HACCP Implementation: *Salmonella* Compliance Test Results January 26, 1998 to January 24, 2000

U.S. Department of Agriculture
Food Safety and Inspection Service
Office of Public Health and Science
Emerging Pathogens and
Zoonotic Diseases Division

I. Background

The Food Safety and Inspection Service is the agency within the U.S. Department of Agriculture responsible for ensuring the safety, wholesomeness, and accurate labeling of meat, poultry, and egg products. On July 25, 1996, FSIS issued its landmark rule, Pathogen Reduction; Hazard Analysis and Critical Control Point (HACCP) Systems.

The Pathogen Reduction and HACCP rule: (1) requires all meat and poultry plants to develop and implement a system of preventive controls, known as HACCP, to improve the safety of their products, (2) sets pathogen reduction performance standards for *Salmonella* that slaughter plants and plants producing raw ground products must meet, (3) requires all meat and poultry plants to develop and implement written standard operating procedures for sanitation, and (4) requires meat and poultry slaughter plants to conduct microbial testing for generic *E. coli* to verify the adequacy of their process controls for the prevention of fecal contamination. Implementation of the rule began on January 27, 1997. Large plants, which are those establishments employing 500 or more employees, became subject to the *Salmonella* performance standards on January 26, 1998. Small plants, which are those establishments employing between 10 and 499 employees, became subject to the *Salmonella* performance standards on January 25, 1999.

II. Sample Collection

In accordance with the Pathogen Reduction and HACCP rule, each establishment must meet product-specific *Salmonella* performance standards. *Salmonella* samples are collected by federal inspection personnel and analyzed in one of three agency laboratories.

To determine whether plants meet the *Salmonella* performance standards for products covered under the Pathogen Reduction and HACCP rule, the agency has codified the maximum number of samples that can be positive for *Salmonella* in a statistically-based set of samples. These *Salmonella* performance standards are found at 9 CFR §§ 310.25(b) and 381.94(b). The number of samples in a sample set varies by product and represents the number of samples that FSIS collects and analyzes for *Salmonella* before

determining whether the performance standard is met. The codified maximum number of samples allowed to be positive in a sample set provide an 80% probability of passing when the establishment is operating at the standard. Plants are typically sampled under one of four sequence codes: A, B, C or D. Most plants subject to one of the *Salmonella* performance standards are sampled under code A. If a plant fails sample set A, it must initiate corrective action and is then targeted for a second sample set under sequence code B. If a plant passes that set, it is returned to routine testing status (code A) for the next sample set. If a plant fails the second sample set, it must reassess its HACCP plan and is then tested for a third time under sequence code C to determine whether its changes to the HACCP plan have been effective. If a plant exceeds the maximum positives allowed in this set, FSIS issues a Notice of Intended Enforcement, and inspection services will be suspended. If a plant that has failed a third consecutive sample set takes action to correct the HACCP system and other measures to reduce the prevalence of pathogens, the suspension of inspection services may be held in abeyance. In these cases, a subsequent sample set is begun under sequence code D to determine whether these changes have been effective.

Between January 26, 1998, and January 24, 2000, federal inspectors collected samples for *Salmonella* analysis from 215 large plants and 498 small plants that produced one of seven products: broilers, hogs, cows and bulls, steers and heifers, ground beef, ground turkey, and ground chicken. The agency conducted 44,272 analyses for *Salmonella* on samples collected from these 713 large and small plants during the first two years of HACCP pathogen reduction testing. These 44,272 total analyses are comprised of samples from products in code A, B, and C sample sets. Of these 44,272 total analyses, 40,974 analyses were from these seven product categories when plants were tested in code A sets, 2,812 analyses were from plants tested in code B sets, and 486 were from plants tested in code C sets. This report presents results from 673 sample sets (35,677 analyses) that were completed by January 24, 2000, showing overall results by product, as well as comparison of routine samples (code A) with samples collected after corrective action following a failed set (code B), and comparison of first and second-year performance for large plants.

III. Summary Results

Results from two years of the large and small plant *Salmonella* testing program from January 26, 1998, through January 24, 2000, are available for all product classes with a *Salmonella* performance standard: broilers, hogs, cows and bulls, steers and heifers, ground beef, ground chicken, and ground turkey. The agency is releasing for the first time summary results from plants that slaughter steers and heifers and plants that produce ground chicken.

For large and small plants combined, *Salmonella* prevalence in plants that have completed at least one code A sample set was lower following the initial two years of HACCP implementation than in baseline data collection programs and surveys conducted before HACCP implementation for each of these seven products (Table 1). In broilers,

Salmonella prevalence was 20% in pre-HACCP baseline studies, and 11.4% after HACCP implementation. In hogs, Salmonella prevalence was 8.7% in pre-HACCP baseline studies, and 7.9% after HACCP implementation. In cows and bulls, Salmonella prevalence was 2.7% in pre-HACCP baseline studies, and 2.2% after HACCP implementation. In steers and heifers, Salmonella prevalence was 1.0% in pre-HACCP baseline studies, and 0.2% after HACCP implementation. In ground beef, Salmonella prevalence was 7.5% in pre-HACCP baseline studies, and 4.4% after HACCP implementation. In ground chicken, Salmonella prevalence was 44.6% in pre-HACCP baseline studies, and 16.2% after HACCP implementation. In ground turkey, *Salmonella* prevalence was 49.9% in pre-HACCP baseline studies, and 33.3% after HACCP implementation. Although it is unlikely that all of these reductions are solely attributable to the implementation of HACCP, the agency nevertheless finds these results encouraging.

Most plants, both large and small, meet or exceed the performance standards. The percentage of complete sample sets that met the performance standards varied by commodity and ranged from 100% passing for steers/heifers and ground chicken to 77% passing for hogs (Table 2). The overall passing rate was 87% of 673 complete sample sets. *Salmonella* prevalence for large and small plants is lower than the performance standard for all commodities except for small hog plants. Analysis of prevalence distribution shows the effect of individual plants with atypically high prevalence on overall prevalence for each commodity (Appendix A). For broilers, ground turkey and hogs, plants that failed the first sample set (code A) were less likely to pass a second sample set (code B) than were plants that passed the first time (Appendix B, table 2B).

The agency is encouraged that most plants achieve the performance standards. While plants failing to meet the performance standards are few in number, they may benefit from targeted outreach and technical assistance in helping them meet the performance standard in subsequent sample sets.

IV. Product Specific Results

Large plants have been subject to the *Salmonella* performance standards since January 26, 1998. Accordingly, many of these plants have completed more than one sample set. That is, in large plants the number of complete sample sets exceeds the number of plants tested. These large plant results will be reported as *Salmonella* prevalence or performance standard passing percentage in complete sample sets. Because most small plants have not completed more than one sample set, in small plants, the number of sample sets is equal to the number of plants tested.

Broilers

Establishments that slaughter broilers must meet the 20% broiler *Salmonella* performance standard found at 9 CFR 381.94(b). For broilers, this equates to a maximum of 12 *Salmonella* positive samples in a 51-sample set. Plants that exceed 12 positive

Salmonella samples in the 51-sample set must initiate corrective action to meet the performance standard.

