Lab Pasteurized Count (LPC)

Fabian Y Bernal M.S., P.A.S
Theodore Escherich
“father” of E. coli

Daniel Salmon DVM
“father” of salmonella

Louis Pasteur
You see something like this....
Or something like this...

<table>
<thead>
<tr>
<th>PICKUP DATE</th>
<th>PICKUP TIME</th>
<th>TICKET</th>
<th>PICKUP ID</th>
<th>TANK</th>
<th>WEIGHT</th>
<th>BFT</th>
<th>PRO</th>
<th>LAC</th>
<th>SNF</th>
<th>OSOL</th>
<th>SCC (X 1000)</th>
<th>COLC</th>
<th>LPC</th>
<th>PI COUNT (X 1000)</th>
<th>SPC (X 1000)</th>
<th>MUN</th>
<th>FRZP</th>
<th>TEMP</th>
<th>AB</th>
<th>FFA</th>
<th>TEST CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015-10-14</td>
<td>19:09:00</td>
<td>21686243</td>
<td>885</td>
<td>01</td>
<td>50734</td>
<td>3.46</td>
<td>3.15</td>
<td>4.77</td>
<td>8.84</td>
<td>5.69</td>
<td>320</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.9</td>
<td>5.46</td>
<td>37</td>
<td>5.04</td>
<td>DFA</td>
</tr>
<tr>
<td>2015-10-14</td>
<td>19:09:00</td>
<td>21686243</td>
<td>885</td>
<td>01</td>
<td>50734</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>16</td>
<td>140</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>9.5</td>
<td>0.544</td>
<td>37</td>
<td>9.90</td>
<td>DFA</td>
</tr>
<tr>
<td>2015-10-13</td>
<td>14:20:00</td>
<td>21686242</td>
<td>884</td>
<td>01</td>
<td>50640</td>
<td>3.62</td>
<td>3.06</td>
<td>4.76</td>
<td>8.73</td>
<td>5.67</td>
<td>300</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>9.5</td>
<td>0.544</td>
<td>37</td>
<td>9.90</td>
<td>DFA</td>
</tr>
<tr>
<td>2015-10-13</td>
<td>07:02:00</td>
<td>21686241</td>
<td>883</td>
<td>01</td>
<td>49060</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>9.5</td>
<td>0.544</td>
<td>37</td>
<td>9.90</td>
<td>DFA</td>
</tr>
<tr>
<td>2015-10-13</td>
<td>07:02:00</td>
<td>21686241</td>
<td>883</td>
<td>01</td>
<td>49060</td>
<td>3.28</td>
<td>2.93</td>
<td>4.82</td>
<td>8.65</td>
<td>5.72</td>
<td>270</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>9.3</td>
<td>0.539</td>
<td>37</td>
<td>2.71</td>
<td>DFA</td>
</tr>
<tr>
<td>2015-10-12</td>
<td>09:14:00</td>
<td>21686240</td>
<td>882</td>
<td>01</td>
<td>50327</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8.9</td>
<td>0.543</td>
<td>37</td>
<td>4.83</td>
<td>DFA</td>
</tr>
<tr>
<td>2015-10-12</td>
<td>09:14:00</td>
<td>21686240</td>
<td>882</td>
<td>01</td>
<td>50327</td>
<td>3.74</td>
<td>3.02</td>
<td>4.79</td>
<td>8.72</td>
<td>5.70</td>
<td>290</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8.9</td>
<td>0.543</td>
<td>37</td>
<td>4.83</td>
<td>DFA</td>
</tr>
<tr>
<td>2015-10-11</td>
<td>11:36:00</td>
<td>21686239</td>
<td>881</td>
<td>01</td>
<td>50020</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8.9</td>
<td>0.543</td>
<td>37</td>
<td>4.83</td>
<td>DFA</td>
</tr>
<tr>
<td>2015-10-11</td>
<td>11:36:00</td>
<td>21686239</td>
<td>881</td>
<td>01</td>
<td>50020</td>
<td>3.69</td>
<td>3.00</td>
<td>4.80</td>
<td>8.71</td>
<td>5.71</td>
<td>310</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8.9</td>
<td>0.543</td>
<td>37</td>
<td>4.83</td>
<td>DFA</td>
</tr>
<tr>
<td>2015-10-10</td>
<td>17:04:00</td>
<td>21597018</td>
<td>880</td>
<td>01</td>
<td>50060</td>
<td>3.62</td>
<td>3.03</td>
<td>4.66</td>
<td>8.60</td>
<td>5.57</td>
<td>330</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8.9</td>
<td>0.543</td>
<td>37</td>
<td>4.83</td>
<td>DFA</td>
</tr>
<tr>
<td>2015-10-09</td>
<td>18:21:00</td>
<td>21686238</td>
<td>302</td>
<td>02</td>
<td>49840</td>
<td>3.61</td>
<td>3.13</td>
<td>4.72</td>
<td>8.76</td>
<td>5.63</td>
<td>S</td>
<td>350</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>0</td>
<td>12.5</td>
<td>0.000</td>
<td>37</td>
<td>9.87</td>
<td>DFA</td>
</tr>
<tr>
<td>2015-10-08</td>
<td>23:49:00</td>
<td>21686237</td>
<td>878</td>
<td>01</td>
<td>49802</td>
<td>3.64</td>
<td>3.10</td>
<td>4.80</td>
<td>8.81</td>
<td>5.71</td>
<td>280</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>12.5</td>
<td>0.000</td>
<td>37</td>
<td>9.87</td>
<td>DFA</td>
</tr>
<tr>
<td>2015-10-08</td>
<td>03:10:00</td>
<td>21686236</td>
<td>877</td>
<td>01</td>
<td>50361</td>
<td>3.59</td>
<td>C</td>
<td>3.17</td>
<td>4.75</td>
<td>8.84</td>
<td>C</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>12.5</td>
<td>0.000</td>
<td>37</td>
<td>9.87</td>
<td>DFA</td>
</tr>
<tr>
<td>2015-10-07</td>
<td>09:25:00</td>
<td>21686235</td>
<td>876</td>
<td>01</td>
<td>50232</td>
<td>3.59</td>
<td>S</td>
<td>3.17</td>
<td>4.75</td>
<td>8.84</td>
<td>S</td>
<td>350</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>0</td>
<td>12.5</td>
<td>0.000</td>
<td>37</td>
<td>9.87</td>
<td>DFA</td>
</tr>
<tr>
<td>2015-10-07</td>
<td>09:25:00</td>
<td>21686235</td>
<td>876</td>
<td>01</td>
<td>50232</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8.4</td>
<td>0.000</td>
<td>37</td>
<td>5.21</td>
<td>DFA</td>
</tr>
<tr>
<td>Total/Avg</td>
<td></td>
<td>10</td>
<td></td>
<td></td>
<td>501076</td>
<td>3.58</td>
<td>3.08</td>
<td>4.76</td>
<td>8.75</td>
<td>5.67</td>
<td>311</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Lab pasteurized count (LPC)

