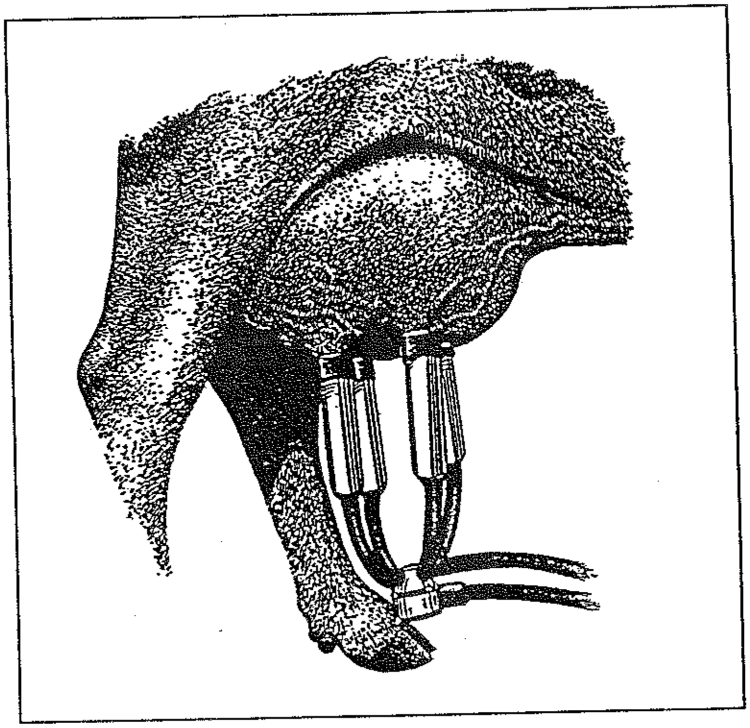
MILK QUALITY:
A PRO-DAIRY Management Focus Workshop For Farm Managers

PARTICIPANT'S MANUAL



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MILK QUALITY - PARTICIPANT'S MANUAL

Table of Contents

A Note to Workshop Participants

Red Tab	Participant's Notes -- Session 1a Managing Milk Quality for Success Excerpt from NYS Milk Code -- Circular 958
Clear Tab	Participant's Notes -- Session 1b 1991 Federal Regulations for Drug Residues in Milk Preventing Drug Residues in Milk and Cull Dairy Cows Dairy Producer's Safe Drug Use Guide
Blue Tab	Participant's Notes -- Session 2a Vocabulary of Mastitis Control Mastitis Causing Organisms: Diagnosis, Source and Factors Relating To Their Control Heifer Mastitis Mastitis Control Program Series: Mastitis - A Closer Look, No. 277 Staph-Infected Dairy Cows, No. 276 Coliform-Infected Dairy Cows, No. 267 Non-Ag. Strep.-Infected Dairy Cows, No. 278 Strep. Ag.-Infected Dairy Cows, No. 275 Using DHI-SSC Linear Scores to Evaluate and Monitor Mastitis Control
Orange Tab	Participant's Notes -- Session 2b
Yellow Tab	Participant's Notes -- Session 3a Milking Techniques Affecting Milk Quality, Yield, Udder Health and Milking Performance
Green Tab	Participant's Notes -- Session 3b Cleaning and Sanitizing of Dairy Farm Milking Equipment Various Samples of Dealer Maintenance Schedules
Pink Tab	Participant's Notes -- Session 4a
Orange Tab	Participant's Notes -- Session 4b

A Note to Workshop Participants

Welcome to **Milk Quality: A PRO-DAIRY Management Focus Workshop for Farm Managers**. This four-session workshop will examine management factors on the farm that effect milk quality. Information on off-flavors, mastitis-causing organisms, milking procedures, and milking equipment maintenance and function will be presented. Two case studies will also be presented for practice in problem solving and tactical planning. The objective of the workshop is to have each participant develop their own detailed tactical plans (plans for action) to help reach their individual goals for producing high quality milk. The workshop draws heavily upon the concepts of setting goals, problem solving, and tactical planning that you learned in **Managing for Success**.

The participant's manual for the **Milk Quality** workshop is divided into eight sessions as tabbed in the notebook. The intent is to have a morning session, lunch, and an afternoon session comprise each workshop day. Estimated workshop time of each session is a bit under two hours.

Each session contains participant's notes followed by resource material for the subject matter covered. The participant's notes are organized into activities showing learning goals and key points. Space for personal note taking is at the lower part of each activity page. A summary of the session's activities is the first page of participant's notes in each session.

A page-numbering system was designed for easy reference between the teacher's and participant's manuals. Participant's notes are numbered consecutively within each session. Overheads are numbered within each session in the order they are presented. Worksheets are printed on yellow paper and numbered consecutively throughout the entire notebook, beginning with the letters **"WS"**.

Resource material for each session comes from a variety of sources. Each reference is self-contained, usually fastened with staples, and pages may or may not be numbered. More in-depth information on the subjects covered in each session is contained in the resource material for your reading.

The authors hope you find the information in this notebook helpful and that participation in this workshop will assist you in meeting your goals and objectives to realize the mission of your dairy farm business.

PARTICIPANT'S NOTES -- Session 1a

SUMMARY

Objective: This session acts as an introductory presentation that sets the workshop atmosphere and familiarizes you with:

1. Factors effecting milk quality and flavor.
2. Criteria and tests of milk quality.
3. Market trends of dairy products.
4. The New York State milk code.

Summary of activities/exercises (time)

1. **Welcome, Registration, Collecting Samples (Upon arrival)**
   The teaching team welcomes you and ask you to complete the Milk Quality Registration form. This information will be used for course evaluation, as well as furnishing you with a personalized fiscal assessment of your current mastitis control program. Results of this assessment will be returned and discussed in session 4b.

2. **Teaching Team Intro/Group Warm-up exercise (30 min)**
   Teaching team members and agriservice representatives introduce themselves. Participants introduce themselves by sharing a management experience or change that has taken place since the Managing for Success Workshop.

3. **Milk flavor taste test (30 min)**
   With the milk flavor taste test, you learn the sensory recognition of common off-flavors in milk.

4. **Mini-lecture on Milk Quality (45 min)**
   A short overhead presentation that asks why milk quality is important, shows dairy market trends, and covers milk quality tests precedes a slide presentation on milk quality and off-flavors.

5. **NYS Milk Code (5 min)**
   How many of you have ever seen the written regulations that govern your marketing of milk. The farm rating system (milk inspections) is based on regulations in the NYS Milk Code administered by the Department of Agriculture and Markets. The portion pertaining to raw milk shipment is covered in Sections 2.8 to 2.28 (pages 15-26). Your reading is suggested.

MILK QUALITY - Session 1a

ACTIVITY 1

Welcome, Registration, Collecting Milk Samples

I. Learning Goals of this Activity

1. Have you feel welcome and eager to participate in this workshop.
2. Collect information for later evaluation of the impact of this Milk Quality workshop.
3. Collect information for a personalized fiscal assessment of the current mastitis control program on your farm.
4. Collect and check labelling on milk samples prior to shipment for culture at a QMPS lab .

II. Key Points

1. You are to complete all questions on the Milk Quality Registration form, giving your best estimate when you are unsure of the exact answer.
2. Feel free to ask questions to any member of the teaching team about the registration form.

III. Personal Notes:

REGISTRATION FORM

Management Focus Workshop on Milk Quality

Name ______________________ Farm Name ______________________

Address ______________________ Town ______________________

State ______ Zip Code ________ Phone No. (____)______________

Herd size (milking & dry) __________ Rolling herd ave. __________

Type of housing ______________ Type of bedding ______________

What season of year do you have most mastitis problems? __________

Information on level of mastitis last year

__________ 1. Number of cows culled last year due to mastitis

__________ 2. Number of cows died last year due to mastitis

__________ 3. Estimate of number of mastitis cases treated last year

__________ 4. Ave number of days milk withheld because of treatment (include treatment days)

__________ 5. Ave market price of a replacement heifer

__________ 6. Ave sale price of cull cows

__________ 7. Does your milk handler offer a quality incentive?

8. If yes, how much and at what somatic cell count?

$0. ____/cwt at ______________ Somatic Cell Count

$0. ____/cwt at ______________ Somatic Cell Count

__________ 9. In the past 12 months, how many months did you not qualify for incentives?

__________ 10. Current milk price (pay price)/cwt

Current Somatic Cell Status

From your recent Somatic Cell Count Report, list the number of cows (not percentage) in each of the linear score categories

LS < 2 ________ LS 5 ________

LS 3 ________ LS 6 ________

LS 4 ________ LS +7 ________

Herd Average LS ________

Setting goals (SMART) for next year

________ 1. Goal for number of cows culled for mastitis

________ 2. Goal for number of cows dying from mastitis

________ 3. Goal for number of months to receive quality incentives

________ 4. Goal for average level of somatic cells in the herd

________ 5. Goal for average number of cows treated per month

Estimated cost of current mastitis control program

Item/Practice	Use	Estimated Annual Cost	Do Not Use
Teat dip	____	$________________	____
Dry Cow Treatment	____	$________________	____
DHI SSC Reporting	____	$________________	____
Udder Sanitizers	____	$________________	____
Paper towels	____	$________________	____
Routine milking machine maintenance	____	$________________	____
Annual QMPS Survey	____	$________________	____

Number of mastitis cultures/year ________ $________/culture

Others (list): ____________________ $________________

____________________ $________________

____________________ $________________

MILK QUALITY - Session 1a

ACTIVITY 2

Teaching Team Introductions/Group Warm-up Exercises

I. **Learning Goals of this Activity**

1. Learn names and backgrounds of the teaching team members.
2. Learn names of fellow participants.
3. Share experiences of how the Managing for Success and/or Management Clinic has altered your way of thinking or operating.
4. Empower you as a member of this workshop to relate freely to the group.

II. **Key Points**

1. All participants in this workshop have the opportunity to learn from each other be sharing ideas and methods of managing their farms. The teaching team will strive to facilitate group interaction so as to enhance this workshop style of learning.
2. Your participation in discussions as well as working on your own farm situation is highly encouraged.

III. **Personal Notes:**

TEACHING TEAM INTRODUCTION FORM

Name:

Address:

Telephone:

Affiliation:

Biographical Sketch:

Name:

Address:

Telephone:

Affiliation:

Biographical Sketch:

Name:

Address:

Telephone:

Affiliation:

Biographical Sketch:

Name:

Address:

Telephone:

Affiliation:

Biographical Sketch:

MILK QUALITY - Session 1a

ACTIVITY 3

Milk Flavor Taste Test

I. **Learning Goals of this Activity**

1. Set stage for discussing milk quality by having you experience through sensory recognition the subject matter presented on off-flavors in milk.

II. **Key Points**

1. Off-flavors in milk caused by on-farm factors may adversely affect consumer perception of milk as a wholesome, healthy product.

III. **Personal Notes:**

MILK QUALITY - Session 1a

ACTIVITY 4

Mini-Lecture on Milk Quality

I. Learning Goals of this Activity

1. Examine the importance of Milk Quality in relation to public perception, consumer products, and greater production.
2. Explain tests done at milk plants which measure quality.
3. Describe how manageable farm factors contribute to milk quality.

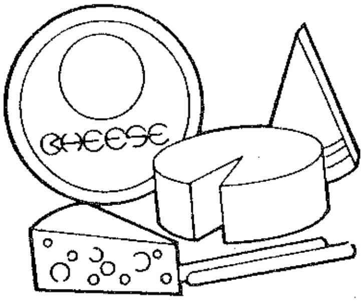
II. Key Points

1. Milk quality is important because of the consuming public as well as a benefit to profitable production.
2. Milk Quality is measured by many tests, the most important tests being: odor/flavor, sediment, bacteria, antibiotic, and somatic cell.
3. All factors that cause poor quality or off-flavors in milk can be controlled by the farm manager.
4. Milk quality starts on the farm. Processing can not improve the quality of milk that is produced on the farm.

III. Personal Notes:

OVERHEAD

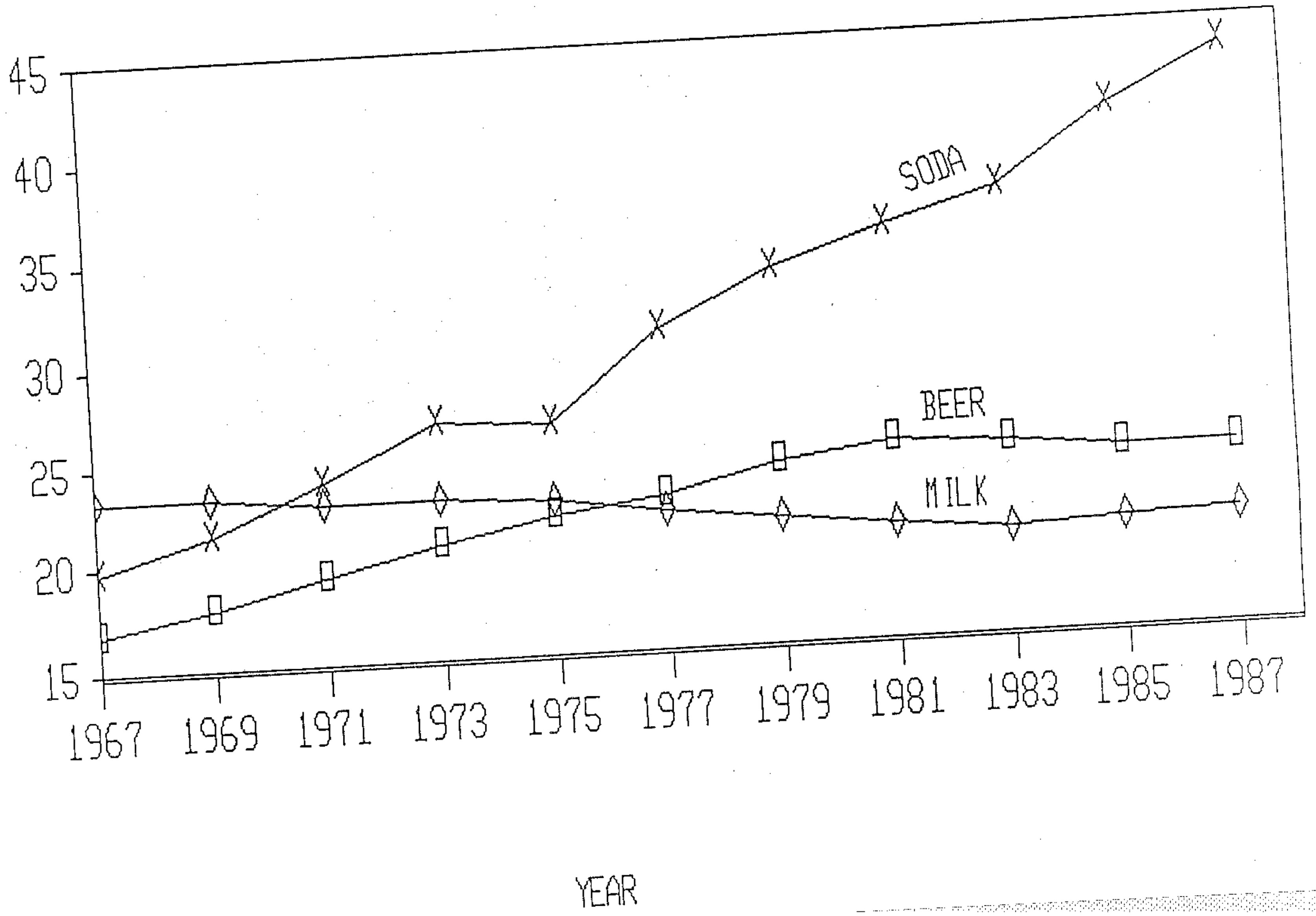
1a.1



Why is Milk Quality Important?

