LDEOC Severity Shifts within a laboratory

As discussed as part of the most recent LDEOC Conference Call on current test severity issues, the TMC has reviewed all of the overall laboratory severity trends in the LDEOC, as shown by CUSUM plots, in an effort to identify time periods of interest for further investigation by the laboratories.

The laboratory CUSUM plots for the LDEOC test area, which were used in this review, can be found in the following directory:

ftp://ftp.astmtmc.cmu.edu/docs/bench/ldeoc/memos/Elastomer%20Analysis/Lab%20CUSUM%20Plots/

There are five files in this directory, one for each elastomer type used in the LDEOC test.

Contained in each file are CUSUM plots for all three parameters in the test, showing all five calibrated laboratories in the industry. The plots are organized by parameter and then by laboratory within a given file.

Each of the five elastomer type plot files is reviewed on the following pages, one plot file per page. The headers first identify which parameter and then subheadings identify the lab in question. A date is then given, along with a small description of the event in question.

The laboratories have been asked to take the information regarding the parameters and time periods involved and use it to guide an internal investigation of possible causes of these shifts. *However, note that the following should not be considered an exhaustive list, but rather only as a possible guide for investigations into the data.*

The results of this investigation will be addressed at future Surveillance Panel meetings on this topic.

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Polyacrylate Elastomer (target changes made on 7/15/2010 and 3/15/2012)

Hardness:

Lab A – 6/22/2010: First test of Batch 3 elastomer, but followed by several Batch 1 runs, and all were severity-shifted relative to the prior runs. The shift does not correlate to an elastomer batch change.

Lab G – 6/11/2010: All tests run on Batch 3 elastomer. On 9/8/2010, Batch 5 elastomer was introduced, resulting in a step change in hardness results.

Tensile Strength:

Lab A – 12/1/2010: Shift in severity, which took place several tests after the introduction of Batch 6 elastomer

Lab B – 4/27/2010: Severity shift right in the middle of Batch 2 elastomer. 10/8/2010: Severity shift in opposite direction, corresponding to intro of Batch 5 elastomer.

Lab G – 7/2/2010: Severity shift in the middle of Batch 3 elastomer. 10/14/2010: Severity shift in the middle of Batch 5 elastomer.

Lab I – 10/19/2010: Severity shift, which starts with the last Batch 3 run and continues into Batch 5 data and beyond.

Volume Change:

Lab A – 9/10/2010: First test since 7/30/2010, first test of Batch 5 elastomer, step change in severity (~3 sigma). In June 2011, a smaller step change in severity, mostly correlating with Batch 7 elastomer introduction. However, one Batch 6 elastomer data point, run amid the Batcth 7 data, shows the same shift.

Lab B – 5/4/2010: reversal in severity, in the middle of Batch 2. January to April 2011: reversal in severity, which seems to match the limited Batch 6 data run here. Batch 7 resumes previous severity trend.

Lab G – 6/11/2010: step change in severity (~4 sigma) in the middle of Batch 3 data. 2/11/2011: reversal in severity, which seems to match Batch 6 data. July 2011

Lab I – 10/28/2010: severity shift, which seems to match the introduction of Batch 5 elastomer.

LDEOC Severity Shifts within a laboratory

Nitrile Elastomer (target changes made on 4/23/2010, 7/15/2010 and 3/15/2012)

Hardness:

Lab A – 9/2011 to 2/2012: change in hardness results in middle of Batch 7 elastomer.

Lab B – 9/28/2010: change in hardness results, mostly coincident to the introduction of Batch 5 elastomer. However, batch data is intermixed, while severity is mostly uniform.

Lab E – 7/28/2012: shift on last two data points, both on Batch 9.

Lab I – 10/18/2010: directional change in severity, corresponding to Batch 5 intro. 5/29/2012: directional change in severity, encompassing Batch 7, 8, and 9 data.

Tensile Strength:

Lab A – 8/20/2010: severity reversal, corresponding to introduction of Batch 5 elastomer.

Lab B – 8/13/2010: step change in severity, in middle of Batch 4 elastomer. 11/30/2010: reversal in severity, in middle of Batch 5 elastomer.

Lab E – 8/8/2012: reversal in severity, second test on Batch 9 elastomer. One data point.

Lab G – 3/8/2010: reversal in severity, not coincident with Batch 4 introduction. 12/20/2010: severity shift coincident with Batch 6 introduction, but shift is not consistent across batch. 4/19/2011: reversal in severity, not coincident with Batch 7 introduction.

Lab I – 3/23/2011: single test with large Yi value, which started severity trend, in middle of Batch 6 data.

Volume Change:

Lab A – 3/18/2010: step change in performance, coincident with Batch 4 introduction, however later, intermixed data on prior batch shows same performance shift. Shift also moderates toward end of Batch 4 data. 8/20/2010: three-week gap in data, coincident with Batch 5 elastomer. Trend slowly changes direction over first few points of Batch 5 data and continues to date.