- The Lab Pasteurized Count is the number of bacteria per ml of milk which survive laboratory pasteurization at 62.8° C (145° F) for 30 minutes.
- This procedure kills the usual mastitis-causing bacteria leaving only those organisms from the environment which can survive elevated temperatures.
- These types of organisms will grow and multiply in the milk handling equipment if cleaning and sanitation procedures are inadequate.
Spore-forming bacteria

Reiter, Superior, Brewster, etc...
Bacteria count measurements:

Laboratory Pasteurized Count (LPC):

- **Defined:** Measures the number of bacteria that survive lab pasteurization at 145°F for 30 minutes.
- ID thermodurics
- Causes milk spoilage
- Milk quality goal: <100 cfu/ml.
- Critical control points: Unclean equipment and/or improper sanitizing practices.

Too basic!!!
The Laboratory Pasteurization Count - Thermoduric Bacteria in Raw Milk -

• While most thermoduric bacteria are not capable of growing at refrigerator temperatures, the ones that do can cause milk spoilage.

• Commonly found thermoduric bacteria in milk include species of Micrococcus, Streptococcus, Lactobacillus, Bacillus, Paenibaccillus and occasionally gram-negative rods.

• The LPC is primarily a means of detecting sources of organisms responsible for high counts in the final product and determining level of on farm sanitation.

Psychrotrophic thermodurics
Most thermoduric strains of bacteria are not capable of reproducing in pasteurized milk under conditions of refrigerated storage.

Other milk defects that have been associated with Bacillus and other psychrotrophic spore-formers include bitter, yeasty, unclean, and rancid off flavors as well as coagulation of the milk proteins. Psychrotrophic Gram-positive organisms other than *Bacillus spp.* also may be responsible for limiting the shelf-life of pasteurized milk.

In addition to being spore-forming bacteria, they can produce proteolytic enzymes that degrade protein and fat in milk.
What is an acceptable count?

- LPC count will be much lower than your SPC because most of the bacteria present in the milk will be killed by pasteurization. However, there is no legal standard for LPC (except in CA where it is 750).

- The milk receiver will determine acceptable LPC standards. As a guide 200 is considered good, 100 high-quality, under 10 excellent quality.
High LPC's

• Often associated with chronic/persistent cleaning failures within the milking system.

• Common causes of high LPC's might include leaky pumps, old and leaky pipe-line gaskets, old, cracked inflations and other rubber parts and milk stone deposits.

• Biofilms...

• Is that all???
Think through and consider other counts

A 2x2 table of Coliform Count and LPC can be used to localize the source of a high SPC.

<table>
<thead>
<tr>
<th>LPC</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>No Problem</td>
<td>Teat Hygiene/Environment</td>
</tr>
<tr>
<td>High</td>
<td>Machine Hygiene</td>
<td>Teat Hygiene/Machine Hygiene/Incubation</td>
</tr>
</tbody>
</table>

* Laboratory Pasteurized Count
Other tests of quality

“sediment”

- Required test but frequency of testing is undefined
- Acceptable levels are $<1.5 \text{mg per gal}$
- Excessive udder hair + bedding materials + poor pre-milking hygiene
Cows and their environment
Reality checks

Investigations many times include individuals searching for a single cause of the problem.

“While driving to the farm, many times we hope and pray we’ll find something wrong so we can fix it.”

Unfortunately this leads to a band-aid approach and seldom treats the cause of the problem.

A complete evaluation of the system should be done. This is not an difficult process, just follow good husbandry practices. Get used to do this type of evaluation, because these tests are going to be here forever.
Questions? Comments?

Fabian Bernal
  c. 859-494-0328
  e. fbernal@dfamilk.com
  www.dfamilk.com

• We are happy to help you!

*Special tanks to GEA Farm technologies for all their help with this presentation.
**Portions excerpted from David Bray Troubleshooting LPCs University of Florida Dairy Update, Vol. 10, No. 3