

## Findings of the National Pork Board *Salmonella* Intervention Assistance Program for Small & Very Small Plants

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### Introduction

The National Pork Board began the *Salmonella* Assistance Intervention Program (SAIP) in 2000. This program targeted primarily small and very small meat packers who were having difficulty meeting the requirements of the United States Department of Agriculture's Food Safety and Inspection Service (USDA-FSIS) *Salmonella* standards. The FSIS set *Salmonella* performance standards to verify whether SSOP/HACCP systems are effective in controlling contamination with harmful bacteria. According to USDA, *Salmonella* was selected because; (1) it is the most common bacterial cause of foodborne illness; (2) FSIS baseline data shows that it colonizes a variety of mammals and birds and occurs at a frequency which permits changes to be detected; (3) current methodologies can recover *Salmonella* from a variety of meat and poultry products; and (4) intervention strategies aimed at reducing fecal contamination and other sources of *Salmonella* on raw products should be effective against other pathogens. Detailed guidelines related to the USDA-FSIS response to *Salmonella* Performance Standards failures by plants may be found at the following web site: <http://www.fsis.usda.gov/OPPDE/rdad/FSISNotices/28-02.htm>.

The pathogen reduction performance standards are based on the prevalence of *Salmonella* as determined from FSIS' nationwide microbial baseline surveys. The standards are based on prevalence of the organism and expressed in terms of the maximum number of positive samples that are allowed per sample set (sample sets are statistically determined with swine requiring 55 samples with a maximum of 6 positives). Baseline samples collected in large plants, showed *Salmonella* prevalence in swine was 8.7% prior to HACCP implementation (Table 1). After HACCP implementation in large plants, *Salmonella* prevalence in swine decreased to 1.6% in 2001. In small swine plants, 18.0% tested positive after HACCP implementation during 1999, compared to the performance standard of 8.7%. Therefore, while 100% of large plants met the performance standards, only 50% of small plants achieved successful performance (Table 2). In 2000, large plants had 4.1% positives (93.8%), small plants had 7.7% positives (70.6%) and very small plants had 7.2% positives.

In the previous progress report covering the three years of 1998-2000, the agency pointed out that small market hog establishments were having the most difficulty meeting an existing performance standard. However, the progress report noted that *Salmonella* prevalence in code "A" market hog carcass samples from small establishments had decreased from 18.0% in Calendar Year (CY) 1999 to 7.7% in CY 2000, compared to the 8.7% baseline prevalence. For CY 2001, the *Salmonella* prevalence in market hog carcasses from small establishments continued to decrease to 3.5% (well below the baseline prevalence). In 2001, the *Salmonella* prevalence for very small market hog establishments was nearly as low, 4.4% as compared with 7.2% in CY 2000.

This baseline data from USDA indicates that smaller pork slaughter plants were more prone to have higher incidences of *Salmonella spp.* than larger plants. It has been theorized that smaller plants were at a disadvantage for several reasons. First, smaller plants lacked the manpower to physically address possible control points as well as larger plants with greater manpower. Second, many smaller plants, again due to economic reasons, may not have in their employment recent college graduates who are trained in greater depth related to food safety issues and intervention methods. Finally, most intervention methods have targeted larger operations and in many cases were beyond the economic scope of many smaller processors.

Thus was born the SAIP as a method of assisting small and very small plants with both technical assistance and novel intervention methods, that were within their financial reach. The NPB staff in conjunction with various university personnel formed the SAIP Team and began responding to requests from pork processors who were concerned about their ability to meet the USDA-FSIS *Salmonella* Performance Standards.

The SAIP Team primarily responded to plants that had already failed either their first or second sampling set collected by USDA. The objective of the team was to evaluate the entire operation, from receiving through shipping, and determine possible scenarios which might improve the operation, thus decreasing the chance of another *Salmonella* sampling set failure. The team arrived prior to Sanitation Standard Operating Procedures (SSOP) pre-op and collected bio-luminance swabs, to indicate the level of cleaning effectiveness after pre-op but prior to operation. In addition, the team observed all portions of the operation for an extended time period to ascertain the standard operating procedures of the plant employees.

The following is a summarization of specific issues, which tended to be recurring at many of the plants evaluated. In some cases, regardless of plant size, the issue related to lack of employee training. Although not comprehensive, this list includes many potential pitfalls that should be closely scrutinized by both large and small plants alike.

### Pre-Harvest

**Transportation** - Length of time during transport and environmental conditions were determined to have possible effects on fecal shedding of *Salmonella* due to animal stress. Recommendations were made to minimize lengthy hauling conditions. If hauling times could not be reduced, it was suggested that establishments institute adequate holding times prior to harvest (minimum of 4 hours).

**Unloading and Handling** - Employee handling of swine entering facilities was evaluated as another area needing improved attention. The movement of swine with minimal stress into holding pens was encouraged. In addition, situations where swine were subjected to increased stress due to abnormal confinement (animals being held in crowded alley ways during employee breaks) were encouraged to be rectified.

**Facility Construction** - It was recommended that all unloading and holding facilities be constructed of materials (mainly concrete) to facilitate adequate cleaning and to optimize animal cleanliness coming into the facility.

**Pre-Harvest Feeding** - It was recommended that feed be withheld from animals a minimum of 6-8 hours prior to harvest in an effort to minimize possible intestinal puncture and leakage of ingesta during the evisceration process.

