



Test Monitoring Center

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

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

MEMORANDUM: 18-020

DATE: June 14, 2018

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

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

SUBJECT: LDEOC Testing from October 1, 2017 through March 31, 2018

A total of 361 LDEOC tests were reported from 8 labs to the Test Monitoring Center during the period from October 1, 2017 through March 31, 2018.

Please find attached a summary of testing activity this period.

MTK/mtk/mem18-020.mtk.doc

cc: Frank Farber

Jeff Clark

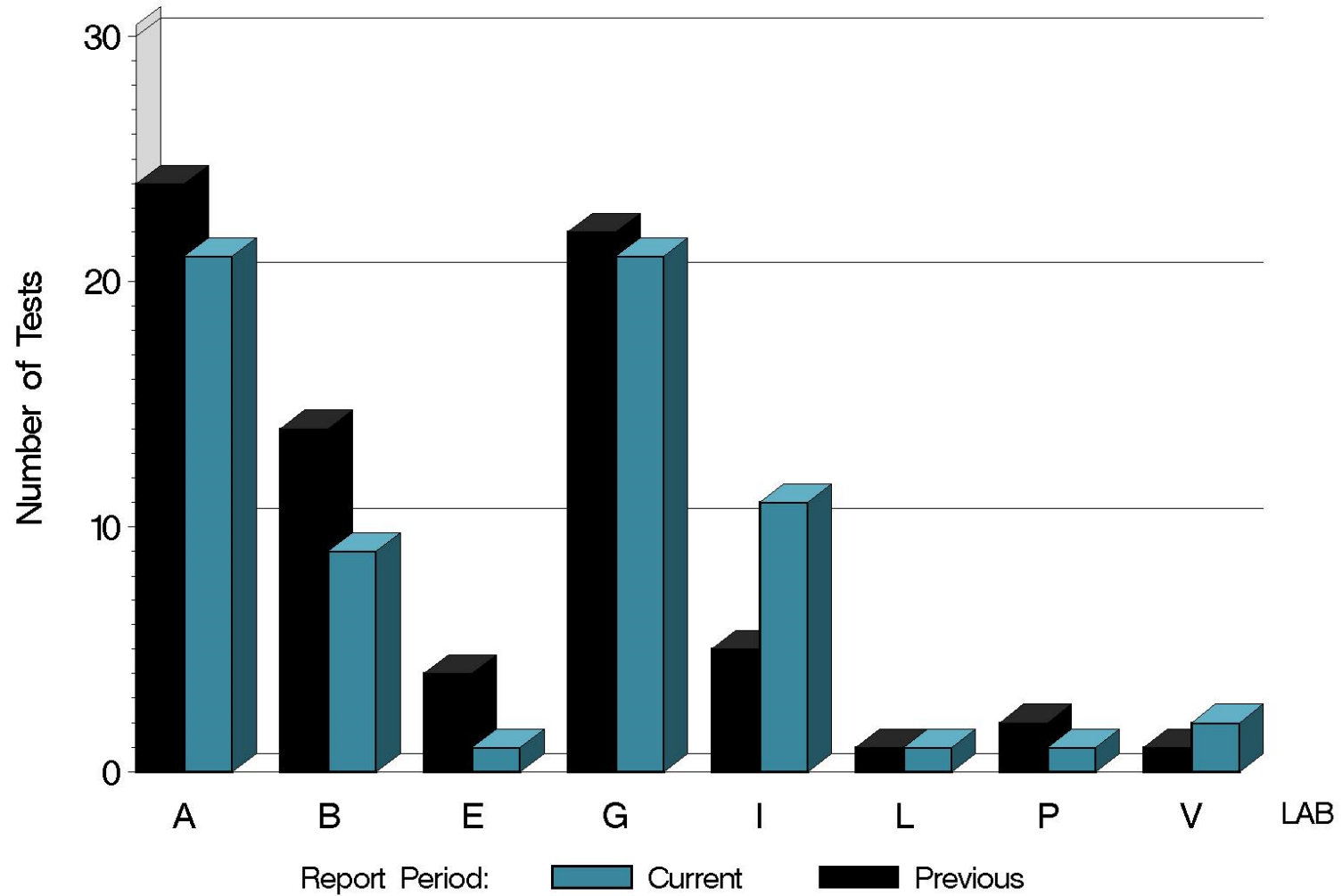
EOEC Surveillance Panel

<http://www.astmtmc.cmu.edu/docs/bench/ldeoc/semiannualreports/ldeoc-04-2018.pdf>

Distribution: email

LDEOC (D 7216)

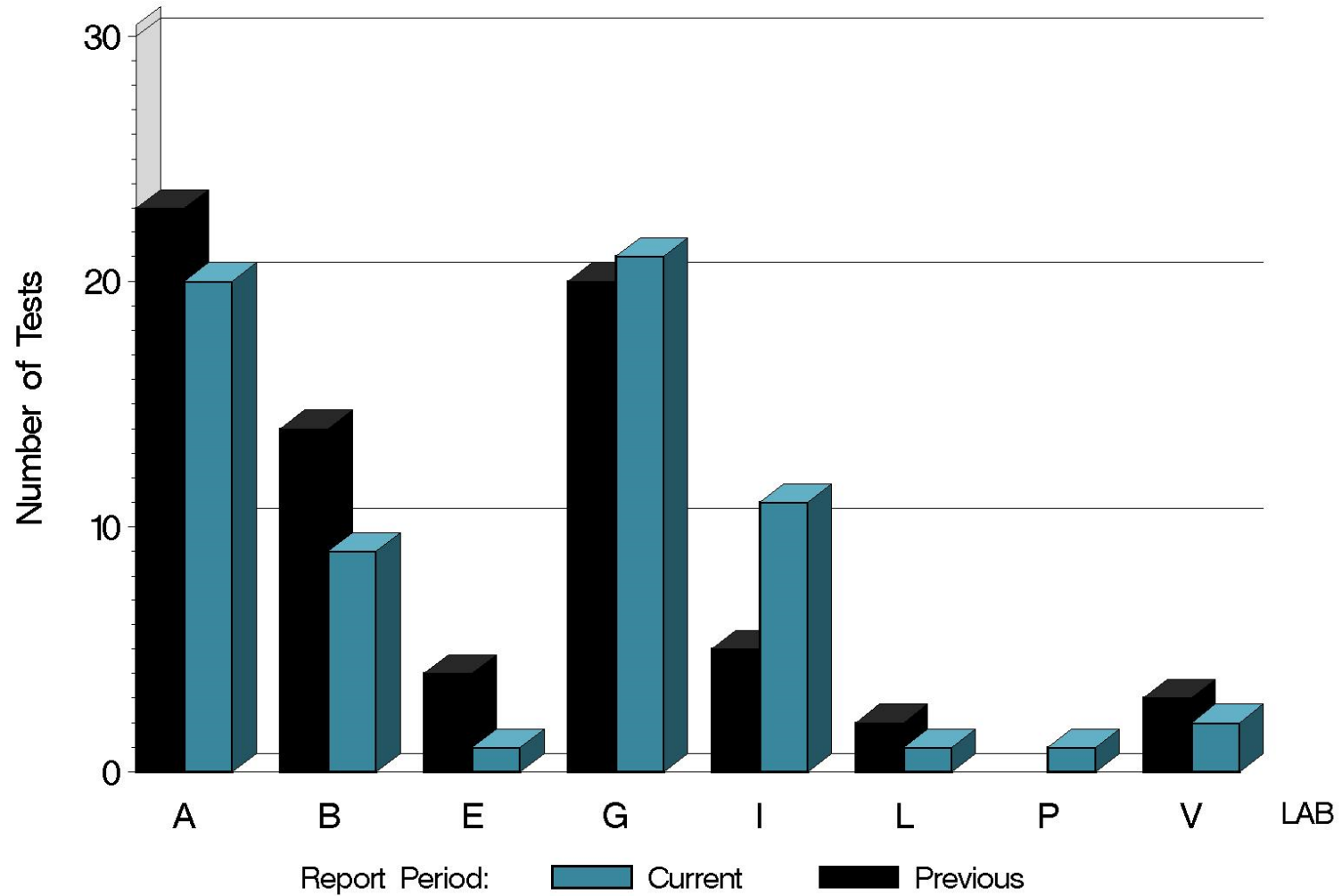
NUMBER OF ETHYLENE ACRYLATE TESTS
REPORTED BY LAB AND REPORT PERIOD



7:51:12 14JUN2016

LDEOC (D 7216)

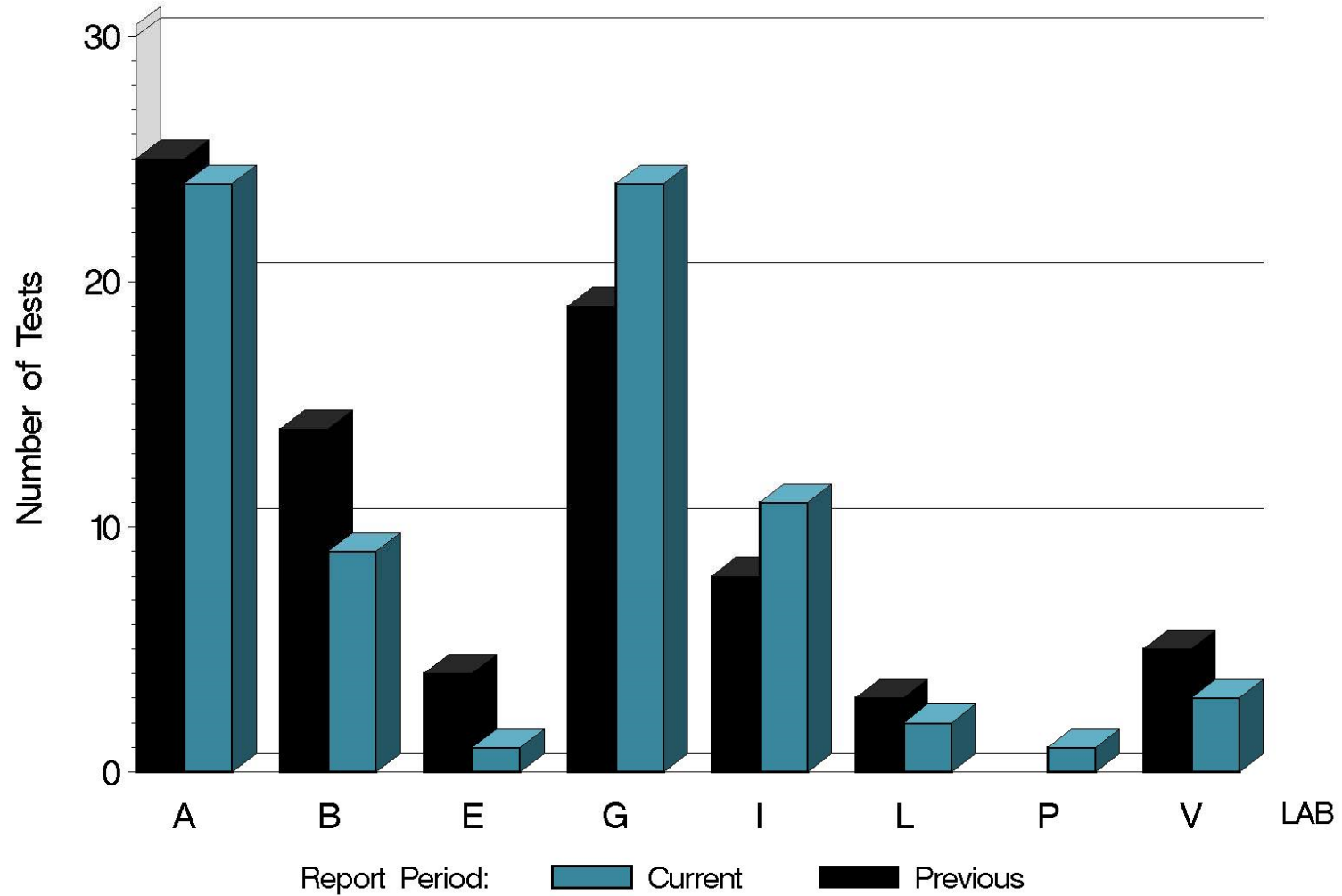
NUMBER OF FLUOROELASTOMER TESTS
REPORTED BY LAB AND REPORT PERIOD



7:51:12 14JUN2018

LDEOC (D 7216)

