A Program of ASTM International

Test Monitoring Center

@ Carnegie Mellon University
6555 Penn Avenue, Pittsburgh, PA 15206, USA

http://astmtmc.cmu.edu
412-365-1000

MEMORANDUM: 18-049

DATE: November 20, 2018

TO: Mike Birke,
Chairman, Engine Oil Elastomer Compatibility Surveillance Panel

FROM: Michael T. Kasimirsky

SUBJECT: LDEOC Testing from April 1, 2018 through September 30, 2018

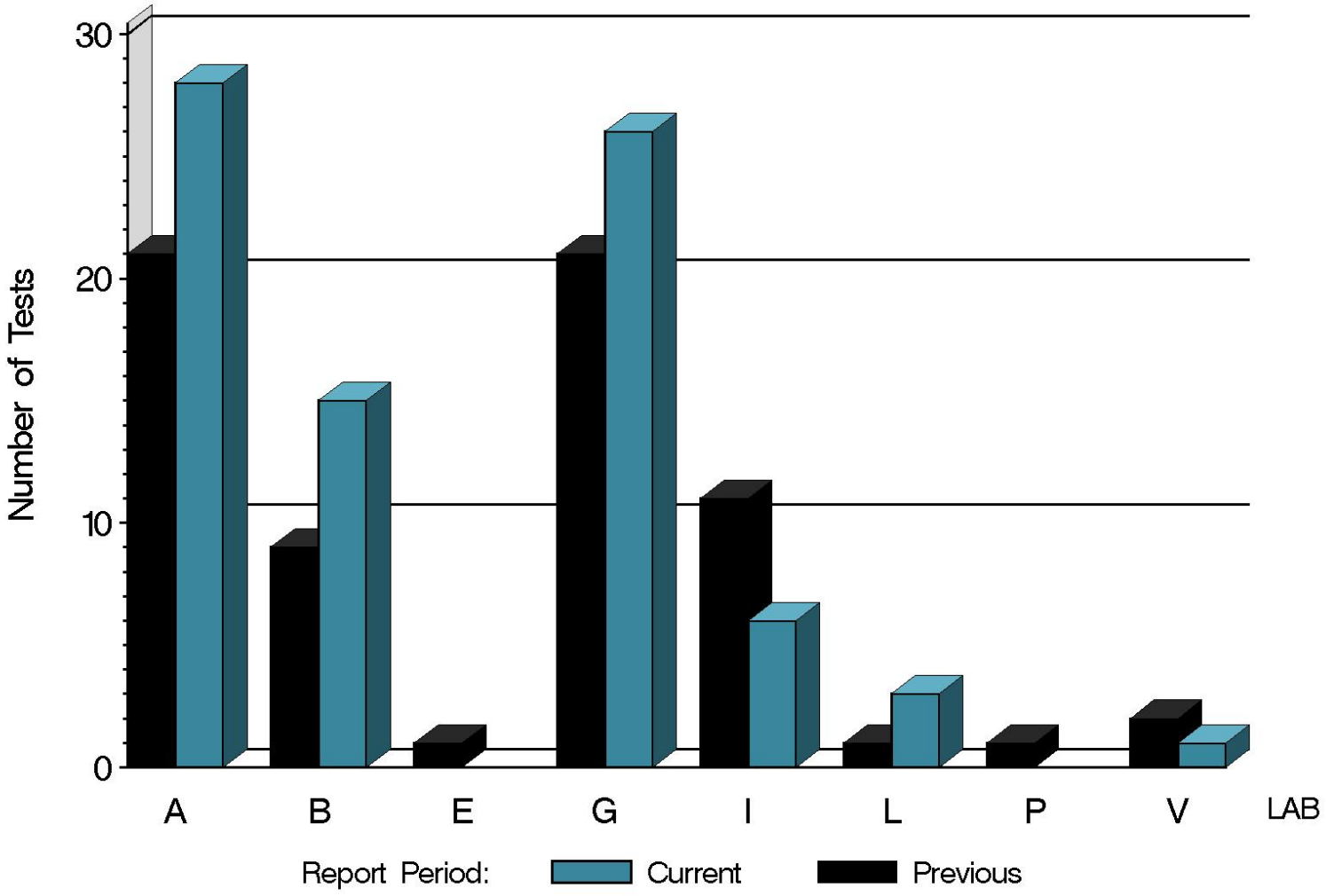
A total of 412 LDEOC tests were reported from 7 labs to the Test Monitoring Center during the period from April 1, 2018 through September 30, 2018.

Please find attached a summary of testing activity this period.

MTK/mtk/mem18-049.mtk.doc
cc: Frank Farber
Jeff Clark
EOEC Surveillance Panel
http://www.astmtmc.cmu.edu/docs/bench/ldeoc/semiannualreports/ldeoc-10-2018.pdf

Distribution: email

LDEOC (D 7216)



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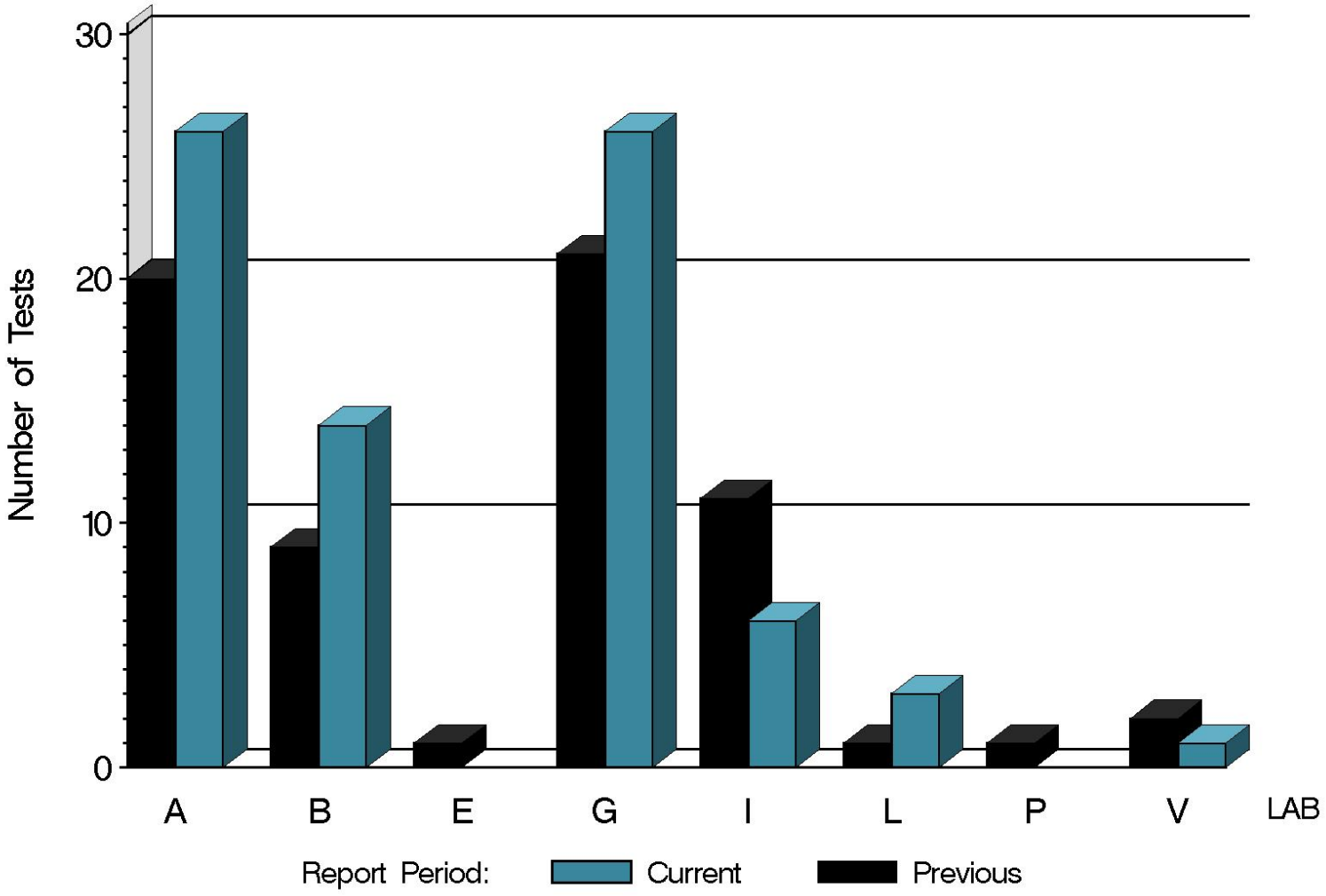
LDEOC (D 7216)



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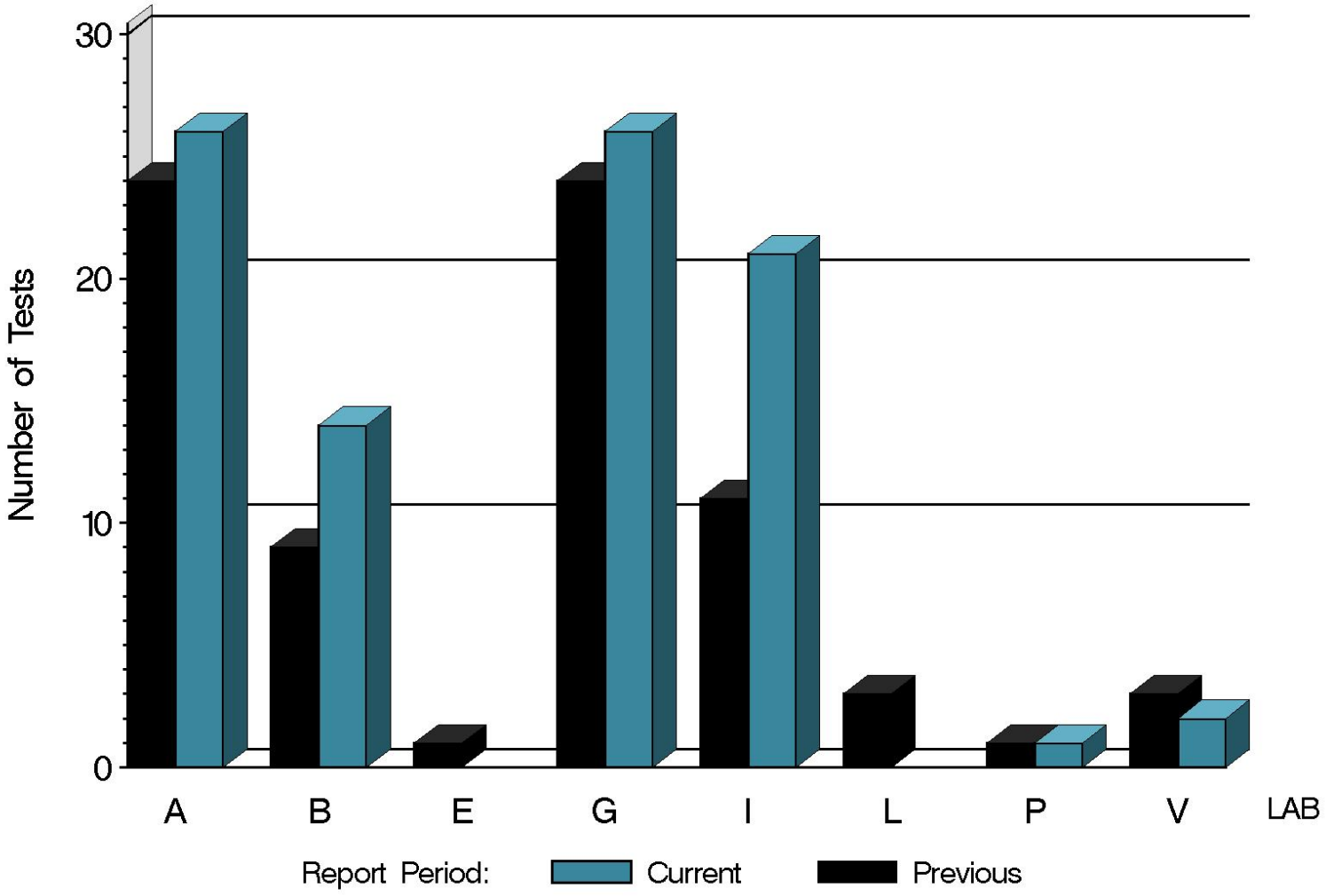
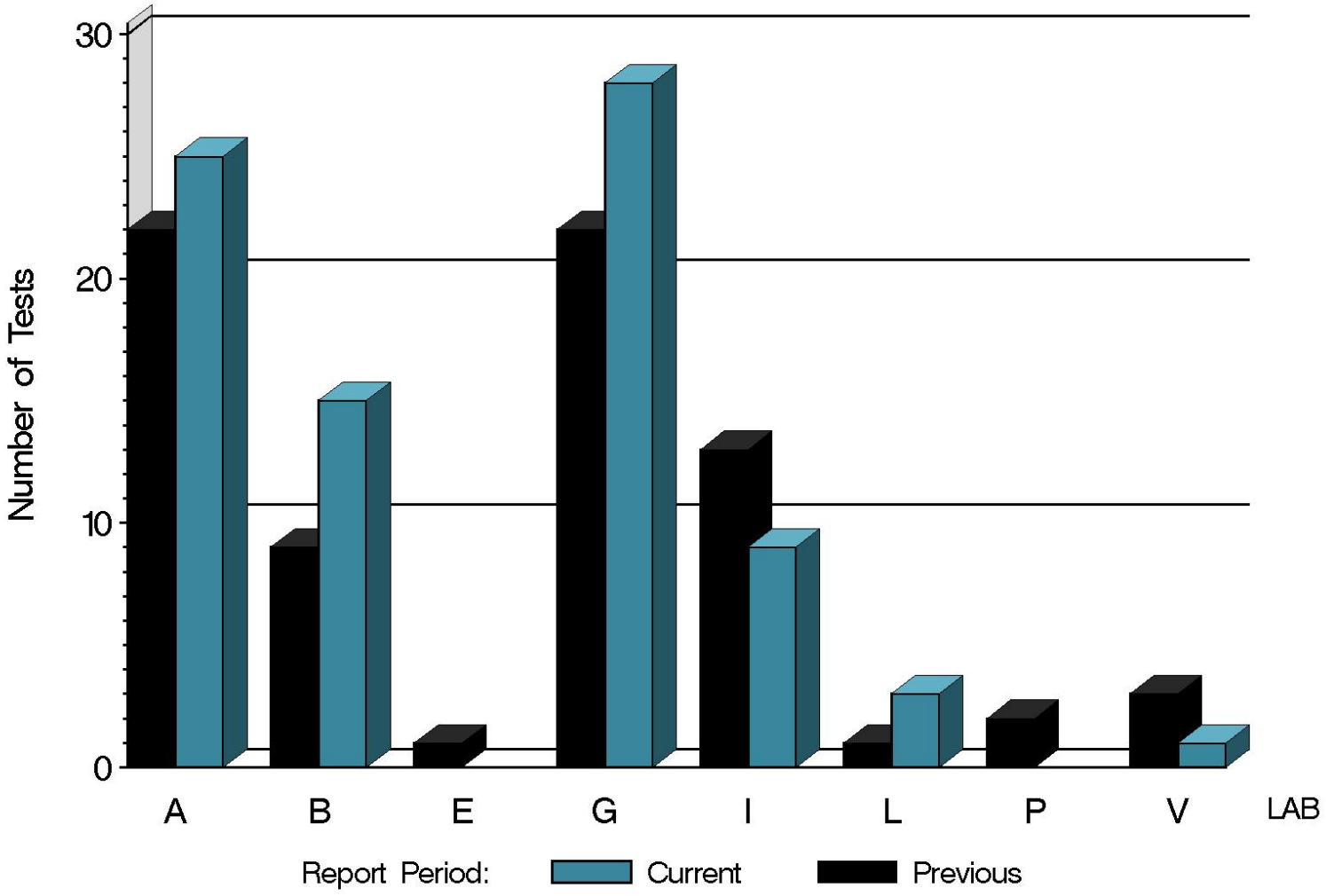
LDEOC (D 7216)


