NATIONAL MARKET COW AND BULL BEEF QUALITY AUDIT-2007:

A SURVEY OF PRODUCER-RELATED DEFECTS

A Thesis

by

JOHN DAVID WHITSON NICHOLSON

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

May 2008

Major Subject: Animal Science

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Approved by:

Chair of Committee:	Jeffrey W. Savell
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ABSTRACT

National Market Cow and Bull Beef Quality Audit-2007:

A Survey of Producer-Related Defects.

(May 2008)

John David Whitson Nicholson, B.S., Texas A&M University

Chair of Advisory Committee: Dr. Jeffrey W. Savell

Packing plants (n = 23), were audited for producer-related defects found in cull cows and bulls. Interviews, live animal and carcass evaluations, and subprimal evaluations were conducted during each audit. A drastic reduction in downer incidence was found between 1999 and 2007. All loads met the AMI guidelines for spacing. Excessive use of electric prods must be addressed by packers and transporters alike. Fewer cattle had mud/manure contamination on hides, horns, and brands than in 1999. Predominant hide color for beef cattle was black, while the predominant dairy color was the Holstein (black and white) pattern. Fewer cattle displayed evidence of bovine ocular neoplasia than in 1994 and 1999. Knots present on live cattle were less in the round and more in the shoulder region than in 1999. Dairy cows were more frequently lame in 2007 than 1999, while beef cows were less lame. Carcass bruising was less evident during the 2007 audit than in previous audits. Fewer cattle had arthritic joints in 2007 than in 1999. An increase in liver, tripe, heart, head, and tongue condemnation was witnessed in 2007 than in 1999. Carcass weights increased since 1999, as well as having less fat, indicating heavier muscled animals being slaughtered. The average fat color score was higher for beef cows (3.14) than dairy cows (2.42). Fabrication trends are similar to data collected in 1999 as almost half of cull cow fabrication yields are primal and subprimal type products. The majority of all cattle (64%) were able to be traced back to their original owner. End-user audits revealed a higher incidence of injection site lesions in dairy rounds (48%) than in beef rounds (12%). Lastly, the incidence of dairy round injection site lesions has increased since 1999 (35%), while beef round lesions were fewer since 1999 (20%).

DEDICATION

First and foremost, this paper is dedicated to my lord and savior, Jesus Christ. I also dedicate this paper to my Dad, the strongest man I ever knew.

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TABLE OF CONTENTS

	Page
ABSTRACT	iii
DEDICATION	v
ACKNOWLEDGEMENTS	vi
TABLE OF CONTENTS	viii
LIST OF TABLES	x
CHAPTER	
I INTRODUCTION AND LITERATURE REVIEW	1
II INTERVIEWS	6
Materials and methods	6
Results and discussion	9
Open interviews	9
Aided interviews	13
III PACKING PLANT AUDITS	18
Materials and methods	18
Receiving and unloading welfare	18
Holding pen welfare	20
Live animal evaluation	20
Individual live animals	21
Visible defects for cattle in holding pens	23
Carcass defect evaluation	23
Bruises, injection sites, and arthritic joints	24
Visceral condemnations	24
Head and tongue condemnations	25
Dentition	25
Carcass grade data	26
Product fabrication	26
Animal traceability	27
Statistical analysis	28

CHAPTER Page

Results and discussion 28
Receiving, unloading and holding pen welfare 28
Live animal evaluation 39
Individual live animal traits 39
Visible defects for cattle in holding pens......... 54
Carcass defect evaluation 58
Bruises, injection sites, and arthritic joints 58
Visceral condemnations and fetal calves 66
Head and tongue condemnations.................... 70
Live animal and carcass condemnations.......... 73
Dentition 76
Carcass grade data 78
Product fabrication 95
Animal traceability 101

IV END-USER AUDITS 103

Materials and methods 103
Processing plant end-user audits 104
Packing plant end-user audits 104
Results and discussion 105
Open and aided interviews..................................... 105
Product defect evaluation 108

V CONCLUSIONS 115

LITERATURE CITED 118

APPENDIX 121

VITA 150

LIST OF TABLES

TABLE		Page
1	Summary of packing plant audits and responsible collaborators.	7
2	Summary of end-user plant audits	8
3	Top ten quality challenges facing the market cow and bull beef industry since 1999	9
4	Top five directives to solve quality challenges facing the market cow and bull beef industry	10
5	Top five improved quality challenges of the market cow and bull beef industry since 1999 from questionnaire	12
6	Top five future quality challenges to face the market cow and bull beef industry since 1999 from questionnaire	12
7	Means of aided questionnaire results for FSIS representative live cattle quality concerns during the packing plant auditing phase – part 1	14
8	Means of aided questionnaire results for FSIS representative live cattle quality concerns during the packing plant auditing phase – part 2	15
9	Means of aided questionnaire results for plant management representative live cattle quality concerns during the packing plant auditing phase – part 1	16
10	Means of aided questionnaire results for plant management representative live cattle quality concerns during the packing plant auditing phase – part 2	17
11	Mean, minimum, and maximum values of cattle transport points of interest for all trailer types	29

TABLE		Page
12	Mean, minimum, and maximum values of cattle transport points of interest for gooseneck and bumperpull trailers...........	30
13	Mean, minimum, and maximum values of cattle transport points of interest for tractor-trailers..	31
14	Frequency distribution of cattle transportation points of interest...	34
15	Frequency distribution of hot shot usage by persons responsible for cattle unloading	36
16	Frequency distribution of aggressive/passive usage of other driving aid types by persons responsible for cattle unloading..	37
17	Frequency distribution of hot shot usage by persons responsible for moving cattle through pens up to the restrainer	38
18	Frequency distribution of aggressive/passive usage of other driving aid types by persons responsible for moving cattle through pens up to the restrainer	39
19	Frequency distribution of predominant hide color on cattle.......	41
20	Frequency distribution of single and multiple identification types...	42
21	Frequency distribution of hide contamination from mud/manure on animal’s legs, belly, side, and topline	43
22	Frequency distribution of brands by number and location	45
23	Frequency distribution of horn size..	46
24	Frequency distribution of bovine ocular neoplasia by severity (cancer eye)..	46
25	Frequency distribution of knots due to injections by location...	48

TABLE | Page

26 Frequency distribution of locomotion scores for cattle 49

27 Means and frequency distribution of muscle scores.................. 49

28 Means and frequency distribution of body condition scores (BCS) for beef animals 51

29 Means and frequency distribution of body condition scores (BCS) for dairy cattle 53

30 Frequency distribution of animals with and without any visible defects... 55

31 Frequency distribution of other visible live animal quality concerns 56

32 Frequency distribution of visible abscesses and lumpy jaw for all animal types 56

33 Frequency distribution of visible reproductive problems in cows and bulls 57

34 Frequency distribution of visible udder problems in beef and dairy cows.. 57

35 Comparison of frequency for bruise severity classifications between past and current audits 59

36 Frequency distribution of bruise severity for cattle surveyed..... 60

37 Frequency distribution of bruise location for cattle with single and multiple bruises.. 61

38 Frequency distribution of injection site lesion severity for cattle surveyed.. 62

39 Frequency distribution of injection site lesion location for cattle with single and multiple lesions...................................... 63

40 Frequency distribution of arthritic joints for cattle surveyed...... 64

TABLE		Page
41	Frequency distribution of grubs and buck shot prevalence for cattle surveyed	65
42	Comparison of offal and carcass condemnation rates from 1994, 1999, and 2007 Market Cow and Bull Beef Quality Audits	67
43	Condemnation rates for offal items during the 2007 National Market Cow and Bull Beef Quality Audit	67
44	Frequency distribution of liver condemnation causes for all beef and dairy animals	68
45	Frequency distribution of tripe condemnation causes for all beef and dairy animals	68
46	Frequency distribution of heart condemnation causes for all beef and dairy animals	69
47	Frequency distribution of beef and dairy cows that contained fetal calves	70
48	Frequency distribution of tongues that were trimmed and condemned for various reasons for all beef and dairy animals	71
49	Frequency distribution of heads that were trimmed and condemned for various reasons for all beef and dairy animals	72
50	Frequency distribution of antemortem and postmortem condemnations for all animals and carcasses surveyed	73
51	Comparison of top ten reasons for carcass condemnations during 1999 and 2007 National Market Cow and Bull Beef Quality Audits	74
52	Top ten reasons for carcass condemnations for cattle surveyed during the 2007 National Market Cow and Bull Beef Quality Audit	75

TABLE | Page

TABLE		Page
53	Frequency distribution of total adult incisors for each animal type	76
54	Frequency distribution of cattle with dental defects that prohibit proper mastication	77
55	Mean values for carcass traits	79
56	Frequency distribution of lean maturity by animal type	80
57	Frequency distribution of skeletal maturity for animal type	81
58	Frequency distribution of overall maturity by animal type	81
59	Frequency distribution of marbling scores for animal type	82
60	Frequency distribution of quality grade by animal type	83
61	Frequency distribution of adjusted fat for animal type	84
62	Frequency distribution of ribeye area by animal type	85
63	Frequency distribution of kidney, pelvic, heart fat percentage for animal type	86
64	Frequency distribution of hot carcass weights for animal type	86
65	Frequency distribution of yield grades by animal type	87
66	Frequency distribution of muscle scores for animal type	88
67	Frequency distribution of fat color scores by animal type	89
68	Frequency distribution of ribeye area/cwt ratio for cattle surveyed	90
69	Frequency distribution of dark cutters, bloodsplash, and calloused ribeyes by animal type	91
70	Frequency distribution of cow packer grade for plants that sorted/classified carcasses	93

TABLE		Page
71	Frequency distribution of bull packer grades for plants that sorted/classified carcasses	93
72	Packer grades vs. plant grades for cows and bulls	94
73	Percentage of plants that produce listed whole muscle cuts	96
74	Average percentage of total plant production for whole muscle cuts from plants that submitted fabrication information	97
75	Average percentage of subprimal cuts derived from forequarters of cow and bull carcasses from plants that submitted fabrication information	98
76	Average percentage of subprimal cuts derived from hindquarters of cow and bull carcasses from plants that submitted fabrication information	99
77	Average percentage of other products derived from cow and bull carcasses from plants that submitted fabrication information	100
78	Frequency distribution for extent of traceback found for all animals traced	102
79	Top five quality challenges facing the market cow and bull beef industry since 1999 according to end-users	106
80	Top five directives to solve problems facing the market cow and bull beef industry since 1999 according to end-users	106
81	Top five improvements made in the market cow and bull beef industry since 1999 according to end-users	107
82	Means of aided questionnaire results for end-user product quality concerns	107
83	Frequency distribution of beef, dairy, and overall top sirloin defects	109

TABLE		Page
84	Frequency distribution of bottom round flat defects	111
85	Frequency distribution of injection site lesion severity for defects found in sirloin caps	112
86	Frequency distribution of injection site lesion severity for defects found in center-cut sirloins	112
87	Frequency distribution of injection site lesion severity for defects found in bottom round flats	113

CHAPTER I

INTRODUCTION AND LITERATURE REVIEW

The National Market Cow and Bull Quality Audits have provided a benchmark for producer performance in cull cow and bull management over the past 13 years. Previous audits include two U. S. audits: NNFBQA – 1994 (Smith et al., 1994) and NMCBBQA – 1999 (Roeber et al., 1999). Two Canadian audits also were conducted: the Canadian Beef Quality Audit–1995-96 (Van Donkersgoed et al., 1997) and the Canadian Beef Quality Audit–1998-1999 (Van Donkersgoed et al., 2001).

Changes in auditing methods from the past studies have included data pertaining to animal welfare, traceability, fabrication of cuts, and subprimal evaluation for internal defects. As in the past, the primary phases of the 2007 cow and bull quality audits consisted of interviews and in-plant audits aimed at offering insight into the quality challenges that face today's cull cow and bull industry. An addition included in the 2007 Audit was an end-users audit, which looked for producer related quality defects that might be found at the further processing segment of the beef industry.

Open and aided questionnaires were submitted in order to gain additional knowledge on quality challenges. The interview process, especially the aided portion, helped in gaining information on how dairy and beef cattle producers have performed since

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This thesis follows the style of Journal of Animal Science.

1999. Interview responses during the 1999 audit addressed key issues such as too frequent bruising on carcasses, antibiotic residues, and buck shot/bird shot (Roeber et al., 2001). With information supplied from the past cow audits, improvements in these areas are to be expected as increased awareness of these problems should lead producers to avoid situations that could allow for these quality concerns to continue.

Grandin (2001) stated that handling animals in a quiet environment preserves meat quality. According to the Recommended Animal Handling Guidelines (AMI, 2007), limitations should be in place to minimize stress on animals before, during, and after transport. Fewer than 25 percent of animals should be touched with a hot shot when attempting to drive them(AMI, 2007). No more than 3 percent should slip while unloading from trailors (AMI, 2007). Lastly, according to the AMI Guidelines (2007), space allotted per animal should not be less than 10.4 square feet. Another rule that should be noted is USDA's 28 hour rule that states: animals that are to be hauled longer than 28 hours should be unloaded and allowed 5 hours of rest and free access to food and water. During the in-plant audits, surveillance of these animal welfare and handling practices may provide producers and packers possible explanations for carcass devaluation that were not documented during past studies. Welfare and handling surveillance included transportation, driving aid methods, and packing plant employee practices while cattle are in holding pens to encompass all aspects of animal handling before slaughter.

Traditionally, cow and bull packing plants primarily marketed lean beef trim, unless they were part of a white cow program. However, 44% of all cull cow beef is currently sold as primals and subprimals (Smith et al., 1999). As a result of cull cows and bulls having less external fat than fed cattle, the majority of whole muscle cuts are being sold as 100% lean subprimals. At the same time, lower amounts of external fat allow these animals to be more susceptible to advanced bruising. Bruising, along with several other defects, plays an important role in product fabrication since damaged tissues result in trim losses, causing the packers severe economic losses, as higher lean yielding cattle are still considered to be more valuable. Several studies (McNally and Warriss, 1996; Hoffman et al., 1998) have indicated higher amounts of bruising found on cattle that are directly sold through auction barns to slaughter plants. As most cull cows and bulls that are in route to a packing plant have passed through an auction barn at least once in its lifetime, these issues can be addressed with livestock markets as well. Dairy and beef producers, as well as auction barns, must be cognizant of possible cattle devaluation through improper handling and how that can ultimately affect the profitability of these animals.

With the increasing trend of primals and subprimals being fabricated from cull cow and bull carcasses, beef and dairy cattlemen must be mindful of any other possible causes for devaluation, as bruising is not the sole reason for carcass devaluation. Possibly, the most common conversation for people involved in cull cow and bull beef is in regards to injection site lesions and antibiotic residues. Common dairy herd management calls for routine injections of hormones and antibiotics. Routine injections cause dairy cows to be identified as primary sources of injection site lesions as well as having a higher probability of not meeting the withdrawal times required to pass residue tests. Roeber et al. (2002) found dairy rounds to be twice more likely to contain injection site lesions than beef rounds. Their research also revealed a decline in injection site lesion blemishes from 1998 to 2000, indicating an increase in producer education on injection site location. Even though dairy cattle are considered to be the most prevalent source of injection lesions, beef cattle are still a common source. Since injection site location can impact quality of muscle cuts, this is the most important control point that can affect the salvage value of cull cow and bull carcasses. Past research (Dexter et al., 1994; Roeber et al., 2001; Roeber et al., 2002) has been aimed at increasing awareness of the economic impact of blemishes caused by intramuscular injections. Roeber et al. (2001) found the frequency of top sirloin butt injection site blemishes declining from 11.4 (1995) to 2.1 (2000). The National Beef Quality Assurance program has funded educational programs that teach producers about moving injection site locations from the round and sirloin to the neck region in hopes of avoiding injection blemishes that could adversely affect the profitability of cattle receiving injections. To quantify injection site lesion locations and severities, end-user audits were conducted to examine the frequencies of injection site blemishes being found in top sirloin butts and bottom round flats, and then compare these findings with previous injection site audit results, conducted by Roeber et al. (2001, 2002).

Live animal and carcass defect evaluation during the in-plant audits were also carried out with the intention of increasing producer awareness of preventable defects. With this data, producers, transporters, packers, auctions, and anyone involved in the handling of live cull cows and bulls, will be able to understand the correlation of poor management and handling practices to carcass productivity.

Lastly, animal traceability is a recurring issue that has caused controversy over the idea of a mandatory identification system. The inclusion of these data will be beneficial for producers to use in determining the need for standardized identification systems such as the National Animal Identification System (NAIS).

Information from this audit, as well as past audits, will allow opportunities for beef and dairy producers to understand value of reducing the incidence of defects related to poor management practices. The use of best management practices when handling these cattle is important. These practices could increase the value of beef and improve consumer confidence in the quality and safety of the beef they purchase

CHAPTER II

INTERVIEWS

Materials and Methods

Interviews were conducted at 23 packing plants (Table 1) with the intention of capturing perspectives and opinions regarding quality challenges. At each plant a FSIS representative and a plant management employee were questioned. Interviews were also conducted with the end-users of cow and bull beef (Table 2). Each representative was asked questions regarding beef quality based on their knowledge of the cow and bull beef industry over the past 8 years, since the completion of the 1999 National Market Cow and Bull Beef Quality Audit. Initially, two interviews were to be collected at each plant, but due to lack of experience, unwillingness to cooperate, and a variety of other reasons, some FSIS representatives were unable to complete questionnaires.

Each interview consisted of two parts: a free response and an aided portion for each person to complete. Free response questions included listing: (1) top ten quality challenges facing the cow and bull industry, (2) top five directives to solve these problems, (3) top five areas of improvement, and (4) future problems that face the beef industry. Aided sections included a list of specific quality challenges (n=57) and then respondents were asked to report if these challenges have improved or

Table 1. Summary of packing plant audits and responsible collaborators

Plant name	Plant location	Date audited	Responsible collaborators
Lone Star Beef	San Angelo, TX	12/14/06	Texas A&M University
San Angelo Packing	San Angelo, TX	2/16/07	Texas A&M University
L&H Packing	San Antonio, TX	3/6/07	Texas A&M University
H&B Packing	Waco, TX	3/8/07	Texas A&M University
ABF Packing	Stephenville, TX	4/10/07	Texas A&M University
XL Foods	Nampa, ID	6/1/07	Texas A&M University
Central Valley Meat Company	Hanford, CA	3/23/07	Cal Poly State University
Cargill Beef Packers	Fresno, CA	4/12/07	Cal Poly State University
Hallmark Beef	Chino, CA	5/22/07	Cal Poly State University
Smithfield Beef Group - Tolleson	Tolleson, AZ	5/29/07	Cal Poly State University
Cargill Taylor Beef	Wyalusing, PA	12/12/06	Pennsylvania State University
Smithfield Beef Group - Souderton	Souderton, PA	4/24/07	Pennsylvania State University
FPL Foods LLC	Augusta, GA	3/5/07	University of Georgia
Central Beef	Center Hill, FL	3/12/07	University of Florida
Caviness Packing	Hereford, TX	12/15/06	West Texas A&M University
Preferred Beef Group	Booker, TX	4/13/07	West Texas A&M University
American Foods Group - Long Prairie Packing	Long Prairie, MN	3/9/07	North Dakota State University
American Foods Group - Gibbon Packing	Gibbon, NE	4/26/07	North Dakota State University
American Foods Group - Cimpls Inc.	Yankton, SD	4/27/07	North Dakota State University
American Foods Group - Green Bay Dressed Beef	Green Bay, WI	5/15/07	North Dakota State University
Smithfield Beef Group - Green Bay	Green Bay, WI	5/16/07	North Dakota State University
American Foods Group - Dakota Premium Foods	South St. Paul, MN	5/17/07	North Dakota State University
Minnesota Beef Industries	Buffalo Lake, MN	9/21/07	North Dakota State University

worsened since the last time the National Cow and Bull Quality Audit was conducted in 1999.

These quality challenges encompass the areas of receiving animals, live animal defects, and carcass defects during harvest and in the coolers. An 11-point scale, ranging from -5 to +5 was used to score the magnitude of decline, improvement, or neither (0) since 1999 for all 57 quality challenges. Aided portions of each survey were split into beef and dairy responses to portray quality challenge scores specific to each cattle type.

Table 2. Summary of end-user plant audits

Audit number	Plant name	Plant location	Date audited	Breed types[a]
1	Outwest Meat Company	Las Vegas, NV	6/12/07	Dairy
2	Dynaco Meat Company	Fresno, CA	7/16 – 7/17/07	Dairy
3	Dynaco Meat Company	Fresno, CA	7/18– 7/19/07	Dairy
4	FPL Foods LLC	Augusta, GA	8/7/07	Beef
5	FPL Foods LLC	Augusta, GA	8/8/07	Beef
6	Cargill Taylor Beef	Wyalusing, PA	9/5/07	Dairy
7	Cargill Taylor Beef	Wyalusing, PA	9/6/07	Dairy
8	Freedman Meat Company	Houston, TX	9/11/07	Dairy

[a] Majority breed types of animals or subprimals processed at each plant were used to classify products by beef or dairy.

Results and Discussion

Open Interviews

According to the top ten listed quality challenges gathered from packers and FSIS personnel (Table 3), pathogen control, welfare and handling issues, declining cattle quality due to poor nutrition, antibiotic residues, bruising, hide damage, lameness, and injection site location and frequency were the most commonly cited producer-related defects. Other concerns, shared by most packers, involved economic issues related to market prices, import/export shortages, and market availability. Condemnation rates of offal and carcasses, as well as the incidence of downers before slaughter, were found to be quality concerns that can either be attributed to mismanagement or poor handling practices by producers and transporters. Packers and FSIS personnel cited methods to solve these problems which included education on: timely culling, handling and welfare, food safety, flooring on trailers, as well as implementation of the National Animal Identification System (Table 4).

Table 3. Top ten quality challenges facing the market cow and bull beef industry since 1999

Rank	Quality challenges
1	Food safety issues with pathogen control
2	Economic issues with market prices, import export shortages, and access to markets
3	Animal welfare and handling issues
4	Declining cattle quality due to poor conditioning/nutrition
5	Anitbiotic residues
6	Bruising
7	Hide damage (branding, insect, latent, etc.)
8	Lameness/soundness issues
9	Condemnation rates of offal and cattle as well as downers prior to slaughter
10	Injection site locations and frequencies

Table 4. Top five directives to solve quality challenges facing the market cow and bull beef industry

Rank	Directives for reducing quality challenges
1	Producer education for more timely culling
2	Animal welfare and handling education
3	Better education for food safety
4	National Animal Identification
5	Better evaluation of flooring on trailers and lameness on cattle in general

Since the implementation of the downer rule in 2004, fewer downer cattle have arrived at slaughter facilities; however, according to the surveys, this is still an issue that must be addressed by both beef and dairy cattlemen. Most producers are deterred from transporting moribund cattle by rising freight costs and the realization of possible monetary losses in transporting cattle that have a possibility of becoming a downer while in transit. While this is an economic issue, this is also an animal welfare issue as animals that are moribund possibly should have been culled earlier.

Many responses to the questionnaire have described some quality concerns specific to dairy or beef cattle. For example, several interviews described dairy cows as having higher amounts of mud and manure on their hides, most likely resulting from the majority of dairy herds being raised and handled in a confined environment. This is not only a problem in terms of lower dressing percentages, but also in terms of safety (pathogen control). In contrast, hide damage has been commonly characterized as a beef-specific issue, and is supported by data from the in-plant phase showing a higher incidence of branding, grubs, and horns that can often be associated with hide damage during transport.

Packer and FSIS interviews also revealed that improvements have been made in areas such as welfare and handling, hide damage, injection site location, and bruising (Table 5). Hide damage, injection site location, and bruising are cited as both, an improvement since 1999, and a current quality concern. This implies that even though progress has been made, beef and dairy producers still need to continue there efforts of alleviating these quality concerns. Table 6 cites the top 5 future quality challenges that packers and FSIS personnel believe to be most pertinent.