OVERHEAD
1a.2

CONSUMPTION OF BEVERAGES--GALLONS/CAPITA



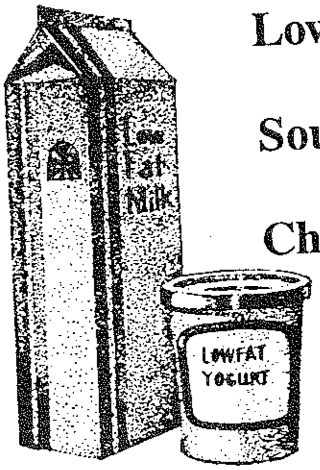
OVERHEAD
1a.3

1977 - 1987 Comparisons

Which Dairy Products Are:

Selling

Yogurt	+ 90%
Low-Fat Cottage Cheese	+ 83
Sour Cream/Dips	+ 46%
Cheese	+ 39%



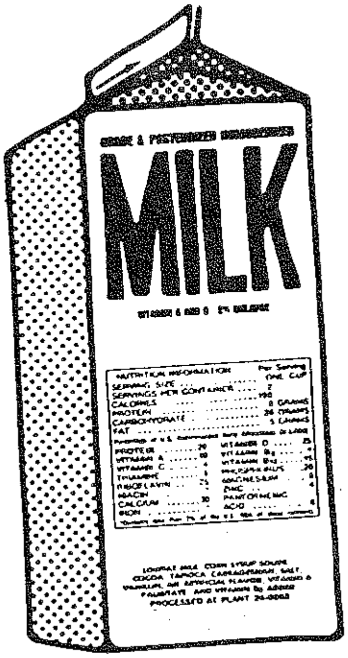
Not Selling

Powdered Milk	- 41%
Whole Milk	- 33%
Creamed Cottage Cheese	- 27%
Evaporated Whole Milk	- 16%

OVERHEAD
1a.4

Milk Quality Tests

- Odor & Flavor
- Temperature
- Bacteria
- Freezing Point
- Antibiotics
- Somatic Cells
- Acidity
- Sediment



A. B. Cs. of Off-Flavors

1. Absorbed - feedy, cowy
2. Bacterial - malty, acid, sour (cooling)
3. Chemical - rancid, cowy (mishandling)

MILK QUALITY - Session 1a

ACTIVITY 5

New York State Milk Code

I. **Learning Goals of this Activity**

1. The New York State Department of Agriculture and Markets Division of Milk Control is responsible for enforcement of the NYS Milk Code.
2. To heighten awareness of the regulations under which you are permitted to ship raw milk.

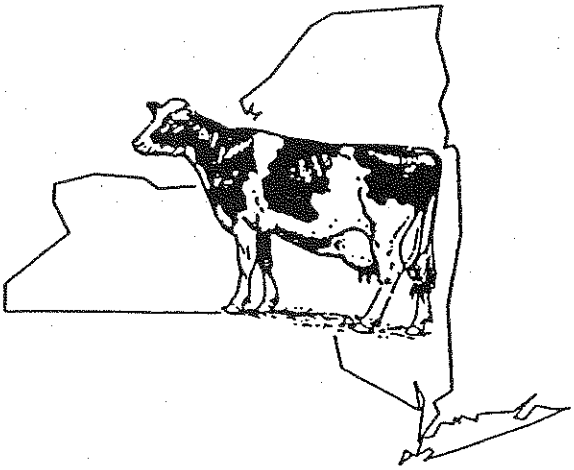
II. **Key Points**

1. Regulations concerning production and shipment of raw milk are covered in Sections 2.8 to 2.28 (pages 15-26) of the NYS Milk Code.

III. **Personal Notes:**

PRO-DAIRY

MANAGING MILK QUALITY FOR SUCCESS



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MANAGING MILK QUALITY FOR SUCCESS

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TABLE OF CONTENTS

PAGE

INTRODUCTION 1

The Need for Quality. 1

RAW MILK TESTS 3

Odor and Flavor 3
Temperature 3
Standard Plate Count. 4
Thermoduric Count 5
Coliform Count. 5
Psychrotrophic Count. 5
PI Count. 6
Freezing Point. 6
Antibiotics 7
Somatic Cells 9
Pesticides. 10
Acidity 10
Sediment. 10

MILK FLAVOR. 11

Off Flavors in Milk 11
Judging and Grading Milk. 12
Off Flavor Descriptions and Causes. 14
Milk Flavor Score Card. 17
Suggested Flavor Scores 18
Rancid Flavor 19
Microbial Flavor. 27
Transmitted (Feed and Unclean) Flavor 40
Oxidized Flavor 46
Other Off-Flavors 48

PRINCIPLES OF CLEANING AND SANITIZING. 51

Types of Cleaners 51
Function of Cleaners. 53
Cleaning Procedures 54
Sanitizing Procedures 54
Pipeline Systems. 55
Manual Cleaning 56
Trouble Shooting Cleaning Problems. 59

PROTECTING FARM RATING 63

Description of IMS Program. 63
Farm Score Sheet. 65

THE NEED FOR MILK QUALITY

High quality is important for maximum sales of milk and dairy products. Achieving and maintaining the best quality is the responsibility of everyone associated with the dairy industry. The starting point is the dairy producer who must use effective procedures for producing, handling and maintaining high quality milk, and do so efficiently and economically in relation to labor, equipment and facilities.

Milk quality has many considerations. The producer must be sure that milk leaves the farm unaffected by adulterants such as dirt, drugs, antibiotics, cleaning chemicals, sanitizers, pesticides or added water. High quality milk must contain low bacteria counts; whether measured as Standard Plate Count, Preliminary Incubation Count, coliforms, etc. Rapid cooling of milk and properly cleaning and sanitizing milking machines and milk handling equipment are important in helping to achieve low bacteria counts. Clean cows and proper premilking preparation procedures are essential for keeping environmental bacteria counts low and reducing new mastitis infections.

Milk should be handled without undue air agitation to avoid increases in acid degree value and rancidity. Other flavor defects should be prevented by effective feeding management and health programs. Effective mastitis control should be maintained and routinely monitored. Somatic cell counts (primarily leucocytes or white blood cells) increase in response to mastitis infections and clinical incidence. This relationship has taken on increased significance in recent years regarding its effect on milk production, mastitis monitoring, milk quality and milk composition, especially as it affects cheese yields.

Milk quality is often a contradictory objective to increased productivity and efficiency. Assuring high quality takes time, effort and thought. However, it contributes to the overall success of the operation.

RAW MILK TESTS

Introduction

Good quality raw milk is essential for desirable pasteurized products and consumer acceptance. State and federal regulations are becoming more rigid. Practical quality standards should be part of any program. A complete quality control program is essential to assure consumer acceptance. The keys are odor and taste as determined at the time of consumption.

Raw milk quality standards assume that all test results are representative of the entire raw supply tested. A program must include representative sampling, proper care of samples, and accurate testing procedures. Milk must be properly mixed and care taken not to contaminate the sample. Supervisors must regularly inform all persons involved about the required practices. This includes training and informing all persons who collect, handle, and test samples. Routine checking must be done to be sure that their procedures and techniques are correct.

Access to a well equipped laboratory is necessary. Tests must be made continually but on an irregular schedule. If testing is reduced or eliminated, quality will decline. A discussion of each quality test will include purpose, general procedures, practical standards, and steps to achieve them.

Tests

Odor and Flavor

Some tests do not require any laboratory or specialized equipment. The bulk milk hauler and receiver at the plant should regularly check all milk for odor by lifting porthole or manhole covers. Although the ability to detect odors and flavors varies, most people can distinguish between good and poor milk.

Odors such as feed, unclean, sour, and malty are usually apparent when the flavor is strong. They are volatile and can be detected by smelling. If the odor is questionable, warm and taste a sample. If you are concerned about safety, heat milk to 150 F then immediately cool before tasting. Warm to 60 F for tasting, or for odor, heat to about 120 F. This intensifies the odor.

See other sections for specific details on judging milk flavor.

Temperature

Milk should be cooled to 40 F or below within two hours of milking and held at that temperature until pasteurized. Every dairy sanitarian and milk hauler should carry an accurate pocket thermometer to be sure that milk is 40 F or less when collected.

Many thermometers on farm bulk tanks are not accurate, so haulers must use a pocket thermometer. All pocket thermometers should be checked against a standard thermometer or in an ice and water mixture at least once a month.

It is recommended that all new farm bulk tanks be installed with a recording thermometer. This provides the temperature history for the hauler at the time of collection. Interval timers should be done on all bulk tanks to agitate the milk about five minutes every hour.

Standard Plate Count (SPC)

Under the Pasteurized Milk Ordinance, at least four SPC's must be performed during each six month period. However, most states require at least one such count each month. Most cooperative, dealer, and some state quality control programs provide for twice a month testing.

The SPC is a determination of the number of bacterial clumps in one milliliter of milk which will grow in 48 hours at 32 C (90 F) incubation temperature. Acceptable modifications of the SPC using the same time and temperature of incubation are the Plate Loop Count and the Oval Tube Method. Frequently, results of the SPC test do not correlate with sanitation conditions on farms. Prompt cooling of milk and sanitizing of equipment may yield low counts and disguise unclean milking equipment or poor production practices. However, raw milk shelf life is limited because spoilage bacteria grow during the holding time prior to pasteurization. Laboratory technicians should note odor of bacterial plates and color and sizes of colonies. Their appearance may be indicative of production practices and raw milk handling. Spoiled or putrid odors and large shiny, yellow-to-blue colonies indicate psychrotrophs and poor production practices.

SPC's should be replaced in regulatory standards by tests which correlate better with production conditions. Tests such as Preliminary Incubation (PI) Count may be high when cleaning is not thorough, sanitizing is omitted, or udder washing does not include a sanitizing solution and paper towels.

Many SPC's of fresh producer samples are less than 10,000 per ml if sanitization is good and cooling is adequate. Most industry standards are 50,000 per ml. Therefore, all plating should be done at 1:100 dilution. Regulatory maximums are generally 100,000 per ml. This assumes that samples are properly collected, kept below 40 F and tested within 36 hours.

Laboratory Pasteurized or Thermoduric Count

This is a determination of the number of bacteria which survive heat treatment. Although SPC standards for pasteurized milk are 20,000 per ml or less, there are no thermoduric standards for raw milk. Desirable levels in raw milk following laboratory pasteurization and in pasteurized milk are less than 1,000 per ml. These are practical standards and are attainable with good sanitation and cooling practices.

Thermoduric bacteria will not grow at refrigeration temperatures of 40 F or below. The presence of these bacteria in milk is not of public health significance because they will not cause disease. Also, these bacteria are not commonly associated with milk spoilage. The presence of thermoduric bacteria usually indicates unclean equipment and/or improper sanitizing practices.

If thermoduric counts are made, heat treatment should be 145 F for 30 minutes and at least five minutes heat-up time. All plating should be at a 1:10 dilution because most counts will be less than 3,000 per ml.

Coliform Count

In states where raw milk may be sold to consumers at farms, the maximum coliform count is 10 per ml. The test may be used as an indication of production methods. If so, a level of less than 50 per ml is considered as acceptable for raw milk for pasteurization.

The test is commonly used to check for contamination following heat treatment in pasteurized milk and dairy products. Pasteurization temperatures kill these bacteria so they should not be present in pasteurized products. Coliform counts should be made using 1 ml directly on violet red bile agar. Incubation is 32 C for 24 hours.

Psychrophilic or Psychrotrophic Count

This is a determination of the bacteria present in milk which will grow at refrigeration temperatures. They cause spoilage of milk held above 40 F and especially after raw milk is more than two days old. They are usually killed by pasteurization. For this reason, all milk should be pasteurized within 48 hours after collection from farms on an every-other-day basis.

The test is usually applied to old raw milk and pasteurized products. Results are only history as the incubation time is seven to ten days at 7.2 C (45 F). Levels in fresh raw milk should be less than 100 per ml. At the time of pasteurization, raw milk should have counts of 50,000 per ml or less. Plating should be done using 1 ml directly in the plate for pasteurized samples and a 1:100 dilution for raw samples.

Preliminary Incubation Counts (PI)

PI Counts are the best measure of raw milk keeping quality and sanitation practices during production on farms. Plating should be at 1:100 dilution as for SPC's following incubation of milk samples at 55 F for 18 hours. Counts should not exceed 100,000 per ml. Desirable results are 50,000 per ml or less. Plates are incubated at 32 C for 48 hours. Again, laboratory technicians should note odor, color, and size of bacterial colonies as they may indicate poor production practices.

This test should be used in place of laboratory pasteurized or thermoduric counts. Whenever permitted by state and federal regulations, PI counts should be made instead of SPC's.

PI counts may be made of truck or storage tank samples in addition to individual farm samples. PI counts of samples of loads of raw milk should be performed regularly.

Freezing Point

Technicians must handle milk samples to maintain temperatures below 40 F. Dairy equipment, free of all residues, must be used. Refer to cryoscope manuals for a more detailed testing procedure.

Samples of milk from individual herds should fall in the normal range -.530 to -.566 C. Values closer to 0 C than this should be considered suspicious. Any mixed samples of raw or processed milk should fall in this range.

Newer cryoscopes give freezing point readings directly. However, no attempt should be made to change these to percentages of added water. This is not valid because it assumes an average freezing point for all milk. It should be sufficient to indicate that a sample of milk seems to contain added water. Steps should be taken to correct values of any samples which fall outside normal ranges.

Every processing plant should have a program which includes regular checking to determine freezing points. A business cannot afford to purchase more than the approximately 87 percent water in milk. The yield of cheese, powder or other products from added water is zero. Regulatory agencies regularly check brands of milk for composition. It is illegal to purchase or sell milk with added water.

Check samples of each tanker load of milk as received on a regular but unannounced schedule. Ideally do this each day, and at least monthly. Any load sample with results above -0.540 C should be considered suspicious. Obtain samples of each producer's milk on that load. One or more will likely be out of the acceptable range. Results of load samples above -0.535 C are usually considered unacceptable. Do not make any accusations, but do start immediate checking to determine the cause.

For individual producer samples, use the range of -0.530 to -0.566 C. Check a sample of each one at least monthly, unless you check all loads as received. Make a visit to the farm on all samples above -.530 C. Usually the problem will be solved when everyone is aware of regular checking.

Antibiotics

The advent of universal sampling has increased the rate of detection. This procedure, along with sampling and testing all bulk tank loads, is the key to a testing program which will assure that antibiotic residues are not present in milk and milk products offered to the consumer.

The elimination of antibiotic residues in milk and dairy products is an industry problem that demands the involvement of all responsible people in the dairy industry and government. Total participation in the education, control, and enforcement aspects of an effective antibiotic control program is a must. The dairy industry is doing a good job with a difficult situation. If ever there was a time when the dairyman and the processor should stand together to solve a problem it is <u>now</u>--in order to maintain the favorable reception in the marketplace. Antibiotic residues are illegal and cannot be tolerated. Preventing contamination is the only answer, since antibiotics cannot be eliminated by processing. Most dairymen will respond if they are aware of the problem and are informed of the proper procedures to follow. More often than not, antibiotics find their way into market supplies by accident. Nevertheless, under present conditions the innocent are likely to suffer with the negligent.

The objections to antibiotics in milk cannot be refuted. Although rare, consumers may experience allergic reactions because of low levels in the milk. Processors cannot make products such as cheese, cultured buttermilk, or cultured sour cream from antibiotic milk because the desirable bacteria cannot grow. Since current official methods of detecting antibiotics take at least several hours, milk is usually already pooled in the dairy plant before test results are obtained. A single contaminated lot of milk, therefore, can contaminate thousands of pounds of storage tank milk. <u>The milk from only one cow treated with 100,000 units of penicillin can cause detectable residues in milk from 1,000 untreated cows</u>. The method now being used by the FDA in checking dry milk samples is roughly ten times more sensitive than earlier methods which are still being used by many dairy plants. The level of detectability is now about .005 units of penicillin.

At this level, an infusion of 1,000,000 units would be measurable in 45, 000 pounds of milk. Producers must follow instructions pertaining to the use of all antibiotics, and they must have <u>positive control</u> to prevent contamination of milk. The source of antibiotics, such as penicillin, is from treated dairy cows and must be controlled at the farm. Receivers of milk need to use the most sensitive official testing procedure available and, in some instances, increase the frequency of sampling and testing. They also need to communicate findings in a meaningful way to producers through educational means as well as punitive means. Let's all get together with a positive attitude toward avoiding the bad effects while still retaining the benefits that antibiotic therapy has to offer.

Recommendations for Detection

1) A universal sample should be taken from each farm bulk tank at every pickup.

2) A composite, properly agitated tanker sample of all producers' milk should be taken from the bulk truck before unloading. This sample should be immediately analyzed for penicillin or other inhibitor by any acceptable method.

3) If the composite tanker sample is positive, each universal sample should be analyzed to determine which producer caused the adulteration. The official test performed on the producer sample must be performed in an "approved laboratory" using analytical procedures prescribed by Standard Methods for the Examination of Dairy Products or Official Methods of Analysis of the Association of Official Analytical Chemists (AOAC) when official action is anticipated. The producer should be immediately notified of a positive test result from his tank.

