



Test Monitoring Center

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

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

MEMORANDUM: 17-046

DATE: November 28, 2017

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

FROM: Michael T. Kasimirsky *Michael T. Kasimirsky*

SUBJECT: LDEOC Testing from April 1, 2017 through September 30, 2017

A total of 417 LDEOC tests were reported from 8 labs to the Test Monitoring Center during the period from April 1, 2017 through September 30, 2017.

Please find attached a summary of testing activity this period.

MTK/mtk/mem17-046.mtk.doc

cc: Frank Farber

Jeff Clark

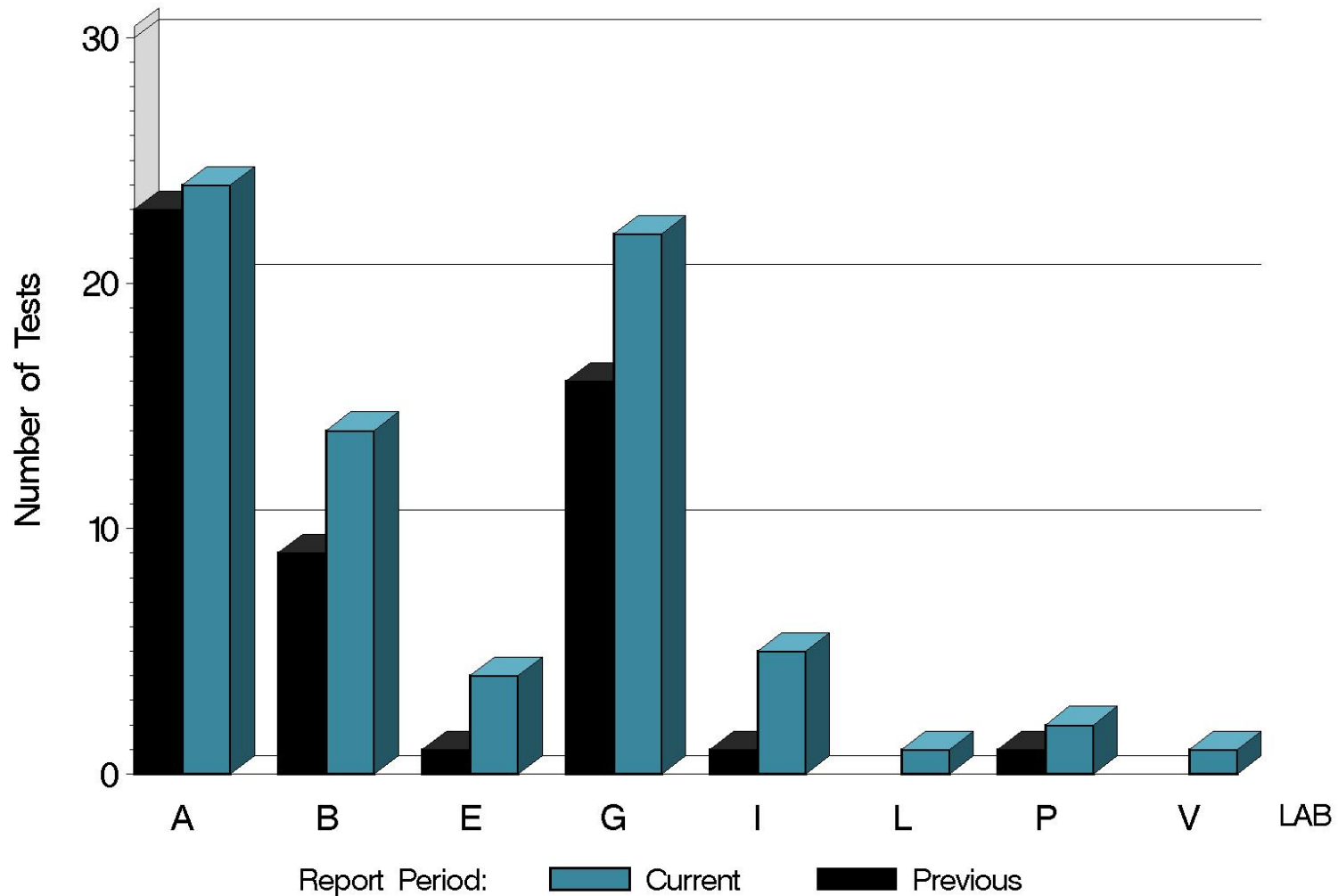
EOEC Surveillance Panel

<http://www.astmtmc.cmu.edu/docs/bench/ldeoc/semiannualreports/ldeoc-10-2017.pdf>

Distribution: email

LDEOC (D 7216)

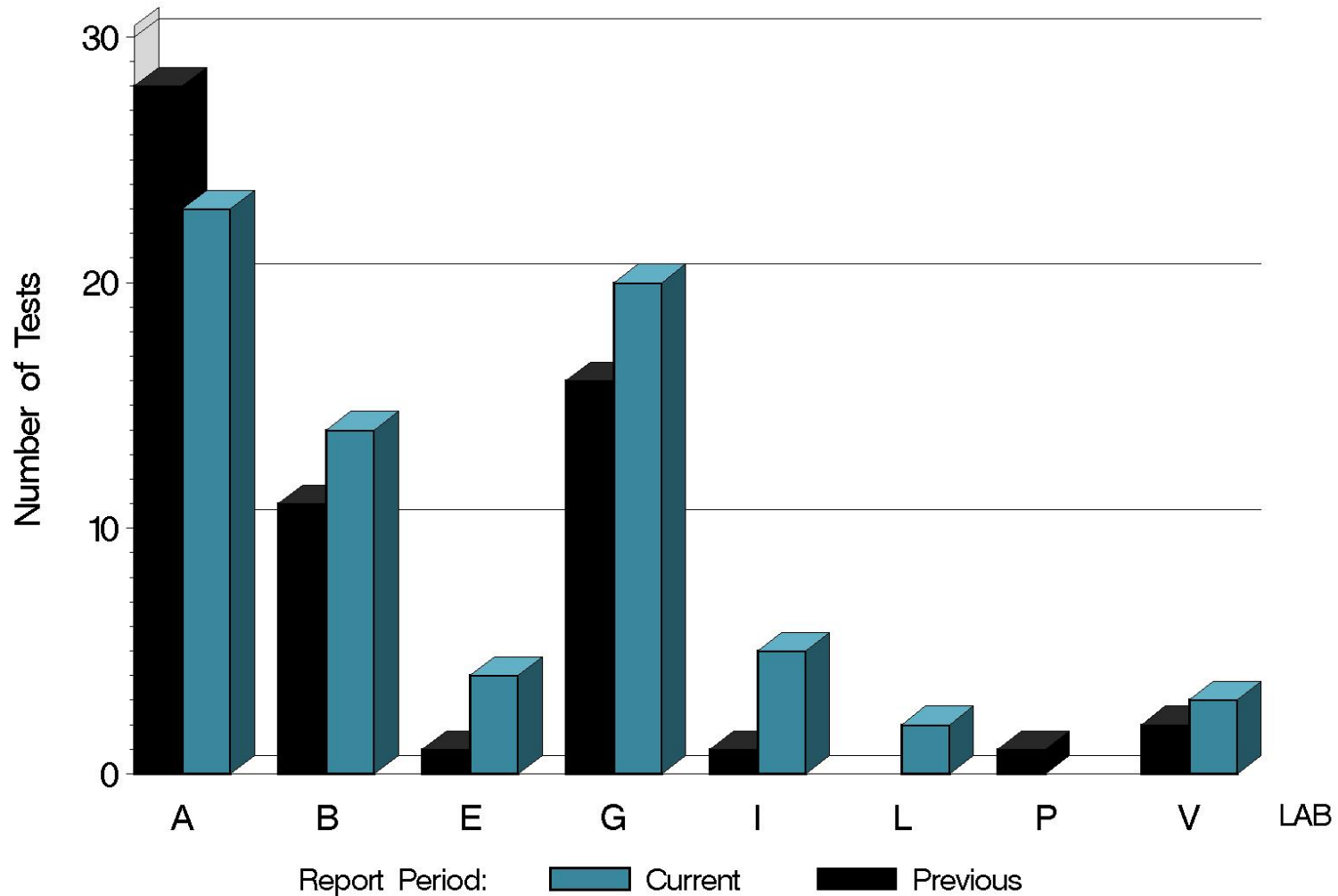
NUMBER OF ETHYLENE ACRYLATE TESTS
REPORTED BY LAB AND REPORT PERIOD



9:21:05 28NOV2017

LDEOC (D 7216)

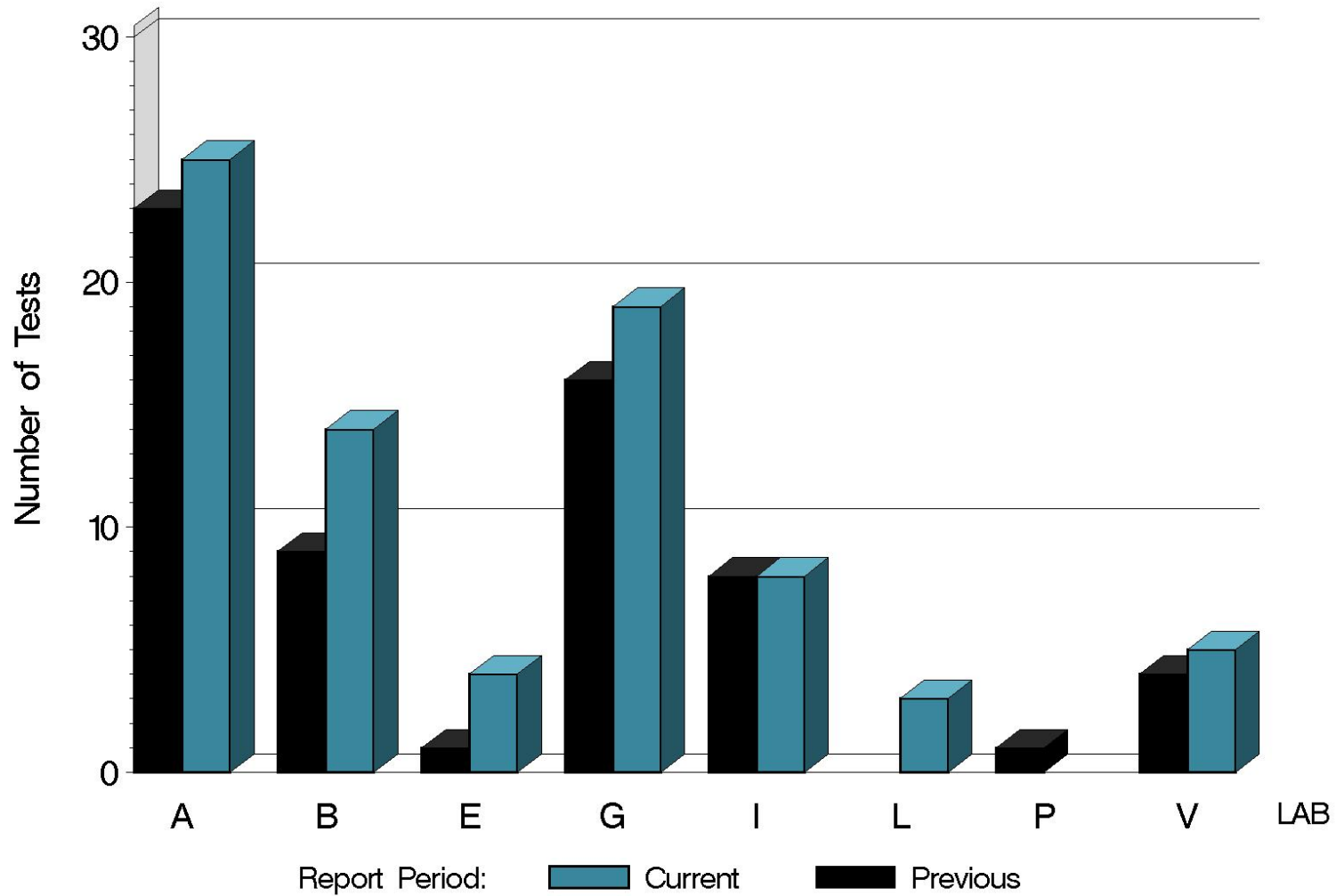
NUMBER OF FLUOROELASTOMER TESTS
REPORTED BY LAB AND REPORT PERIOD



9:21:05 28NOV2017

LDEOC (D 7216)