Table 5. Top five improved quality challenges of the market cow and bull beef industry since 1999 from questionnaire

Rank	Quality challenge improvements
1	Herd management techniques
2	Animal welfare and handling
3	Hide damage (latent, insect, branding, etc.)
4	Injection site location
5	Bruising

Table 6. Top five future quality challenges to face the market cow and bull beef industry since 1999 from questionnaire

Rank	Future quality challenges
1	Food safety issues with pathogen control and monitoring
2	Cattle availability
3	National Animal Identification and Country of Origin Labeling
4	Cattle conditioning and nutrition
5	Increasing feed prices

Aided Interviews

Based on questionnaire responses, cattle producers and drivers have made improvements in the majority of areas that were listed as quality concerns since the last cow and bull audit that was conducted in 1999 (Tables 7 through 10). Even as results show improvements being made, dairymen have failed to make a positive impact on several issues addressed in the 1999 audit. Cattle receiving and handling before slaughter, along with antemortem quality concerns, have improved for both beef and dairy with space allotted on trailers, hot shot usage by truck drivers, proper cattle loading procedures, prevalence of downers, deads, and moribunds, advanced lameness, and extreme lameness being cited as the most improved for all cattle. Quality concerns on the harvest floor and in the coolers were reported to have more declining issues since 1999 than the other areas surveyed, according to the questionnaire respondents. Tripe, liver and tongue condemnations, as well as insufficient muscling and ribeye areas were listed as the areas that have declined the most since the last market cow and bull quality audit.

Table 7. Means of aided questionnaire responses[a] for FSIS representative live cattle quality concerns during the packing plant auditing phase – part 1

Live cattle quality concerns	Beef	Dairy
Cattle receiving		
Inadequate space on trailer	2.00	2.13
Excessive hot shot usage by truckers	1.71	2.25
Incorrect loading of cattle	1.71	1.25
Too frequent use of jailhouse/doghouse	1.57	1.25
Overall quality of cow and bulls	1.14	1.13
Poor flooring conditions on trailers	0.29	1.25
Antemortem		
Prevalence of downers	3.00	2.56
Prevalence of deads	2.43	1.67
Prevalence of moribunds	2.29	1.22
Advanced lameness	2.29	0.44
Extreme emaciation	2.00	0.67
Abscesses/knots	1.83	1.00
Horns	1.80	1.40
Exessive mud/manure on hides	1.57	1.00
Lumpy jaw	1.57	0.83
Excessive brands on hides	1.00	1.00
Insufficient muscling	1.00	0.13
Prolapsed rectum/vagina and/or retained placentas	0.86	1.11
Latent/insect damage on hides	0.86	0.50
Udder/teat problems (cows)	0.86	0.11
Exessive live external fat	0.80	1.00
Location of brands on hides	0.80	0.00
Prevalence of epithelioma	0.60	0.43
Insufficient live weight	0.40	-0.33
Sheath/penis problems (bulls)	0.20	0.00
Excessive live weight	0.00	-0.75
Insufficient live external fat	-0.20	0.00

[a] Responses were based on an 11-point scale of -5 (greatly declined) to 5 (greatly improved) with “0” representing neither declined or improved since 1999

Table 8. Means of aided questionnaire responses[a] for FSIS representative carcass quality concerns during the packing plant auditing phase – part 2

Carcass quality concerns	Beef	Dairy
Harvest		
Grubs	2.00	1.20
Injections-site lesions	1.86	1.38
Carcass Condemnations	1.86	1.13
Antibiotic residues	1.57	0.75
Arthritic joints	1.57	0.50
Bruises	1.29	1.13
Buck shot/ bird shot	1.14	1.00
Hair sore (tongues)	1.00	0.00
Johne's disease	0.80	-0.67
Cactus tongue	0.67	1.25
Prevalence of fetal calves	0.57	0.43
Head Condemnations	0.43	-0.38
Trim losses	0.33	-0.29
Low dressing percentage	0.00	0.00
Tongue Condemnations	-0.14	-0.13
Tripe Condemnations	-0.43	-1.00
Liver Condemnations	-0.71	-1.00
Cooler		
Excessive yellow fat color	1.00	0.75
Dark cutters	1.00	0.75
Insufficient carcass weight	1.00	0.50
Blood splash	0.00	0.50
Insufficient marbling	0.00	0.00
Excessive dark lean color	0.00	0.00
Lack of muscle firmness	0.00	0.00
Calloused ribeye or other muscles	0.00	0.00
Excessive carcass weight	0.00	-0.50
Excessive ribeye size	0.00	-0.50
Insufficient ribeye size	0.00	-0.50
Insufficient muscling on carcass	-0.33	-0.75
Excessive external carcass fat	-1.33	-0.75

[a] Responses were based on an 11-point scale of -5 (greatly declined) to 5 (greatly improved) with "0" representing neither declined or improved since 1999.

Table 9. Means of aided questionnaire responses[a] for plant management representative live cattle quality concerns during the packing plant auditing phase – part 1

Live cattle quality concerns	Beef	Dairy
Cattle receiving		
Inadequate space on trailer	1.79	1.31
Incorrect loading of cattle	1.71	1.56
Overall quality of cow and bulls	1.63	0.76
Excessive hot shot usage by truckers	1.60	1.94
Poor flooring conditions on trailers	1.47	0.94
Too frequent use of jailhouse/doghouse	1.00	1.31
Antemortem		
Prevalence of downers	3.06	3.00
Prevalence of deads	1.87	1.33
Prevalence of moribunds	1.80	1.76
Lumpy jaw	1.27	1.18
Prolapsed rectum/vagina and/or retained placentas	1.20	1.44
Exessive live external fat	0.93	0.29
Advanced lameness	0.88	0.61
Extreme emaciation	0.88	0.22
Excessive brands on hides	0.87	0.69
Horns	0.75	0.65
Abscesses/knots	0.69	0.38
Location of brands on hides	0.63	0.67
Prevalence of epithelioma	0.60	0.47
Udder/teat problems (cows)	0.40	0.35
Exessive mud/manure on hides	0.33	0.41
Latent/insect damage on hides	0.33	0.41
Sheath/penis problems (bulls)	0.31	0.50
Insufficient muscling	0.31	-0.18
Excessive live weight	0.27	0.18
Insufficient live external fat	0.00	0.24
Insufficient live weight	0.00	0.06

[a] Responses were based on an 11-point scale of -5 (greatly declined) to 5 (greatly improved) with "0" representing neither declined or improved since 1999.

Table 10. Means of aided questionnaire responses[a] for plant management representative carcass quality concerns during the packing plant auditing phase – part 2

Carcass quality concerns	Beef	Dairy
Harvest		
Antibiotic residues	1.19	0.73
Bruises	1.13	0.88
Carcass Condemnations	1.00	0.00
Injections-site lesions	0.63	0.31
Prevalence of fetal calves	0.53	0.19
Arthritic joints	0.50	0.31
Johne's disease	0.36	-0.36
Trim losses	0.27	0.44
Grubs	0.06	0.50
Low dressing percentage	0.00	0.06
Head Condemnations	0.00	-0.50
Hair sore (tongues)	-0.13	-0.19
Cactus tongue	-0.40	-0.07
Buck shot/ bird shot	-0.50	0.33
Tongue Condemnations	-0.93	-0.63
Tripe Condemnations	-1.00	-0.69
Liver Condemnations	-1.13	-1.06
Cooler		
Excessive carcass weight	0.73	0.25
Excessive external carcass fat	0.67	0.06
Dark cutters	0.38	0.31
Excessive ribeye size	0.33	0.13
Calloused ribeye or other muscles	0.33	0.13
Blood splash	0.20	0.06
Excessive dark lean color	0.20	-0.06
Excessive yellow fat color	0.13	0.31
Insufficient muscling on carcass	0.13	-0.13
Insufficient carcass weight	0.07	0.38
Lack of muscle firmness	0.00	-0.31
Insufficient ribeye size	-0.13	-0.56
Insufficient marbling	-0.27	-0.63

[a] Responses were based on an 11-point scale of -5 (greatly declined) to 5 (greatly improved) with "0" representing neither declined or improved since 1999.

CHAPTER III

PACKING PLANT AUDITS

Materials and Methods

Packing Plant Audits (n = 23) were conducted to quantify producer-related defects found at the packing plant level. Plants were selected to represent a total of twelve states spanning across the United States throughout the 2007 Fiscal Year. Each plant was audited during the course of one full production day. Data collection was separated into six primary categories: animal welfare and handling, live animal evaluation, carcass/offal defect evaluation, carcass grade data, product fabrication, and animal traceability. All packing plant audit data were segregated, when possible, by cattle type (beef vs. dairy) and by gender (cow vs. bull). Prior to auditing, a correlation meeting was held to standardize all collaborators with data collection procedures.

Receiving and Unloading Welfare

Ten percent or a minimum of five of the total daily truck loads for each packing plant were surveyed to evaluate cattle care and handling procedures during transport and unloading. The driver of each truck was questioned to determine estimated time of travel, distance traveled, and if the cattle were unloaded in route. Origin of cattle along with the time and date that cattle were loaded and unloaded also were recorded as alternative information to derive possible distances and times traveled. In the case that distance traveled was unknown to the driver, a map was used to obtain approximate distances from the cattle origin (prior to arriving at the plant) to the packing plant. Travel times were also calculated by taking the difference between times and dates loaded and unloaded.

Along with the information gathered from each driver, data were collected to characterize trailer conditions under which each load was transported. Number of cattle slipping while coming off of each truck was recorded to depict possible poor flooring conditions. Each trailer was measured for length and width dimensions in order to create a total area allowed for each animal, as well as, noting how many compartments actually contained cattle. Recorders identified if cattle had been loaded into trailer compartments known as the doghouse, or jailhouse. The Beef Quality Assurance program has recognized, that in some trailers, this area may be too small to humanely haul larger cattle. Data on total numbers of animals, deads, and moribunds within each trailer were collected as well as noting if bulls and cows had been loaded into separate trailer compartments. Trailers that only carried cows or bulls were considered to be gender separated.

Driving aid types and the manner in which the person responsible for unloading the cattle used them were documented. If electric prods were one of the driving aids, the number of times it was used while unloading a trailer was recorded. Comments that were made by recorders regarding the manner in which driving aids other than a hot shot were used were classified as aggressive (contact) or passive (non-contact).

Holding Pen Welfare

The manner in which cattle were moved from the holding pen to the restrainer was also examined. One-third, or up to 100 head, of all cattle processed that day were examined for handling techniques that might impact the quality of beef and value of the cattle. Pens were evaluated throughout the course of a full production day in order to monitor potential changes in employee temperaments and animal handling techniques that occurred due to fatigue. Driving aid types, manner of usage, and the number of times that an electric prod was used were recorded in the same manner as specified during cattle receiving. Individual pens were also assessed on gender separation and total number of animals within each. All manner comments pertaining to driving aids other than electric prods, were classified on whether or not the employees made contact with the animals. Antemortem condemnation causes were also determined when made available by USDA-FSIS.

Live Animal Evaluation

One-third of all animals processed during one full production day were evaluated before harvest by trained personnel. Two separate forms (Individual Live Animal Data and Holding Pen Visible Defects) were used to record producer related defects and overall animal traits in the holding pens at each packing plant.

Individual Live Animals

Primary hide color was determined as black, white, yellow, brindle, roan, red, brown, grey, Holstein or other dairy. Individual identification types were classified as electronic, barcode, individual visual, lot tag, metal clip, and back tag. Mud/manure location (no visible, legs, belly, side, topline, and tail), amount (none, small, moderate, large, and extreme), and type (dry or wet) were recorded for each animal evaluated. Hot iron and freeze brand locations, along with dimensions to find total branded area, were recorded. Brand locations were defined as “butt” brands being those located on the rump and round regions, “side” brands located along the loin, rib or plate, and “shoulder” brands as those on the chuck and neck regions (McKenna, 2002). Horns were identified as those less than 1 inch, between 1 and 5 inches, and greater than 5 inches in length. Location and prevalence of knots, most likely resulting from subcutaneous injections, were also identified by neck, shoulder, top butt, and round regions.

All cattle evaluated were assigned a score (0 to 5) for cancer eye or bovine ocular neoplasia. A score of 0 represented cattle with no epitheliomic growth, otherwise known as normal. Cattle that exhibited a small, benign tumor that produced a finger-like growth (generally on the lower eye-lid) were assigned a score of 1. Those cattle showing evidence of a small white elevated plaque on the eyeball (premalignant tumor) were assigned a score of 2. A cancer eye score of 3 indicated cattle with a growth on the inner third eyelid, or a tumor that was vascular in nature typically resulting in postmortem head condemnations. Cancer eye scores of 4 were reserved for cattle with tumors that had metastasized to the bony tissue surrounding the eye or those which exhibited lymphatic involvement of the parotid gland typically resulting in head and carcass condemnation. Lastly, scores of 5 were assigned to cattle with the most advanced stage resulting in a prolapsed eyeball from the orbit and/or necrotic condition within that region.

The Zinpro locomotion five-point scoring system was used to assess lameness or movement issues with market cows and bulls. Cattle receiving a score of 1 were able to stand and walk normally. Cattle receiving a score of 2 (mildly lame) would stand with a flat back, but arch when walking with the gait being slightly abnormal. Cattle standing and walking with an arched back while making short strides with one or more legs would be considered a score of 3 (moderately lame). Locomotion scores of 4 (lame) were assigned to cattle that maintained an arched back while standing and walking, while one or more limbs were favored but at least partially weight bearing. Cattle receiving scores of 5 (severely lame) displayed an arched back at all times and refused to bear weight on one limb.

Body condition scores (BCS) were assigned to ascertain variation in fat cover on all animals evaluated. Due to inherent differences in fat deposition between beef and dairy cattle, separate scoring systems were used to classify these cattle types. BCS assessment for beef cattle (1 = extremely emaciated to 9 = extremely fat) was similar to methods described by Richards et al. (1986). BCS measurements for dairy cattle were defined by a dairy BCS scoring guide created by Elanco (McClary). Dairy cattle were scored on a five-point scale 1 being extremely emaciated to 5 being extremely fat. Beef cattle BCS determination was based on total body composition, while dairy cattle condition scores were based on fat cover over the lumbar and pelvic regions of the animal.

Lastly, a scoring system was in place for evaluation of overall muscling. Muscle scores ranged from 1 (lightly muscled) to 5 (heavily muscled). Muscle scores from 1 to 3 were typically reserved for cows, while 4 and 5 scores were typically assigned to bulls.

Visible Defects for Cattle in Holding Pens

Recorders evaluated cattle for other producer related defects as well. Incidence of defects were recorded for prolapse (rectal and vaginal), retained placentas, latent and insect hide damage, lumpy jaw (actinomycosis), extreme emaciation, foot abnormalities, broken penises, udder problems, and abscesses. Udder defects were classified by prevalence of bottle teats, failed suspensory ligaments, mastitis and multiple udder problems. Also, abscesses were identified by locations, which were the jaw/tooth, knee/hock, and hook/pin regions.

Carcass Defect Evaluation

One-third of all carcasses were surveyed concurrently with the harvesting process during one production day. Carcasses were visually appraised for bruises, injection sites, arthritic joints, visceral condemnations and fetal calves, head and tongue condemnations, and dentition. Carcasses were either classified as beef cow, dairy cow, beef bull, or dairy bull based on visual examination, or lot information would be used to later classify groups of animals as each of the four types mentioned above. In addition to visceral and cranial condemnations, postmortem carcass condemnations were recorded for each plant during one production day as well.

Bruises, Injection Sites, and Arthritic Joints

Recorders, stationed at a point past hide removal, would inspect primal regions on carcasses to determine the extent of bruising and economic impact of losing saleable yield to bruises. Bruise location (round, loin, rib, chuck, and flank/plate/brisket), severity (minor, medium, major, extreme), and number per carcass were recorded. Minor bruises were considered to be any bruise resulting in trim losses of less than 1 pound per bruise site. Medium bruises were between the size of a golf ball and softball. Major bruises were larger than a softball, requiring substantial trim per bruise site. Lastly, extreme bruises were so severe that the trim loss was nearly the size of an entire primal cut.

Injection site lesions were assessed in the same manner. Number of injection site blemishes per carcass, primal location, and severity were collected to project possible economic losses. Buck shot location and frequency was also collected. Personnel also would note if grubs were present on the carcass. Numbers of arthritic joints (0, 1, or 2) per carcass were identified as well.

Visceral Condemnations

Upon FSIS inspection of the viscera, frequency and reasons for condemnation were collected for the liver, tripe, and heart for each evaluated carcass. Reasons for liver condemnation were classified as abscesses, flukes, telangiectasis, contamination, and other. Tripe condemnations were grouped by abscesses, ulcers, contamination, and other. Heart condemnations were grouped by pericarditis and other. Frequency of fetal calves was also recorded.

Head and Tongue Condemnations

The head and tongue for one third of all carcasses were evaluated for trim and condemnation losses. Due to differences in how FSIS personnel handle certain defects, each head and tongue defect was classified as trimmed or condemned. Head defects were listed as abscesses, contamination, diseased lymph glands, and other. Reasons for tongue trimming and/or condemnations were diseased lymph glands, hair sores, cactus tongue, contamination, and other.

Dentition

The number of adult incisors (0 through 8) was counted for each animal that was evaluated. Additional oral defects, broken jaw (any defects impacting proper mastication) and gummers (older cattle with 8 extremely worn down adult incisors), were observed as well. Cattle that were classified as gummers were not recorded for number of incisors due to the assumption that all gummers had 8 adult incisors.

Carcass Grade Data

Twenty percent of all carcasses present in the coolers for each audited plant were evaluated for yield and quality grade factors, and other carcass characteristics. Personnel with previous beef grading experience would evaluate carcasses for lean maturity, skeletal maturity, overall maturity, and percent marbling in order to determine overall USDA quality grades. Yield grade factors (carcass weight, adjusted fat depth, ribeye area, and percent KPH) would also be evaluated. Each carcass would be classified by sex class (cow, bull, heifer, and bullock) as well as cattle type (beef and dairy). Muscle scores of 1 (light muscled) through 5 (heavy muscled) with low, medium, and high increments within each numerical score were used to evaluate each carcass on total carcass muscling. Fat color scores (1 = white to 6 = orangish yellow) were also assigned based on the degree of yellow tint in fat on the carcass. In-house carcass grades were recorded for cow carcasses. In-house, bull plant grades were recorded in the same fashion. These records were used to identify any commonality for in-house carcass grading systems across all plants.

Product Fabrication

Records of meat products were obtained at each plant to show variety and amount of cuts that are fabricated from cow and bull carcasses. A predetermined list of cuts comprised of typical cow and bull fabricated cuts, was presented to personnel at each plant. Plant representatives reported approximate pounds produced, for one production day, for each cut. Stock keeping units, or SKU's, were allowed to replace this form if the plant desired. When possible, fabricated items would be separated into lbs of cuts derived from cows vs. bulls.

Animal Traceability

For the purpose of determining if we can traceback a carcass to the place (ranch, farm, etc.) that it came from before harvest, two percent of carcasses in coolers for each plant were randomly selected. Information recorded from the carcass included carcass type and sex, individual identification type, and any information present on carcass tags that would aid in tracing the origin of that animal. The information that was gathered in the coolers was then presented to plant personnel to correlate back tag numbers, bangs tag numbers, and previous owners or auction information that were with that animal prior to harvest. Extent of traceback and the number of contacts involved while finding the final point of origin was collected for each animal. The extent of traceback was listed as original owner, cattle dealer/trader, auction barn, and/or plant. Original owners were defined as cattlemen or ranches that either used beef cattle primarily for reproduction purposes or dairy cattle for milk production and/or reproduction purposes. Original owners were those that considered these cattle as personal stock rather than for trading purposes. From information supplied by previous owners, an approximate distance traveled was formulated.

Statistical Analysis

Frequency distributions, as well as mean, minimum, and maximum values were calculated. The PROCFREQ and PROCMEAN procedures of SAS (SAS Inst. Inc., Cary, NC) were used to calculate frequencies and means for data collected on an individual and group basis for animals and carcasses.

Results and Discussion

Receiving, Unloading and Holding Pen Welfare Results

Loads that were surveyed at each plant demonstrated distinct differences between trailers carrying only beef or only dairy animals (Table 11). Dairy loads had fewer cattle per load, less time traveled, and was predominately brought in on gooseneck or bumper pull trailers when compared to beef loads.

In contrast, Table 12 and 13 shows that beef loads had more loads that were brought in on tractor-trailers than goosenecks and bumper pull trailers. Consequently, the average number of cattle per load, travel time, distance, and trailer area were higher for these loads, unlike the all dairy loads. Average area allotted for one animal for beef loads and dairy loads were 40.3 sq ft and 36.3 sq ft, respectively, which failed to warrant any corrective actions as the minimum area per animal should be at least 10.4 sq ft (Grandin, 2007). Trailers that do not meet this minimum amount can result in bruising and increase the chances of cattle going down during transit.

Table 11. Mean, minimum, and maximum values of cattle transport points of interest for all trailer types

	All loads (n = 103)			Beef loads (n = 34)			Dairy loads (n = 39)			Mixed loads (n = 30)		
Transportation details	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Time traveled (h)	5.9	0.2	32.0	6.4	0.5	20.0	2.6	0.2	12.0	9.8	0.5	32.0
Trailer area (sq ft)	589.8	84.0	960.0	591.1	84.0	901.0	390.6	84.0	960.0	840.8	768.0	901.0
Area allotted per load for one animal (sq ft)	34.7	10.3	256.0	40.3	13.7	168.0	36.3	10.3	256.0	26.2	19.6	65.4
Distance traveled (mi)	282.5	1.0	1250.0	319.5	1.0	1050.0	124.9	5.0	602.0	450.9	22.0	1250.0
Number of cattle per load	24	1	51	26	1	51	15	1	37	34	13	46
Number of cattle slipping during unloading	2	0	39	1	0	4	1	0	9	4	0	39

Table 12. Mean, minimum, and maximum values of cattle transport points of interest for gooseneck and bumperpull trailers

	All loads (n = 36)			Beef loads (n = 12)			Dairy loads (n = 24)		
Transportation details	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Time traveled (h)	1.4	0.2	5.0	1.5	0.5	4.5	1.3	0.2	5.0
Trailer area (sq ft)	172.7	84.0	280.0	156.2	84.0	280.0	180.9	84.0	280.0
Area allotted per load for one animal (sq ft)	43.4	10.3	168.0	68.1	13.7	168.0	31.1	10.3	112.0
Distance traveled (mi)	70.4	1.0	300.0	74.4	1.0	208.0	68.5	5.0	300.0
Number of cattle per load	8	1	20	6	1	20	8	1	14
Number of cattle slipping during unloading	0	0	7	0	0	1	0	0	7

Table 13. Mean, minimum, and maximum values of cattle transport points of interest for tractor-trailers

	All loads (n = 65)			Beef loads (n = 21)			Dairy loads (n = 14)			Mixed loads (n = 30)		
Transportation details	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Time traveled (h)	8.6	0.5	32.0	9.4	1.5	20.0	4.9	0.8	12.0	9.8	0.5	32.0
Trailer area (sq ft)	838.1	424.0	960.0	863.7	816.0	901.0	790.6	424.0	960.0	840.8	768.0	901.0
Area allotted per load for one animal (sq ft)	29.8	16.0	256.0	24.3	16.0	45.3	47.0	16.1	256.0	26.2	19.6	65.4
Distance traveled (mi)	409.2	22.0	1250	472.9	60.0	1050.0	227.1	25.0	602.0	450.9	22.0	1250.0
Number of cattle per load	34	3	51	38	18	51	27	3	37	34	13	46
Number of cattle slipping while unloading	3	0	39	1	0	4	2	0	9	4	0	39

Trailer type comparisons, in Tables 12 and 13, revealed that dairy loads transported on gooseneck/bumper pull trailers were more crowded than dairy loads on tractor-trailers, but for the most part, allowed enough area to exceed 10.4 sq ft. Beef loads were the inverse as the minority trailer type were goosenecks and bumper pull trailers with these having higher area per animal ratios than their tractor-trailer counterparts. All surveyed beef loads were found to exceed the minimum area allotted per head of 10.4 sq ft. Loads delivered on tractor-trailers had less time and distance traveled, as well as fewer cattle per load for all dairy loads than beef loads.