NUMBER OF NITRILE TESTS
REPORTED BY LAB AND REPORT PERIOD
Number of Tests
30
20
10
0
A
B
E
G
I
L
P
V
LAB
Report Period:
Current
Previous
10:07:18 20NOV2018

LDEOC (D 7216)



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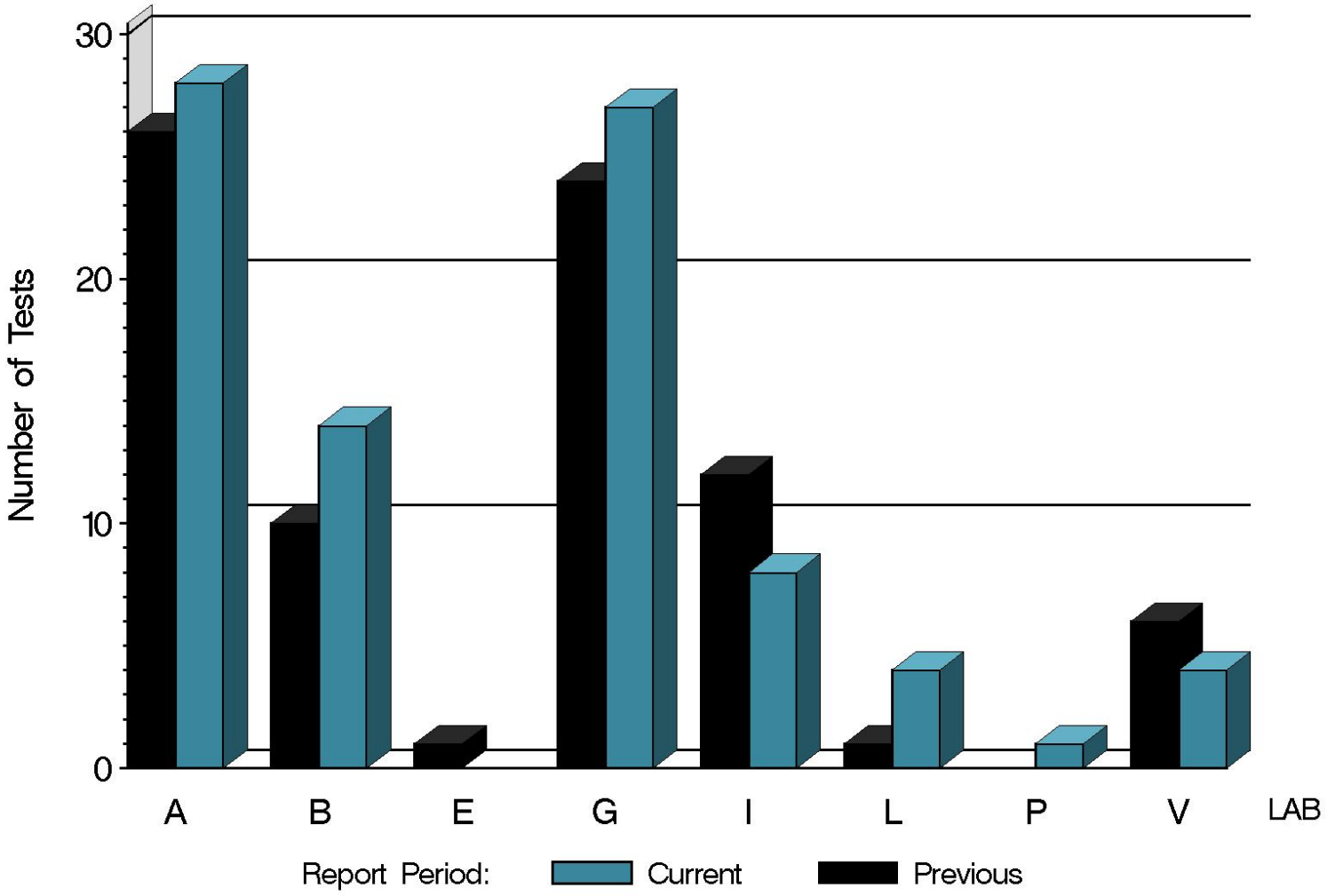
LDEOC (D 7216)



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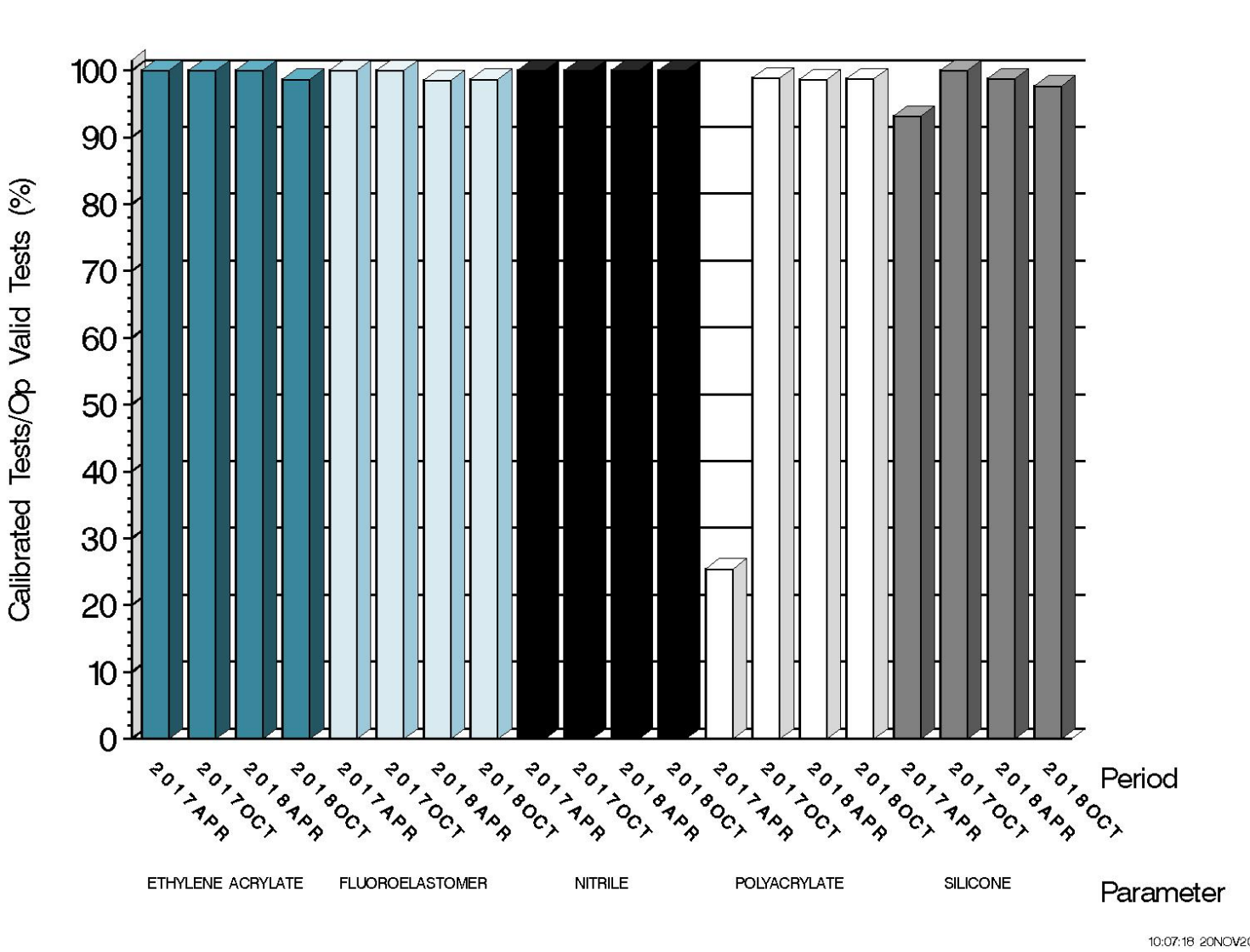
LDEOC (D 7216)

Test Distribution by Oil and Validity

		Ethylene Acrylate	Fluoroelastomer	Nitrile	Polyacrylate	Silicone	This Period	Last Period
Accepted for Calibration	AC	77	75	90	80	83	405	358
Rejected	OC	1	1	0	1	2	5	3
Acceptable Information Run	NI	0	0	0	0	0	0	0
Unacceptable Information Run	MI	0	0	0	0	0	0	0
Invalid Information Run (TMC)	LI	0	0	0	0	0	0	0
Invalid Information Run (TMC)	RI	0	0	0	0	0	0	0
Operationally Invalid (lab)	LC	1	0	0	0	1	2	0
Acceptable Shakedown Run	AS	0	0	0	0	0	0	0
Aborted Calibration	XC	0	0	0	0	0	0	0
Total		79	76	90	81	86	412	361

LDEOC (D 7216)


OPERATIONALLY VALID TESTS
MEETING ACCEPTANCE CRITERIA
Calibrated Tests/Op Valid Tests (%)
100
90
80
70
60
50
40
30
20
10
0
2017APR
2017OCT
2018APR
2018OCT
Period
ETHYLENE ACRYLATE
FLUOROELASTOMER
NITRILE
POLYACRYLATE
SILICONE
Parameter
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LDEOC (D 7216)

LOST TESTS PER START BY LAB AND ELASTOMER TYPE

	Ethylene Acrylate			Fluoroelastomer			Nitrile			Polyacrylate			Silicone			Total		
Lab	Lost	Starts	%	Lost	Starts	%	Lost	Starts	%	Lost	Starts	%	Lost	Starts	%	Lost	Starts	%
A	0	28	0	0	26	0	0	26	0	0	25	0	0	28	0	0	133	0
B	0	15	0	0	14	0	0	14	0	0	15	0	0	14	0	0	72	0
E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G	1	26	3.8	0	26	0	0	26	0	0	28	0	0	27	0	1	133	0.8
I	0	6	0	0	6	0	0	21	0	0	9	0	0	8	0	0	50	0
L	0	3	0	0	3	0	0	0	0	0	3	0	0	4	0	0	13	0
P	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0
V	0	1	0	0	1	0	0	2	0	0	1	0	1	4	25	1	9	11
Total	1	79	1.3	0	76	0	0	90	0	0	81	0	1	86	1.2	2	412	0.5

LDEOC (D 7216)

CAUSES FOR LOST TESTS

Lab	Cause	Elastomer					Validity			Loss Rate		
		Ethylene Acrylate	Fluoroelastomer	Nitrile	Polyacrylate	Silicone	LC	RC	XC	Lost	Starts	%
G	Wrong Test Length	1	0	0	0	0	1	0	0	1	133	0.8
V	Equipment Failure	0	0	0	0	1	1	0	0	1	9	11.1
	Lost	1	0	0	0	1	2	0	0			
	Starts	79	76	90	81	86	412	412	412			
	%	1.3	0	0	0	1.2	0.5	0	0			

Lost tests are calibration attempts that were either aborted or operationally invalid

LDEOC (D 7216)

Average Δ/s by Lab					
Elastomer	Lab	n	VOLCYI	HARDYI	TENSYI
Ethylene Acrylate	A	28	-1.023	-0.542	0.956
	B	15	-0.652	0.586	0.262
	E	-	-	-	-
	G	25	-1.099	1.099	-0.067
	I	6	0.580	-0.110	-0.009
	L	3	-2.186	2.271	0.165
	P	-	-	-	-
	V	1	-0.468	-2.857	-1.266
	Industry	78	-0.890	0.313	0.361
Fluoroelastomer	A	26	-0.521	0.944	-0.251
	B	14	-1.414	-0.182	0.731
	E	-	-	-	-
	G	26	-0.746	-0.161	-0.161
	I	6	0.067	-0.465	-0.465
	L	3	-0.511	0.525	0.525
	P	-	-	-	-
	V	1	-1.600	1.515	-2.101
	Industry	76	-0.730	0.238	0.366
Nitrile	A	26	1.360	-0.756	-0.288
	B	14	0.946	-0.156	-0.207
	E	-	-	-	-
	G	26	1.443	0.172	-1.113
	I	21	1.023	-0.539	-0.748
	L	-	-	-	-
	P	1	1.183	1.322	-1.914
	V	2	1.617	-0.402	-0.117
	Industry	90	1.245	-0.313	-0.635

LDEOC (D 7216)

