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Test Monitoring Center

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

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

MEMORANDUM: 16-017

DATE: June 1, 2016

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

FROM: Michael T. Kasimirsky

SUBJECT: LDEOC Testing from October 1, 2015 through March 31, 2016

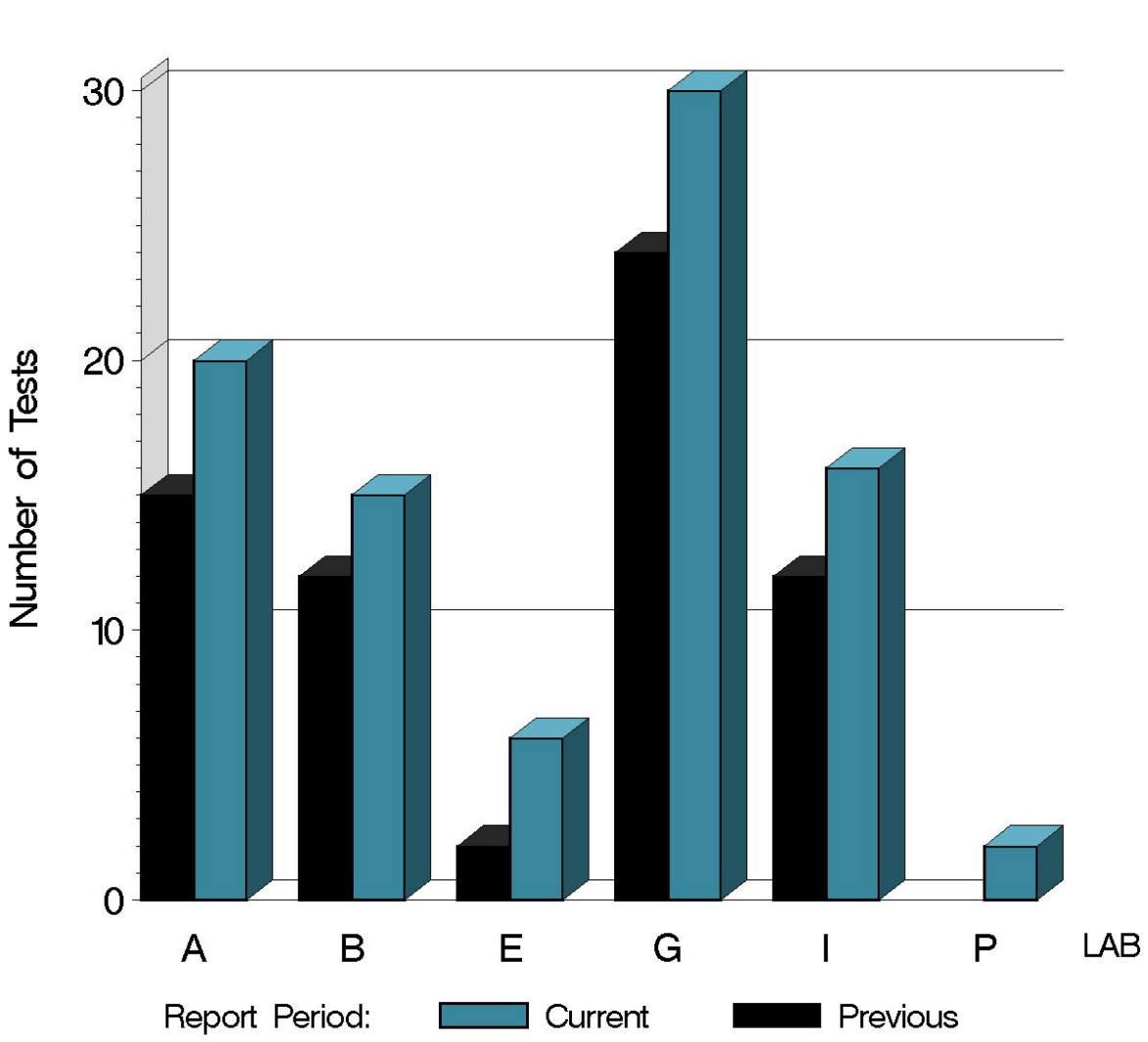
A total of 422 LDEOC tests were reported from 6 labs to the Test Monitoring Center during the period from October 1, 2015 through March 31, 2016.

Please find attached a summary of testing activity this period.

MTK/mtk/mem16-017.mtk.doc
cc: Frank Farber
Jeff Clark
EOEC Surveillance Panel
ftp://ftp.astmtmc.cmu.edu/docs/bench/ldeoc/semiannualreports/ldeoc-04-2016.pdf

Distribution: email

LDEOC (D 7216)



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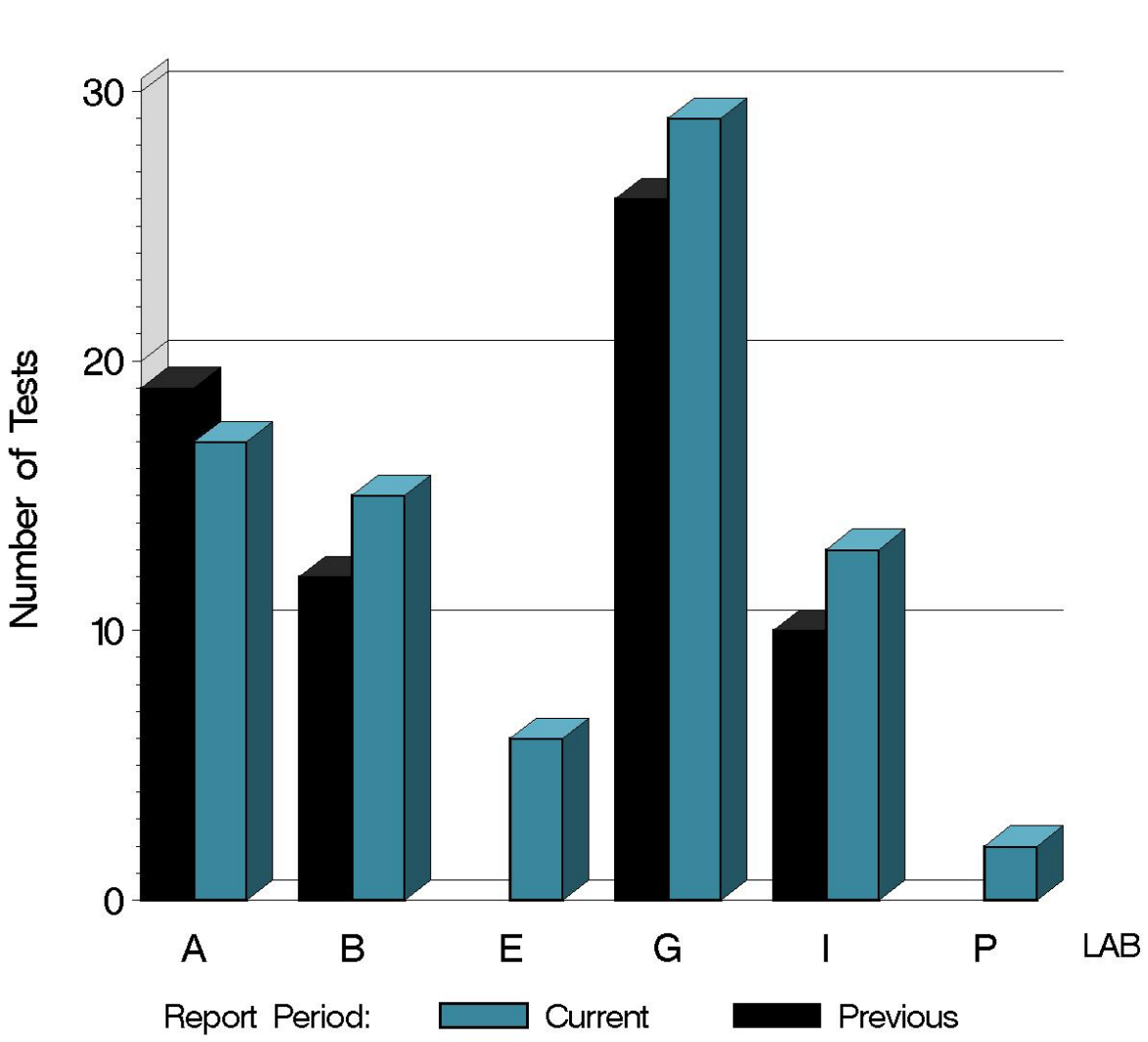
LDEOC (D 7216)



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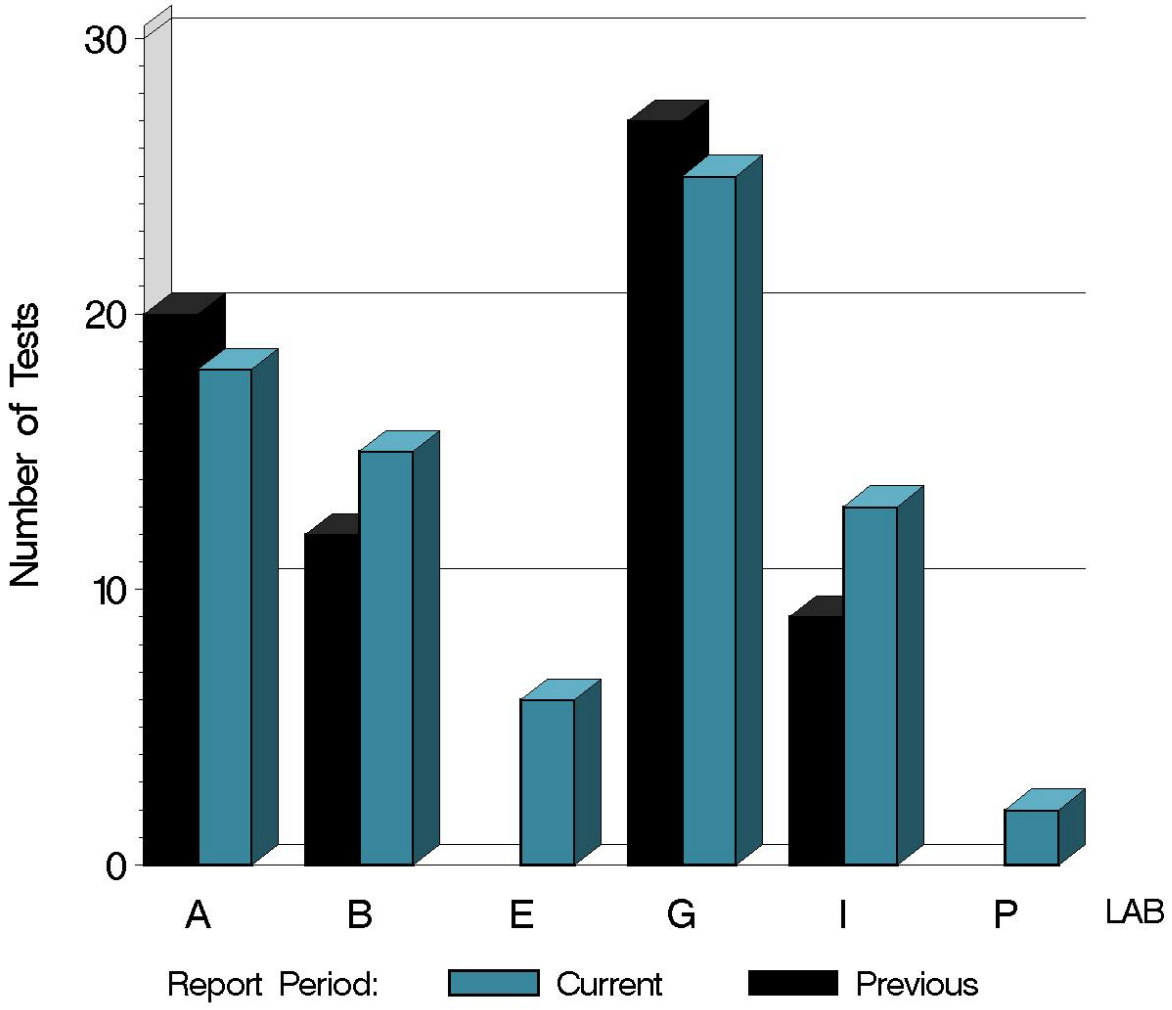