Between January 26, 1998 and January 24, 2000, the agency collected and analyzed 11,404 total carcass rinse samples for *Salmonella* from 129 large broiler plants. Of the 129 large broiler plants tested during this time period, 122 completed their first code A set and 67 completed their second code A set, for a total of 189 complete code A sample sets (Table 3). In these 189 complete sets, the *Salmonella* prevalence was 10.3% (n=9,639) compared to 20% in pre-HACCP baseline studies (Table 4). The *Salmonella* prevalence in the 6,222 broiler carcass rinse samples from the first complete code A sample set was 11.0%. The *Salmonella* prevalence in the 3,417 broiler carcass rinse samples from the 67 plants with complete second code A sample set was 9.0%. Although comparisons between *Salmonella* prevalence during compliance testing and previous baseline studies must be done cautiously, the agency finds these results encouraging.

Of the 189 complete code A sample sets from large broiler plants, 171 (91%) met the broiler *Salmonella* prevalence performance standard (Table 3). In the 189 sample sets, the prevalence of *Salmonella* ranged from 0% to 47.1% (Table 5). Of the 171 sample sets that met the performance standard, 119 (70%) had a *Salmonella* prevalence of less than 10% in complete sample sets, while 70 (41%) had a *Salmonella* prevalence of less than 5% in complete sample sets. Of the 18 sample sets that did not meet the *Salmonella* performance standard, 9 had a *Salmonella* prevalence of less than 30%.

A second sample set has been completed for 76 large broiler plants. *Salmonella* prevalence and compliance with the performance standard differ for second sets depending upon the outcome of the first set. For 67 plants that passed the first set, *Salmonella* prevalence for the second code A set was 9.0%, compared with 21.4% for 9 plants that had failed the first set and were sampled for the second time as code B sample sets (Appendix B, Table 1B). Of those plants that passed the first set, 93% also passed the second code A set; in contrast, of the 9 plants that failed initially, 4 plants, or 44%, also failed to meet the performance standard on the second, code B set (Appendix B, Table 2B). While the number of plants failing to meet the standard with each sample set is small, the agency is concerned that a few plants might have consistent difficulty meeting the standard. It is the agency's intent to provide technical assistance to these plants to help them take effective corrective actions.

Between January 25, 1999 and January 24, 2000, the agency collected and analyzed 2,652 carcass rinse samples for *Salmonella* from 49 small broiler plants. Of these plants, 43 completed their first code A set (Table 6). The *Salmonella* prevalence in the 2,193 broiler carcass rinse samples from the first complete code A sample set was 16.3% compared to 20% in pre-HACCP baseline studies (Table 7). Summary results from second sample sets in small broiler slaughter plants are insufficient to report at this time. Although comparisons between *Salmonella* prevalence during the first year of small plant compliance testing and previous baseline studies must be done cautiously, the agency finds these results encouraging.

Of these 43 small broiler complete code A sample sets, 34 (79%) met the broiler *Salmonella* performance standard (Table 6). In these plants with complete sample sets, the prevalence of *Salmonella* ranged from 0% to 70.6% (Table 8). Of the 34 sample sets that met the performance standards, 21 (62%) had a *Salmonella* prevalence of less than 10% in complete sample sets, while 12 (35%) had a *Salmonella* prevalence of less than 5% in complete sample sets. Follow-up *Salmonella* testing in 7 of the broiler slaughter plants that did not meet the performance standard has begun.

For large plants, the first sample set was typically completed in the first year of operation under the HACCP program, and the second set (whether code A or B sets) was completed in the second year of operation under HACCP. Of 76 large plants with completed first and second sets, *Salmonella* prevalence was 10.9% for first sets, and 10.4% for second sets (Appendix B, Table 3B). These data correspond to prevalence for large plants in their first and second years of operation under HACCP.

Sample sets were collected as code C samples for 7 large and small broiler plants that failed the first two sample sets. At this time, four plants have passed, and testing is in progress for three.

The agency is interested in the relative compliance outcomes for plants by their size, and whether or not they were compliant on a prior sample set. Distributions of prevalence for all large and small broiler plants in the second HACCP year, Jan 25, '99 through Jan 24, '00, are depicted in Appendix A, Figure 1A. Large plants that passed a sample set the prior year show the best outcome. Small plants show a greater range of prevalence rates (Appendix A, Figure 1A). Large plants that failed the prior sample set do not show the trend toward very low prevalence seen for the other two plant types. The agency intends to use this information to better target technical assistance.

Hogs

Establishments that slaughter hogs must meet the 8.7% hog *Salmonella* performance standard found at 9 CFR 310.25(b). For hogs, this equates to a maximum of 6 positive *Salmonella* samples in a 55-sample set. Plants that exceed 6 positive *Salmonella* samples in the 55-sample set must initiate corrective action to meet the performance standard. In this report, references to "hogs" for baseline and compliance sampling refer to market hogs, or barrows and gilts.

Between January 26, 1998 and January 24, 2000, the agency collected and analyzed 2,978 carcass sponge samples for *Salmonella* from 32 large hog plants. Of the 32 large hog plants tested during this time period, 32 completed the first code A set and 13 completed the second A set for a total of 45 complete A sets (Table 3). In these 45 complete sets, the *Salmonella* prevalence was 4.4% (n=2,475) compared to 8.7% in pre-HACCP baseline studies (Table 4). The *Salmonella* prevalence in the 1,760 hog carcass sponges from the first complete A sample sets was 5.5%. The *Salmonella* prevalence in the 715

hog carcass sponges from the second complete code A sample sets was 2.0%. Although comparisons between *Salmonella* prevalence during compliance testing and previous baseline studies must be done cautiously, the agency finds these results encouraging.

Of these 45 complete sample sets from large hog plants, 39 (87%) met the hog *Salmonella* prevalence performance standard (Table 3). In the 45 sample sets, the prevalence of *Salmonella* ranged from 0% to 45.5% (Table 9). Of the 39 sample sets that passed the performance standard, 35 (90%) had a *Salmonella* prevalence of less than 5%. Of the 6 sample sets that did not meet the performance standard, 4 had a *Salmonella* prevalence between 11 and 15%.

A second sample set has been completed for 18 large hog plants. *Salmonella* prevalence and compliance with the performance standard differ for second sets depending upon the outcome of the first set. For 13 plants that passed the first set, *Salmonella* prevalence for the second code A set was 2.0%, compared with 17.5% for 5 plants that had failed the first set and that were sampled for the second time as code B sets (Appendix B, Table 1B). Of those plants that passed the first set, 100% also passed the second code A set; in contrast, of the 5 plants that failed initially, 2 plants, or 40%, also failed to meet the performance standard on the second, code B set (Appendix B, Table 2B). While the number of plants failing to meet the standard with each sample set is small, the agency is concerned that a few plants may have consistent difficulty meeting the standard. It is the agency's intent to provide technical assistance to these plants to help them take effective corrective actions.

Between January 25, 1999 and January 24, 2000, the agency collected and analyzed 1,196 carcass sponge samples for *Salmonella* from 28 small hog plants. Of the 28 small hog plants tested during this time period, 15 completed their first code A set (Table 6). The *Salmonella* prevalence in the 825 hog carcass sponge samples from the first complete code A sample set was 18.2% compared to 8.7% in pre-HACCP baseline studies (Table 7). Results from second sample sets in small hog slaughter plants are insufficient to report at this time.

Of these 15 small hog plant complete sample sets, the prevalence of *Salmonella* ranged from 0% to 58.2% (Table 10). Of these 15 sample sets, 7 (47%) met the hog *Salmonella* prevalence performance standard (Table 6). Follow-up *Salmonella* testing in 4 of the small hog slaughter plants that did not meet the performance standard has begun.