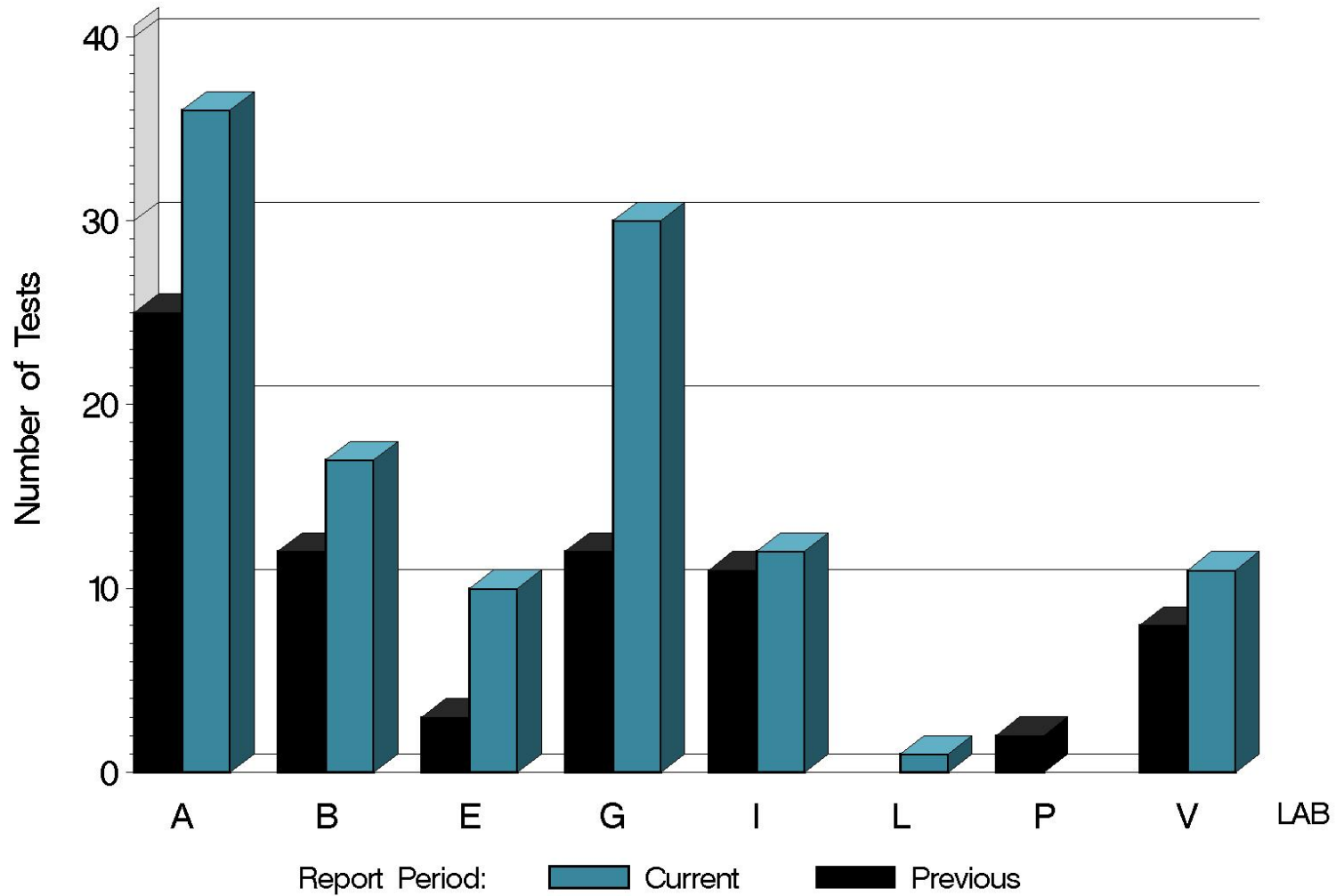
NUMBER OF NITRILE TESTS
REPORTED BY LAB AND REPORT PERIOD



9:21:05 28NOV2017

LDEOC (D 7216)

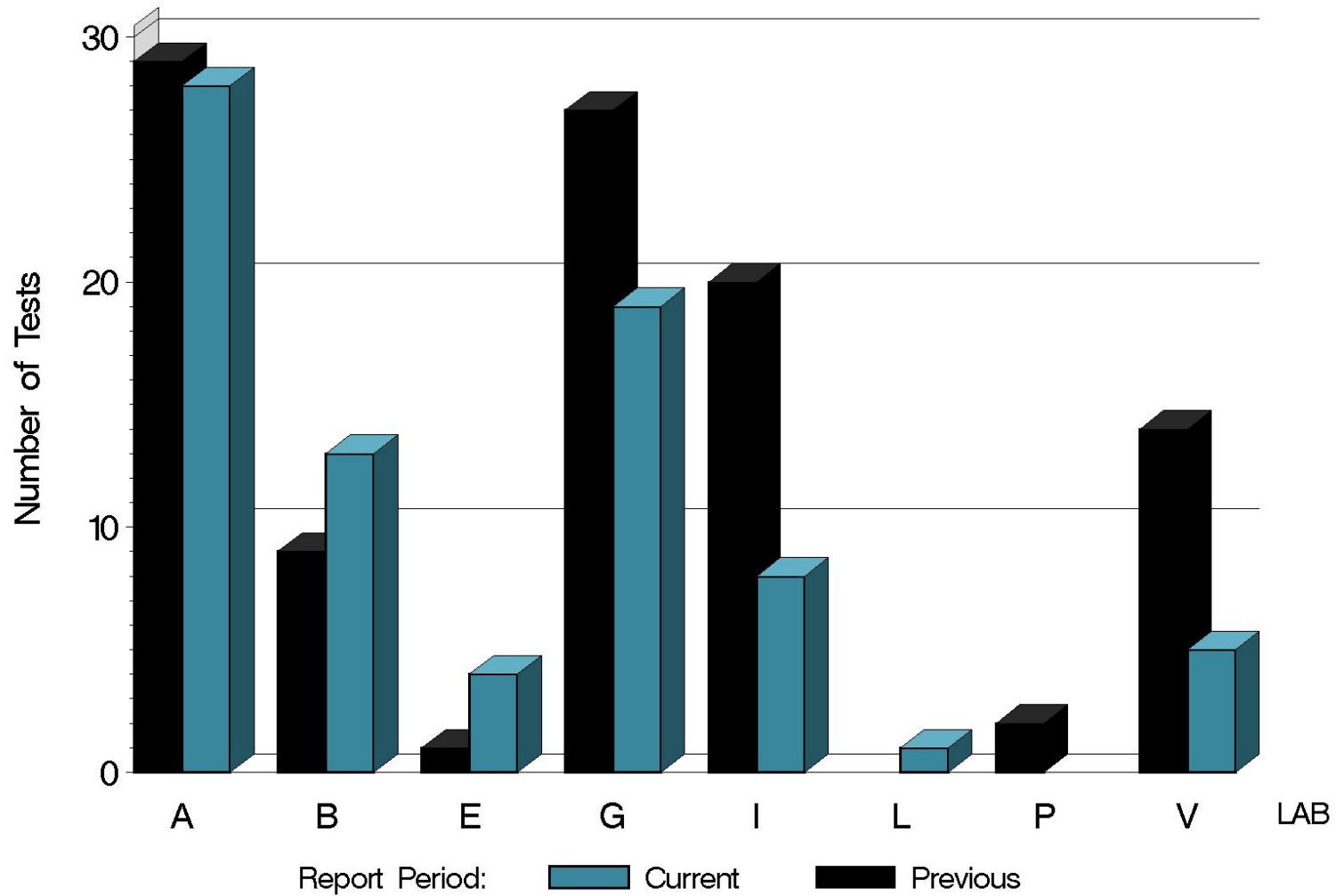
NUMBER OF POLYACRYLATE TESTS REPORTED BY LAB AND REPORT PERIOD



9:21:05 28NOV2017

LDEOC (D 7216)

NUMBER OF SILICONE TESTS REPORTED BY LAB AND REPORT PERIOD



9:21:05 28NOV2017

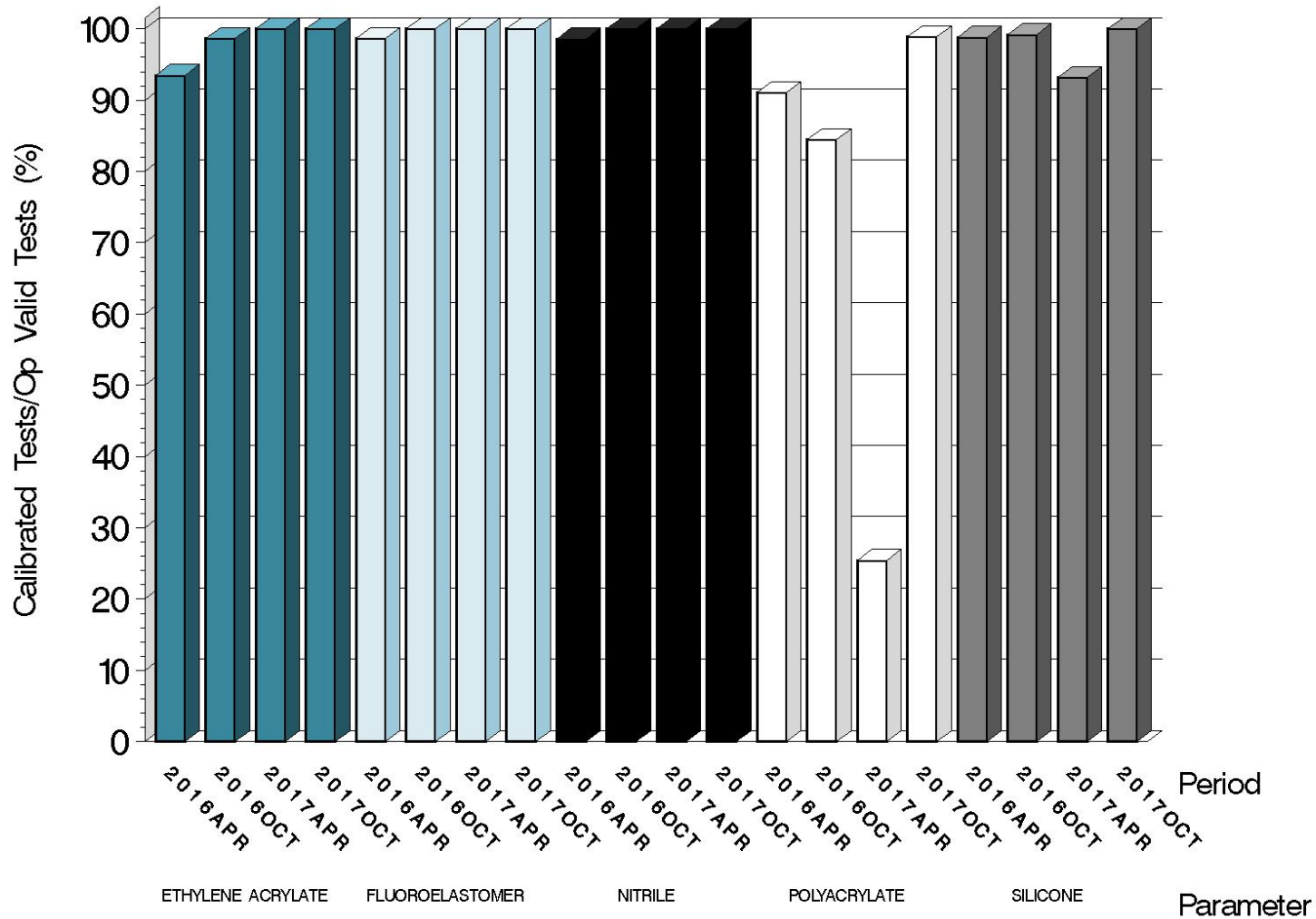
LDEOC (D 7216)

Test Distribution by Oil and Validity

| | | Ethylene Acrylate | Fluoroelastomer | Nitrile | Polyacrylate | Silicone | This Period | Last Period |
|-------------------------------|----|-------------------|-----------------|-----------|--------------|-----------|-------------|-------------|
| Accepted for Calibration | AC | 73 | 71 | 77 | 89 | 78 | 388 | 275 |
| Rejected | OC | 0 | 0 | 0 | 1 | 0 | 1 | 48 |
| Acceptable Information Run | NI | 0 | 0 | 0 | 26 | 0 | 26 | 16 |
| Unacceptable Information Run | MI | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| Invalid Information Run (TMC) | LI | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Invalid Information Run (TMC) | RI | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Operationally Invalid (lab) | LC | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Acceptable Shakedown Run | AS | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Aborted Calibration | XC | 0 | 0 | 1 | 1 | 0 | 2 | 0 |
| Total | | 73 | 71 | 78 | 117 | 78 | 417 | 345 |

LDEOC (D 7216)

OPERATIONALLY VALID TESTS
MEETING ACCEPTANCE CRITERIA



9:21:05 28NOV2017

LDEOC (D 7216)

The rejection rate for Polyacrylate elastomer tests has gone down significantly, compared to last period, due to the introduction of a Correction Factor on Volume Change results.

The rejection rate for Silicone elastomer tests has gone down, compared to last period, due to a return to more on-target performance by Lab E on Tensile Strength results.