Table 14 demonstrates that of the potbellies or double-deck trailers that were surveyed during the 2007 audit, 84.1 percent did not contain cattle in the jailhouse/doghouse area while 15.9 percent contained cattle in this area. Typically this compartment is reserved for smaller-framed cattle that weigh less than 700 lbs. However, one collaborating university noted that on several loads containing primarily dairy cows, bulls would be loaded in this area as an effort to keep cows and bulls separate. Examples such as this are not only a cause for animal welfare concern, but also allow for carcass devaluation as this method of loading is conducive to bruising for cattle that exceed the 700 lb limit. Cattle transporters should be aware of this and also realize the benefits of proper loading techniques that are outlined in the Master Cattle Transporter Guide (2006).

Frequencies for trailers that were identified by containing both, cows and bulls, showed that 73.3 percent of beef loads were not separated by gender whereas 50 percent of dairy loads were not separated (Table 14). Mixing cows and bulls is extremely hazardous to cows as this can lead to increased bruising and lameness. Separating cows and bulls is also advantageous as this can reduce the chances of cows becoming downers during travel.

According to AMI guidelines (Grandin, 2007) no more than three percent of livestock should slip during unloading. There were 27.3 percent and 29 percent of beef and dairy loads, respectively, which had more than three percent of cattle slip during unloading (Table 14). Slipping can not only be a result of poor flooring conditions on trailers but lameness as well. Higher percentages of dairy loads having more than three percent slip could be correlated to more dairy cows having locomotion scores indicating greater lameness than beef cows.

Table 14. Frequency[a] distribution of cattle transportation points of interest (%)

	All loads (n = 103)	Beef loads (n = 34)	Dairy loads (n = 39)	Mixed loads (n = 30)
Trailer information				
Percent of tractor-trailer loads	64.0	64.0	37.0	100.0
Percent of gooseneck/bumper pull trailer loads	36.0	36.0	63.0	0.0
Double deck trailers not containing cattle in jailhouse/doghouse	84.1	85.7	83.3	82.1
Double deck trailers containing cattle in jailhouse/doghouse	15.9	14.3	16.7	17.9
Load sorting information				
Multi-gender loads	35.0	44.1	10.3	56.7
Single-gender loads	65.0	55.9	89.7	43.3
Multi-gender loads separated by gender	33.3	26.7	50.0	35.3
Multi-gender loads not separated by gender	66.7	73.3	50.0	64.7
Cattle unloading information				
Loads that cattle did not slip	65.3	63.6	71.0	60.0
Loads that cattle slipped	34.7	36.4	29.0	40.0
Loads where 3% or less of cattle slipped	70.3	72.7	71.0	66.7
Loads where more than 3% of cattle slipped	29.7	27.3	29.0	33.3
Other transportation details				
Percent moribund	0.24	0.0	1.04	0.0
Percent dead	0.04	0.0	0.0	0.10

[a] Frequencies are expressed as a percentage of total loads within each column.

Primary driving aid types that were used by persons responsible for unloading cattle included electric prods, paddles, sticks, PVC pipes, metal pipes, whips, gates, and body parts. AMI guidelines (AMI, 2007) state that only 25 percent or less of animals should be touched with electric prods. According to Table 15, hot shots were used less frequently for dairy loads than beef along with more beef loads having greater than 25 percent of the animals touched with an electric prod than dairy.

The manner in which other driving aid types were used were classified as aggressive (contact) or passive (non-contact). Dairy loads had a lower frequency of being handled in an aggressive manner than beef loads with drastic differences in driving aid types involved (Table 16). Recorders only listed body parts as a driving aid for aggressively handled dairy loads, while aggressively handled beef loads involved the use of PVC pipes, sticks, paddles, metal pipes, whips, and flashlights. Differences in how dairy loads are handled in comparison to beef loads could be a result of more intensive management styles for dairy herds. On average, dairy cattle have more human contact on a daily basis. Beef cattle, on average, tend to have less direct human interaction which, in turn, can necessitate more aids to mitigate the cattle driver's efforts.

The percentage of packing plants using electric prods was also noted, as almost 83 percent of plants applied hot shots to animals moving through the holding pens up to the knock box (Table 17). Approximately 65 percent of plants applied electric prods to greater than 25 percent of the animals that were viewed during the audits. In Table 18, driving aids other than electric prods were used in an aggressive manner more frequently (39.1 %) than those that were witnessed while unloading cattle (13.6 %). Paddles, whips, metal pipes, gates, and motorized transport instruments were listed as alternate driving aid types used to make contact with these animals in order to drive them to the knock box. Several collaborating universities also documented that packing plant employee's temperament would change as they would become increasingly careless in the way that animals were handled as the day progressed.

Table 15. Frequency[a] distribution of hot shot usage by persons responsible for cattle unloading (%)

	All loads (n = 103)	Beef loads (n = 34)	Dairy loads (n = 39)	Mixed loads (n = 30)
Hot shot usage				
Loads that hot shot was not applied to animals	77.7	67.6	84.6	80.0
Loads that hot shot was applied to animals	22.3	32.4	15.4	20.0
Loads that hot shot was applied to 25% or less of animals	87.4	82.4	89.7	90.0
Loads that hot shot was applied to greater than 25% of the animals	12.6	17.6	10.3	10.0

[a] Frequencies are expressed as a percentage of total loads within each column.

Table 16. Frequency[a] distribution of aggressive/passive usage of other driving aid types by persons responsible for cattle unloading (%)

	All loads (n = 103)	Beef loads (n = 34)	Dairy loads (n = 39)	Mixed loads (n = 30)
Manner of usage				
Loads that other driving aids were used in a passive[b] manner	86.4	85.3	94.9	76.7
Loads that other driving aids were used in an aggressive[c] manner	13.6	14.7	5.1	23.3
Other driving aid types used aggressively				
Driving aid 1	Stick	PVC Pipe	Body parts	Stick
Driving aid 2	Paddle	Stick		Paddle
Driving aid 3	Body parts	Paddle		Body parts
Driving aid 4	PVC Pipe	Metal Pipe		
Driving aid 5	Metal Pipe	Whip		
Driving aid 6	Whip	Flashlight		
Driving aid 7	Flashlight			

[a] Frequencies are expressed as a percentage of total plants.
[b] Passive handling was considered to not have made contact with animals with driving aids other than hot shots.
[c] Aggressive handling was considered to have made contact with animals with driving aids other than hot shots.

Table 17. Frequency[a] distribution of hot shot usage by persons responsible for moving cattle through pens up to the restrainer (%)

	All plants (n = 23)
Hot shot usage	
Plants that hot shot was not applied to animals	17.4
Plants that hot shot was applied to animals	82.6
Plants that hot shot was applied to 25% or less of animals	34.8
Plants that hot shot was applied to greater than 25% of the animals	65.2

[a] Frequencies are expressed as a percentage of total plants.

Table 18. Frequency[a] distribution of aggressive/passive usage of other driving aid types by persons responsible for moving cattle through pens up to the restrainer (%)

	All plants (n = 23)
Manner of usage	
Plants that used other driving aids in a passive[b] manner	60.9
Plants that used other driving aids in an aggressive[c] manner	39.1
Other driving aid types used aggressively	
Driving aid 1	Paddle
Driving aid 2	Whip
Driving aid 3	Metal Pipe
Driving aid 4	Gate
Driving aid 5	Motorized transport instrument

[a] Frequencies are expressed as a percentage of total plants.
[b] Passive handling was considered to not have made contact with animals with driving aids other than hot shots.
[c] Aggressive handling was considered to have made contact with animals with driving aids other than hot shots.

Live Animal Evaluation

Individual Live Animal Traits

Table 19 shows that the predominant colors for all animals surveyed during the 2007 cow and bull quality audit. The majority of beef cows and bulls had predominant hide colors of black, red or white. Holstein was the most common hide pattern for dairy cows (92.9 %) and bulls (90.1 %). This table also shows a small percentage beef cows and bulls as having a black and white hide pattern, similar to that of a Holstein.

Overall, 92.1 percent of cattle that were surveyed displayed some type of identification and 7.9 percent had no form of ID (Table 20). Approximately 67 percent (combining cattle with single ID and multiple ID combinations) of all cattle had back tags, representing cattle that came through auction barns before slaughter. Cattle with lot tags, visual ID (VID), and even electronic ID (EID) possibly represent cows and even heiferette's that have spent a period of time in a feed lot to increase condition scores before slaughter. This technique is more prevalent in the north- and mid-western states, according to information supplied by plant personnel.

While 57.3 percent of all cattle had mud present on their hides, slightly higher frequencies were found for dairy cows and bulls than beef cows and bulls (Table 21). Dairy cows had twice (2.2 %) the percentage of animals having extreme mud/manure hide contamination than beef cows and almost 10 percent more hides contaminated with dried mud and manure. Dry mud and manure represents hides that have been contaminated for longer periods of time. Also, beef cows displayed a lower frequency (1.7 %) of cattle having mud on their legs, belly, side, topline and tail than dairy cows (3.8 %).

Table 19. Frequency distribution of predominant hide color on cattle (%)

	All cattle (n = 7036)	Beef cows (n = 3164)	Dairy cows (n = 3218)	Beef bulls (n = 413)	Dairy bulls (n = 162)
Color					
Holstein (dairy) or black/white (beef)	43.4	0.3	92.9	1.9	90.1
Black	24.7	44.2	0.0	52.3	0.0
Red	16.9	32.3	0.0	28.6	0.0
White	3.4	5.7	0.0	10.4	0.0
Brown	3.3	5.1	0.0	1.0	0.0
Yellow	2.5	4.8	0.0	1.7	0.0
Other Dairy	2.0	0.0	7.1	0.0	9.9
Brindle	1.7	3.4	0.0	1.2	0.0
Grey	1.7	3.3	0.0	2.7	0.0
Roan	0.5	1.0	0.0	0.2	0.0

Table 20. Frequency distribution of single and multiple identification types (%)

	All cattle (n = 5780)	Beef cows (n = 2799)	Dairy cows (n = 2374)	Beef bulls (n = 396)	Dairy bulls (n = 136)
ID prevalence					
Any ID present	92.1	93.6	92.2	85.6	80.1
No ID present	7.9	6.4	7.8	14.4	19.9
Cattle with single ID type					
Back tag	11.0	10.5	9.8	19.4	19.1
Metal clip	5.5	8.5	1.5	9.3	0.7
VID	5.3	4.8	4.7	9.3	12.5
Other	0.7	0.6	0.8	1.5	0.7
Cattle with multiple ID types					
Back tag/VID	22.1	16.2	29.9	18.7	21.3
Back tag/VID/metal clip	21.1	24.7	20.2	7.8	5.2
Back tag/metal clip	9.0	11.1	6.6	9.9	5.2
VID/metal clip	6.4	8.0	4.7	5.3	2.9
Back tag/VID/metal clip/lot tag	3.2	2.9	4.1	0.5	1.5
Back tag/VID/EID	1.4	0.4	2.7	0.0	0.7
Other ID combinations	6.4	5.9	7.2	3.9	10.3

Table 21. Frequency distribution of hide contamination from mud/manure on animal's legs, belly, side, and topline (%)

	All cattle (n = 5736)	Beef cows (n = 2809)	Dairy cows (n = 2335)	Beef bulls (n = 413)	Dairy bulls (n = 101)
Mud/manure prevalence					
No mud present	42.7	44.6	40.6	43.1	36.6
Mud present	57.3	55.4	59.4	56.1	63.4
Mud/manure severity					
Small	42.8	41.5	44.2	43.1	37.6
Moderate	10.8	10.9	10.4	11.1	17.8
Large	2.3	2.0	2.6	1.9	5.9
Extreme	1.5	1.0	2.2	0.7	2.0
Mud/manure freshness					
Dry	40.5	36.4	45.3	40.0	50.5
Wet	15.0	17.1	12.5	14.3	10.9
Wet/dry	1.9	2.0	1.5	2.7	2.0
Mud/manure location					
Legs only	20.8	20.7	20.6	22.8	18.8
Legs and belly	12.1	12.6	11.5	10.9	12.9
Legs and tail	4.7	3.0	6.5	6.5	6.9
Legs, belly, and tail	4.2	5.5	3.0	2.7	4.0
Legs, belly, and side	3.7	3.0	4.4	2.4	8.9
Legs, belly, side, topline, and tail	2.7	1.7	3.8	2.4	5.9
Legs, belly, side, and tail	2.5	3.0	2.1	1.7	2.0
Other combinations	6.6	5.9	7.5	6.7	4.0

Frequencies of branding on hides (Table 22) can vary due to branding laws for individual states. In general, branding was more common to beef than dairy cattle, with 31.3 and 37.6 percent of beef cows and bulls being branded, respectively. Frequencies of branded cattle were 9.9 and 28.1 for dairy cows and bulls. Across all cattle, the most predominant branded region was the butt (15.1 %), with the side being second (4.8 %). While branding is the more traditional method of identifying cattle, this can be detrimental to the drop value for packers, as a native hide is preferred by packers and is the most valuable drop item.

Beef cows had a higher percentage of cattle with horns than dairy cows. According to Table 23, 89.6 percent of dairy cows were polled, as most are dehorned early in their lives while 80.8 percent of beef cows were polled. Of the 19.2 percent of beef cows that were horned, greater than half of those animals had horns longer than five inches, which can result in hide damage, bruising, and even lameness. Another key point is that both, beef and dairy bulls, had higher percentages of animals with horns than their female counterparts. With the high numbers of non-separated cow and bull mixed loads, this only emphasizes the need for attention to detail on how cattle are loaded.

Even though bovine ocular neoplasia (cancer eye) is most commonly associated with beef breeds, especially white-faced breeds such as Herefords, dairy cattle are susceptible to this disease as well. Frequency distributions, in Table 24, of animals surveyed during the packing plant audits show 3.8 percent of beef cows and 1.7 percent of dairy cows displaying any signs of cancer eye with the majority of cases found at early stages of this disease. Lower percentages and less cases with advanced severity overall are a direct result of better herd management as these cattle are being identified prior to the latter stages of this disease, reducing the chance of possible head and carcass condemnations for the packer.

Table 22. Frequency distribution of brands by number and location (%)

	All Cattle (n = 5539)	Beef cows (n = 2810)	Dairy cows (n = 2090)	Beef bulls (n = 396)	Dairy bulls (n = 135)
Brand prevalence					
No brands present (native)	76.4	68.7	90.1	62.4	71.9
Cattle with branded hides	23.6	31.3	9.9	37.6	28.1
Single brand location					
Butt	15.1	19.5	7.4	22.7	20.0
Side	4.8	6.7	1.7	7.8	1.5
Shoulder	0.9	0.9	0.6	1.0	5.2
Multiple brand location					
Side/butt	2.3	3.4	0.2	4.6	1.5
Shoulder/butt	0.3	0.6	0.0	0.5	0.0
Shoulder/side	0.1	0.1	0.0	0.7	0.0
Shoulder/side/butt	0.1	0.2	0.0	0.3	0.0

Table 23. Frequency distribution of horn size (%)

	All cattle (n = 5539)	Beef cows (n = 2810)	Dairy cows (n = 2090)	Beef bulls (n = 396)	Dairy bulls (n = 135)
Horn size					
No horns present	83.4	80.8	89.6	79.3	54.8
<1”	4.2	3.1	5.5	2.3	15.6
1” to 5”	5.3	5.3	4.2	4.8	23.7
>5”	7.1	10.8	0.8	13.6	5.9

Table 24. Frequency distribution of bovine ocular neoplasia by severity (cancer eye) (%)

	All cattle (n = 5691)	Beef cows (n = 2809)	Dairy cows (n = 2314)	Beef bulls (n = 388)	Dairy bulls (n = 106)
Severity					
None	97.1	96.2	98.3	97.2	99.1
1	1.4	1.9	0.9	1.6	0.0
2	0.6	0.7	0.4	0.8	0.9
3	0.4	0.5	0.2	0.3	0.0
4	0.2	0.3	0.2	0.0	0.0
5	0.3	0.5	0.1	0.3	0.0

There was a higher percent of dairy cows having knots than beef cows (Table 25). These numbers are to be expected due to the number of injections that dairy cows receive to synchronize estrus cycles, increase milk production, and manage herd health. Nevertheless, Beef Quality Assurance (BQA) efforts are becoming evident as 92 percent dairy cows with knots were located in the shoulder or neck regions, respectively.

According to Table 26, dairy cows were more frequently lame than beef cows as almost half received a locomotion score of 2 or greater. Lameness has been more commonly associated with dairy cows as most of these animals spend more of their lives on concrete than beef cows. Lameness may also have been caused by not segmenting genders during transport. Fifty percent of all dairy loads that contained cows and bulls were not sex-separated.

In Table 27, the average muscle score for beef cows was 2.34 with the majority of the animals scoring 2 and lower, which is similar to results found during 1999 audit. However, comparing the results from the 2007 and 1999 cow and bull quality audits display an increase in the percent of beef cows scoring 2 and a decline in muscle scores of 1 since 1999. This is a positive note for beef producers as improved genetic selection, feeding, and overall herd management can be attributed to this change.

Dairymen have seen similar results as there has also been an improvement in the average muscle score (1.81) and frequency of cattle with muscle scores of 2 rather than 1. Improved herd management and feeding can also be credited to this change, as well as this being a possible side effect of the Cooperators Working Together (CWT) program that was set in motion in 2003 as an effort to alleviate declining milk prices.

Herd buyouts, as part of the CWT, can affect age, condition, as well as overall quality of dairy cows as this interrupts the typical production cycle for these animals.

Table 25. Frequency distribution of knots due to injections by location (%)

	All cattle (n = 5520)	Beef cows (n = 2797)	Dairy cows (n = 2087)	Beef bulls (n = 393)	Dairy bulls (n = 135)
Knot prevalence					
No knots present	92.1	95.7	85.8	98.7	91.1
Knots present	7.9	4.3	14.2	1.3	8.9
Location					
Neck	2.6	1.8	4.3	0.0	1.5
Shoulder	4.6	2.1	8.8	1.0	6.7
Top Butt	0.2	0.1	0.4	0.0	0.0
Round	0.5	0.3	0.7	0.3	0.7

Table 26. Frequency distribution of locomotion scores for cattle (%)

	All cattle (n = 5586)	Beef cows (n = 2807)	Dairy cows (n = 2112)	Beef bulls (n = 431)	Dairy bulls (n = 130)
Score					
1	70.0	83.8	51.4	68.7	77.7
2	20.0	12.7	31.1	16.0	11.5
3	5.8	2.5	9.5	9.1	6.9
4	3.0	0.9	5.4	4.4	3.9
5	1.3	0.2	2.7	1.9	0.0

Table 27. Means and frequency distribution of muscle scores

	All cattle (n = 5069)	Beef cows (n = 2501)	Dairy cows (n = 1954)	Beef bulls (n = 385)	Dairy bulls (n = 127)
Mean values					
Muscle score	2.21	2.34	1.81	3.31	2.61
Frequencies of muscle score (%)					
1	21.3	13.8	35.0	1.6	11.0
2	45.5	47.2	50.2	13.8	39.4
3	25.1	31.0	13.4	45.7	29.1
4	7.0	7.5	1.4	29.6	18.9
5	1.1	0.6	0.1	9.4	1.6

According to the results from the 2007 cow and bull quality audit, approximately 30 percent of beef cows and 14 percent of beef bulls received a body condition score of 3 or lower (Table 28). While most would expect bull to be leaner animals, the average BCS was 4.91. Greater amounts of muscling for bulls might have created an illusion of better conditioning which could have affected on these scores.

Wagner (1984) and Dunn et al. (1983) found this beef body condition scoring system to be highly correlated to carcass external fat deposition. Most producers find themselves in a controversial situation as several packing plants have expressed the need for “lean” cattle, as the majority of their profits are still derived from 85 percent and higher lean trim. Cattle that yield this type of trim are typically the lower scores on the BCS system, failing to give producers an incentive to cull animals earlier. However, from an animal welfare standpoint, producers should be encouraged to sell older cows before falling below a BCS of 3 to avoid problems associated with cattle reaching the stages of emaciation. Based on the standards set by certain packers that purchase and provide incentives for “lean” cows, producers have not been discouraged from attempting to use these poorly conditioned animals for continued production even though, at this point, the animals age and nutrition plane are not conducive to calving or milking. Richards et al. (1986) defined beef cows falling below a body condition score of 4 as having longer post calving intervals to estrus and pregnancy, which can disrupt a producer’s ability to rebreed cows, ultimately affecting productivity of these cattle. All of these factors must be addressed by cattlemen and packers alike, as this not only sparks controversy but sends mixed messages to producers as to what types of cows and bulls are most profitable.

Table 28. Means and frequency distribution of body condition scores (BCS) for beef animals

	Beef cows (n = 2800)	Beef bulls (n = 431)
Mean values		
BCS scores	4.53	4.91
Frequencies of BCS scores[a] (%)		
1	0.9	0.5
2	9.1	1.6
3	19.9	11.4
4	21.2	26.2
5	21.2	29.2
6	15.5	19.7
7	8.0	8.1
8	3.0	2.1
9	1.2	1.2

[a] Beef BCS was a 9-point scoring system (1 = extremely emaciated to 9 = extremely obese).

Dairy cows and bulls that were surveyed during the 2007 audit had average body condition scores of 2.49 and 3.38 (Table 29). The higher average BCS for bulls can also be attributed to greater amounts of muscling, much like beef cattle. According the 2007 data, most dairy cows that were found at packing plants fell within the BCS range of 2.5 to 3.5. Even though this range is considered typical for most dairy cows, these animals were most likely culled due to lower milk production levels.

In accordance with the Elanco body condition scoring guide, condition scores for dairy cows during early lactation should not be reduced by more than 1 full grade from that animals BCS at calving. Early lactation for dairy cows is considered the peak milk production period as the majority of energy for that animal is being used for milk production. The typical BCS for dairy cows during this stage is approximately 2.5 due to lactation creating an inability to store excess fat because of energy required for lactation. Cows that fall below this score are typically less efficient and require increased feed intake to maintain normal milk production levels. Dairy body condition scores that are less than 3.0, with the exception of early lactation, and above 4.0 at calving, are considered to be inefficient and have a higher likelihood of being culled. Milk productivity and efficiency is the primary driving force behind culling dairy cows, so cows that were less than 2.5 and above 3.5 were most likely culled for inefficient feed conversion.

Table 29. Means and frequency distribution of body condition scores (BCS) for dairy cattle

	Dairy cows (n = 2103)	Dairy bulls (n = 124)
Mean values		
BCS scores	2.49	3.38
Frequencies of BCS scores[a] (%)		
1	6.0	1.6
1.5	16.2	2.4
2	19.4	4.8
2.5	22.4	9.7
3	16.4	22.6
3.5	10.7	22.6
4	6.4	25.0
4.5	2.1	8.1
5	0.5	3.2

[a] Dairy BCS was a 5-point scoring system with half increments (1 = extremely emaciated to 5 = extremely obese).