For large plants, the first sample set was typically completed in the first year of operation under the HACCP program, and the second set (whether code A or B) was completed in the second year of operation under HACCP. Of large hog plants with completed first and second sets, *Salmonella* prevalence was 6.5% for first sets, and 6.3% for second sets (Appendix B, table 3B). These data correspond to prevalence for large plants in their first and second years of operation under HACCP.

Two large hog plants that failed two consecutive sample sets have completed and passed third code C sample sets.

The agency is interested in the relative compliance outcomes for plants by their size, and whether or not they were compliant on a prior sample set. Distributions of prevalence for all large and small hog plants in the second HACCP year, Jan 25, '99 through Jan 24, '00, are depicted in Appendix A, Figure 2A. Large plants that passed a sample set the prior year show the best outcome, while small plants show a greater range of prevalence rates. Large plants that failed the prior sample set do not show the trend toward very low prevalence seen for large plants that passed. The agency intends to use this information to better target technical assistance.

Ground Beef

Establishments that produce ground beef must meet the 7.5% ground beef *Salmonella* performance standard found at 9 CFR 310.25(b). For ground beef, this equates to a maximum of 5 positive *Salmonella* samples in a 53-sample set. Plants that exceed 5 positive *Salmonella* samples in the 53-sample set must initiate corrective action to meet the performance standard.

Between January 26, 1998, and January 24, 2000, the agency collected and analyzed 2,060 samples for *Salmonella* from 25 large ground beef producing plants. Of the 25 large ground beef producing plants tested during this time period, 22 completed their first code A set and 10 completed their second A set for a total of 32 complete A sets (Table 3). The *Salmonella* prevalence in the 1,696 ground beef samples from the first and second complete code A sample sets was 5.8% compared to 7.5% in pre-HACCP baseline studies (Table 4). The *Salmonella* prevalence in the 1,166 ground beef samples from the first complete code A sample set was 5.2%. The *Salmonella* prevalence in the 530 ground beef samples from the 10 plants with complete second code A sample sets was 7.4%.

Of these 32 complete sample sets from large ground beef producing plants, 28 (88%) met the ground beef *Salmonella* prevalence performance standard (Table 3). In the 32 complete code A sample sets, the prevalence of *Salmonella* ranged from 0% to 47.2% (Table 11). Of these 28 sample sets, 23 (82%) had a *Salmonella* prevalence of less than 5%.

A second sample set has been completed in 11 large ground beef plants. Ten plants met the performance standard, along with one plant sampled a second time under code B following a failed sample set in the first year (Appendix B, Tables 1B, 2B and 3B). The agency is encouraged that all large ground beef plants have now demonstrated the ability to meet the performance standard. Follow-up *Salmonella* testing in one plant that did not meet the performance standard on its second A set has begun.

Between November 1998 and January 24, 2000, the agency collected and analyzed 18,160 samples for *Salmonella* from 356 small ground beef producing plants. Of the 356 small ground beef producing plants tested during this time period, 274 completed their first code A set (Table 6). The *Salmonella* prevalence in the 14,522 ground beef samples from the first complete code A sample set was 4.3% compared to 7.5% in pre-HACCP baseline studies (Table 7). Although comparisons between *Salmonella* prevalence during compliance testing and previous baseline studies must be done cautiously, the agency finds these results encouraging.

In the 274 small ground beef-producing plants with complete sample sets, the prevalence of *Salmonella* ranged from 0% to 47.2% (Table 12). Of these 274 ground beef producing plants, 239 (87%) met the 7.5% performance standard (Table 6). Of these 239 plants, 193 (81%) had a *Salmonella* prevalence of less than 5% in complete sample sets. Follow-up *Salmonella* testing in 27 small ground beef producing plants that did not meet the performance standard has begun.

For large plants, the first sample set was typically completed in the first year of operation under the HACCP program, and the second set (whether code A or B) was completed in the second year of operation under HACCP. Of large ground beef producing plants with completed first and second sets, *Salmonella* prevalence was 4.8% for first sets, and 7.6% for second sets (Appendix B, table 3B). These data correspond to prevalence for large plants in their first and second years of operation under HACCP. The apparent increased overall prevalence is explained by one large plant with a prevalence of 47.2%. Eight of 9 remaining plants had prevalence below 5%, and all 9 met the performance standard.

One large and 7 small ground beef producing plants failed two consecutive sample sets. One small plant has passed a subsequent code C sample set, while two small plants failed and have been evaluated for enforcement action while they undergo sampling as code D sample sets. Testing under code C is ongoing in the remaining plants.

The agency is interested in the relative compliance outcomes for plants by their size, and whether or not they were compliant on a prior sample set. Distributions of prevalence for all large and small ground beef plants in the second HACCP year, Jan 25, '99 through Jan 24, '00, are depicted in Appendix A, Figures 3A and 4A. The agency is encouraged that most large and small ground beef plants met the performance standard at low prevalence.

Ground Turkey

Establishments that produce ground turkey must meet the 49.9% ground turkey *Salmonella* performance standard found at 9 CFR 381.94(b). For ground turkey, this equates to a maximum of 29 positive *Salmonella* samples in a 53-sample set. Plants that

exceed 29 *Salmonella* positive samples in the 53-sample set must initiate corrective action to meet the performance standard.

Between January 26, 1998, and January 24, 2000, the agency collected and analyzed 1,878 samples for *Salmonella* from 21 large ground turkey producing plants. Of the 21 large ground turkey producing plants tested during this time period, 20 completed their first code A set and 9 completed their second A set for a total of 29 complete A sets (Table 3). The *Salmonella* prevalence in the 1,537 ground turkey samples from the first and second complete A sample sets was 34.6% compared to 49.9% in pre-HACCP baseline studies (Table 4). The *Salmonella* prevalence in the 1,060 ground turkey samples from the 20 plants with first complete code A sample set was 36.2%. The *Salmonella* prevalence in the 477 ground turkey samples from the 9 plants with complete second code A sample sets was 31.0%. Although comparisons between *Salmonella* prevalence during compliance testing and previous baseline studies must be done cautiously, the agency finds these results encouraging.

Of these 29 complete sample sets from ground turkey producing plants, 27 (93%) met the ground turkey *Salmonella* prevalence performance standard (Table 3). In the 29 complete sample sets, the prevalence of *Salmonella* ranged from 11.3% to 67.9% (Table 13).

A second sample set has been completed for 11 large ground turkey plants. *Salmonella* prevalence and compliance with the performance standard differ for second sets depending upon the outcome of the first set. For 9 plants that passed the first set, *Salmonella* prevalence for the second code A set was 31.0%, compared with 51.9% for 2 plants that had failed the first set and were sampled for the second time as B sets (Appendix B, Table 1B). Of those plants that passed the first set, 100% also passed the second code A set; in contrast, of the 2 plants that failed initially, 1 plant also failed to meet the performance standard on the second, code B set (Appendix B, Table 2B). While the number of plants failing to meet the standard with each sample set is small, the agency is concerned that a few plants might have consistent difficulty meeting the standard. It is the agency's intent to provide technical assistance to these plants to help them take effective corrective actions.

Between January 25, 1999, and January 24, 2000, the agency collected and analyzed 363 samples for *Salmonella* from 11 small ground turkey producing plants. There are an insufficient number of these plants with completed sample sets to report at this time.

For large ground turkey producing plants, the first sample set was typically completed in the first year of operation under the HACCP program, and the second set (whether code A or B) was completed in the second year of operation under HACCP. Of 11 large plants with completed first and second sets, *Salmonella* prevalence was 36.4% for first sets, and 34.8% for second sets (Appendix B, Table 3B). These data correspond to prevalence for large plants in their first and second years of operation under HACCP.

