# Appendix One

# S & J Laboratories, Inc.

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Report To: Dr. Don Berdahl/Mr. Greg Reynhout (Kalsec®, Inc.)

From: James C. Lin, Ph.D. (S & J Laboratories, Inc.)

Date: May 15, 2006

Title: Microbial profiles, color, and sensory evaluation of commercial packaged ground beef under pre-determined storage conditions.

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## SUMMARY

Commercially available MAP ground beef packages including Hi-Ox samples (82% oxygen/18% carbon dioxide) and CO-pk (0.4% CO) were used to study the temperature/time effect on microbiological, color and sensory profile. The microbial data of each study group were presented; the effects of temperatures/time on the beef color & sensory impact were measured. A preliminary survey of commercially available ground beef in a variety of packaging was conducted to determine whether the high plate counts observed in many of the CO-pk samples was an anomaly. Tentative conclusions, based on current experimental design and data, were drawn.

## MATERIALS & METHODS

The analyses on the ground beef packages purchased from local supermarkets were separated into (4) studies. Each study group contained both Hi-Ox samples (82% oxygen/18% carbon dioxide) and CO-pk (0.4% CO).

Study I. Samples were kept at 21°C (70°F) for up to 24 hours under fluorescence light. Control samples were stored in the dark at refrigeration temperature (4°C, or 39°F). Initial very high plate counts in the CO-pk samples led to this study being repeated.

Study II. Study one was repeated using a different, lower plate count CO-pk meat sample. Samples were kept at 21°C (70°F) for up to 28 hours under fluorescence light.

Study III. Samples were abused at 21°C (70°F) for 8 hours under fluorescence light, and then kept at refrigeration temp (4°C, or 39°F) until the end of their labeled use by date.

Study IV. Samples representing a variety of packaging forms were purchased and immediately analyzed for plate count.

All investigations were carried out on the premises of S&J Laboratories, Inc., Portage, MI. Microbiological analyses, including aerobic plate count and anaerobic plate count, were performed by S & J Laboratories personnel. Color measurements (generating L, a*, and b* values), using a Minolta CR-300 hand held Colorimeter were conducted by Kalsec® personnel. The sensory evaluation was conducted by sniffing the odor right after sample packages were opened, with both S&J Lab and Kalsec® personnel being involved in the evaluation. Kalsec® personnel also photographed all meat packages at each study stage. Oxygen and carbon dioxide levels in the atmospheres of certain packages were measured by Kalsec® personnel using a Dansensor Checkmate 9900.



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RESULTS AND DISCUSSION

Study I. Temperature Abuse 21°C (70°F)

Table 1A presents all the microbial data for this study. Initial aerobic and anaerobic plate counts showed significant ($p<0.05$) difference between Hi-Ox and CO-pk samples. The CO-pk samples were about 3 log units higher in microbial count than the High-Ox samples. The anaerobic and aerobic plate counts for the CO-pk samples trended upward reaching a level above $1x10^7$ cfu/g. Anaerobic and aerobic counts for the Hi-Ox samples trended up over the course of the study, reaching $1x10^7$ cfu/g at the end of the study. Given the high initial plate count of the CO-pk samples, it was decided to repeat this study with different meat samples.

No colorimetry was done on this study, but by visual inspection, the CO-pk samples remained bright red and fresh-looking throughout the temperature abuse interval. The red color of the High-Ox samples dropped throughout the test, reaching what was deemed as unacceptable at about 16 hours.

In Table 1B, both Hi-Ox & CO-pk samples had similar fresh beef odor, except CO-pk sample #2 had slight sulfur compound odor. Hi-Ox samples showed slight buttery, oxidized odor after 16 hours and the intensity of this aroma grew throughout the rest of the test. The sulfur aroma became more noticeable at 16 hours into the test.