LDEOC (D 7216)

LOST TESTS PER START BY LAB AND ELASTOMER TYPE

| Lab | Ethylene Acrylate | | | Fluoroelastomer | | | Nitrile | | | Polyacrylate | | | Silicone | | | Total | | |
|-------|-------------------|--------|---|-----------------|--------|---|---------|--------|-----|--------------|--------|-----|----------|--------|---|-------|--------|-----|
| | Lost | Starts | % | Lost | Starts | % | Lost | Starts | % | Lost | Starts | % | Lost | Starts | % | Lost | Starts | % |
| A | 0 | 24 | 0 | 0 | 23 | 0 | 0 | 25 | 0 | 0 | 36 | 0 | 0 | 28 | 0 | 0 | 136 | 0 |
| B | 0 | 14 | 0 | 0 | 14 | 0 | 0 | 14 | 0 | 0 | 17 | 0 | 0 | 13 | 0 | 0 | 72 | 0 |
| E | 0 | 4 | 0 | 0 | 4 | 0 | 0 | 4 | 0 | 0 | 10 | 0 | 0 | 4 | 0 | 0 | 26 | 0 |
| G | 0 | 22 | 0 | 0 | 20 | 0 | 0 | 19 | 0 | 0 | 30 | 0 | 0 | 19 | 0 | 0 | 110 | 0 |
| I | 0 | 5 | 0 | 0 | 5 | 0 | 0 | 8 | 0 | 1 | 12 | 8.3 | 0 | 8 | 0 | 1 | 38 | 2.6 |
| L | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 8 | 0 |
| P | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| V | 0 | 1 | 0 | 0 | 3 | 0 | 1 | 5 | 20 | 0 | 11 | 0 | 0 | 5 | 0 | 1 | 25 | 4 |
| Total | 0 | 73 | 0 | 0 | 71 | 0 | 1 | 78 | 1.3 | 1 | 117 | 0.9 | 0 | 78 | 0 | 2 | 417 | 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 | % |
| | | | | | | | | | | | | |
| V | Sample Handling Error | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 25 | 4.0 | |
| I | Bath Failure | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 38 | 2.6 | |
| | Lost | 0 | 0 | 1 | 1 | 0 | 0 | 2 | | | | |
| | Starts | 73 | 71 | 78 | 117 | 78 | 417 | 417 | 417 | | | |
| | % | 0 | 0 | 1.3 | 0.9 | 0 | 0 | 0 | 0.5 | | | |

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 | 24 | -0.740 | -0.751 | 0.684 |
| | B | 14 | -0.923 | 0.518 | 1.008 |
| | E | 4 | -1.659 | -0.659 | 0.822 |
| | G | 22 | 0.059 | -0.310 | 0.417 |
| | I | 5 | -1.044 | 1.538 | -1.075 |
| | L | 1 | -2.039 | 2.637 | 0.220 |
| | P | 2 | -1.786 | -0.659 | -0.659 |
| | V | 1 | -2.390 | -2.857 | -0.181 |
| | Industry | 73 | -0.675 | -0.193 | 0.498 |
| Fluoroelastomer | A | 23 | -0.942 | 1.084 | -0.216 |
| | B | 14 | -0.414 | 0.171 | 0.609 |
| | E | 4 | -0.733 | 0.030 | 0.309 |
| | G | 20 | -0.997 | -0.020 | 1.024 |
| | I | 5 | -1.147 | 0.129 | 0.866 |
| | L | 2 | -0.967 | 1.020 | 0.276 |
| | P | - | - | - | - |
| | V | 3 | -1.289 | 1.845 | -1.756 |
| | Industry | 71 | -0.871 | 0.497 | 0.351 |
| Nitrile | A | 25 | 1.244 | 0.218 | -0.732 |
| | B | 14 | 1.661 | -0.484 | -0.911 |
| | E | 4 | 1.513 | -0.690 | -0.785 |
| | G | 19 | 1.181 | 0.959 | -0.771 |
| | I | 8 | 1.692 | -0.259 | -0.659 |
| | L | 3 | 1.522 | 1.322 | -0.812 |
| | P | - | - | - | - |
| | V | 4 | 1.542 | -1.839 | -1.431 |
| | Industry | 77 | 1.391 | 0.113 | -0.809 |

Test Monitoring Center

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LDEOC (D 7216)

| Average Δ /s by Lab | | | | | |
|----------------------------|----------|----|--------|--------|--------|
| Elastomer | Lab | n | VOLCYI | HARDYI | TENSYI |
| Polyacrylate | A | 32 | -0.311 | -0.989 | -0.639 |
| | B | 13 | -0.048 | -0.816 | -0.624 |
| | E | 4 | -0.758 | -1.253 | -0.401 |
| | G | 26 | -0.256 | -0.142 | -0.610 |
| | I | 7 | 0.714 | -0.859 | -0.666 |
| | L | 1 | -0.333 | -0.766 | -0.425 |
| | P | - | - | - | - |
| | V | 7 | -1.035 | -0.673 | -0.464 |
| | Industry | 90 | -0.254 | -0.694 | -0.604 |
| Silicone | A | 28 | -0.146 | -0.671 | 1.795 |
| | B | 13 | -0.095 | -0.442 | 1.530 |
| | E | 4 | 0.020 | 0.765 | 0.001 |
| | G | 19 | 1.392 | -0.964 | 1.174 |
| | I | 8 | -1.684 | 0.152 | 0.844 |
| | L | 1 | -1.371 | 1.745 | 2.720 |
| | P | - | - | - | - |
| | V | 5 | -0.050 | -0.608 | 2.137 |
| | Industry | 78 | 0.078 | -0.511 | 1.444 |

LDEOC (D 7216)

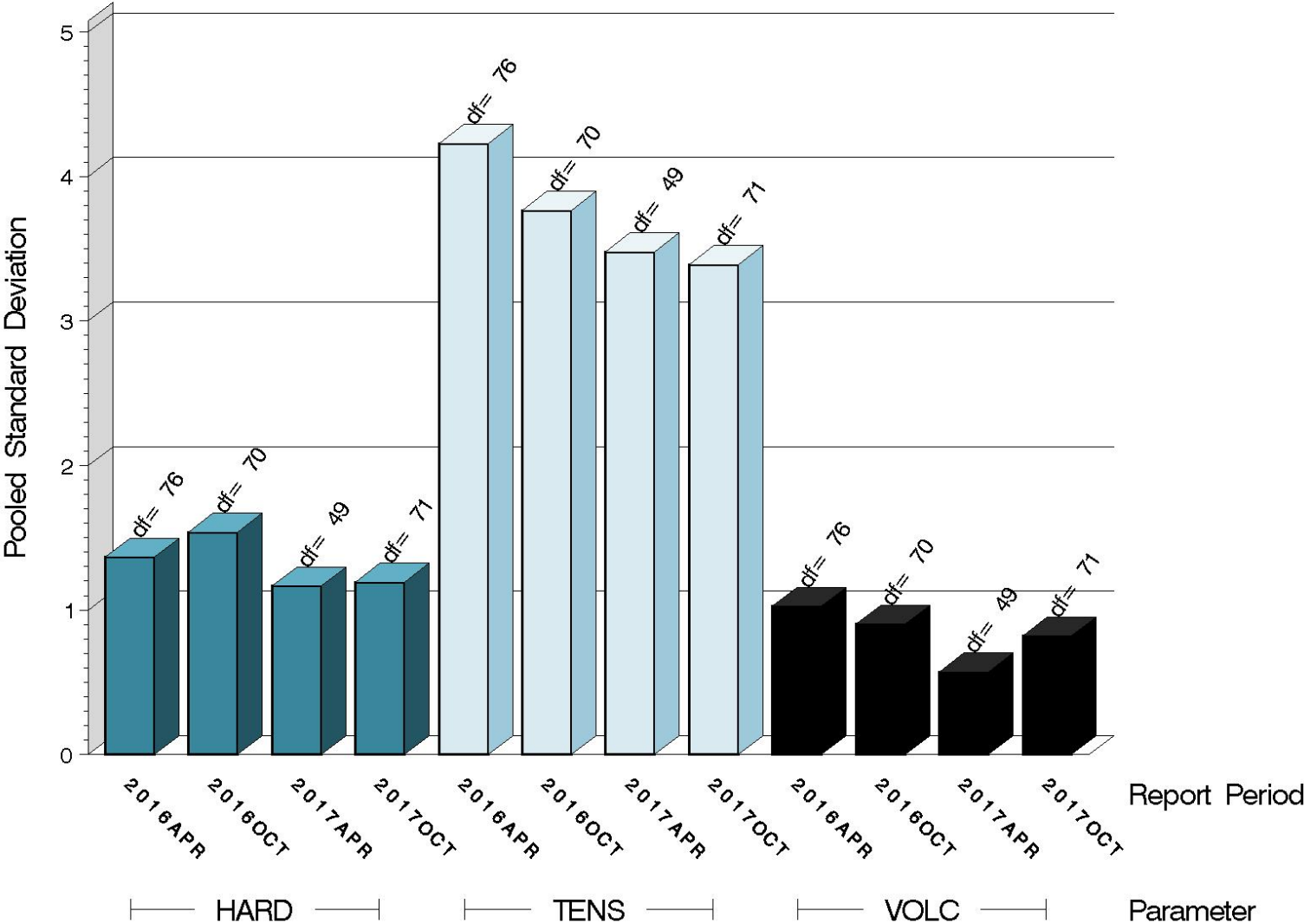
Individual test results can be viewed at the links shown in the following table:

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

LDEOC (D 7216)

ETHYLENE ACRYLATE TEST PRECISION

POOLED STANDARD DEVIATION BY SIX-MONTH ASTM REPORT PERIOD



9:21:05 28NOV2017

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<http://astmtmc.cmu.edu>

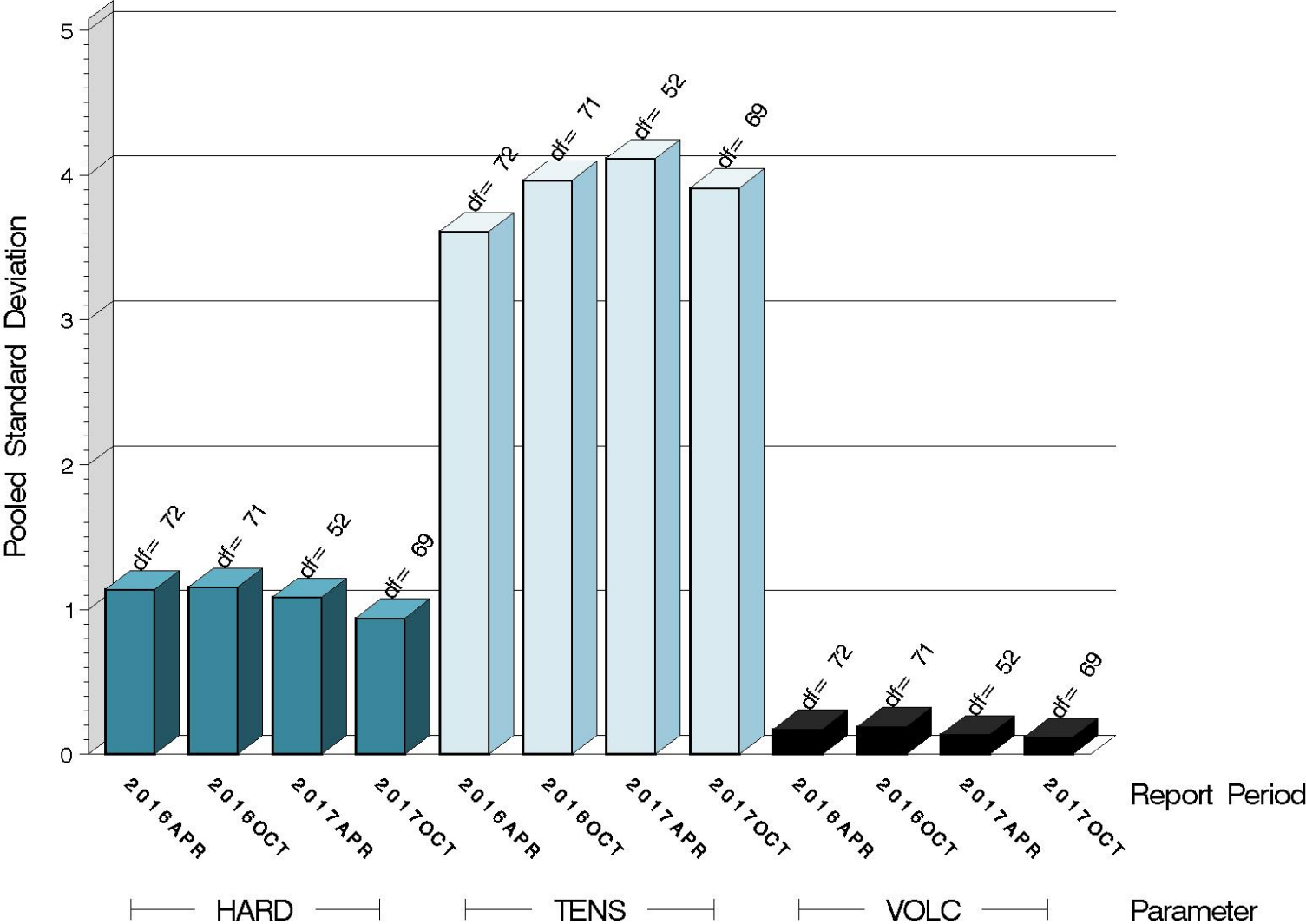


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LDEOC (D 7216)

