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Test Monitoring Center

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

Spring 2020

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Heavy Duty Testing

Executive Summary

- ▶ Reference Oils
 - Re-blend of ISM reference oil (830-3) introduced.
- ▶ Test Issues
 - ISM introduction of new crosshead batch completed.

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Calibrated Labs and Stands*

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

*As of 03/31/2020

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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*

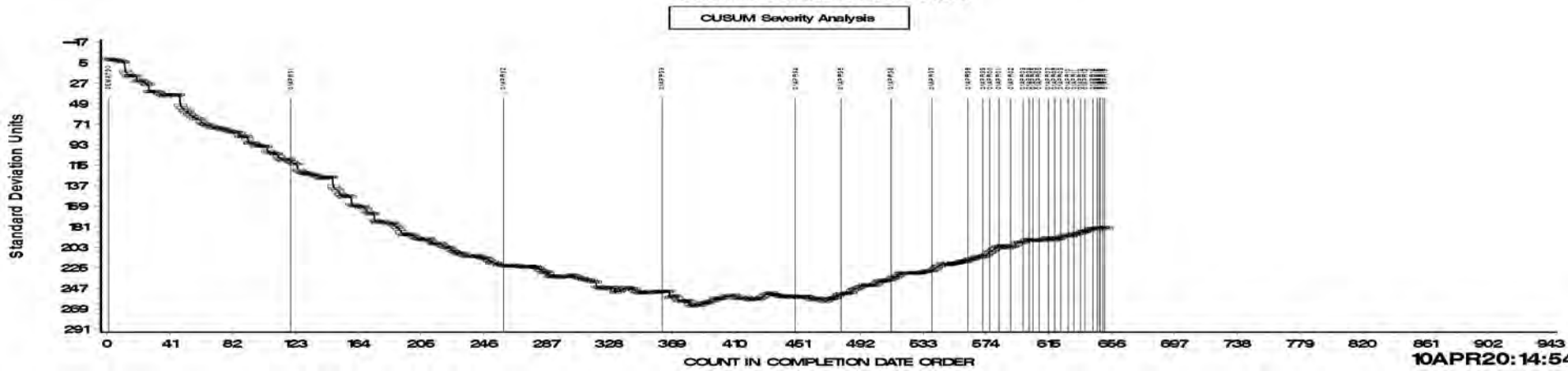
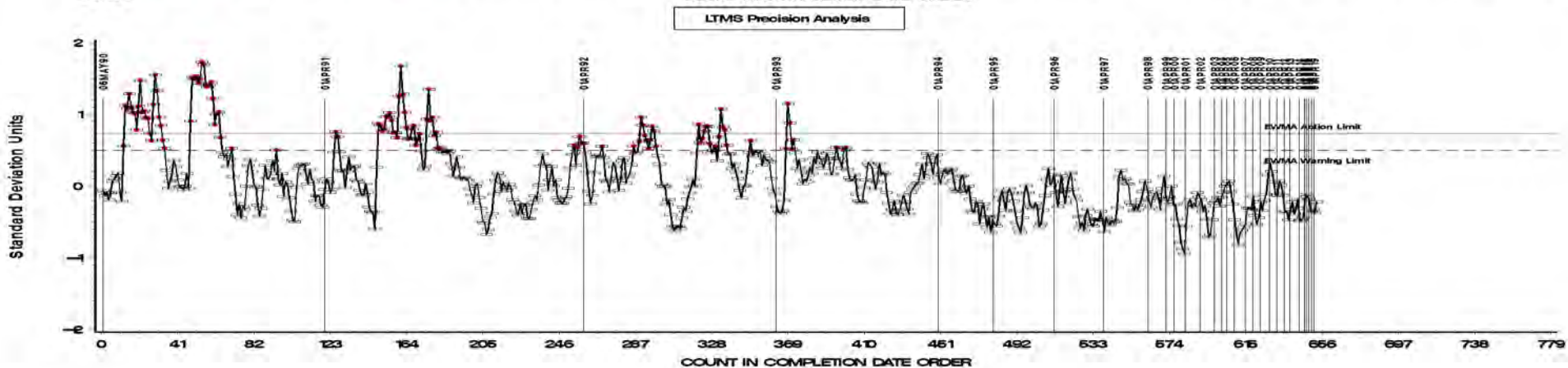
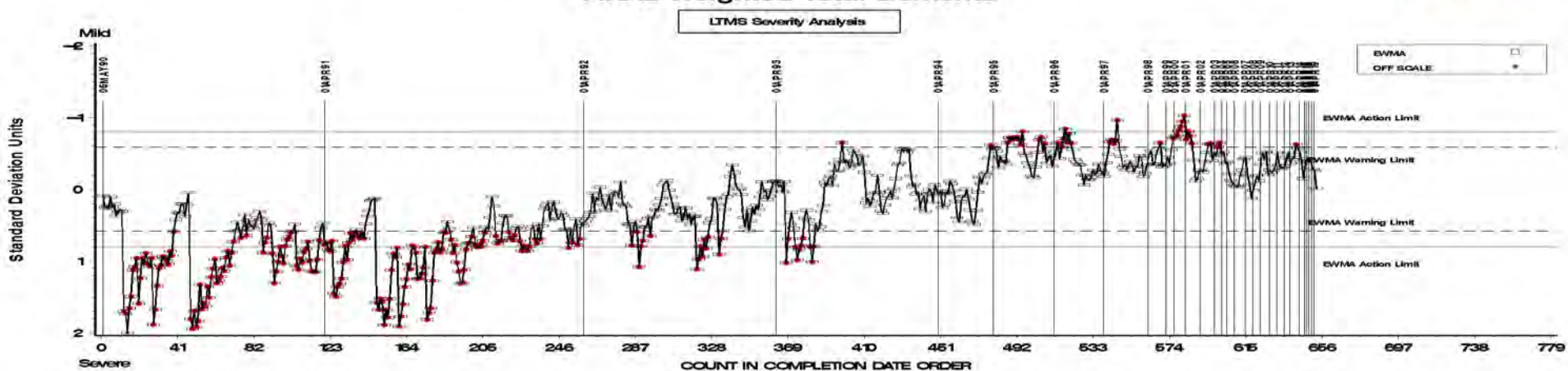
Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		0

*Invalid and aborted tests

1 K Test Severity

- ▶ TGF is in warning alarm in the mild direction
- ▶ BSOC is in action alarm in the mild direction
- ▶ WDK, TLHC and EOTOC are in control

FINAL Weighted Total Demerits

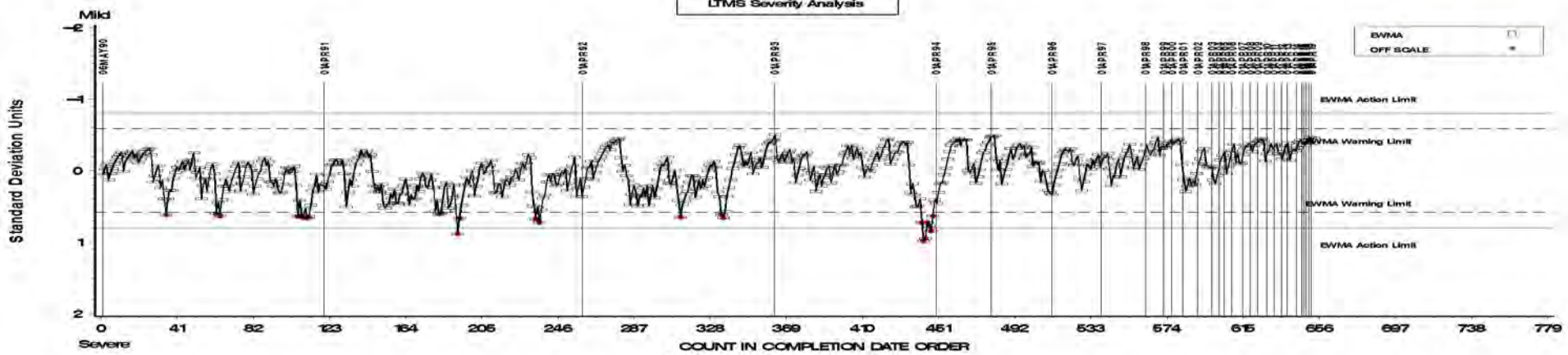


CATERPILLAR 1K INDUSTRY OPERATIONALLY VALID DATA

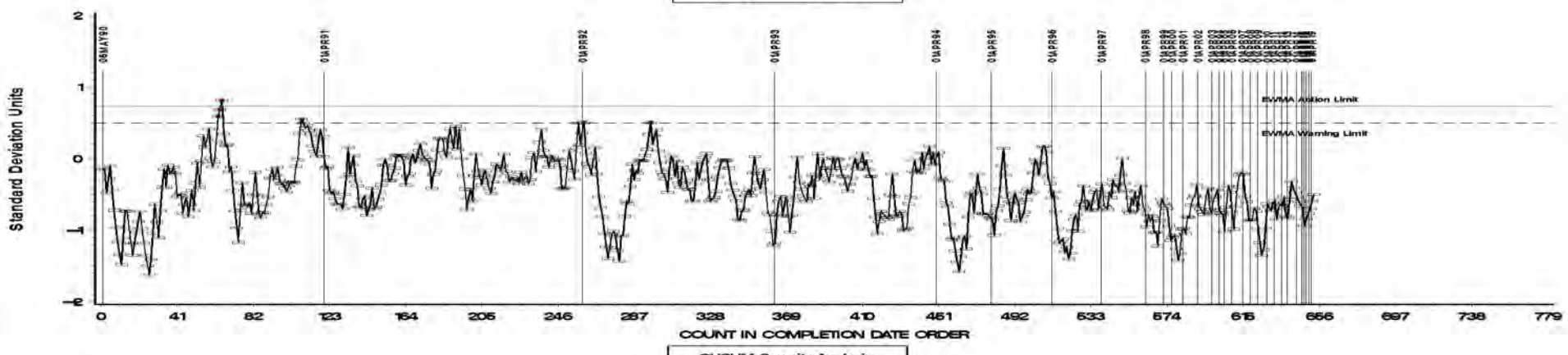


FINAL TLHC

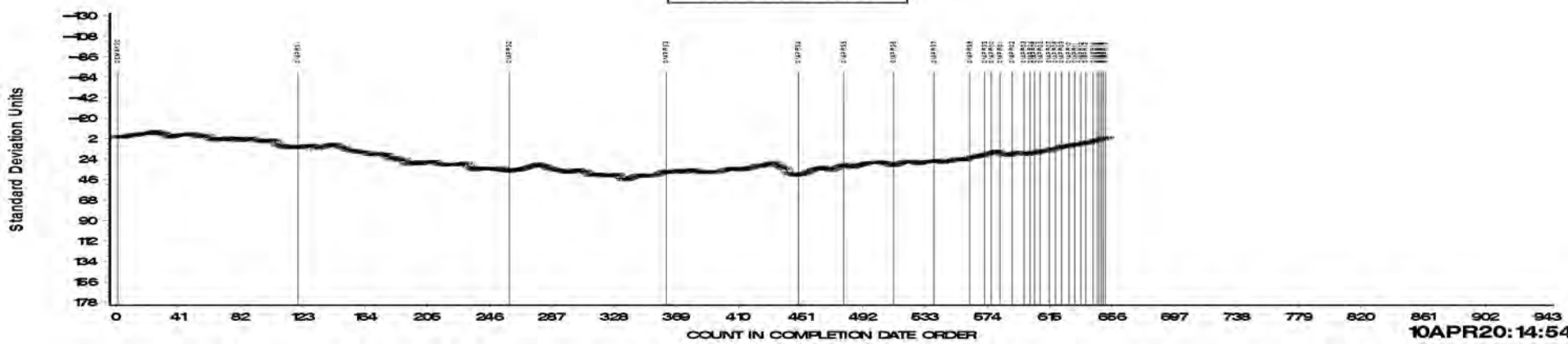
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

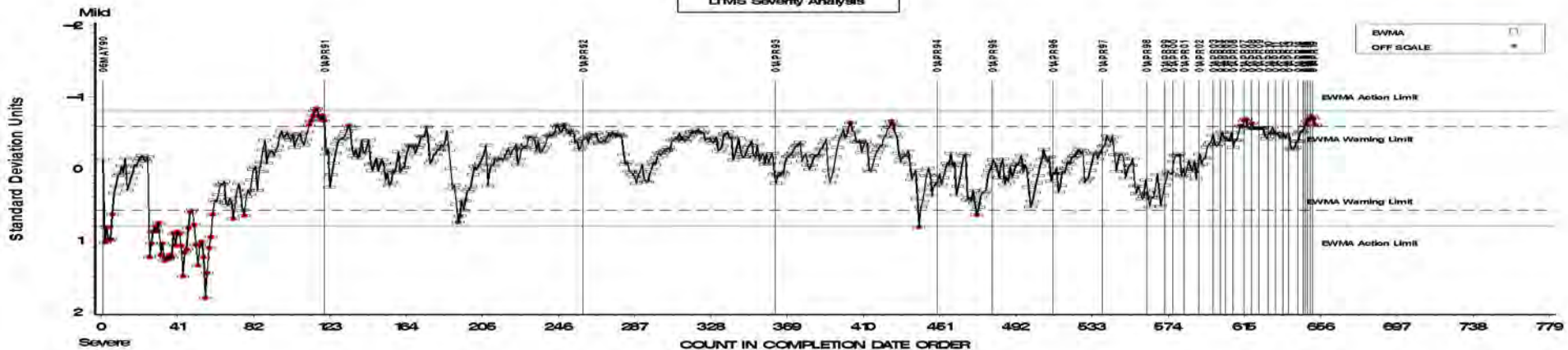


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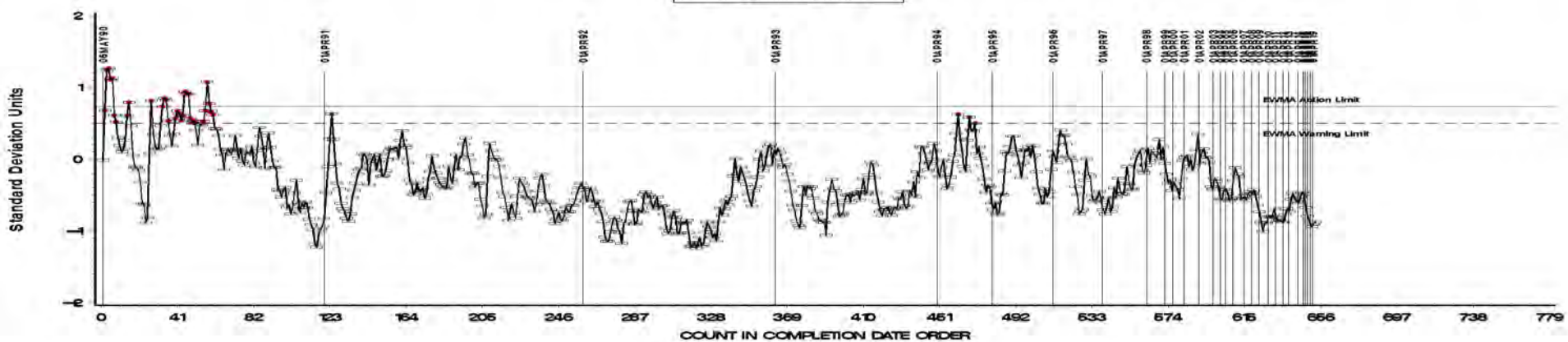


FINAL TGF

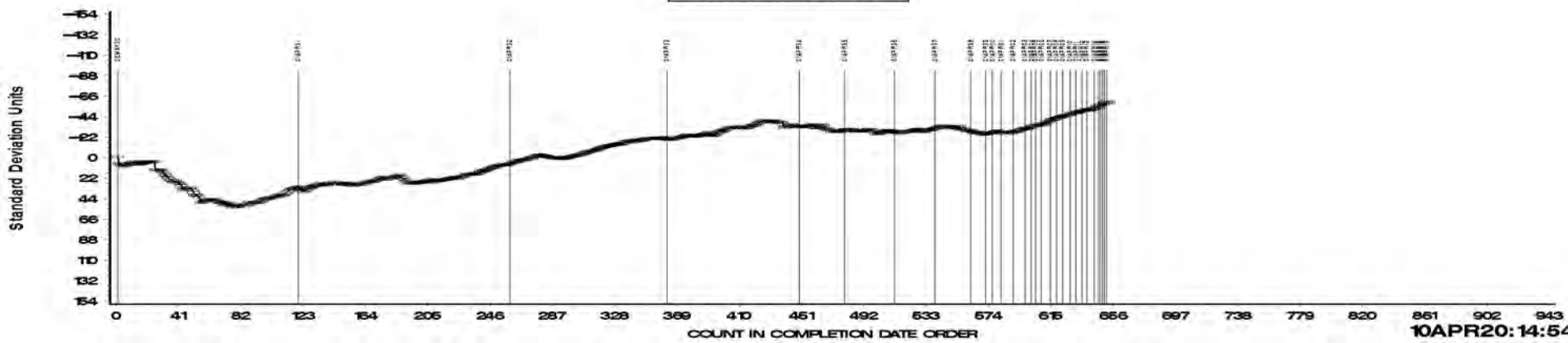
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis



CATERPILLAR 1K INDUSTRY OPERATIONALLY VALID DATA

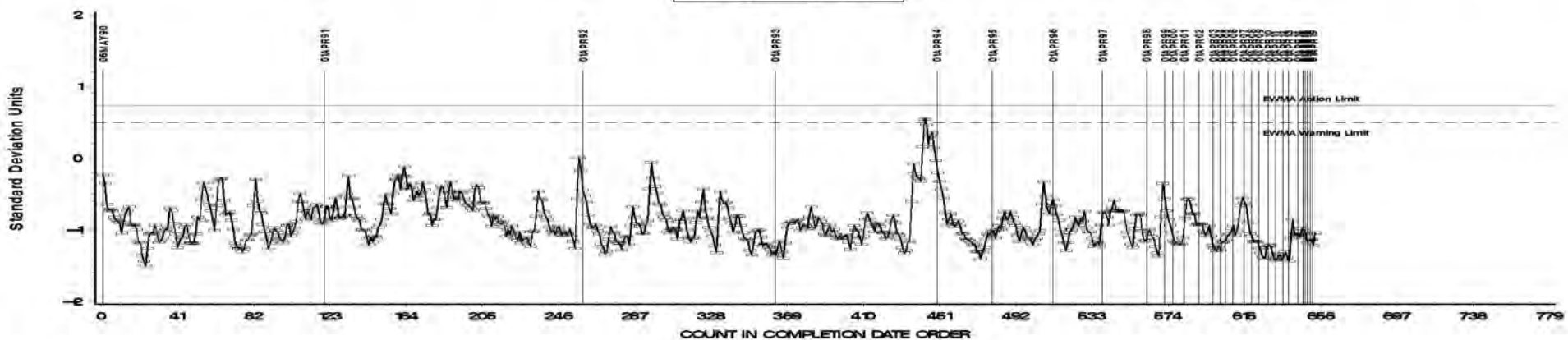


FINAL EOTOC

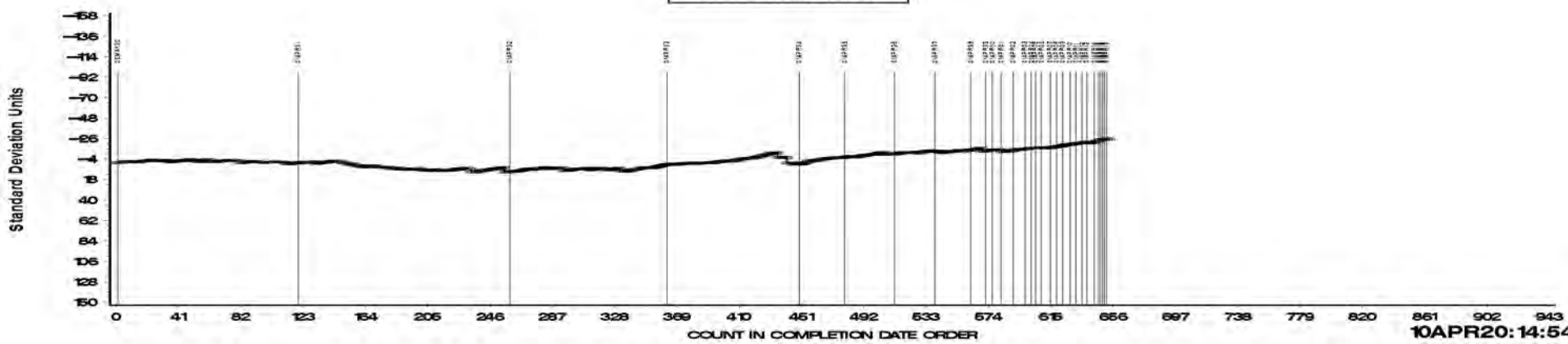
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

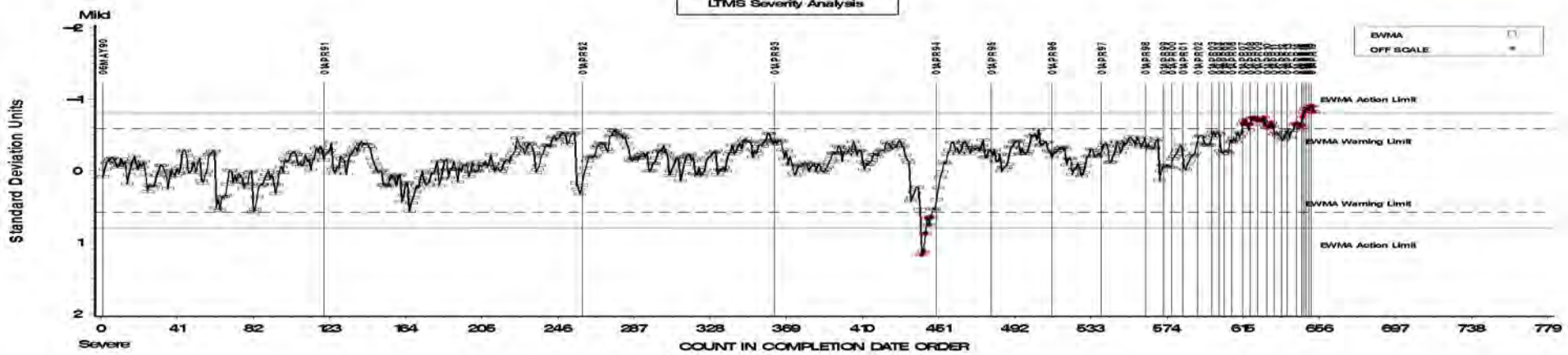


CATERPILLAR 1K INDUSTRY OPERATIONALLY VALID DATA

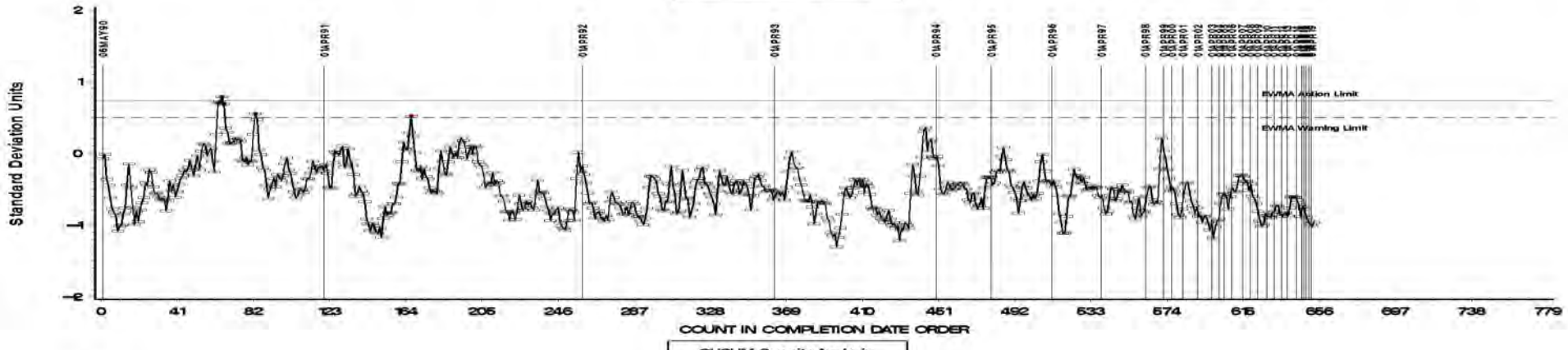


FINAL BSOC

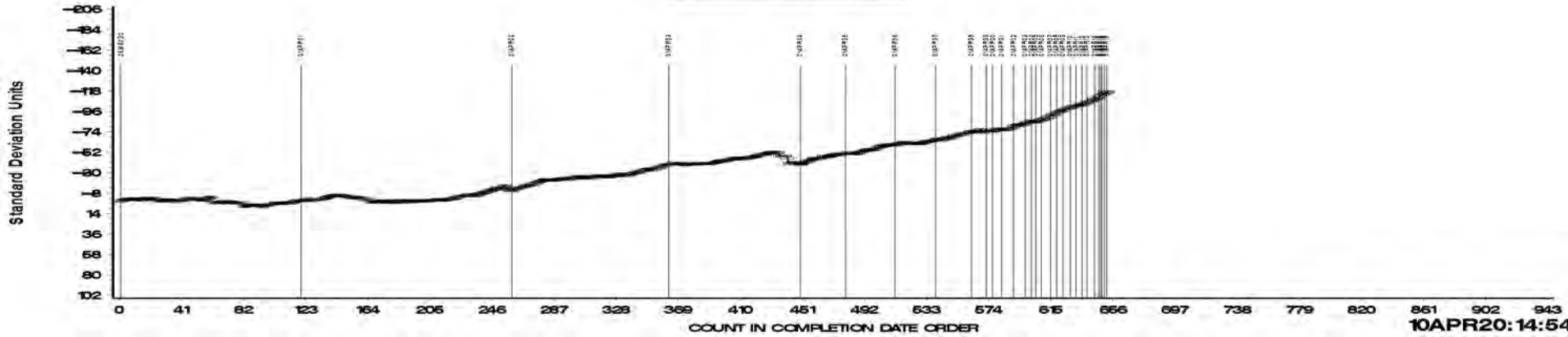
LTMS Severity Analysis



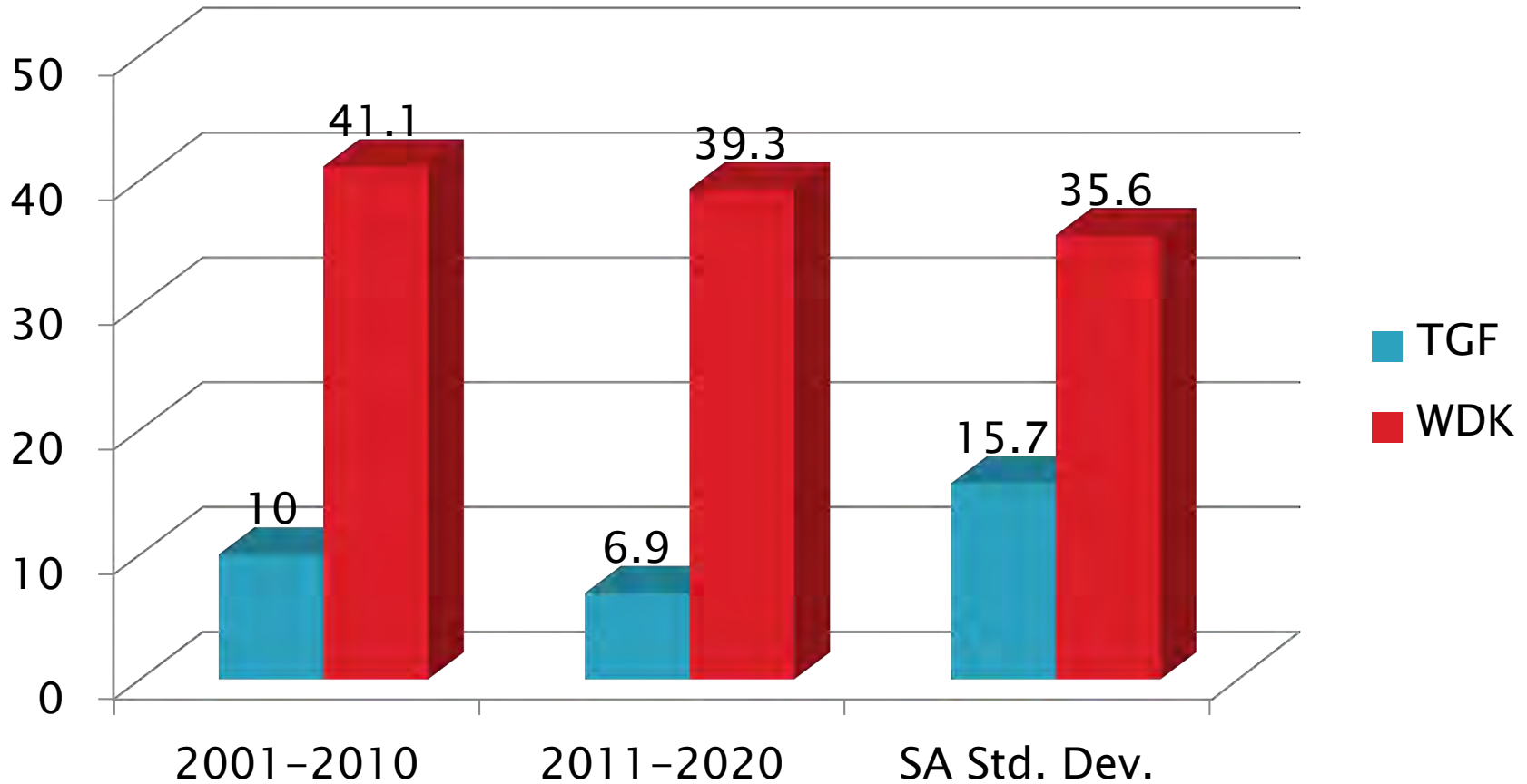
LTMS Precision Analysis



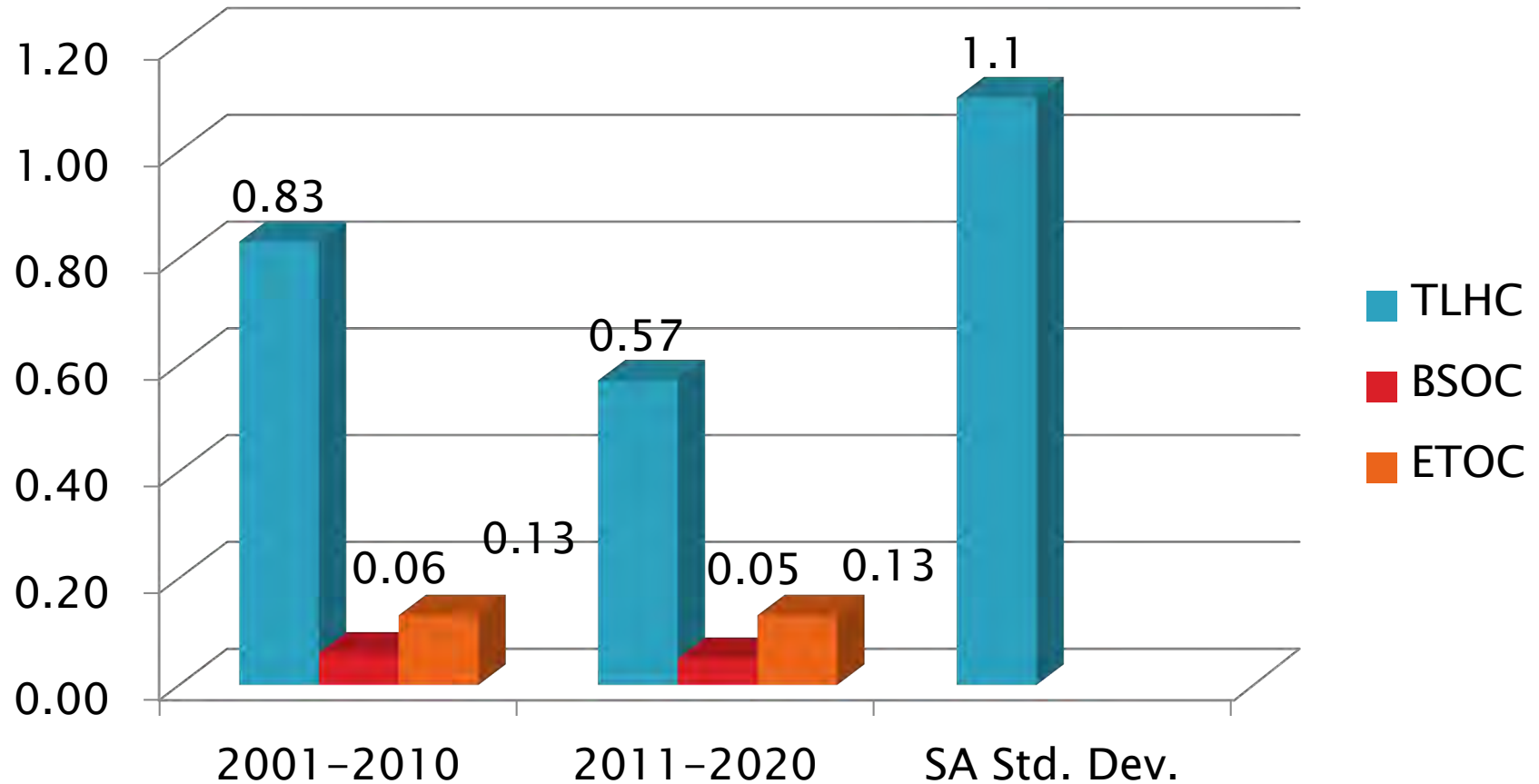
CUSUM Severity Analysis



1 K Precision Estimates



1 K Precision Estimates



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1 N Test Activity

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

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	Test aborted due to cracked piston	1
Total		1

*Invalid and aborted tests

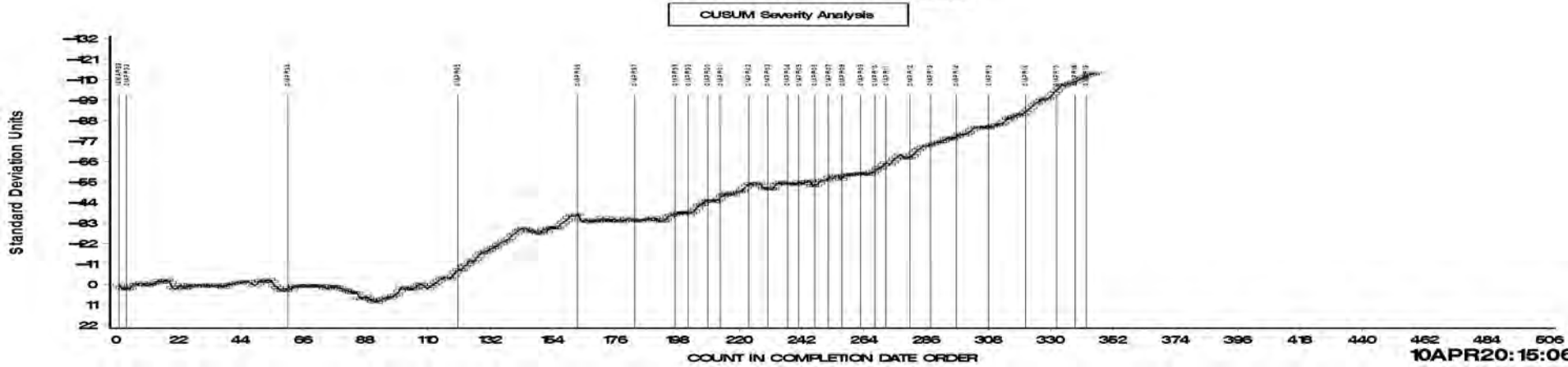
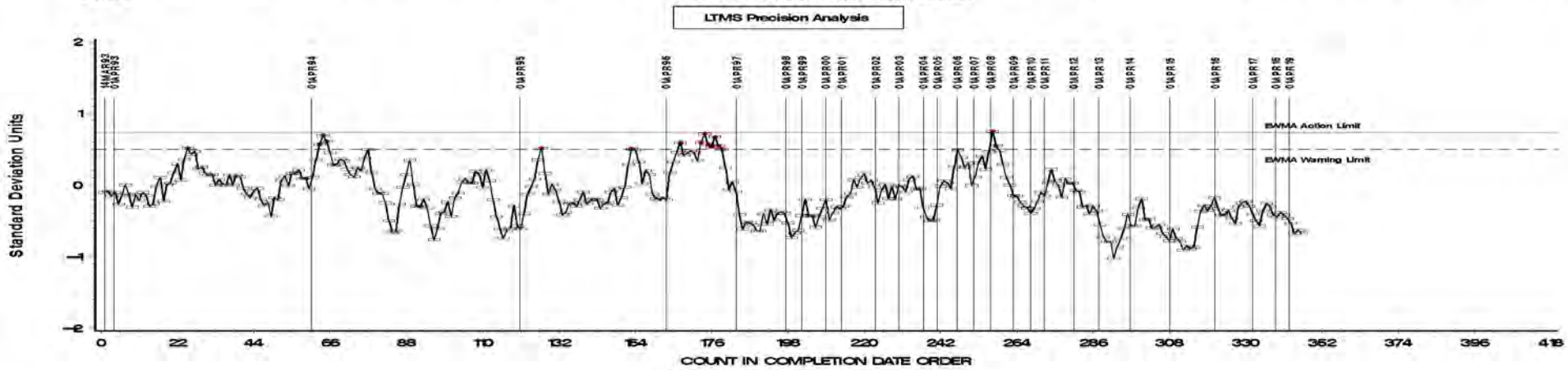
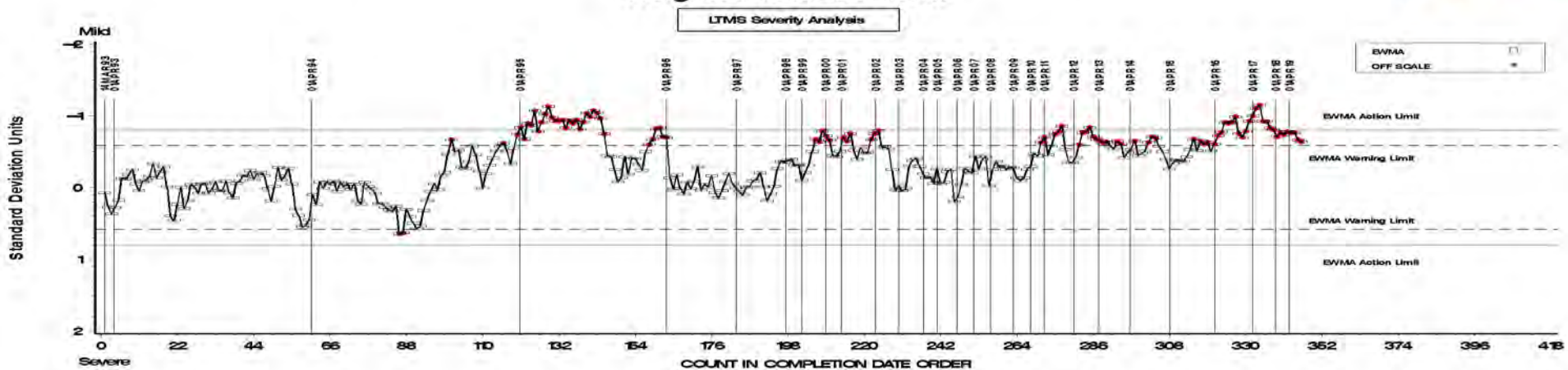
1 N Test Severity

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

CATERPILLAR IN INDUSTRY OPERATIONALLY VALID DATA



Weighted Total Demerits

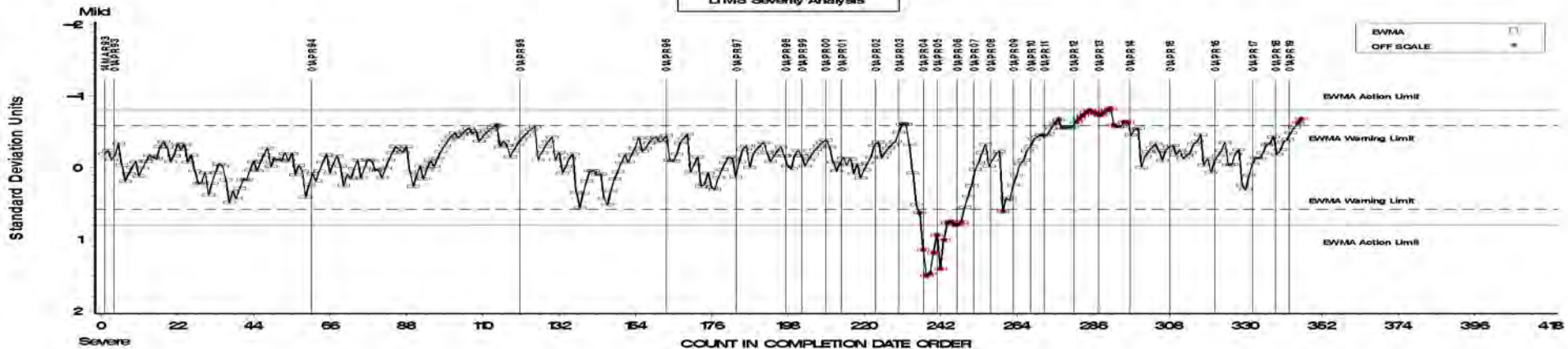


CATERPILLAR IN INDUSTRY OPERATIONALLY VALID DATA

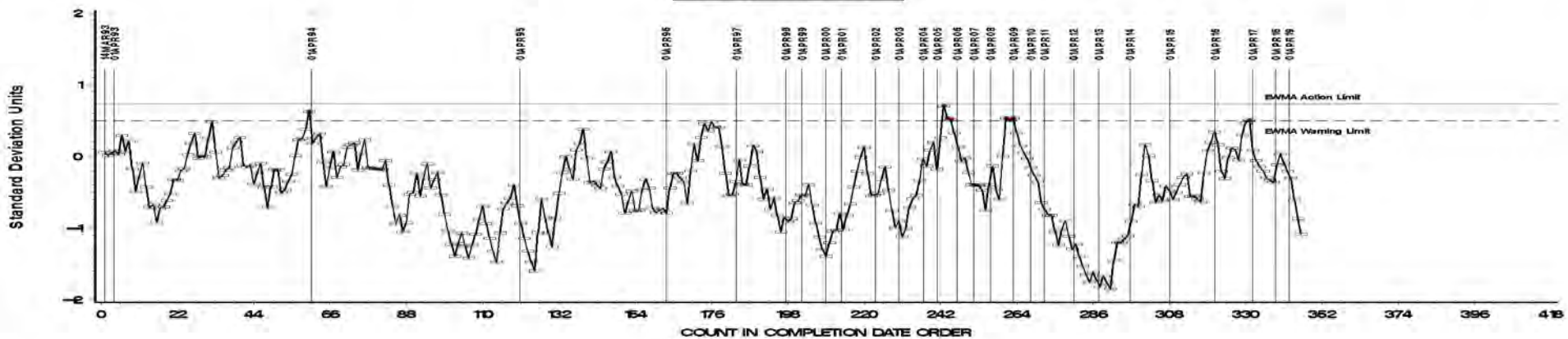


Top Land Heavy Carbon

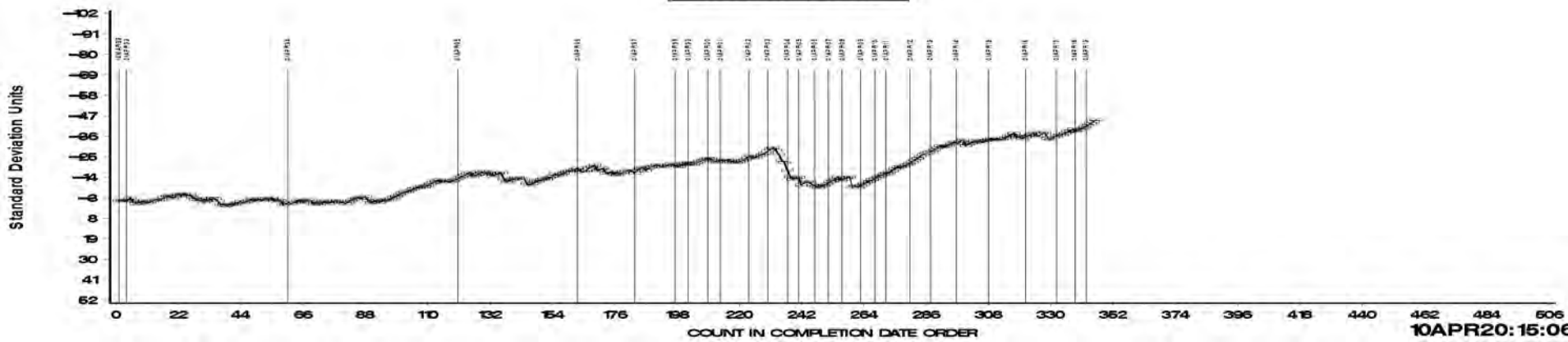
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

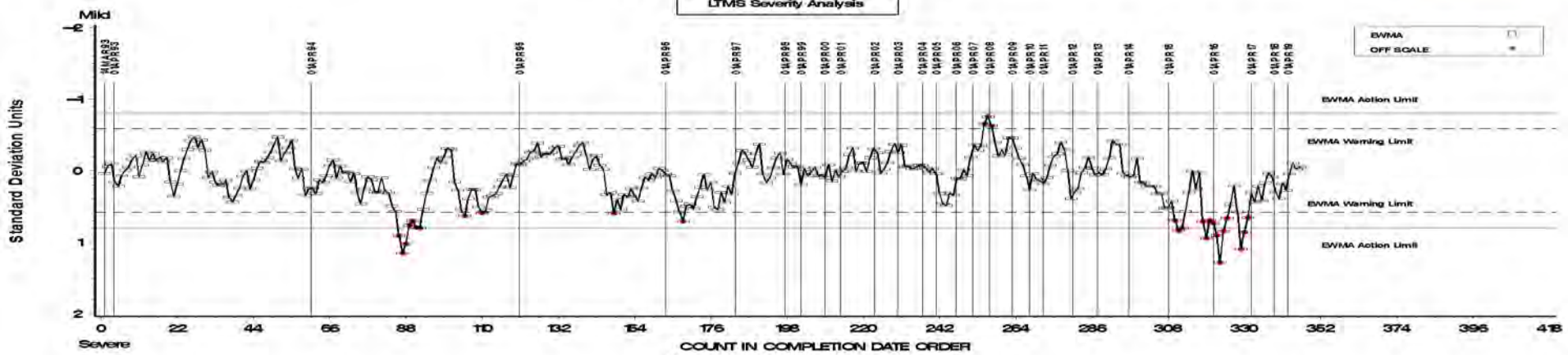


CATERPILLAR IN INDUSTRY OPERATIONALLY VALID DATA

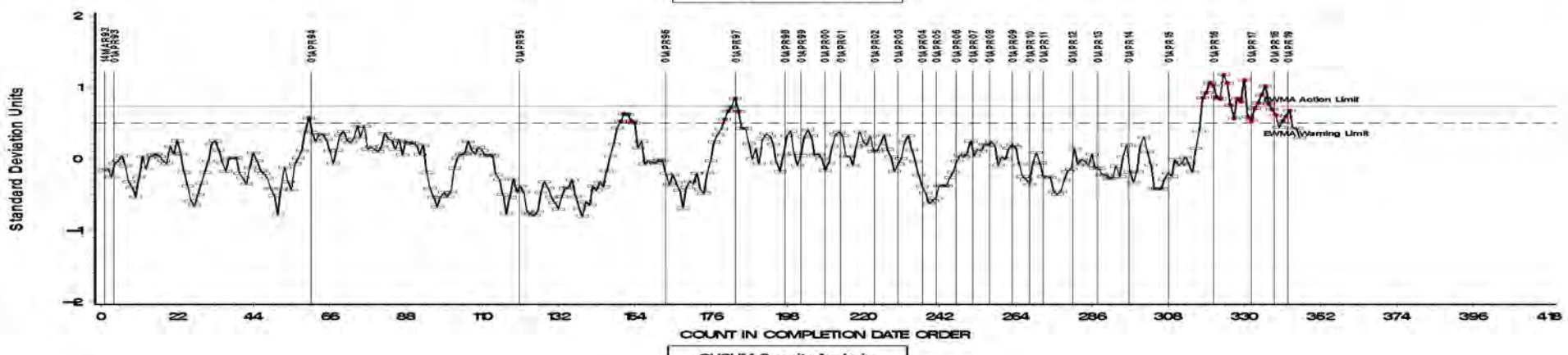


FINAL CORRECTED TGF

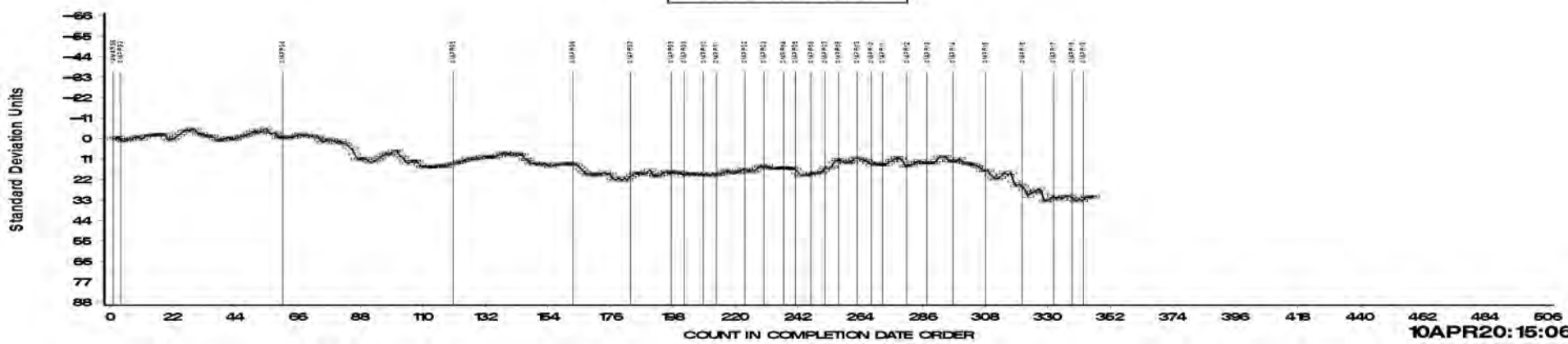
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

