U.S. EXPERIENCE:

DECONTAMINATION PROCEDURES FOR MEAT

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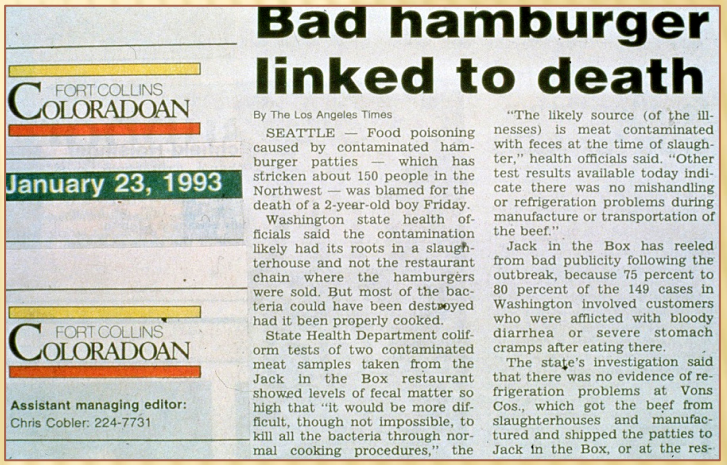
Hazards Associated With Foodborne Illness

Foodborne illness incidents/outbreaks due to:

Chemical Hazards 4%

Physical Hazards 2%

Biological Hazards 94%


FORT COLLINS COLORADOAN

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Bad hamburger linked to death

By The Los Angeles Times

SEATTLE — Food poisoning caused by contaminated hamburger patties — which has stricken about 150 people in the Northwest — was blamed for the death of a 2-year-old boy Friday.

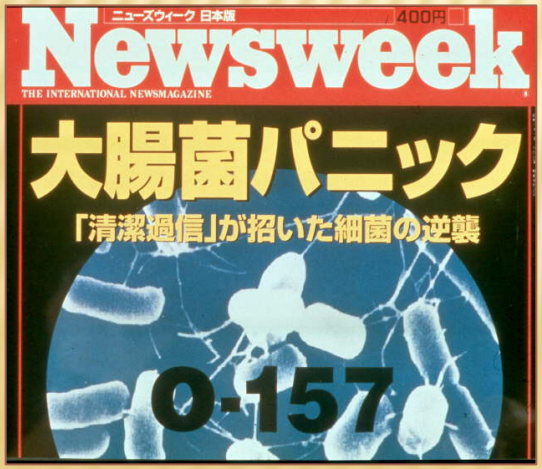
Washington state health officials said the contamination likely had its roots in a slaughterhouse and not the restaurant chain where the hamburgers were sold. But most of the bacteria could have been destroyed had it been properly cooked.

State Health Department coliform tests of two contaminated meat samples taken from the Jack in the Box restaurant showed levels of fecal matter so high that "it would be more difficult, though not impossible, to kill all the bacteria through normal cooking procedures," the

"The likely source (of the illnesses) is meat contaminated with feces at the time of slaughter," health officials said. "Other test results available today indicate there was no mishandling or refrigeration problems during manufacture or transportation of the beef."

Jack in the Box has reeled from bad publicity following the outbreak, because 75 percent to 80 percent of the 149 cases in Washington involved customers who were afflicted with bloody diarrhea or severe stomach cramps after eating there.

The state's investigation said that there was no evidence of refrigeration problems at Vons Cos., which got the beef from slaughterhouses and manufactured and shipped the patties to Jack in the Box, or at the res-




The New York Times

The Burger That Shattered Her Life

Trail of E. Coli Shows Flaws in Ground Beef Inspection System

Detainee's Case Shows Hurdles To Getting Out

Guantánamo Transfers Delayed by Problems

HEALTH OVERHAUL IS DRAWING CLOSE TO FLOOR DEBATE

DEMOCRATS OPTIMISTIC

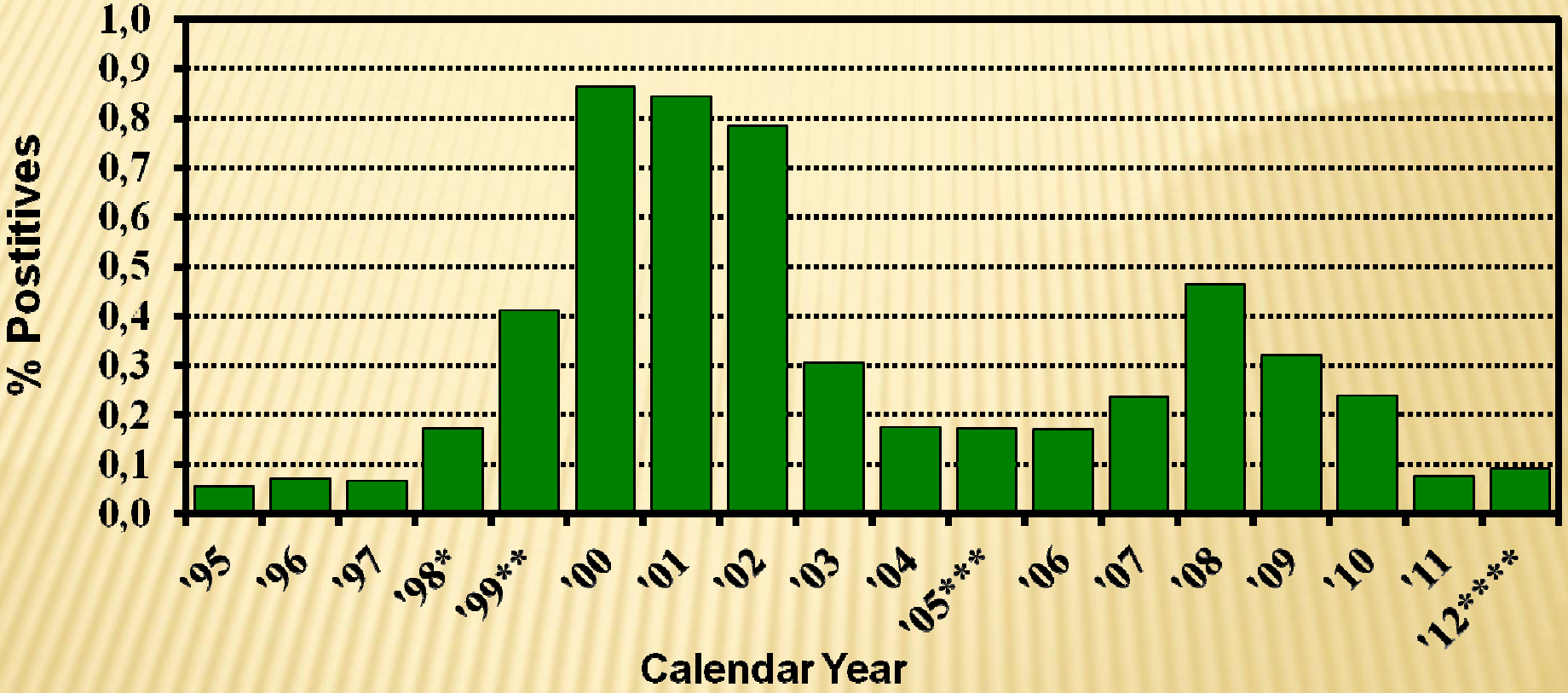
Annual Foodborne Illnesses in the U.S.

(Of 9.4/38.4 million est. cases by 31 pathogens/unspecified agents, respectively)

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Pathogen	Rank (cases)	Est. No. Episodes	Hospitalizations	Deaths	%
Norovirus (viral)	1	5,461,731	14,663	149	0.0027
Salmonella spp., Nontyphoidal	2	1,027,561	19,336	378	0.0368
Clostridium perfringens	3	965,958	438	26	0.0027
Campylobacter spp.	4	845,024	8,463	76	0.0090
Staphylococcus aureus	5	241,148	1,064	6	0.0025
Shigella spp.	6	131,254	1,456	10	0.0076
Non-O157 STECs	7	112,752	271	0	0.0000
Yersinia enterocolitica	8	97,656	533	29	0.0297
Toxoplasma gondii (parasite)	9	86,686	4,428	327	0.3772
Giardia intestinalis (parasite)	10	76,840	225	2	0.0026
Bacillus cereus	11	63,400	20	0	0.0000

USDA-FSIS Raw Ground Beef *E. coli* O157:H7 Testing Program[1]



[1] Results of raw ground beef products analyzed for *E. coli* O157:H7 in federal plants.