4) All positive samples should be held in frozen storage until all chances of legal action are exhausted.

5) Each handler should have on record the antibiotic tests results for each load of milk purchased, transferred, or sold.

6) Immediate notification shall be made to the proper regulatory agency.

Test Procedures Available

A. Official Tests	Sensitivity (Units of Penicillin)
1) Disc Assay Method B. subtilis (1)	
Method A (Long Incubation)	.02
Method B (Short Incubation)	.03
2) Cylinder Plate Method S. Lutea (2)	.01
3) B. stearothermophilus disc assay	.008

B. Unofficial Tests

1) Delvotest P - B. stearothermophilus (3) .003-.006

Somatic Cells and Abnormal Milk

Milk is abnormal when the number of somatic cells is excessive. Somatic cells include leucocytes or white blood cells and are always present in normal milk. Their number vary quite widely, sometimes being less than 100,000 per milliliter. Somatic cells in excess of 500,000 per ml are considered to be above normal. Most herds producing abnormal milk are mastitic, and the majority will show mastitic organisms under the microscope. Cows in late lactation may have higher cell counts than normal. Cows that are in poor health from any cause as well as from mastitis may have excessive somatic cell numbers.

In New York State, punitive action is required when the DMSCC (Direct Microscopic Somatic Cell Count) is in excess of 1,000,000 per ml*. On the first such count the buyer is required to notify the producer and perform another test within 15 days. If two of the last four monthly tests are above the 1,500,000 limit, the producer's score can be debited 15 points when a particular supply is rated. If the high counts continue, the exclusion of the producer is required.

A laboratory determination of somatic cell counts by the direct microscopic method is the official means of determining somatic cell levels, although other methods may be acceptable. The method is very time consuming. Screening methods of cell count estimation are commonly used by many laboratories. The microscope is then used on samples that do not pass the screening test.

In some areas, electronic methods of cell counting are in general use, such as the Coulter Counter or the Fossomatic. Such methods are more automated and eliminate much of the tediousness and human judgement required in making a microscopic count.

A high count reported to the producer should alert him to the fact that a problem exists, and that he should immediately take steps to find the cause and to determine which animals are affected. If the count is not repetitive, it may indicate simply that some cows in the herd are reaching the end of their lactation. Since they are producing only small amounts and the milk has become abnormal, they should be dried off.

However, in many cases it is not that simple to make the correction. The cell count history may indicate that a problem has been developing over a period of time and has become quite serious. A complete overview of herd management, milking

procedures, and a thorough check of milking procedures, and a thorough check of milking equipment should be made. This will include milking time visits by the fieldman

Pesticides

Samples of raw milk should be checked whenever retail samples indicate problems. Load samples should be checked, then individual farm samples. Producers outlined in the latest edition of Official Methods of Analysis of the Association of Official Analytical Chemists should be followed.

Direct Microscopic Count (DMC)

Checking a sample of milk using the microscope should not be the only test used for acceptance or rejection of a bulk tank or load of milk. However, a look at a properly prepared smear may be helpful in determining the source of a bacterial problem. The type of bacteria seen may indicate cooling or sanitation problems. A DMC is suggested during bad weather, emergencies, or when you question the age of a load of milk. PI or 16-hour tank samples may be checked for causes of problems.

Acidity

Do not use the results of a titratable acidity test as the sole basis for accepting or rejecting loads of milk. Milk may have odor, taste, and bacterial problems, yet acidity may be acceptable. On the other hand, results of an acidity test may complement your odor or taste judgments. It may provide valuable information on tank loads of milk, especially when source and age are questionable. Values in the .012-.017% are considered desirable. If results exceed this, do other tests prior to rejecting a load of milk.

Sediment

Results of this teste provide an indication of milk production practices and the cleanliness of cows and surroundings. This test is required in NY State for both manufacturing and fluid milk. Acceptable levels are less than 1.50 mg per gallon of milk.

MILK FLAVOR

Off-flavors commonly found in milk can be classified in three basic categories -- the ABC's of off-flavor development. These are Absorbed, Bacterial, and Chemical. Some, however, are caused by more than one of these actions. Consequently, they are listed in more than one category.

1) Absorbed -- feedy, barny, cowy, unclean, weedy, foreign.

2) Bacterial -- acid, malty, unclean, fruity, putrid and lacks freshness.

3) Chemical -- cowy (ketosis), rancid, oxidized, sunlight, foreign and lacks freshness.

Absorbed flavor defects can develop before, during and after milking and when milk is left uncovered in the consumer's refrigerator.

Bacterial degradation generally results from dirty cows, improperly washed or sanitized equipment, external contamination and improper cooling.

Chemical defects can occur both before and after milking. The cowy flavor is the result of the animal suffering from acetonemia or ketosis. Certain cows, either due to their genetic makeup, the feed consumed, or the stage of lactation, can produce milk that is spontaneously susceptible to rancidity or oxidation. Most rancid and oxidized flavors, however, are induced by poor handling techniques or faulty equipment during and after milking. A foreign flavor can be caused by medications, a reaction to pesticides, disinfectants or any number of contaminants.

Off-Flavors in Milk

In order to detect off-flavors successfully and consistently, it is necessary to first be fully familiar with the characteristics of good tasting milk. Such milk has a pleasant, slightly sweet taste, no odor and no aftertaste. This natural taste must be firmly fixed in one's mind so that it may serve as a reference when evaluating milk samples for flavor quality. It is helpful to have a sample of good tasting milk available for comparison at the time of judging.

The most serious off-flavor problems are: rancid, oxidized, unclean, and microbial. These vary in frequency and intensity depending upon the time of year, the type of equipment used, the production practices followed, and the protection given to the milk. They ruin the delicate sweet taste of fresh milk and produce a lingering after-taste.

JUDGING AND GRADING MILK

Flavoring Milk

Temperature -- 60-70°F (15.5-21°C) -- so that any odor present may be detected readily by sniffing the container.

Noting odor -- by placing nose directly over the container immediately after shaking and taking a full "whiff" of air--any off odor present may be noted.

Also want a temperature rise when taking into the mouth; serves to volatize any notable constituents.

Need to make sure we have a representative sample -- mixing or agitation are important.

Agitation -- leaves a thin film of milk on the inner surface which tends to evaporate -- giving off odor if present.

Sampling -- generous sip -- roll about the mouth -- note flavor sensation -- and expectorate.

Swallowing milk -- poor practice.

Can enhance after-taste by drawing a breath of fresh air slowly through the mouth -- and then exhale slowly through the nose.

With this practice -- can note even faint odors.

Scoring Flavor

Flavor - 10 points

Good flavor of normal whole milk -- pleasantly sweet, no foretaste nor aftertaste other than that imparted by the natural richness.

No "taste". If there is a taste -- look for trouble (defect).

Flavor Groups

Excellent (no criticism)	10
Good	8 - 9.5
Fair	6 - 7.5
Poor	5.5 or less
Bad or Unsalable	No Score

<u>Undesirable Flavors in Milk</u> -- Milk has a <u>flavor defect</u> if it has an odor, a foretaste or an aftertaste -- or does not leave the mouth in a clean, sweet, pleasant condition after tasting.

Some samples may have more than one flavor defect.

In this case, flavor score is reduced to correspond to the most objectionable off-flavor present.

A scoring or judging routine enables the evaluator to make efficient use of his time and facilitates concentration of thought.

It is appropriate to review the evaluation of milk first, since the quality of other dairy products is very dependent upon the quality of the milk used to manufacture them.

The scoring or grading of milk probably demands keener, more fully developed senses of smell and taste than does the evaluation of any other dairy product.

Typical Milk Flavor (no criticism) -- Very little distinct odor. Excellent milk is pleasantly sweet and leaves only a clean, pleasing sensation after tasting. The flavor is quite subtle in character.

Astringent -- Noted by peculiar mouthfeel, tongue and mouth lining feel shriveled, puckered. Occasionally associated with staleness (i.e., milk powder).

Barny (Smothered) -- Has a rather unpleasant distinct odor. Milk absorbed odor of barn, stable, poor ventilation.

Bitter -- If no odor associated, the bitter taste will often not be noted until expectoration, but then it will persist.
Cause: -- Frequently microbiological origin, certain weeds.

Cooked -- Note odor. Sweetish nature. Pleasant. Slightly nutty-like. Lightly heated.
Cause: -- Over-pasteurization, higher heat treatment and/or for longer time period.

Scorched -- Carmelized, cabbage or mushroom-like. Boiled. Note sulphury odor. (Sulphydryl groups from amino acids).
Cause: -- Severe over-pasteurization, too high heat treatment.

Cowy (Acetone) -- Has a distinct odor (medicinal, cow's breath-like), sometimes a persistent aftertaste.
Cause: -- Generally due to animal physiological malfunction, i.e., ketosis or acetonemia, (acetone bodies in the milk).

Feed -- Odor. Aromatic, usually pleasant. Hay, alfalfa, silage (frequently slightly unclean). Usually clears up very readily after discharge from mouth.
Cause: -- Cow consumes particular feed prior to milking, inhales odors from barn or feed lot, the feed etc. transmits it to milk.

Flat -- No odor. Lacks flavor fullness and/or sweetness. Like watered milk.
Cause: -- Adulteration with water, milk low in total solids content.

Foreign -- May have an odor. Not commonly associated with milk. Depends on causative agent, such as chemical sanitizers, miscellaneous chemical contaminants, phenolic-taste, medicinal.
Cause: -- Foreign substance contaminates milk.

Garlic/onion (Weedy) -- Characteristic pungent odor and taste. Highly objectionable.

Cause: -- Animals feeding in weed infected pastures.

High Acid -- Some odor. Sour, tart, tingling sensation on tongue.

Cause: -- Lactic acid producing organisms such as *S. lactis*.

Lacks Freshness (Stale) -- A milk off-flavor defect that lacks specific characteristics to make identification easy. Lacks fine pleasing flavor.

Cause: -- Usually due to age or staleness of sample, may be initial stage of psychrotrophic off-flavor (unclean).

Malty -- Peculiar odor like grape-nuts. Malt-like aroma and taste. Flavor seems out of place. Pronounced malt.

Cause: -- Growth of *S. lactis* var. *maltigenes* in milk.

Metallic -- Easily detected as a "metallic feel", similar to rusty metal or metal foil. Has a quick reaction and adaptation time. Also frequently suggests flatness associated with early stages of metal-induced oxidation.

Oxidized (Copper induced) -- Metallic, wet cardboard, oily, tallowy, chalky. Mouth usually perceives a puckery mouth feel. Taste sensation comes quickly, mouth feel lingers.

Cause: -- Milk fat oxidation catalyzed by copper and certain other metals with oxygen and air. Copper contamination, dry feeding of cows in late lactation.

Sunlight -- Odor, burnt-protein or burnt-feathers-like, "medicinal"-like flavor. Sunlight or fluorescent light-activated. Slight burnt taste.

Cause: -- UV-rays from sunlight or fluorescent lighting catalyze oxidative reaction in unprotected milk. Reason for use of amber-colored glass bottles.

Rancid -- Odor. Butyric acid-flavor, soapy, blue cheese-like aroma, slight bitter. Foul, pronounced after-taste, does not clear up readily.

Cause: -- Hydrolysis of milk fat by lipase enzyme. Improper handling, cooling and pumping of milk. Mixing of homogenized and raw milk is the prevalent cause.

Salty -- No odor. Generally easily and quickly detected. Gives a cleansing feeling to the mouth.

Cause: -- Commonly associated with milk from cows in late stages of lactation and/or mastitis milk.

Unclean -- Unpleasant odor. Mouth fails to clean up after sample expectoration. Sometimes suggestive of mustiness, staleness, spoilage, fruity, putrid, dirty-like, psychrotrophic flavor.

Cause: -- Generally due to the growth of psychrotrophic type microorganisms in poorly processed milk (spoilage bacteria).

MILK FLAVOR SCORECARD

DATE ______________ TIME ________ NAME ______________________________

SAMPLE NUMBER										
SCORE*										
Criticisms:										
Astringent										
Bitter										
Cooked										
Cowy/Barny										
Feed										
Flat										
Foreign										
Fruity/Fermented (Psychrotrophic)										
Garlic/Onion										
High Acid - Sour										
Lacks Freshness										
Malty										
Oxidized/Light Induced										
Oxidized/Metalic										
Rancid										
Salty										
Unclean										

*Score samples on a 10 point scale using the following guideline: Good 8-10; Fair 6-7; Poor 0-5.

SUGGESTED FLAVOR SCORES FOR MILK WITH DESIGNATED INTENSITIES OF FLAVOR DEFECTS

Flavor Criticisms	Intensity of Defect Slight	Definite	Pronounced
Astringent	(8)	(7)	(5)
Barny	(7)	(5)	(3)
Bitter	(7)	(5)	(3)
Cooked	(9)	(8)	(6)
Cowy	(6)	(4)	(1)
Feed	(9)	(7)	(5)
Flat	(9)	(8)	(7)
Foreign	(5)	(3)	(0)
Garlic/onion	(5)	(3)	(1)
High acid	(3)	(1)	(0)
Bacterial	(5)	(3)	(0)
Lacks Freshness	(7)	(5)	(3)
Malty	(7)	(5)	(3)
Oxidized	(7)	(5)	(3)
Rancid	(7)	(5)	(3)
Salty	(8)	(6)	(4)
Unclean	(7)	(5)	(3)

RANCID FLAVORS IN MILK

The incidence of rancid flavors in milk has increased in recent years. This is due in part to abuses introduced by some milk handling practices. Excessive agitation and foaming of raw milk is a primary cause of the increase in rancid flavor.

A rancid flavor in milk is characterized by a sharp, unclean, soapy, astringent taste response that lingers as an unpleasant after-taste. It is often accompanied by a strong odor when the off-flavor is intense. The rancid flavor and odor are frequently associated with stale nutmeats and certain cheeses such as blue or roquefort. It is caused by the hydrolysis of milk fat. This means that fat is split into its basic components of glycerol and free fatty acids. The rancid odor and taste come mostly from volatile, short chain, fatty acids such as butyric, capric and caproic. The soapy sensation comes from the glycerol.

In normal milk, the fat globule is protected by a layer or membrane of lecithin and protein which prevents the lipase from reacting with the fat. Whenever the fat globule membrane is weakened or disturbed, the lipase makes contact with the fat, resulting in hydrolytic rancidity. This membrane damage is caused mechanically by violent agitation, such as excessive pumping, pipeline obstructions or homogenization of raw milk. The membrane is usually in a less protective state in the last stages of lactation.

It takes some time for rancid flavor to develop after lipase action upon fat has been initiated. Usually, with fluid milk, several hours will pass before any off-flavor is detectable, and up to 24 to 48 hours before the peak intensity of off-flavor is reached. Conventional pasteurization was once generally assumed to halt any further natural lipase activity. This may not be true of lipases produced by bacteria. In any event, it does not remove or reduce the off-flavor already present.

Rancidity in milk can be measured both chemically and by the sense of taste. A chemical test is often useful in confirming low or questionable levels of rancid flavor. The most common chemical test is known as the "acid degree value", or "ADV". Normal milk has an ADV of 0.40 to 0.80 by the Thomas, Neilsen, Olson method.[1] A person sensitive to rancid flavor will not generally detect any rancidity until the ADV reaches about 1.0. Some will not notice this flavor until the ADV is well above 1.5. Milk with an acid degree value above 1.5 is usually considered rancid or well on its way to becoming so. However, it should be clear that the ADV is not an accurate measure by itself. It must always be confirmed by a reliable taste judgement.

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[1] Procedures available from author in reprint form.

CAUSES

The mechanism that causes rancid flavor is often called "lipolysis", and includes all natural enzymes which have the ability to hydrolyze glycerides in milk fat. These lipases either originate in raw milk, or are produced by certain bacteria. The natural lipolytic enzymes are heat sensitive and are believed to be destroyed by pasteurization.

Natural lipases in raw milk are not a problem if fat globule membranes remain intact. However, when the globule surface is broken through rough mechanical treatment, the fat is exposed and the hydrolysis begins. This is called induced lipolysis and is a principal problem with farm milk supplies. It can be induced anywhere along the line up to the time of pasteurization or heat treatment. The degree of rancidity is definitely limited by the quantity of fat globules with damaged membranes.