FLUOROELASTOMER TEST PRECISION

POOLED STANDARD DEVIATION BY SIX-MONTH ASTM REPORT PERIOD



9:21:05 28NOV2017

Test Monitoring Center

<http://astmtmc.cmu.edu>

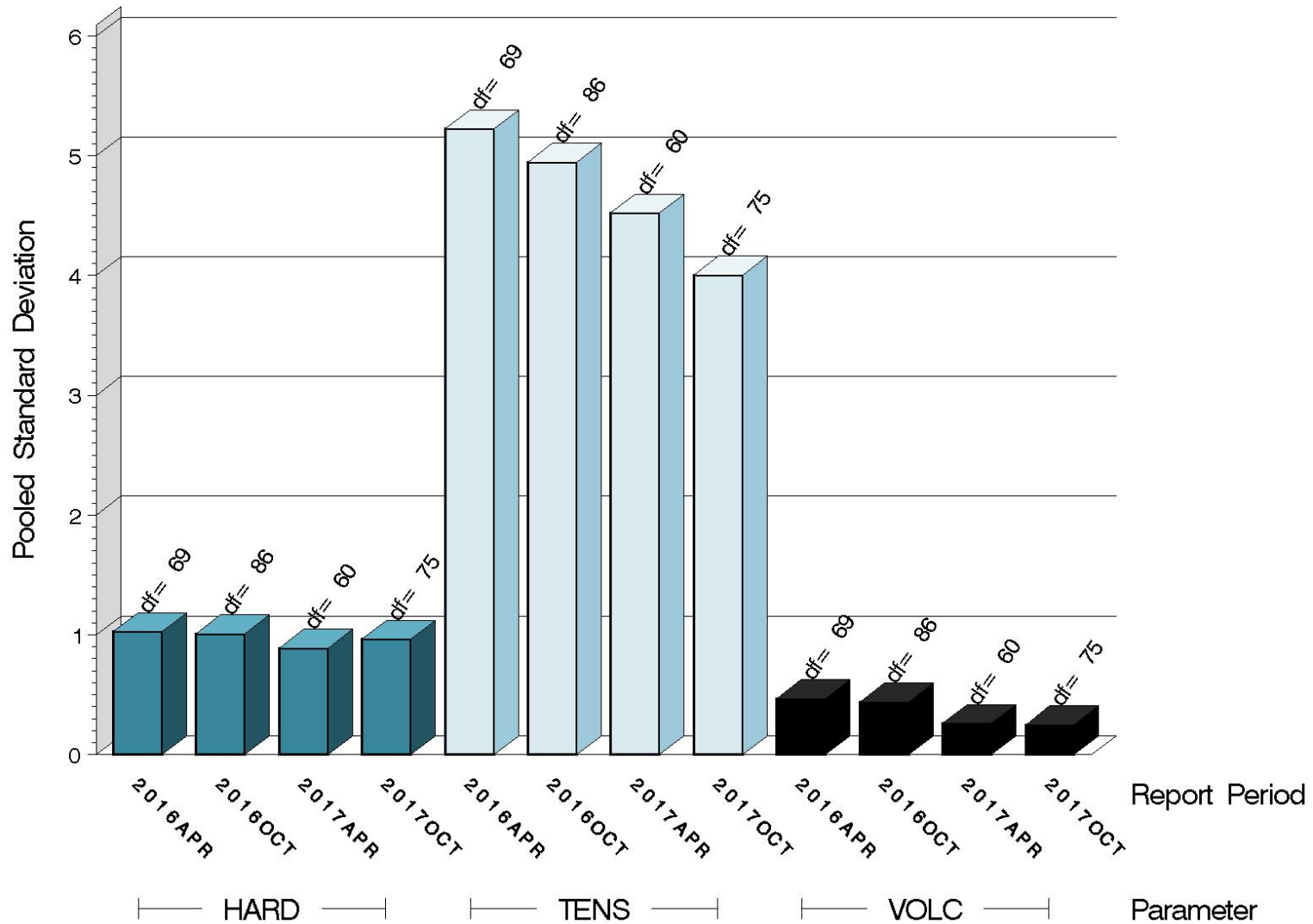


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LDEOC (D 7216)

NITRILE TEST PRECISION

POOLED STANDARD DEVIATION BY SIX-MONTH ASTM REPORT PERIOD

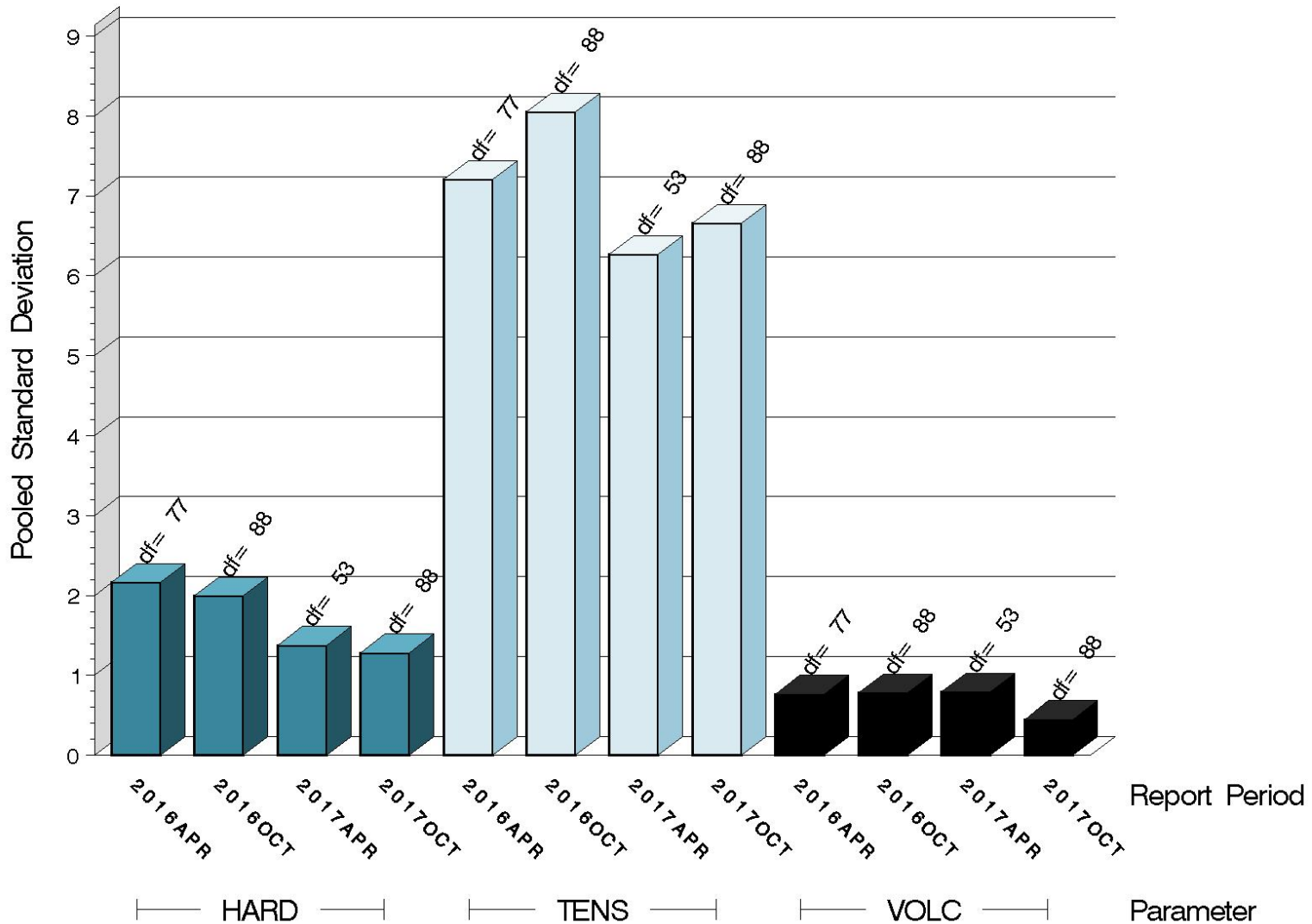


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LDEOC (D 7216)

POLYACRYLATE TEST PRECISION

POOLED STANDARD DEVIATION BY SIX-MONTH ASTM REPORT PERIOD

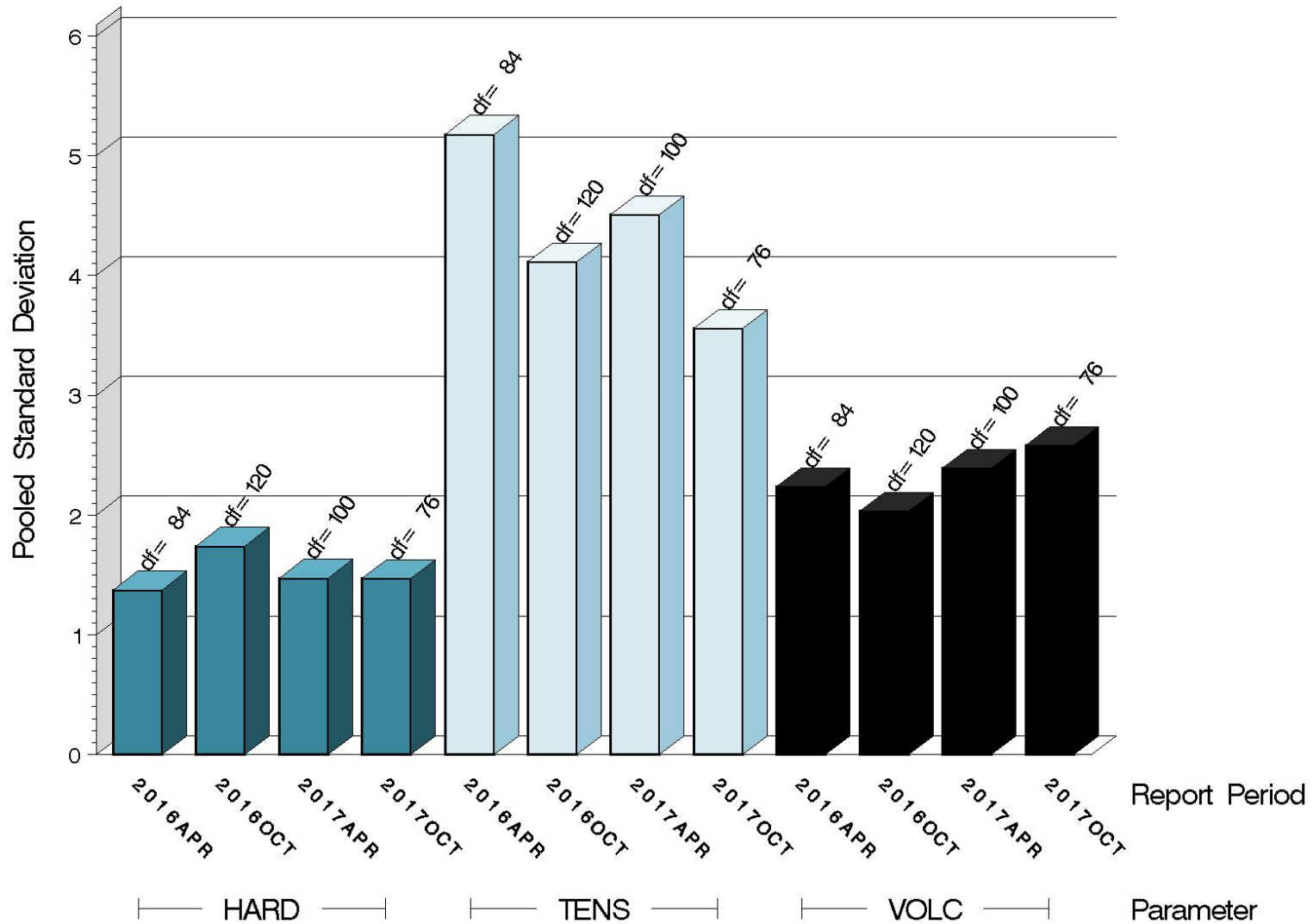


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LDEOC (D 7216)

SILICONE TEST PRECISION

POOLED STANDARD DEVIATION BY SIX-MONTH ASTM REPORT PERIOD



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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 | Within limits | Within limits | Severe |
| Fluoroelastomer | Mild | Within limits | Severe |
| Nitrile | Severe | Within limits | Mild |
| Polyacrylate | Within limits | 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 | 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 | Warning |

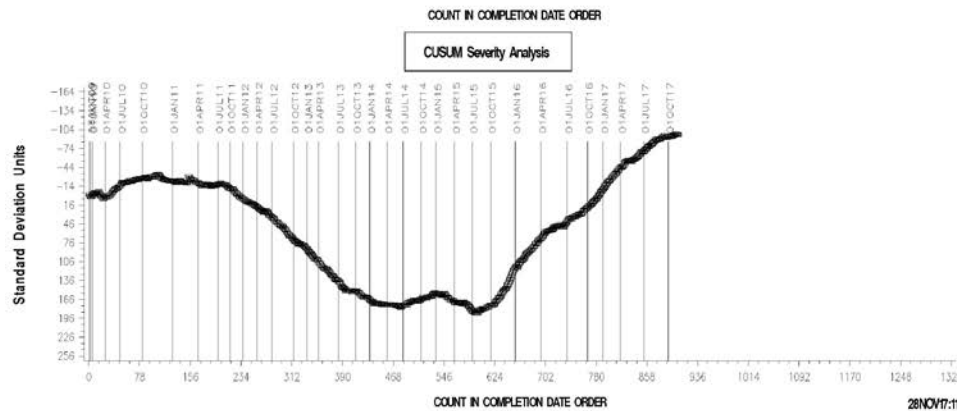
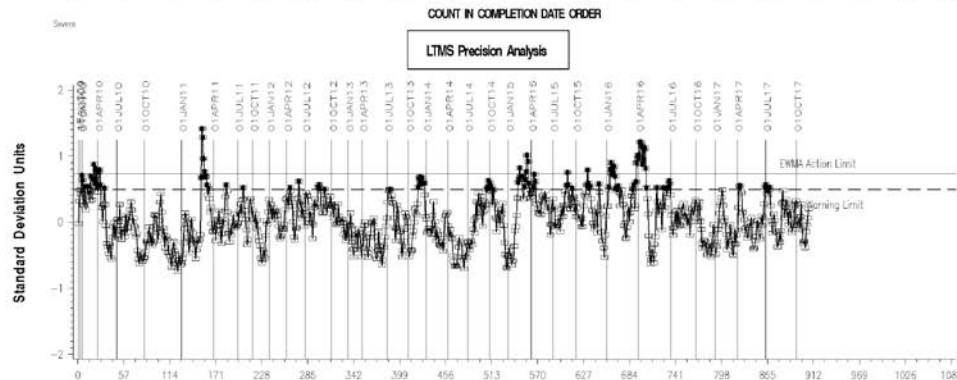
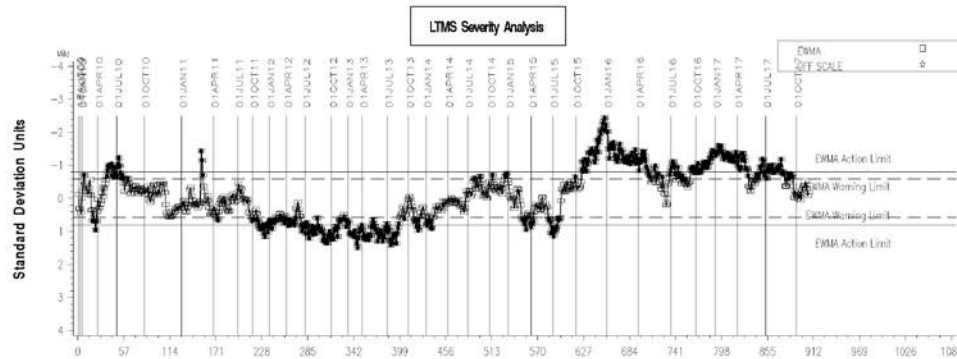
Industry control charts follow.