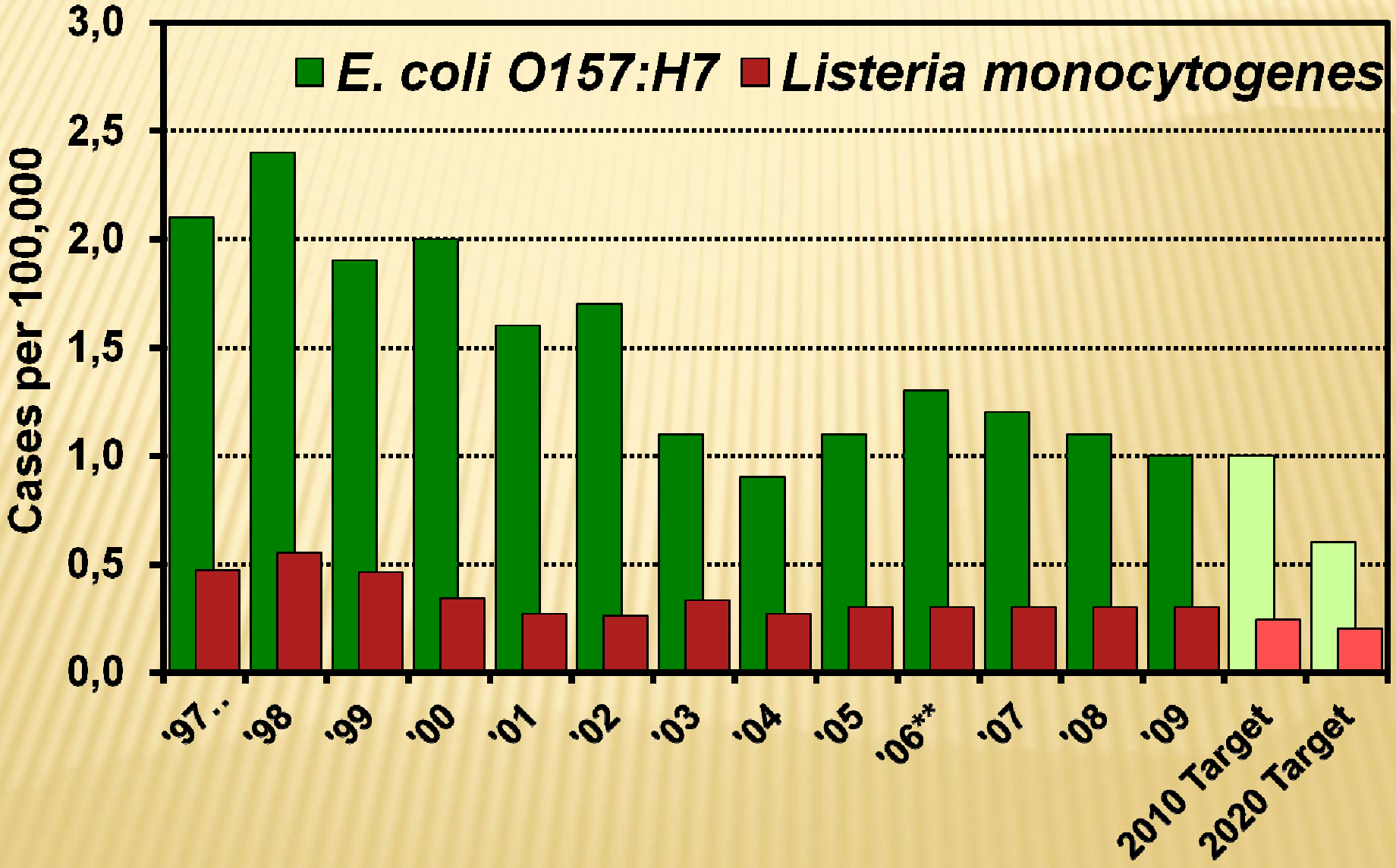
* In '98, FSIS increased sample size from 25 g to 375 g.

** In July '99, FSIS changed to a more sensitive analytical method.

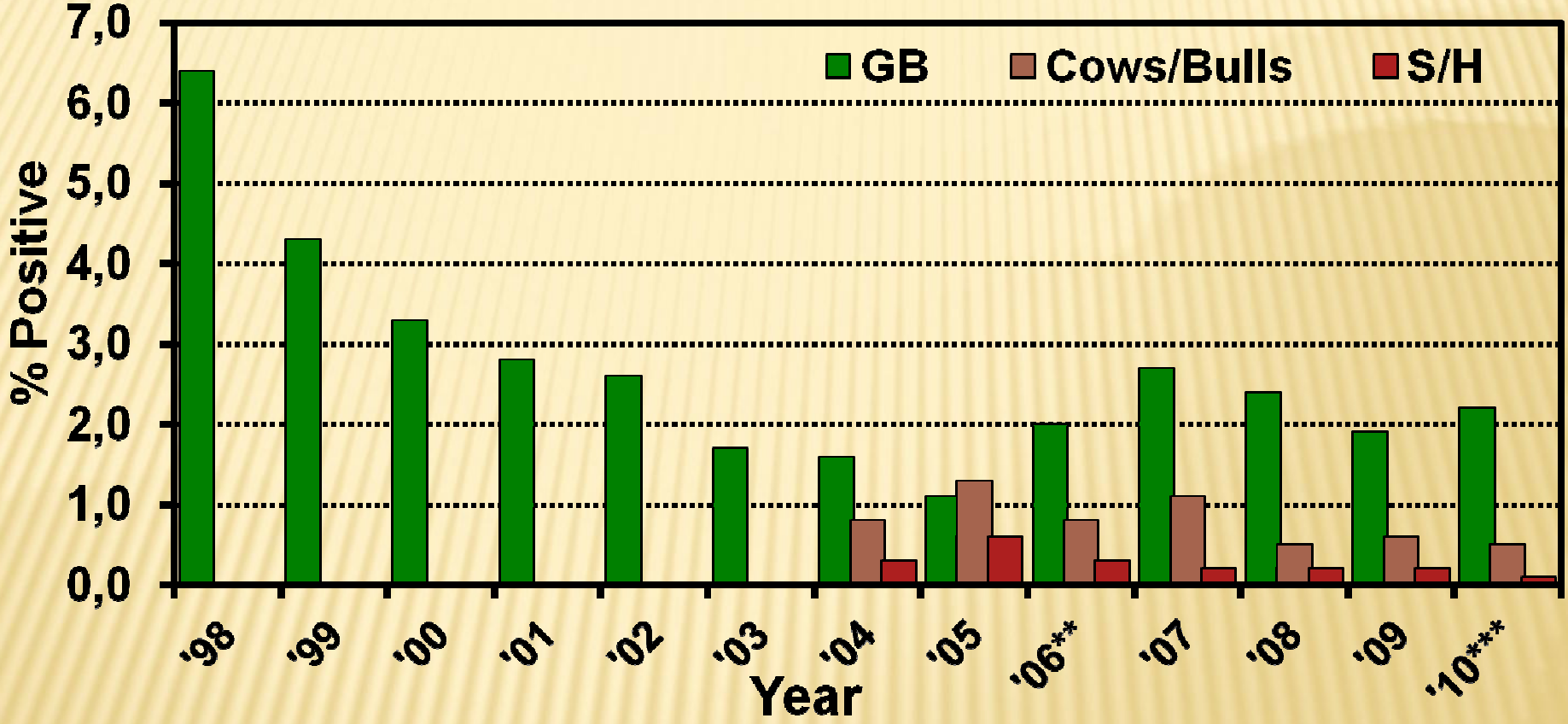
*** In Oct '05, a new screening method was introduced to reduce the number of screen positives that do not confirm positive.

****Raw GB through May 20, 2012.

2010 CDC Healthy People Data & Targets (Accessed May 29, 2012)



USDA-FSIS Prevalence Of *Salmonella* spp. In/On Beef*

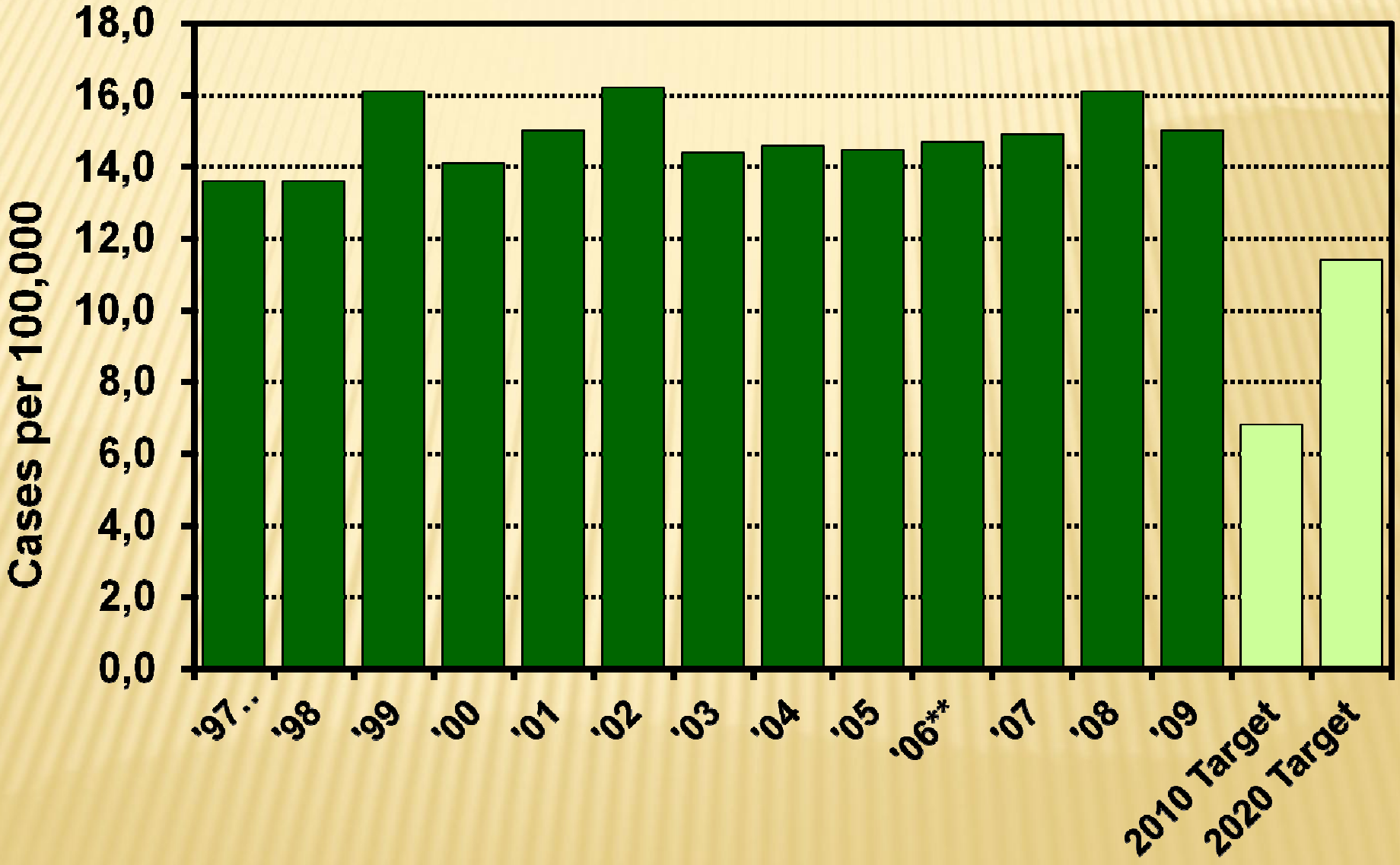


* FSIS results of ground beef analyzed for *Salmonella* spp. Data for '98 through '05 reflects "A" sample sets, while data for '06-'09 reflects all samples.