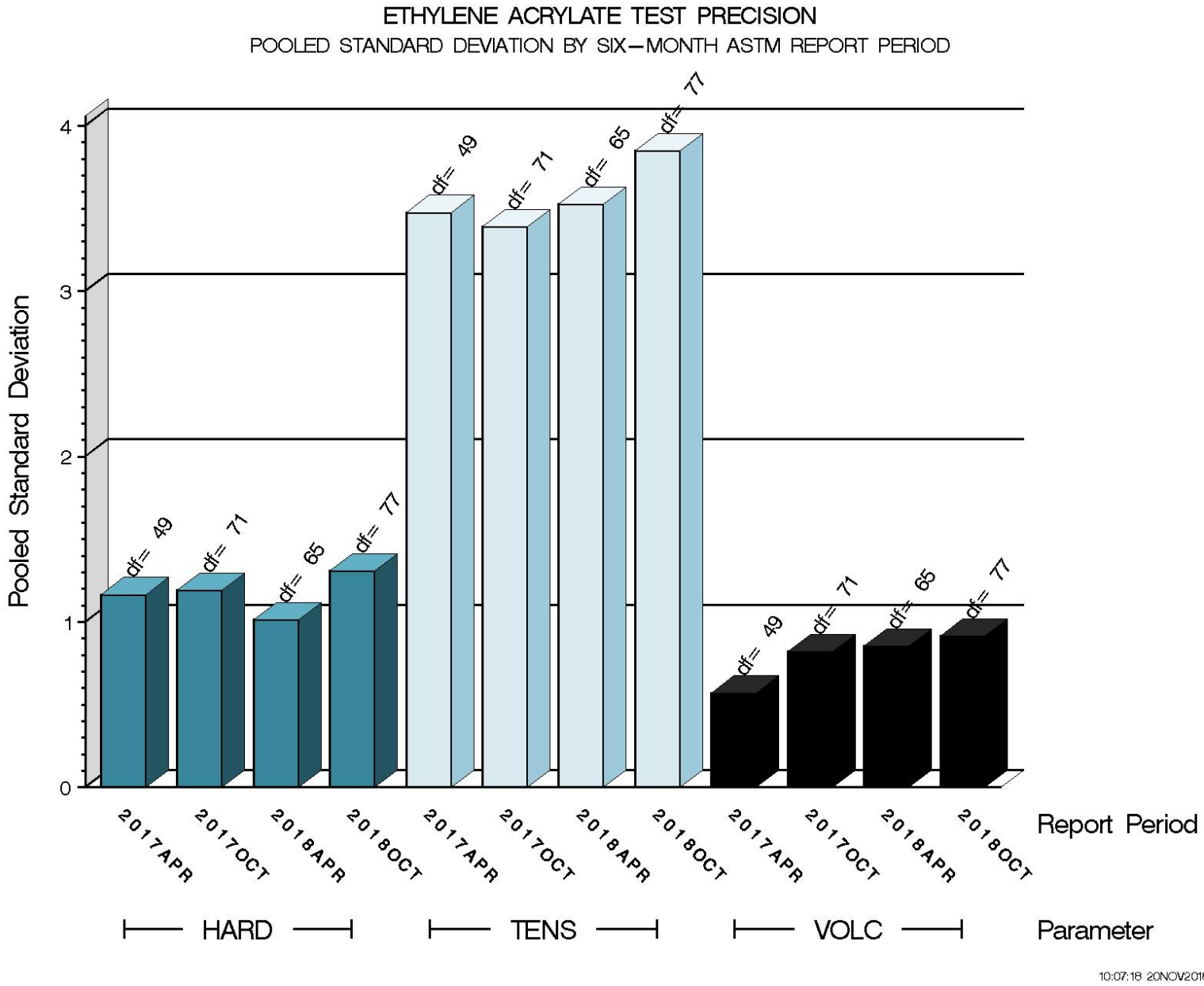
Average Δ/s by Lab					
Elastomer	Lab	n	VOLCYI	HARDYI	TENSYI
Polyacrylate	A	25	-0.359	-0.714	-0.504
	B	15	-0.213	-0.896	-0.542
	E	-	-	-	-
	G	28	-0.506	0.788	-0.672
	I	9	0.534	-0.045	-0.857
	L	3	-0.475	-0.766	-0.410
	P	-	-	-	-
	V	1	-1.030	-2.714	-0.366
	Industry	81	-0.296	-0.181	-0.603
Silicone	A	28	-0.046	-0.933	1.760
	B	14	0.127	-1.196	1.450
	E	-	-	-	-
	G	27	1.225	-0.488	1.182
	I	8	-1.390	-0.461	1.098
	L	4	-1.507	1.255	2.424
	P	1	-1.652	1.255	-1.224
	V	3	0.175	-1.359	2.100
	Industry	85	0.180	-0.677	1.471

LDEOC (D 7216)

Individual test results can be viewed at the links shown in the following table:

Links to Individual Test Result Data	
Elastomer Type	**Web Link to Data**
Ethylene Acrylate	http://www.astmtmc.cmu.edu/ftp/refdata/bench/ldeoca/data/
Fluoroelastomer	http://www.astmtmc.cmu.edu/ftp/refdata/bench/ldeocf/data/
Nitrile	http://www.astmtmc.cmu.edu/ftp/refdata/bench/ldeocn/data/
Polyacrylate	http://www.astmtmc.cmu.edu/ftp/refdata/bench/ldeocp/data/
Silicone	http://www.astmtmc.cmu.edu/ftp/refdata/bench/ldeocs/data/

LDEOC (D 7216)



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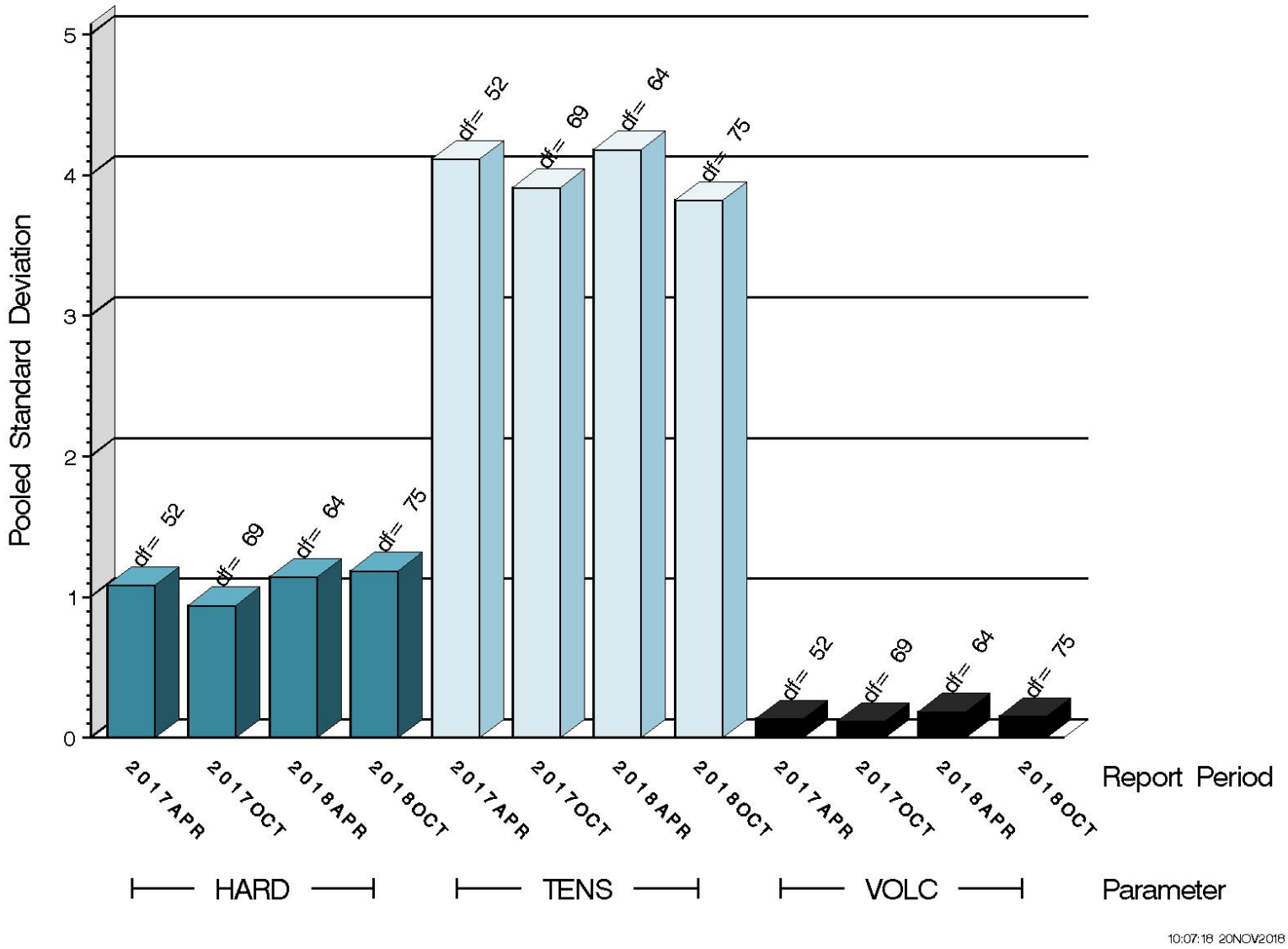
LDEOC (D 7216)



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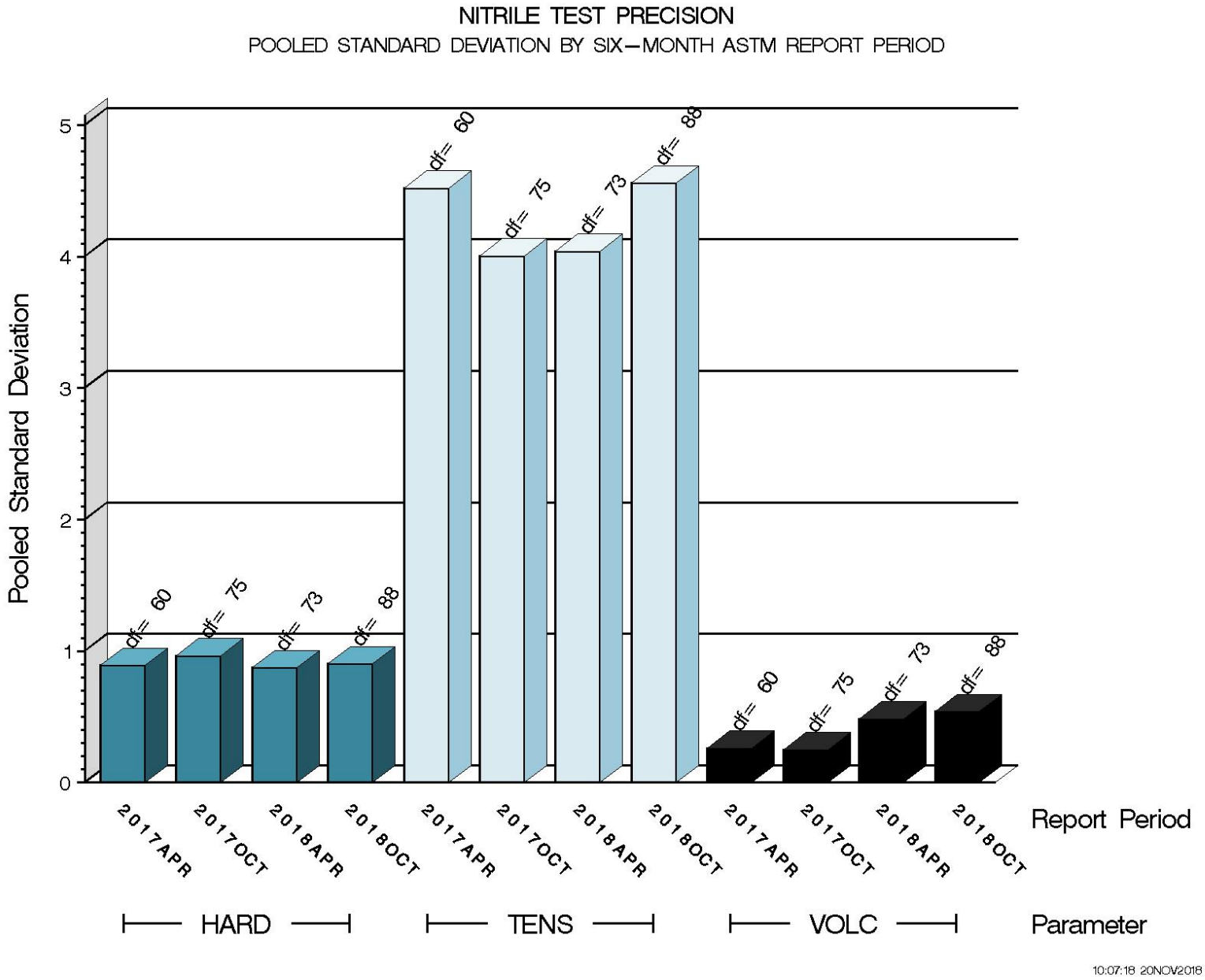
LDEOC (D 7216)