LDEOC (D 7216)

LDEOC – ETHYLENE ACRYLATE INDUSTRY OPERATIONALLY VALID DATA



REF ETH ACRYLATE VOLUME CHANGE AVERAGE

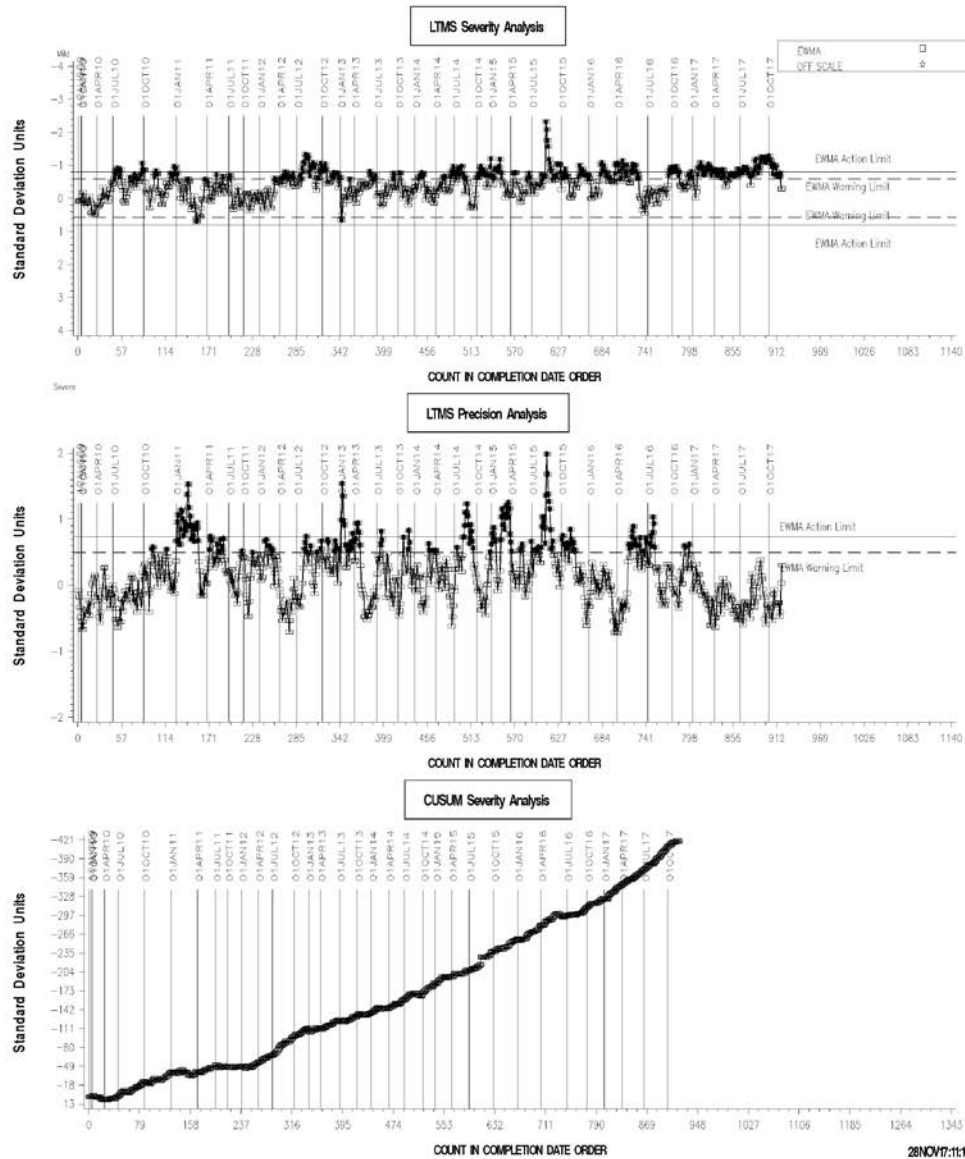


LDEOC (D 7216)

LDEOC – FLUOROELASTOMER INDUSTRY OPERATIONALLY VALID DATA



REF FLUOROELASTOMER VOLUME CHANGE AVERAGE

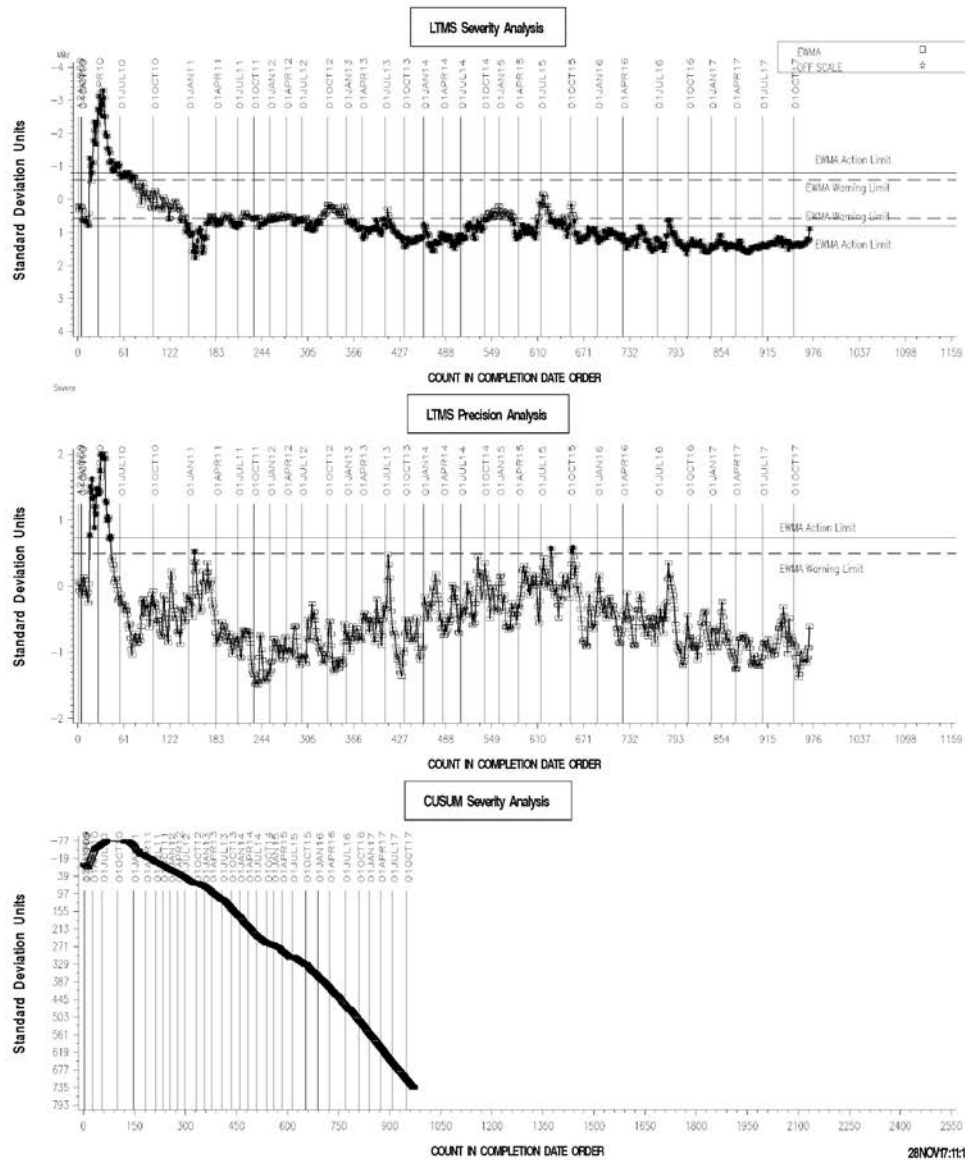


LDEOC (D 7216)

LDEOC – NITRILE INDUSTRY OPERATIONALLY VALID DATA



REFERENCE NITRILE VOLUME CHANGE AVERAGE

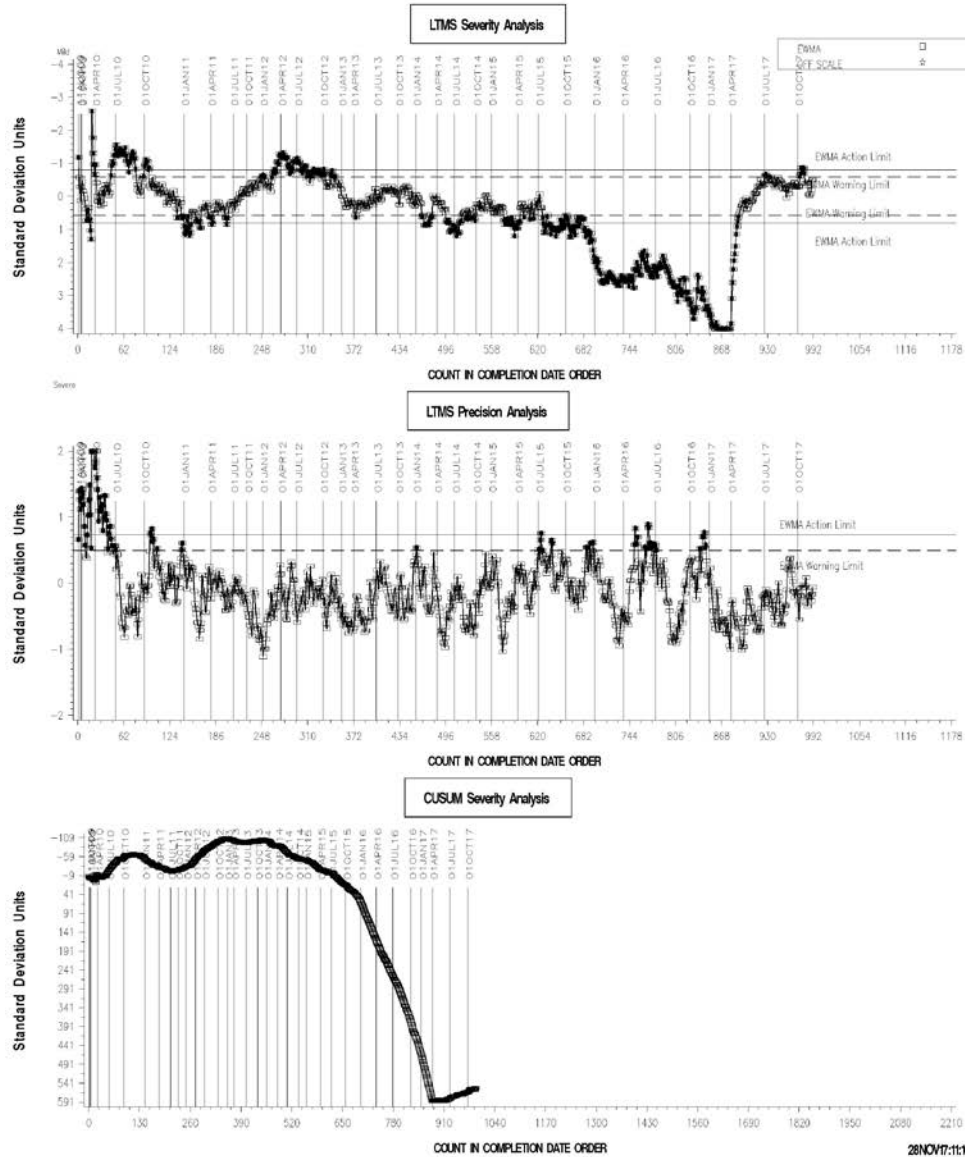


LDEOC (D 7216)