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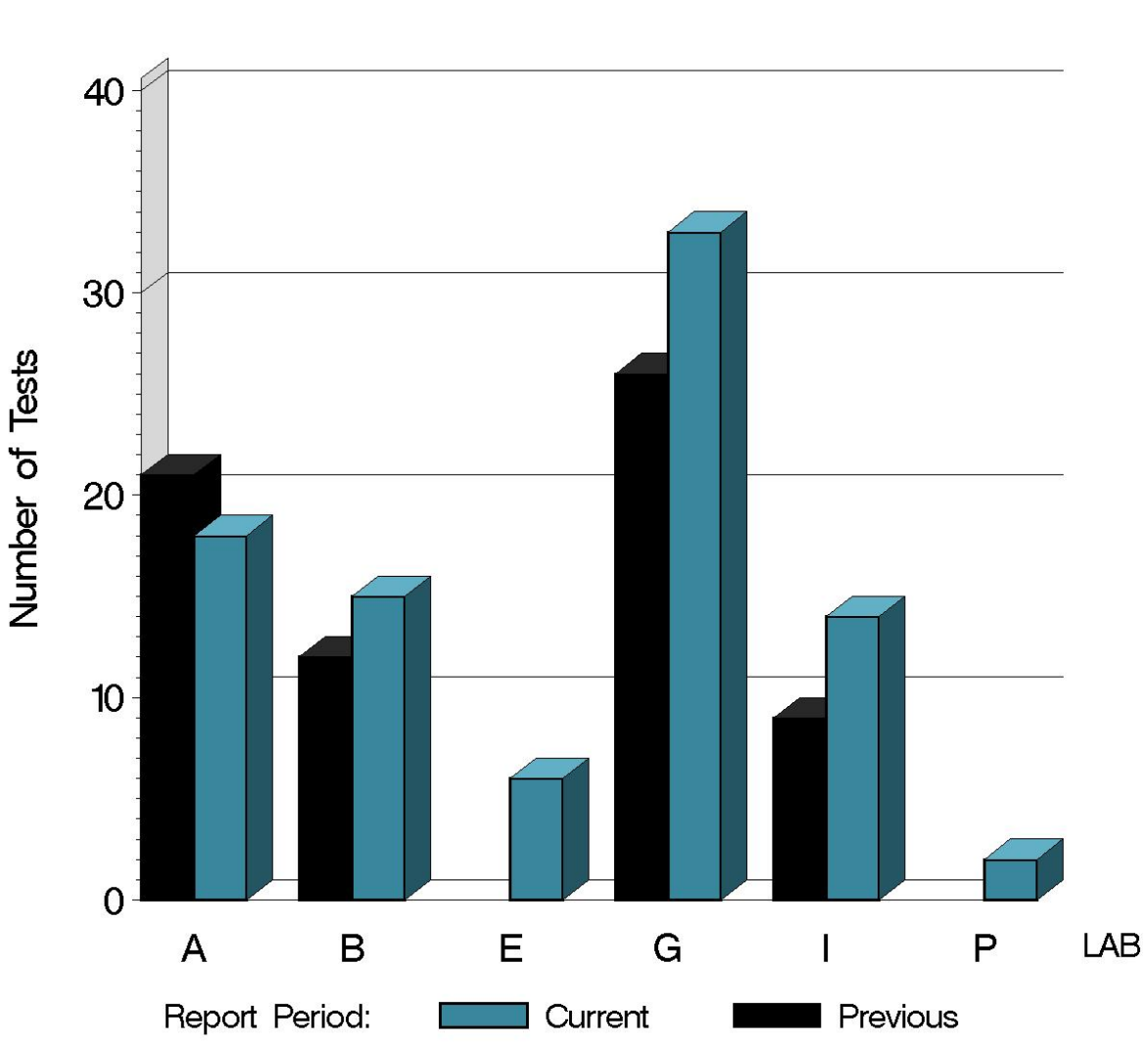
LDEOC (D 7216)



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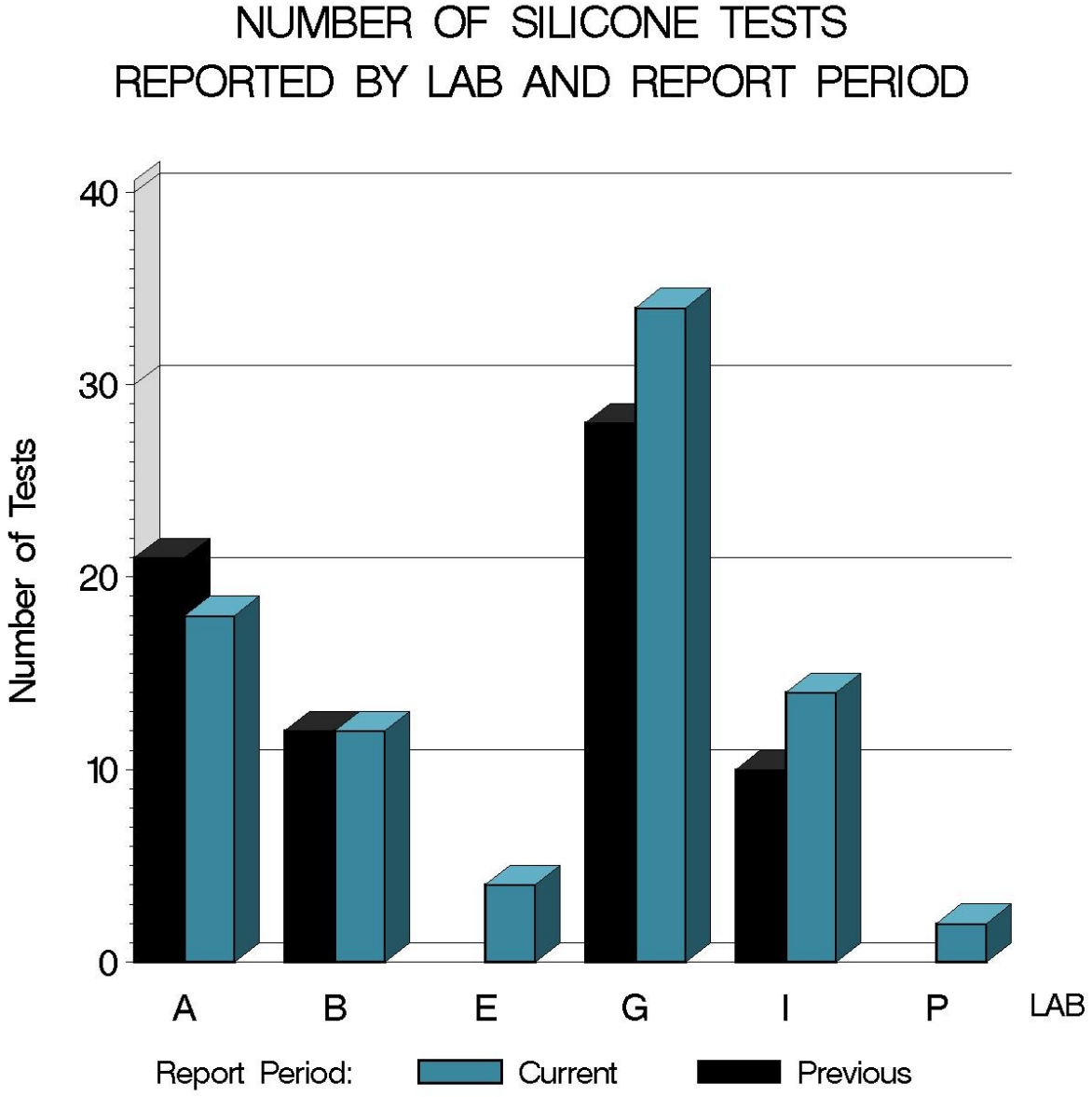

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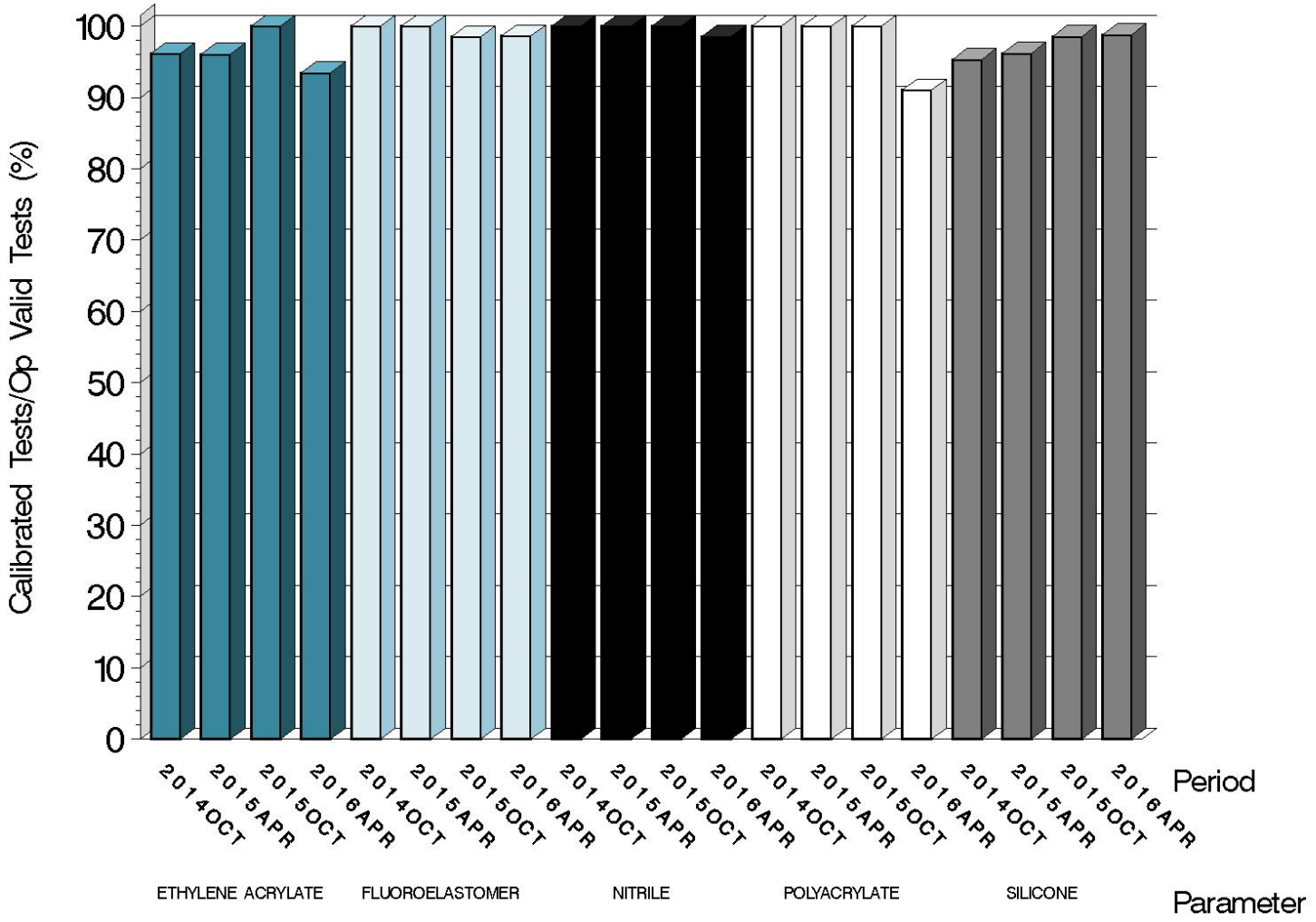
LDEOC (D 7216)

Test Distribution by Oil and Validity

		Ethylene Acrylate	Fluoroelastomer	Nitrile	Polyacrylate	Silicone	This Period	Last Period
Accepted for Calibration	AC	72	72	69	71	83	367	324
Rejected	OC	5	1	1	7	1	15	2
Acceptable Information Run	NI	11	8	8	8	0	35	0
Unacceptable Information Run	MI	0	0	0	0	0	0	0
Invalid Information Run (TMC)	LI	0	0	0	1	0	1	0
Invalid Information Run (TMC)	RI	0	0	0	0	0	0	3
Operationally Invalid (lab)	LC	0	0	0	0	0	0	5
Operationally Invalid (lab/TMC)	RC	0	0	0	0	0	0	5
Aborted Calibration	XC	1	1	1	1	0	4	1
Total		89	82	79	88	84	422	340

LDEOC (D 7216)

OPERATIONALLY VALID TESTS
MEETING ACCEPTANCE CRITERIA



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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	18		1	15		1	16		0	16		0	18		2	83	
B	0	13		0	13		0	13		0	13		0	12		0	64	
E	0	4		0	4		0	4		0	4		0	4		0	20	
G	1	27		0	27		0	23		1	30		0	34		0	141	
I	0	14		0	13		0	13		0	14		0	14		2	70	
P	0	2		0	2		0	2		0	2		0	2		0	10	
Total	1	78		1	74		1	71		1	79		0	84		2	386	

LDEOC (D 7216)

CAUSES FOR LOST TESTS

Lab	Cause	Elastomer					Validity			Loss Rate		
		Ethylene Acrylate	Fluoroelastomer	Nitrile	Polyacrylate	Silicone	LC	RC	XC	Lost	Starts	%
A	Bath Failure	0	1	1	0	0	0	0	2	2	83	2.4
G	Wrong Elastomer Used	1	0	0	1	0	0	0	2	2	141	1.4
	Lost	1	1	1	1	0	0	0	4			
	Starts	78	74	71	79	84	386	386	386			
	%	1.3	1.4	1.4	1.3	0	0	0	1.0			

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

LDEOC (D 7216)

