RESEARCH REPORT
PORK SAFETY

Title: Prevalence and Levels of Salmonella spp. on Retail Pork Cuts – **NPB #06-186**

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Institution: Food Safety Net Services.

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Industry Summary:

Objective: To examine retail pork products for presence and levels of *Salmonella* spp. to measure the overall impact of current industry practices for reduction of this foodborne pathogen, and further, assess the risk of foodborne illness related to *Salmonella* spp. upon consumption of retail pork products.

Study Approach: A total of 4,000 retail pork products were examined during January – March, 2007, from 4 locations in the Midwestern and Southwestern United States, including Green Bay, WI, Dallas, TX, San Antonio, TX and Phoenix, AZ. Four representative pork products were collected during this study, including enhanced pork chops, enhanced boneless pork roasts, un-enhanced (natural) pork chops and un-enhanced (natural) boneless pork roasts. Pork products were collected in a similar manner at each location for the first two-thirds of the sampling period. For the final, one-third of the collection period only enhanced products primarily from the Phoenix, AZ location were sampled based on the inability to recover *Salmonella* spp. from un-enhanced products, and further, on the limited number of positive samples recovered in enhanced products at the other 3 locations.

Retail samples were first screened for the presence of *Salmonella* spp. in sets of 5 per product type. If the sample set screened positive, further testing was performed on the individual samples associated with the set. In the event that an individual sample was determined to be positive for *Salmonella* spp., it was assessed for the estimated level of *Salmonella* spp. present per gram of product.

Findings: *Salmonella* spp. was found at a rate of 4.81%, or 13 out of 270 sets (5 samples per set) for both the enhanced pork chops and boneless pork roast sets. Upon further testing these products as individual samples, 18 out of a total of 1,350 samples (1.33%) of pork chops were positive for *Salmonella* spp. and 10 out of 1,350 samples (0.74%) of pork roasts. No *Salmonella* spp. was found in any of the un-enhanced (natural) products tested.

Geographically, 2 out of the 13 enhanced pork chop sample sets positive for *Salmonella* spp. were collected in Green Bay, WI, and the remaining were from Phoenix, AZ. One of the 13 pork roast sample sets positive for *Salmonella* spp. was collected in Dallas, TX while the remaining were

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collected in Phoenix, AZ. With regard to the 18 individual enhanced pork chop samples that tested positive for *Salmonella* spp., 3 were from samples collected in Green Bay, WI, and the remaining from Phoenix, AZ. Individual samples of enhanced boneless pork roast collected in Dallas, TX represented 1 out of the 10 that tested positive for *Salmonella* spp. while the remaining were from Phoenix, AZ.

The estimated levels of *Salmonella* spp. present on the products that tested positive were low, ranging from <0.3 to 0.72 per gram of product for enhanced pork chops, and <0.3 to 1.40 per gram of product for enhanced pork roasts.

Industry Implications: The results of this study demonstrate that the overall rate of *Salmonella* spp. on retail products acquired in the Midwestern and Southwestern United States is low based on the 0% recovery for un-enhanced products, and 0.74% to 4.81% for enhanced products, respectively, based on the individual or sample sets tested. Further, for those samples that tested positive for *Salmonella* spp., the estimated level of this microorganism was either undetectable (<0.3 per gram) or 1.40 per gram at the highest level. Therefore, it can be concluded based on this regional study that the overall risk of foodborne illness caused by *Salmonella* spp. on retail pork is minimal. Further evaluation of retail products from locations across the United States may be warranted to better capture the national prevalence and associated levels.

You may contact the Principal Investigator, Wendy Warren-Serna, Ph.D. by e-mail at wwarren@food-safetynet.com or by phone at 210-340-8870. Dr. Warren-Serna is located at the corporate facility in San Antonio, TX at 221 W. Rhapsody, San Antonio, TX 78216.

Scientific Abstract:

Overall purpose of this study was to determine the prevalence and levels of *Salmonella* spp. on retail pork products to better understand the impact of pathogen control practices at the processing level, and further, the overall risk of retail pork associated salmonellosis.

A total of 4,000 retail pork samples collected from 4 locations in the Midwestern and Southwestern United States, including Green Bay, WI, San Antonio, TX, Dallas, TX, and Phoenix, AZ, were analyzed for the presence and levels of *Salmonella* spp. using the PCR-BAX® System and USDA-FSIS cultural methods. Four product types were assessed, including enhanced and un-enhanced (natural) pork chops and boneless pork roasts over 11 weeks from January – March, 2007. Enhanced products were preferentially sampled beginning on the 7th sampling week due to the absence of confirmed positive *Salmonella* spp. for the un-enhanced products tested.

Samples were initially screened as a composite of 5 samples each per product type for a total of 800 composites. Of the composites tested, 4.81% of all enhanced pork chop (n = 13/270) and enhanced roast samples (n = 13/270) were confirmed positive for *Salmonella* spp. Positive composite samples were further evaluated by re-sampling and analysis of the associated individual samples. Based on the total number of individual samples per product type, 1.33% of enhanced pork chop (n=18/1,350) and 0.74% of enhanced pork roasts (n=10/1,350) were confirmed positive for *Salmonella* spp. A most probable number (MPN) analysis was subsequently performed on all positive individual samples and revealed low levels of Salmonella spp. ranging from lower than the detection limit of <0.30 MPN/gram to 0.72 MPN/gram for enhanced pork chops and 1.40 MPN/gram for enhanced boneless pork roasts, respectively.

Introduction:

The current incidence of salmonellosis reported by the Centers for Disease Control and Prevention is estimated at 1.4 million cases per year in the United States, and of those cases >500 are fatal.[1] As recent FoodNet data demonstrates that there is not a significant decrease on *Salmonella* infections, there has been increased concern for control of this foodborne pathogen.[2] In fact, USDA-FSIS has recently launched an initiative designed to control Salmonella in meat and poultry.[3] As such, current knowledge and understanding of the overall prevalence and levels of *Salmonella* spp. on retail pork products and further, associated salmonellosis risk is of interest to the pork industry. Thus, the overall purpose of this study was to examine a representative group of retail products for the presence of *Salmonella* spp. as well as overall levels when present.

A total of 4,000 retail pork products in 4 categories were examined during this study and included, enhanced and natural (un-enhanced) pork chops and boneless roasts. Test products were collected at various retail locations, as described in more detail below, from 4 U.S. cities, including: 1) Phoenix, Arizona; 2) San Antonio, Texas; 3) Dallas, Texas; and, 4) Green Bay, Wisconsin. Retail samples were forwarded to Food Safety Net Services (FSNS; San Antonio, TX) for detection and enumeration of *Salmonella* spp. as described in detail below in Materials and Methods.

