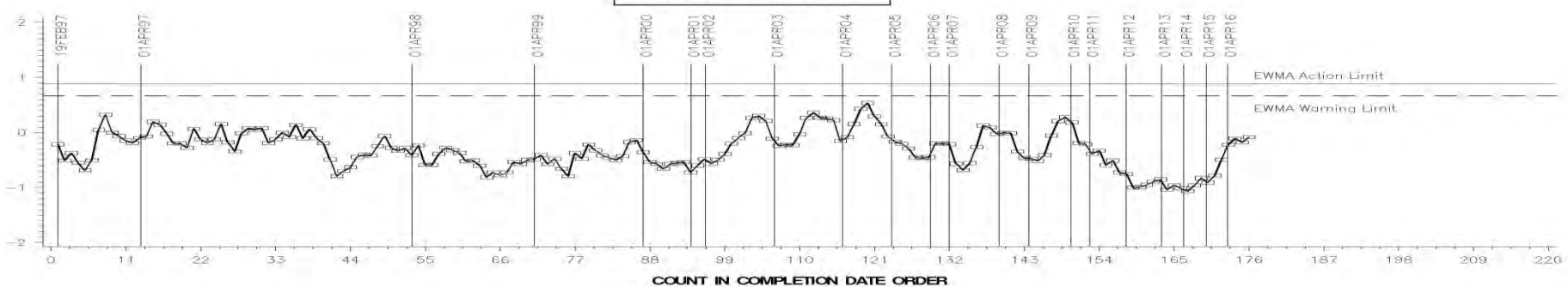
08MAY17:13:25

TOP LAND CARBON

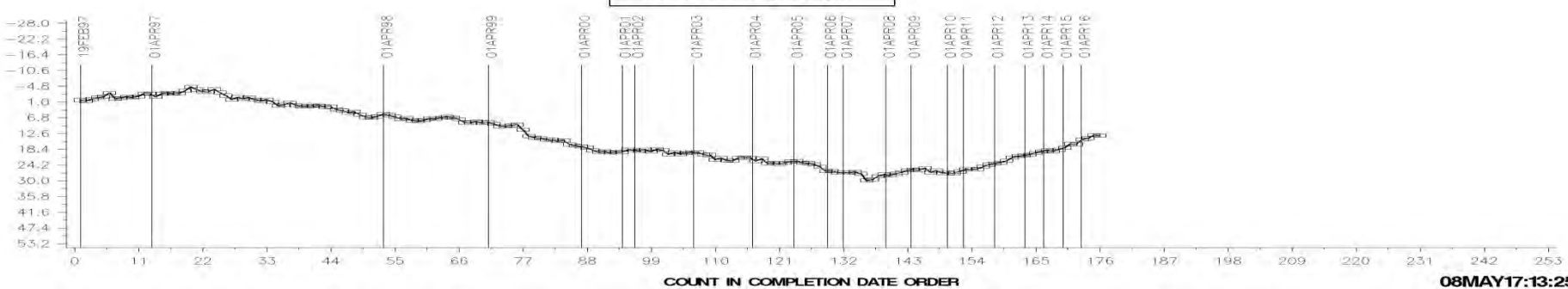
LTMS Severity Analysis



LTMS Precision Analysis



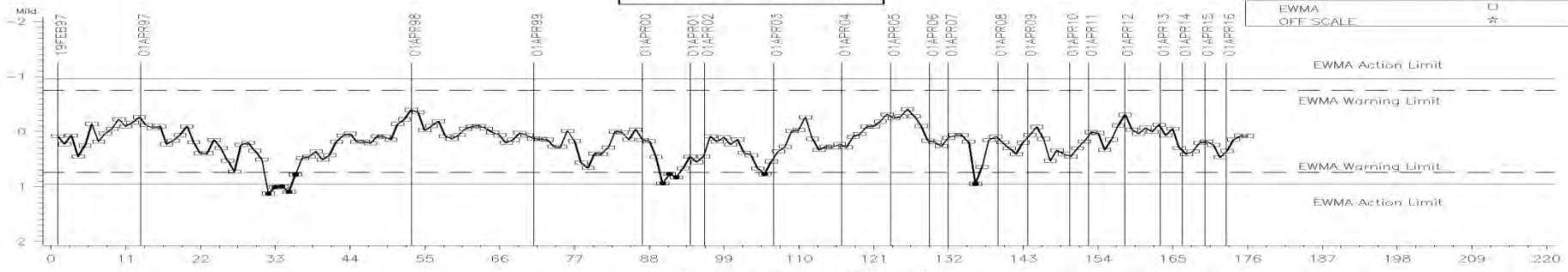
CUSUM Severity Analysis



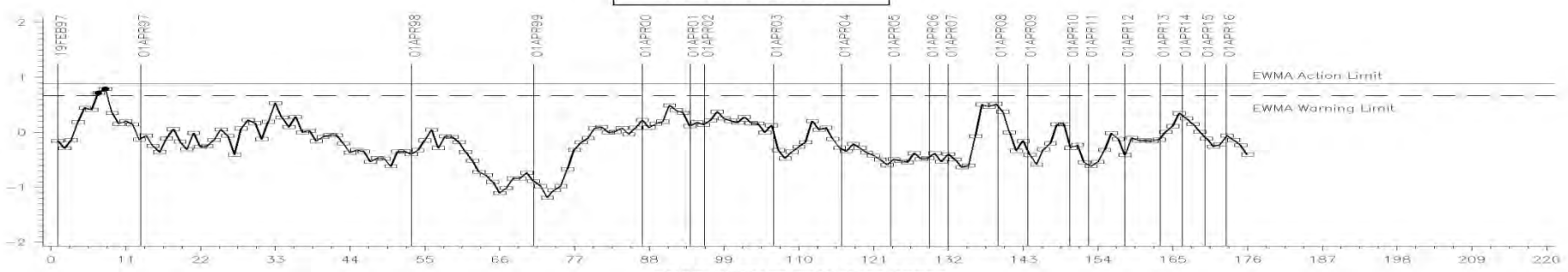
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WEIGHTED TOTAL DEMERITS

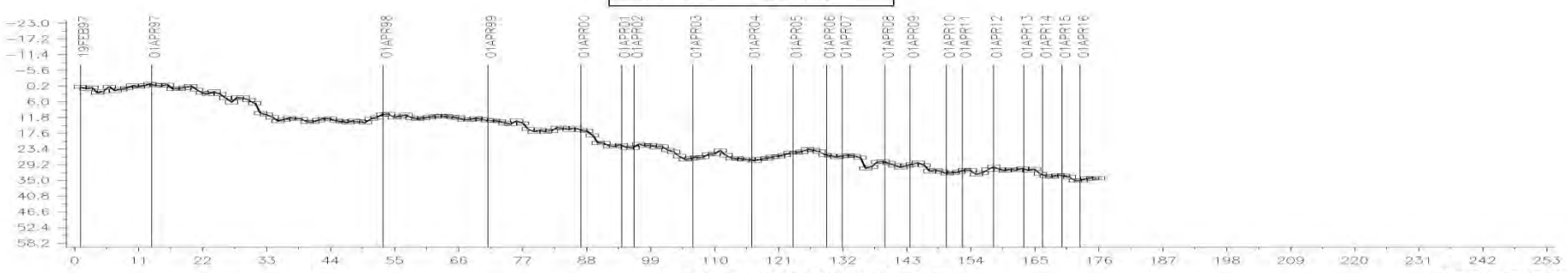
LTMS Severity Analysis



LTMS Precision Analysis



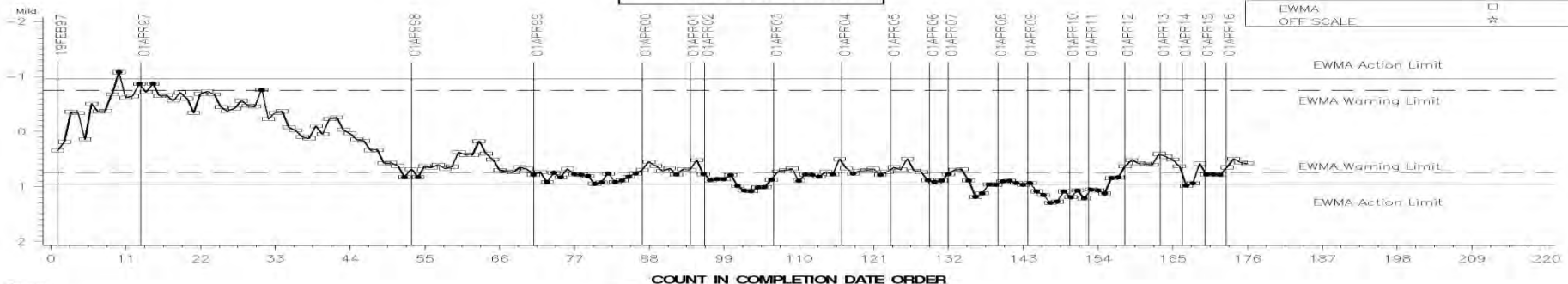
CUSUM Severity Analysis



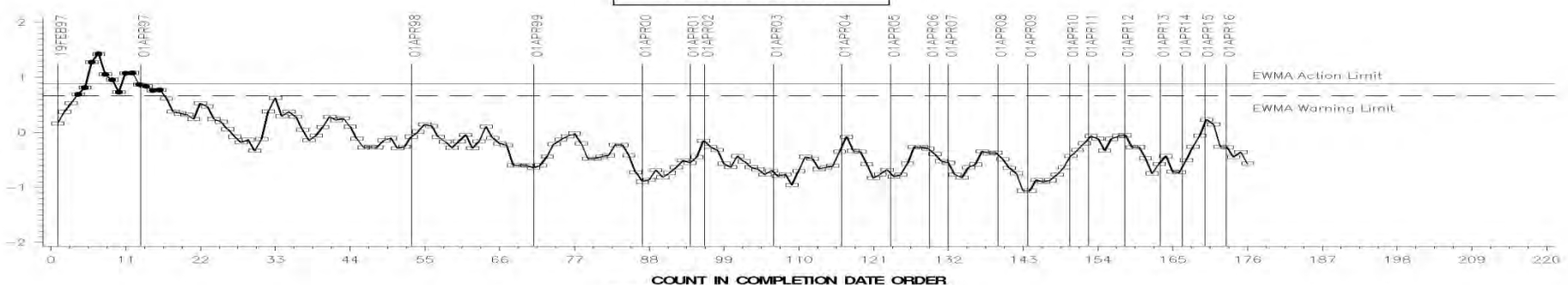
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OIL CONSUMPTION

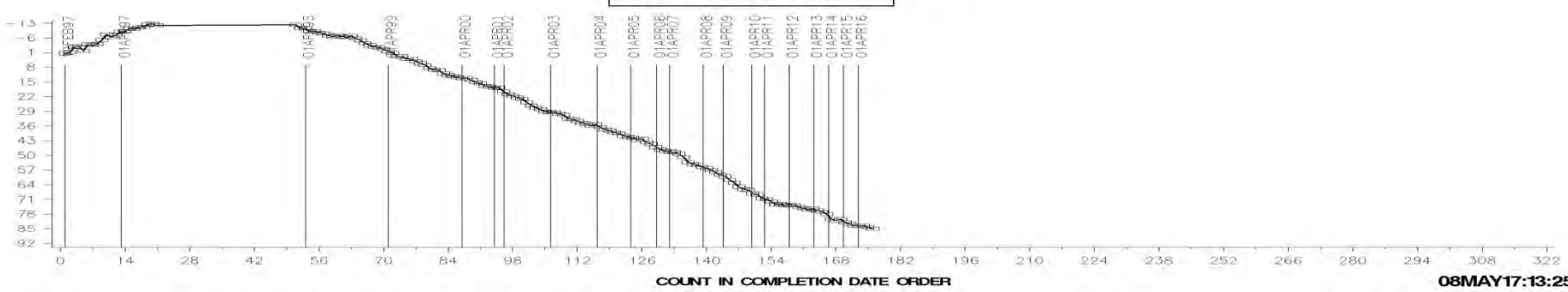
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis



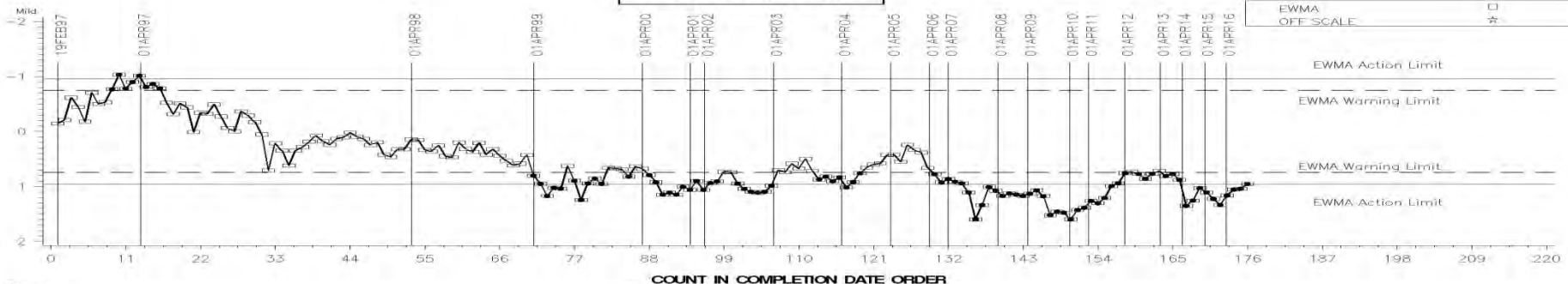
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CATERPILLAR 1P INDUSTRY OPERATIONALLY VALID DATA

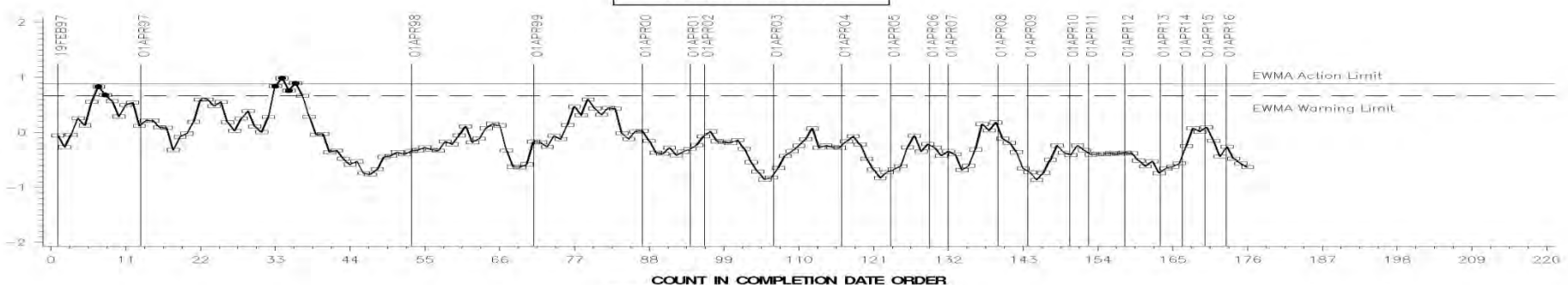


EOTOC

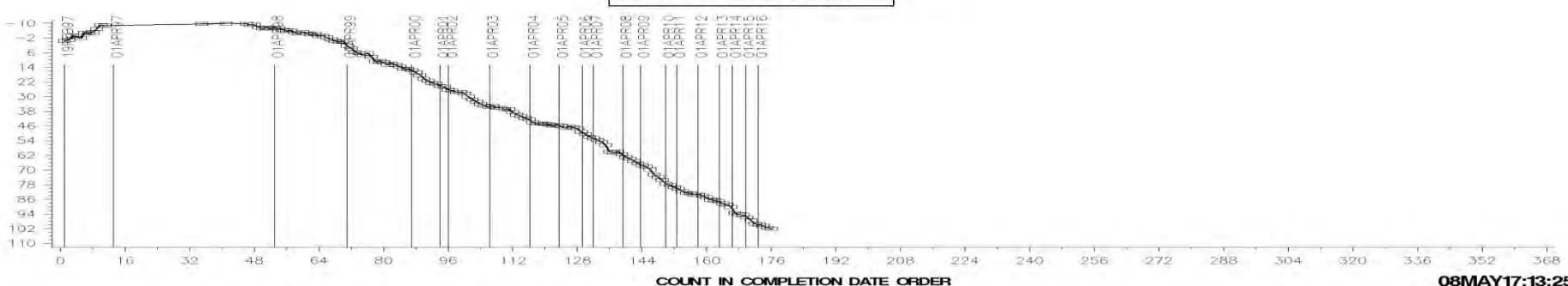
LTMS Severity Analysis



LTMS Precision Analysis



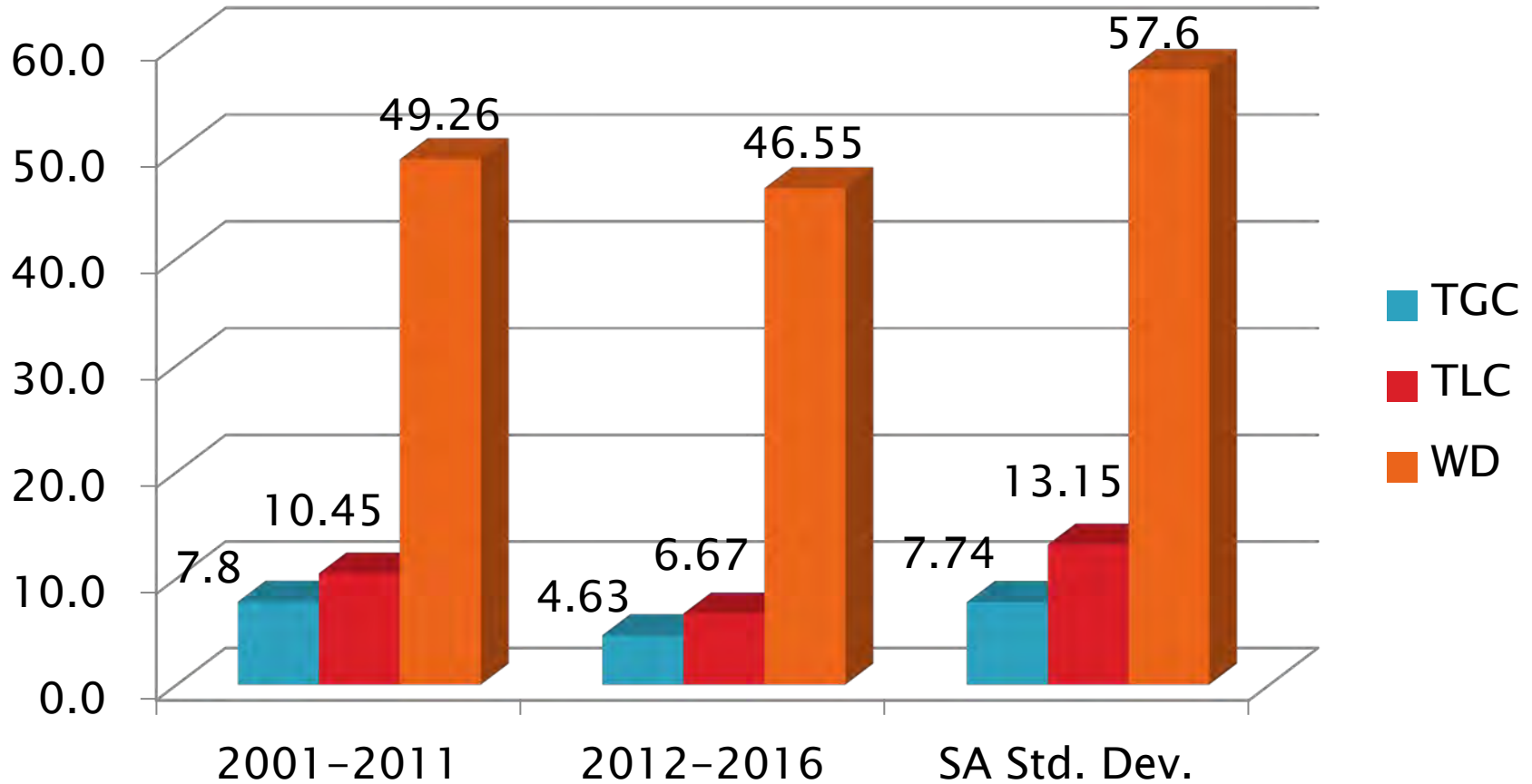
CUSUM Severity Analysis



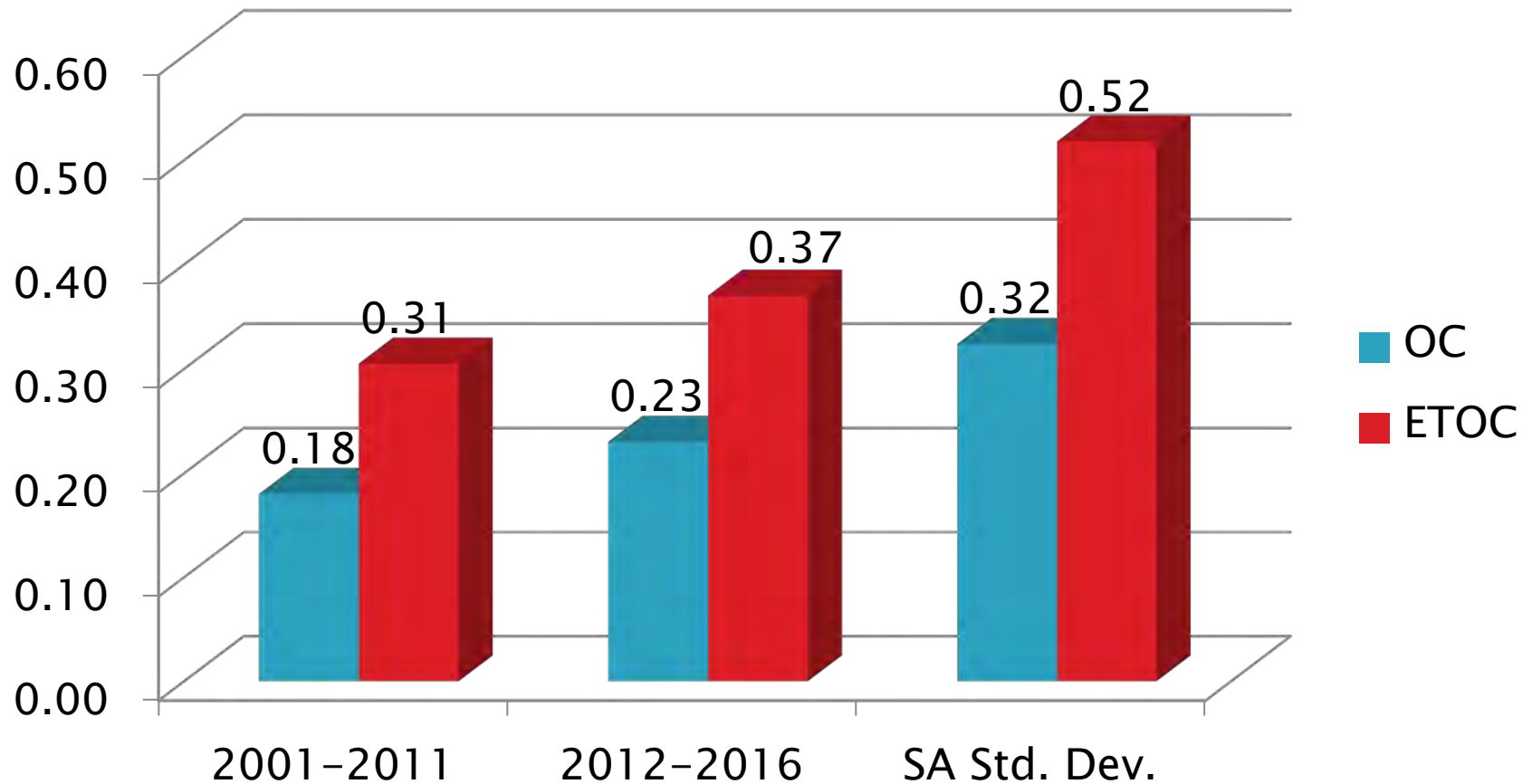
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1P Precision Estimates



1P Precision Estimates



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SCOTE 1 R

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1 R 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 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	No aborted tests	0
Total		0

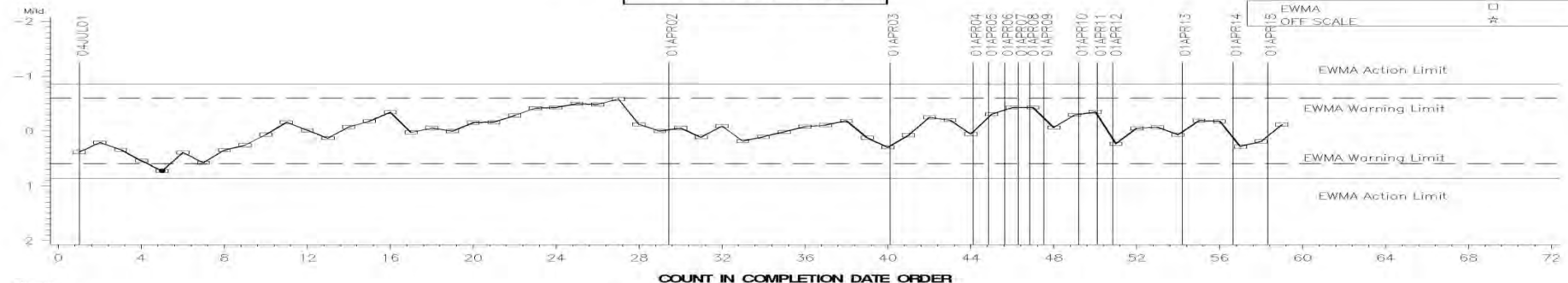
*Invalid and aborted tests

1 R Test Severity

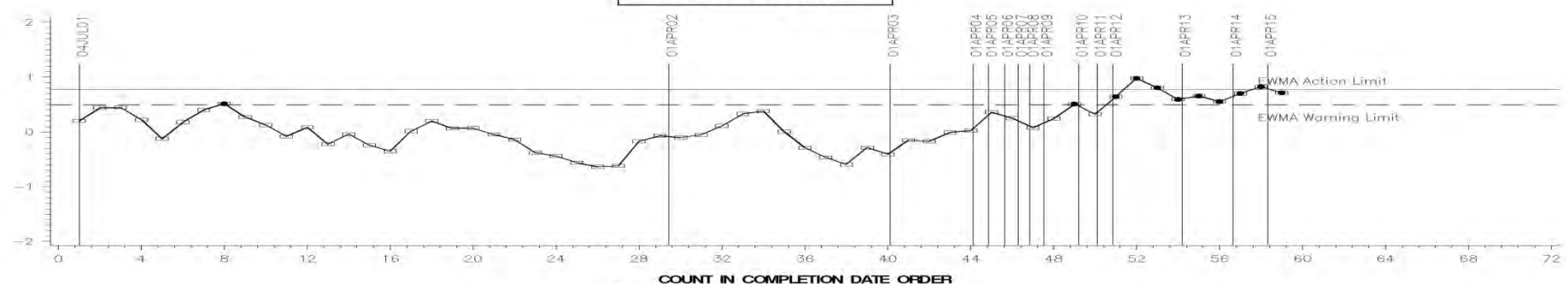
- ▶ As no 1R tests were run during this period no statement about test severity can be made.

FINAL TOP GROOVE CARBON (DEMERITS)

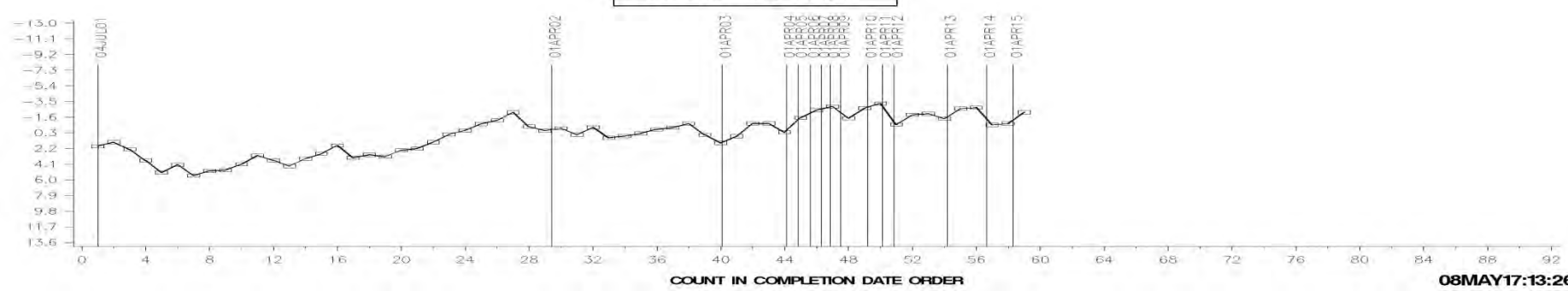
LTMS Severity Analysis



LTMS Precision Analysis



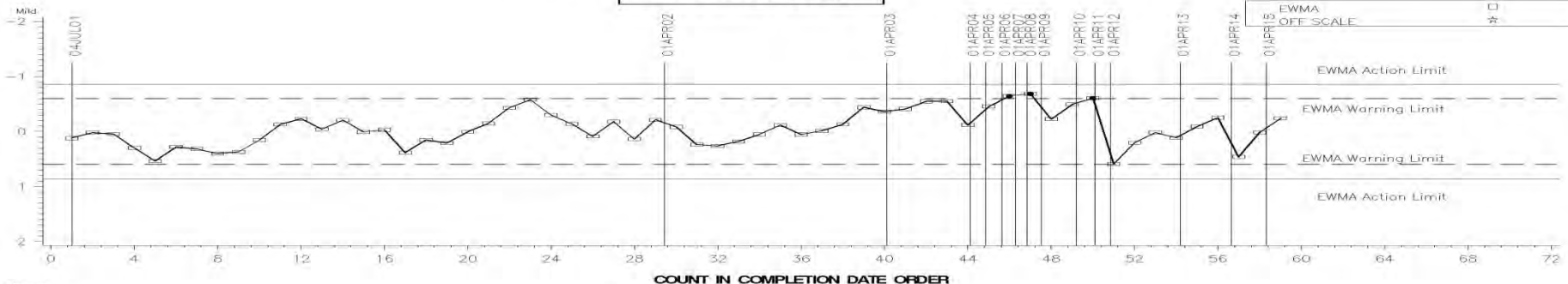
CUSUM Severity Analysis



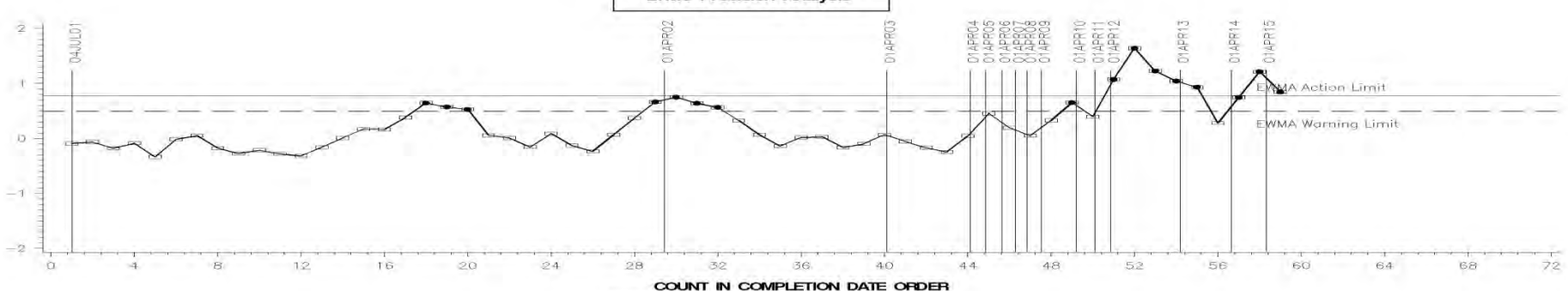
08MAY17:13:26

FINAL TOP LAND CARBON (DEMERITS)