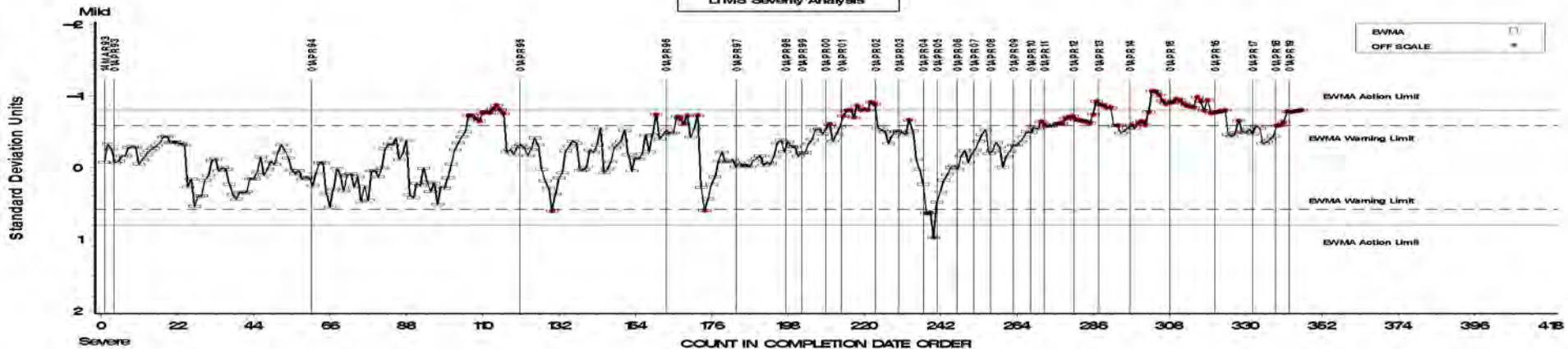


CATERPILLAR IN INDUSTRY OPERATIONALLY VALID DATA

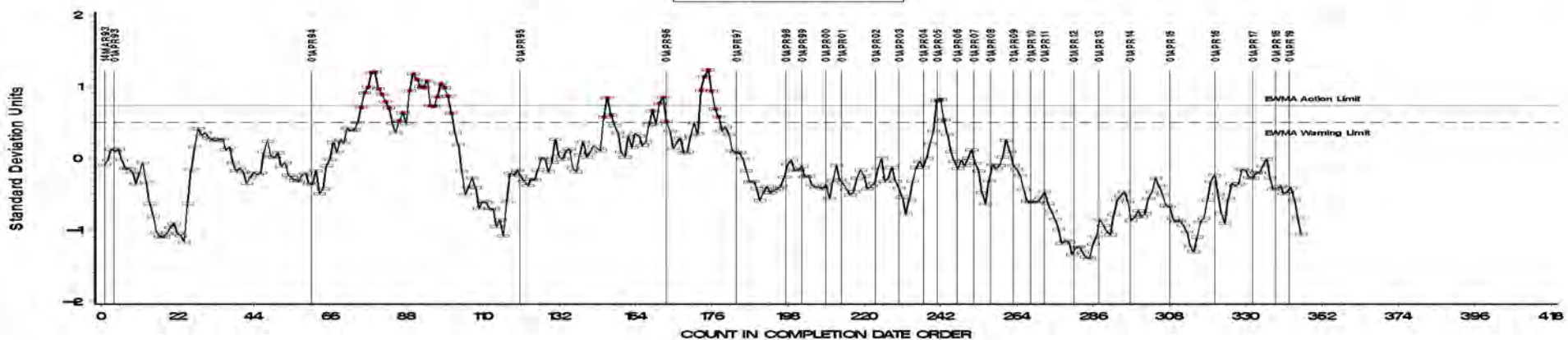


BSOC

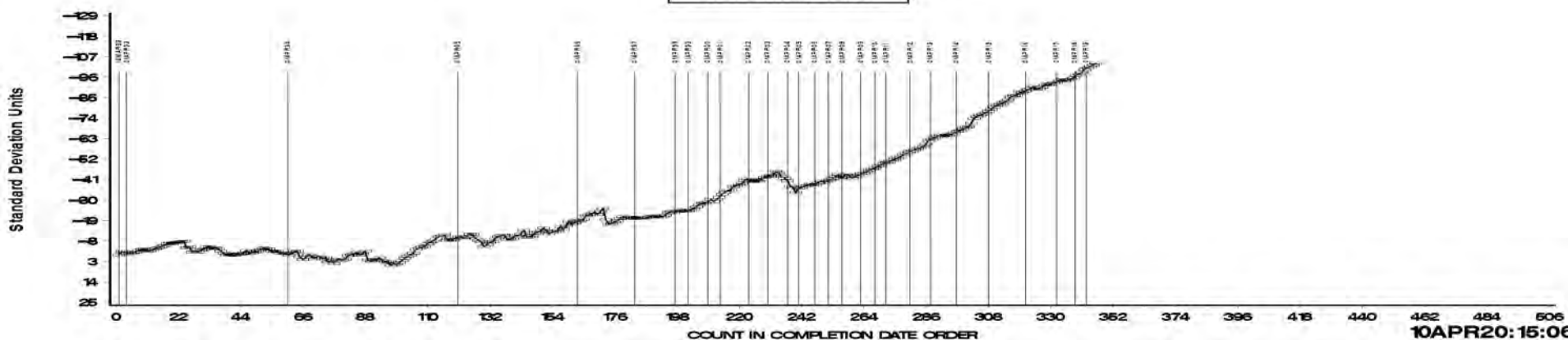
LTMS Severity Analysis



LTMS Precision Analysis

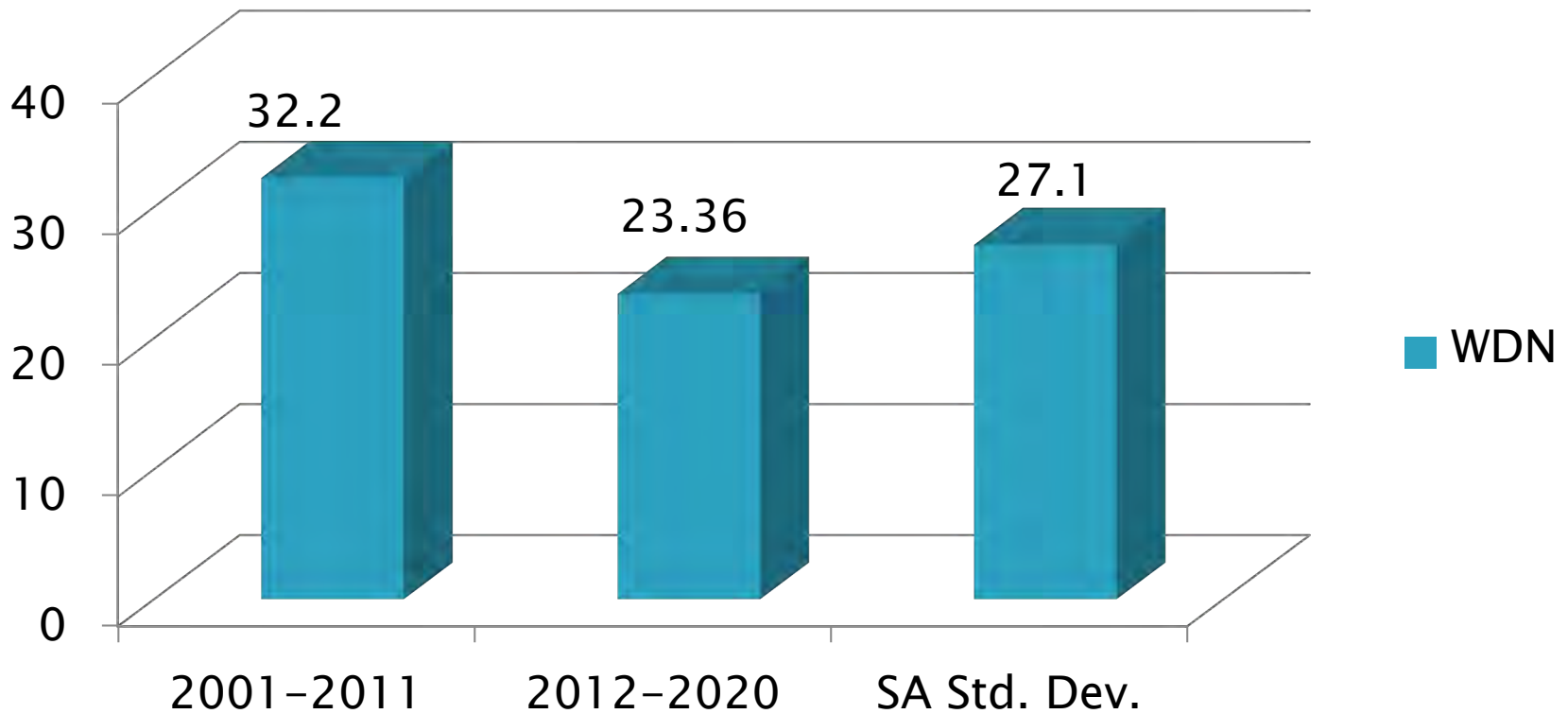


CUSUM Severity Analysis

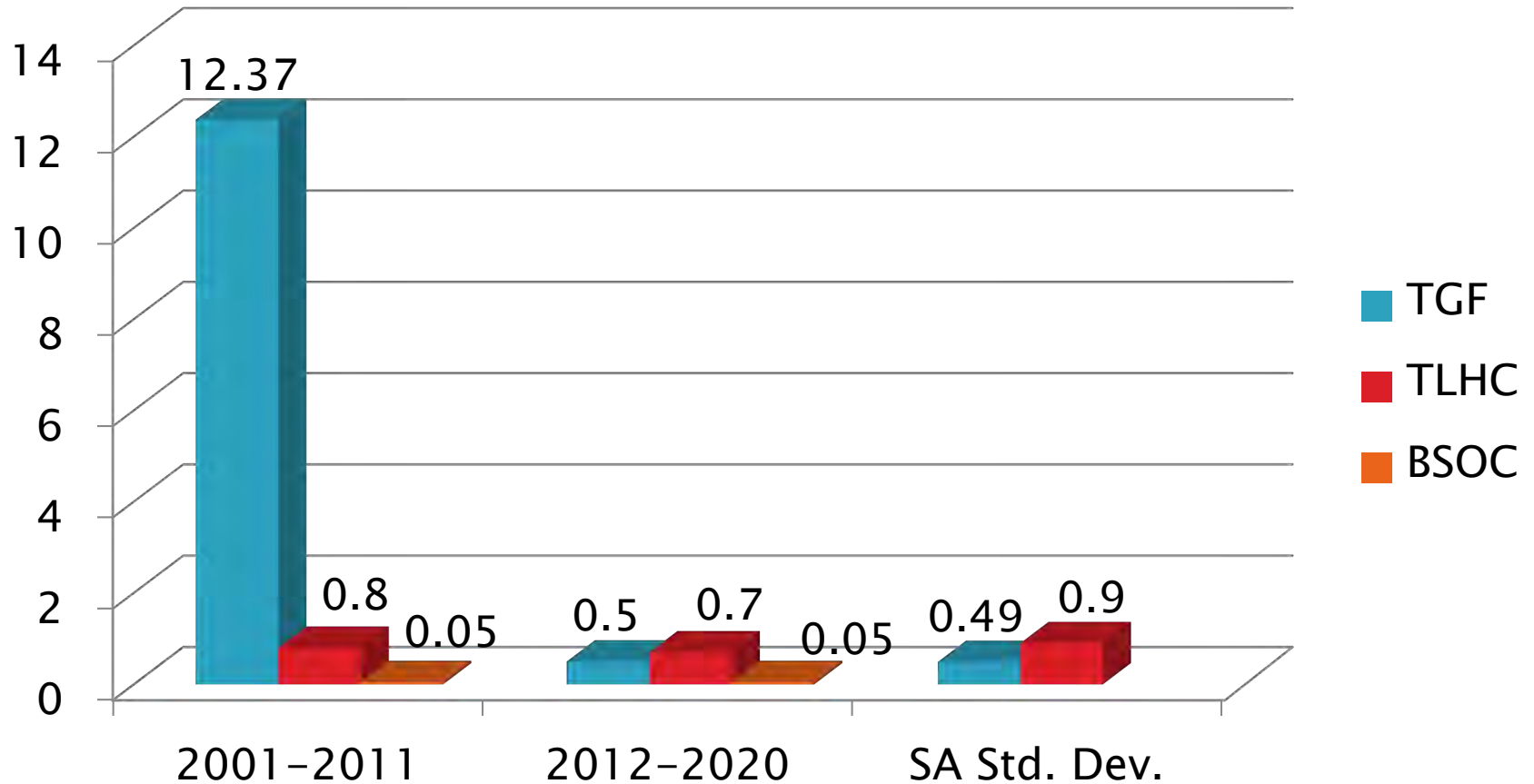


1 N Precision Estimates

WDN



1N Precision Estimates



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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*

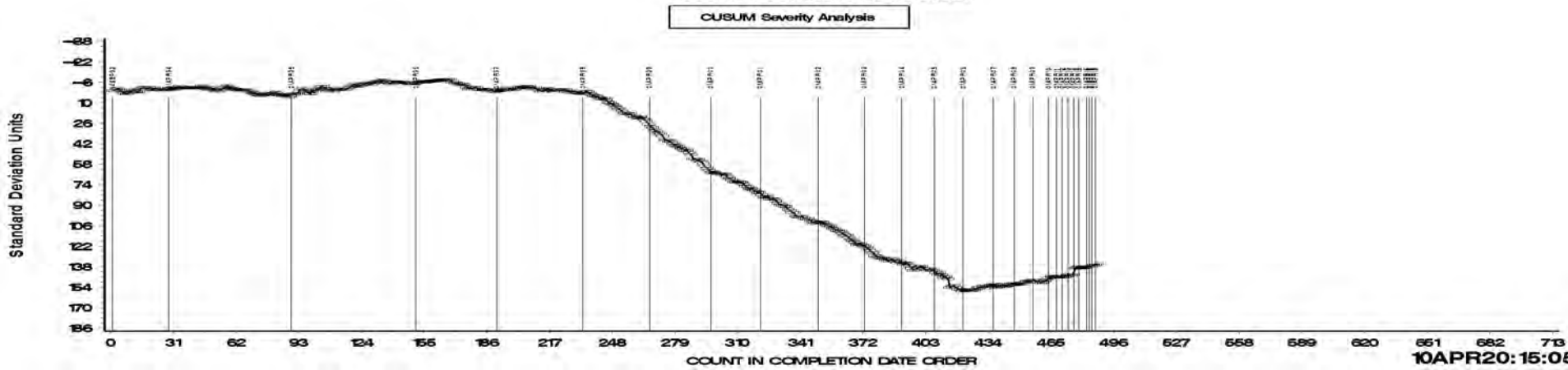
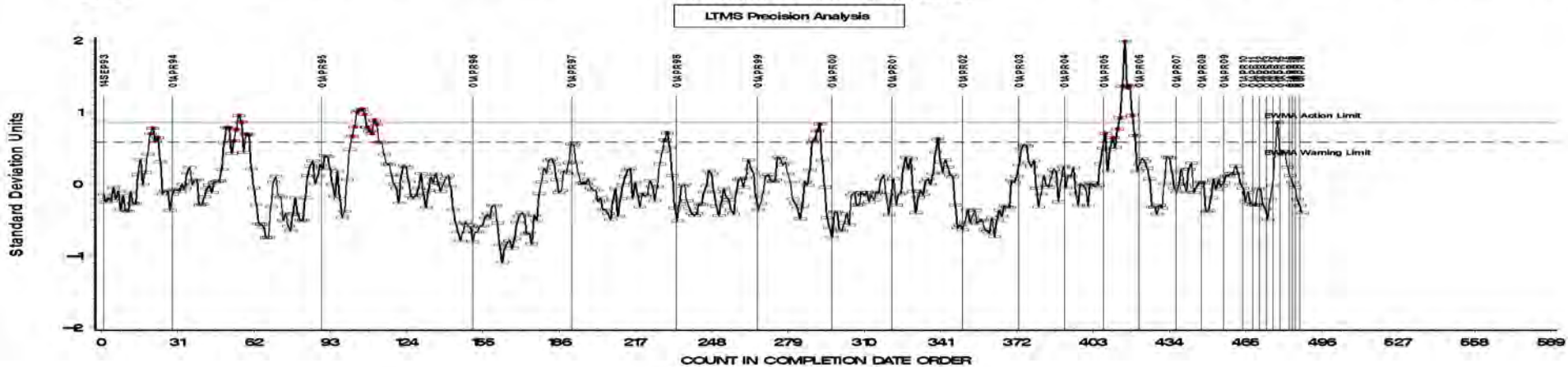
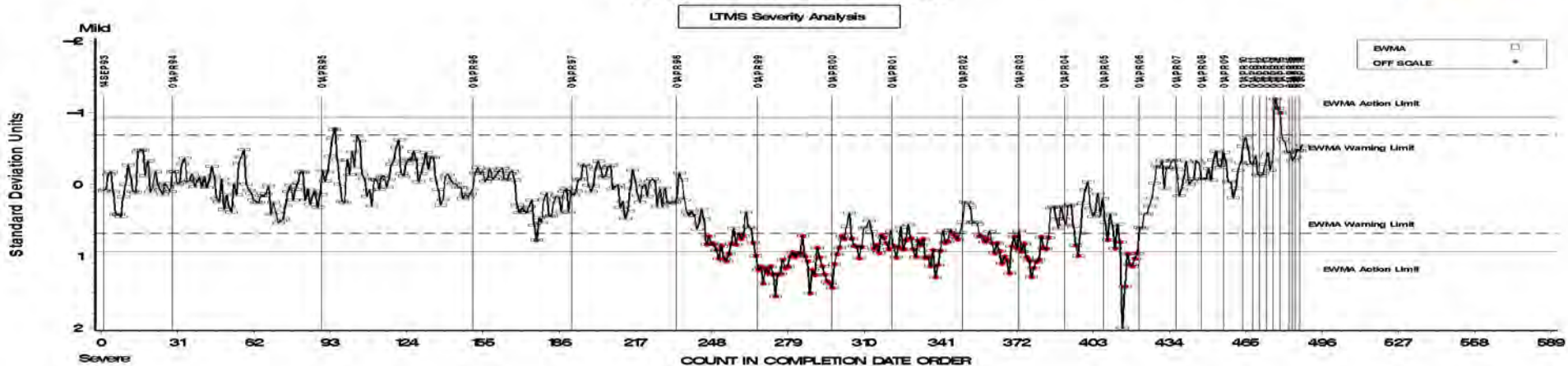
Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		0

*Invalid and aborted tests

1 M-PC Test Severity

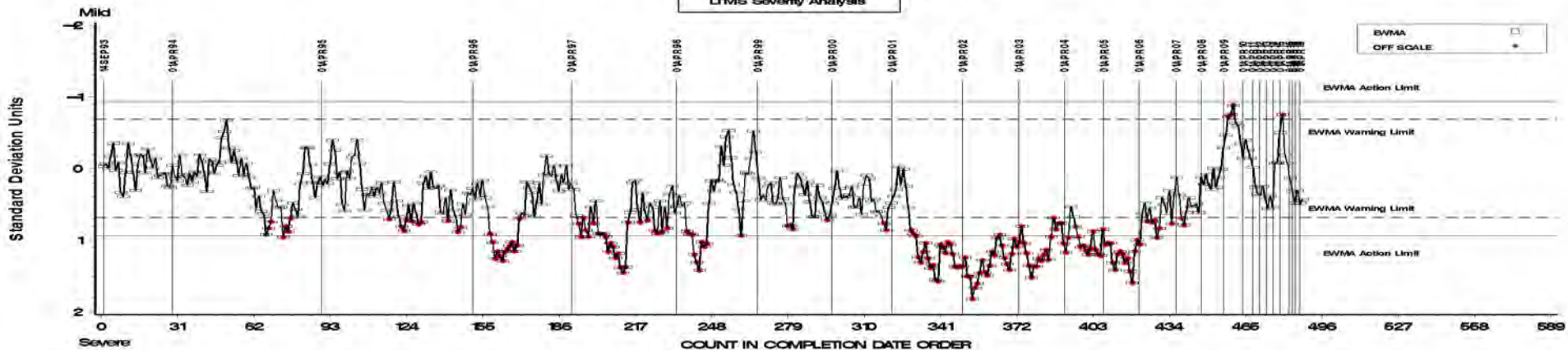
- ▶ TGF and WTD are in control.

Weighted Total Demerits

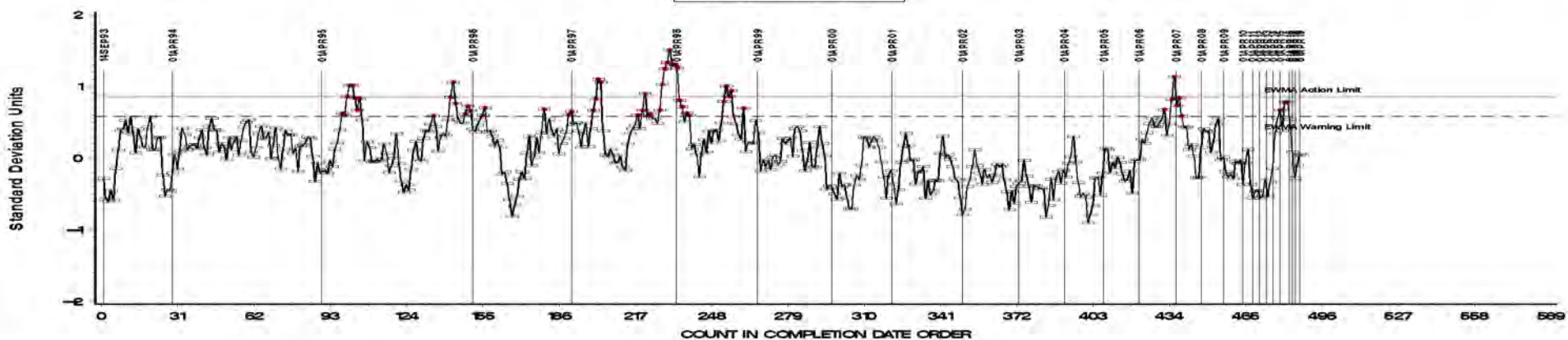


FINAL TOP GROOVE FILLING

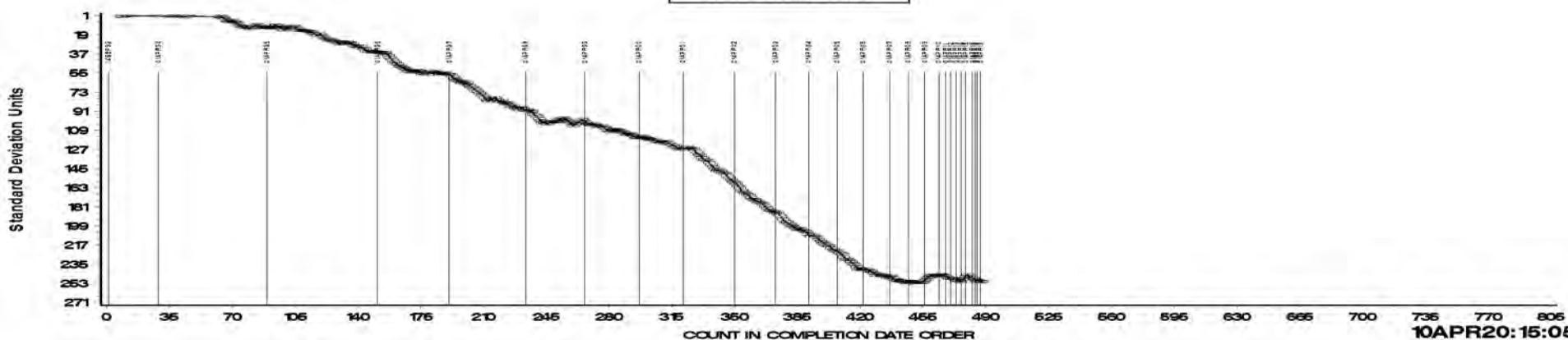
LTMS Severity Analysis



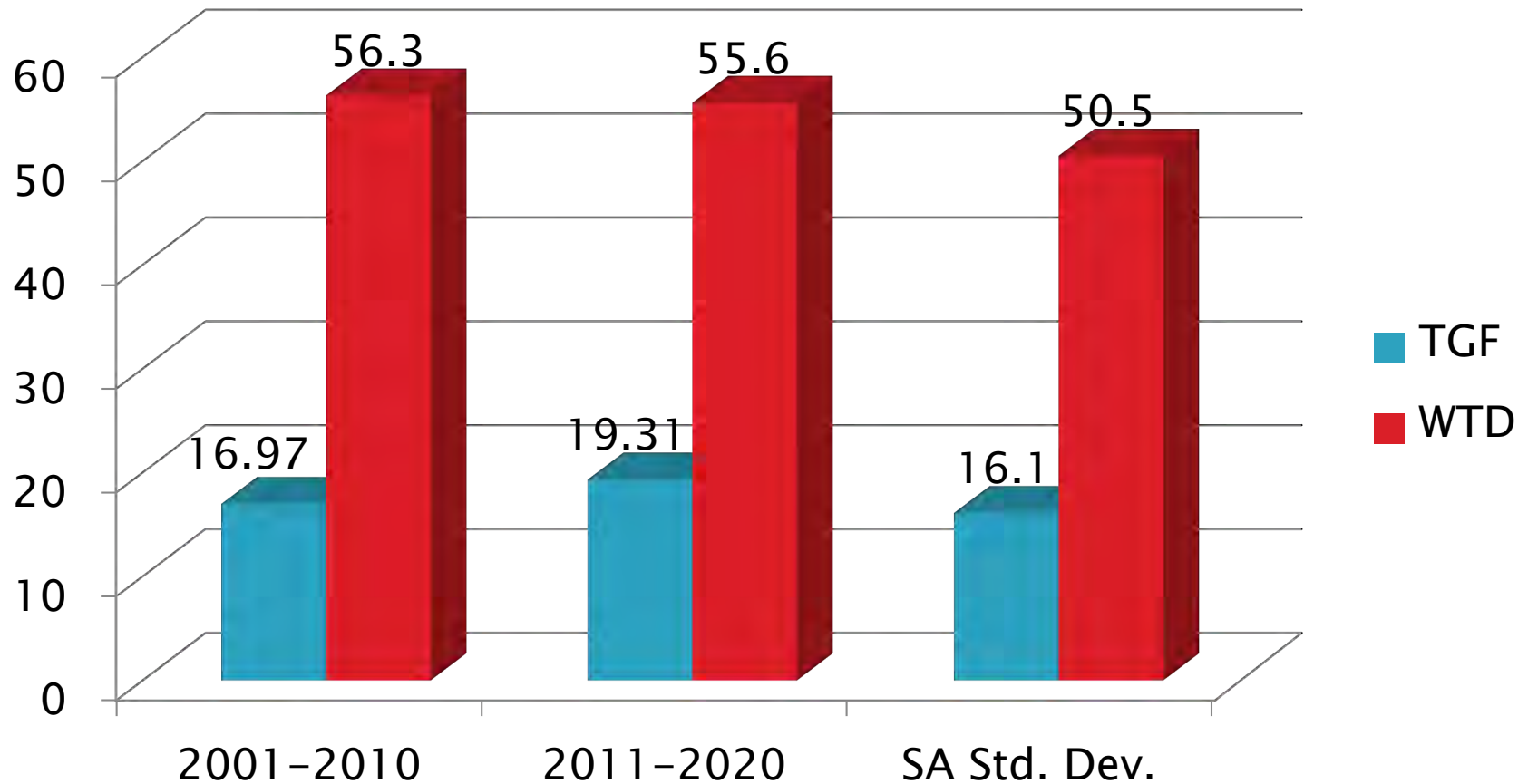
LTMS Precision Analysis



CUSUM Severity Analysis



1 MPC Precision Estimates



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SCOTE 1 P

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1P 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

1 P Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

1P Lost Tests*

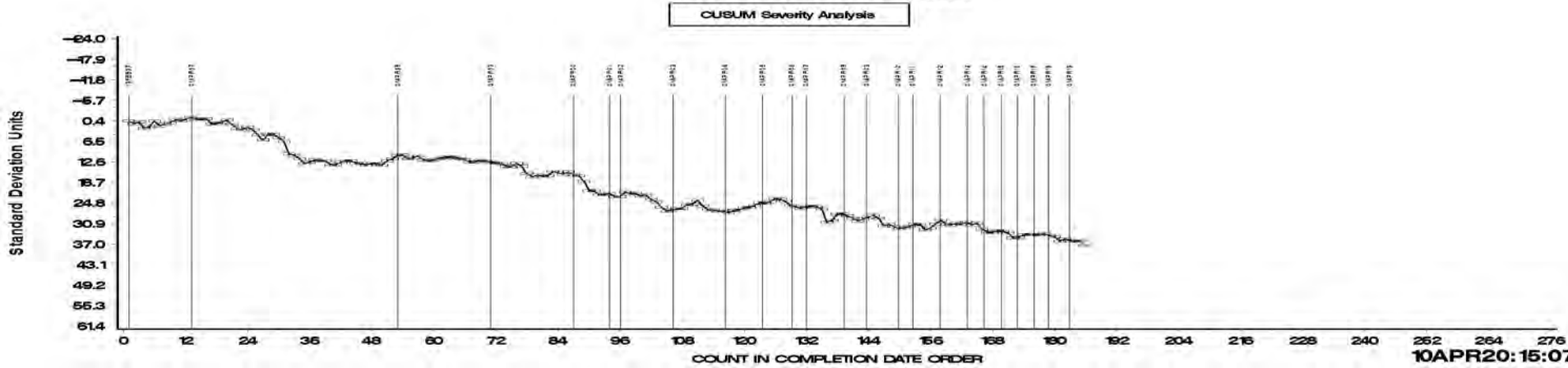
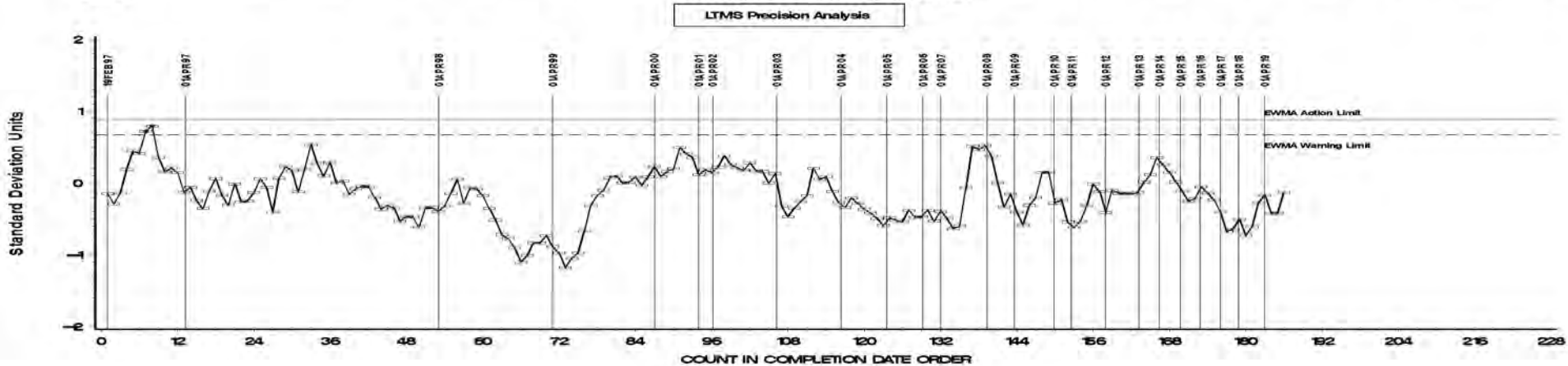
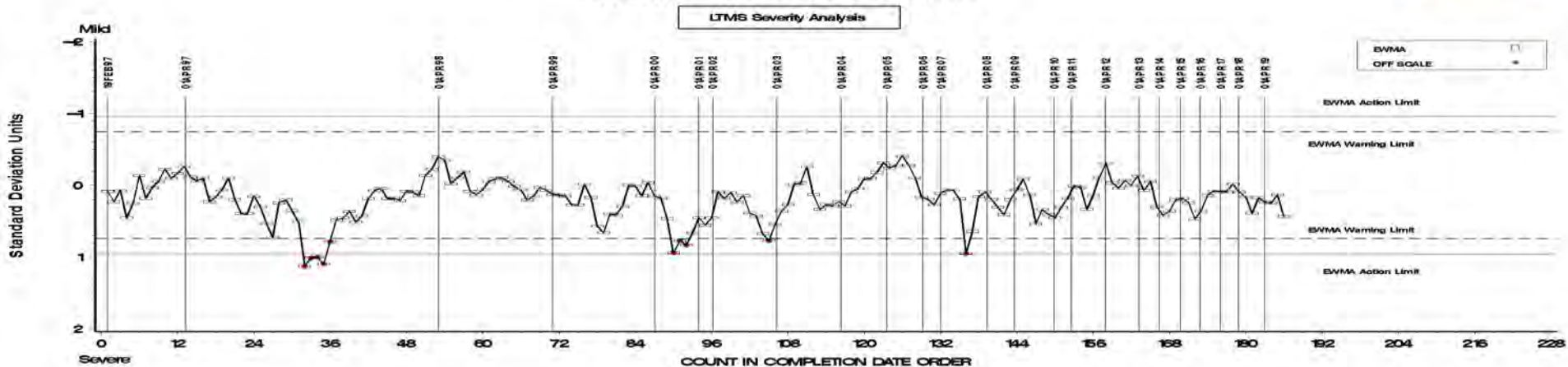
Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		0

*Invalid and aborted tests

1 P Test Severity

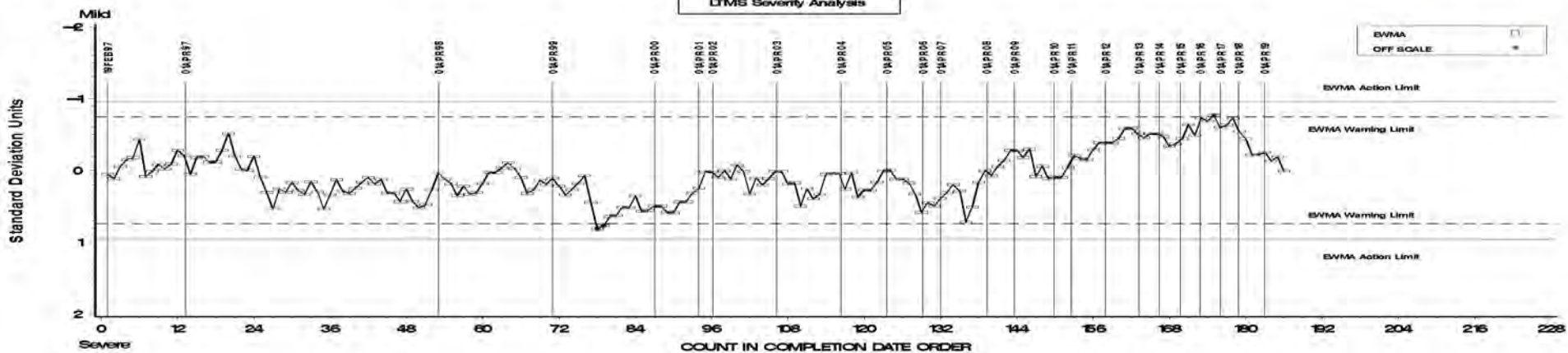
- ▶ WD, TGC, TLC and OC are in control
- ▶ ETOC in action alarm in the severe direction

WEIGHTED TOTAL DEMERITS

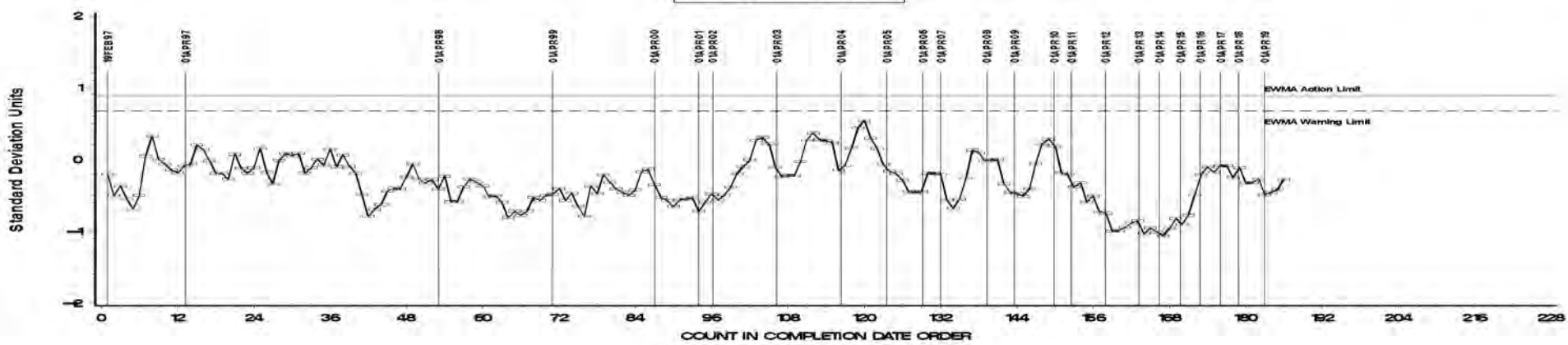


TOP LAND CARBON

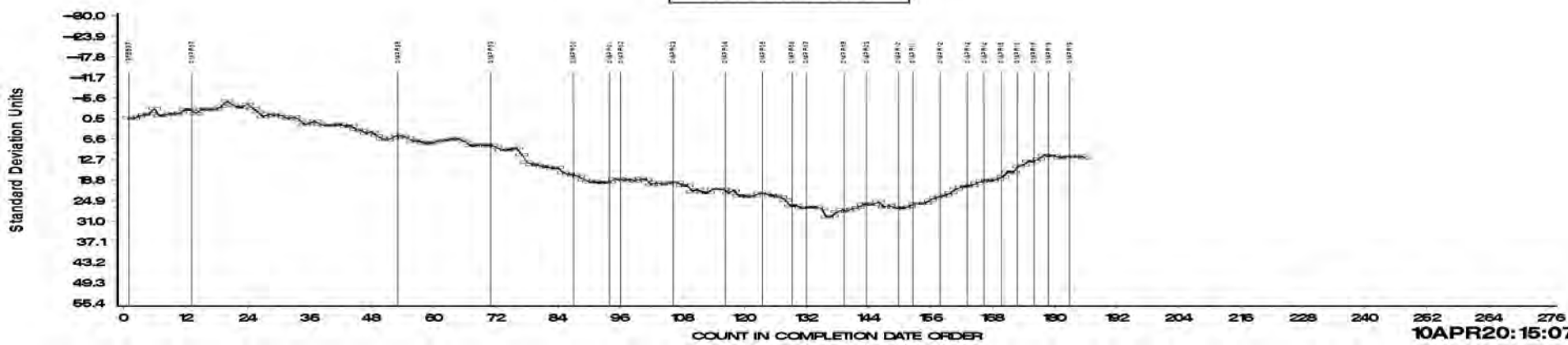
LTMS Severity Analysis



LTMS Precision Analysis

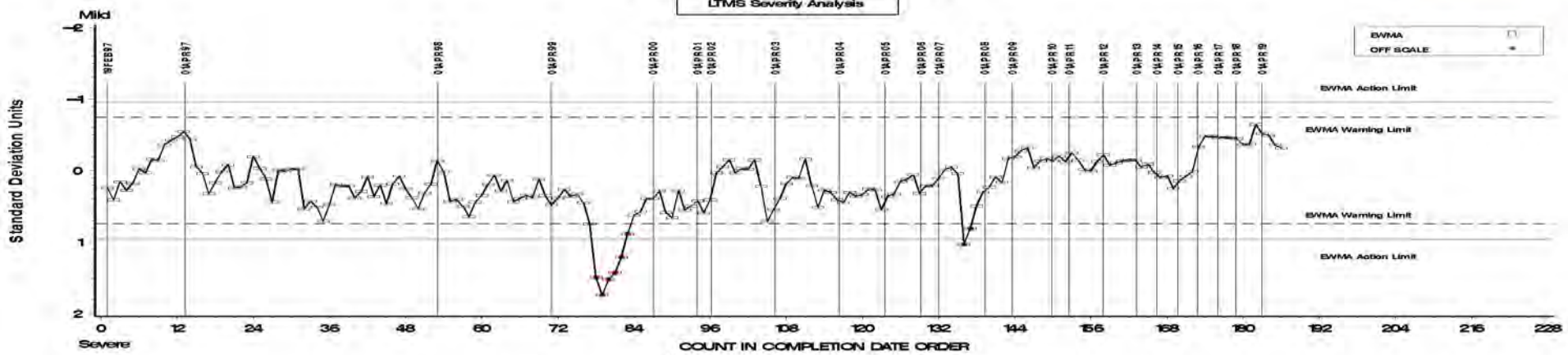


CUSUM Severity Analysis

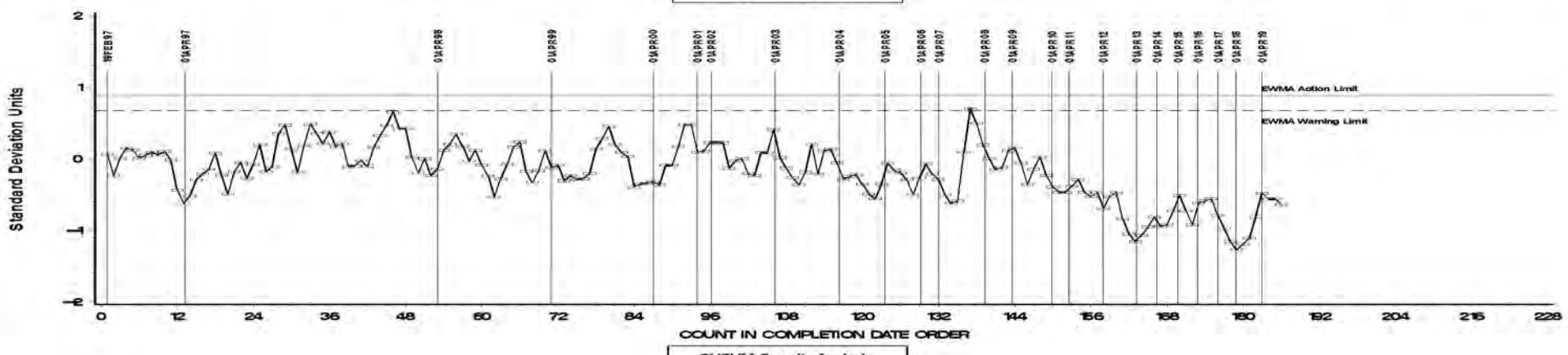


TOP GROOVE CARBON

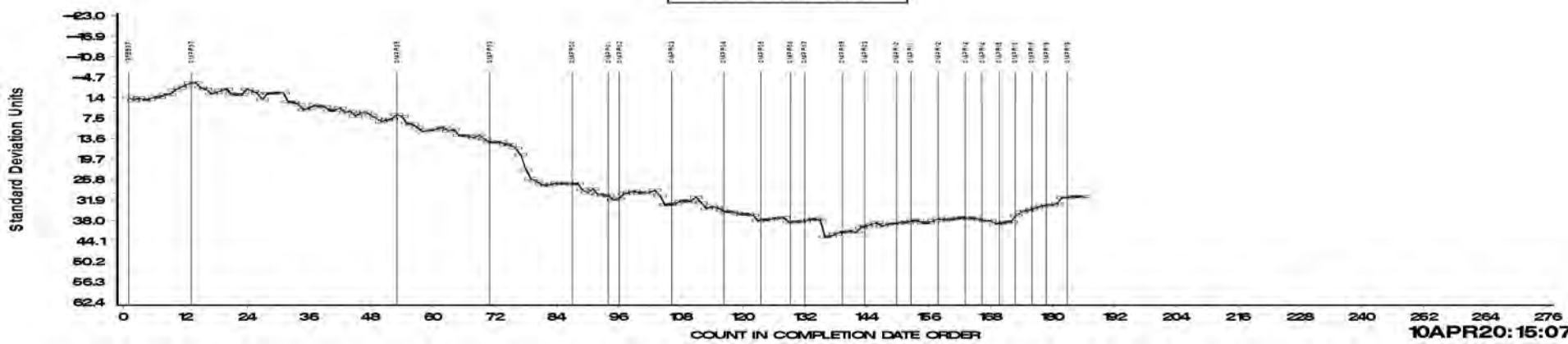
LTMS Severity Analysis



LTMS Precision Analysis



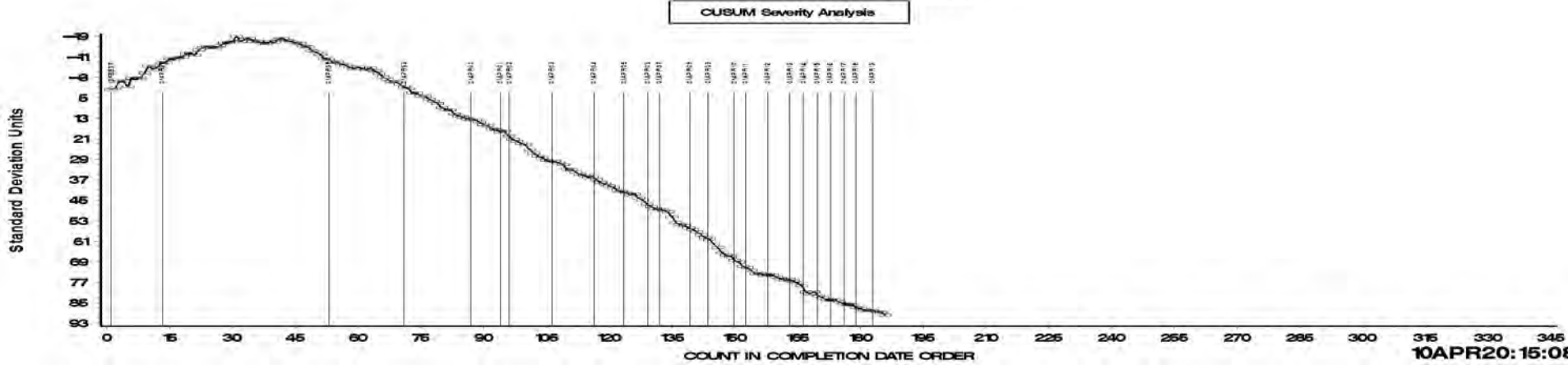
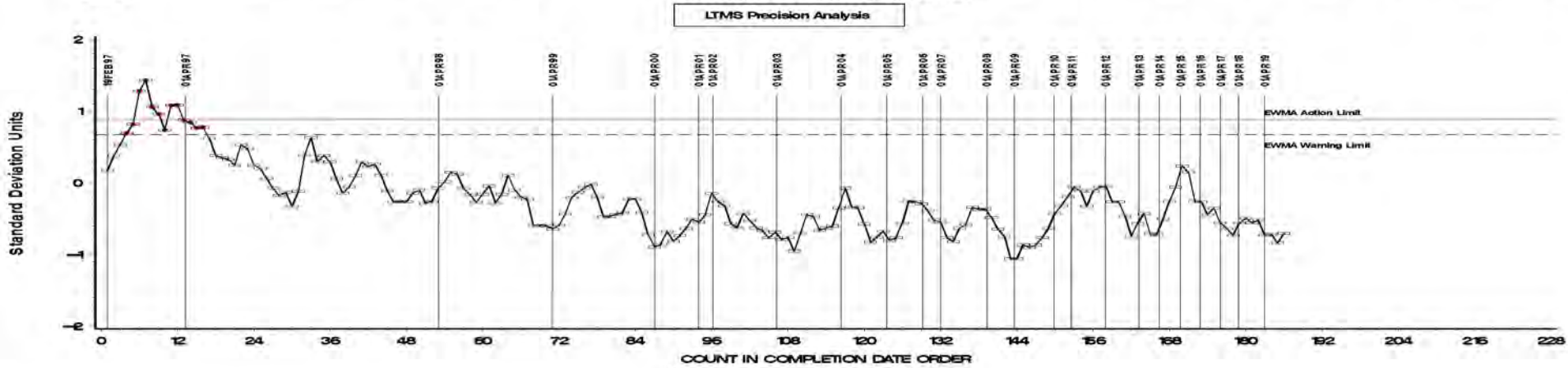
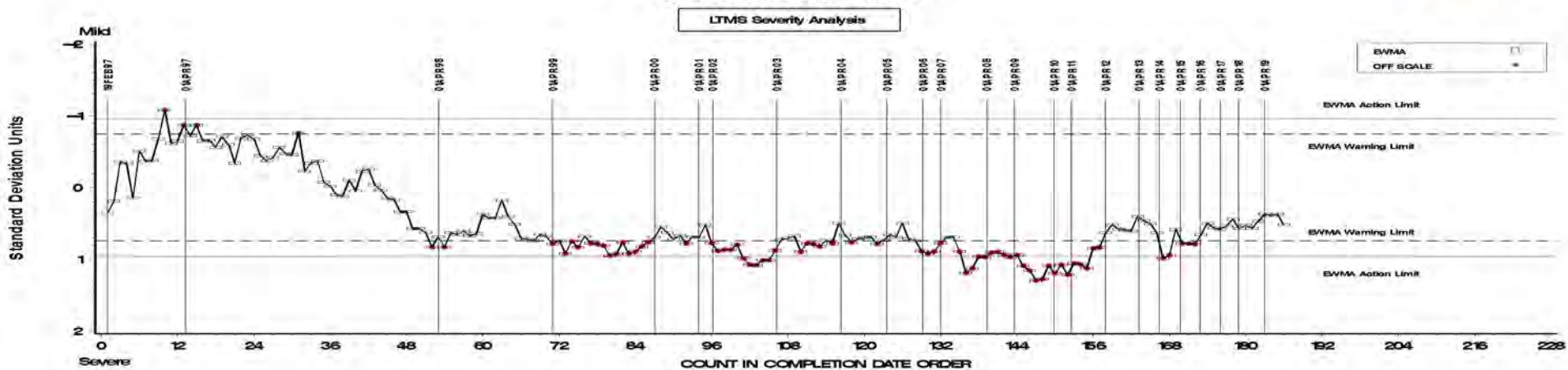
CUSUM Severity Analysis