Upon receipt, all test samples were further composited by product category into sets of five samples. This composite was initially screened for the presence of *Salmonella* spp. using a DNA-based detection system. Any presumptive positive composites were independently re-sampled and analyzed as individual samples using the same system. Any individual sample that screened positive was again, re-sampled and analyzed according to a most probable number (MPN) assay using the same detection system to estimate the associated level of *Salmonella* spp. present on the pork sample.

Objective:

To examine retail pork products for *Salmonella* spp. prevalence as a measurement of current industry practices for effective pathogen reduction, and further, provide baseline data for risk assessment purposes.

Materials and Methods:

Collection of test samples: Four product types were evaluated, including: 1) Natural (un-enhanced) pork chops; 2) Natural (un-enhanced) boneless pork roast; 3) Enhanced pork chops; and, 4) Enhanced, boneless pork roast. An initial target of 1,000 samples of each product type was established; however, based on findings, the actual numbers were adjusted during the study as described below. Samples were collected from the Southwestern and Midwestern United States at retail stores in Phoenix, AZ, San Antonio, TX, Dallas, TX and Green Bay, WI.

Samples were collected from grocery stores (i.e., HEB, Tom Thumb, Fry's), superstores (i.e., Walmart, Super Target), and specialty grocery stores (i.e., Whole Foods, Sprout's Market) from

[1] CDC – Salmonellosis Technical Information updated October 13, 2005; accessed at http://www.cdc.gov/ncidod/dbmd/diseaseinfo/salmonellosis_t.htm

[2] Preliminary FoodNet Data on the Incidence of Infection with Pathogens Transmitted Commonly Through Food; MMWR - April 13, 2007 56(14):336-339.

[3] USDA-FSIS *Salmonella* Verification Sample Result Reporting: Agency Policy and Use in Public Health Protection; Federal Register – February 27, 2006 71(38):9772-9777.

January to March. Collection information was recorded on a form to capture date, time, location, number of samples per location, and temperature of the retail case using the thermometer placed by the retail organization (see Appendix A). Products were classified as either enhanced or un-enhanced based on the ingredient list and other relevant packaging information. Individual retail establishments were assigned a unique code by location for blinded reporting.

All samples were maintained at 1 – 4ºC for transport and overnight shipment to FSNS in San Antonio, TX (FSNS-SA) for evaluation as described below.

Sample processing: All samples were assessed for temperature upon receipt at FSNS-SA using a calibrated thermometer and were maintained at 1 – 4ºC prior to analysis. All packaging information relevant to the study was recorded for association with a specific sample based on the following (see also Appendix B): 1) In-house store vs. processor packaging; 2) Modified atmosphere or vacuum packaged vs. overwrap; and, 3) Labeling information to include use-by date, ingredients and any other relevant information. Labeling information was also retained to assist with data tracking as required.

A sub-sample of each product was evaluated for pH following procedures described in the USDA Microbiology Laboratory Guidebook (USDA-MLG), Chapter 2, Section 2.3.

Evaluation for *Salmonella* spp.: As illustrated below in Figure 1, test products were composited into sets of 5 samples each per product type and were screened for the presence of *Salmonella* spp. using the DNA-based screening technology, BAX® System (DuPont Qualicon; Wilmington, DE). Individually excised, 25-gram (g) sub-samples from each of the 5 samples were composited into a total of 125-g and enriched in buffered peptone water (BPW; BD Diagnostic Systems, Sparks, MD) at a 1:10 dilution. Sample composites were incubated at 35 ± 1ºC for 20 – 24 hr. Aliquots of the

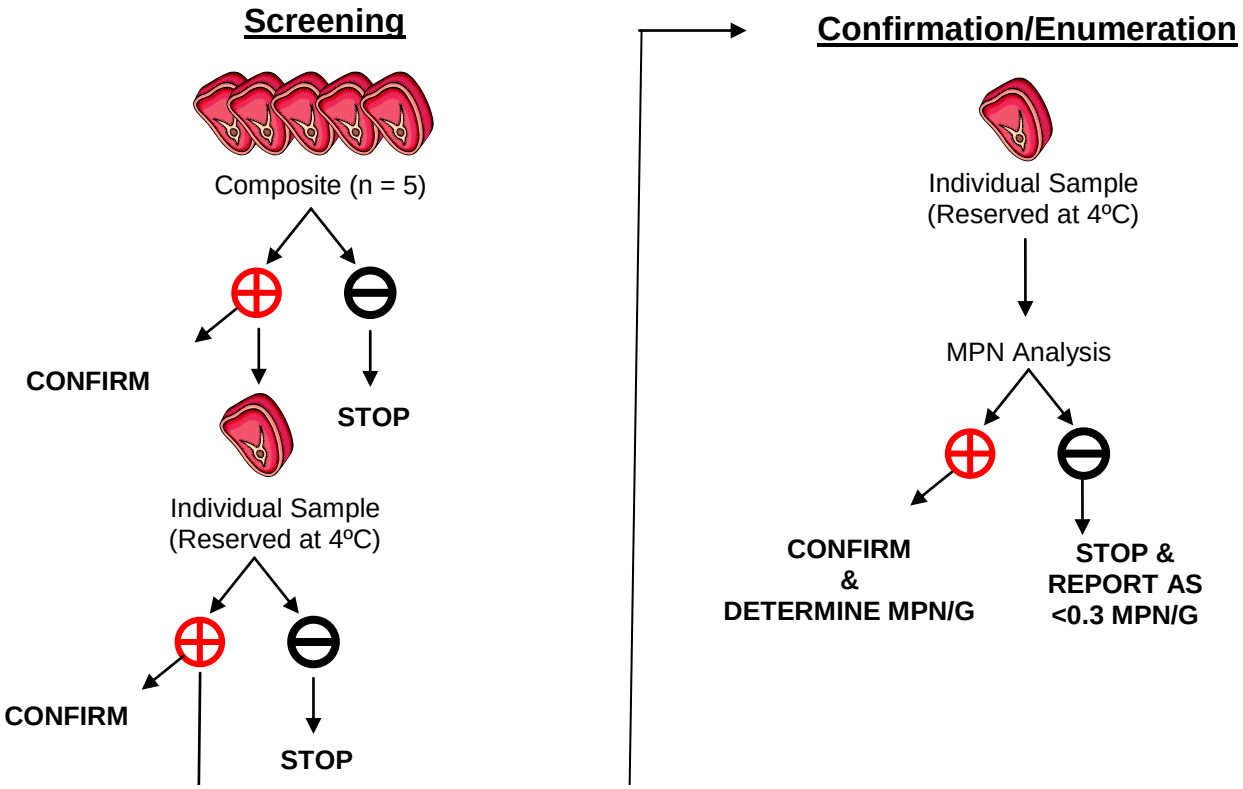


Figure 1. Sample processing scheme. Retail pork samples were evaluated for the presence of *Salmonella* spp. as illustrated. In the event that *Salmonella* spp. was detected in a composite, individual samples were re-excised for testing, and enumerated as applicable. All BAX® positive samples were subjected to USDA-FSIS cultural confirmation.

