

Daily Procedures:

10 identified and tagged for off-line re-processing at point A will be removed as pre-process samples for whole carcass rinse once/day/

10 identified and tagged for off-line re-processing at point A will be removed at point D as post-process samples and visually inspected once/day.

10 identified and tagged at point A removed at point B as post-treatment samples for whole carcass rinse once/day.

10 identified and tagged carcasses from point D as pre-treatment samples removed for whole carcass rinse once/day.

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10 carcasses from the re-processing station removed at point C as post-process samples for whole carcass rinse once/day.

In Phase I of the protocol, all procedures to be repeated 3 days per week for 4 weeks with the system operating on a single line. During Phase II of the protocol, all procedures to be repeated 1 day per week for 8 weeks with the system running on all plant lines and the sampled line to be alternated weekly between each of the plant lines.

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Sampling Schedule *(Revised 06/3)*

Phase I (Single Line)

- Sampling to be conducted three days per week for a total of four weeks (twelve sample days).
- Ten samples to be collected per sampling site per day.
- No split samples, all samples to be handled by the “standard handling” methodology.

Sample Site & Description		Sampling Schedule/Plating Schedule				
		E. coli Enumerate	Salmonella Incidence	Salmonella Enumerate	Campy. Incidence	Campy. Enumerate
A.	Post-evisceration	10	10	NA	NA	NA
D.	Post-wash (pre-treatment)	10	10	NA	NA	NA
B.	Post-Sanova (post-treatment)	10	10	NA	NA	NA
C.	Post-offline reprocessing	10	10	NA	NA	NA
No. of samples per day by organism & plate type		40	40	NA	NA	NA
No. of samples per week by organism & plate type		120	120	NA	NA	NA
No. of samples for Phase I by organism & plate type		480	480	NA	NA	NA

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Phase II (All Lines)

- Sampling to be conducted one day per week for a total of eight weeks (eight sample days).
- Ten samples to be collected per sampling site per day.
- No split samples, all samples to be handled by the “standard handling” methodology.

Sample Site & Description		E. coli Enumerate	Salmonella Incidence	Campy. Incidence	Campy. Enumerate
A.	Post-evisceration	10	10	10	NA
D.	Post-wash (pre-treatment)	10	10	10	10
B.	Post-Sanex [®] (post-treatment)	10	10	10	10
C.	Post-offline reprocessing	10	10	10	NA
E.	Post-chill ¹	NA	NA	10	10
No. of samples per day/week by organism & plate type		40	40	50 ¹	30 ²
No. of samples for Phase II by organism & plate type		320	320	200	60

¹ Only do incidence for Campylobacter incidence on 4 of the 8 days during Phase II.

² Only do enumeration for Campylobacter on 2 of the 8 days during phase II.

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Summary of Overall Performance for Continuous On-line Processing

Comparison of Continuous On-line Processing (COP) c.f. Off-line Reprocessing (OLR)

Organism	Post COP	Post OLR	Difference
Quantitative Assessments			
<i>E. coli</i> (log ₁₀ cfu/ml)	0.59 ^b	2.37 ^a	+1.78
Campylobacter (log ₁₀ cfu/ml)	1.14 ^b	2.89 ^a	+1.15
Qualitative Assessments			
Salmonella (%)	10.00 ^b	31.62 ^a	+21.62
Campylobacter (%)	49.13 ^b	73.20 ^a	+25.07

(Within rows, means with no common superscript are significantly different, $p < 0.001$)

Post Continuous On-line Processing (COP), the microbial counts and incidence estimations from carcass rinse samples are significantly lower than are seen Post Off-line Reprocessing (OLR). All of the microbial species that were evaluated show the same trend towards statistically significant, lower values post COP.

Comparison of Carcass Wash c.f. Off-line Reprocessing

Organism	Post Wash	Post OLR	Difference
Quantitative Assessments			
<i>E. coli</i> (log ₁₀ cfu/ml)	2.27 ^b	2.37 ^a	+0.10
Campylobacter (log ₁₀ cfu/ml)	2.62	2.89	+0.27
Qualitative Assessments			
Salmonella (%)	31.40	31.62	+0.22
Campylobacter (%)	74.78	73.20	-1.58

(Within rows, means with no common superscript are significantly different, $p < 0.001$)

The results of carcass rinse samples taken Post Wash are equivalent to those noted from Post OLR samples. Final microbial counts are the same for all of the microbial species evaluated, except for *E. coli*. Microbial counts for the latter are significantly lower Post Wash than are recorded Post OLR.