Visible Defects for Cattle in Holding Pens

Visual appraisal for all cattle revealed that 30.8 percent were identified for having some sort of visible defect with dairy cows having the highest percent (37 %) of animals with a visible defect (Table 30). Reasons unforeseen by auditors that would result in culling, instead of visible defects, could be attributed to the current drought conditions throughout the United States as inadequate forage can be a common cause for culling these animals. Table 31 shows that beef cows and bulls were most frequently identified as having insect hide damage. Interestingly, beef bulls had the highest percent (10.76 %) of animals that exhibited latent hide damage, most likely resulting from aggressive temperaments of male animals in general. Frequency of extreme emaciation was similar for beef (4.08 %) and dairy cows (4.54 %), a possible outcome from malnutrition or disease. Foot abnormalities were found to be most common in dairy cows (7.16 %). Possible explanations for foot abnormalities could be either concrete flooring found at most dairy operations as well as high grain rations that most dairy cattle are fed.

Abscess frequency and location, along with presence of lumpy jaw, were identified for cattle in Table 32. Dairy cows and bulls had the highest percentage of cattle with abscess at the knee/hock location most likely caused by arthritis. Hook/pin abscesses were more frequent in dairy cows (0.69 %) than beef cows (0.35 %), a common side-effect of improper injections. Lumpy Jaw, or actinomycosis, and jaw/tooth abscess frequencies were higher for beef cows than dairy cows. Actinobacteria are usually connected to jaw abnormalities such as “Woody Tongue” and “Lumpy Jaw.”

Reproductive defects, found in Table 33, for cows such as vaginal prolapses and retained placentas were minimal for both beef and dairy animals. Retained placentas can also be attributed to cows having calves on the packing plant premise. A situation such as this is a serious oversight by producers and cattle dealers, as cows this late in their gestation cycle should be identified and allowed to calve prior to reaching the slaughter facility. Lastly, 4.08 percent of bulls were identified as having a “broken penis.”

According to Table 34, dairy cows had more udder defects than did beef cows. Dairy cows with udder defects were primarily found at later, more severe stages of possible mammary gland problems. Dairy cows exhibiting mastitis (8.7 %) and/or multiple udder defects (9.9 %) should have been culled at an earlier stage of production.

Table 30. Frequency distribution of animals with and without any visible defects (%)

	All cattle (n = 5407)	Beef cows (n = 2817)	Dairy cows (n = 2026)	Beef bulls (n = 381)	Dairy bulls (n = 183)
Defect prevalence					
No defect present	69.2	72.0	63.0	76.1	80.3
Any defect present	30.8	28.0	37.0	23.9	19.7

Table 31. Frequency distribution of other visible live animal quality concerns (%)

	All cattle (n = 5407)	Beef cows (n = 2817)	Dairy cows (n = 2026)	Beef bulls (n = 381)	Dairy bulls (n = 183)
Quality concern					
Rectal prolapse	0.04	0.07	0.00	0.00	0.00
Insect hide damage	3.05	5.08	0.54	2.36	1.09
Latent hide damage	5.99	0.53	2.57	10.76	4.92
Extreme emaciation	3.96	4.08	4.54	1.31	1.09
Foot abnormalities	4.57	2.52	7.16	6.30	3.83
Other defects	0.11	0.04	0.20	0.00	0.55

Table 32. Frequency distribution of visible abscesses and lumpy jaw for all animal types (%)

	All cattle (n = 5407)	Beef cows (n = 2817)	Dairy cows (n = 2026)	Beef bulls (n = 381)	Dairy bulls (n = 183)
Quality Concern					
Abscess, Jaw/Tooth	0.39	0.53	0.15	0.26	1.09
Abscess, Knee/Hock	1.22	0.35	2.27	0.79	3.83
Abscess, Hook/Pin	0.50	0.35	0.69	0.00	1.64
Lumpy Jaw (actinomycosis)	0.59	0.78	0.15	1.31	1.09

Table 33. Frequency distribution of visible reproductive problems in cows and bulls (%)

	All breeds	Beef	Dairy
Cow reproductive defect	(n = 4843)	(n = 2817)	(n = 2026)
Vaginal prolapse	0.23	0.39	0.00
Retained placentas	0.31	0.14	0.54
Bull reproductive defect	(n = 564)	(n = 381)	(n = 183)
Broken Penis	4.08	4.20	3.83

Table 34. Frequency distribution of visible udder problems in beef and dairy cows (%)

	All cows (n = 4843)	Beef cows (n = 2817)	Dairy cows (n = 2026)
Udder defect prevalence			
No udder defects present	83.9	89.5	76.1
Udder defects present	16.1	10.5	23.9
Mammary gland defect			
Bottle teats	3.7	5.2	1.7
Failed Suspensory Ligament	2.7	2.0	3.6
Mastitis	3.9	0.4	8.7
Multiple udder defects	5.8	2.9	9.9

Carcass Defect Evaluation

<u>Bruises/Injection Sites/Arthritic Joints</u>

As reported in Table 35, a drastic improvement in the number of cow carcasses that had no bruises was found in 2007 when compared to 1999, with fewer carcasses having minor, medium, and major bruising. However a jump in extreme bruises since 1999 can be attributed to the increase in poor condition cattle as these cattle have less fat protect them from bruising. During 2007, beef cow carcasses were more frequently bruised than dairy cows (Table 36). However, extreme bruising was more frequent in dairy cows than beef cows. Overall, when combining single and multiple bruises, 33 percent of all carcasses had bruises in the round area and 19.6 percent had bruises on the loin (Table 37). Beef cows, had a higher percentage of carcasses with round and loin bruises than did dairy cows, a possible consequence of the more frequent aggressive handling while unloading. Since 1999, the overall frequency of bruising has improved, nevertheless, producers, truck drivers, and packing plants must continue in their effort of creating an environment that alleviates the chances of bruising as this continues to plague the market cow and bull industry with economic losses.

According to Table 38, injection site lesions visible on the carcass were found to be more frequent for dairy cows than beef cows and are consistent with the numbers of cows displaying knots during the live animal evaluation portion of this audit. Dairy cows with injection site blemishes were more severe than beef cows, as 8.7 percent were classified as medium or higher. The most common location for visible carcass injection blemishes was the round (approximately 7.39 %), even though during live animal evaluation most visible knots were located on the neck and shoulder regions (Table 39). Knots that are seen through the skin of live animals are more likely to be larger, more severe, injection site lesions. Also some knots that were visible on live animal's neck and shoulder were removed during hide removal.

Table 35. Comparison of frequency for bruise severity classifications between past and current audits (%)

Bruise severity[a]	1994	1999	2007
Cows			
None	20.3	11.8	36.6
Minor	51.5	77.2	36.7
Medium	53.9	41.7	30.9
Major	30.7	21.6	12.4
Extreme	-	2.4	5.4
Bulls			
None	63.8	47.1	46.8
Minor	25.3	44.4	31.5
Medium	19.5	16.7	20.1
Major	7.4	6.9	11.5
Extreme	-	1.0	7.6

-Totals within columns can be more than 100% due to cattle with more than one bruise type.
[a] Bruise severity classifications are as follows:
Minor = resulted in trim of <1lb per bruise site
Medium = between the size of a golf ball and softball
Major = larger than a softball, requires substantial trim per bruise site
Extreme = resulting in an area requiring trim that was nearly the size of an entire primal

Table 36. Frequency distributions of bruise severity for cattle surveyed (%)

	All cattle (n = 5662)	Beef cows (n = 2468)	Dairy cows (n = 2624)	Beef bulls (n = 356)	Dairy bulls (n = 121)
Bruise severity [a]					
No bruises present	37.1	34.2	38.8	49.2	39.7
Minor	36.5	41.3	32.4	30.1	35.5
Medium	30.2	32.1	29.8	19.4	22.3
Major	12.4	12.0	12.8	12.6	8.3
Extreme	5.6	4.5	6.2	6.7	9.9

[a] Bruise severity classifications are as follows:
Minor = resulted in trim of <1lb per bruise site
Medium = between the size of a golf ball and softball
Major = larger than a softball, requires substantial trim per bruise site
Extreme = resulting in an area requiring trim that was nearly the size of an entire primal

Table 37. Frequency distribution of bruise location for cattle with single and multiple bruises (%)

	All cattle (n = 5662)	Beef cows (n = 2468)	Dairy cows (n = 2624)	Beef bulls (n = 356)	Dairy bulls (n = 121)
Bruise prevalence					
No bruises present	37.1	34.2	38.8	49.2	39.7
Carcasses with at least 1 bruise present	62.9	65.8	61.2	50.8	60.3
Single bruise locations					
Round	14.0	13.7	14.0	13.5	19.0
FPB	10.7	11.8	10.0	9.0	7.4
Loin	6.5	6.7	6.1	6.2	8.3
Rib	2.1	0.9	3.4	1.7	0.0
Chuck	1.9	2.0	1.7	0.8	3.3
Multiple bruise locations					
Round/loin	7.6	11.1	4.8	5.6	5.8
Round/FPB	4.6	4.7	4.5	3.9	5.0
Round/loin/FPB	1.8	2.4	1.4	0.6	0.0
Round/rib	1.3	0.7	1.9	0.8	0.8
Loin/FPB	1.3	1.6	1.1	0.6	2.5
Round/chuck	1.3	1.1	1.6	0.3	2.5
Round/loin/chuck	1.2	1.8	0.9	0.3	0.0
Round/loin/rib	1.2	1.4	1.0	0.8	0.0
Rib/FPB	1.1	0.6	1.6	0.8	0.0
Chuck/FPB	1.1	1.2	1.0	0.8	2.5
Other combinations	5.2	4.1	6.2	5.1	3.2

Table 38. Frequency distribution of injection site lesion severity for cattle surveyed (%)

	All cattle (n = 5662)	Beef cows (n = 2468)	Dairy cows (n = 2624)	Beef bulls (n = 356)	Dairy bulls (n = 121)
Lesion severity[a]					
No lesion present	93.5	97.7	88.8	98.6	99.2
Minor	1.8	1.2	2.5	0.8	0.8
Medium	2.3	0.8	3.9	0.6	0.0
Major	1.5	0.3	3.0	0.0	0.0
Extreme	0.9	0.1	1.8	0.0	0.0

[a] Lesion severity classifications are as follows:
Minor = resulted in trim of <1lb per bruise site
Medium = between the size of a golf ball and softball
Major = larger than a softball, requires substantial trim per bruise site
Extreme = resulting in an area requiring trim that was nearly the size of an entire primal

Table 39. Frequency distribution of injection site lesion location for cattle with single and multiple lesions (%)

	All cattle (n = 5662)	Beef cows (n = 2468)	Dairy cows (n = 2624)	Beef bulls (n = 356)	Dairy bulls (n = 121)
Lesion prevalence					
No lesions present	93.48	97.65	88.83	98.60	99.17
Carcasses with at least 1 lesion	6.52	2.35	11.17	1.40	0.83
Single lesion locations					
Round	3.41	0.49	6.67	0.56	0.00
Chuck	1.47	1.42	1.49	0.84	0.83
FPB	0.72	0.24	1.30	0.00	0.00
Rib	0.39	0.00	0.80	0.00	0.00
Loin	0.11	0.16	0.08	0.00	0.00
Multiple lesion locations					
Round/loin	0.14	0.00	0.30	0.00	0.00
Round/rib	0.12	0.00	0.27	0.00	0.00
Round/FPB	0.09	0.00	0.15	0.00	0.00
Other lesion combinations	0.08	0.04	0.12	0.00	0.00

Table 40 shows arthritic joints as being more common for dairy cows (6.9 %) than beef cows (4.6 %). Dairy cows that were identified as such had predominately 1 joint that showed signs of arthritis. Overall, bulls were found to be more frequently arthritic than cows. Lastly, frequency distributions of grubs and buckshot were reported in Table 41. There was no buck shot found in carcasses that were surveyed during this audit which coincides with results from the interview process as this was not mentioned in the top 10 lists. Even though no buck shot was reported and has been reduced overall, producers must continue their efforts in suppressing this issue, as single cases of buck shot can cause severe trim losses for individual carcasses and pose a potential human health hazard.

Table 40. Frequency distribution of arthritic joints for cattle surveyed (%)

	All cattle (n = 5662)	Beef cows (n = 2468)	Dairy cows (n = 2624)	Beef bulls (n = 356)	Dairy bulls (n = 121)
Number of arthritic joints					
None	93.8	95.3	93.1	91.3	91.7
1	5.2	4.3	5.4	7.3	5.8
2	1.0	0.3	1.5	1.4	2.5

Table 41. Frequency distribution of grubs and buck shot prevalence for cattle surveyed (%)

	All cattle (n = 5662)	Beef cows (n = 2468)	Dairy cows (n = 2624)	Beef bulls (n = 356)	Dairy bulls (n = 121)
Grub prevalence					
No grubs present	99.95	99.92	99.96	100.00	100.00
Cattle with grubs present	0.05	0.08	0.04	0.00	0.00
Buck shot prevalence					
No buck shot present	100.00	100.00	100.00	100.00	100.00
Cattle with buck shot present	0.00	0.00	0.00	0.00	0.00

Visceral Condemnations and Fetal Calves

Since 1999, condemnation rates have increased for each offal item surveyed during these audits (Table 42). Several packers expressed concern for the variation in inspection overall and how FSIS personnel handle condemnations differently. Overall, beef animals had higher liver condemnation rates than dairy with abscesses being the primary reason for liver condemnations (Table 43). Flukes were frequently cited as a condemnation reason for beef livers and are anticipated as flukes are typically transferred orally through grazing, which is common for beef cattle production (Table 44). Dairy animals had higher overall condemnation rates for tripe and the number one reason was contamination, a result of accidents during evisceration (Table 45). Table 46 shows that dairy cattle had higher heart condemnation rates than beef cattle with pericarditis, contamination, and pneumonia reported as the most frequent causes.

Of cows evaluated, 10.6 percent were pregnant (Table 47). Prevalence of cows containing fetal calves was slightly higher for dairy cows than beef cows. Even though fetal calve blood can offer a lucrative situation for packers and is used for medical research to benefit mankind; this poses problems for the cow and bull beef industry in terms of public perception.

Table 42. Comparison of offal and carcass condemnation rates from 1994, 1999, and 2007 National Market Cow and Bull Beef Quality Audits (%)

	1994	1999	2007
Offal items			
Liver	30.8	24.1	45.3
Tripe	44.8	19.2	20.5
Heart	11.0	7.2	16.1
Head	11.1	6.7	10.2
Tongue	5.9	9.5	10.0

[a] Columns, when totaled, will not equal 100% due to cattle having multiple offal items condemned.

Table 43. Condemnation rates[a] for offal items during the 2007 National Market Cow and Bull Beef Quality Audit (%)

	All cattle (n = 4896)	Beef cows (n = 1625)	Beef bulls (n = 201)	Dairy cows (n = 1952)	Dairy bulls (n = 63)
Offal items					
Liver	45.3	47.8	32.3	37.6	34.9
Heart	16.1	12.5	12.4	13.7	6.4
Tripe	20.5	13.5	12.4	21.2	15.9
Head	10.2	11.8	15.0	9.3	20.3
Tongue	10.0	14.7	12.2	5.7	10.0

[a] Columns, when totaled, will not equal 100% due to cattle having multiple offal items condemned.

Table 44. Frequency distribution of liver condemnation causes for all beef and dairy animals (%)

	All cattle (n = 4896)	Beef animals (n = 2015)	Dairy animals (n = 2459)
Overall liver condemn rate			
Not condemned	54.7	52.1	60.1
Condemned	45.3	47.9	39.9
Reason for condemnation			
Abscess	13.7	12.4	14.0
Contamination	6.7	5.3	7.3
Flukes	5.5	7.8	2.4
Telangiectasis	5.0	7.4	2.5
Other	14.3	15.0	13.8

Table 45. Frequency distribution of tripe condemnation causes for all beef and dairy animals (%)

	All cattle (n = 4896)	Beef animals (n = 2015)	Dairy animals (n = 2459)
Overall tripe condemn rate			
Not condemned	79.6	84.9	76.5
Condemned	20.4	15.1	23.5
Condemnation cause			
Contamination	8.6	7.9	8.1
Abscess	6.1	4.3	7.2
Ulcer	0.1	0.2	0.2
Other	5.6	2.7	8.0

Table 46. Frequency distribution of heart condemnation causes for all beef and dairy animals (%)

	All cattle (n = 4896)	Beef animals (n = 2015)	Dairy animals (n = 2459)
Overall heart condemn rate			
Not condemned	84.0	86.9	82.1
Condemned	16.0	13.1	17.9
Condemnation cause			
Pericarditis	3.6	1.6	5.8
Other[a]	12.4	11.6	12.1

[a] Other reported reasons for heart condemnation were (in order of prevalence) contamination, pneumonia, heart abscesses, adhesion, cirrhosis, cancerous lesions, endocarditis, and septicemia.

Table 47. Frequency distribution of beef and dairy cows that contained fetal calves (%)

	All cows (n = 3577)	Beef (n = 1625)	Dairy (n = 1952)
Pregnancy status			
Pregnant	10.60	10.28	10.86
Open	89.40	89.72	89.14

Head and Tongue Condemnations

Head and tongue condemnation rates have increased since 1999. Changes in FSIS policy, regarding how cactus tongue and hair sores are to be handled, had an effect in this change. Cactus tongue, once were trimmed, are now mandatory condemnation whereas hair sores are just the reverse. Rates of trimming and condemning tongues, as stated in Table 48, were higher in beef animals than dairy. Across all cattle, the main reason for trimming was hair sores, while for condemnation was contamination, followed by cactus tongue. Beef cattle also had higher condemnation rates for heads than dairy with contamination being the leading cause for trimming and condemnation (Table 49).

Table 48. Frequency distribution of tongues that were trimmed and condemned for various reasons for all beef and dairy animals (%)

	All cattle (n = 5260)	Beef animals (n = 1760)	Dairy animals (n = 2263)
Overall tongue trim/condemn rate			
Not trimmed/condemned	81.58	75.21	87.70
Trimmed/condemned	18.42	24.79	12.30
Reason for trimming			
Hair sore	4.42	8.83	1.81
Contamination	1.87	0.34	1.23
Lymph glands	0.76	0.91	1.01
Cactus tongue	0.02	0.00	0.04
Other	1.33	0.23	2.51
Reason for condemnation			
Contamination	2.63	3.82	2.16
Cactus tongue	2.17	3.25	0.66
Hair sore	1.82	3.19	1.63
Lymph glands	0.95	1.99	0.26
Other	2.46	2.22	0.97

Table 49. Frequency distribution of heads that were trimmed and condemned for various reasons for all beef and dairy animals (%)

	All cattle (n = 5260)	Beef animals (n = 1760)	Dairy animals (n = 2263)
Overall head trim/condemn rate			
Not trimmed/condemned	85.6	84.1	88.6
Trimmed/condemned	14.4	15.9	11.4
Reason for trimming			
Contamination	2.5	2.5	0.9
Lymph glands	0.8	0.1	0.4
Abscess	0.2	0.1	0.1
Other	0.7	1.1	0.5
Reason for condemnation			
Contamination	4.7	5.5	5.3
Abscess	2.0	2.6	1.1
Lymph glands	1.0	1.9	0.8
Other	2.5	2.1	2.3

Live Animal and Carcass Condemnations

0.25 percent of all animals were condemned during antemortem inspection, while 0.83 percent of all carcasses were condemned. As reported in Table 50, 1.19 percent of dairy cow carcasses were condemned which is a higher than the 0.66 percent of beef cows. Since 1999, the most impressive change was the elimination of carcasses being condemned for bruises/injuries (Table 51). Table 52 shows the top ten, most prevalent reasons for carcass condemnation for both animal types during the 2007 cow and bull quality audit.

Table 50. Frequency distribution of antemortem and postmortem condemnations for all animals and carcasses surveyed (%)

	All cattle (n = 14574)	Beef cows (n = 7553)	Dairy cows (n = 5954)
Condemnation type			
Antemortem	0.25	0.04	0.57
Postmortem	0.83	0.66	1.19

Table 51. Comparison of top ten reasons for carcass condemnations during 1999 and 2007 National Market Cow and Bull Beef Quality Audits (%)

	1999	2007
Condemnation cause		
Malignant lymphoma	14.9	32.1
Pneumonia	8.0	13.3
Epithelioma	19.8	11.5
Septicemia	10.5	7.9
Pericarditis	3.0	7.9
Carcinoma	4.5	6.1
Abscess pyemia	9.7	4.9
Peritonitis	4.3	4.2
Nephritis	2.5	1.8
Bruises/injuries	5.9	0.0

Table 52. Top ten reasons for carcass condemnations for cattle surveyed during the 2007 National Market Cow and Bull Beef Quality Audit (%)

	All cattle (n = 164)	Beef cattle (n = 56)	Dairy cattle (n = 109)
Condemnation cause			
Malignant lymphoma	32.1	25.0	35.8
Pneumonia	13.3	7.1	16.5
Epithelioma	11.5	25.0	4.6
Pericarditis	7.9	3.6	10.1
Septicemia	7.9	1.8	11.0
Carcinoma	6.1	7.1	5.5
Dropsy	5.5	12.5	1.8
Abscess pyemia	4.9	3.6	5.5
Peritonitis	4.2	1.8	5.5
Toxemia and Nephritis	1.8	3.6	0.9

Dentition

On Table 53, dairy cattle are shown to have higher percentage of animals with four or less adult incisors than beef cattle, indicating the approximate age of those animals is less than four years old. The majority of both animal types were found to have all 8 adult incisors. "Gummers" (animals with 8 adult incisors that are worn down to the gum line), were also noted for animals that are approximately over 120 months (Table 54). The frequency of gummers was higher for beef cows (17.1 %) than dairy cows (5.7 %) which is expected as the lifespan for a beef animal is, on average, longer than a dairy animal's. Broken mouths, or any defect prohibiting proper mastication, were also found at a higher rate for beef cows than dairy cows.

Table 53. Frequency distribution of total adult incisors for each animal type (%)

	All cattle (n = 5161)	Beef cattle (n = 2633)	Dairy cattle (n = 1381)
Number of adult incisors[a]			
0	0.6	0.7	0.7
1	0.4	0.7	0.1
2	2.7	1.6	6.2
3	1.5	1.7	2.0
4	4.0	1.9	8.2
5	2.7	3.5	1.1
6	6.5	5.7	6.8
7	12.4	17.2	6.7
8	58.1	50.8	62.6

[a] Chronological age of cattle per number of adult incisors is as follows: 0 = less than 18 months, 1 = 18-24 months, 2 = 24-30 months, 3 = 36 months, 4 = 42-48 months, more than 4 adult incisors = > 48 months.

Table 54. Frequency distribution of cattle with dental defects that prohibit proper mastication (%)

	All cattle (n = 5161)	Beef cows (n = 2426)	Dairy cows (n = 1341)	Beef bulls (n = 207)	Dairy bulls (n = 40)
Dental defect					
Gummer[a]	11.2	17.1	5.7	6.3	2.5
Broken Mouth[b]	10.6	12.1	9.2	4.8	15.0

[a] Gummer is defined as any animal that has a full set of adult incisors (8) that are completely worn (approximately even with the gum-line). Approximate age for these animals would be greater than 120 months.

[b] Broken mouth is defined as any dental defect that could prohibit proper mastication.

Carcass Grade Data

Data shown on Table 55 reveal that, on average, beef cows were further advanced in lean, skeletal, and overall maturity, while having a lower marbling score average (Slight^{14}) when compared to dairy cows (Slight^{88}). Dairy cows typically have higher levels of intramuscular fat deposition, which result in a greater demand for subprimals derived from younger dairy cows. Adjusted fat depth was comparable across both breed types, according to Table 55. Average ribeye area was actually two-tenths higher for dairy cows than beef cows. Kidney, pelvic, and heart (KPH) fat is typically removed during the cattle dressing process, since yield grades are not typically assigned at cow and bull packing plants, however, measurements were still taken and dairy cows showed a higher average percent KPH, which is genetically inherent to most dairy breeds. Dairy cow carcasses were heavier (648.8 lbs) and less muscular (1.58 muscle score) when compared beef cows that weighed, on average 634.9 lbs and had a muscle score of 2.19. Fat color scores were higher for beef cattle than dairy cattle, which was anticipated due beef cows being more often grass fed, resulting in external fat having a yellow tint due to higher consumption levels of beta-carotene.