Lab B – start to 9/28/2010: Batch 2 and 4 data have severity trends in opposite directions; intermixed data shows batch trend. After this date, Batch 5 introduced and severity reversed again. Trend continues for remaining batches.

Lab G – start to 2/23/2010: Initial trend on Batches 1 & 2. Step change in performance corresponding to Batch 4 material. Moderation of trend corresponds to target change. 8/19/2010: Severity reversal, coincident to Batch 5 introduction.

Lab I – start to 12/9/2010: Several changes in directional severity; none coincide to an elastomer batch. After date, shift in severity in middle of Batch 6 elastomer.

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Silicone Elastomer (target changes made on 7/15/2010 and 3/15/2012)

Hardness:

Lab E – 7/5/2012: Severity reversal coincident with Batch 9 introduction.

Lab I – 12/7/2010: Severity reversal in the middle of Batch 5 elastomer.

Tensile Strength:

Lab A – 4/13/2010: Severity reversal in the middle of Batch 2 elastomer.

Lab B – 11/18/2010: Severity reversal in the middle of Batch 5 elastomer. 5/25/2012 to present: Step change in severity in the middle of Batch 8 elastomer.

Lab E – 7/5/2012: Severity reversal coincident with Batch 9 elastomer.

Lab G – 7/30/2010 to 10/11/2010: Severity reversal starting in the middle of Batch 3 and ending in the middle of Batch 5 elastomer. 4/6/2011 to 6/17/2011: Two severity reversals in the middle of Batch 7 elastomer.

Volume Change:

None

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Fluoroelastomer Elastomer (target changes made on 7/15/2010 and 5/1/2012)

Hardness:

- Lab A – 4/12-25/2011: Severity reversals in the middle of Batch 6.
- Lab B – 8/18/2010: Severity reversal coincident with Batch 3 introduction. 2/6/2012: Change in long-term severity trend in middle of Batch 7 elastomer.
- Lab G – 8/6/2012: Change in long-term severity trend, which does not correspond to the introduction of a new elastomer batch.

Tensile Strength:

- Lab B – 5/12/2010: Severity shift in the middle of Batch 2 elastomer. 7/22/2010: Return to previous severity trend, still in Batch 2 elastomer. 5/14/2012: Reversal of severity trend, starting on last test on Batch 7 elastomer and continuing with Batch 8 material.
- Lab I – 11/18/2010: Large severity shift in the middle of Batch 3 elastomer.

Volume Change:

- Lab G – 6/9/2010: Large severity shift in the middle of Batch 3 elastomer. 4/27/2012: Severity reversal in the middle of Batch 7 elastomer.
- Lab I – 12/30/2010: Highly variable results in the middle of Batch 5 elastomer. 3/23/2011: Severity shift in the middle of Batch 6 elastomer. 7/14/2011 Severity reversal in the middle of Batch 6 elastomer. 2/29/2012: Severity reversal in the middle of Batch 7 elastomer.

LDEOC Severity Shifts within a laboratory

Ethylene Acrylate (target changes made on 7/15/2010 and 3/27/2012)

Hardness:

- Lab A – 3/15/2011: Severity shift coincident with first Batch 7 elastomer data point, however subsequent data shows the same trend and is on intermixed batch data.
- Lab B – 6/30/2010: Large shift in long-term severity in the middle of Batch 3 data. 1/26/2011: Large shift in severity. Batch data intermixed and trend continues across several elastomer batches.
- Lab G – 10/21/2011: Shift in severity in the middle of Batch 7 elastomer.
- Lab I – 12/2/2010: Severity reversal coincident with Batch 5 introduction. 3/2/2011: Severity reversal coincident with Batch 6 introduction.

Tensile Strength:

- Lab B – 9/3/2010: Severity shift at lab. Not coincident with Batch 4 introduction and subsequent batch data is intermixed. 2/15/2011: Severity reversal; does not coincide with elastomer batch data.
- Lab G – 6/9/2010: Severity reversal in the middle of Batch 4 elastomer. 1/3/2012: Severity reversal in the middle of Batch 7 elastomer.
- Lab I – 11/23/2010: Severity shift starting with last test on Batch 4 elastomer. 1/18/2011: Severity shift starting with last test on Batch 5 elastomer.

Volume Change:

- Lab A – 12/13/2010: Severity shift in the middle of Batch 5 elastomer.
- Lab B – 7/16/2010: Severity shift coincident with target change. 11/19/2010: Severity shift in the middle of Batch 5 elastomer.
- Lab G – 6/2/2010: Severity shift coincident with introduction of Batch 4 elastomer. 10/16/2011: Severity shift mostly coincident with introduction of Batch 7 elastomer.
- Lab I – 7/14/2011: Severity shift at lab; not coincident with any batch change. 2/2/2012: Severity shift in the middle of an elastomer batch. 6/1/2012: Severity reversal. 8/2/2012: Severity reversal.