**Since June 2006, establishments have been scheduled based on risk-based criteria designed to focus FSIS resources on establishments with the most samples positive for *Salmonella* and the greatest number of samples with serotypes most frequently associated with human salmonellosis.

***Following 2010, % prevalence became useless because of targeted/class sampling policy.

2010 CDC Healthy People *Salmonella* Data & Targets (Accessed May 29, 2012)



FEDERAL MEAT INSPECTION ACT
21 CFR, CHAPTER 12

FSIS

Sec. 602. Congressional statement of findings

Meat & meat food products are an important source of the Nation's total supply of food. They are consumed throughout the Nation & the major portion thereof moves in interstate or foreign commerce. It is essential in the public interest that the health & welfare of consumers be protected by assuring that meat & meat food products distributed to them are wholesome, not adulterated, & properly marked, labeled, & packaged . . .

FSIS RESPONSIBILITIES

1. Antemortem inspection.
2. Humane methods.
3. Postmortem inspection.
4. Product inspection.
5. **Assurance that all plants adopt & use HACCP.**
6. Assurance that SSOPs are practiced by personnel.
7. Verification of HACCP System effectiveness (*Salmonella* performance standards).
8. Oversight of plant generic *E. coli* testing protocols.
9. Laboratory determinations & assays.
10. Control & restriction of condemned products.
11. Marking, labeling, & inspection insignia.
12. Facilities construction & operational sanitation.

Pre-requisite Programs to HACCP

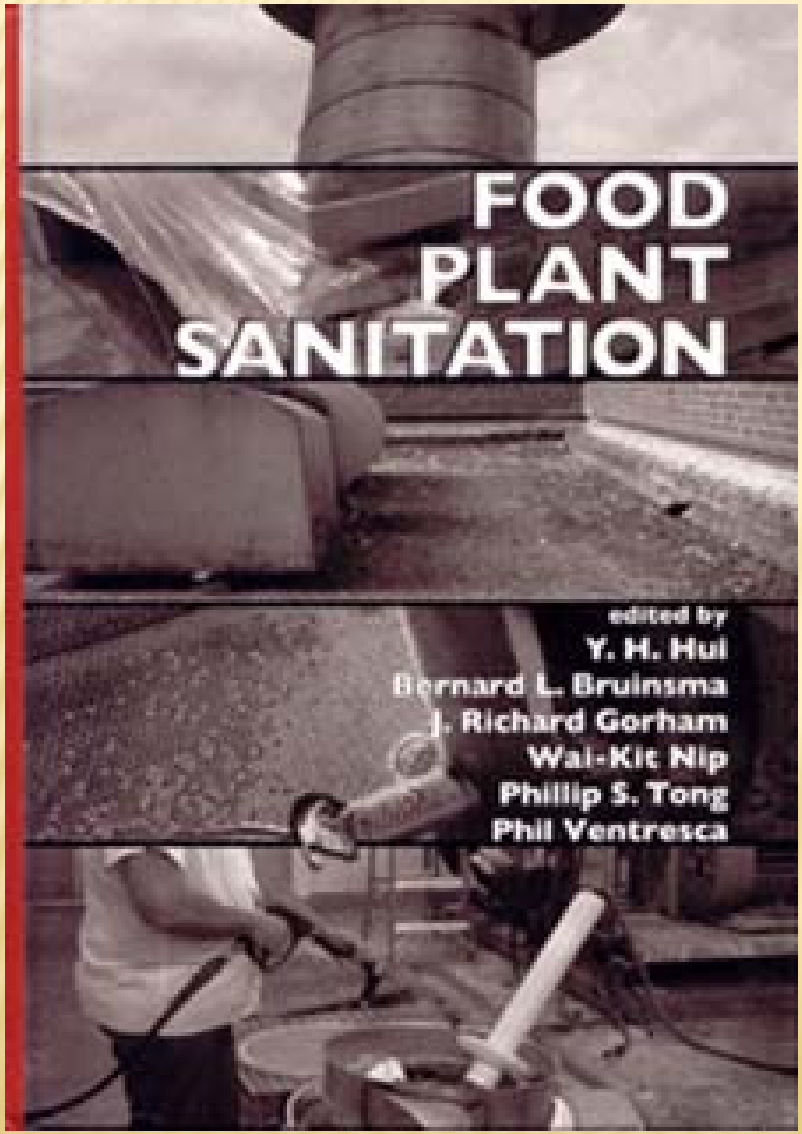
NACMCF

(1) Facilities
(2) Supplier Control
(3) Specifications
(4) Production Equipment
*(5) Cleaning & Sanitation
*(6) Personal Hygiene
(7) Employee Education/Training
(8) Chemical Control
(9) Receiving/Storage/Shipping
(10) Traceability & Recall
(11) Pest Control

FDA

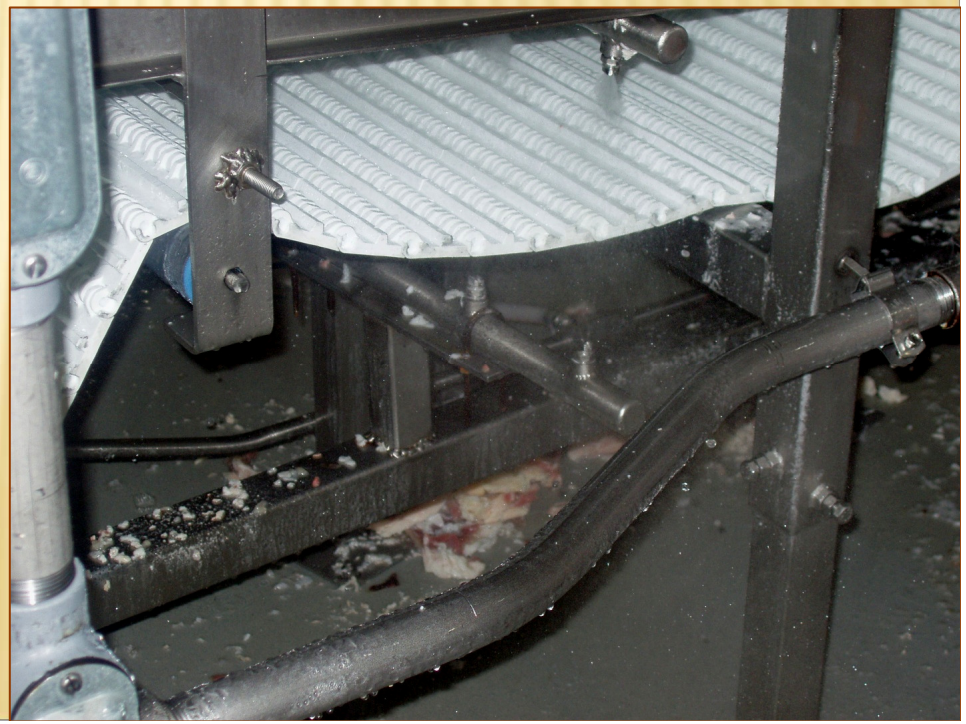
(12) Allergen Control
(13) Complaint Investigation
(14) Labeling
(15) Preventive Maintenance
(16) Water Quality & Treatments
(17) Document & Record Control
(18) Internal Audits
(19) Calibration
(20) Sensory Testing

Plant Pre-Operational Sanitation (SSOPs)



1. Equipment disassembly & dry pick-up (often by plant personnel).
2. Rinsing (from top of equipment or structures down towards the floor).
3. Foaming (w/ cleaner).
4. Scrubbing of all product contact surfaces.
5. Rinsing & 2nd scrubbing as needed.
6. Application of 1st & strongest sanitizer.
7. 3rd Rinse.