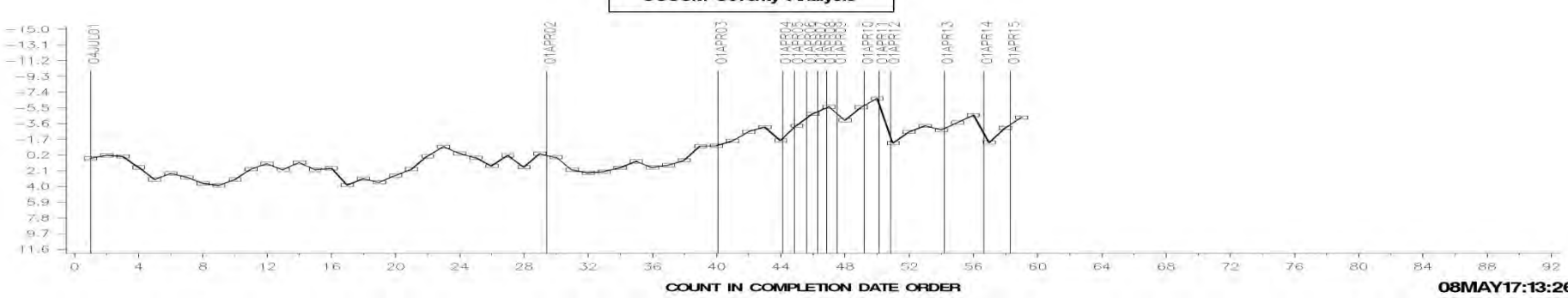
LTMS Severity Analysis



LTMS Precision Analysis



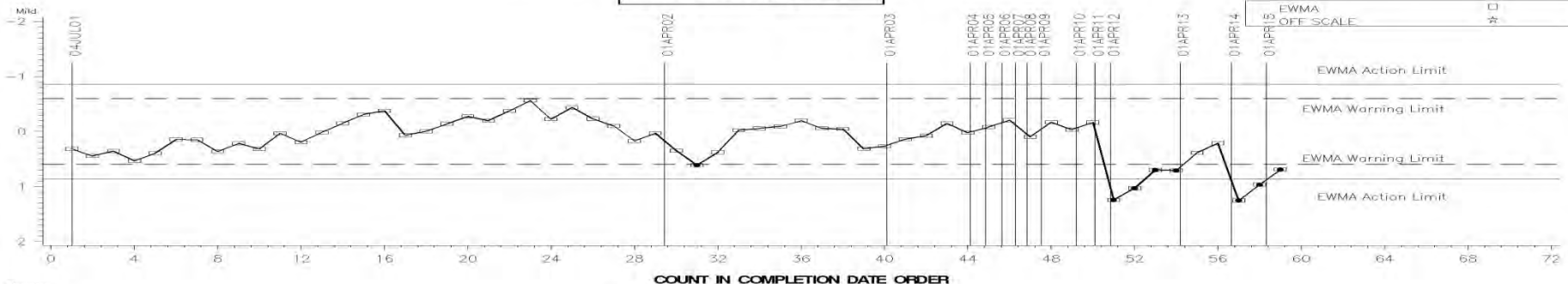
CUSUM Severity Analysis



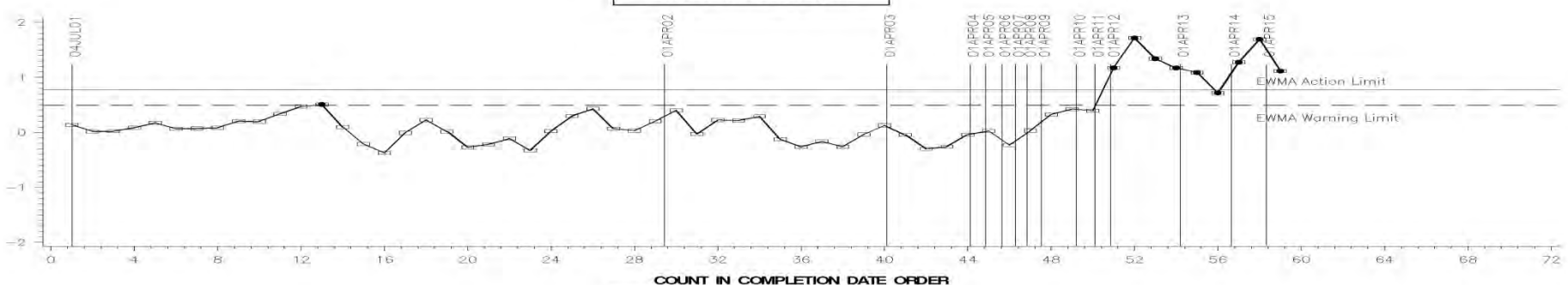
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FINAL WEIGHTED TOTAL DEMERITS (DEMERITS)

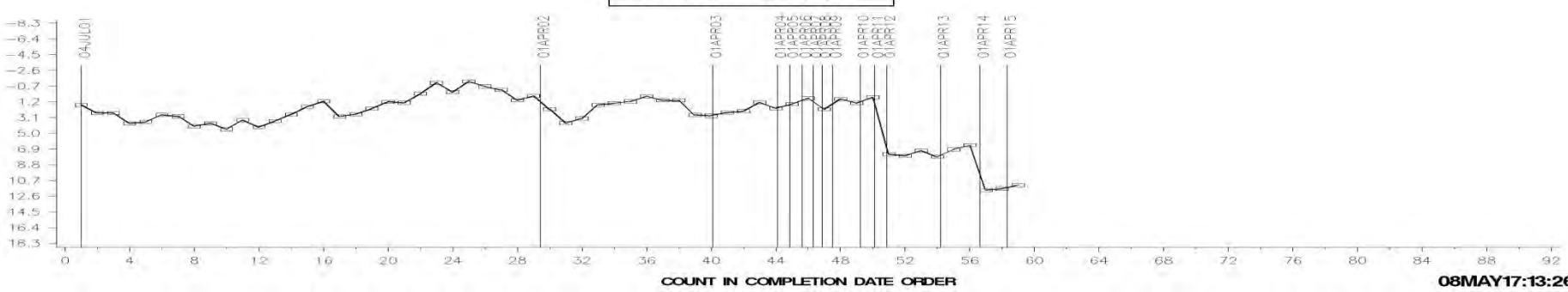
LTMS Severity Analysis



LTMS Precision Analysis



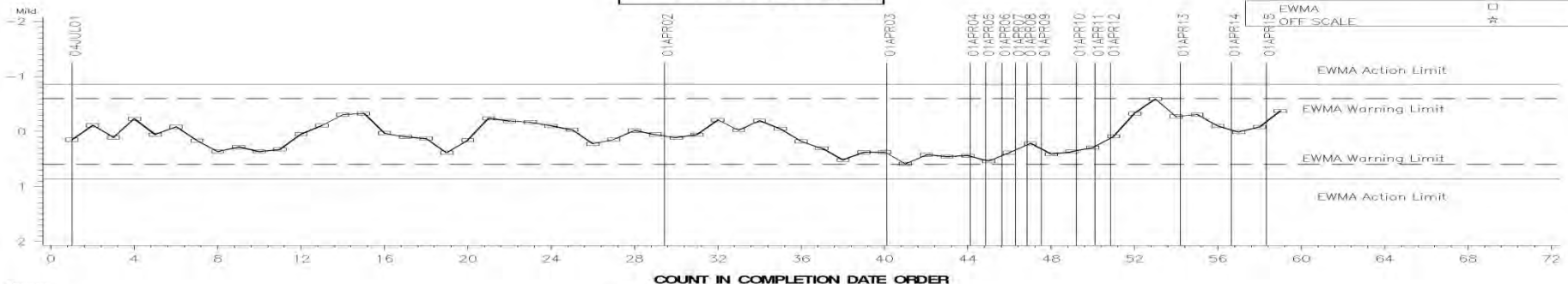
CUSUM Severity Analysis



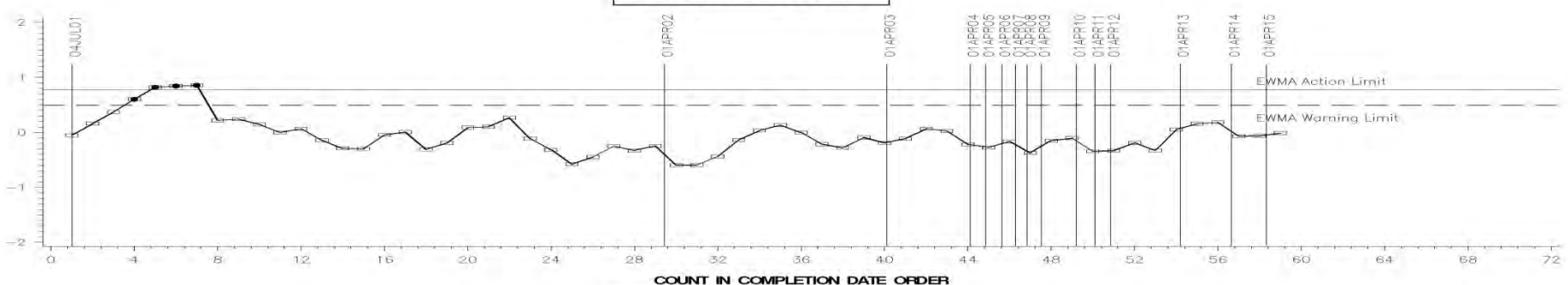
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FINAL BOTOC

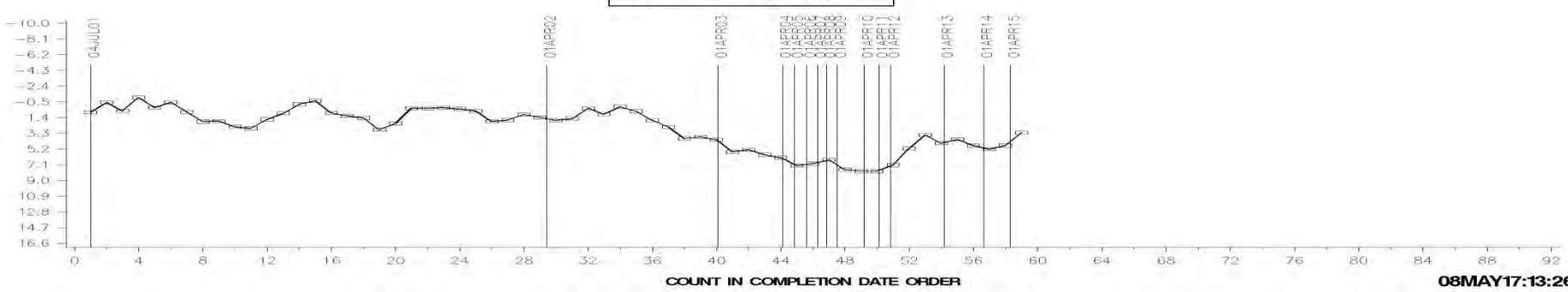
LTMS Severity Analysis



LTMS Precision Analysis



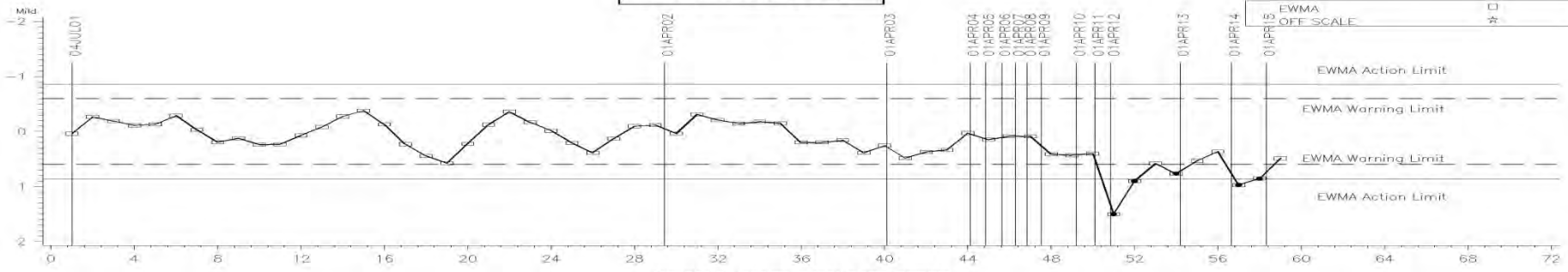
CUSUM Severity Analysis



08MAY17:13:26

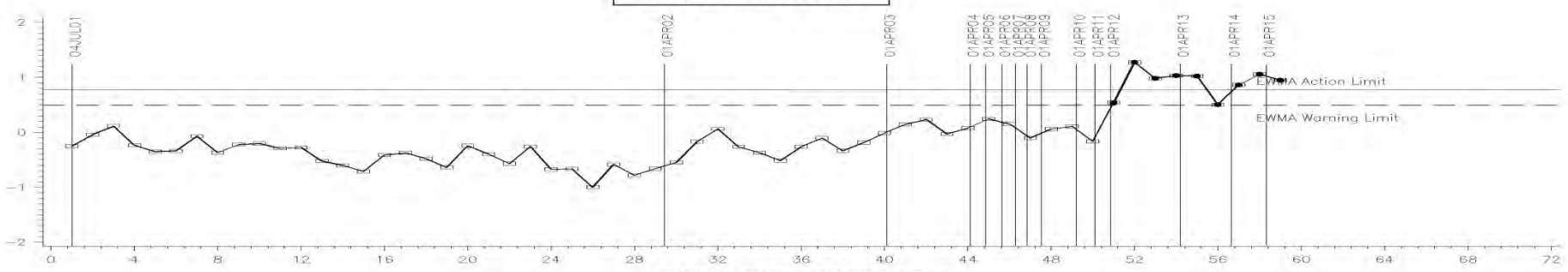
FINAL EOTOC (g/h)

LTMS Severity Analysis



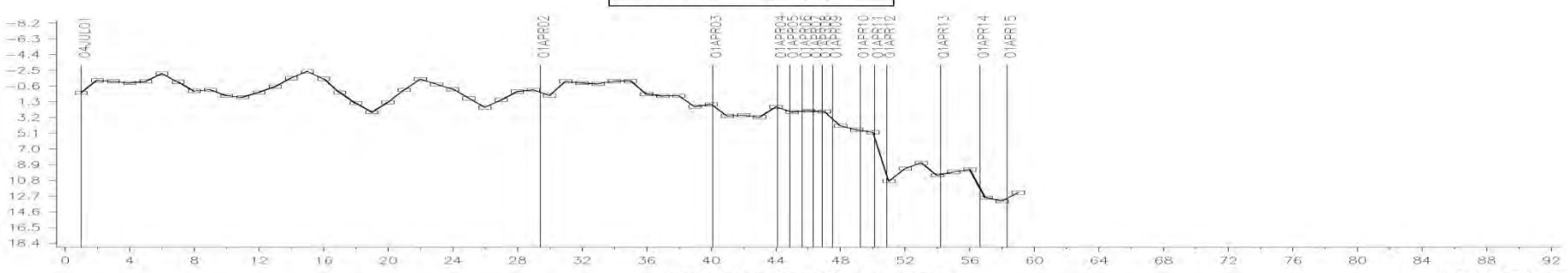
COUNT IN COMPLETION DATE ORDER

LTMS Precision Analysis



COUNT IN COMPLETION DATE ORDER

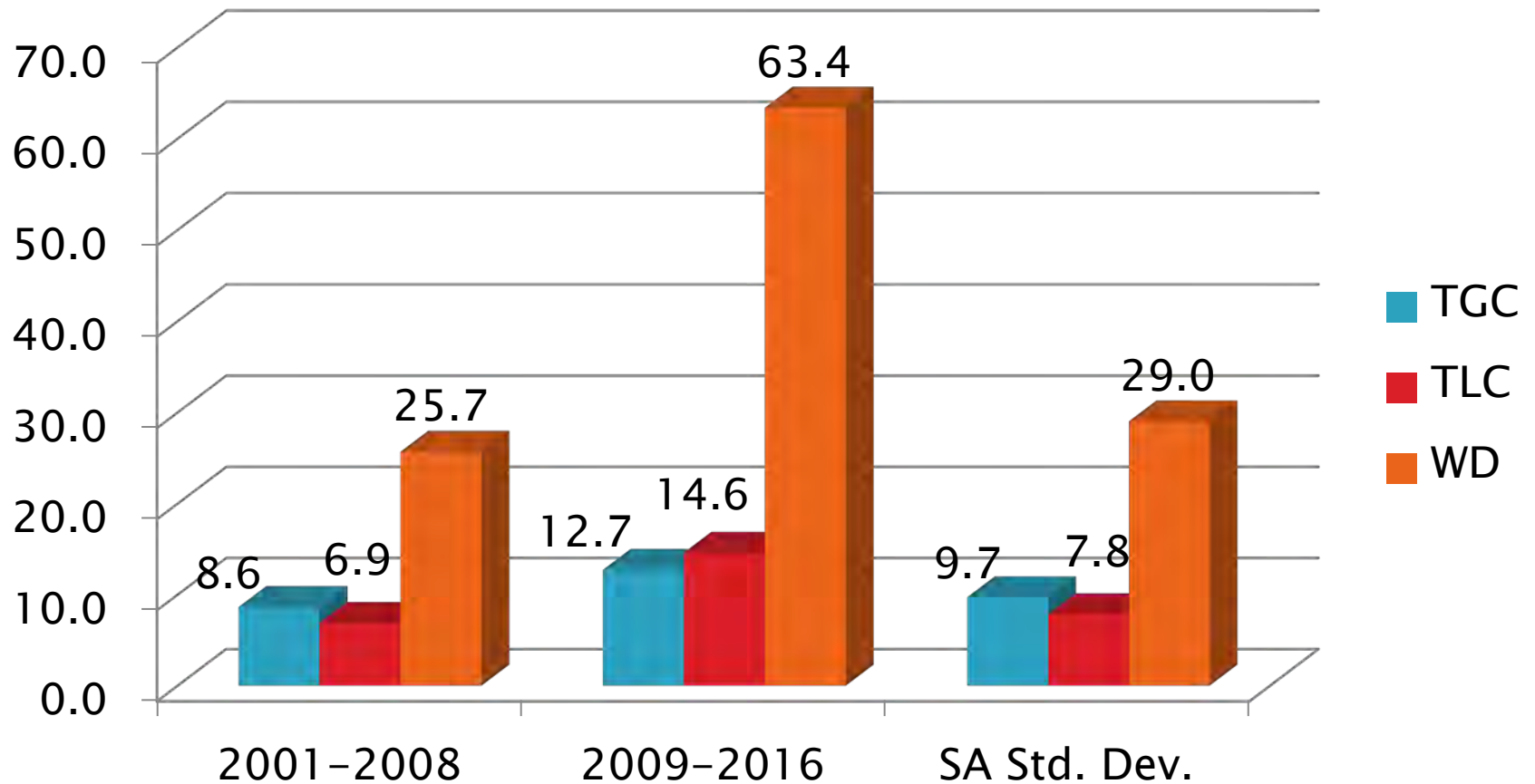
CUSUM Severity Analysis



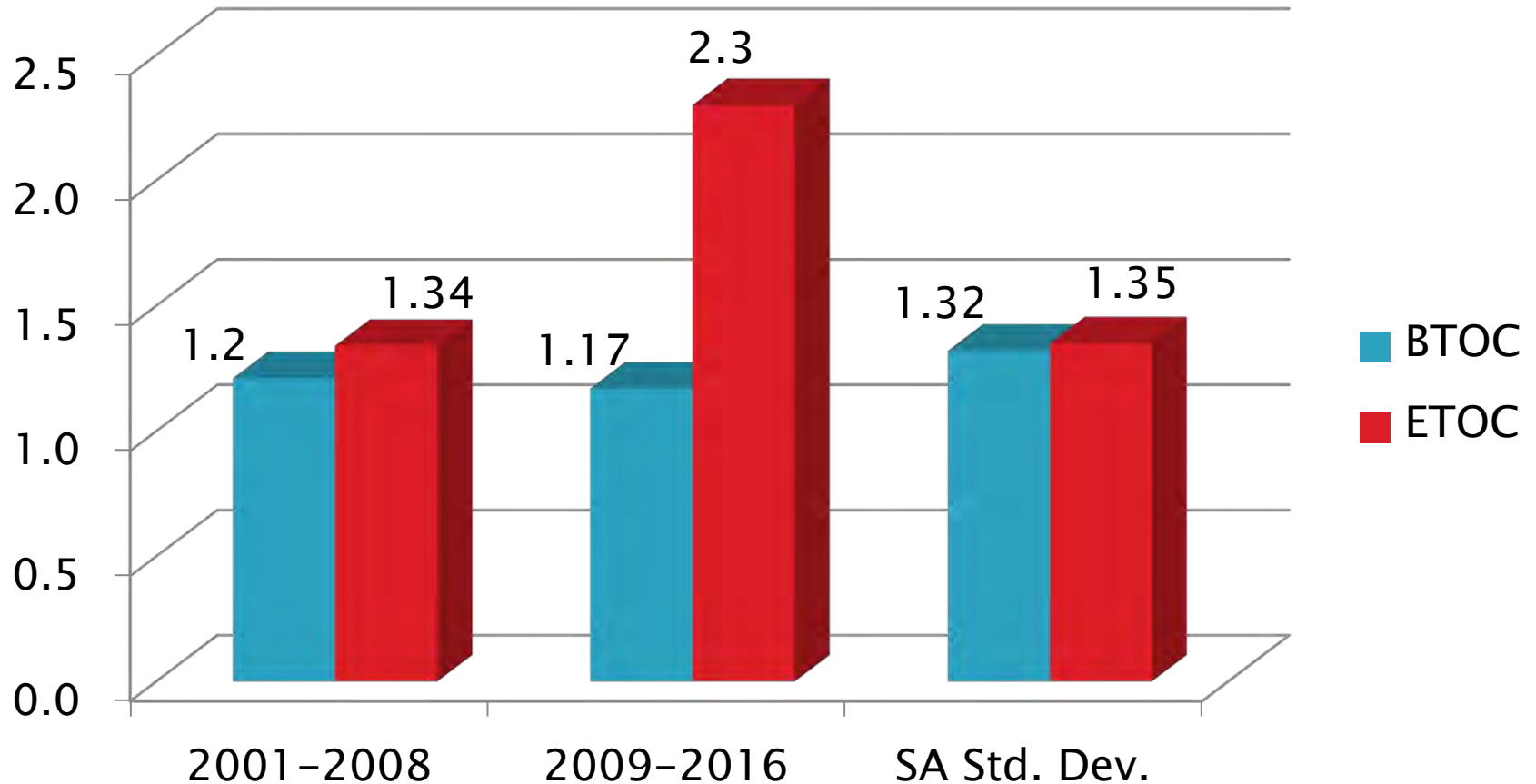
COUNT IN COMPLETION DATE ORDER

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1R Precision Estimates



1R Precision Estimates



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Test Monitoring Center
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CAT C13

»» April 2017

Test Monitoring Center

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A Program of ASTM International

C13 Test Activity

Test Status	Validity Code	C13
Acceptable Calibration Test	AC	3
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	2
Total		5

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	Loss of temperature control	1
Aborted	High Oil Consumption	1
Total		2

*Invalid and aborted tests

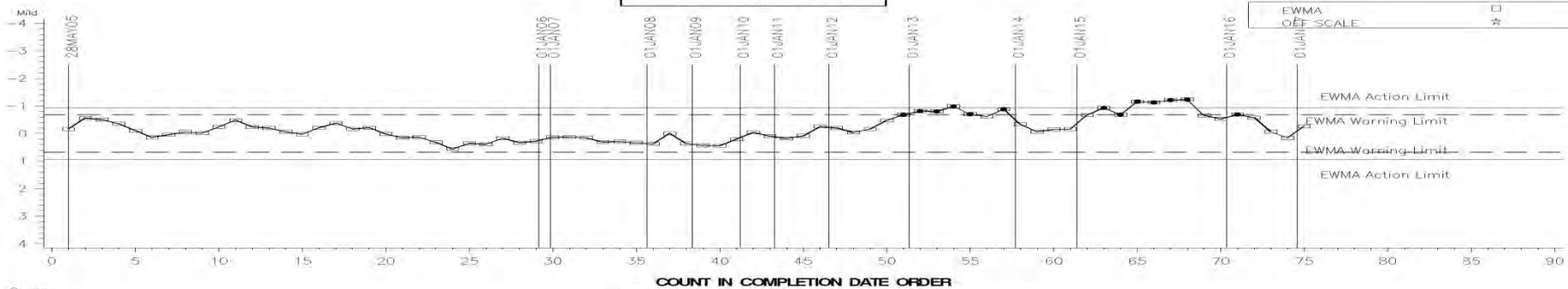
C13 Test Severity

- ▶ OC in control but nearing severity warning alarm in severe direction
- ▶ TGC and R2TC in precision warning alarm.
- ▶ TLC in severity warning alarm mild direction.

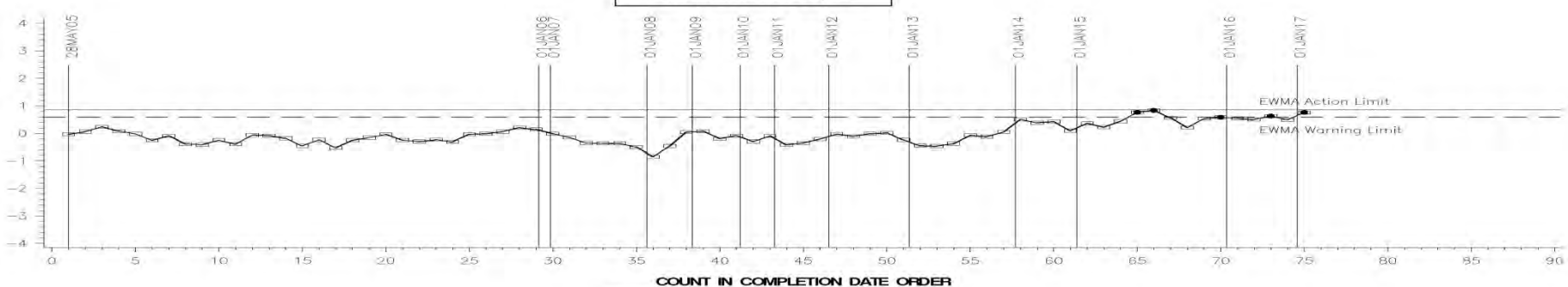
C13 INDUSTRY OPERATIONALLY VALID DATA

TOP GROOVE CARBON AVG — FINAL RESULT

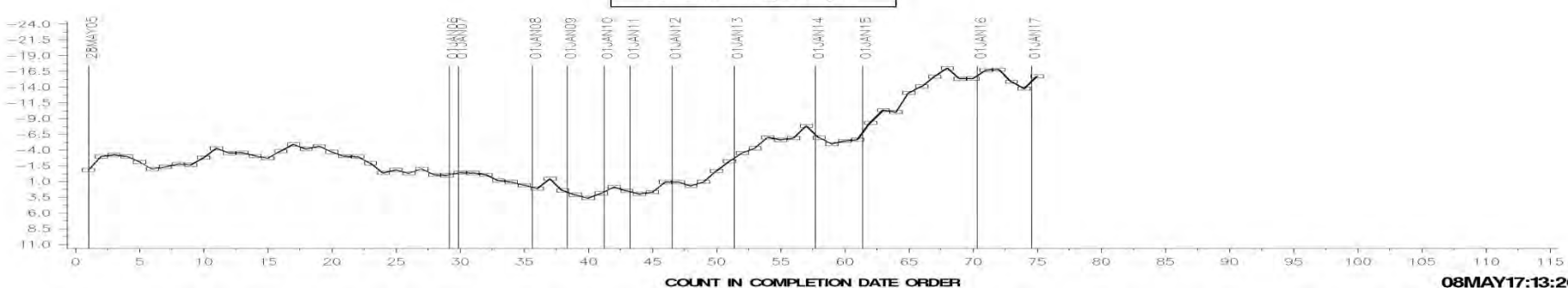
LTMS Severity Analysis



LTMS Precision Analysis



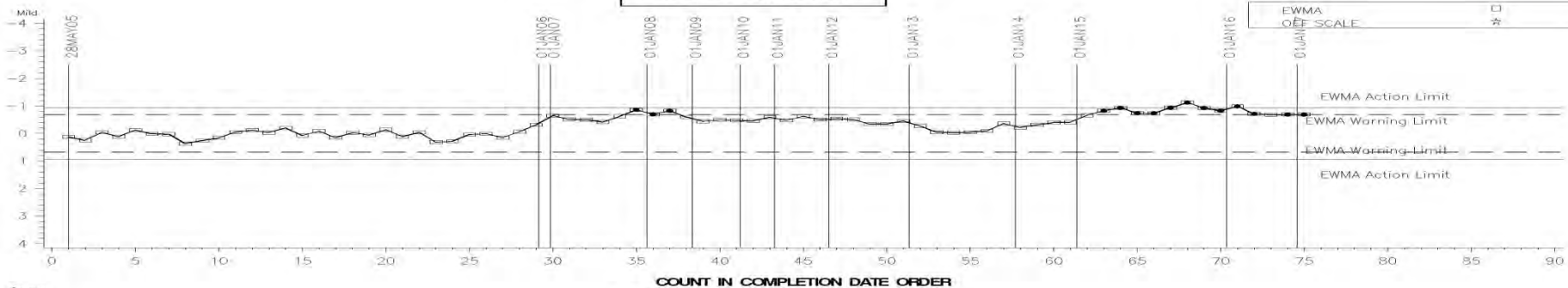
CUSUM Severity Analysis



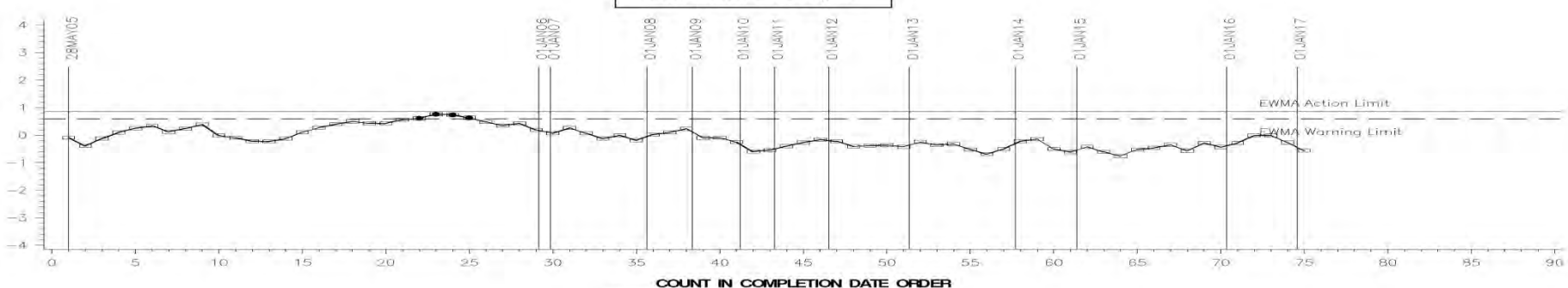
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TOP LAND CARBON AVG. — FINAL RESULT

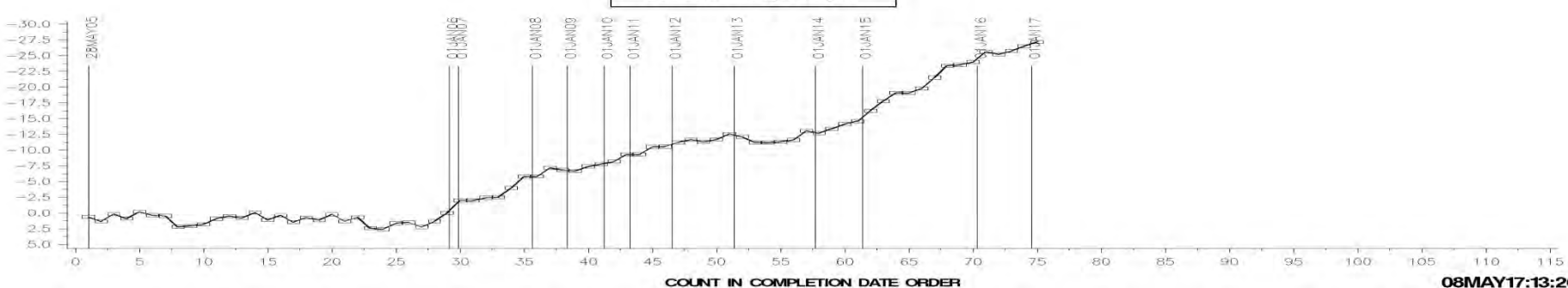
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