One large ground turkey producing plant that failed two consecutive sample sets is undergoing sampling as a code C set.

The agency is interested in the relative compliance outcomes for plants by their size, and whether or not they were compliant on a prior sample set. Distributions of prevalence for all large and small ground turkey plants in the second HACCP year, Jan 25, '99 through Jan 24, '00, are depicted in Appendix A, Figure 5A. Most large and small plants met the performance standard.

Cows and Bulls

Establishments that slaughter cows and bulls must meet the 2.7% *Salmonella* performance standard found at 9 CFR 310.25(b). For these livestock, this equates to a maximum of 2 positive *Salmonella* samples in a 58-sample set. Plants that exceed 2 positive *Salmonella* samples in the 58-sample set must initiate corrective action to meet the performance standard.

There are an insufficient number of large cow and bull slaughter plants subject to the *Salmonella* performance standard to report summary results at this time.

Between January 25, 1999 and January 24, 2000, the agency collected and analyzed 1,875 carcass sponge samples for *Salmonella* from 37 small cow and bull slaughter plants. Of the 37 small cow and bull plants tested during this time period, 22 completed their first code A set (Table 6). For the 22 plants with complete first code A sets, the *Salmonella* prevalence was 2.3% (n=1276) compared to 2.7% in pre-HACCP baseline studies. Although comparisons between *Salmonella* prevalence during compliance testing and previous baseline studies must be done cautiously, the agency finds these results encouraging.

In the 22 small cow and bull slaughter plants with complete sample sets, 17 (77%) met the cow and bull *Salmonella* prevalence performance standard (Table 6). In these 22 sample sets, the prevalence of *Salmonella* ranged from 0% to 10.3% (Table 14).

One small cow and bull slaughter plant has failed three consecutive sample sets and has been evaluated for enforcement action while it undergoes sampling as a code D sample set.

Distributions of prevalence for large and small cow and bull slaughter plants in the second HACCP year, Jan 25, '99 through Jan 24, '00, are depicted in Appendix A, Figure 7A.

Steers and Heifers

Establishments that slaughter steers and heifers must meet the 1.0% *Salmonella* performance standard found at 9 CFR 310.25(b). For these livestock, this equates to a

maximum of 1 positive *Salmonella* sample in an 82-sample set. Plants that exceed 1 positive *Salmonella* sample in the 82-sample set must initiate corrective action to meet the performance standard.

For steers and heifers, only combined large and small plant results are available at this time due to the relatively few plants in each size category. Between January 26, 1998 and January 24, 2000, the agency collected and analyzed 1,080 carcass sponge samples for *Salmonella* from 14 large or small steer and heifer plants. Of the 14 steer and heifer plants tested during this time period, there were 8 completed first or second code A sets representing 7 plants. For plants with complete first or second code A sets, the *Salmonella* prevalence was 0.2% (n=656) compared to 1.0% in pre-HACCP baseline studies (Table 1). Although comparisons between *Salmonella* prevalence during compliance testing and previous baseline studies must be done cautiously, the agency finds these results encouraging.

Of these 8 complete sample sets from steers and heifers, all 8 (100%) met the *Salmonella* prevalence performance standard (Table 2). In the 8 sample sets, the prevalence of *Salmonella* ranged from 0% to 1.2%. For 7 of the 8 sample sets, zero of the 82 samples were positive for *Salmonella*. In the remaining 82-sample set, one sample was positive.

Ground Chicken

Establishments that produce ground chicken must meet the 44.6% ground chicken *Salmonella* performance standard found at 9 CFR 381.94(b). For ground chicken, this equates to a maximum of 26 positive *Salmonella* samples in a 53-sample set. Plants that exceed 26 *Salmonella* positive samples in the 53-sample set must initiate corrective action to meet the performance standard.

For ground chicken producing plants, only combined large and small plant results are available at this time due to the relatively few plants in each size category. Between January 26, 1998 and January 24, 2000, the agency collected and analyzed 424 samples for *Salmonella* from 10 large or small ground chicken producing plants. Testing to date is limited to first sample sets. Of the10 ground chicken producing plants tested during this time period, 7 completed their first code A set. For the 7 plants with complete first code A sets, the *Salmonella* prevalence was 16.2% (n=371) compared to 44.6% in pre-HACCP baseline studies (Table 1). Although comparisons between *Salmonella* prevalence during compliance testing and previous baseline studies must be done cautiously, the agency finds these results encouraging.

In these 7 plants, the prevalence of *Salmonella* ranged from 0% to 49.1% (Table 15). Of these 7 sample sets, all 7 (100%) met the ground chicken *Salmonella* prevalence performance standard (Table 2).

Distributions of prevalence for ground chicken producing plants in the second HACCP year, Jan 25, ’99 through Jan 24, ’00, are depicted in Appendix A, Figure 6A.

Table 1. Large and small plants, *Salmonella* prevalence in first and second complete sets. January 26, 1998 through January 24, 2000.

Class of Product	***Salmonella* Performance Standard (%)***	**Post-HACCP implementation *Salmonella* Prevalence (%, n=no. samples)**
Broilers	20.0%	11.4% (n=11,832)
Hogs	8.7%	7.9% (n=3,300)
Cows and Bulls	2.7%	2.2% (n=1,392)
Steers and Heifers	1.0%	0.2% (n=656)
Ground Beef	7.5%	4.4% (n=16,271)
Ground Chicken	44.6%	16.2% (n=371)
Ground Turkey	49.9%	33.3% (n=1,855)

*9 CFR §§ 310.25(b) and 381.94(b)

Table 2. Large and small plants, *Salmonella* compliance in first and second complete sets. January 26, 1998 through January 24, 2000.

Class of Product	**Number of Samples in Set**	**Maximum Number of Positives in Set**	**No. of Complete Sets**	**Percent (Number) of Sets Meeting Performance Standard***
Broilers	51	12	232	88% (205)
Hogs	55	6	60	77% (46)
Cows and Bulls	58	2	24	79% (19)
Steers and Heifers	82	1	8	100% (8)
Ground Beef	53	5	307	87% (268)
Ground Chicken	53	26	7	100% (7)
Ground Turkey	53	29	35	91% (32)
Total			673	87% (585)

*9 CFR §§ 310.25(b) and 381.94(b)

Table 3. Large plants, *Salmonella* compliance in first and second complete sets. January 26, 1998 through January 24, 2000.

Class of Product*	**Number of Samples in Set**	**Maximum Number of Positives in Set**	**Number of Complete Sets**	**Percent (Number) Meeting Performance Standard****
Broilers	51	12	189	90% (171)
Hogs	55	6	45	87% (39)
Ground Beef	53	5	32	88% (28)
Ground Turkey	53	29	29	93% (27)
Total			295	90% (265)

*Reflects testing results from products with 10 or more complete sample sets

**9 CFR §§ 310.25(b) and 381.94(b)

Table 4. Large plants, *Salmonella* prevalence in first and second compliance sets. January 26, 1998 through January 24, 2000.*

Class of Product	***Salmonella* Performance Standard (%)****	**Post-HACCP implementation *Salmonella* Prevalence (%, n=no. samples)**
Broilers	20.0%	10.3% (n=9,639)
Hogs	8.7%	4.4% (n=2,475)
Ground Beef	7.5%	5.8% (n=1,696)
Ground Turkey	49.9%	34.6% (n=1,537)

*Reflects testing results from products with 10 or more complete sample sets

**9 CFR §§ 310.25(b) and 381.94(b)

Table 5. Large Broiler Plants. Distribution of *Salmonella* prevalence in 189 complete sample sets. January 26, 1998 to January 24, 2000.