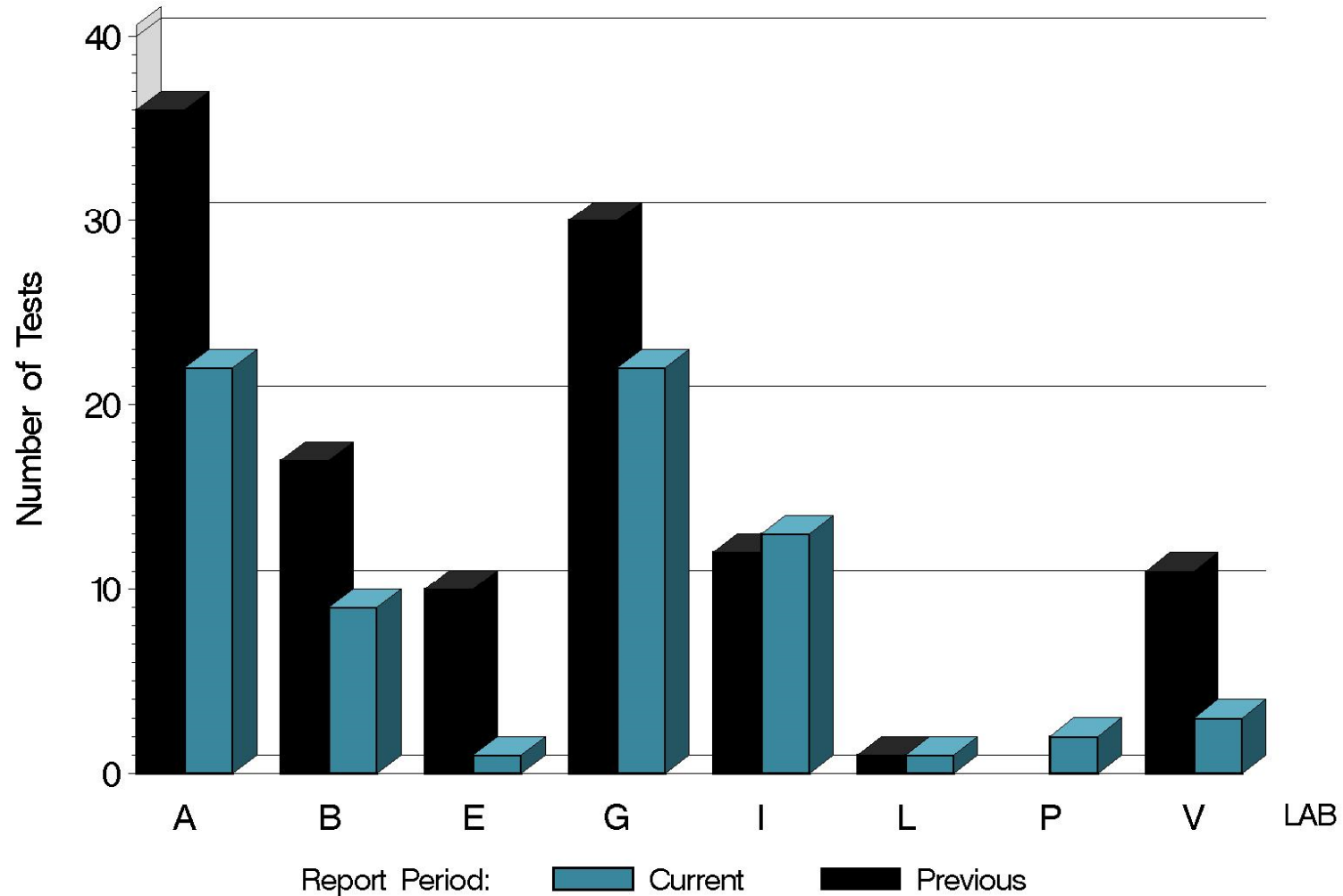
NUMBER OF NITRILE TESTS REPORTED BY LAB AND REPORT PERIOD



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LDEOC (D 7216)

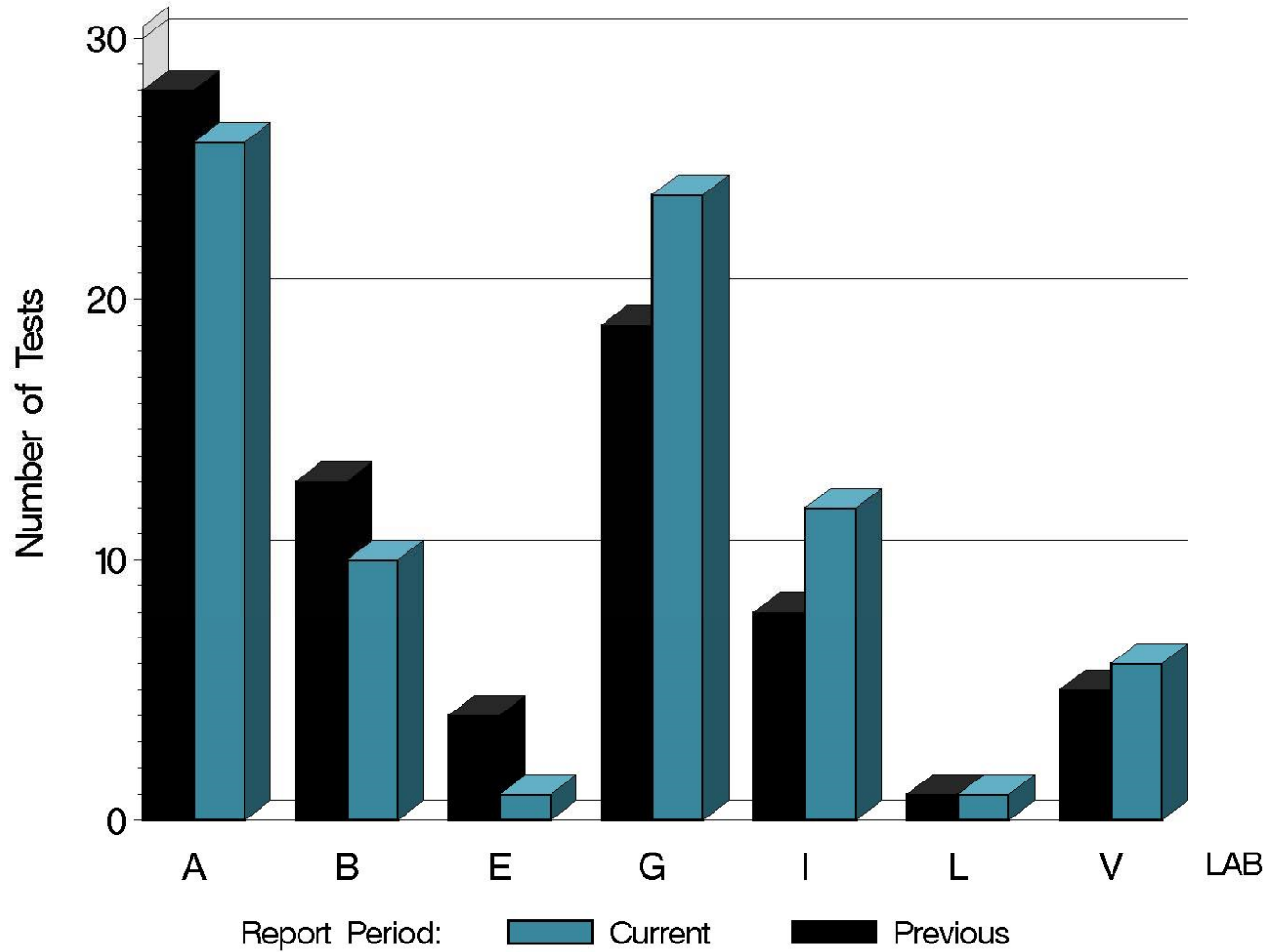
NUMBER OF POLYACRYLATE TESTS REPORTED BY LAB AND REPORT PERIOD



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LDEOC (D 7216)

NUMBER OF SILICONE TESTS
REPORTED BY LAB AND REPORT PERIOD



7:51:12 14JUN2016

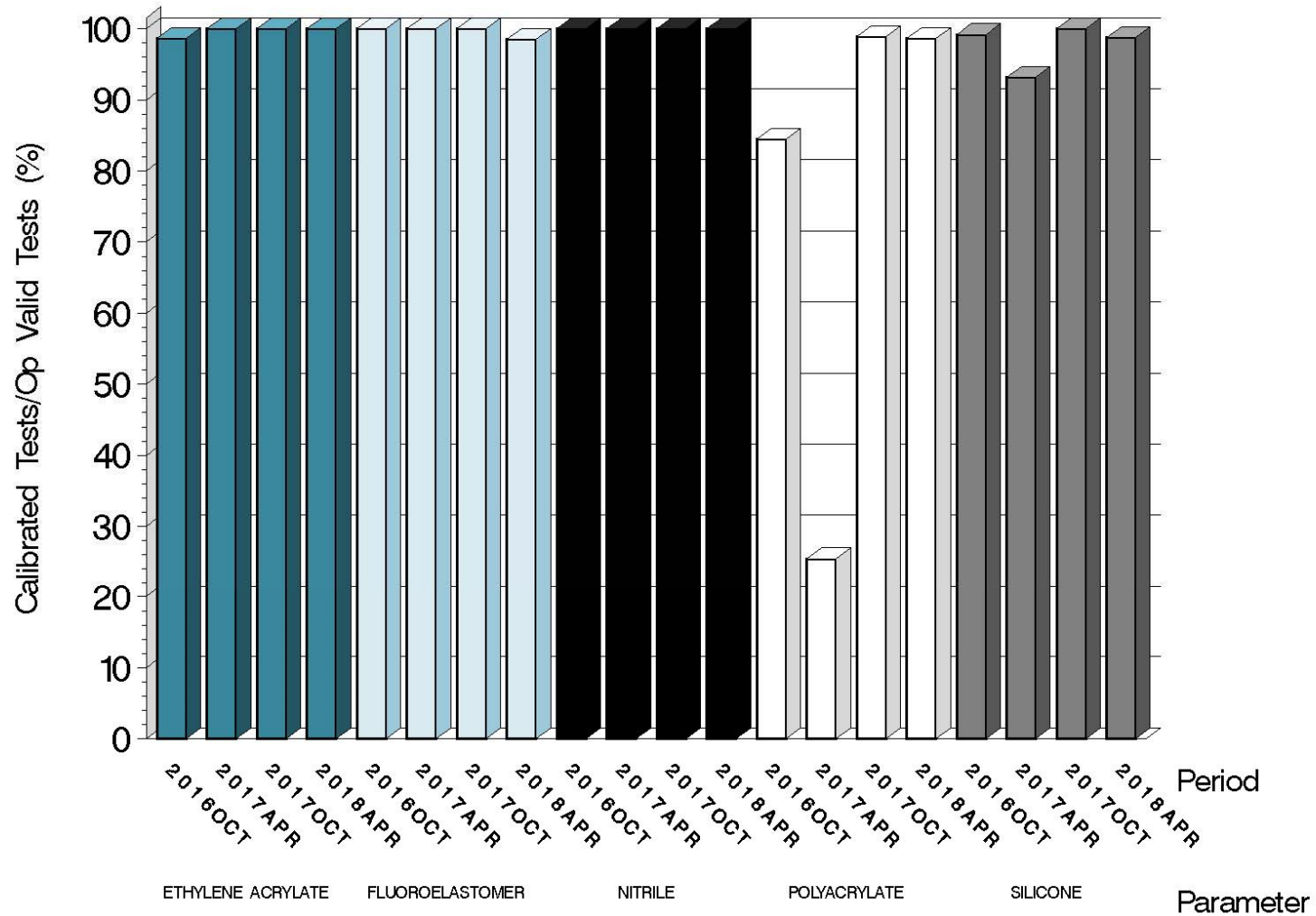
LDEOC (D 7216)

Test Distribution by Oil and Validity

| | | Ethylene Acrylate | Fluoroelastomer | Nitrile | Polyacrylate | Silicone | This Period | Last Period |
|-------------------------------|----|-------------------|-----------------|-----------|--------------|-----------|-------------|-------------|
| Accepted for Calibration | AC | 67 | 65 | 75 | 72 | 79 | 358 | 388 |
| Rejected | OC | 0 | 1 | 0 | 1 | 1 | 3 | 1 |
| Acceptable Information Run | NI | 0 | 0 | 0 | 0 | 0 | 0 | 26 |
| 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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Acceptable Shakedown Run | AS | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Aborted Calibration | XC | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| Total | | 67 | 66 | 75 | 73 | 80 | 361 | 417 |

LDEOC (D 7216)

OPERATIONALLY VALID TESTS MEETING ACCEPTANCE CRITERIA



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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 | 21 | 0 | 0 | 20 | 0 | 0 | 24 | 0 | 0 | 22 | 0 | 0 | 26 | 0 | 0 | 113 | 0 |
| B | 0 | 9 | 0 | 0 | 9 | 0 | 0 | 9 | 0 | 0 | 9 | 0 | 0 | 10 | 0 | 0 | 46 | 0 |
| E | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 5 | 0 |
| G | 0 | 21 | 0 | 0 | 21 | 0 | 0 | 24 | 0 | 0 | 22 | 0 | 0 | 24 | 0 | 0 | 112 | 0 |
| I | 0 | 11 | 0 | 0 | 11 | 0 | 0 | 11 | 0 | 0 | 13 | 0 | 0 | 12 | 0 | 0 | 58 | 0 |
| L | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 6 | 0 |
| P | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 5 | 0 |
| V | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 6 | 0 | 0 | 16 | 0 |
| Total | 0 | 67 | 0 | 0 | 66 | 0 | 0 | 75 | 0 | 0 | 73 | 0 | 0 | 80 | 0 | 0 | 361 | 0 |

LDEOC (D 7216)