CATERPILLAR 1P INDUSTRY OPERATIONALLY VALID DATA



OIL CONSUMPTION

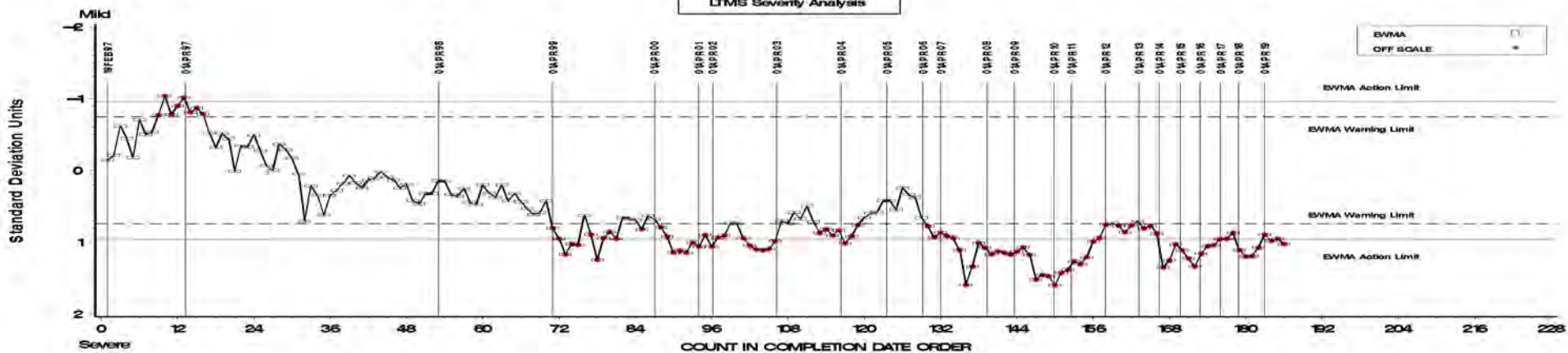


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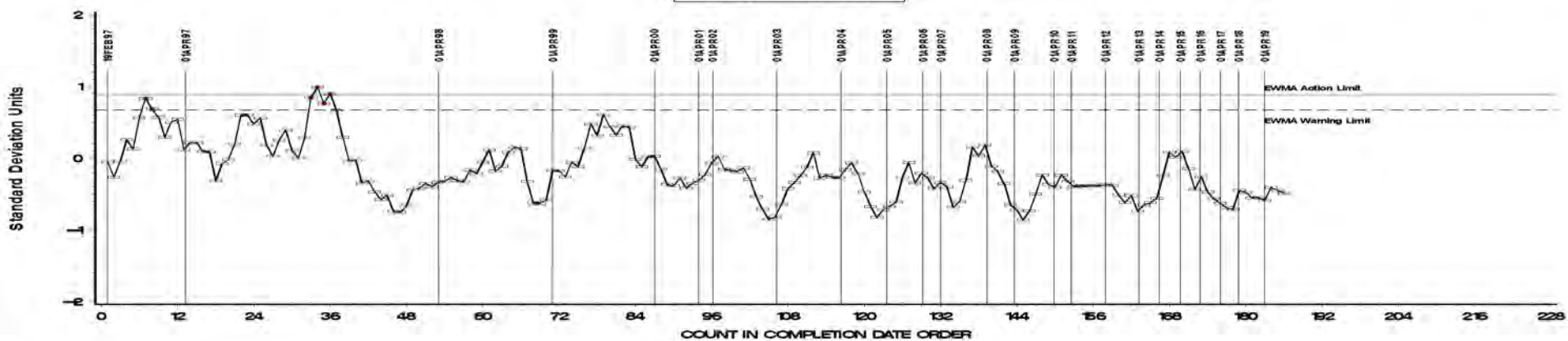


EOTOC

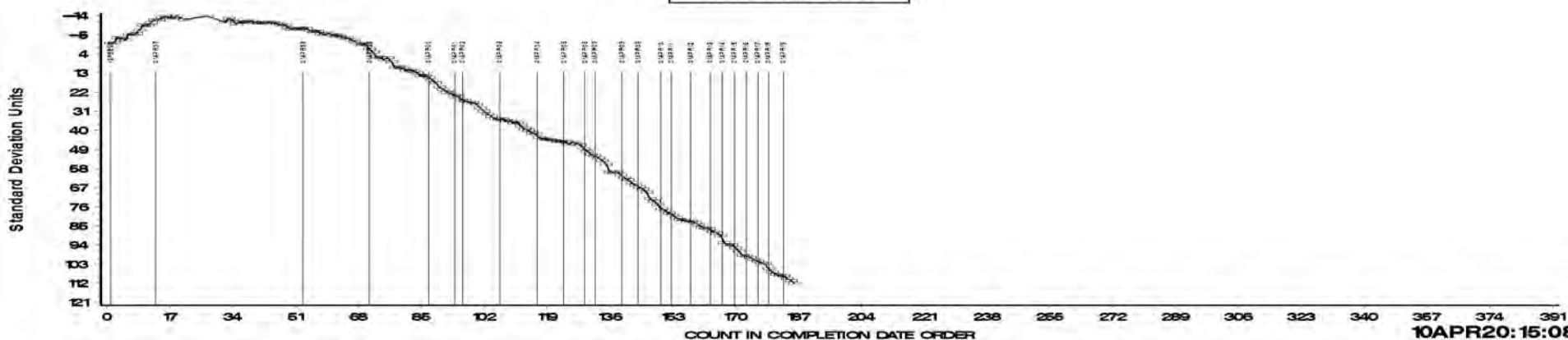
LTMS Severity Analysis



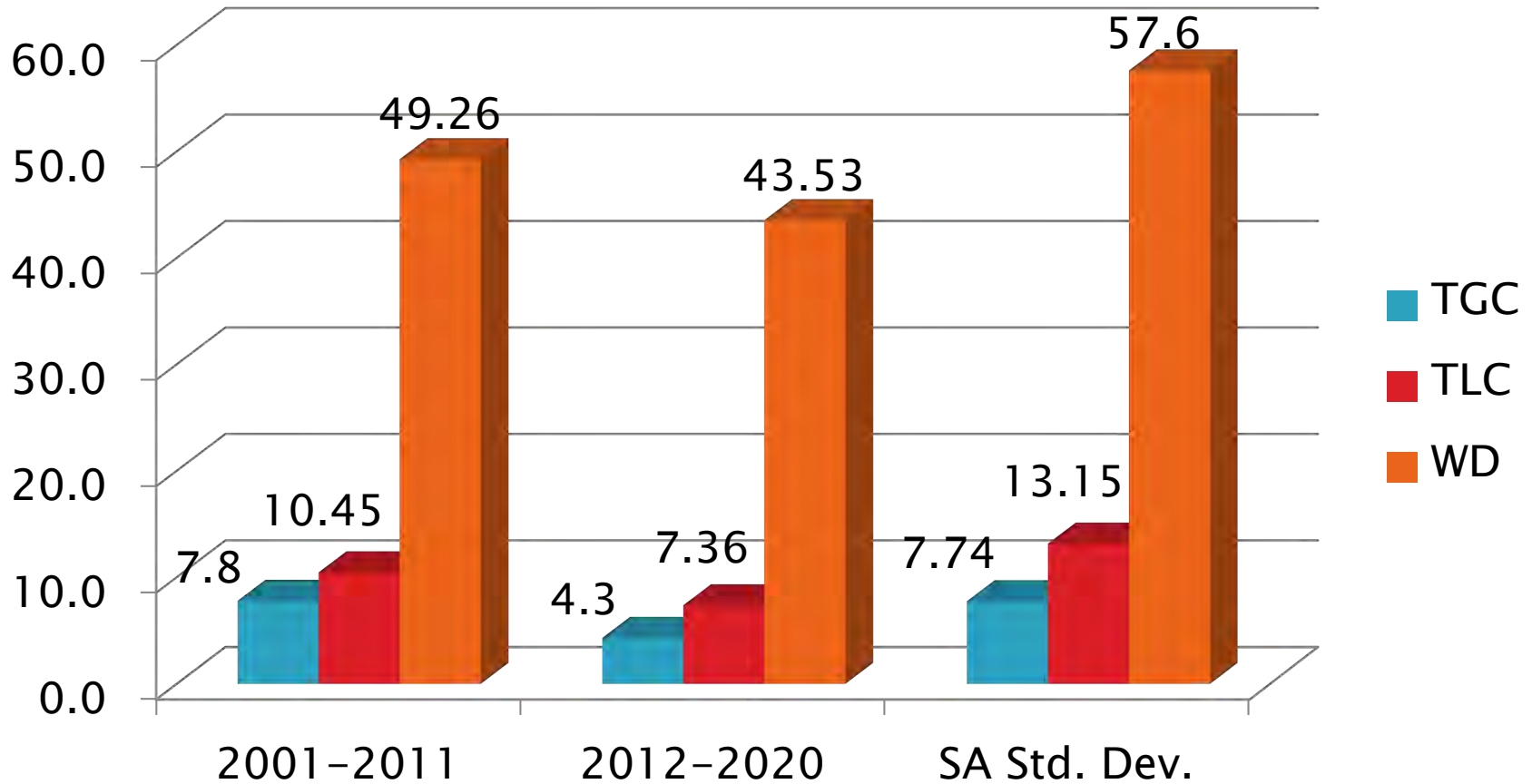
LTMS Precision Analysis



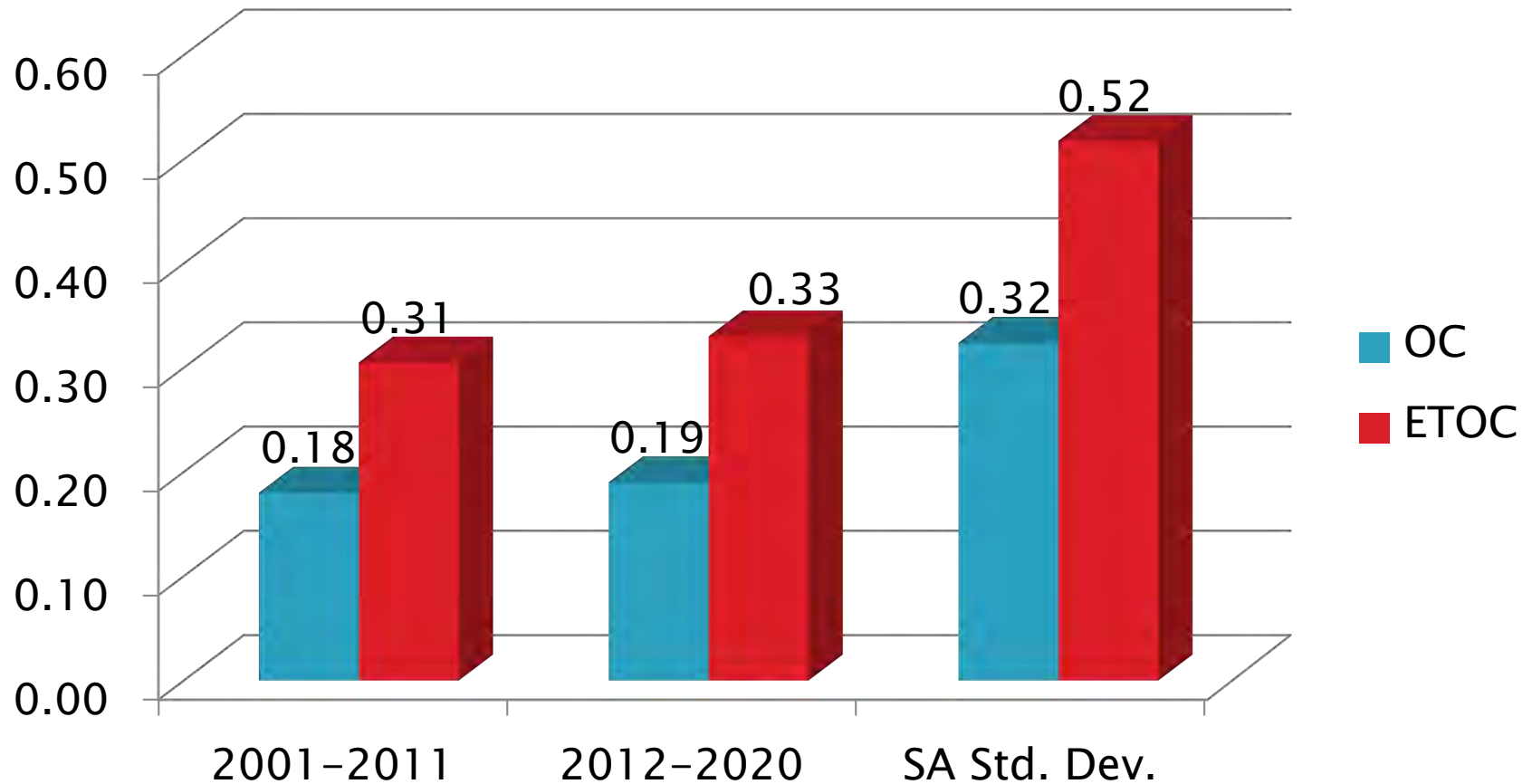
CUSUM Severity Analysis



1P Precision Estimates



1P Precision Estimates



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1 R 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 R Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

1 R Lost Tests*

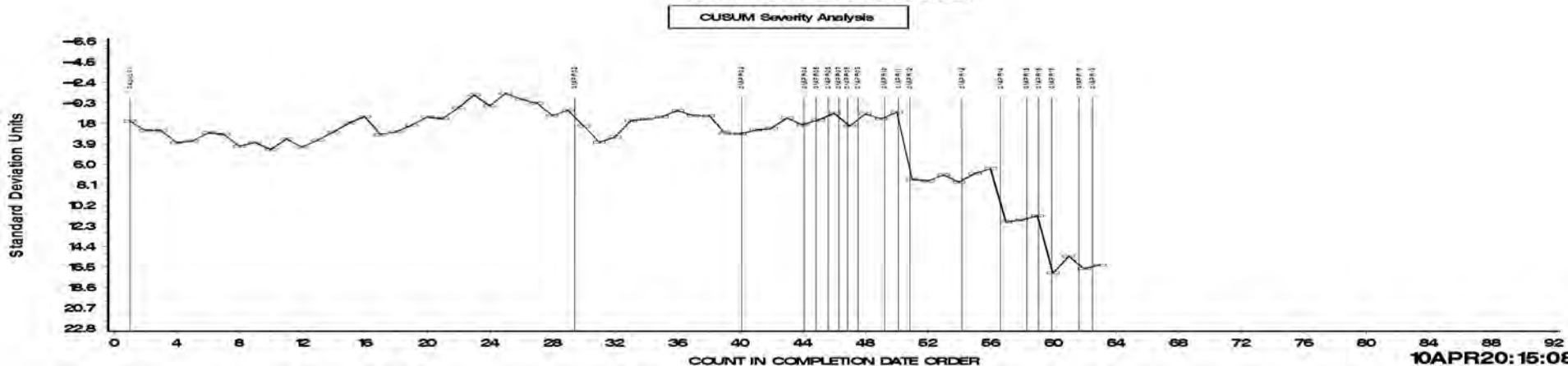
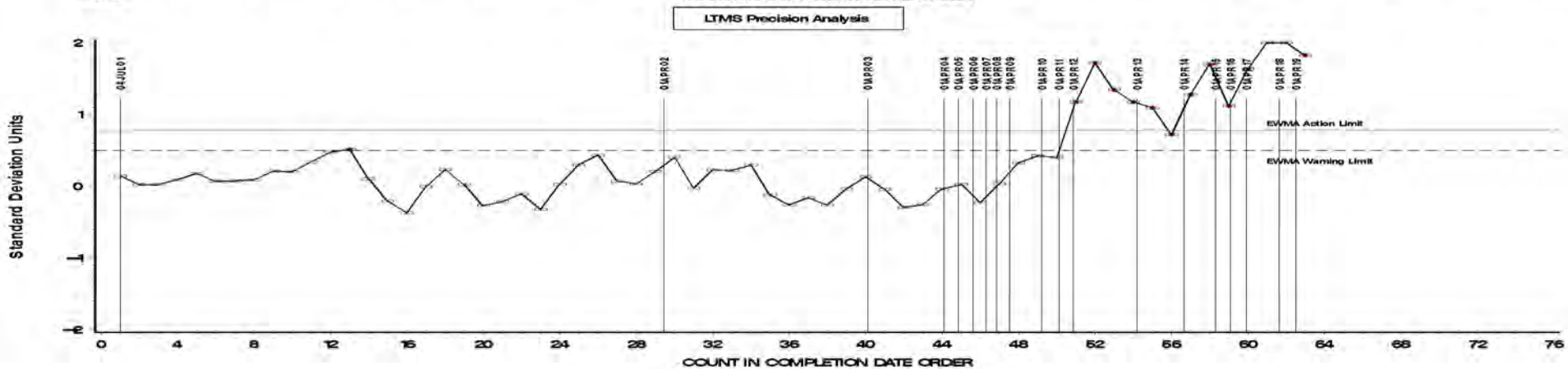
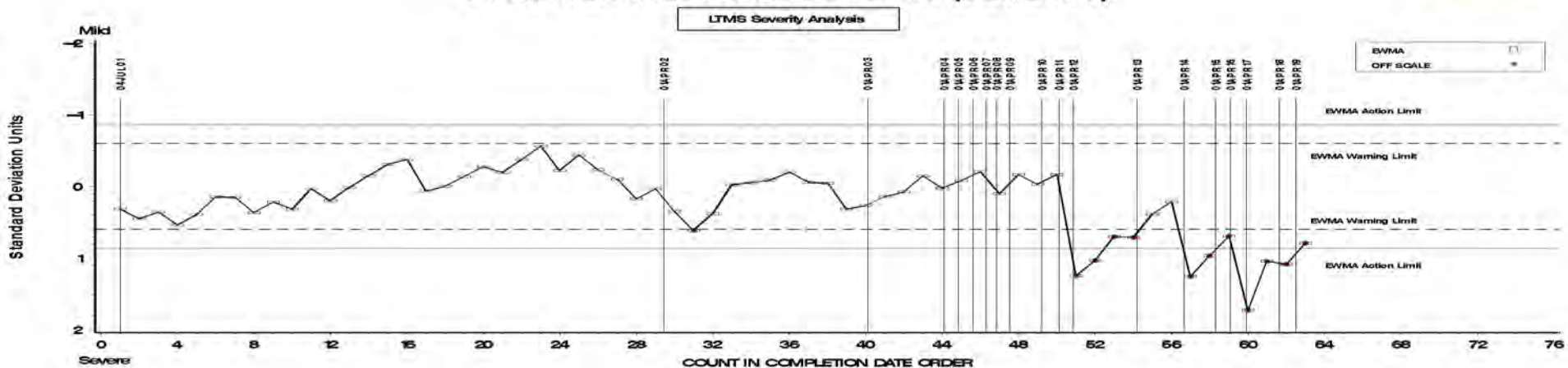
Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		0

*Invalid and aborted tests

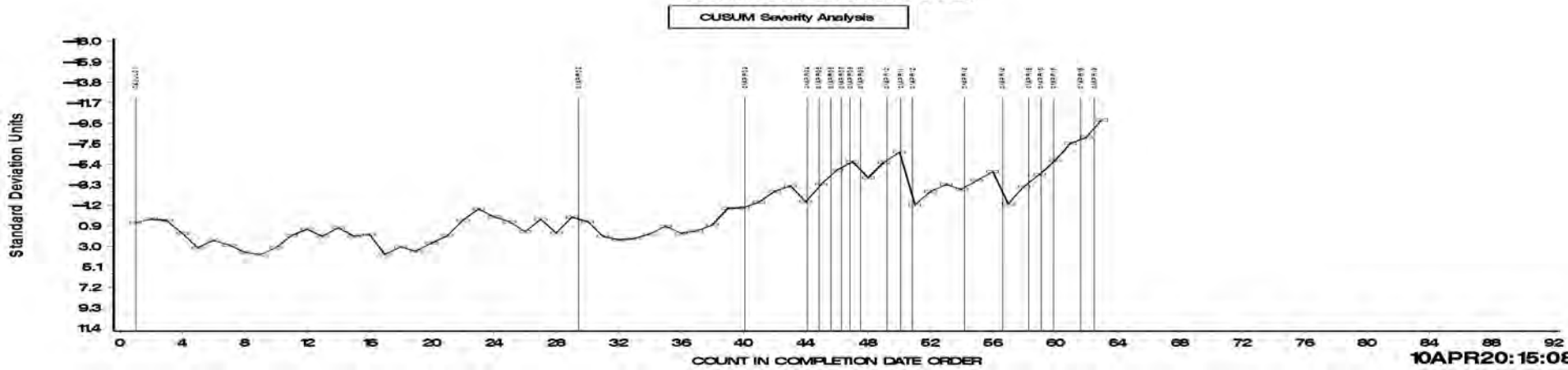
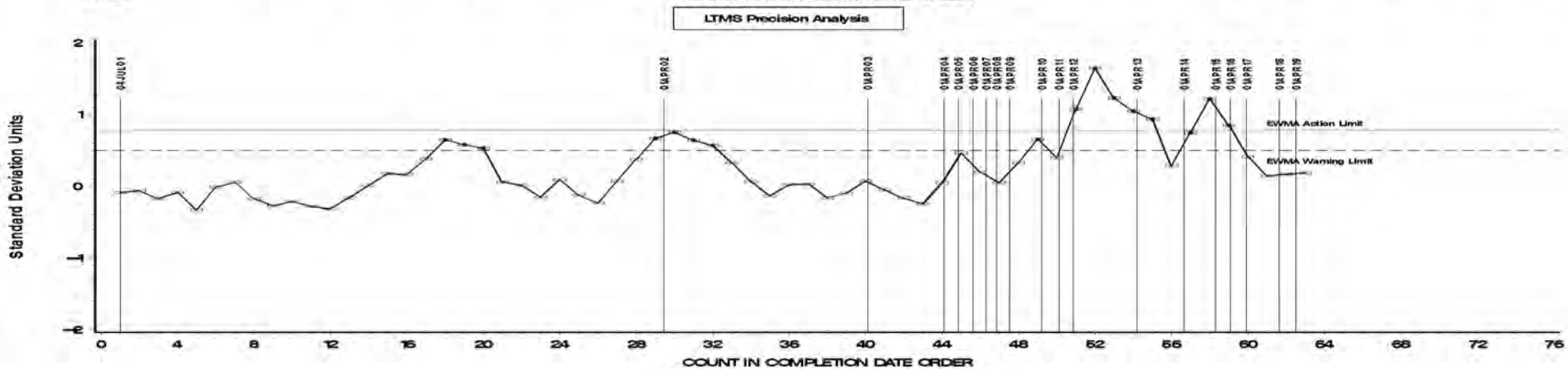
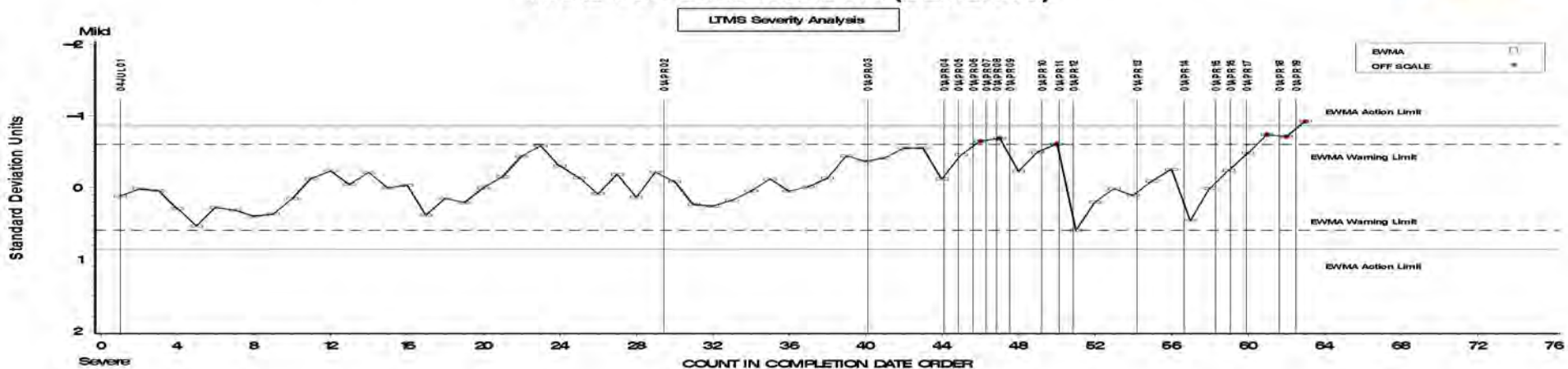
1 R Test Severity

- ▶ WD is in severity warning alarm in severe direction
- ▶ TLC, BTOC are in severity action alarm in mild direction
- ▶ WD and TGC in precision action alarm
- ▶ ETOC in precision warning alarm

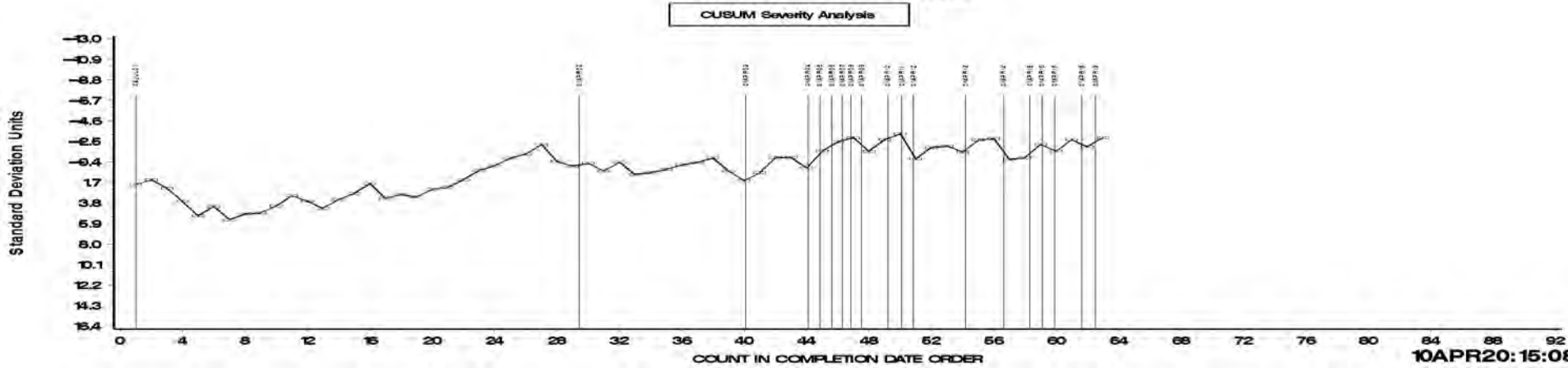
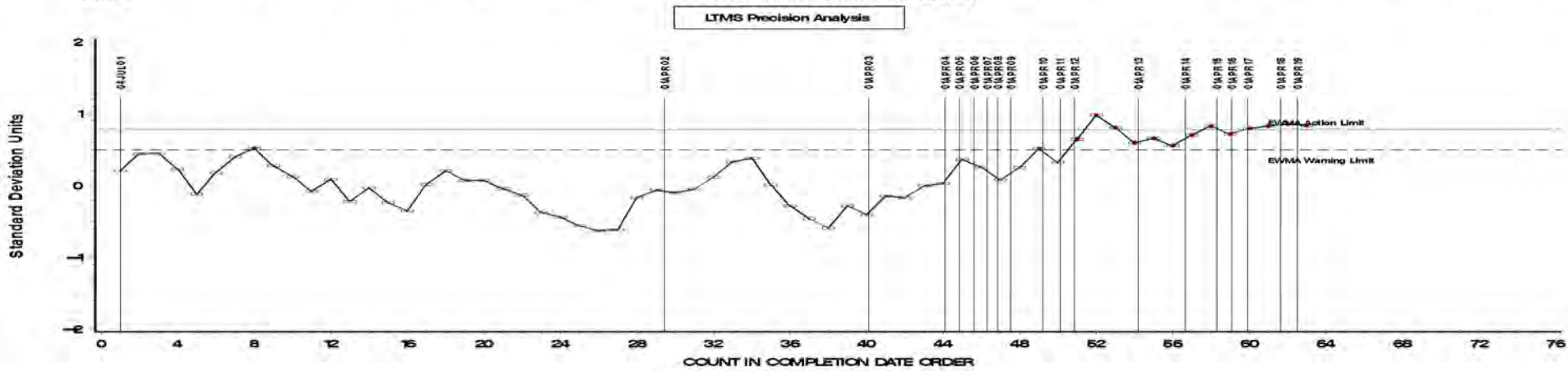
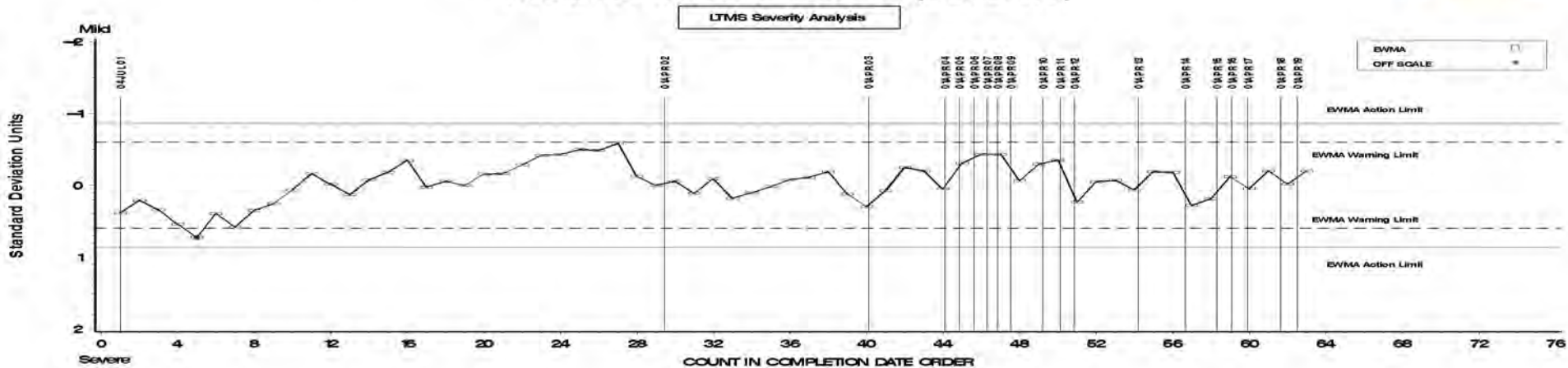
FINAL WEIGHTED TOTAL DEMERITS (DEMERITS)



FINAL TOP LAND CARBON (DEMERITS)



FINAL TOP GROOVE CARBON (DEMERITS)

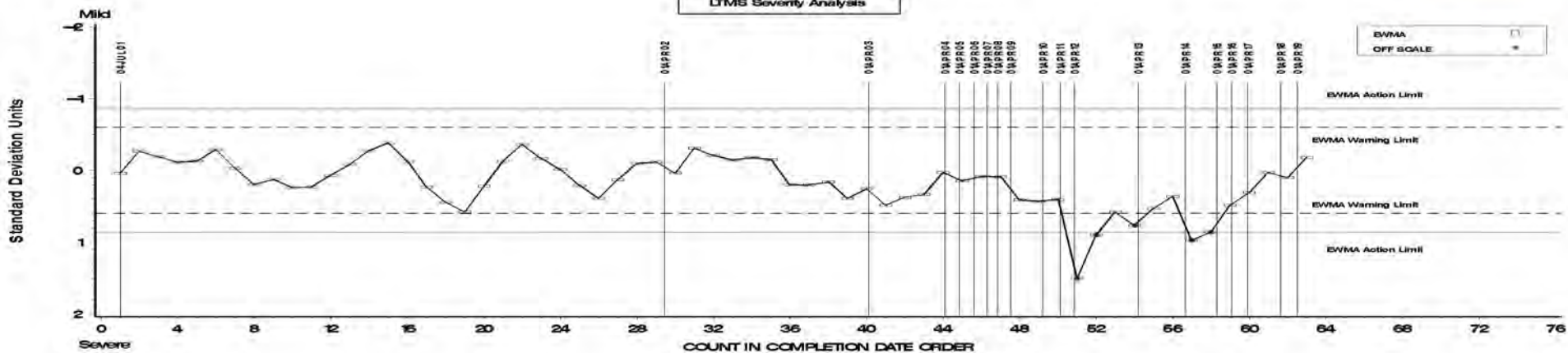


CATERPILLAR 1R INDUSTRY OPERATIONALLY VALID DATA

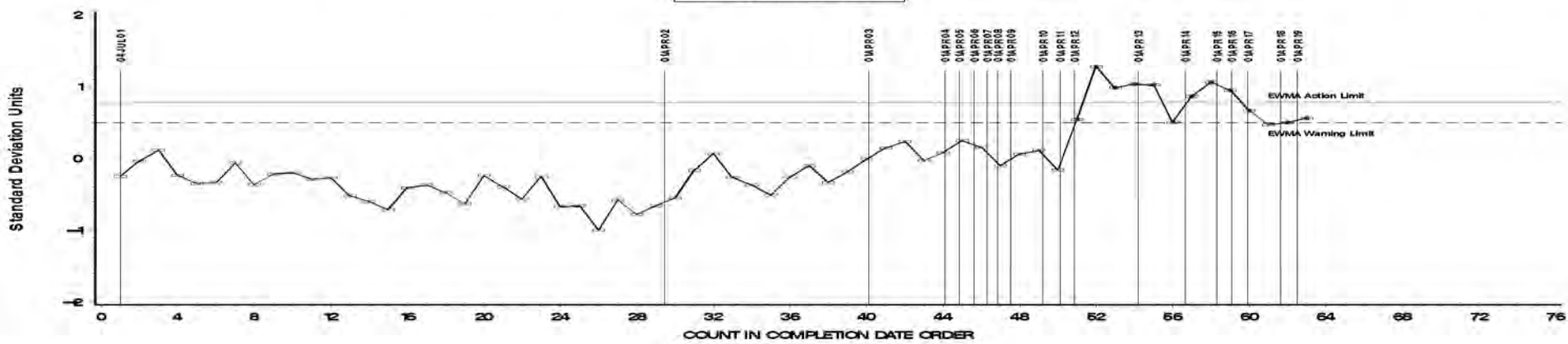


FINAL EOTOC (g/h)

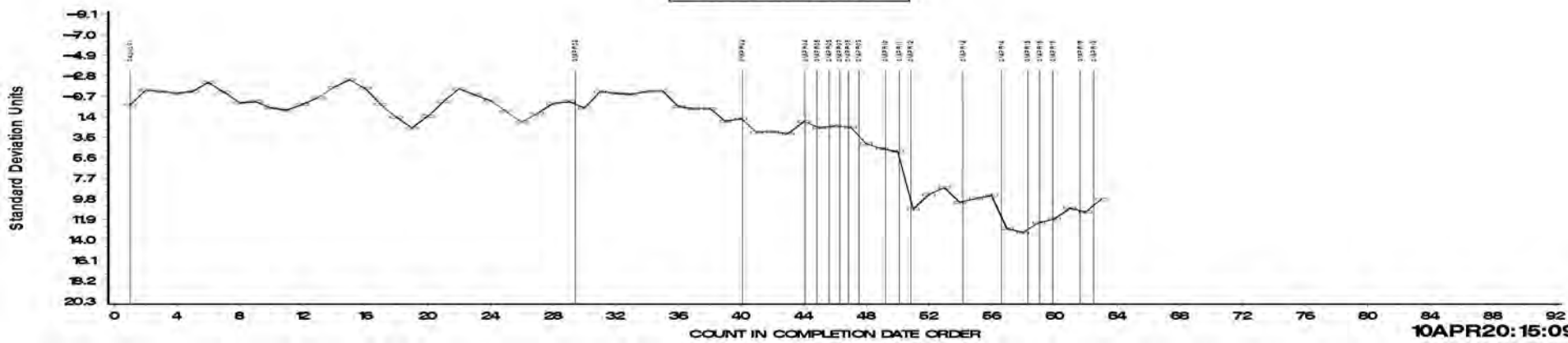
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

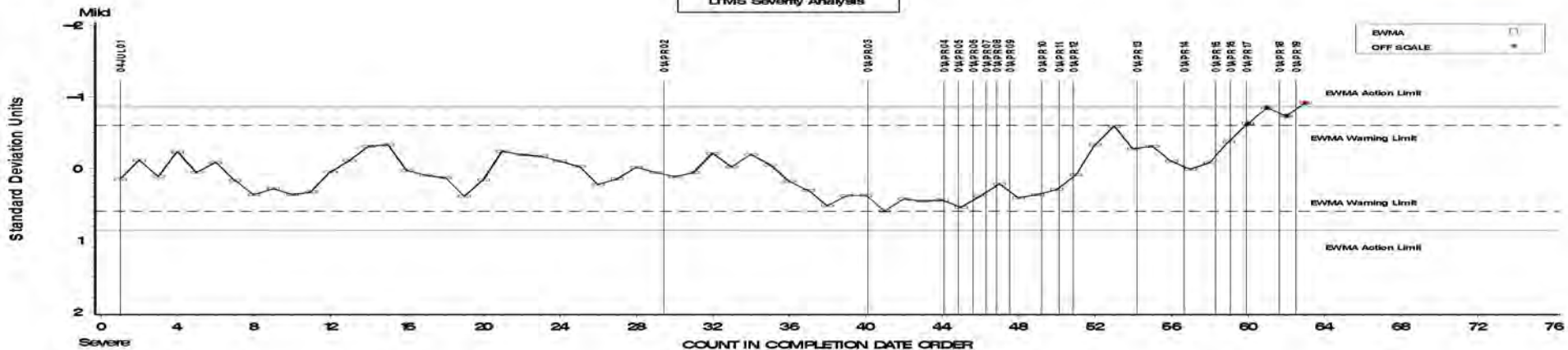


CATERPILLAR 1R INDUSTRY OPERATIONALLY VALID DATA

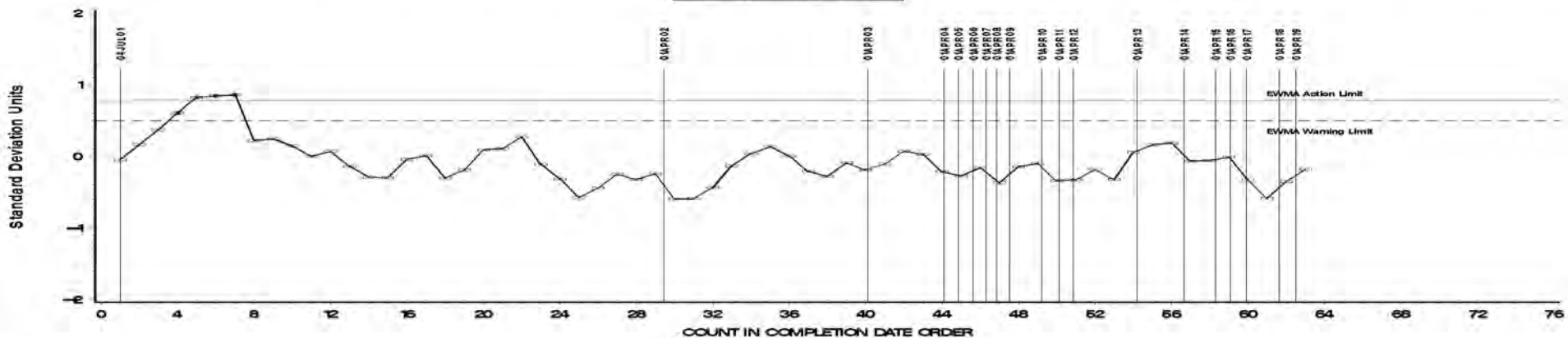


FINAL BOTOC

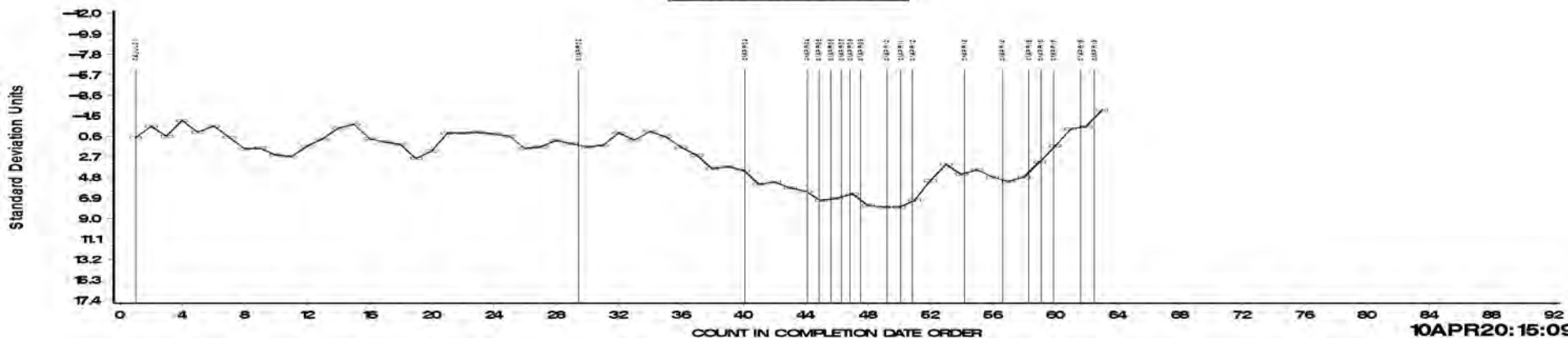
LTMS Severity Analysis



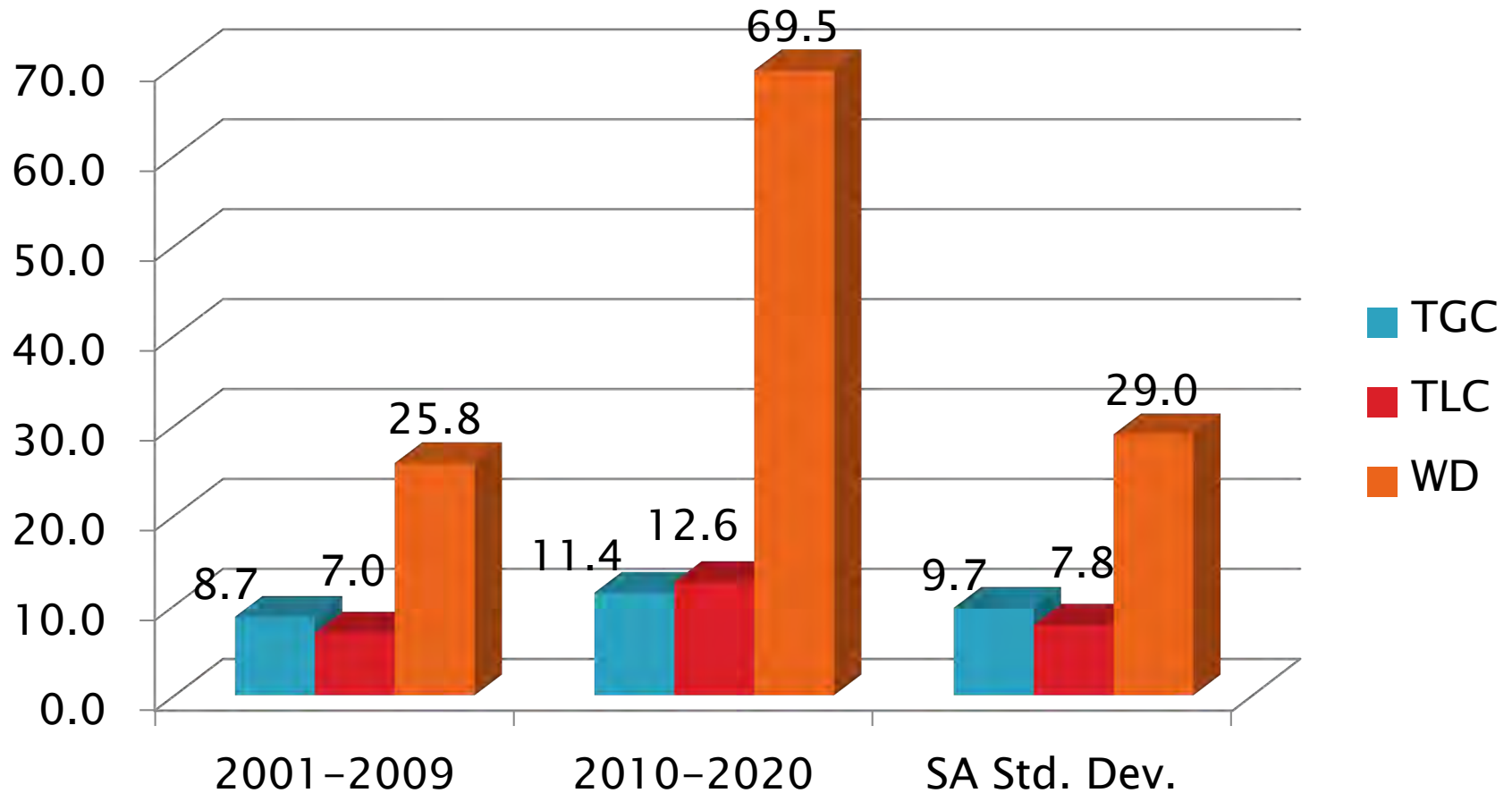
LTMS Precision Analysis



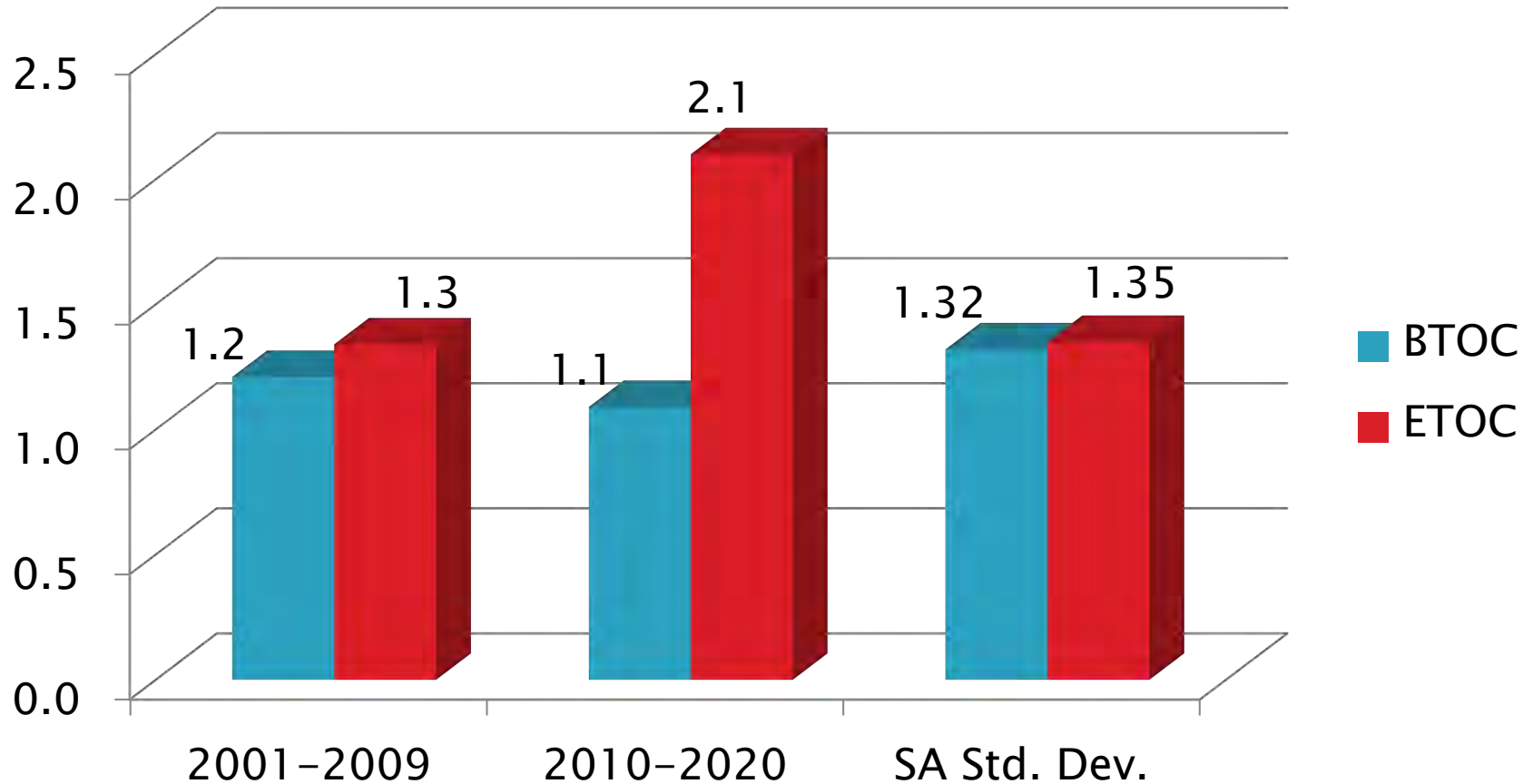
CUSUM Severity Analysis



1R Precision Estimates



1 R Precision Estimates



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CAT C13

»» April 2020

Test Monitoring Center

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C13 Test Activity

Test Status	Validity Code	C13
Acceptable Calibration Test	AC	1
Failed Calibration Test	OC	0
Operationally Invalid	LC	0
Aborted	XC	0
Total		1