Operational Sanitation



SEVEN PRINCIPLES OF HACCP

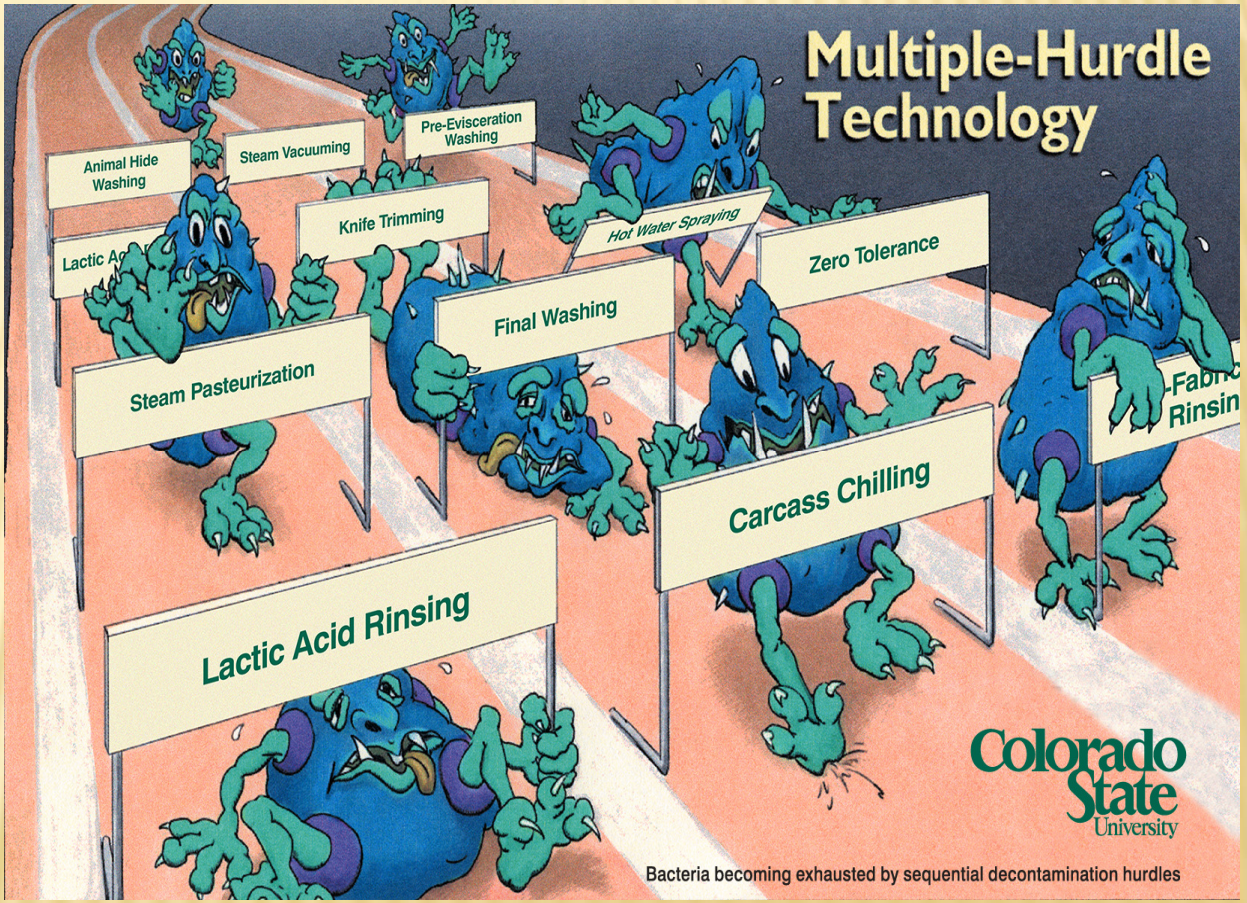
Following full implementation of written Pre-Requisite Programs (GMPs, SSOPs):

1. Conduct a Hazard Analysis.
2. Identify Critical Control Points (CCPs).
3. Establish Critical Limits (CLs).
4. Monitor the Critical Control Points.
5. Determine Appropriate Corrective Actions.
6. Establish Verification procedures to ensure that the system works.
7. Maintain accurate Record-Keeping.

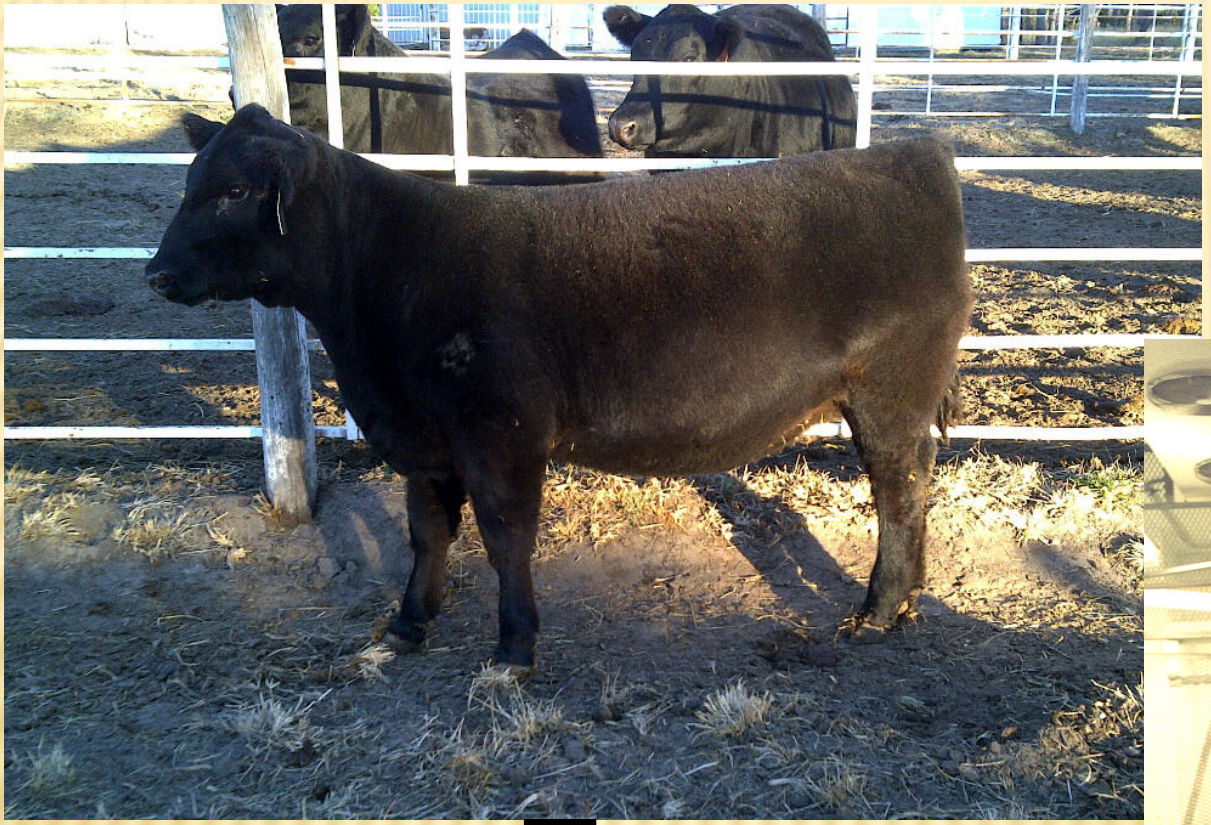
Multiple Hurdles Technology

Beef Slaughter

- Antemortem Inspection
- Immobilization
- Stunning
- Exsanguination
- Hide washing
- Hoof removal
- Hide removal
- Head removal
- Pre-Evis washing/OA
- Bunging
- Evisceration
- Splitting
- Postmortem Inspection
- Washing/TP/OA
- Chilling



Carcass Contamination



Prevalence Of *E. Coli* O157:H7 In Feedlot Cattle Feces, Hides, & Carcasses

Of 15 lots tested:

- 87% at least one positive feedlot fecal sample.
- 54% positive hide sample.
- 80% positive colon.
- 47% positive pre-evis.
- 6% positive post-evis.
- 6% positive final intervention.

	Stratified by % E. coli O157:H7 on Pen Floor	
Samples	> 20%	< 20%
Hide	20%	5.7%
Colon	46.3%	7.1%
Pre-Evis	12.5%	7.1%
Post-Evis	2.5%	0.0%
Post-Final	0.6%	0.0%

Ransom *et al.* (2003)

Funded by USDA-CSREES

Hide Washing Systems

Cargill's system includes a water and sodium hydroxide mix to release contaminants, followed by a high-pressure rinse and lactic acid application.

Cargill sharpens its edge on E. coli O157:H7

A unique partnership yields a promising new carcass wash system

By Daniel J. Vovich, senior editor

During the rainiest weeks of the year, it's not unusual for producers to bring cattle whose hides are infected with E. coli O157:H7 at a rate of 60 percent or higher to the plant.

The dangers and heightened public awareness of E. coli O157:H7 have prompted all packers/processors and their suppliers to rethink and retool their food safety technologies. Among the more promising endeavors is a unique partnership between Cargill Foods' Excel division, Birko Corp. and Chad Co. in manufacturing a new intervention technology.

Dubbed the "cattle wash" by Excel President Bill Buckner, the two-step process has been installed with little fanfare at the company's beef plants in Dodge City, Kan., Fort Morgan, Colo., hit with a water and sodium hydroxide mixture, which releases soils and contaminants from the hide. The carcass then moves to a second cabinet, where it is rinsed at high pressure with water before before being steam vacuumed with a lactic acid application, according to Matt Osborn, the general manager of Excel's Schuyler plant.

"Through the combination of high water pressure, temperature control, pH control and mechanical action, this appears to be a show-stopper as it applies to food safety," Osborn says.

Using 600 gallons of recycled water per minute, oscillating spray nozzles hit the carcass from a distance of 12 inches to 18 inches. Foaming is controlled by an anti-foaming agent.

"The immediate thing you notice, from a physical standpoint, is how clean the hides are when they come out of the cabinet," Osborn says. "There is a big, visible difference in the cleanliness of cattle going down the line."