Study II. 21°C (70°F) under fluorescent light for 28 hours

In Table 2A, the initial bacteria count showed little difference between Hi-Ox and CO-pk ground beef, Hi-Ox was at $10^2$~$10^3$ and CO-pk was at ~$10^3$. Significant differences were observed right after 8 hours temperature abuse. Hi-Ox samples kept at low plate count, ~$10^5$, for both aerobic and anaerobic plate counts, whereas CO-pk samples jumped to ~$10^4$ for aerobic and ~$10^5$ for anaerobic. The more acceleration of the growth of anaerobic microorganisms in CO-pk were observed after 12 hours at 21°C, which the microbial count reached ~$10^6$ in some testing samples, whereas Hi-Ox samples were maintained around ~$10^3$. The CO environment enhanced the growth of anaerobic microorganisms. Hi-Ox samples also reached ~$10^6$ after 24 hours, and further grew to ~$10^7$ after another 4 hours. CO-pk reached ~$10^6$ (anaerobic) after 16 hours at 21°C under fluorescence light & eventually reached ~$10^7$.

For CO-pk samples, the color was consistent throughout the entire study (Table 2B, redness: a* value ~ 26) despite the microbial count increased from ~$10^3$ to ~$10^7$, whereas the Hi-Ox samples lost its fresh redness gradually from ~25 to ~15 in 28 hours. Hi-Ox samples not only lost its redness, the decrease of its brightness also observed ("L" values, Kalsec® data) during 28 hours study. This color fading was mainly due to the metabolites generated during the microbial growth that reduced oxygen concentration, lowered pH value. If the study persisted, the depleted oxygen in conjunction with the lowered pH will eventually denatured meat protein and altered the color to dark brown, a scenario known as met-myoglobin . On the other hand, CO-pk samples always preserve its bright redness despite the microbial load, pH value, even the PI (iso-electric point, ~5.4) was reached. However, the lost of water holding capacity was noticeable by observing running meat juice in some CO-pk samples after 12 hours at 21°C. This exudation may be due to the PI point reached hence the myoglobin denatured.

Both Hi-Ox & CO-pk samples had similar fresh beef odor initially (Table 2C). However, after 8 hours incubation at 21°C, Hi-Ox samples began to show slightly oxidized, rancid odor & CO-pk samples start



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to have slightly sulfur compound odor. For Hi-Ox samples, the intensity of the oxidized, rancid odor increased in each of 4-hour evaluation, whereas CO-pk samples also increased the strength of the unique, unpleasant sulfur compound odor at each 4-hour evaluation period. It may be that CO-pk creates a favorable environment for anaerobic & facultative anaerobes to grow & generates sulfur-containing compounds in the head space of the meat package. This sulfur aroma was not detectable in any of the Hi-Ox samples.

Study III. 21°C (70°F) 8 hours under fluorescent light & stored at 4°C (39.2°F) refrigeration

Initial bacteria count showed difference between Hi-Ox and CO-pk ground beef, Hi-Ox was at $10^2$~$10^3$ and CO-pk was at ~$10^5$ (Table 3A). After 8 hours abuse at 21°C, Hi-Ox samples remained at low levels (~$10^3$) for both aerobic and anaerobic plate counts, whereas CO-pk samples increased 1 log cycle to ~$10^6$ for both aerobic and anaerobic. Refrigeration after first 8 hours temp abuse (21°C) did slow the subsequent rate of microbial growth for both samples. Microbial counts after 20 hours refrigeration showed Hi-Ox samples remaining at low levels (~$10^3$), whereas the CO-pk samples were between the mid and high end of ~$10^6$. From the data on the third day (4/29/06), it appears that CO-pk had reached its stationary phase with microbial counts at ~$10^7$ and kept at similar log values throughout the rest of the study. The microbial counts of Hi-Ox samples increased much slower & reached ~$10^5$ on May 3rd, 2006.

For CO-pk samples, the color was in a narrow range throughout the study (Table 3B, redness: a* value: 26~ 29) despite the microbial count increased from ~$10^5$ to ~$10^7$. Hi-Ox samples lost their bright redness right after the first 8 hours at 70°F (from ~25 to ~19), and remained at a somewhat similar value thereafter. Since Hi-Ox samples were stored at 4°C after the 8 hours of temp abuse, the final microbial counts did not exceed $10^6$ hence the colors were maintained. The CO-pk maintained almost the same color throughout the study.

Both Hi-Ox & CO-pk samples had similar fresh beef odor initially (Table 3C). However, after 8 hours incubation at 21°C (70°F), Hi-Ox samples began to show a slight oxidized, rancid odor & CO-pk samples started to exhibit a slight sulfur compound odor. For Hi-Ox samples, the intensity of the oxidized, rancid odor remained at a very similar level throughout the study. On the other hand, the sulfur compound note developed faster in CO-pk samples. The 8-hour temp abuse may accelerate the odor development.