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Comparison of Continuous On-line Processing (COP) c.f. Chill

Organism	Post COP	Post Chill	Difference
Quantitative Assessments			
<i>E. coli</i> (log ₁₀ cfu/ml)	0.59 ^b	0.84 ^a	+0.25
Campylobacter (log ₁₀ cfu/ml)	1.14 ^a	0.64 ^b	-0.50
Qualitative Assessments			
Salmonella (%)	10.00	12.50	+2.50
Campylobacter (%)	49.13	57.64	+8.51

(Within rows, means with no common superscript are significantly different, $p < 0.001$)

Microbial counts and/or microbial incidence from carcass rinse samples Post COP are either significantly lower than, or equivalent to, Post Chill for all of the microbial species evaluated. The one exception to this is the enumeration data for Campylobacter spp., which shows a continued decline Post Chill.

E. coli. – Sample Distribution

Data Frequency Distribution		% Post COP	% Post OLR
Unacceptable	> 1000	0.9	16.3
Marginal (“M”)	100 to 999	5.0	54.8
Acceptable (“m”)	0 to 100	94.1	28.9
Acceptable	< 10	74.3	2.2

Probability of Meeting USDA Compliance Criteria

	Probability of Exceeding:	
	“m” = 100 cfu/ml	“M” = 1000 cfu/ml
Post COP	1:20	1:100
Post OLR	1:2	1:6

On the assumption that pre-chill carcass *E. coli* counts and distribution frequencies do not change (worsen due to cross contamination) during chilling, Post COP carcasses would have a significantly greater chance of passing current USDA “m” and “M” microbial limit criteria when compared with Post OLR carcasses.

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***Escherichia coli* Counts (log₁₀ cfu/ml)
Summary Data**

Experiment No.	n	Post Evisceration	n	Post Wash	n	Post Sanova	n	Post Off-line	n	Post Chill
072198PF - Phase I	-	-	180	2.39 ^b	180	0.80 ^c	180	2.60 ^a	-	-
020199PF - Phase II	80	3.29 ^a	78	2.93 ^b	80	1.11 ^d	80	2.37 ^c	-	-
021599GK - Phase I	120	2.82 ^a	120	2.04 ^b	120	0.48 ^c	120	2.20 ^b	-	-
031599GK - Phase II	80	2.80 ^a	80	2.12 ^b	80	0.71 ^c	80	2.17 ^b	-	-
050499PF - Phase I	120	3.04 ^a	120	2.43 ^c	120	0.25 ^d	120	2.79 ^b	-	-
060199PF - Phase II	80	3.16 ^a	80	2.64 ^b	80	0.24 ^c	80	2.61 ^b	-	-
060899TI - Phase I	120	3.09 ^a	120	2.60 ^b	120	0.55 ^c	120	2.65 ^b	-	-
072799TI - Phase II	80	2.76 ^a	80	2.30 ^b	80	0.43 ^d	80	2.50 ^b	80	0.70 ^c
062299TP - Phase I	130	2.90 ^a	130	2.07 ^c	130	0.88 ^d	130	2.43 ^b	-	-
072799TP - Phase II	80	2.77 ^a	80	2.03 ^b	80	0.59 ^c	80	2.11 ^b	80	0.97 ^d
Summary all data	890	2.87^a	1068	2.27^c	1070	0.59^c	1070	2.37^b	160	0.84^d