Sharing the success

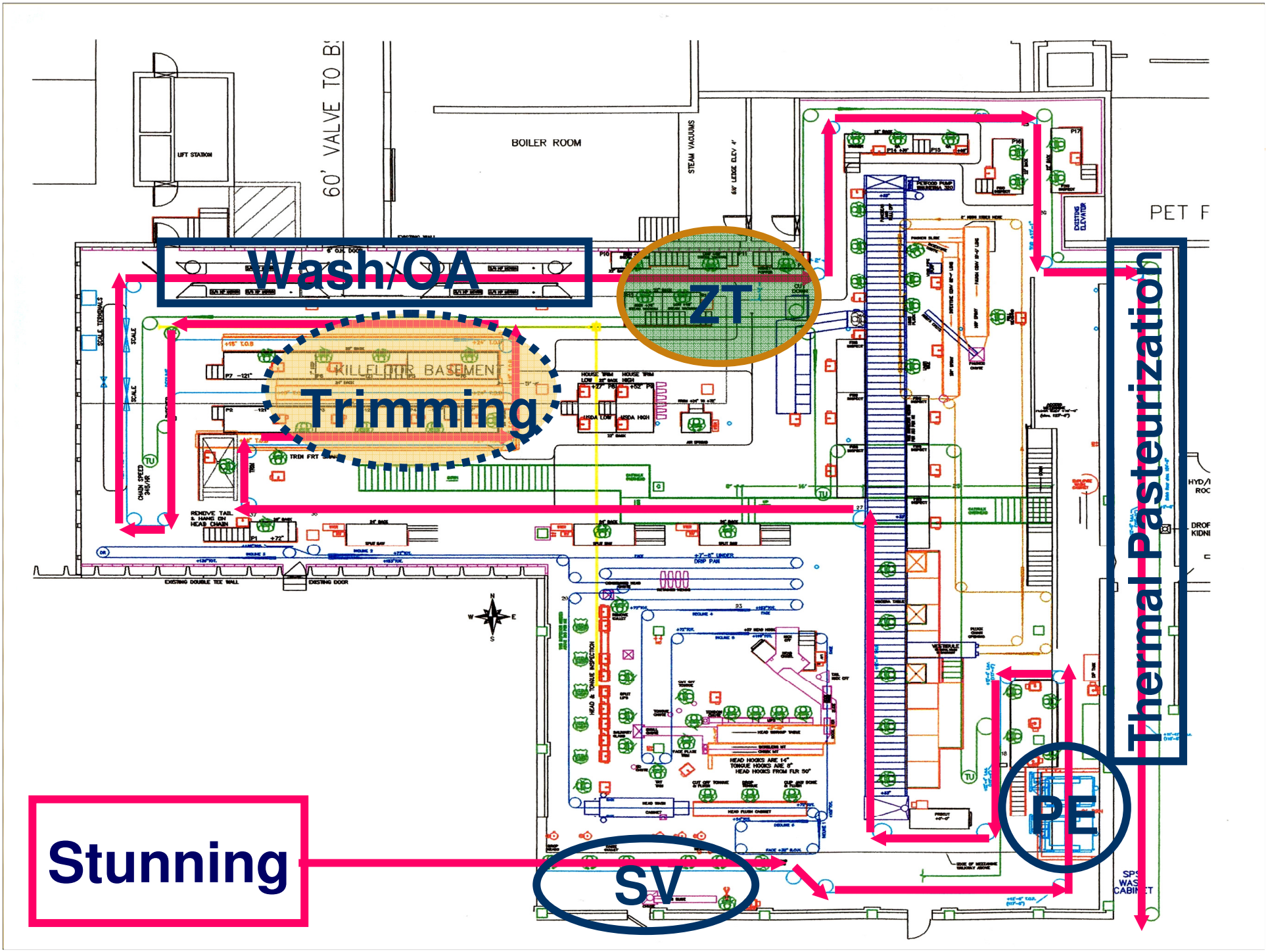
Until September, both Birko and Chad were prohibited by Cargill from talking cess until they had data to support that claim, which should be available before year's end.

Clint Heffer, Birko's vice president and equipment manager, says the introduction of its patented Cattlegard solution to the cattle wash system immediately made the sodium hydroxide more soluble with water.

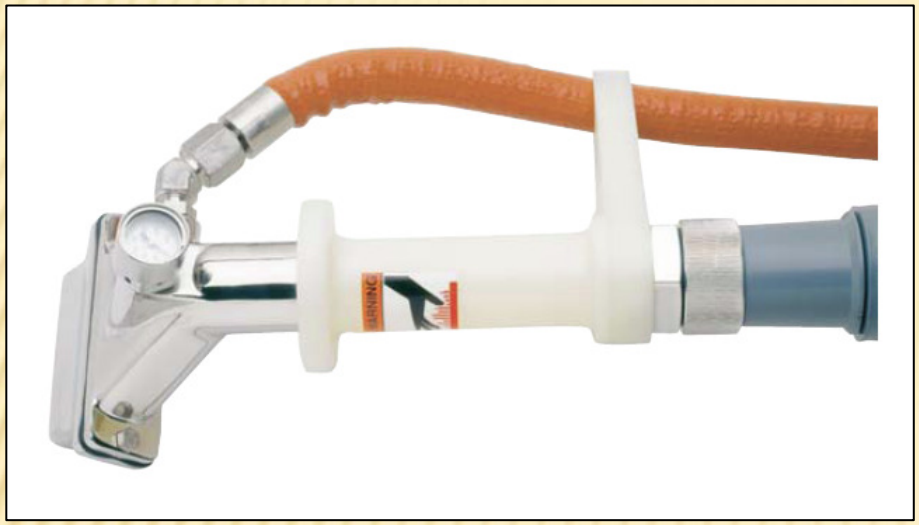
"The challenge for us was to figure out the exact proportion of what was needed, and then to engineer a way to deliver the mixture," Heffer says. "We think this could end up being an industry icon."

Food safety is not proprietary, and the American Meat Institute has already videotaped Cargill's cattle wash with the intent of including it in upcoming media operations that tout innovation in food safety.

"The first one we built was something of a prototype, if you will, and we've fine tuned it along the way," says Chad engineer Jerry Anderson. "We've learned something from each of the four installations, and have gotten all of the bugs worked out."


Wash/OA
ZT
Trimming
Thermal Pasteurization
PE
Stunning
SV
BOILER ROOM
LIFT STATION
60' VALVE TO B
STEAM VACUUMS
KILL FLOOR BASEMENT
EXISTING ELEVATOR
PET F

Hock/Carcass Steam-Vacuuming



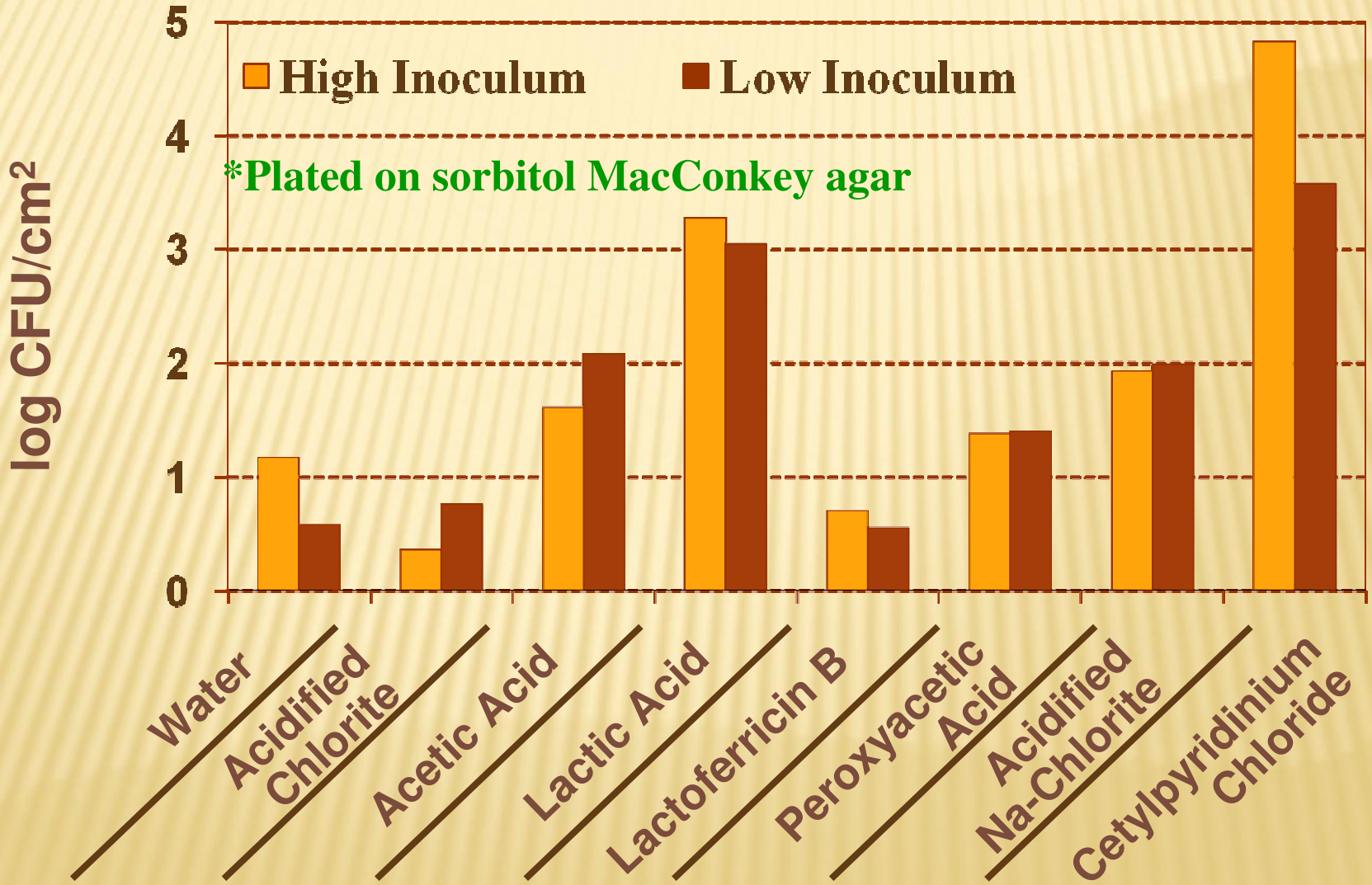
Pre-evisceration Washing/OA Spraying Of Carcasses