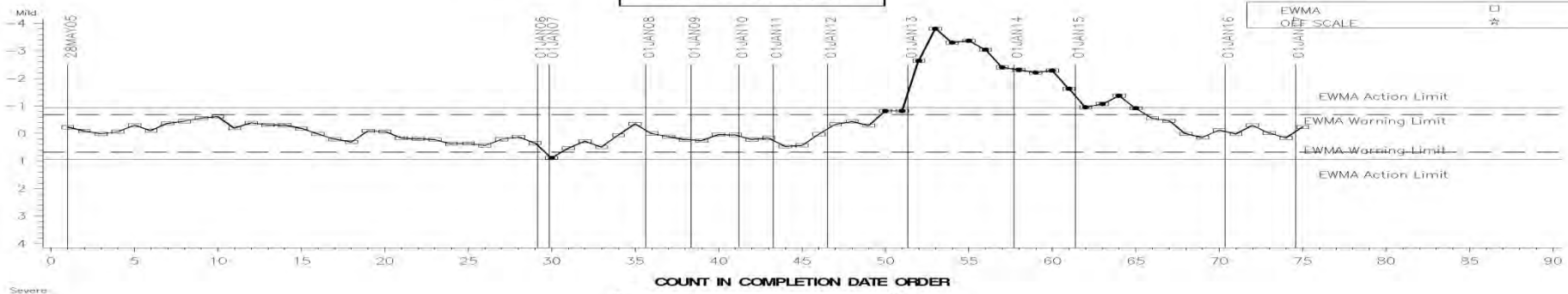


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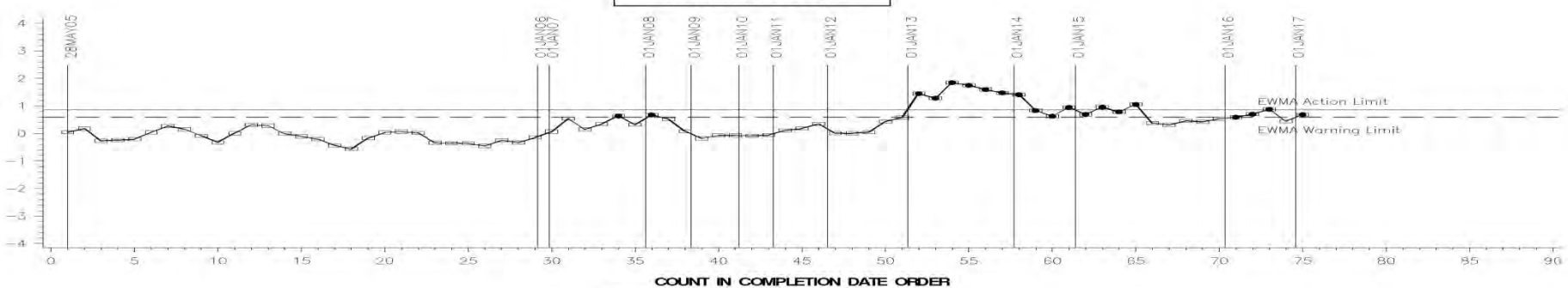
C13 INDUSTRY OPERATIONALLY VALID DATA

2ND RING TOP CARBON AVG. — FINAL RESULT

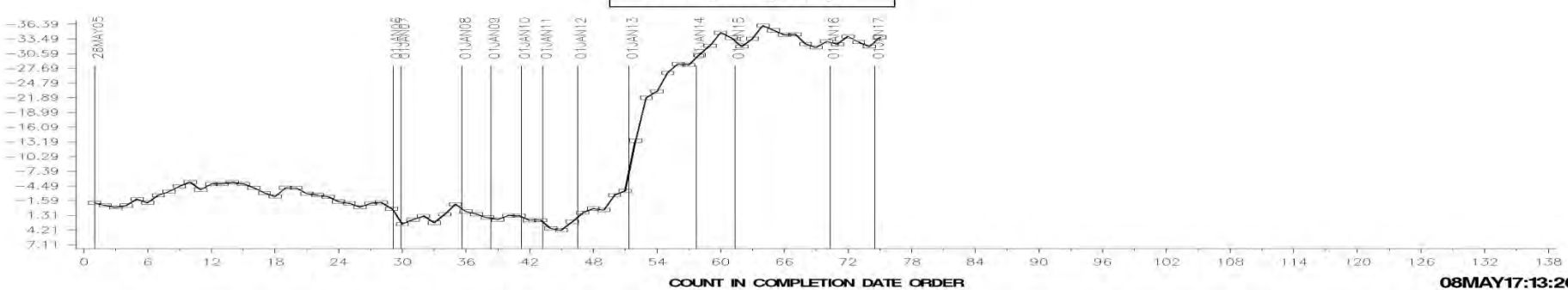
LTMS Severity Analysis



LTMS Precision Analysis



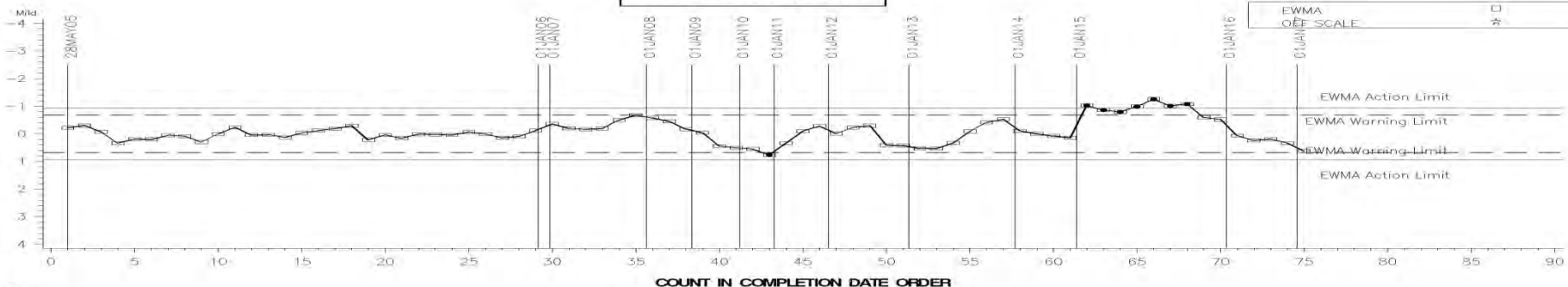
CUSUM Severity Analysis



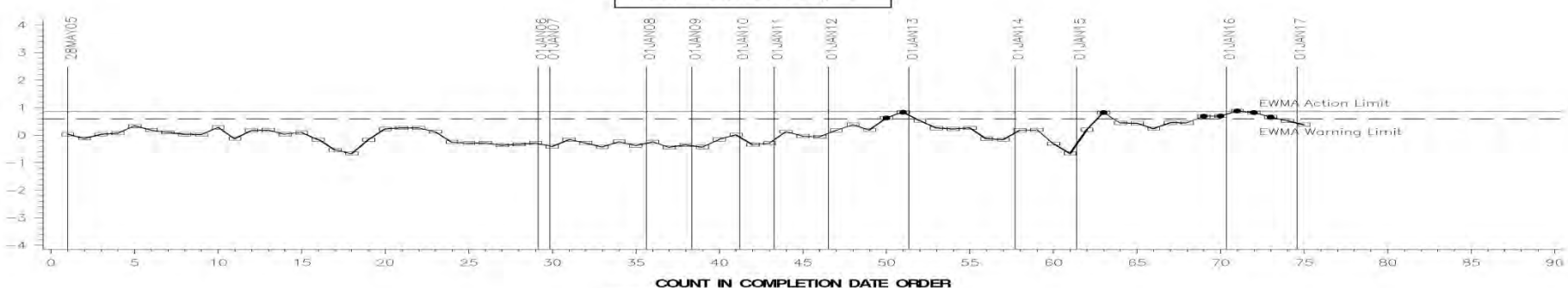
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OIL CONS. DELTA — FINAL RESULT

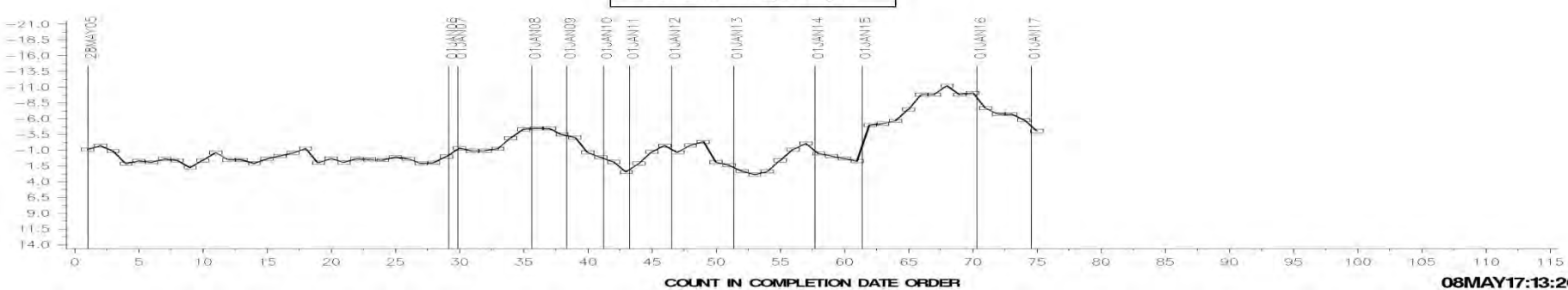
LTMS Severity Analysis



LTMS Precision Analysis

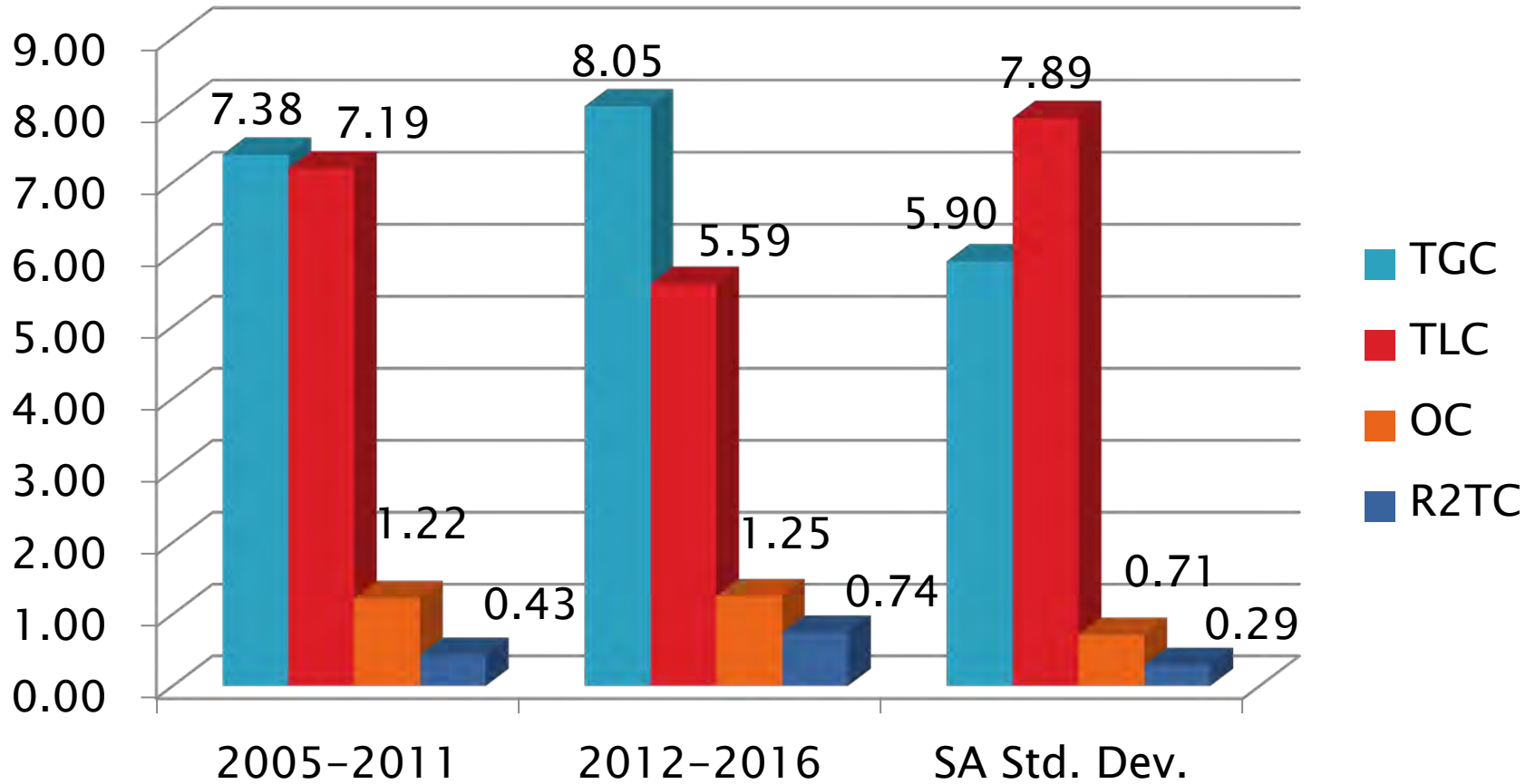


CUSUM Severity Analysis



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C13 Precision Estimates



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Test Monitoring Center

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C13 Oil Aeration (COAT)

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Test Monitoring Center

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COAT Test Activity

Test Status	Validity Code	COAT
Acceptable Calibration Test	AC	0
Failed Calibration Test	OC	1
Operationally Invalid	LC	0
Aborted	XC	0
Pending*	PC	1
Total		2

*Calibration test pending SP activity to restore test availability

COAT Failed Tests

Failed Parameter	Number of Tests
Average Aeration Severe	1
Total	1

COAT Lost Tests*

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

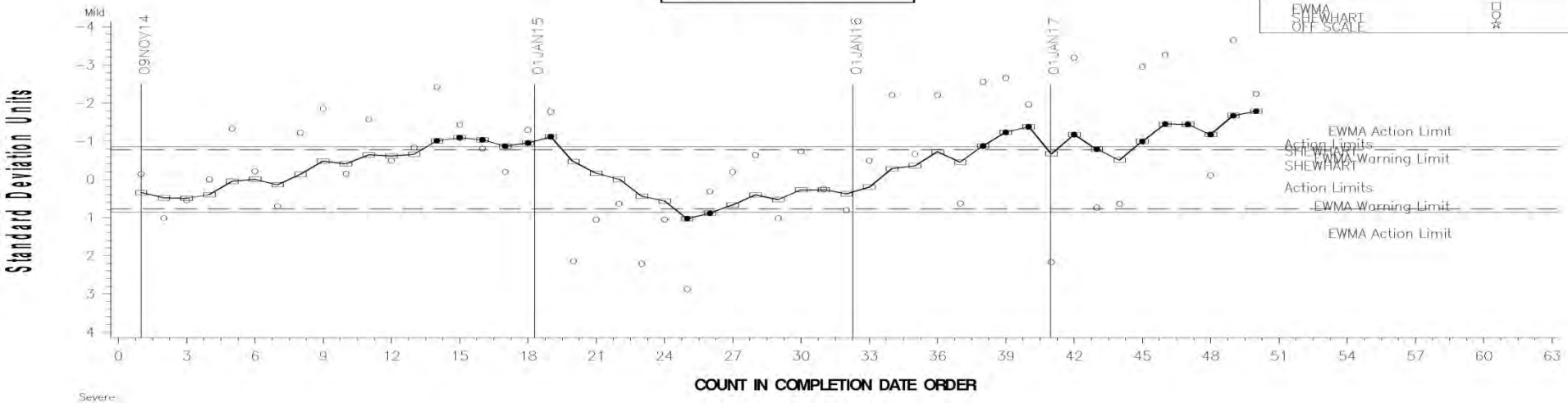
*Invalid and aborted tests

COAT Test Severity

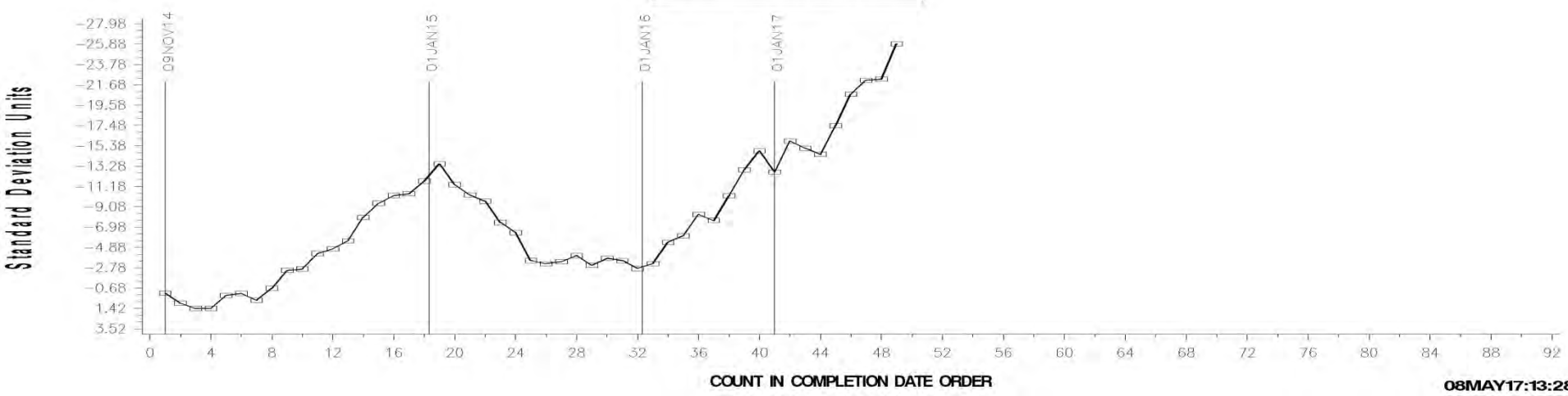
- ▶ AAVE is in action alarm (Level 2 Zi Alarm) in the mild direction.

FINAL AVERAGE OIL AERATION OVER TEST HOURS 40-50

LTMS Severity Analysis



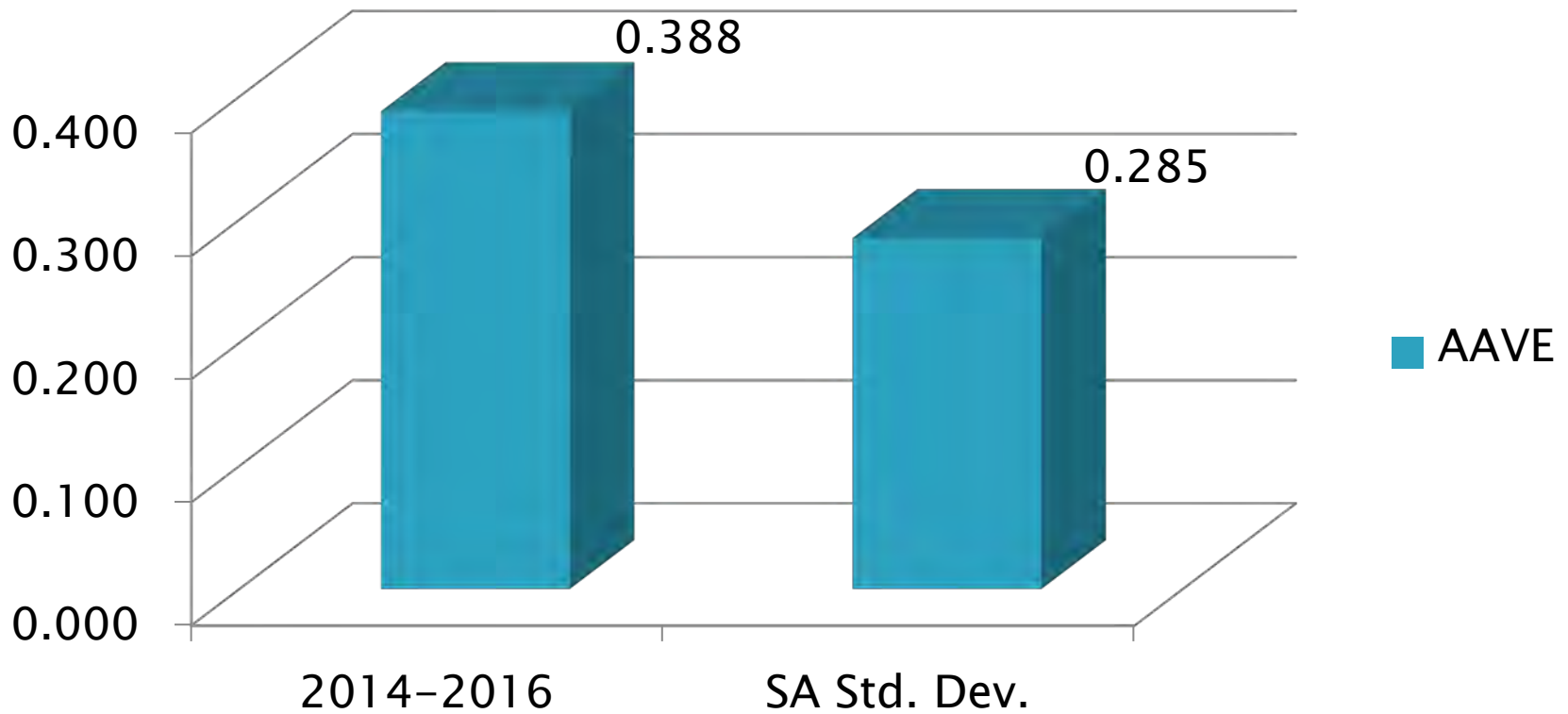
CUSUM Severity Analysis



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COAT Precision Estimates

AAVE



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Daimler DD13 Scuffing Test

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Test Monitoring Center

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DD13 Test Activity*

Test Status	Validity Code	COAT
Acceptable Calibration Test	AC	3
Failed Calibration Test	OC	1
Operationally Invalid	LC	0
Aborted	XC	0
Total		4

DD13 Failed Tests

Failed Parameter	Number of Tests
Hours to Scuff Mild	1
Total	1

DD13 Lost Tests*

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

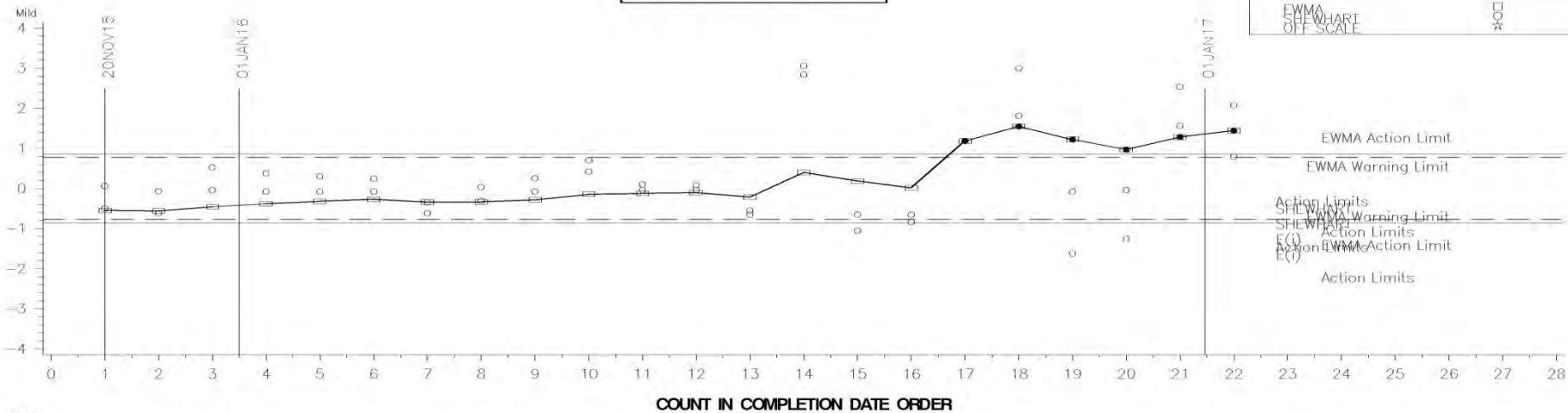
*Invalid and aborted tests

DD13 Test Severity

- ▶ HRS2SCF is in action alarm (Level 2 Zi Alarm) in the mild direction.

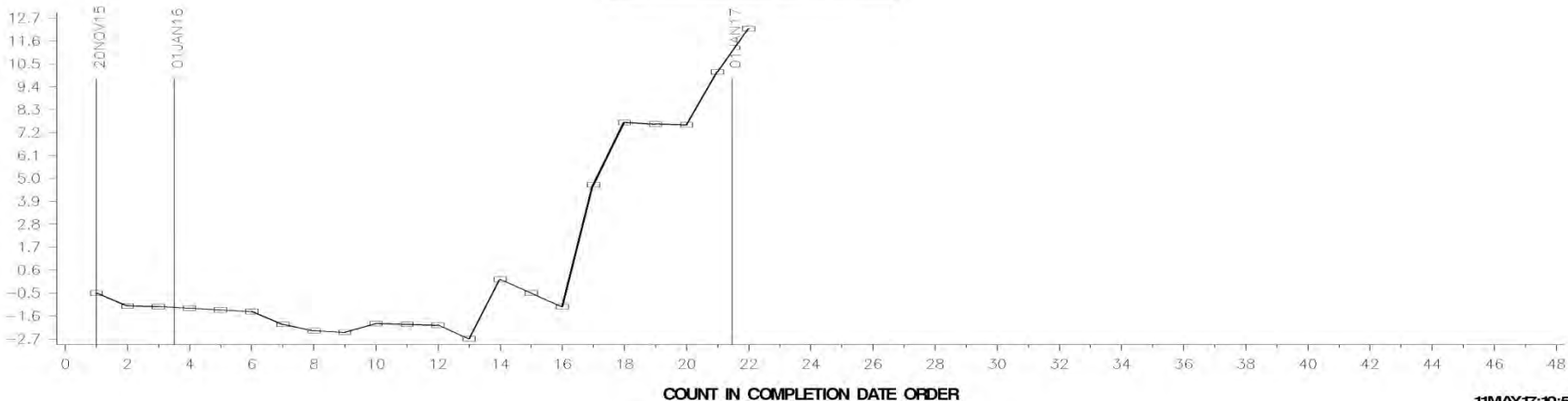
FNL. ORIG. UNIT HOURS TO SCUFF

LTMS Severity Analysis



COUNT IN COMPLETION DATE ORDER

CUSUM Severity Analysis

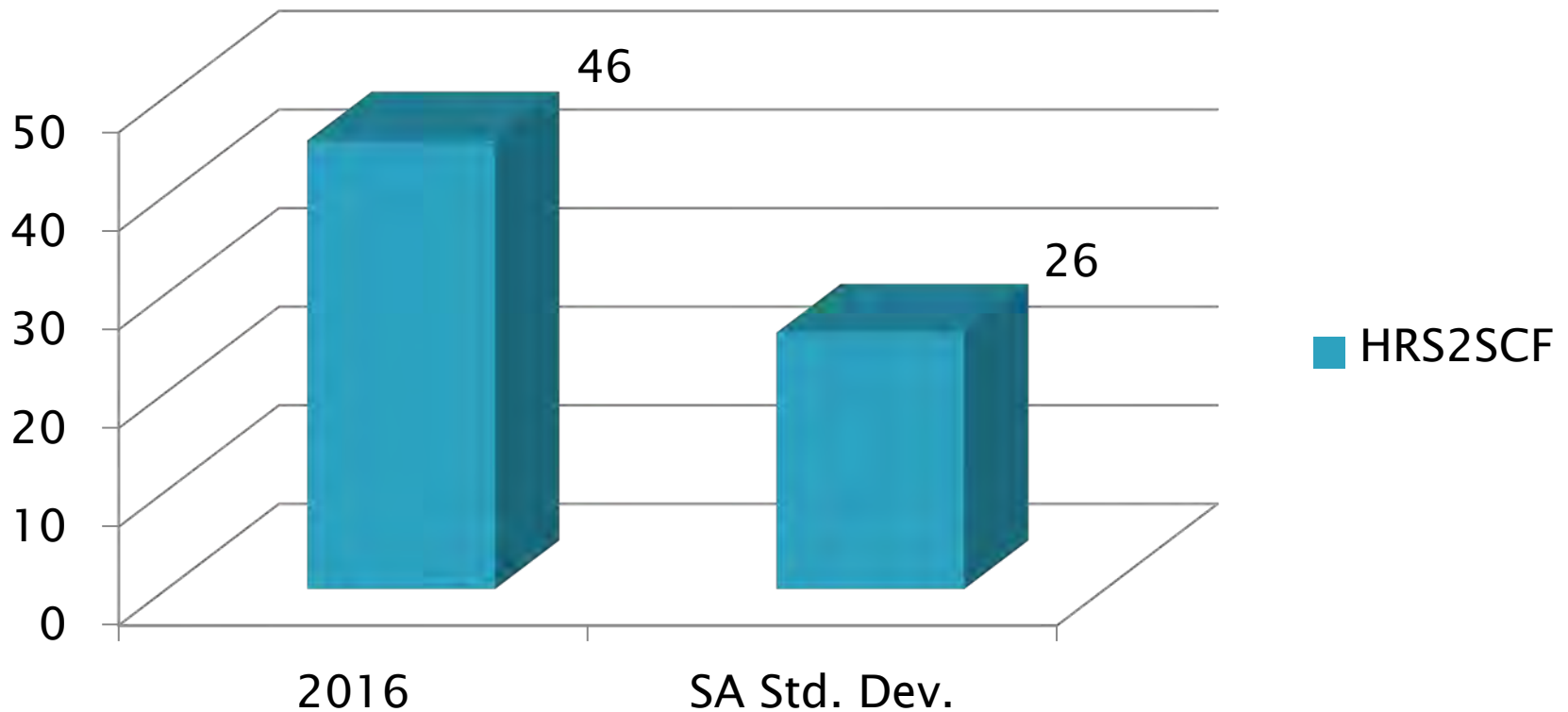


COUNT IN COMPLETION DATE ORDER

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DD13 Precision Estimates

HRS2SCF



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Cummins ISB

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Test Monitoring Center

<http://astmtmc.cmu.edu>



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ISB Test Activity

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

ISB Failed Tests

Failed Parameter	Number of Tests
Severe Average Tappet Weight Loss (ATWL)	2
Total	2

ISB Lost Tests*

Status	Cause	#
Invalid	No Invalid Tests	0
Aborted	No Aborted Tests	0
Total		0

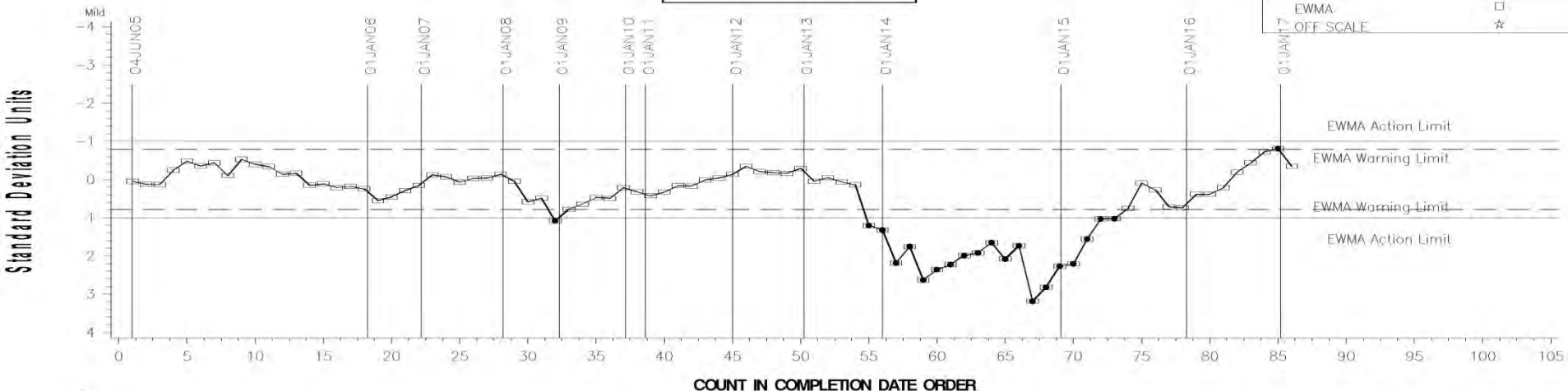
*Invalid and aborted tests

ISB Test Severity

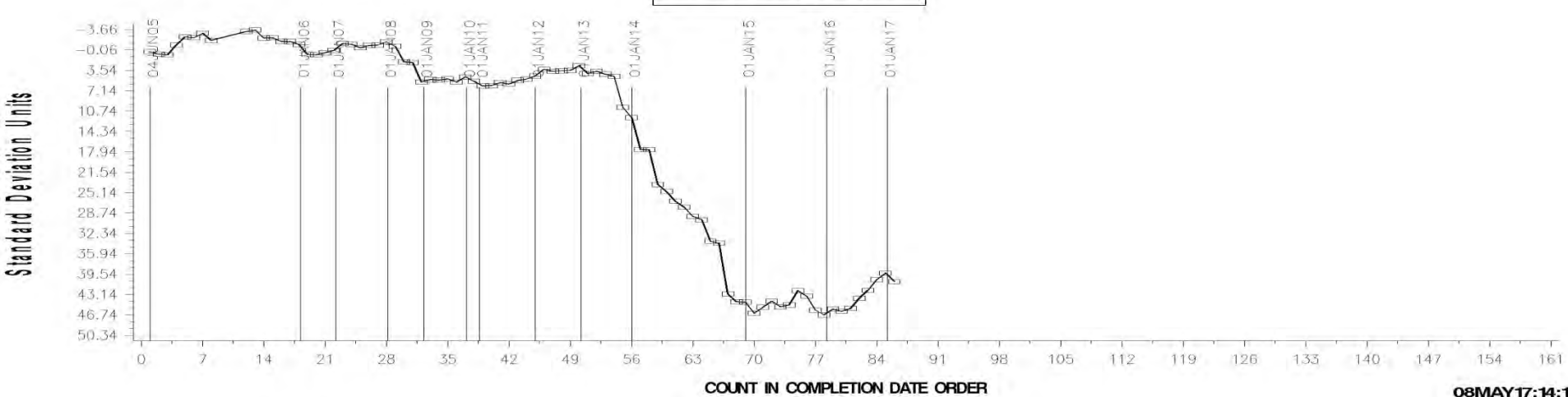
- ▶ ACSW and ATWL are in control.