Study IV. Preliminary Survey of Plate Counts of Commercial Ground Beef Samples

Various samples of ground beef were purchased by Kalsec® personnel and transported to S&J laboratories in coolers. The bacteria counts of freshly-purchased ground beef samples in various types of packaging are shown in Table 4. Additional instances of high plate counts in CO-pk meat samples have been found ~ within the use or sell by dates. Only one sample with over $10^6$ plate count in a High-Ox sample was found. The bright red fresh-looking color of all the CO-pk samples



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CONCLUSION

Hi-Ox and CO-pk ground beef packages developed two different odor and color patterns that are very easy to differentiate. The traditional visual evaluation to predict ground beef quality that was associated with meat freshness and microbial load can no longer be used as an indicator where CO-pk ground beef was involved.

A preliminary survey of meat available to consumers indicates that very high microbial plate counts are observed more often in CO-treated meat than in the other forms available. We recommend investigation of additional samples to verify this.



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Table 1A. The microbial profile of ground beef samples abused at 21 °C, (70 °F) under fluorescent light for 24 hours.

| TESTING TIME | ANALYSIS | High Ox G.B. Sample # 1 (80% Lean, sell by 4/23/06) | High Ox G.B. Sample # 2 (80% Lean, sell by 4/23/06) | CO Packed G.B. Sample # 1 (92% Lean, use or freeze by 4/18/06) | CO Packed G.B. Sample # 2 (92% Lean, use or freeze by 4/18/06) |
|---|---|---|---|---|---|
| 4/17/06 12 A.M. | Aerobic Plate Count/gm | 400 | 1,600 | 2,500,000 | 3,000,000 |
| 4/17/06 12 A.M. | Anaerobic Plate Count/gm | 700 | 1,300 | 3,100,000 | 3,600,000 |
| 4/17/06 8 A.M. | Aerobic Plate Count/gm | 3,000 | 6,000 | 5,000,000 | 11,000,000 |
| 4/17/06 8 A.M. | Anaerobic Plate Count/gm | 10,000 | 8,000 | 6,000,000 | 13,000,000 |
| 4/17/06 12 P.M. | Aerobic Plate Count/gm | 8,000 | 17,000 | 12,000,000 | 9,000,000 |
| 4/17/06 12 P.M. | Anaerobic Plate Count/gm | 19,000 | 27,000 | 13,000,000 | 15,000,000 |
| 4/17/06 4 P.M. | Aerobic Plate Count/gm | 290,000 | 110,000 | 15,000,000 | 5,900,000 |
| 4/17/06 4 P.M. | Anaerobic Plate Count/gm | 840,000 | 130,000 | 24,000,000 | 9,100,000 |
| 4/17/06 8 P.M. | Aerobic Plate Count/gm | 1,700,000 | 1,900,000 | 19,000,000 | 23,000,000 |
| 4/17/06 8 P.M. | Anaerobic Plate Count/gm | 1,500,000 | 2,000,000 | 13,000,000 | 21,000,000 |
| 4/18/06 12 A.M. | Aerobic Plate Count/gm | 10,000,000 | 13,000,000 | 9,600,000 | 14,000,000 |
| 4/18/06 12 A.M. | Anaerobic Plate Count/gm | 13,000,000 | 15,000,000 | 12,000,000 | 14,000,000 |

* Reference: Official Methods of Analysis of AOAC International, Ch.17, 17th edition, 2000. Bacteriological Analytical Manual By AOAC, 8th edition, 1998 Revision A.