enrichment were analyzed for *Salmonella* spp. following procedures outlined in the BAX® System User's Guide and USDA-FSIS Microbiology Laboratory Guidebook (MLG; Chapter 4C.01) at a individual samples were pulled from 4ºC retain, re-excised at 25-g per sample and re-screened using the BAX®; and, 2) If an individually re-screened sample was BAX® positive, it was pulled again from 4ºC retain and re-excised at 25-g per sample for enumeration following an MPN procedure (see below). All BAX® positive samples were culturally confirmed following USDA-FSIS procedures (Chapter 4.03).

Enumeration of *Salmonella* spp.: For any individual sample that screened as positive using the BAX® System, an enumeration following the most probable number (MPN) protocol was followed to estimate the level of *Salmonella* spp. on the product. Set up of the MPN assay was based on the principles outlined in the FDA-BAM Appendix 2 and USDA-MLG Appendix 2.02 for a detection limit of 0.3 MPN/g, based on the use of 1.0-g, 0.1-g and 0.01-g of inocula. Enumeration was determined using the BAX® System as a screening tool. Confirmation to species and serogroup (O group) determination was performed following USDA-FSIS methods and using Difco antisera (BD). All isolates were frozen at -80ºC until shipment to Dr. Paula Cray at USDA-ARS for further evaluation and characterization.

Deviations from the protocol: Two primary deviations from the originally proposed sampling protocol were implemented over the course of the study as follows: 1) Un-enhanced product sampling was discontinued and re-focused on enhanced products; and, 2) Sampling was re-focused from 4 locations to 2 (Green Bay, WI and Phoenix, AZ) and ultimately 1 (Phoenix, AZ) to increase the total number of positive individual products.

These deviations were pursued to support the detection of the highest number of confirmed individual samples possible during the project sampling period of 3 months. As no confirmed *Salmonella* spp. was detected in individual un-enhanced products, sampling of the 2 un-enhanced product types was discontinued after 6 weeks. Further, as the *Salmonella* spp. positive samples were clustered principally in the Green Bay, WI and Phoenix, AZ areas, sampling at the San Antonio, TX and Dallas, TX locations was discontinued after 7 weeks. To further concentrate sampling in an area yielding the most positive samples, sample collection was focused exclusively on the Phoenix, AZ area beginning week 9.

Results:

Prevalence of *Salmonella* spp.: The overall results for the 4,000 retail pork products analyzed are shown in Tables 2 and 3, below. The data is shown in terms of composite sample results (Table 2) and individual sample results (Table 3). Product samples were categorized as product groups based product type, using the abbreviations shown in Table 1.

Table 1. Product type abbreviations

Product	Abbreviation
Pork Chops, Enhanced	PCE
Pork Chops, Un-Enhanced	PCUE
Pork Roasts, Enhanced	PRE
Pork Roasts, Un-Enhanced	PRUE

Table 2. Overall results for sample composites by product group

Product Group	Total Composites	Presumptive Composites	Composite Rate	Confirmed Composites	Confirmed Composite Rate
PCE	270	15	5.56%	13	4.81%
PCUE	137	0	0.00%	0	0.00%
PRE	270	17	6.30%	13	4.81%
PRUE	123	1	0.81%	0	0.00%
TOTAL	**800**	**33**	**4.13%**	**26**	**3.25%**

Table 3. Overall results for individual samples by product group

Product Group	Individual Samples	Presumptive Samples	Individual Rate	Confirmed Samples	Confirmed Individual Rate
PCE	1,350	19	1.41%	18	1.33%
PCUE	685	0	0.00%	0	0.00%
PRE	1,350	10	0.74%	10	0.74%
PRUE	615	0	0.00%	0	0.00%
TOTAL	**4,000**	**29**	**0.73%**	**28**	**0.70%**

A total of 3.25% of all composite samples tested returned a confirmed *Salmonella* spp. result. However, when the individual samples that were represented in these composites were retested, the overall confirmed positive rate dropped to 0.70%. The reduction in this rate could be explained as follows: 1) only a subset of individual samples represented in the composite samples will actually serve as a source of *Salmonella* spp. and, thus the overall rate for individual samples would be reduced; 2) individual samples that may have been positive at the time of composite testing based on the 25-g excision sample that was tested may not remain positive due to uneven distribution, particularly for samples with very low levels; and, 3) interventions applied at the processing facility may of injured *Salmonella* spp. such that recovery of the organism is more difficult over time, even within the 72 hours of re-sampling.

Geographic distribution of confirmed *Salmonella* spp. samples: No confirmed *Salmonella* spp. was observed for un-enhanced products. Preferential detection of *Salmonella* spp. in enhanced products was likely related to the presence of the marinade used for enhancement based on the increased moisture content and higher likelihood of cross contamination. Additionally, no *Salmonella* spp. was observed from samples collected in San Antonio, TX. Figures 2 through 5 illustrate the distribution of confirmed *Salmonella* spp. by product and location.