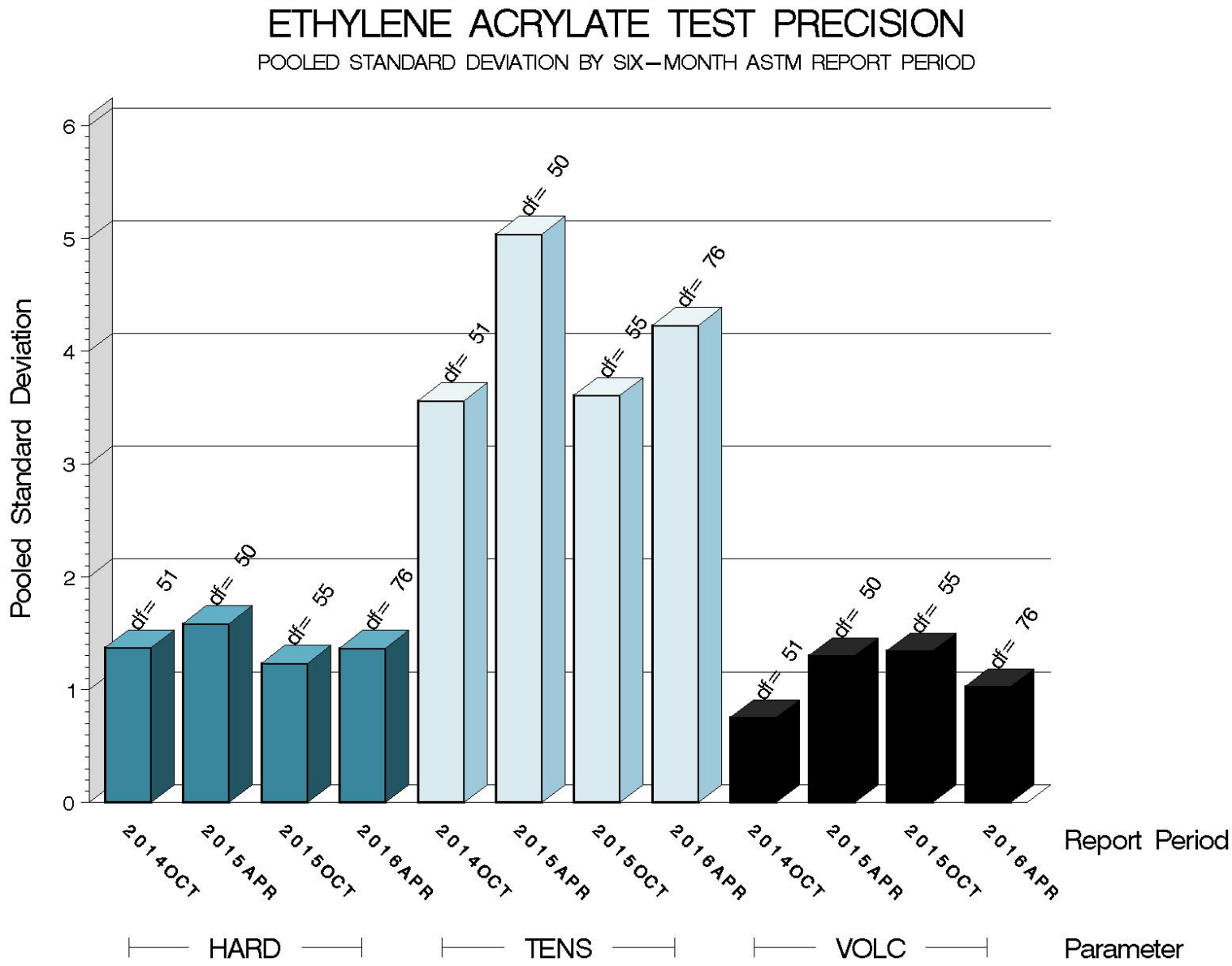
Average Δ/s by Lab					
Elastomer	Lab	n	VOLCYI	HARDYI	TENSYI
Ethylene Acrylate	A	18	-1.771	-1.148	0.589
	B	13	-1.644	-0.900	-0.620
	E	4	-2.143	-1.209	-0.412
	G	26	-1.303	0.482	0.095
	I	14	-0.462	-0.110	-0.818
	P	2	-1.351	-1.758	-0.620
	Industry	77	-1.362	-0.386	-0.121
Fluoroelastomer	A	14	-0.714	0.242	-0.245
	B	13	-0.815	-0.161	0.180
	E	4	-0.367	-0.960	-1.256
	G	27	-0.440	-0.649	0.123
	I	13	-0.395	-0.161	1.162
	P	2	-1.333	2.505	-1.318
	Industry	73	-0.572	-0.235	0.133
Nitrile	A	15	1.170	-0.670	-0.650
	B	13	1.073	-0.800	-0.607
	E	4	1.221	-0.977	-0.088
	G	23	0.905	-0.327	-1.210
	I	13	1.069	-0.093	-0.138
	P	2	0.875	-2.126	0.263
	Industry	70	1.041	-0.534	-0.673
Polyacrylate	A	16	1.878	-0.766	-0.905
	B	13	1.508	-1.366	-1.279
	E	4	3.019	-0.766	-1.036
	G	29	1.774	0.644	-1.008
	I	14	1.590	0.764	-1.509
	P	2	3.121	-1.416	-0.319
	Industry	78	1.816	-0.084	-1.106
Silicone	A	18	-0.308	-0.951	1.960
	B	12	0.257	-0.379	1.311
	E	4	0.206	0.642	0.220
	G	34	1.038	-0.533	0.044
	I	14	-0.918	0.169	0.670
	P	2	0.300	-1.196	1.150
	Industry	84	0.255	-0.443	0.774

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	ftp://ftp.astmtmc.cmu.edu/refdata/bench/ldeoca/data/
Fluoroelastomer	ftp://ftp.astmtmc.cmu.edu/refdata/bench/ldeocf/data/
Nitrile	ftp://ftp.astmtmc.cmu.edu/refdata/bench/ldeocn/data/
Polyacrylate	ftp://ftp.astmtmc.cmu.edu/refdata/bench/ldeocp/data/
Silicone	ftp://ftp.astmtmc.cmu.edu/refdata/bench/ldeocs/data/

LDEOC (D 7216)



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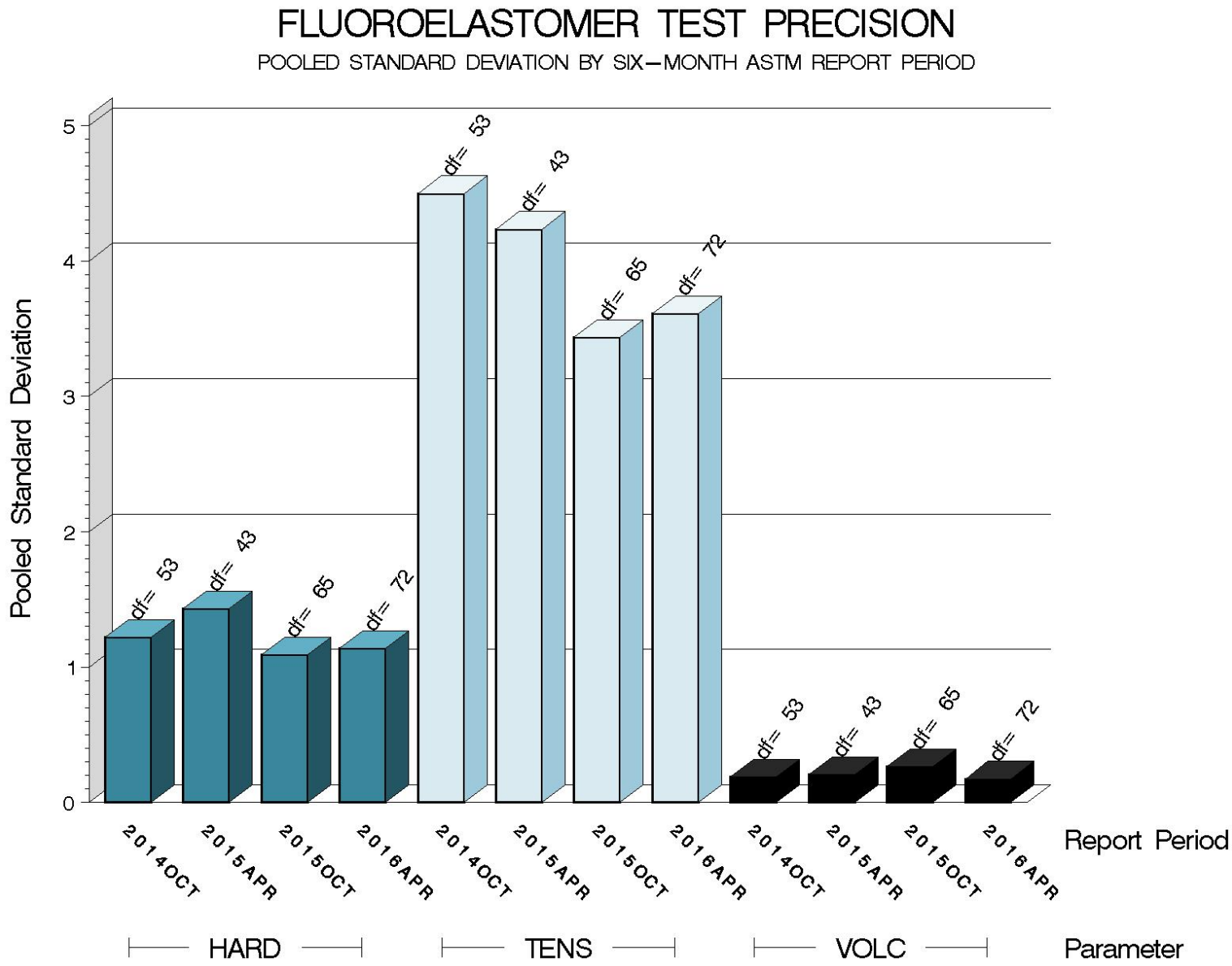
LDEOC (D 7216)