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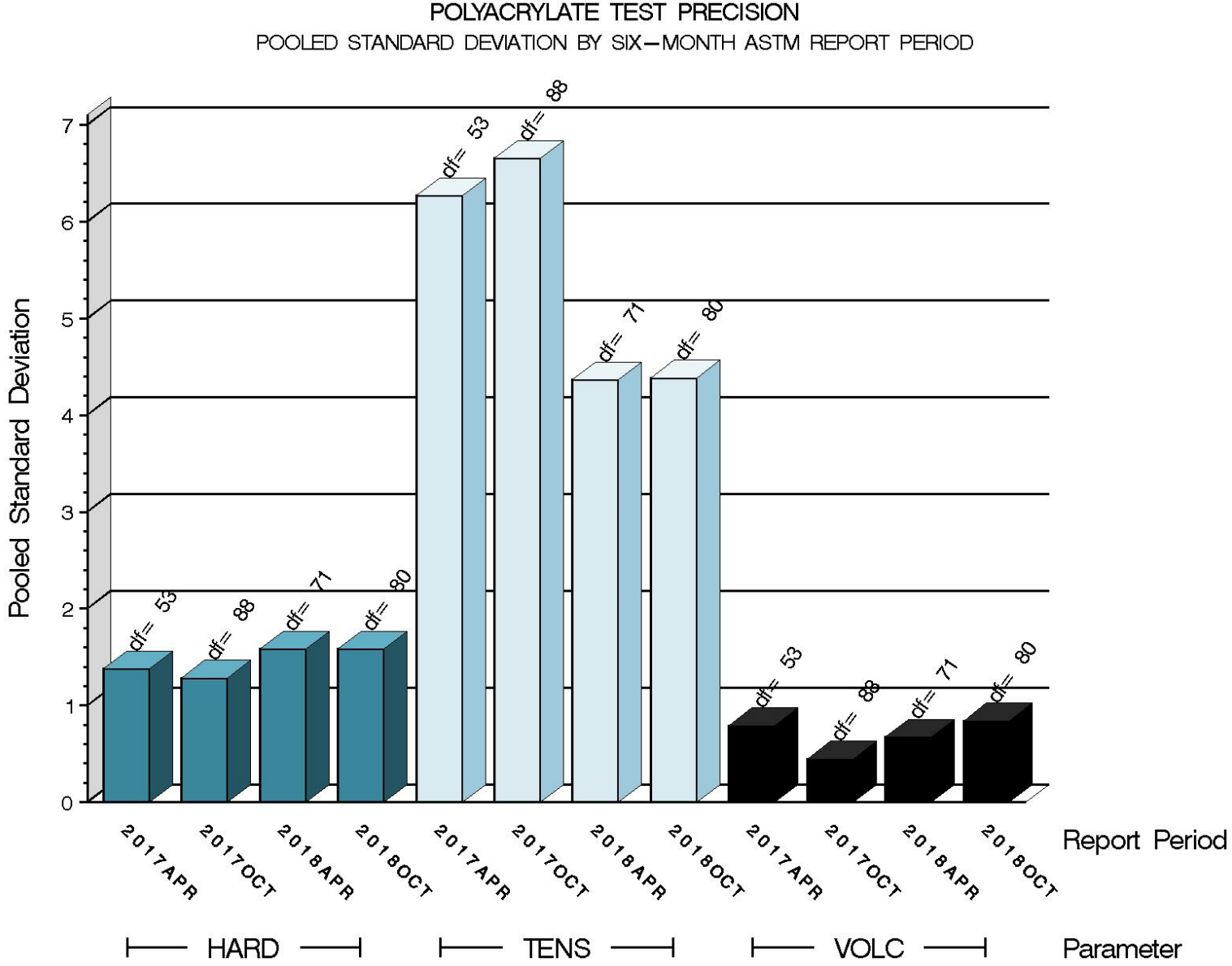
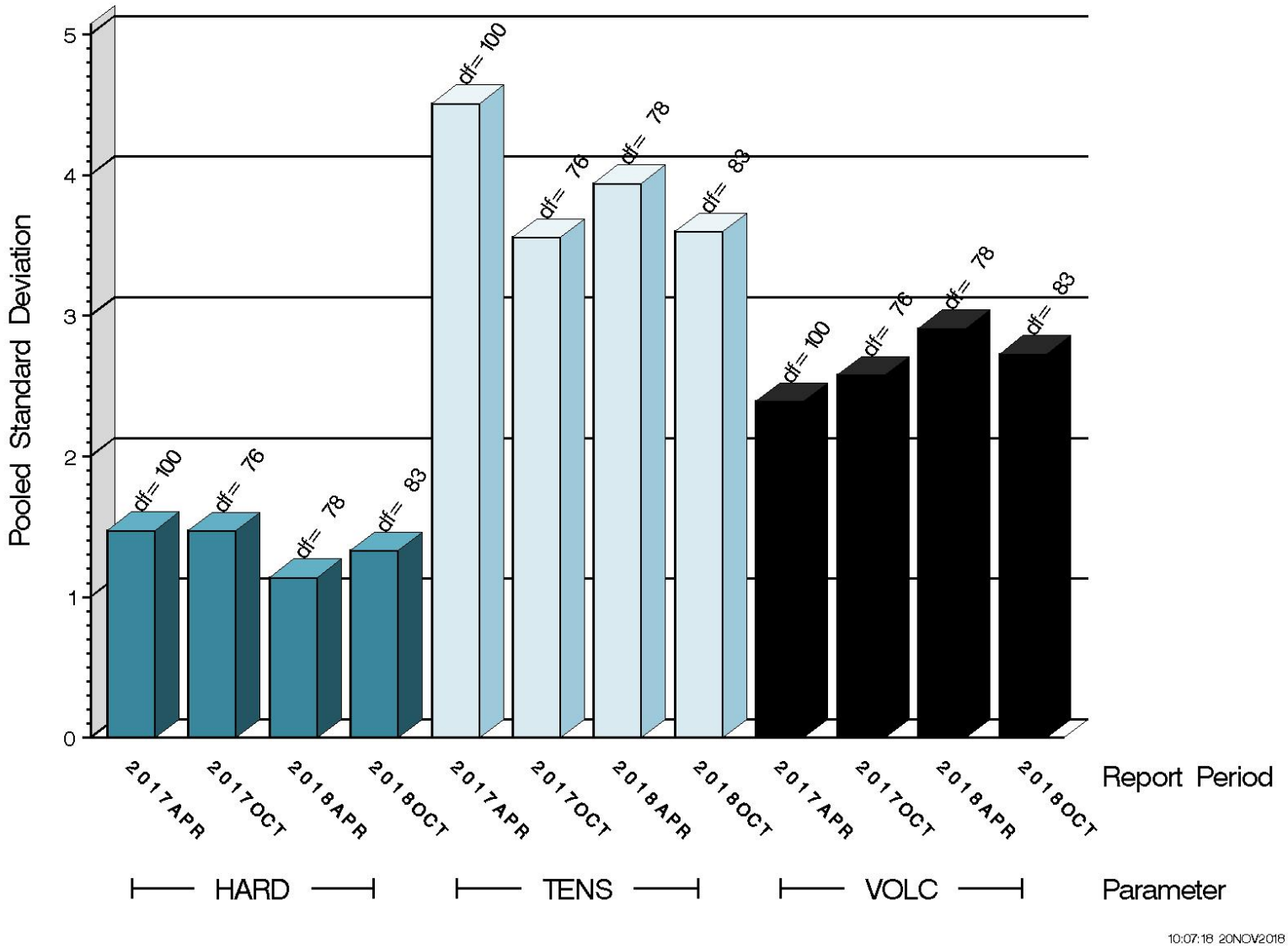
LDEOC (D 7216)


POLYACRYLATE TEST PRECISION
POOLED STANDARD DEVIATION BY SIX–MONTH ASTM REPORT PERIOD
Pooled Standard Deviation
0
1
2
3
4
5
6
7
df= 53
df= 88
df= 71
df= 80
df= 53
df= 88
df= 71
df= 80
df= 53
df= 88
df= 71
df= 80
2017APR
2017OCT
2018APR
2018OCT
2017APR
2017OCT
2018APR
2018OCT
2017APR
2017OCT
2018APR
2018OCT
Report Period
HARD
TENS
VOLC
Parameter
10:07:18 20NOV2018

LDEOC (D 7216)


SILICONE TEST PRECISION
POOLED STANDARD DEVIATION BY SIX–MONTH ASTM REPORT PERIOD
Pooled Standard Deviation
0
1
2
3
4
5
df= 100
df= 76
df= 78
df= 83
df= 100
df= 76
df= 78
df= 83
df= 100
df= 76
df= 78
df= 83
2017APR
2017OCT
2018APR
2018OCT
2017APR
2017OCT
2018APR
2018OCT
2017APR
2017OCT
2018APR
2018OCT
Report Period
HARD
TENS
VOLC
Parameter
10:07:18 20NOV2018

LDEOC (D 7216)

SUMMARY OF SEVERITY & PRECISION

Summary of Severity as Measured by LTMS Control Charting			
Elastomer	**VOLC**	**HARD**	**TENS**
Ethylene Acrylate	**Mild**	Within limits	Within limits
Fluoroelastomer	**Mild**	Within limits	**Severe**
Nitrile	**Severe**	Within limits	**Mild**
Polyacrylate	Within limits	Within limits	**Mild**
Silicone	Within limits	Within limits	**Severe**

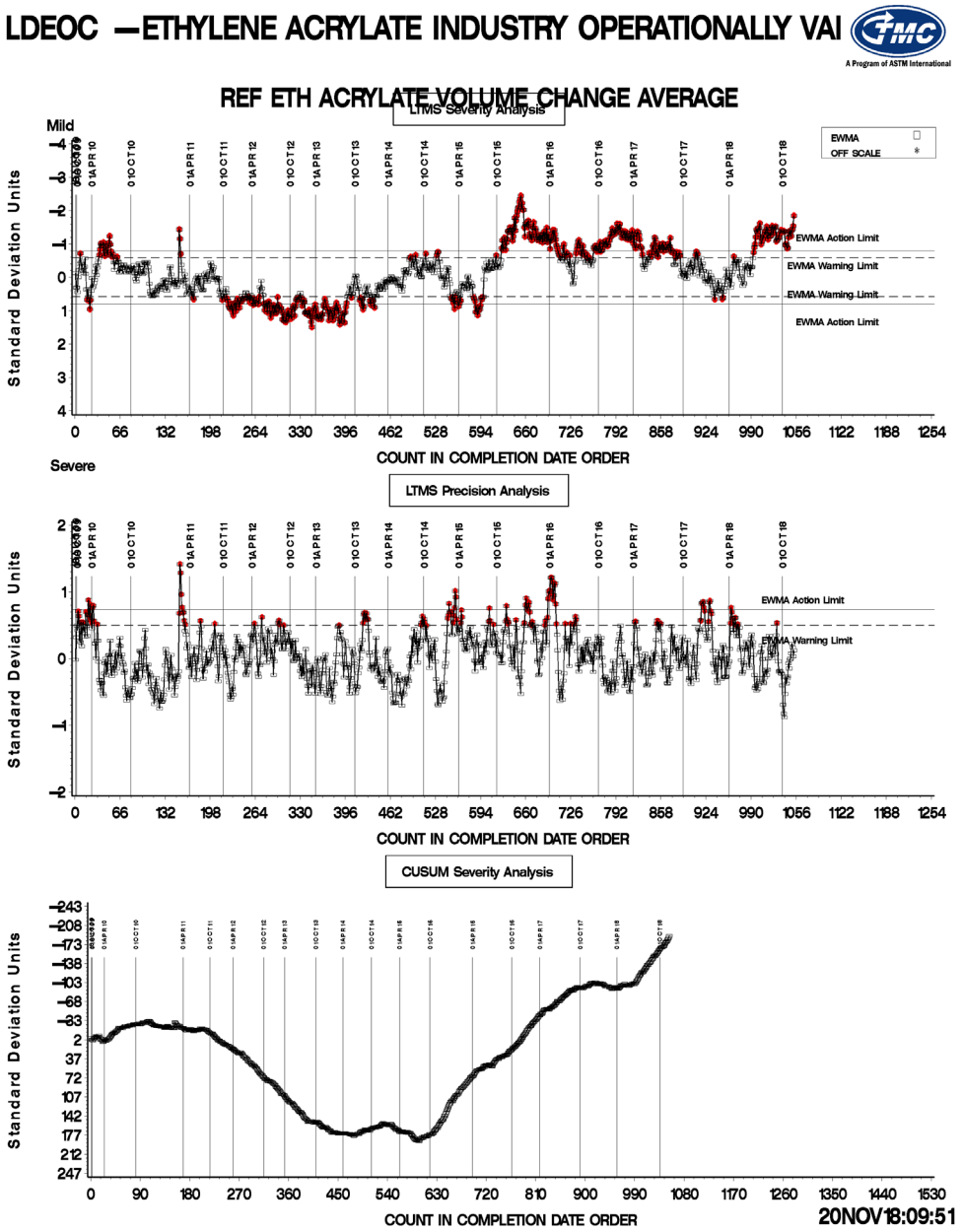
LDEOC (D 7216)

SUMMARY OF SEVERITY & PRECISION (continued)

Summary of Precision as Measured by LTMS Control Charting			
Elastomer	**VOLC**	**HARD**	**TENS**
Ethylene Acrylate	Within limits	Within limits	Within limits
Fluoroelastomer	Within limits	Within limits	Within limits
Nitrile	Within limits	Within limits	Within limits
Polyacrylate	Within limits	Within limits	Within limits
Silicone	Within limits	Within limits	Within limits

Industry control charts follow.

LDEOC (D 7216)