Table 1B. The sensory evaluation of ground beef samples abused at 21 °C, (70 °F) under fluorescent light for 24 hours.

| TESTING TIME | **High Ox G.B.**<br>**Sample # 1&2**<br>**(80% Lean, sell by 4/23/06)** | **CO Packed G.B.**<br>**Sample # 1&2**<br>**(92% Lean, use or freeze by 4/18/06)** |
|---|---|---|
| 4/17/06 12 A.M. | Fresh beef odor | Very slight sulfur comp odor |
| 4/17/06 8 A.M. | No off odor detected | Very slight sulfur comp odor |
| 4/17/06 12 P.M. | No off odor detected | Slight sulfur comp odor |
| 4/17/06 4 P.M. | Slight butter /oxidized odor | Noticeable sulfur comp odor |
| 4/17/06 8 P.M. | Off spoiled / sour odor | Noticeable sulfur comp odor |
| 4/18/06 12 A.M. | Off spoiled / sour odor | Strong sulfur comp odor |

Table 2A. The microbial profile of ground beef samples abused at 21°C (70°F) under fluorescent light for 28 hours.

| TESTING TIME | ANALYSIS | High Ox G.B. Sample # 1 (96% Lean, sell by 5/4/06) | High Ox G.B. Sample # 2 (96% Lean, sell by 5/4/06) | CO Packed G.B. Sample # 1 (96% Lean, use or freeze by 5/9/06) | CO Packed G.B. Sample # 2 (96% Lean, use or freeze by 5/9/06) |
|---|---|---|---|---|---|
| 4/27/06 12 P.M. | Aerobic Plate Count/gm | 1,000 | 1,600 | 4,300 | N/A |
| 4/27/06 12 P.M. | Anaerobic Plate Count/gm | 200 | 800 | 6,800 | N/A |
| 4/27/06 8 P.M. | Aerobic Plate Count/gm | 1,000 | 2,000 | 79,000 | 91,000 |
| 4/27/06 8 P.M. | Anaerobic Plate Count/gm | 2,000 | 2,000 | 200,000 | 190,000 |
| 4/28/06 12 A.M. | Aerobic Plate Count/gm | 8,000 | 9,000 | 510,000 | 560,000 |
| 4/28/06 12 A.M. | Anaerobic Plate Count/gm | 4,000 | 4,000 | 1,400,000 | 640,000 |
| 4/28/06 4 A.M. | Aerobic Plate Count/gm | 100,000 | 130,000 | 1,100,000 | 1,000,000 |
| 4/28/06 4 A.M. | Anaerobic Plate Count/gm | 80,000 | 70,000 | 2,700,000 | 4,000,000 |
| 4/28/06 8 A.M. | Aerobic Plate Count/gm | 500,000 | 190,000 | 4,300,000 | 4,400,000 |
| 4/28/06 8 A.M. | Anaerobic Plate Count/gm | 1,200,000 | 280,000 | 7,800,000 | 12,000,000 |
| 4/28/06 12 P.M. | Aerobic Plate Count/gm | 3,100,000 | 2,000,000 | 7,200,000 | 7,200,000 |
| 4/28/06 12 P.M. | Anaerobic Plate Count/gm | 4,400,000 | 1,700,000 | 11,000,000 | 11,000,000 |
| 4/28/06 4 P.M. | Aerobic Plate Count/gm | 24,000,000 | 30,000,000 | 16,000,000 | 12,000,000 |
| 4/28/06 4 P.M. | Anaerobic Plate Count/gm | 28,000,000 | 26,000,000 | 23,000,000 | 28,000,000 |

* Reference: Official Methods of Analysis of AOAC International, Ch.17, 17th edition, 2000. Bacteriological Analytical Manual By AOAC, 8th edition, 1998 Revision A.

Table 2B. The color (a* value) profile of ground beef samples abused at 21°C (70°F) under fluorescent light for 28 hours.

| TESTING TIME | **High Ox G.B.**<br>**Sample # 1&2**<br>**(96% Lean, sell by 5/4/06)** | **CO Packed G.B.**<br>**Sample # 1&2**<br>**(96% Lean, use or freeze by 5/9/06)** |
|---|---|---|
| 4/27/06 12 P.M. | 25.53±1.76 | 26.11±2.38 |
| 4/27/06 8 P.M. | 19.41±3.34 | 24.96±0.84 |
| 4/28/06 12 A.M. | 20.07±1.13 | 26.54±0.58 |
| 4/28/06 4 A.M. | 17.88±0.60 | 25.86±2.53 |
| 4/28/06 8. A.M. | 17.52±0.18 | 25.17±1.37 |
| 4/28/06 12 P.M. | 14.69±1.89 | 26.14±1.22 |
| 4/28/06 4 P.M. | 15.32±1.13 | 26.91±0.42 |