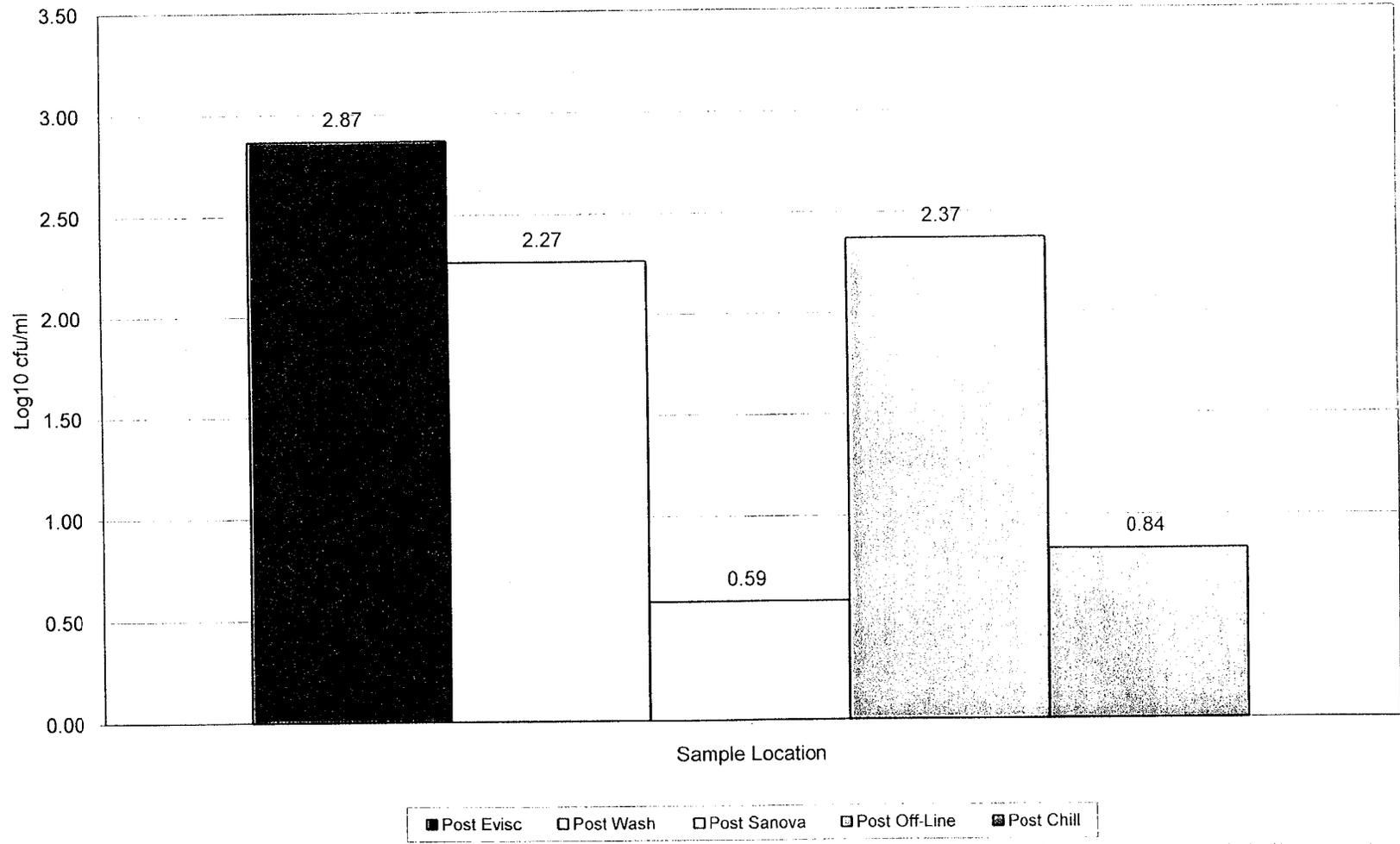
(Within rows, means with no common superscript are significantly different, p < 0.001)

Average *Escherichia coli* **reduction** due to off-line reprocessing = 0.50 log₁₀ cfu/ml

Average *Escherichia coli* **reduction** due to Continuous On-line Processing = 2.28 log₁₀ cfu/ml

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E. coli - Fresh Data (Log10 cfu/ml)
All Data Combined