AVERAGE CAMSHAFT WEAR

LTMS Severity Analysis



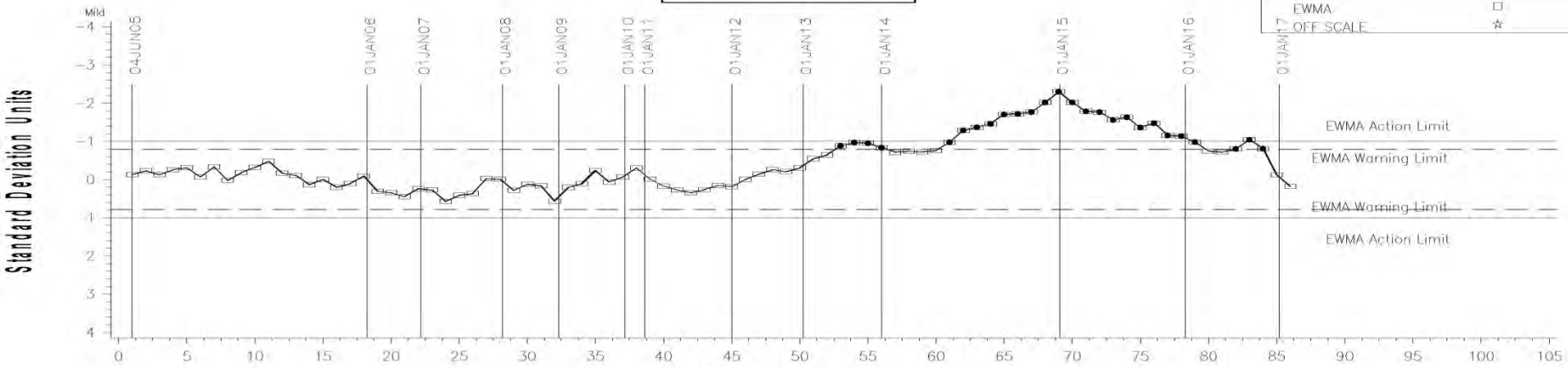
CUSUM Severity Analysis



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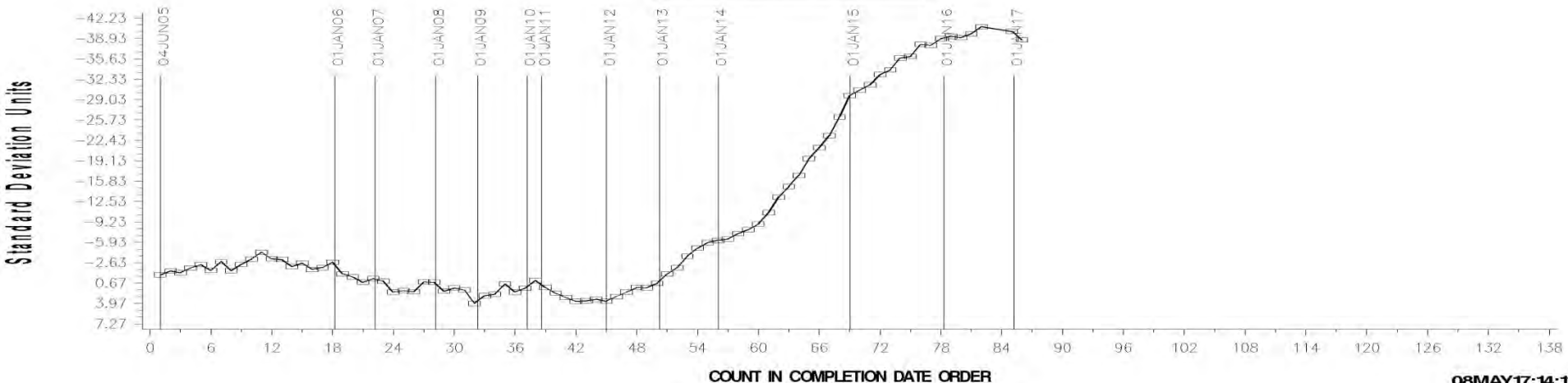
AVERAGE TAPPET WEIGHT LOSS

LTMS Severity Analysis



COUNT IN COMPLETION DATE ORDER

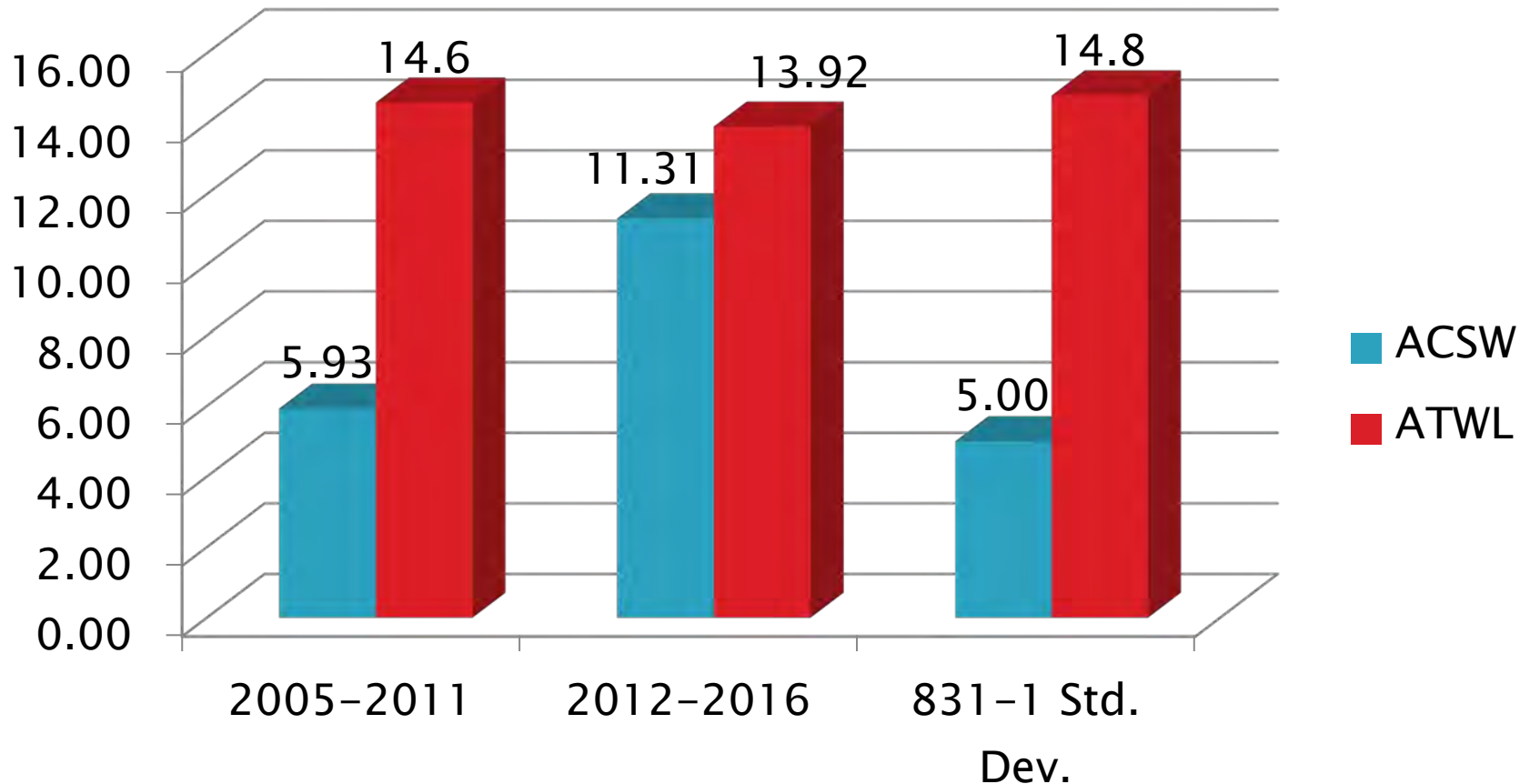
CUSUM Severity Analysis



COUNT IN COMPLETION DATE ORDER

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ISB Precision Estimates



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Cummins ISM

»» April 2017

Test Monitoring Center

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ISM Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	4
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	0
Total		4

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

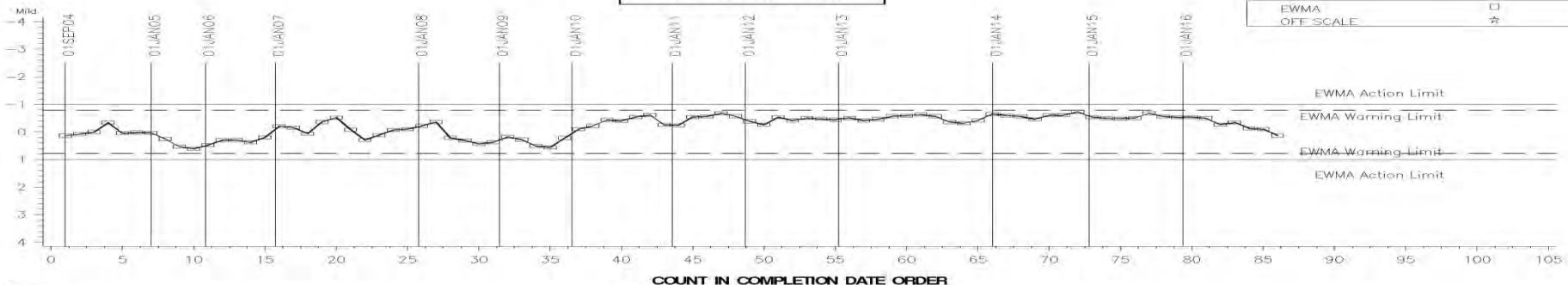
ISM Test Severity

- ▶ ASR, CWL, FPD and IAS in control.
 - FPD trending mild and near warning alarm.

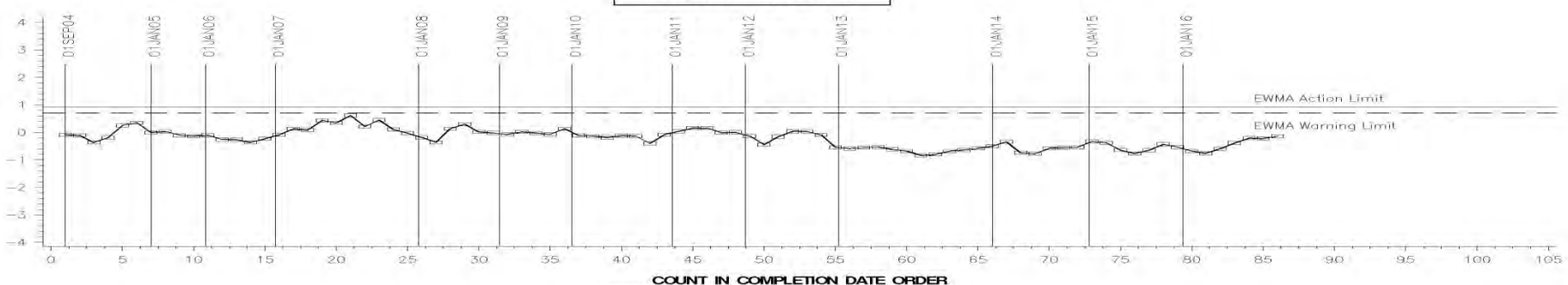
ISM INDUSTRY OPERATIONALLY VALID DATA

CROSSHEAD WEIGHT LOSS ADJUSTED TO 3.9 % SOOT

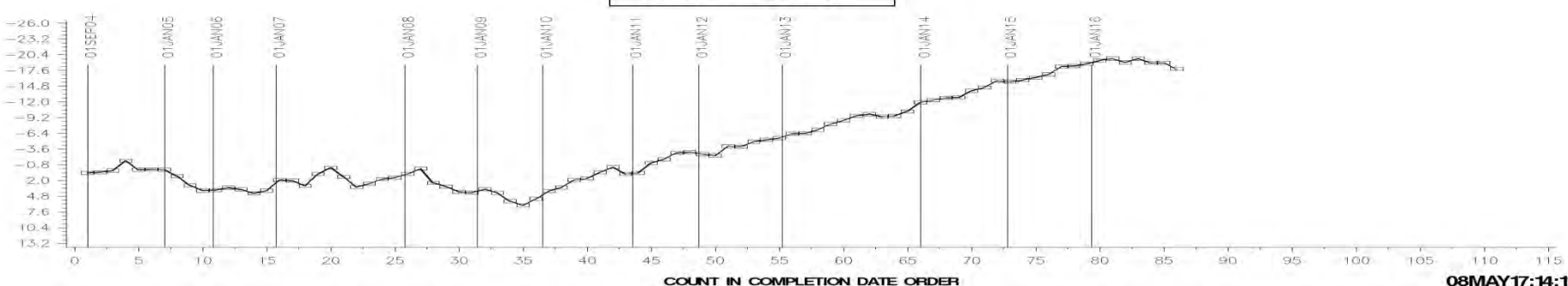
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

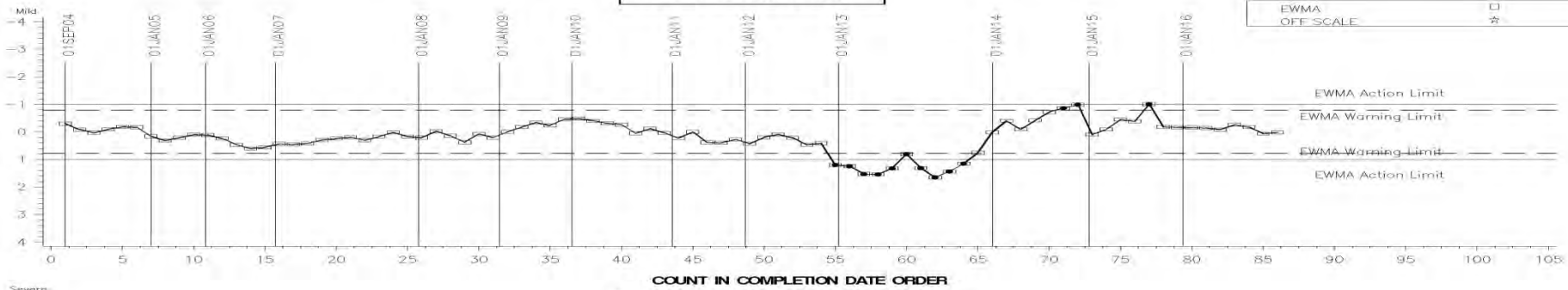


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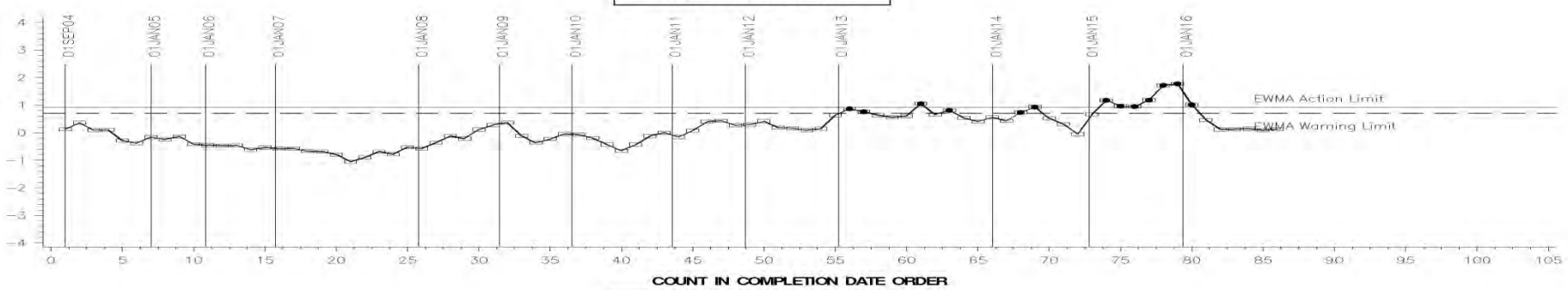
ISM INDUSTRY OPERATIONALLY VALID DATA

INJECTOR SCREW WEIGHT LOSS ADJUSTED TO 3.9% SOOT

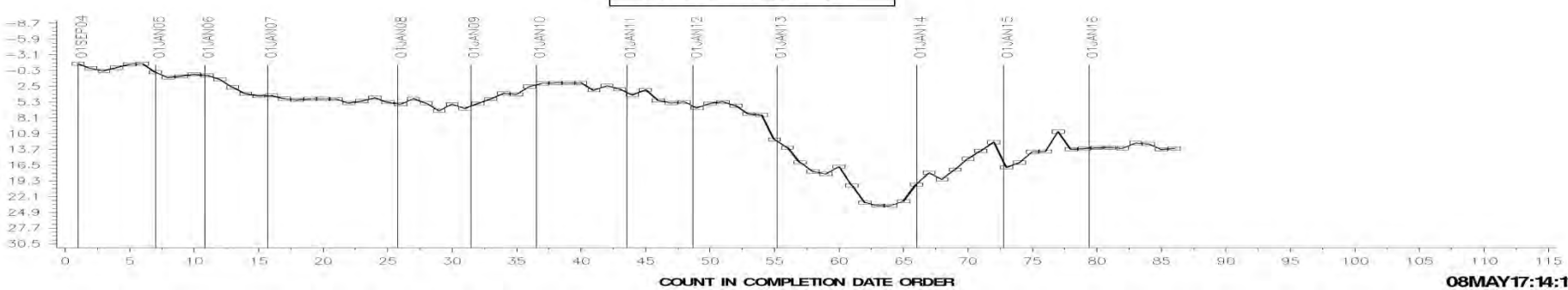
LTMS Severity Analysis



LTMS Precision Analysis



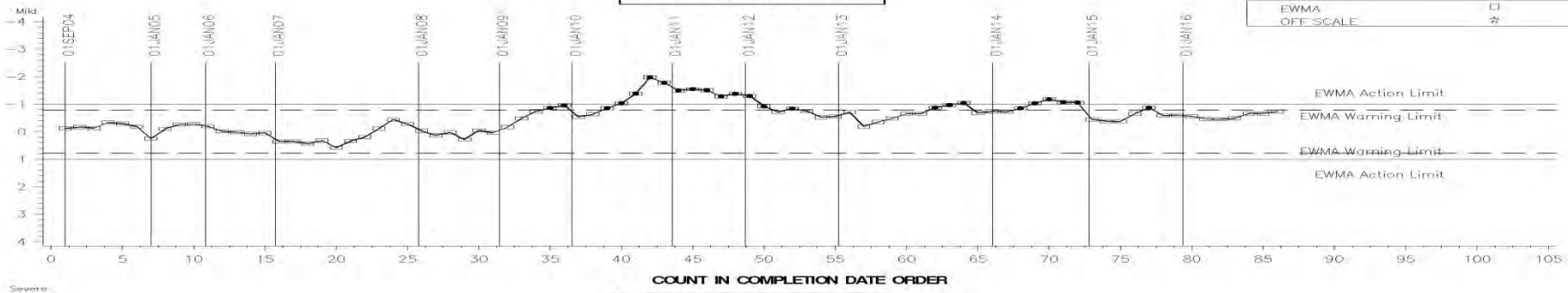
CUSUM Severity Analysis



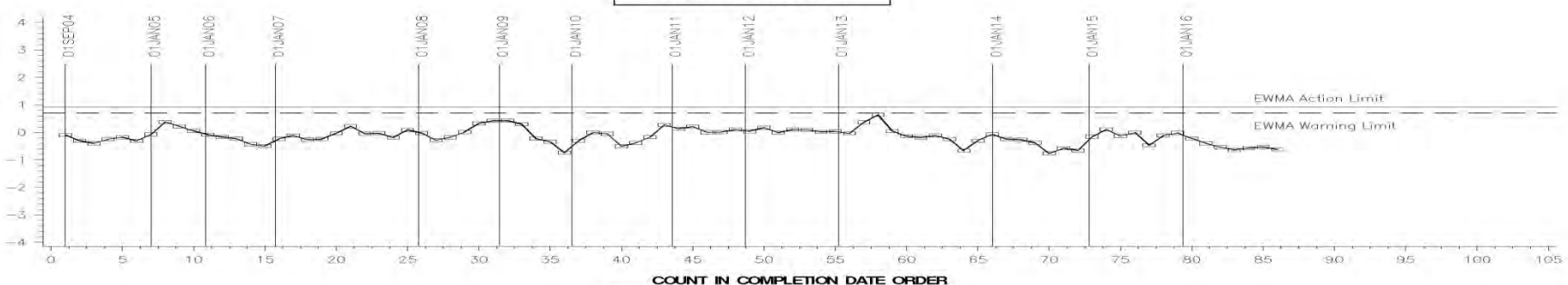
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FILTER PLUGGING DELTA P

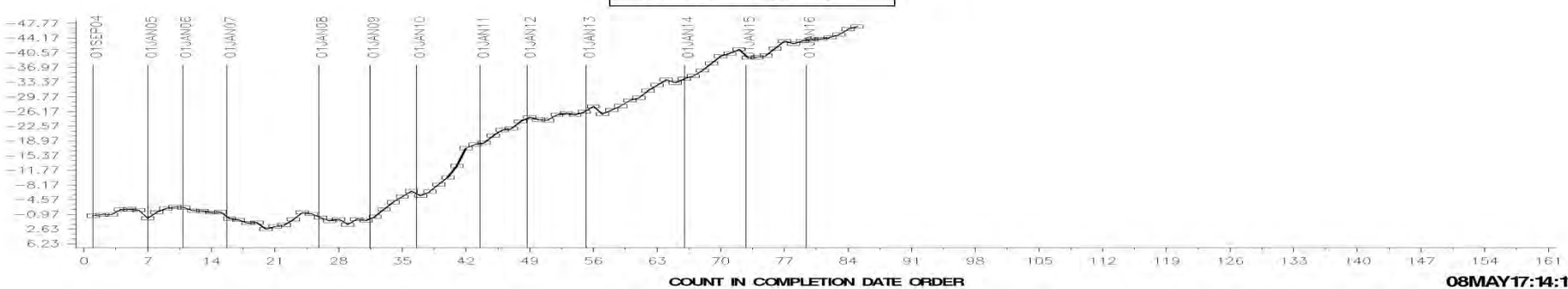
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

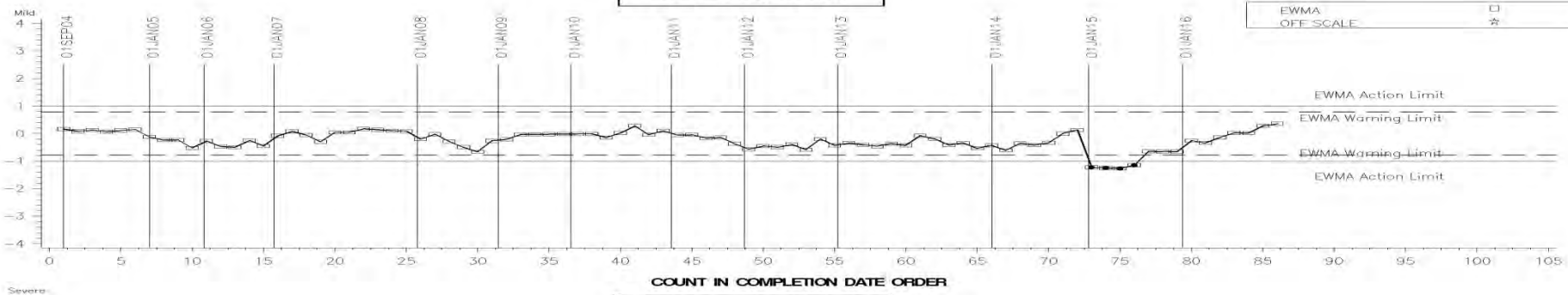


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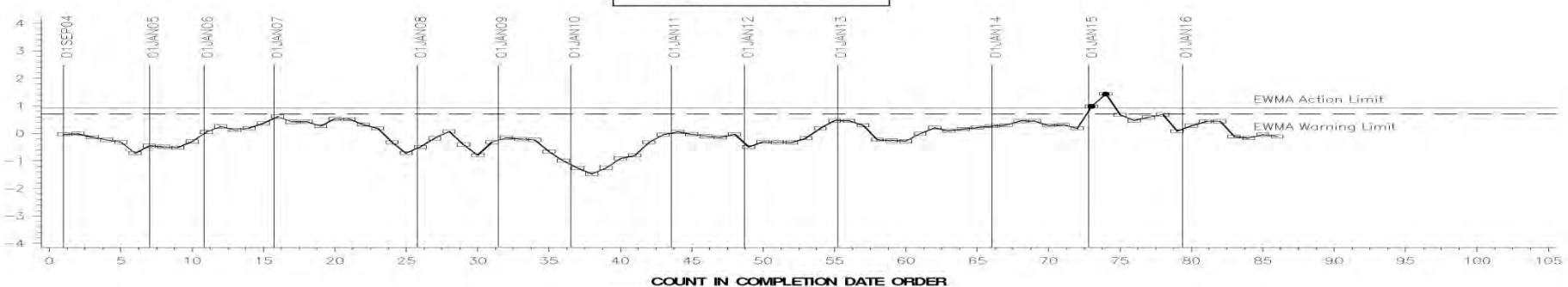
ISM INDUSTRY OPERATIONALLY VALID DATA

AVERAGE SLUDGE RATING

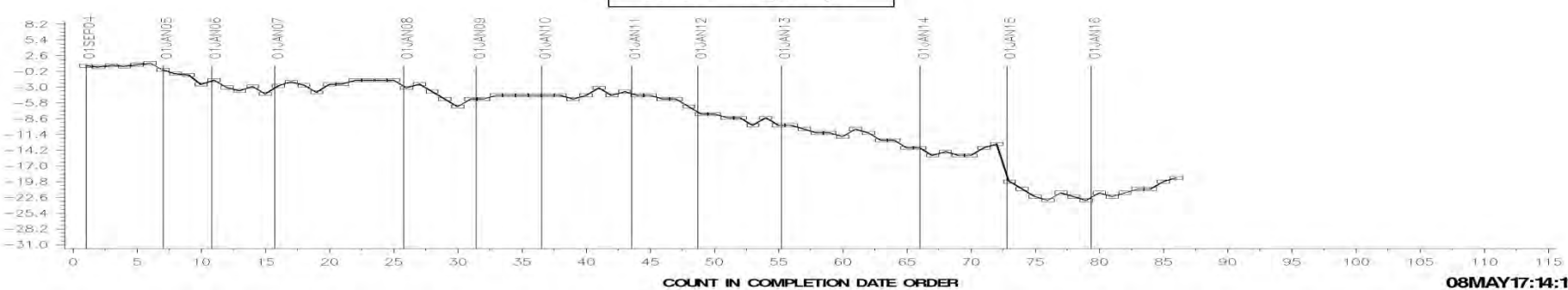
LTMS Severity Analysis



LTMS Precision Analysis

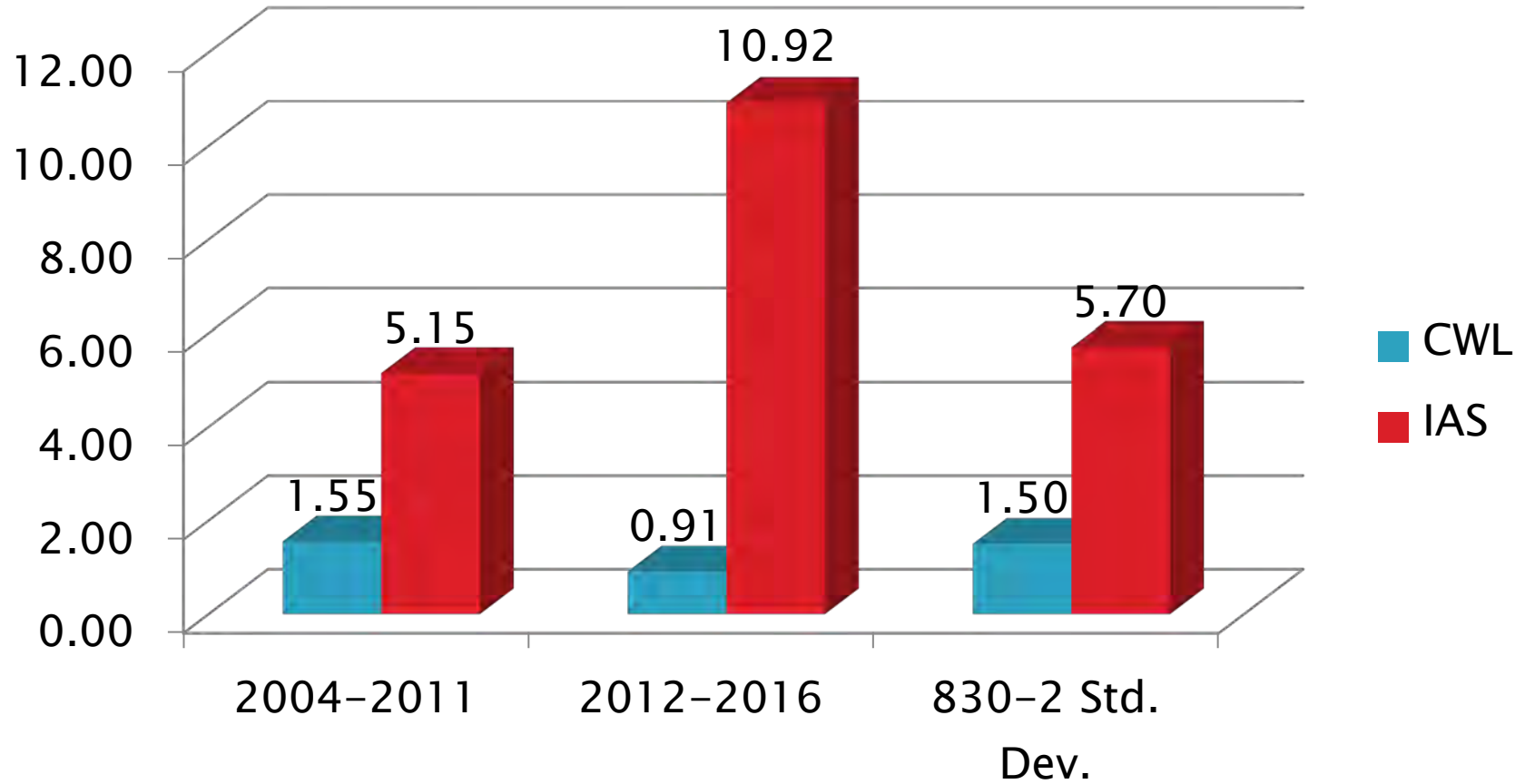


CUSUM Severity Analysis

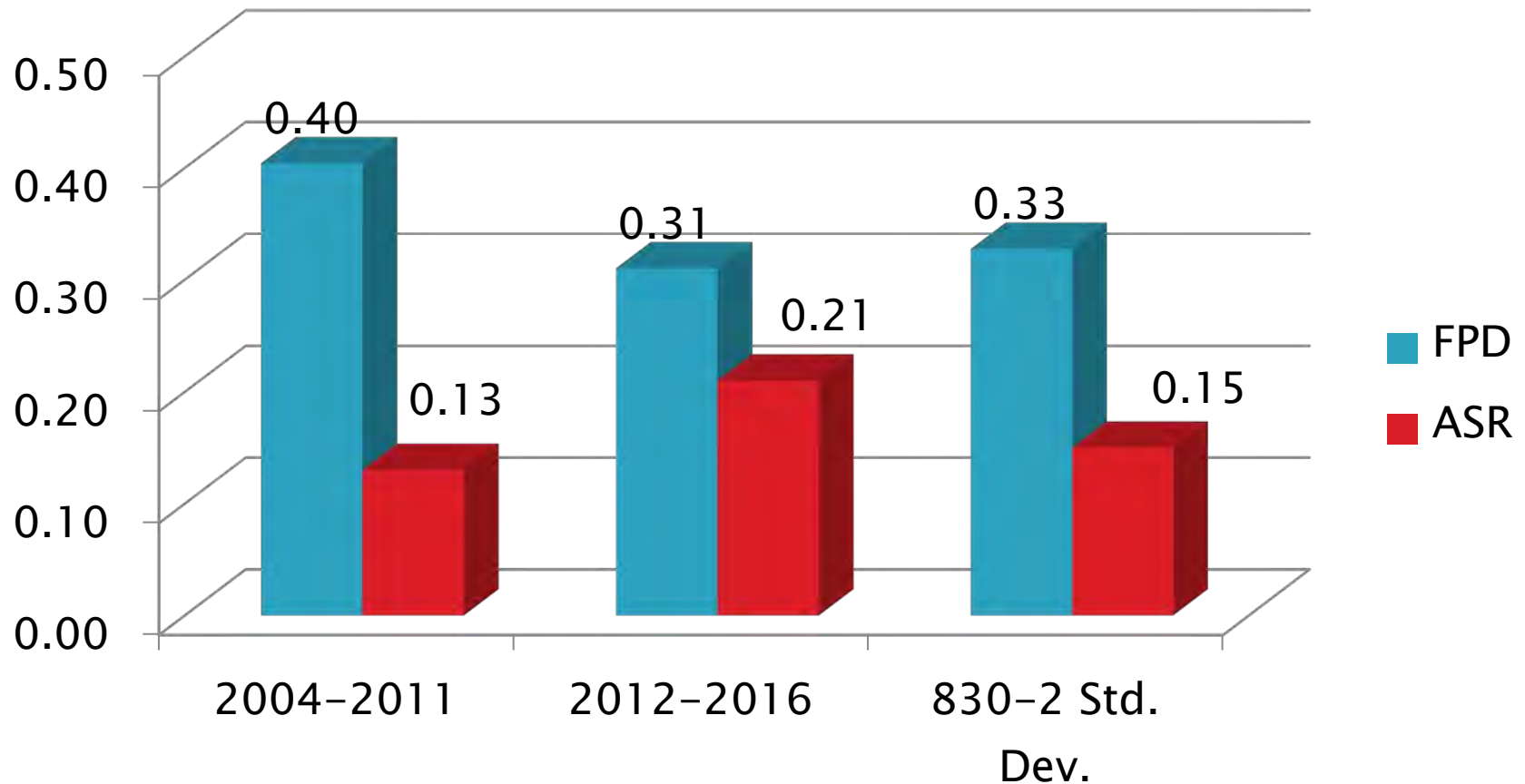


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ISM Precision Estimates



ISM Precision Estimates



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Test Monitoring Center

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EOAT

»» April 2017

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

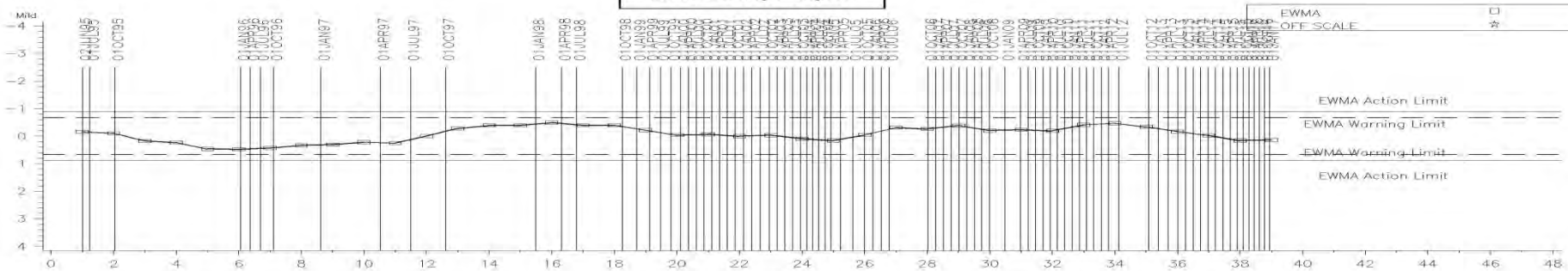
EOAT Test Severity

- ▶ AEOA is in control.