Table 55. Mean values for carcass traits

	All animals (n = 3037)	Beef cows (n = 1315)	Dairy cows (n = 1320)	Beef bulls (n = 245)	Dairy bulls (n = 95)
Carcass trait					
Lean maturity	C^{89}	D^{18}	C^{39}	C^{78}	C^{54}
Skel. maturity	D^{94}	E^{25}	D^{89}	D^{14}	C^{87}
Overall maturity	D^{54}	D^{82}	D^{25}	C^{94}	C^{67}
Marbling[a]	Sl^{29}	Sl^{14}	Sl^{88}	Tr^{28}	Tr^{90}
Overall quality grade[b]	Ut^{44}	Ut^{15}	Ut^{94}	Ut^{40}	Co^{19}
Adjusted fat thickness (in)	0.22	0.25	0.22	0.12	0.07
Ribeye area (in^2)	10.0	9.5	9.7	14.1	11.7
KPH (%)	0.6	0.3	1.1	0.2	0.6
Hot carcass weight (lb)	671.2	634.9	648.8	873.1	927.9
Overall yield grade	2.56	2.57	2.83	1.61	1.94
Muscle score	2.06	2.19	1.58	3.56	2.94
Fat color score	2.68	3.14	2.42	2.09	1.56
REA/CWT ratio	1.54	1.57	1.43	1.72	1.64

-Data is representative of ribbed and non-ribbed carcasses.
[a]Sl = Slight, Tr = Traces
[b]Ut = Utility, Co = Commercial

According to Table 56, dairy cows had more carcasses with A and B lean maturity than beef, while beef had higher numbers of cattle with darker lean scores falling into the C and E categories. Skeletal maturity, as reported in Table 57, for beef cows showed higher amounts of carcasses with D and E maturity than dairy, while dairy cows had more A, B, and C maturity carcasses than beef. Increased administration of hormones in dairy cattle, as opposed to beef, can accelerate the skeletal aging process. This is a possible explanation for finding the majority of dairy cow carcasses in E skeletal maturity (61 %), while frequencies of lean maturity are evenly distributed throughout all maturity classes.

Table 56. Frequency distribution of lean maturity by animal type (%)

	All animals (n = 1801)	Beef cows (n = 1057)	Dairy cows (n = 538)	Beef bulls (n = 168)	Dairy bulls (n = 15)
Lean maturity score[a]					
A	11.6	6.5	24.3	2.5	0.0
B	15.5	13.5	16.3	24.5	14.3
C	26.6	25.5	23.8	37.4	71.2
D	20.6	20.3	21.9	19.6	7.1
E	25.8	34.3	13.7	16.0	7.1

[a] Lean maturity data were gathered from carcasses that were ribbed directly above the 13th rib.

Table 57. Frequency distribution of skeletal maturity for animal type (%)

	All animals (n = 3037)	Beef cows (n = 1315)	Dairy cows (n = 1320)	Beef bulls (n = 245)	Dairy bulls (n = 95)
Skeletal maturity score					
A	3.7	1.2	4.0	10.7	14.9
B	7.7	3.2	9.2	14.0	21.3
C	10.5	7.1	11.7	18.9	17.0
D	16.4	17.2	14.2	25.9	14.9
E	61.7	71.3	61.0	30.5	31.9

Table 58. Frequency distribution of overall maturity by animal type (%)

	All animals (n = 1801)	Beef cows (n = 1057)	Dairy cows (n = 538)	Beef bulls (n = 168)	Dairy bulls (n = 15)
Overall Maturity					
A	3.5	0.8	8.6	4.9	0.0
B	10.5	6.4	12.4	22.7	42.9
C	12.6	10.5	12.6	26.4	14.3
D	38.6	38.2	43.8	24.5	28.6
E	34.9	44.1	22.7	21.5	14.3

Frequencies for overall maturity (Table 58) show beef cattle having double the percentage of cattle falling into the E-maturity category than that of dairy cattle. Marbling score frequencies (Table 59) show a higher percentage of dairy cows with at least Small marbling than beef cows, which results in higher overall quality grades (Table 60). The majority of cattle had less than 0.3 inches of adjusted fat depth, with beef cows having carcasses more frequently above 0.3 inches (Table 61). Frequencies of ribeye areas displayed higher percentages of beef cow carcasses within 9 to 12 inches, while dairy cows were predominately within 7 to 11 inches (Table 62). Frequency distribution for KPH percentages can be found on Table 63. Table 64 reports frequency distribution of carcass weights. Beef cow carcasses displayed a higher amount of cattle below 499 lbs, when compared to dairy cows. Frequency distribution of yield grades, based on data derived from carcasses that were ribbed above the 13th rib, can be found on Table 65.

Table 59. Frequency distribution of marbling scores for animal type (%)

	All animals (n = 1801)	Beef cows (n = 1057)	Dairy cows (n = 538)	Beef bulls (n = 168)	Dairy bulls (n = 15)
Marbling score[a]					
Moderately abundant	0.6	0.2	1.7	0.0	0.0
Slightly abundant	2.0	1.4	3.6	0.0	0.0
Moderate	3.9	3.3	5.8	0.6	6.7
Modest	7.6	6.5	12.2	0.6	6.7
Small	16.0	15.1	22.8	1.2	0.0
Slight	25.2	26.2	26.5	15.0	20.0
Traces	27.8	27.8	17.2	58.1	53.3
Practically Devoid	14.2	16.8	8.0	19.2	13.3
Devoid	2.8	2.7	2.2	5.4	0.0

[a] Marbling score data were gathered from carcasses that were ribbed directly above the 13th rib.

Table 60. Frequency distribution of quality grade by animal type (%)

	All animals (n = 1801)	Beef cows (n = 1057)	Dairy cows (n = 538)	Beef bulls (n = 168)	Dairy bulls (n = 15)
Quality grade					
Prime	0.2	0.2	0.4	0.0	0.0
Choice	3.6	1.7	8.4	0.6	7.1
Select	0.9	0.3	2.3	0.6	0.0
Standard	7.9	4.8	9.5	17.3	28.6
Commercial	7.0	5.1	12.5	0.6	7.1
Utility	43.5	43.8	43.8	41.4	35.7
Cutter	28.8	33.2	19.5	35.2	21.4
Canner	8.0	11.0	3.6	4.3	0.0

Table 61. Frequency distribution of adjusted fat for animal type (%)

	All animals (n = 1801)	Beef cows (n = 1057)	Dairy cows (n = 538)	Beef bulls (n = 168)	Dairy bulls (n = 15)
Adjusted fat depth (in)					
< 0.10	37.4	38.4	29.4	52.9	73.9
0.10	19.3	16.7	20.8	30.4	8.7
0.20	14.8	11.4	23.0	9.4	13.0
0.30	8.6	8.1	11.8	2.6	0.0
0.40	7.3	9.2	4.6	4.2	4.4
0.50	3.1	3.9	2.7	0.5	0.0
0.60	3.8	4.8	3.4	0.0	0.0
0.70	1.8	2.3	1.4	0.0	0.0
0.80	2.0	2.5	1.9	0.0	0.0
0.90	0.6	0.9	0.2	0.0	0.0
1.0 to 2.0	1.2	1.7	0.7	0.0	0.0
> 2.0	0.1	0.1	0.2	0.0	0.0

Table 62. Frequency distribution of ribeye area by animal type (%)

	All animals (n = 1801)	Beef cows (n = 1057)	Dairy cows (n = 538)	Beef bulls (n = 168)	Dairy bulls (n = 15)
Ribeye area (in^2) [a]					
< 5.0	4.1	6.8	0.6	0.0	0.0
5.0	4.6	6.2	3.0	1.2	0.0
6.0	7.3	9.3	5.6	1.8	0.0
7.0	9.7	9.7	12.2	3.6	0.0
8.0	9.8	9.5	12.2	2.4	13.3
9.0	13.5	11.8	19.1	6.6	13.3
10.0	13.7	12.1	18.7	6.0	20.0
11.0	12.7	12.9	14.4	7.1	13.3
12.0	10.2	11.9	8.2	6.0	6.7
13.0	5.4	5.4	3.4	8.9	13.3
14.0	4.3	2.9	2.3	19.1	6.7
15.0	1.4	0.7	0.2	8.3	6.7
16.0	1.1	0.9	0.2	6.0	0.0
17.0	0.7	0.1	0.0	6.0	6.7
18.0	0.8	0.0	0.0	8.3	0.0
19.0	0.3	0.0	0.0	3.0	0.0
20.0	0.3	0.0	0.0	3.6	0.0
> 20.0	0.2	0.0	0.0	2.4	0.0

[a] Ribeye area data were gathered from carcasses that were ribbed directly above the 13th rib.

Table 63. Frequency distribution of kidney, pelvic, heart fat percentage for animal type (%)

	All animals (n = 3037)	Beef cows (n = 1315)	Dairy cows (n = 1320)	Beef bulls (n = 245)	Dairy bulls (n = 95)
KPH%					
≤ .5	77.5	86.6	65.3	93.9	74.7
1.0	6.6	4.0	9.4	3.7	14.7
1.5	2.7	2.1	3.3	2.0	3.2
2.0	5.1	3.2	8.2	0.0	5.3
2.5	2.8	1.1	4.8	0.4	1.1
3.0	3.3	2.5	5.0	0.0	1.1
3.5	1.2	0.3	2.5	0.0	0.0
4.0	0.5	0.2	1.0	0.0	0.0
> 4.0	0.3	0.1	0.5	0.0	0.0

Table 64. Frequency distribution of hot carcass weights for animal type (%)

	All animals (n = 3037)	Beef cows (n = 1315)	Dairy cows (n = 1320)	Beef bulls (n = 245)	Dairy bulls (n = 95)
Hot carcass weight (lb)					
200 to 299	0.5	1.2	0.1	0.0	0.0
300 to 399	5.9	9.8	3.8	0.5	0.0
400 to 499	14.8	18.2	14.5	5.9	2.2
500 to 599	17.4	15.5	21.6	9.0	4.4
600 to 699	20.3	17.4	24.9	9.9	12.0
700 to 799	15.9	16.2	16.8	11.3	13.0
800 to 899	12.2	13.0	11.0	11.7	18.5
900 to 999	6.4	5.2	4.8	18.0	9.8
1000 to 1099	3.9	2.5	2.4	18.9	8.7
1100 to 1199	1.8	0.9	0.2	9.0	18.5
1200 to 1299	0.7	0.2	0.0	3.6	9.8
1300 to 1399	0.2	0.0	0.0	1.4	2.2
> 1400	0.1	0.0	0.0	0.9	1.1

Table 65. Frequency distribution of yield grades by animal type (%)

	All animals (n = 1801)	Beef cows (n = 1057)	Dairy cows (n = 538)	Beef bulls (n = 168)	Dairy bulls (n = 15)
Yield grade					
1	29.3	28.3	17.8	70.3	50.0
2	41.1	42.8	43.4	24.1	41.7
3	21.5	20.3	28.9	4.1	8.3
4	6.4	6.6	8.0	1.4	0.0
5	1.7	1.9	1.8	0.0	0.0

Carcass muscle scores (Table 66)for beef and dairy cows showed about the same percentage of cattle with scores of 2 and below, and greater than 2, as the live animal muscle scores. On the other hand, the upward shift seen with the live animals since 1999 from 1's to 2's was not seen at the carcass level.

Table 66. Frequency distribution of muscle scores for animal type (%)

	All animals (n = 3037)	Beef cows (n = 1315)	Dairy cows (n = 1320)	Beef bulls (n = 245)	Dairy bulls (n = 95)
Muscle score [a]					
1	38.5	32.0	53.0	4.9	11.7
2	32.0	31.5	36.8	13.1	27.7
3	18.8	25.3	9.4	30.7	28.7
4	6.8	8.3	0.8	23.4	19.2
5	3.9	2.9	0.0	27.9	12.8

[a] Muscle scores were based on a 1 (extremely light muscle carcasses) to 5 (extremely heavy muscled carcass).

Fat color scores, on Table 67, show that beef cows were more frequently found with scores of 4 (indicating extreme yellow-orange coloration) and higher, than dairy cows. Dairy cows, inversely, had more than twice the number of carcasses with fat color scores of 1 (white). The younger lean color, combined with the whiter fat, has allowed the beef industry to market larger portions of dairy meat products as part of a "white fat" or "white cow" program. This allows for premiums to be paid for these products as they are more appealing to the consumer and are more likely to be sold as a cheaper steak product rather than a further processed product.

Table 67. Frequency distribution of fat color scores by animal type (%)

	All animals (n = 3037)	Beef cows (n = 1315)	Dairy cows (n = 1320)	Beef bulls (n = 245)	Dairy bulls (n = 95)
Fat color score [a]					
1	27.3	15.9	34.8	33.9	11.7
2	27.6	24.1	28.0	38.8	27.7
3	17.4	21.3	15.0	16.3	28.7
4	12.0	16.6	9.2	8.2	19.2
5	9.4	12.7	8.3	1.6	12.8
6	6.3	9.4	4.7	1.2	0.0

[a] Fat color scores were based on a 1 (white) to 6 (yellow-orange) range.

Calculated ribeye area/cwt ratios are found on Table 68. This ratio is an alternate method of determining overall carcass muscling for cattle. Dairy cattle had higher percentages of lower ribeye/cwt ratios than beef cows, which is to be expected due to inherent anatomical differences between the two breeds. Higher percentages of beef cows were found at a ratio of 1.5:1 and above when compared to dairy cows.

Table 68. Frequency distribution of ribeye area/cwt ratio for cattle surveyed (%)

	All animals (n = 1801)	Beef cows (n = 1057)	Dairy cows (n = 538)	Beef bulls (n = 168)	Dairy bulls (n = 15)
Ratio ranges					
0.50 to 0.99	4.6	5.2	4.2	2.8	7.1
1.00 to 1.49	47.2	41.3	63.5	25.5	42.9
1.50 to 1.99	38.6	41.4	29.7	51.7	35.7
2.00 to 2.49	7.9	9.6	2.3	17.2	7.1
2.50 to 2.99	1.3	1.8	0.2	2.8	0.0
3.00 and higher	0.5	0.7	0.2	0.0	7.1

Table 69 shows defects that can result from poor handling practices prior to slaughter. Dark cutters were more often found among dairy cows than beef cows; conversely, there was a higher incidence of blood splash for beef cows than dairy cows. Dark cutting beef is a result of long term stress which older animals are more susceptible to than younger animals. Although dairy loads traveled less time and distances, lower muscling scores and traveling through adverse weather conditions in the northern dairy regions may be accredited as possible reasons for this higher percentage.

Table 69. Frequency distribution of dark cutters, bloodsplash, and calloused ribeyes by animal type (%)

	All animals (n = 1801)	Beef cows (n = 1057)	Dairy cows (n = 538)	Beef bulls (n = 168)	Dairy bulls (n = 15)
Quality concern					
Dark cutter [a]	2.1	1.7	2.7	2.6	2.2
Bloodsplash	1.6	2.5	0.9	0.0	0.0
Calloused ribeye	0.1	0.1	0.1	0.0	0.0

[a] Dark cutter was assigned as either present or not present and treated as full dark cutter for quality grading purposes.

The percentage of plants that sorted cow carcasses by relative merit (47.8 %) was reported in Table 70. Frequency distributions of packer grades that were used by university personnel as general nomenclature for the different cow grades are also found here. Most beef cow carcasses fell below the cutter/canner packer grades, while the majority of dairy cows were considered boning utility and better. The majority of plants that were audited revealed that carcasses were typically sorted by visible lean and fat on carcasses, rather than maturity and marbling like typical fed plants. This method of sorting allows packers to predict the percent of lean that will be derived from cattle going into fabrication.

Less than half of the plants sorted bull carcasses by relative merit were approximately 47.8 % (Table 71). Packer grades for bulls include lean bulls (commonly referred to as bologna bulls), regular bulls, and fat bulls. Higher percentages of dairy and beef bulls fell into the lean or regular bull category while a small percentage were considered fat bulls. Table 72 displays the different plant grades that each plant used as methods for carcass classification.

Table 70. Frequency distribution of cow packer grade for plants that sorted/classified carcasses (%)

	All cows (n = 1177)	Beef (n = 754)	Dairy (n = 423)
Packer grade prevalence			
Plants that sorted	47.8		
Plants that did not sort	52.2		
Packer Grade[a]			
Cutter/canner	50.0	52.8	45.1
Boning utility	42.1	38.8	48.2
Breaking utility	5.7	7.4	2.6
White/fat cow	1.8	1.1	3.1
Standard	0.0	0.0	0.0
Select	0.3	0.0	1.0
Choice	0.0	0.0	0.0
Prime	0.0	0.0	0.0

[a] Packer grades were assigned by university personnel based on descriptions provided by each packer.

Table 71. Frequency distribution of bull packer grades for plants that sorted/classified carcasses (%)

	All bulls (n = 205)	Beef (n = 145)	Dairy (n = 60)
Packer grade prevalence			
Plants that sorted	47.8		
Plants that did not sort	52.2		
Packer Grade[a]			
Lean bull	37.6	33.6	39.3
Bull	58.5	61.1	51.8
Fat bull	6.3	5.4	8.9

[a] Packer grades were assigned by university personnel based on descriptions provided by each packer.

Table 72. Packer grades[a] vs. plant[b] grades for cows and bulls

Packer Grades[a]	Plant Grades[b] Assigned to Carcasses of a Given Packer Grade
Canner/Canner Cow	0, 1, 2, 3, 8, 50, 51, 4A, 4B, 4C, 5A, 5B, 5C, GD1, Red, L
Boner Cow	2, 3, 4, 54, 10A, 10B, 10C, 11A, 11B, 11C, GD2, F, Pink, Green
Breaker Cow	3, 4, 5, 6, 53, 13A, 13B, 14A, 14B, GD3, GD4, F, Yellow
White Cow	4, 5, GD5, W, Blue
Standard Cow	5
Select Cow	52
Bull	1, 2, 5, 74, 2A, 2B, 2X, Brown
Lean Bull	0, 4, 7, 51, 75, 1A, 1B, 1C, 1X, Blue, Orange
Fat Bull	3, 4, 5, 8, 53, 73, 3B, 3X, 4X

[a] Based on industry and market terminology.
[b] Assigned by packing-plant representative.

Product Fabrication

Table 73 shows the percentage of plants that produced each subprimal that was listed as a typical cut for current cow and bull packing facilities. Most plants that reported whole muscle cuts were fabricating subprimals from the rib, round and loin primal regions. According to Table 74, the average percent produced, during one full production day, of whole muscle cuts was 27.98 percent. Tables 75 and 76 show the breakdown of average production percentages for each cut across all plants that reported this information. Prevalent topics of discussion concerning the state of market cow and bull fabrication tend to imply that most packers are producing more whole muscle cuts than in the past. According to data found on Table 77, average percent production of trim and SPB (Small Pieces of Beef) consist of approximately 59 percent of the average plants production, indicating a possible shift in production. However, the majority of whole muscle cuts that are fabricated have a high likelihood of ultimately being sold for future ground and/or sliced products, which explains the large percent of 100% lean subprimals derived from cow and bull rounds.

Table 73. Percentage of plants that produce listed whole muscle cuts (%)

	Plants (n = 14)
Items produced	
Rib, ribeye roll	100.0
Loin, tenderloin	100.0
Round, knuckle 100% lean	85.7
Round, knuckle, peeled	85.7
Flank, flank steak and other flank cuts	85.7
Round, top inside	78.6
Round, top inside 100% lean	71.4
Loin, strip, bnls	71.4
Loin, top sirloin butt	71.4
Loin, strip, bnls 100% lean	64.3
Chuck, chuck tender	57.1
Round, eye of round 100% lean	57.1
Round, outside round 100% lean	50.0
Round, flats and eyes 100% lean	50.0
Round, eye of round	42.9
Chuck, chuck roll	28.6
Loin, bottom sirloin butt, flap	28.6
Round, flats and eyes	21.4
Brisket	21.4
Round, outside round	21.4
Brisket 100% lean	14.3
Rib, ribeye roll 100% lean	14.3
Loin, top sirloin butt 100 % lean	14.3
Loin, semi-bnls shortloin	14.3
Chuck, shoulder clod	14.3
Loin, bottom sirloin butt, tri-tip	14.3
Loin, bottom sirloin butt, ball-tip	7.1
Round, knuckle	7.1

- Percentages are representative of plants that fabricate these subprimal cuts

Table 74. Average percentage of total plant production for whole muscle cuts from plants that submitted fabrication information (%)

	Total
Forequarter cuts	10.81
Hindquarter cuts	28.35
Total subprimals	27.98

- Percentages were of each plant's total fabrication during one full production day and then averaged across all plants.

Table 75. Average percentage of subprimal cuts derived from forequarters of cow and bull carcasses from plants that submitted fabrication information (%)

	Total
Subprimal type	
Chuck tender	2.36
Chuck roll	2.60
Clod	0.54
Brisket	0.48
Ribeye	5.02
Plate	0.45
Short ribs	0.15
Back ribs	0.01
100% lean subprimals	
Brisket	0.07
Ribeye	0.05

- Percentages were of each plant's total fabrication during one full production day and then averaged across all plants.

Table 76. Average percentage of subprimal cuts derived from hindquarters of cow and bull carcasses from plants that submitted fabrication information (%)

	Total
Subprimal type	
Strip loin	2.42
Tenderloin	3.42
Short loin	0.21
Top sirloin	2.28
Bottom sirloin flap	0.13
Tri-tip	0.04
Ball-tip	0.03
Flank	1.12
Inside round	4.19
Outside round	0.78
Knuckle	0.15
Eye of round	1.00
Flat and Eye of round	0.55
Other	0.45
100 % lean subprimals	
Strip loin	0.92
Top sirloin	0.86
Inside round	2.33
Outside round	1.52
Knuckle	4.41
Eye of round	1.08
Flat and Eye of round	2.03

- Percentages were of each plant's total fabrication during one full production day and then averaged across all plants.

Table 77. Average percentage of other products derived from cow and bull carcasses from plants that submitted fabrication information (%)

	Total
Product type	
Shank cuts	0.89
SPB	1.47
Other 100% lean cuts	0.32
Trim	57.95

- Percentages were of each plant's total fabrication during one full production day and then averaged across all plants.

Animal Traceability

Table 78 shows the percentage of animals that were able to be traced back from the packer to the furthest extent in the trail of ownership. The majority of beef (70.8 %) and dairy (55.6 %) animals were able to be traced back to the point of origin prior to arriving at the slaughter facility. However, a large percentage of all animal's traceability ended at an auction barn or a cattle dealer/trader. Auction barns, for the most part, were cooperative in aiding this process, although some were uncooperative and stated certain privacy laws prohibiting them from divulging such information. People that are involved in cattle trading represented the endpoint of trace back for 12.7 percent of all cattle. Through conversation with auction barn personnel, and others involved with the trace back process, cattle dealers were noted for typically disregarding any identification information for animals that they bought and sold, resulting in a break in the ownership traceability trail. The percent of cattle that weren't able to be traced back any further than the packing plant are a result of lack of identification prior to arrival at the plant, or not identifying carcasses in the cooler.