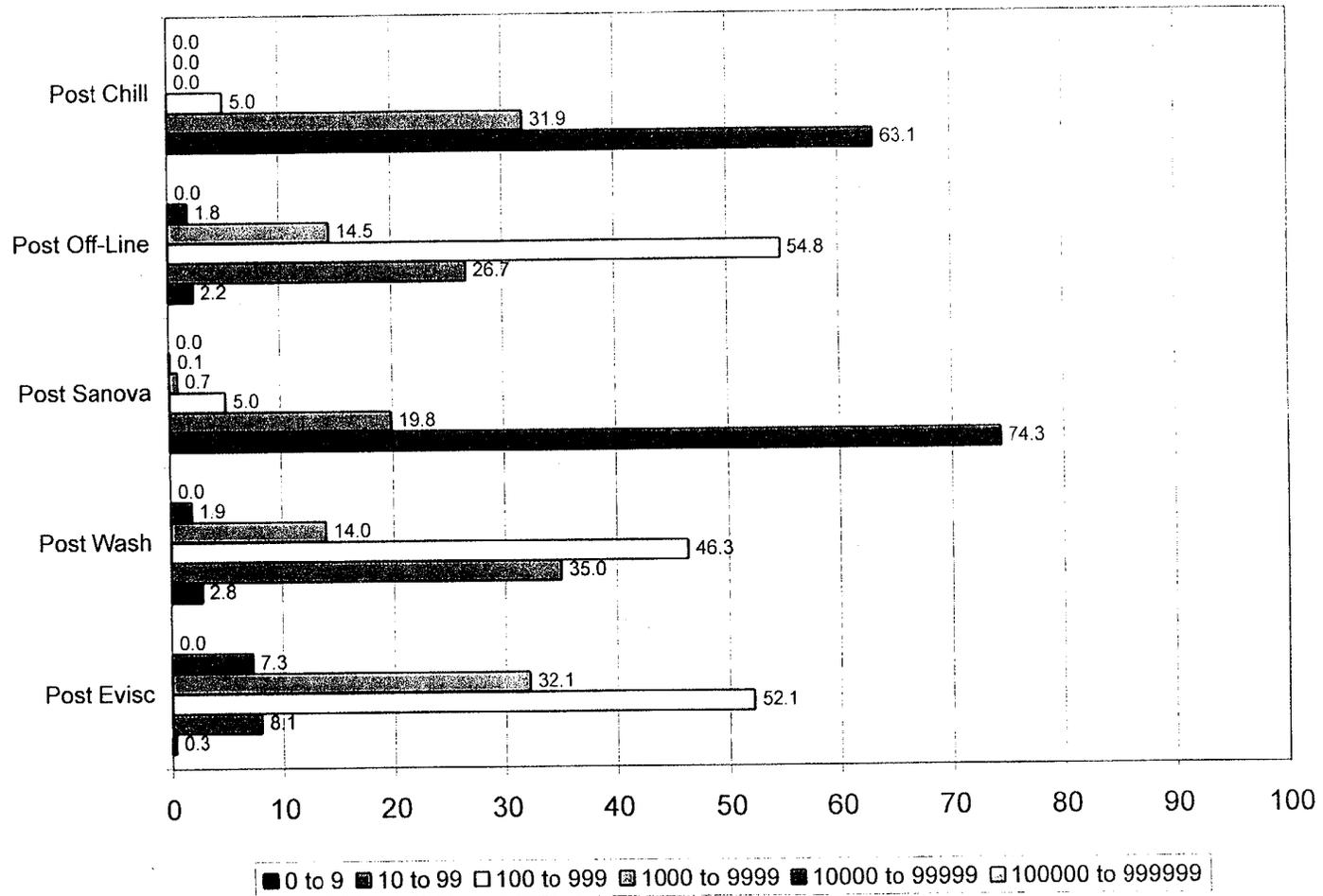
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COP - All Data Combined
***Escherichia coli* Fresh Data Frequency Distribution**

Data Range	Post Evisc	Post Wash	Post Sanova	Post Off-Line	Post Chill
n =	890	1068	1070	1070	160
	%	%	%	%	%
0 to 9	0.3	2.8	74.3	2.2	63.1
10 to 99	8.1	35.0	19.8	26.7	31.9
100 to 999	52.1	46.3	5.0	54.8	5.0
1000 to 9999	32.1	14.0	0.7	14.5	0.0
10000 to 99999	7.3	1.9	0.1	1.8	0.0
100000 to 999999	0.0	0.0	0.0	0.0	0.0
Total	100	100	100	100	100

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E. coli - Fresh Data Frequency Distribution All Studies Combined



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Incidence of Salmonella spp. (%)
Summary Data