Figure 2. Distribution of confirmed Salmonella spp. composites by location (PCE)

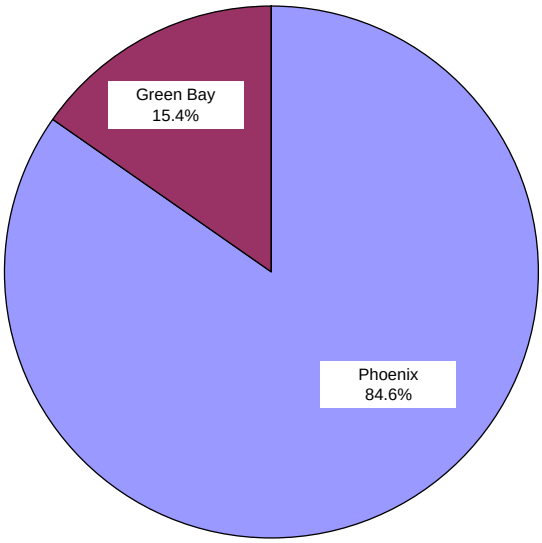


Figure 3. Distribution of confirmed Salmonella spp. composites by location (PRE)

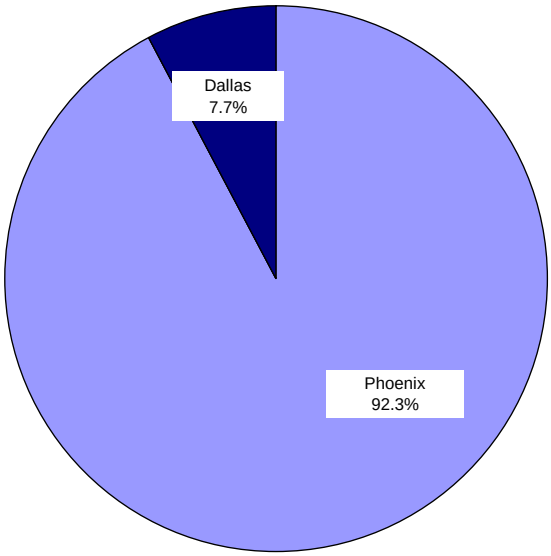


Figure 4. Distribution of confirmed Salmonella spp. individuals by location (PCE)

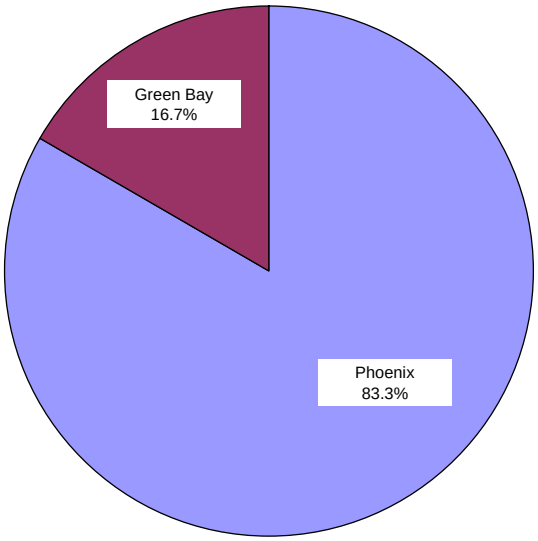
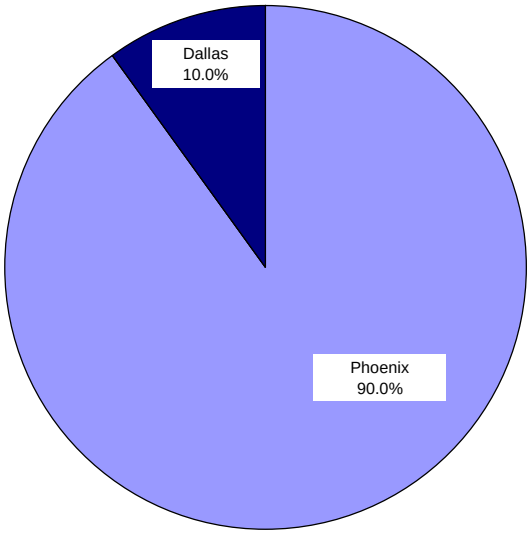


Figure 5. Distribution of confirmed Salmonella spp. individuals by location (PRE)



In both pork roast and chop enhanced products, the majority of confirmed *Salmonella* spp. was present in the samples obtained in the Phoenix market. It is suspected that sourcing from a limited number of retail locations and thus, processing facilities played a role in this finding. Further baseline assessments sampling from a more geographically distinct markets may be useful in further determinations of the national prevalence of *Salmonella* spp. on retail pork.

Most probable number (MPN) analysis: Levels of *Salmonella* spp. present for individually positive samples were also assessed following a most probable number (MPN) protocol to estimate overall levels. The limit of detection for this enumeration was 0.3 MPN of *Salmonella* spp. per gram of sample compared to 0.04 CFU/g (1 CFU/25g) for the BAX® System. Tables 4 and 5 show the number of individual enumerations performed, the number of enumerations that resulted in an MPN at or above the detection limit (per gram), and the average MPN value detected.

Table 4. MPN Results by location

Location	Number of positive individual samples	Observable MPN	MPN Range	Average observed MPN amount
Dallas, TX	1	1	0.30	0.30
Green Bay, WI	3	0	Not Applicable	<0.30
Phoenix, AZ	24	12	0.30 – 1.40	0.54

Table 5. MPN Results by product type

Product Type	Number of positive individual samples	Observable MPN	MPN Range	Average Observed MPN amount
PCE	18	6	0.30 – 0.72	0.44
PRE	10	7	0.30 – 1.40	0.60

Overall, very low levels of *Salmonella* spp. were isolated from individual samples. The highest level observed in any sample was 1.40 MPN/g. Over half (53.6%) of the individual samples tested that were positive for the presence of *Salmonella* spp. did not have an observable MPN (i.e., <0.30 MPN/g). Although there were more individual positive enhanced chop samples, the enhanced roast samples had slightly higher observed MPN values. This may be related to an increased amount of marinade per gram of sample based on standard processing techniques.

Salmonella spp. serology data: *Salmonella* spp. O group serological analysis was performed for all isolates obtained from both positive composite samples and individual samples, and results are shown below in Table 6. The most predominant serogroups were B and C1.

Isolates were also forwarded to Dr. Paula Cray at USDA-ARS for further serological testing. Data from Dr. Cray's analysis will be provided under separate cover.