Table 2C. The sensory evaluation of ground beef samples abused at 21°C (70°F) under fluorescent light for 28 hours.

| TESTING TIME | **High Ox G.B.**<br>**Sample # 1&2**<br>**(96% Lean, sell by 5/4/06)** | **CO Packed G.B.**<br>**Sample # 1&2**<br>**(96% Lean, use or freeze by 5/9/06)** |
|---|---|---|
| 4/27/06 12 P.M. | Fresh beef aroma | Fresh beef aroma |
| 4/27/06 8 P.M. | Slight oxidized odor | Slight off, unpleasant odor |
| 4/28/06 12 A.M. | Slight oxidized odor | Off odor, sulfur comp odor |
| 4/28/06 4 A.M. | Oxidized, acidic or sour odor | Strong sulfur comp odor |
| 4/28/06 8. A.M. | Oxidized, acidic or sour odor | Stronger sulfur comp odor |
| 4/28/06 12 P.M. | Strong oxidized odor | Very strong sulfur comp odor |
| 4/28/06 4 P.M. | Strong oxidized odor | Very strong sulfur comp odor |

Table 3A. The microbial profile of ground beef samples abused at 21°C (70°F) 8 hours under fluorescent light & stored at refrigeration temp (4°C, 39.2°F).

| TESTING TIME | ANALYSIS | High Ox G.B. Sample # 1 (96% Lean, sell by 5/4/06) | High Ox G.B. Sample # 2 (96% Lean, sell by 5/4/06) | CO Packed G.B. Sample # 1 (93% Lean, use or freeze by 5/9/06) | CO Packed G.B. Sample # 2 (93% Lean, use or freeze by 5/9/06) |
|---|---|---|---|---|---|
| 4/27/06 12 P.M. | Aerobic Plate Count/gm | 1,000 | 1,600 | 210,000 | N/A |
| 4/27/06 12 P.M. | Anaerobic Plate Count/gm | 200 | 800 | 200,000 | N/A |
| 4/27/06 8 P.M. | Aerobic Plate Count/gm | 1,000 | 2,000 | 4,000,000 | 4,000,000 |
| 4/27/06 8 P.M. | Anaerobic Plate Count/gm | 2,000 | 2,000 | 5,600,000 | 3,800,000 |
| 4/28/06 4 P.M. | Aerobic Plate Count/gm | 1,000 | 3,000 | 9,600,000 | 6,200,000 |
| 4/28/06 4 P.M. | Anaerobic Plate Count/gm | 1,000 | 2,000 | 8,500,000 | 7,400,000 |
| 4/29/06 4 P.M. | Aerobic Plate Count/gm | 4,000 | 9,000 | 21,000,000 | 19,000,000 |
| 4/29/06 4 P.M. | Anaerobic Plate Count/gm | 1,000 | 10,000 | 17,000,000 | 26,000,000 |
| 4/30/06 4 P.M. | Aerobic Plate Count/gm | 6,000 | 8,000 | 38,000,000 | 48,000,000 |
| 4/30/06 4 P.M. | Anaerobic Plate Count/gm | 14,000 | 26,000 | 32,000,000 | 57,000,000 |
| 5/1/06 4 P.M. | Aerobic Plate Count/gm | 22,000 | 6,000 | 32,000,000 | 19,000,000 |
| 5/1/06 4 P.M. | Anaerobic Plate Count/gm | 64,000 | 20,000 | 34,000,000 | 32,000,000 |
| 5/2/06 4 P.M. | Aerobic Plate Count/gm | 11,000 | 18,000 | 38,000,000 | 14,000,000 |
| 5/2/06 4 P.M. | Anaerobic Plate Count/gm | 69,000 | 56,000 | 15,000,000 | 38,000,000 |
| 5/3/06 4 P.M. | Aerobic Plate Count/gm | 8,000 | 7,000 | 28,000,000 | 38,000,000 |
| 5/3/06 4 P.M. | Anaerobic Plate Count/gm | 260,000 | 310,000 | 27,000,000 | 45,000,000 |
| 5/4/06 4 P.M. | Aerobic Plate Count/gm | 120,000 | 120,000 | 21,000,000 | 21,000,000 |
| 5/4/06 4 P.M. | Anaerobic Plate Count/gm | 270,000 | 490,000 | 23,000,000 | 23,000,000 |

* Reference: Official Methods of Analysis of AOAC International, Ch.17, 17th edition, 2000. Bacteriological Analytical Manual By AOAC, 8th edition, 1998 Revision A.