Percent *Salmonella* in 51 broiler carcass rinse samples*	**Number (%) of sample sets****
0 – 5%	70 (37.0%)
5.1 – 10	49 (25.9%)
10.1 – 15	26 (13.7%)
15.1 – 20	19 (10.1%)
20.1 – 23.6	7 (3.7%)
23.7 – 30	9 (4.8%)
30.1 – 35	1 (1.0%)
35.1 – 40	4 (2.1%)
40.1 – 45	3 (1.6%)
45.1 – 50	1 (1.0%)
Total	189 (100%)

* Less than 23.6% equates with the maximum number of positives at 9 CFR 381.95(b)

** Total percentage may not equal 100 due to rounding

Table 6. Small plant *Salmonella* compliance in the first complete sample set. January 25, 1999 through January 24, 2000.

Class of Product*	**Number of Samples in Set**	**Maximum Number of Positives in Set**	**Plants With Complete Sets**	**Percent (Number) Meeting Performance Standard****
Broilers	51	12	43	79% (34)
Hogs	55	6	15	47% (7)
Cows and Bulls	58	2	22	77% (17)
Ground Beef	53	5	274	87% (239)
Total			354	84% (297)

*Reflects testing results from products with 10 or more complete sample sets

**9 CFR §§ 310.25(b) and 381.94(b)

Table 7. Small plants, *Salmonella* prevalence in first complete sample set. January 25, 1999 through January 24, 2000.*

Class of Product	***Salmonella* Performance Standard (%)****	**Post-HACCP implementation *Salmonella* Prevalence (%, n=no. samples)**
Broilers	20.0%	16.3% (n=2,193)
Hogs	8.7%	18.2% (n=825)
Cows and Bulls	2.7%	2.3% (n=1,276)
Ground Beef	7.5%	4.3% (n=14,522)

*Reflects testing results from products with 10 or more complete sample sets

**9 CFR §§ 310.25(b) and 381.94(b)

Table 8. Small Broiler Plants. Distribution of *Salmonella* prevalence in 42 complete sample sets. January 25, 1999 to January 24, 2000.

Percent *Salmonella* in 51 broiler carcass rinse samples*	**Number (%) of sample sets****
0 – 5%	12 (28%)
5.1 – 10	9 (21%)
10.1 – 15	4 (9%)
15.1 – 20	6 (14%)
20.1 – 23.6	3 (7%)
23.7 – 30	1 (2%)
30.1 – 35	3 (7%)
35.1 – 40	1 (2%)
40.1 – 45	1 (2%)
45.1 – 50	1 (2%)
70.1 – 75	1 (2%)
Total	42 (100%)

* Less than 23.6% equates with the maximum number of positives at 9 CFR 381.95(b)

** Total percentage may not equal 100 due to rounding

Table 9. Large Hog Plants. Distribution of *Salmonella* prevalence in 45 complete sample sets. January 26, 1998 to January 24, 2000.

Percent of 55 hog carcass sponge samples with *Salmonella**	**Number (%) of large hog sample sets****
0 – 5.0%	35 (78%)
5.1 – 8.7	4 (9%)
8.8 – 11	0 (0%)
11.1 – 15	4 (9%)
15.1 – 20	1 (2%)
20.1 – 45	0 (0%)
45.1 – 50	1 (2%)
Total	45 (100%)

* Less than 11% equates with the maximum number of positives at 9 CFR 310.25(b)

** Total percentage may not equal 100 due to rounding

Table 10. Small Hog Plants. Distribution of *Salmonella* prevalence in 15 complete sample sets. January 25, 1999 to January 24, 2000.

Percent of 55 hog carcass sponge samples with *Salmonella**	**Number (%) of small hog sample sets****
0 – 5.0%	2 (13%)
5.1 – 8.7	3 (20%)
8.8 – 11	2 (13%)
11.1 – 15	1 (7%)
15.1 – 20	1 (7%)
20.1 – 25	1 (7%)
25.1 – 30	3 (20%)
30.1 – 35	0 (0%)
35.1 – 40	1 (7%)
40.1 – 55	0 (0%)
55.1 – 60	1 (7%)
Total	15 (100%)

* Less than 11% equates with the maximum number of positives at 9 CFR 310.25(b)

** Total percentage may not equal 100 due to rounding

Table 11. Large Ground Beef Producing Plants. Distribution of *Salmonella* prevalence in 32 complete sample sets. January 26, 1998 to January 24, 2000.

Percent of 53 ground beef samples with *Salmonella**	**Number (%) of large ground beef sample sets****
0 – 5.0%	23 (71.9%)
5.1 – 7.5	3 (9.4%)
7.6 – 10.0	2 (6.3%)
10.1 – 15	1 (3.1%)
15.1 – 20	1 (3.1%)
25.1 – 30	1 (3.1%)
30.1 – 45	0 (0.0%)
45.1 - 50	1 (3.1%)
Total	32 (100%)

* Less than 9.5% equates with the maximum number of positives at 9 CFR 310.25(b)

** Total percentage may not equal 100 due to rounding

Table 12. Small Ground Beef Producing Plants. Distribution of *Salmonella* prevalence in 274 complete sample sets. November 1998 to January 24, 2000.

Percent of 53 ground beef samples with *Salmonella**	**Number (%) of small ground beef sample sets****
0 – 5.0%	193 (70.4%)
5.1 – 7.5	16 (5.8%)
7.6 – 10.0	30 (10.9%)
10.1 – 15	18 (6.6%)
15.1 – 20	8 (2.9%)
20.1 – 25	7 (2.6%)
25.1 – 30	1 (0.4%)
30.1 – 45	0 (0.0%)
45.1 - 50	1 (0.4%)
Total	274 (100%)

* Less than 9.5% equates with the maximum number of positives at 9 CFR 310.25(b)

** Total percentage may not equal 100 due to rounding

Table 13. Large Ground Turkey Producing Plants. Distribution of *Salmonella* prevalence in 28 complete sample sets. January 26, 1998 to January 24, 2000.

Percent of 53 ground turkey samples with *Salmonella**	**Number (%) of large ground turkey sample sets****
10 – 15%	1 (3.6%)
15.1 – 20%	5 (17.9%)
20.1 – 25	5 (17.9%)
30 – 35	3 (10.7%)
35.1 – 40	6 (21.4%)
40.1 – 45	1 (3.6%)
45.1 – 50	4 (14.3%)
50.1 – 55	2 (7.1%)
65 – 70	1 (3.6%)
Total	28 (100%)

* Less than 55% equates with the maximum number of positives at 9 CFR 381.95(b)

** Total percentage may not equal 100 due to rounding

Table 14. Small Cow and Bull Plants. Distribution of *Salmonella* prevalence in 22 complete sample sets. January 25, 1999 to January 24, 2000.

Percent of 58 cow/bull carcass sponge samples with *Salmonella**	**Number (%) of small cow/bull sample sets****
0 – 5.0%	17 (77%)
5.1 – 10.0	4 (18%)
10.1 – 15	1 (5%)
Total	22 (100%)

* Less than 5% equates with the maximum number of positives at 9 CFR 310.25(b)

** Total percentage may not equal 100 due to rounding

Table 15. Large and Small Ground Chicken Producing Plants. Distribution of *Salmonella* prevalence in 7 complete sample sets. January 26, 1998 to January 24, 2000.