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

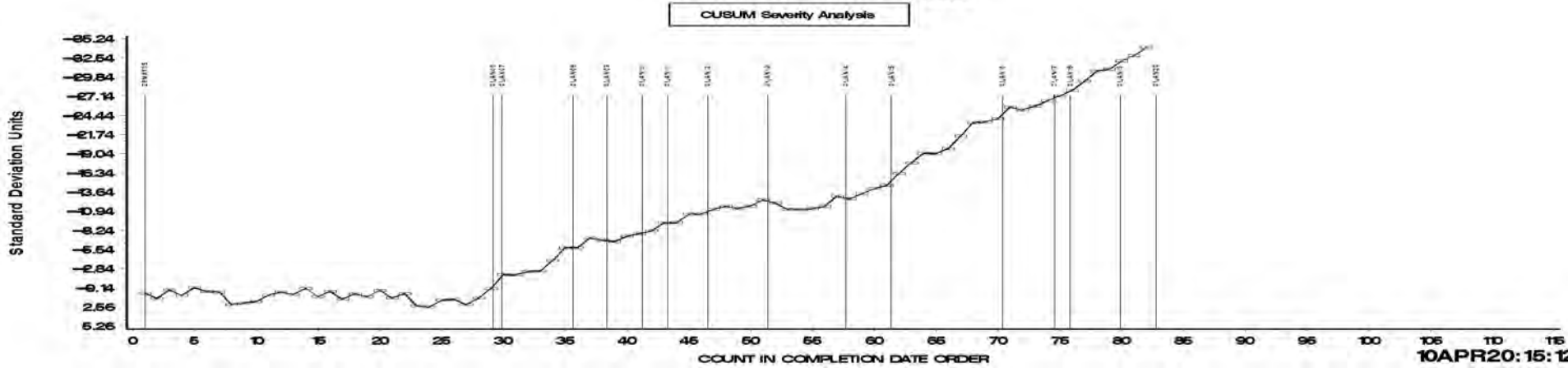
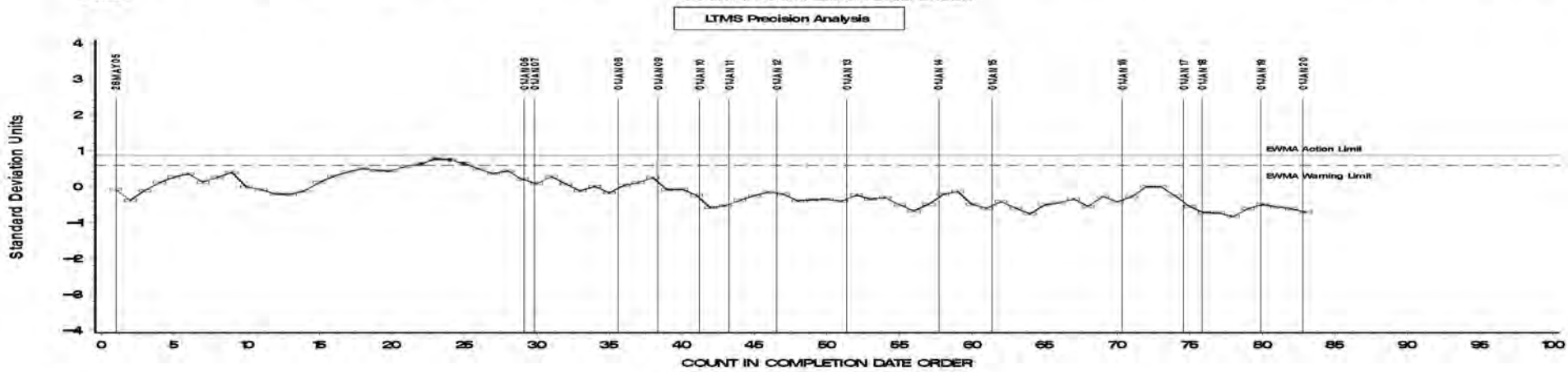
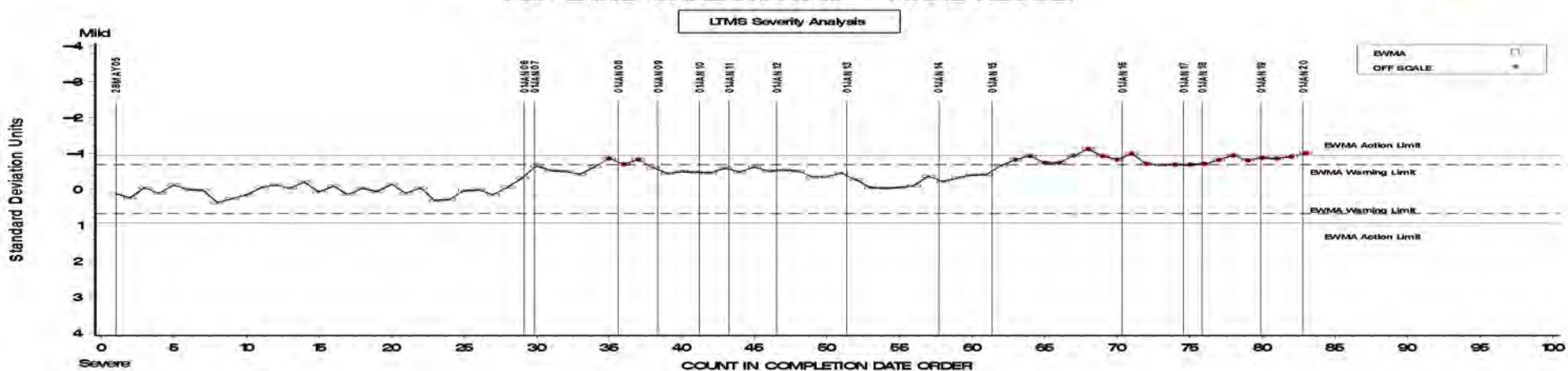
C13 Test Severity

- ▶ OC is in control
- ▶ TLC in severity action alarm in the mild direction
- ▶ TGC and R2TC is in precision warning alarm

C13 INDUSTRY OPERATIONALLY VALID DATA



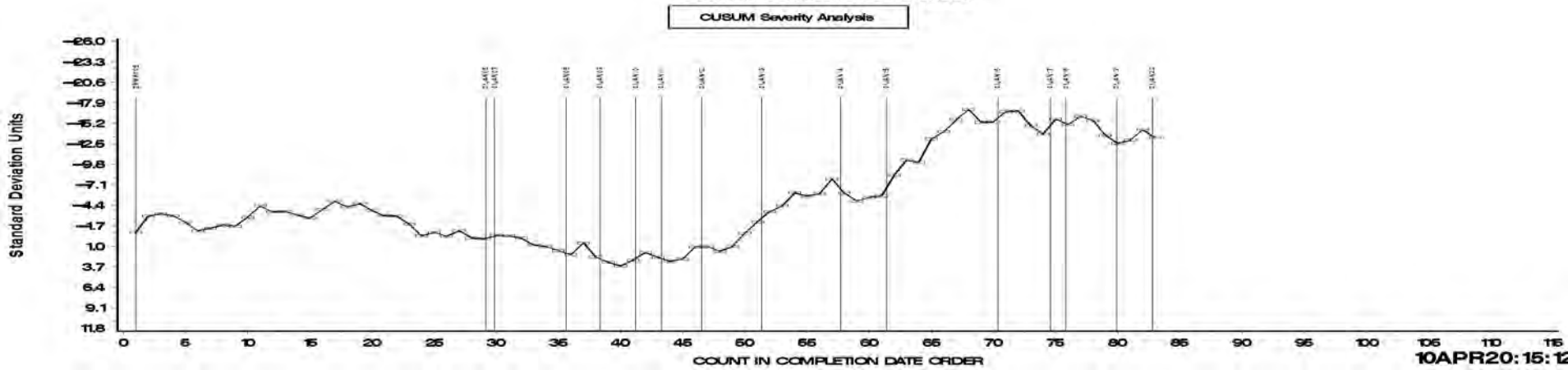
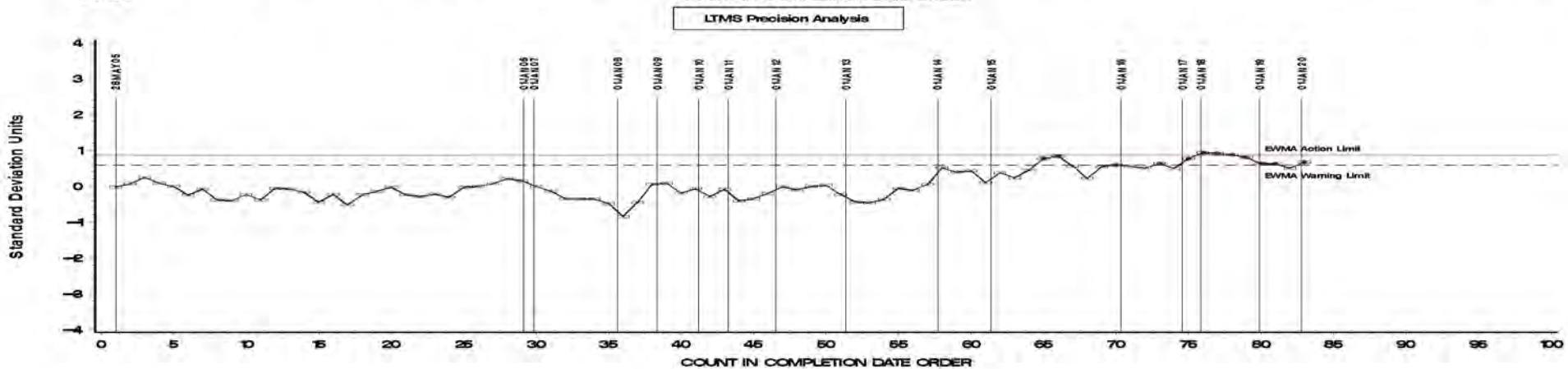
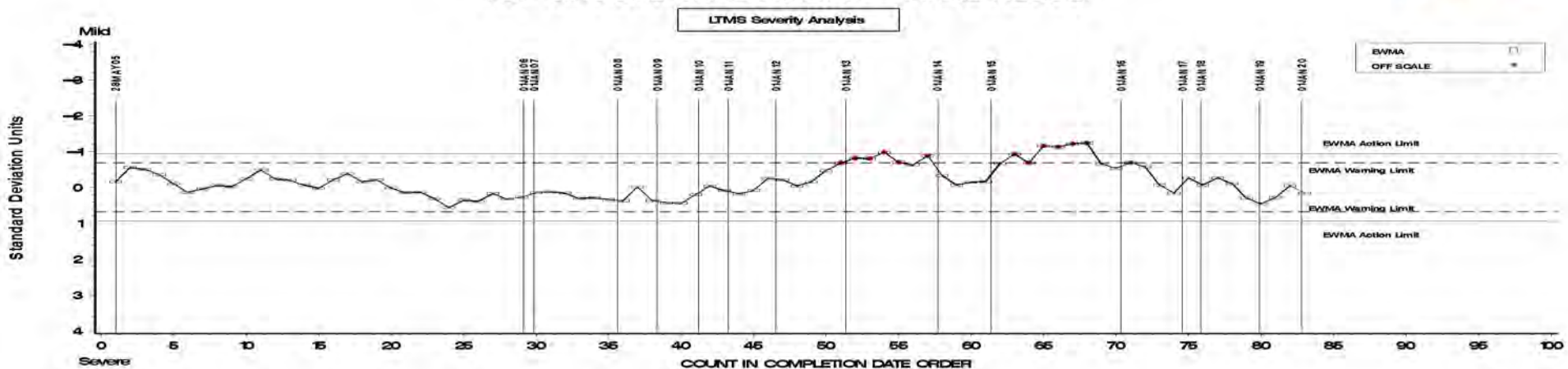
TOP LAND CARBON AVG. — FINAL RESULT



C13 INDUSTRY OPERATIONALLY VALID DATA



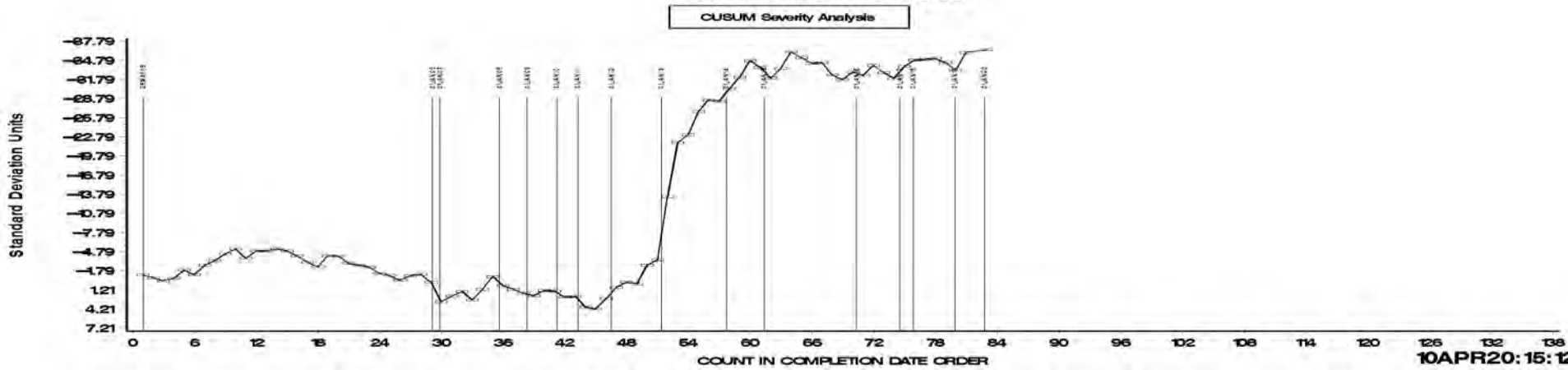
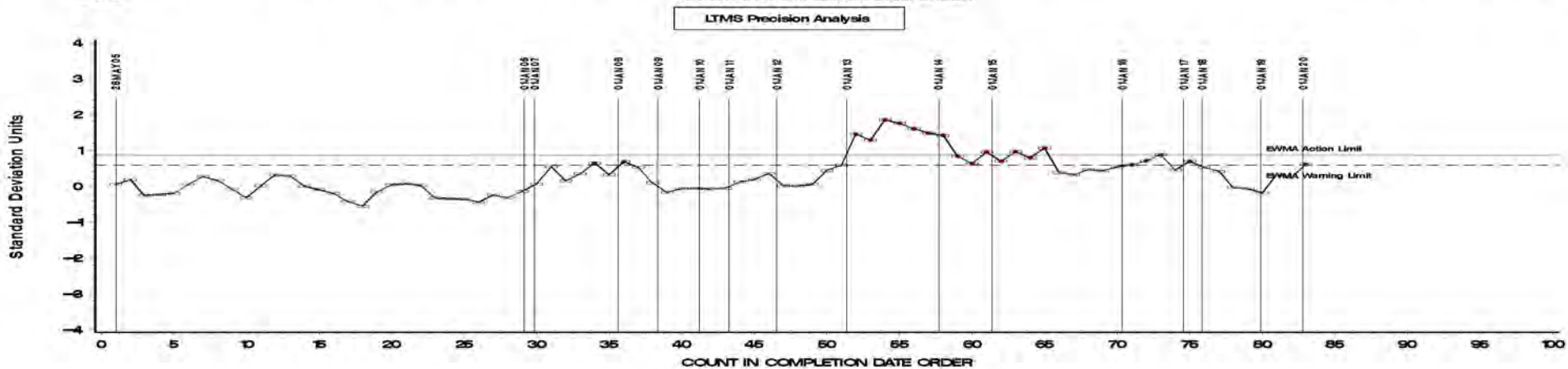
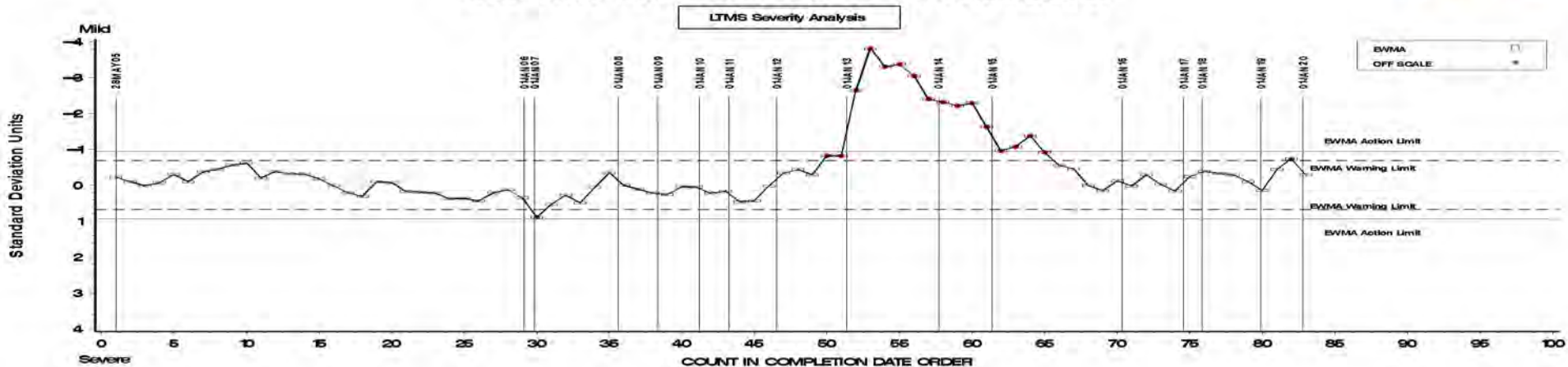
TOP GROOVE CARBON AVG — FINAL RESULT



C13 INDUSTRY OPERATIONALY VALID DATA



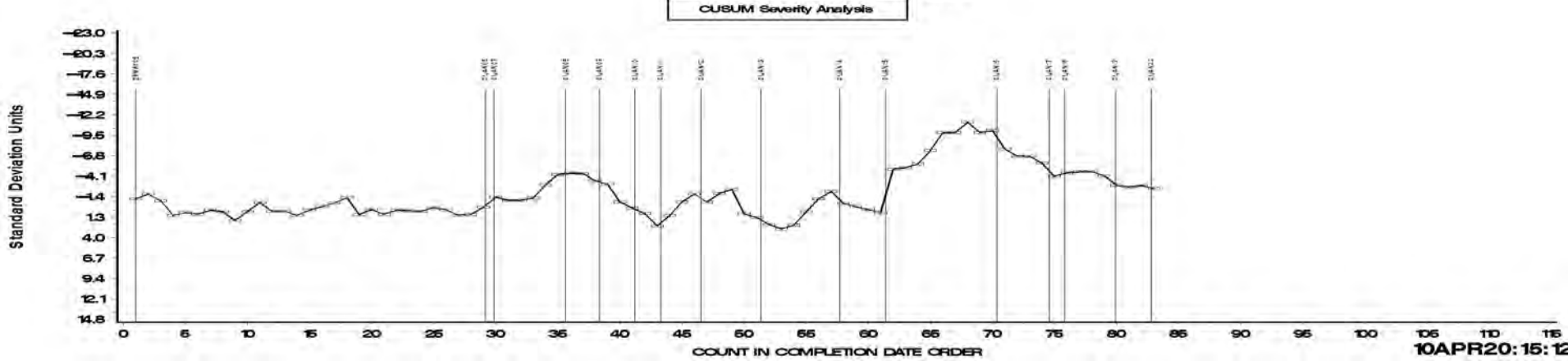
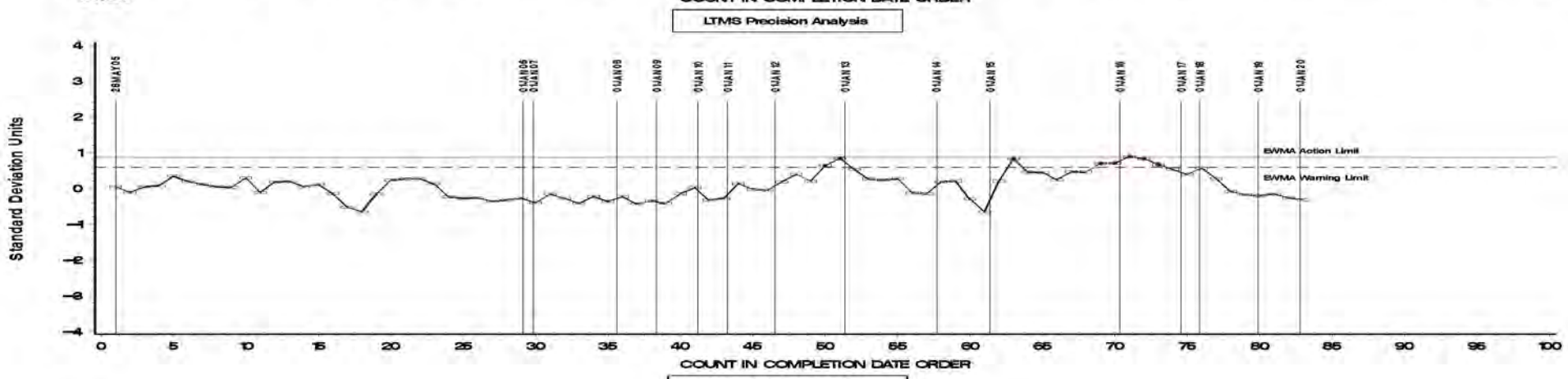
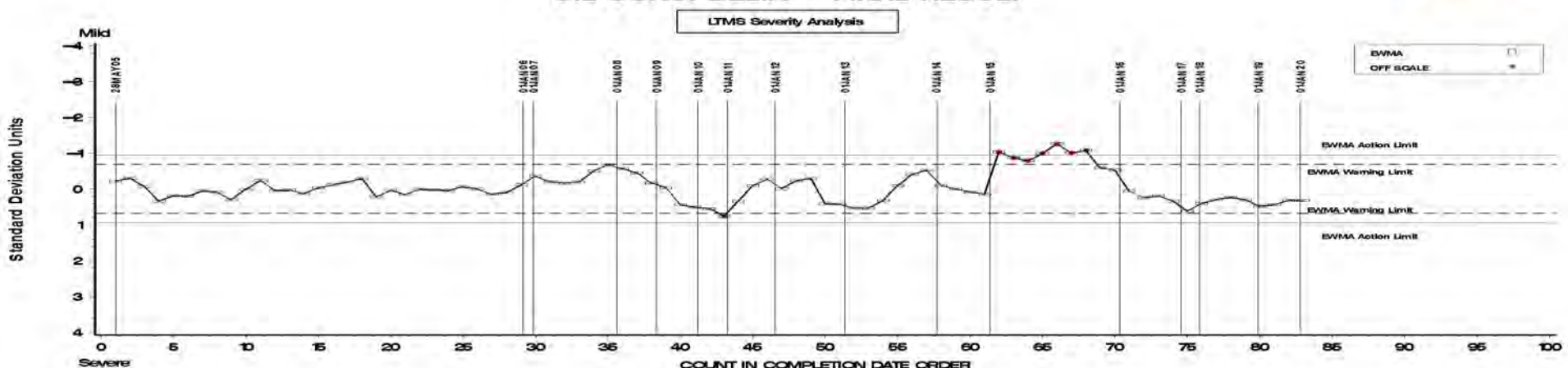
2ND RING TOP CARBON AVG. — FINAL RESULT



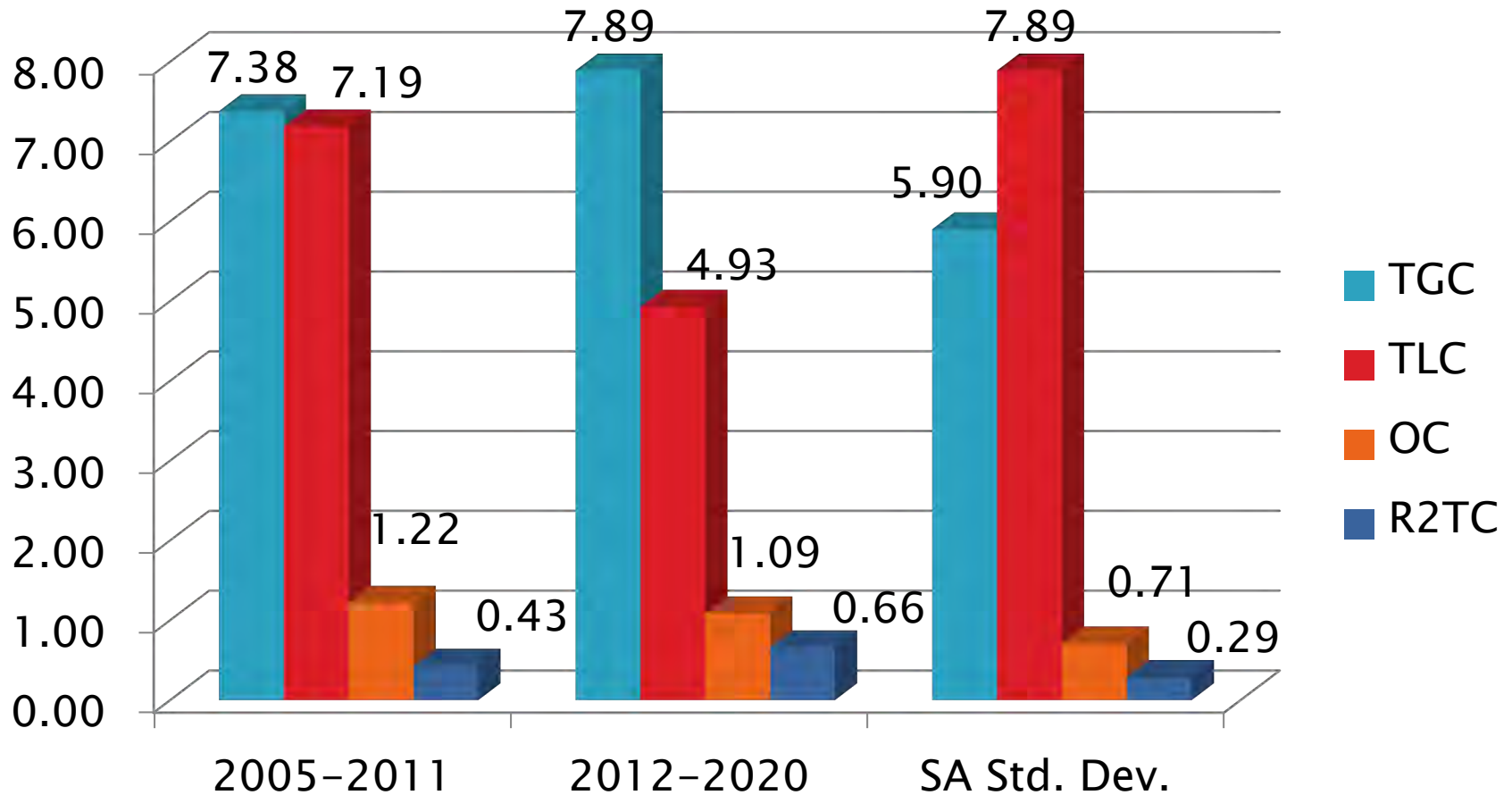
C13 INDUSTRY OPERATIONALLY VALID DATA



OIL CONS. DELTA — FINAL RESULT



C13 Precision Estimates



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C13 Oil Aeration (COAT)

»» April 2020

Test Monitoring Center

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COAT Test Activity

Test Status	Validity Code	COAT
Acceptable Calibration Test	AC	3
Failed Calibration Test	OC	0
Operationally Invalid	LC	1
Aborted	XC	1
Informational Run	NN	0
Total		5

COAT Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

COAT Lost Tests*

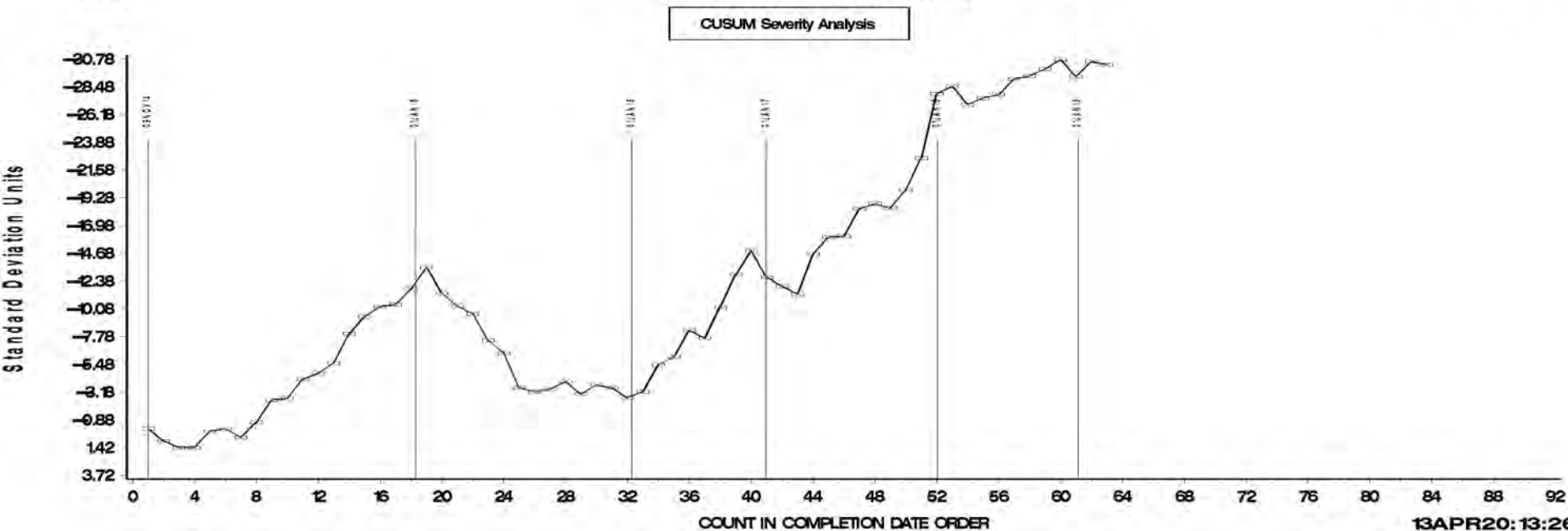
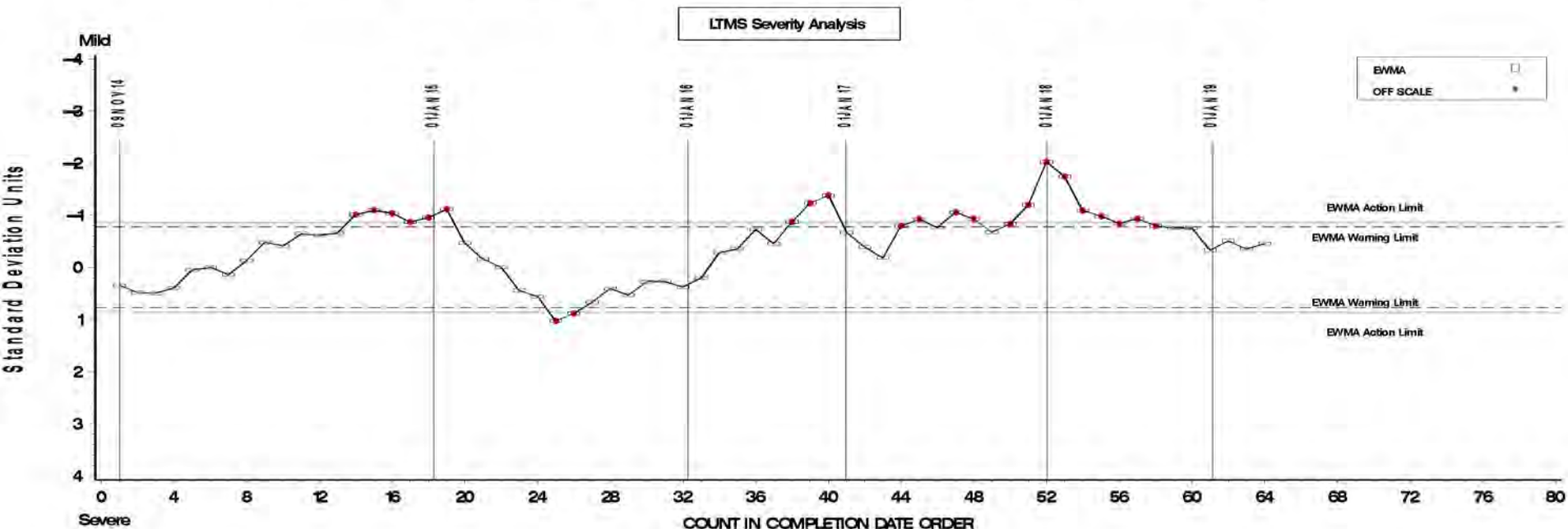
Status	Cause	#
Invalid	Bad micro-motion communication drop outs	1
Aborted	Failed micro-motion pressure transducer	1
Total		2

*Invalid and aborted tests

COAT Test Severity

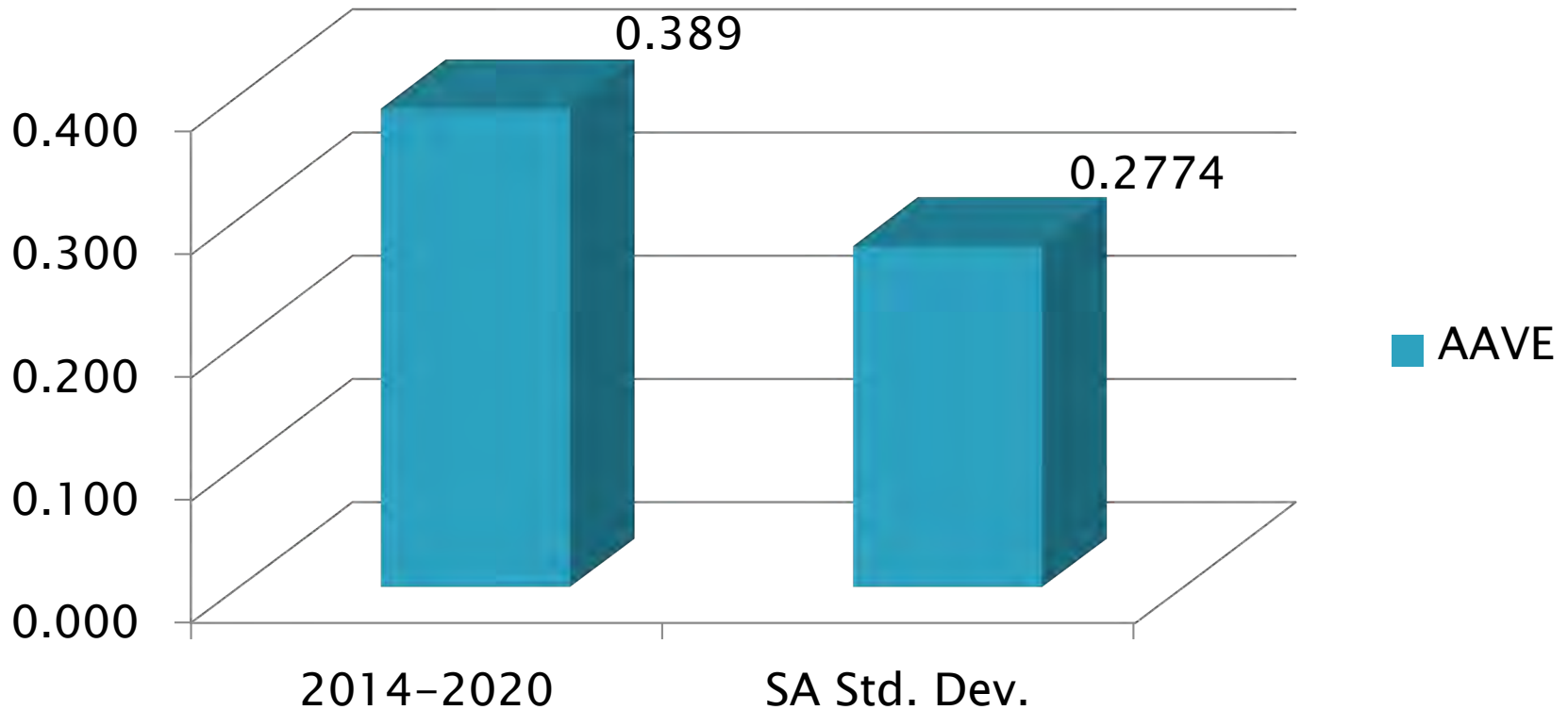
- ▶ AAVE is in control

FINAL AVERAGE OIL AERATION OVER TEST HOURS 40-50



COAT Precision Estimates

AAVE



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Daimler DD13 Scuffing Test

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Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

DD13 Test Activity

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

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

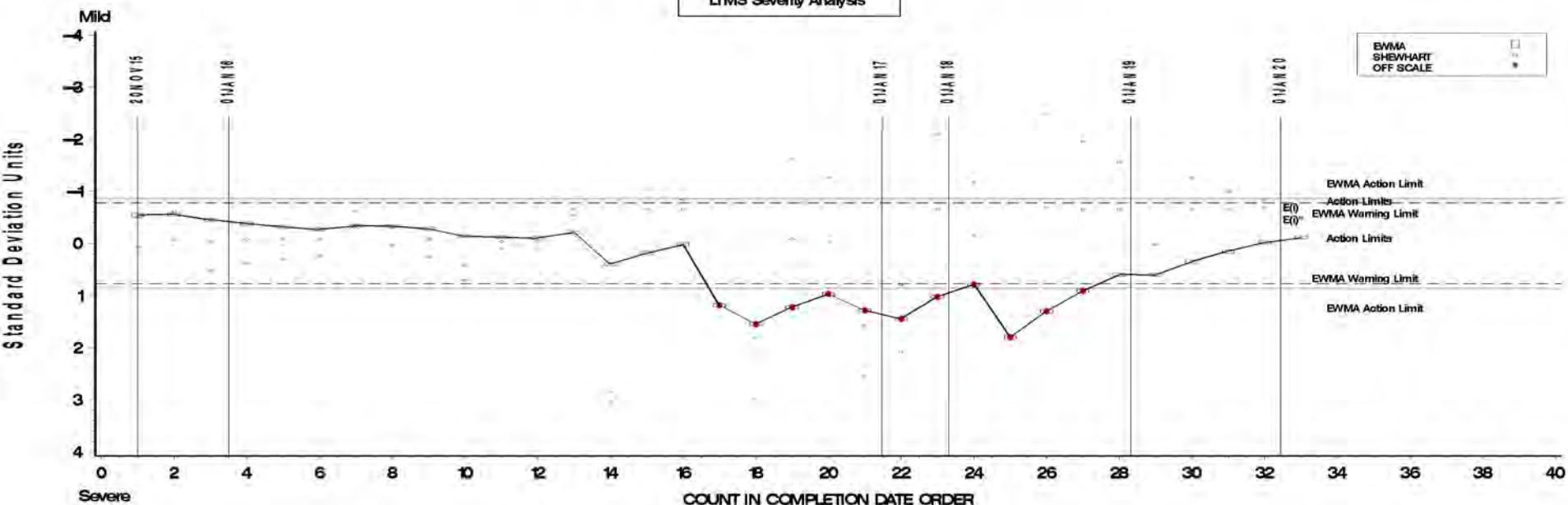
*Invalid and aborted tests

DD13 Test Severity

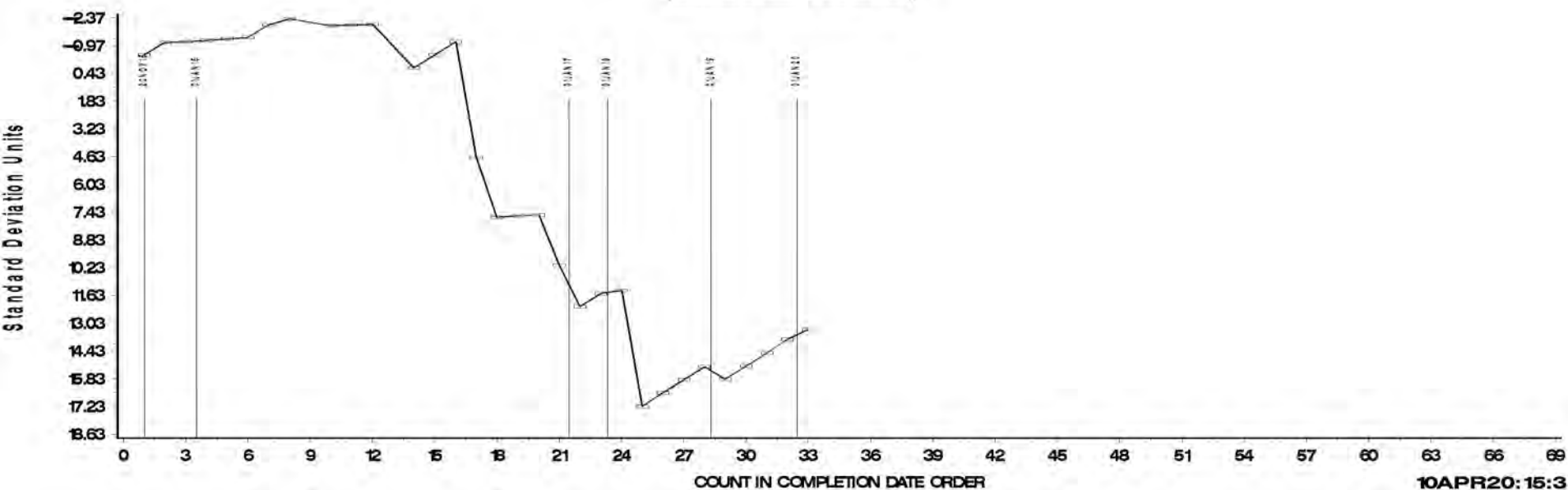
- ▶ HRS2 is in control.