CAUSES FOR LOST TESTS

| Lab | Cause | Elastomer | | | | | Validity | | | Loss Rate | | |
|-----|---------------|-------------------|-----------------|---------|--------------|----------|----------|-----|-----|-----------|--------|---|
| | | Ethylene Acrylate | Fluoroelastomer | Nitrile | Polyacrylate | Silicone | LC | RC | XC | Lost | Starts | % |
| | | | | | | | | | | | | |
| - | No Lost Tests | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 361 | 0 |
| | Lost | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | |
| | Starts | 67 | 66 | 75 | 73 | 80 | 361 | 361 | 361 | | | |
| | % | 0 | 0 | 0 | 0 | 0 | 0 | 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 | 21 | -0.354 | -0.398 | 0.821 |
| | B | 9 | -0.126 | 0.195 | 0.678 |
| | E | 1 | -1.052 | -1.758 | -1.897 |
| | G | 21 | 0.641 | -0.555 | 0.188 |
| | I | 11 | -0.235 | 0.240 | -0.376 |
| | L | 1 | -2.234 | 1.538 | 1.083 |
| | P | 1 | 1.026 | -1.758 | -1.757 |
| | V | 2 | -0.422 | -2.308 | 0.065 |
| | Industry | 67 | -0.012 | -0.331 | 0.309 |
| Fluoroelastomer | A | 20 | -0.790 | 0.475 | 0.546 |
| | B | 9 | -0.556 | -0.135 | 0.571 |
| | E | 1 | 0.067 | -1.455 | 1.053 |
| | G | 21 | -0.651 | -0.324 | 1.136 |
| | I | 11 | -0.242 | -1.095 | 1.805 |
| | L | 1 | -0.467 | 1.515 | 0.293 |
| | P | 1 | -1.667 | -0.465 | -0.005 |
| | V | 2 | -0.433 | 1.515 | -1.606 |
| | Industry | 66 | -0.607 | -0.120 | 0.878 |
| Nitrile | A | 24 | 0.998 | 0.220 | -0.314 |
| | B | 9 | 1.304 | 0.300 | -0.378 |
| | E | 1 | 1.950 | -2.126 | -1.351 |
| | G | 24 | 0.873 | 0.125 | -0.927 |
| | I | 11 | 0.488 | -0.350 | -0.519 |
| | L | 2 | 1.683 | 0.747 | -1.128 |
| | P | 1 | 1.933 | -0.977 | -1.051 |
| | V | 3 | 1.472 | -1.743 | -0.470 |
| | Industry | 75 | 0.982 | 0.004 | -0.600 |

LDEOC (D 7216)

| Average Δ /s by Lab | | | | | |
|----------------------------|----------|----|--------|--------|--------|
| Elastomer | Lab | n | VOLCYI | HARDYI | TENSYI |
| Polyacrylate | A | 22 | -0.494 | -0.560 | -0.429 |
| | B | 9 | 0.532 | -1.343 | -0.140 |
| | E | 1 | -0.348 | -1.416 | -0.846 |
| | G | 22 | -0.175 | 0.444 | -0.567 |
| | I | 13 | -0.198 | -0.317 | -0.997 |
| | L | 1 | -0.121 | -0.766 | -0.552 |
| | P | 2 | 3.000 | -0.766 | -0.668 |
| | V | 3 | -0.980 | -1.416 | -0.295 |
| | Industry | 73 | -0.136 | -0.366 | -0.544 |
| | Silicone | A | 26 | -0.083 | -1.026 |
| B | | 10 | -0.142 | -0.804 | 0.894 |
| E | | 1 | 0.337 | 0.765 | -3.182 |
| G | | 24 | 1.326 | -0.604 | 0.984 |
| I | | 12 | -1.664 | -0.257 | 0.605 |
| L | | 1 | -1.135 | 1.255 | 2.625 |
| P | | - | - | - | - |
| V | | 6 | 0.390 | -1.441 | 1.458 |
| Industry | | 80 | 0.123 | -0.737 | 1.197 |

LDEOC (D 7216)

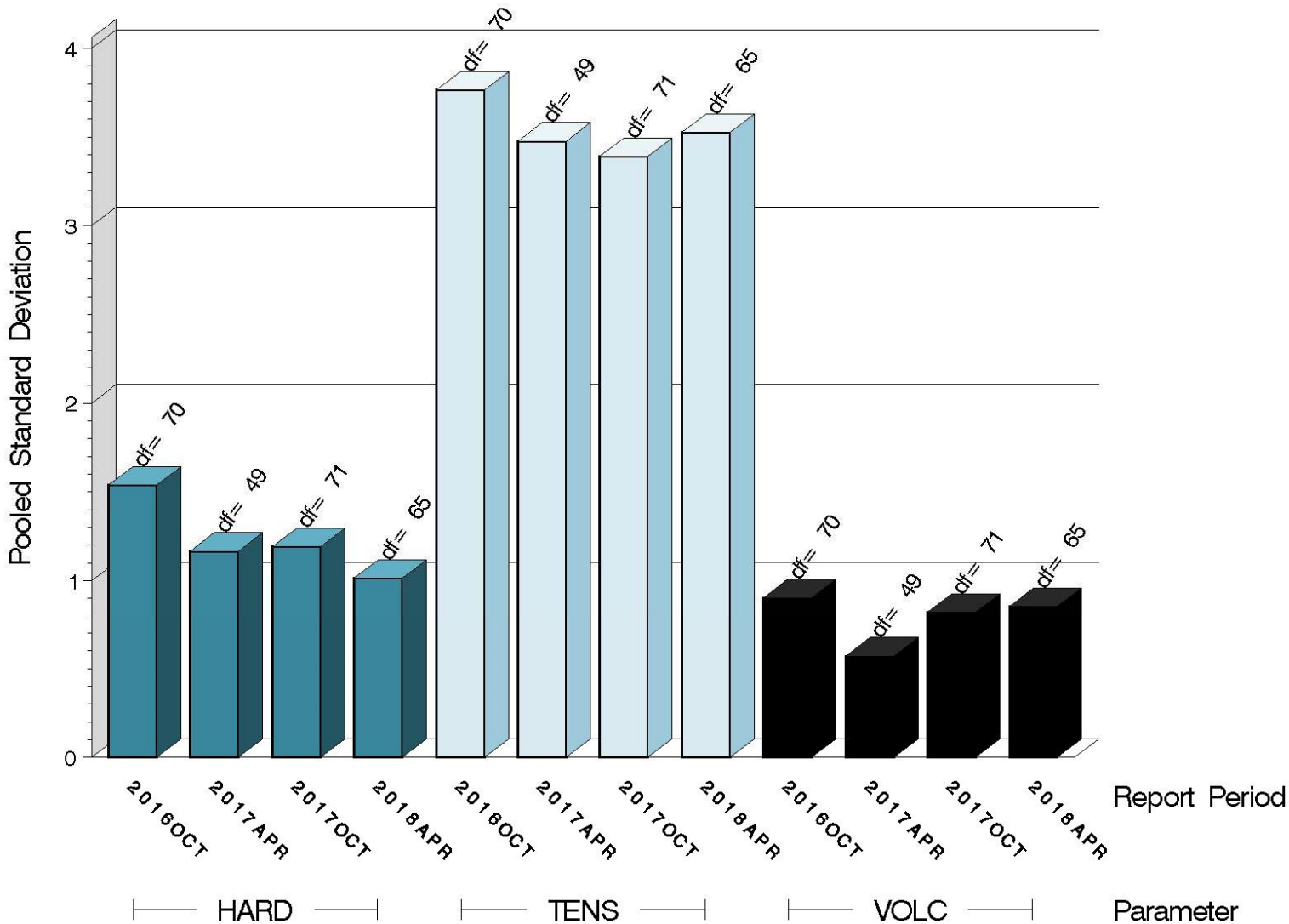
Individual test results can be viewed at the links shown in the following table:

| <i>Links to Individual Test Result Data</i> | |
|---|---|
| Elastomer Type | Web Link to Data |
| Ethylene Acrylate | http://www.astmtmc.cmu.edu/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)

ETHYLENE ACRYLATE TEST PRECISION

POOLED STANDARD DEVIATION BY SIX-MONTH ASTM REPORT PERIOD

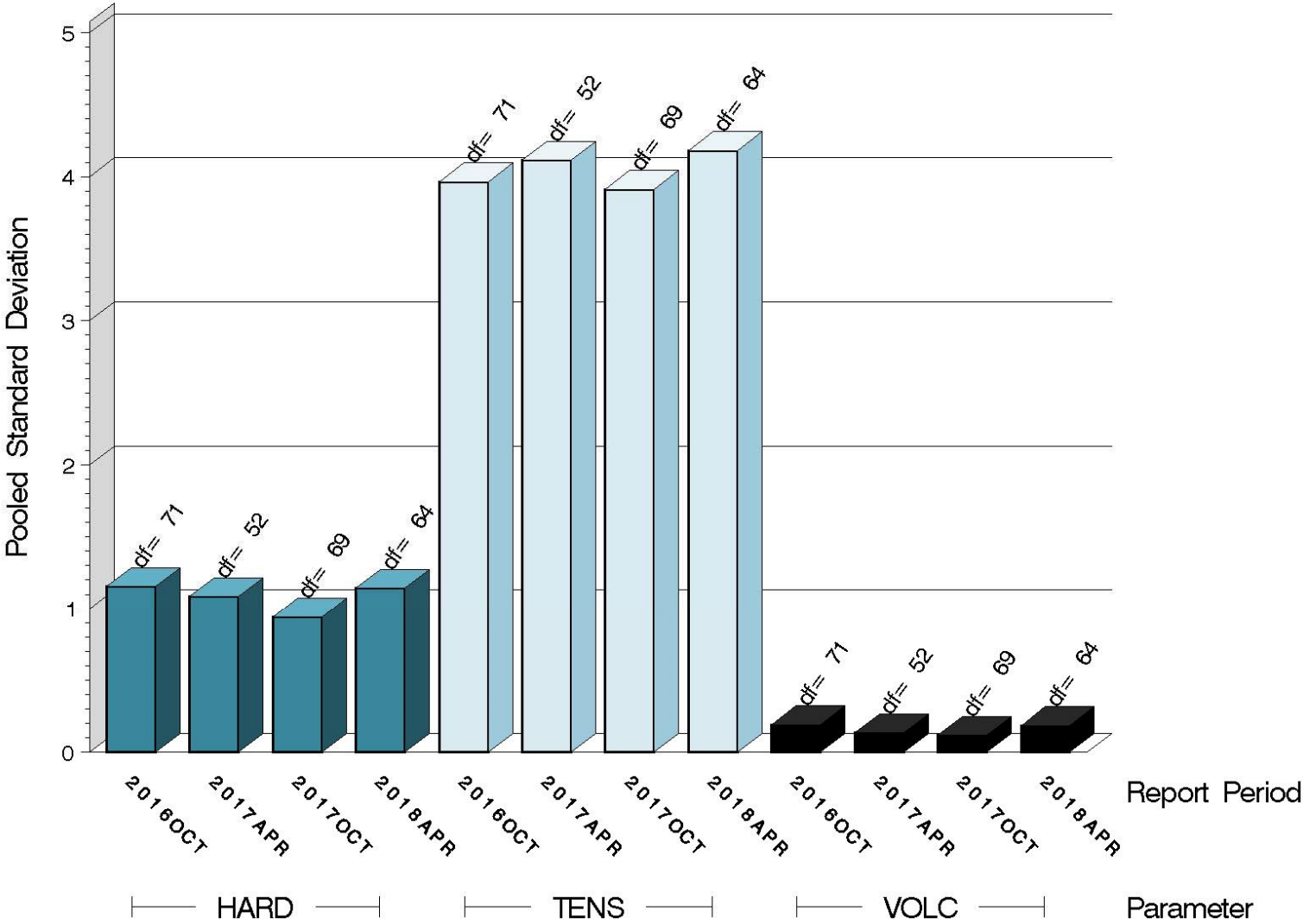


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LDEOC (D 7216)