Table 6. Salmonella spp. O group designations

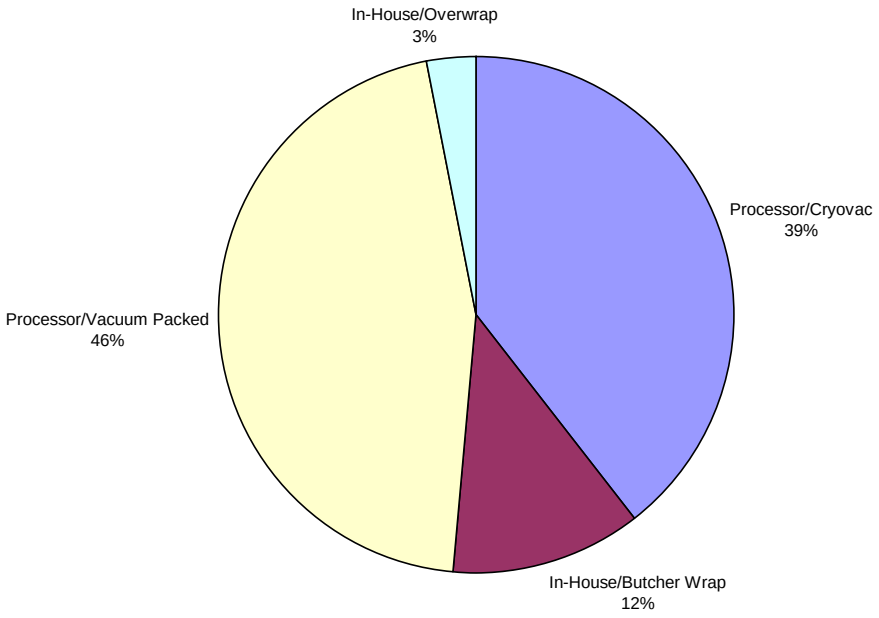
Composite sample ID[1]	Composite Sample O Group	Number of positive individuals from composite	Individual Sample O Group
Green Bay Wk1 PCE Comp #7	C1	3	B, C1, C2
Phoenix Wk2 PCE Comp #4	C1	2	C1, C1
Phoenix Wk2 PCE Comp #5	C1	1	C1
Phoenix Wk2 PRE Comp #5	C2	0	-
Dallas Wk3 PRE Comp #4	B	1	B
Green Bay Wk5 PCE Comp #1	C1	0	-
Phoenix Wk5 PCE Comp #7	B	0	-
Phoenix Wk5 PRE Comp #4	E2	2	E2, E2
Phoenix Wk7 PRE Comp #10	C1	1	C1
Phoenix Wk8 PCE Comp #1	B	1	B
Phoenix Wk8 PCE Comp #4	C1	0	-
Phoenix Wk8 PCE Comp #5	C1	1	C1
Phoenix Wk8 PCE Comp #8	B	3	B, B, B
Phoenix Wk8 PCE Comp #9	B	4	B, B, B, B
Phoenix Wk8 PRE Comp #6	B	0	-
Phoenix Wk8 PRE Comp #9	C1	1	C1
Phoenix Wk8 PRE Comp #12	B	1	B
Phoenix Wk9 PRE Comp #6	B	1	B
Phoenix Wk9 PRE Comp #7	B	0	-
Phoenix Wk9 PRE Comp #15	C1	0	-
Phoenix Wk9 PRE Comp #18	B	2	B, B
Phoenix Wk9 PRE Comp #19	C2	1	C2
Phoenix Wk10 PCE Comp #10	C1	1	C1
Phoenix Wk10 PCE Comp #19	C1	2	C1, C1
Phoenix Wk10 PCE Comp #24	C1	0	-
Phoenix Wk11 PRE Comp #16	B	0	-

[1]ID is based on location of collection, week sampled, product type and composite number in sequential order

Generally, the O group serotype of *Salmonella* spp. isolates obtained from individual samples was consistent with the single isolate from the corresponding composite sample. However, there was one instance (Green Bay Wk1 PCE Comp #7) where a variety of individual isolates with additional O group types were observed, indicating that several strains of *Salmonella* spp. were present. It is possible that the overall levels of various *Salmonella* spp. played an important role in this observation, and potentially the source of contamination (i.e., processor vs. retailer).

Salmonella spp. by packaging type: A variety of different packaging types were encountered during this project that were associated with presumptive *Salmonella* spp. composites rates. Figure 6, below, shows this distribution graphically.

Figure 6. Presumptive composites by packaging type



The majority (85%) of composite samples presumptive for *Salmonella* spp. were processor packed (i.e., not packaged in-store), indicating that contamination of the pork is more likely to occur at the process level rather than at the retail level since these products are not handled at retail.

pH analysis: Sample pH was measured for all incoming samples. The pH values were typically between 6.0 and 7.0, with an overall high value of 7.11 and an overall low value of 5.36. Summary data of these readings is shown in Figures 7 through 10, below. For each graph, the standard deviation from the average reading is shown as an error bar.