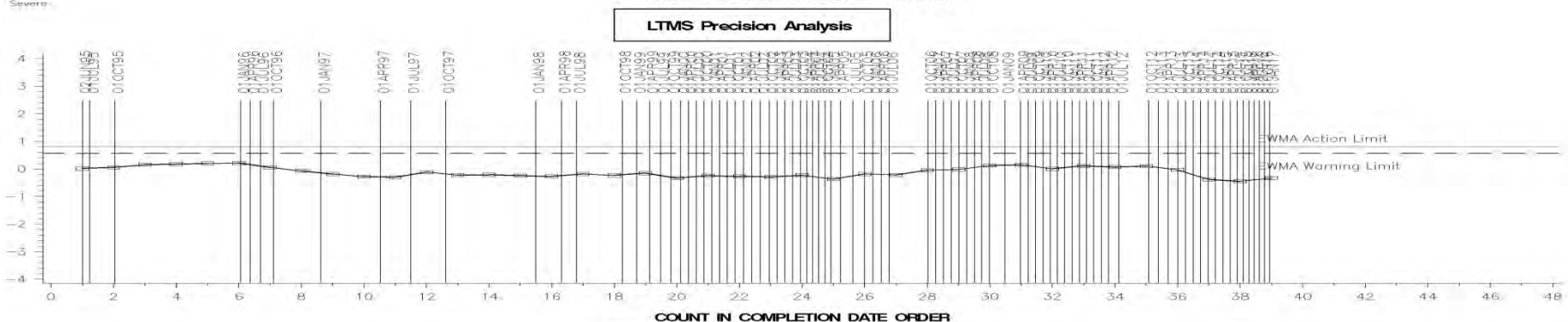
EOAT INDUSTRY OPERATIONAL VALID DATA

ENGINE OIL AERATION

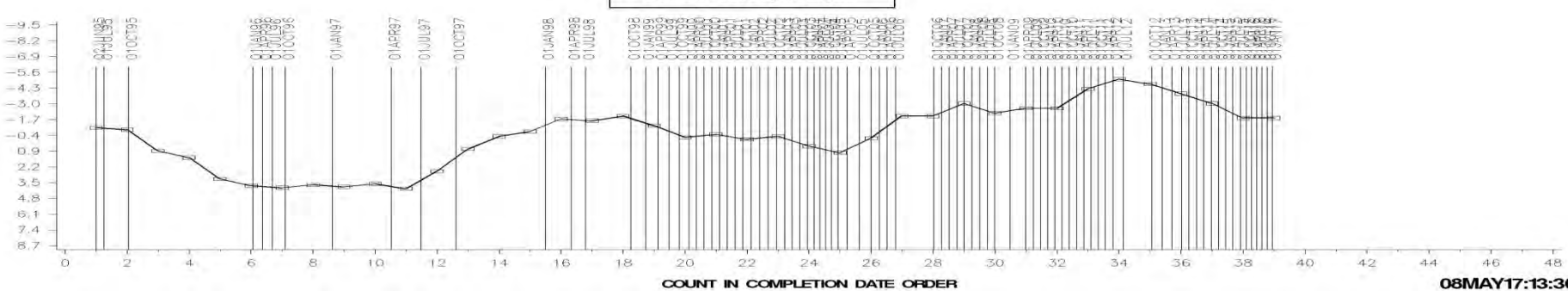
LTMS Severity Analysis



LTMS Precision Analysis



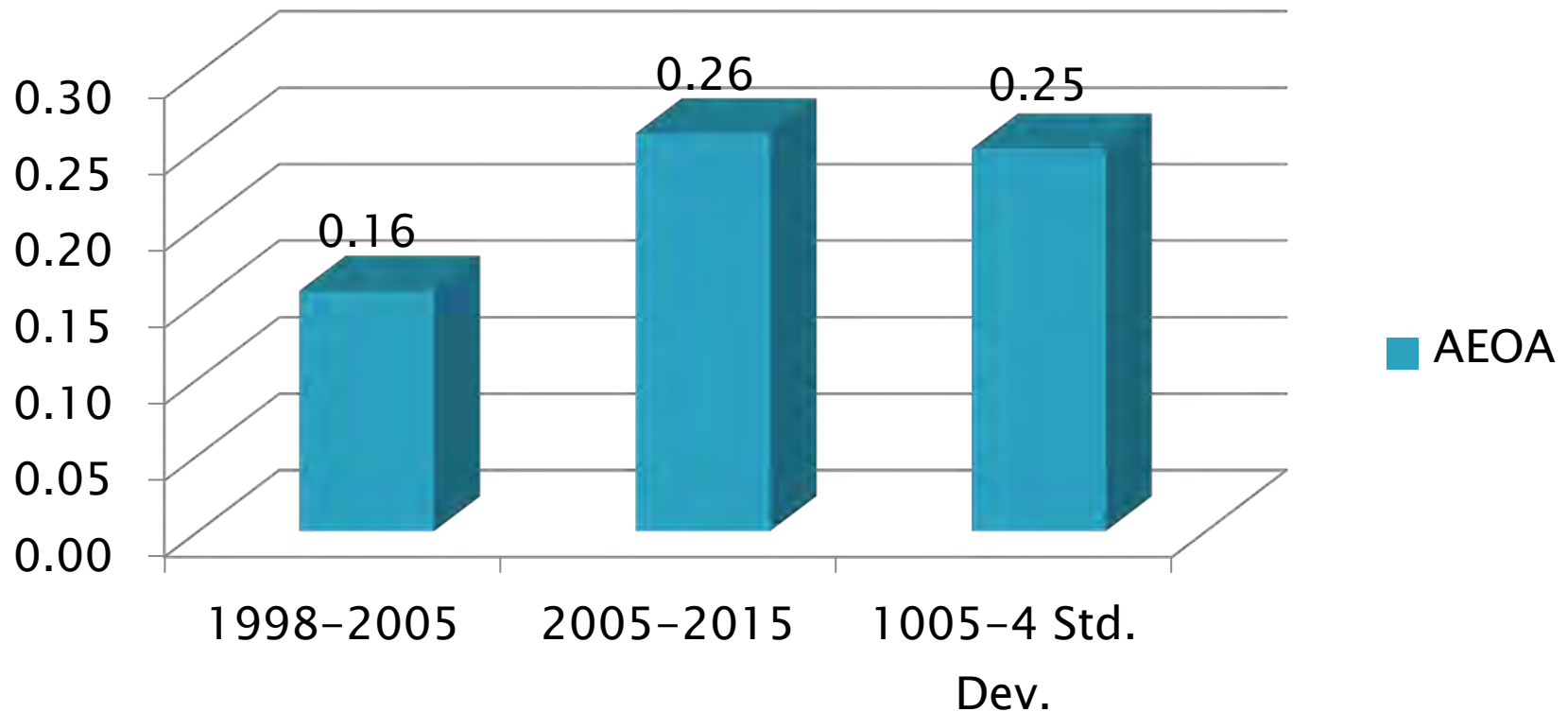
CUSUM Severity Analysis



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EOAT Precision Estimates

AEOA



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Test Monitoring Center

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RFWT

»» April 2017

RFWT 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

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

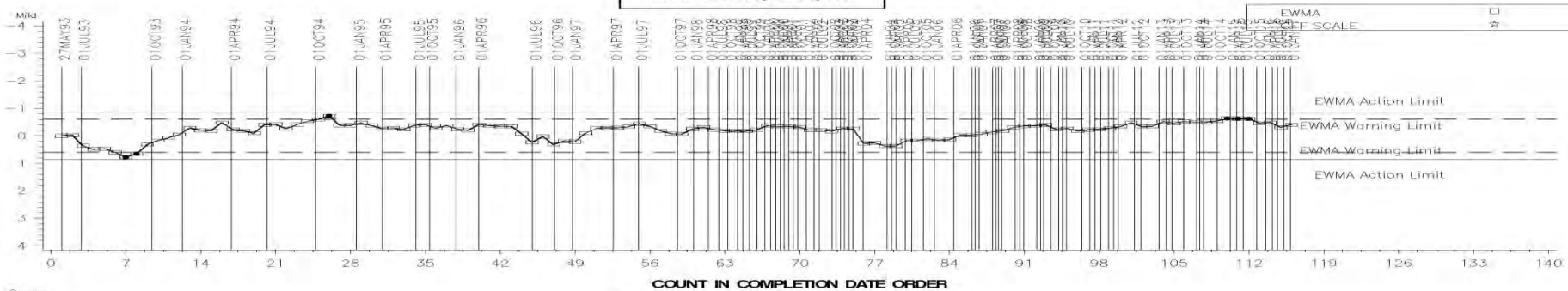
*Invalid and aborted tests

RFWT Test Severity

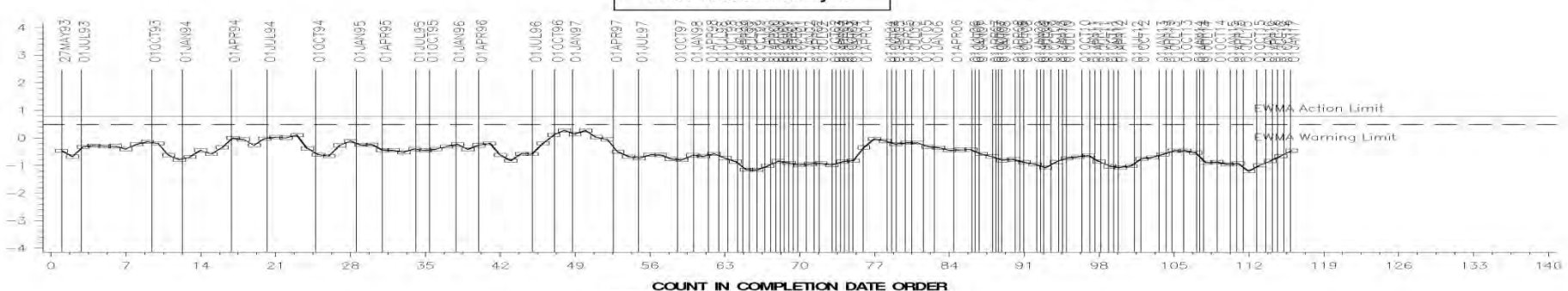
- ▶ AFW is in control.

Average Follower Wear

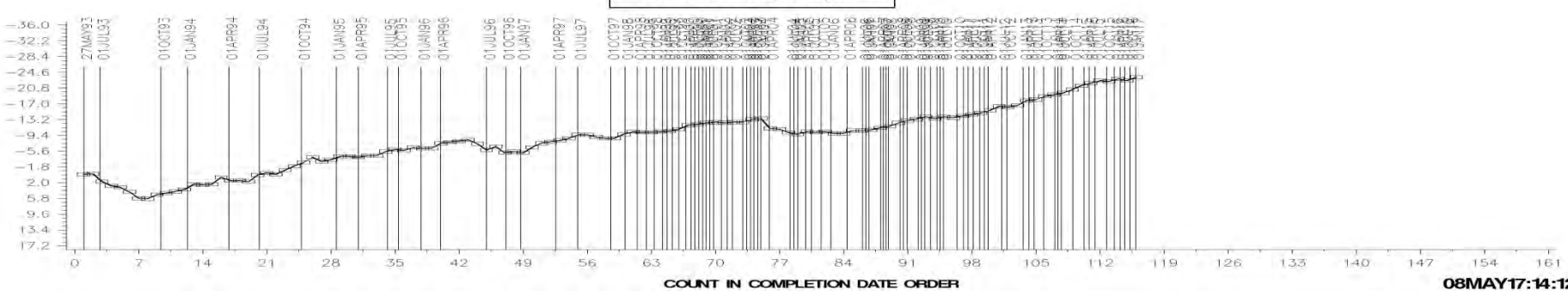
LTMS Severity Analysis



LTMS Precision Analysis



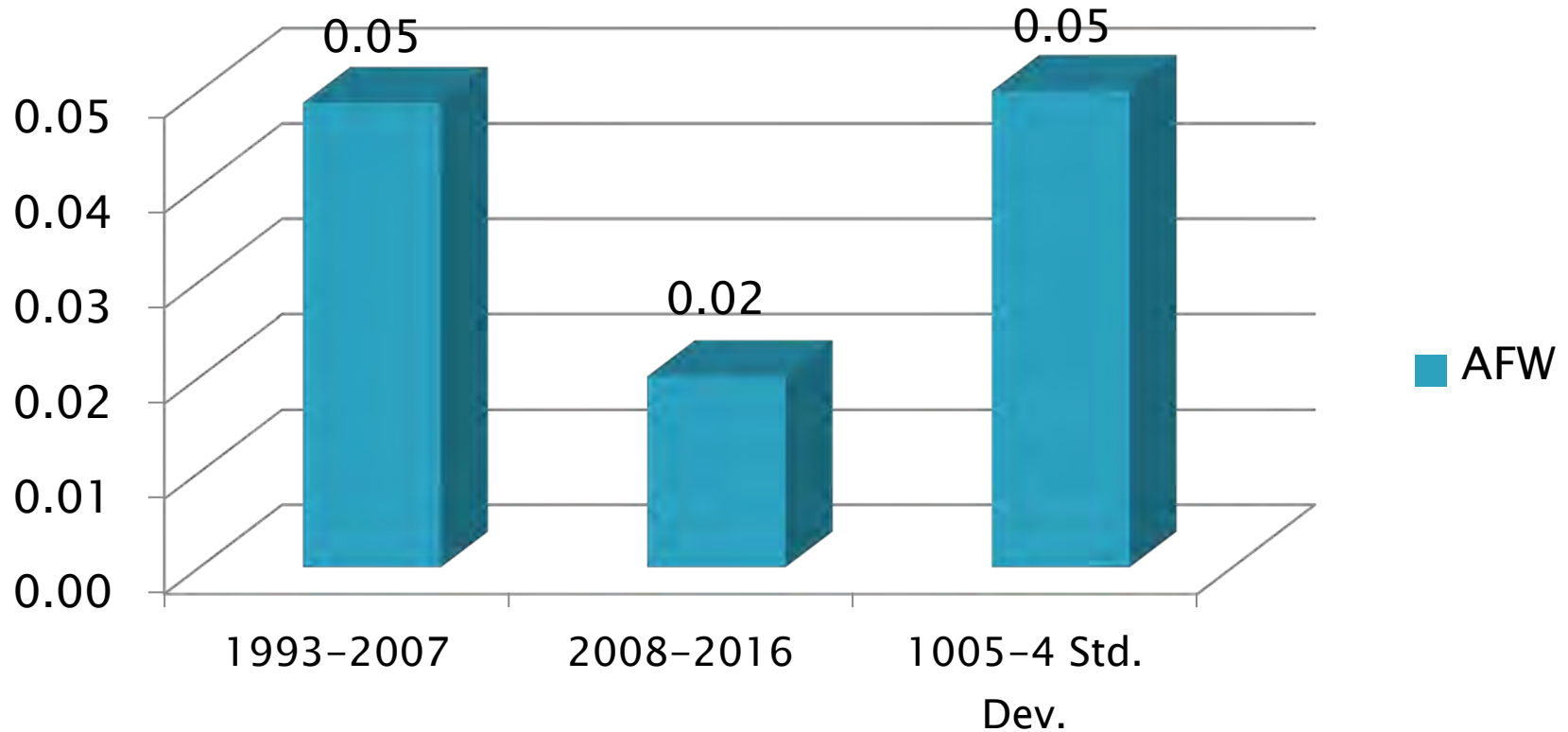
CUSUM Severity Analysis



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RFWT Precision Estimates

AFW



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Mack T-8/T-8E

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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	1
Total		3

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	High Oil Consumption	1
Total		1

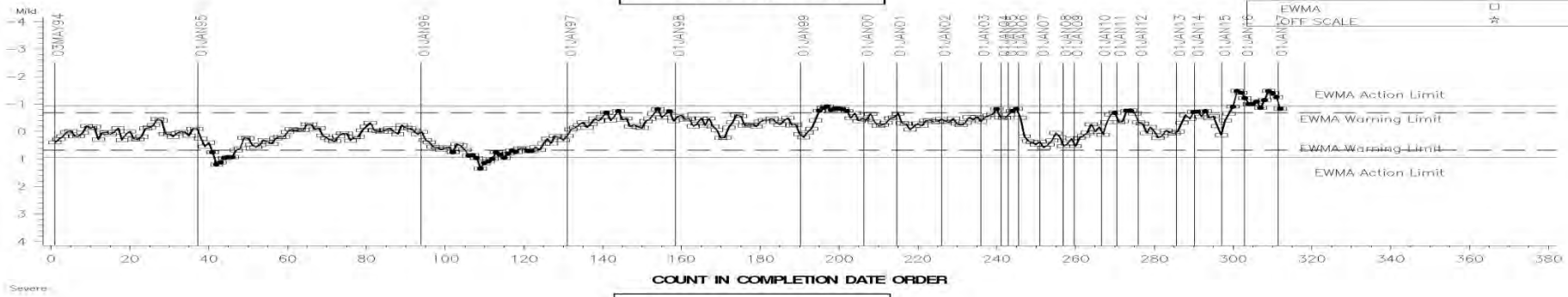
*Invalid and aborted tests

T-8/T-8E Test Severity

- ▶ VI38 is in severity warning alarm in mild direction.
- ▶ RV48 and RV2 are in control.

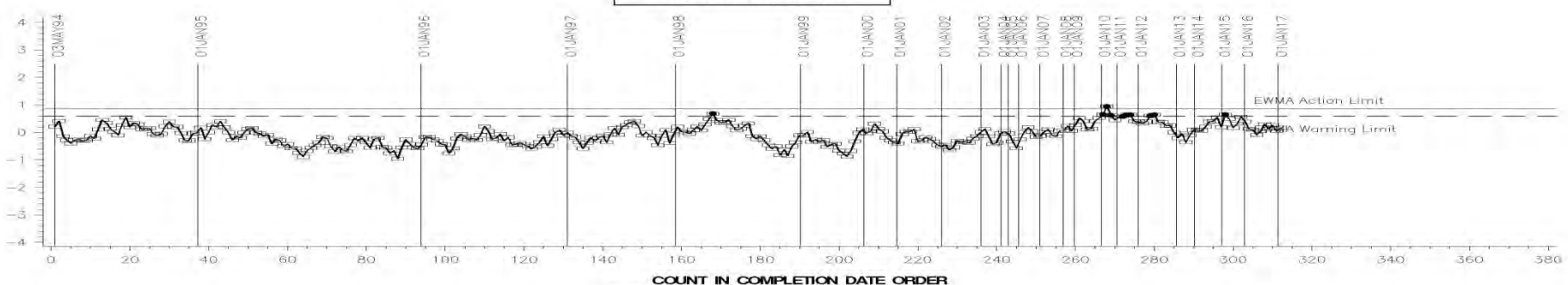
FINAL REFERENCE VISCOSITY AT 3.8% TGA SOOT LEVEL

LTMS Severity Analysis



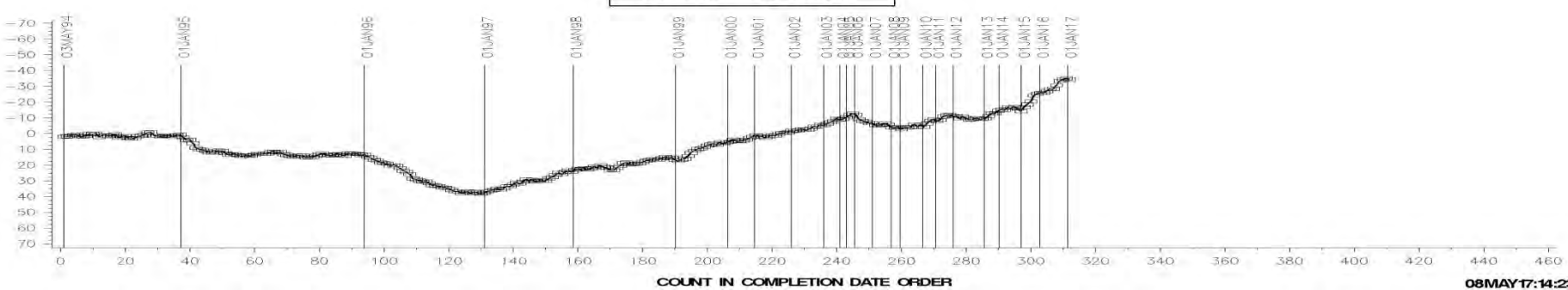
COUNT IN COMPLETION DATE ORDER

LTMS Precision Analysis



COUNT IN COMPLETION DATE ORDER

CUSUM Severity Analysis

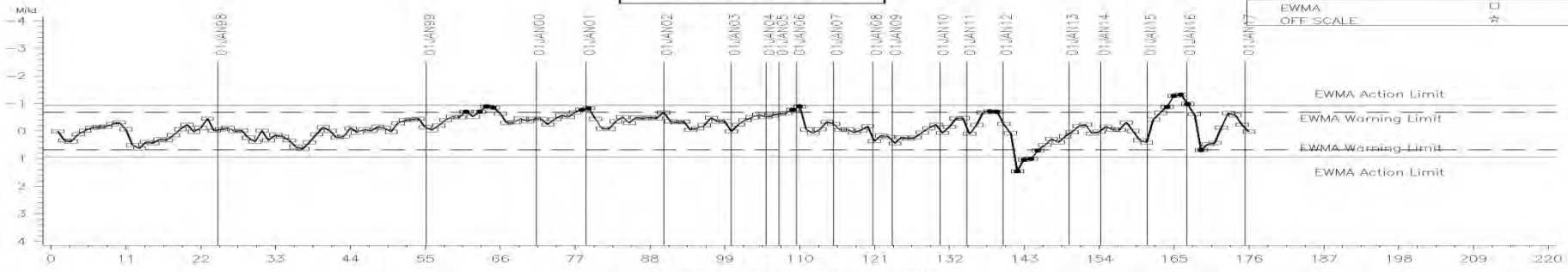


COUNT IN COMPLETION DATE ORDER

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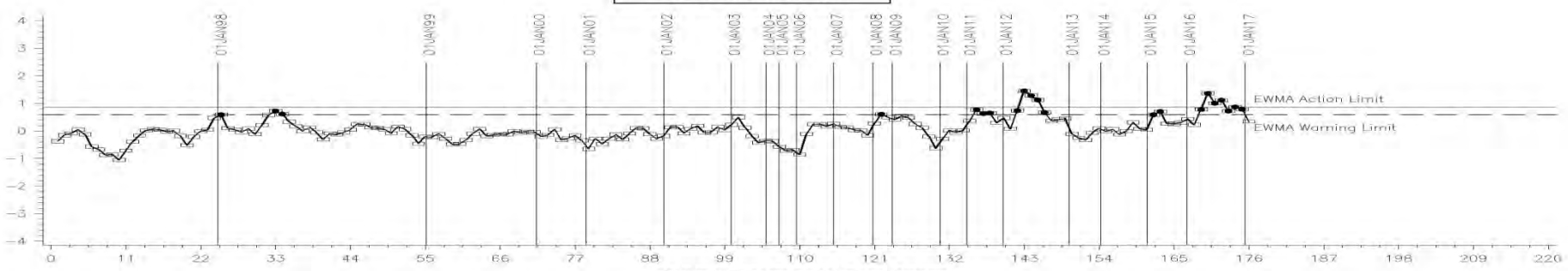
FINAL RELATIVE VISCOSITY (50% LOSS)

LTMS Severity Analysis



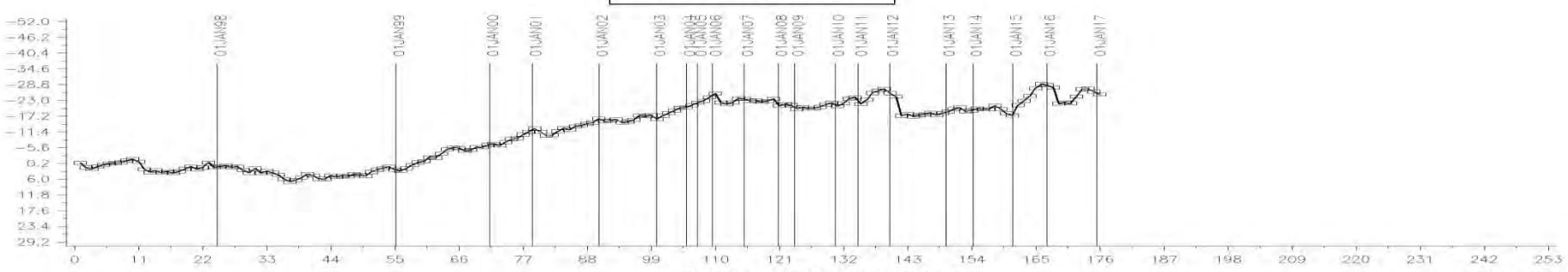
COUNT IN COMPLETION DATE ORDER

LTMS Precision Analysis



COUNT IN COMPLETION DATE ORDER

CUSUM Severity Analysis

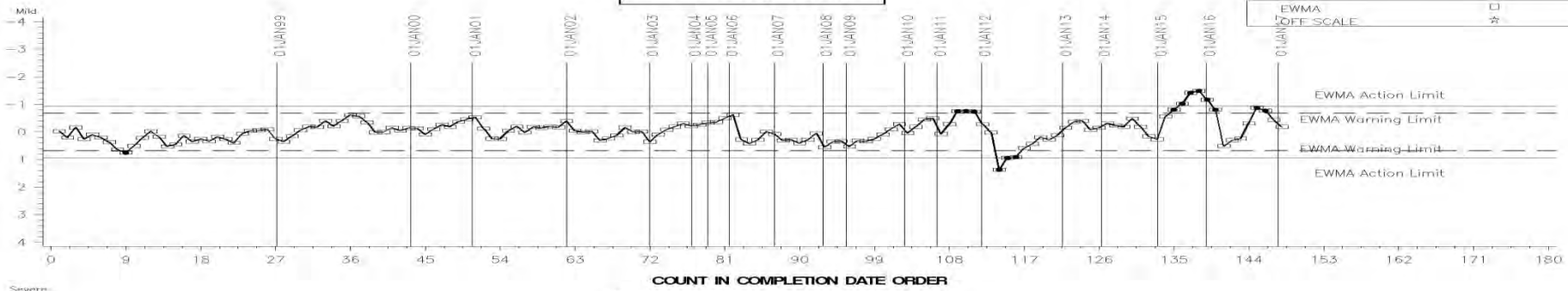


COUNT IN COMPLETION DATE ORDER

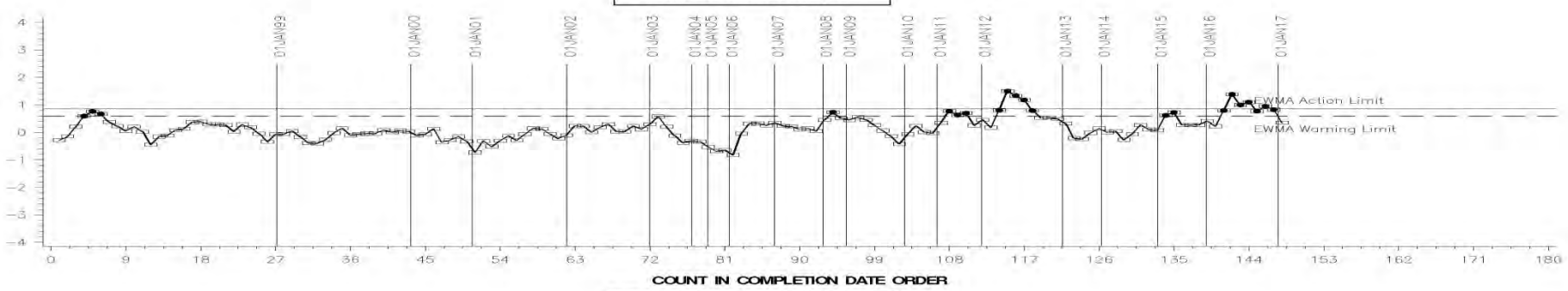
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FINAL RELATIVE VISCOSITY (100% LOSS)