FNL. ORIG. UNIT HOURS TO SCUFF

LTMS Severity Analysis

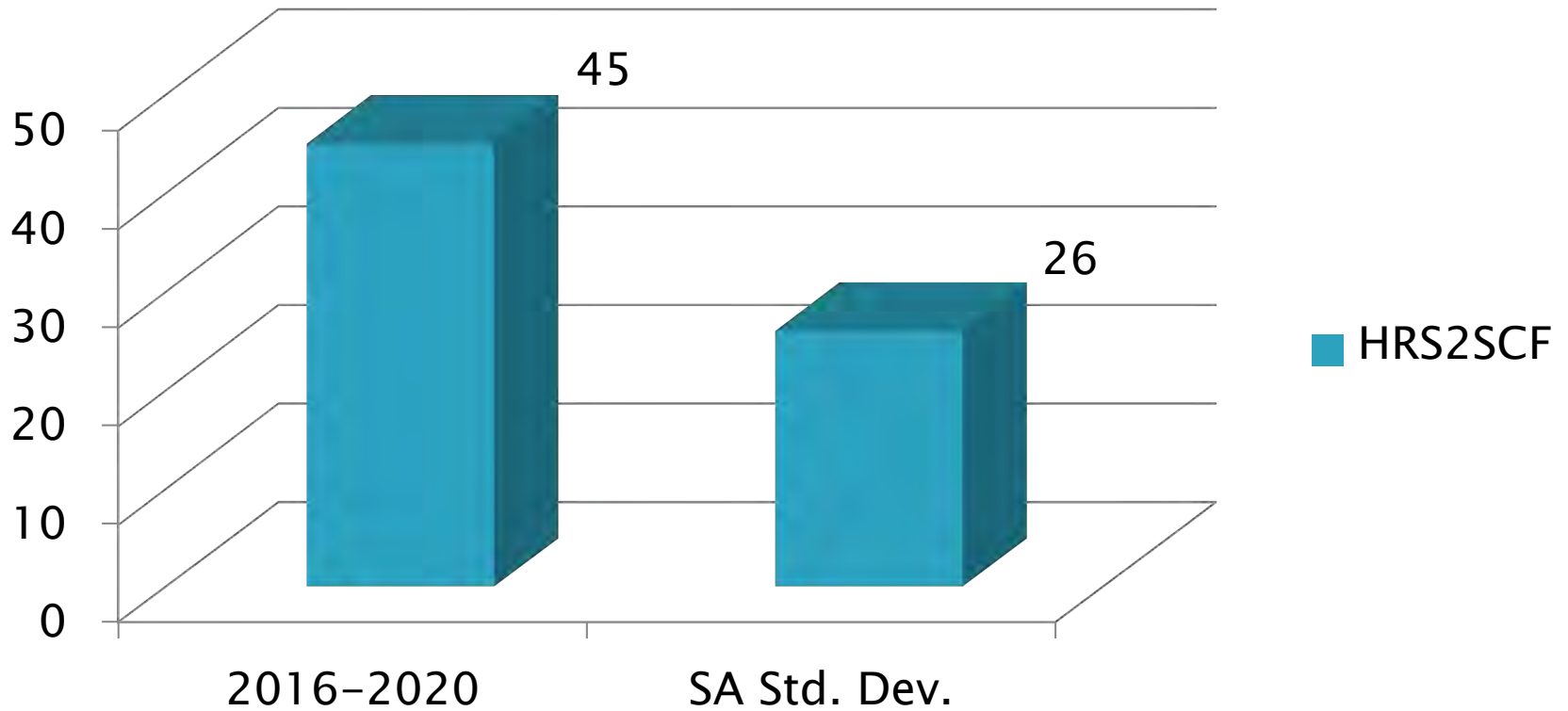


CUSUM Severity Analysis



DD13 Precision Estimates

HRS2SCF



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Cummins ISB

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Test Monitoring Center

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A Program of ASTM International

ISB Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	1
Failed Calibration Test	OC	2
Operationally Invalid	LC	0
Aborted	XC	0
Total		3

ISB Failed Tests

Failed Parameter	Number of Tests
ACSW Severe	2
Total	2

ISB Lost Tests*

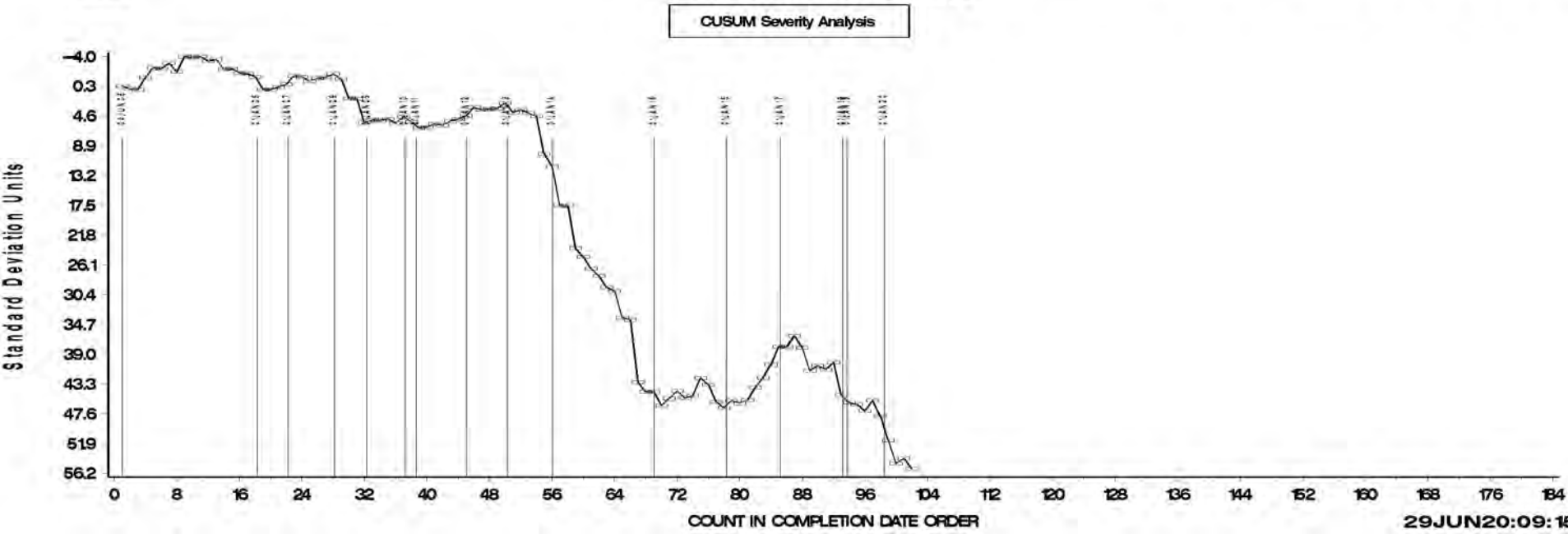
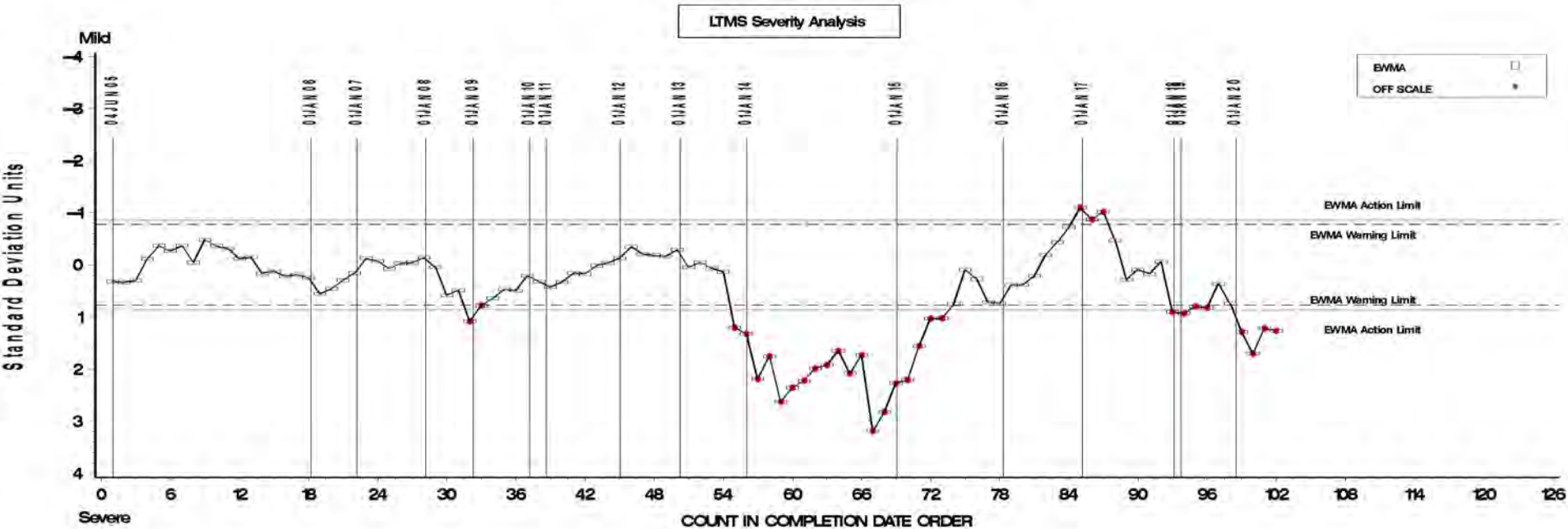
Status	Cause	#
Invalid	No invalid tests	0
Aborted	No Aborted Tests	0
Total		0

*Invalid and aborted tests

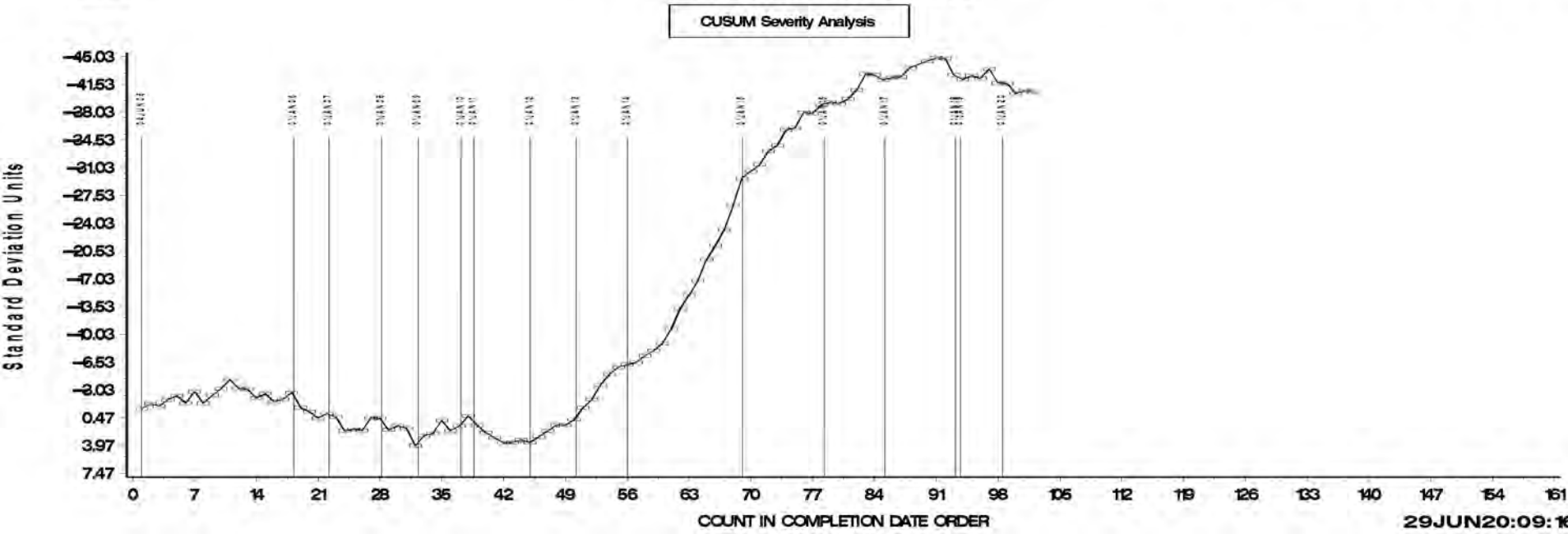
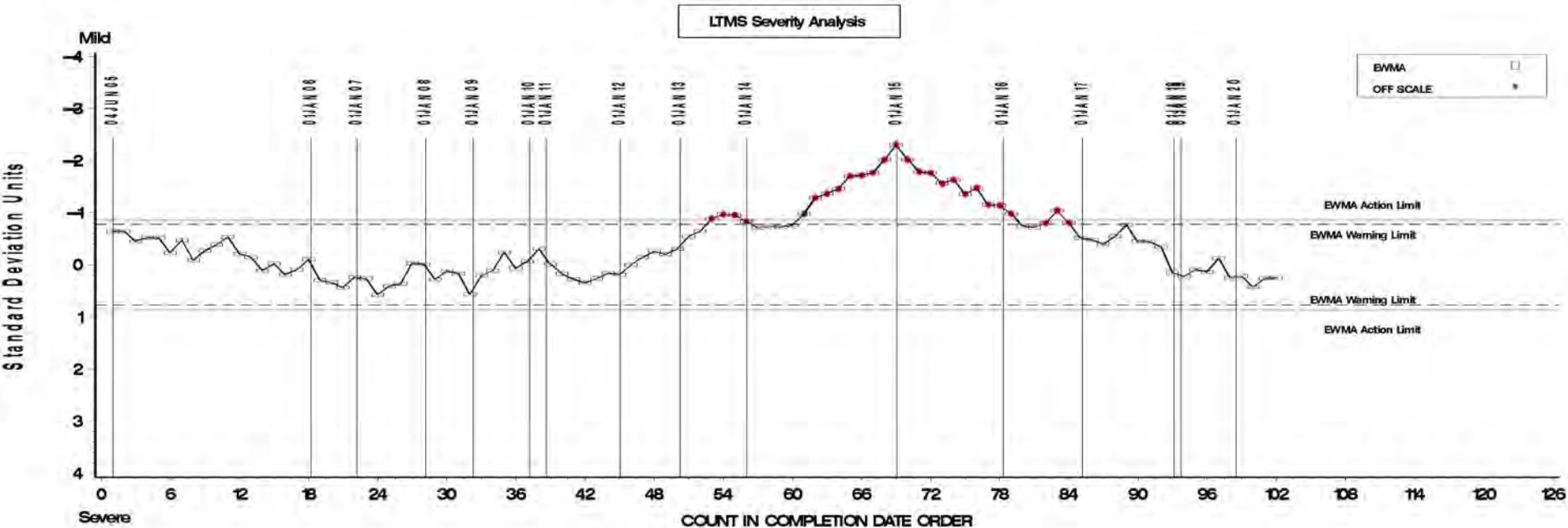
ISB Test Severity

- ▶ ATWL in control.
- ▶ ACSW in Zi level 2 (action) alarm.

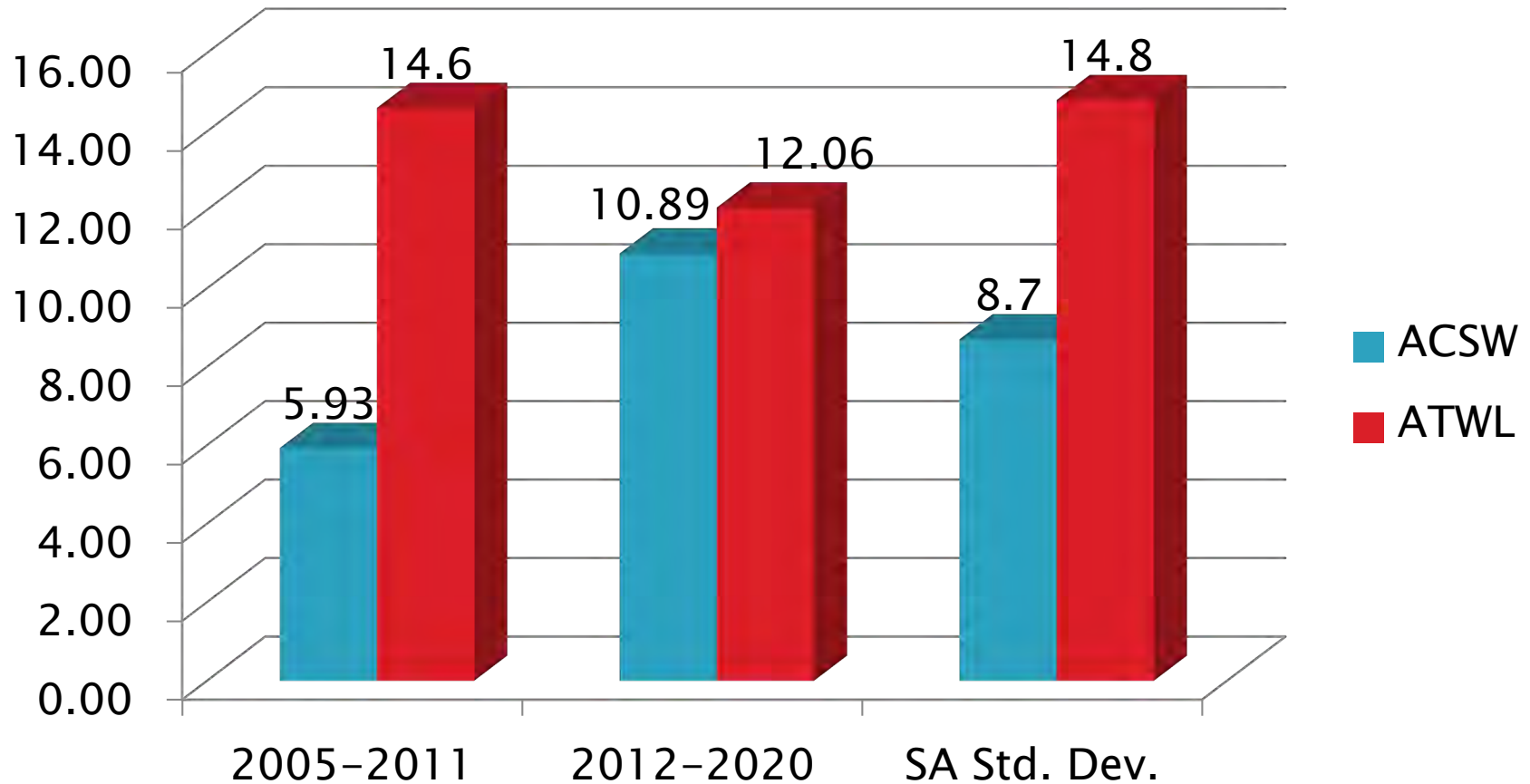
AVERAGE CAMSHAFT WEAR



AVERAGE TAPPET WEIGHT LOSS



ISB Precision Estimates



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Cummins ISM

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ISM Test Activity

Test Status	Validity Code	#
Acceptable Calibration	AC	4
Failed Calibration	OC	1
Operationally Invalid	LC	0
Aborted	XC	0
Total		5

ISM Failed Tests

Failed Parameter	Number of Tests
FPD and IAS severe. ASR mild	1
Total	1

ISM Lost Tests*

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

*Invalid and aborted tests

ISM Test Severity

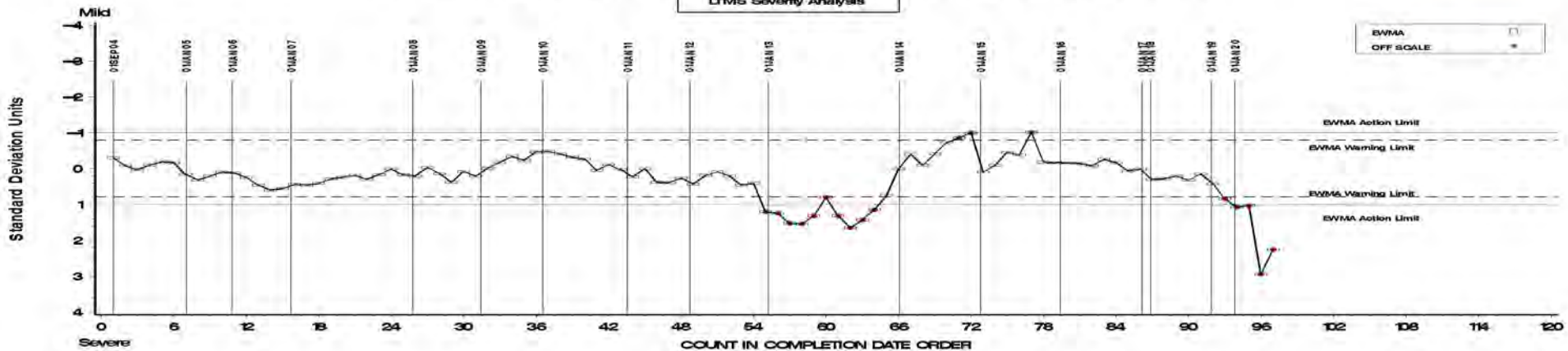
- ▶ CWL and FPD are in control.
- ▶ ASR is in a precision warning alarm.
- ▶ IAS is in severity action alarm in the mild direction as well as a precision action alarm.

ISM INDUSTRY OPERATIONALLY VALID DATA

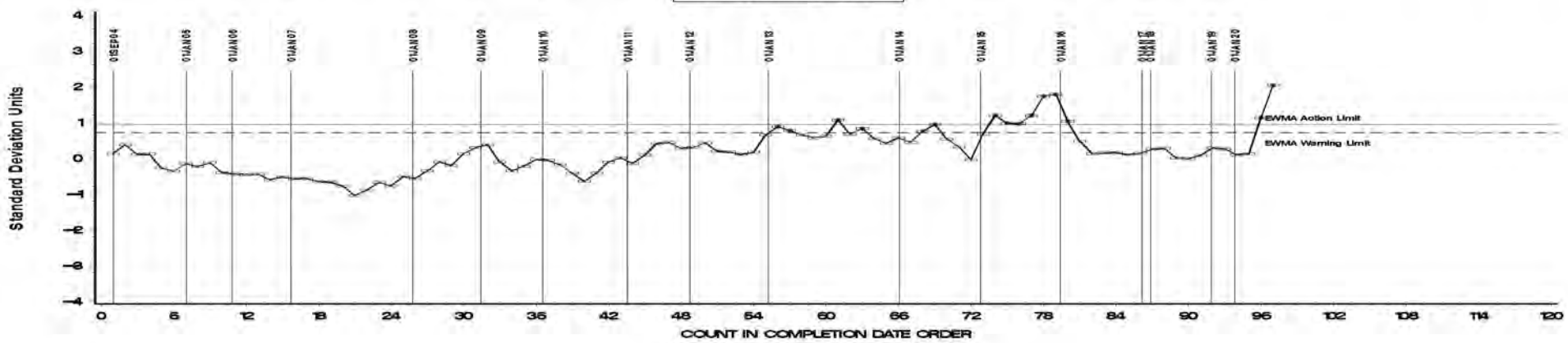


INJECTOR SCREW WEIGHT LOSS ADJUSTED TO 3.9% SOOT

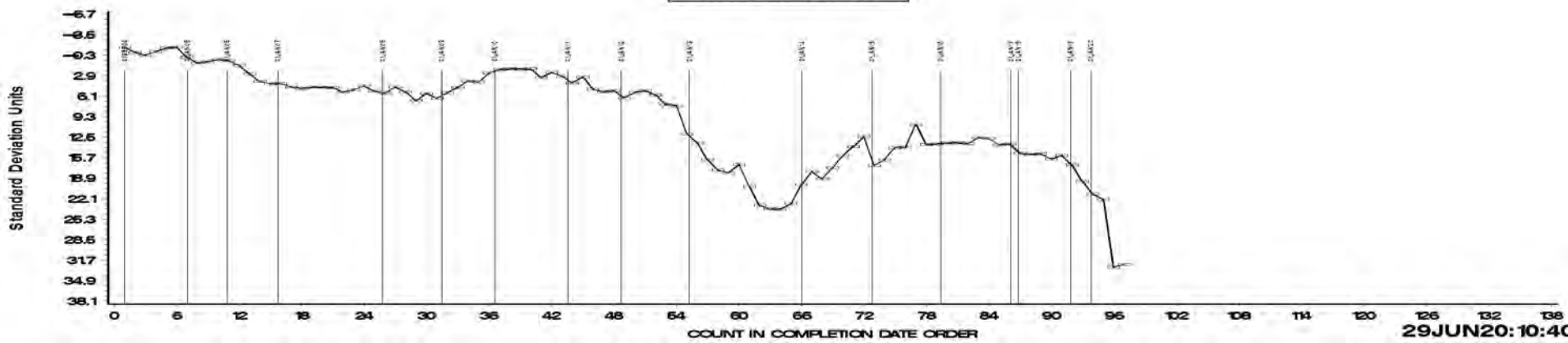
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

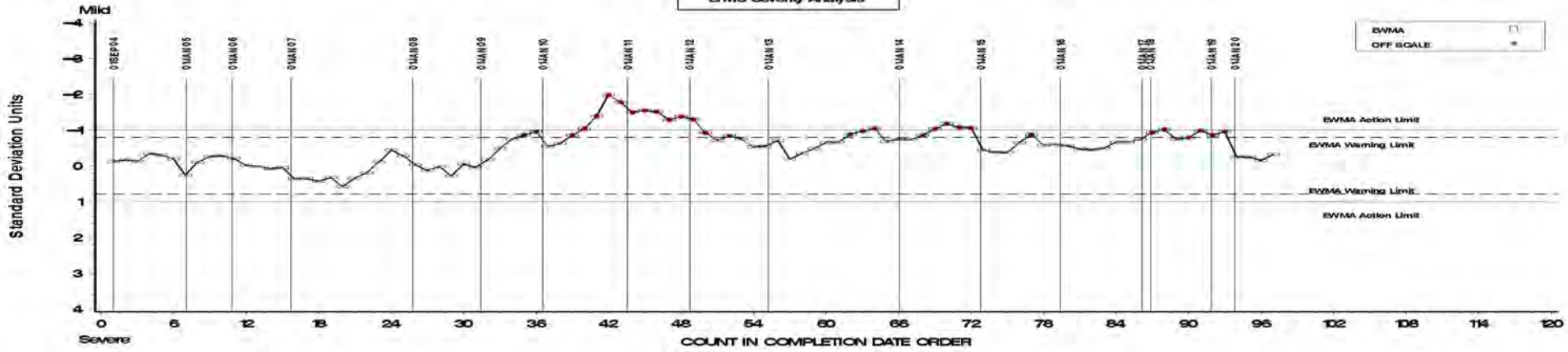


ISM INDUSTRY OPERATIONALLY VALID DATA

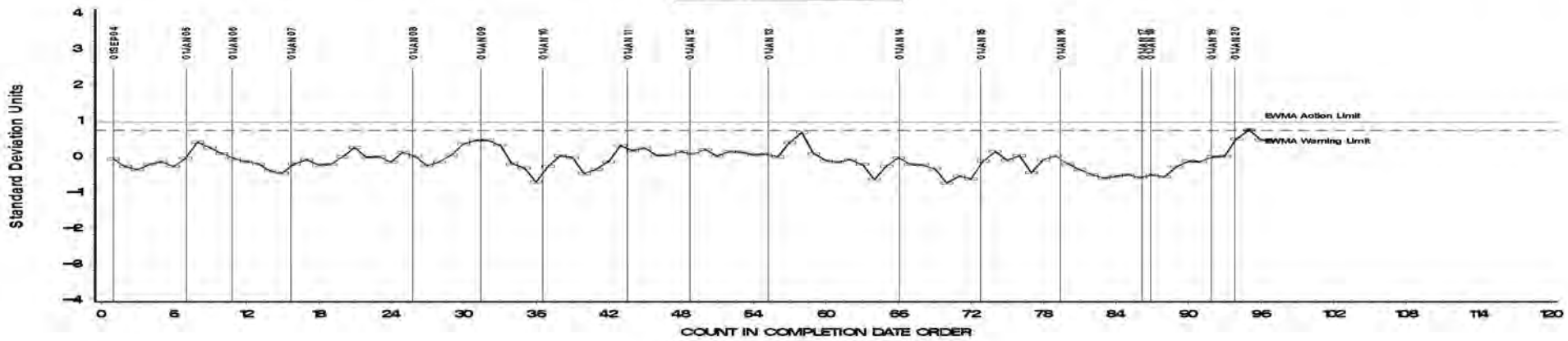


FILTER PLUGGING DELTA P

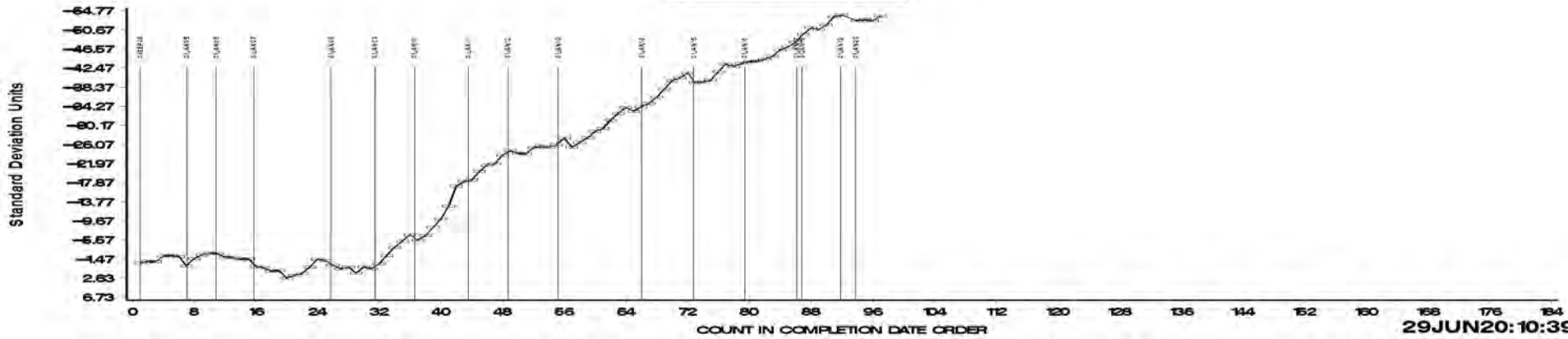
LTMS Severity Analysis



LTMS Precision Analysis

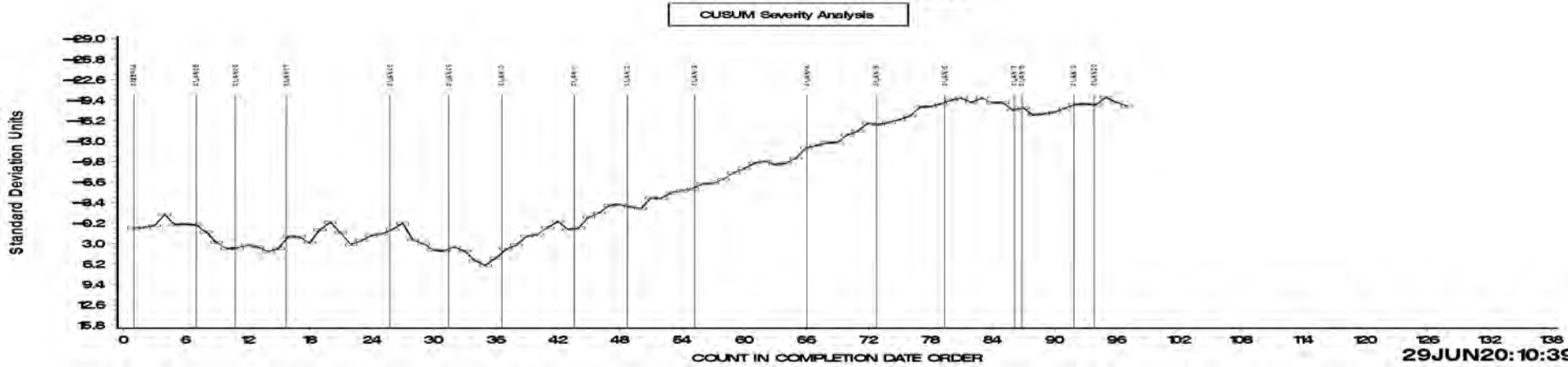
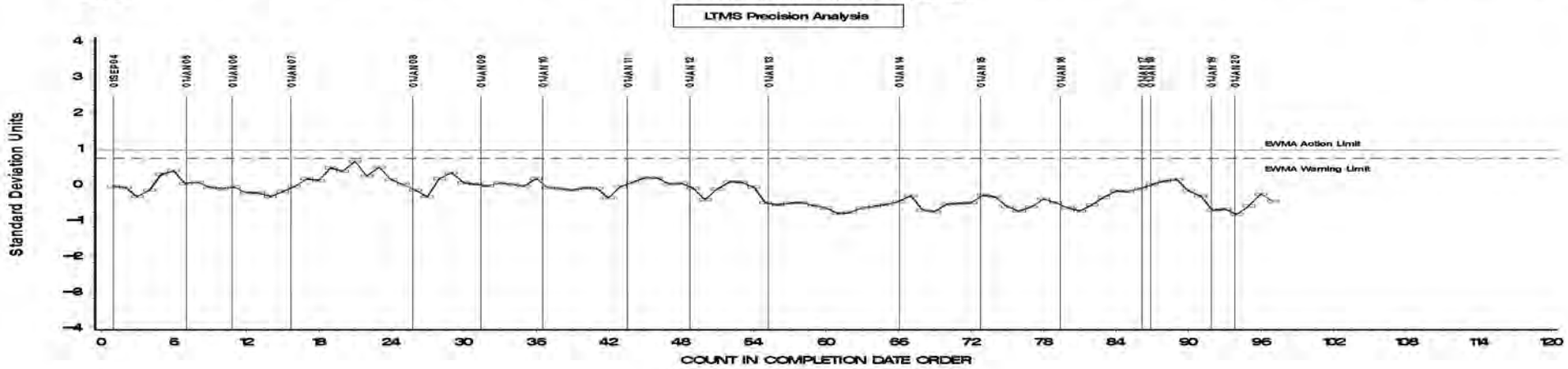
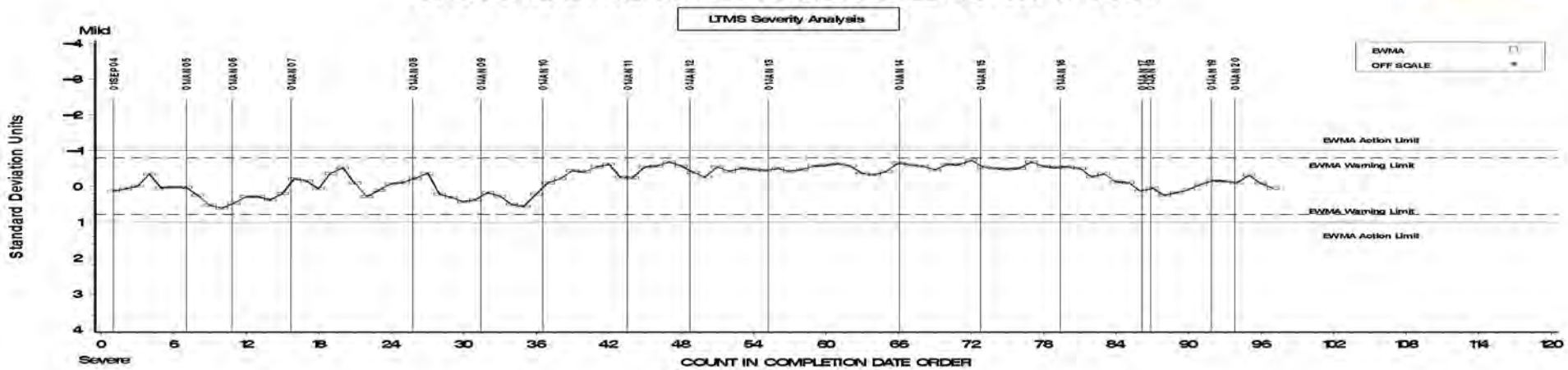


CUSUM Severity Analysis



ISM INDUSTRY OPERATIONALLY VALID DATA

CROSSHEAD WEIGHT LOSS ADJUSTED TO 3.9 % SOOT



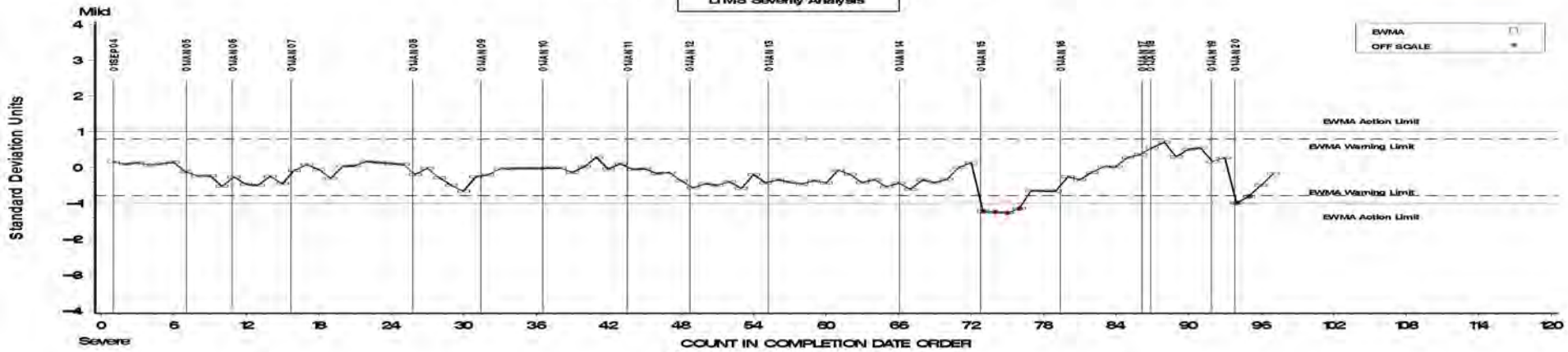
ISM INDUSTRY OPERATIONALLY VALID DATA



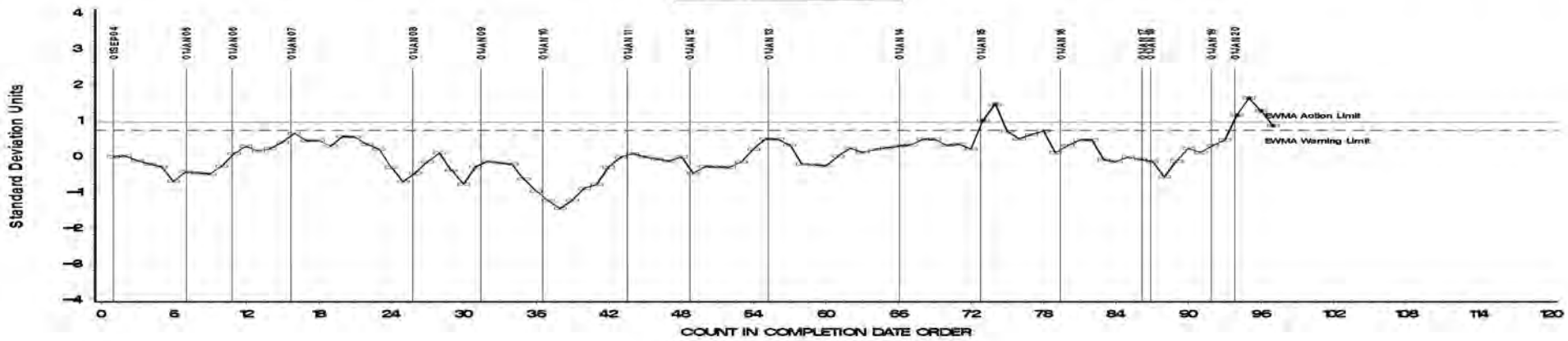
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AVERAGE SLUDGE RATING

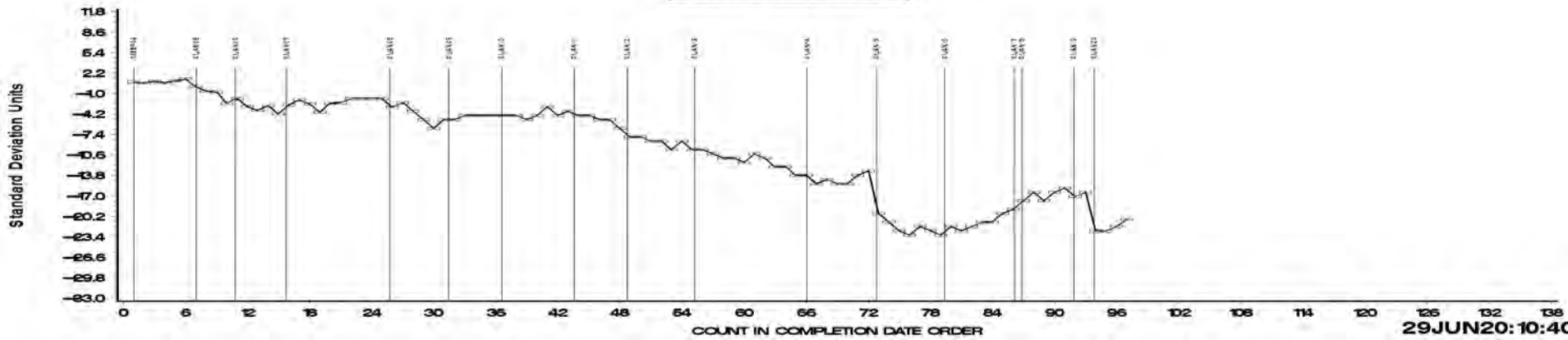
LTMS Severity Analysis



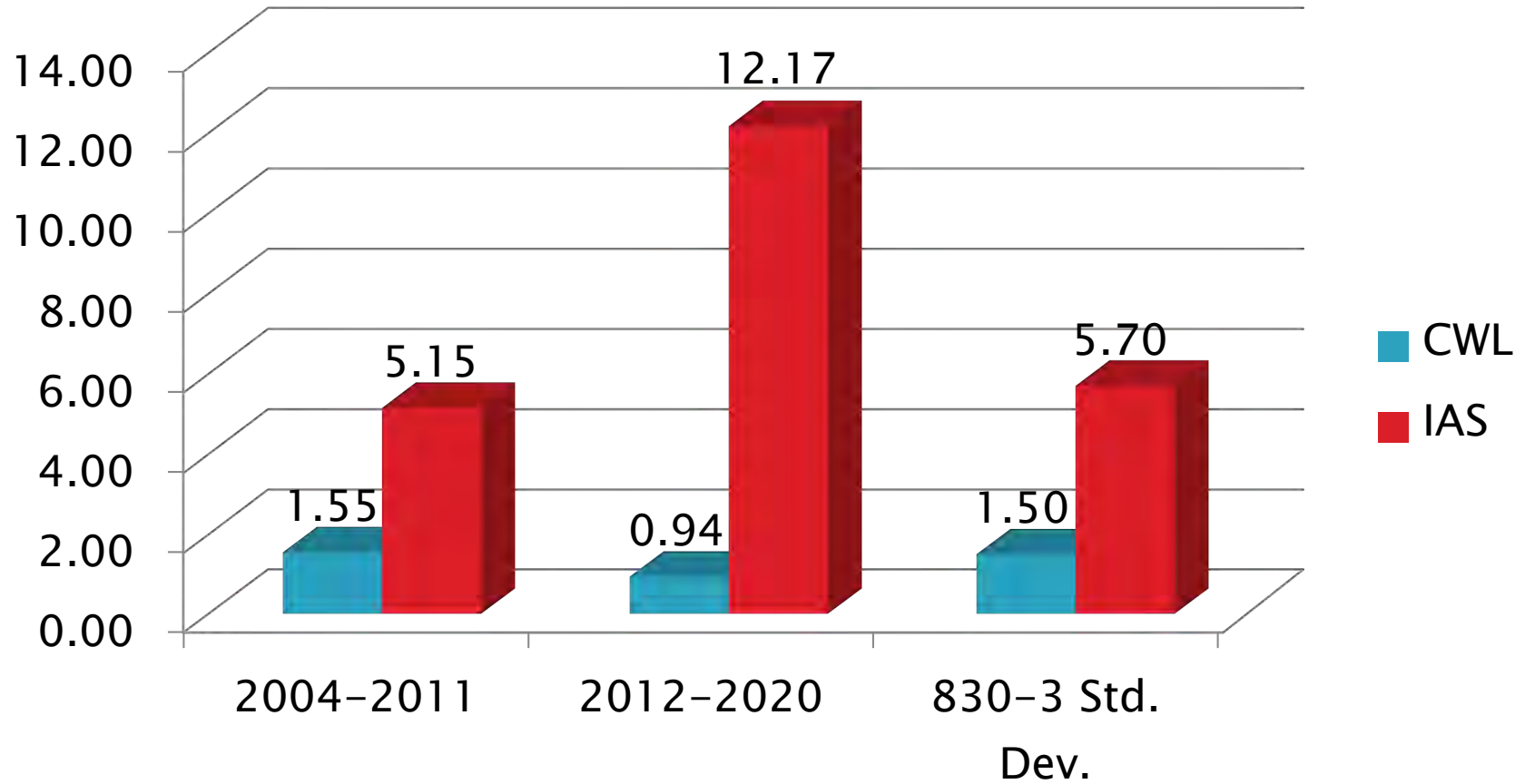
LTMS Precision Analysis



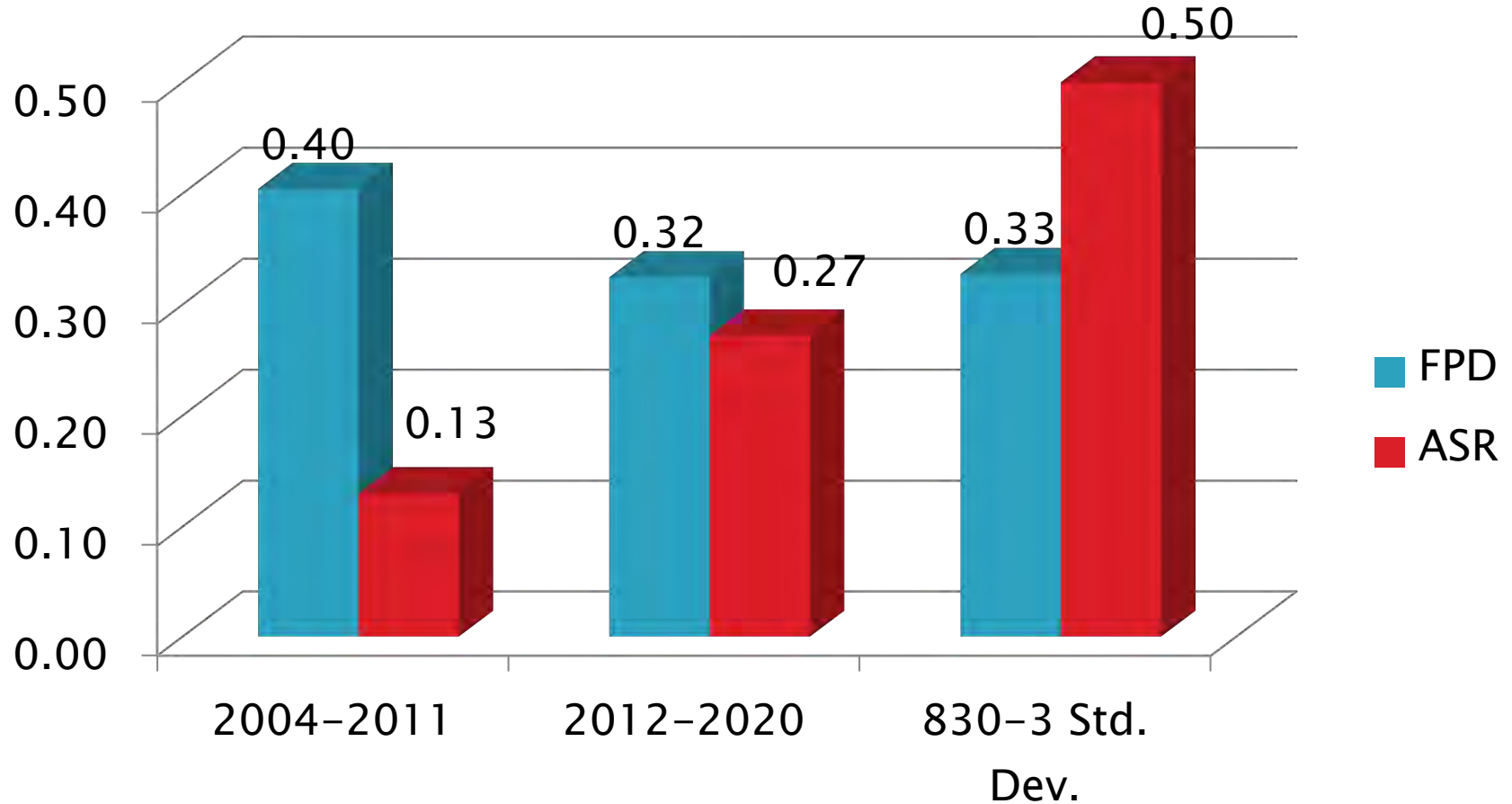
CUSUM Severity Analysis



ISM Precision Estimates



ISM Precision Estimates



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EOAT

»» April 2020

Test Monitoring Center

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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