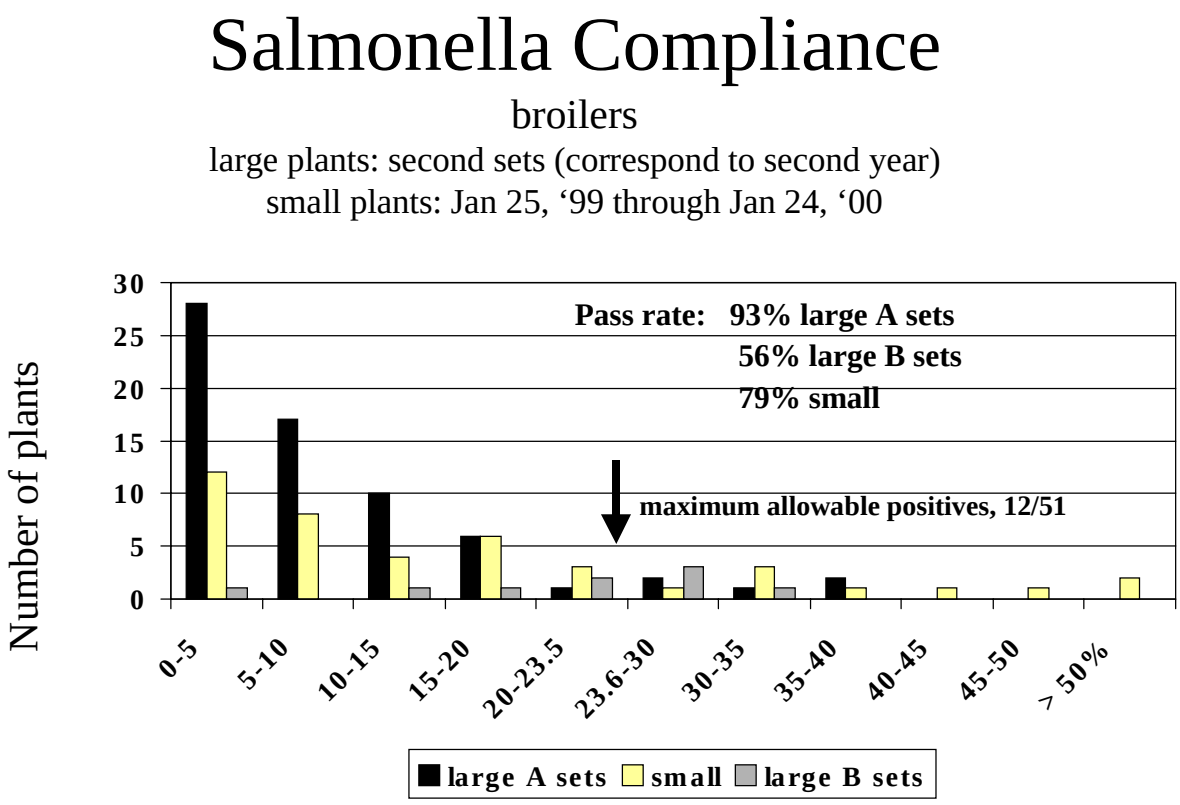
Percent of 53 ground chicken samples with *Salmonella**	**Number (%) of ground chicken sample sets****
0 – 5%	2 (29%)
5.1 – 10%	1 (14%)
10.1 – 15%	1 (14%)
15.1 – 20%	1 (14%)
20.1 – 25	0 (0%)
25.1 – 30%	1 (14%)
30.1 – 45	0 (0%)
45.1 – 50	1 (14%)
Total	7 (100%)

* Less than 50% equates with the maximum number of positives at 9 CFR 381.95(b)

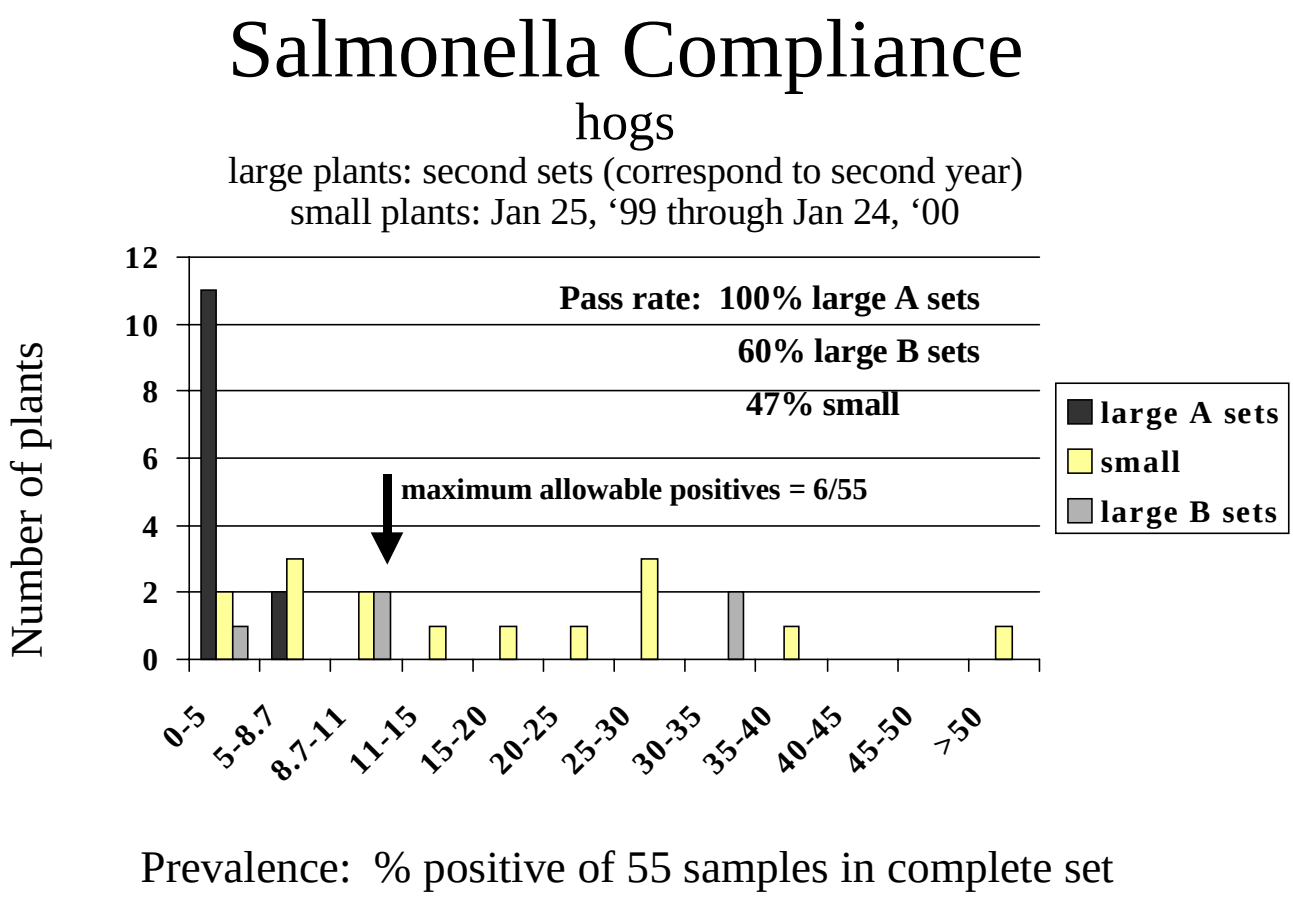
** Total percentage may not equal 100 due to rounding