Figure 7. Average pH per Week of Sampling - San Antonio, TX

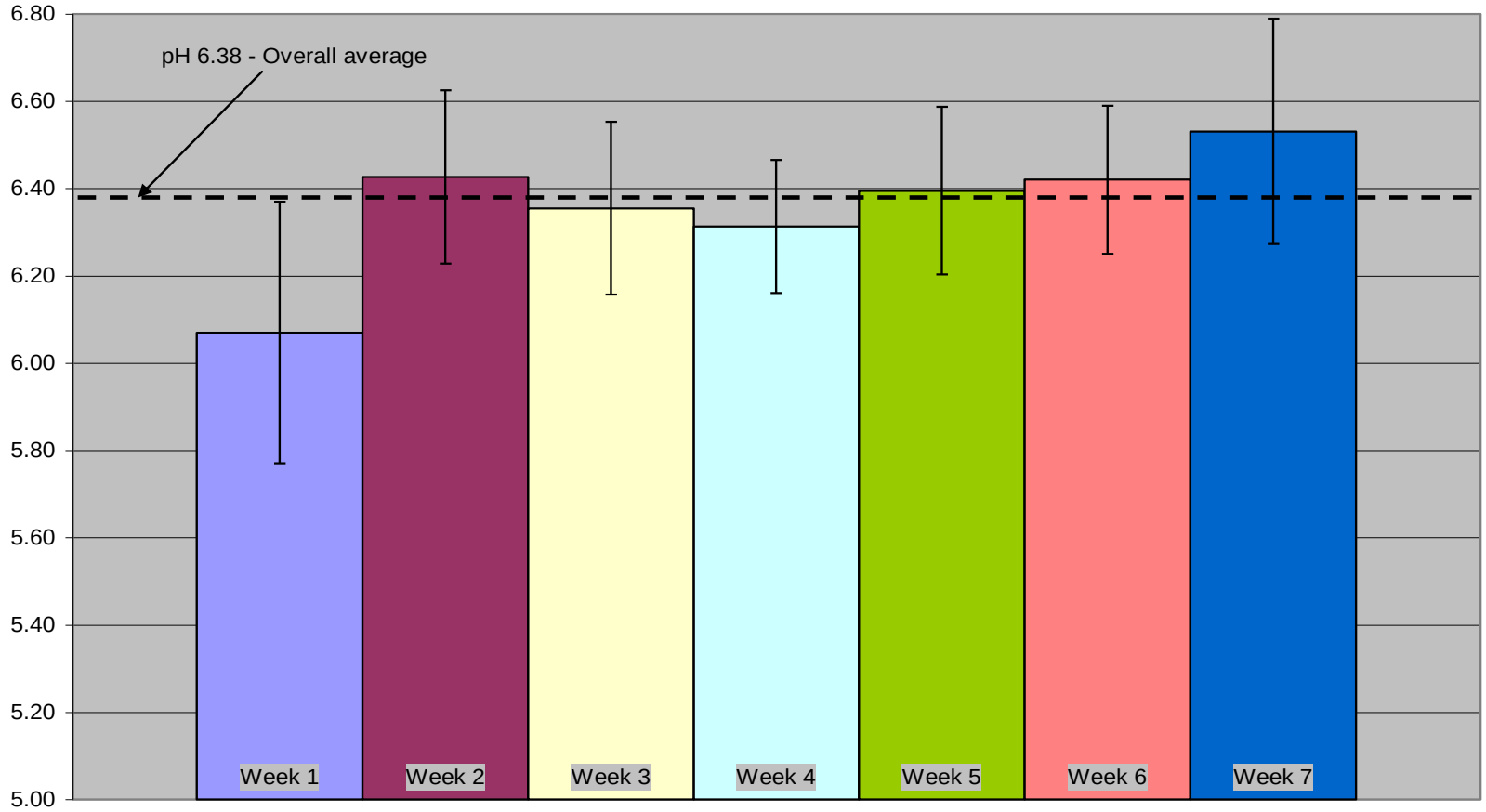


Figure 8. Average pH per Week of Sampling - Phoenix, AZ

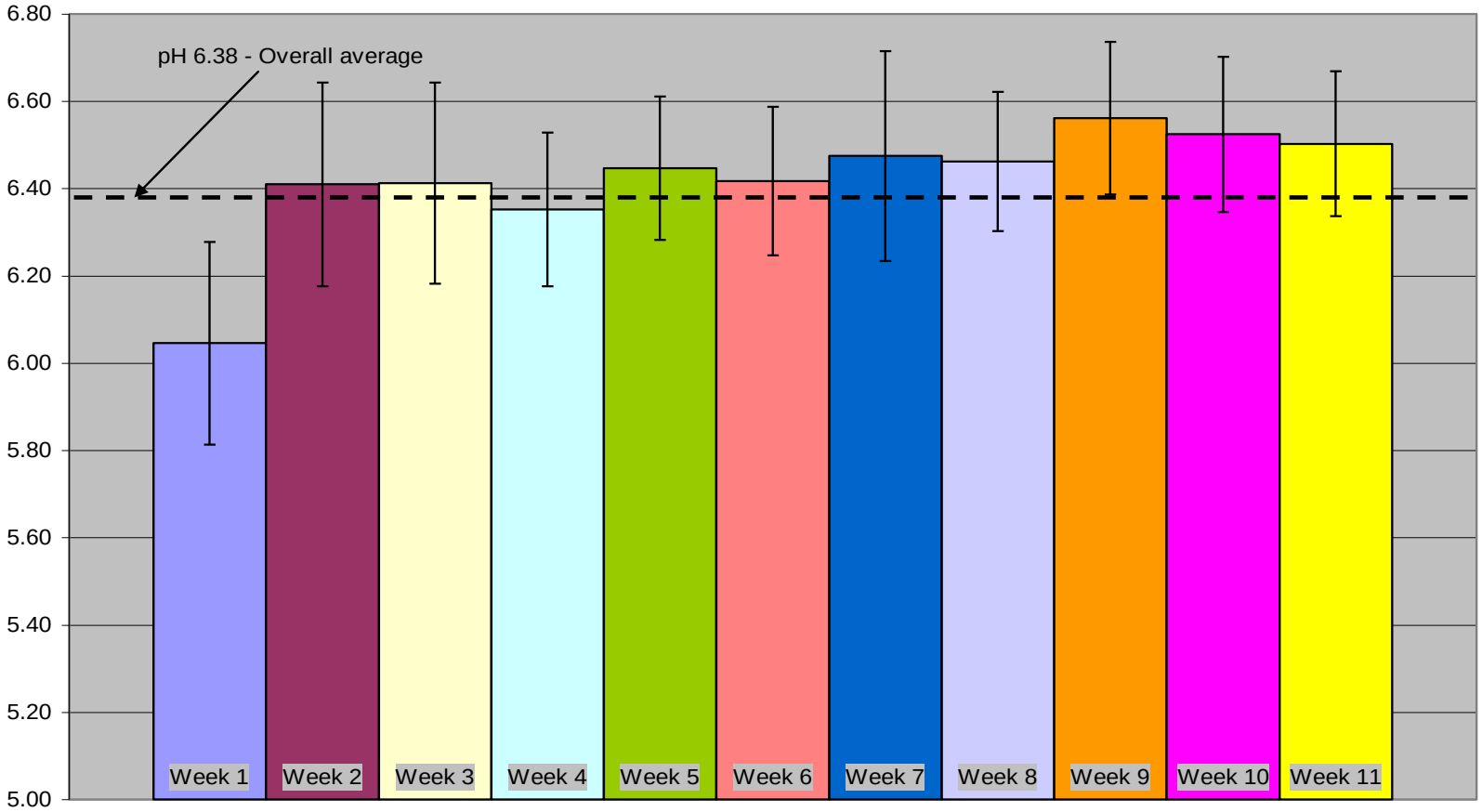


Figure 9. Average pH per Week of Sampling - Green Bay, WI

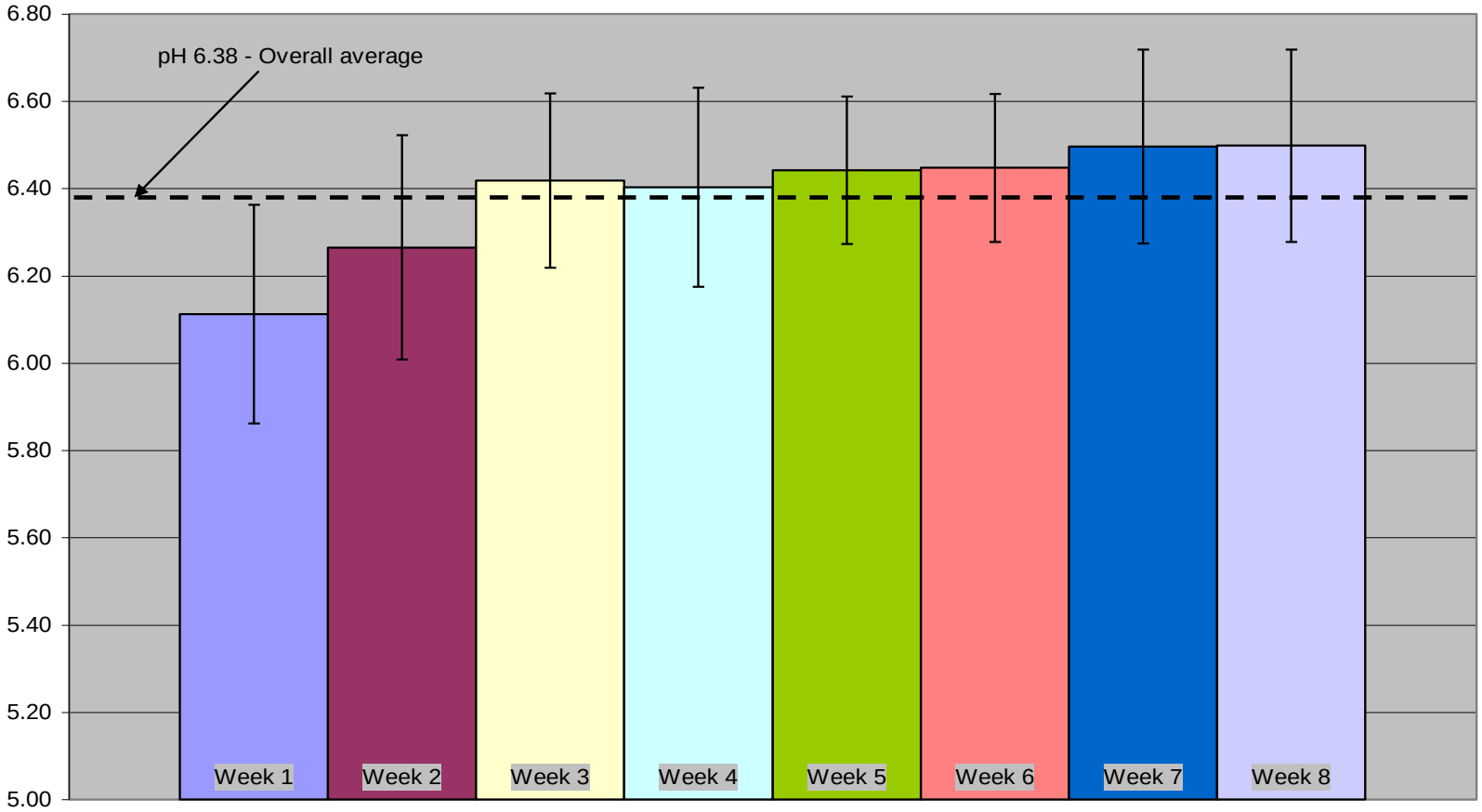
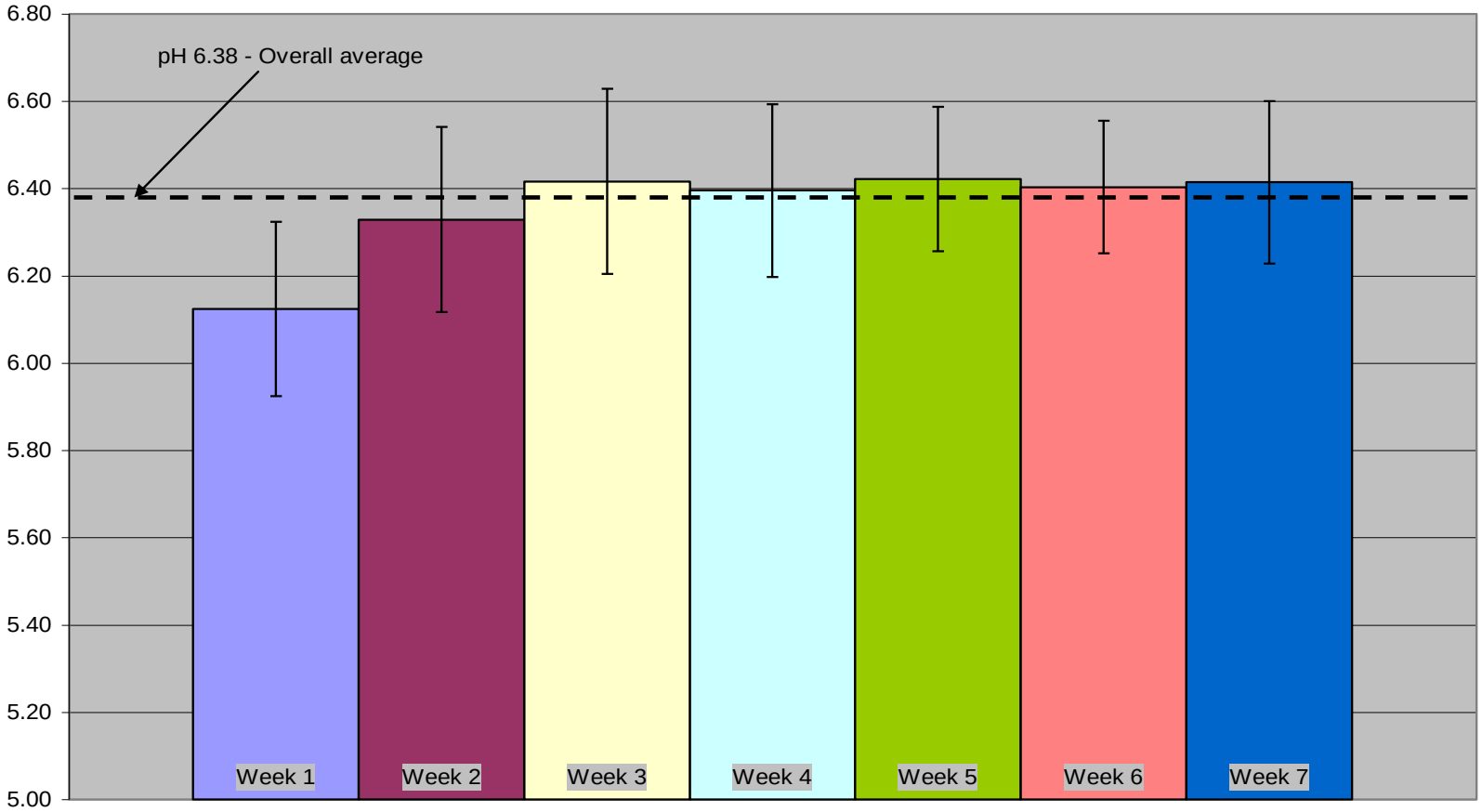


Figure 10. Average pH per Week of Sampling - Dallas, TX



With the exception of samples collected during the first week, which were uniformly lower for all four geographic sampling areas, pH readings were within one standard deviation of the average pH value for the entire study (pH 6.38). The uniformly lower values collected for the first week may have been related to variability in the electrode used for measuring, related to calibration or product temperature. Regardless, there did not appear to be a trend in a particular pH range and presence of *Salmonella* spp.