FLUOROELASTOMER TEST PRECISION

POOLED STANDARD DEVIATION BY SIX-MONTH ASTM REPORT PERIOD

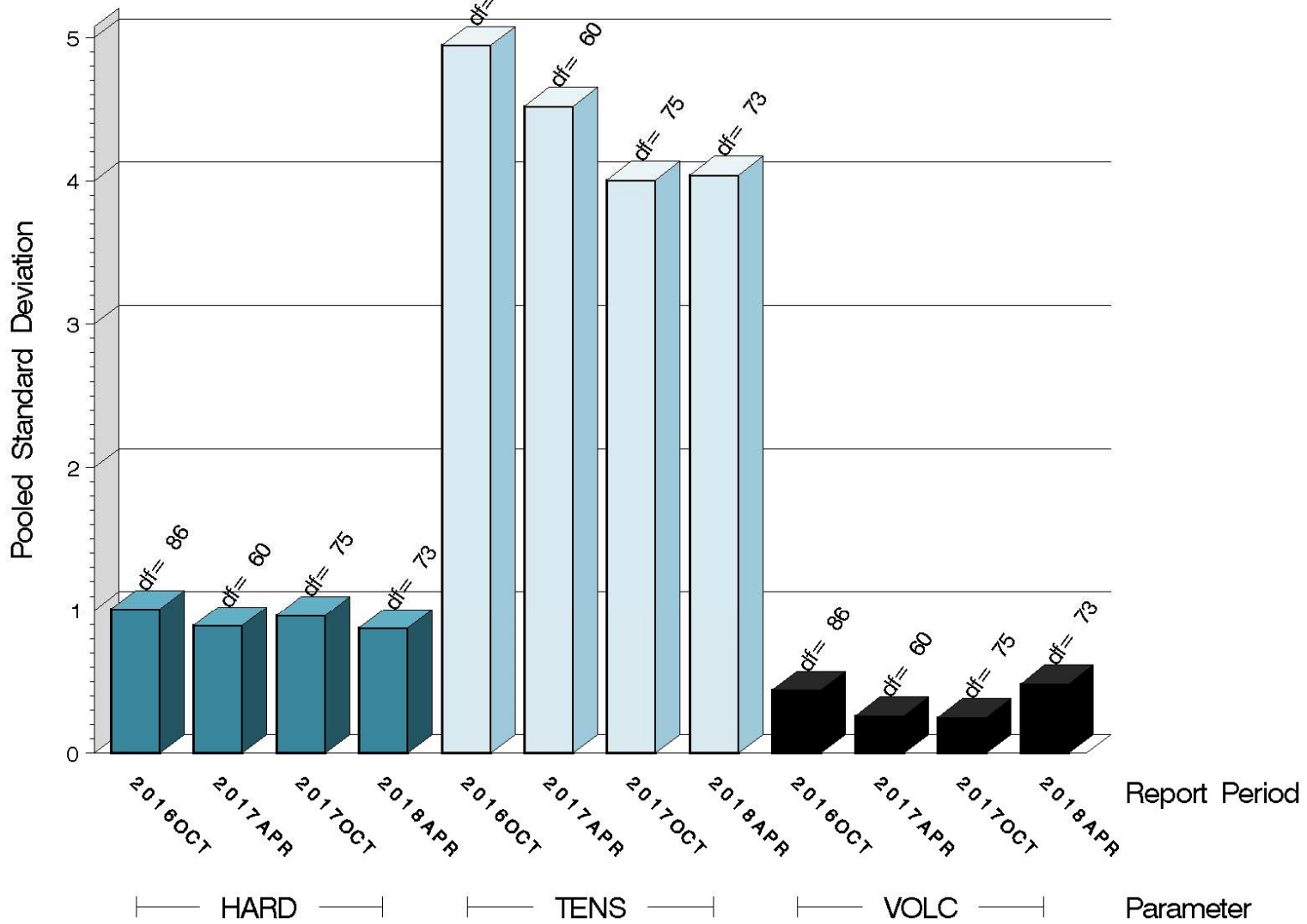


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LDEOC (D 7216)

NITRILE TEST PRECISION

POOLED STANDARD DEVIATION BY SIX-MONTH ASTM REPORT PERIOD

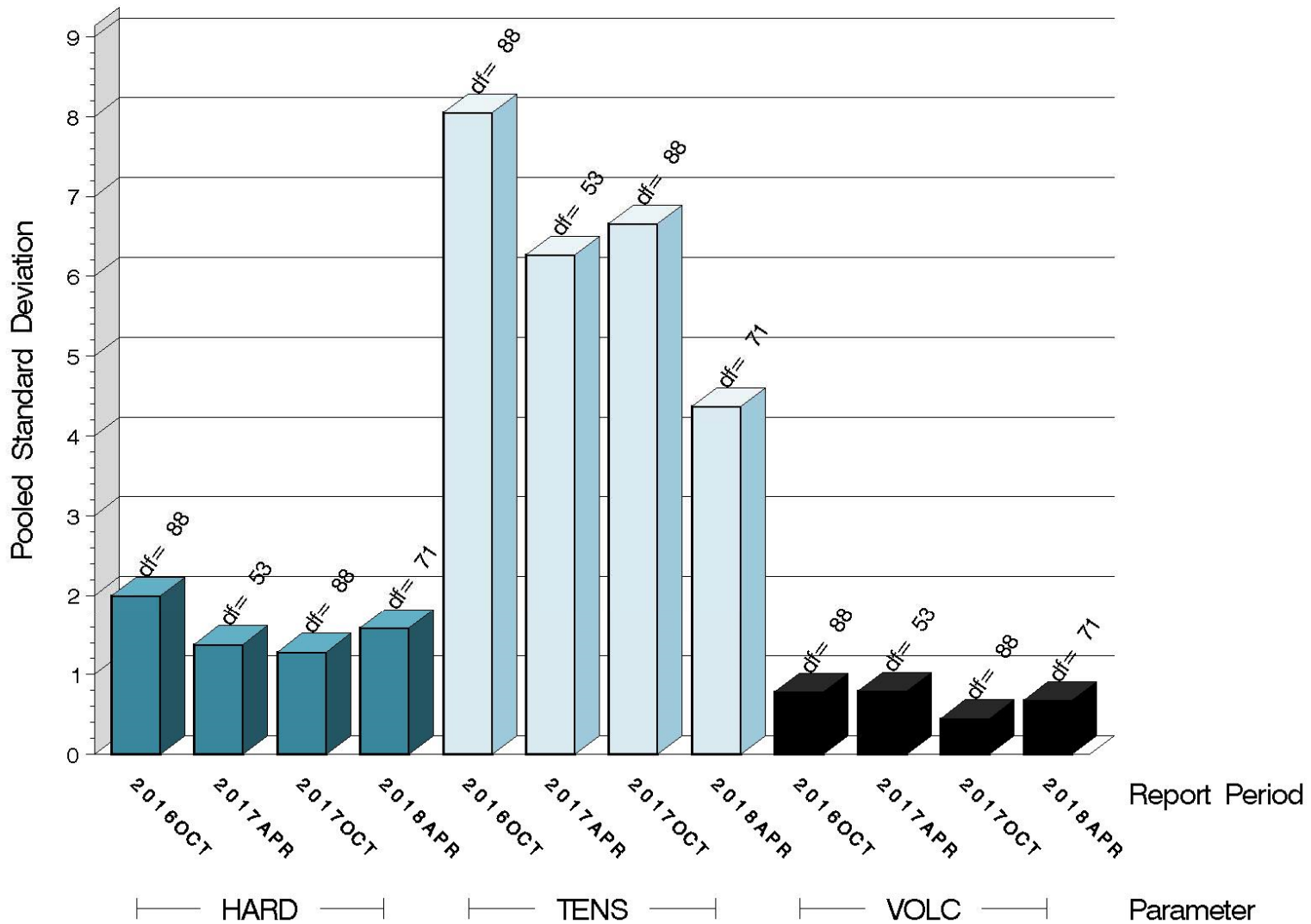


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LDEOC (D 7216)

POLYACRYLATE TEST PRECISION

POOLED STANDARD DEVIATION BY SIX-MONTH ASTM REPORT PERIOD

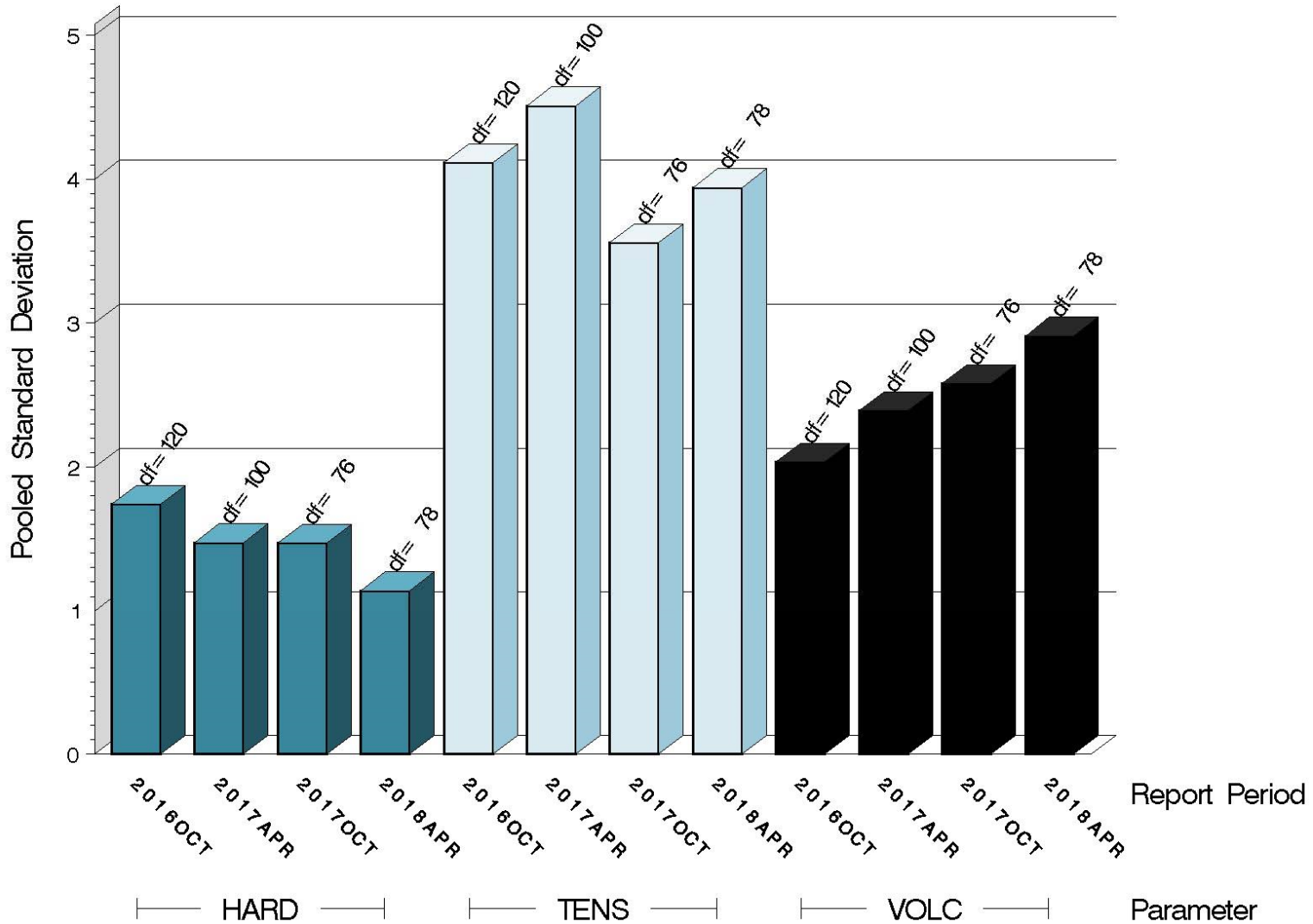


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LDEOC (D 7216)

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

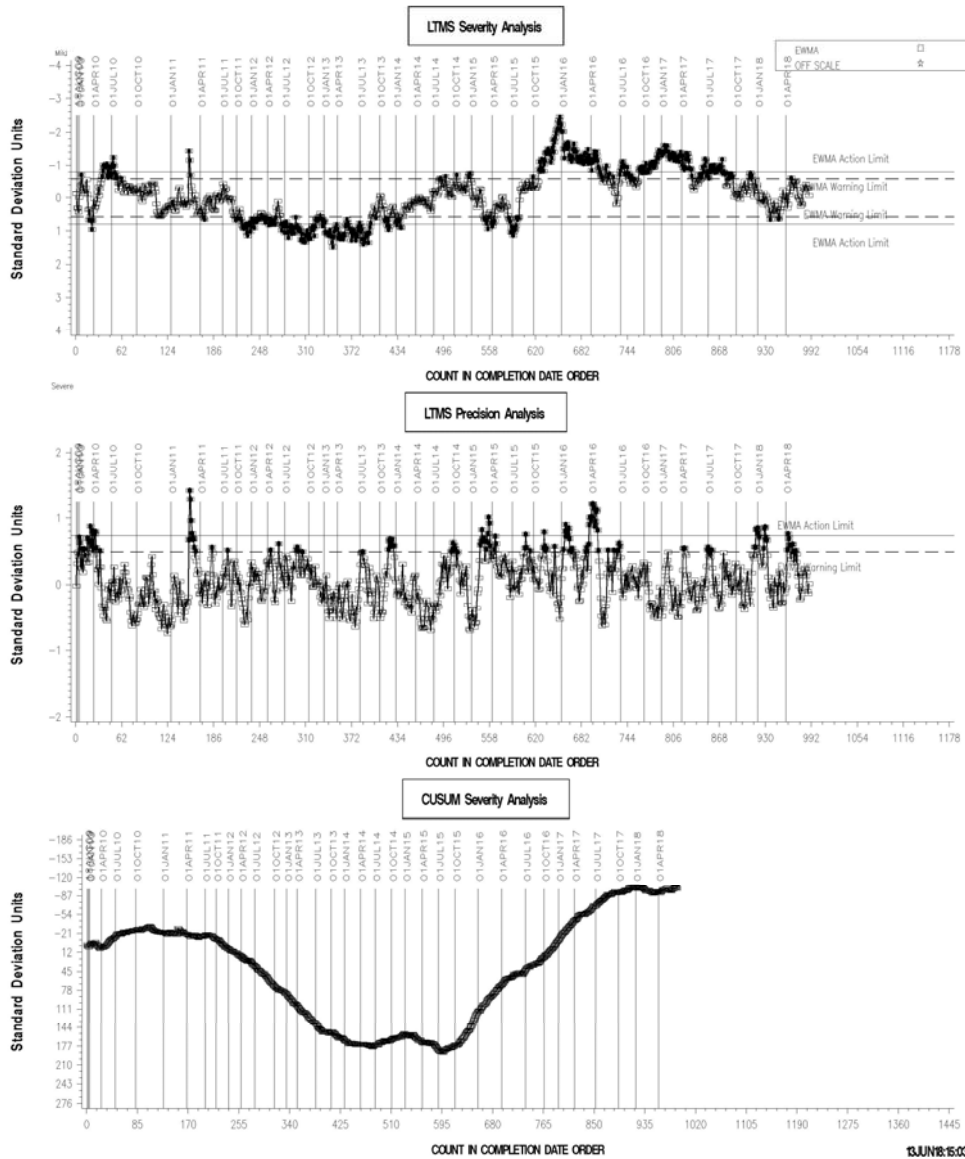
Industry control charts follow.