On rare occasions, spontaneous lipolysis or rancidity may occur. This spontaneous rancidity has no apparent external stimulus. Someday, research in the area of genetics and animal nutrition may uncover the reason for this phenomenon.

Both induced and spontaneous rancidity can occur simultaneously, making it difficult to assess the cause and correct the problem. Timely pasteurization (within 48 hours) particularly when the heat treatment is above 170~ F, can minimize both rancid flavor developments.

Bacterial Lipases

There is new evidence that pasteurization does not totally destroy bacterial lipase and this may be responsible for some rancid flavor development in stored milk. These come from psychrotrophic bacteria which produce lipase and often gain entry to the product as a result of post-pasteurization contamination. Certain species of *Pseudomonas*, *Achromobacter*, *Aerobacter*, *Bacillus*, *Flavobacterium*, and *Micrococcus* may produce these enzymes.

Many of these organisms can be harbored in the crevices of pipelines, gaskets, and fillers, as the result of poor cleaning and incomplete sanitizing. Several recent studies have shown increases in acid degree values and rancid flavor in samples of milk held for shelf-life testing.

Summary of Causes

Basically, rancidity can be activated by any of the following situations:

1) Temperature activation (warming cold raw milk to 86 F 30 C, and recooling);
2) State of lactation (weakened protective membrane);

3) Excessive agitation caused by any of the following:

    a. Pipeline obstructions and risers
    b. Underfed or starved pumps
    c. Air leaks in pipelines
    d. Partially filled transport tanks or containers
    e. Improper pasteurization
    f. Leaky valves
    g. Homogenizing raw milk (unless immediately pasteurized)
    h. Mixing homogenized milk or homogenized milk products with raw milk or raw milk products

4) High psychrotrophic bacteria counts in raw milk; and

5) Post-pasteurization contamination by bacteria that can produce lipase.

RANCIDITY ON THE FARM

Many rancid milk problems can be traced to situations which exist on the farm. In some cases, it has been found that individual cows spontaneously produce rancid milk regardless of stage of lactation. However, stripper cows or cows in the late stage of lactation generally are the main sources of milk which is rancid at the time of milking. This is apparently due to the misformation of fat globules and an inadequate protective coating of lecithin.

Often the influence of the cow on rancidity can be reduced by proper farm management. The following recommendations can be helpful:

1) Avoid long intervals between milking (should be equal interval between evening-morning and morning-evening milkings).

2) Dry off cows in late lactation and low production.

3) Spread calving over the entire year to avoid a peak in number of late lactating cows.

4) Cull cows that produce spontaneously rancid milk.

5) Avoid feeds that may cause or impart a rancid flavor. (High concentrations of liquid protein supplement can give a rancid-like taste to the milk.)

6) Check feeding program to be sure adequate protein is fed in relation to level of cow milk production.

By far, the greatest damage takes place in handling milk after it is taken from the cow. Equipment should be designed and operated to insure a gentle flow to reduce the breakup of the globules. Milk is most susceptible to damage while it is warm and the fat is liquid. Care must be taken to eliminate as much air as possible.

1) Check pipelines for leaky gaskets and fittings.

2) Limit air intake at teat cup clusters to the minimum.

3) Avoid sudden breaks in vacuum during milking.

The milking system should be engineered to produce milk that would have acid degree values no higher than that of hand milking. Farmers should get this assurance from the dealer at the time of purchase. Items to look for in a properly designed system are:

1) Pipeline of large enough diameter (to prevent flooding);

2) Milk line kept as low as possible to minimize lift at stall or parlor;

3) Milk entering milk line at side or top;

4) No risers;

5) Proper slope all the way to releaser jar;

6) Proper controls to prevent pumps from running in a starved condition (pump chamber must be full);

7) Inline filter placed on discharge side of pump;

8) Bulk tank of proper size. If tank is too large, agitation will be impossible at first milking; and

9) Milk not allowed to freeze on refrigerated surface of tank. Freezing will disturb fat globule membrane. If milk freeze-on" is a problem, start compressor for bulk tank <u>after</u> milk has reached the agitator. If milk does not reach the agitator <u>before</u> the end of the first milking, other measures must be taken.

Similar care must be exercised by the bulk tank driver to prevent rancid flavor development. Milk can be easily damaged by the following practices:

1) Partial pickups, leaving the remainder for another one or two days.

2) Extending the collecting period to more than every other day.
3) Pumping air and foam when farm tank is empty. Truck pump should not run more than 30 seconds at end of pick-up.

4) Transporting partial tank loads over long distances.

5) Excessive agitation of mix tank loads prior to sampling.

There appears to ba a cumulative effect in each step of assembling a milk supply. Everyone involved must do his share to minimize the damaging effects of mechanical handling.

RANCIDITY IN THE DAIRY PLANT

As long as milk is in the raw state, excessive agitation in the plant is likely to expose more fat surface and cause rancidity. The plant activities listed below may be responsible for producing rancid flavors:

1) Pumping raw milk through underfed centrifugal pumps or obstructed pipelines (equipment should be sized to similar capacity). Prevent leaky fittings.

2) Violently agitating warm, raw milk.

3) Mixing warm and cold milk to a blend temperature of about 85 F and recooling without pasteurizing.

4) Separating or clarifying warm raw milk (not immediately followed by pasteurization).

5) Homogenizing raw milk at temperatures below 140 F (60 C) and not pasteurizing immediately.

6) Mixing homogenized and raw milk or homogenized products with raw milk (i.e., returned milk).

7) Improperly or incompletely pasteurizing (returning drippings from a batch pasteurizer with a leaky valve to the vat at the end of the holding period).

8) Holding raw milk any longer than necessary before pasteurizing and processing. Forty eight (48) hours should be the maximum from farm pickup to container.

9) Adding fresh milk to a storage tank before it has been emptied, thoroughly cleaned and sanitized.

The most effective means of controlling rancid flavors in the plant is rapid processing. Rancidity can be prevented, and in some cases activated milk can be stopped short of a detectable off-flavor level by pasteurizing as soon as possible.

Homogenized milk and raw milk should never be mixed, or allowed to come in contact with the same unwashed surface. The mixture will become rancid very quickly, although neither product by itself is susceptible. The ruptured fat globules of homogenized milk have no protective coating and the lipase in the raw milk can readily react with the fat. Should it be necessary to utilize homogenized milk returns with raw milk for manufactured products, the raw milk should first be pasteurized or the mixture immediately heat-treated after combining the two.

Checking Milk for Rancid Flavor

The fastest and often most effective way to check milk for rancidity is to taste it. The sample should be placed in a covered jar or bottle. It should be smelled and tasted at a temperature of 60 F to 70 F (15-21 C).

The sample should also be heated (in a closed bottle) to 135 F (55 C). If the milk is rancid, it will have a sharp odor.

The acid degree value is useful to confirm an organoleptical finding and to measure increases at various stages in the plant operations.

Control

A rancid flavor problem is a most serious situation which will immediately affect the marketing of milk. There will be consumer complaints, returns, and possibly a permanent loss in customers. Immediate steps should be taken by the dairy plant management and field staff to track down the source.

First, determine if the source of the problem is in the plant, on the farm, or a combination of the two. The following procedures should be followed:

1) Check the flavor of milk from bulk storage tanks. Remember that it takes time for rancid flavor to develop.

2) Make a thorough inspection of plant equipment and practices, looking particularly for any of the following:

    a. Pumping, separating, clarifying or homogenizing warm milk at 96-120 F (30-49 C);

    b. Other excessive agitation or foaming, and mixing milk and foam;

c. Warming to 86 F (30 C) and cooling raw milk (such as pumping warm milk into a holding tank which had a small portion of previously cooled milk);

d. Improper pasteurization (such as a leaking valve);

e. Mixing raw and homogenized milk or using cotton unwashed vats or pipes for both products;

f. Holding raw milk too long;

3) If the problem is <u>not</u> found in the plant, the fieldmen or bulk tank drivers should immediately take samples from individual producers. Generally, one-half pint samples of mixed herd milk from each producer will be sufficient. Half of this sample should be laboratory pasteurized and evaluated for flavor and odor. The other half should be stored at 40 F (4.5 C) for three days, then laboratory pasteurized and evaluated.

4) If the check of herd samples shows some farm milk to be rancid, the following steps should be taken:

   a. Determine the stage of lactation and level of production of all milking animals. Cows giving less than ten pounds of milk per day or within six weeks of freshening should be dried off;

   b. Recommend that the producer check protein level in feed in relation to milk production;

   c. Immediately inspect milk handling equipment, looking for:

      1) Pipeline agitation, risers, air leaks, leaky fittings or excessive pumping.

      2) Temperature activation.

      3) Improper cooling of bulk tank milk, or mixing evening and morning milk in can milk operations.

   d. If necessary, individual samples should be taken from each cow in the herd. This sample should be divided into two parts, the first part to be laboratory pasteurized and examined as soon as possible and the second part to be examined two to three days later. (Do not pasteurize second part until it has aged two or three days.) If individual cows are producing rancid milk, their milk should be excluded from shipment.

SUMMARY

Rancid flavor problems have a way of developing slowly over a long period of time. Regular tasting of the finished product by a critical flavor judge is the only way to prevent the problem. Plant managers and quality control directors must think "rancidity prevention" and avoid all practices that could contribute to the flavor.

Sanitarians, engineers, animal scientists, and the various regulatory agencies must work together to protect the delicate taste of milk. Efforts need to be coordinated to ensure that introduction of new milk handling equipment and practices do not lead to rancid milk.

MICROBIAL FLAVORS IN MILK

Introduction

Bacterial flavors are characterized by terms such as lacks freshness, malty, putrid, fruity, spoiled, sour, and even unclean. The source of bacteria is unclean equipment which was not completely washed or sanitized. This may be at a location between the cow and the container. After the initial contamination, age and temperatures above 40 F permit growth of bacteria. These flavors are the result of bacterial growth. As few as 50,000 psychrotrophs or other spoilage bacteria per ml may cause objectionable flavors. The type of bacteria is more important than the numbers.

Milk is an excellent growth medium for bacteria. It provides the nutrients and moisture and has a near neutral pH. Oxygen is present and when milk temperature rises above 40 F all conditions necessary for growth are present. The higher the temperature, the more rapid the growth. However, psychrotrophic bacteria will grow at 40 F or less and cause spoilage of milk within a few days.

Raw milk seldom becomes sour until millions of lactic acid producing bacteria are present. Proper cleaning and sanitizing of equipment and adequate cooling prevent the growth of the Streps. However, low levels of psychrotrophs may eventually multiply causing off-flavors even when acidity is normal.

Psychrotrophs include many kinds of bacteria, all of which cause spoilage. Their ideal growth temperature is 65-70 F. However, low levels of psychrotrophs may eventually multiply causing off-flavors even when acidity is normal.

Psychrotrophs include many kinds of bacteria, all of which cause spoilage. Their ideal growth temperature is 65-70 F. However, they will grow at refrigerator temperatures especially above 40 F. Cold temperatures slow the growth of psychrotrophs, but do not kill them. At 45 F or above growth is steady and off-flavors may be present in 2-3 days.

There are three separate bacterial flavor problems. Usually it is possible to identify malty, high acid or sour and putrid or other spoilage tastes.

Malty

Milk with a malty flavor tastes like the grapenuts and milk which you might eat for breakfast. In fact, that is how we make a malty sample, by adding a tablespoon of grapenuts to a quart of milk. The real cause is lack of cooling. However, the taste is the same.

The usual cause is someone forgetting to turn on the bulk tank at the first P.M. milking, then realizing it the next A.M. Most dairy farmers cool the milk, add the next three milkings and hope. If a milk hauler smells and tastes the milk before collecting it, he would most likely reject it. However, milk which is not properly cooled, will always be of unacceptable bacterial quality and flavor. Unfortunately, the problem becomes much greater as the milk from one bulk tank is mixed with that from many others and mixed again in a plant raw milk storage tank.

A sample of milk from a farm bulk tank not cooled for 12 hours will always have a high bacteria count. This may be a few hundred thousand or the bacteria count may be a few million per ml. This all depends on the source and amount of contamination. If all milking equipment had been thoroughly cleaned and sanitized before use, the bacteria count might be near the 100,000 per ml regulatory maximum.

Malty flavor is generally the forerunner of high acid or sour. It is the result of a large number of Streptococcus lactis variety maltigenes. This rarely develops in pasteurized milk. However, the characteristic flavor will remain after processing, even though the flavor developed in the raw milk. If not stopped by pasteurization, a malty flavor will later become high acid or sour.

To determine if a problem exists in raw milk, taste it and run a SPC. Titratable acidity may increase only slightly. Do not rely on the results of this to determine acceptability of raw milk. Bacterial counts in the millions per ml are usually necessary to cause malty or spoiled flavors.

High Acid or Sour

Sour milk used to be a common problem. With adequate cooling, the problem has virtually disappeared. Most milking equipment used to be washed only once a day and seldom sanitized. Bacterial contamination was present and slow cooling allowed bacterial growth.

Bacterial growth is necessary for the manufacture of cheese and buttermilk. However, bacterial flavors are not acceptable in milk for fluid or manufacturing purposes.

To prevent malty and high acid flavors, wash all milk handling equipment surfaces after each use and sanitize them just prior to reuse. This means washing all milking units, pails and pipelines on a twice-a-day basis. Farm bulk tanks must be washed each time they are emptied, usually every-other-day. An occasional rinse job is not good enough.

Teats and lower udders should be washed with a sanitizer solution and dried. Use iodine at 25 ppm as a sanitizer. Cow cloths or paper towels are recommended for getting the solution to the udder. Avoid sponges.

Be sure that all milk is collected from the bulk tank at least every other day. Longer time periods or partial emptying of a tank causes problems. Any milk left in a bulk tank for more than three days because of weather or travel conditions should be dumped. If collected it will cause problems of high bacteria counts and off-flavors for fluid milk or manufactured products.

Putrid

Most of the bacterial flavors are caused by spoilage bacteria called psychrotrophs. These flavors may be stale, lacks freshness, fruity, spoiled or putrid. Frequently the pH and titratable acidity may be near normal.

Putrid flavors are the result of bacterial contamination, storage temperature above 40 F and age. Spoilage of the milk is by bacterial action on the protein rather than on the lactose. In the case of malty or high acid milk, spoilage is due to bacterial action on lactose. Putrid milk will curdle, separate and may smell rotten if left for a few days.

The most common source of the problem is contamination in processing plants following pasteurization. Psychrotrophs do not generally survive pasteurization unless large numbers of bacteria are present in the raw milk. Usually the contamination occurs because some part of the pumping, holding and filling system is not clean and not sanitized. Much of the fault is in fillers which are not overflowed with sanitizer solution or hot water.

When gross contamination takes place after pasteurization, the milk may spoil in two or three days. Frequently, a problem may not be noticed until samples are held for 7 to 10 days. In either case, the cause is usually contamination after pasteurization.

Early stages of putrid flavors are noted by stale or lacks freshness tastes. This soon develops into a distinctly putrid odor and finally to separation into curds and a watery fluid.

Bacterial flavors are more of a problem during hot weather. Field work on farms serves as an excuse for washing pipelines once a day and giving bulk tanks only a good rinse job. In plants, problems increase when regular employees are on vacation and inexperienced help sanitize equipment, operate processing system controls and run the fillers. With proper supervision, a satisfactory job could still be done. However, those in charge may be on vacation.

Putrid flavors may originate in raw milk, caused by contamination and holding raw milk for three or four days after collection from farms. Occasionally, retail samples of milk are fund with putrid flavors and excellent bacterial counts. This can be caused by bacteria counts in the millions in the raw milk at the time of pasteurization. Proper pasteurization and packaging without contamination eliminates most of the psychrotrophs. Even though virtually all bacteria are destroyed, the spoiled flavor remains. No heating, vacuum treatment or other processing procedure will lessen the flavor.

Prevention

This involves strict sanitary practices to prevent contamination of milk, keeping it below 40 F at all times, getting it processed within 48 hours after collection and consumed within 10 days of packaging. Milk does not improve with age. It must be treated as a highly perishable food.

To prevent microbial flavors, follow a regular quality control program which includes tasting samples from every load when received at the processing plant. If any off-flavors are noted, you should taste samples from each individual farm.

The situation regarding raw milk quality has improve greatly in recent years because of two practices. These have been adopted in many areas of the country. They include universal sampling and performing Preliminary Incubation Counts (P.I.). An aseptic sample is collected from the farm tank at every pickup. Either sterile plastic bags or vials are used. They are transported in ice and may be used for any test. These samples should be held for the past two pickups until the raw milk has been processed and distributed.