LDEOC – POLYACRYLATE INDUSTRY OPERATIONALLY VALID DATA



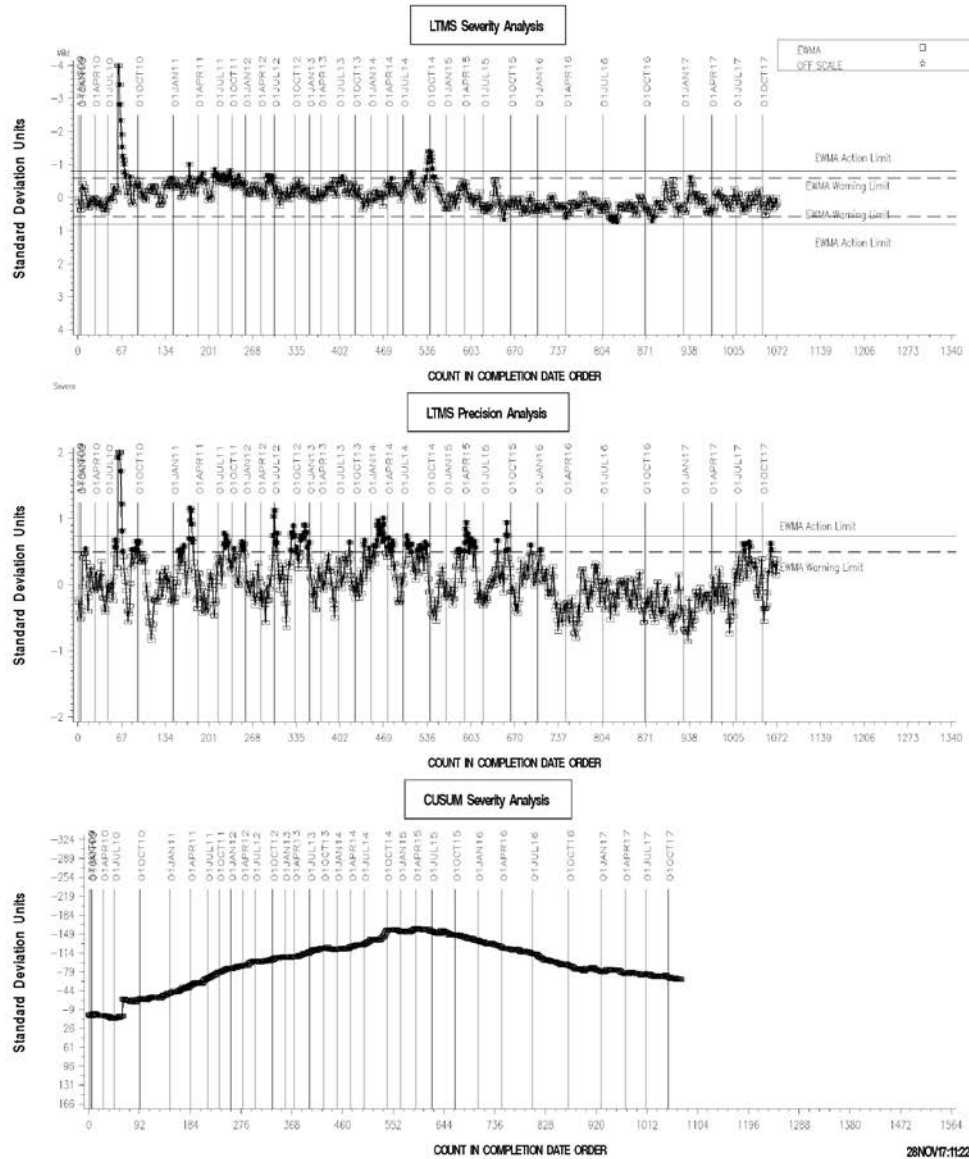
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LDEOC (D 7216)

LDEOC – SILICONE INDUSTRY OPERATIONALLY VALID DATA

REFERENCE SILICON VOLUME CHANGE AVERAGE

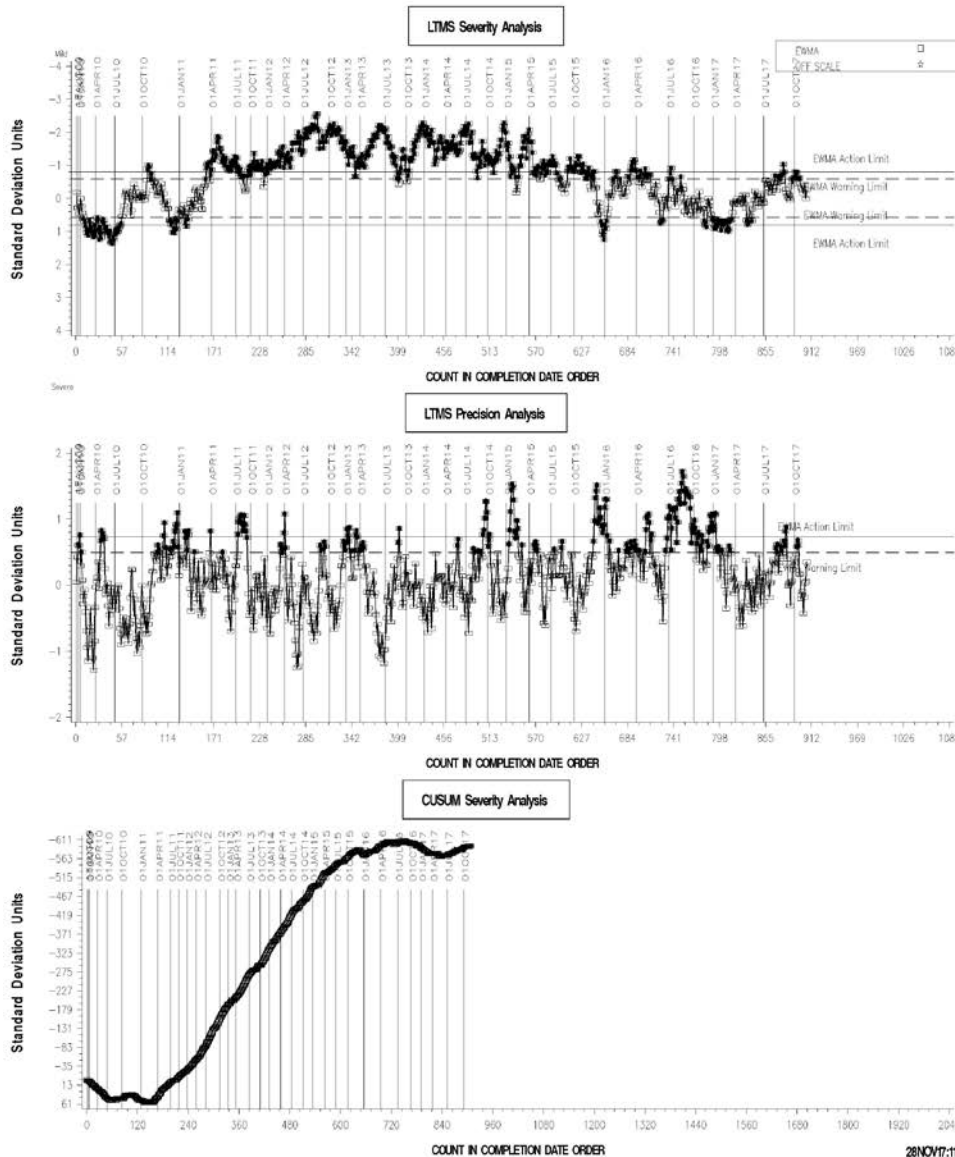


LDEOC (D 7216)

LDEOC – ETHYLENE ACRYLATE INDUSTRY OPERATIONALLY VALID DATA



REF ETH ACRYLATE POINTS HARDNESS CHANGE AVG

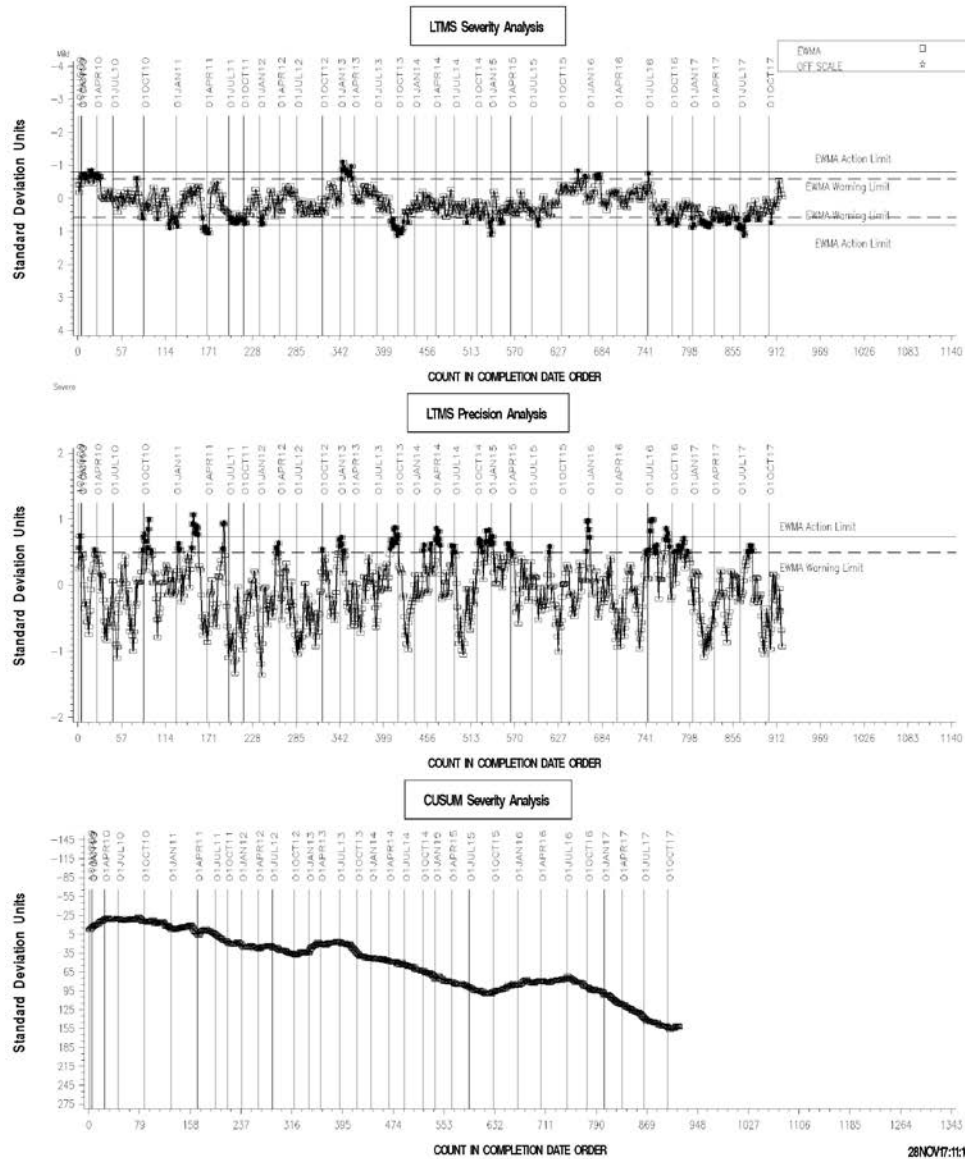


LDEOC (D 7216)

LDEOC – FLUOROELASTOMER INDUSTRY OPERATIONALLY VALID DATA



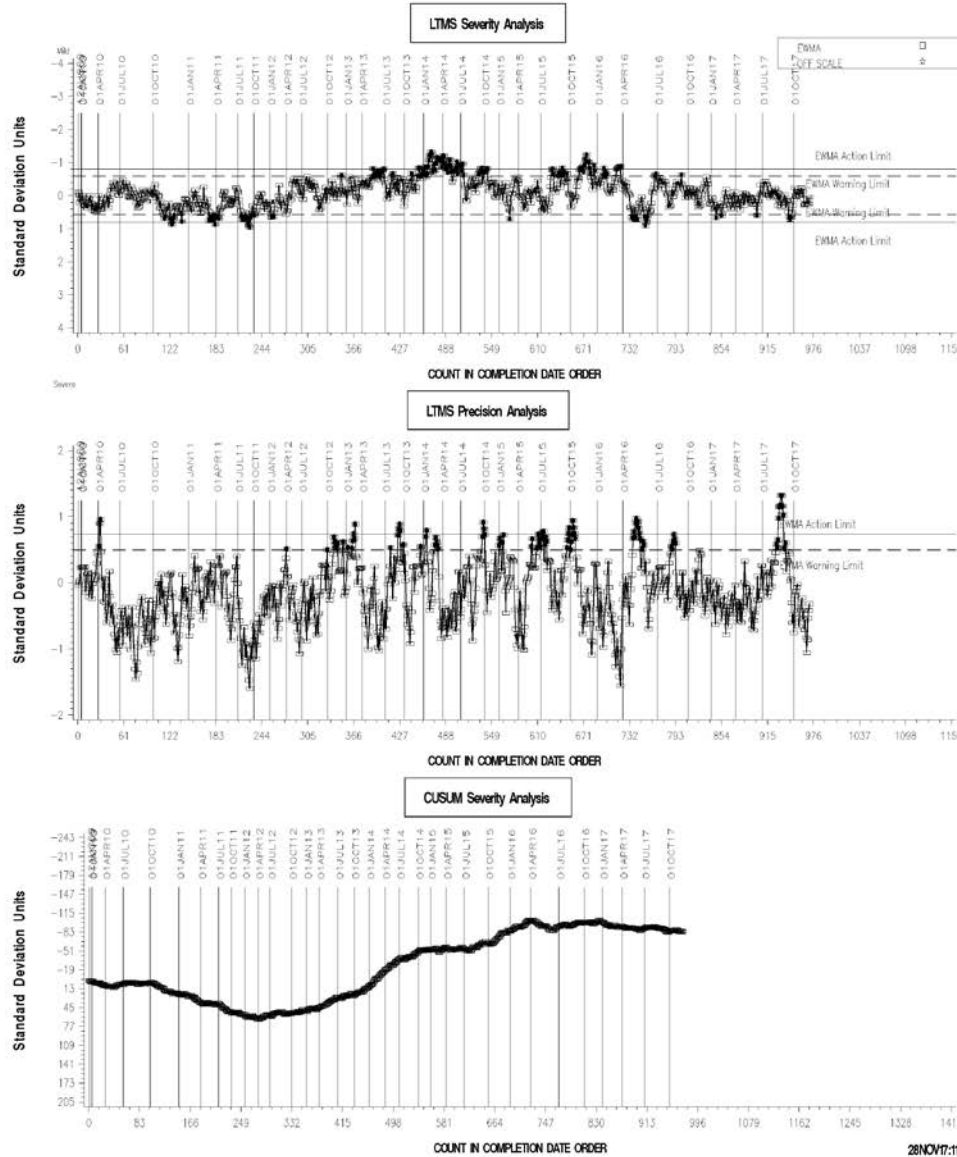
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LDEOC (D 7216)