LDEOC (D 7216)

LDEOC – ETHYLENE ACRYLATE INDUSTRY OPERATIONALLY VALID DATA



REF ETH ACRYLATE VOLUME CHANGE AVERAGE

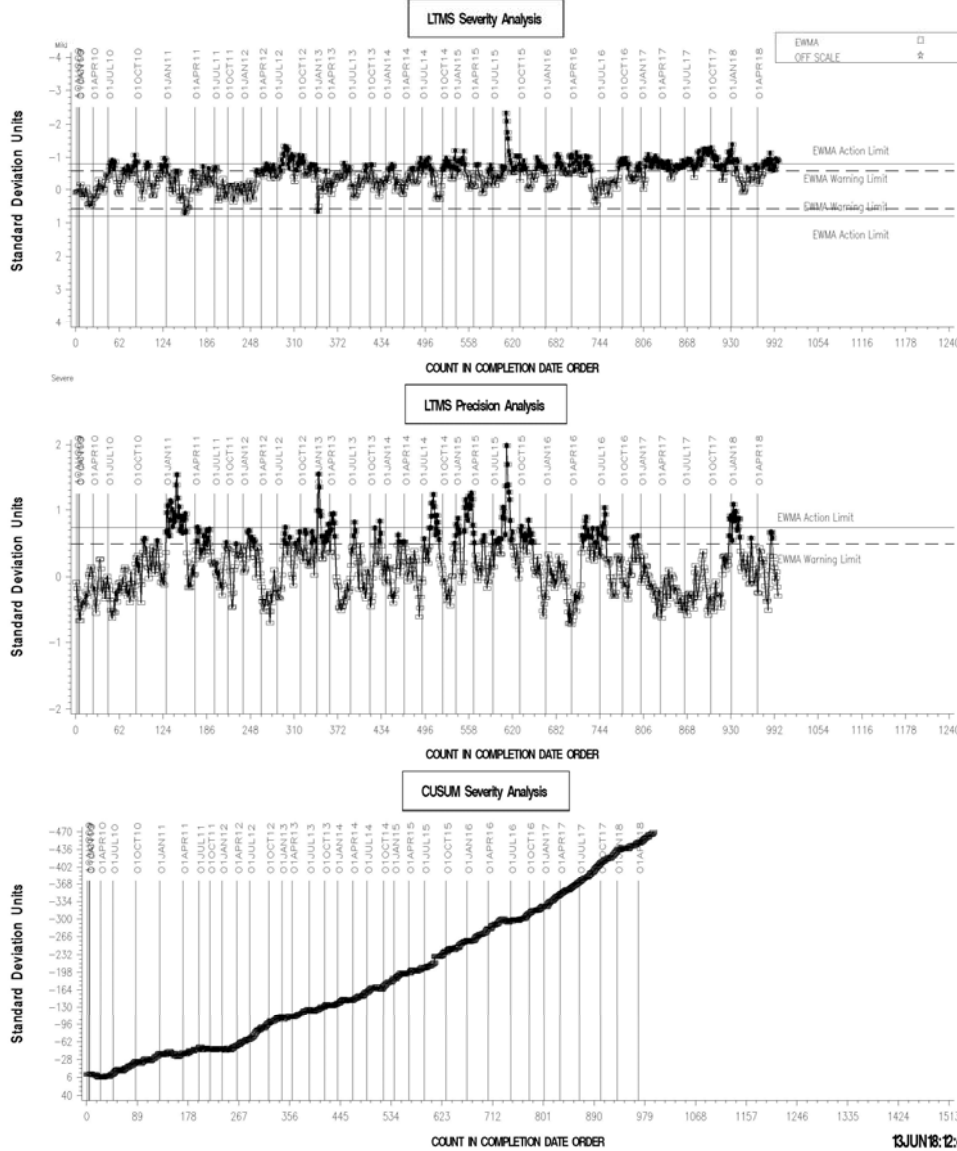


LDEOC (D 7216)

LDEOC – FLUOROELASTOMER INDUSTRY OPERATIONALLY VALID DATA



REF FLUROELASTOMER VOLUME CHANGE AVERAGE

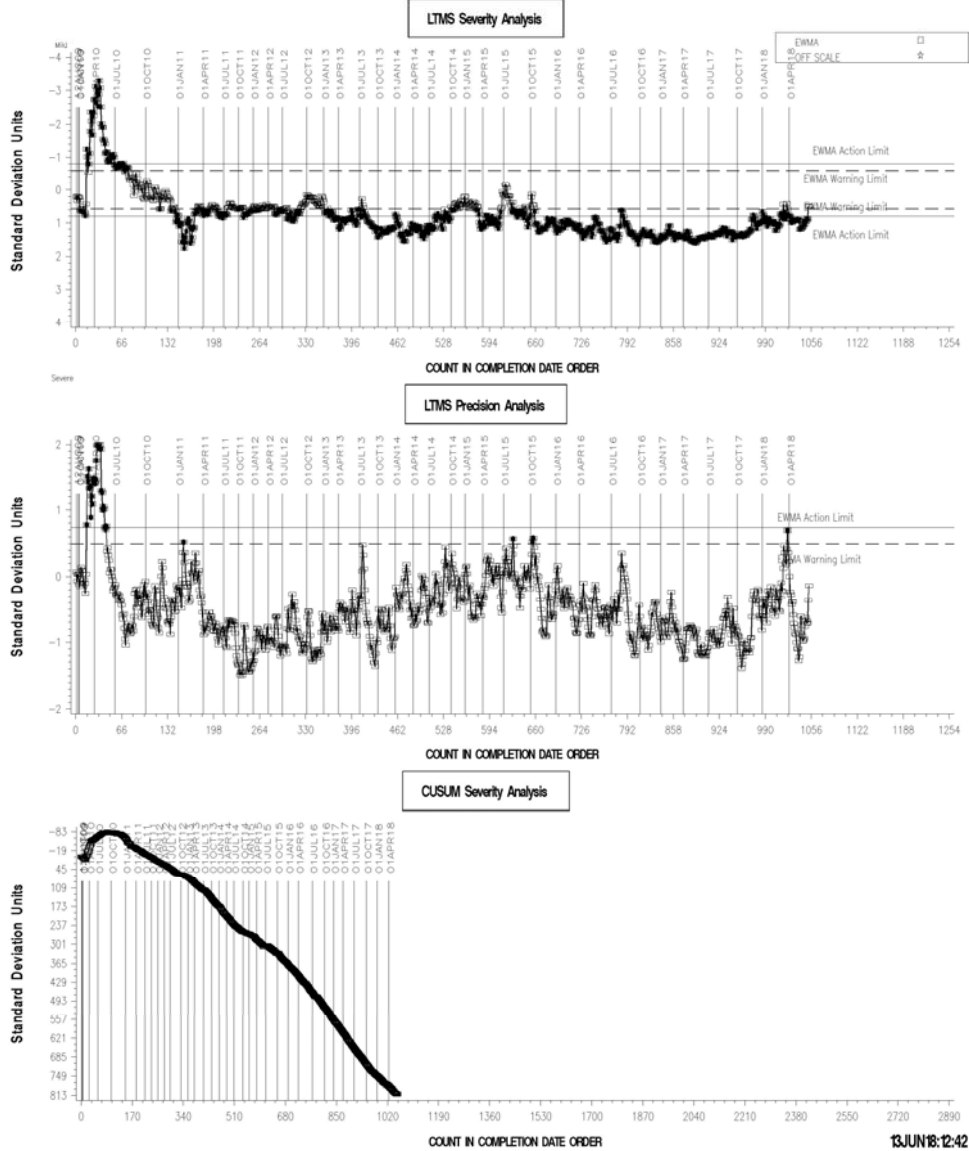


LDEOC (D 7216)

LDEOC – NITRILE INDUSTRY OPERATIONALLY VALID DATA



REFERENCE NITRILE VOLUME CHANGE AVERAGE

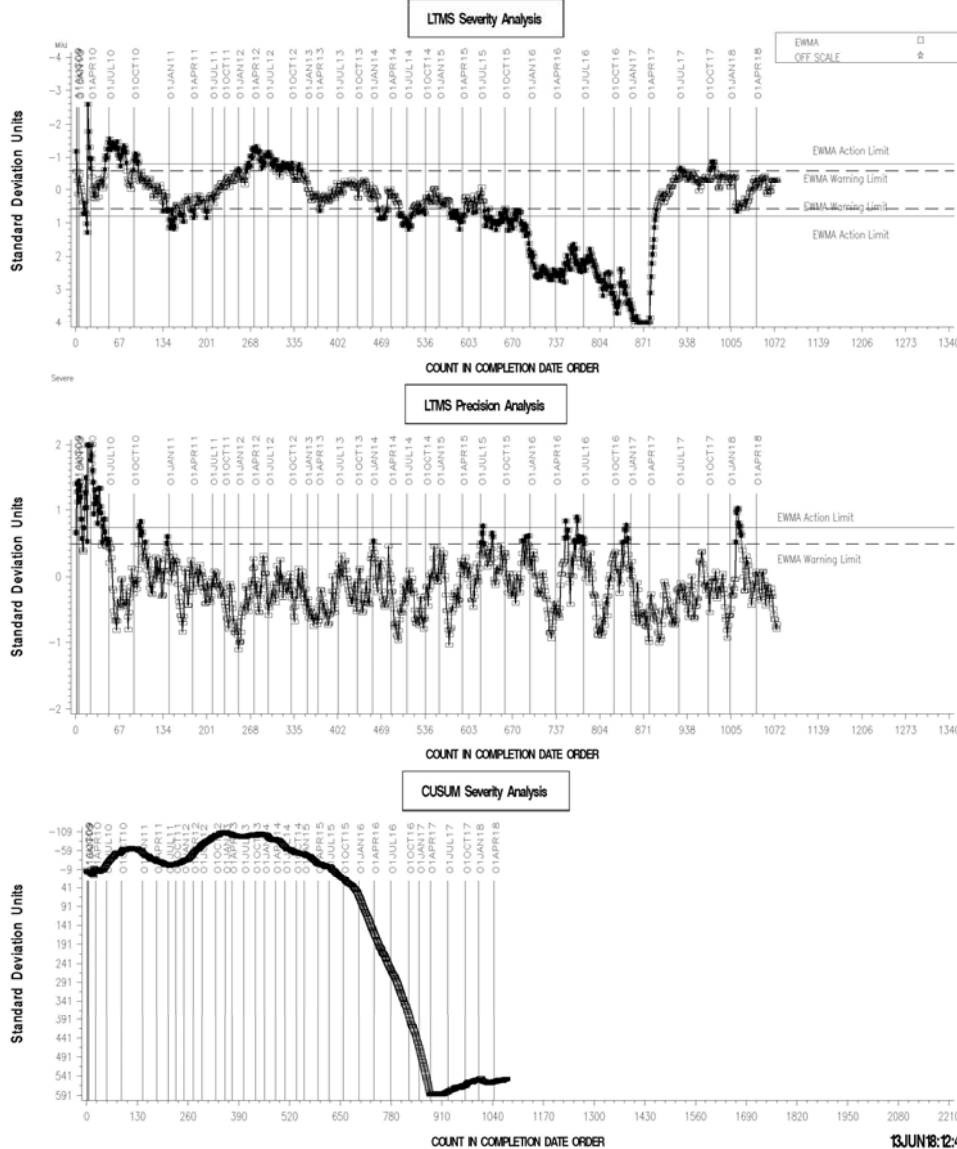


LDEOC (D 7216)