LDEOC —ETHYLENE ACRYLATE INDUSTRY OPERATIONALLY VAI
A Program of ASTM International
REF ETH ACRYLATE VOLUME CHANGE AVERAGE
LTMS Severity Analysis
Mild
Standard Deviation Units
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
COUNT IN COMPLETION DATE ORDER
Severe
LTMS Precision Analysis
Standard Deviation Units
EWMA Action Limit
EWMA Warning Limit
COUNT IN COMPLETION DATE ORDER
CUSUM Severity Analysis
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
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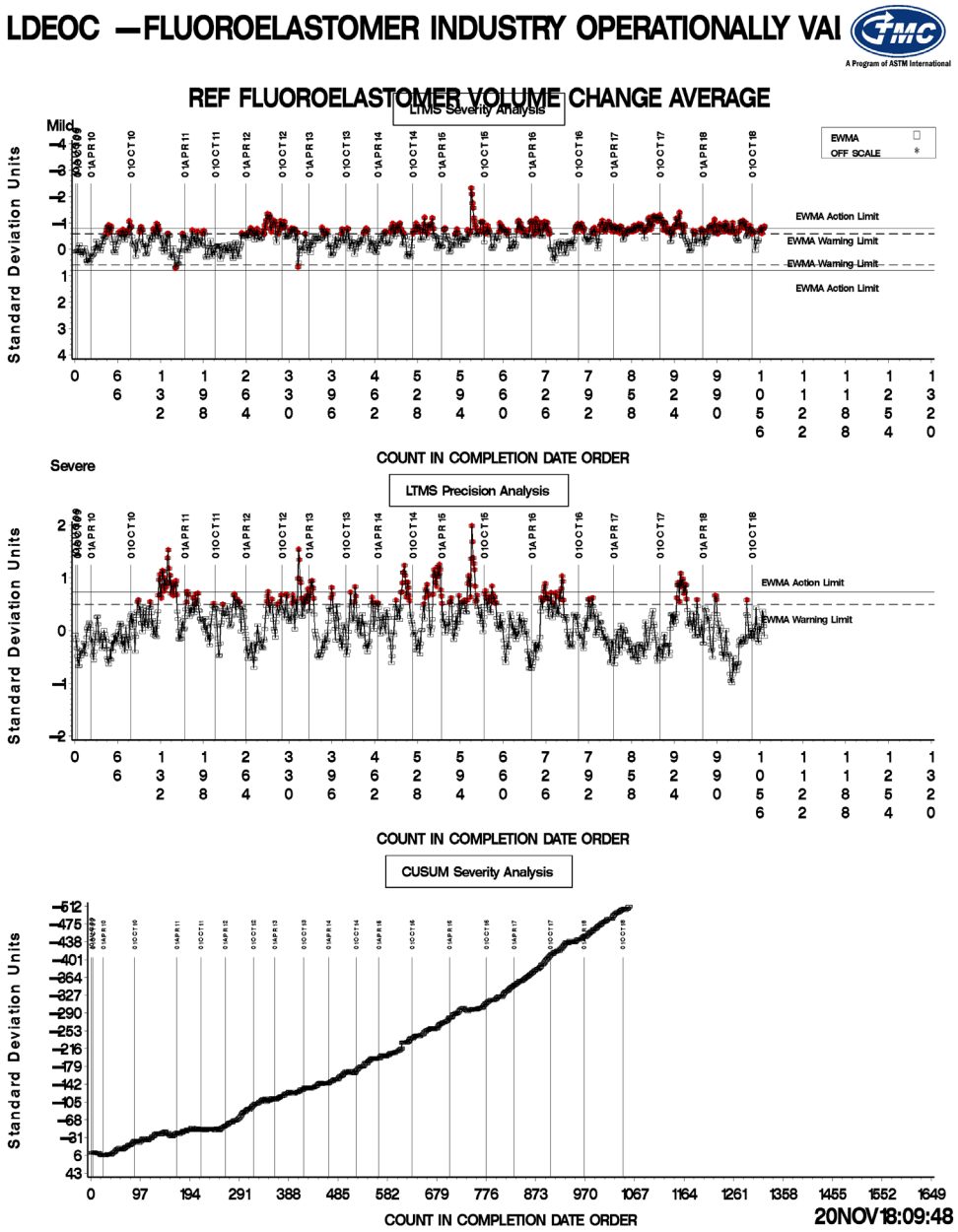
LDEOC (D 7216)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A Program of ASTM International
REF FLUOROELASTOMER VOLUME CHANGE AVERAGE
LTMS Severity Analysis
Mild
Standard Deviation Units
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
COUNT IN COMPLETION DATE ORDER
Severe
LTMS Precision Analysis
Standard Deviation Units
EWMA Action Limit
EWMA Warning Limit
COUNT IN COMPLETION DATE ORDER
CUSUM Severity Analysis
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
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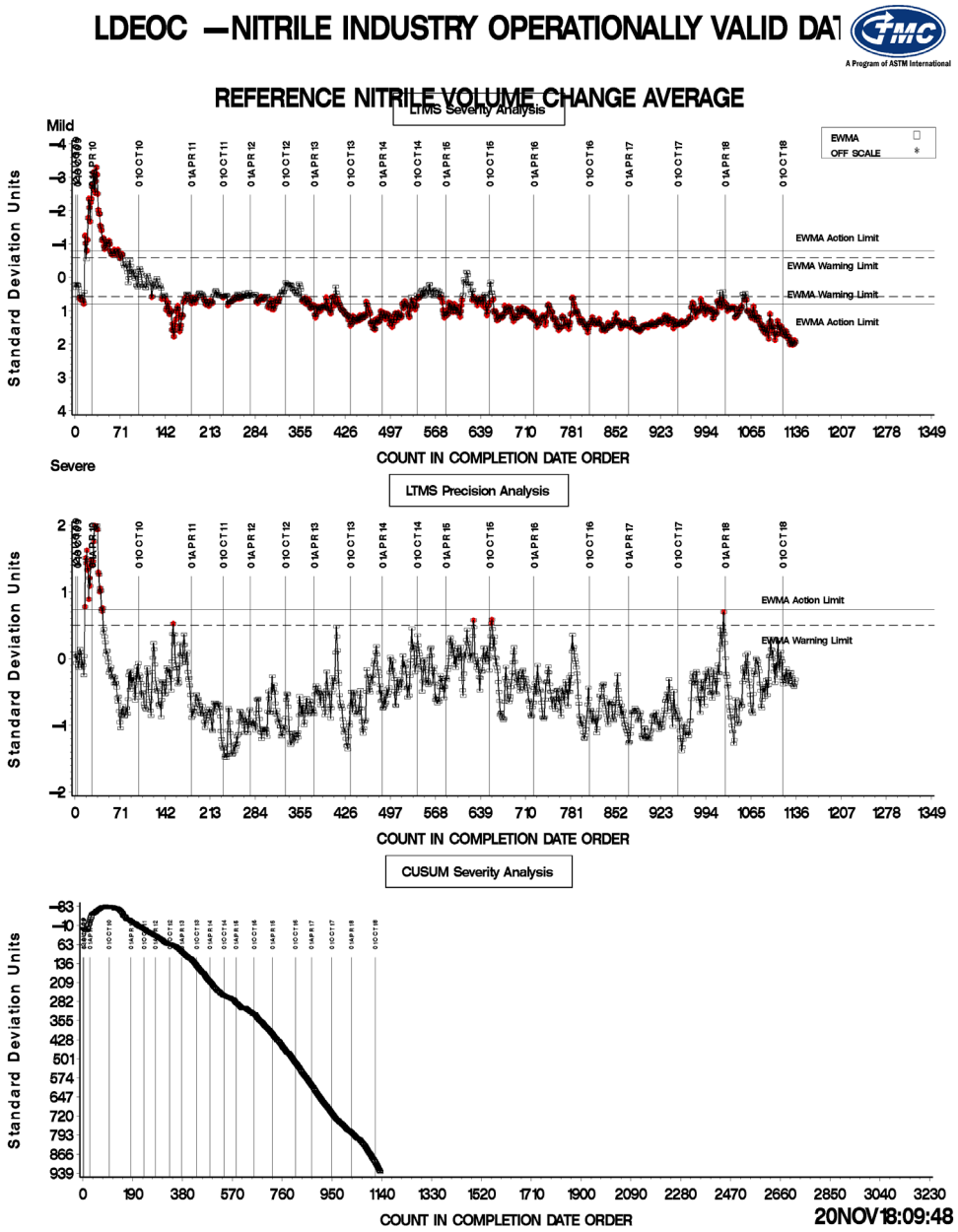
LDEOC (D 7216)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A Program of ASTM International
REFERENCE NITRILE VOLUME CHANGE AVERAGE
LTMS Severity Analysis
Mild
Standard Deviation Units
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
COUNT IN COMPLETION DATE ORDER
Severe
LTMS Precision Analysis
Standard Deviation Units
EWMA Action Limit
EWMA Warning Limit
COUNT IN COMPLETION DATE ORDER
CUSUM Severity Analysis
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
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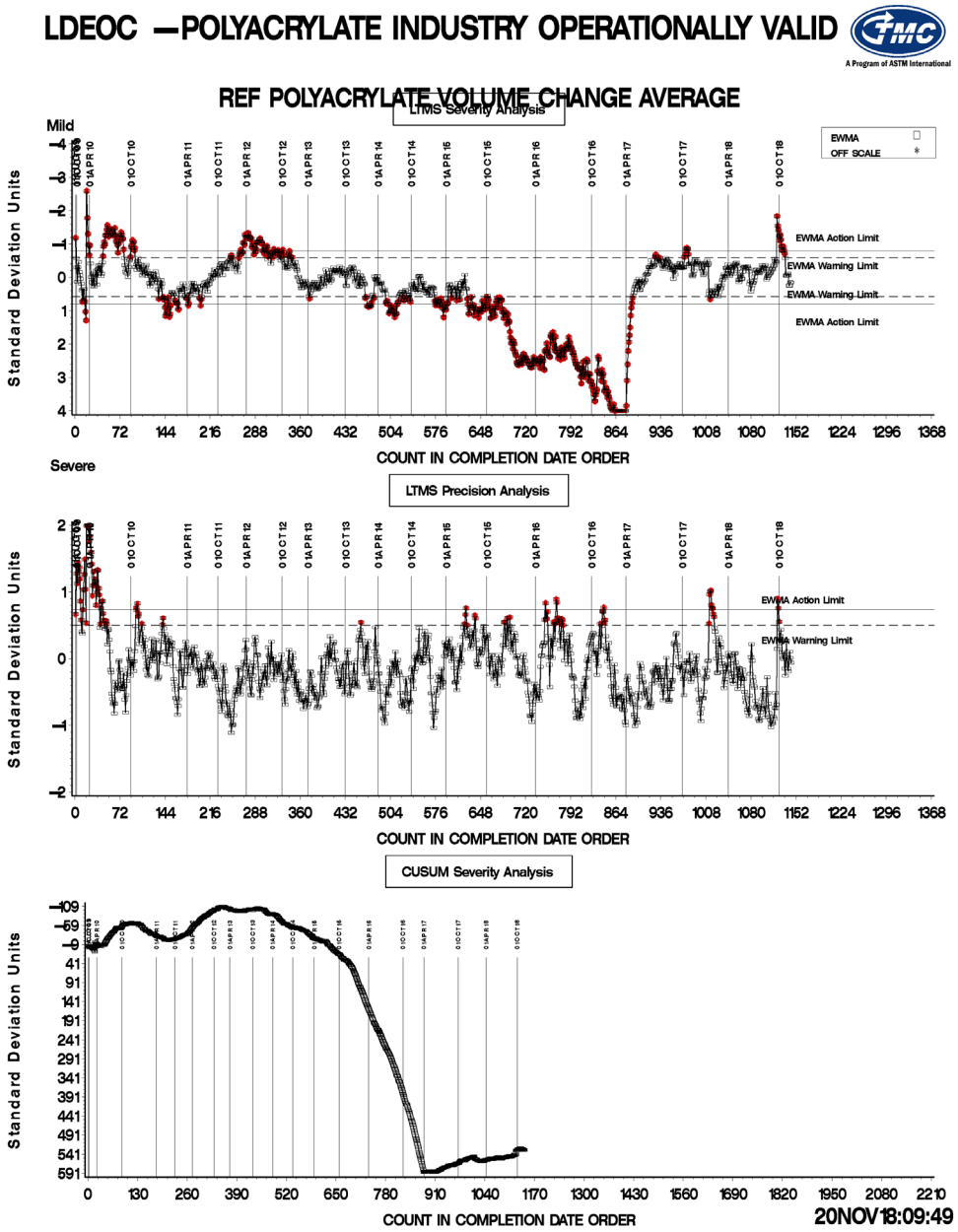
LDEOC (D 7216)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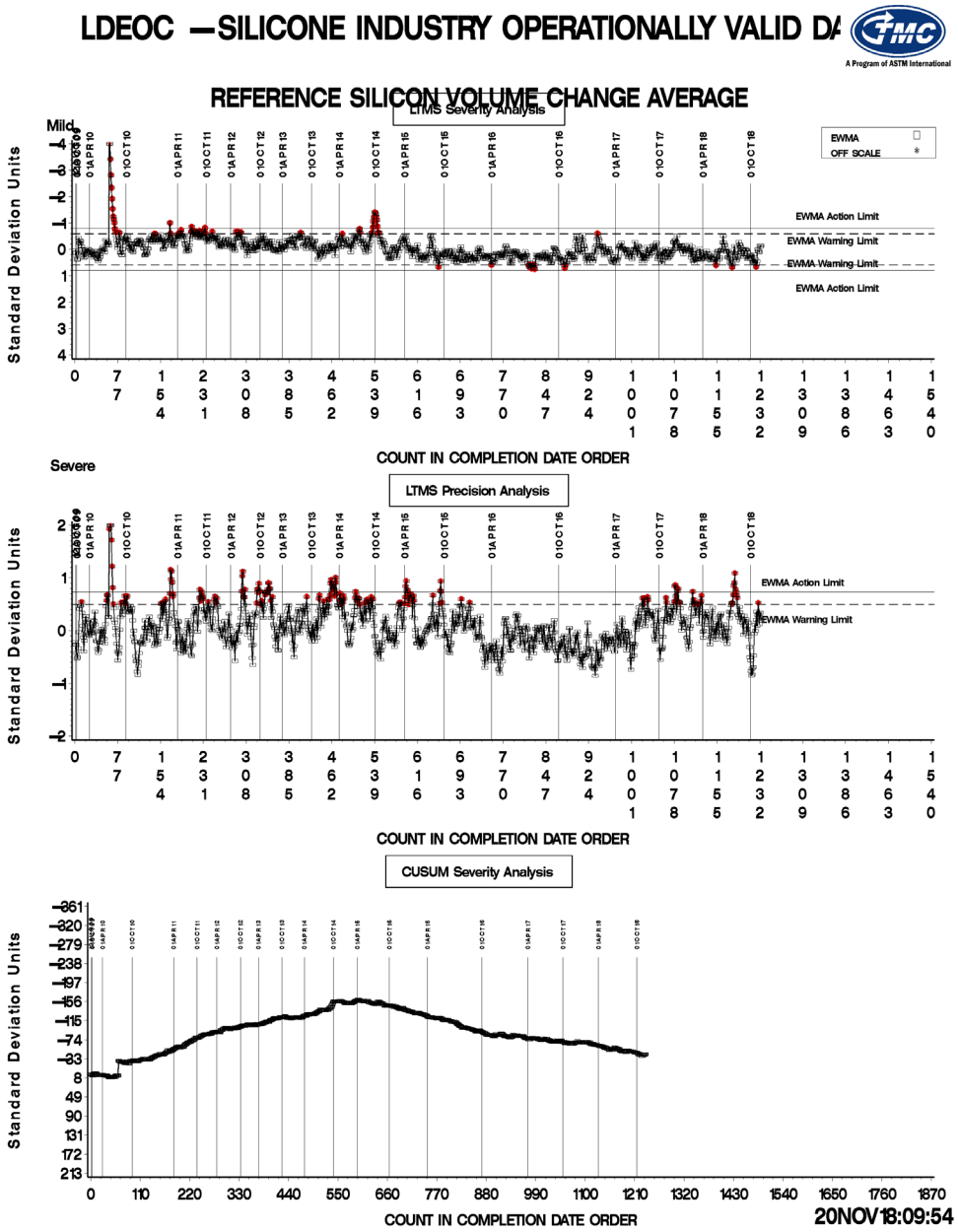
A Program of ASTM International
REF POLYACRYLATE VOLUME CHANGE AVERAGE
LTMS Severity Analysis
Mild
Standard Deviation Units
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
COUNT IN COMPLETION DATE ORDER
Severe
LTMS Precision Analysis
Standard Deviation Units
EWMA Action Limit
EWMA Warning Limit
COUNT IN COMPLETION DATE ORDER
CUSUM Severity Analysis
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
20NOV18:09:49