Appendix A: Compliance of large and small plants with *Salmonella* performance standard in the second year of HACCP implementation

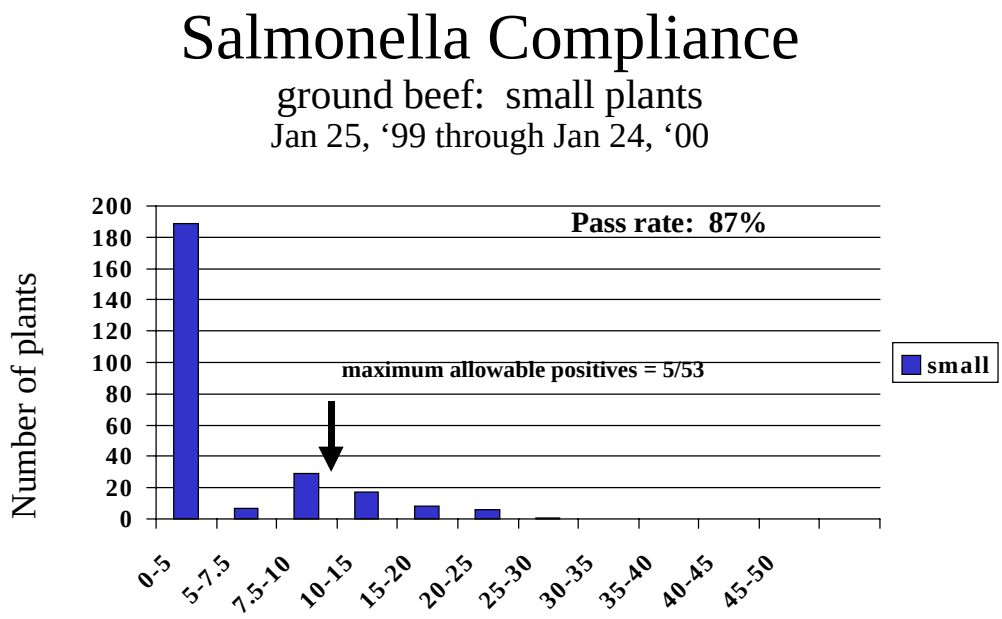
Figure 1A.



Appendix A, Figure 2A.

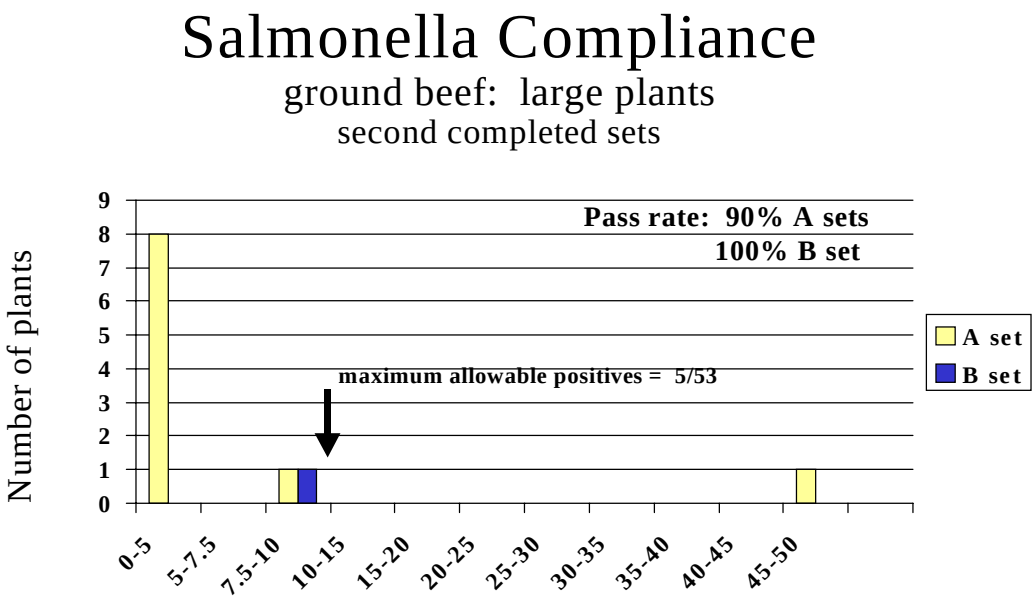


Appendix A, Figure 3A



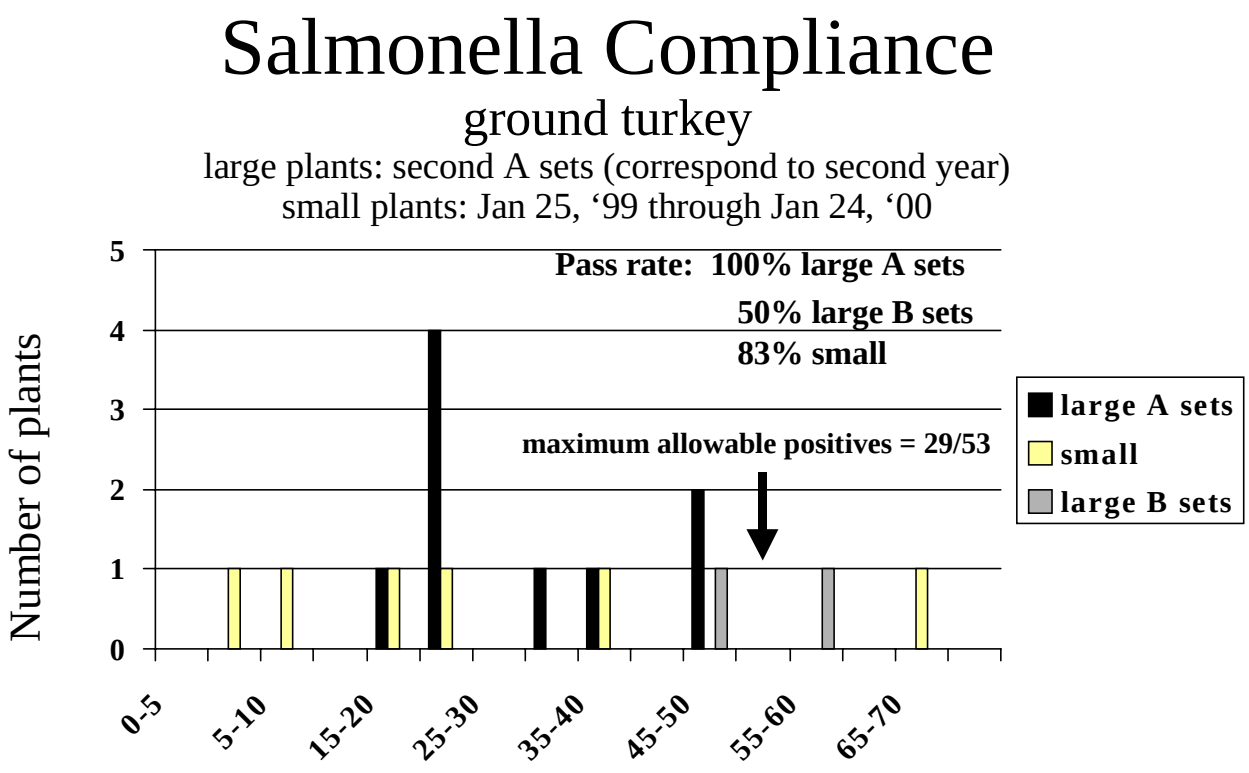
Prevalence: % positive of 53 samples in complete set

Figure 4A.