Table 3B. The color (a* value) profile of ground beef samples abused at 21°C (70°F) 8 hours under fluorescent light & stored at refrigeration temp (4°C, 39.2°F).

| TESTING TIME | High Ox G.B. Sample # 1&2 (96% Lean, sell by 5/4/06) | CO Packed G.B. Sample # 1&2 (93% Lean, use or freeze by 5/9/06) |
|---|---|---|
| 4/27/06 12 P.M. | 25.53±1.76 | 26.44±1.04 |
| 4/27/06 8 P.M. | 19.41±3.34 | 27.40±2.21 |
| 4/28/06 4 P.M. | 20.37±0.57 | 27.09±1.06 |
| 4/29/06 4 P.M. | 19.32±0.54 | 26.18±2.27 |
| 4/30/06 4 P.M. | 19.26±1.77 | 28.84±0.83 |
| 5/1/06 4 P.M. | 19.11±3.03 | 28.32±1.44 |
| 5/2/06 4 P.M. | 20.18±0.79 | 29.27±0.54 |
| 5/3/06 4 P.M. | 19.98±0.59 | 28.63±0.74 |
| 5/4/06 4 P.M. | 18.698±1.30 | 27.734±1.48 |

Table 3C. The sensory evaluation of ground beef samples abused at 21°C (70°F) 8 hours under fluorescent light & stored at refrigeration temp (4°C, 39.2°F).

| TESTING TIME | **High Ox G.B.**<br>**Sample # 1&2**<br>**(96% Lean, sell by 5/4/06)** | **CO Packed G.B.**<br>**Sample # 1&2**<br>**(93% Lean, use or freeze by 5/9/06)** |
|---|---|---|
| 4/27/06 12 P.M. | Fresh beef aroma | Fresh beef aroma |
| 4/27/06 8 P.M. | Slight oxidized odor | Slight off odor, very slight sulfur odor |
| 4/28/06 4 P.M. | Slight oxidized odor | Very slight sulfur comp odor |
| 4/29/06 4 P.M. | Slight oxidized odor | Sulfur comp odor |
| 4/30/06 4 P.M. | Slight oxidized odor | Noticeable sulfur comp odor |
| 5/1/06 4 P.M. | Slight oxidized odor | Strong sulfur comp odor |
| 5/2/06 4 P.M. | Slight oxidized odor | Strong sulfur comp odor |
| 5/3/06 4 P.M. | Slight sour, oxidized odor | Very strong sulfur comp odor |
| 5/4/06 4 P.M. | Oxidized odor | Very strong sulfur comp odor |