**Animal Condition and Health** - It was noted that in many operations, slower growing, *tail-enders* were harvested as specialty market items to meet the market demand for *roasters*. The health and physical condition of these animals potentially increased bacterial contamination throughout processing.

**Pre-Harvest Intervention Method** - In many cases, it was noted that incoming



Figure 1. Swine Harvest Flow Diagram

animals were very contaminated with feces and mud. An intervention wash consisting of water and/or 200ppm of chlorine was recommended to decrease the potential of cross contamination.

Year	Baseline Prevalence (%)	Large Establishments		Small Establishments		Very Small Establishments		All Sizes Establishments	
		# Samp	% Pos	# Samp	% Pos	# Samp	% Pos	# Samp	% Pos
2001	8.7	1,419	1.6%	1,385	3.5%	5,286	4.4%	8,090	3.8%
2000	8.7	1,919	4.1%	2,144	7.7%	1,107	7.2%	5,170	6.2%
1999	8.7	973	1.8%	950	18.0%	0	0	1,923	9.8%
1998	8.7	1,390	5.8%	0	0	0	0	1,390	5.8%
1998-2001	8.7	5,701	3.5%	4,479	8.6%	6,393	4.9%	16,573	5.4%

**Table 1. USDA Salmonella Performance Data for Market Hogs**

## Processing

**Plant Environment** - Many items were noted during the pre-operational audit that related to plant design and operation. Ventilation from outdoors onto the slaughter floor was noted as having a possible detrimental effect, especially when incoming airflow was located next to the holding facilities. In addition, the construction of many plants was such that it was difficult to continually maintain a sanitary environment. Furthermore, it was noted that many plants had an employee traffic flow problem from the harvest area into other further processing areas of the plant.

Year	Large Establishments		Small Establishments		Very Small Establishments		All Sizes Establishments	
	# Sets	% Pass	# Sets	% Pass	# Sets	% Pass	# Sets	% Pass
2001	25	96.0%	23	91.3%	49	77.6%	97	85.6%
2000	32	93.8%	34	70.6%	0	0	66	81.8%
1999	26	100.0%	12	50.0%	0	0	38	84.2%
1998	16	68.8%	0	0	0	0	16	68.8%
1998-2001	99	91.9%	69	73.9%	49	77.6%	217	82.9%

**Table 2. Percent of Sample Sets meeting the Salmonella Performance Standards for Market Hogs by Calendar Year, 1998-2001**

Throughout the processing area in many plants the following deficits were noted:

- Employee use of cotton gloves spreading contamination from one carcass to another
- Lack of sufficient work space between employees to allow for improved attention to detail
- Rapid line speeds which minimized the ability of employees to adequately sanitize equipment between carcasses
- Lack of appropriate sanitizers distributed strategically throughout the harvest floor for employee utilization
- Lack of employee training programs to emphasize their role in food safety
- Inadequate cooler spacing of carcasses to minimize contamination from one carcass to another
- Lack of multiple antimicrobial intervention methods to adequately address potential contamination

## Recommendations

The following recommendations were made to many plants in efforts to reduce their potential for *Salmonella* contamination.

- Implement an independent testing program to be carried out in conjunction with that of USDA. This testing should evaluate each swab sampling area independently in an attempt to identify possible areas of increased contamination.
- Implement an employee training program aimed at educating employees of their role in producing a safe product and the reasons behind the operation's standard operating procedure.
- Increase the availability of appropriate sanitizers for employees in the harvest area both for equipment and hands/gloves. Possible sanitizers included hot water, water sterilizers, and chlorine dips (up to 200ppm for knives and saws).
- Minimize the time from stunning to cooler to no more than 30 minutes to reduce carcass temperature as quickly as possible.
- Implement multiple carcass antimicrobial intervention methods to reduce microbial populations prior to the carcasses entering the cooler. These should include at least two methods

and may range from a hot water wash (>140°F), a chlorine (50ppm) and/or organic acid (2%) spray, or re-singeing (10 seconds) of the carcass. Recent data from the University of Kentucky has demonstrated that each of these methods, especially when used in a multiple intervention system has the ability to enhance microbial decontamination.

- Increase carcass spacing within the cooler and decrease cooler temperature.
- Increase airflow to enhance proper chilling of the carcass within 24 hours.
- Implement an antimicrobial intervention method during chilling (chlorine spray) to further reduce microbial contamination.
- Increase attention to all aspects of Sanitation Standard Operating Procedures (SSOPs) to reduce the possibility of microbial contamination from poorly cleaned equipment and plant environments.
- Work closely with the USDA inspector to identify any possible modes of contamination, which may have been inadvertently overlooked.

## Summary

Although no one problem at any of the plants visits tended to be the sole issue related to possible *Salmonella* contamination, many small yet significant items were identified as having potential negative affects as a microbial source. The findings from this program re-enforce the standard, long-lasting philosophy that *Cleanliness is next to Godliness*. Basically, in order to produce a high quality, sanitary product, it is important to maintain a sanitary facility and to have outstanding personal hygiene in addition to utilizing all possible technological advancements available. Plants that employ these tactics will succeed in their quest to produce a safe and wholesome product demanded by today's consumers.

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