LDEOC – POLYACRYLATE INDUSTRY OPERATIONALLY VALID DATA



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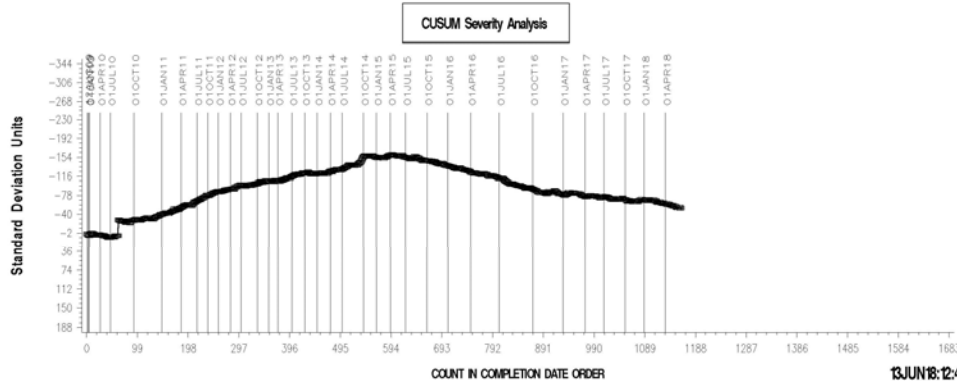
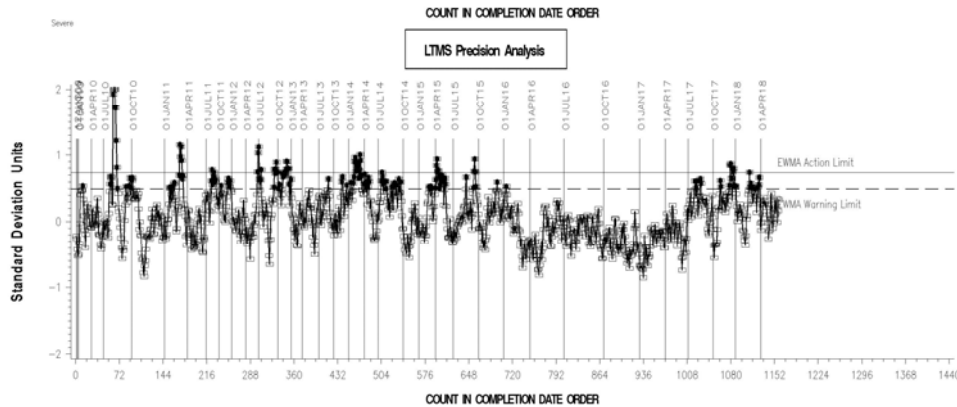
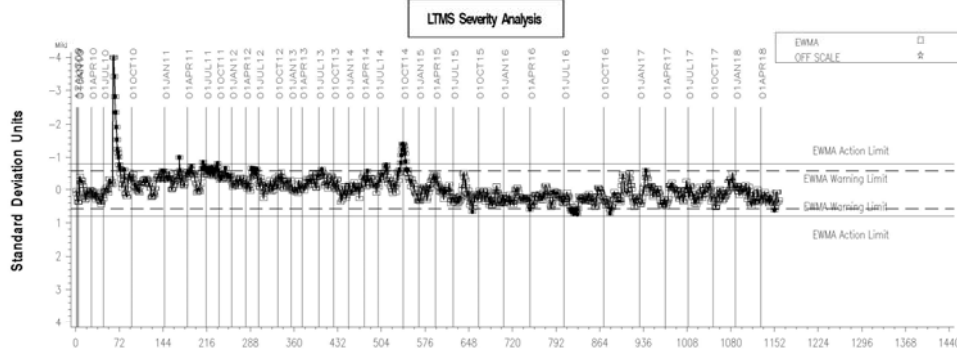


LDEOC (D 7216)

LDEOC – SILICONE INDUSTRY OPERATIONALLY VALID DATA



REFERENCE SILICON VOLUME CHANGE AVERAGE



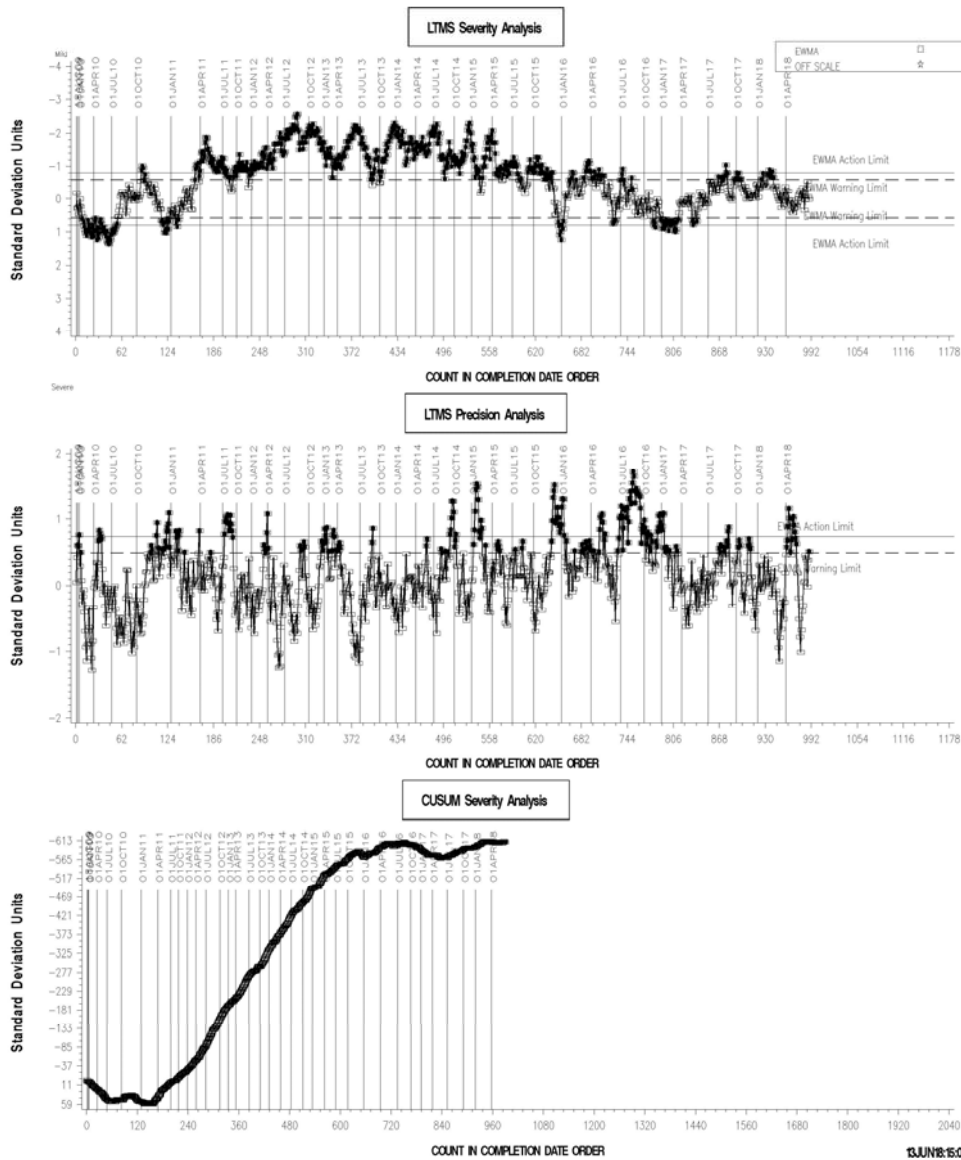
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LDEOC (D 7216)

LDEOC – ETHYLENE ACRYLATE INDUSTRY OPERATIONALLY VALID DATA



REF ETH ACRYLATE POINTS HARDNESS CHANGE AVG

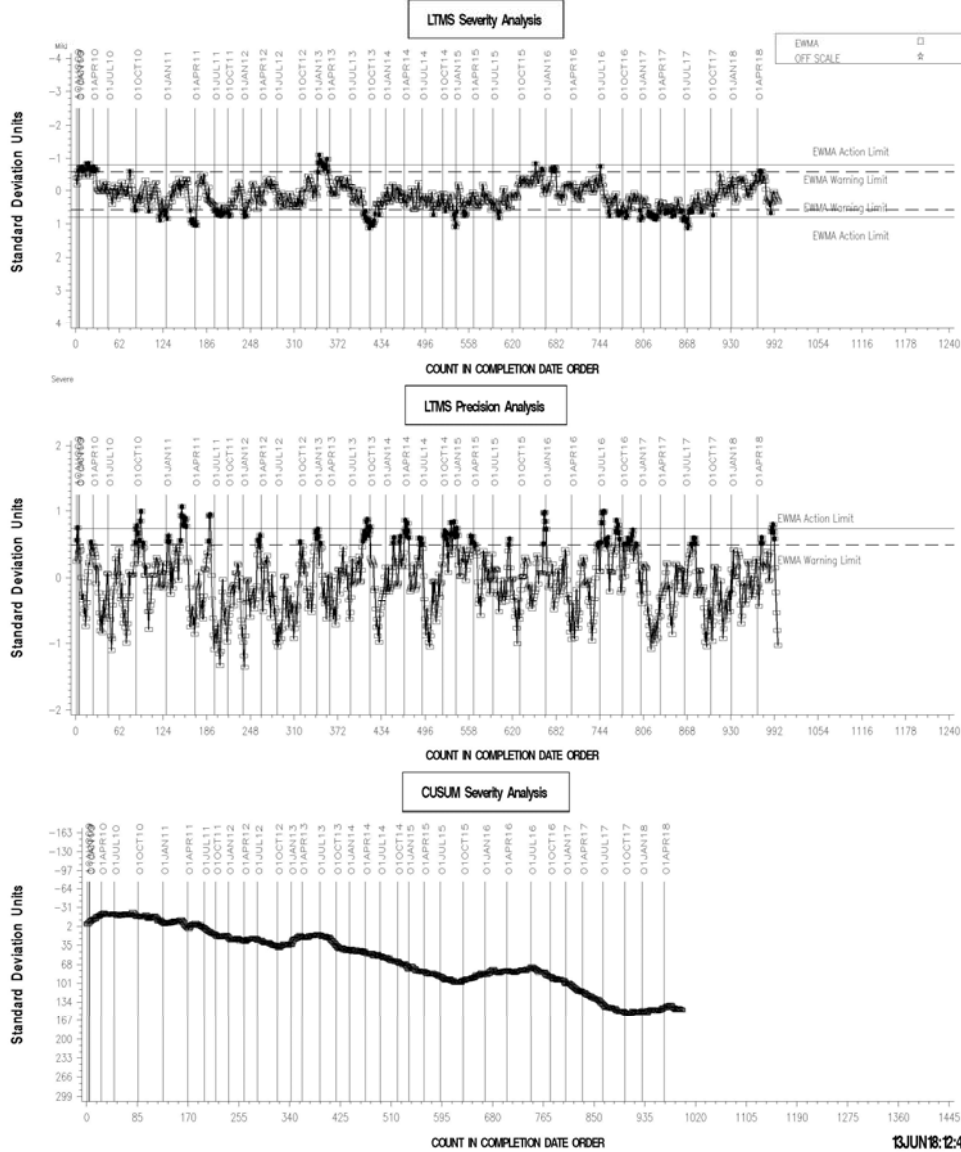


LDEOC (D 7216)

LDEOC – FLUROELASTOMER INDUSTRY OPERATIONALLY VALID DATA



REF FLURO POINTS HARDNESS CHANGE AVERAGE

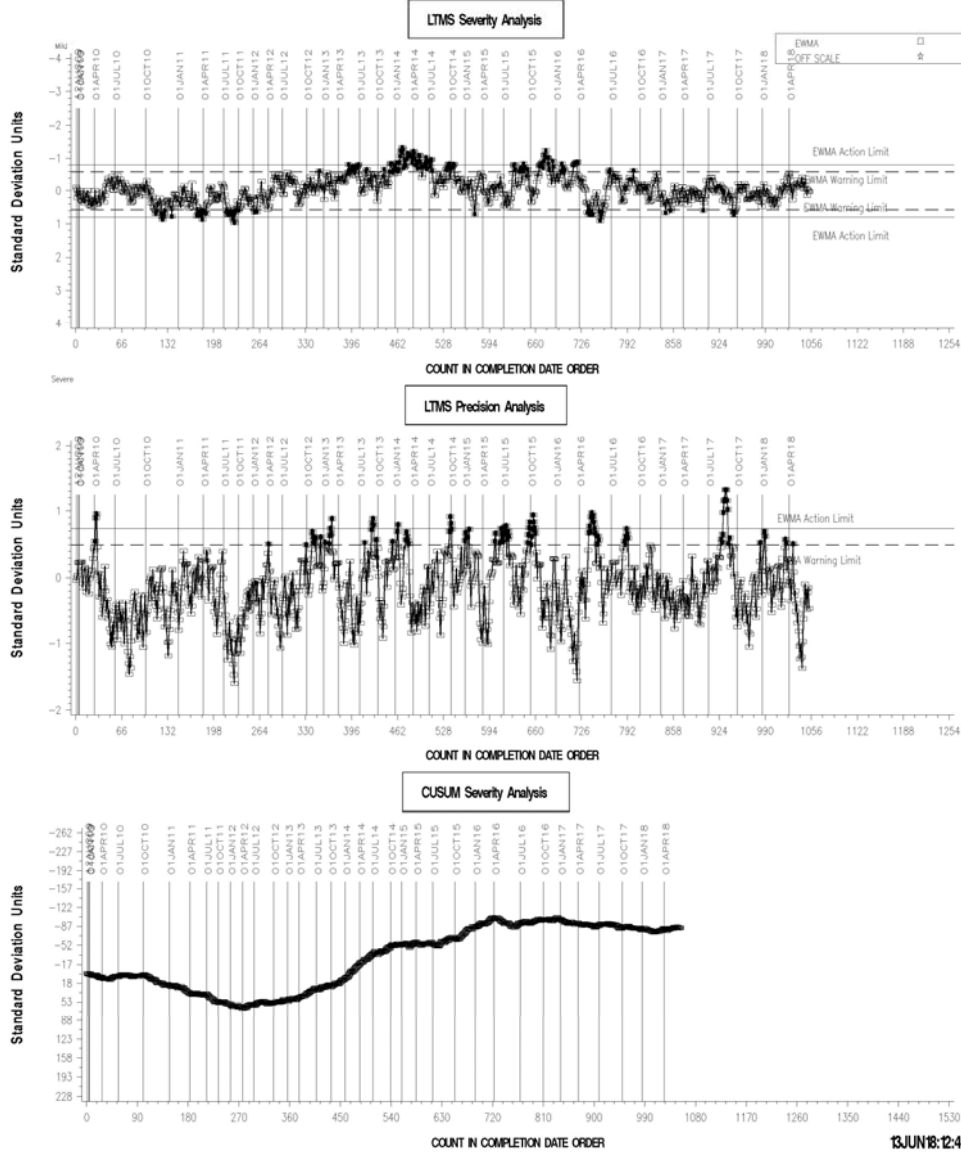


LDEOC (D 7216)