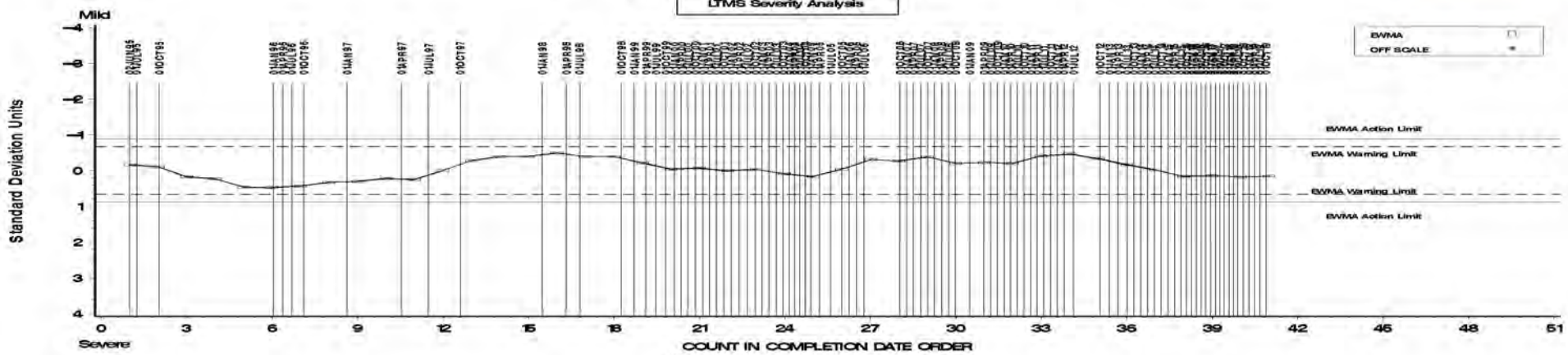
- ▶ AEOA is in control

EOAT INDUSTRY OPERATIONALLY VALID DATA

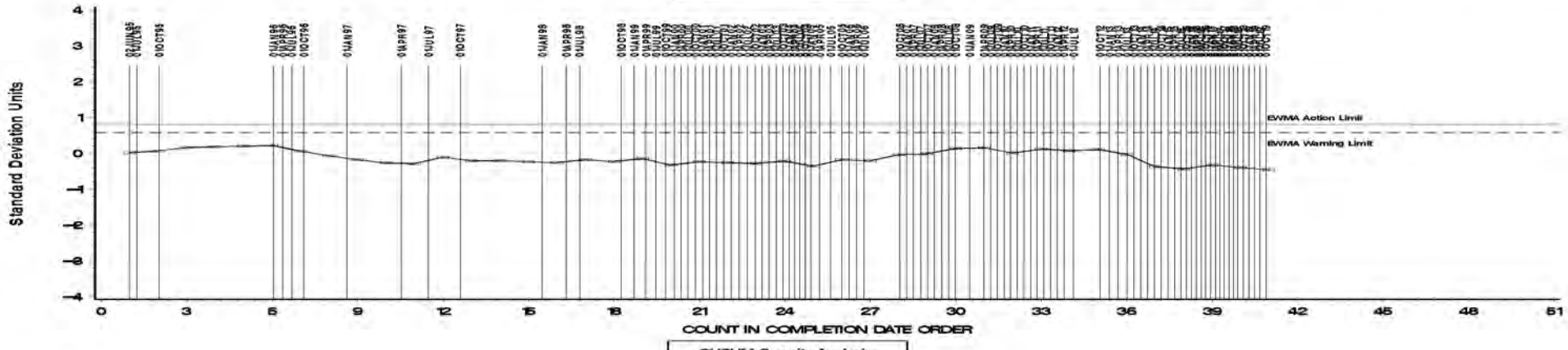


ENGINE OIL AERATION

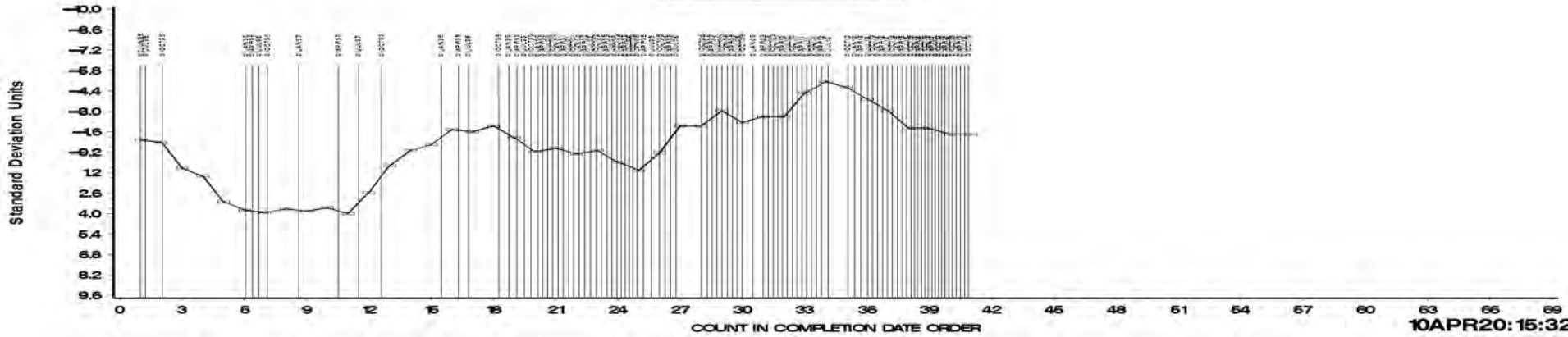
LTMS Severity Analysis



LTMS Precision Analysis

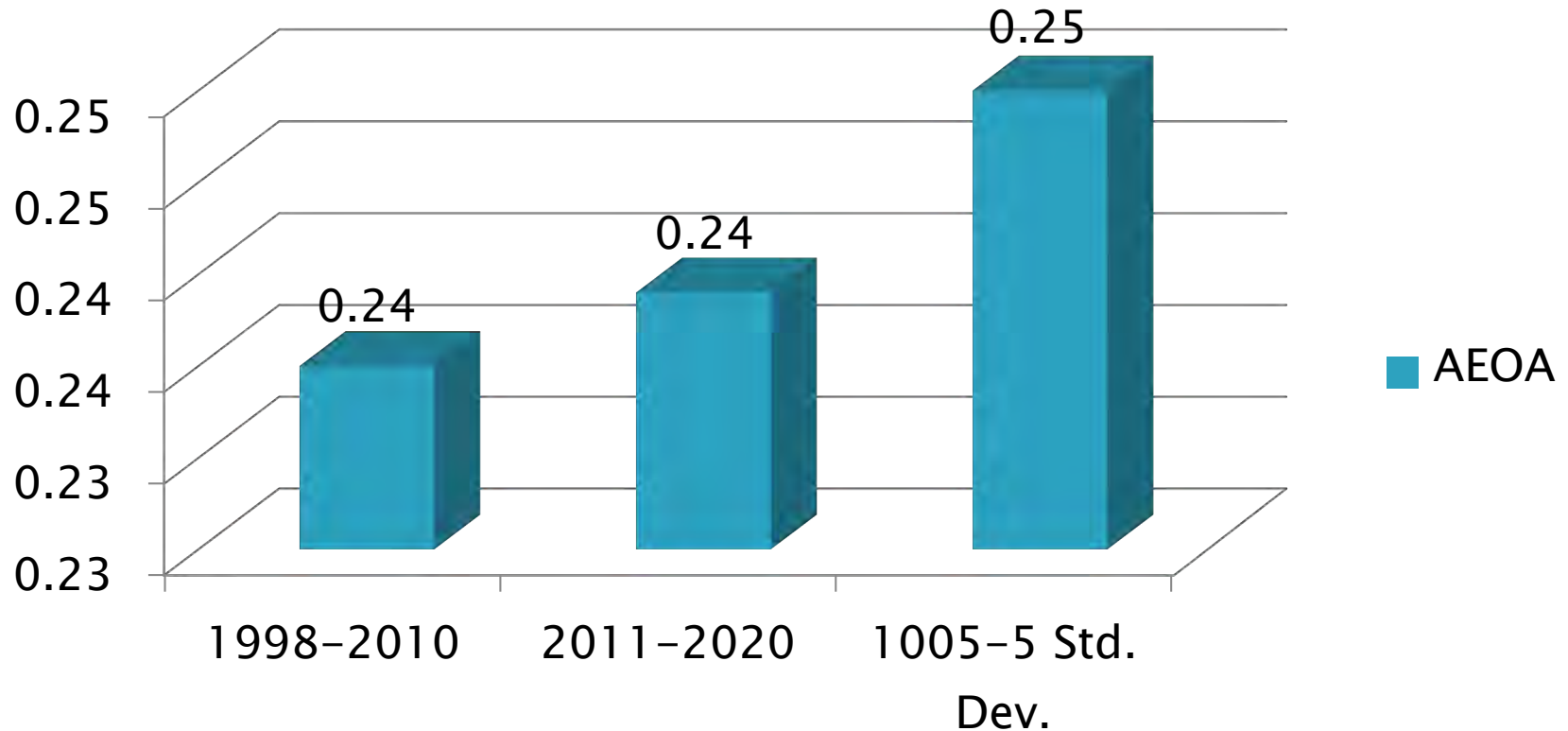


CUSUM Severity Analysis



EOAT Precision Estimates

AEOA



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Test Monitoring Center

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RFWT

»» April 2020

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

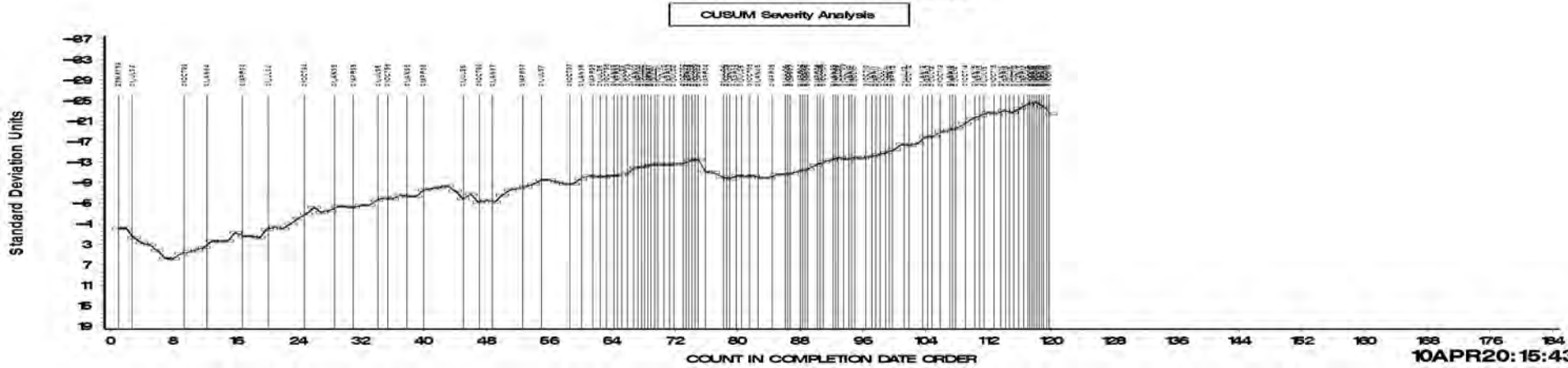
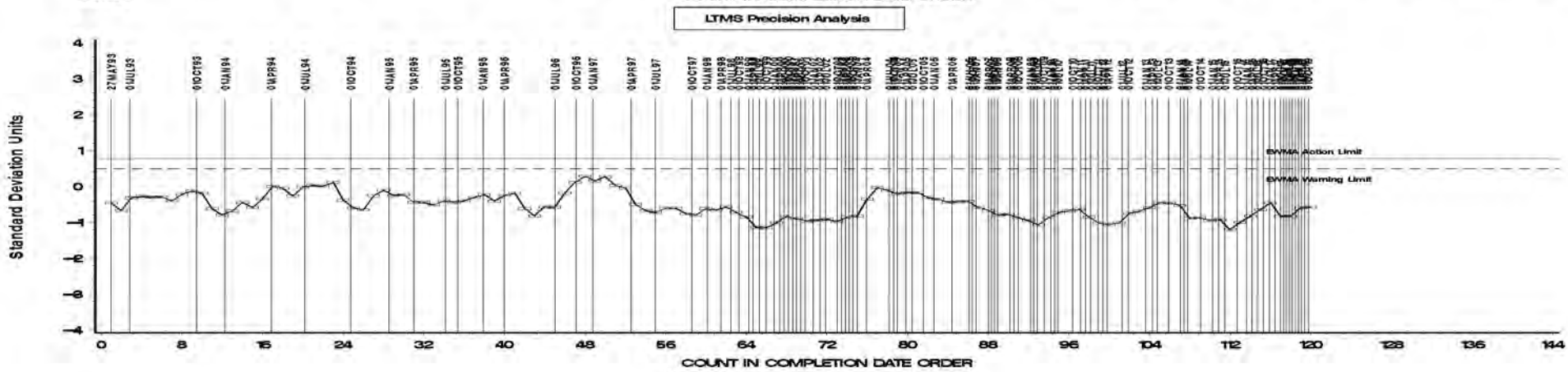
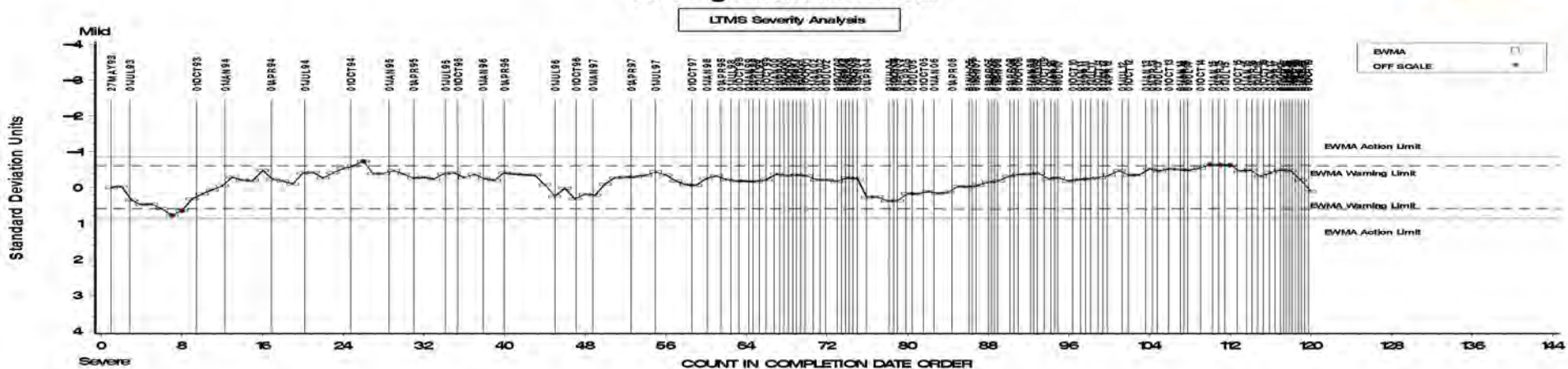
RFWT Test Severity

- ▶ AFW is in control

RFWT INDUSTRY OPERATIONALLY VALID DATA

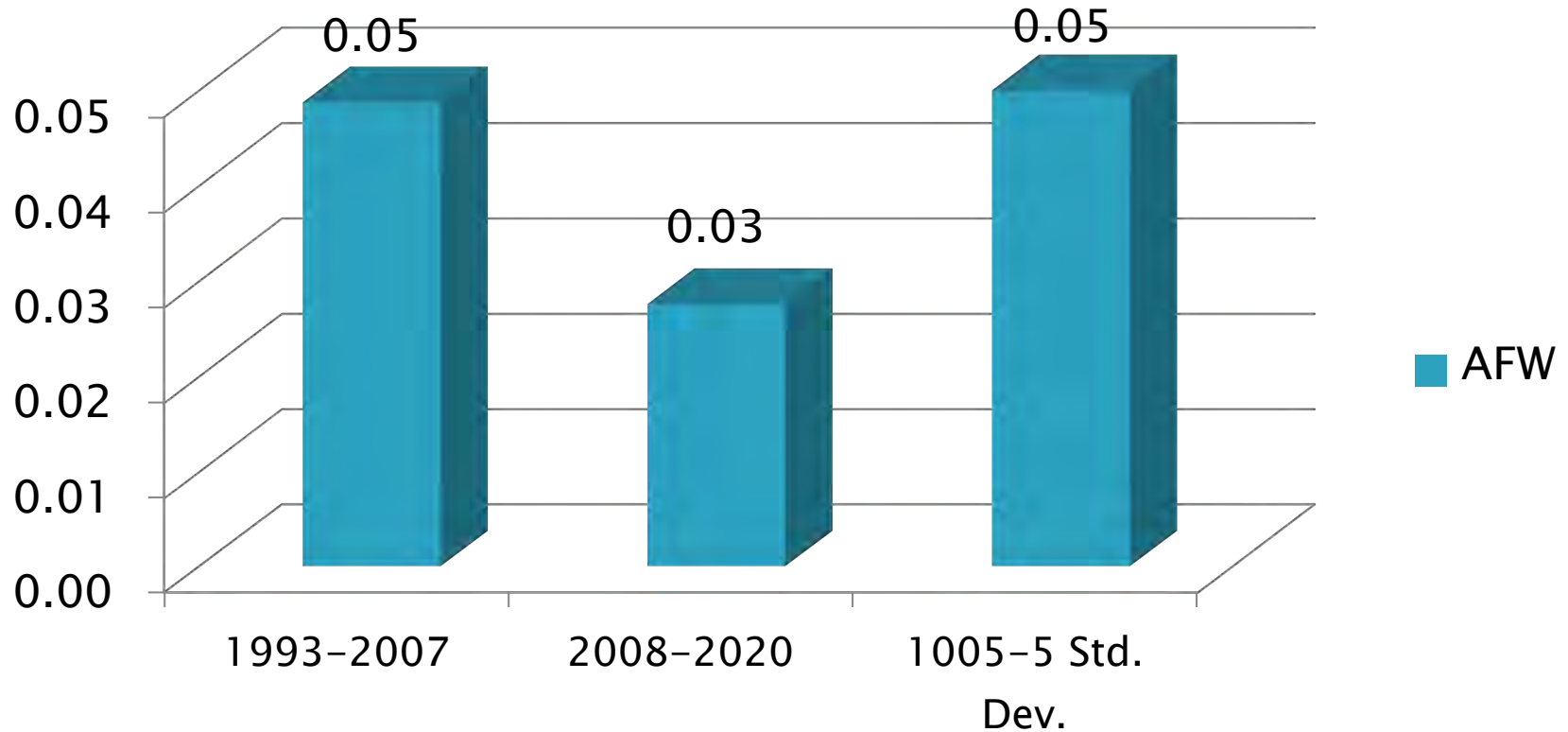


Average Follower Wear



RFWT Precision Estimates

AFW



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Mack T-8/T-8E

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Test Monitoring Center

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T-8/T-8E Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	3
Failed Calibration Test	OC	1
Operationally Invalid	LC	2
Aborted	XC	0
Total		6

T-8/T8-E Failed Tests

Failed Parameter	Number of Tests
RV2 (RELATIVE VISCOSITY @ 4.8% SOOT 100% DIN Shear Loss) Severe	1
Total	1

T-8/T8-E Lost Tests*

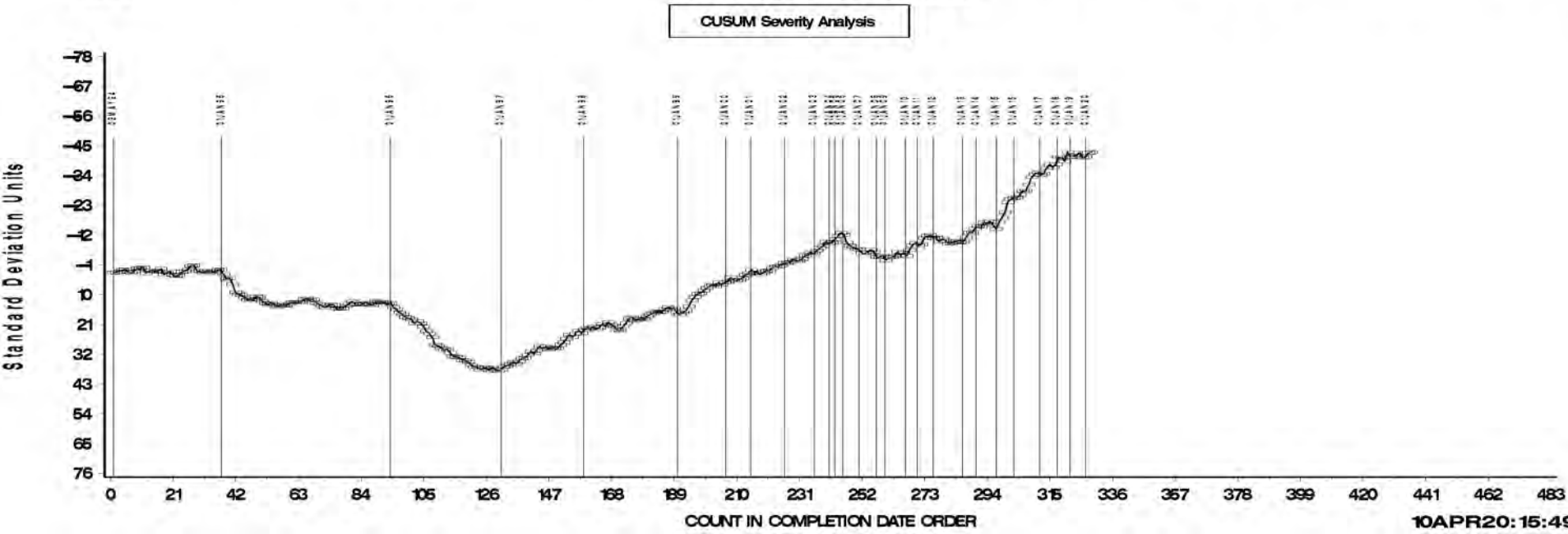
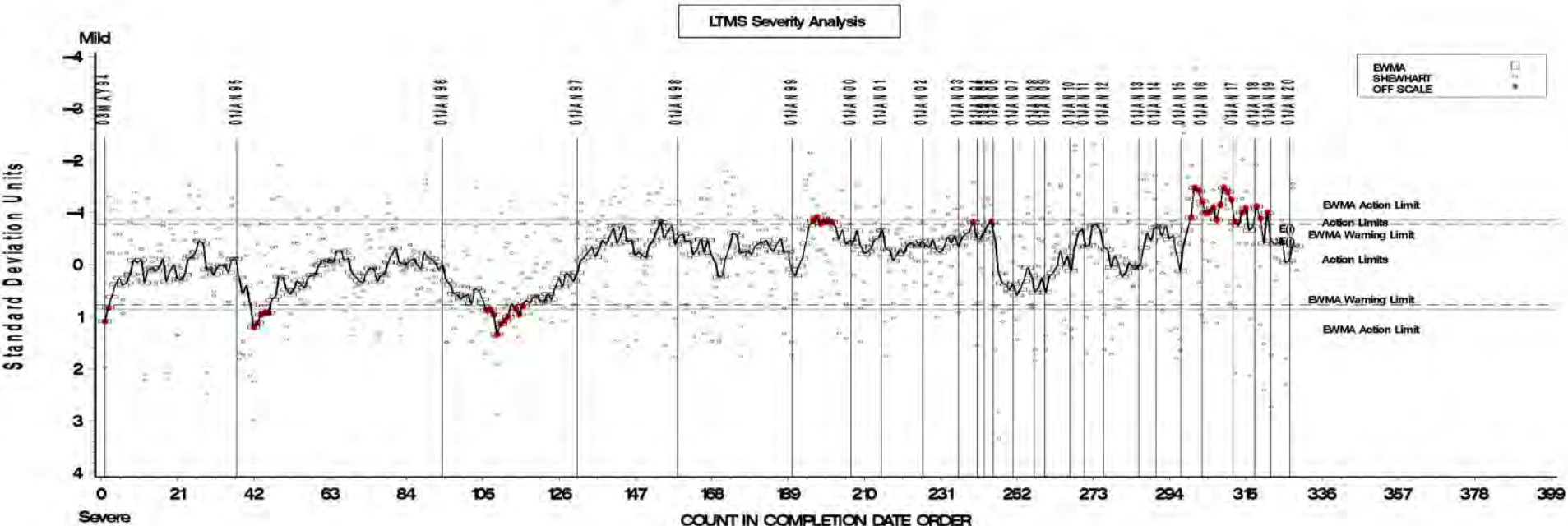
Status	Cause	#
Invalid	Missed soot window	1
Invalid	High oil consumption	1
Aborted	No aborted tests	0
Total		2

*Invalid and aborted tests

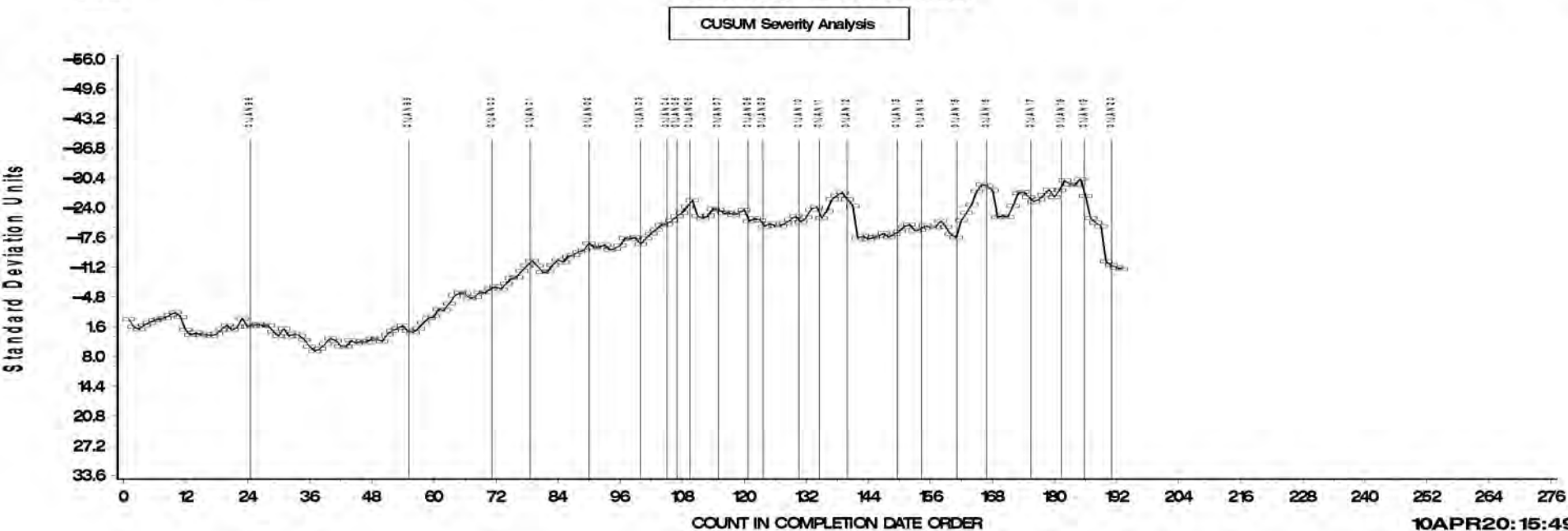
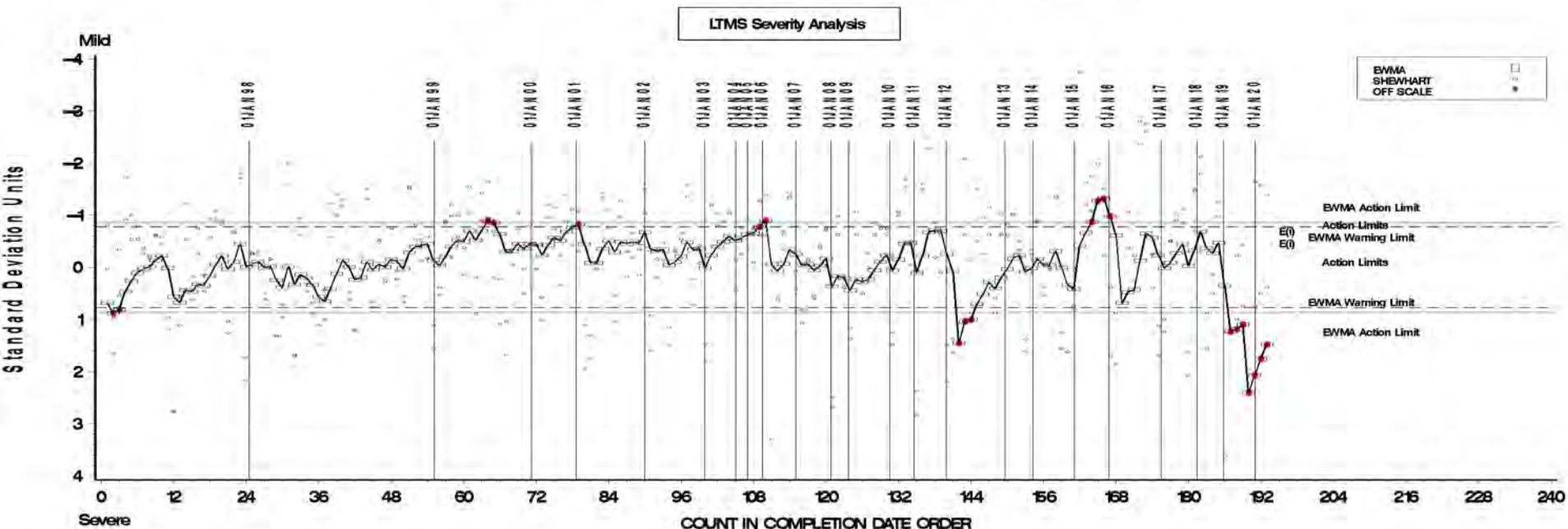
T-8/T-8E Test Severity

- ▶ VI38 is in control.
- ▶ RV48 is in Level 2 Zi alarm in severe direction.
- ▶ RV2 is in Level 2 Zi alarm in severe direction.

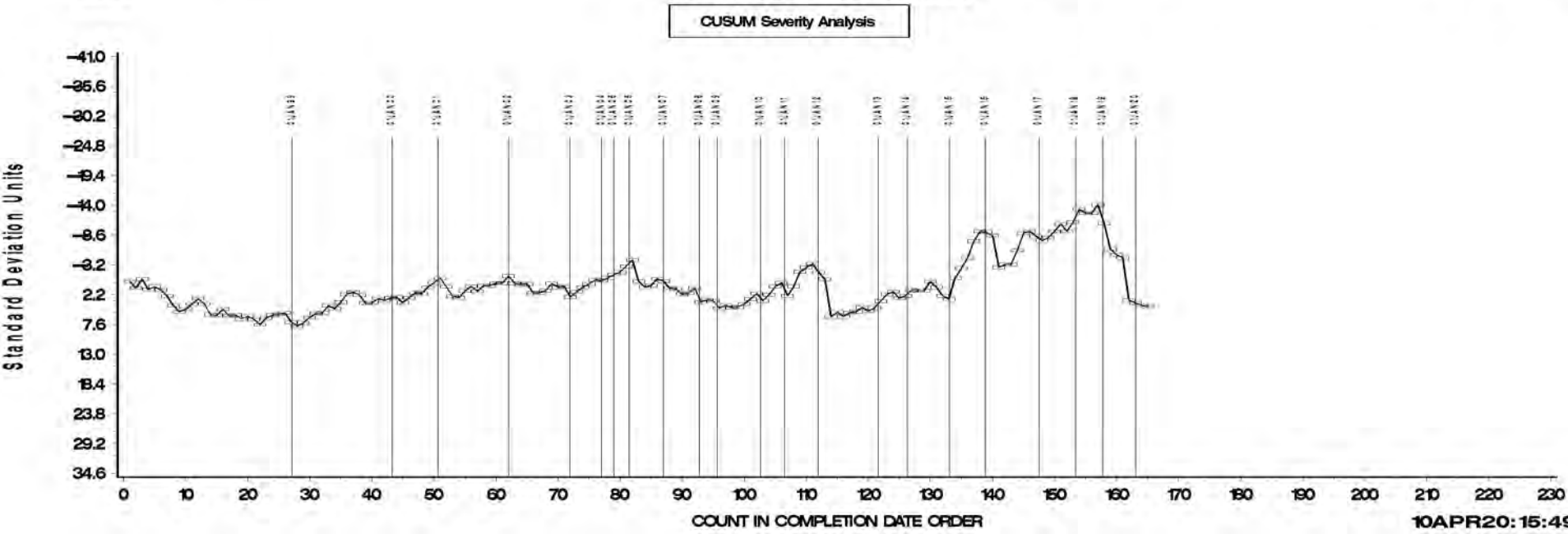
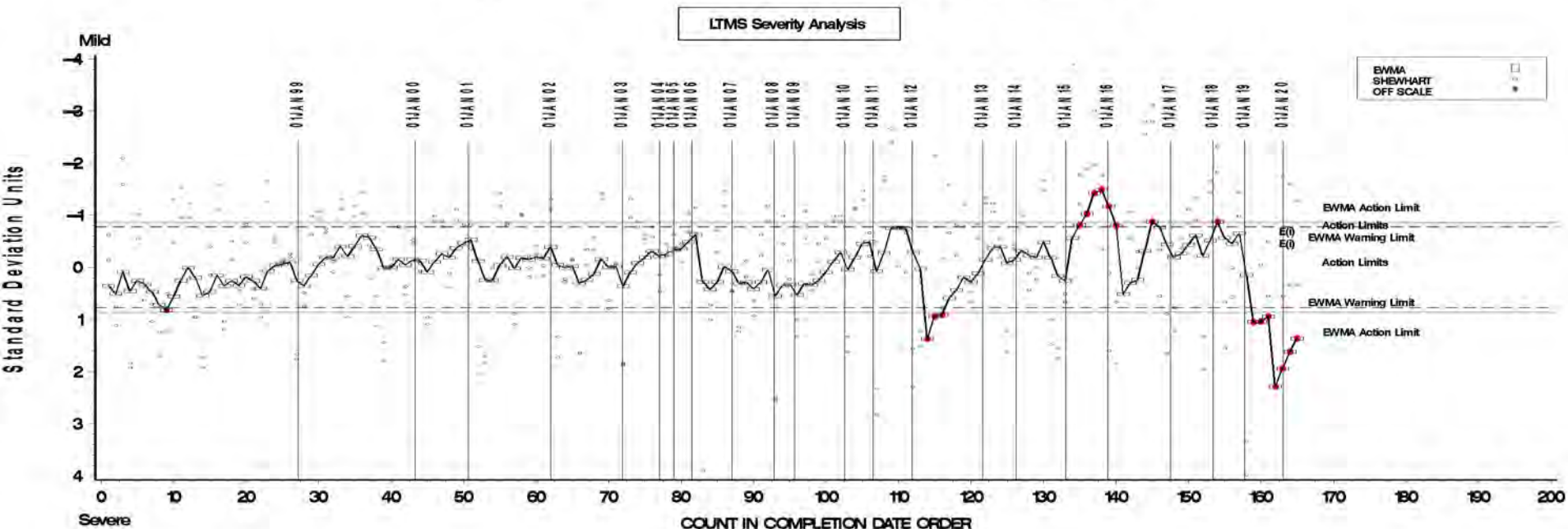
VISCOSITY INCR @ 3.8% SOOT



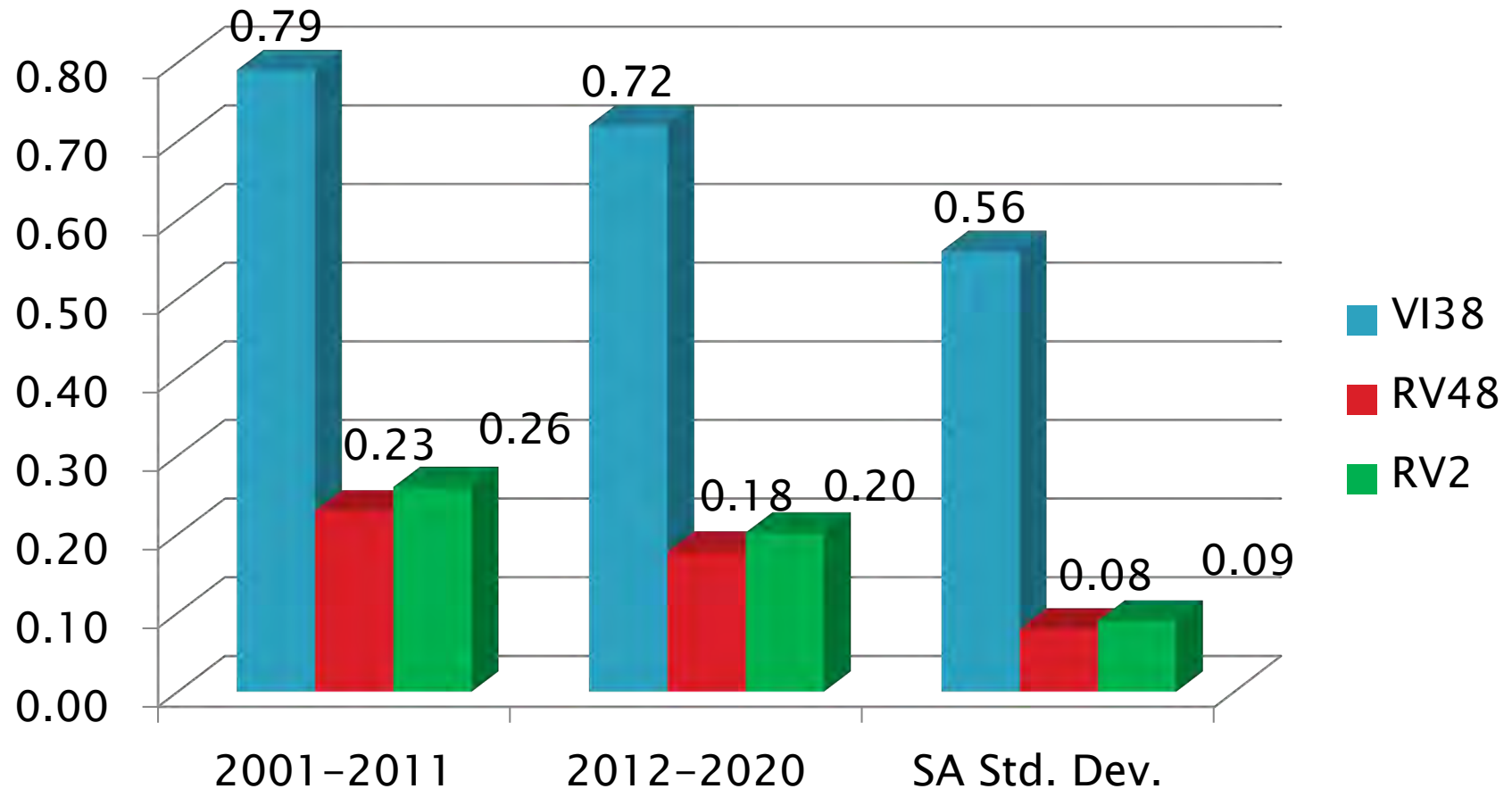
RELATIVE VISCOSITY @ 4.8% (50% LOSS)



RELATIVE VISCOSITY @ 4.8% (100% LOSS)



T-8/E Precision Estimates



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Mack T-11

»» April 2020

Test Monitoring Center

<http://astmtmc.cmu.edu>



A Program of ASTM International

T-11 Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	3
Failed Calibration Test	OC	0
Operationally Invalid	LC	1
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	Loss of fuel flow control	1
Aborted	No aborted tests	0
Total		1

*Invalid and aborted tests

T-11 Test Severity

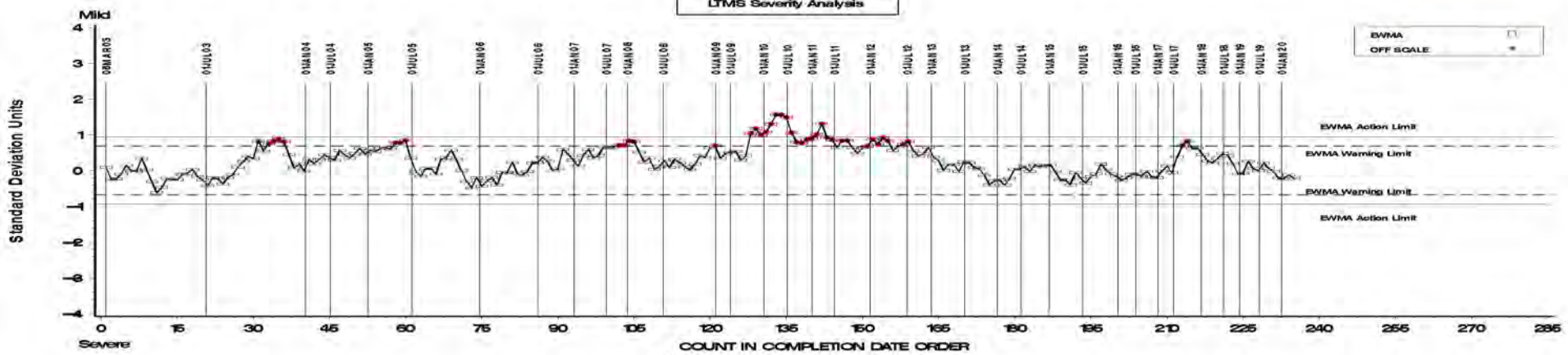
- ▶ SOOT and SOOT5 are in control.
- ▶ SOOT4 and MRV are in severity action alarm in the severe direction.
- ▶ MRV is in precision action alarm.

T-11 INDUSTRY OPERATIONALLY VALID DATA

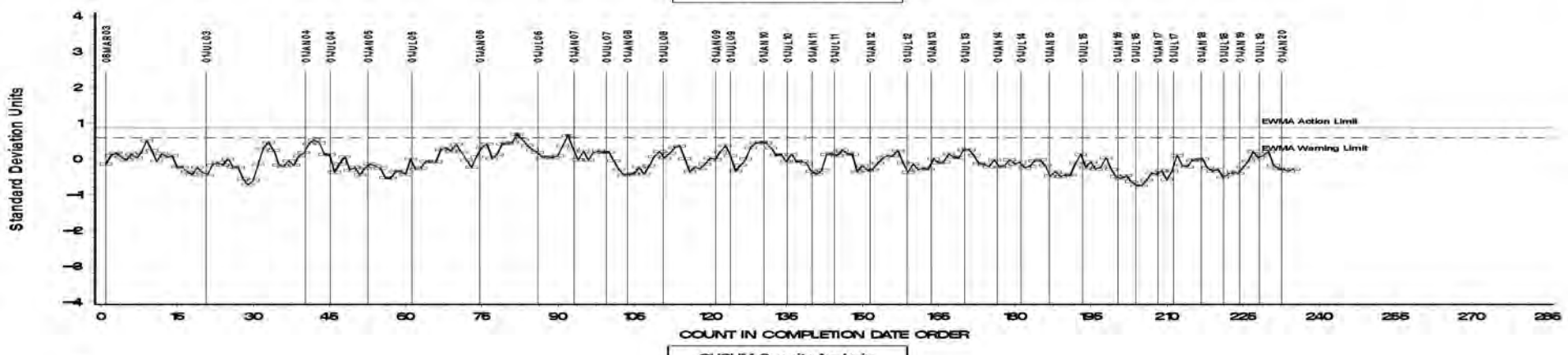


SOOT AT 12 cSt

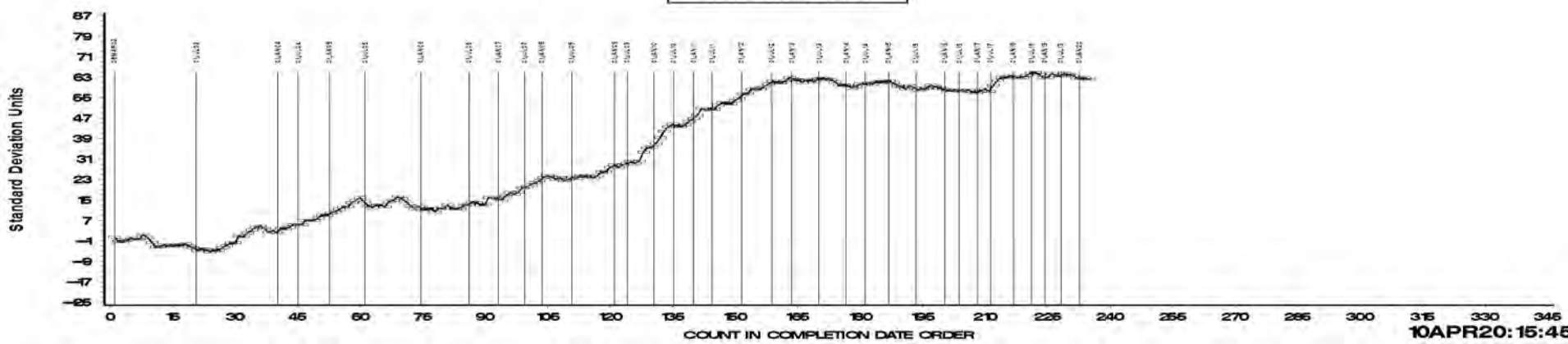
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

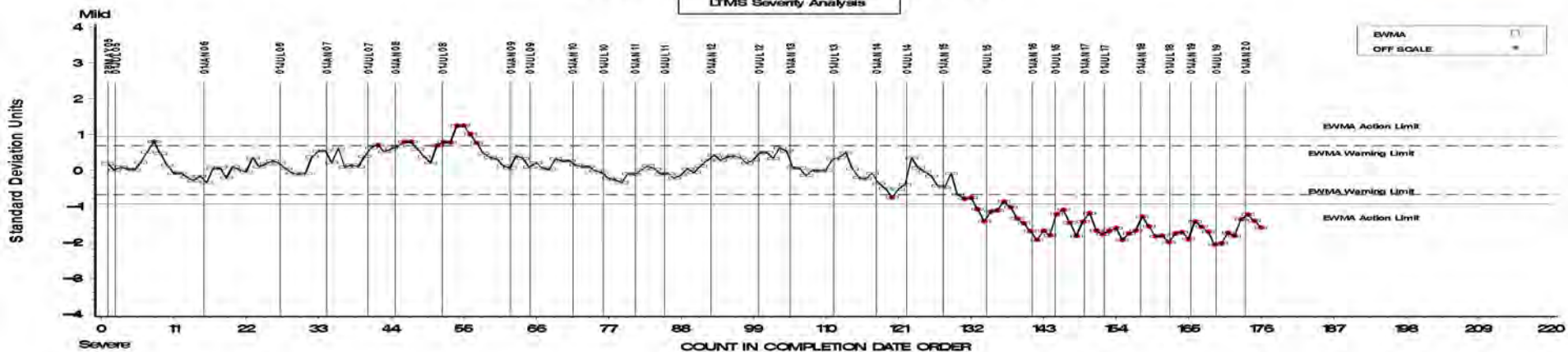


T-11 INDUSTRY OPERATIONALLY VALID DATA

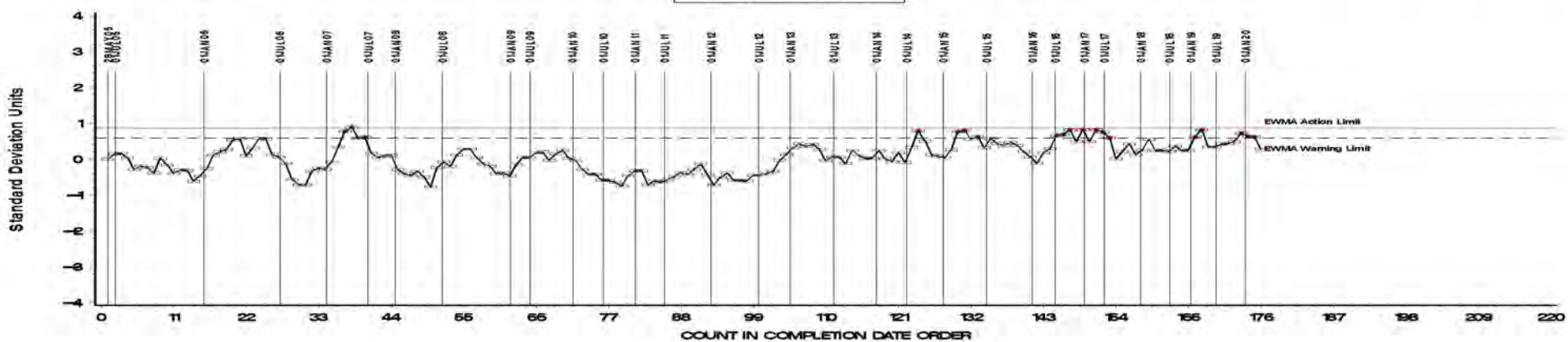


SOOT @ 4 cSt — FINAL RESULT

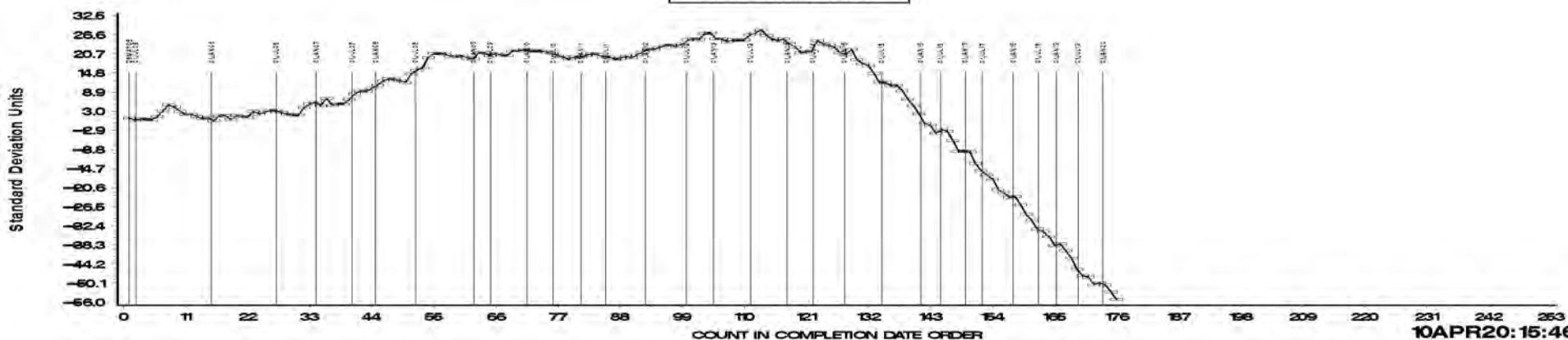
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