Table 78. Frequency distribution for extent of traceback found for all animals traced (%)

	Total (n = 308)	Beef (n = 161)	Dairy (n = 142)
Extent of traceback[a]			
Original Owner	63.5	70.8	55.6
Auction barn	19.2	16.2	21.8
Cattle dealer/trader	12.7	10.6	15.5
Packing plant	4.9	2.5	7.0

[a] Extent of traceback is defined as the furthest point of origin until the original owner is located

CHAPTER IV

END-USER AUDITS

Materials and Methods

The purpose of this phase of the audit was to identify the prevalence of producer related defects, specifically injection site lesions, found at the further processing plant level. Each audit included surveying top sirloin butts and bottom round flats for producer-related defects as well as conducting open and aided questionnaires that were similar to those described during the packing-plant auditing phase. A total of eight audits (Table 2) were conducted among five plants that either cut or ground cow and bull beef loin, top sirloin butts (IMPS #184), and beef round, outside rounds (flats) (IMPS #171B) (NAMP, 2003). These cuts were selected because they previously had been identified as a common site for injections of animal health products. The top sirloin butt was evaluated for defects by first segregating this subprimal into the beef loin, top sirloin, cap (IMPS #184D) and the beef loin, top sirloin butt, center-cut, boneless, cap off (IMPS #184B). End-user audit plants included three steak cutting operations that were purveyors of cow and bull top sirloin butts, as well as two packing plants that ground cow and bull top sirloin butts and bottom round flats themselves or sold them to a grinding operation. Packing plant and further processing plant subprimals were classified as either beef, dairy, or unknown based on the predominant type of cattle that were typically harvested at that location or at the plants that sold those subprimals to the further processor.

Processing Plant End-User Audits

All center cut sirloins and sirloin caps processed during one full production day were evaluated for prevalence and severity of producer-related quality defects. Injection site lesions were identified as active (fluid filled), woody callus, and fibrous scars. Active lesions are fluid filled blemishes that are pale in color. These fluid filled lesions are variable in size as these can be seen as large abscesses or small pale blemishes as stated earlier. As stated by Dexter et al. (1994), woody calluses and fibrous scars are older injection site blemishes that are replaced by connective tissue and fat. Other defects that were investigated included needles, bruises, buck shot, dark cutters, and blood splash.

Each subprimal exhibiting any of the defects mentioned above were classified as minor, severe or condemned, with the exception of dark cutting beef and fibrous scars. Minor was defined as any defect that would cause less than 50% of the subprimal to be trimmed. Severe was defined as any defect causing at least 50% of the subprimal to be trimmed without being condemned. Condemned was defined as any defect severe enough to cause condemnation for the entire subprimal.

Packing Plant End-User Audits

Most beef jerky operations procure cow and bull beef round subprimals as the primary raw meat ingredient for their product. An initial visit was made to a local beef jerky plant, however, due to certain manufacturing procedures; most defects found internally in subprimals would not be able to be identified in this type of manufacturing system. Packing plants were an optimal source for finding defects within the *M. biceps femoris*, the primary muscle found in the beef outside round, without any interference from production practices. During the packing plant end-user audits, auditors would cut into 20 percent of all beef outside rounds and beef top sirloin butts fabricated during one full production day. In addition to external defect evaluation, subprimals were cut anterior to posterior, creating approximately 2 inch incisions throughout the entire muscle, to evaluate internal defects by simulating the process of cutting steaks.

Results and Discussion

Open and Aided Interviews

Top five reported concerns for persons surveyed during the interview portion of the end-user audits are product uniformity, product quality, buck shot, cattle availability, and injection sites (Table 79). Table 80 lists the top five directives to solve the current quality challenges faced by end-users of cow and bull products. The top five reported improvements include injection site frequency, improvement in overall quality, abscess frequency, and animal nutrition (Table 81). Injection sites were cited as an improvement and a decline, meaning that, while progress has been made, there is still room for improvement. Apparently, buck shot is still being found in subprimals from cow and bull carcasses, so efforts must be continued to eliminate this problem. According to Table 82, the most improved quality concerns during the aided questionnaires were needles, abscesses, injection site lesions, buck shot, and bruising. An improvement for bruising and injection site lesion frequency is also supported by the results from the 2007 packing plant audits.

Table 79. Top five quality challenges facing the market cow and bull beef industry since 1999 according to end-users

Rank	Quality challenges
1	Product uniformity
2	Product quality
3	Buckshot
4	Cattle availability
5	Injection sites

Table 80. Top five directives to solve problems facing the market cow and bull beef industry since 1999 according to end-users

Rank	Directives
1	Producer handling education
2	Producer injection site/buckshot evaluation
3	Better employee training
4	Proper nutrition
5	Advertisement

Table 81. Top five improvements made in the market cow and bull beef industry since 1999 according to end-users

Rank	Improvements
1	Frequency of injection sites
2	Improvement in overall quality
3	Frequency of abscesses
4	Animal handling
5	Animal nutritution

Table 82. Means of aided questionnaire results[a] for end-user product quality concerns

End-user quality concerns	Score
Needles	3.33
Abscesses	2.50
Injection site lesions	2.33
Buck shot	2.17
Bruising	2.00
Insufficient marbling	0.20
Muscle firmness	0.17
Uniformity	0.17
Yellow fat	0.00
Dark colored meat	-0.17
Light colored meat	-0.33

[a] Results were based on an 11-point scale of -5 (greatly declined) to 5 (greatly improved) with “0” representing no change since 1999.

Product Defect Evaluation

Table 83 displays frequencies of each defect type that was found in top sirloin caps and center-cut top sirloin butts. Overall, higher frequencies of defects were found in the caps rather than the center-cut sirloins. For caps, dairy subprimals were slightly higher in fresh, or active, lesions as well as older, or woody callus, lesions than beef. Fibrous scar rates were higher for beef than dairy. These scars, which are most likely a result of an injection, can be misconstrued with calloused tissue most likely resulting from muscle trauma experienced in isolated regions on the animal. Beef cows were more frequently found to have less than one-tenth of an inch of adjusted fat depth according to Table 61, which would allow for a higher risk of such damage to occur as there is less cover to protect this animal from prolonged exposure to aggressive handling as found in Table 16. Center-cut sirloins that were surveyed during the end-user audits had more frequent active lesions and woody calluses than beef subprimals. Dark cutters, while rare overall, were higher for dairy caps and center-cuts than beef.

Table 83. Frequency distribution of beef, dairy, and overall top sirloin defects (%)

	Overall sirloin cap defects (n = 2555)	Beef sirloin cap defects (n = 884)	Dairy sirloin cap defects (n = 1671)	Overall center-cut sirloin defects (n = 2563)	Beef center-cut sirloin defects (n = 892)	Dairy center-cut sirloin defects (n = 1671)
Defect Prevalence						
No defect present	90.06	90.16	90.01	95.75	94.96	96.17
Defect present	9.94	9.84	9.99	4.25	5.04	3.83
Injection site lesion defects						
Active lesions[a]	4.11	4.07	4.13	1.56	0.59	0.98
Woody callus[b]	2.70	2.26	2.93	0.78	0.12	0.66
Fibrous scar[c]	1.53	2.38	1.08	0.51	0.39	0.12
Bruise	1.02	0.57	1.26	0.90	0.43	0.47
Other defects						
Dark cutter	0.70	0.68	0.72	0.51	0.23	0.27
Blood splash	0.04	0.00	0.06	0.00	0.00	0.00

[a] Active lesion is defined as a clear scar containing fluid.
[b] Woody callus is defined as scar filled with connective tissue and/or fat.
[c] Fibrous scar is defined as any scar with connective tissue dispersed throughout the muscle to create a "marbling effect".

Table 84 displays frequency distributions for bottom round flat defects. Higher numbers of injection site caused lesions were found in dairy subprimals than beef with older blemishes, or woody calluses, being the highest overall at 24.06 percent. According to Roeber et al., (2002), in 2000, 57.5 percent of dairy type bottom rounds and 28.7 percent of beef bottom rounds had injection site lesions. Approximately 54 percent of dairy bottom rounds were found to have an injection site lesion of some sort, while about 14 percent of beef bottom rounds contained lesions during the 2007 audits. This creates a cause for concern, as most bottom rounds are used for further processed products, limiting the chance for these defects to be found prior to consumption. Severity score frequencies for surveyed subprimals show dairy sirloin caps, center-cut sirloins, and bottom round flats as having a higher percentage of severe defects and condemned subprimals than beef (Tables 85 through 87).

Table 84. Frequency distribution of bottom round flat defects (%)

	Overall (n = 1495)	Beef (n = 884)	Dairy (n = 611)
Defect prevalence			
No defect present	66.95	84.95	40.92
Defect present	33.05	15.05	59.08
Injection site lesion defects			
Woody callus[b]	15.52	9.62	24.06
Active lesions[a]	10.37	2.04	22.42
Fibrous scar[c]	3.61	2.26	5.56
Bruise	0.80	0.00	1.96
Other defects			
Dark cutter	2.74	1.13	5.07

[a] Active lesion is defined as a clear scar containing fluid.
[b] Woody callus is defined as scar filled with connective tissue and/or fat.
[c] Fibrous scar is defined as any scar with connective tissue dispersed throughout the muscle to create a "marbling effect".

Table 85. Frequency distribution of injection site lesion severity for defects found in sirloin caps (%)

	Overall (n = 2556)	Beef (n = 884)	Dairy (n = 1672)
Defect prevalence			
No defect present	90.06	90.16	90.01
Defect present	9.94	9.84	9.99
Lesion severity[a]			
Minor	7.59	6.79	8.02
Severe	0.12	0.11	0.12
Condemned	0.12	0.00	0.18

[a] Lesion severity does not include fibrous scars, dark cutters, and blood splash since these defects are unable to be trimmed.

Table 86. Frequency distribution of injection site lesion severity for defects found in center-cut sirloins (%)

	Overall (n = 2563)	Beef (n = 892)	Dairy (n = 1671)
Defect prevalence			
No defect present	95.75	94.96	96.17
Defect present	4.25	5.04	3.83
Lesion severity[a]			
Minor	3.20	3.25	3.18
Severe	0.04	0.00	0.06
Condemned	0.00	0.00	0.00

[a] Lesion severity does not include fibrous scars, dark cutters, and blood splash since these defects are unable to be trimmed.

Table 87. Frequency distribution of injection site lesion severity for defects found in bottom round flats (%)

	Overall (n = 1495)	Beef (n = 884)	Dairy (n = 661)
Defect prevalence			
No defect present	66.95	84.95	40.92
Defect present	33.05	15.05	59.08
Lesion severity[a]			
Minor	25.29	11.66	45.01
Severe	1.28	0.00	3.10
Condemned	0.13	0.00	0.33

[a] Lesion severity does not include fibrous scars, dark cutters, and blood splash since these defects are unable to be trimmed.

While all defects were segregated into 3 severity types based on projected trim losses, none of the five evaluated plants would actually trim these defects when found in the beef top sirloin butt. Of the plants surveyed, one had a protocol in place to remove injection site blemishes for beef outside rounds, but even these were only identified at the external surface for each cut. Primarily, these blemishes are overlooked at the packing plant level as most are found interior to the muscle leaving retail/processing operations to suffer the loss and the possibilities exists that these injection site defects could be passed on to the consumer. The remaining plants would typically characterize defects such as woody calluses, and fibrous scaring as marbling.

Trimming injection site blemishes did not always insure that the affected tissues would not find its way into a further processed meat product, as most trim losses from the actual steaks were combined with regular beef trim. The only time that injection site blemishes would be removed was when that blemish was severe enough to consider it an abscess. At this point, the abscessed area was removed and any retrievable product would typically be used as beef trim. As public perception plays a vital role in cow and bull beef production, prevalence of these defects and how they are handled once discovered are both concerns that should be addressed by not only packers, but processors as well.

CHAPTER V

CONCLUSIONS

Since the last time the National Market Cow and Bull Beef Quality Audit was conducted, certain events have shaped the way cull cows and bulls are marketed, purchased, and processed. For example, finding the first BSE stricken animal in the U.S. has a drastically reduced the number of downed animals arriving at packing plants. Another example is the changes within FSIS policy that have altered the way cactus tongue and hair sores are handled. Lastly, the number of recent pathogen-related product recalls has already had an affect within the quality control sector of the cow and bull beef industry.

Even though measures have been taken to adapt production standards to meet the needs of the growing presence of health-conscious consumers, certain areas must be addressed. While no carcasses containing buckshot or birdshot were found during this audit, surveys conducted in this project, reveal the problem still exists. A scenario such as this must be handled in a different fashion than other quality defects such as bruising or lameness. While both represent devaluation to the packer, buckshot causes severe losses because of the extensive trimming that must occur, all the while creating a poor image for the beef-eating consumer. This is not only poor management tactics by the producer, but reflects poorly on the humane handling and animal welfare efforts to ensure the safety of these animals and maintain sound public relations with consumers.

Injection site lesions are also an issue that continues to plague the producer/packer relationship. Several attempts have been made to educate producers on proper injection procedures; however a strong percentage of dairy and beef producers still choose to not abide by these guidelines. Improvements have been seen, but like the buckshot/birdshot scenario, efforts must be continued to ensure safe and unadulterated products. Education must persist to inform producers to realize the opportunities for maximizing profit in cull cows and bulls.

Along with injection site blemishes is the topic of antibiotic residues. Producer education for proper withdrawal times is vital to ensure the elimination of these products from edible tissues. Cull dairy and beef animals are less likely to be under close surveillance to meet the designated withdrawal times as most producers wouldn't view this as an important issue since their primary function is to producer milk and offspring, rather than meat.

The 2007 National Market Cow and Bull Beef Quality Audit supplied producers and packer answers to several questions that were established during the previous audits in 1994 and 1999. Producers have excelled at reducing several identified quality concerns from the past such as reducing the number of cattle with horns, reducing the amount on mud/manure on hides, and increasing the number of native hided cattle. Improvements are still needed in areas such as frequency of injection sites on live animals and carcasses, bruising, and also cattle conditioning. Efforts must be continued to not only maintain the reduced incidence of these problems, but strive for further reduction and possible eradication of particular quality challenges. As consumer perception plays a vital role in the beef industry, producers must take a proactive stance to ensure that sound handling and management practices are adhered to so that they not only maximize profit for themselves, but everyone else within the cull cow and bull industry.

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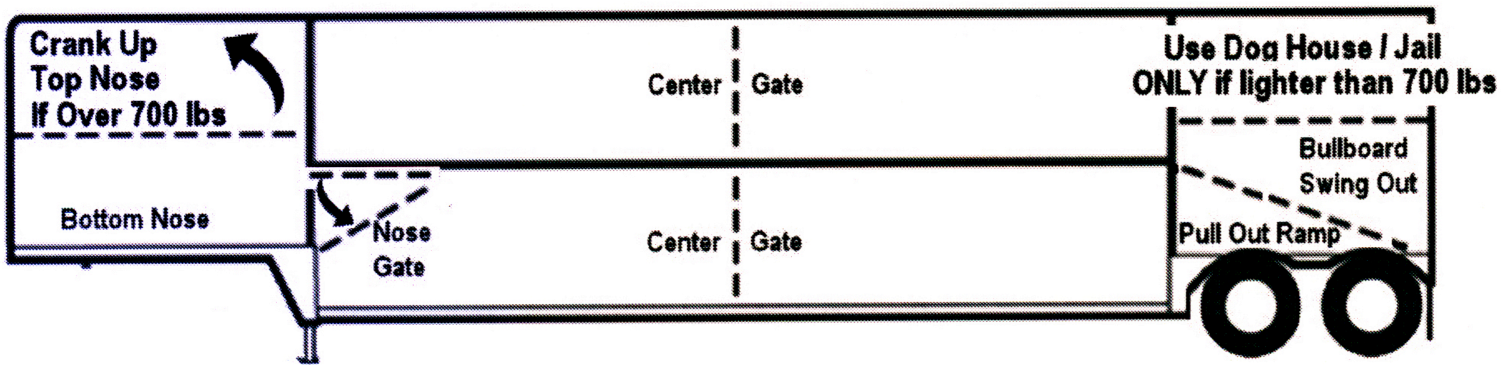
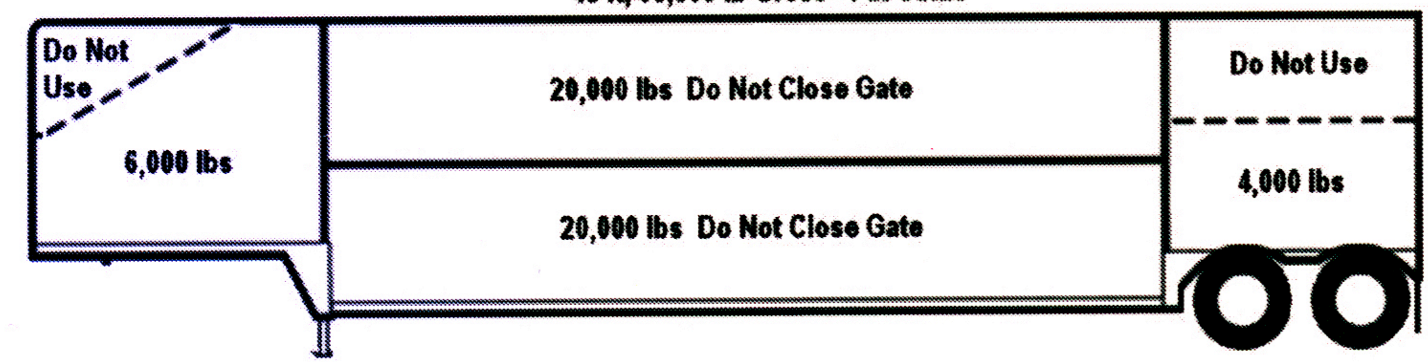
APPENDIX

Proper Loading Diagrams

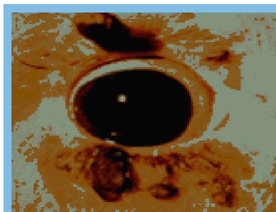


48 ft, 50,000 lb Gross - Fat Cattle

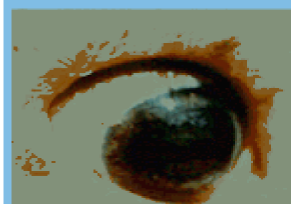


- Source: adopted from Master Cattle Transporter Guide from NCBA, Centennial, CO.

Cancer Eye Scores

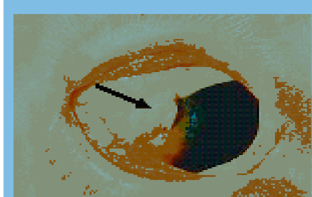


Grade 1
Small benign tumor producing finger like growth
Precancerous



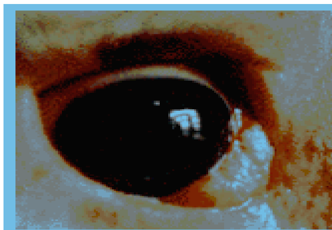
Grade 2
Small white elevated plaque on the eyeball
Precancerous

Grade 2
Small white elevated plaque on the eyeball
Precancerous

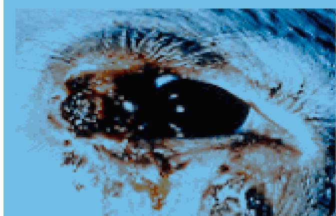


Grade 2
Papilloma on the eyeball
Precancerous

Cancer Eye Scores Continued

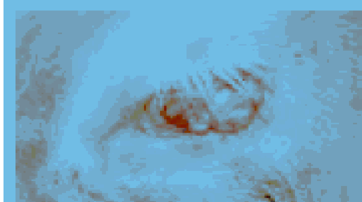


Grade 3
Growth on the third eyelid or a tumor that is vascular in nature
Cancerous

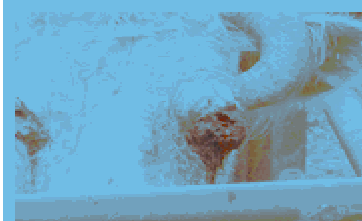


Cancerous

Grade 4
Tumors that have metastasized to the bony structure around the eye or exhibit lymphatic involvement of the parotid gland



Grade 4
Tumors that have metastasized to the bony structure around the eye or exhibit lymphatic involvement of the parotid gland
Cancerous



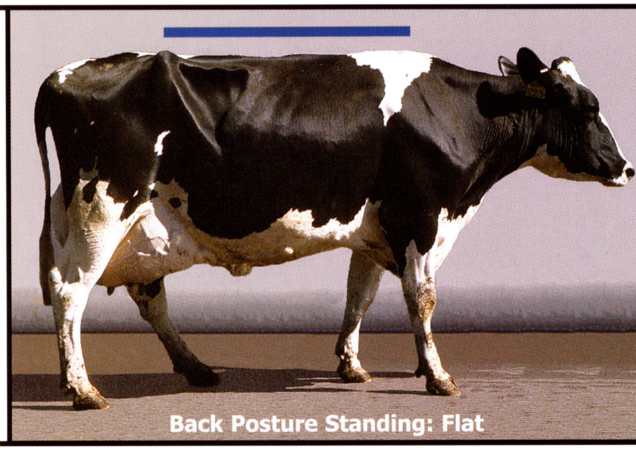
Grade 5
Cattle in which the eyeball has prolapsed from the orbit and/or exhibits a necrotic condition
Cancerous

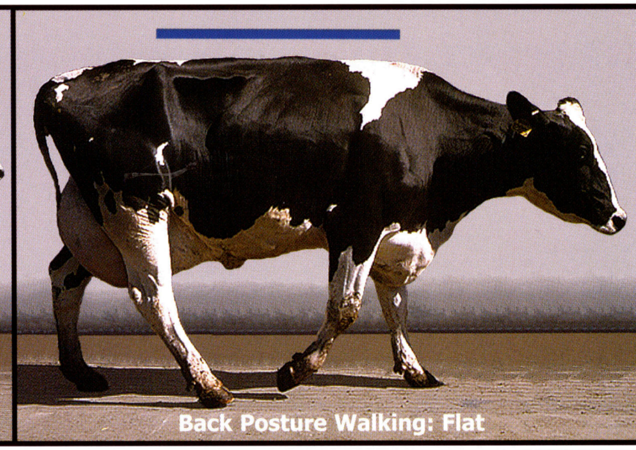
Lameness/Locomotion Scoring

Locomotion Score 1

Clinical Description:
Normal

Description:
Stands and walks normally. All feet placed with purpose.

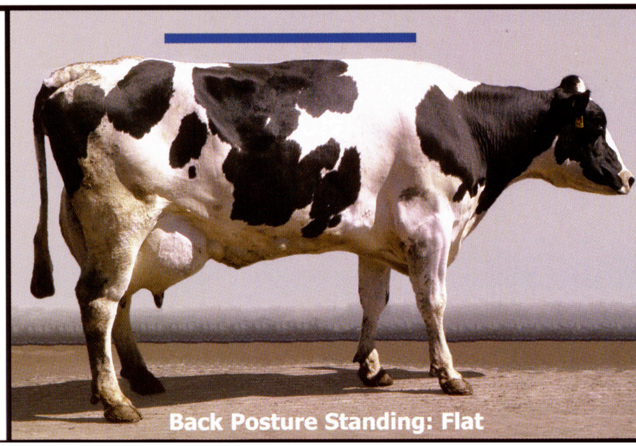


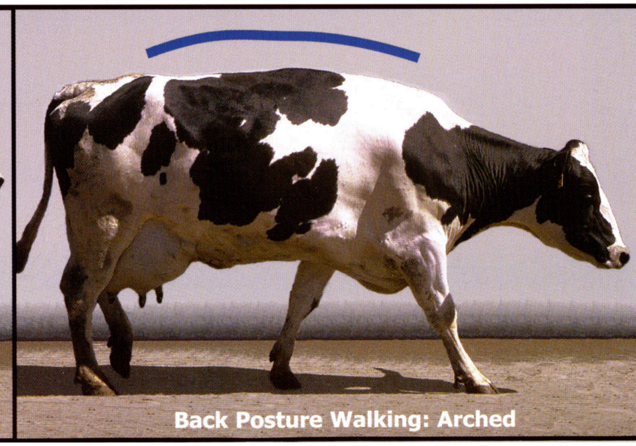


Locomotion Score 2

Clinical Description:
Mildly Lame

Description:
Stands with flat back, but arches when walks. Gait is slightly abnormal.