LDEOC – NITRILE INDUSTRY OPERATIONALLY VALID DATA



REF NITRILE POINTS HARDNESS CHANGE AVERAGE

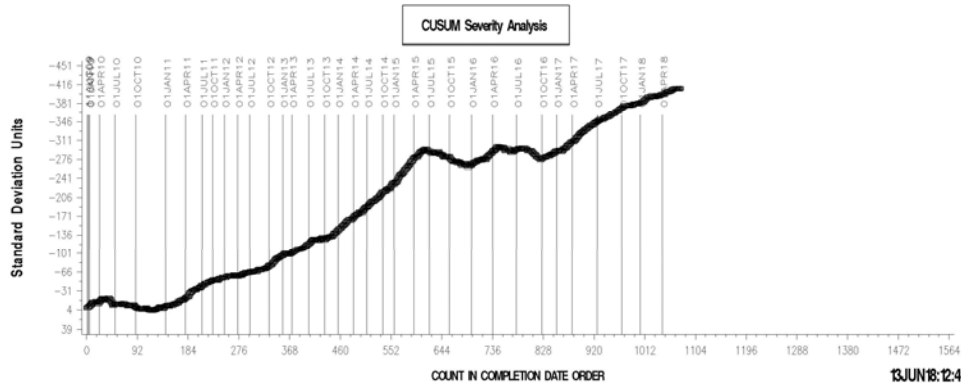
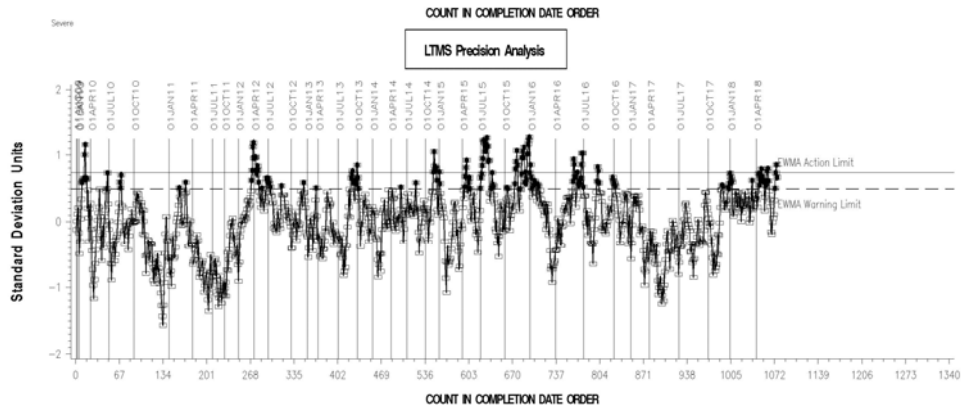
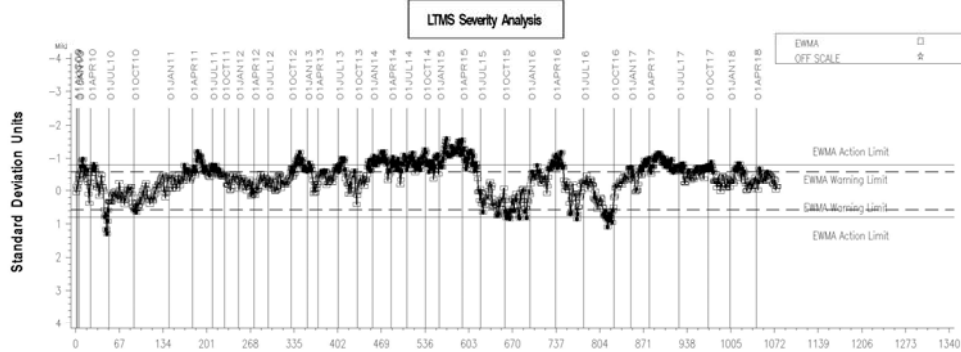


LDEOC (D 7216)

LDEOC – POLYACRYLATE INDUSTRY OPERATIONALLY VALID DATA



REF POLYACRYLATE POINTS HARDNESS CHG AVG



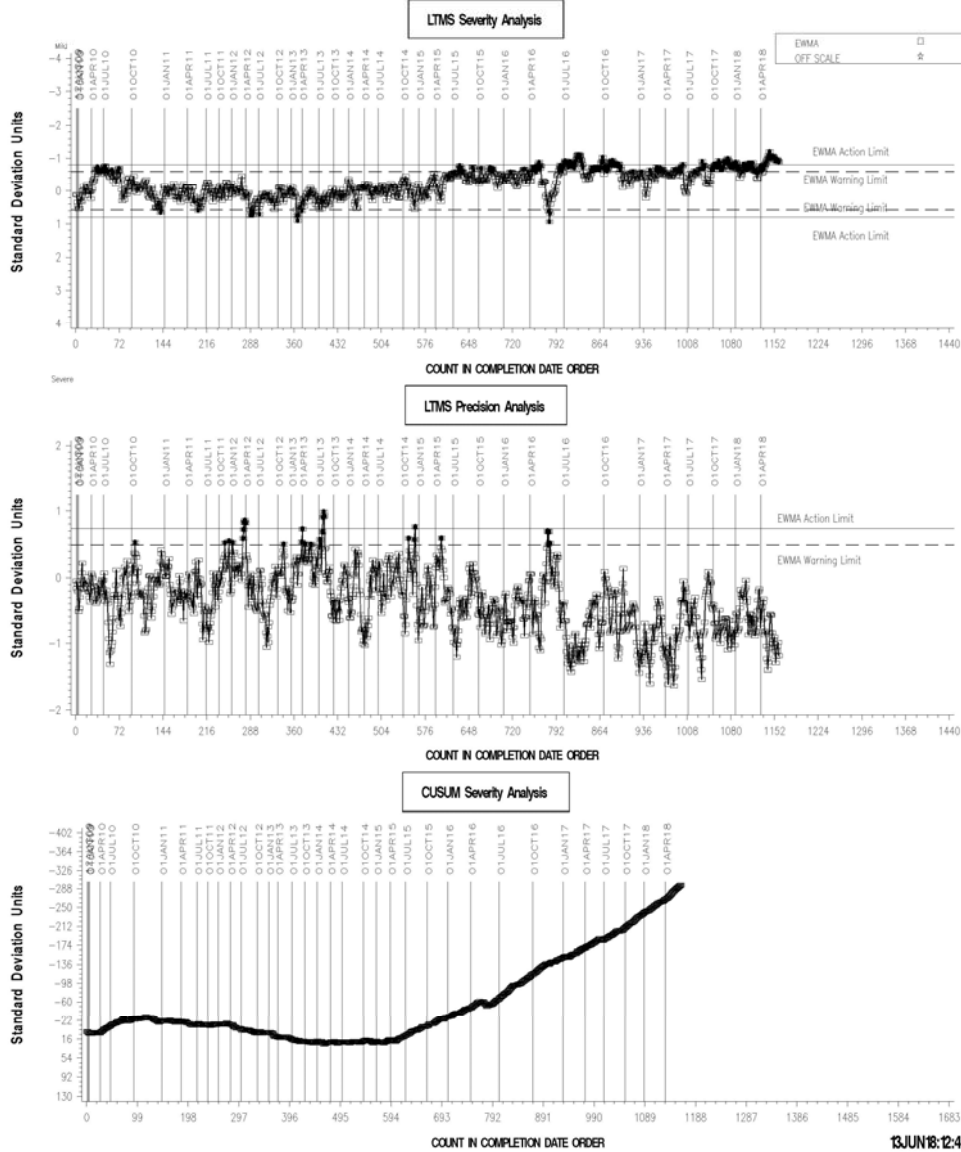
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LDEOC (D 7216)

LDEOC – SILICONE INDUSTRY OPERATIONALLY VALID DATA



REF SILICON POINTS HARDNESS CHANGE AVERAGE

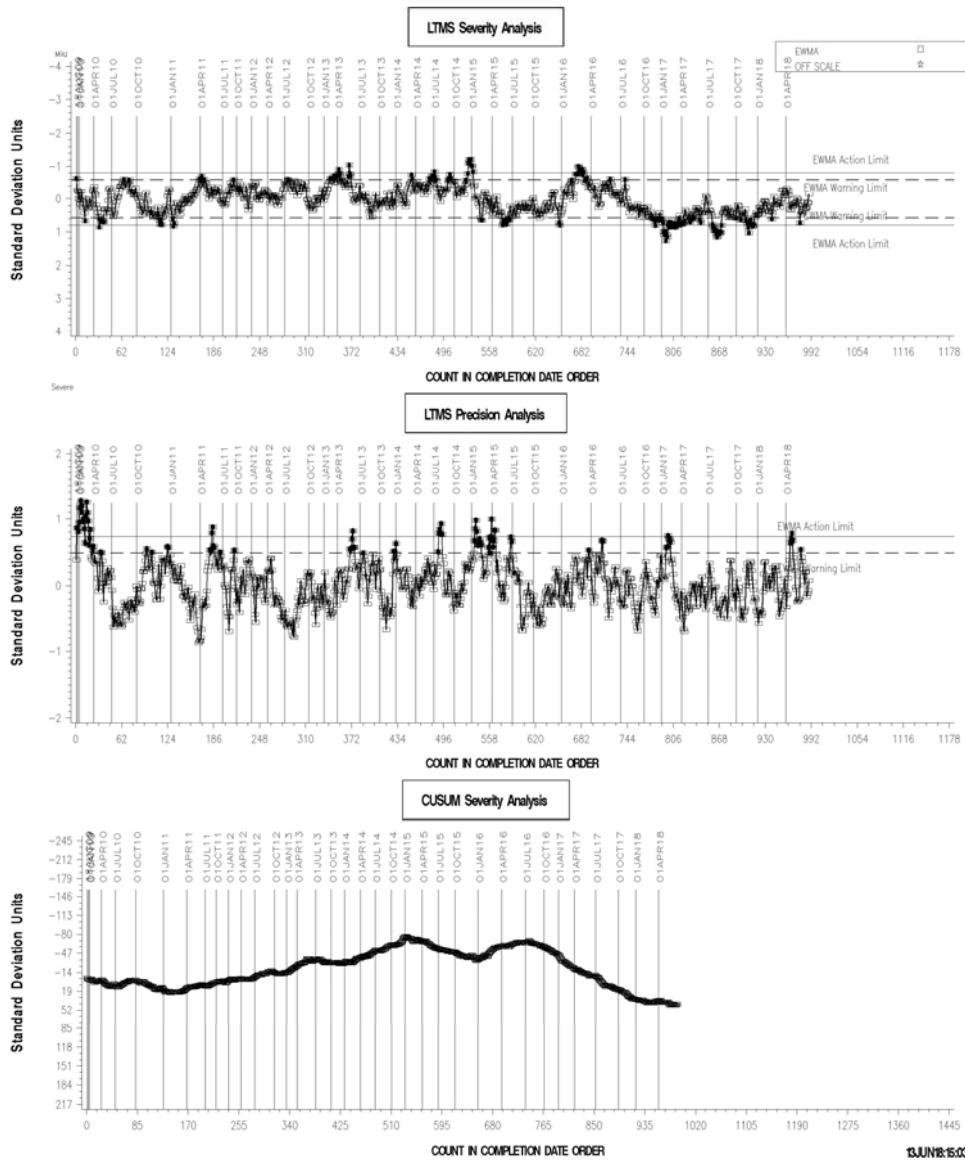


LDEOC (D 7216)