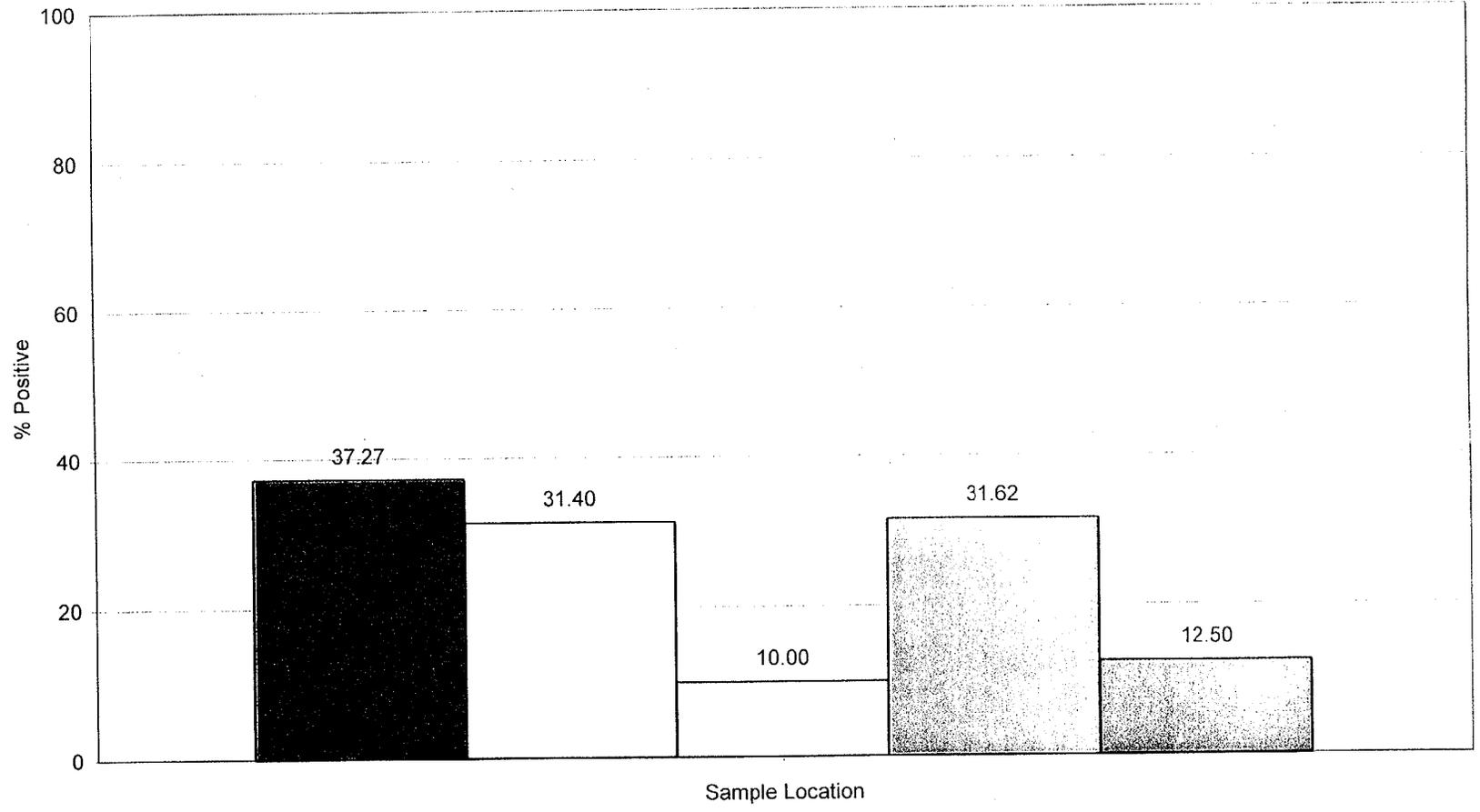
Experiment No.	n	Post Evisceration	n	Post Wash	n	Post Sanova	n	Post Off-line	n	Post Chill
072198PF - Phase I	-	-	180	22.78 ^a	180	9.44 ^b	180	27.78 ^a	-	-
020199PF - Phase II	79	70.00 ^a	79	52.50 ^b	80	17.50 ^c	79	53.75 ^b	-	-
021599GK - Phase I	120	50.00 ^a	120	52.50 ^{bc}	120	15.83 ^d	120	40.83 ^{ac}	-	-
031599GK - Phase II	80	27.50 ^a	80	25.00 ^a	80	7.50 ^b	80	18.75 ^a	-	-
050499PF - Phase I	119	18.33 ^a	120	22.50 ^{ab}	120	10.92 ^{ac}	120	25.00 ^{ab}	-	-
060199PF - Phase II	80	3.75 ^b	80	8.86 ^{ab}	80	1.25 ^b	80	15.19 ^a	-	-
060899TI - Phase I	120	76.67 ^a	120	69.17 ^a	120	21.67 ^a	120	74.17 ^b	-	-
072799TI - Phase II	80	46.25 ^a	80	40.00 ^a	80	11.25 ^b	80	37.50 ^a	80	18.75 ^b
062299TP - Phase I	130	30.00 ^a	130	20.00 ^{ac}	130	6.15 ^d	130	16.15 ^{bc}	-	-
072799TP - Phase II	80	16.25 ^a	80	7.50 ^b	80	6.25 ^b	80	18.75 ^a	80	6.25 ^b
Summary all data	888	37.27^a	1070	31.40^b	1070	10.00^c	1069	31.62^b	160	12.50^c