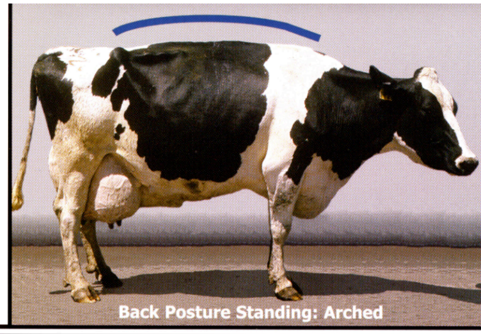
- Source: adopted from the Locomotion Scoring of Dairy Cattle by Zinpro Corporation, Eden Prairie, MN.

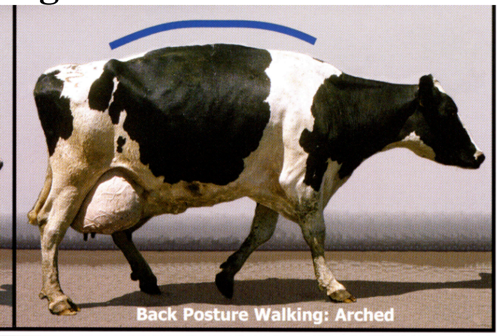
Lameness/Locomotion Scoring Continued

Locomotion Score 3

Clinical Description:
Moderately Lame

Description:
Stands and walks with an arched back. Short strides with one or more legs.

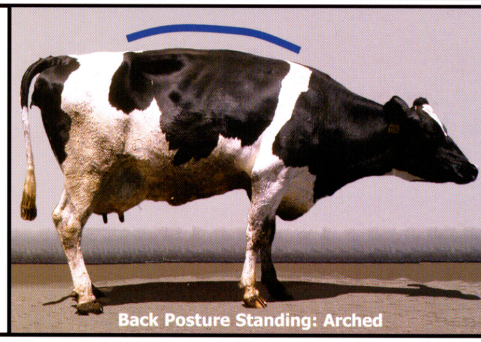


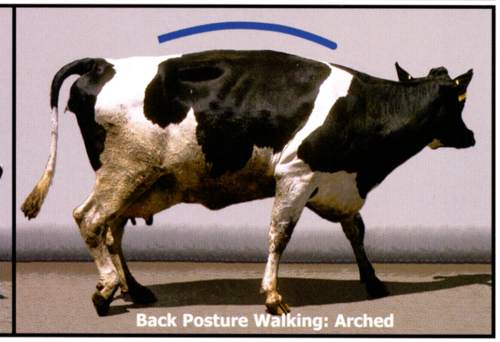


Locomotion Score 4

Clinical Description:
Lame

Description:
Arched back standing and walking. One or more limbs favored but at least partially weight bearing.

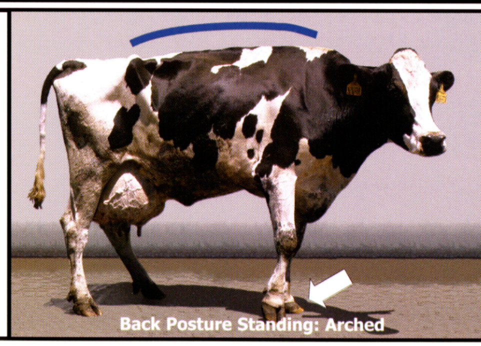


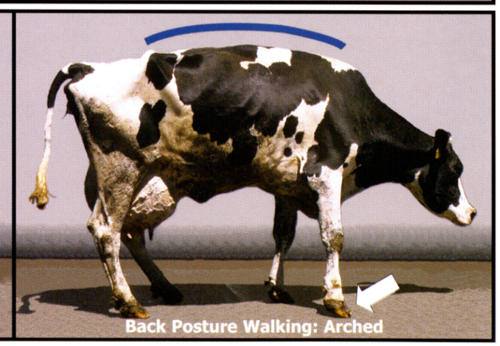


Locomotion Score 5

Clinical Description:
Severely Lame

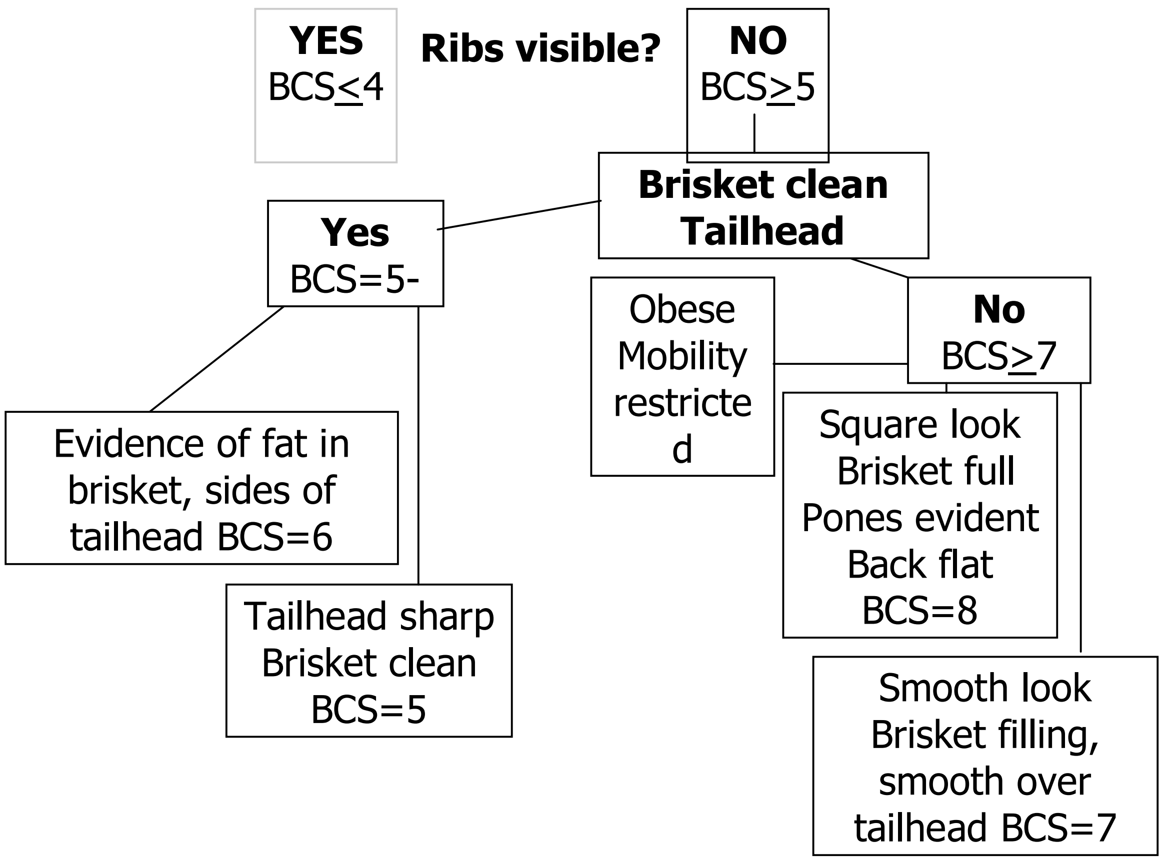
Description:
Arched back, refuses to bear weight on one limb. May refuse or have great difficulty moving from lying position.



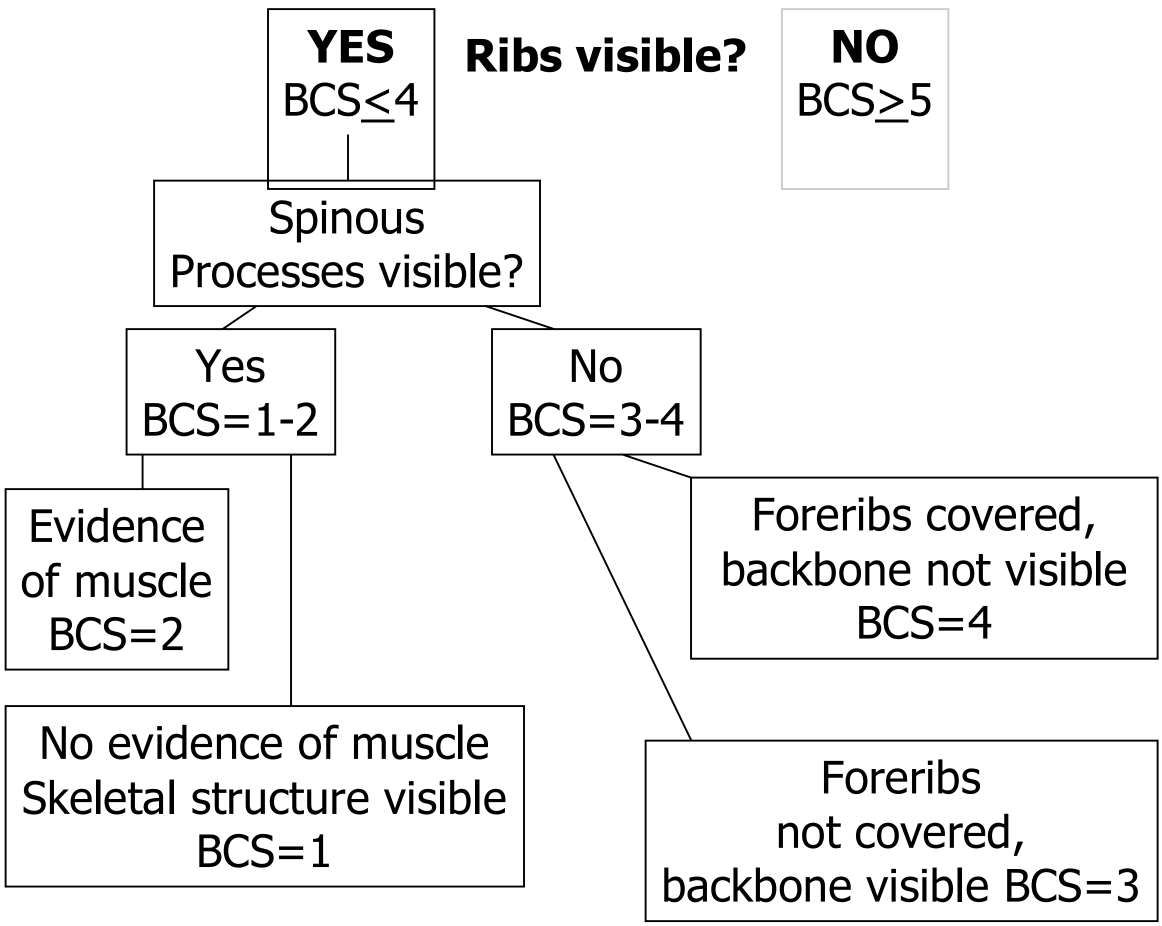


- Source: adopted from the Locomotion Scoring of Dairy Cattle by Zinpro Corporation, Eden Prairie, MN.

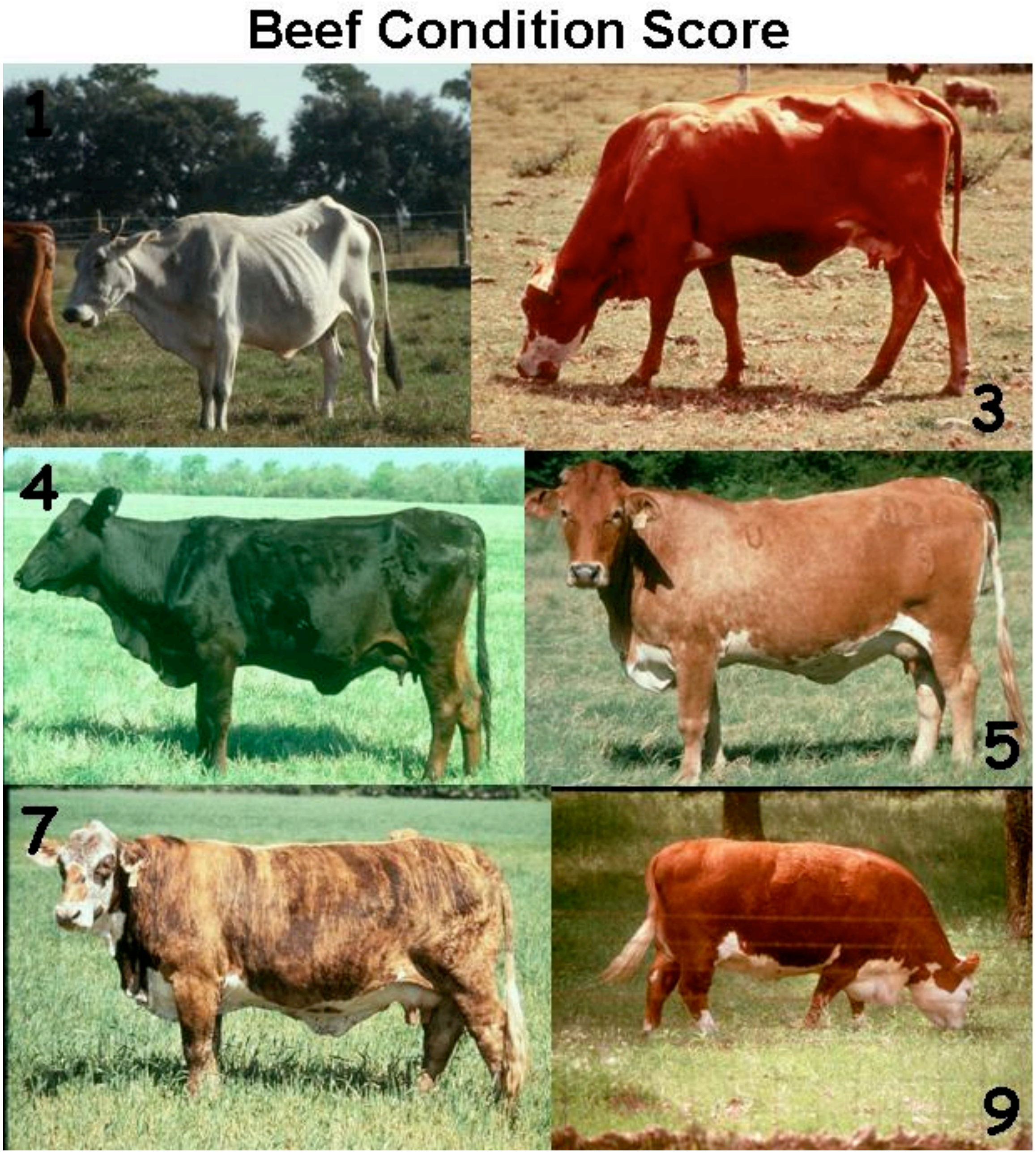
Beef Body Condition Scoring



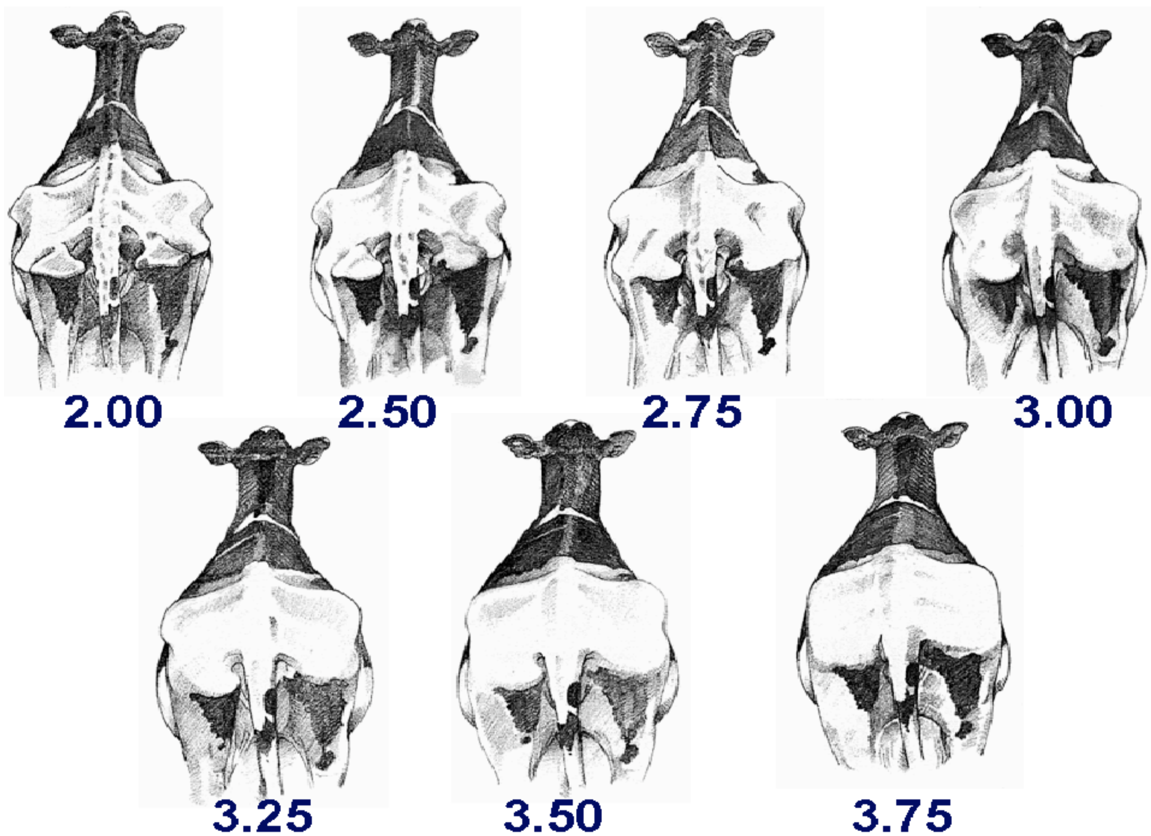
Beef Body Condition Scoring Continued



Beef Condition Scoring Continued

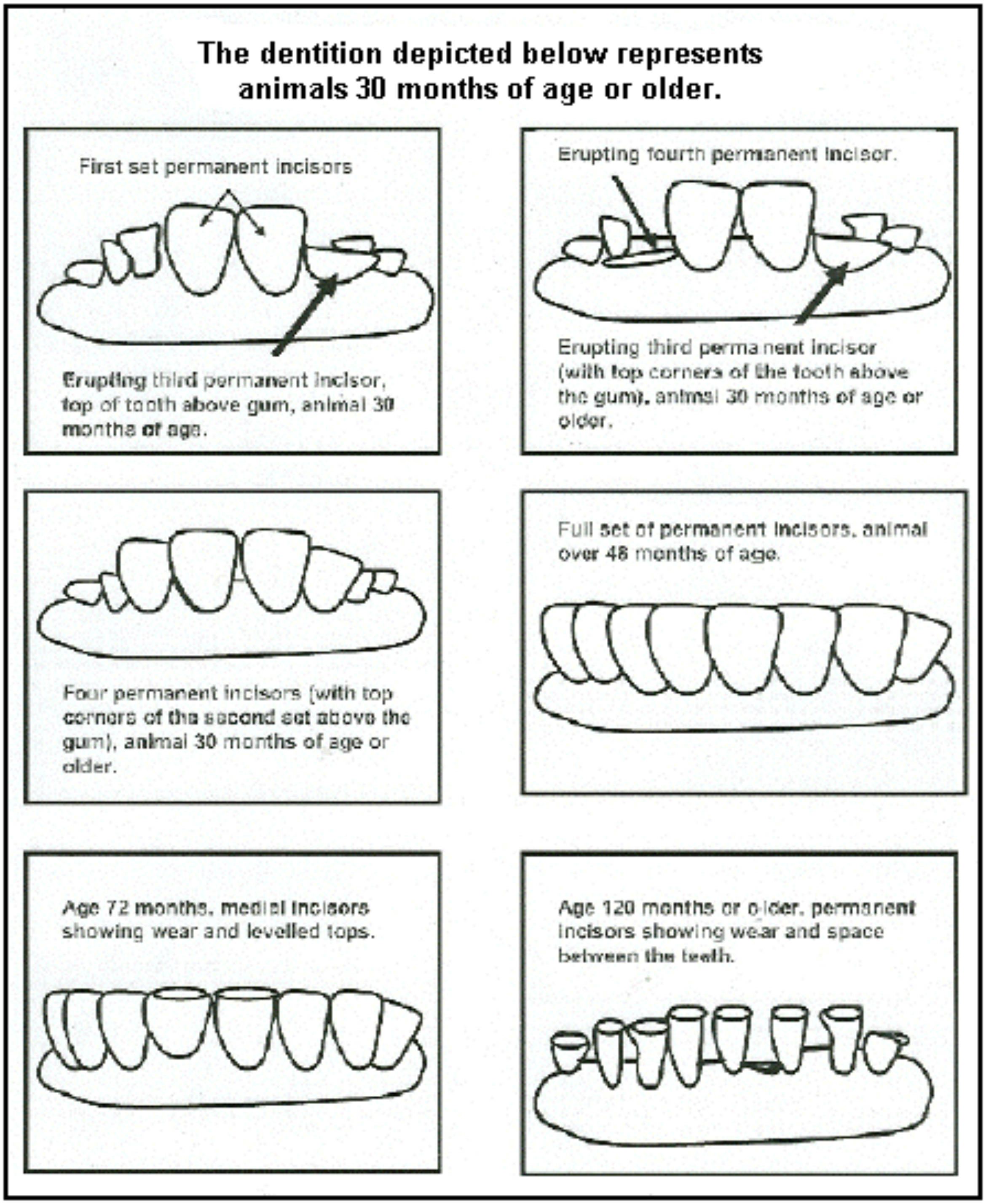


Dairy Body Condition Scoring



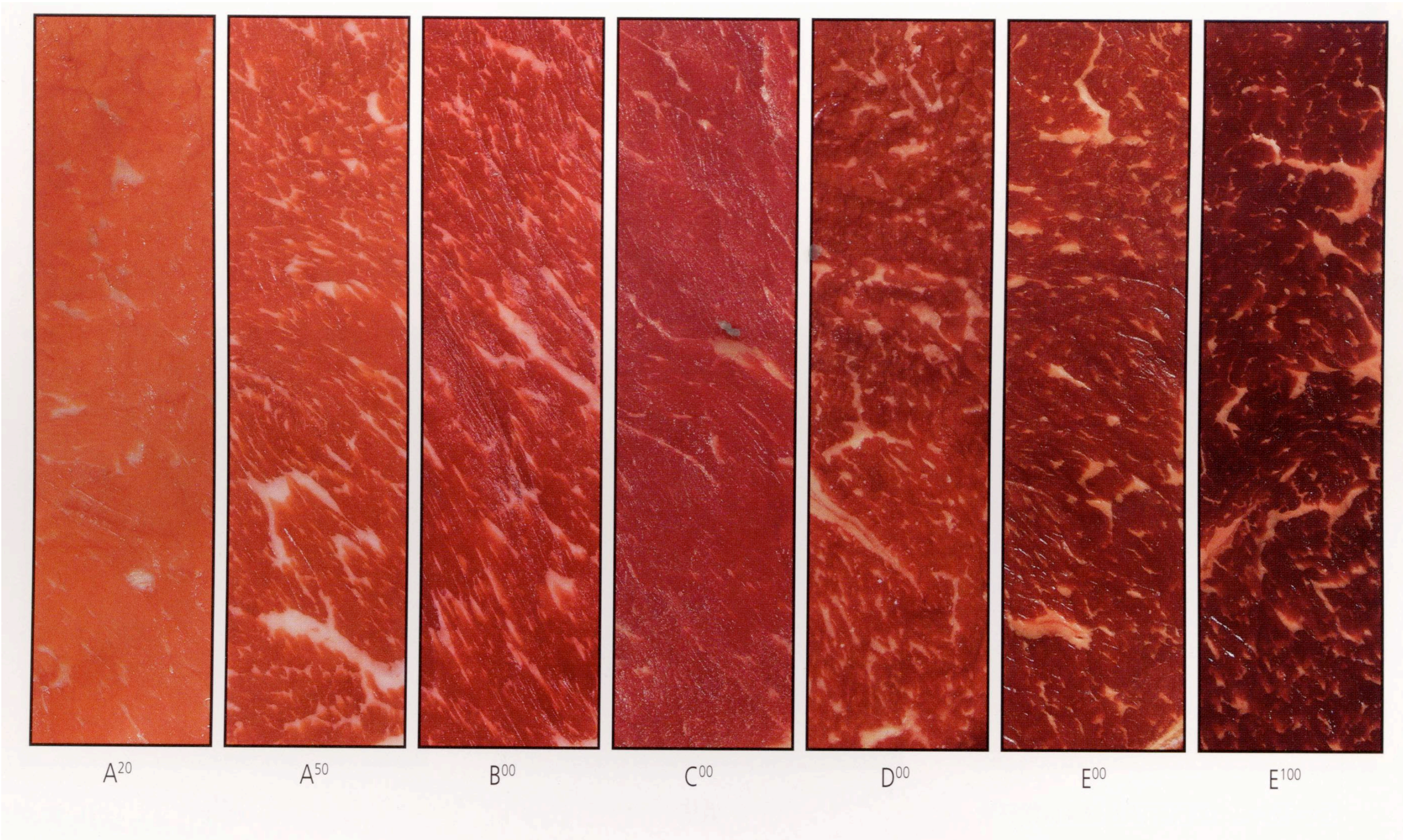
Source: adopted from Body Condition Scoring in Dairy Cattle from Elanco Animal Health, Greenfield, IN.