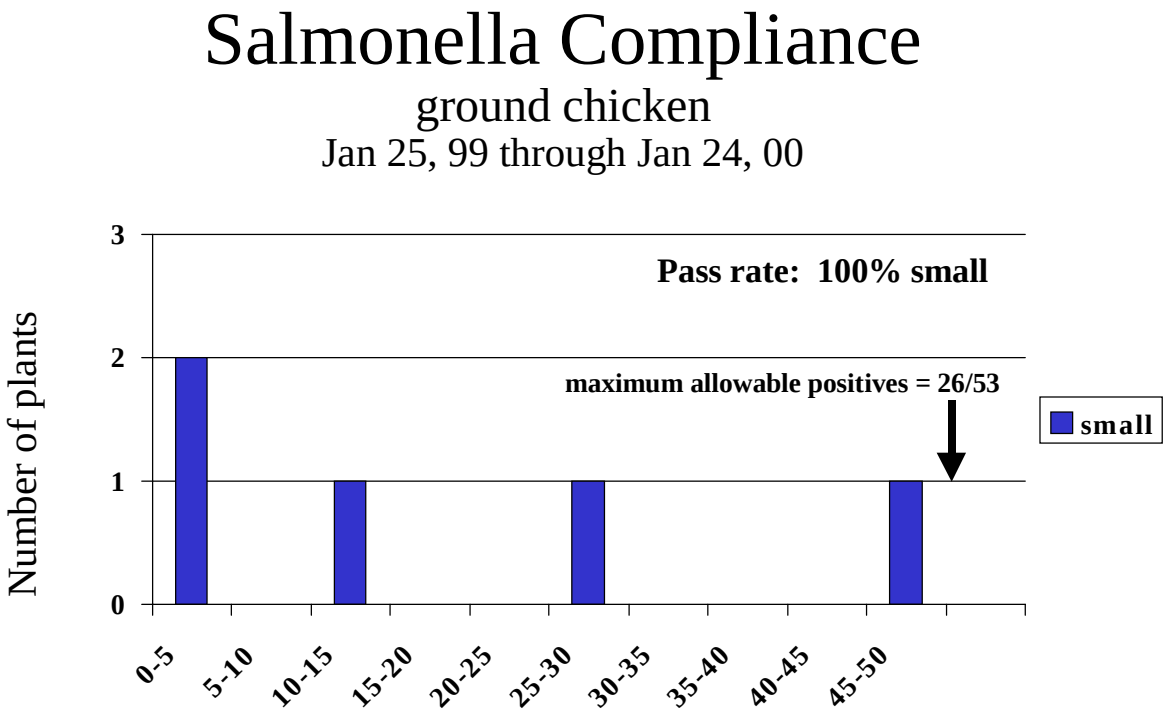


Prevalence: % positive of 53 samples in complete set

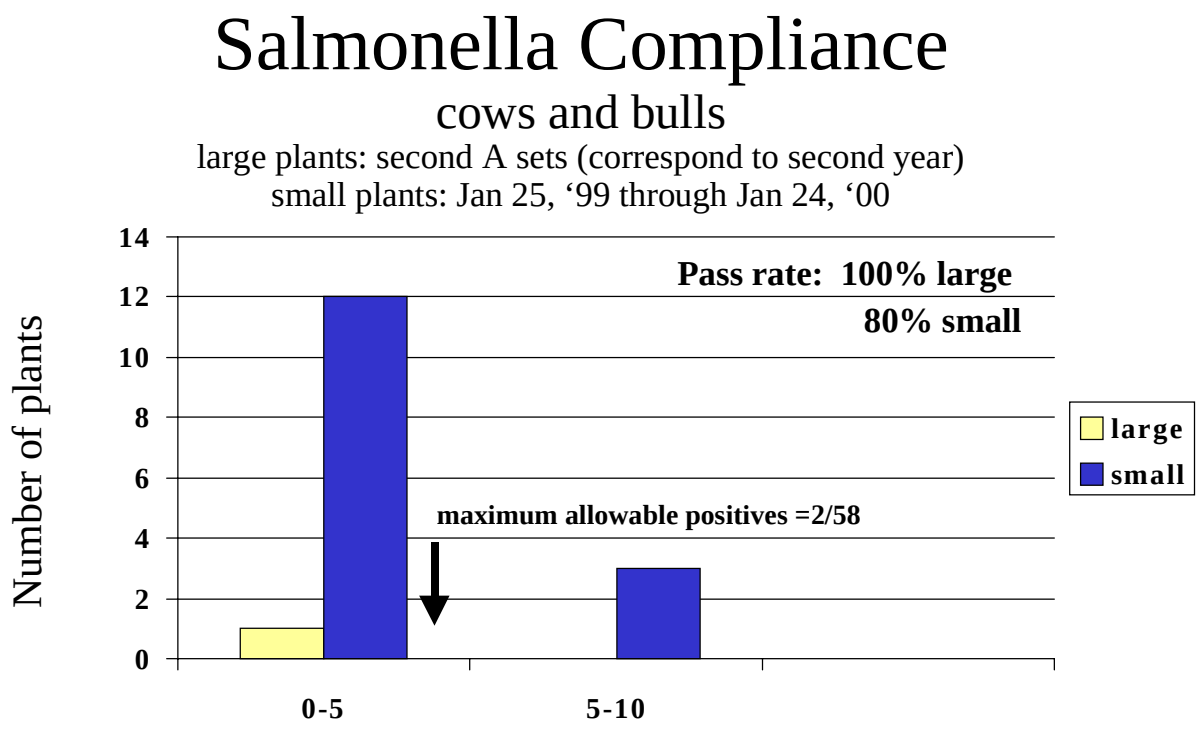
Appendix A, Figure 5A.



Appendix A, Figure 6A.



Appendix A, Figure 7A.



Prevalence: % positive of 58 samples in complete set

Appendix B: Comparison of first and second years of HACCP implementation

Table 1B. Prevalence of *Salmonella* in meat and poultry products: large plants with complete sample sets post–HACCP implementation:
number in parentheses = number of plants with complete sets

Product	Performance standard	First year (first A set)	Second A set	B set (following failed A set)
Broilers	20.0%	10.9% (76)	9.0% (67)	21.4% (9)
Hogs	8.7%	6.5% (17)	2.0% (13)	17.5% (5)
Ground beef	7.5%	4.8% (10)	7.4% (10)	9.4% (1)
Ground turkey	49.9%	36.4% (11)	31.0% (9)	51.9% (2)

Table 2B. Compliance for *Salmonella* sampling; percentage of large plants with completed sample sets meeting performance standard:
number in parentheses = number of plants with complete sets

Product	First year (first A set)	Second A set	B sets (following failed A set)
Broilers	91% (76)	93% (67)	56% (9)
Hogs	71% (17)	100% (13)	60% (5)
Ground beef	90% (10)	90% (10)	100% (1)
Ground turkey	91% (11)	100% (9)	50% (2)

Table 3B. Prevalence for large plants, first year vs. second year
number in parentheses = number of plants with complete sets

Product	Performance standard	First year (first A sets)	Second year A + B sets
Broilers	20.0%	10.9% (76)	10.4% (76)
Hogs	8.7%	6.5% (17)	6.3% (18)
Ground beef	7.5%	4.8% (10)	7.6% (11)
Ground turkey	49.9%	36.4% (11)	34.8% (11)