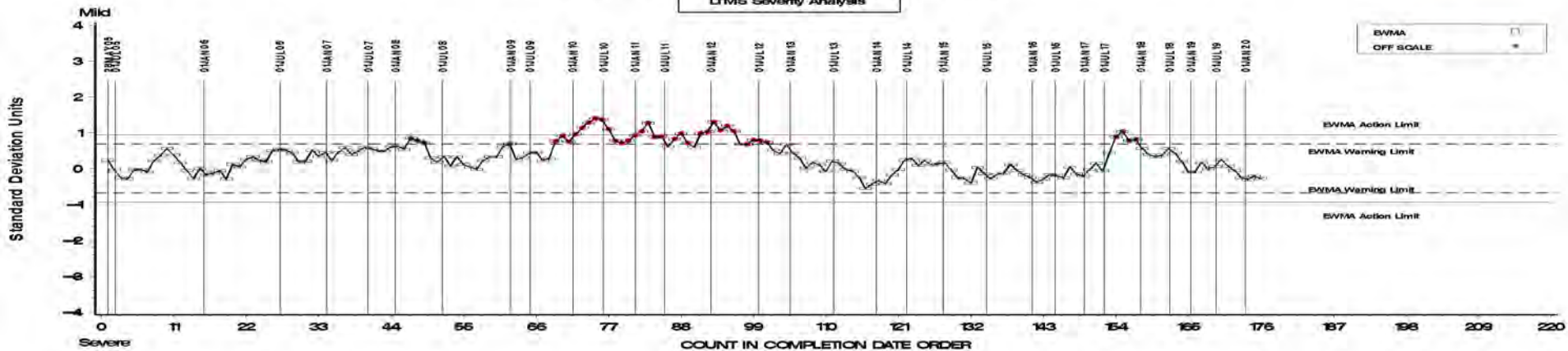


T-11 INDUSTRY OPERATIONALLY VALID DATA

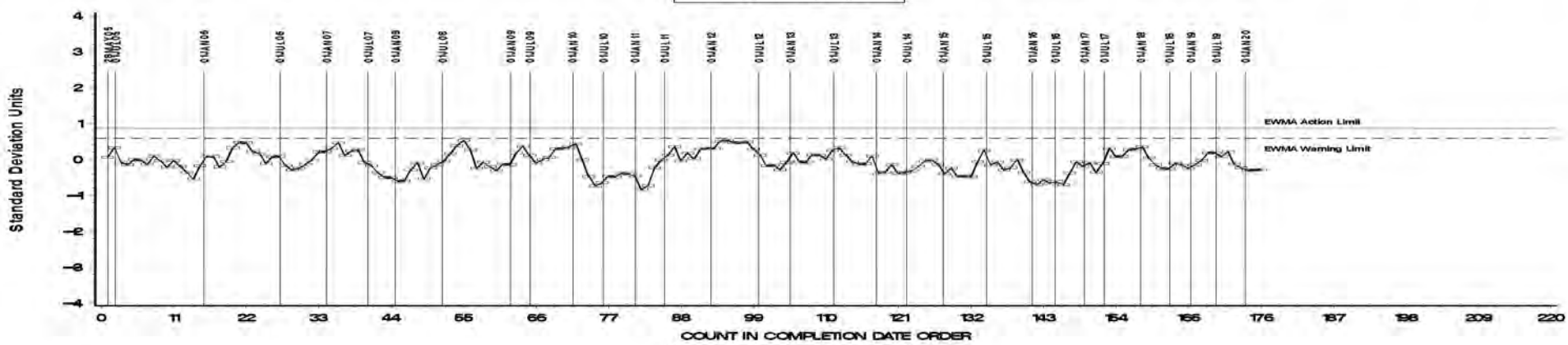


SOOT @ 15 cSt — FINAL RESULT

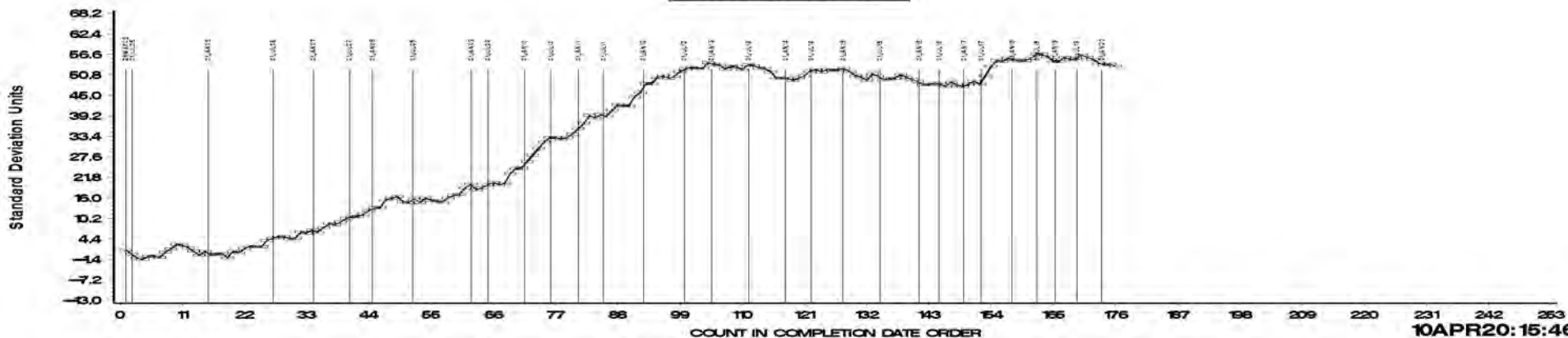
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

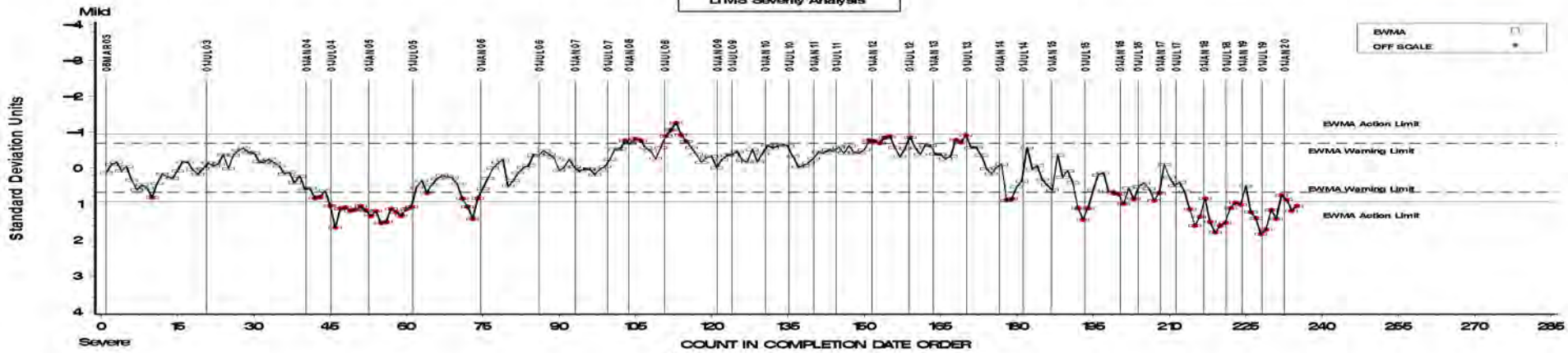


T-11 INDUSTRY OPERATIONALLY VALID DATA

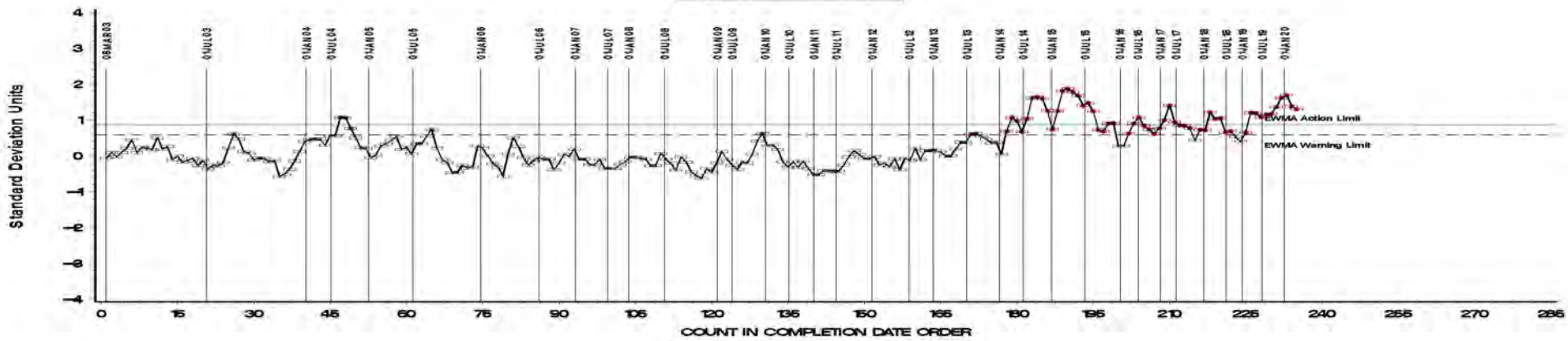


MRV VISCOSITY

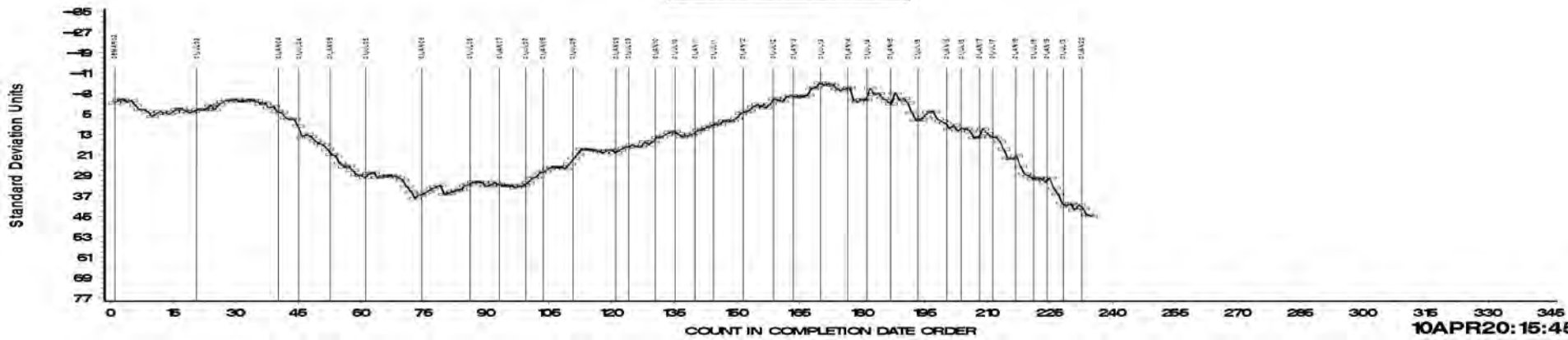
LTMS Severity Analysis



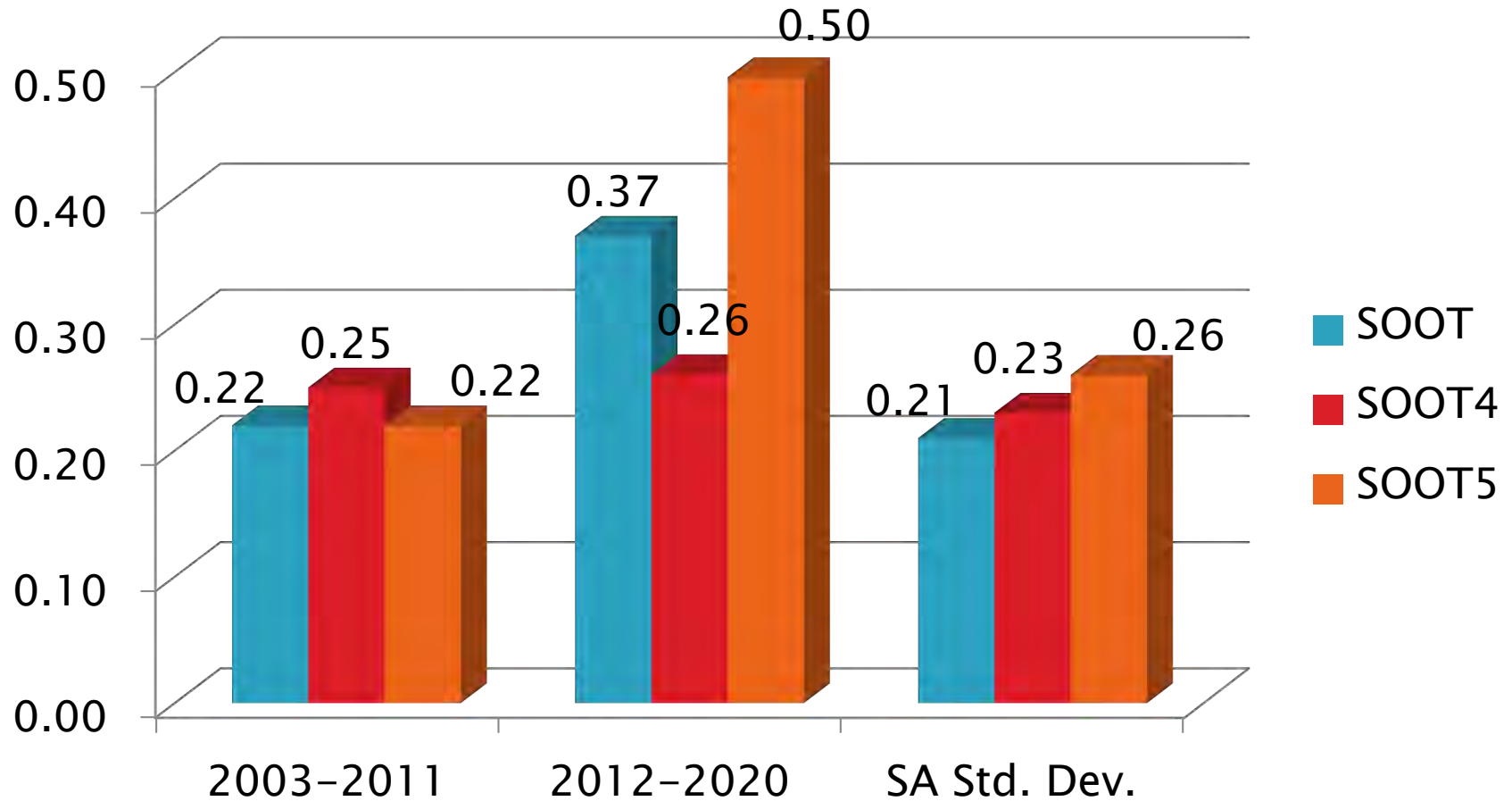
LTMS Precision Analysis



CUSUM Severity Analysis

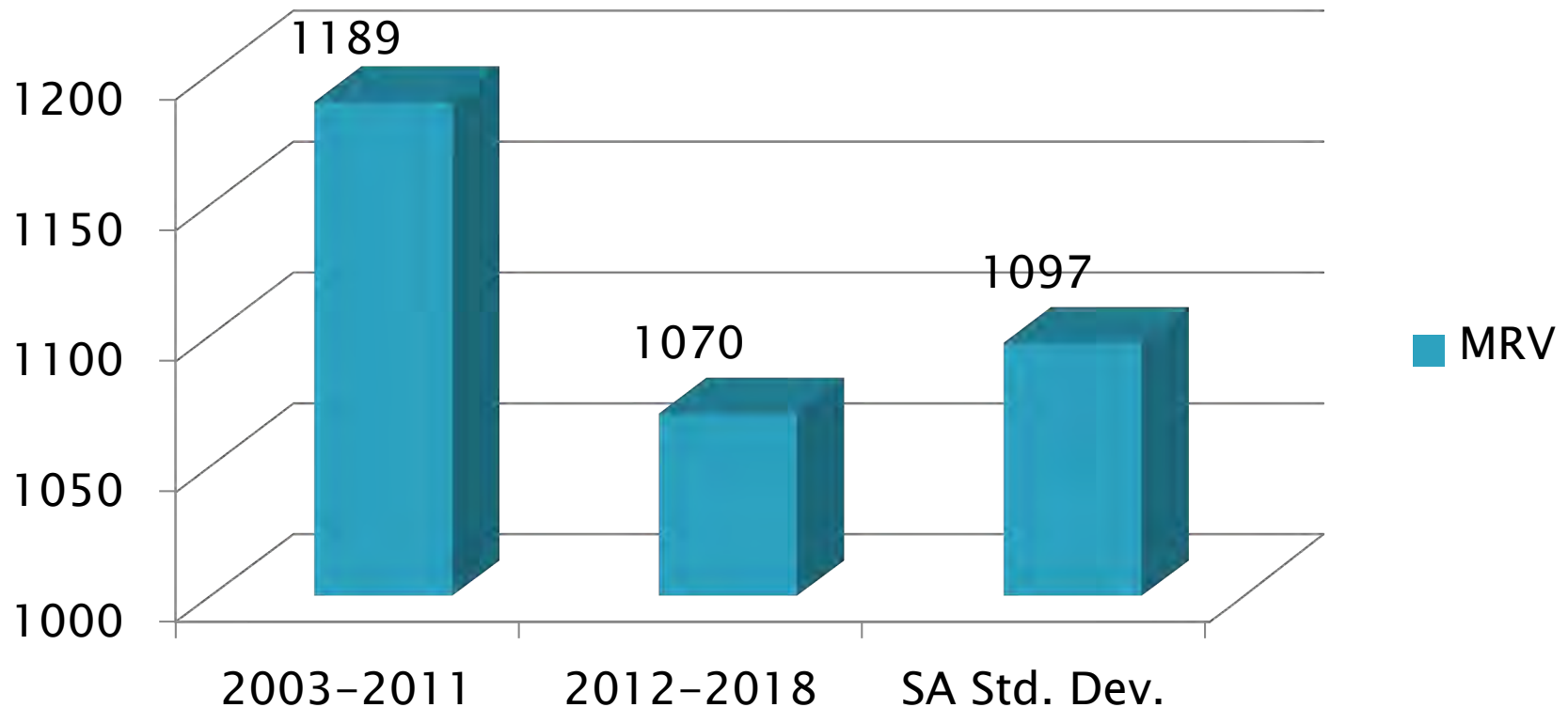


T-11 Precision Estimates



T-11 Precision Estimates

MRV



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Mack T-12

»» April 2020

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T-12 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-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

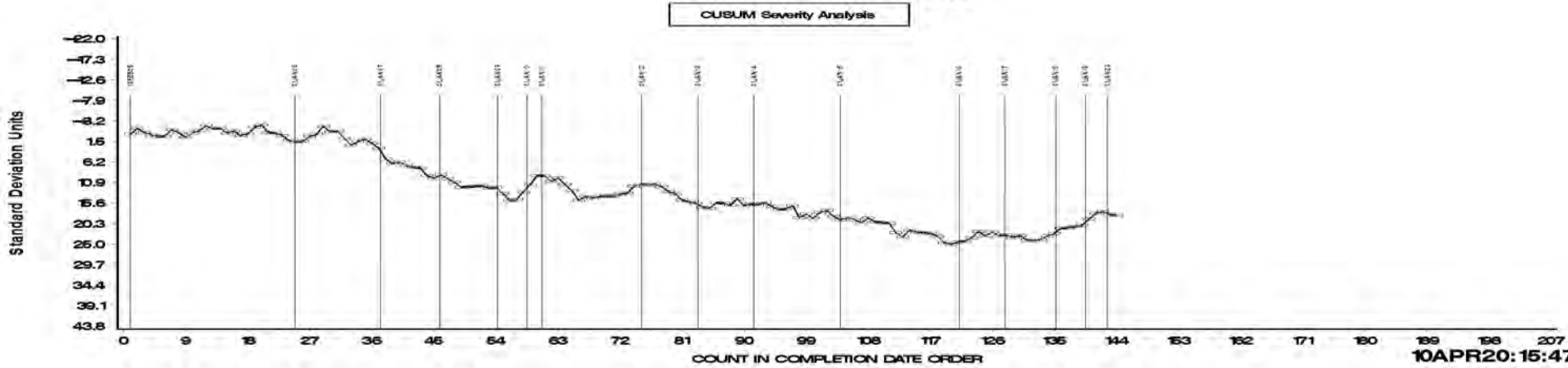
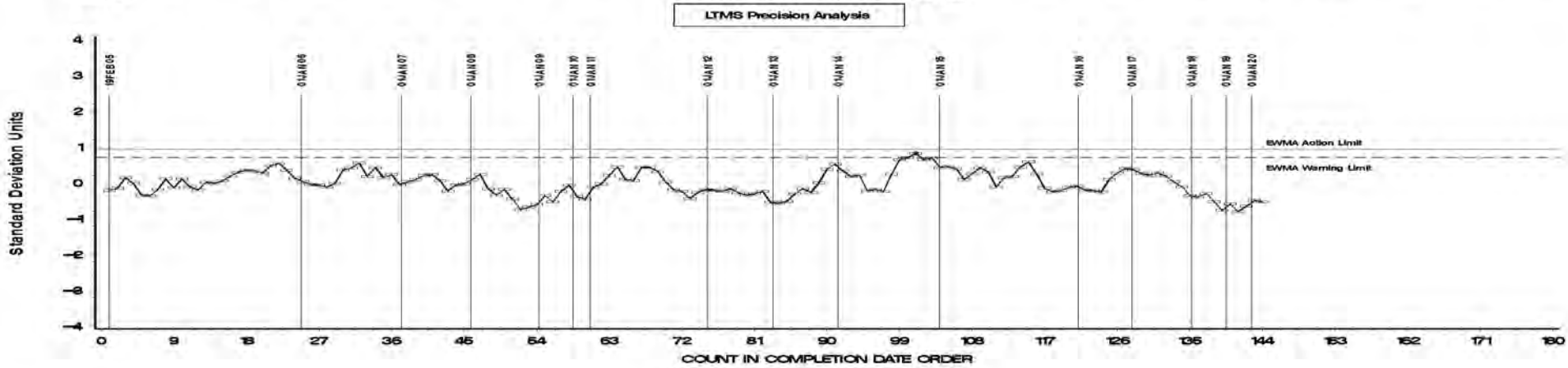
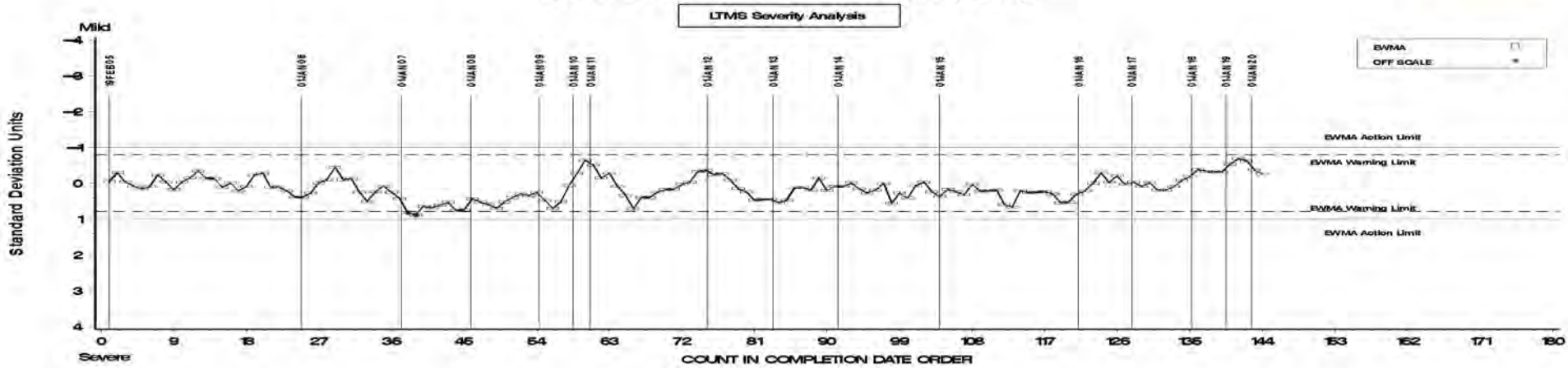
T-12 Test Severity

- ▶ CLW, Pb, Pb2, TRWL and OC are in control.

MACK T-12 INDUSTRY OPERATIONALLY VALID DATA



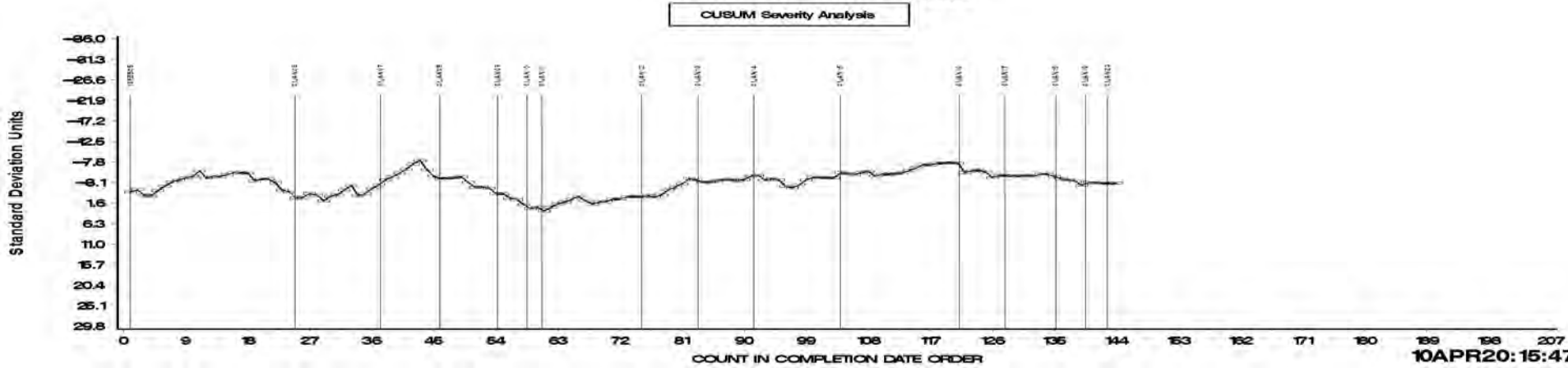
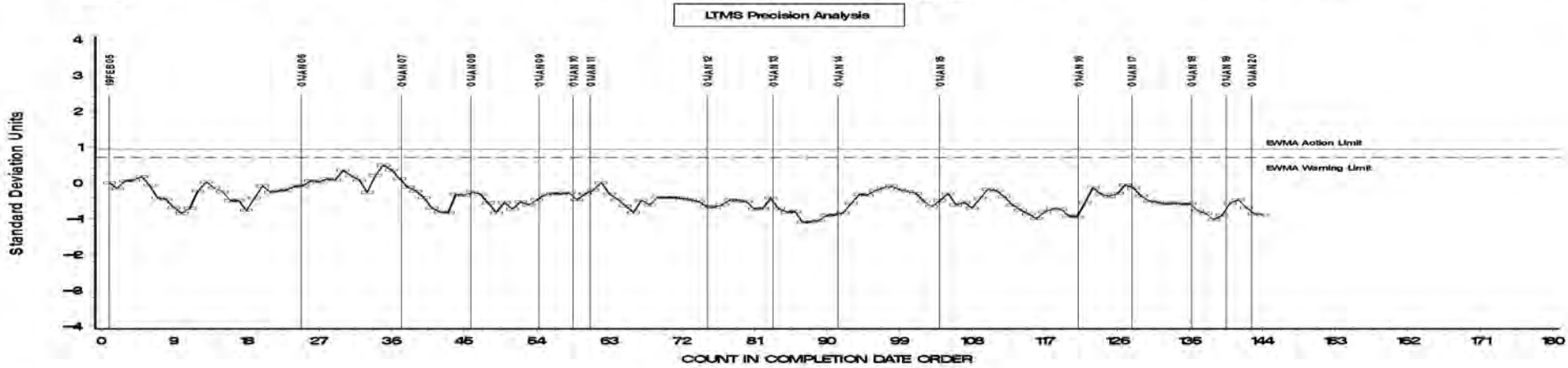
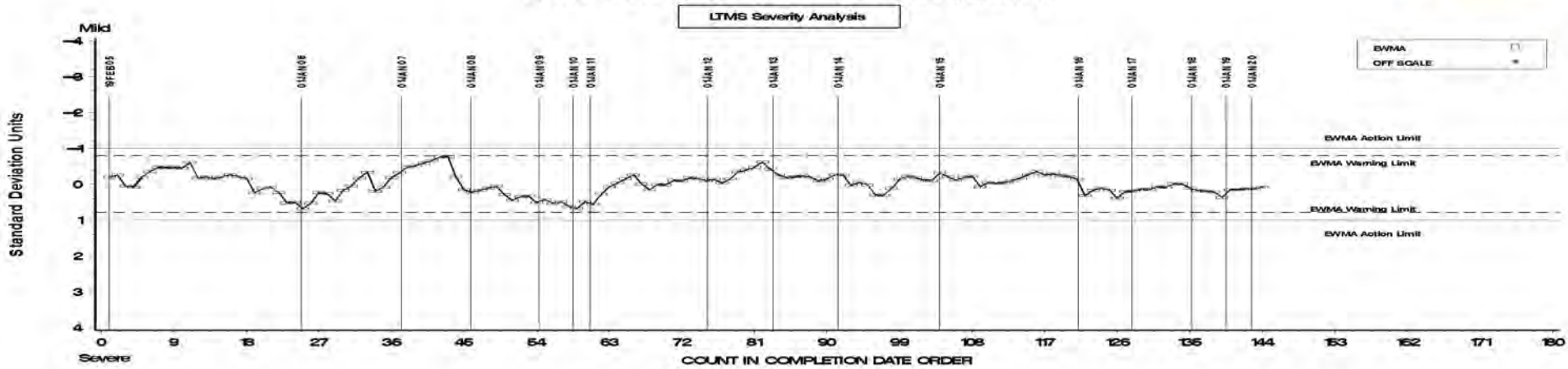
AVG. CYLINDER LINER WEAR (CLW)



MACK T-42 INDUSTRY OPERATIONALLY VALID DATA



AVG. TOP RING WEIGHT LOSS (TRWL)

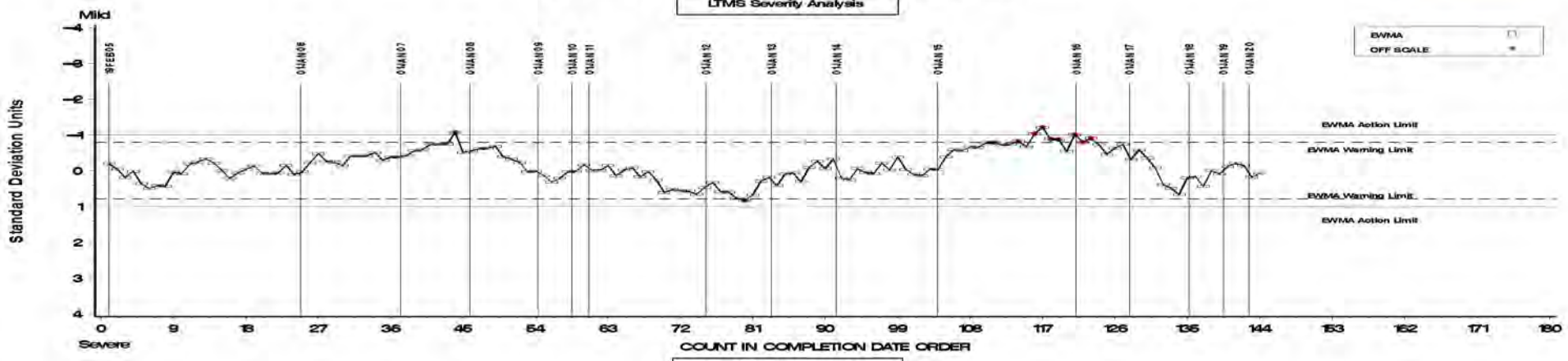


MACK T-12 INDUSTRY OPERATIONALLY VALID DATA

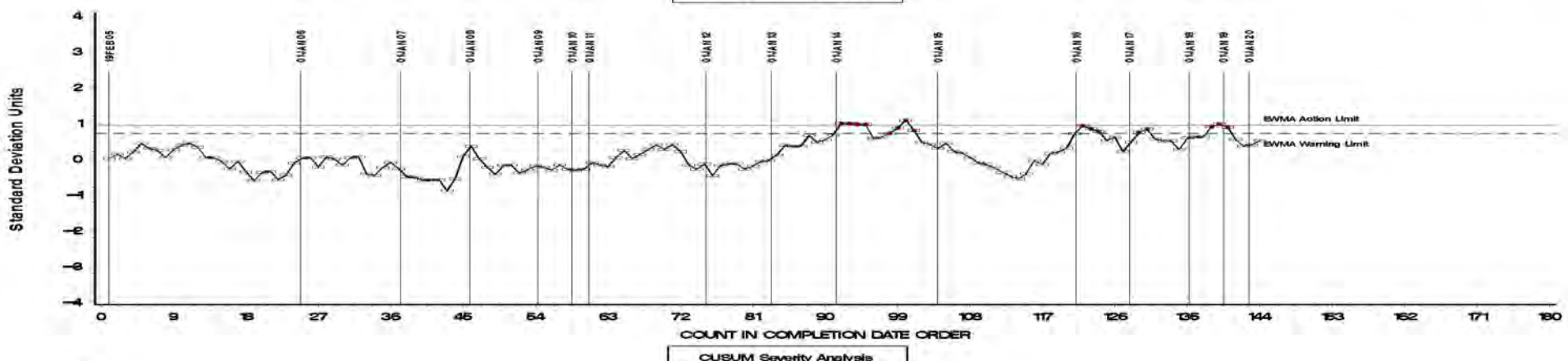


FINAL TRANS. RES. DELTA PB @ EOT

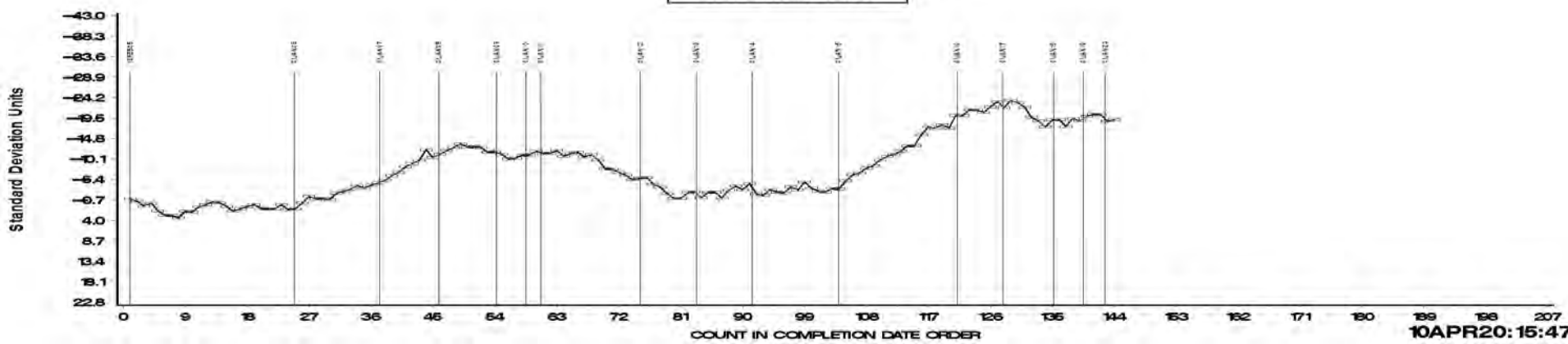
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis



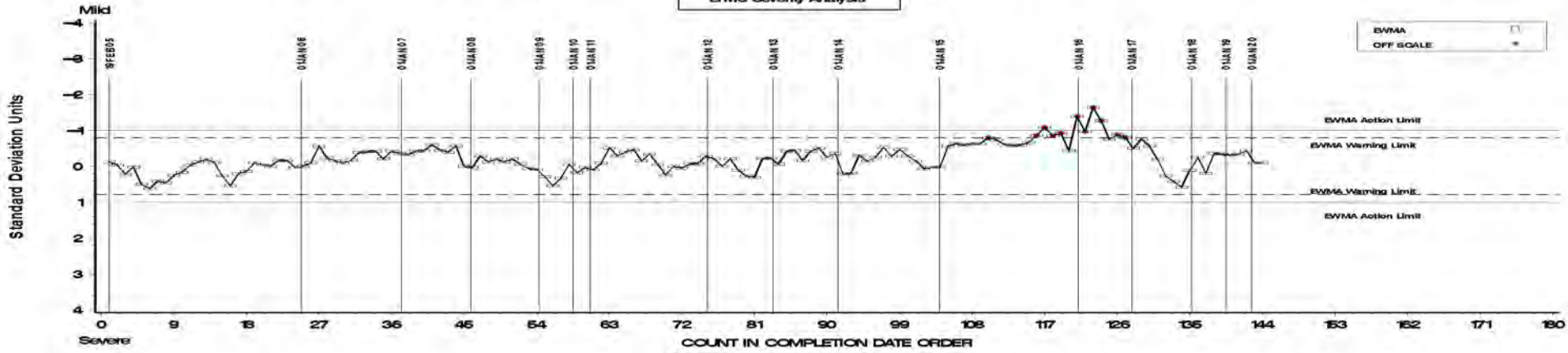
MACK T-42 INDUSTRY OPERATIONALLY VALID DATA



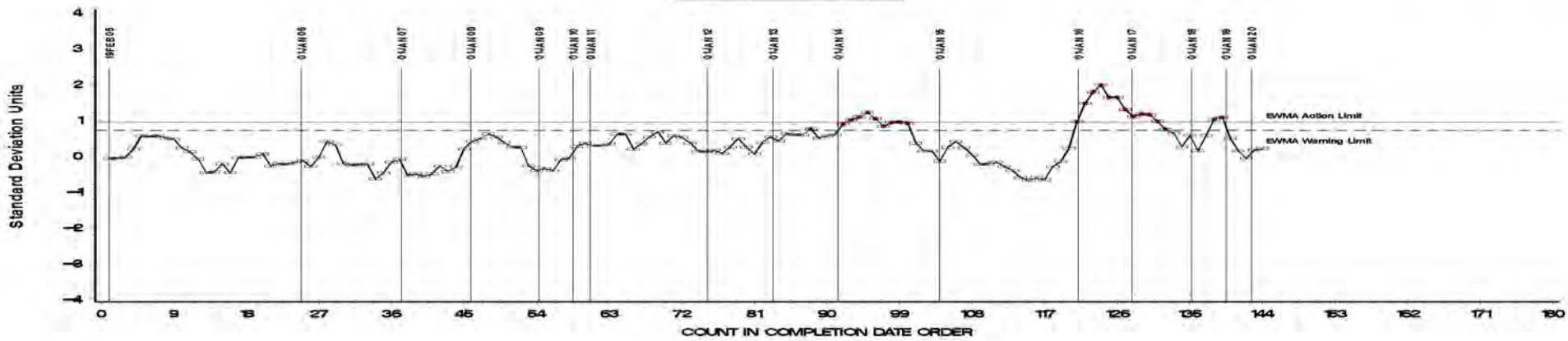
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FINAL TRANS. RES. DELTA PB 250-300H

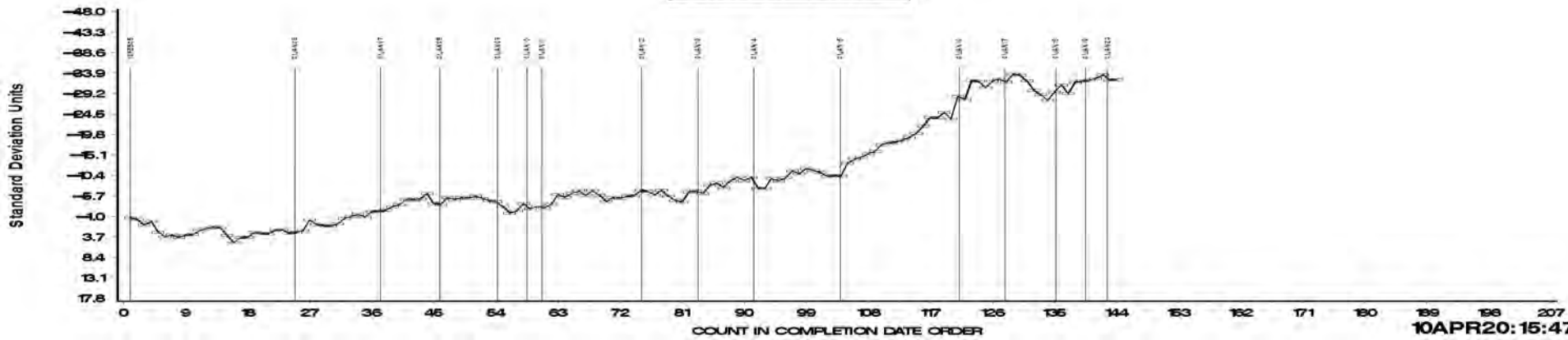
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis