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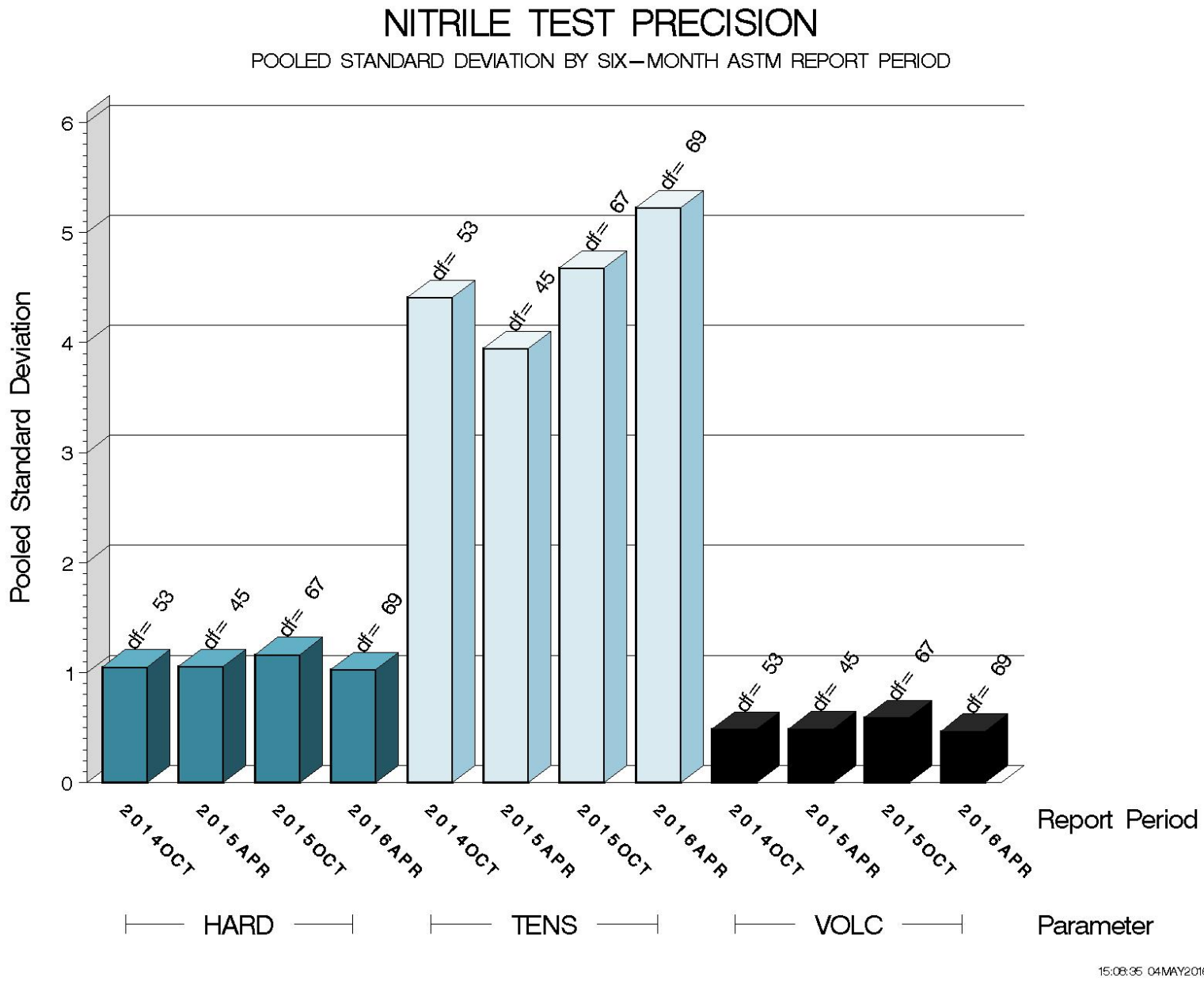
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Pooled Standard Deviation
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2
3
4
5
6
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HARD
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Parameter
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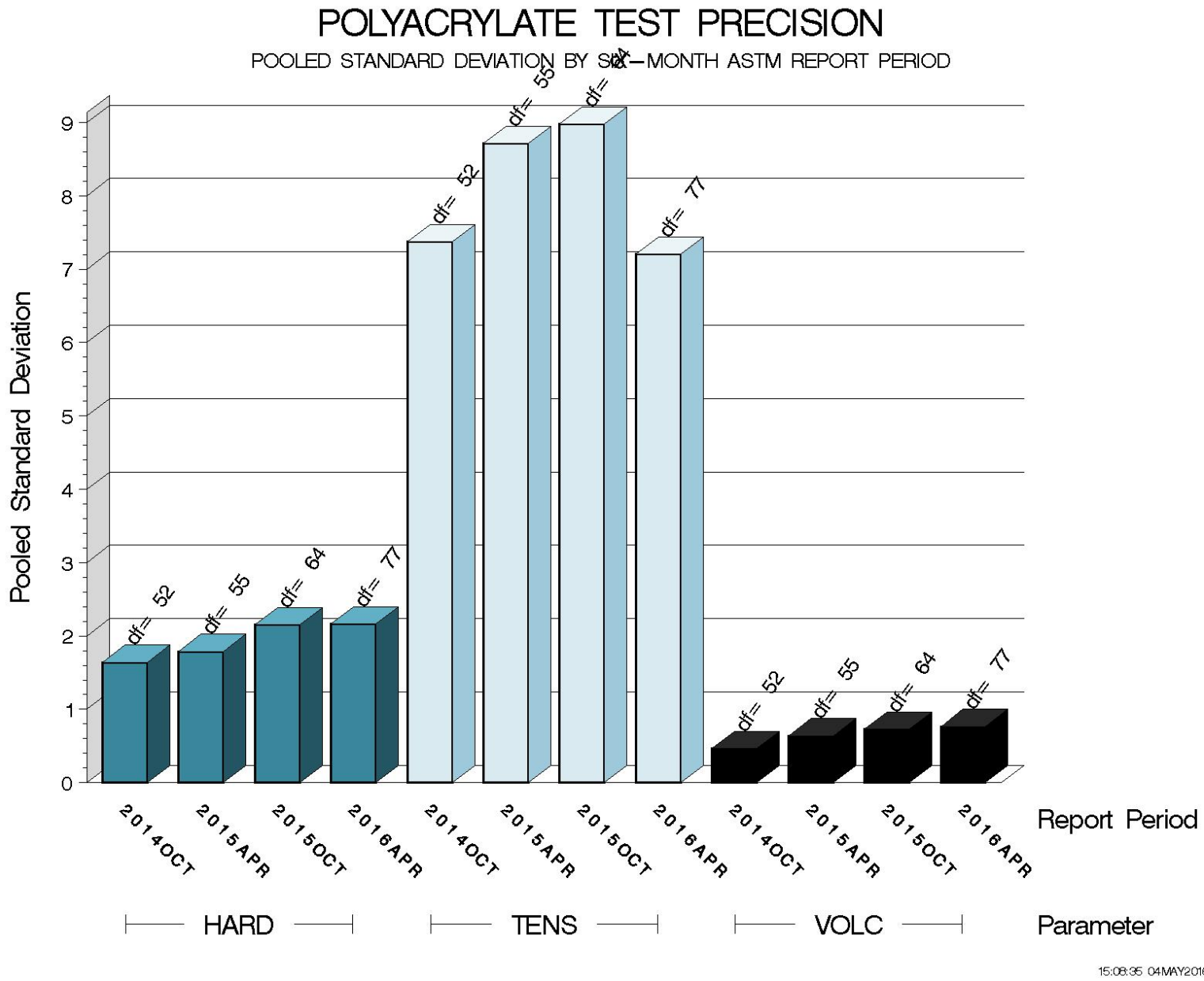
LDEOC (D 7216)



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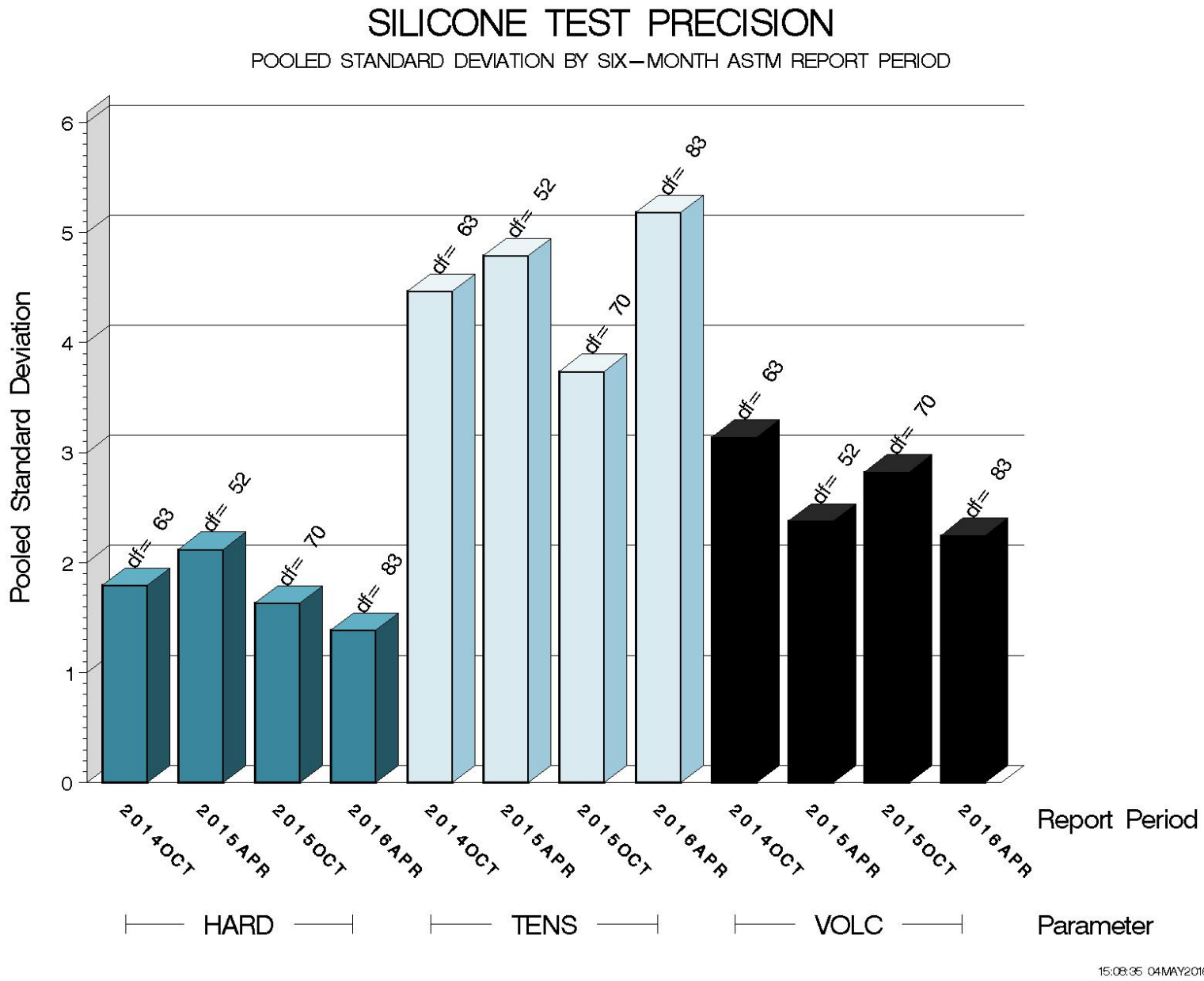

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LDEOC (D 7216)

SUMMARY OF SEVERITY & PRECISION

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

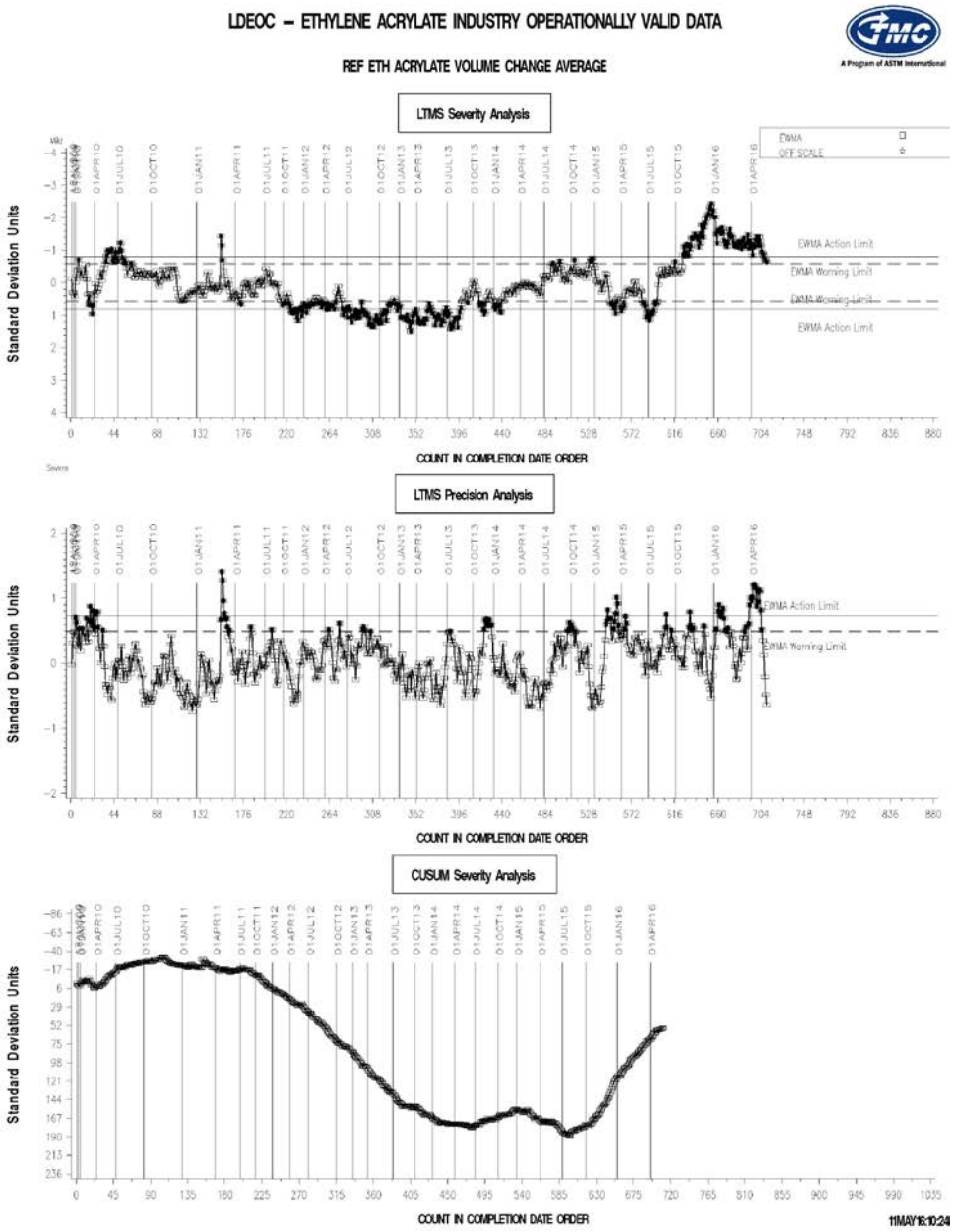
LDEOC (D 7216)

SUMMARY OF SEVERITY & PRECISION (continued)

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

Industry control charts follow.