LDEOC – NITRILE INDUSTRY OPERATIONALLY VALID DATA

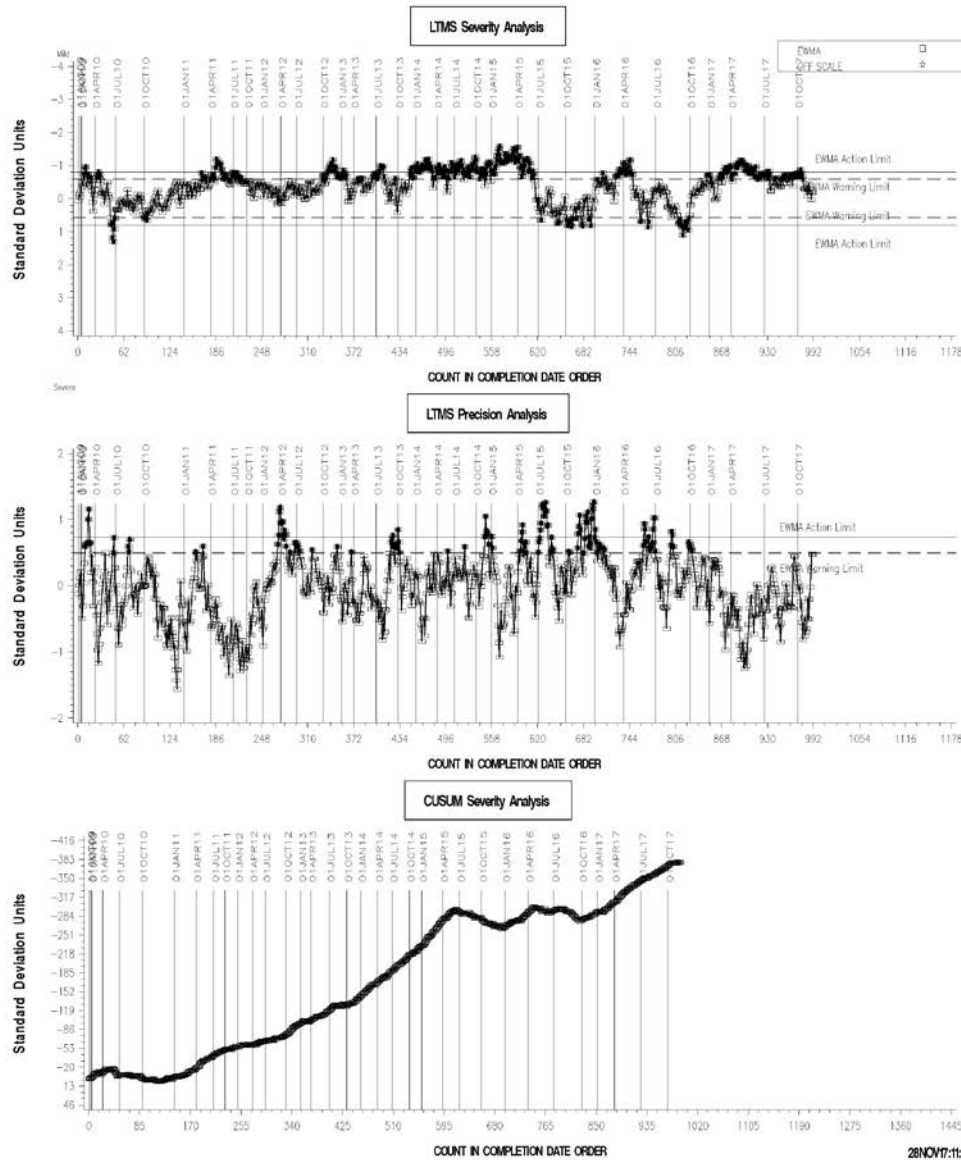
REF NITRILE POINTS HARDNESS CHANGE AVERAGE



LDEOC (D 7216)

LDEOC – POLYACRYLATE INDUSTRY OPERATIONALLY VALID DATA

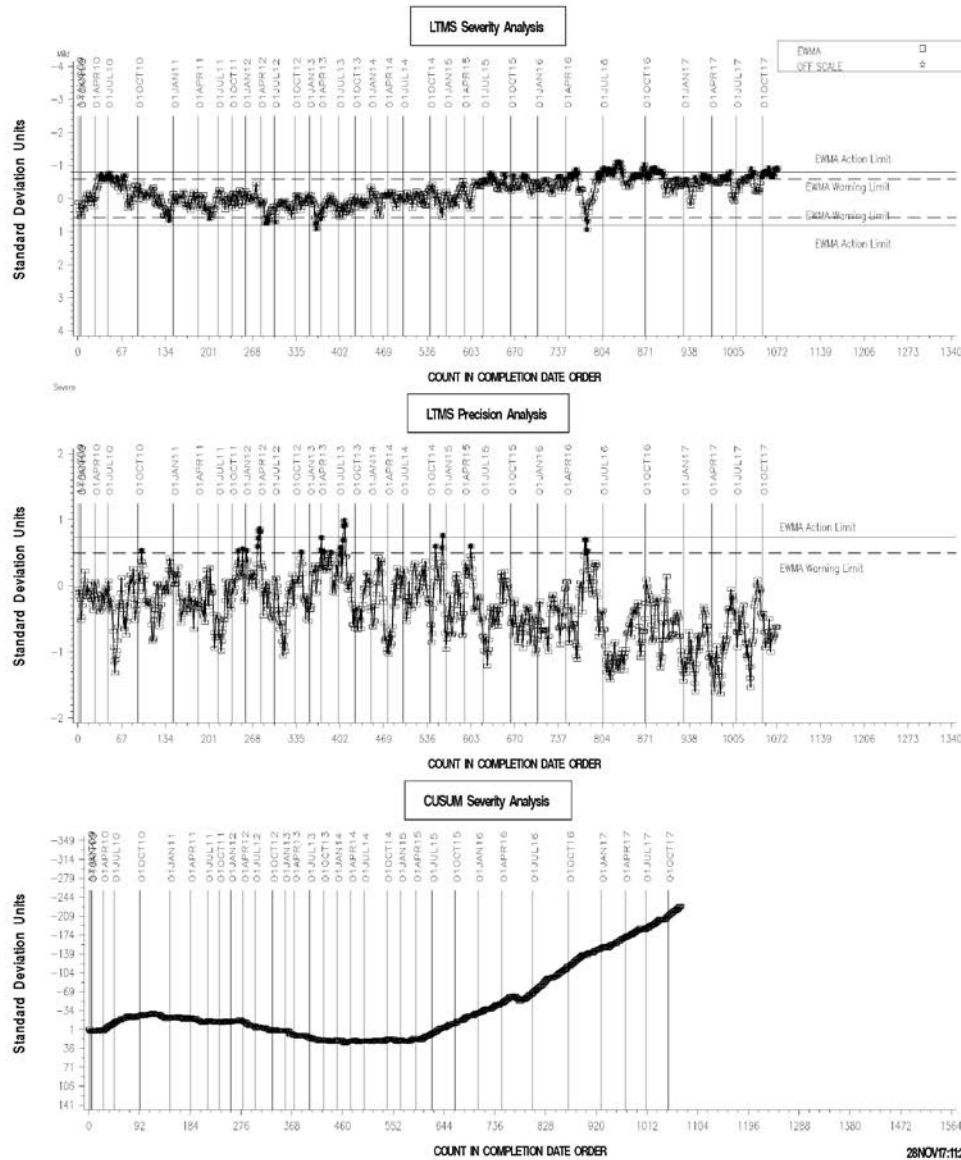
REF POLYACRYLATE POINTS HARDNESS CHG AVG



LDEOC (D 7216)

LDEOC – SILICONE INDUSTRY OPERATIONALLY VALID DATA

REF SILICON POINTS HARDNESS CHANGE AVERAGE

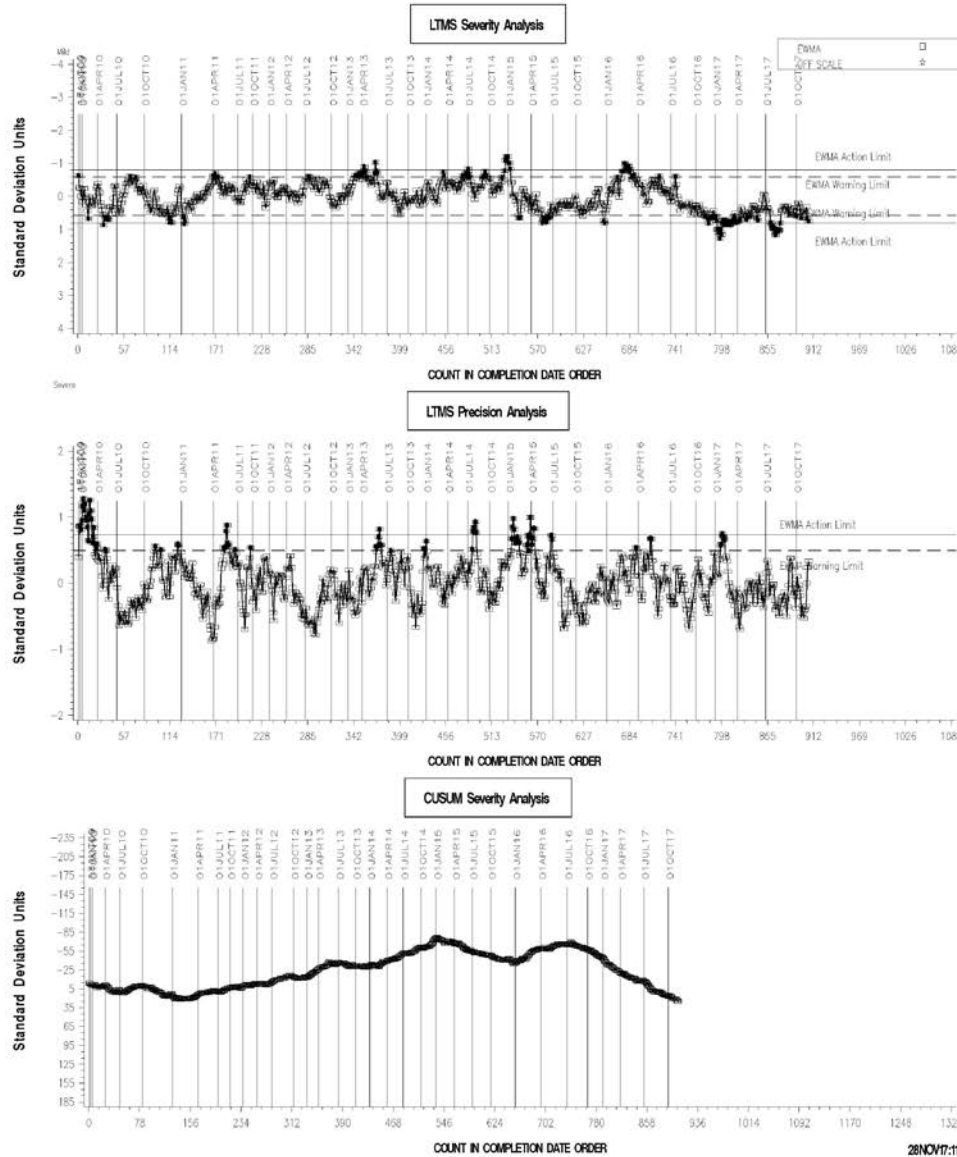


LDEOC (D 7216)

LDEOC – ETHYLENE ACRYLATE INDUSTRY OPERATIONALLY VALID DATA



REF ETH ACRYLATE TENSILE STRENGTH CHANGE AVG

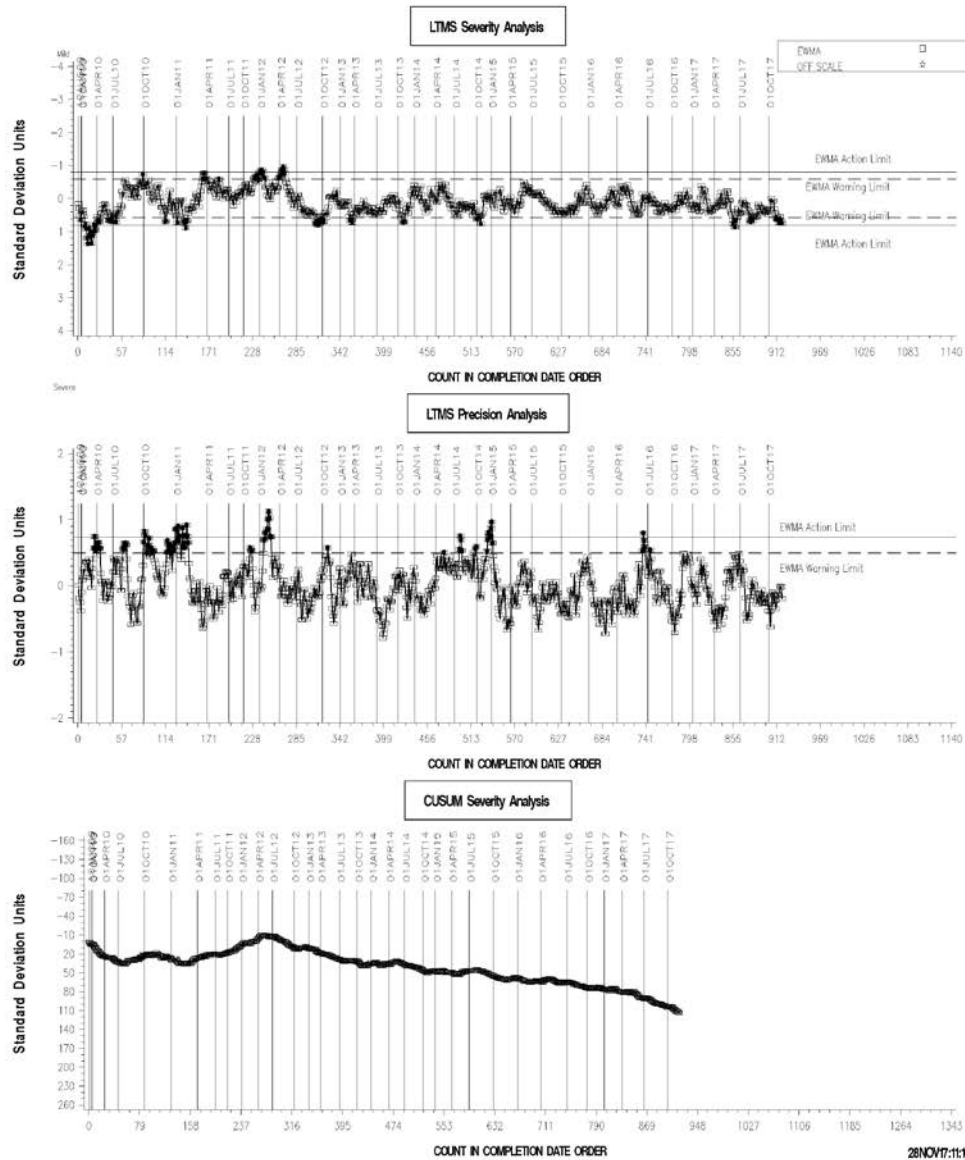


LDEOC (D 7216)