Table 4. Preliminary Survey of Plate Counts of Commercial Ground Beef Samples

| ANALYSIS DATE | WHERE PURCHASED | PURCHASE DATE | SELL BY DATE | DAYS OF SHELF LIFE REMAINING | DANSENSOR O2 | DANSENSOR CO2 | PERCENT FAT | AEROBIC | ANAEROBIC | PACKAGE | CARBON MONOXIDE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5/9/2006 | A | 5/8/2006 | 5/16/2006 | 7 | 0.03 | 17.2 | 4 | 25,000 | 35,000 | MAP | YES |
| 5/9/2006 | A | 5/8/2006 | 5/16/2006 | 7 | 0 | 19.7 | 8 | 18,000 | 57,000 | MAP | YES |
| 5/9/2006 | A | 5/8/2006 | 5/17/2006 | 8 | 0.001 | 20.7 | 8 | 170,000 | 540,000 | MAP | YES |
| 5/9/2006 | A | 5/8/2006 | 5/9/2006 | 0 | 0 | 20.3 | 25 | 10,000 | 110,000 | MAP | YES |
| 5/9/2006 | A | 5/8/2006 | 5/9/2006 | 0 | 0 | 20.3 | 25 | 10,000 | 150,000 | MAP | YES |
| 5/9/2006 | A | 5/8/2006 | 5/11/2006 | 2 | 0 | 20.4 | 25 | 1,500,000 | 3,000,000 | MAP | YES |
| 5/9/2006 | A | 5/8/2006 | 5/16/2006 | 7 | 0.44 | 15.8 | 15 | 2,100,000 | 4,600,000 | MAP | YES |
| 5/9/2006 | B | 5/9/2006 | 5/18/2006 | 9 | 0 | 20.3 | 20 | 15,000 | 32,000 | MAP | YES |
| 5/9/2006 | B | 5/9/2006 | 5/20/2006 | 11 | 0 | 19 | 10 | 69,000 | 170,000 | MAP | YES |
| 5/9/2006 | C | 5/9/2006 | 5/13/2006 | 4 | 71.1 | 19.7 | 4 | 1,700 | 100 | MAP | NO |
| 5/9/2006 | C | 5/9/2006 | 5/15/2006 | 6 | 69.3 | 18.6 | 17 | 1,500 | 2,000 | MAP | NO |
| 5/9/2006 | D | 5/9/2006 | 5/10/2006 | 1 | 76.8 | 13.5 | 4 | 6,000 | 15,000 | MAP | NO |
| 5/9/2006 | D | 5/9/2006 | 5/10/2006 | 1 | 76.6 | 11.8 | 15 | 14,000 | 41,000 | MAP | NO |
| 5/9/2006 | D | 5/9/2006 | 5/13/2006 | 4 | 78.2 | 11.6 | 27 | 1,200,000 | 1,700,000 | MAP | NO |
| 5/9/2006 | D | 5/9/2006 | 5/15/2006 | 6 | 79.5 | 11.1 | 27 | 7,700 | 12,000 | MAP | NO |
| 5/9/2006 | D | 5/9/2006 | 5/16/2006 | 7 | 76.7 | 13.7 | 4 | 500 | 600 | MAP | NO |
| 5/9/2006 | D | 5/9/2006 | 5/16/2006 | 7 | 80 | 11.4 | 15 | 200 | 400 | MAP | NO |
| 5/9/2006 | C | 5/9/2006 | 5/10/2006 | 1 | NA | NA | 26 | 7,000 | 17,000 | Overwrap | NO |
| 5/9/2006 | E | 5/9/2006 | 5/11/2006 | 2 | NA | NA | 10 | 17,000 | 19,000 | Overwrap | NO |
| 5/9/2006 | E | 5/9/2006 | 5/11/2006 | 2 | NA | NA | 14 | 6,000 | 21,000 | Overwrap | NO |
| 5/9/2006 | F | 5/9/2006 | 5/11/2006 | 2 | NA | NA | | 34,000 | 10,000 | Overwrap | NO |
| 5/9/2006 | G | 5/9/2006 | 5/9/2006 | 0 | NA | NA | 27 | 54,000 | 51,000 | Paper Wrap | NO |
| 5/9/2006 | D | 5/9/2006 | 5/16/2006 | 7 | NA | NA | 7 | 3,900 | 3,700 | Chub | NO |
| 4/27/2006 | C | 4/27/2006 | 5/4/2006 | 7 | NA | NA | 4 | 1,300 | 500 | MAP | NO |
| 4/27/2006 | A | 4/27/2006 | 5/9/2006 | 12 | NA | NA | 4 | 4,300 | 6,800 | MAP | YES |
| 4/27/2006 | A | 4/27/2006 | 5/9/2006 | 12 | NA | NA | 7 | 210,000 | 200,000 | MAP | YES |
| 4/27/2006 | A | 4/27/2006 | 5/4/2006 | 7 | NA | NA | 7 | 530,000 | 3,400,000 | MAP | YES |
| 4/27/2006 | A | 4/27/2006 | 5/2/2006 | 5 | NA | NA | 7 | 3,900,000 | 12,000,000 | MAP | YES |
| 4/17/2006 | A | 4/15/2006 | 4/18/2006 | 1 | NA | NA | 8 | 2,750,000 | 3,350,000 | MAP | YES |
| 4/17/2006 | C | 4/16/2006 | 4/23/2006 | 6 | NA | NA | 20 | 1,000 | 1,000 | MAP | NO |

* Reference: Official methods of Analysis of AOAC International, Ch 17, 17th edition, 2000. Bacteriological Analytical Manual By AOAC, 8th edition. 1998 Revision