P.I. Counts and milk from each farm should be tested once or twice each month. The results of this test provide a much better indication of production methods and the potential shelf-life of raw milk than does a Standard Plate Count (SPC). The test involves holding a sample at 55 F for 18 hours then following the same procedure as for an SPC. Industry standards should be the same as for the SPC.

Maximum	-- 100,000 per ml
Goal	-- 10,000 per ml

Plants should collect samples from every load of raw milk when it is received. In addition to flavor, freezing point, compositional tests, and bacterial counts should be made. Results will be history, but you have a record, so that you know what to expect from each source.

Major emphasis should be placed on testing load samples rather than individual farm samples. it is less expensive, and provides a broad picture of the entire raw milk supply.

The results of an acidity test and microscopic examination may be helpful for load samples. Do not use the results of either test as the sole reason for accepting or rejecting loads of milk. In general, our raw milk supply is of such good bacterial quality that these tests are of little value. In addition, they fail to detect our more common off-flavor problems. Odor and flavor judgments by trained, experienced persons are much more valuable.

Whenever erratic or partial collection practices are suspected, an acidity test or microscopic examination can be worthwhile. This may be necessary following severe winter storms. These tests may be helpful in determining when a farm has refrigeration problems. However, this could be detected by tasting milk, also.

Normal acidity tests results vary from .13 to .17% depending upon composition. Before a hint of acid taste can be detected this must usually rise above .20%. It can safely be used for fluid purposes if acidity does not exceed this and you cannot detect any acid taste at the time of pasteurization.

To satisfy regulatory standards, bacterial results of load samples must be less than 300,000 per ml. When using the microscope for screening, a value of 300,000 to 500,000 per ml should be used. Do not be satisfied with counts of 1,000,000 or more per ml whether the milk is intended for fluid or manufacturing purposes.

Samples of milk from farms should be tested on a frequent but irregular schedule. When you have universal samples, test those collected on Saturday, Sunday and holidays. Avoid the testing of samples collected only Monday through Wednesday as was done for many years. You need to know the quality of milk received seven days each week.

Proper temperature cannot be over emphasized. Raw milk should be cooled to 40 F and held there (or below) until consumed. For maximum shelf life 45 F is not acceptable. See Chapter 12 for recommended handling procedures for packaged milk in plants, stores, schools and homes.

Utilize a variety of quality control tests to assure maximum shelf-life. See Chapter 10 for other recommended procedures.

Proper cleaning and sanitizing procedures for farms and processing plants can be found in Chapters 7 and 8. The step most frequently eliminated is that of sanitizing. For raw milk either iodine at 25 ppm or chlorine at 200 ppm are recommended. Whenever possible, equipment used for pasteurized milk should be hot water sterilized. Water must be at least 170 F at the discharge point and must be circulated for at least five minutes. All surfaces must be sprayed or flooded.

A list of prevention measures to avoid high bacteria counts of raw milk from farms includes the following:

A) Cows

  1. Reasonably clean.
  2. Hair clipped from udders, teats and flanks.
  3. Free of disease.

B) Udder Washing

  1. An iodine sanitizer used and maintained at 25 ppm.
  2. Solution is in clean plastic, rubber, or stainless steel pail.
  3. Individual paper towels or cow cloths are used.
  4. Solution is changed when brown color disappears or when dirty.
  5. Teats and udder are dried with individual towel.

C) Production Methods

  1. Cows are fenced out of muddy or swampy areas.
  2. A strip cup is used at every milking.
  3. Chores such as feeding, sweeping, and bedding are not done during milking.
  4. Filter material does not plug and is reasonably free of bedding and dirt.
  5. Hand stripping and "wet-hand" milking are not done.

D) Cleaning Materials and Procedures

  1. Adequate hot water is used at 140~F or above.

2. Water has been tested for hardness and other conditions and is treated if necessary.
3. A cleaning program is posted, and followed.
4. Directions for temperature of solutions, amounts of cleaner and sanitizer, and quantity of water are followed.
5. Necessary brushes, cleaners and sanitizers are used.

E) Milking Equipment

1. Inflations and other rubber or plastic parts are clean, smooth, and free of cracks.
2. Vacuum hoses are clean and stored dry.
3. Gaskets and valves are removed and clean.
4. Check valves are in good condition and clean.
5. Pulsators are clean.
6. Vacuum line is properly sloped and reasonably clean.
7. All surfaces drain or are dried by forced air.
8. All milk contact surfaces are free of deposits when dry.
9. Surfaces not cleaned by circulation are hand washed.

F) 1. Thermometer is accurate within 1 F.

2. Milk is held below 40 F.
3. Valve, bridge, agitator, and other surfaces are clean.
4. A rinse hose equipped with dispenser is used for sanitizing.
5. Condensation does not collect on ceiling or overhead pipes.
6. Milk is removed for house or other uses only through the outlet valve which is sanitized after use.

Facilities and Animals

Cows areas should be reasonably clean. Cows should not be permitted in areas where mud and stagnant water will get on udders and teats. Spoilage bacteria are usually found in large numbers under such conditions. These include coliforms, psychrotrophs, and other types of bacteria which cause high SPC or PI Counts.

Hair on udders, teats, and flanks should be clipped to make udder washing easier. Cows should be provided with clean, bedded stalls for resting.

Washing and drying udders and teats with a sanitizer solution is required by regulation. A clean, nonporous pail should be used. Iodine sanitizers are recommended because of the color indicator. A concentration of 25 ppm and a brown color should be maintained. Individual paper towels are the ideal material for washing and drying udders. Man-made fiber cloths are satisfactory, but sponges should never be used. If cloth toweling or other cotton material is used, it should be for individual cow only and not reused until washed and sanitized. A supply should be washed and dried in the household washer and dryer. Sponges and cloths usually do not dry between milkings and are a major source of bacterial contamination of milk.

Cows' udders and teats should be washed about one minute before attaching the unit to stimulate milk letdown. A strip cup should be used to check milk from each quarter after the udder and teats are dried.

Chores which stir up dust should not be performed during milking. Sweeping floors and bedding cows are examples of what should not be done at this time. Feeding should be avoided during milking, if possible. Grain may have to be fed. However, silage and hay should be fed only after milking is completed.

When cows are machine-milked, hand stripping should not be necessary. "Wet-hand" milking should not be done under any circumstances.

Check filter material to determine if proper production practices are followed. Filters should remain relatively clean and should not plug or break under pressure. Sediment testing and nylon screens at outlet valves are suggested ways of determining if proper practices are followed during milking.

Cooling

Milk should be cooled to 40 F or below within two hours after milking. On subsequent milkings, the blend temperature should not rise above 50 F and should be cooled to 40 F or less within one hour and maintained at that temperature until collected.

Check bulk tank thermometers to be sure that they are accurate. Milk samplers should regularly check temperature of milk in each tank and show this on the patron receipt.

Condensers should be kept clean. Frequently, condensers become clogged with dust and dirt and operate poorly. Air cooled units should be provided with adequate air, and water cooled units should be kept free from scale. Bulk tanks designed for every-other-day collection should never be filled to more than 25% capacity for each milking. They cannot be used for every day pickup, unless designed for this purpose. When production exceeds tank capacity, a larger tank should be in stalled.

Refrigeration systems should be equipped with automatic controls. It is recommended that milk in bulk tanks be agitated every hour.

Recording thermometers are a useful tool to monitor milking cooling and cleaning practices. Portable units should be available for sanitarians to use when problems are suspected.

Other Possible Causes

On rare occasions a serious herd infection problem may contribute to an increased bacteria count. However, cooling usually prevents growth of these bacteria, so levels seldom exceed 50,000 per ml. Individual quarter samples may be high, but this does not usually affect a bulk tank sample.

Do not consider cows as a possible source of a high bacteria count until all other causes have been eliminated. A milking time inspection usually reveals other sources of contamination. The sanitarian should arrive well before milking starts and check cleanliness of all equipment. then observe sanitizing, udder washing and milking practices. Take aseptic samples and immediately cool in ice to confirm suspicions.

Make a thorough inspection. Do not hesitate to ask questions of the dairy farmer, his family, or hired help who may do milking and cleaning.

Remember that high bacteria counts and high somatic cell counts are not related. Do not look in one area as the cause for the other.

Water may be another source of bacterial contamination. This may be from the water supply or condensation which gets into milk. All water used for rinsing and sanitizing should contain iodine or chlorine unless water is free of coliform bacteria. A potable water supply is a must on all dairy farms. However, some farm water supplies are not totally free of bacteria. Never rinse a sanitized surface with plain water.

Avoid rinsing the top of a bulk tank with a hose. Water frequently splashes under covers and into the milk.

When rinsing pipelines or transfer systems, disconnect them from the bulk tank. All water should be discharged to drain.

Do not dip containers into the bulk tank to remove milk for household use or for sale. Rinse the bulk tank valve before and sanitize after use. The cap should be replaced on the valve.

Occasionally milk samplers or laboratory technicians may contribute to increased bacteria counts. Samples must be collected under aseptic conditions, held at temperatures below 40 F, and tested within 36 hours of collection. Milk samplers must carry sampling dippers in proper strength sanitizer solution such as 25 ppm iodophor solution or 200 ppm of a hypochlorite solution. Check solutions at the end of collection route. Sampling containers must be protected from contamination from dirt or moisture.

Laboratories must test all samples within 36 hours of collection. This means that samples collected in the morning must be tested the following afternoon at the latest. Two successive days' samples cannot be accumulated and sent to the laboratory. This has been common practice in past years. However, the first day's samples were at least 48 hours old when tested.

Laboratory technicians should be trained and supervised by an experienced laboratory director. Acceptable variation of bacteria counts is plus or minus 30% between technicians for the same sample of milk.

Dairy sanitarians should receive written results of all high bacteria counts within 7 days after collection. This permits them to determine causes of all high counts before rechecks are taken. Notification of sanitarians by telephone the day plates are counted is recommended for all results over 50,000 per ml.

Correction

Lists of corrective measures can be helpful. However, they include only the more common causes. To correct bacterial flavor problems traced to one farm, check these items.

1) Be sure that the bulk tanks is turned on and cooling the milk. Dump any milk which remains unrefrigerated in the bulk tank overnight.

2) Wash all milking equipment (after each use) with dairy detergents and the recommended procedure. Brush all surfaces and disassemble valves and other parts.

3) Sanitize all milk contact surfaces with a chlorine solution of 200 ppm or iodine at 25 ppm. Let drain, but do not flush with untreated water.

4) Observe udder washing practices to be sure that a proper strength sanitizer is used. Wipe excess moisture from teats using cow cloths or paper towels but <u>NOT</u> sponges.

5) Check the water supply to be sure that it does not contain coliforms or psychrotrophs, or have a high total bacteria count.

6) Keep milk temperature below 40 F at all times as determined by an accurate thermometer.

To reduce P.I. Counts of milk on farms, the majority of causes can be eliminated by doing the following:

1) Clip hair from udder and flanks of cow and keep them reasonably clean.

2) Use a sanitizer solution for washing cows' udders. The iodine compounds provide a color indicator at the proper strength of 25 ppm. Use paper towels or cow cloths (not a sponge) to wash and dry the lower udder and teats.

3) Wash all milk handling equipment after each use. Disassemble and clean valve, covers, bridge and agitator of bulk tank each time milk is picked up. Clean milker units, transfer system or pipeline <u>twice</u> each day using dairy detergents and a recommended procedure.

4) Sanitize all milk contact surfaces with a chlorine or iodine sanitizer solution. Proper strengths are 200 ppm chlorine or 25 ppm iodine. Do this just before using the equipment and not after cleaning.

5) Cool your milk to 40 F or below within two hours after milking. Blend temperatures should not exceed 50 F during the second and subsequent milkings.

6) Check the bacterial count of your water supply to be sure that it contains no coliforms or spoilage bacteria.

Correction of coliform or psychrotrophic problems in plants involves many pieces of equipment and a lot of specific locations. This list includes the most common sources of trouble.

1) Lines, valves and pumps are not thoroughly clean after each processing day. All parts not satisfactorily cleaned by circulation, must be disassembled and washed in a parts wash sink or by hand.

2) Pasteurized surge tanks, including agitators and measuring gauges may not be clean. Check all parts on at least a weekly basis to be sure they are free of deposits.

3) Fillers are the most critical area. All milk contact surfaces must be manually brushed or circulation cleaned. Treat bowl covers, defoamers and plastic hoses as milk contact surfaces. Include them in your regular cleaning and sanitizing procedures.

4) Close all cases of empty paper or plastic containers to prevent entrance of dust and bacteria. Use partial cases within a few days. Although this is not a common cause of coliforms, it represents good sanitary practices.

5) Be sure that moisture condensation from pipes or ceiling cannot drop into vats or filler bowls of pasteurized milk. Whenever possible locate water, steam and milk lines other than above vats and fillers. Keep all openings on vats and fillers covered at all times.

6) Common lines should never be used for both raw milk and pasteurized. Rinsing between uses will not eliminate all bacteria. If it is necessary to use a common line, pump or plastic hose for both raw and pasteurized milk, it must be completely rinsed, washed and sanitized each time.

7) Occasionally a fitting may leak, or a gasket may break. Whenever surfaces are touched by hand or hands are put in milk, start the processing procedure over. This means repasteurizing all products involved, and cleaning and sanitizing all milk contact surfaces.

8) A water supply will frequently contain coliform and spoilage bacteria. Therefore, NEVER rinse off fillers or any pasteurized milk equipment with plain water from your well or a municipal supply. Always use a sanitizer solution to rinse mandrels, filler valves and covers on vats.

9) Check pumps, drums and solution tanks to be sure that they contain cleaners and sanitizers and that they are dispensed into the system at the correct time.

10) Use test kits to check strength of cleaning and sanitizing solutions. This should be done on at least a monthly basis. Some plants which have their own laboratory make this a weekly practice.

11) The most common cause of coliforms is failure to contact all milk equipment with hot water or a chemical sanitizer. To be effective, hot water must be at least 170 F as it discharges from filler valves and should be circulated for at least 5 minutes. Chlorine sanitizers should be at least 100 ppm as discharged and iodine sanitizers at least 12.5 ppm. Let drain from equipment and do not rinse.

12) The most important factor in preventing coliform problems of milk is the operator. Even with automated cleaning you need to check to be sure that all surfaces are clean, that cycles are completed and that temperatures are maintained, especially for hot water sterilization.

The majority of microbial flavors of pasteurized milk are the responsibility of the processing plant management. Prevention would include these points:

1) Process raw milk within 48 hours of collection from farms.

2) Follow recommended procedures for pasteurization.

3) Empty, wash and sanitize raw milk storage tanks each processing day.

4) Thoroughly wash and hot water sterilize all processing equipment at least daily.

5) Use open dates on all fluid product containers not to exceed 10 days from date of processing.

6) Place milk in containers at 40 F or below and keep at that temperature until consumed.

7) Do not permit exposure of milk to moisture, condensation or other means of contamination.

8) Allow plant personnel time to clean and sanitize processing equipment. This may take 20% or more of the daily work schedule.

9) Secure the support of top management for all quality control efforts. Commitment from management, supervisors and all workers is essential.

TRANSMITTED FLAVORS

(Feed and Unclean)

Transmitted flavors are described as feed weed, cowy, barny and unclean. Some grass or silage flavor is common in milk and is readily accepted. Only the strong objectionable odors and flavors are considered here.

Strong transmitted flavors in raw milk are found in 10% or more of samples from farms depending upon the time of year. The incidence is much higher during the winter months when cows are kept inside. However, some problems may arise when cows are on pasture or eating green chop, especially in early spring.

Transmitted flavors may enter milk as a result of what cows eat or by odors they inhale. These are usually absorbed through the cow's system rather than directly into milk. The primary causes are feeding silage or total mixed rations before milking, and allowing strong odors of feeds to accumulate in cow housing areas. Unclean flavors may come from cows with ketosis, other metabolic disorders, dirty milking equipment or strong odors in the barn.

Feed flavors vary from sweet to bitter and may be accompanied by an odor. These are usually detected rather quickly after a drink of milk. Frequently the after-taste disappears soon after the milk is swallowed. The strong bitter flavors, like those that are unclean, tend to remain in the back of the mouth for a few minutes.