Warm-water Carcass Washing/Zero Tolerance Trimming

Thermal Pasteurization Of Carcasses

Organic Acid Spraying

Reductions In Inoculated *E. Coli* O157:H7 On Beef Carcass Tissue Using Various Decontamination Solutions *(Ransom et al., 2001)*



Effect of BoviBrom on Hot Carcass Surface TPC

(Pittman et al., 2011)

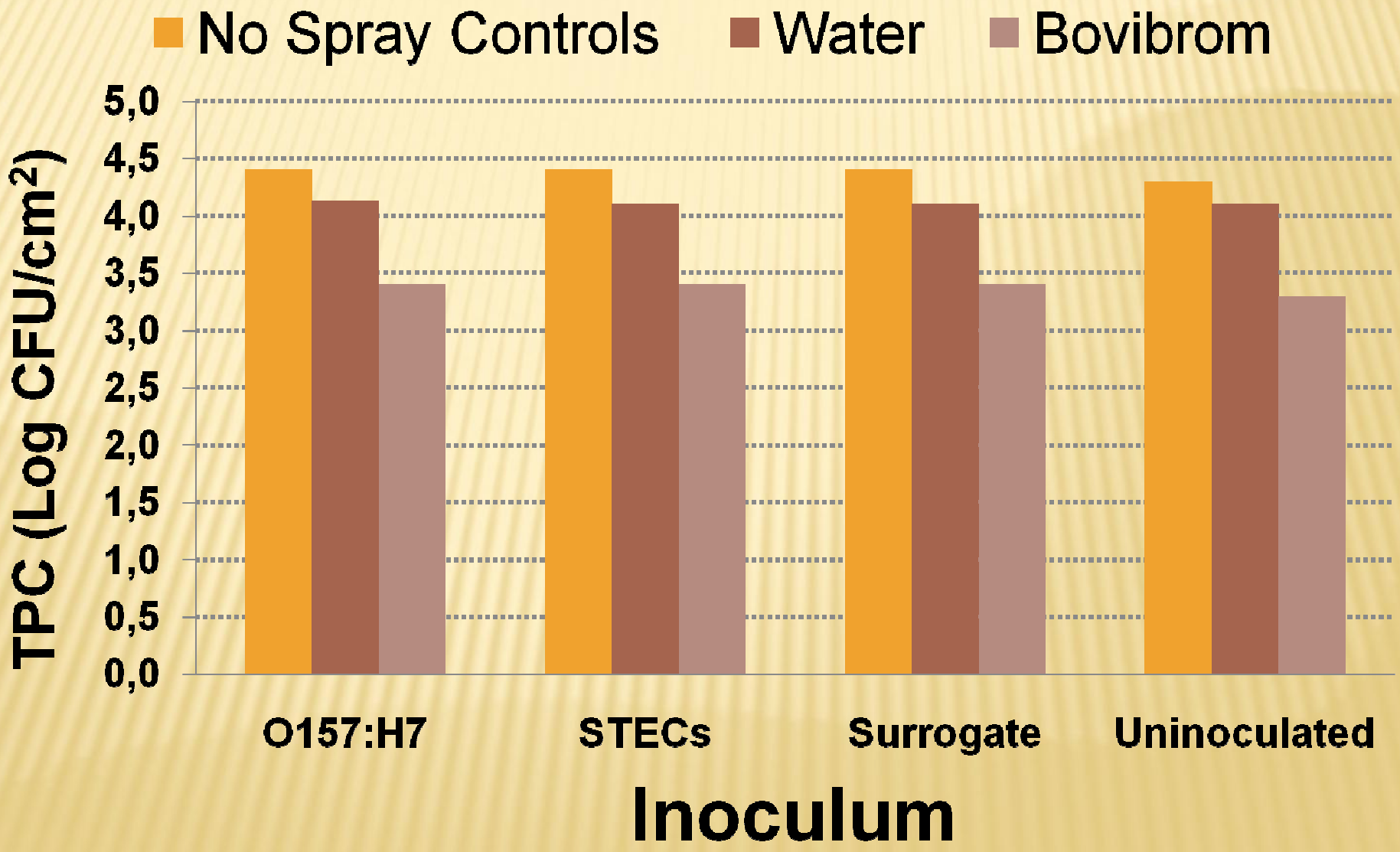
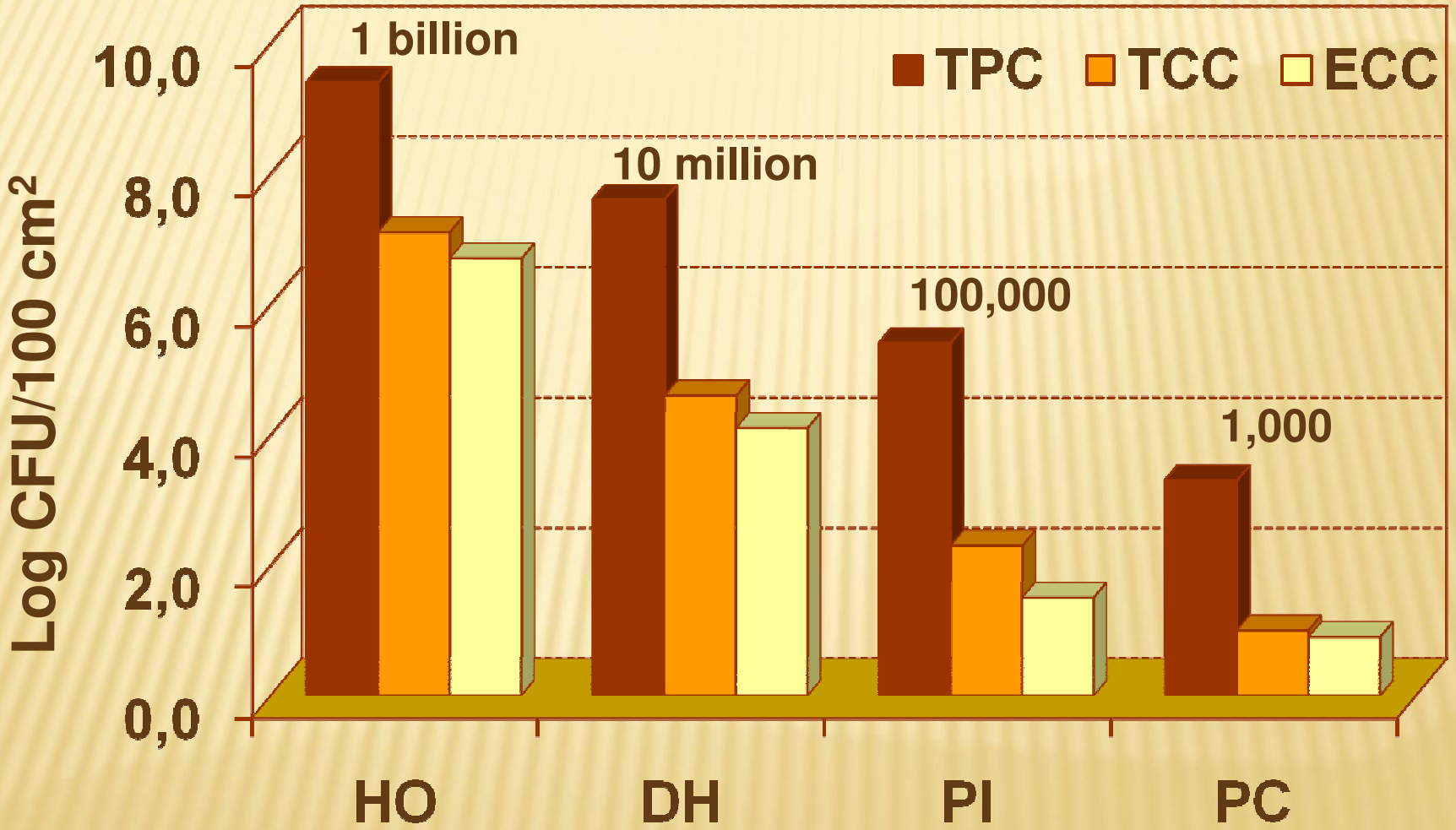


Plate Counts By Sampling Site

(8 Plants; N = 1,280; Bacon et al., 2000)



Salmonella On Beef Carcasses At Two In-plant Sampling Sites *(Source: Bacon et al., 2001)*

Plant	Hide-On (Site 1)		Carcass (Site 2)	
	No. Positive Samples	% Prevalence	No. Positive Samples	% Prevalence
1	19	47.5[a]	3	7.5[b]
2	4	10.0[a]	0	0.0[b]
3	0	0.0	0	0.0
4	9	23.1[a]	0	0.0[b]
5	0	0.0	0	0.0
6	4	10.0[a]	0	0.0[b]
7	7	17.5[a]	0	0.0[b]
8	6	15.0[a]	1	2.5[b]
Total	49	15.4[a]	4	1.3[b]

AMIF Project Summary:
Incidence of *E. coli* O157:H7

Beef Packing Plants	n =	Hide-on (%)	Prior to washing (%)	Following Intervention (%)
12	2,248	3.56[a]	0.44[b]	0.00[c]

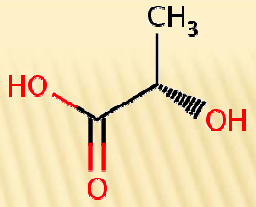
- **No beef trimming samples were found to test positive for *E. coli* O157:H7 when sampled on the same days as carcasses.**

Source: Incidence Of *Escherichia coli* O157:H7 (AMIF/CSU, 2000)

Organic Acid Systems

- Worker safety hazards are minimized
  - Ventilation
  - In-Line mixing
  - Drainage
  - Air curtains
  - Low application concentrations

Lactic Acid



- Processing Aid at concentrations up to 5% (USDA-FSIS, 2006).
- Human blood contains 8-17 mg /100 ml plasma (USFDA, 1978).
- Humans produce 140 g daily during metabolism (Kreisberg et al., 1971; USFDA, 1978).