LDEOC – ETHYLENE ACRYLATE INDUSTRY OPERATIONALLY VALID DATA



REF ETH ACRYLATE TENSILE STRENGTH CHANGE AVG

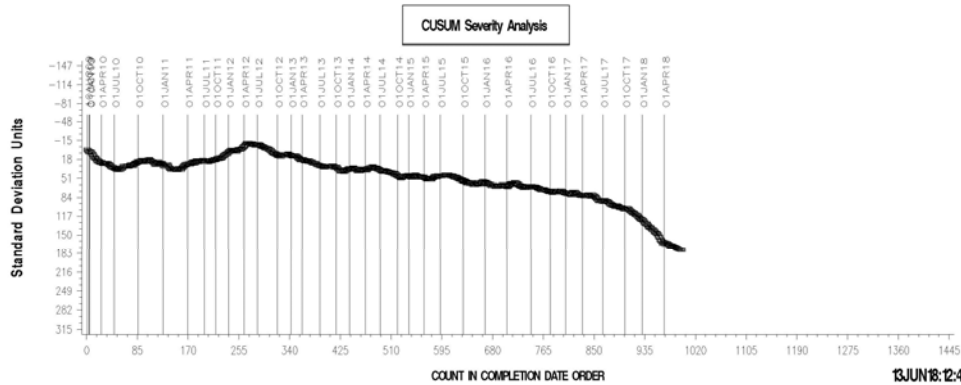
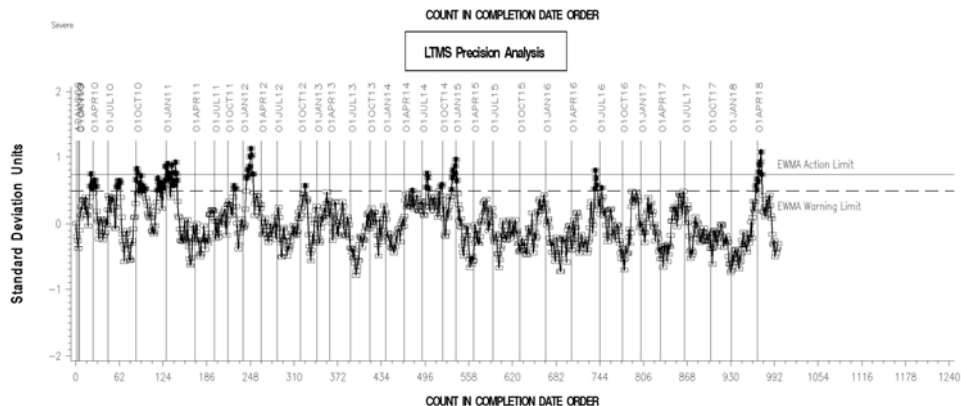
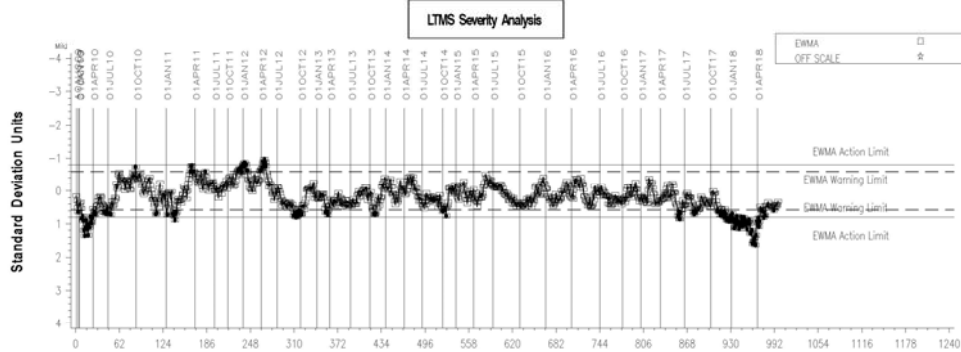


LDEOC (D 7216)

LDEOC – FLUROELASTOMER INDUSTRY OPERATIONALLY VALID DATA



REF FLURO TENSILE STRENGTH CHANGE AVERAGE



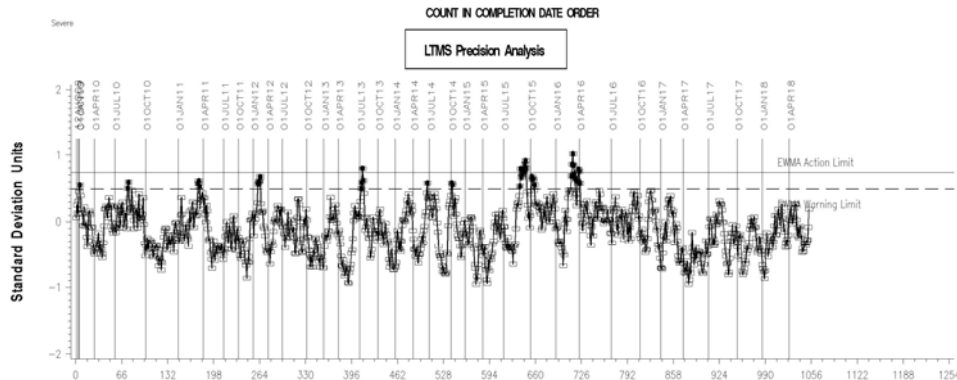
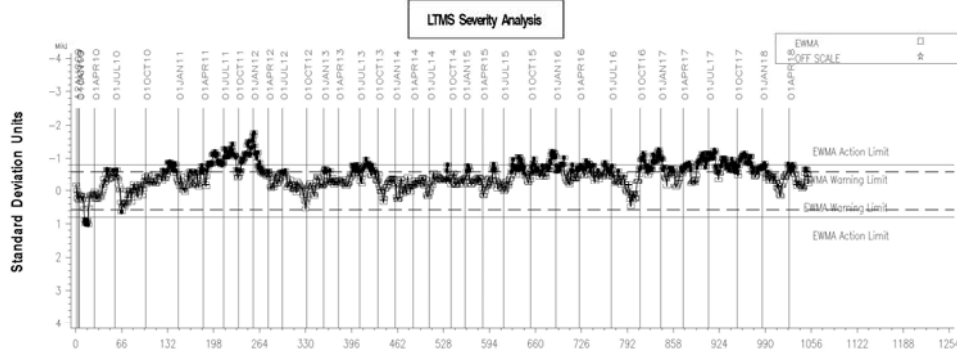
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LDEOC (D 7216)

LDEOC – NITRILE INDUSTRY OPERATIONALLY VALID DATA



REF NITRILE TENSILE STRENGTH CHANGE AVERAGE



13JUN18:12:42

Test Monitoring Center

<http://astmtmc.cmu.edu>



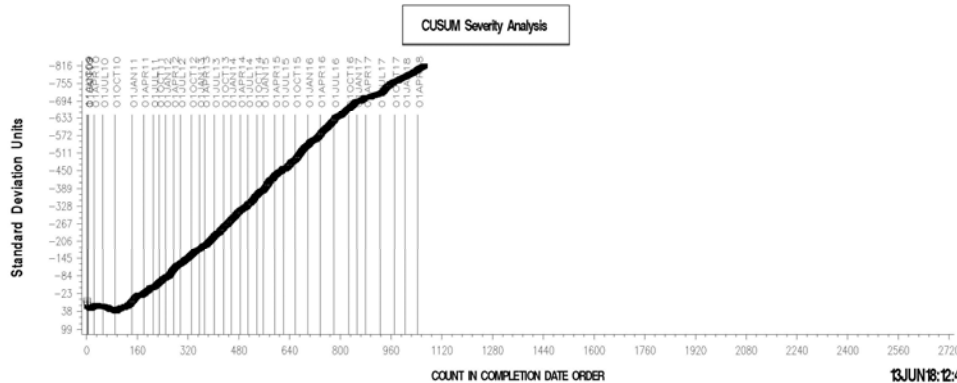
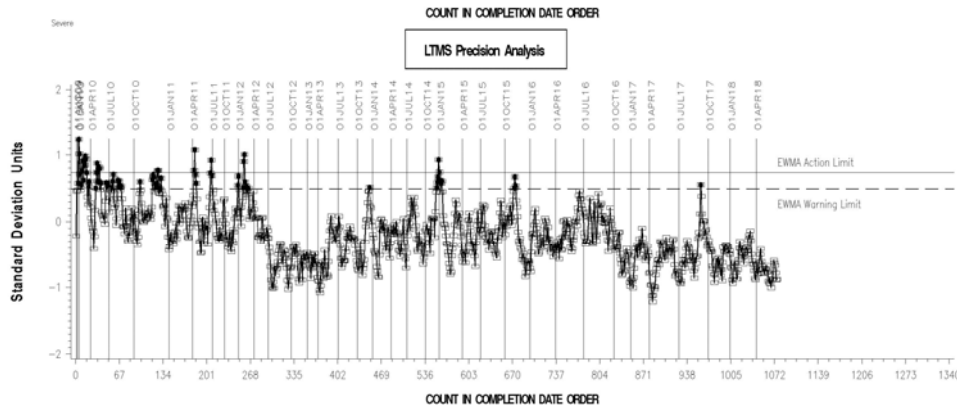
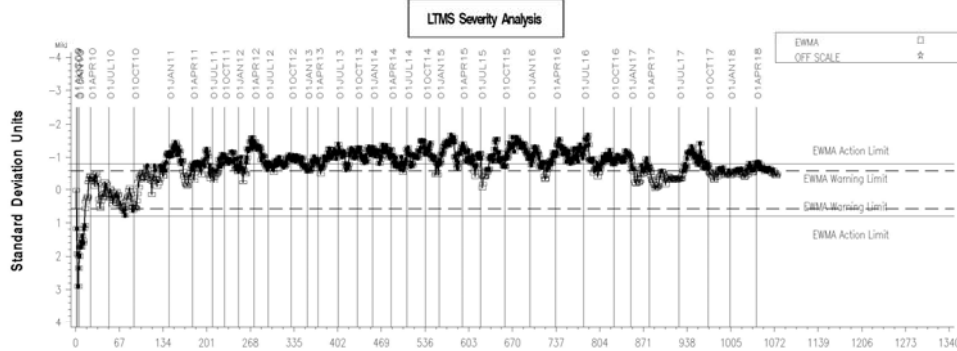
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LDEOC (D 7216)

LDEOC – POLYACRYLATE INDUSTRY OPERATIONALLY VALID DATA



REF POLYACRYLATE TENSILE STRENGTH CHG AVG

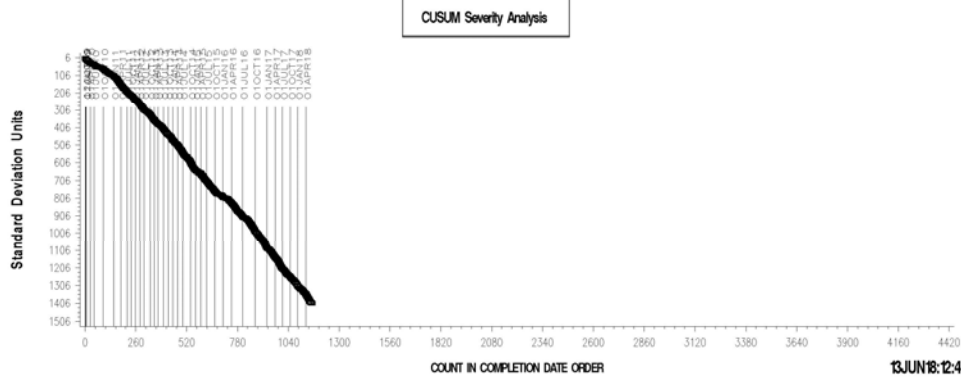
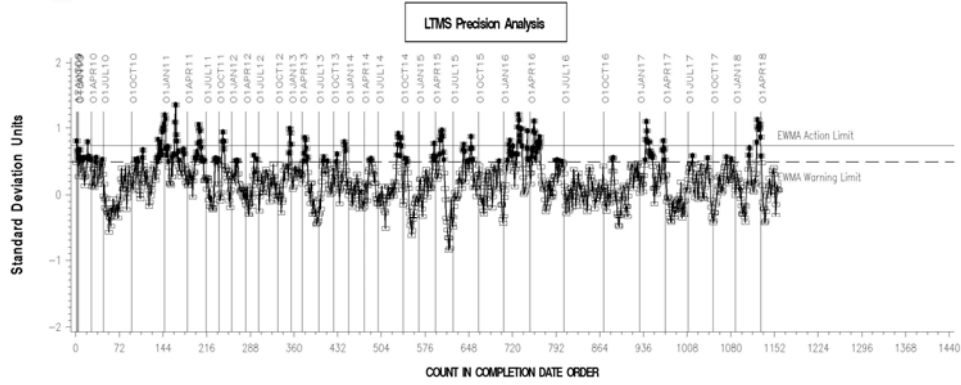
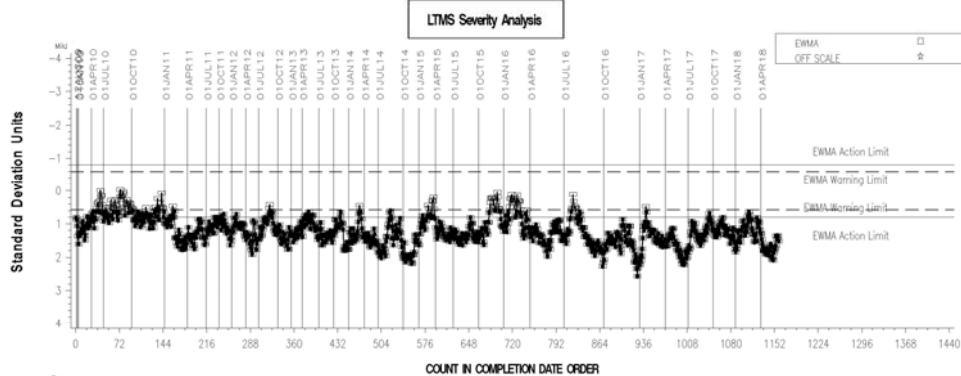


LDEOC (D 7216)

LDEOC – SILICONE INDUSTRY OPERATIONALLY VALID DATA



REF SILICON TENSILE STRENGTH CHANGE AVERAGE



LDEOC (D 7216)

INFORMATION LETTERS

No Information Letters were issued this period.

LDEOC (D 7216)

STATUS OF REFERENCE OIL SUPPLY

| Oil | Samples @ Labs | @ TMC | |
|--------|-------------------|---------------------|---------|
| | | Samples (750 mL) | Gallons |
| 1006-1 | 47 | 0 | 0 |
| 1006-2 | 248 | 6,500 | 1288 |
| Total | 295 | 6,500 | 1288 |

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.