LDEOC (D 7216)


LDEOC —SILICONE INDUSTRY OPERATIONALLY VALID DA
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REFERENCE SILICON VOLUME CHANGE AVERAGE
LTMS Severity Analysis
Mild
Standard Deviation Units
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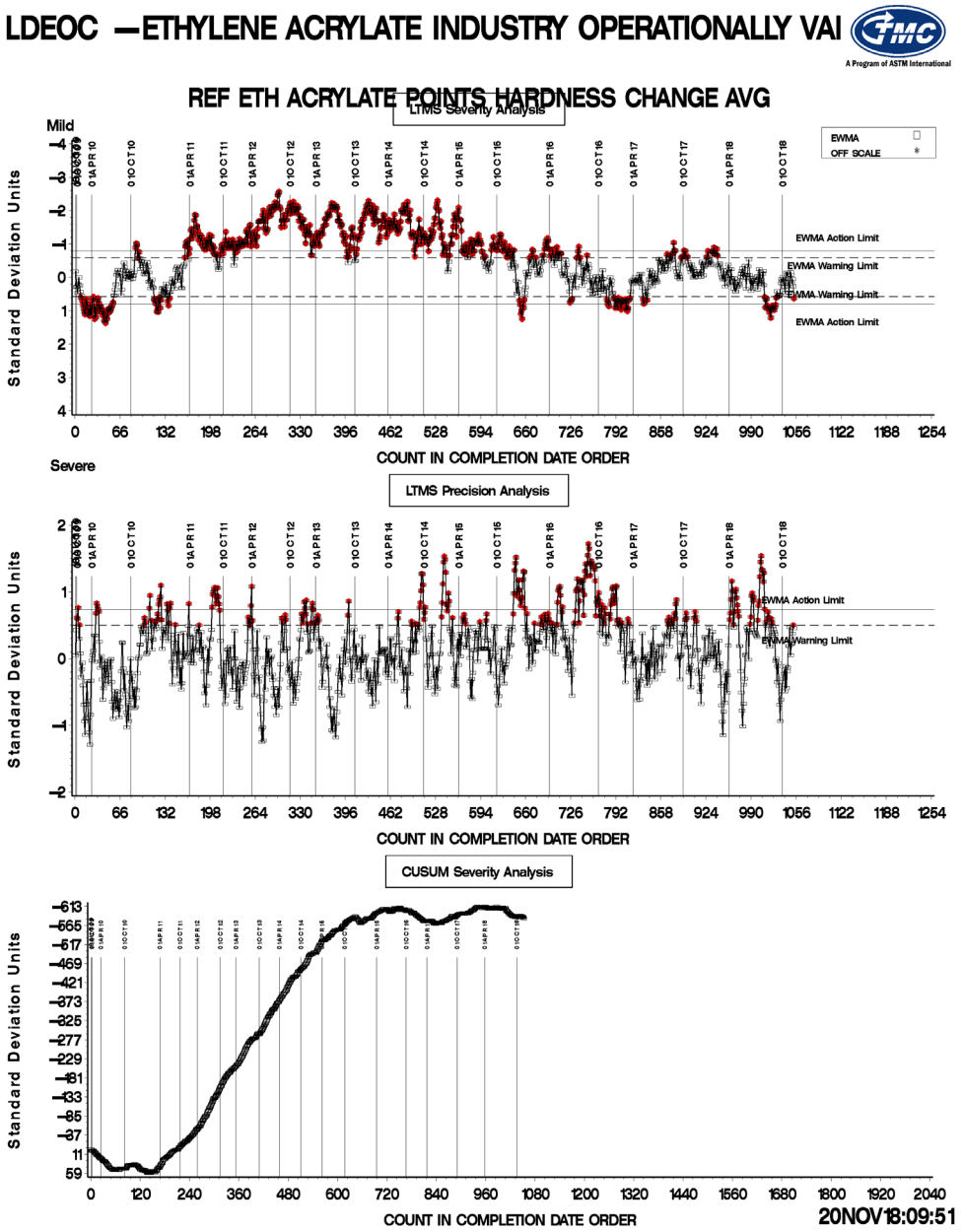
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
COUNT IN COMPLETION DATE ORDER
Severe
LTMS Precision Analysis
Standard Deviation Units
EWMA Action Limit
EWMA Warning Limit
COUNT IN COMPLETION DATE ORDER
CUSUM Severity Analysis
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
20NOV18:09:54

LDEOC (D 7216)


LDEOC —ETHYLENE ACRYLATE INDUSTRY OPERATIONALLY VAI
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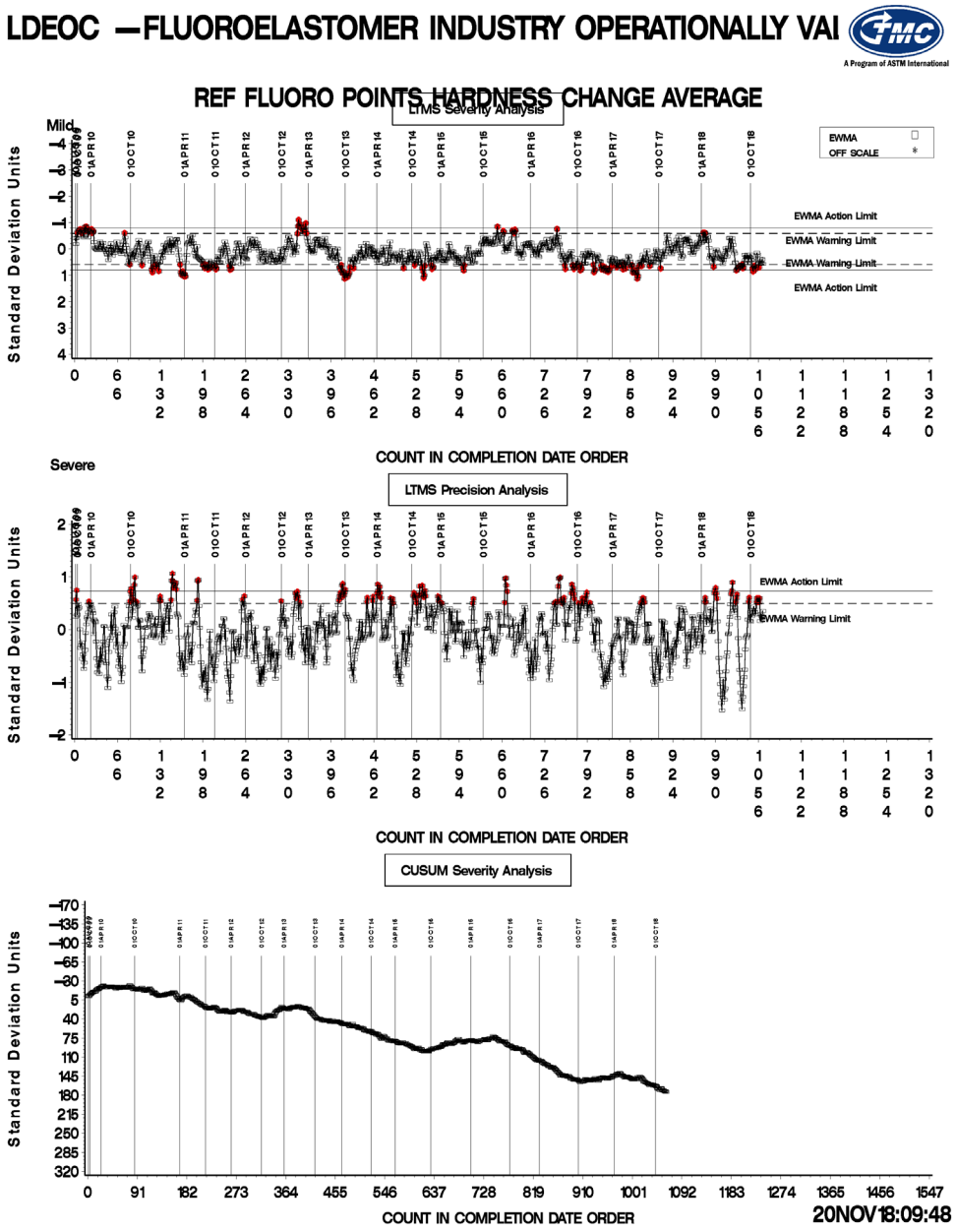
REF ETH ACRYLATE POINTS HARDNESS CHANGE AVG
LTMS Severity Analysis
Mild
Standard Deviation Units
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
COUNT IN COMPLETION DATE ORDER
Severe
LTMS Precision Analysis
Standard Deviation Units
EWMA Action Limit
EWMA Warning Limit
COUNT IN COMPLETION DATE ORDER
CUSUM Severity Analysis
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
20NOV18:09:51

LDEOC (D 7216)



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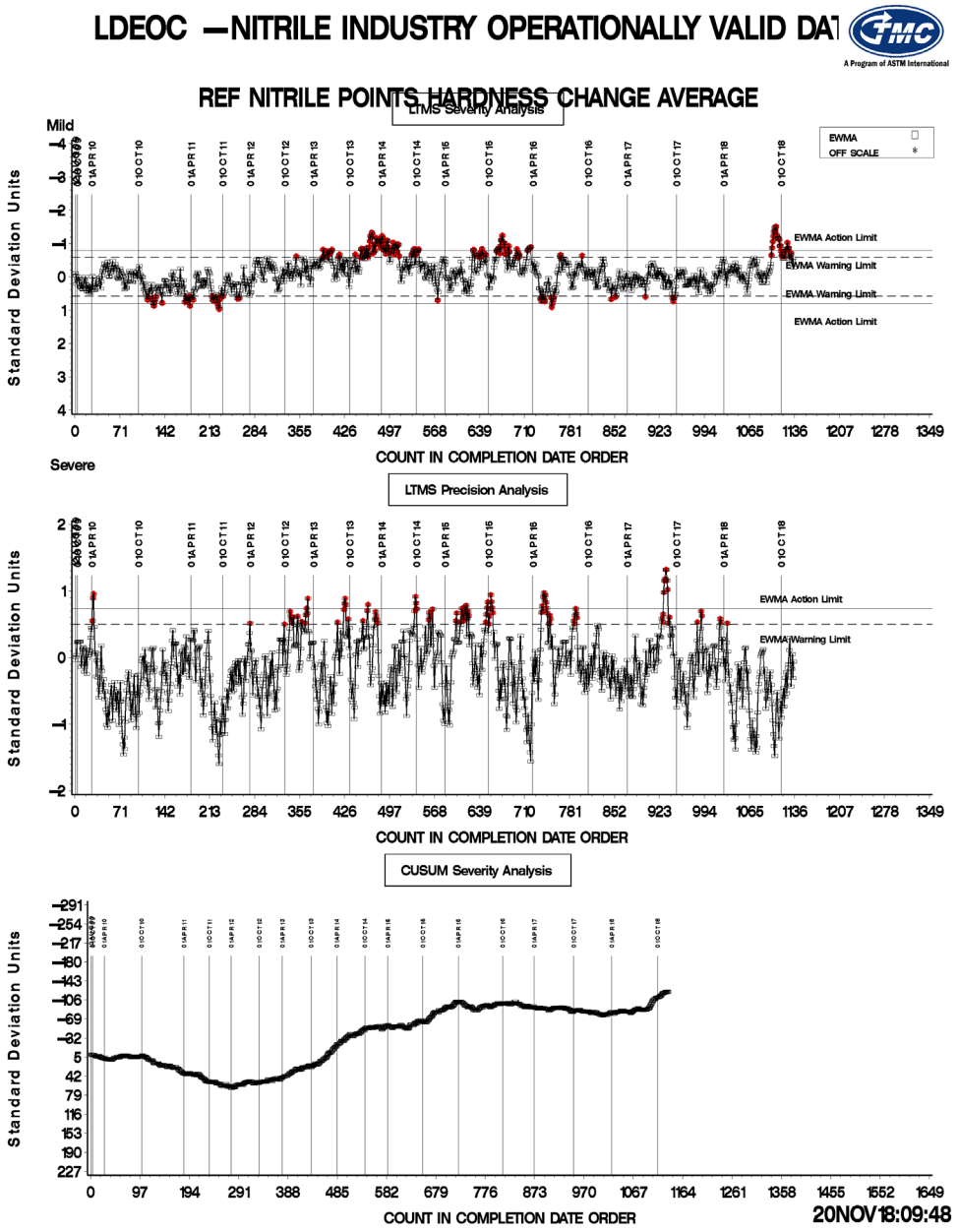