Residual lactic acid on beef samples after dipping for 30 sec at 55°C in lactic acid solution

Lactic acid solution (%)	Control (ppm)	Treated (ppm; mg/kg)
2.5	16.8	28.0
5.0	33.6*	56.0*

* Assuming a linear relationship between lactic acid spray concentration and meat residue concentration

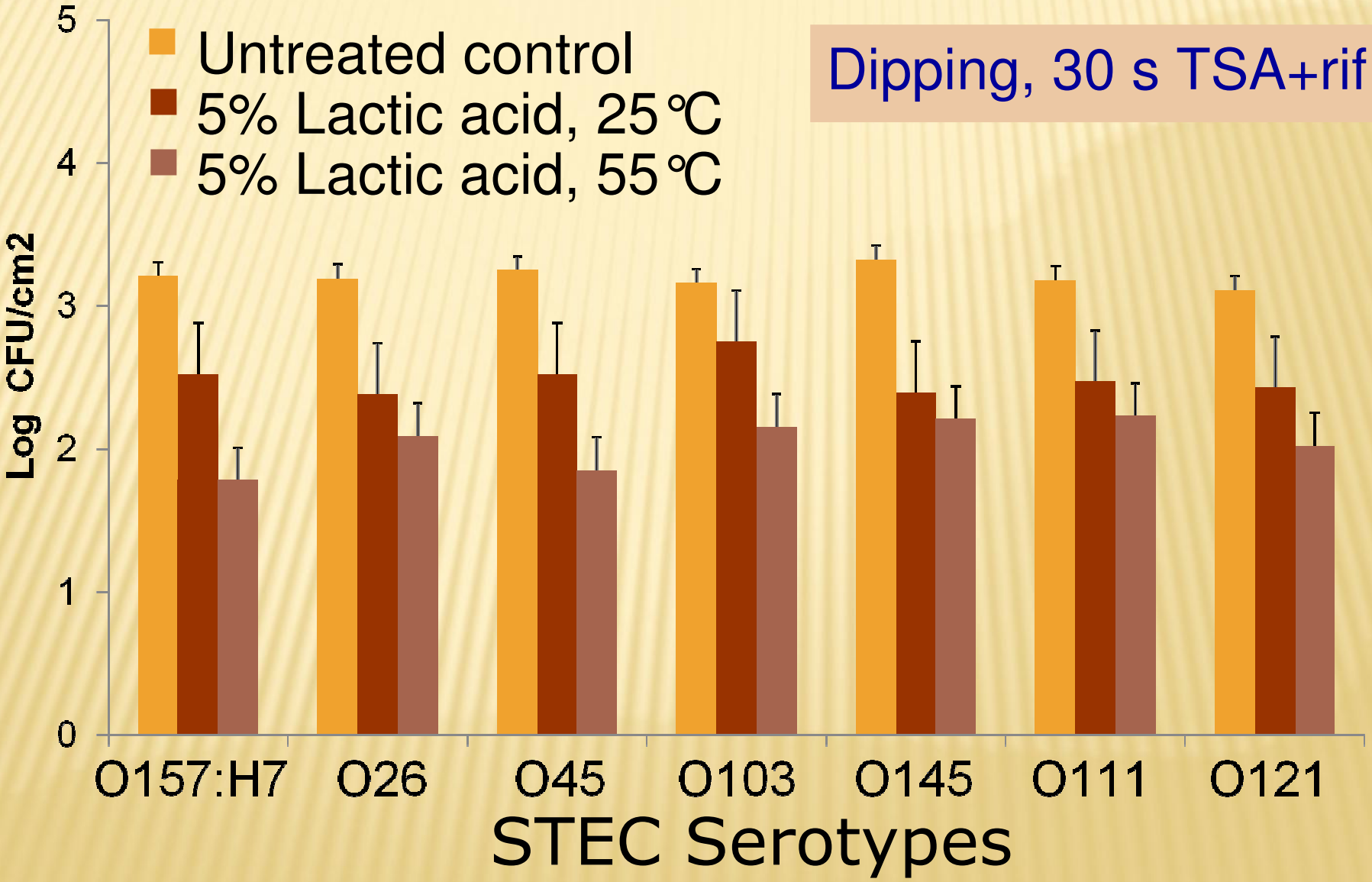
Source: Rose et al. (2004)

- Worst case: Residual concentration from 5.0% LA spray = 56 mg/kg beef.

Animal	Route	Acute Toxicity LD_{50} (mg/kg)
Rat	Intraperitoneal (Na lactate)	2,000
Rat	Oral (lactic acid)	3,730
Mouse	Oral	4,875

Source: WHO (1974)

LA on Beef Trimmings (SOURCE: Fouladkhah et al., 2011)