Scores for feed flavors may vary from 9 for very slight to 5 or below for strong flavors. The dairy industry needs to be concerned with the strong flavors which score 6 or below. A milk sample with a slight unclean flavor may score 7. However, most ar 6 or below. Samples of milk from farms or loads of milk with objectionable flavors should be rejected. Any sample scoring below 6 causes consumer complaints, rejection of milk and loss of sales.

The two primary methods of flavor absorption are by the digestive or respiratory systems. This can be diagrammed as follows:

Breathing

Mouth or nose → Lungs → Blood → Milk

Ingestion

Mouth → Digestive Tract → Blood → Milk

Fortunately, not all flavorful substances inhaled or ingested by the cow are deposited in the udder and secreted in the milk. Some go to all organs of the body and some are excreted. The lungs will remove some of the compounds as the blood circulates and these are exhaled. However, if the atmosphere is still heavily laden, more will be absorbed into the blood stream than is removed. Consequently, as long as the cow is eating or breathing these volatile substances, the blood will become more and more saturated and more flavor will be deposited into the milk.

When the cow no longer has access to the strong flavor material, or if the feed does not have a strong odor and the barn is well ventilated, the process is reversed. Odors in the milk are picked up by the blood in the udder and are removed as the blood again passes through the lungs. This is in turn exhaled by the cow. If the cow is taken off the offending feeds or weeds two to four hours prior to milking, and the atmosphere up to milking time is relatively odor free and well ventilated, most of the feed and weed off-flavors are eliminated.

This dynamic equilibrium between the lungs, the blood stream and the udder cells should be carefully described to the dairymen having a feed, weed or unclean problem. It is important to point out that inhaled odors enter the milk supply much more rapidly than those that are ingested. The odor of a raw onion, placed in front of a cow, may show up on the milk in as little as 20 minutes. The result of eating bitterweed, on the other hand, might not show up in the milk for one or two hours. A similar situation exists for the reverse process of removing the flavor from the milk. The lungs are more quickly purged of the odor than the digestive tract of the flavor.

Unclean flavors may enter milk by direct contact between milk and dirty equipment, such as a pipeline milking or bulk tank. It may come from bacterial or chemical contamination of the milk after removal from the cow.

Causes

Feeds that may produce an off-flavor in milk are listed below:

All fermented silage or haylage (corn, legume, grass)

Alfalfa (green or hay)

Clover hay

Distiller's or brewer's grain in wet form

Green barley or green rye

Roasted soy beans

Cabbage, turnips, turnip and beet tops

Musty hay or silage

Onions

Weeds (garlic, chives, French weed, mustard, bonesel, buckthorn, pepper grass, skunk cabbage, ragweed, bitter weed, wild dog fennel, tac weed, ailanthus shoots, others)

Some feeds have been shown by experiment to have little or no effect on milk flavor. These are:

Corn, grain

Most concentrates

Oats, rye and green peas

Carrots, pumpkins, potatoes

Soybean hay

Sugar beets and dried pulp

Timothy hay

Molasses

Urea

Abrupt changes in feeding practices cause a feed/unclean flavor of milk. Some of this may be caused by metabolic changes in the cow. However, usually this is due to the lush feed in pastures in the Spring or the silage in the Fall. In the Spring this can be minimized by pasturing cows only a few hours for the first week or 10 days. This could be accomplished by removing cows from pasture just before or right after noontime.

The primary cause of unclean flavor is inadequate ventilation in free stall or stanchion housing. The air must be reasonably clean smelling or an off-flavor will result. Housing, feeding and milking areas must be well-ventilated. This requires movement of sufficient volumes of air by mechanical or other means. Do not rely on the wind or convection on quiet, humid days.

Proper preparation of the cow before milking is of primary importance for flavor control. A recommended program of washing and drying of udders and teats should be practiced. This should include using a sanitizer and single service paper towel on each cow. The udder should be dried before attaching the milking machine. Washing is much more effective when cows are clipped and clean.

Unclean flavor due to dirty milking equipment and utensils can be avoided by proper cleaning and sanitizing. The clean-up chore is lightened by prompt rinsing of milk handling equipment as soon as possible after milking. Follow the directions provided by the manufacturer of the dairy cleaners and sanitizers which are used.

Ketosis may require assistance from a veterinarian. It is generally controlled with a dietary change, but may require medication. It produces a cowy-like strong, objectionable odor in the milk of the affected animal. It also appears on the breath of the cow and the odor may be picked up by neighboring cows, tainting their milk too. This is particularly true in a poorly ventilated barn. Just one cow with ketosis may cause off-flavors strong enough to be picked up when diluted 50 or 60 times in a bulk tank.

Ketosis or acetonemia is due to faulty metabolism in the cow. It appears most frequently in winter and early spring and may be brought on by stresses of calving and freshening. It may be influenced by deficiencies in nutrition or the lack of certain hormones. Acetone bodies are produced and released into the blood stream due to incomplete metabolism of fat. Some acetone and ketone bodies may be imparted to milk via silage or haylage that has undergone abnormal fermentation.

Faulty metabolism may cause other feed/unclean flavors which cannot be corrected by the usual measures. Usually this involves herds that are overfed concentrates, underfed forage or fed rations improperly balanced for protein, minerals and vitamins. Dairy cows are ruminants and proper bacterial action in the rumen requires large amounts of coarse roughage

Control

Transmitted flavors develop at the farm. Except for the unclean flavor caused by dirty equipment, they do not increase in intensity after milk is put into the bulk tank. When these flavors are detected in retail samples or as a result of consumer complaints, the most obvious place to look is the raw milk supply. Check loads of milk and samples from individual farms.

Prevention of feed and weed flavors means elimination of the offending feed from the cow's diet or letting the cow eat it immediately after milking. For example, if cows must eat from pasture containing wild onions or garlic, it should be just after milking. They should be removed 4 to 6 hours prior to the next milking.

Feed bunks in free stall housing systems should be filled with silage just after milking. Put in only the amount which you expect that the cows will eat prior to the next milking. If necessary, fence the cow away from the feed bunk for at least two hours before milking.

Proper ventilation in feeding and housing areas is necessary to prevent the feed and unclean flavors. In closed stables, mechanical ventilation is a must, even though energy costs are increasing. At least two or more fans should be used with one fan operating at all times, even during cold weather.

In stall barns, keep loaded silage carts out of the stable until ready to feed. The doors to the silo room should be tight fitting and kept closed. Do not remove silage from silos more than 3 hours prior to feeding as it has a relatively short bunk life. After 3 to 6 hours abnormal compounds form in the silage.

Prevention of week flavor problems involves eliminating weeds from the fields. Pastures should be clipped to prevent weeds from going to seed and should be sprayed with approved chemicals. Renovating native pastures, whenever possible, will provide more nutritional forage for cows.

Control of unclean flavors may involve many things in addition to adequate ventilation. Cows, surroundings and milking equipment must be clean. Good practices of cow preparation and milking must be followed. Animals with ketosis or other diseases must be kept isolated as much as possible.

After a transmitted flavor is detected in a load sample, milk must be collected from every bulk tank represented on the load. Smelling and tasting these will identify the farms with the off-flavor. Then farm visits are required to determine the cause and explain to the dairyman what must be changed and why. Remember the farm family drinks their milk every day and is used to the flavor, so to them it may be good.

To prevent feed and unclean flavors, follow these suggestions:

1) Keep cows away from silage and other problem feeds for two to four hours prior to milking.

2) Eliminate objectionable feeds from the cows' diet or feed them after milking.

3) Provide adequate ventilation of feeding and housing areas.

4) Change feeds gradually, such as barn feeding to pasture.

5) Maintain a balanced ration.

6) Keep floors, walls and ceilings of dairy housing and milking areas clean.

7) Clip hair from udder, teats and flanks of milking cows.

8) Provide adequately bedded stalls.

9) Wash udder and teats with a sanitizer solution and dry prior to attaching milker units.

10) Clean and sanitize all milk handling equipment between uses.

11) Withhold milk from cows with ketosis.

OXIDIZED FLAVOR

This flavor is characterized by a metallic, tallowy or cardboard-like taste. It is less common than the light induced flavor. during the winter and early spring, as many as 10% of the farm samples may be oxidized. Oxidized flavor is caused by the buildup of off-flavor compounds as a result of the breakdown of saturated fatty acids in the presence of oxygen, copper, iron, sulfur and light.

Copper, iron and sulfur will cause oxidized flavor. As little as 0.1 ppm of these minerals in a water supply can cause the problem. Treatment is necessary and may be quite expensive. All milk contact surfaces must be stainless steel, glass, rubber or plastic. Even so, copper tubing used to convey acid water to the milk house may cause plating of copper on a bulk tank or equipment surfaces. When copper tubing is used for water pipe, the pH of the water supply should not be lower than 7.0. If the water is acid, plastic piping is recommended.

Milk contact surfaces on farms and in plants must be clean. Residues of protein oxidize and cause milk flowing over these surfaces to develop an oxidized flavor.

Oxidized flavor is more of a problem during the late winter and early spring when cows are eating stored feeds. If cows are fed stored feeds year around, oxidized flavor may be a continual problem. Green feeds contain vitamin E, which is an antioxidant. This dissipates in stored feeds and cannot be stored by animals in sufficient quantities to last from one pasture season to another.

The solution of oxidized flavor caused by lack of vitamin E, is to provide it as a supplement. To correct a problem, provide 1,000 I.U. of vitamin E per animal per day for 10 days. Then reduce this to 500 I.U. per cow each day and continue until cows receive green feed. Current levels added to concentrates by feed companies may not be adequate to prevent or correct an oxidized flavor.

Chlorine sanitizers will cause oxidation, if not completely drained from milking and processing equipment. Do not use solutions of greater strength than 200 ppm. Use hot water sterilization for plant processing equipment and iodine sanitizers for farm milking equipment, if you think that chlorine solutions cannot be drained.

Excessive agitation and foaming can contribute to oxidized flavor. Usually this causes rancid flavor prior to any oxidation. Air injection, foaming and flooding of raw milk lines can contribute to oxidized flavor problems.

Both pasteurization temperature above the minimum, and homogenization inhibit oxidized flavor development. Additions of iron and some vitamins may promote an oxidized flavor. Often, oxidized flavor may be noted in skim milk before it occurs in low fat or whole milk.

OTHER OFF-FLAVORS

Several other off-flavors may be encountered from time to time. These stem from poor practices on the farm or in the plant. They may be due to accidents, carelessness, disease, malnutrition or improper control of equipment.

Foreign and Medicinal

The foreign and medicinal flavors are caused by the introduction of medications, disinfecting materials, sanitizers, fly sprays, gasoline or other compounds commonly used on the farm or in the plant. Milk may absorb the odors of these and other substances such as tar or creosote if stored or used nearby. These materials may enter the milk supply directly as in the case of medications used on the cow's udder, sanitizing compounds or disinfectant sprays drifting into open milk containers. Additionally, pesticides used to spray crops or animals may enter the milk through ingestion by the cow or absorption through the skin. Pesticides in particular, cannot only impart an off-flavor to the milk but can permanently damage the health of the cow or the consumer. These materials should be used with care and according to the directions of the manufacturer.

Salty

The salty taste of milk is a farm problem and may be caused by cows suffering from mastitis or in the last stages of lactation. Cows infected with mastitis should be treated and the milk withheld from sale. Cows in the last stages of lactation should be "dried off" as soon as it is apparent that the milk is becoming salty. This milk should be withheld from the supply during the drying off process.

Flat

A flat taste is characteristic of milk low in solids or milk that has been watered. It lacks the pleasing sweetness of good tasting milk but generally does not produce consumer complaints unless the solids are excessively low or the milk has been grossly watered. Often, this flavor will be confused with a mildly oxidized milk. This can be checked if the sample is held for another two or three days and there is no development of oxidized flavor. In some cases the flat taste can only be corrected by eliminating some individual cows from the herd. In some instances, the low solids is due to poor nutrition and this can be corrected by following a balanced feeding program. If it appears through laboratory analysis that the milk contains added water, then a careful check of washing techniques should be made to see that all utensils and pipelines are thoroughly drained before use.

Lacks Freshness

The term "lacks freshness" is used to describe an "old" taste or a minor off-flavor defect which cannot be positively identified. This flavor may be a threshold concentration of any of the more objectionable flavors described before, i.e., oxidized, rancid, unclean, malty high-acid or psychrotrophic. Also, it may be a combination of low intensity flavors which causes the milk to have less than a good taste. Holding the sample for an additional day or two will probably yield a more definite answer, unless of course, the milk just lacks freshness due to old age.

In trouble-shooting any of the flavors outlined in the "other off-flavors" sections, the techniques listed for the previous sections will apply.

PRINCIPLES OF CLEANING AND SANITIZING DAIRY FARM EQUIPMENT

Types of Soil

The primary concern is to remove the various soils that form on equipment surfaces. Unless these soils are completely removed, they provide a nutrient source and a breeding ground for bacteria. This causes contamination and spoilage of milk and dairy products.

The removal of soils is the fundamental purpose of cleaning. Therefore an understanding of the types of soils that may be encountered is essential. There are two basic types of soils. These are, 1) organic, and 2) mineral.

1) Organic soils. These include the fats, proteins and sugars that comprise the major constituents of milk. They are very complex, and may be difficult to remove from contact surfaces. It is for this reason that cleaning should begin immediately after equipment and utensils have been used.

2) Mineral soils. Mineral deposits are not as visible as the organic soils derived from milk. These result from the precipitation of certain inorganic salts such as calcium, magnesium and iron. In addition, mineral precipitation may be derived by improper cleaning agents.

Mineral deposition is directly related to water hardness and its capability with cleaning materials. Therefore, it is necessary that an analysis of the water supply be made in order to be able to select cleaning compounds.

The "cleaning" or removal of surface soils is accomplished through a combination of both mechanical and chemical action. Mechanical action is supplied by means of a brush and "elbow grease" in hand washing procedures, and by solution velocities, flow rates and pressures when circulation or spray cleaning methods are employed. Chemical action depends on "detergency" or the ability of a chemical cleaning agent to convert an insoluble soil into a soluble one that can be readily removed from a surface.

Type of Cleaners

The basic types of cleaners used to accomplish the chemical removal of soils from dairy equipment are 1) the alkaline cleaners, and 2) acid cleaners.

1) Alkaline cleaners. Their primary function is to provide the chemical action required for the removal of organic soils. Alkaline cleaners are not designed or formulated for removing mineral films. Actually they will add to these films.

The principal ingredients are basic alkalies, phosphates, wetting agents, and chelating agents. The nature of the soil to be removed and the water conditions determine the balance of cleaner ingredients. Each of the compounds perform a specific function in the cleaning operation.

The basic alkalies (sodium hydroxide, carbonate and silicates) are used for their ability to provide alkalinity and serve to saponify fats. In addition, the alkaline silicates are useful as corrosion inhibitors to protect soft or easily corrodible metals and hands.

Tri-sodium phosphate imparts good cleaning properties and removes water hardness minerals by precipitation. The polyphosphates are all good water softeners, free rinsers, peptizing agents, emulsifiers, dispersants, deflocculents and suspending agents. It is for these properties that they have been used so extensively in balancing cleaners for specific cleaning tasks.

The wetting agents are surface active agents and are used in cleaners to provide wetting action and penetration of cleaning solutions. Also, these materials are good emulsifiers of fats, act as dispersants and suspending agents, and impart good rinsing properties of cleaner solutions.

Chelating agents act to prevent precipitation of minerals in a similar function to the polyphosphates. They vary in their abilities to sequester metallic ions, and so must be selected with care for specific applications.

The chlorinated alkaline cleaners are prepared by adding chlorine to alkaline detergents. The chlorine acts to enhance the removal of protein deposits from the milk contact surfaces.

2) Acid cleaners. These products are composed of mild organic and inorganic acids. Their function is to prevent or remove mineral deposits.

These acids react with water insoluble salts, making them soluble and easy to remove. The acids have essentially no effect on organic soils. However, when suitable wetting agents are combined with acids some detergency of organic soils is provided.

Factors Affecting the Function of Cleaners

Cleaner ingredients serve definite and specific functions in a cleaning program. No one ingredient can perform all of the necessary cleaning functions. It is the combination of individual ingredients that leads to balanced cleaning. the basic factors that affect the action of cleaners are outlined as follows:

1) Concentration of cleaner. To be effective, cleaning agents must be used as concentrations recommended by the manufacturer for a specific cleaning job. Measure the amount of water and regulate cleaner usage accordingly. Low concentration of cleaner results in incomplete removal of soils through reduced chemical action. However, a high concentration of cleaner may result in mineral deposition and a reduced efficiency of cleaning.