LDEOC – FLUOROELASTOMER INDUSTRY OPERATIONALLY VALID DATA



REF FLUORO TENSILE STRENGTH CHANGE AVERAGE



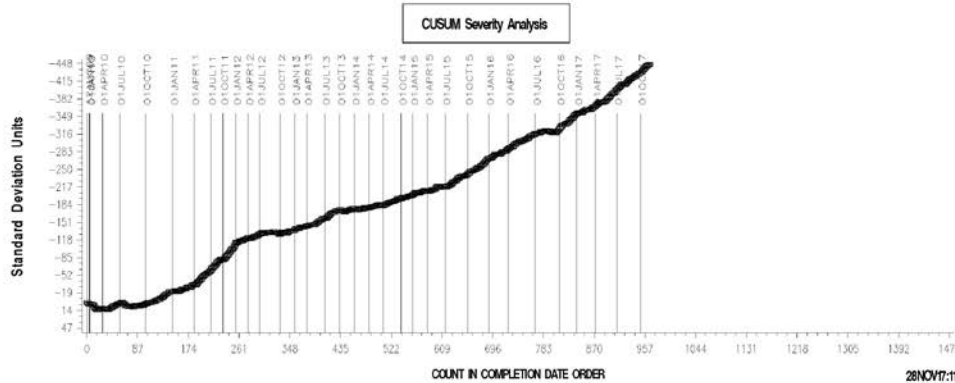
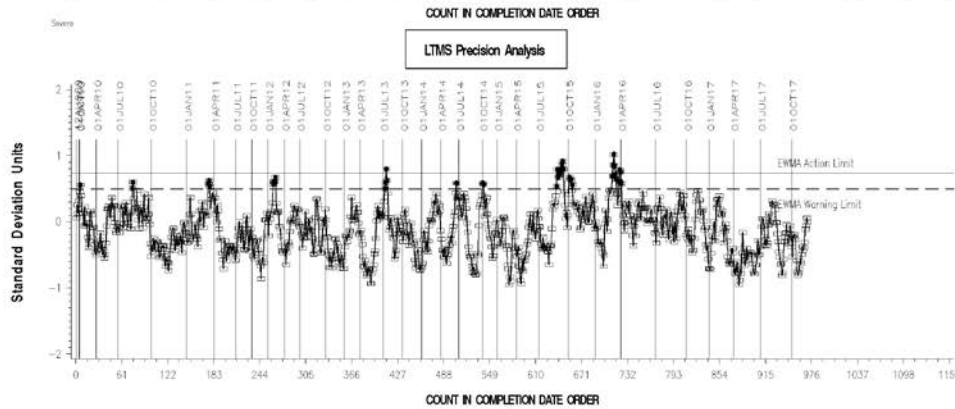
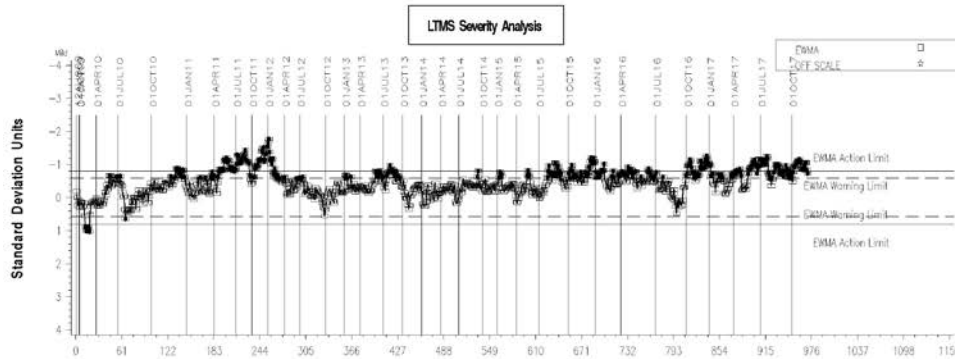
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LDEOC (D 7216)

LDEOC – NITRILE INDUSTRY OPERATIONALLY VALID DATA

REF NITRILE TENSILE STRENGTH CHANGE AVERAGE



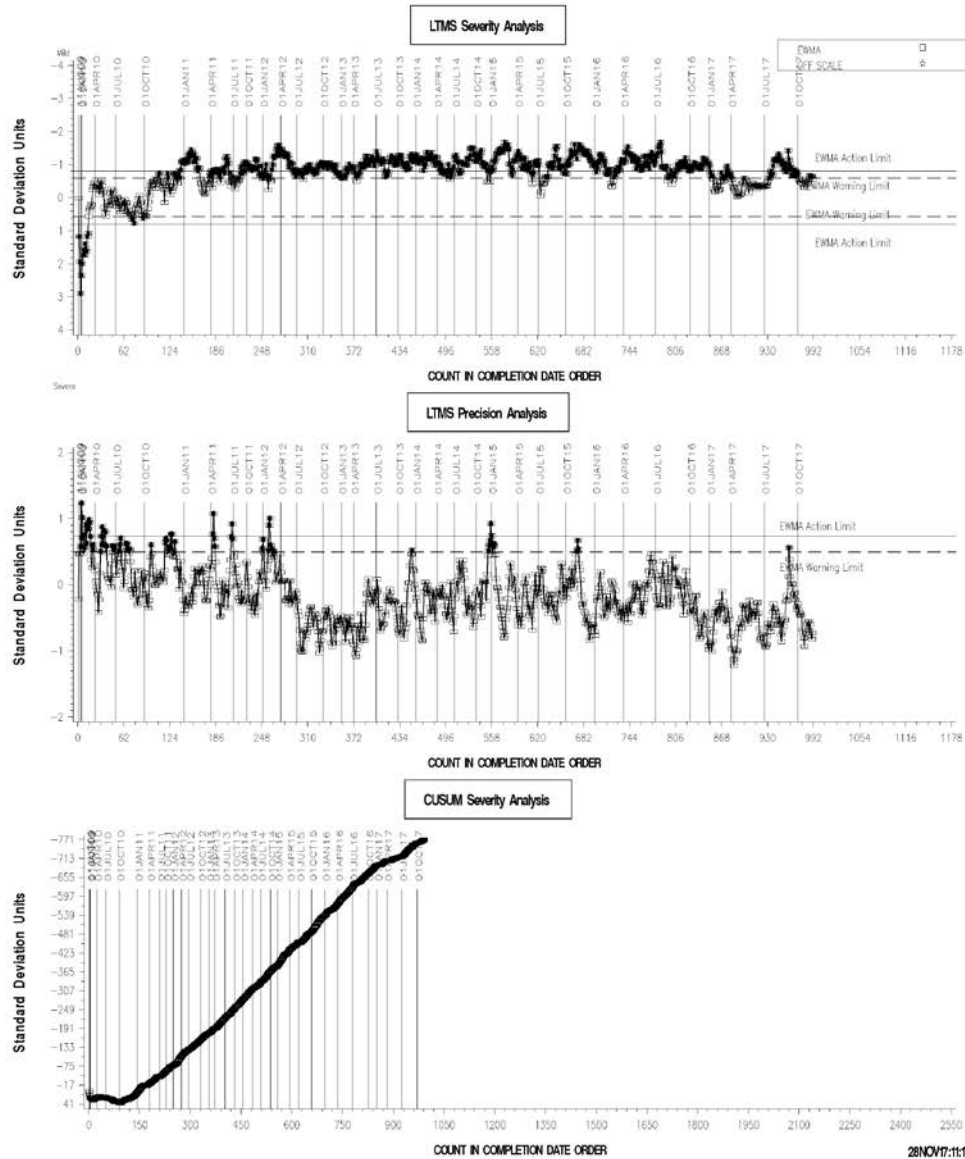
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LDEOC (D 7216)

LDEOC – POLYACRYLATE INDUSTRY OPERATIONALLY VALID DATA

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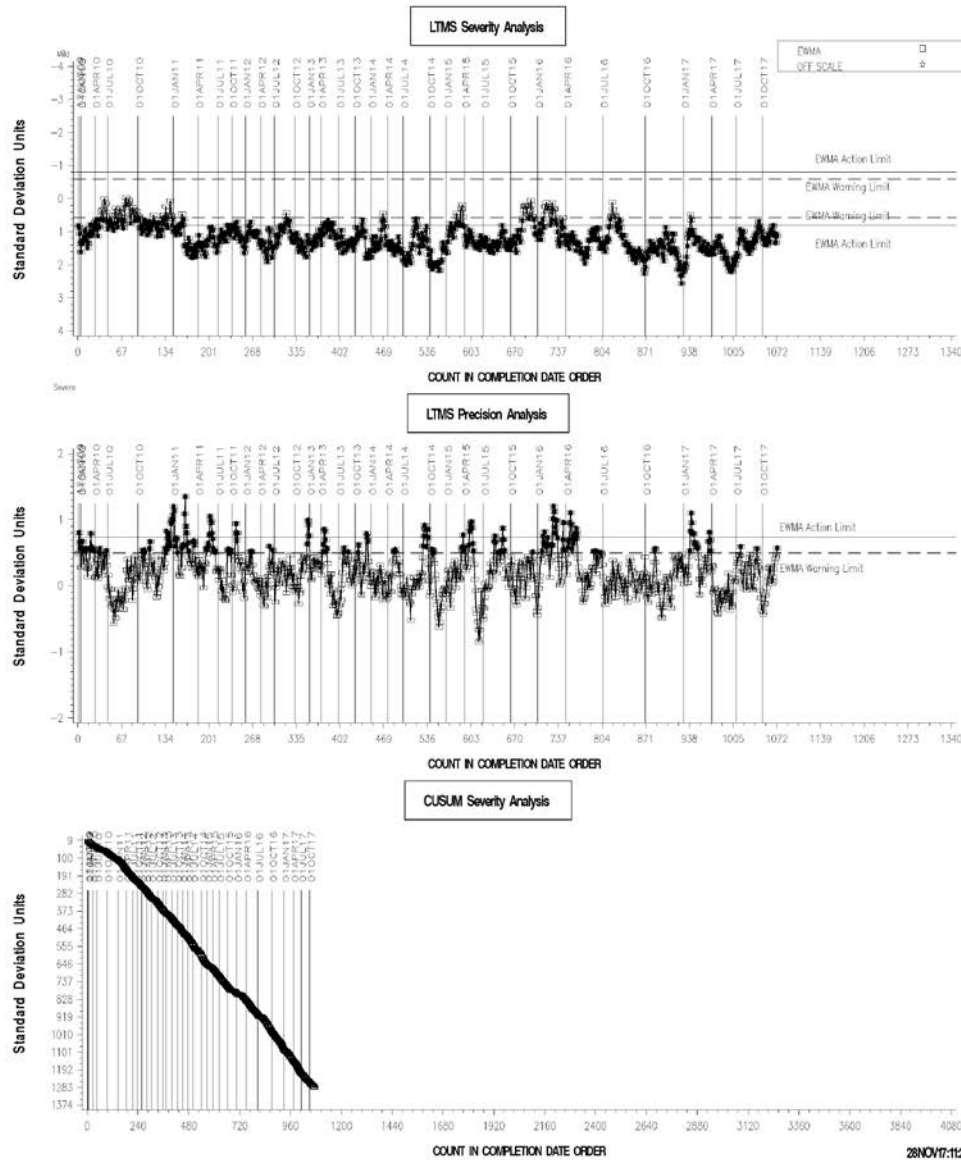


LDEOC (D 7216)

LDEOC – SILICONE INDUSTRY OPERATIONALLY VALID DATA



REF SILICON TENSILE STRENGTH CHANGE AVERAGE



LDEOC (D 7216)

INFORMATION LETTERS

EOEC Information Letter 17-1, Sequence No. 6, dated April 12, 2017.

- New Reference Oil
- Light Duty Polyacrylate Elastomer Correction Factor for Volume Change

EOEC Information Letter 17-2, Sequence No. 7, dated April 27, 2017.

- Light Duty Polyacrylate Elastomer Correction Factor for Volume Change

EOEC Information Letter 17-3, Sequence No. 8, dated August 7, 2017.

- Light Duty Polyacrylate Elastomer Correction Factor for Volume Change

EOEC Information Letter 17-4, Sequence No. 9, dated September 24, 2017.

- Light Duty Polyacrylate Elastomer Correction Factor for Volume Change

LDEOC (D 7216)

STATUS OF REFERENCE OIL SUPPLY

| Oil | Samples @ Labs | @ TMC | |
|--------|-------------------|---------------------|---------|
| | | Samples (750 mL) | Gallons |
| 1006-1 | 53 | 0 | 0 |
| 1006-2 | 294 | 7,933 | 1572 |
| Total | 347 | 7,933 | 1572 |

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.