LDEOC (D 7216)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CUSUM Severity Analysis
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
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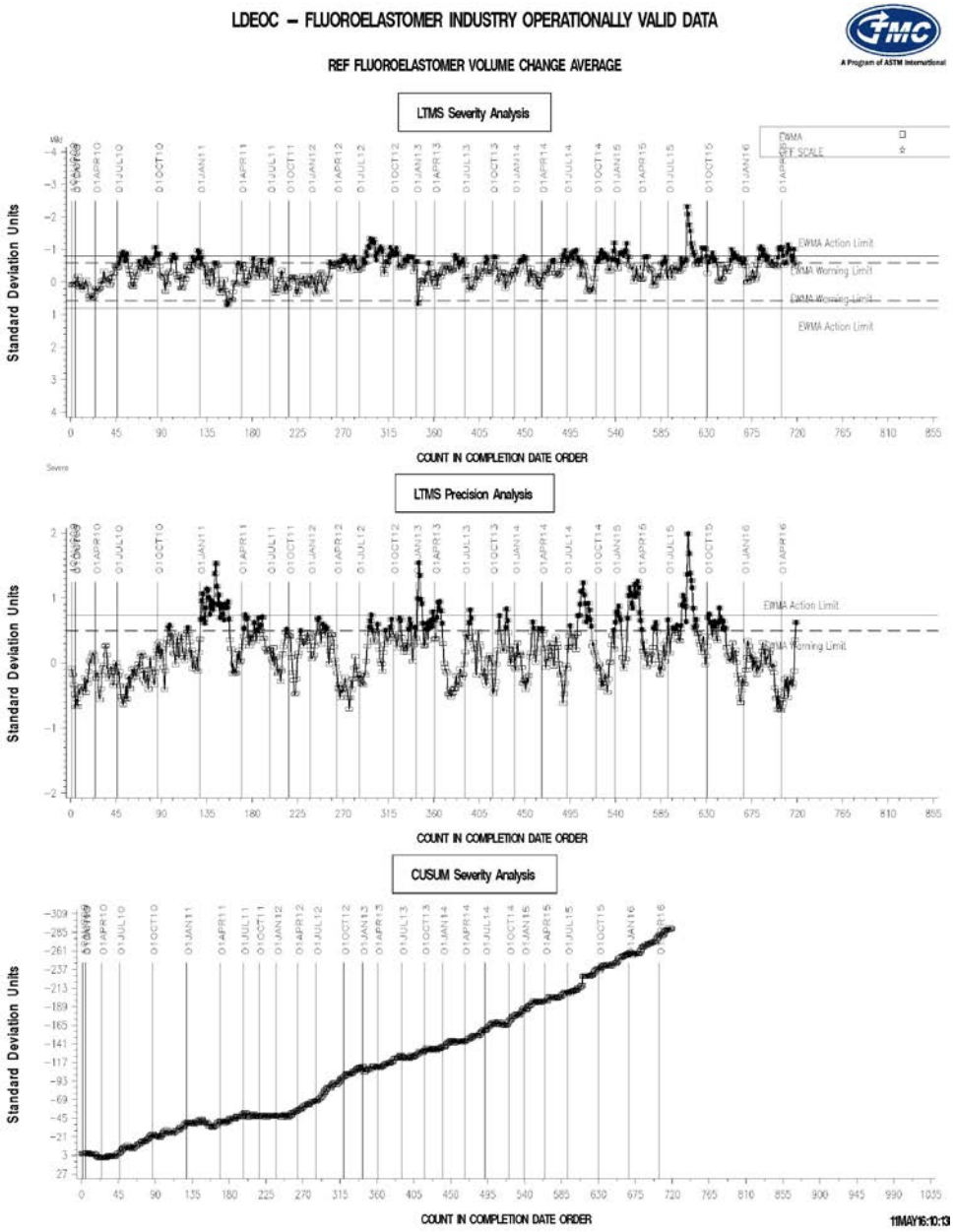
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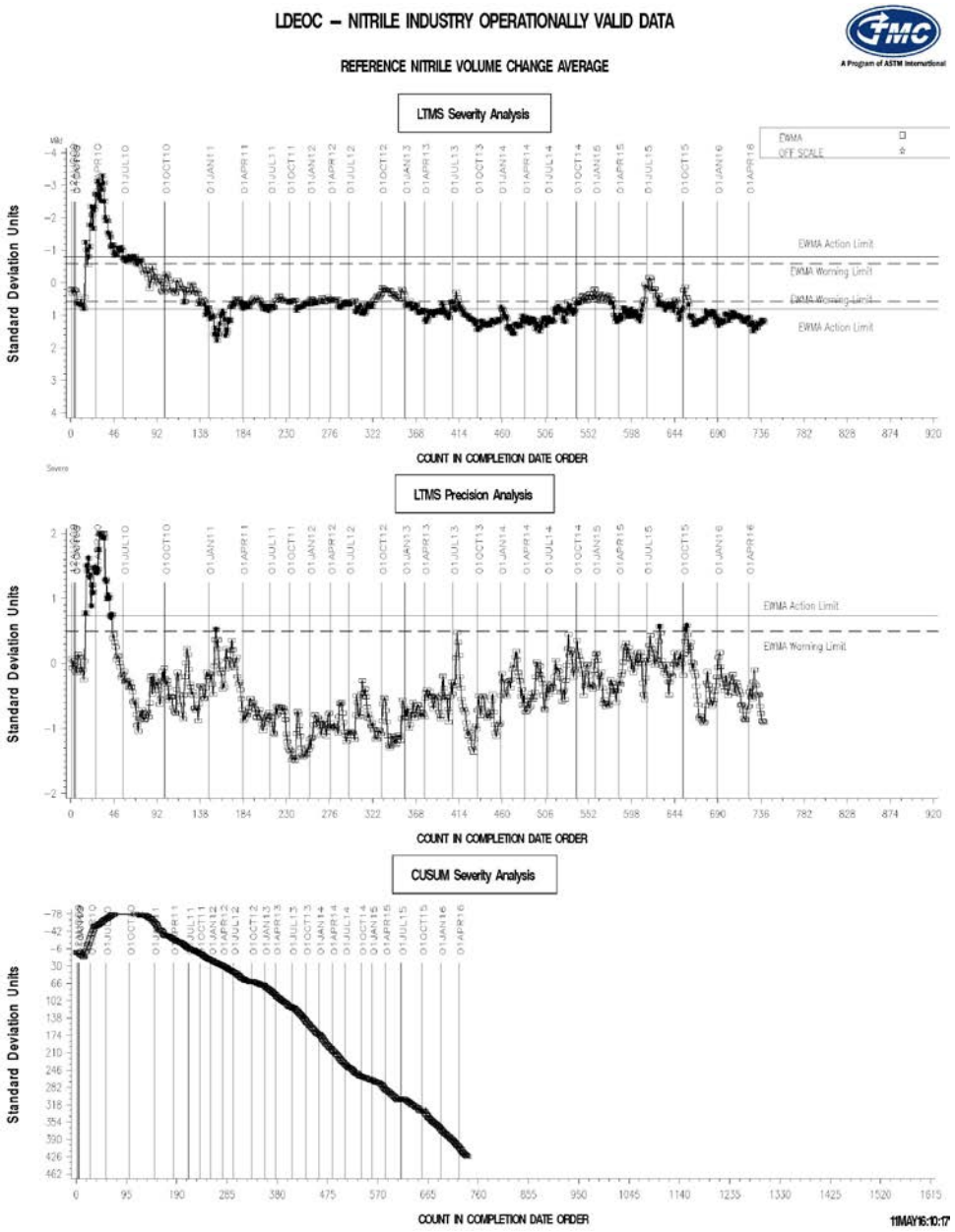
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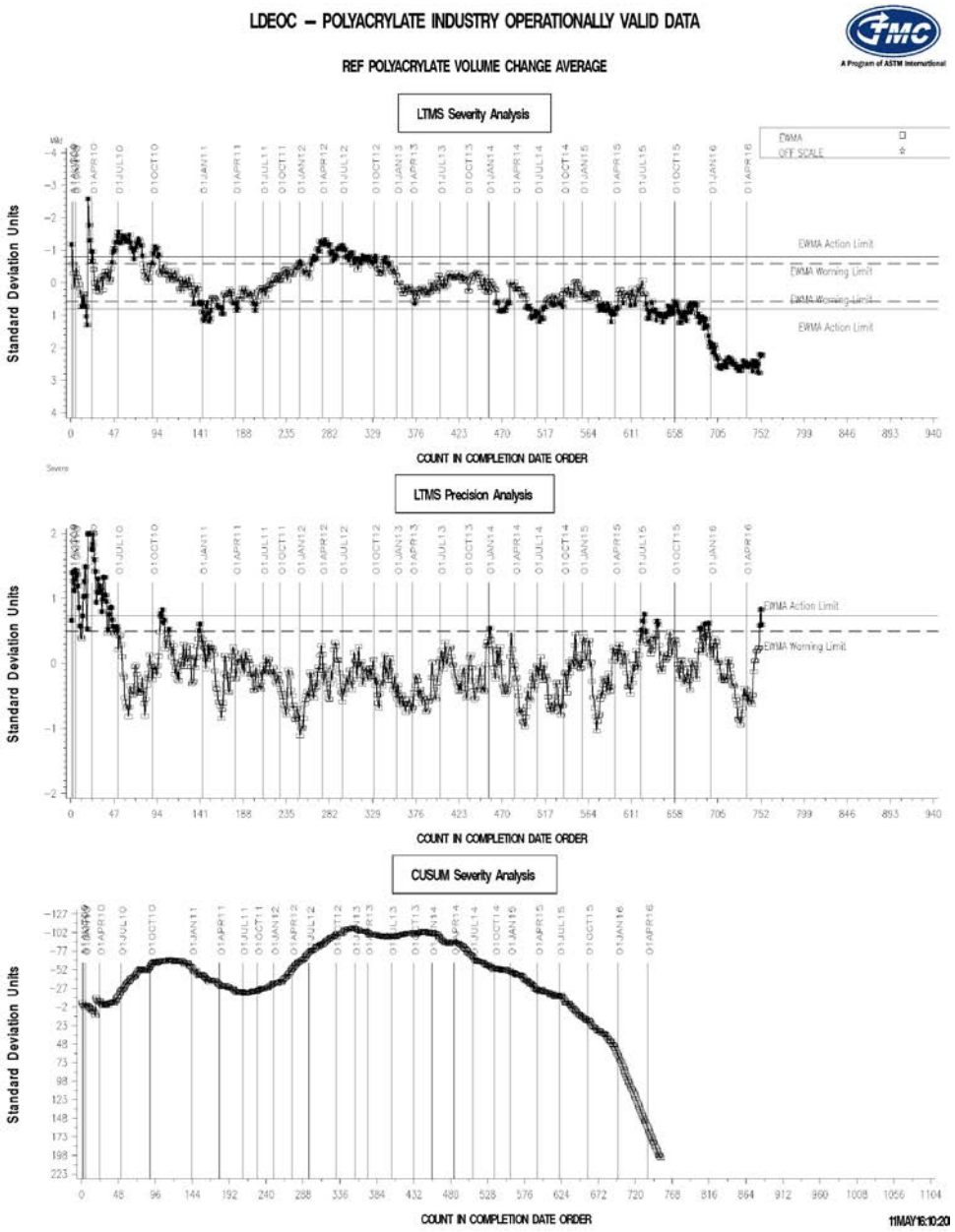