(Within rows, means with no common superscript are significantly different, $p < 0.001$)

Average Salmonella spp. **reduction** in incidence due to off-line reprocessing = 5.65%
Average Salmonella spp. **reduction** in incidence due to Continuous On-line Processing = 27.27%

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Salmonella - Fresh Data (%)
All Data Combined



■ Post Evisc □ Post Wash □ Post Sanova ▨ Post Off-Line ▩ Post Chill

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Zero Fecal Tolerance Compliance Status

Experiment No.	Assessment for Fecal Tolerance			
	n	+ve	-ve	%
072198PF - Phase I	150	0	150	100
020199PF - Phase II	80	1	79	99
021599GK - Phase I	170	0	170	100
031599GK - Phase II	80	0	80	100
050499PF - Phase I	120	0	120	100
060199PF - Phase II	80	0	80	100
060899TI - Phase I	120	0	120	100
072799TI - Phase II	87	0	87	100
062299TP - Phase I	150	0	150	100
072799TP - Phase II	90	1	89	99
Summary all data	1127	2	1125	99.8

Zero fecal tolerance failures were recorded on only two occasions during the period of conduct of all five studies. This represents a total of 2 carcasses out of the 1127 evaluated or 0.18%. In both instances a single carcass was visually observed as being fecal contaminated. Upon detection and as per their Standard Operating Procedures, appropriate corrective actions were immediately implemented by plant personnel.. No further instances of zero fecal tolerance failure were recorded by either plant, following completion of these corrective actions.

These data demonstrate that the reconfigured carcass wash and inside outside bird washers installed at each test location are able to effectively take care of fecal and food contaminated carcasses in all but the most severely contaminated of circumstances. Note that as a part of the Sanova COP system, severely fecal contaminated carcasses are required to be routed to the off-line reprocessing area for separate handling.

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Summary of Campylobacter spp. Performance

Campylobacter spp. – Sample Distribution

Data Frequency Distribution		% Post COP	% Post OLR
Unacceptable	> 1000	6.3	52.2
Marginal (“M”)	100 to 999	15.3	24.6
Acceptable (“m”)	0 to 100	78.5	23.2
Acceptable	< 10	50.0	0.0

On the assumption that pre-chill carcass Campylobacter spp. counts and distribution frequencies do not change (worsen due to cross contamination) during chilling, Post COP carcasses will have a significantly lower count and improved microbiological quality post-chill. These carcasses would also have a greater chance of passing any possible USDA microbial limit criteria that might be established (when compared with Post OLR carcasses).

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Campylobacter spp. Counts (log₁₀ cfu/ml)
Summary Data

Experiment No.	n	Post Evisceration	n	Post Wash	n	Post Sanova	n	Post Off-line	n	Post Chill
020199PF - Phase II	62	3.70 ^a	69	3.12 ^b	64	1.59 ^c	69	2.89 ^b	63	1.53 ^c
031599GK - Phase II	-	-	20	2.06 ^a	20	0.84 ^b	-	-	-	-
060199PF - Phase II	-	-	20	1.73 ^a	20	0.48 ^b	-	-	-	-
072799TI - Phase II	-	-	20	2.93 ^a	20	1.07 ^b	-	-	20	0.81 ^b
072799TP - Phase II	-	-	20	2.06 ^a	20	0.77 ^b	-	-	20	0.47 ^c
Summary all data	62	3.70^a	149	2.62^b	144	1.14^c	69	2.89^b	103	0.64^d