Cattle Dentition



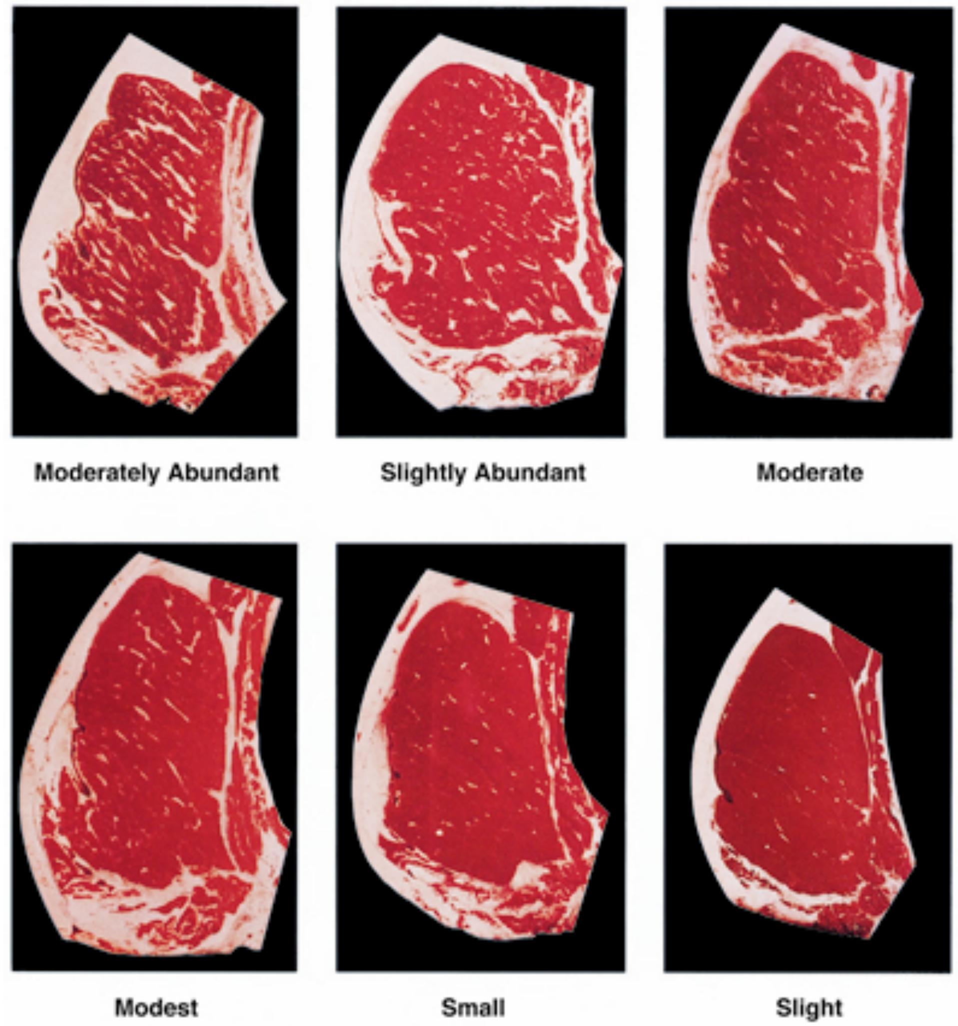
- Source: adopted from the Canadian Food Inspection Agency Guidelines on Cattle Dentition

Lean Maturity Classification



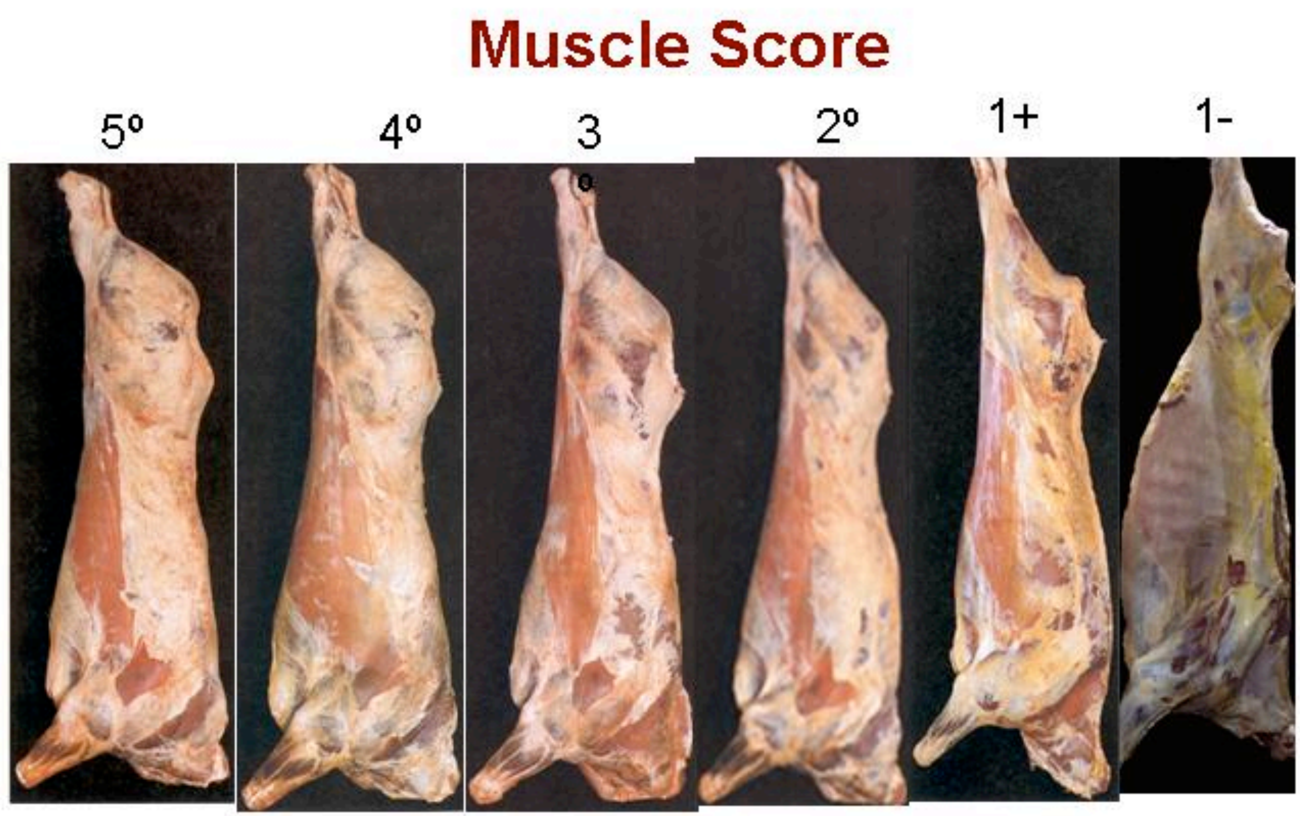
- Source: adopted from the Meat Evaluation Handbook, AMSA, Savoy, IL.

Marbling Scores



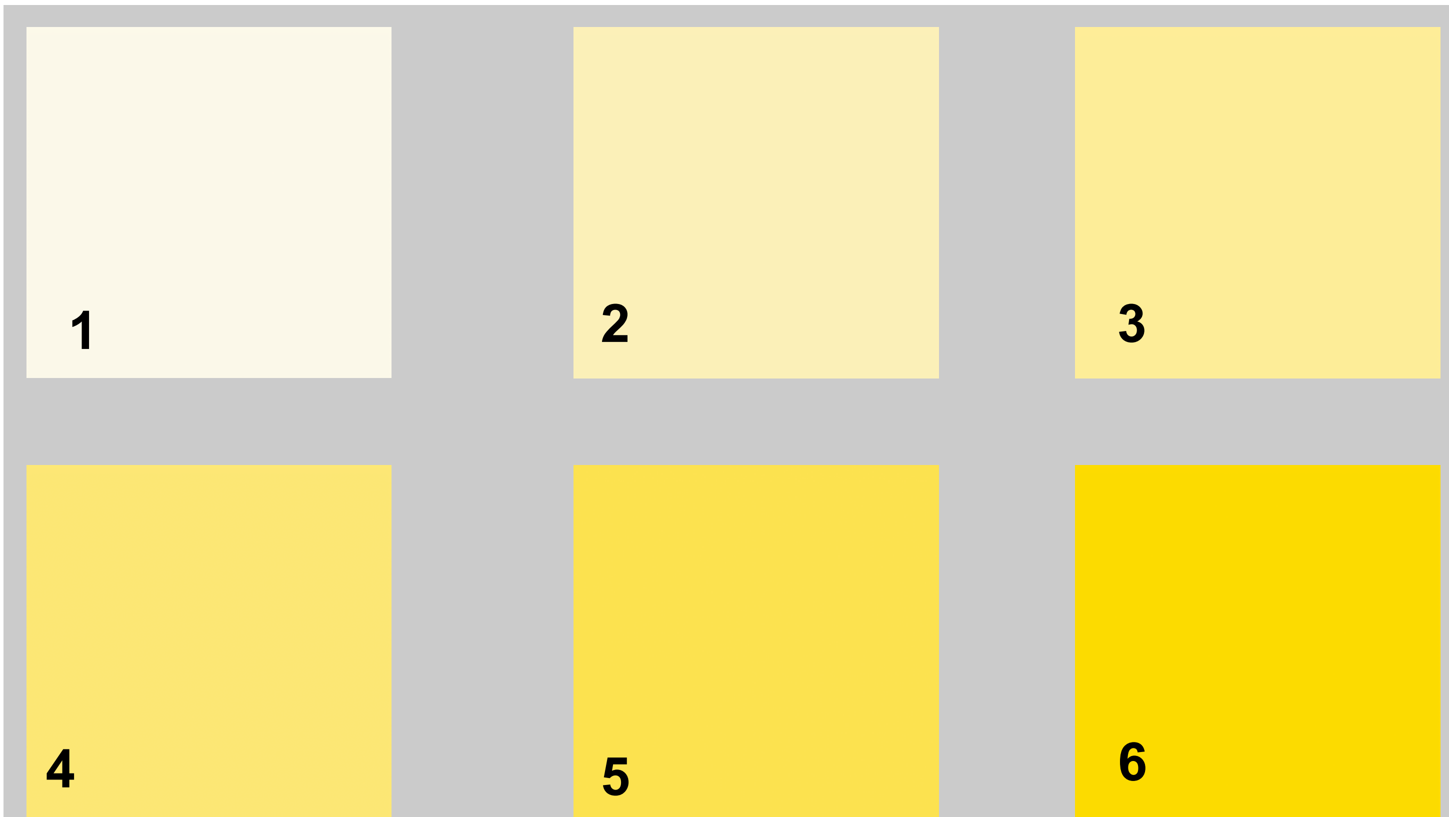
- Source: adopted from the Meat Evaluation Handbook, AMSA, Savoy, IL.

Carcass Muscle Scores



- Source: adopted from a EU system for carcass conformation classification.

Fat Color Scores



BEEF COW			DAIRY COW		BEEF BULL		DAIRY BULL		
Color: primary	Black	White	Yellow	Brindle	Roan				
	Red	Brown	Grey	Holstein	Other Dairy				
Individual ID:	None	Electronic	Barcode	Indiv Visual	Lot Tag	Metal Clip	Back Tag		
Mud: Locat.	No visible	legs	belly	side	topline	Fecal/Tail			
Mud: Amt.	none	S M L E	S M L E	S M L E	S M L E	S M L E			
Mud: D/W		D W	D W	D W	D W	D W			
Brand:	NONE			**Horns**					
Location	**butt**	**side**	**shoulder**	NONE					
Size	×	×	×	<1”					
Size	×	×	×	1-5”					
Size	×	×	×	>5”					
Cancer Eye:	0	1	2	3	4	5			
Knots:	None	Neck	Shoulder	Top Butt	Round				
Locomotion:	1	2	3	4	5				
Muscle Score:	1	2	3	4	5				
Dairy Condition:	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
Beef Condition:	1	2	3	4	5	6	7	8	9

Pen #: ________	Prolapse		Retained Placenta	Hide Damage		Abscess			Lumpy Jaw	Ext. Emac	Foot Abnorm.	Broken Penis	Bottle Teats	FSL	Mastitis	Mult. Udder Problems	No Defect
# in Pen: ________	Rec	Vag		Ins	Lat	Jaw/tooth	Knee/hock	Hook/pin									
BEEF COW # Evaluated: ________																	
DAIRY COW # Evaluated: ________																	
BEEF BULL # Evaluated: ________																	
DAIRY BULL # Evaluated: ________																	

Other Producer Related Defects:

- **FSL = Failed Suspensory Ligaments**

BEEF COW	DAIRY COW		BEEF BULL		DAIRY BULL
BRUISES: 0	**1**	**2**	**3**	**4**	**Buck Shot**
LOCATION:	**Rnd Ln Rb Chk FPB**	**Rnd Ln Rb Chk FPB**	**Rnd Ln Rb Chk FPB**	**Rnd Ln Rb Chk FPB**	**Rnd Ln Rb Chk FPB**
SEVERITY:	**Min Med Maj Ext**	**Min Med Maj Ext**	**Min Med Maj Ext**	**Min Med Maj Ext**	**GRUBS** **Other:** ____________
INJ. SITES: 0	**1**	**2**	**3**	**4**	
LOCATION:	**Rnd Ln Rb Chk FPB**	**Rnd Ln Rb Chk FPB**	**Rnd Ln Rb Chk FPB**	**Rnd Ln Rb Chk FPB**	**Arthritic Joints:** **0** **1** **2**
SEVERITY:	**Min Med Maj Ext**	**Min Med Maj Ext**	**Min Med Maj Ext**	**Min Med Maj Ext**	

Minor-resulted in trim of <1lb per bruise site
Medium-between the size of a golf ball and softball
Major-larger than a softball, requires substantial trim per bruise site
Extreme-resulting in an area requiring trim that was nearly the size of an entire primal cut

LOT #:________ # in lot:_______	LIVER					TRIPE				HEART		None	FETUS
	Abs	Flu	Tlang	Cont	Other	Abs	Ulcers	Cont	Other	Pericar	Other		
BEEF COW **# Evaluated:** ________													
DAIRY COW **# Evaluated:** ________													
BEEF BULL **# Evaluated:** ________													
DAIRY BULL **# Evaluated:** ________													
UNKNOWN **# Evaluated:** ________													

Other Reasons for Condemnation:

LOT #: ________ # in lot ________	**Head**				**Tongue**					**None**
	T C Lymph	**T C** Abscess	**T C** Cont	**T C** Other	**T C** Lymph	**T C** Hair Sore	**T C** Cactus Tongue	**T C** Cont	**T C** Other	
BEEF COW **# Evaluated:** ________										
DAIRY COW **# Evaluated:** ________										
BEEF BULL **# Evaluated:** ________										
DAIRY BULL **# Evaluated:** ________										
UNKNOWN **# Evaluated:** ________										

Other Reasons for Condemnations/Trimming:

LOT #: _______ # in lot: _______	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Gummer**	**Broken Mouth**
BEEF COW **# Evaluated:** _____________											
DAIRY COW **# Evaluated:** _____________											
BEEF BULL **# Evaluated:** _____________											
DAIRY BULL **# Evaluated:** _____________											
UNKNOWN **# Evaluated:** _____________											

REASON FOR CONDEMNATION	BEEF COW	DAIRY COW	BEEF BULL	DAIRY BULL	Unknown
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

BEEF COW **DAIRY COW** **BEEF BULL** **DAIRY BULL** **BEEF HEIFER** **DAIRY HEIFER** **BEEF BULLOCK** **DAIRY BULLOCK**	**L. MAT.(%)**	A	B	C	D	E	**Carcass Weight:**
	S. MAT.(%)	A	B	C	D	E	**Ribbed: Y N**

MARB (%)	D	PD	TR	SL	SM	MT	MD	SA	MA

DARK C.	**Bl. Spl.**	**Calloused Eye**
ADJ. FAT:	**REA:**	**KPH%:**

Muscle Score	1	2	3	4	5
	- o +	- o +	- o +	- o +	- o +
Fat Color	1 2	3	4	5	6
Plant Cow Grade		**Plant Bull Grade**			

Cooler Checklist

for the daily kill:

	Dairy	Beef
Cows	________	________
Bulls	________	________

Cow Packer Grades:	Plant Grades:	Descriptions:
Canner		
Cutter		
Boning		
Breaking		
Bull Packer Grades:	**Plant Grades:**	**Descriptions:**
Bull Standard		
Select Select		
Lean Bull Choice		
Fat Bull Prime		

Postmortem Reason For Retained:	Animal Type:			
	BEEF COW	DAIRY COW	BEEF BULL	DAIRY BULL
	BEEF COW	DAIRY COW	BEEF BULL	DAIRY BULL

100%	Cow lbs.	Bull lbs.
112 Rib, ribeye roll, light		
112 Rib, ribeye roll, medium		
112 Rib, ribeye roll, heavy		
Chuck, boneless 85%		
168 Round, top inside, light		
168 Round, top inside, medium		
168 Round, top inside, heavy		
169A Round, top inside cap-off, light		
169A Round, top inside cap-off, medium		
169A Round, top inside cap-off, heavy		
171B Round, outside round		
171C Round, eye of round		
Loin, Semi-Bnls Short Loin, light		
Loin, Semi-Bnls Short Loin, medium		
Loin, Semi-Bnls Short Loin, heavy		
180 Loin, strip, bnls, light		
180 Loin, strip, bnls, medium		
180 Loin, strip, bnls, heavy		
182 Loin, sirloin butt		
184 Loin, top sirloin butt		
191A Loin, butt tender, peeled		
90% Lean		
100% Lean-Inside Rounds		
100% Lean-Outside Rounds		
100% Lean-Eye of Round		
100% Lean-Flats and eyes		
100% Lean-Striploin		
100% Lean-S.P.B.		
116B Chuck, chuck tender		
167A Round, knuckle, peeled		
190 Loin, tenderloin, 2-3		
190 Loin, tenderloin, 3-4		
190 Loin, tenderloin, 4-5		
190 Loin, tenderloin, 5+		
193 Flank, flank steak		
Defect Checklist:	Cows	Bulls
Number of Injection Site Lesions Found:		
Number of Abscesses Found:		
Number of Lead/Shot Found:		
Number of alarms by Metal Detector:		
Magnitude of Metal Detector:		

BEEF COW	DAIRY COW	BEEF BULL		DAIRY BULL
INDIVIDUAL ID:	Electronic	Barcode	Indiv. Tag	OTHER:
NONE	Metal Clip	Back Tag	Lot Tag	
TRACEBACK INFORMATION ON BACK TAG:				
PLANT CARCASS #:				
PLANT TRACEBACK INFORMATION:				
DISTANCE TRAVELED:				
EXTENT OF TRACEBACK:	AUCTION OWNER OTHER:____________________			
OWNER CONTACT INFORMATION:				

2006/2007 National Cow and Bull Beef Quality Audit
Questionnaire

Page 1

Name: ___________________________

Company: ________________________

Title: ____________________________ Circle one: FSIS PLANT REP.

Date/Meeting: _____________________

1. In your opinion, what are the top ten challenges for quality facing the market cow and bull industry?

2. List the top five directives to solve these problems.

2006/2007 National Cow and Bull Beef Quality Audit
Questionnaire

Page 2

3. What future problems do you foresee the market cow and bull industry facing?

4. In your opinion, what are the top 5 areas of improvement in quality for the market cow and bull industry?

Page 3 - 2007 National Market Cow and Bull Beef Quality Audit Questionnaire
Name:________________ Company:_____________ Title:______________

Date:____________ Circle one: FSIS Plant Representative

Defect Description	Beef	Dairy
The last Market Cow and Bull Audit was in 1999, since that time has the quality in the following areas either improved or declined? Please use the scale at the bottom of this page and score the magnitude of decline or improvement since the 1999 audit for each category. **Receiving**		
Inadequate Space for Cattle on Trailers		
Incorrect Loading of Cattle		
Too Frequent Loading in Jailhouse/Doghouse		
Excessive Hot Shot Usage by Truckers		
Poor Flooring Conditions on Trailers (Cattle Slipping When Exiting)		
Overall Quality of Cows and Bulls		
Antemortem		
Excessive Live External Fat		
Insufficient Live External Fat		
Excessive Live Weight		
Insufficient Live Weight		
Epithelioma		
Deads		
Moribund		
Downers		
Extreme Emaciation		
Advanced Lameness		
Insufficient Muscling		
Excessive Mud/Manure on Hides		
Latent/Insect Damage on Hides		
Excessive Brands on Hides		
Location of Brands on Hides		
Prolapsed Rectum/Vagina and/or Retained Placentas		
Udder/Teat Problems (cows)		
Sheath/Penis Problems (bulls)		
Lumpy Jaw		
Horns		
Abscesses/Knots		

-5 (Greatly Declined)	**-4**	**-3 (Moderately Declined)**	**-2**	**-1**	**0 (Neither Improved or Declined)**	**1**	**2**	**3 (Moderately Improved)**	**4**	**5 (Greatly Improved)**

Page 4 - 2007 National Market Cow and Bull Beef Quality Audit Questionnaire
Name:________________ Company:_____________ Title:______________

Date:____________ Circle one: FSIS Plant Representative

Defect Description	Beef	Dairy
The last Market Cow and Bull Audit was in 1999, since that time has the quality in the following areas either improved or declined? Please use the scale at the bottom of this page and score the magnitude of decline or improvement since the 1999 audit for each category. **Harvest**		
Low Dressing Percentage		
Johne's Disease		
Grubs		
Arthritic Joints		
Bruises		
Carcass Condemnations		
Head Condemnations		
Liver Condemnations		
Tripe Condemnations		
Tongue Condemnations		
Injection-Site Lesions		
Cactus Tongue		
Hair Sore (Tongues)		
Buckshot/Birdshot		
Antibiotic Residues		
Prevalence of Fetal Calves		
Trim Losses		
Cooler		
Excessive Carcass Weight		
Insufficient Carcass Weight		
Insufficient Muscling on Carcasses		
Excessive Ribeye Size		
Insufficient Ribeye Size		
Excessive External Carcass Fat		
Insufficient Marbling		
Excessive Dark Lean Color		
Lack of Muscle Firmness		
Excessive Yellow Fat Color		
Blood Splash		
Calloused Ribeye or Other Muscles		
Dark Cutters		

-5 (Greatly Declined)	**-4**	**-3 (Moderately Declined)**	**-2**	**-1**	**0 (Neither Improved or Declined)**	**1**	**2**	**3 (Moderately Improved)**	**4**	**5 (Greatly Improved)**

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