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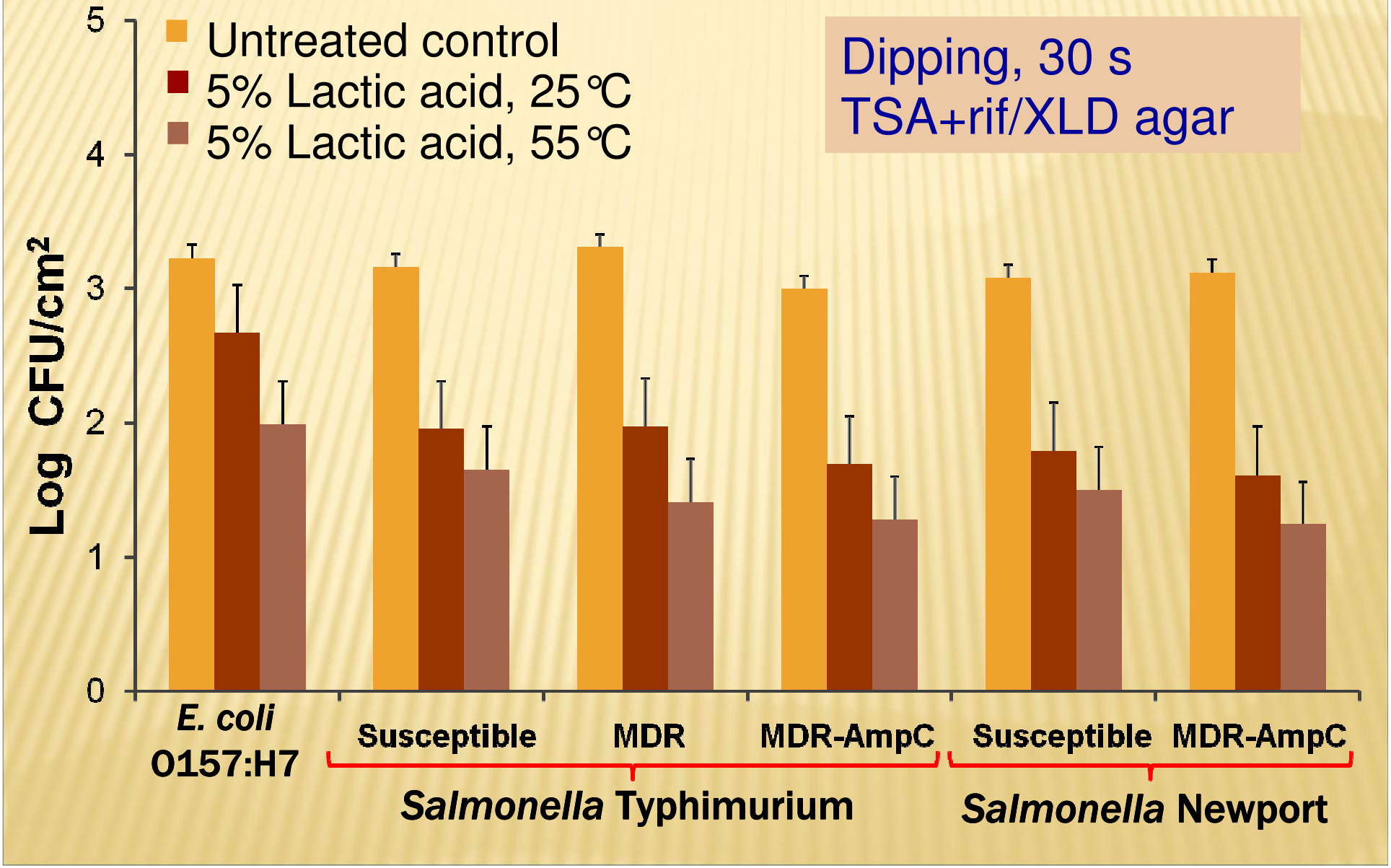
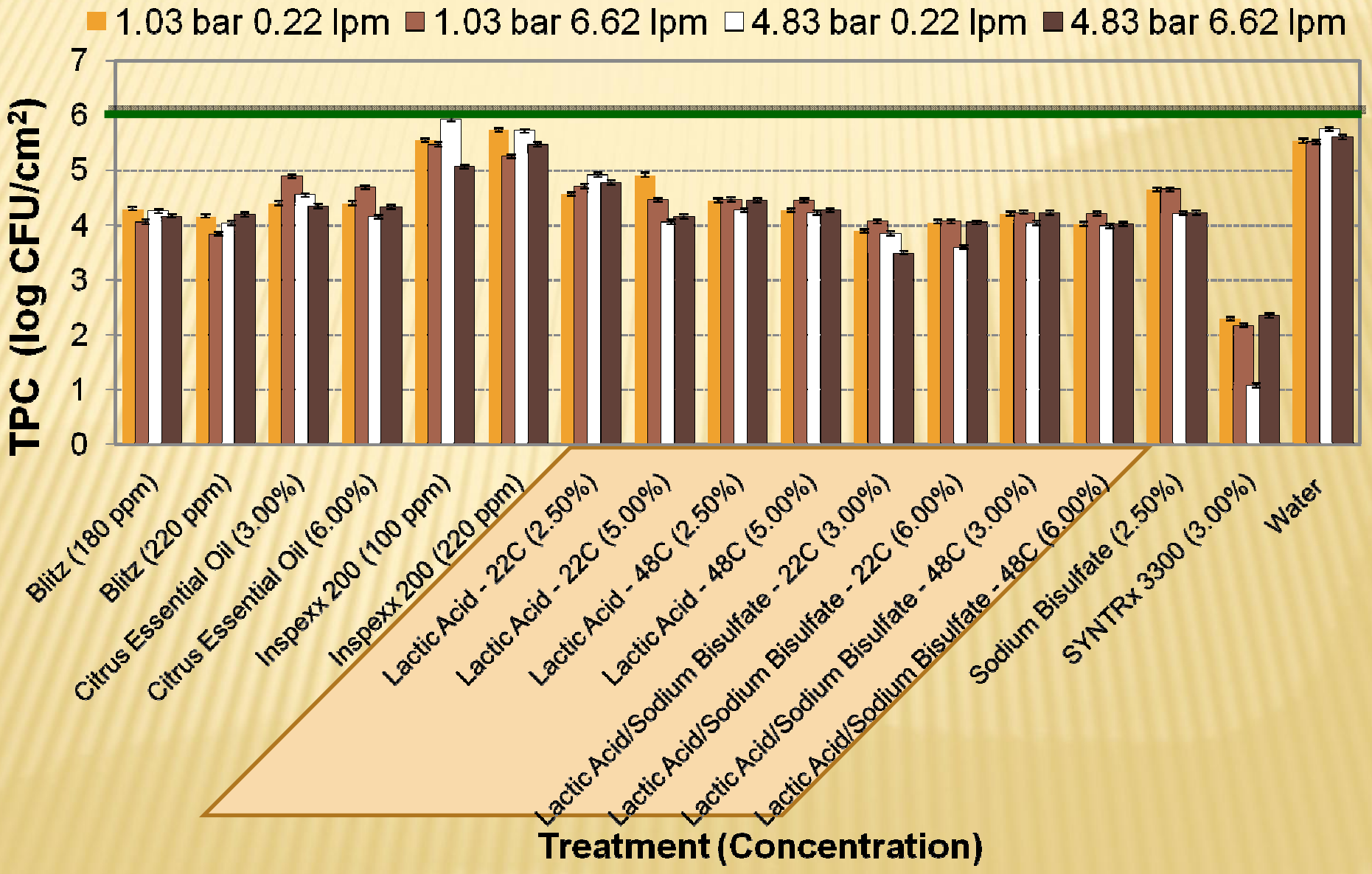
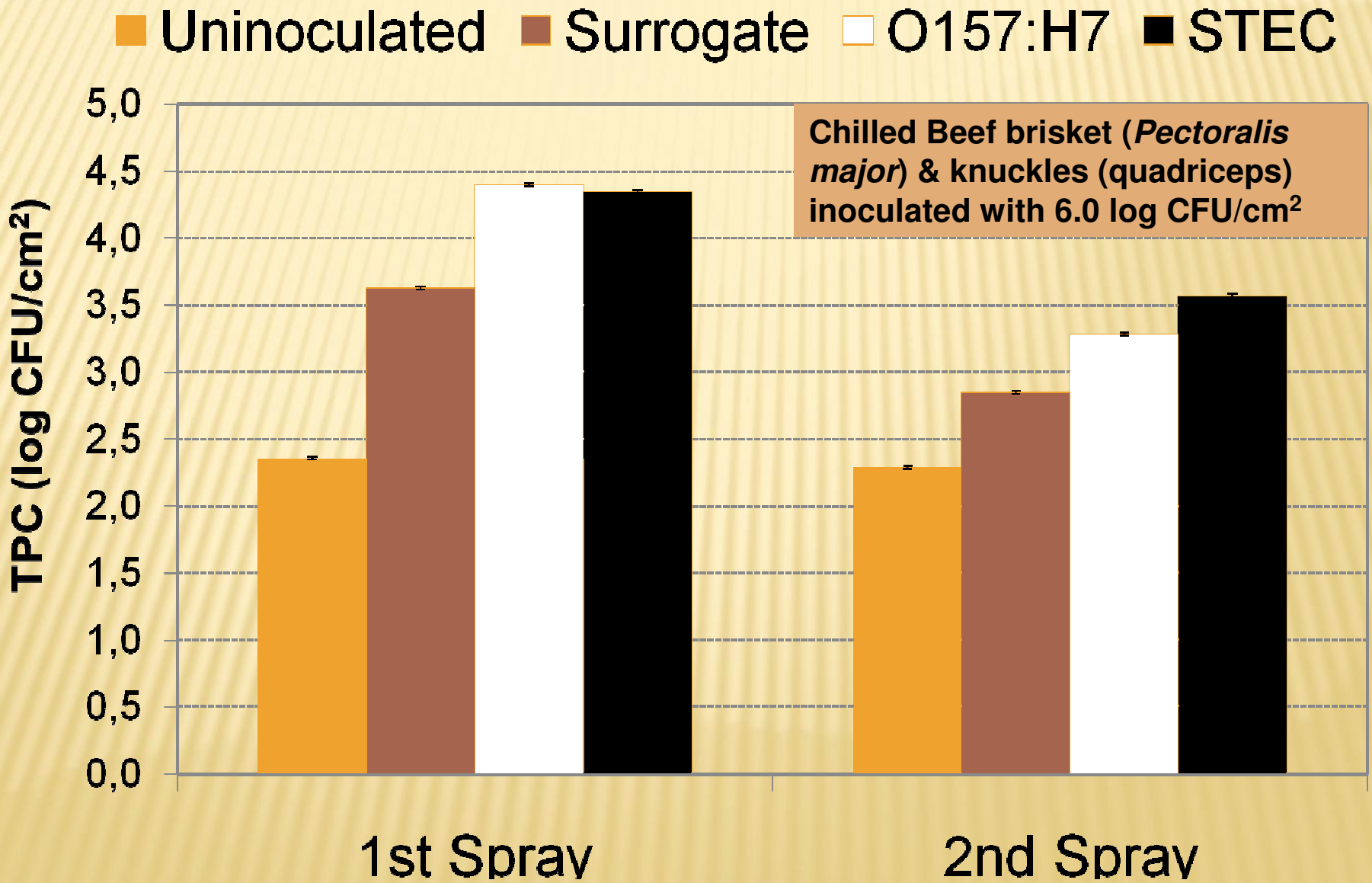


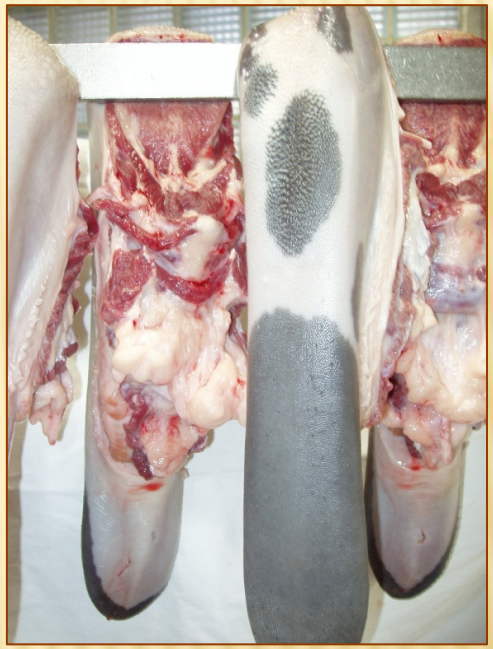
TPC Remaining 0-hr Following Treatment At Various Application Parameters On **Chilled** Beef Brisket Sections



TPC for Differing Inoculants Remaining After Treatment With 1st & 2nd Lactic Acid Applications



Variety Meat Interventions



Variety Meat Interventions

(Sources: Delmore et al., 1998; Zerby et al., 1998; CSU/USMEF)

	Beef APC (log CFU/g)		
Intervention	L. Intestine	Tongue	Oxtail
Control/A	4.5^{a}	5.9^{a}	3.2^{a}
Control/B	2.4^{c}	5.9^{a}	
AASP or DP/A	3.7^{ab}	3.1^{bc}	2.5^{b}
AASP or DP/B	2.6^{c}	2.3^{c}	
LADP/A	3.3^{b}	2.5^{c}	
LADP/B	3.6^{b}	3.5^{b}	

^{a,b} Means in a column bearing different superscript letters differ ($P < .05$).