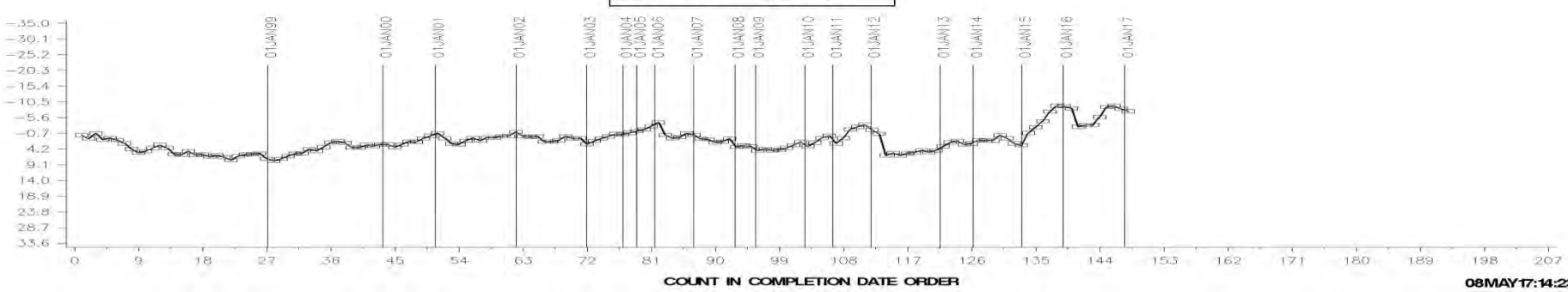
LTMS Severity Analysis



LTMS Precision Analysis

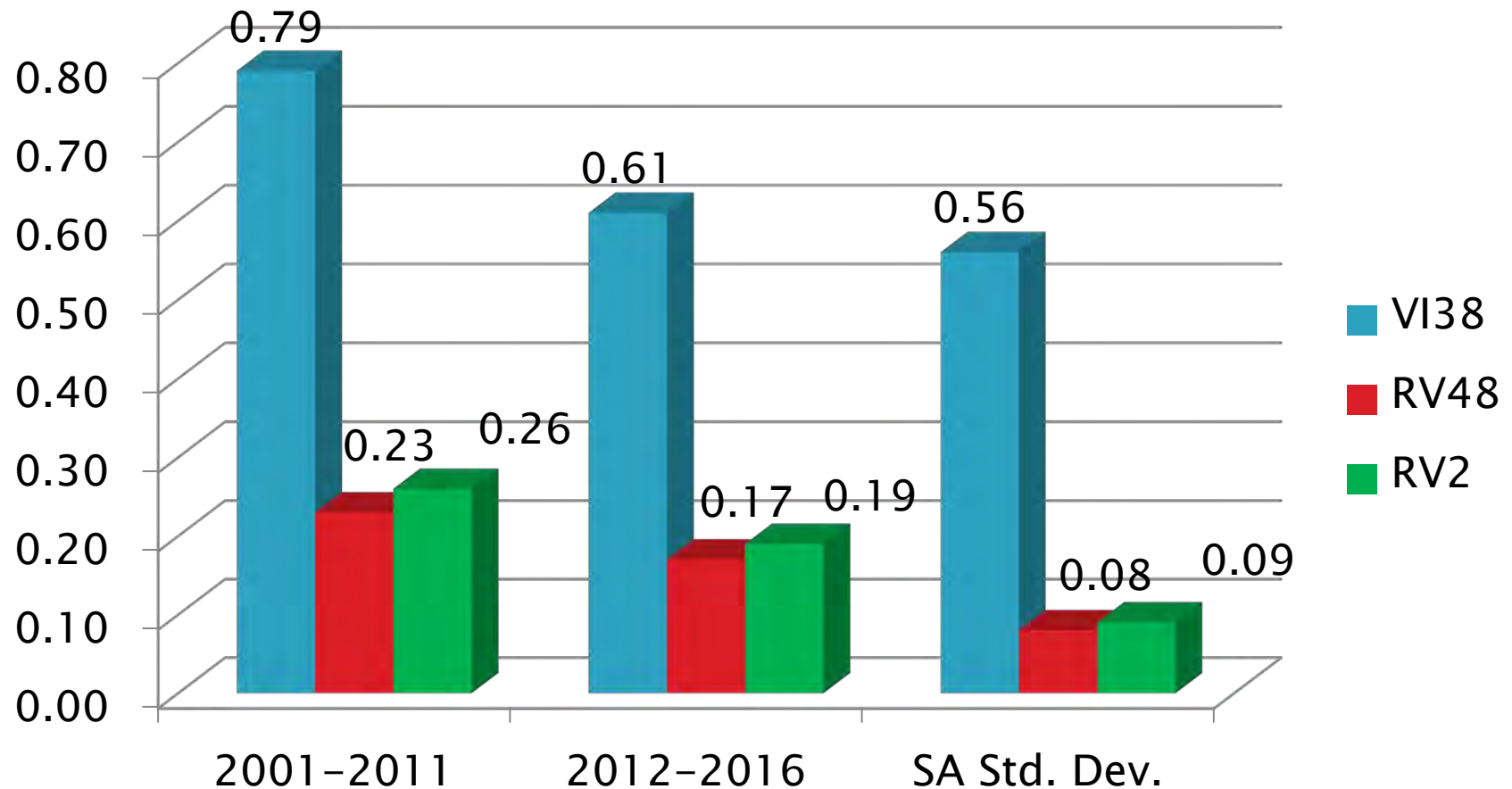


CUSUM Severity Analysis



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T-8/E Precision Estimates



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Mack T-11

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T-11 Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	4
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	0
Total		4

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

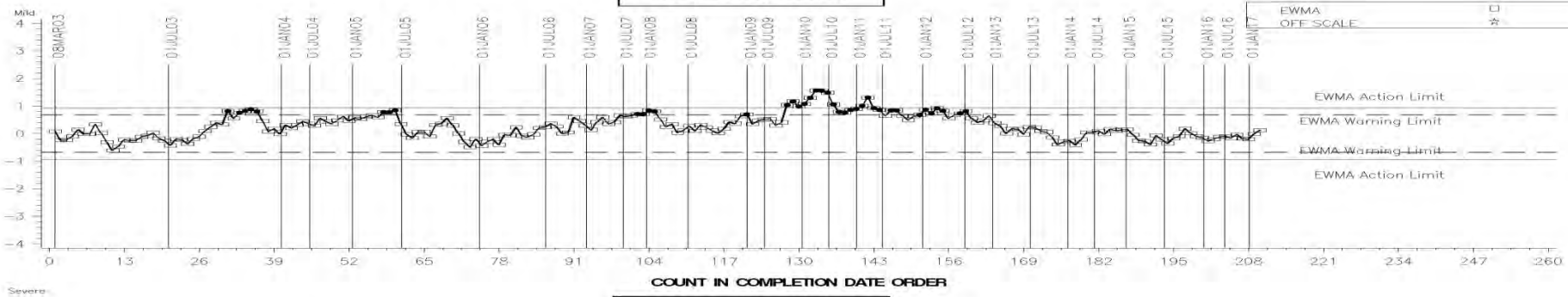
T-11 Test Severity

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

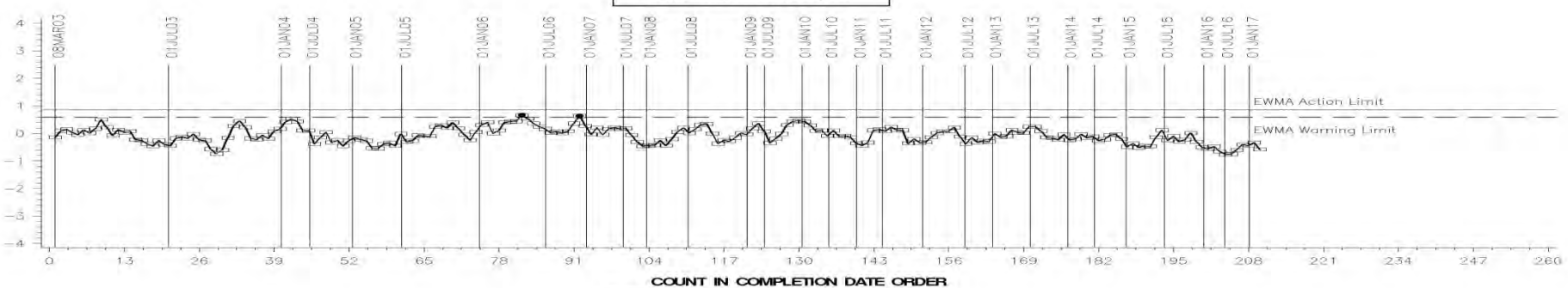
T-11 INDUSTRY OPERATIONAL VALID DATA

SOOT AT 12 cSt

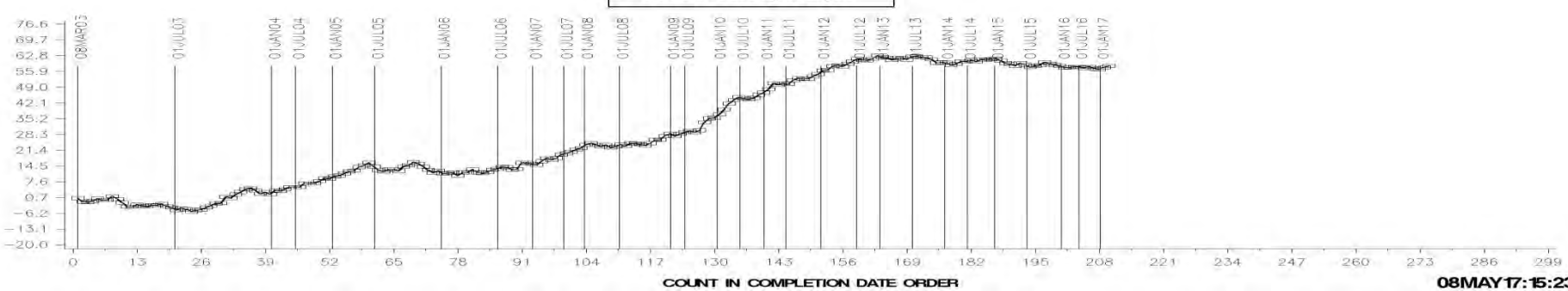
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

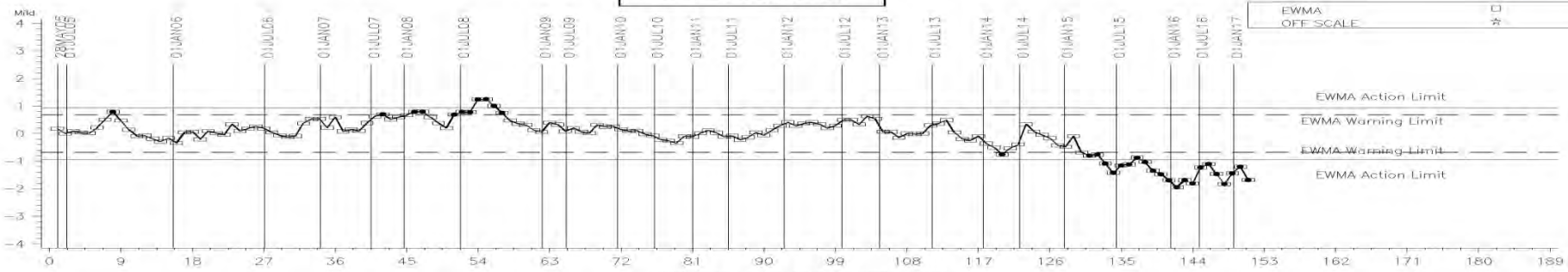


08MAY17: 15:23

T-11 INDUSTRY OPERATIONALLY VALID DATA

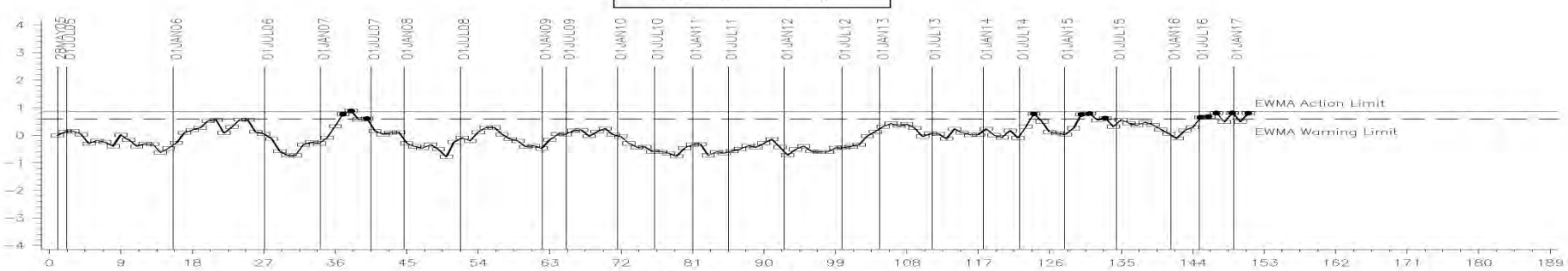
SOOT @ 4 cSt - FINAL RESULT

LTMS Severity Analysis



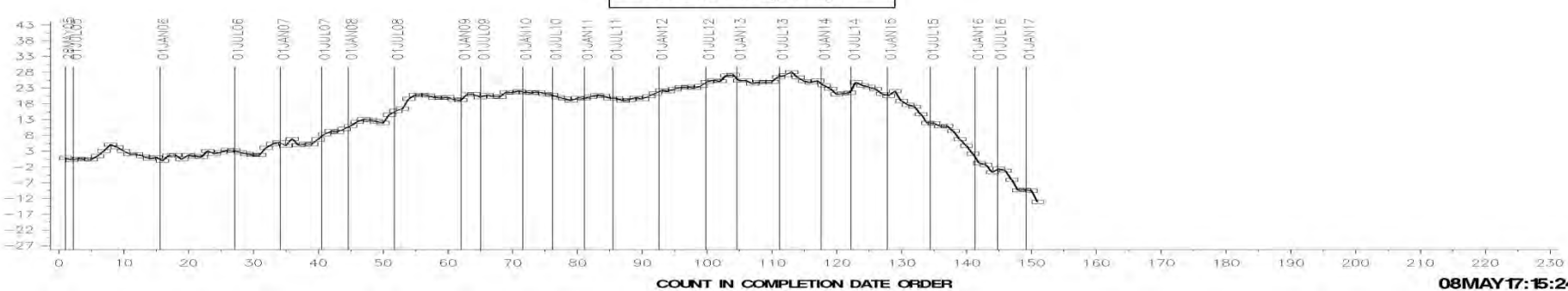
COUNT IN COMPLETION DATE ORDER

LTMS Precision Analysis



COUNT IN COMPLETION DATE ORDER

CUSUM Severity Analysis

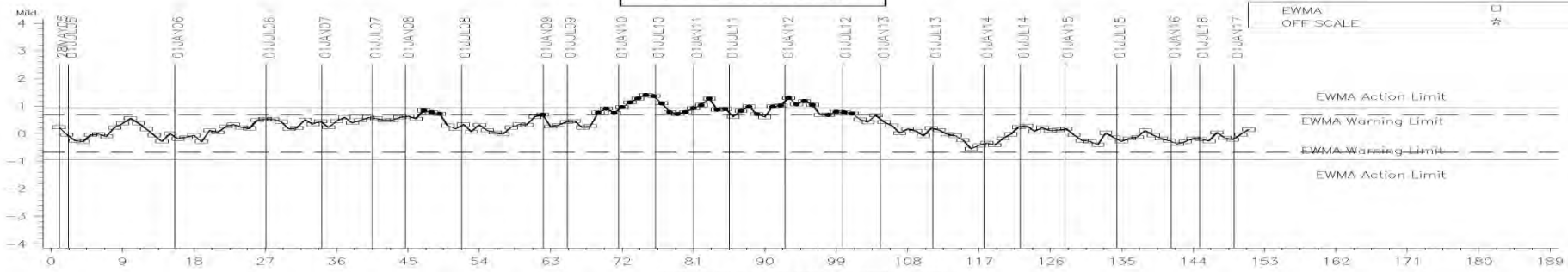


08MAY17: 15:24

T-11 INDUSTRY OPERATIONALLY VALID DATA

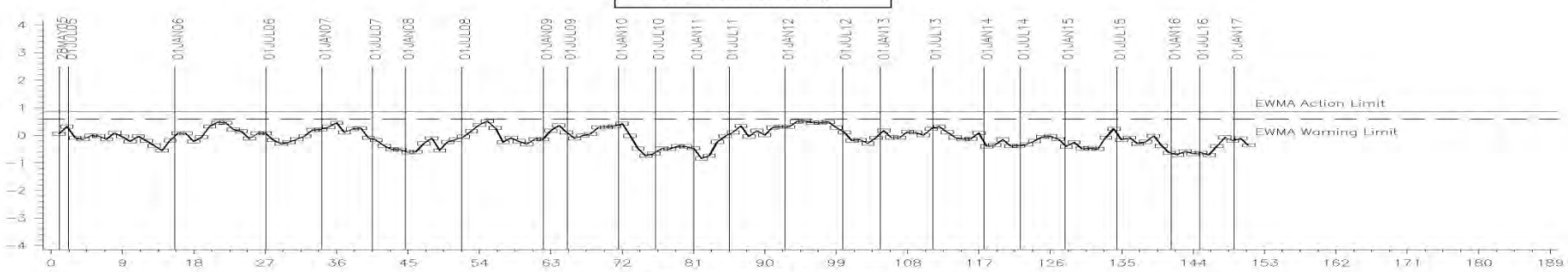
SOOT @ 15 cSt — FINAL RESULT

LTMS Severity Analysis



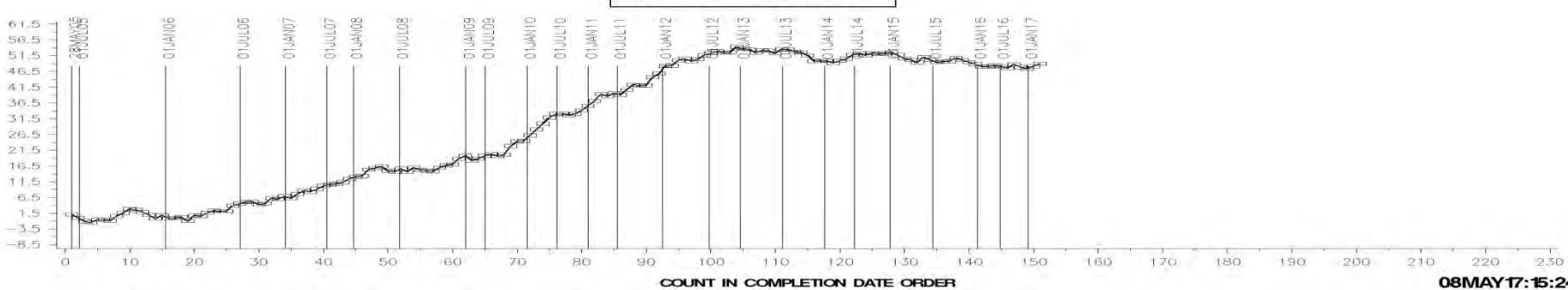
COUNT IN COMPLETION DATE ORDER

LTMS Precision Analysis



COUNT IN COMPLETION DATE ORDER

CUSUM Severity Analysis

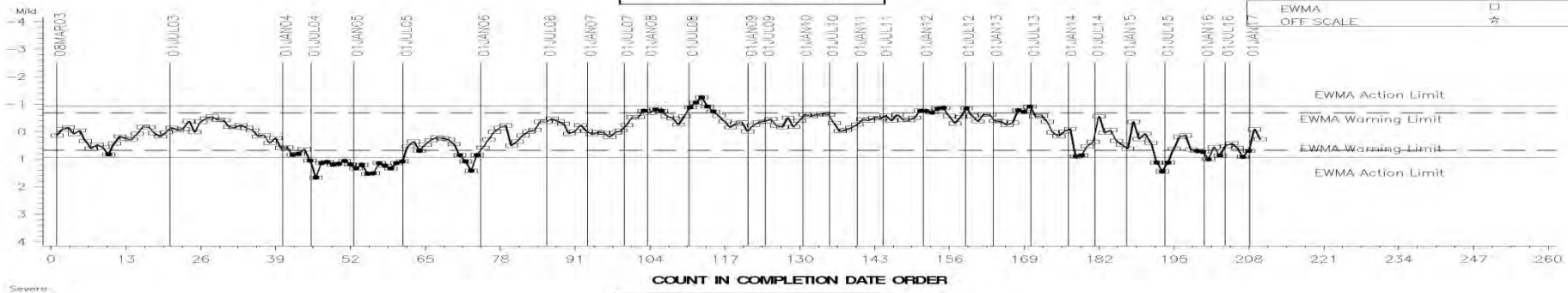


08MAY17: 15:24

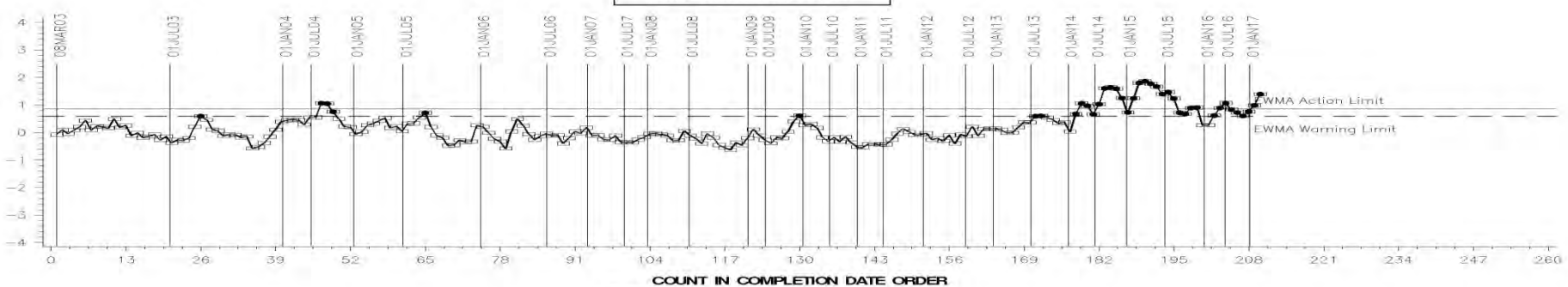
T-11 INDUSTRY OPERATIONALLY VALID DATA

MRV VISCOSITY

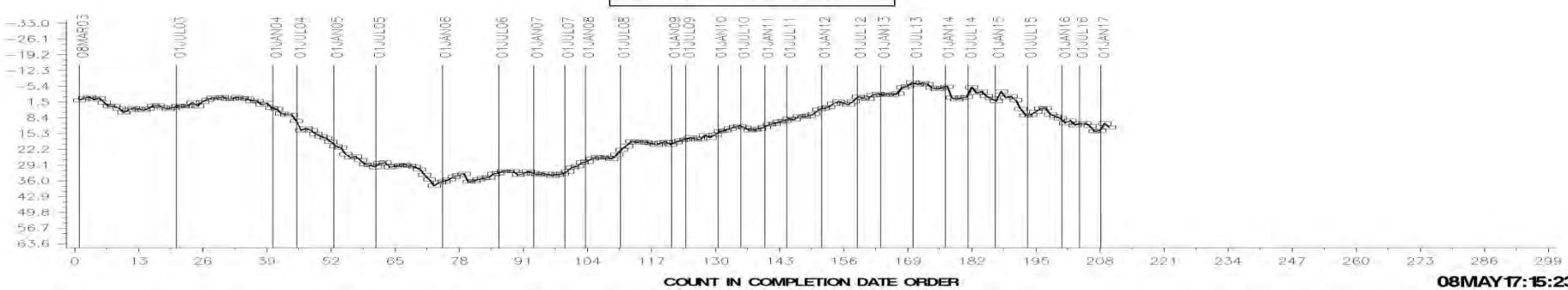
LTMS Severity Analysis



LTMS Precision Analysis

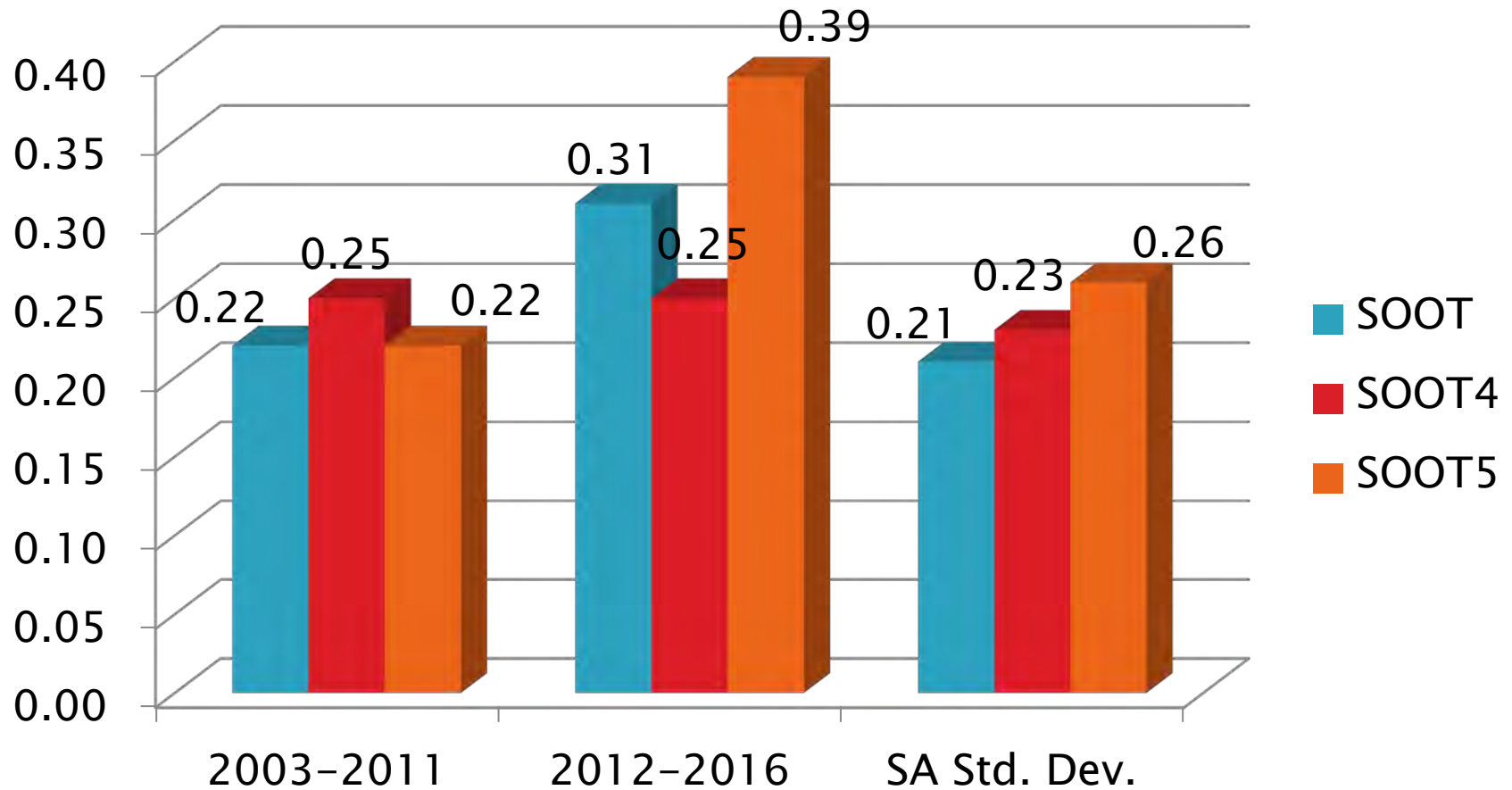


CUSUM Severity Analysis



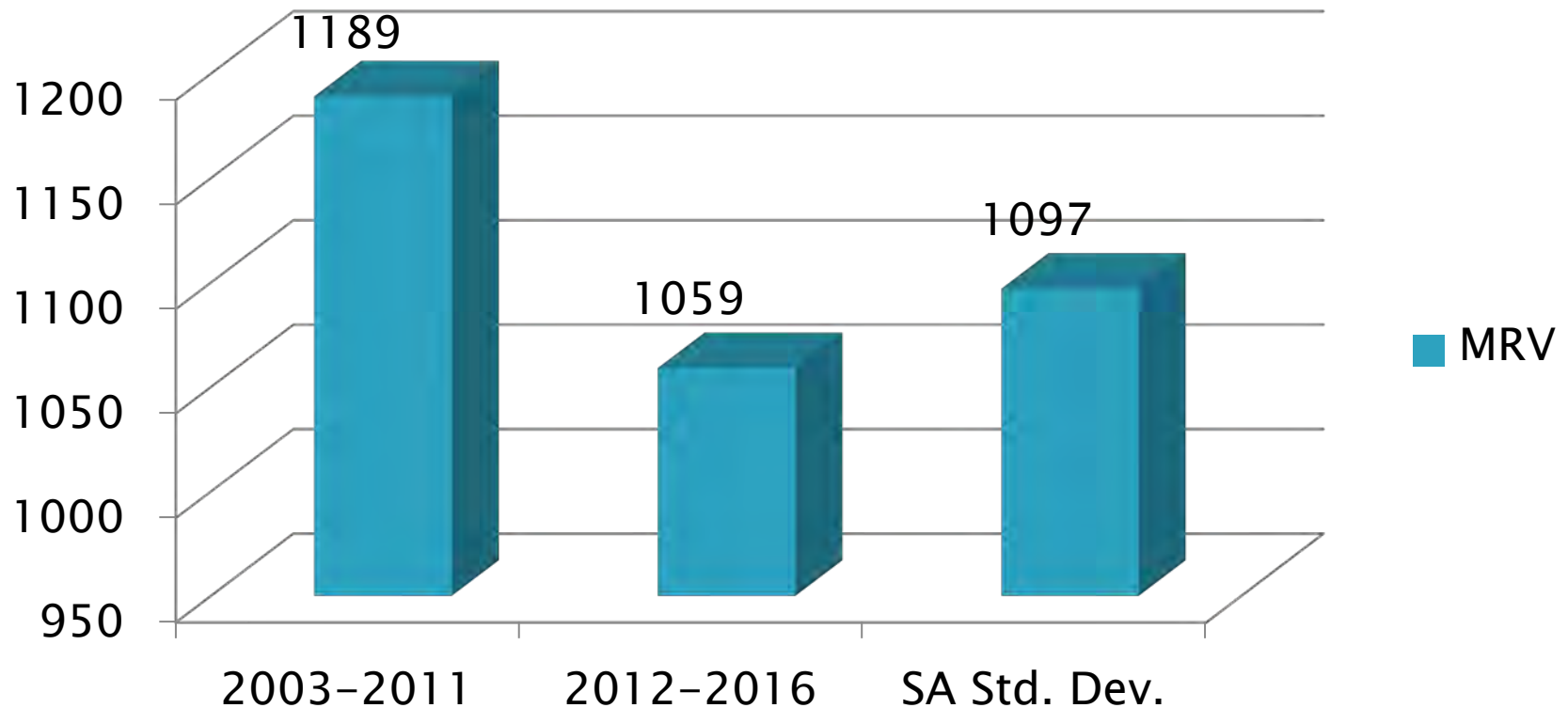
08MAY17: 15:23

T-11 Precision Estimates



T-11 Precision Estimates

MRV



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Mack T-12

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T-12 Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	4
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	0
Total		4

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

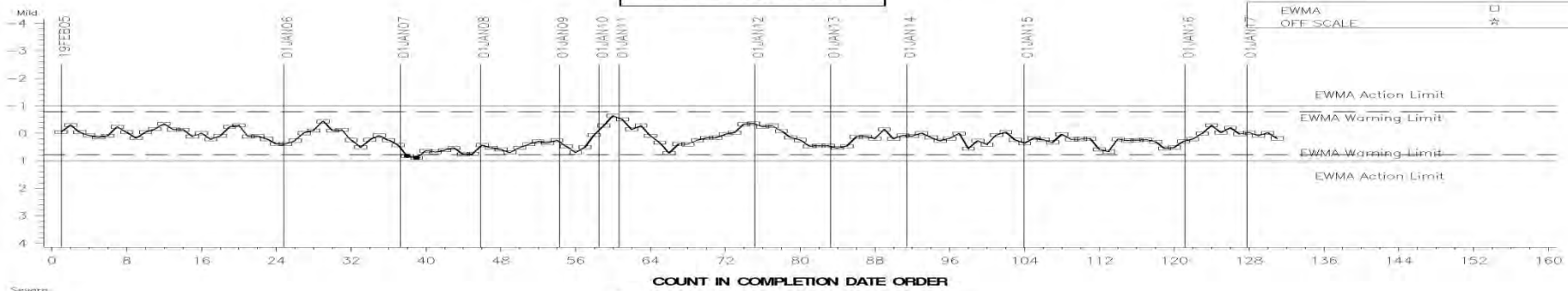
*Invalid and aborted tests

T-12 Test Severity

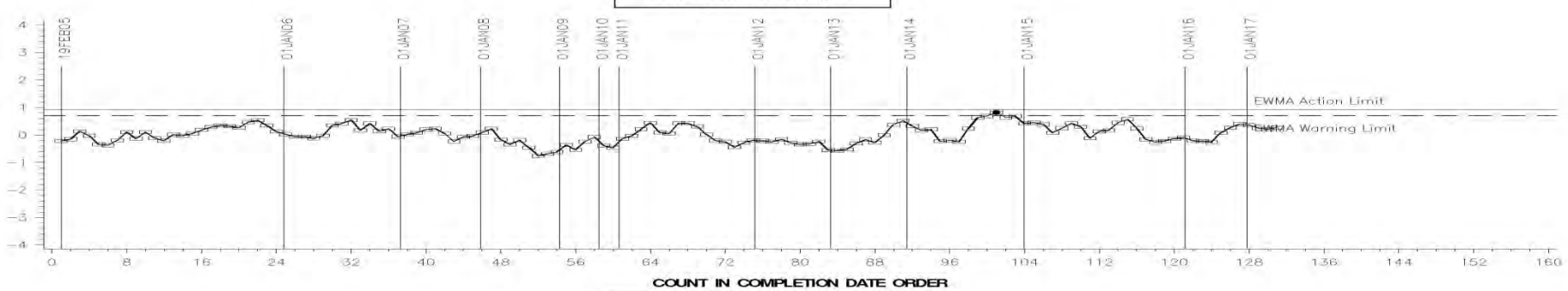
- ▶ PB, CLW, TRWL and OC parameters are in control.
- ▶ PB2 in precision warning alarm.