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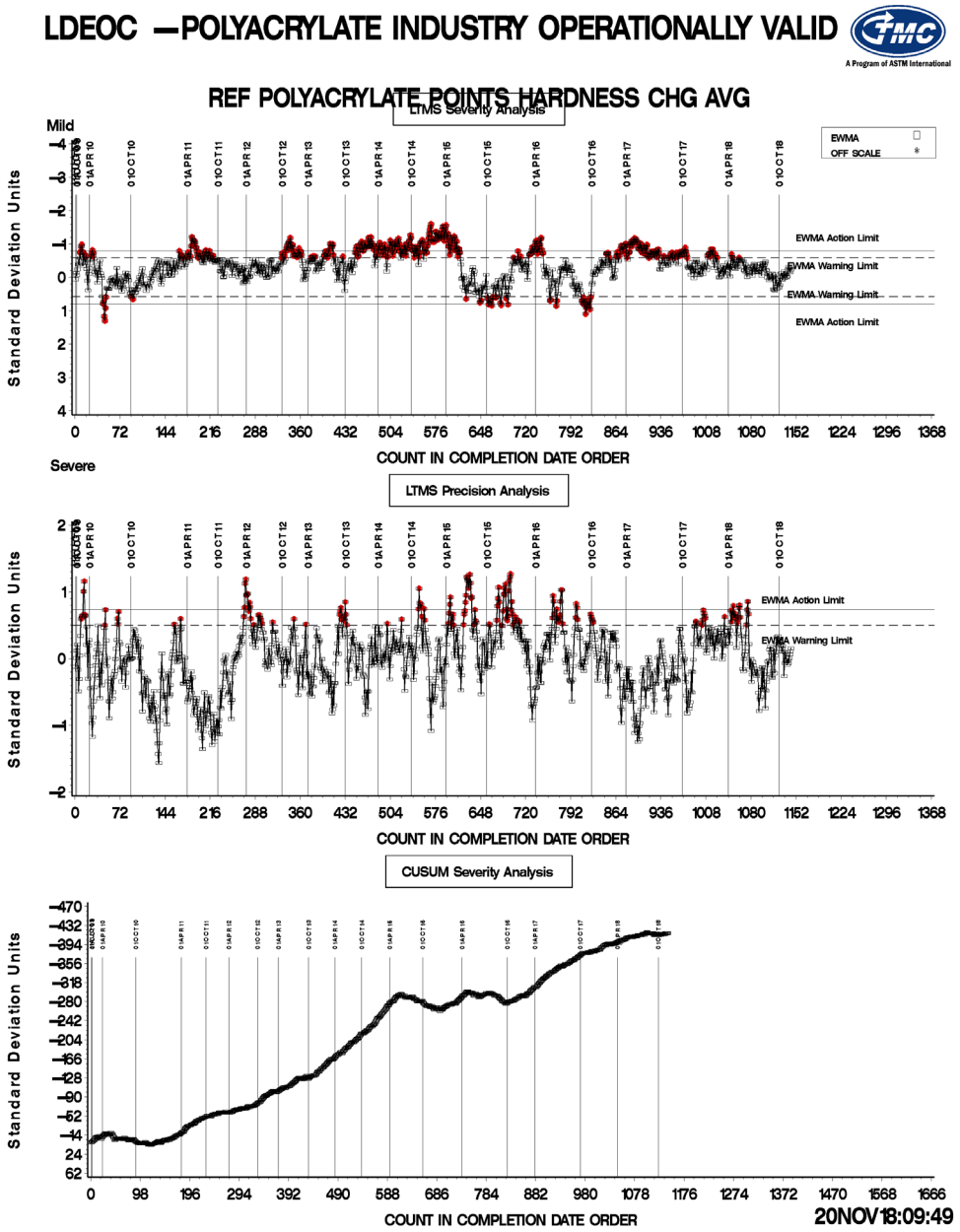
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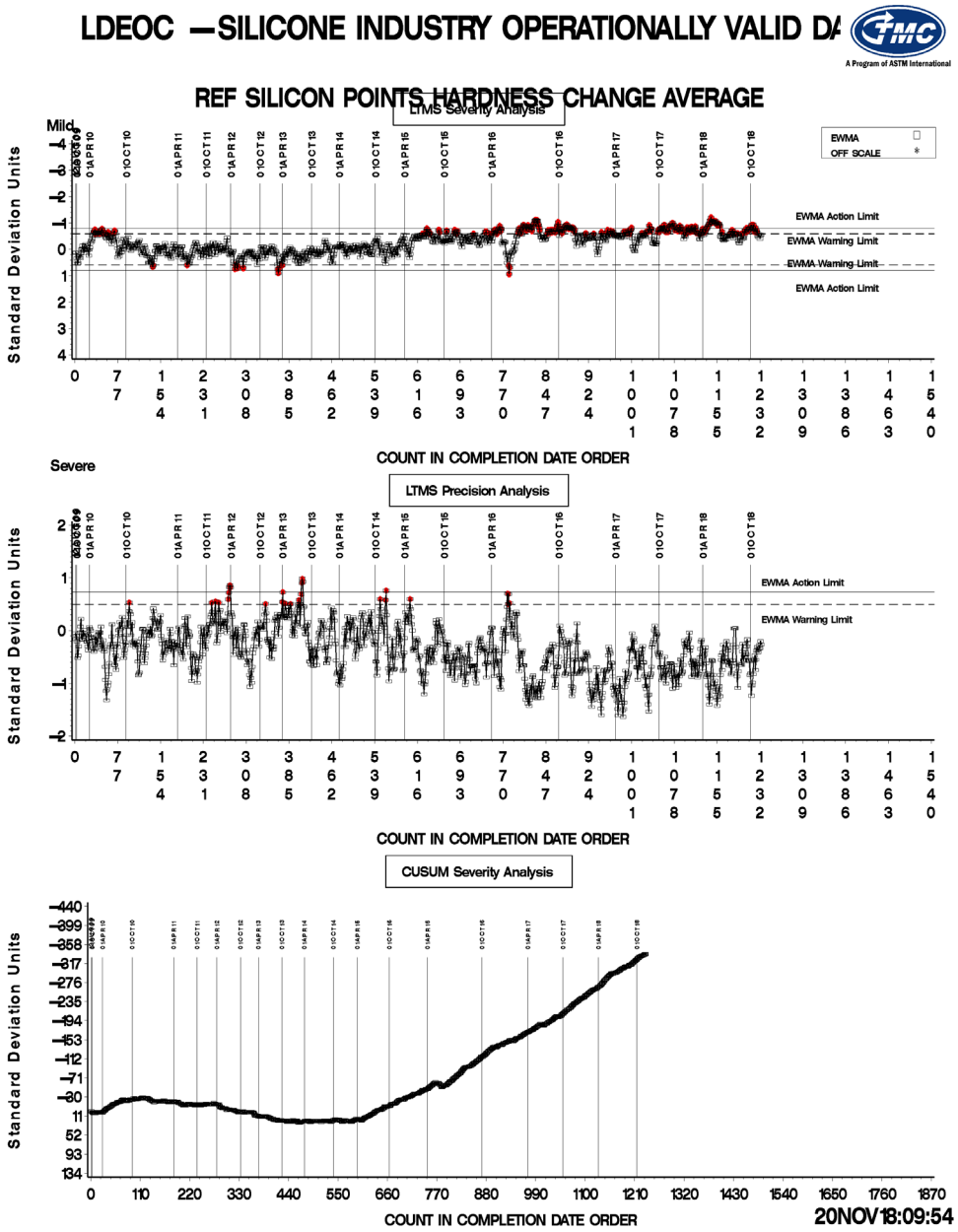
A Program of ASTM International
REF POLYACRYLATE POINTS HARDNESS CHG AVG
LTMS Severity Analysis
Mild
Standard Deviation Units
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
COUNT IN COMPLETION DATE ORDER
Severe
LTMS Precision Analysis
Standard Deviation Units
EWMA Action Limit
EWMA Warning Limit
COUNT IN COMPLETION DATE ORDER
CUSUM Severity Analysis
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
20NOV18:09:49

LDEOC (D 7216)


LDEOC —SILICONE INDUSTRY OPERATIONALLY VALID DA
REF SILICON POINTS HARDNESS CHANGE AVERAGE
LTMS Severity Analysis
Mild
Standard Deviation Units
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
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COUNT IN COMPLETION DATE ORDER
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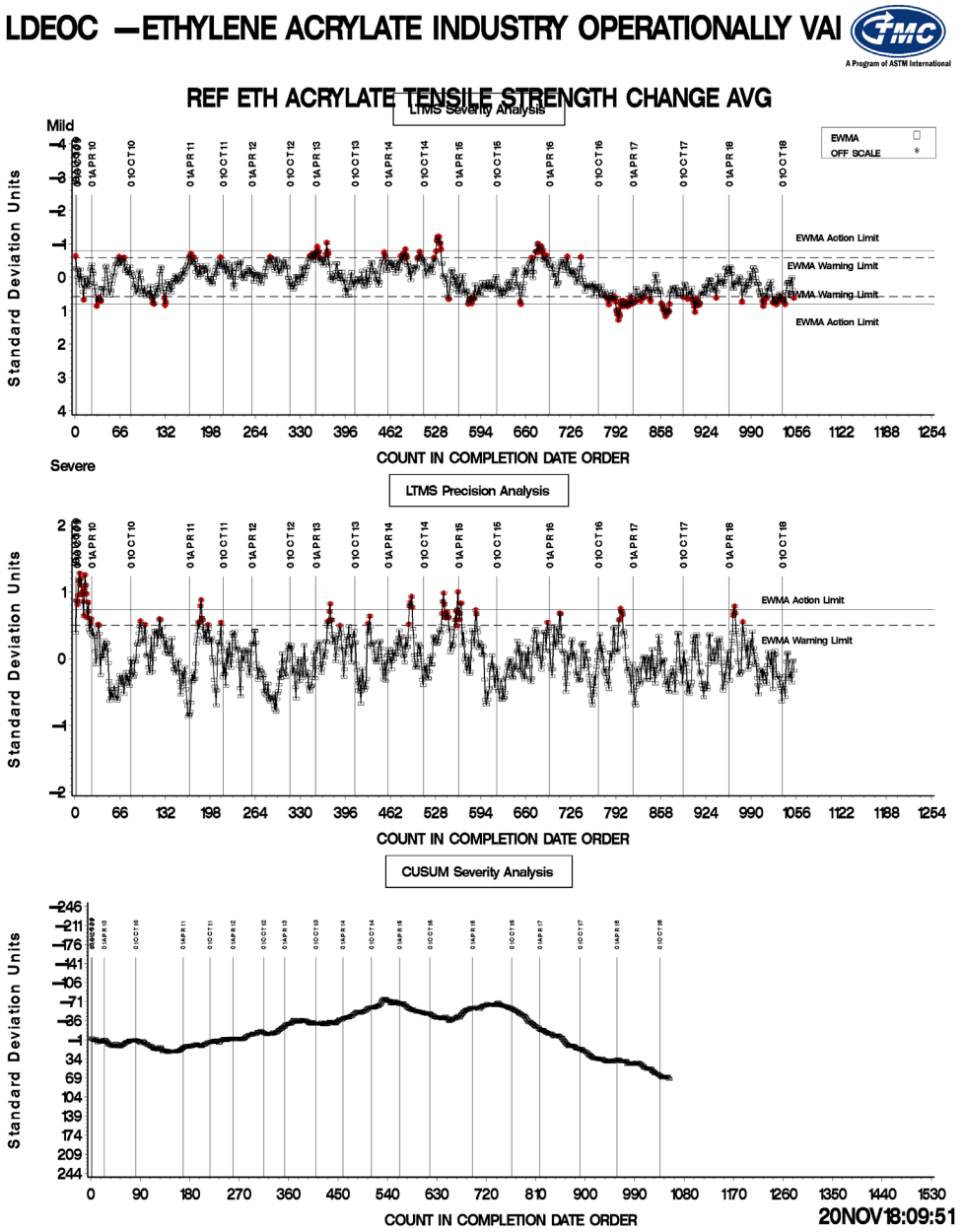
LDEOC (D 7216)


LDEOC —ETHYLENE ACRYLATE INDUSTRY OPERATIONALLY VAI
A Program of ASTM International
REF ETH ACRYLATE TENSILE STRENGTH CHANGE AVG
LTMS Severity Analysis
Mild
Standard Deviation Units
EWMA
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EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
COUNT IN COMPLETION DATE ORDER
Severe
LTMS Precision Analysis
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EWMA Action Limit
EWMA Warning Limit
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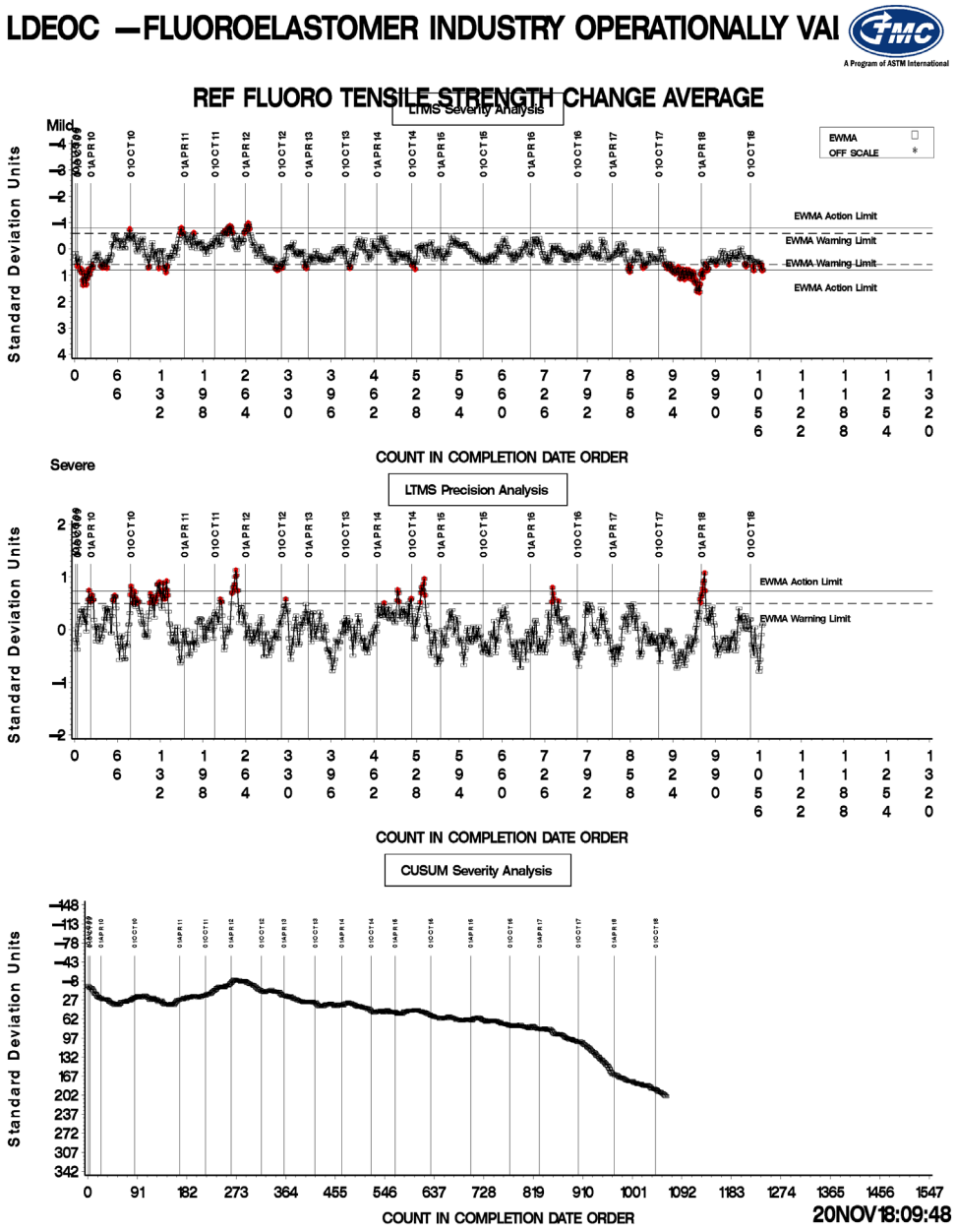
CUSUM Severity Analysis
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
20NOV18:09:51