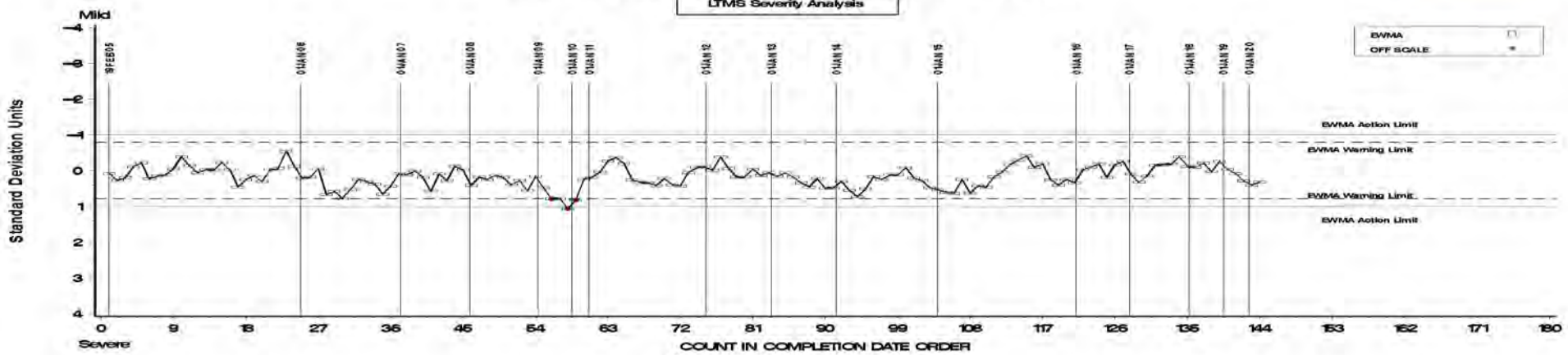


MACK T-42 INDUSTRY OPERATIONALLY VALID DATA

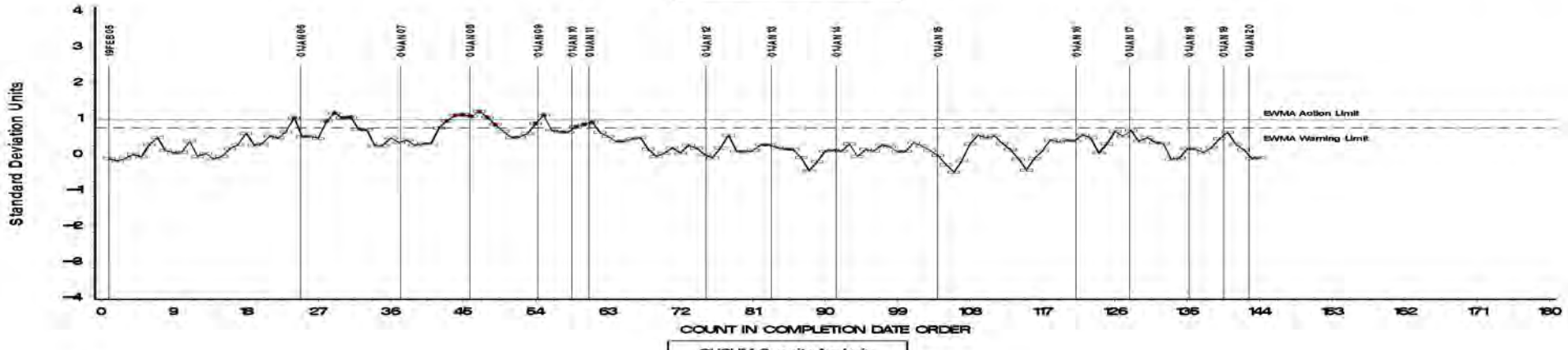


FINAL TRANS. RES. OIL CONSUMPTION

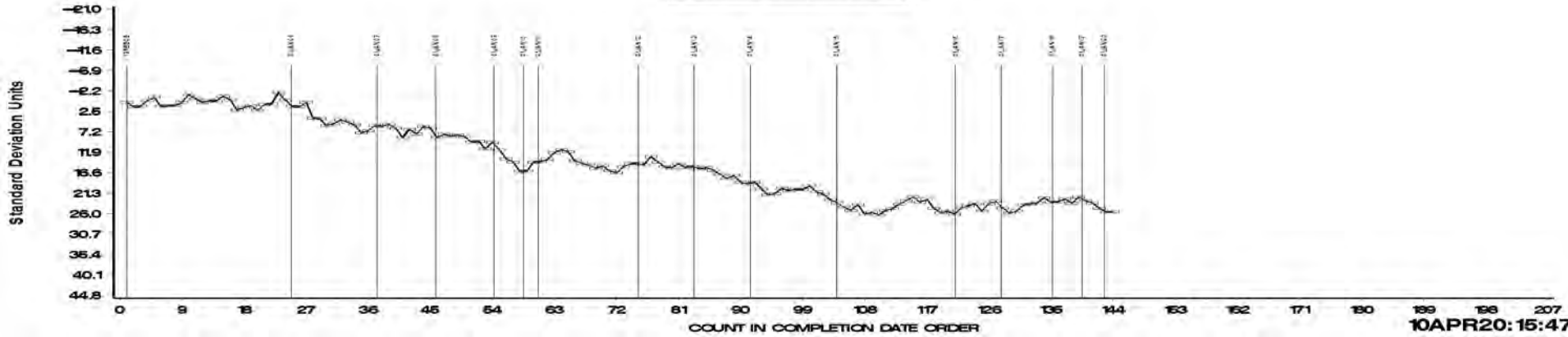
LTMS Severity Analysis



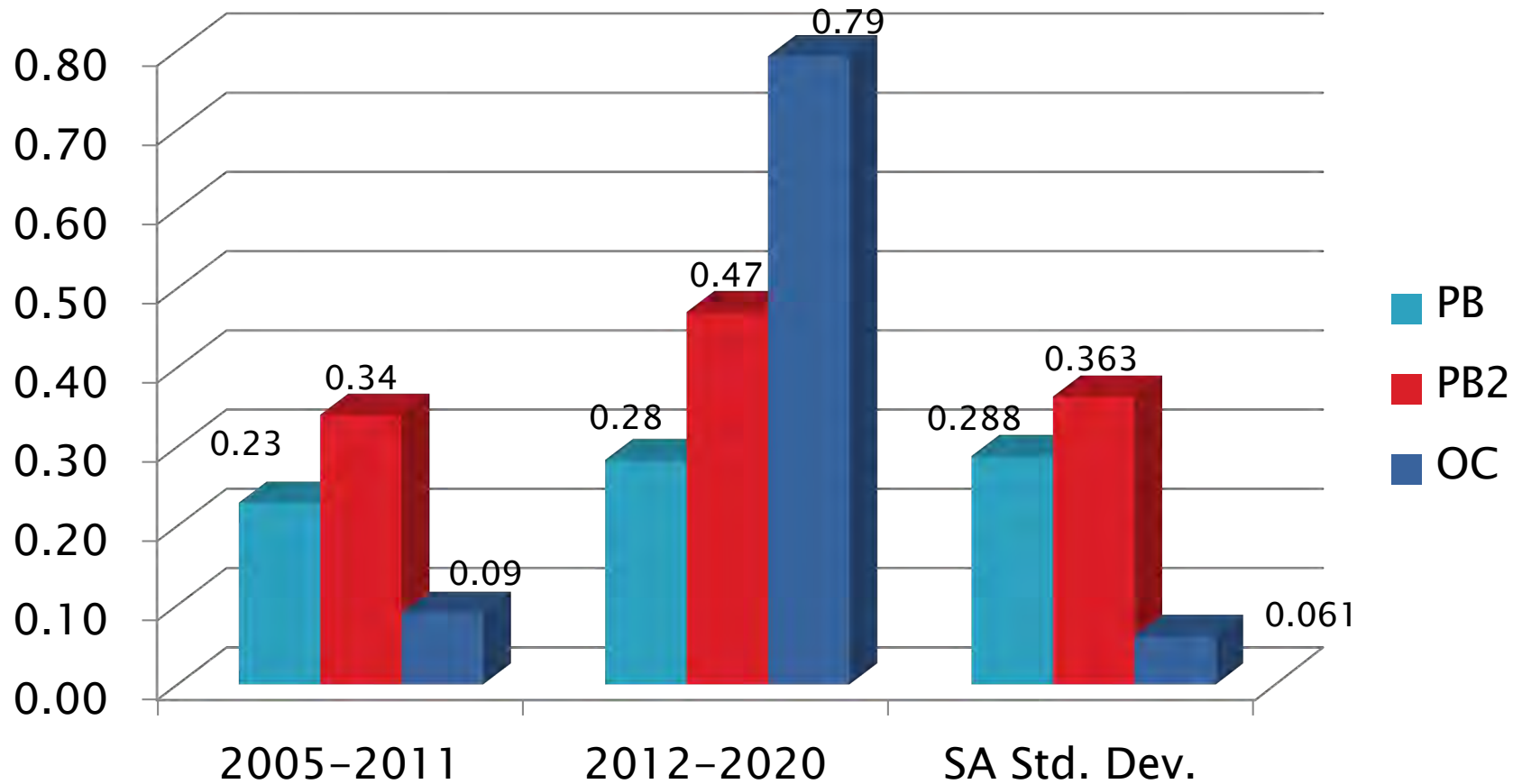
LTMS Precision Analysis



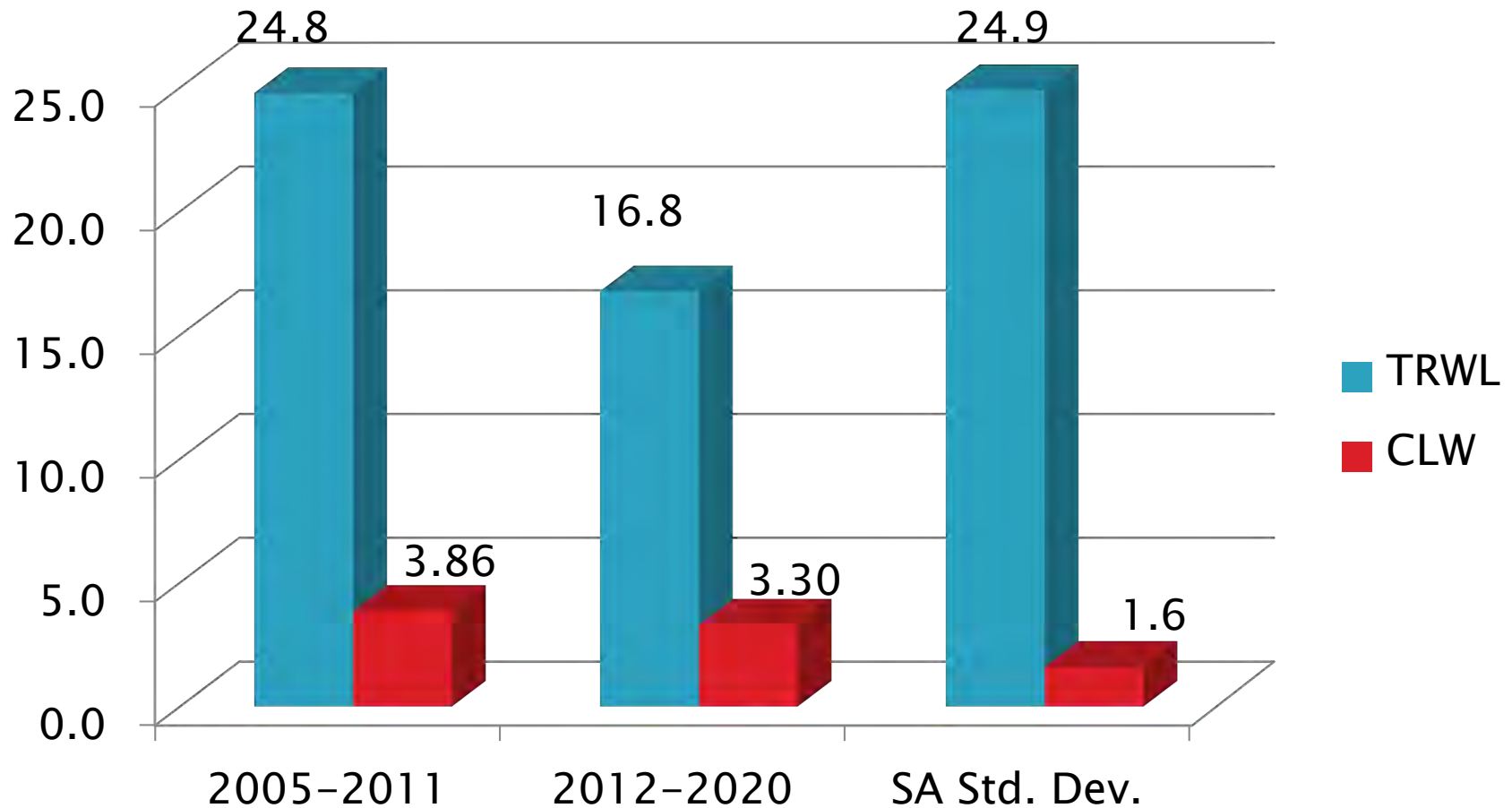
CUSUM Severity Analysis



T-12 Precision Estimates



T-12 Precision Estimates



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Mack T-12A

»» April 2020

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T-12A 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-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

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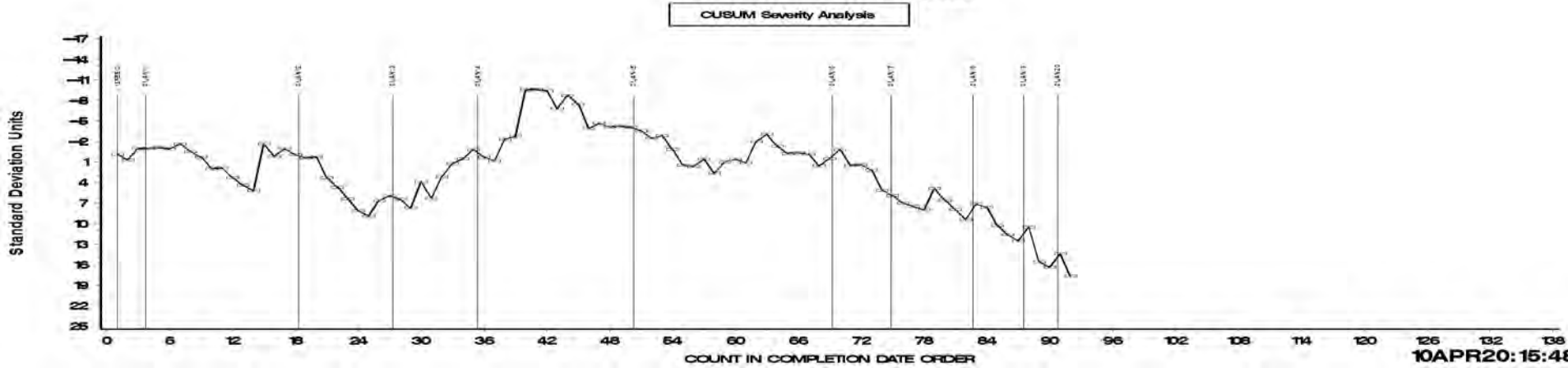
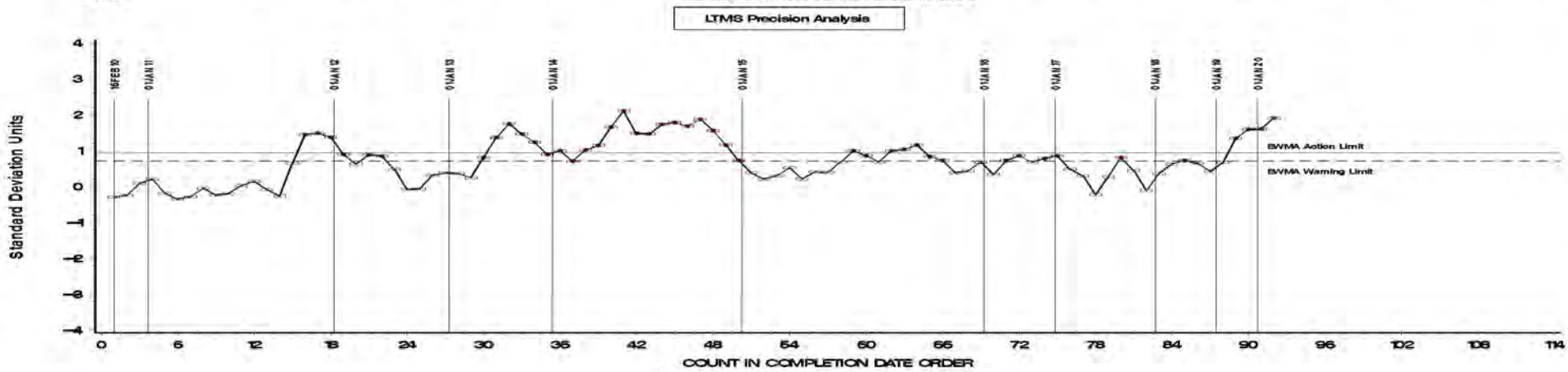
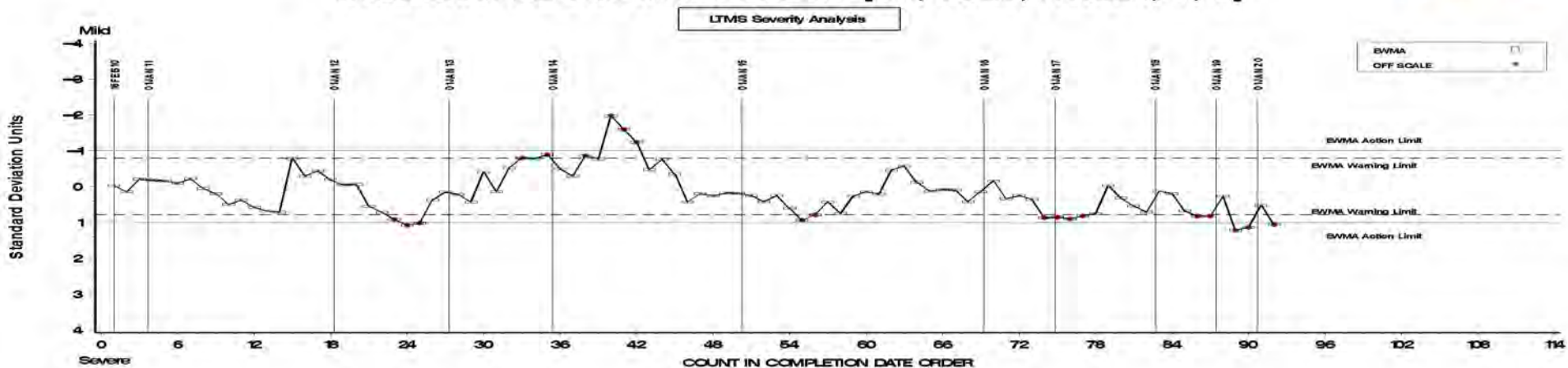
T-12A Test Severity

- ▶ MRV is in severity and precision action alarm.

MACK T-2A INDUSTRY OPERATIONALLY VALID DATA

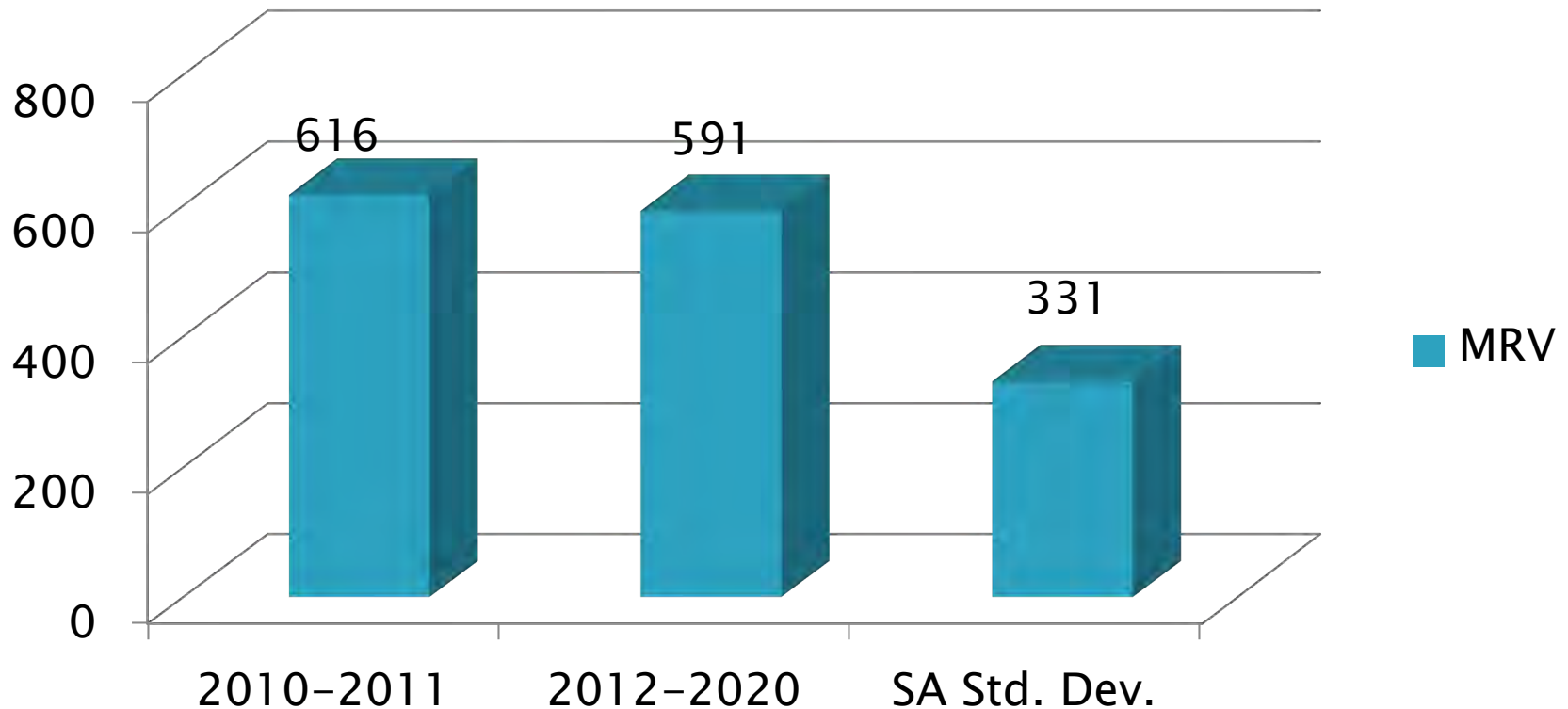


FINAL ORIGINAL UNIT MRV VISCOSITY [NM, SOLID, FROZEN, <, >]



T-12A Precision Estimates

MRV



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Mack T-13

»» April 2020

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T-13 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-13 Failed Tests

Failed Parameter	Number of Tests
No failed tests	0
Total	0

T-13 Lost Tests*

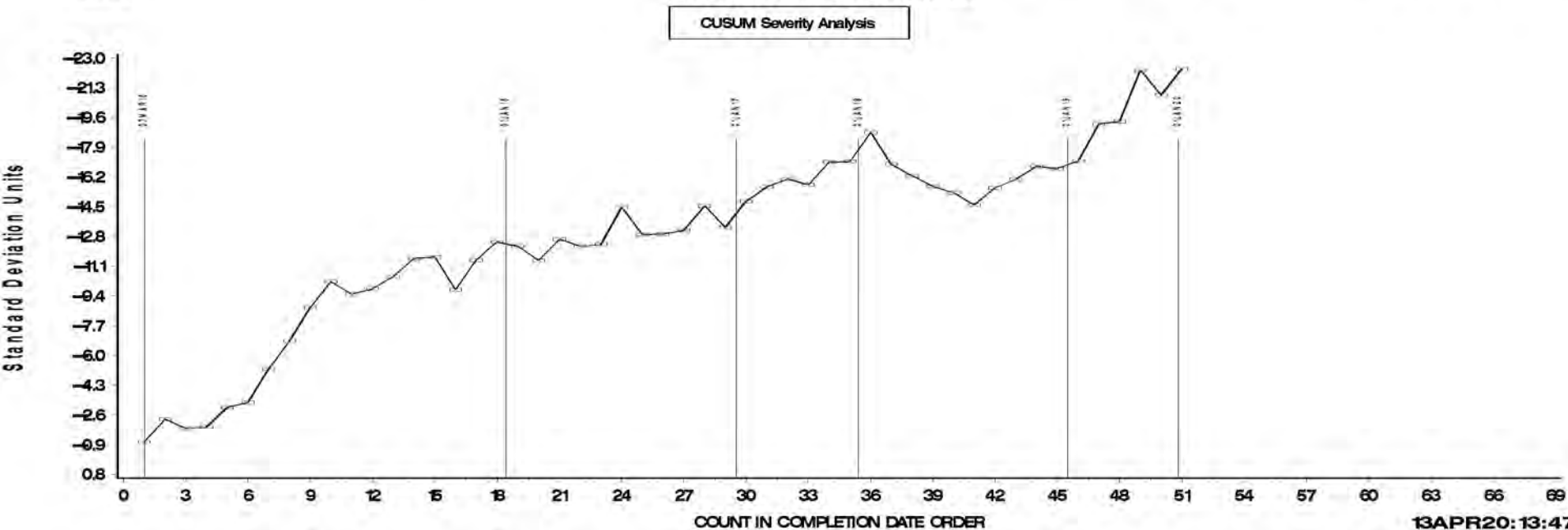
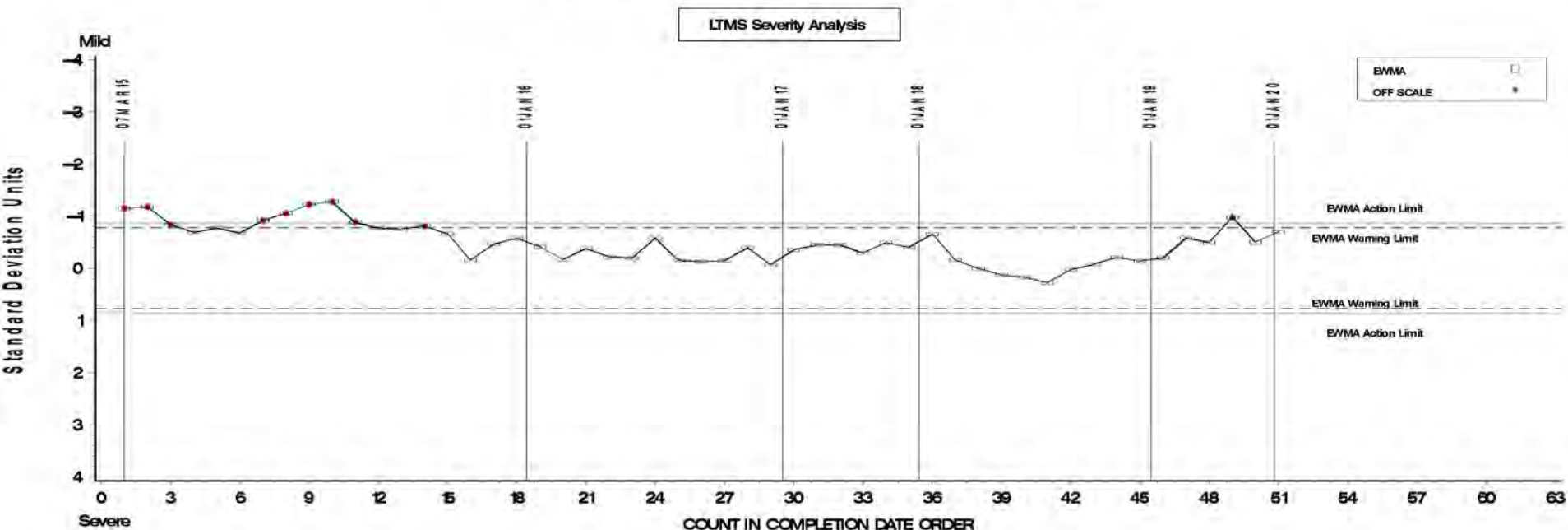
Status	Cause	#
Invalid	No invalid tests	0
Aborted	No aborted tests	0
Total		0

*Invalid and aborted tests

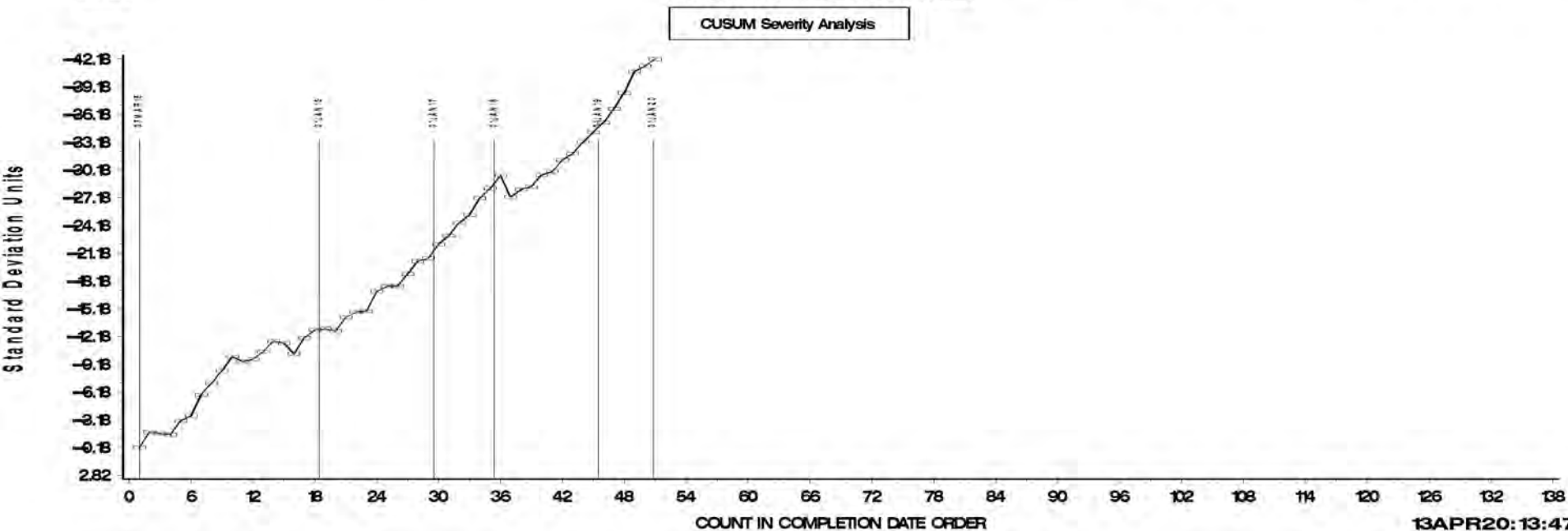
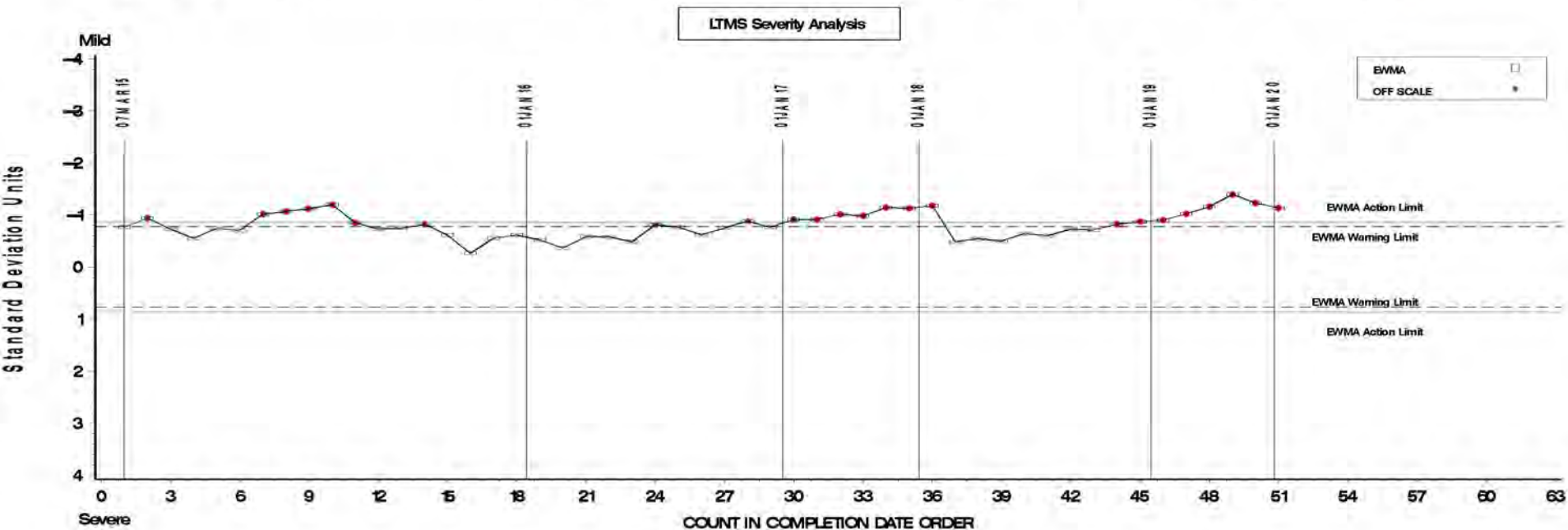
T-13 Test Severity

- ▶ IRPH is in control but nearing level 1 Zi alarm
- ▶ KV40 is in level 2 Zi alarm

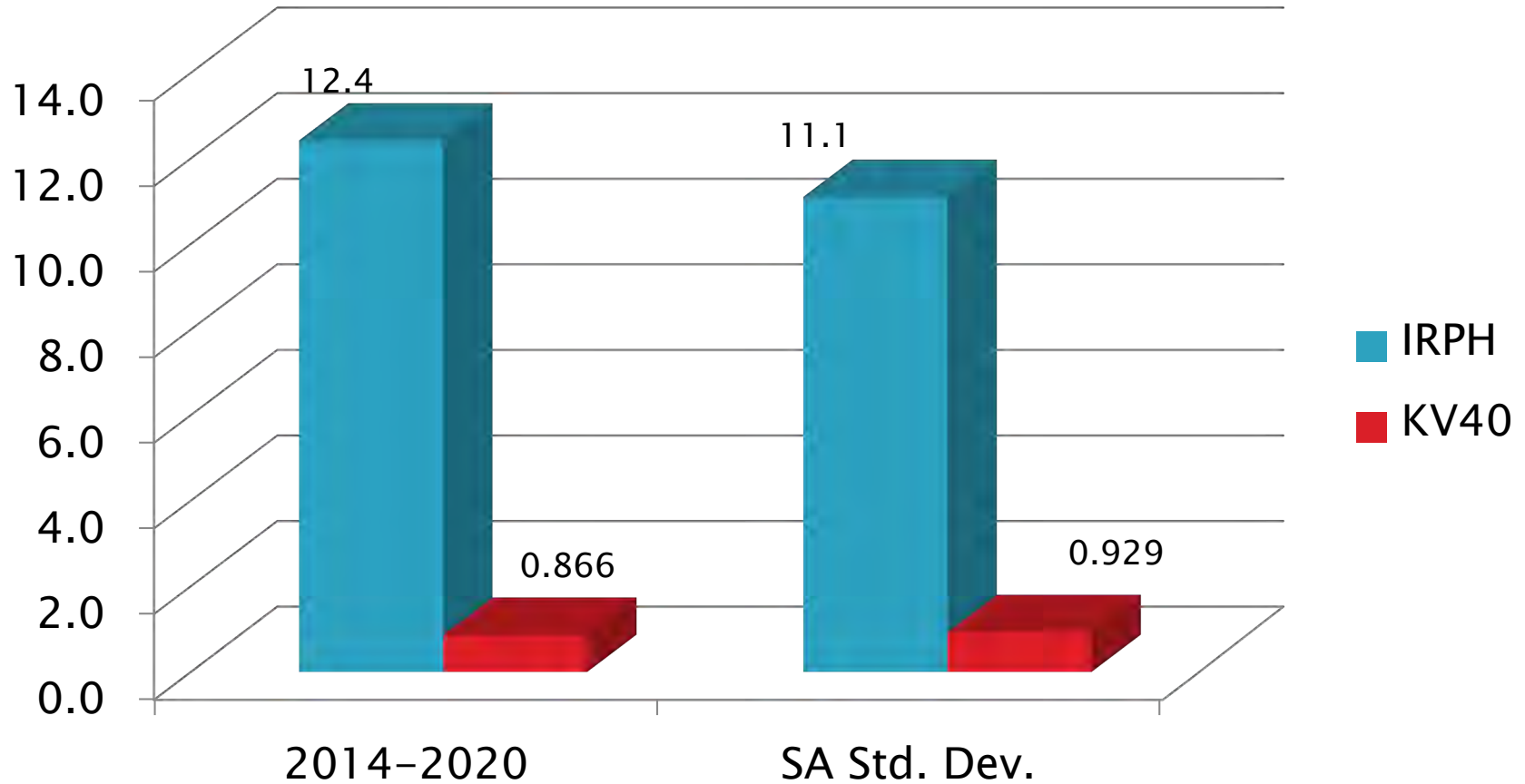
FINAL ORIGINAL PEAK HEIGHT IR AT EOT



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



T-13 Precision Estimates



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Information Letters

»» October 1, 2019 –
March 31, 2020

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Information Letters*

Test	Date	IL	Topic
COAT	10/3/2019	19-1	COAT 40-50 Hour Aeration Result Correction Factor

*Available from TMC Website

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Memos

»» October 1, 2019–
March 31, 2020

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Memos*

Date	Number	Topic
N/A	N/A	N/A

*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

- ▶ ISM Oil 830-3 introduced

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	30	2048	116	5+ years
811-2	1K, 1N	1732	30	865	40	5+ years
821-4	T-12	4495	0	2625	75	5+ years
822-2	1R, T-11	4386	112	2478	112	3+ years
823	T-13	1796	0	678	140	1.6 years
830-3	ISM	2891	125	2661	100	5+ years
831-4	C13, ISB	1699	120	1305	175	5+ years

Reference Oil Inventory Estimated Life

Oil	Tests	Original Blend Amount	Quantity Shipped in last 6 months	TMC Inventory	Lab Inventory	Estimated Life
832-1	COAT	1951	28	1529	140	5+ years
833-1	COAT	1248	0	856	112	4+ years
864-1	DD13	1576	25	893	75	2+ years
873-2	1M-PC	1650	20	6	20	1 years
1005-5	1P, 1R, EOAT, RFWT, T-8/E	3826	267	1668	207	1.5 years

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LTMS Deviations

»» October 1, 2019–

March 31, 2020

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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, 2019–

March 31, 2020

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Quality Index Deviations

- ▶ T12 – Negative QI for inlet manifold temperature.

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	7
T-13	2
COAT	4

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TMC Laboratory Visits

»» October 1, 2019–

March 31, 2020

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TMC Lab Visits

Test	Number of Labs-Number of Stands
1K/1N	2-4
1P	2-2
1R	1-1
C13	2-2
ISB	2-2
ISM	1-1

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Lab Visit Issues

- ▶ 1K/1N
 - No discrepancies were found.
- ▶ 1P
 - No discrepancies were found.
- ▶ 1R
 - No discrepancies were found.
- ▶ C13
 - No discrepancies were found.
- ▶ ISB
 - Incorrect intake air temperature and pressure locations found and corrected by lab.
- ▶ ISM
 - No discrepancies were found.

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Test Area Timelines

»» October 1, 2019–
March 31, 2020

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Test Area Timeline Additions*

Test	Date	IL/Memo	Topic
COAT	10/3/2019	19-1	COAT 40-50 Hour Aeration Result Correction Factor

*As of 3/31/2020

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Rating Workshop Data



2019 Heavy Duty Workshop

Test Monitoring Center

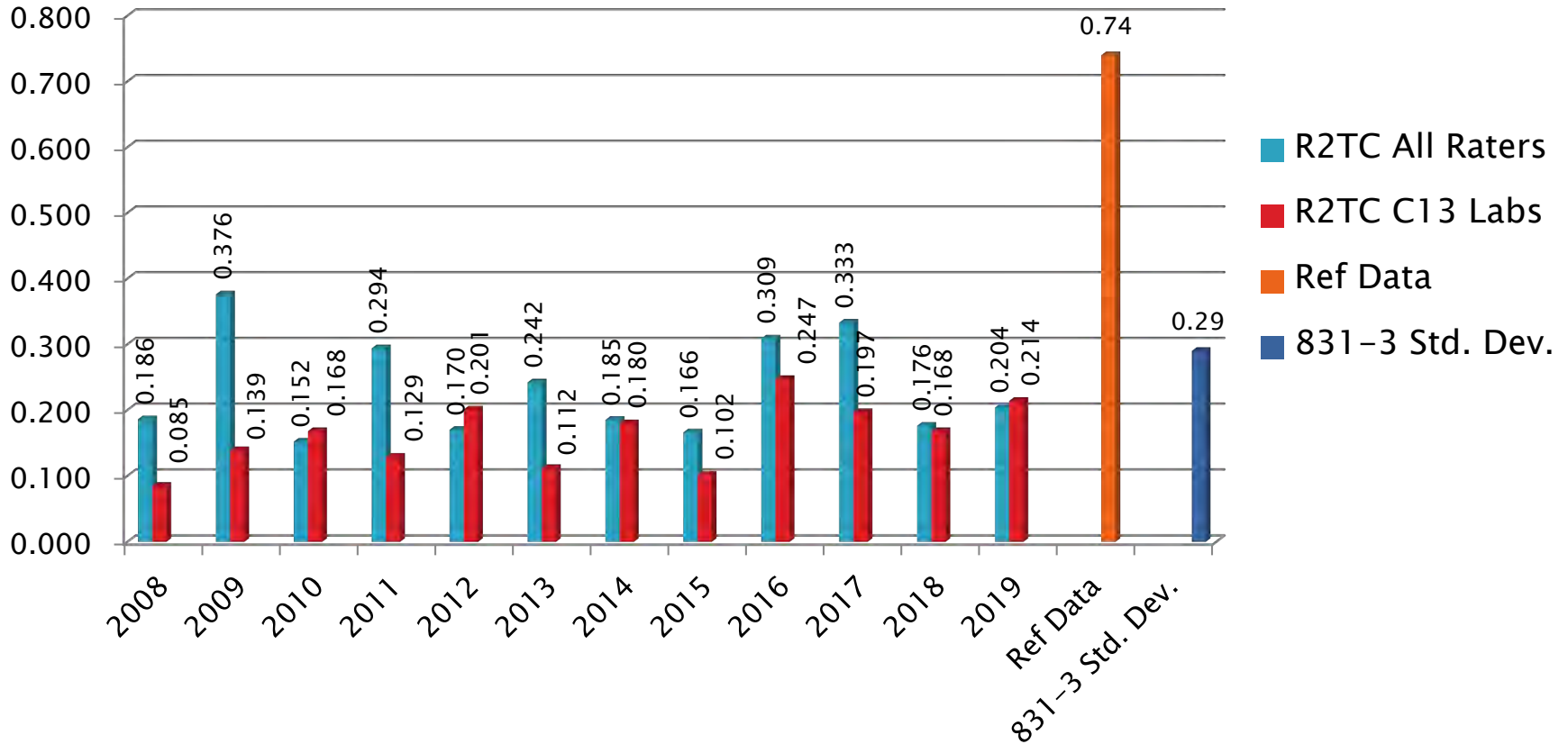
<http://astmtmc.cmu.edu>



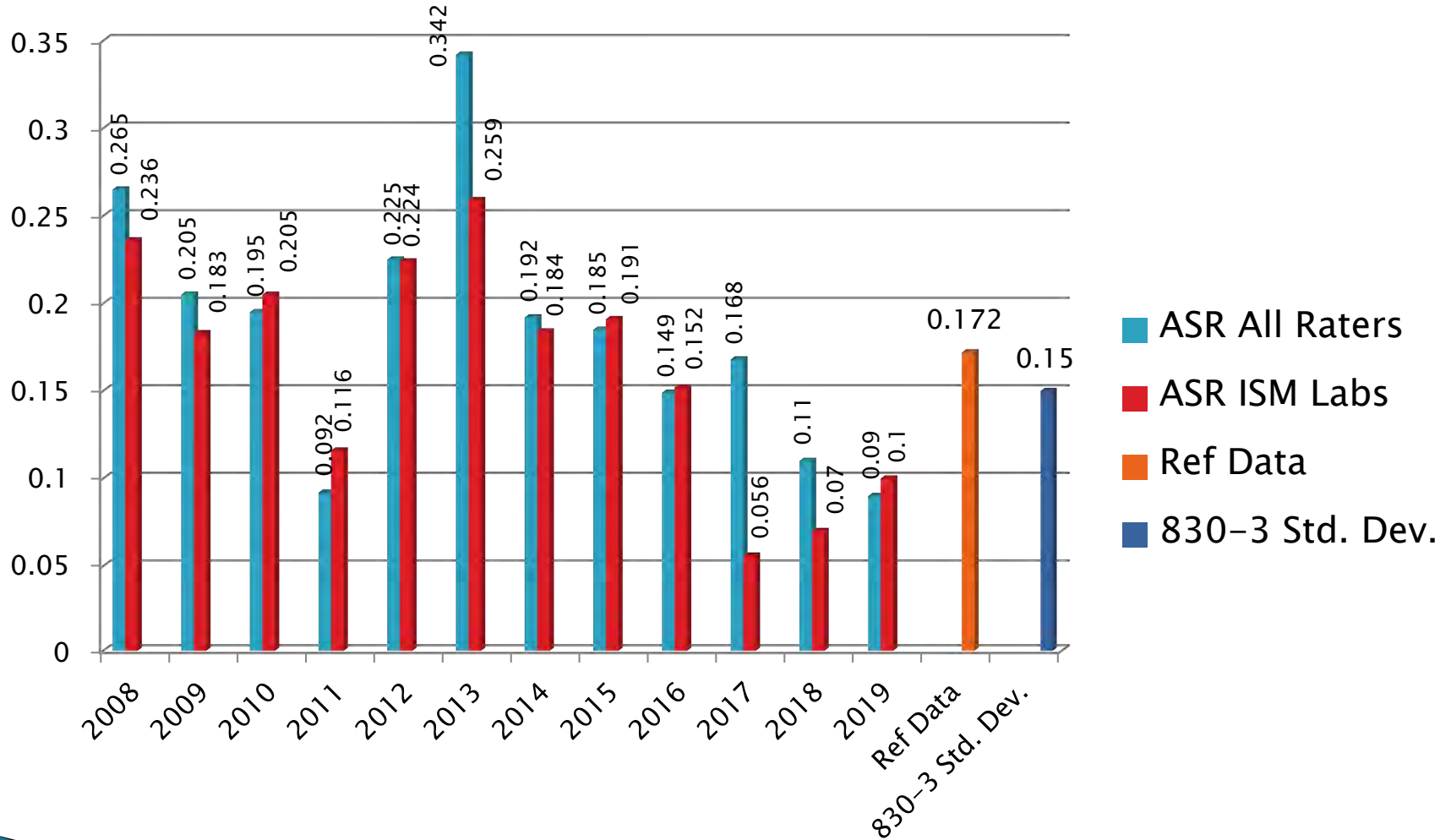
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C13 2nd Ring Carbon Precision – Rating Workshop Data

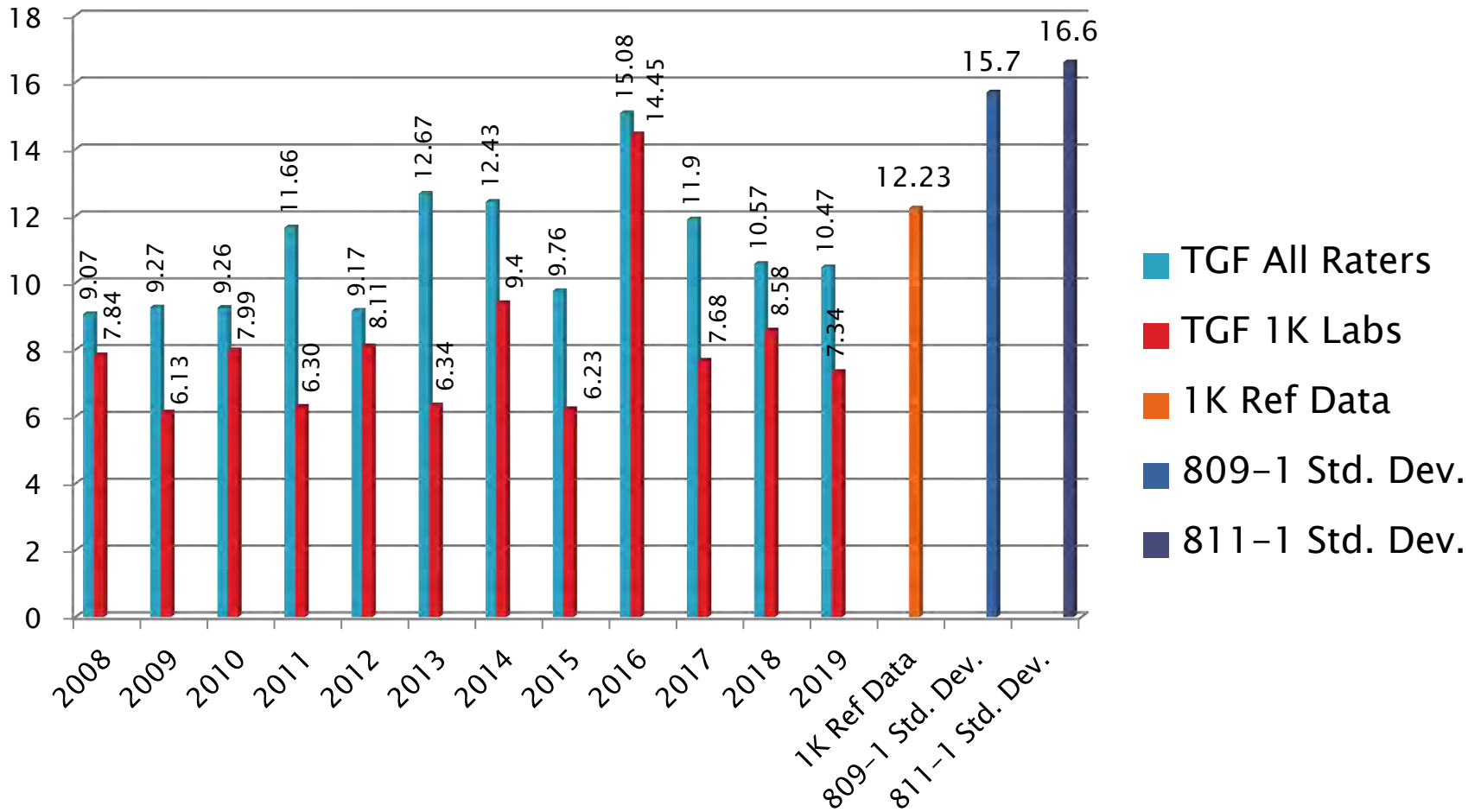
R2TC



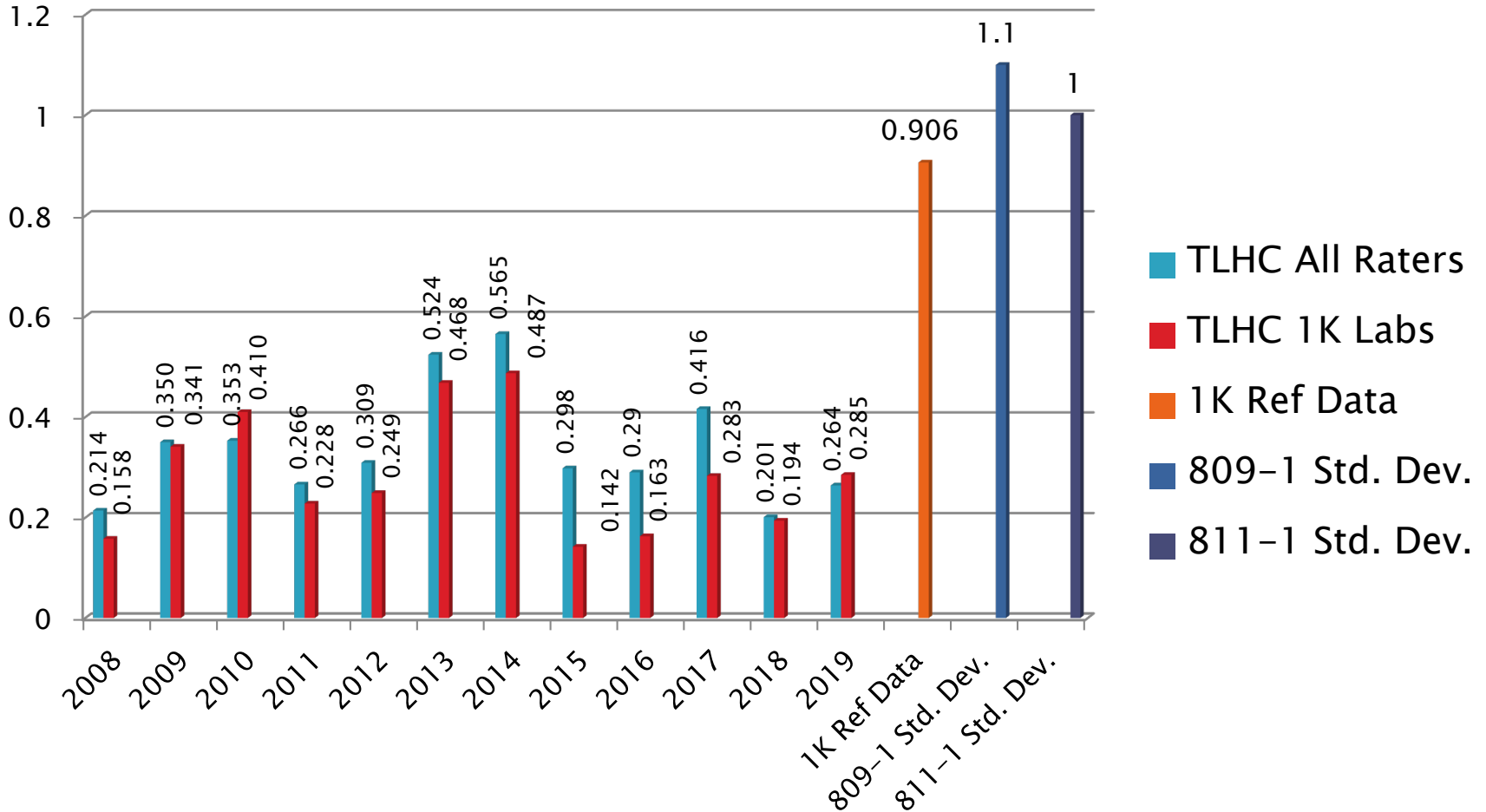
ISM Sludge Rating Precision - Rating Workshop Data



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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