AVG. CYLINDER LINER WEAR (CLW)

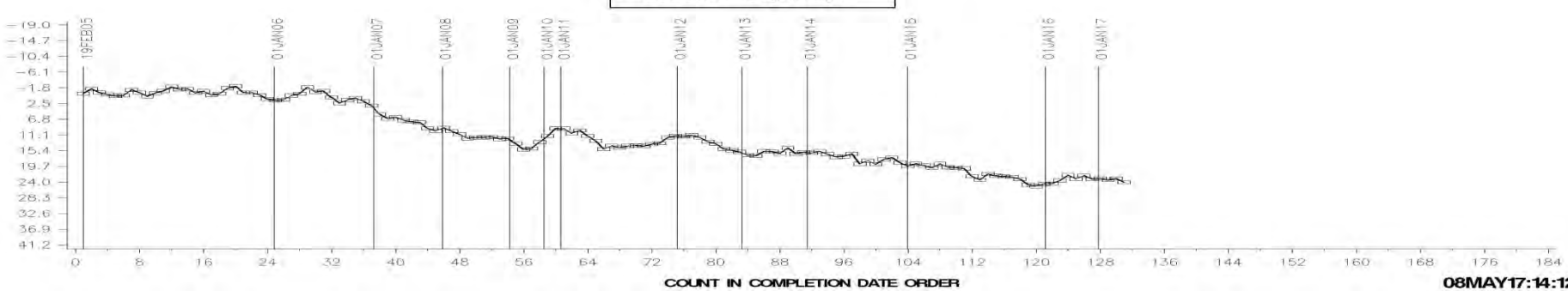
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

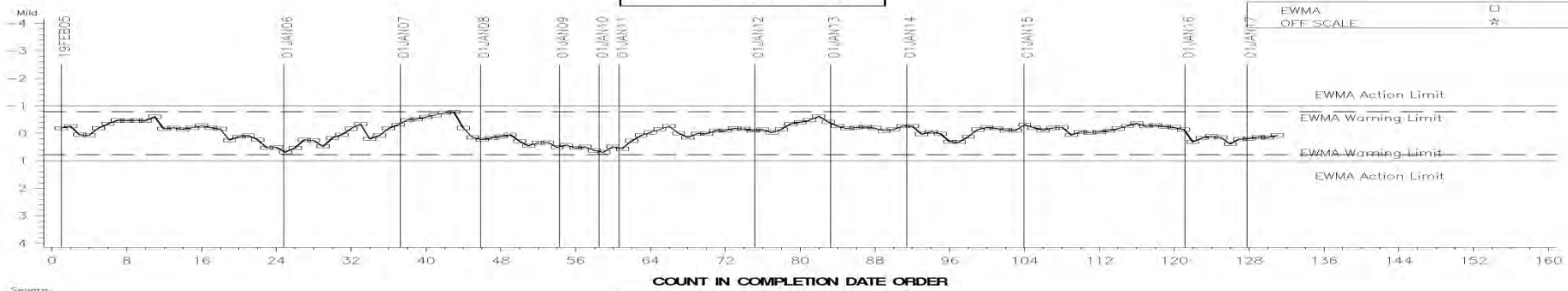


08MAY17:14:12

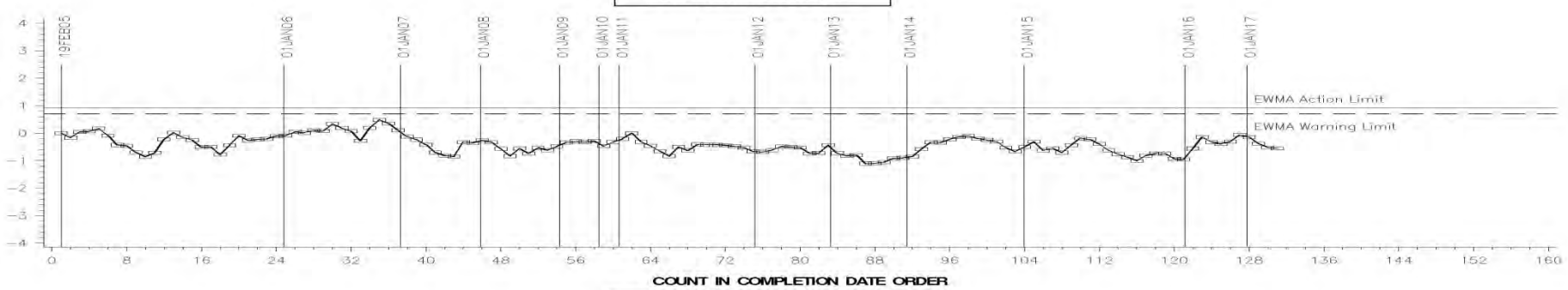
MACK T-12 INDUSTRY OPERATIONALLY VALID DATA

AVG. TOP RING WEIGHT LOSS (TRWL)

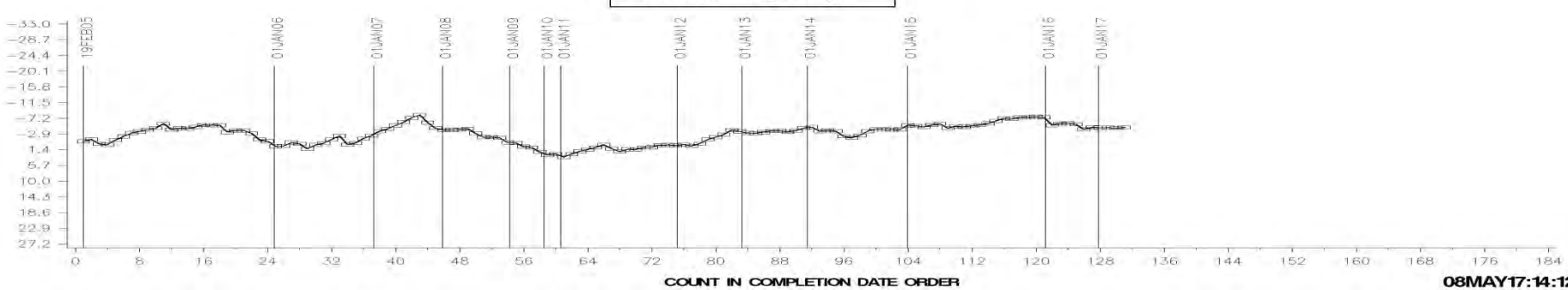
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

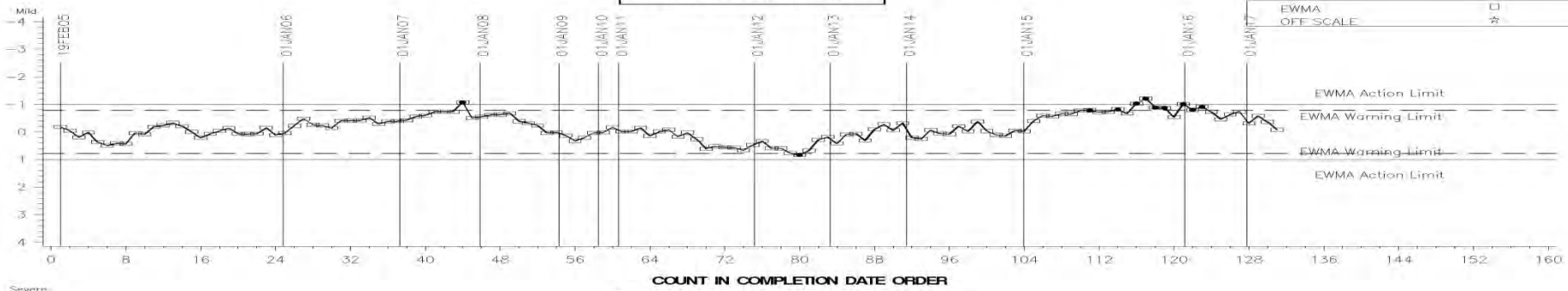


08MAY17:14:12

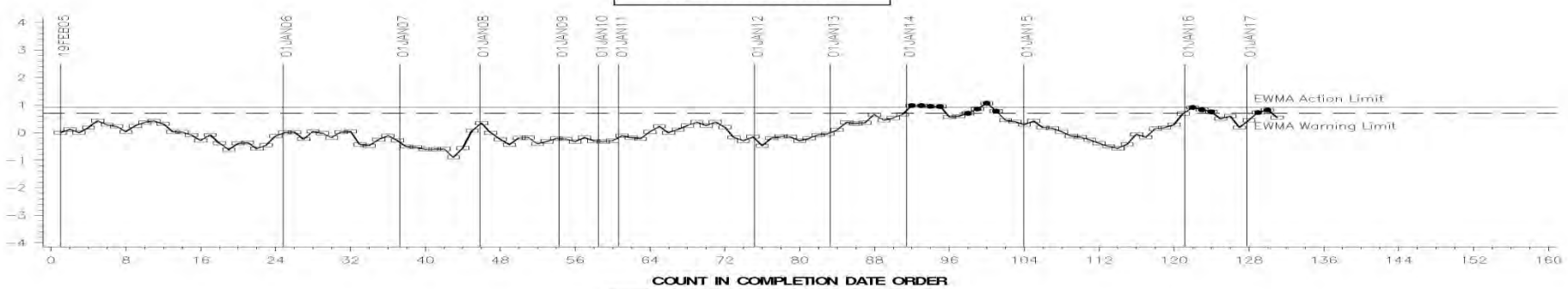
MACK T-12 INDUSTRY OPERATIONAL VALID DATA

FINAL TRANS. RES. DELTA PB @ EOT

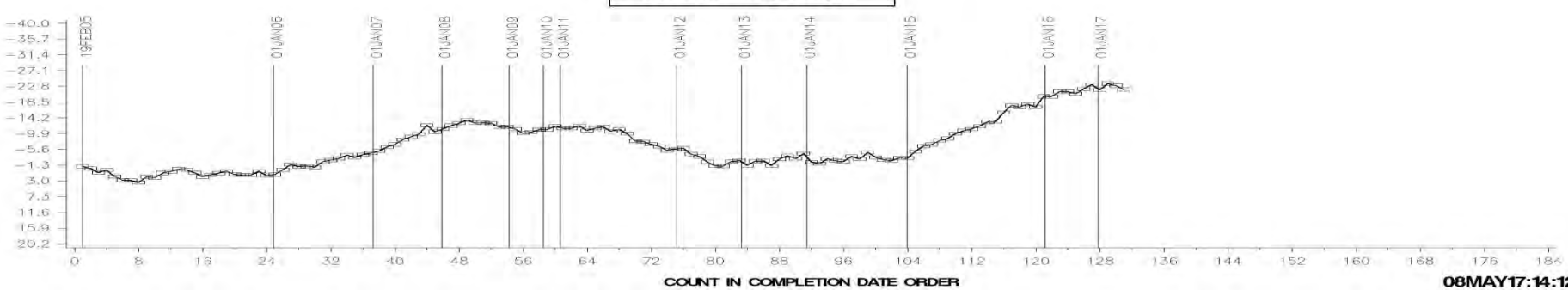
LTMS Severity Analysis



LTMS Precision Analysis



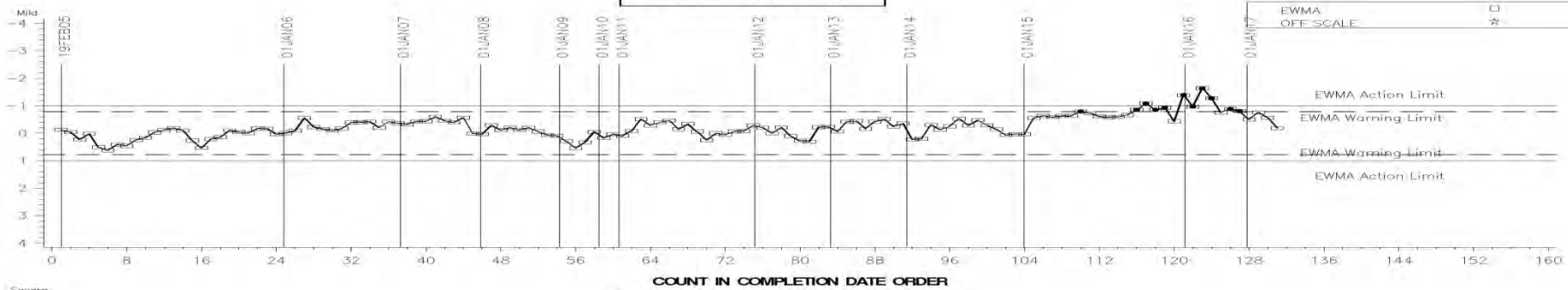
CUSUM Severity Analysis



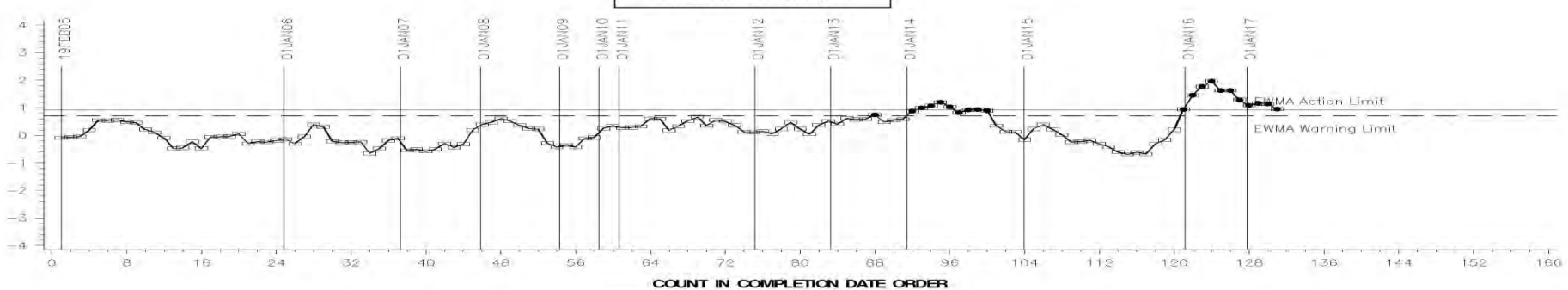
08MAY17:14:12

FINAL TRANS. RES. DELTA PB 250-300H

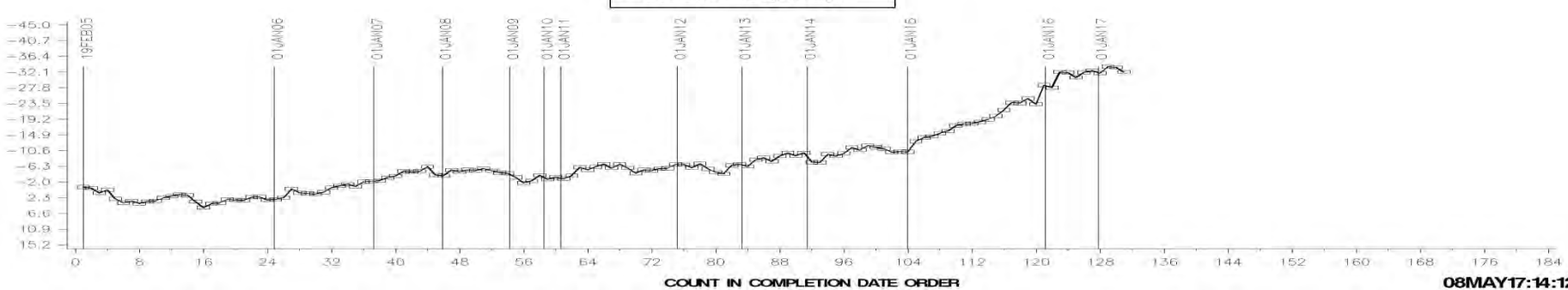
LTMS Severity Analysis



LTMS Precision Analysis



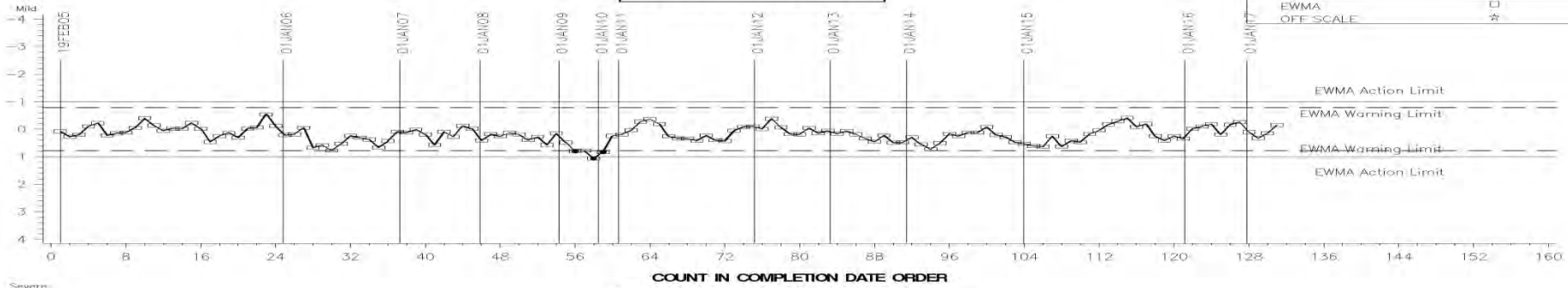
CUSUM Severity Analysis



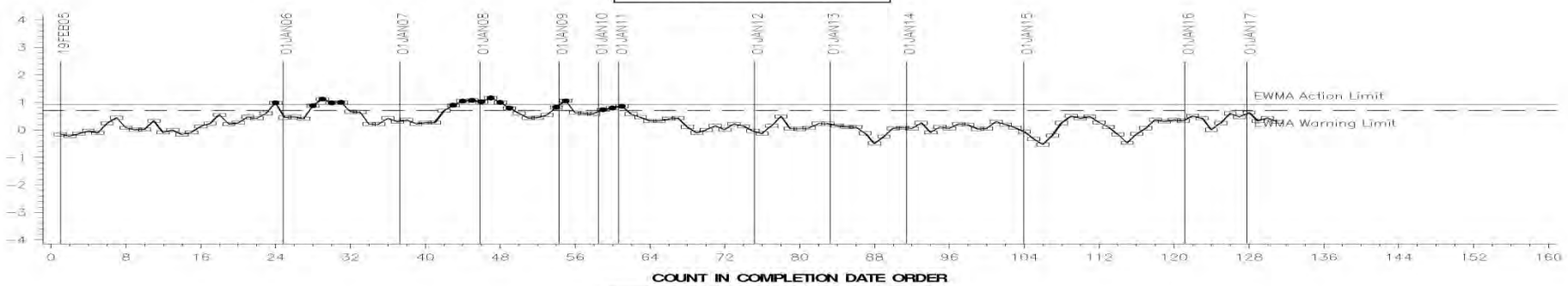
08MAY17:14:12

FINAL TRANS. RES. OIL CONSUMPTION

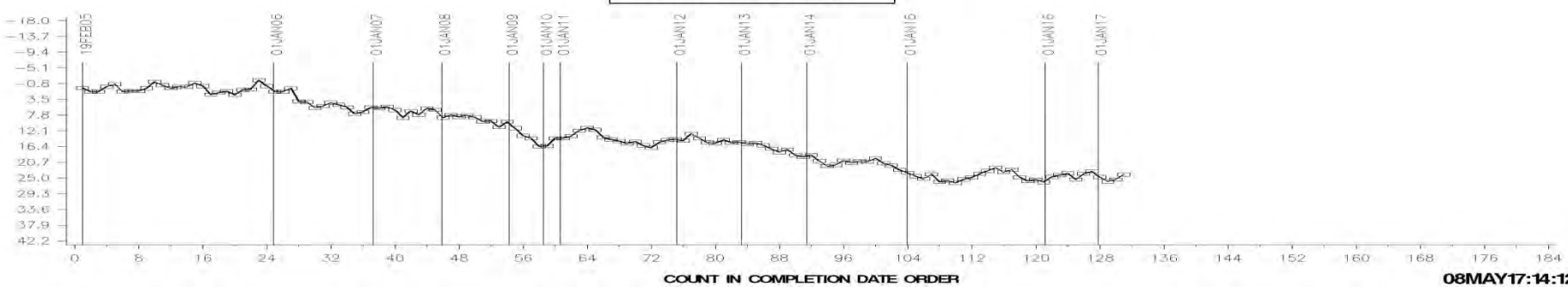
LTMS Severity Analysis



LTMS Precision Analysis

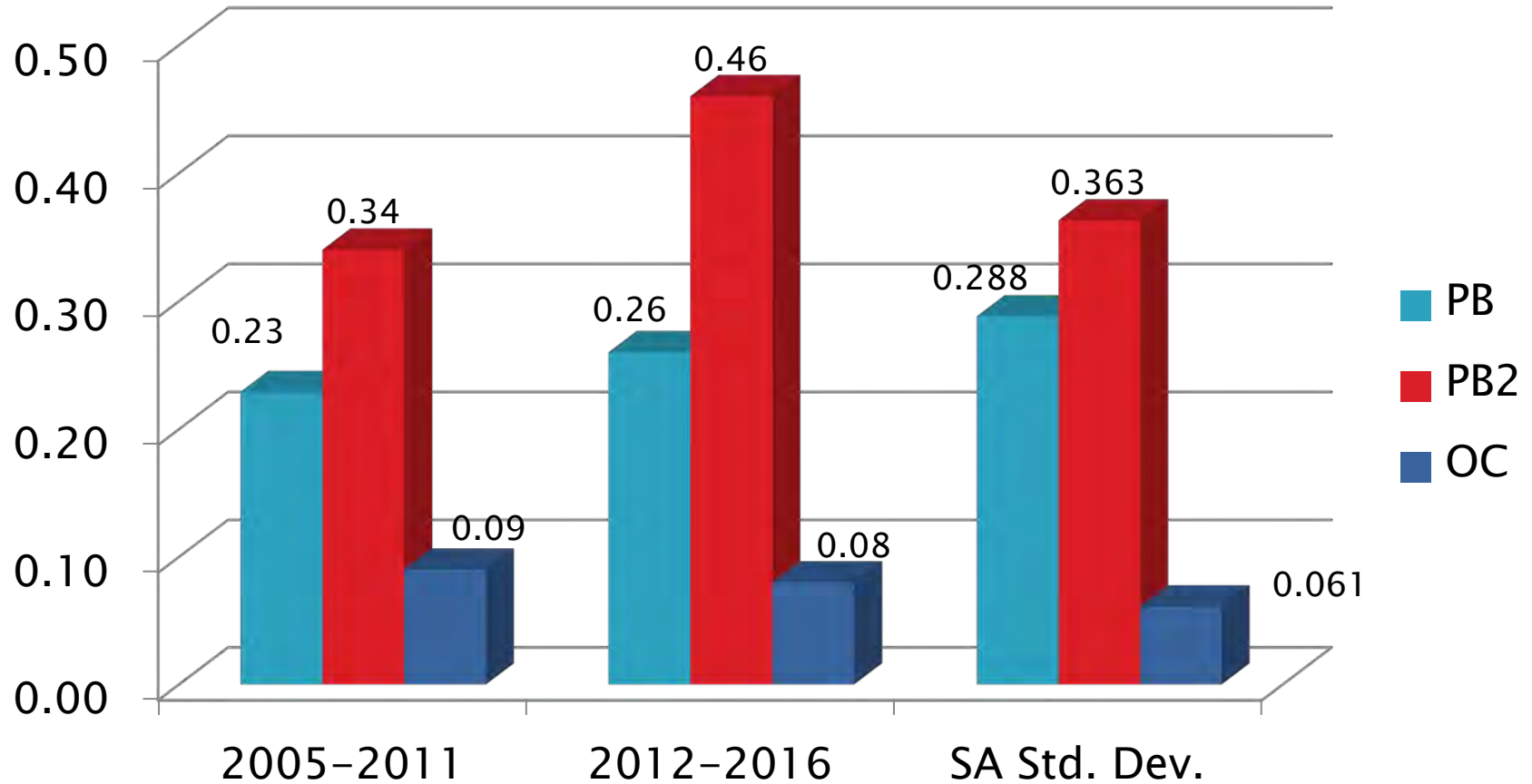


CUSUM Severity Analysis

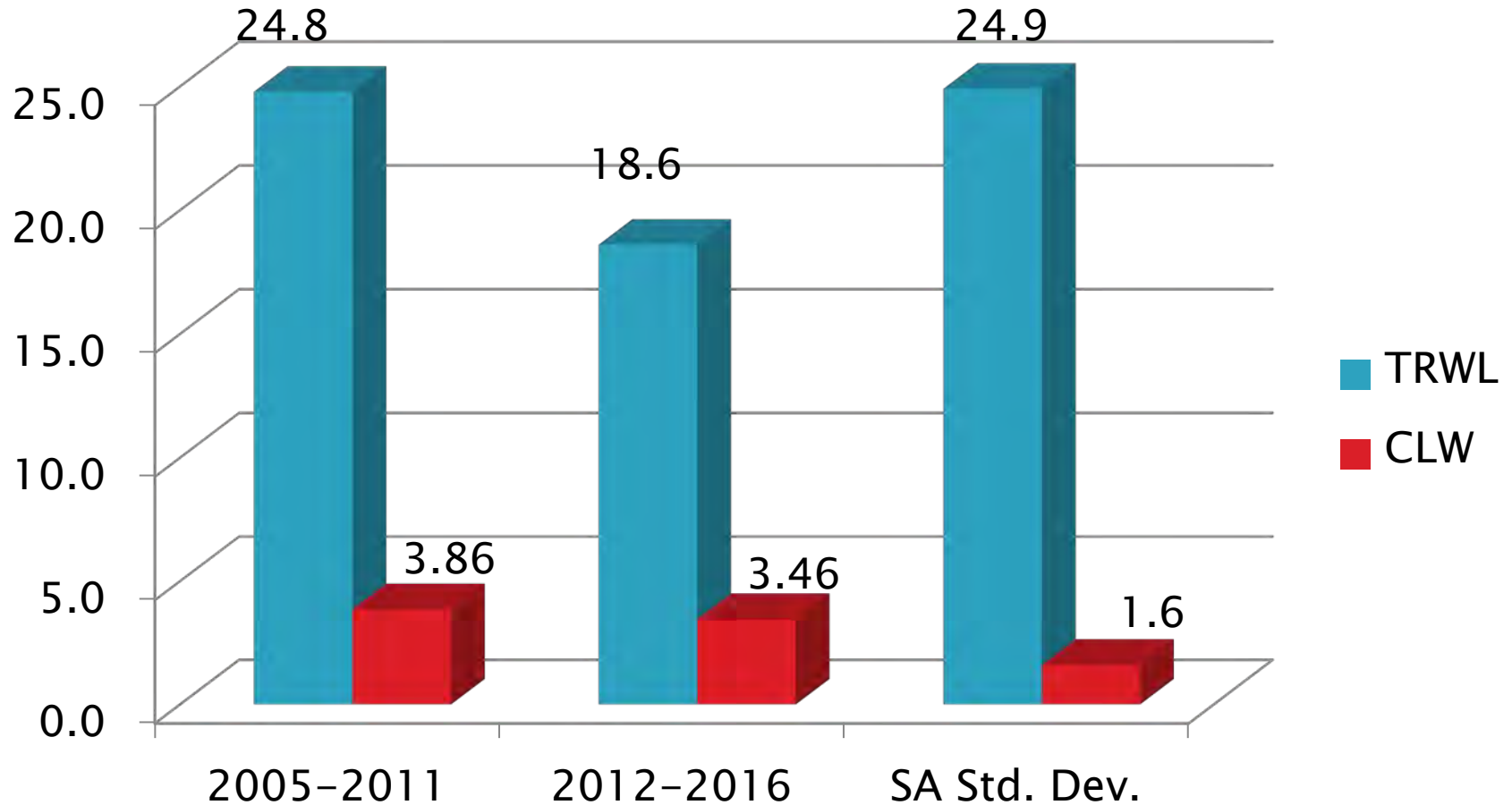


08MAY17:14:12

T-12 Precision Estimates



T-12 Precision Estimates



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Mack T-12A

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T-12A Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	4
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	0
Total		4

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 test	0
Total		0

*Invalid and aborted tests

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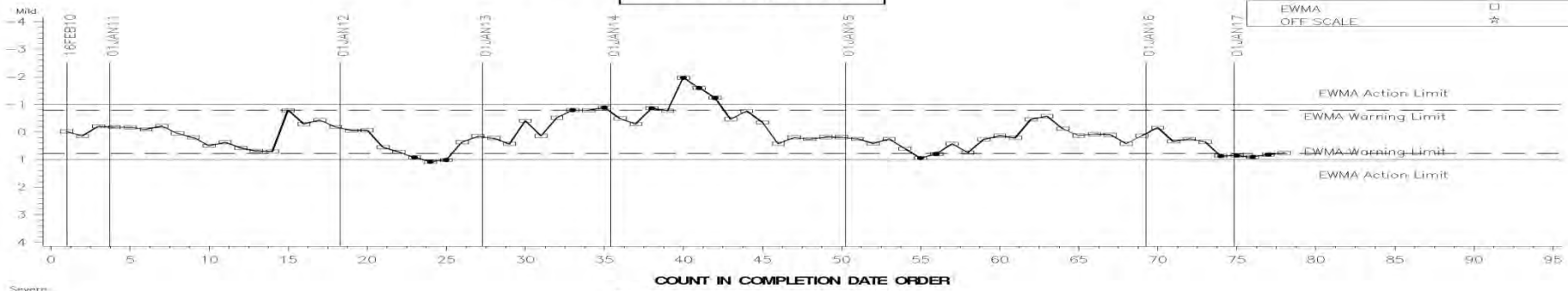
T-12A Test Severity

- ▶ MRV is in control.