2) Temperature of cleaning solutions. Cleaners must be used at temperatures within the range specified by the cleaner manufacturer. At high temperatures, cleaner ingredients may undergo reversion or breakdown. At low temperatures sufficient chemical action is not provided. In general, dairy cleaners are not effective when solution temperatures drop below 110 F.

3) Contact time. Time must be allowed for the cleaner to contact the soil and react with it so that it may be removed. The actual time required varies with the amount and type of soil, as well as the temperature of the cleaning solution. Time must be sufficient to provide a physically clean surface.

4) Application of cleaners. Use the right cleaner for the job at hand. Using improper cleaners may result in soil formations due to antagonism between the cleaner and the soil. Organize a balanced cleaning program using alkaline cleaners to combat organic soils and acid cleaners to control mineral soils. Post cleaning procedures so that workers know procedures to be followed. Include types and amounts of cleaner to be used for the existing conditions of water quantity and quality.

Cleaning Procedures

There are certain fundamental steps which must be followed in any good cleaning program.

1) Pre-rinse. Immediately after use, all equipment and utensils should be rinsed with lukewarm (110-120 F) water to remove and prevent drying of milk solids. For circulation cleaning the rinse water should not be recirculated, but should discharge to the drain at the outlet. Do not use hot water as this may destabilize proteins and cause formation of protein films on surfaces. If cold water is used, this may result in a greasy film. After rinsing, disassemble all parts that must be hand washed and place in a wash sink.

2) Wash. Prepare appropriate cleaning solutions. Follow directions and use a dairy cleaner in the proper portion to the amount of water to be used. Do not guess at these; measure amounts and be certain. Maintain the wash solution temperature within the recommended range.

   For hand washing operations, use appropriate brushes for the type of equipment to be cleaned. Do not use metal sponges or abrasive scouring pads, as these will damage the equipment surfaces. For circulation cleaning, maintain solution flow rates at the recommended temperature for the required time.

3) Rinse. Following washing, rinse all equipment with water to remove suspended soils and traces of cleaning compounds. For most applications, the water should be lukewarm and acid cleaner should be added to adjust the acidity of the water to about pH 5.0. Use one ounce for every 5 gallons of water. An acidified rinse holds the mineral matter in solution, thereby preventing formation of mineral films.

4) Storage. Following rinsing, all utensils and equipment should be stored to drain and lines should be air dried.

Sanitizing Procedures

Equipment should be sanitized just before use to eliminate bacterial contamination of surfaces. Cleaning by itself does not kill all types of bacteria, although good cleaning greatly reduces the initial bacterial concentration. Furthermore, equipment which has not been properly cleaned cannot be sanitized since residual soils protect bacteria from sanitizer action. In short, sanitizers do not compensate for poor cleaning jobs.

Sanitizing itself refers to a process of treating equipment with chemicals to inactivate most of the bacteria present. It is not a sterilization process although these two terms are often mistakenly interchanged. Sterilization is defined as being a process that destroys all microorganisms and their spores. This condition is probably never achieved in a sanitizing procedure.

Certain chemical compounds are effective for sanitizing dairy equipment. These include a) chlorine, b) iodine, c) quaternary ammonium compounds, and d) acid-wetting agents. The activity of chemical sanitizers is influenced by temperature, pH of the solution, concentration of sanitizer and contact time.

In order for chemical sanitizers to be effective, equipment must first be thoroughly clean. Recommended concentrations must be followed, and equipment must not be rinsed with water following sanitizing. For best results, equipment should be sanitized just before use and the sanitizer allowed to drain from the surface. Certain sanitizers, particularly chlorine, can be corrosive to equipment and should not be in contact with stainless steel for more than about 30 minutes before surfaces are contacted with milk.

Cleaning the Pipeline Milking System

The cleaning program must be designed to fit the equipment to be cleaned. A cleaning method which is adequate for one system may not be adaptable to another pipeline system. The following basic procedure applies to all systems.

1) Rinse. Pre-flush the entire system with a large volume of clean, clear, lukewarm water. The rinse should discharge to the drain and should continue until the water discharged from the line is clear. Water temperatures above 100 F aids in removing the fat.

2) Wash. Prepare the alkaline washing solution in hot water using the cleaning compound at a rate recommended by the manufacturer. Usually temperatures between 140 F and 160 F are necessary, so that the final temperature does not drop below 110 F at the end of the cycle. A booster heater may be necessary. Measure the cleaner and the water so as to be sure of the proper amount. Circulate the cleaner solution through the line. Actual circulation time is usually between 10 and 15 minutes, as set by the manufacturer. Brush all parts not considered to be adequately cleaned by the circulating cleaning solution.

3) Rinse. Rinse the line with an ample volume of acidified (pH 5.0-5.5) water to remove all traces of cleaner solution. Usually one ounce of acid for every 5 gallons of water will be sufficient.

4) Drain. After rinsing, allow the system to drain completely and visually inspect parts such as lines, pumps, receiver jars and vacuum releasers for proper cleaning.

5) Sanitize. Just before the next milking, circulate an approved sanitizer solution through the lines following directions supplied by the manufacturer of the sanitizing agent. Allow the system to drain before milking to prevent sanitizer residues in the milk. Iodine sanitizers should be at a strength of 25 ppm while chlorine requires 200 ppm. DO NOT RINSE WITH UNTREATED WATER!

Cleaning Farm Milk Tanks

The farm milk tank has provided a vastly improved method for cooling and holding milk at the farm than was possible with cans. However, unless farm tanks are properly cleaned and sanitized, they can become a breeding ground for psychrotrophic bacteria that can affect the keeping quality of milk.

The farm milk tank is not difficult to clean, provided one is aware of the proper procedure.

There are two basic methods of cleaning a farm tank; the manual procedure and mechanical methods.

Manual Cleaning

1) Rinse. Immediately after the tank has been emptied of milk, rinse all surfaces with lukewarm (100 to 110 F) water. A warm water rinse at this time is vital to ease in cleaning the tank. A cold water rinse causes fats to solidify and form a "greasy" film on the tank, and a "hot" rinse will make proteins adhere to the tank surface.

2) Wash. Following rinsing, prepare 1 to 2 gallons of hot (120 to 160 F) cleaning solution in a plastic or rubber pail, using a chlorinated alkaline cleaner. Follow the manufacturers or dealers directions for the amount of cleaner to use depending on water conditions. It is highly recommended that a cleaning chart which outlines the amount of cleaner be maintained for reference in the milkroom.

Cover all interior tank surfaces with a solution using a tank brush. Then scrub all surfaces with the brush, including the underside of covers, bridge, agitator shaft and blades.

Thoroughly brush the outlet valve and calibration rod. Rinse these parts with lukewarm water and allow them to drain. Use the remaining solution in the pail to clean the outside of the tank.

3) Rinse. Spray all surfaces with lukewarm water. Finish the rinse with acidified water to control mineral deposits.

4) Sanitize. Just prior to adding milk, sanitize with an approved compound prepared according to manufacturers recommendations. Make certain that the sanitizer solution drains from the tank before milk is added in order to prevent residues in the milk.

Mechanical Cleaning

Most of the mechanical cleaning of farm tanks is accomplished by pressure recirculation of cleaning solutions through a spray device located within the tank.

It is imperative that low foaming cleaners be used for mechanical cleaning of farm tanks. Because most of the cleaning is done at relatively low temperatures, detergent concentrations must be adjusted to be in balance with the actual water temperature during cleaning. The maximum starting temperature for the cleaning solution depends upon the type of tank to be cleaned. it is advisable to insure that cleaning solution temperatures not be allowed to drop below 110 F, since lower temperatures may result in poor cleaning efficiency.

A general guideline for mechanical cleaning is outlined as follows:

1) Rinse. Immediately after milk is removed from the tank, rinse all surfaces with lukewarm (100 to 110 F) water. This is usually done by the milk hauler.

2) Wash. Disassemble manhole covers and gaskets and remove the calibration rod for cleaning manually. Prepare the washing solution by dissolving the recommended amount of low foaming chlorinated alkaline cleaner in water. Add the cleaning solution to the correct amount of water at proper temperature. Turn on the mechanical cleaning device and allow it to operate until clean, usually about 10 minutes. Make certain that the cleaning solution temperature does not drop below 110~F during the wash cycle. The cleaning unit used must be designed for the style and capacity of the tank.

After completion of the wash cycle, inspect the tank to insure that all milk contact surfaces have bee contacted with cleaning solution. Any items or surfaces not contacted by cleaner must be manually cleaned by brushing.

Drain the solution from the tank. Brush the tank outlet and disassembled valve. Save sufficient cleaning solution to wash the outside of the tank.

3) Rinse. Spray the tank completely with lukewarm water, finishing the rinse with acidified water to control mineral deposits.

4) Sanitize. Just before the next milking, spray the tank with sanitizer. Allow it to drain from the outlet to prevent residues in milk.

The greatest problem areas in cleaning farm tanks are the outlet valve, tank covers, agitator, calibration rod, and the support bridge for the agitator motor. These are the areas most frequently neglected and therefore require careful attention if a good cleaning job is to be done. Abrasive devices such as steel wool or stainless steel "sponges" should never be used on tank surfaces because they tend to damage the polished surface.

Acidified rinse water and sanitizing solutions are most easily applied by means of commercial metering units that are attached to the rinse water hose. Such devices should be equipped with check valves to prevent backflow of chemicals into the water line.

Whenever films of residues appear on tank surfaces or streaking of surfaces occurs, it is an indication of poor cleaning, and suggests that cleaning methods need revision. White or grayish-white films are most suggestive of mineral deposits, bluish films are most likely to be caused by protein deposits. Protein deposits occur when there is an insufficient cleaner concentration in solution and/or when cleaning solution temperatures are too low. Reddish or rust colored films on equipment are a good indication of iron hardness problems.

TROUBLE-SHOOTING FILMS AND DEPOSITS ON EQUIPMENT

Film/Deposit	Description or Identification	*Cause	Removal	Prevention
Protein	Blue rainbow hue Varnish-like "Apple Sauce"	1) Using non-chlorinated cleaner. 2) Inadequate pre-rinse. 3) Improper (sporadic or periodic) cleaning. 4) Improper initial clean-up.	Initial clean-up equal parts of chlorine, chlorinated alkaline detergent, and hot water.	1) Chlorinated alkaline detergent. 2) Proper cleaning with proper use dilution after each usage. 3) Adequate pre-rinse.
Milkstone or (Waterstone)	White to yellow.	1) Mineral from milk. 2) Mineral from water.	A. Initial cleaning. B. Acid wash.	Regular and proper cleaning procedures coupled with acidified rinse.
Fat/Grease	Hanging water droplets. Greasy (white) appearance. Oil	1) Same as protein. 2) Low temperature or improper detergent. 3) Regular use of acids in washing. 4) Pulsator oil on equipment surface.	Initial clean-up.	Regular and proper cleaning procedures coupled with acidified rinse.
Mineral (Calcium, Magnesium)	White (Waterstone) Chalky to gray.	1) Improper rinsing. 2) Drop-out of minerals from water supply 3) No acidified rinse. 4) Non-compatible alkaline detergent. 5) Failure to use acid detergents.	Acid wash.	1) Acid rinse. 2) Product use has good water conditioning properties. 3) Water softener or treatment.

Film/Deposit	Description or Identification	*Cause	Removal	Prevention
Iron	Red to brown/black.	1) Water supply. 2) Aggressive supply — iron from system components. 3) Improper procedures.	Acid wash.	1) Regular acid rinse. 2) Water treatment. 3) Proper selection of sanitizers.
Silica	White to gray glazed appearance.	1) Use of mechanical cleaner for manual cleaning. 2) Poor rinsing. 3) Water supply. 4) Failure to manually clean outside surface of equipment cleaned mechanically inside.	Special acid wash.	1) Complete post rinse. 2) Regular acid rinse. 3) Water treatment. 4) Manually clean outside surface of equipment cleaned mechanically inside.
A. Inking (blacking)	A. Black in rubber parts.	1) Reaction between chlorine or chlorinated compound and rubber.	Acid wash.	1) Acid rinse. 2) Proper dry storage.
B. Black	B. Black residue deposit.	1) Rubber migration 2) Contact of dissimilar materials.		1) Acid rinse. 2) Proper dry storage. 3) Proper installation.
Wetting Agent	Blue	1) Poor/inadequate rinsing.	Initial clean-up.	1) Proper compound. 2) Proper rinsing.
Factory Soil	Grease, factory dirt—black deposit, rusting.	1) Improper or no initial clean-up.	Initial clean-up.	Thorough cleaning before equipment is used — initially.

Film/Deposit	Description or Identification	*Cause	Removal	Prevention
Corrosion	Rust/pitting.	1) Iron, metal particles, improper chemical usage. 2) Freezing or sanitizing.		
Etching	Pitted and white discoloration "imbedded" in stainless steel surface.	1) Improper use of chemicals. 2) Use of improper chemicals.	Repolish-re-passivation.	Proper procedures and passivating acid rinse.
Plastics**				
Opaque	Lack of transparency; white, not clean	1) Improper draining. 2) Moisture absorption.	Exposure to heat or light (sunlight)	Blower or dryer. Good drainage, ventilation.
Yellow	Yellow color.	1) Old age, improper use of iodophor 2) Hand soil stain.	None.	Proper product application. Replace.
Brown/Black	Brown discoloration.	1) Rubber migration. 2) Carbon from motors on dryers.	Acid wash--if not removed, replace.	1) Acid wash. 2) Proper filtration. 3) Segregation of plastics and rubber. 4) Replace.
Red	Red color -- stain.	1) Serratia 2) Marcescens	None.	1) Proper procedures on regular basis.

Film/Deposit	Description or Identification	*Cause	Removal	Prevention
Pink/Purple	Pink/purple color.	1) Streptococcus 2) Rubrireticuli	Strong alkaline wash.	Proper procedures on regular basis.

*Films and deposits are usually caused by improper cleaning, rinsing, hard water or incompatible products. In mechanical cleaning, problems may be also due to malfunction of the system or lack of proper solution control.

**After continuous use, periodic replacement of plastic materials is eventually necessary.

PROTECTING YOUR FARM RATING FOR INTERSTATE MILK SHIPMENTS

New York produces more milk than can be consumed within its boundaries. If the milk is to be sold anywhere in the country or to be bought by federal agencies, it must be a rated supply under the Interstate Milk Shippers Program. To qualify, the farm and plant must be inspected and pass with an overall score of 90 percent.

Most dairymen do not care for inspection at all. But the program today is far better than it was, say 25 years ago, when as many as five or more different inspectors came to the farm (often they had different codes and contradictory demands on the procedures you followed). Now we have only one set of rules and every effort is made to uniformly enforce them throughout the United States.

The rules are contained in the "Grade A Pasteurized Milk Ordinance" which are set by the U.S. Public Health Service, a branch of the Federal Food and Drug Administration. The regulations are reviewed every other year in a meeting of the Interstate Milk Shipments delegates. Each state has one vote with a chance for producers, processors and regulatory agencies to debate issues of concern in their part of the country. When meetings are over, all milk inspectors are given the same guidelines to interpret the rules.

The individual states are responsible for the routine inspections on all farms and plants. They may do this with inspectors hired and paid for by the state or with industry personnel called "Certified Milk Inspectors" as we do in New York. Uniformity is achieved, throughout the country by a system of check ratings performed by FDA employees. These are done on a random basis to determine if the local enforcement agencies are doing their job.

A farm supply that is "check rated" must score within five points of the listed rating made by a state rating officer. When a farm supply is scored more than five points below the listed rating, but is still above 80 percent, the state is obligated by the Milk Shippers Agreements to reinspect the entire supply within 60 days. If a farm supply scores more than 10 points below the listed rating on a check rating, the farm supply is automatically deleted from the program for at least a 15 day waiting period. For example, a farm supply that has a listed rating of 90% (by local inspectors), must score at least 85.5 percent on an official check rating. If the supply scores between 81.0 percent and 85.4 percent, then it must be reinspected within 60 days. If the score is less than 81 percent, there is an automatic delist.