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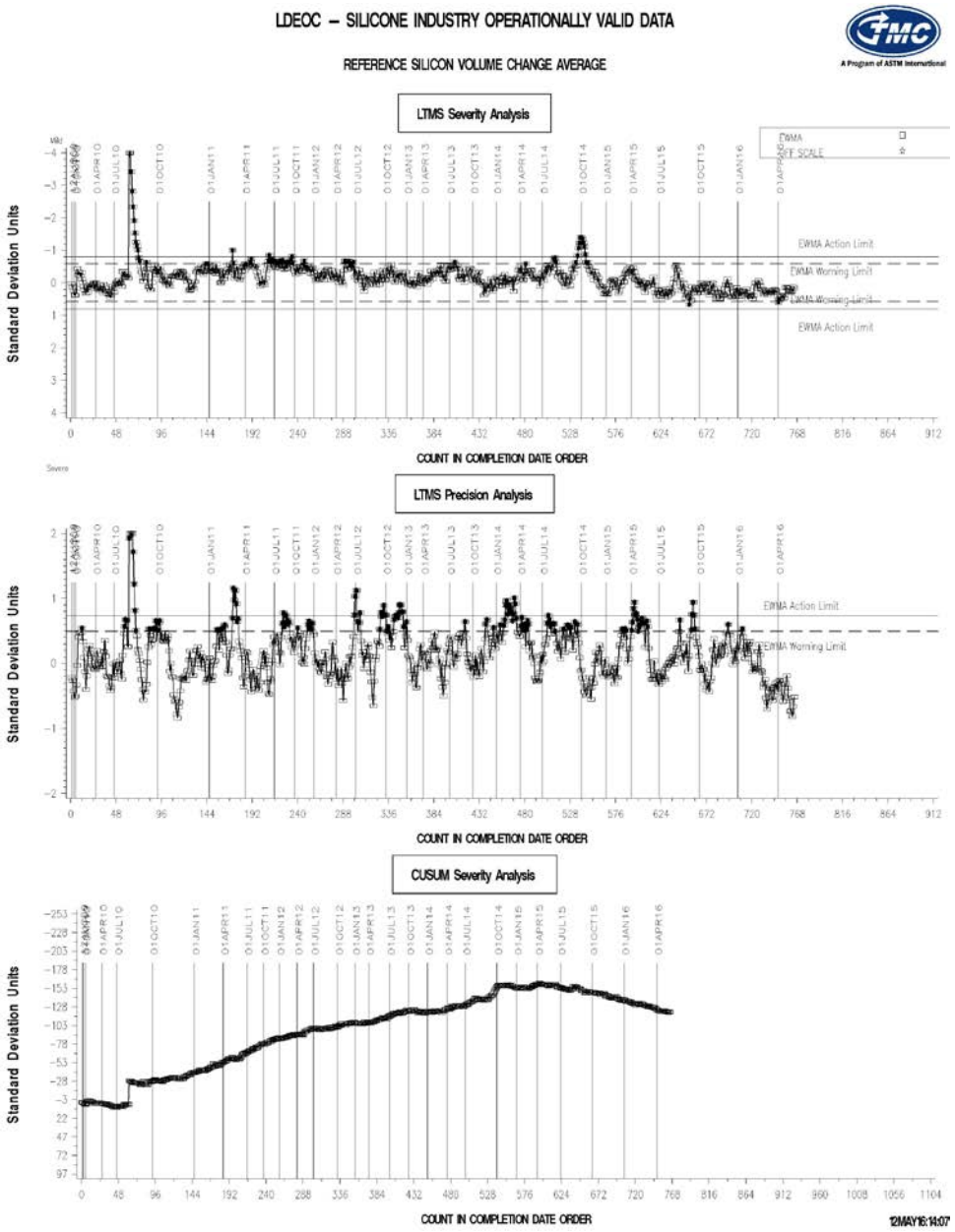
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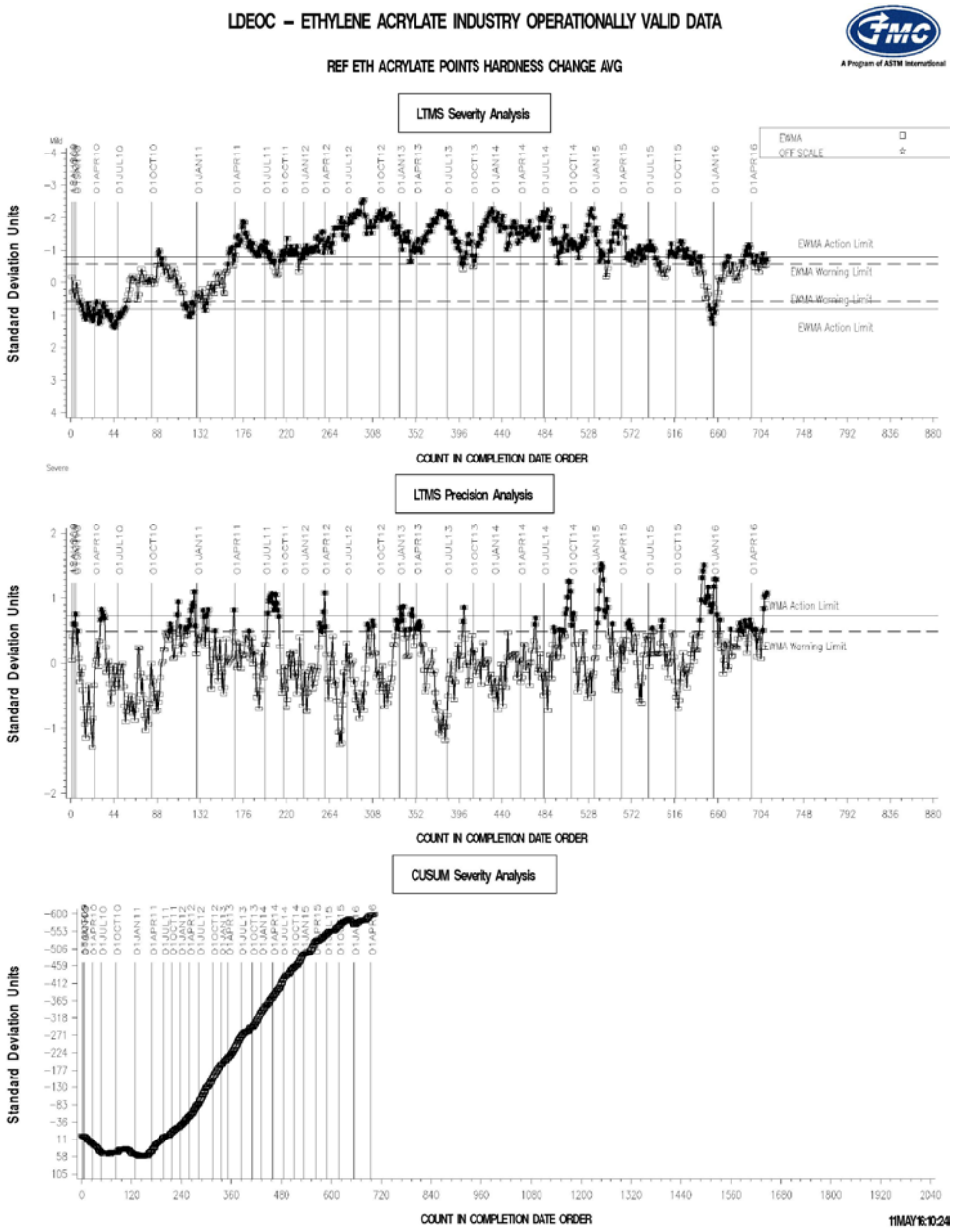
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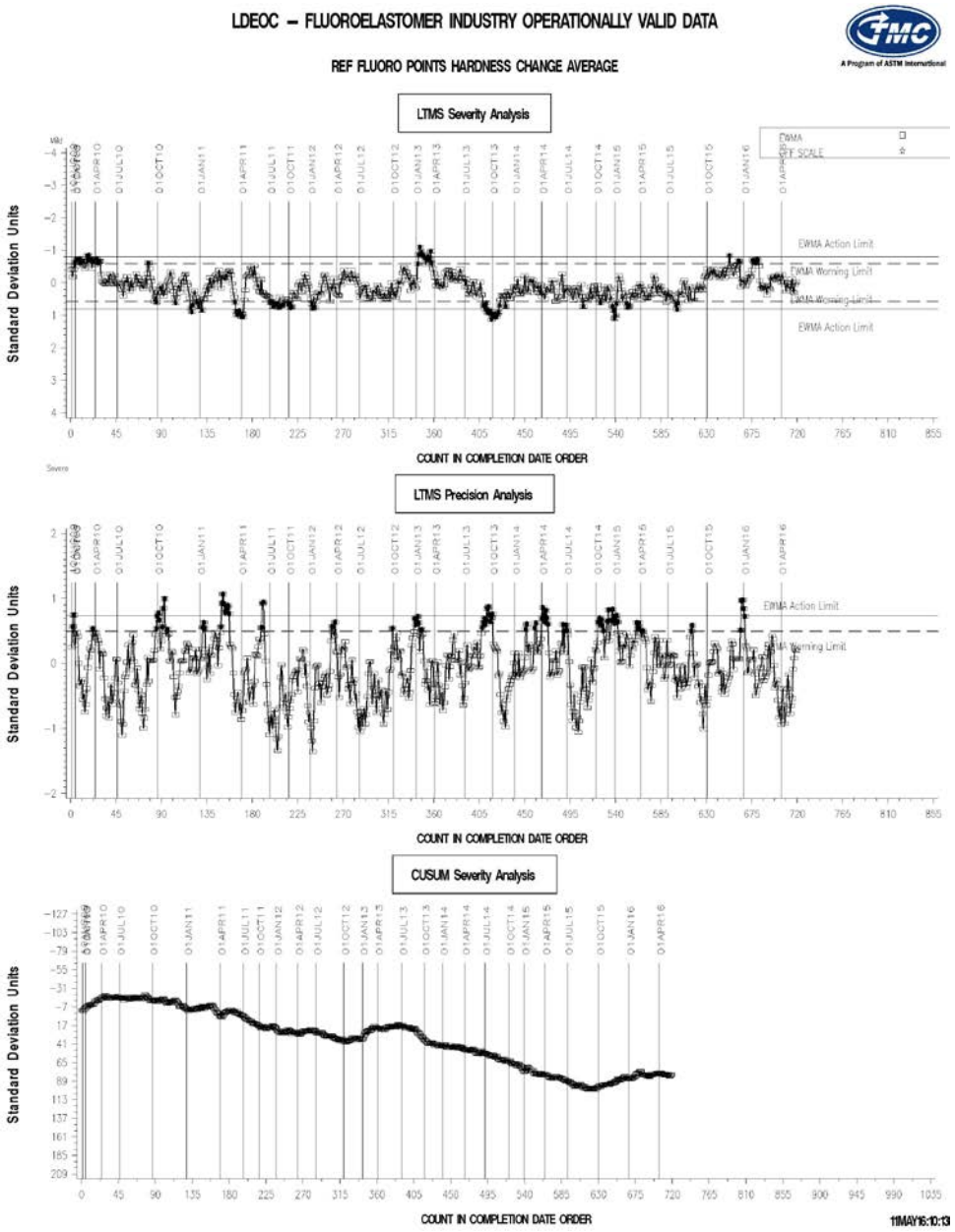
LDEOC (D 7216)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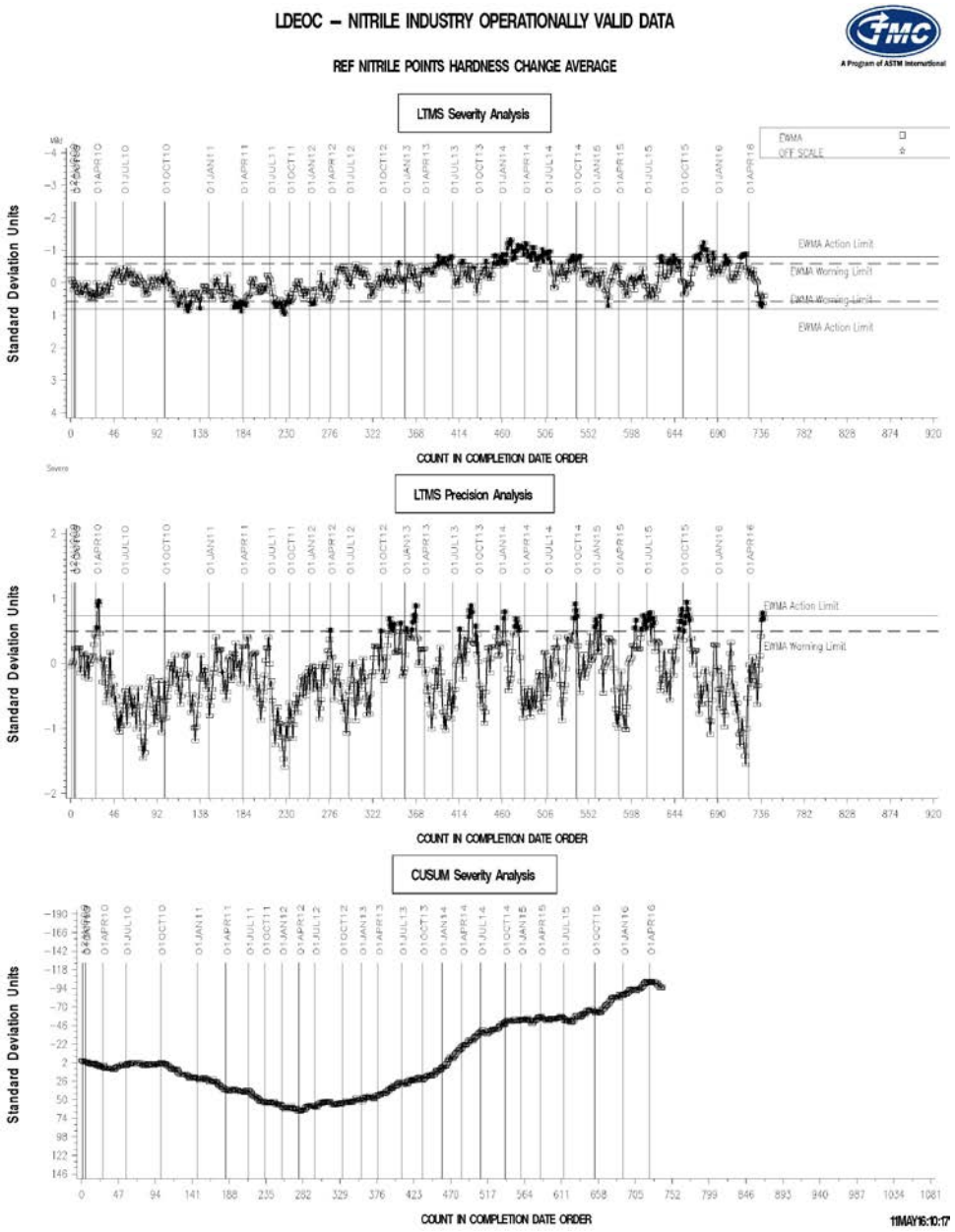
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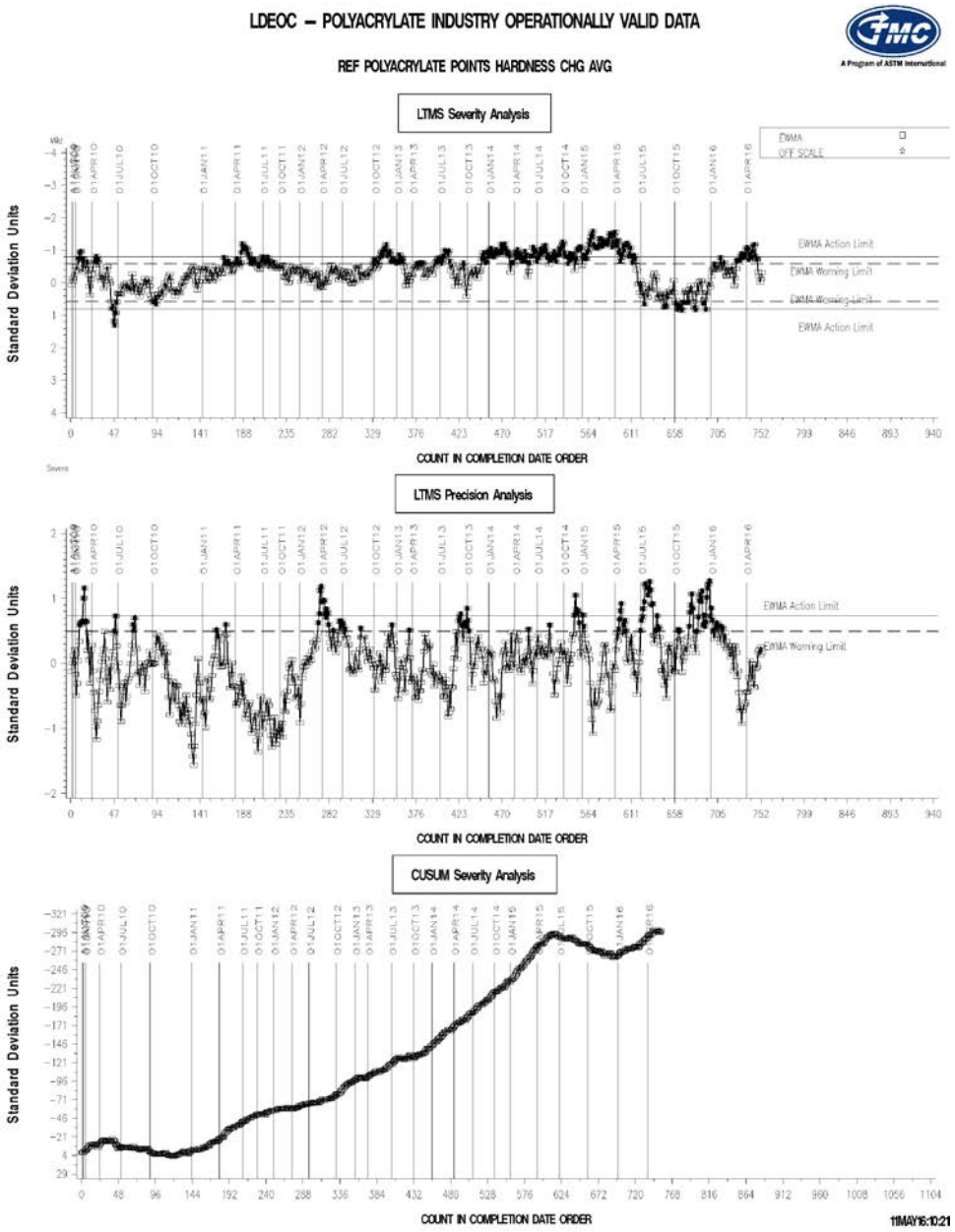