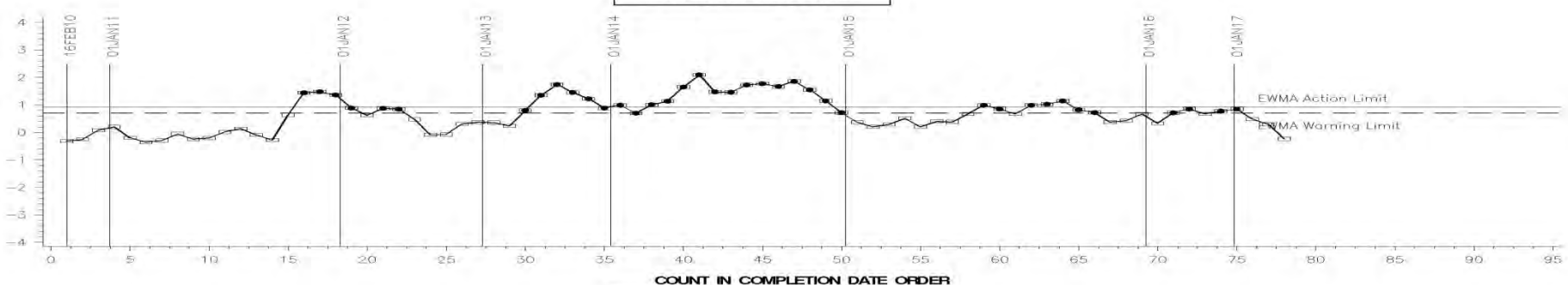
MACK T-12A INDUSTRY OPERATIONAL VALID DATA

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

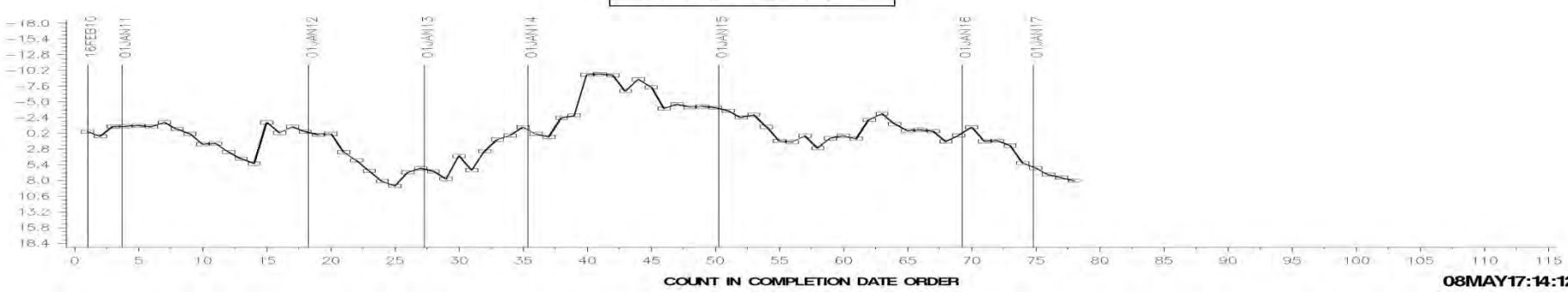
LTMS Severity Analysis



LTMS Precision Analysis



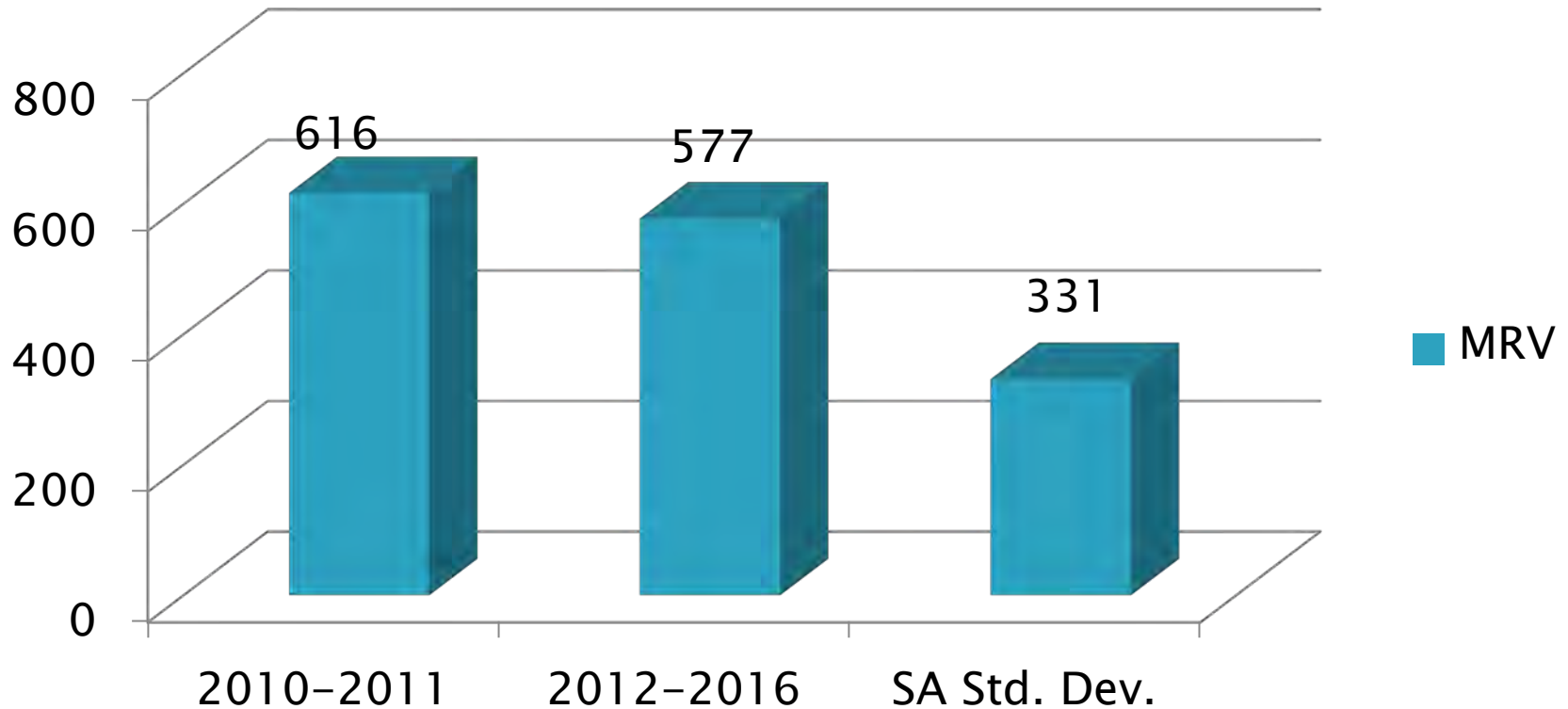
CUSUM Severity Analysis



08MAY17:14:12

T-12A Precision Estimates

MRV



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»» April 2017

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T-13 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-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	No aborted tests	0
Total		0

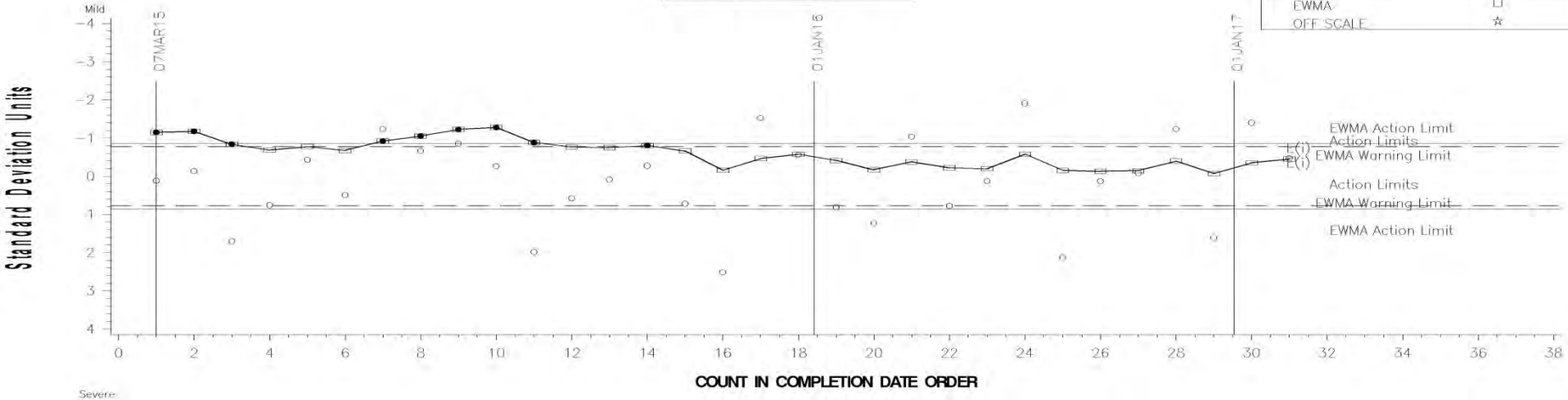
*Invalid and aborted tests

T-13 Test Severity

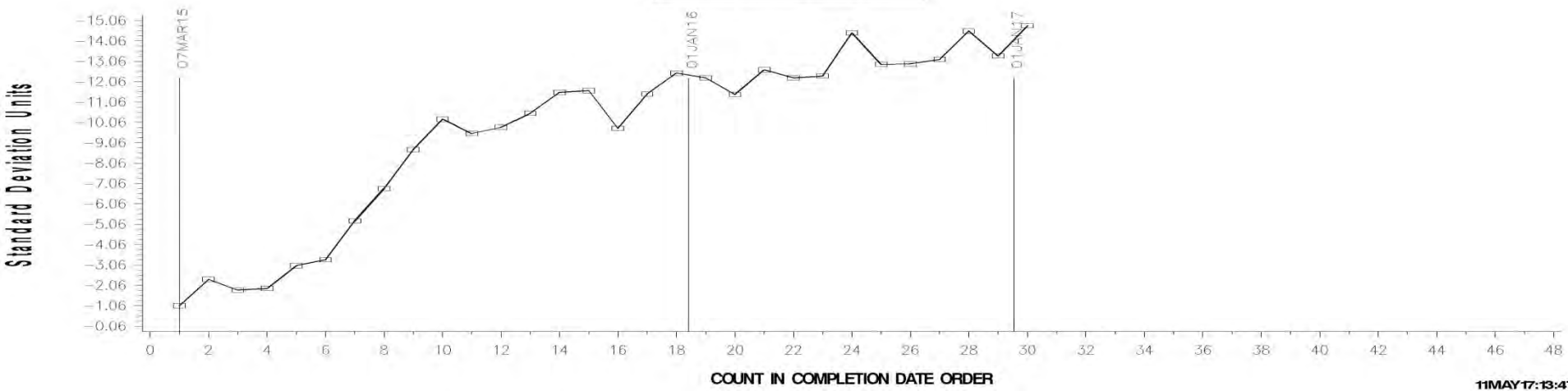
- ▶ IRPH and KV40PC are in control.
 - KV40PC near the severity warning limit in the mild direction.

FINAL ORIGINAL PEAK HEIGHT IR AT EOT

LTMS Severity Analysis



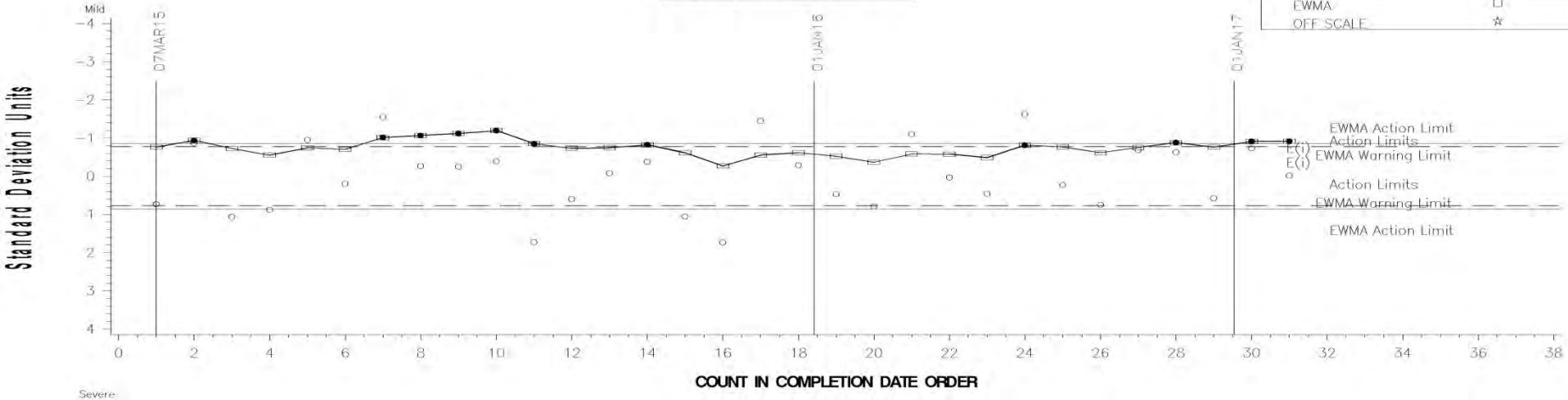
CUSUM Severity Analysis



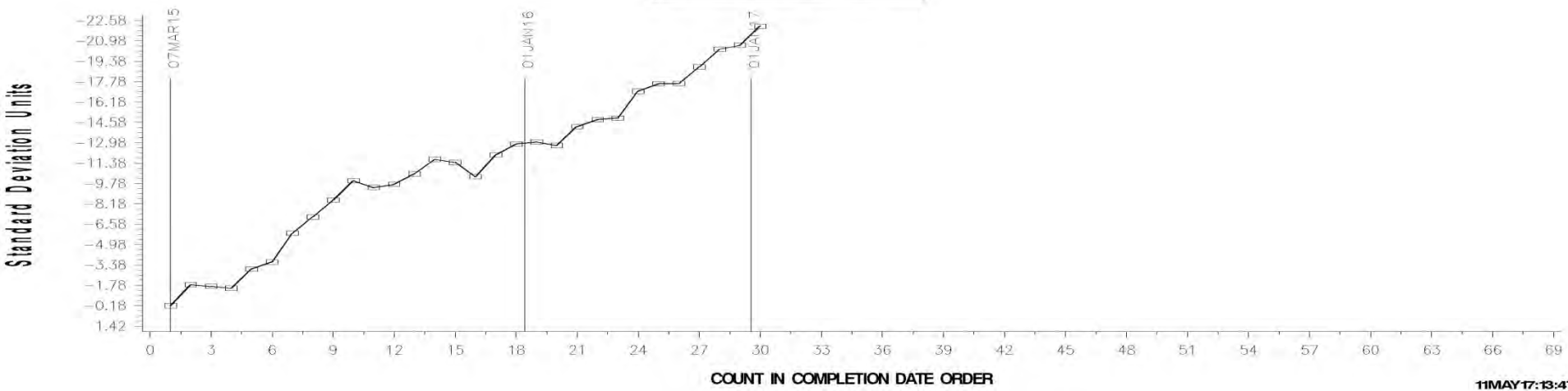
11MAY17:13:47

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

LTMS Severity Analysis

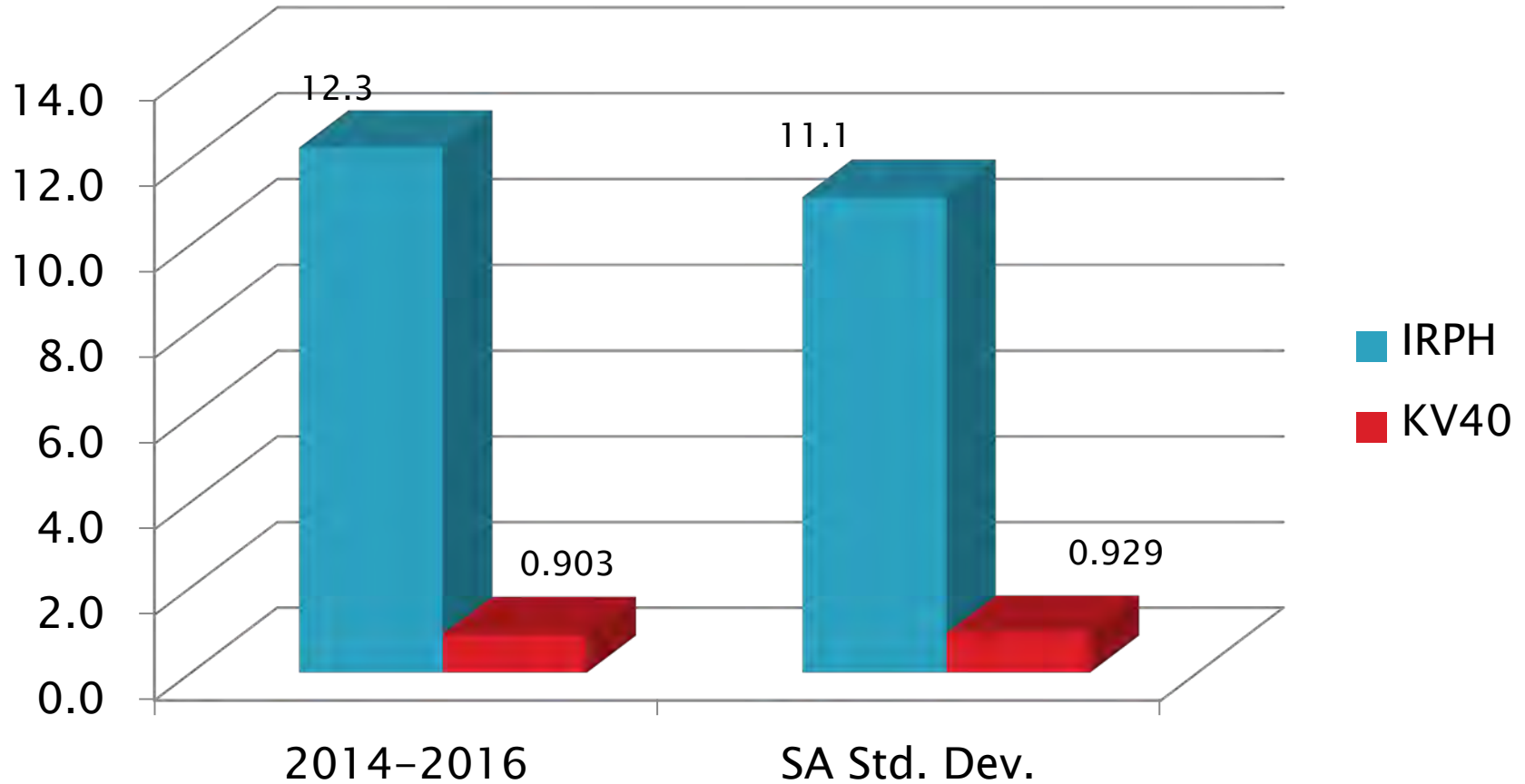


CUSUM Severity Analysis



11MAY17:13:47

T-13 Precision Estimates



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Information Letters

»» October 1, 2016 –
March 31, 2017

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Information Letters*

Test	Date	IL	Topic
T13	10/7/2016	16-4	T-13 Coolant Filter Requirement and Upper Bearing Outlier Screening
ISM	11/7/2016	16-3	New IAS Mass Loss Correction Factor
DD13	12/2/2016	16-1	DD13 Clarification on Hours to Scuff
T12	3/7/2017	17-1	VXYPD Hardware Correction Factors Update

*Available from TMC Website

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Reference Oil Inventory

»» Actions, Re-blends, Inventories
and Estimated Life

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Reference Oil Reblends

- ▶ Reblend of 830–2 complete.
 - 830–3 to be introduced with coordinated reference tests.
- ▶ Reblend of 831–3 complete.
 - 831–4 to be introduced with coordinated reference tests.

Reference Oil Inventory Estimated Life

Oil	Tests	Original Blend Amount	Quantity Shipped in last 6 months	TMC Inventory	Lab Inventory	Estimated Life
809-1	1K, 1N	9134	65	2120	126	5+ years
811-2	1K, 1N	1732	40	958	40	5+ years
821-4	T-12	4495	275	2803	275	5+ years
822-2	1R, T-11	4386	112	3179	196	5+ years
823	T-13	1796	100	1089	196	3 years
830-2	ISM	3786	0	140	225	1.5 years
830-3	ISM	2891	0	2891	0	5+ years
831-3	C13, ISB	972	200	106	280	1 year
831-4	C13, ISB	1699	0	1699	0	5+ years

Reference Oil Inventory Estimated Life

Oil	Tests	Original Blend Amount	Quantity Shipped in last 6 months	TMC Inventory	Lab Inventory	Estimated Life
832	COAT	1166	168	515	140	1.5 years
833	COAT	1152	140	383	168	1 year
864	DD13	121	0	21	0	0.1 years
864-1	DD13	1576	200	1324	175	5+ years
866	DD13	341	25	266	25	3 years
873-2	1M-PC	1650	10	57	40	2.5 years
1005-4	1P, 1R, EOAT, RFWT, T-8/E	2000	0	74	30	< 0.5 years
1005-5	1P, 1R, EOAT, RFWT, T-8/E	3826	158	2908	204	3 years

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LTMS Deviations

»» October 1, 2016 – March 31, 2017

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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

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Quality Index Deviations

»» October 1, 2016 –
March 31, 2017

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Quality Index Deviations

- ▶ No Quality Index Deviations during this reporting period.

Quality Index Deviations

Historical Count of HD Quality Index Deviations

Test	Qi Deviations
1P	14
1R	1
ISM	3
C13	2
T-10A	1
T-11	3
T-12	6
T-13	1
COAT	3

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TMC Laboratory Visits

»» October 1, 2016 –
March 31, 2017

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TMC Lab Visits

- ▶ No Heavy-Duty lab visits were conducted during this period

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Test Area Timelines

»» October 1, 2016 –
March 31, 2017

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Test Area Timeline Additions*

Test	Date	IL/Memo	Topic
T13	10/7/2016	16-4	T-13 Coolant Filter Requirement and Upper Bearing Outlier Screening
ISM	11/7/2016	16-3	New IAS Mass Loss Correction Factor
T12	3/7/2017	17-1	VXYPD Hardware Correction Factors Update

*As of 3/31/2017

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Rating Workshop Data

»» 2016 Heavy Duty Workshop

Test Monitoring Center

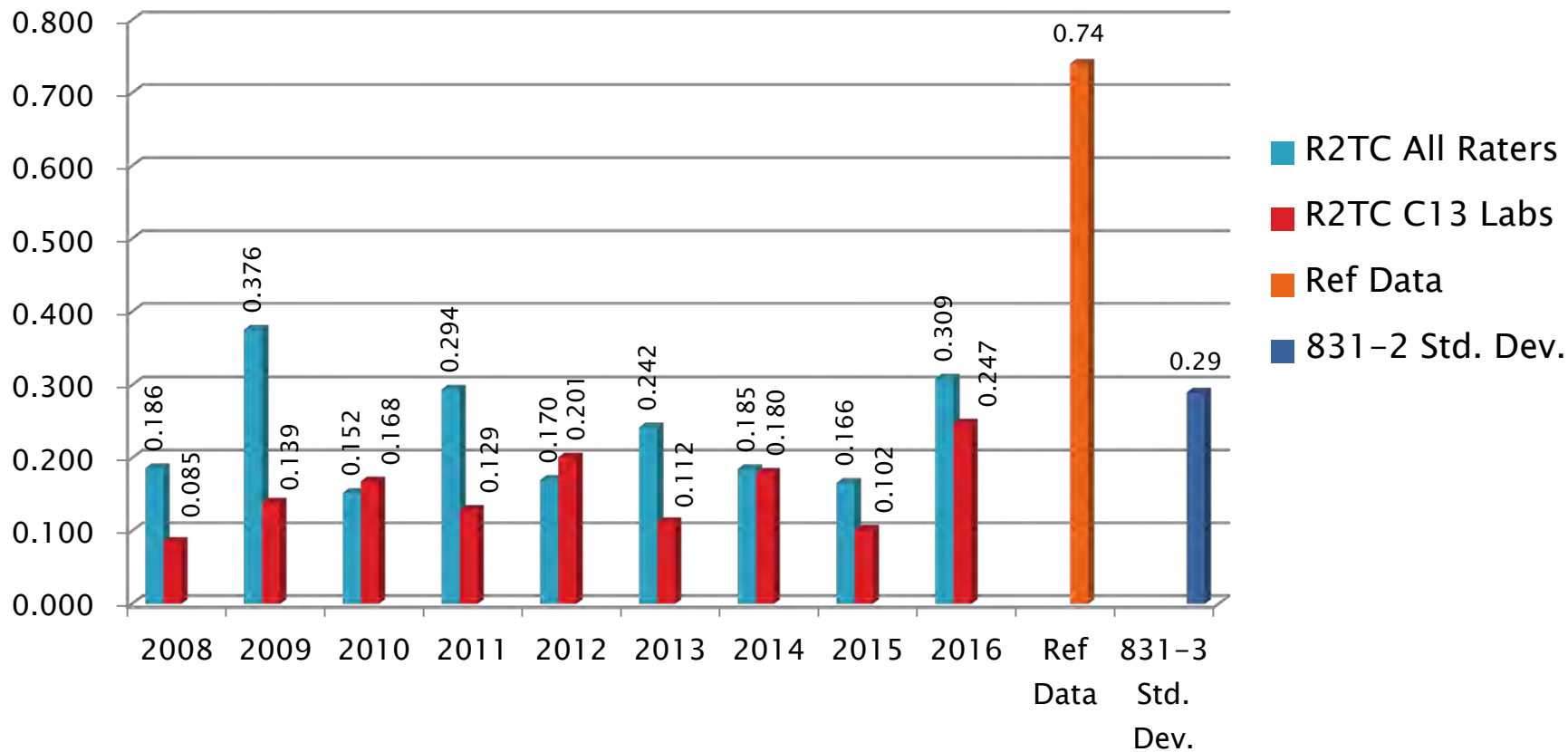
<http://astmtmc.cmu.edu>



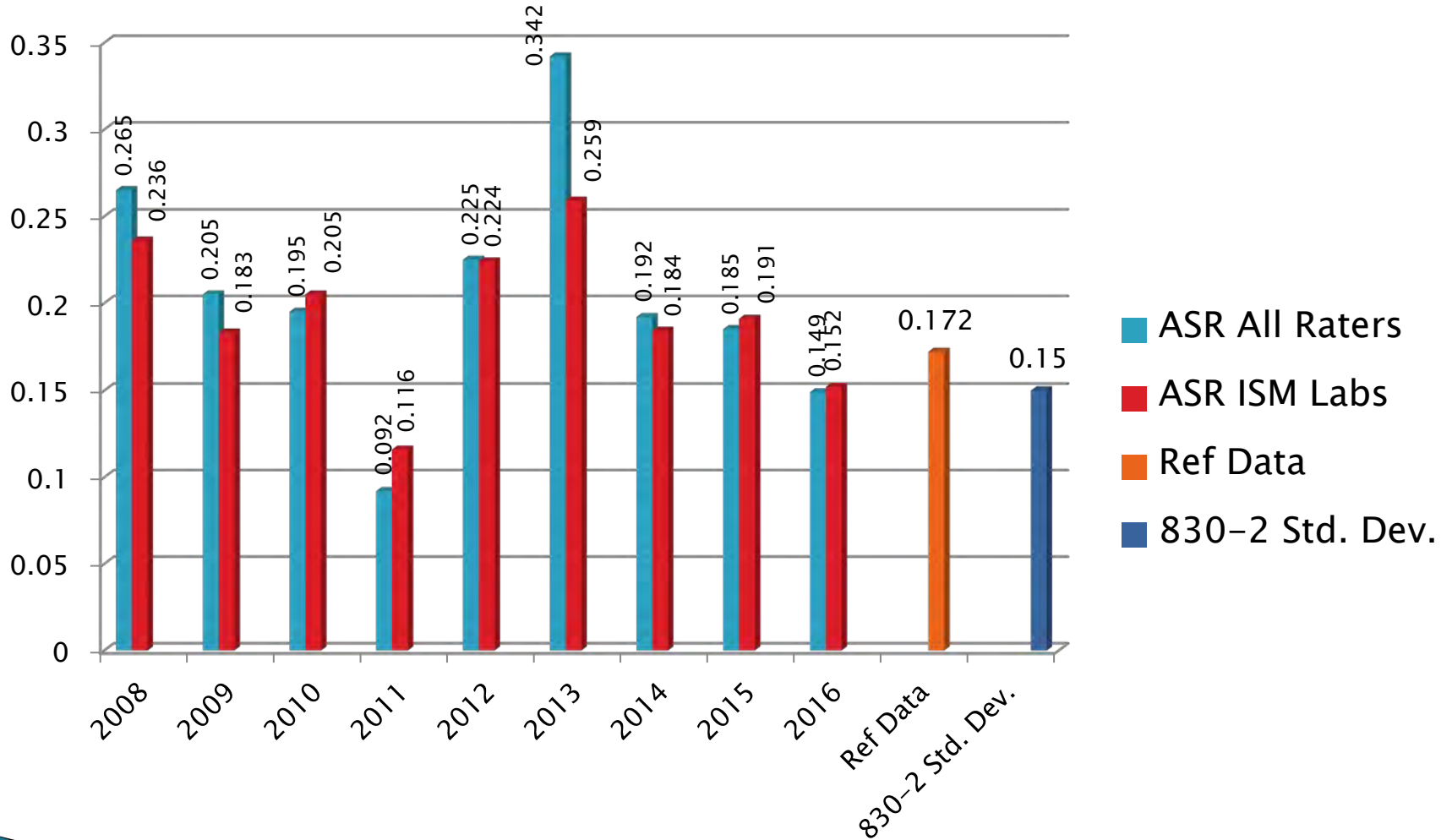
A Program of ASTM International

C13 2nd Ring Carbon Precision – Rating Workshop Data

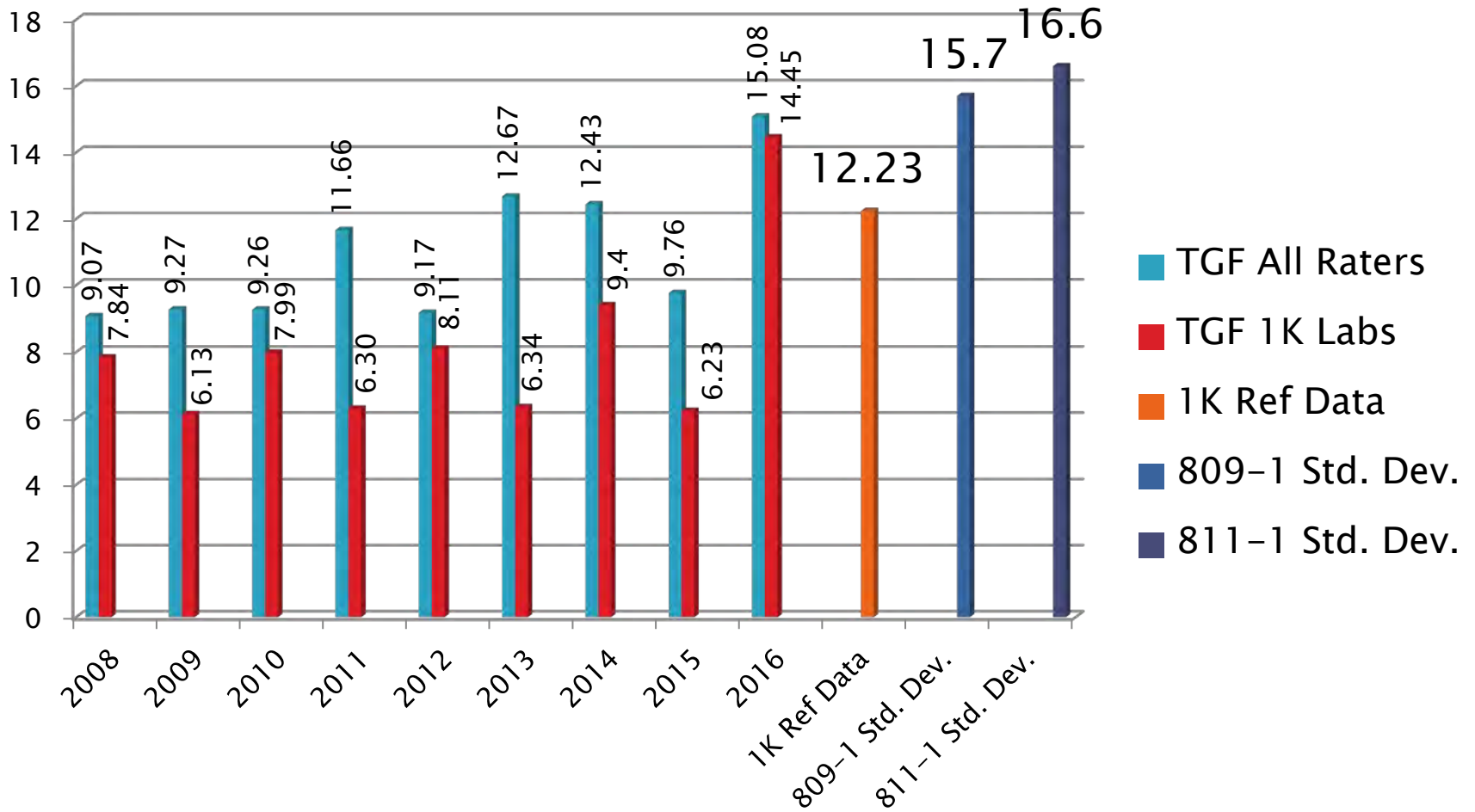
R2TC



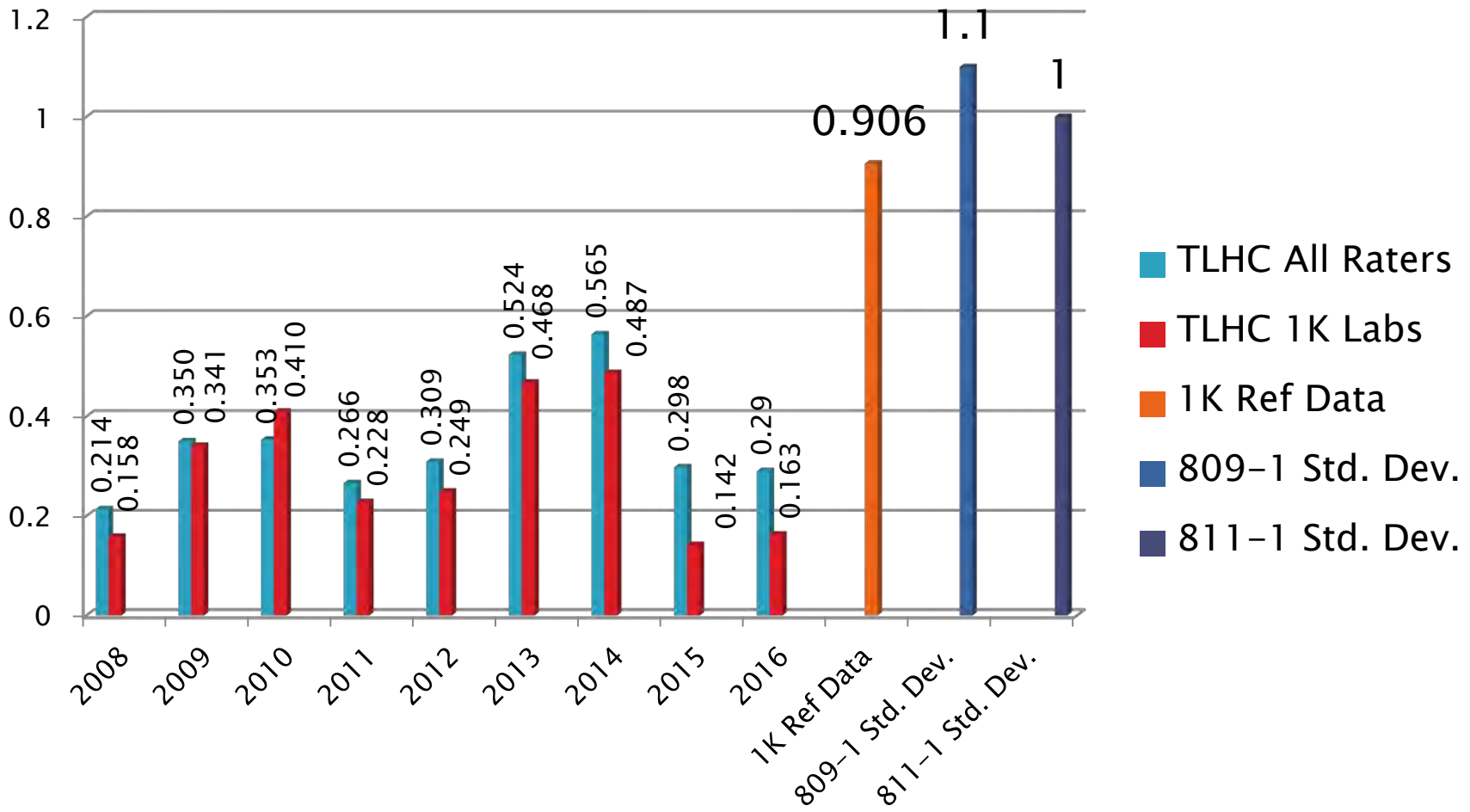
ISM Sludge Rating Precision - Rating Workshop Data



Deposit Rating Precision - Rating Workshop Data



Deposit Rating Precision - Rating Workshop Data



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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

- ▶ www.astmtmc.cmu.edu

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