LDEOC (D 7216)


LDEOC —FLUOROELASTOMER INDUSTRY OPERATIONALLY VAI
A Program of ASTM International
REF FLUORO TENSILE STRENGTH CHANGE AVERAGE
LTMS Severity Analysis
Mild
Standard Deviation Units
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
COUNT IN COMPLETION DATE ORDER
Severe
LTMS Precision Analysis
Standard Deviation Units
EWMA Action Limit
EWMA Warning Limit
COUNT IN COMPLETION DATE ORDER
CUSUM Severity Analysis
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
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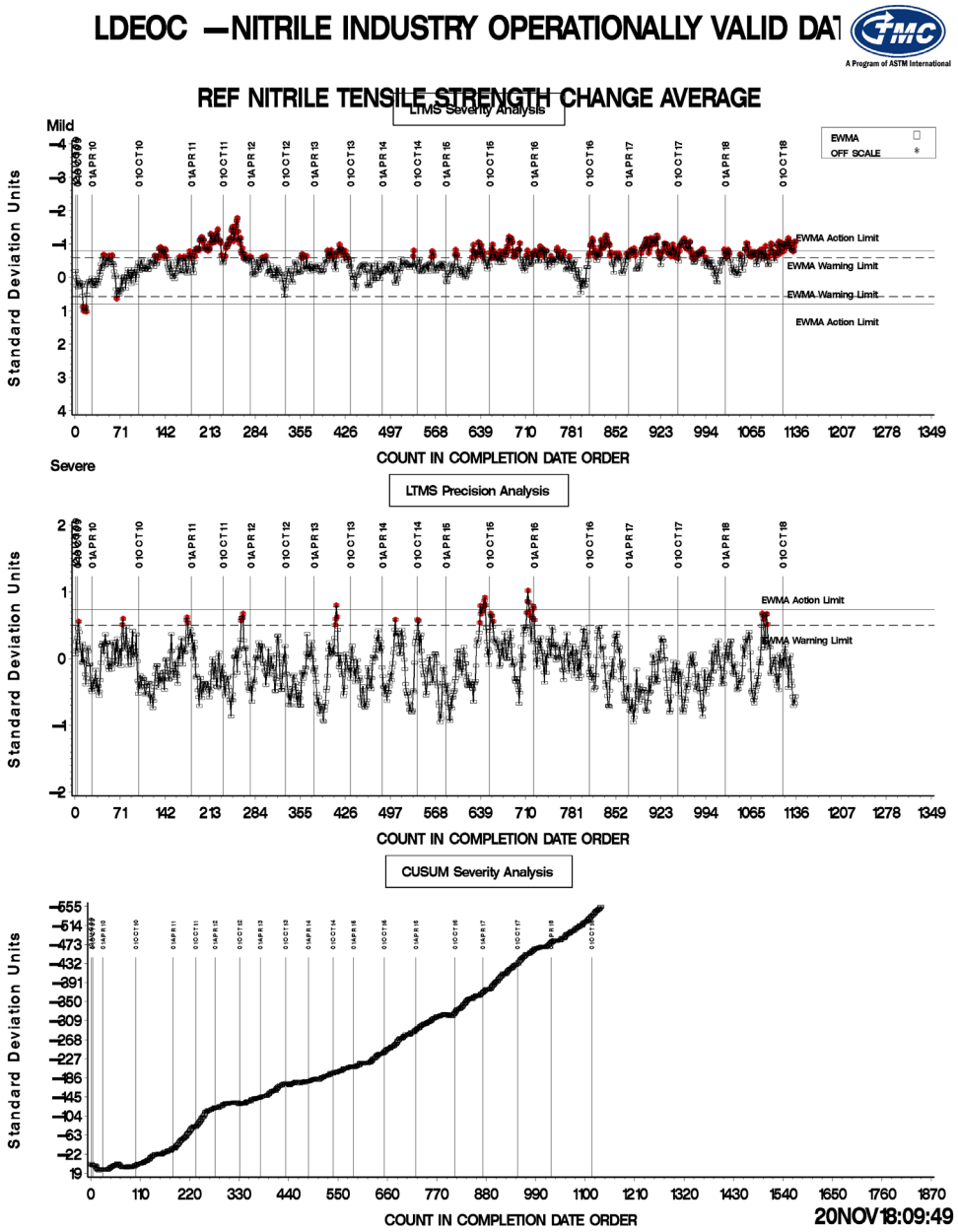
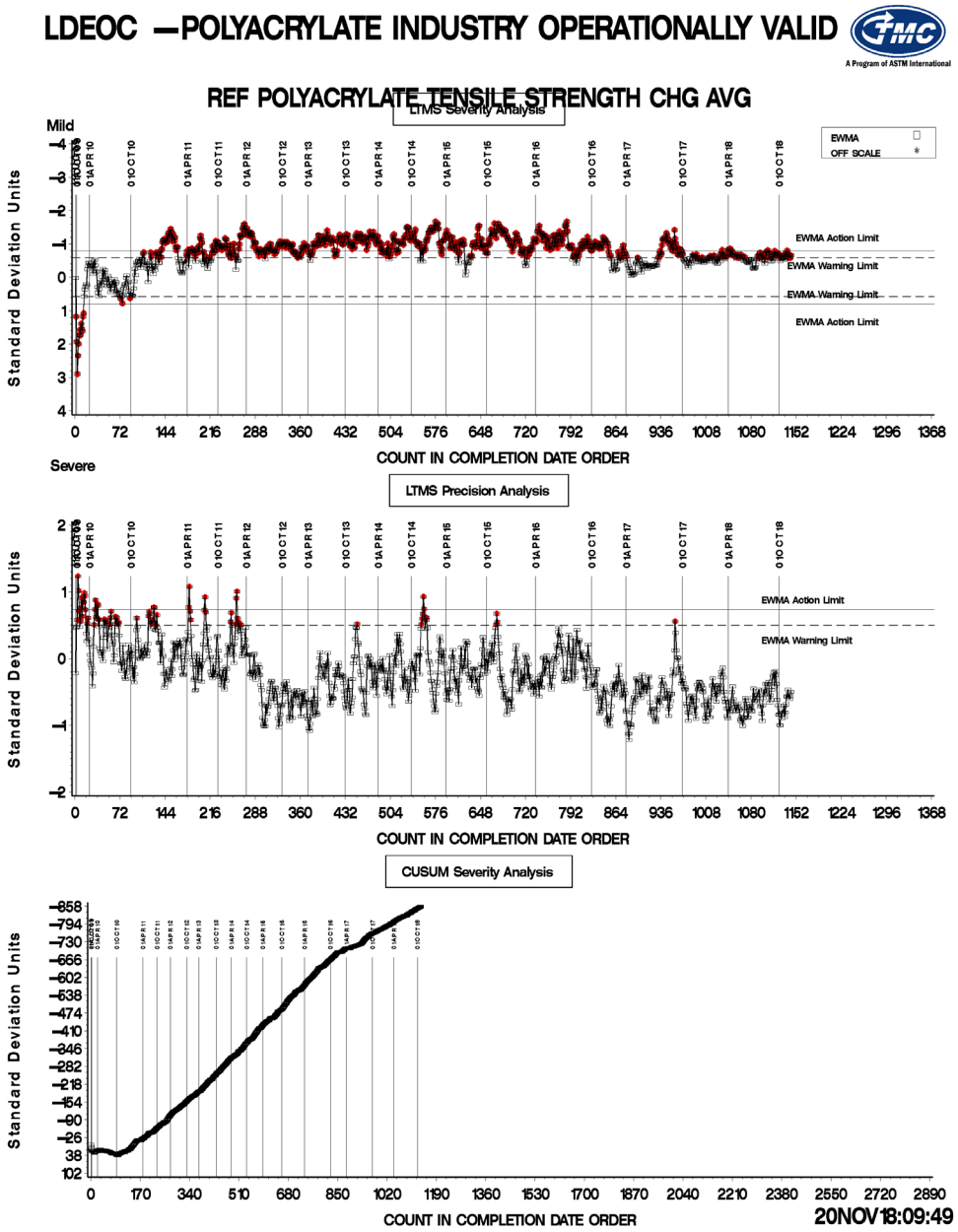
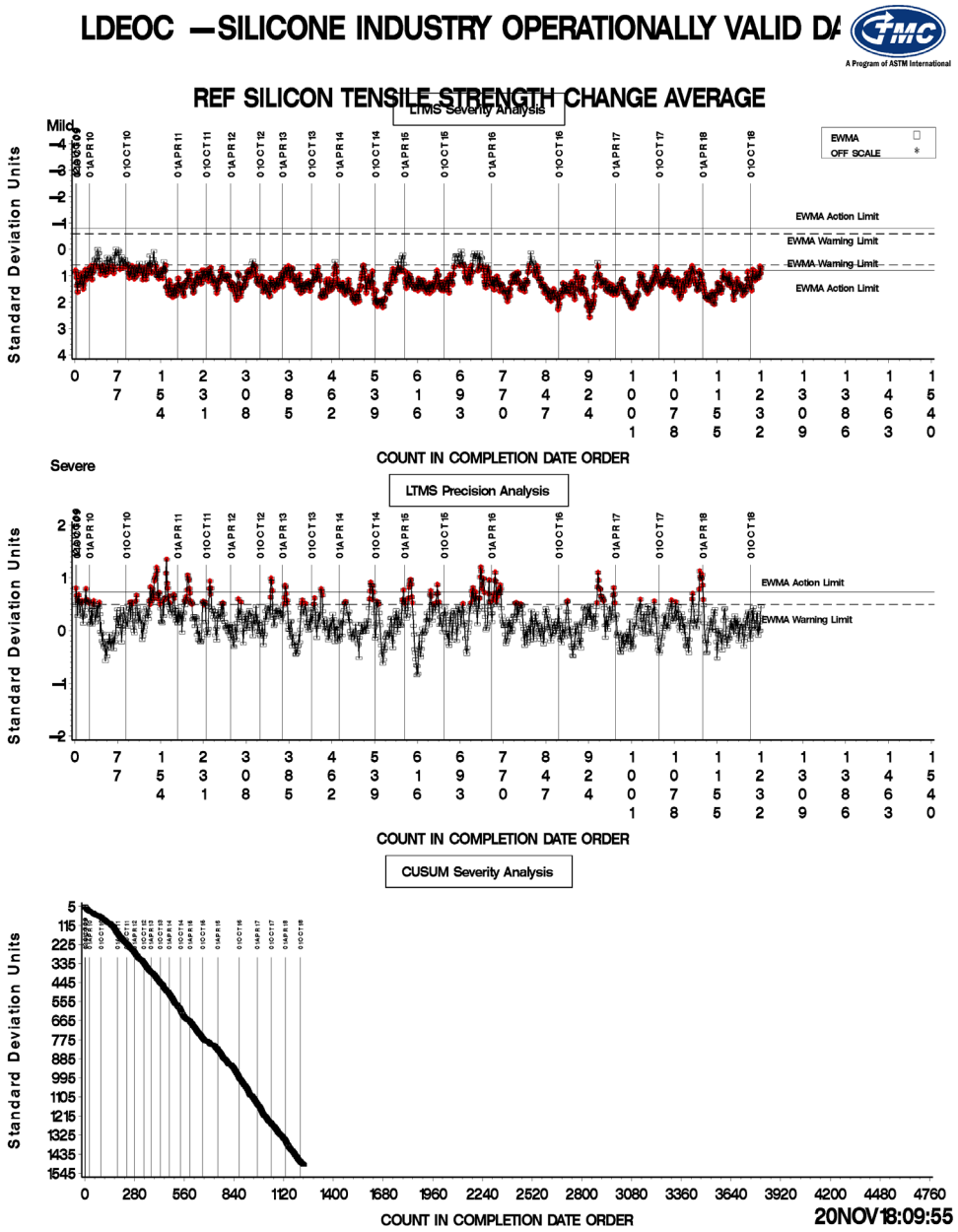
LDEOC (D 7216)


LDEOC —NITRILE INDUSTRY OPERATIONALLY VALID DAT
A Program of ASTM International
REF NITRILE TENSILE STRENGTH CHANGE AVERAGE
LTMS Severity Analysis
Mild
Standard Deviation Units
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
COUNT IN COMPLETION DATE ORDER
Severe
LTMS Precision Analysis
Standard Deviation Units
EWMA Action Limit
EWMA Warning Limit
COUNT IN COMPLETION DATE ORDER
CUSUM Severity Analysis
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
20NOV18:09:49

LDEOC (D 7216)


LDEOC —POLYACRYLATE INDUSTRY OPERATIONALLY VALID
A Program of ASTM International
REF POLYACRYLATE TENSILE STRENGTH CHG AVG
LTMS Severity Analysis
Mild
Standard Deviation Units
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
COUNT IN COMPLETION DATE ORDER
Severe
LTMS Precision Analysis
Standard Deviation Units
EWMA Action Limit
EWMA Warning Limit
COUNT IN COMPLETION DATE ORDER
CUSUM Severity Analysis
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
20NOV18:09:49

LDEOC (D 7216)


LDEOC —SILICONE INDUSTRY OPERATIONALLY VALID DA
A Program of ASTM International
REF SILICON TENSILE STRENGTH CHANGE AVERAGE
LTMS Severity Analysis
Mild
Standard Deviation Units
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
COUNT IN COMPLETION DATE ORDER
Severe
LTMS Precision Analysis
Standard Deviation Units
EWMA Action Limit
EWMA Warning Limit
COUNT IN COMPLETION DATE ORDER
CUSUM Severity Analysis
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
20NOV18:09:55

LDEOC (D 7216)

INFORMATION LETTERS

No Information Letters were issued this period.

LDEOC (D 7216)

STATUS OF REFERENCE OIL SUPPLY

		@ TMC	
Oil	Samples @ Labs	Samples (750 mL)	Gallons
1006-1	47	0	0
1006-2	201	4,867	964
Total	248	4,867	964

The TMC inventory of oil 1006-1 is depleted.

Reference Oil 1006-2 has been approved for LDEOC testing, using the existing test targets for reference oil 1006-1.