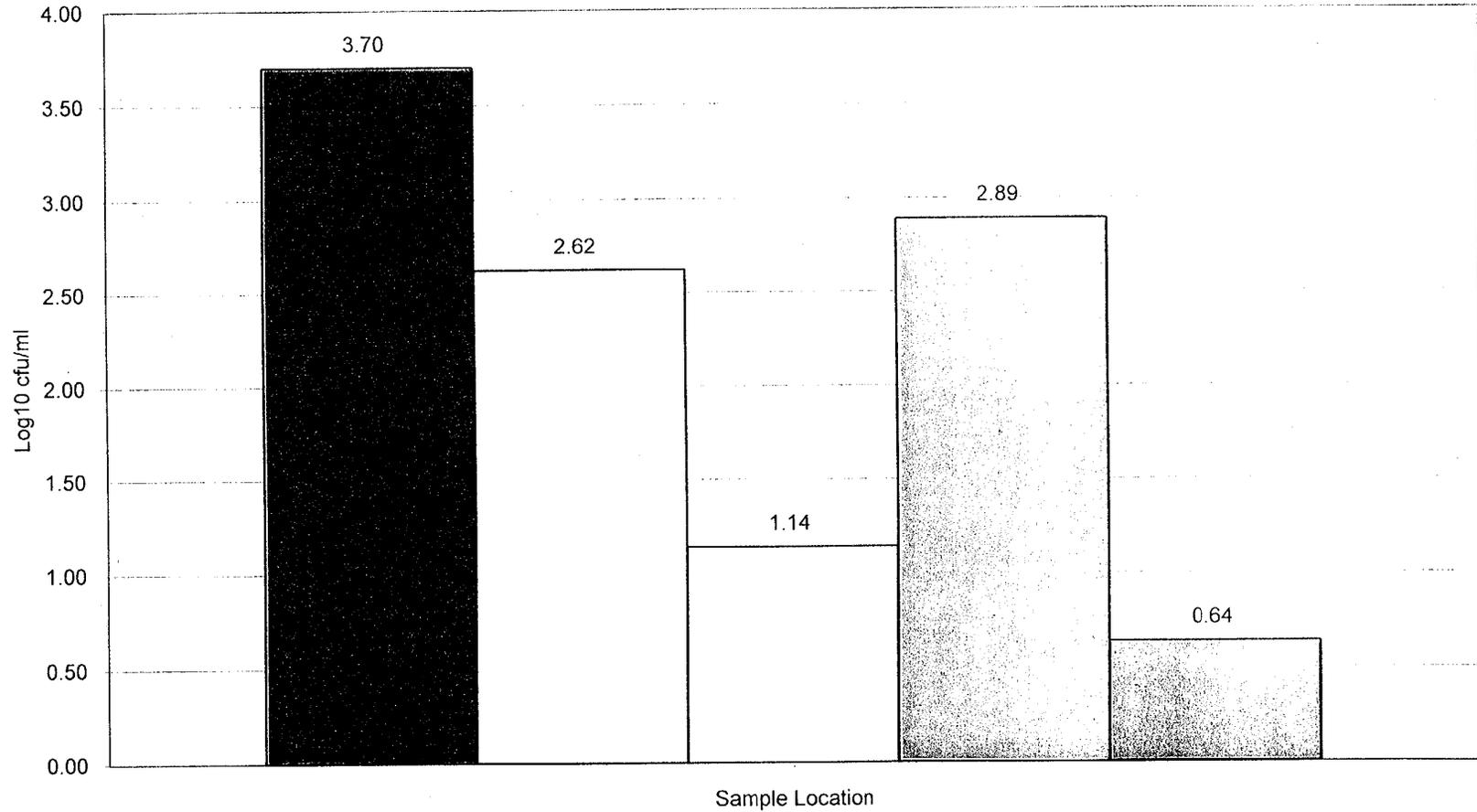
(Within rows, means with no common superscript are significantly different, p < 0.001)

Average Campylobacter spp. **reduction** due to off-line reprocessing = 0.81 log₁₀ cfu/ml

Average Campylobacter spp. **reduction** due to Continuous On-line Processing = 2.56 log₁₀ cfu/ml

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Campylobacter spp. - Fresh Data (Log10 cfu/ml)
All Studies Combined



■ Post Evisceration □ Post Wash □ Post Sanova ▨ Post Off-Line ▨ Post Chill

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