Discussion:

While *Salmonella* spp. was detected on enhanced retail pork products, it is present at low levels. A total of 4,000 individual pork products were composited into 800 composites and tested for the presence of *Salmonella* spp. Of those samples, 4.81% of enhanced pork chop and enhanced pork roast samples were confirmed for the presence of *Salmonella* spp. When tested as individual samples, 1.33% of enhanced pork chop samples were confirmed for the presence of *Salmonella* spp., while 0.74% of individual enhanced pork roast samples were confirmed. No confirmed *Salmonella* spp. was detected on any un-enhanced pork chop or un-enhanced pork roast products tested.

MPN analysis was carried out for all positive, individual samples, and showed that while the majority of the individual sample positives were isolated from enhanced pork chops, the enhanced pork roasts had slightly higher MPN values (0.60 MPN/g of sample compared to 0.44 MPN/g of sample), indicating that while the incidence of *Salmonella* spp. may be lower on enhanced pork roasts, the amount of *Salmonella* spp. present in each event is slightly higher.

Of the 4 locations sampled, *Salmonella* spp. positive products were most concentrated in the Phoenix, AZ area. This could indicate a supplier effect, as retail stores in that area are likely supplied by different processing facilities than those in the other areas studied. For the last several weeks of the study, sampling was focused on the Phoenix area due to the relative lack of positive samples obtained from the other 3 locations. The intent of this action was to increase the total number of individual positive samples for statistical analysis and use in a risk assessment; however, it should be noted that the data is accordingly skewed.

The current study demonstrated that based on the locations samples, the level of *Salmonella* spp. on retail pork products is relatively low. A more extensive evaluation of retail products representing all regions of the U.S., including seasonality, would provide a more comprehensive assessment on the national prevalence of *Salmonella* spp. on retail pork products.

APPENDIX A. Copy of Sample Collection Form

NATIONAL PORK BOARD BASELINE STUDY

Sample Collection Instructions

1. Purchase pork products at grocery stores (i.e., HEB, Cub Foods, Fry's, Tom Thumb, Kroger) or superstores (i.e., Walmart, Super Target, Sam's Club and Costco). One sample equates to an intact, individually packaged product of at least 0.5 lbs.
2. Record date and time of collection.
3. Record collector's identity.
4. Record store identity and location (include the physical address).
5. Record case temperature per the thermometer installed in the case (ask if you can't find it).
6. Verify product identity as either:
    a. Un-enhanced pork chops (raw, no water or phosphates added)
    b. Un-enhanced boneless pork roast (raw, no water or phosphates added)
    c. Enhanced pork chops (raw, added water and/or phosphates / no marinades or "extras")
    d. Enhanced boneless pork roast (raw, added water and/or phosphates / no marinades or "extras")

    Note: if it is not obvious whether the product meets these criteria, please consult with the meat department or seek further assistance with Wendy Warren-Serna at 210-340-8870 (office), 210-861-0864 (cell)
7. Record collection time (total time to collect samples) and mileage.
8. Send notification to FSNS-SA of shipment details and a copy of this form if possible – preferably by email

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DATE / TIME OF COLLECTION:_____

COLLECTOR:_____

STORE NAME:_____

STORE LOCATION:_____

_____

CASE TEMPERATURE:_____

PRODUCT TYPE (indicate number of packages of each):

UN-ENHANCED PORK CHOPS:_____

UN-ENHANCED BONELESS PORK ROAST:_____

ENHANCED PORK CHOPS:_____

ENHANCED BONELESS PORK ROAST:_____

COLLECTION TIME AND MILEAGE:_____

APPENDIX B. Copy of Sample Processing Form

NATIONAL PORK BOARD BASELINE STUDY

Sample Processing Instructions

9. Record date and time of receipt.
10. Record identity of the receiving technician.
11. Record the temperature upon receipt (should be between 1 – 4ºC).
12. Record packaging information, including: 1) In-house store vs. processor packaging; 2) Modified atmosphere or vacuum packaged vs. overwrap; and, 3) Labeling information to include use-by date, ingredients and any other relevant information.
13. Log samples into LIMS with FSNS-SA as customer for pH and *Salmonella* spp. (PCR-BAX) (an additional test for MPN may need to be added later) – use this sheet (Appendix B) and a copy of the collection form (Appendix A) as the sample submission information.
14. Analyze samples per the testing scheme shown in Figure 1 of the study proposal. The sample composite will be 125-g, based on 25-g of each of five samples. Individual samples will be 25-g. MPN will be 25-g, using 1.0-g x 3 (10 ml), 0.1-g x 3 (1 ml) and 0.01-g (0.1 ml) of inocula.
15. Hold and store all samples at 1 – 4ºC until all analysis is complete.
16. Each phase of testing will initiate based on the initial PCR results; however, all PCR positive samples will be subjected to cultural confirmation through O-group analysis (same as RGBC/YCBL).
17. Save all isolates at -80ºC. We will be sending these isolates to USDA-ARS (Paula Cray).

PRODUCT TYPE: ☐ Enhanced ☐ Un-enhanced ☐ Pork Chop #_____ ☐ Pork Roast #_____

DATE / TIME OF RECEIPT:_____

RECEIVING TECHNICIAN:_____

RECEIPT TEMPERATURE:_____

PACKAGING INFORMATION:

Packaging Type:	In-House / Store	☐	Additional comments:
	Processor	☐	
Packaging Atmosphere:	Modified/gas flush	☐	Additional comments:
	Vacuum	☐	
	Overwrap only	☐	
Labeling Information:	Use by date:		
	Ingredients:		
	Other relevant information:		