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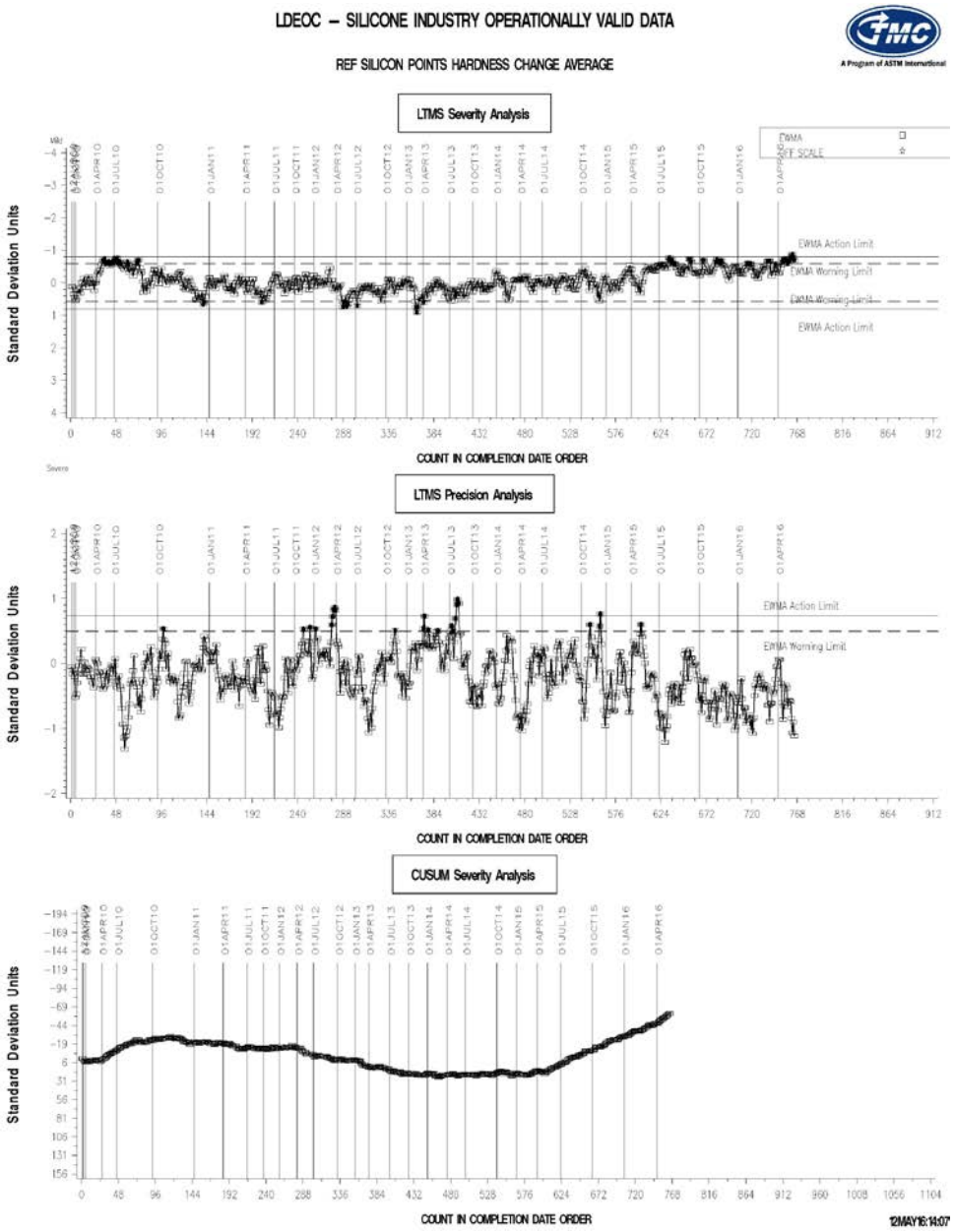
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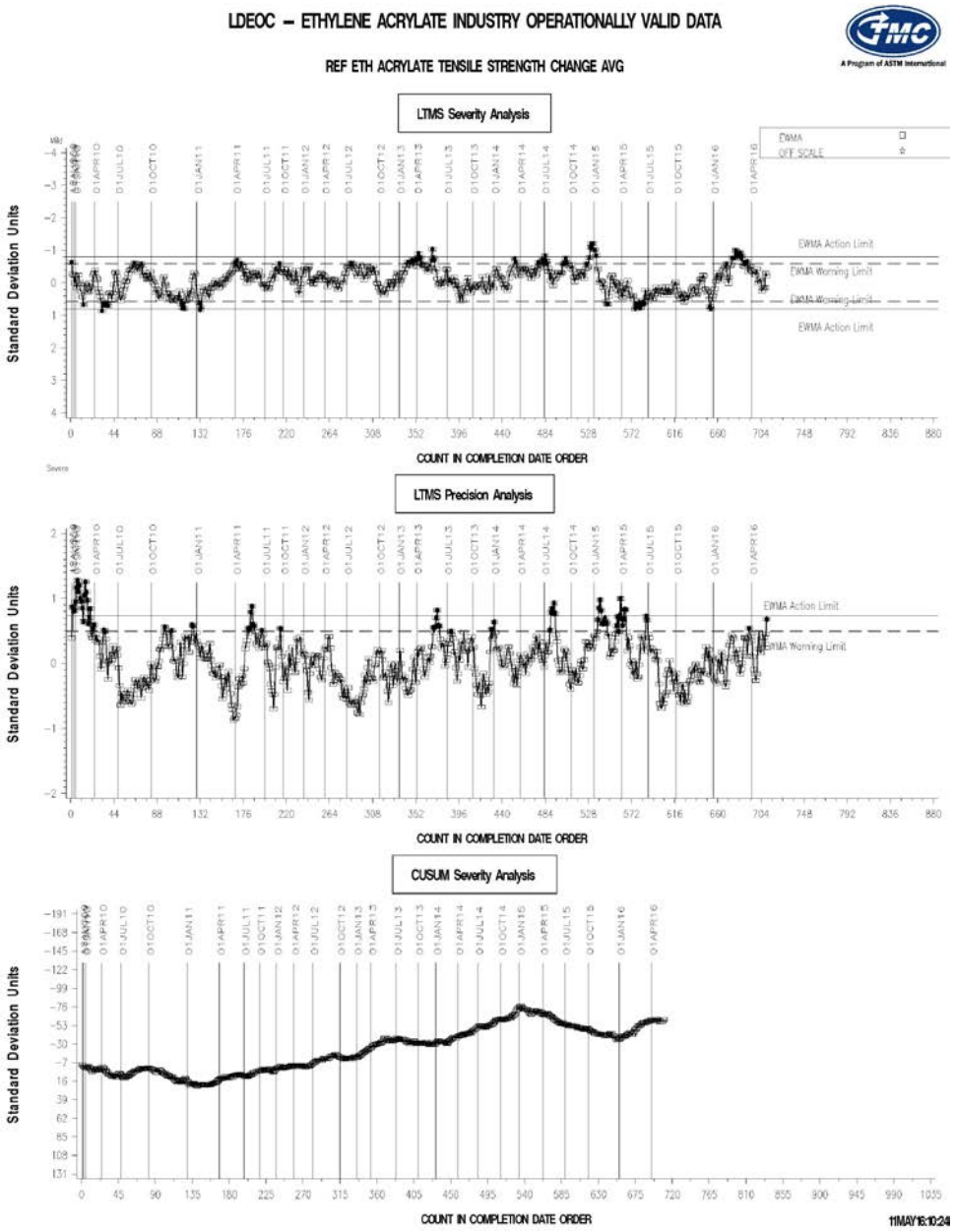
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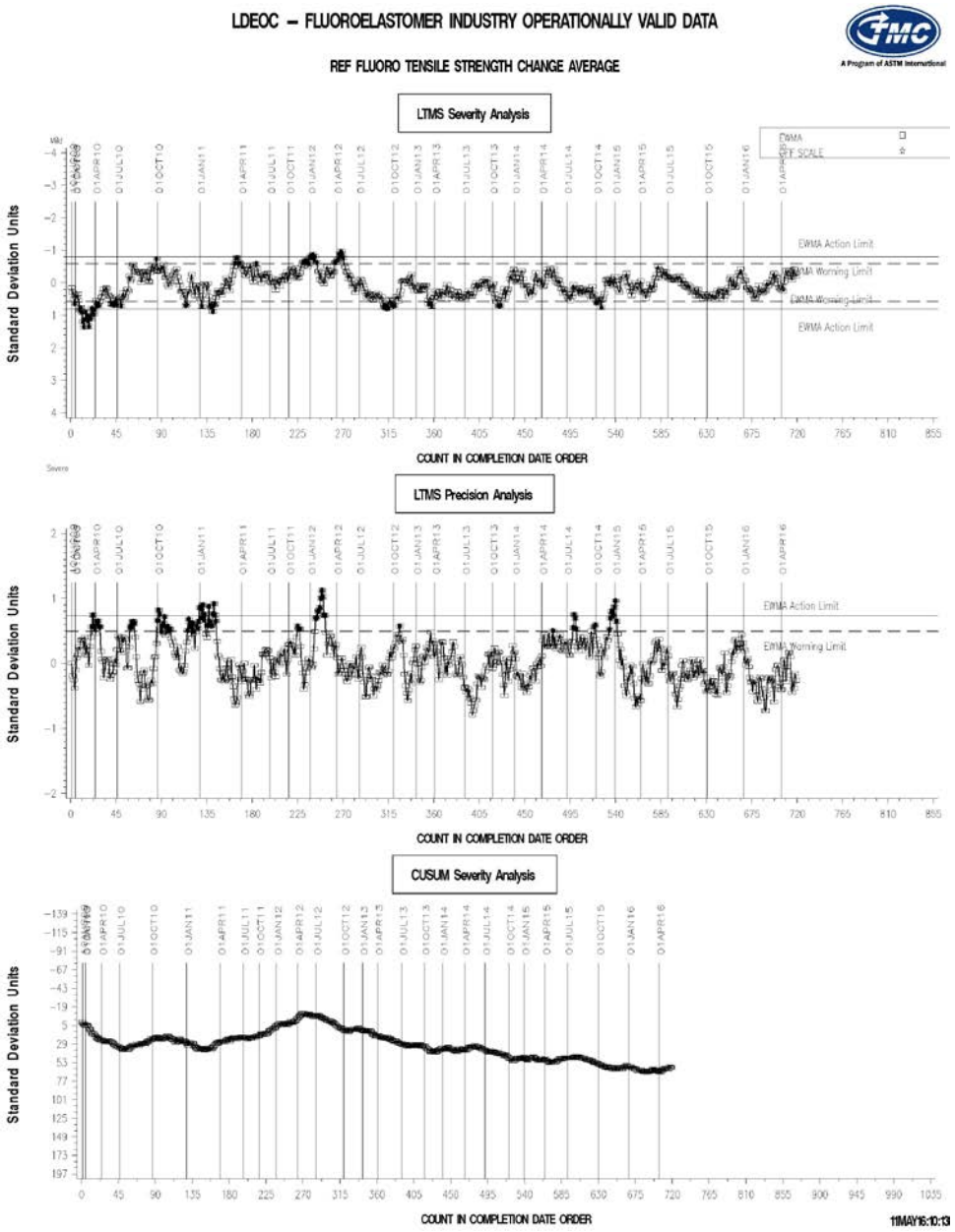
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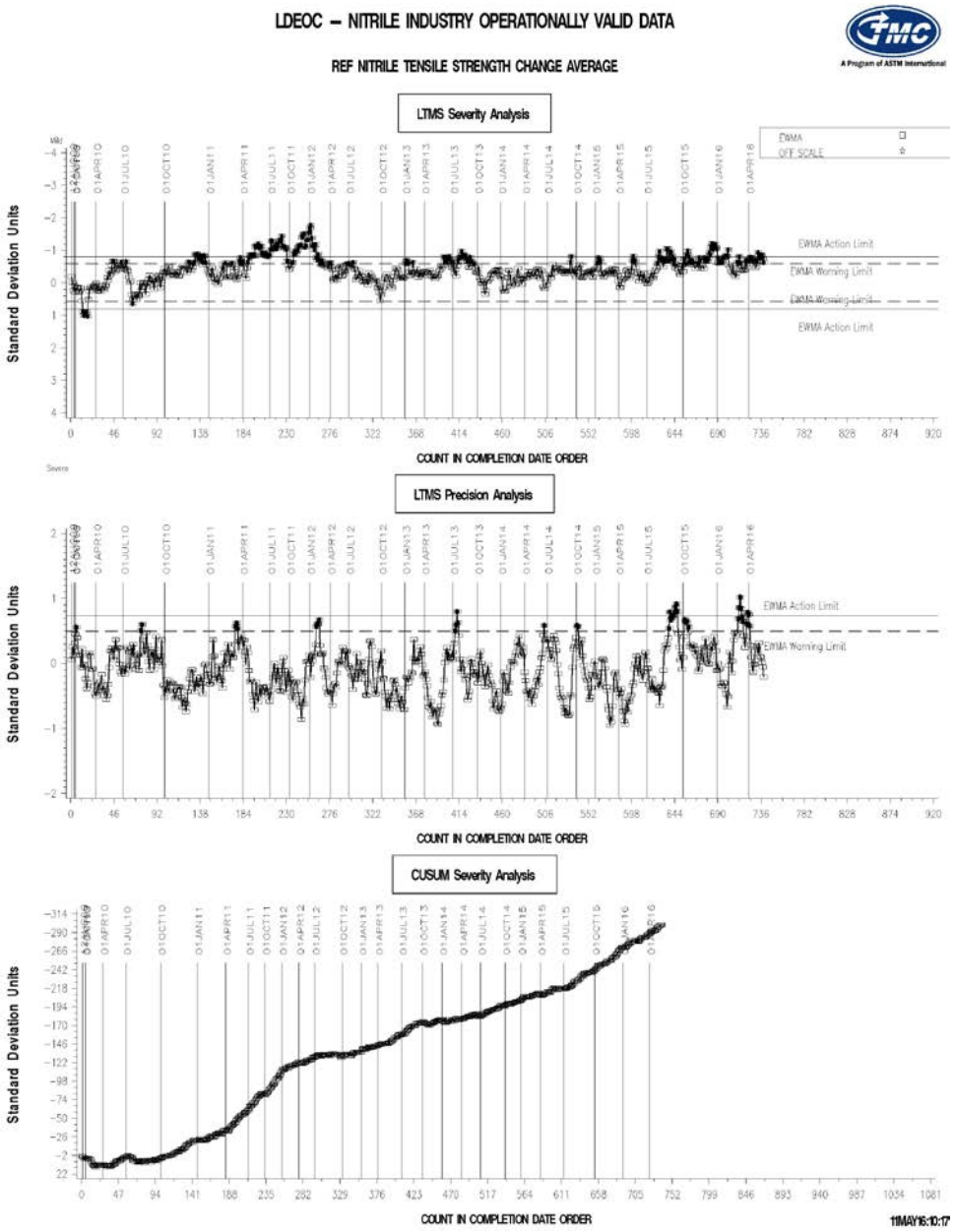
LDEOC (D 7216)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Standard Deviation Units
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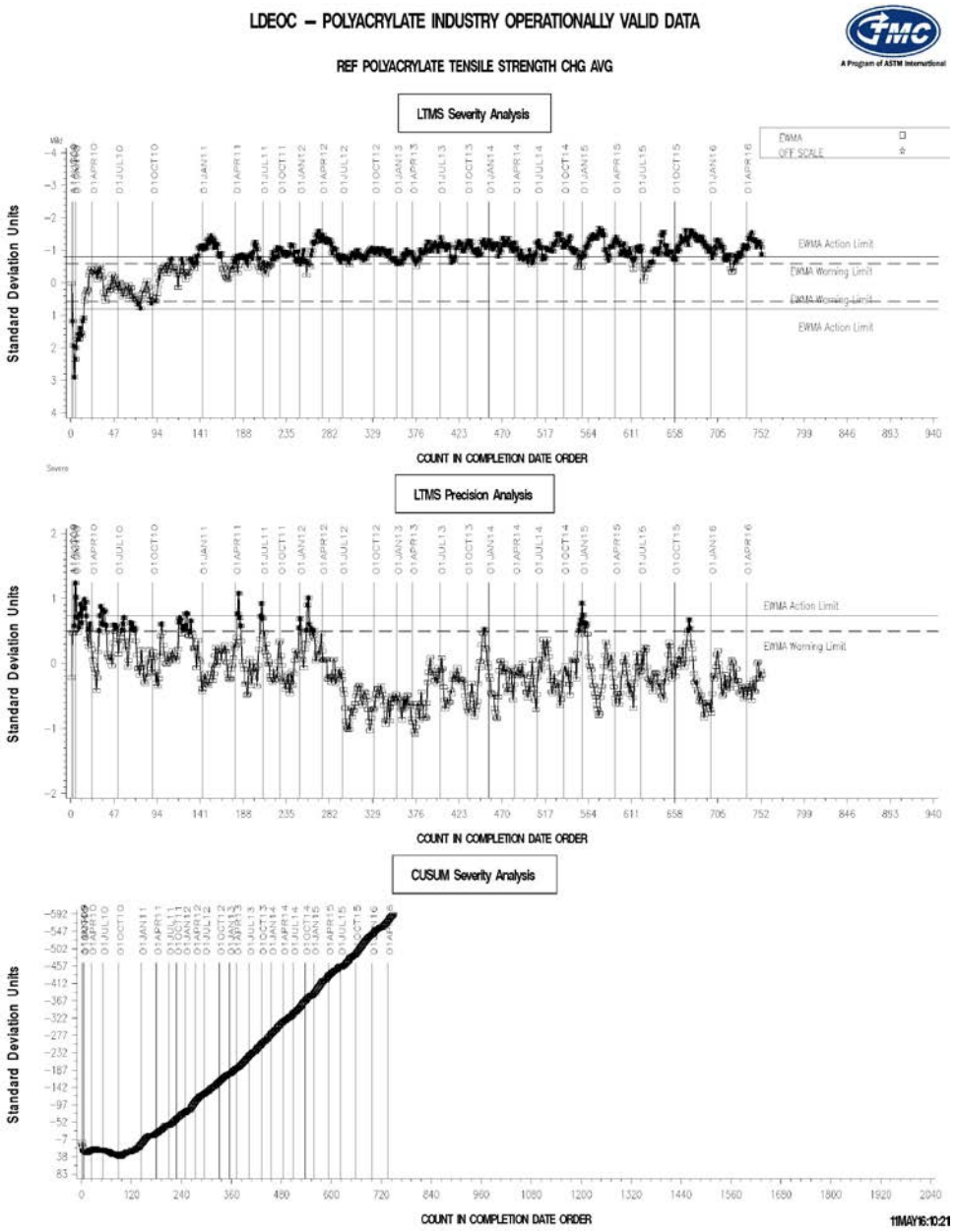
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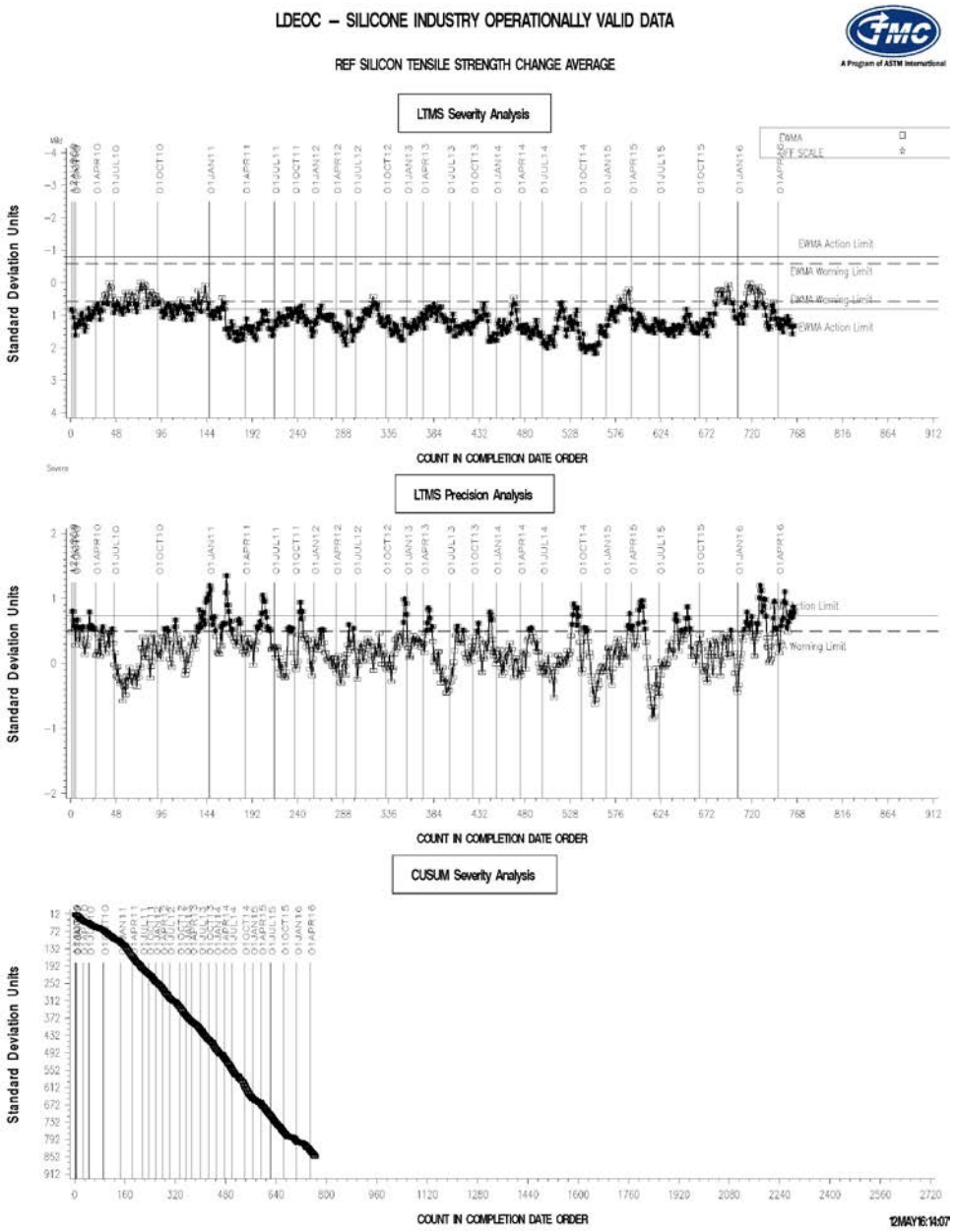
EWMA Warning Limit
EWMA Action Limit
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
LTMS Precision Analysis
EWMA Action Limit
EWMA Warning Limit
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
CUSUM Severity Analysis
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
11MAY16:10:21

LDEOC (D 7216)


LDEOC – SILICONE INDUSTRY OPERATIONALLY VALID DATA
REF SILICON TENSILE STRENGTH CHANGE AVERAGE
LTMS Severity Analysis
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
LTMS Precision Analysis
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
CUSUM Severity Analysis
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
12MAY16:14:07

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	134	0	0
1006-2	161	13,459	2667
Total	295	13,459	2667

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. These will be evaluated after 30 data points on each elastomer type are available.