Dirty equipment and unsatisfactory water supplies are the principal causes for failing a rating. An unapproved water supply can cost five points on the score sheet. The Certified

Milk Inspector or the Ag. and Markets Dairy Specialist can assist you in making sure that the water supply meets USPHS standards. If it doesn't, you could be risking the health of both people and animals on the farm.

Points off for dirty equipment leads to more failures than any other item. Soiled equipment will reduce the rating by at least 5 points and maybe 10, since 5 points can also be lost because it's impossible to sanitize dirty equipment. Often when dirty equipment is found, it comes as a complete surprise to the owner/operator. This is because the dairyman doesn't know where to look, or never takes the time to examine the equipment after it has been washed and the surface becomes completely dry. Equipment dealers should provide specific cleaning instructions along with guidelines for regular inspection of hard to clean parts.

Research at Cornell has tried to determine the potential trouble spots with each brand of equipment. This information is regularly transmitted to the industry inspectors and equipment installers. While specific installations will differ, it's clear that you can not clean-in-place all pieces of equipment forever. Regular inspection of all parts of the milk system will reveal which areas need specific attention. The gasketed fittings and small milking machine parts are the most likely problem areas.

With rapid cooling, the bacteria count may not always warn of dirty equipment. The large volume of milk will dilute the high bacteria count to a reasonable level. However, the damage will be done when the milk spoils before the consumer has had time to use it and we may lose a long time customer.

Inspection is necessary if we want to maintain the reputation of milk and be able to compete in the world marketplace. The standards are not that difficult to meet. One way to stay on top of the program is to learn what is required to make a "self inspection" as you go about your chores. Your fieldman (in New York) is a Certified Milk Inspector. He would be glad to make an informal check of your farm and teach you how to be your own "sanitarian". Once you do that, you have nothing to fear from the real inspector.

STATUS OF RAW MILK FOR PASTEURIZATION

Name of Shipper ____________________

Date of Survey ____________ ____________

(NOTE—If any item or part of an item is violated indicate by (X) under that item)

Sanitation Compliance Rating[1] ____________ %

NAME OF PRODUCER DAIRY	POUNDS SOLD DAILY (100 # UNITS)	ITEMS OF SANITATION																																					REMARKS
			MILKING BARN								MILKHOUSE								UTENSILS AND EQUIPMENT					MILKING			PERSON-NEL				INSECTS AND RODENTS								
			CONSTRUCTION								CONSTRUCTION AND FACILITIES																												
		ABNORMAL MILK	FLOORS	WALLS AND CEILINGS	SEPARATE STALLS	LIGHTING	FEED STORAGE	VENTILATION	CLEANLINESS	COWYARD	FLOORS	WALLS AND CEILINGS	LIGHTING AND VENTILATION	MISCELLANEOUS REQUIREMENTS	CLEANING FACILITIES	CLEANLINESS	TOILET	WATER SUPPLY	CONSTRUCTION	CLEANING	SANITIZATION	STORAGE	HANDLING	FLANKS, UDDERS AND TEATS	SURCINGLES, MILK STOOLS	PROTECTION FROM CONTAMINATION	HANDWASHING FACILITIES	PERSONNEL CLEANLINESS	COOLING	VEHICLES	Fly breeding minimized, Manure packs maintained	Milkhouse openings screened, doors tight, Milkhouse free of insects	Approved pesticides used, Equipment and utensils not exposed to contamination	Surroundings neat and clean	BACTERIAL COUNT	SOMATIC CELL COUNT	TOTAL DEBITS[2]	POUNDS SOLD DAILY (100 # UNITS) X TOTAL DEBITS	
	ITEM	1	2						3	4	5					6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21								
			a	b	c	d	e	f																							a, b	c, d	e, f	g					
	WEIGHT	10	2	1	1	1	1	2	2	2	1	1	2	2	2	3	5	5	3	6	5	2	2	3	1	2	3	2	5	1	3	2	2	1	10	5			
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[1] Sanitation compliance rating = $100 - \frac{\text{Total pounds sold daily (100 \# Units)} \times \text{Total debits}}{\text{Total pounds sold daily (100 \# units)}}$

[2] Total debits for each producer dairy is the sum of the weights of the items violated

FORM FD 2359K (7/78) PREVIOUS EDITION IS OBSOLETE.

State of New York
Agriculture and Markets
Albany, New York 12235

Excerpted from

Circular 958

1NYCRR, Part 2

NYS Milk Code

Farm Requirements

Requirements for the
Production, Processing and
Distribution of Grade A Milk
and Milk Products
(Effective December 1, 1981)

SANITATION REQUIREMENTS FOR RAW MILK FOR PASTEURIZATION (PREPASTEURIZED MILK)

2.8 ABNORMAL MILK - (Item 1r.) (a) Milk which is found to be abnormal by sight, odor, or tests shall not be offered for sale or sold for human consumption. Milk from cows which shows evidence of the secretion of abnormal milk in one or more quarters, based on bacteriological, chemical, or physical examination and from cows which have been treated with or have consumed chemical, medicinal, or radioactive agents which may be capable of being secreted in the milk and may be deleterious to health in the Commissioner's opinion, shall be milked last or with separate equipment and shall not be offered for sale for human consumption.

Equipment, utensils and containers used to handle abnormal milk shall be cleaned and sanitized before being used for milk to be sold. Such equipment shall meet the construction requirements set forth in ITEM 9r. Section 2.16. Milk from cows treated with or exposed to insecticides not approved for use on dairy cattle by the U.S. Environmental Protection Agency shall not be offered for sale until such milk has been tested and found acceptable by the Department of Agriculture and Markets.

(b) Acceptable Detection Tests. The Wisconsin Mastitis Test (WMT) may be used as a screening test. A WMT of 17 mm or higher shall be considered to indicate abnormal milk and shall require confirmation. Confirmation shall be made by the Direct Microscopic Somatic Cell Count method or an electronic counting method approved by the Commissioner. The Commissioner may periodically approve additional testing methods or make changes in screening test results requiring confirmation based upon further research.

(c) Compliance requirements. The permittee responsible for the assembly of milk and the producers shall follow the procedures (1) through (6) below as applicable:

(1) The milk shipped by each producer shall be tested for abnormalities on a monthly basis and the results of such examination sent to each producer and posted by the producer in his milk house. The samples shall be examined by an acceptable screening test and when required, re-examined by an acceptable confirmatory test. Screening tests may be omitted if all producer milk samples are routinely examined by an acceptable confirmatory method.

(2) When a confirmatory test on a routine sample indicates a somatic cell count above 1,000,000 cells per ml, a written notice shall be sent to the producer of such unsatisfactory cell count and a recheck sample shall be collected within 21 days but not prior to 5 days after said notice has been made. The recheck samples shall be examined by an acceptable confirmatory method.

(3) When the somatic cell count of a recheck sample of the producer's milk is above 1,000,000 cells per ml, the producer shall be sent written notification to enroll in the New York State Mastitis Control Program. The producer must enroll within ten days after said notification. No receiving plant shall accept milk from said producer after this ten day period unless said producer has enrolled in the NYSMCP. After the NYSMCP has conducted its first survey of such farm, a meeting called by the NYSMCP director shall be held to develop an appropriate plan of corrective action to be followed by the dairy farmer. Such meeting shall be attended by the Certified Milk Inspector, the dairy farmer, the practicing veterinarian, and a NYSMCP representative. Said producer thereafter must comply with the procedures and directives of the NYSMCP directly designed to correct the cause of the violation. The

producer must remain enrolled in the NYSMCP at least six months and until three out of the last four routine monthly samples had a somatic cell count of 1,000,000 cells per ml or less.

(4) Two routine samples having a somatic cell count above 1,000,000* per ml, among the last four samples collected, constitutes a violation of this part. When two out of the last four routine samples have a somatic cell count above 1,000,000* per ml, written notification of said violation shall be sent to the producer and the producer shall be notified that another sample with a somatic cell count above 1,000,000* per ml shall require exclusion until an acceptable somatic cell count is obtained. Said producer shall also be required to enroll in the Mastitis Control Program within ten days as described in (3) above, if not already participating in the program. In addition to said written notice of violation, an inspection of the dairy farm shall be made as soon as possible after said written notice has been sent. An evaluation of the milking equipment and milking procedures made at this time by the NYSMCP may be accepted in lieu of an inspection by a Certified Milk Inspector.

(5) An additional sample shall be taken within 21 days, but not before five days after the notice of violation described in (4) above has been sent to the producer. If the somatic cell count of this sample exceeds 1,000,000* per ml, the producer shall be excluded until a subsequent sample indicates a somatic cell count has been reduced to below 1,000,000* per ml. The producer record must show a loss of the production of at least one milking during this period before reinstatement.

(6) During the 21 days following reinstatement, a total of four samples shall be examined for somatic cell count at a rate not to exceed two samples per week. The first such sample shall be collected within one week after reinstatement. If the somatic cell count of these samples is 1,000,000* or less, the producer may be returned to routine sample collection frequency.

After reinstatement, the producer begins a new quality control record for abnormal milk. If any of the four samples collected during the 21 day period exceeds 1,000,000 cells per ml, follow up action shall be repeated, as described in (2) and subsequent steps of this procedure.

2.9 MILKING BARN, STABLE, OR PARLOR - CONSTRUCTION AND MAINTENANCE (ITEM 2r.) (a) A milking barn, stable, or parlor shall be provided on all dairy farms in which the milking herd shall be housed during milking time operations. The areas used for milking purposes shall meet the following requirements:

(1) Floors, feed troughs (and gutters if present) shall be constructed of good quality concrete or equally impervious material. Floors shall be constructed so as to be easily cleaned (brushed surfaces permitted) and shall be graded to drain.

(2) Walls and ceilings are finished with wood, tile, smooth-surfaced concrete, cement plaster, brick, or other equivalent materials with light colored surfaces. Walls, partitions, doors, shelves, windows, and ceilings shall be kept in good repair, and surfaces shall be refinished whenever wear or discoloration is evident. Whenever feed is stored overhead, ceilings shall be constructed to prevent the sifting of chaff and dust into the milking barn, stable or parlor. If a hay opening is provided from loft into the milking portion of the barn, such opening shall be provided with a dust tight door which shall be kept closed during milking operations.

**1,500,000 until June 1, 1983.*

(3) Separate pens shall be provided for bulls, horses, and calves. These areas shall be separated by tight partitions, from the milking area. Such portion of the barn not so separated shall comply with all items of this section. In addition, a curbing shall be provided to separate horses, bulls, and calves from the milking area. The curbing shall effectively eliminate the flow of manure and urine from such areas.

(4) The milking barn is provided with natural and/or artificial light to insure that all surfaces and particularly the working areas will be plainly visible. The equivalent of at least 10 foot-candles of light in all working areas shall be provided.

(5) Air cirulation is sufficient to minimize odors and to prevent condensation upon walls and ceilings.

(6) Overcrowding is not evidenced by the presence of calves, cows, or other barnyard animals in walks or feed alleys. Inadequate ventilation and excessive odors may also be evidence of an overcrowded barn.

(7) A dust tight partition, provided with doors that are kept closed except when in actual use, shall separate the milking portion of the barn from any feed room or silo in which feed is ground or mixed, or in which sweet feed is stored. Feed may be stored in the milking portion of the barn only in such manner as will not increase the dust content of the air, attract flies, or interfere with cleaning of the floor (as in covered, dust tight boxes or bins). Open feed dollies or carts may be used for distributing the feed, but not storing feed, in the milking barn.

When conditions warrant, the Commissioner may approve a barn without four walls extending from floor to roof, or a shed-type barn provided the requirement of ITEM 3r. Section 2.10 prohibiting animals and fowl entering the barn is satisfied. Cattle-housing areas (stables without stanchions, such as loose-housing stables, pen stables, resting barns, free stall barns, holding barns, loafing sheds, wandering sheds) may be of shed-type construction, provided no milking is conducted therein. (They are classified as part of the cowyard under ITEM 4r. Section 2.11.)

2.10 MILKING BARN, STABLE OR PARLOR - CLEANLINESS (ITEM 3r.) (a). The interior of the milking barn, stable, or parlor shall meet the following standards of cleanliness:

(1) The interior of such facilities shall be kept clean.

(2) Leftover feed in feed mangers appears fresh and is not wet or soggy.

(3) The bedding material, if used, does not contain more manure than has accumulated since the previous milking.

(4) Outside surfaces of pipeline systems located in the milking barn, stable, or parlor are reasonably clean.

(5) Gutter cleaners are reasonably clean.

(6) All pens, calf stalls, and bull pens, if not separated from the milking barn, stable, or parlor, are clean.

(7) Swine and fowl are kept out of the milking barn.

2.11 COWYARD - (ITEM 4r.) (a) Cowyards shall meet the following requirements:

(1) The cowyard, which is the enclosed or unenclosed area adjacent to the milking barn, in which the cows may congregate, including cattle-housing areas and feed lots, is graded and drained; depressions and soggy areas are filled; cow lanes are reasonably dry.

(2) Approaches to the barn door and the surroundings of stock watering and feeding stations are solid to the footing of the animal.

(3) Wastes from the barn or milkhouse are not allowed to pool in the cowyard. Cowyards which are muddy due to recent rains should not be considered as violating this item.

(4) Manure, soiled bedding, and waste feed are not stored or permitted to accumulate therein in such a manner as to permit the soiling of cows' udders and flanks. Cattle-housing areas (stables without stanchions, such as loose-housing stables, pen stables, resting barns, holding barns, loafing sheds, wandering sheds, free-stall housing) shall be considered a part of the cowyard. Manure packs shall be solid to the footing of the animal.

(5) Cowyards are kept reasonably free of cattle droppings. Cattle droppings shall not be allowed to accumulate in piles that are accessible to the animals.

2.12 MILKHOUSE OR ROOM - CONSTRUCTION AND FACILITIES (ITEM 5 r.) (a) The milkhouse or room shall meet the following construction requirements:

(1) A separate milkhouse of sufficient size is provided in which the cooling, handling, and storing of milk and the washing, sanitizing, and storing of milk containers and utensils shall be conducted: Except as provided for in ITEM 12r. Section 2.19.

(2) The floors of all milkhouses are constructed of good quality concrete (float finish permissible), or equally impervious tile, or brick laid closely with impervious material, or metal surfacing with impervious joints, or other material the equivalent of concrete and maintained free of breaks, depressions, and surface peelings.

(3) The floor slopes to drain to that there are no pools of standing water. The joints between the floor and the walls shall be watertight.

(4) The liquid wastes are disposed of in a sanitary manner; all floor drains are accessible and are trapped if connected to a sanitary sewer.

(5) Walls and ceilings are constructed of smooth dressed lumber or similar material, well painted with a light-colored washable paint, and are in good repair. Surfaces and joints shall be tight and smooth. Sheet metal, tile, cement block, brick, concrete, cement plaster, or similar materials of light color may be used; the surfaces and joints shall be smooth.

(6) A minimum of 20 foot-candles of light is provided for all working areas from natural and/or artificial light for milkhouse operations.

(7) Windows and solid doors are closed during dusty weather.

(8) The milkhouse is adequately ventilated to minimize odors and condensation on floors, walls, ceilings, and clean utensils.

(9) Vents, if installed, and light fixtures are installed in a manner to preclude the contamination of bulk milk tanks or clean utensil storage areas.

(10) The milkhouse is used for no other purpose than milkhouse operations.

(11) There is no direct opening into any barn, stable, or room used for domestic purposes; except than an opening between the milkhouse and milking barn, stable or parlor is permitted when a tight-fitting self-closing solid door(s) hinged to be single or double acting is provided.

(12) A vestibule, if used, complies with the applicable milkhouse construction requirements.

(13) The transfer of milk from a bulk-holding/cooling tank to a transport tank is through a hose port located in the milkhouse wall. The port shall be fitted with a tight door, which shall be in good repair. It shall be kept closed except when the port is in use. An easily cleanable surface shall be constructed under the hose port, adjacent to the outside wall, sufficiently large to protect the milk hose from contamination. Such surface shall be at least 36 inches wide and shall extend from the working area at the rear of the bulk tank truck to the hose port.

(14) Water under pressure is piped into the milkhouse.

(15) Each milkhouse is provided with facilities for heating water in sufficient quantity and to such temperatures for the effective cleaning of all equipment and utensils.

(16) The milkhouse is equipped with a wash-and-rinse vat having at least two compartments. Each compartment must be of sufficient size to accommodate the largest utensil or container used. The cleaning-in-place vat for milk pipelines and milk machines may be accepted as one part of the two-compartment vat: *Provided*, That the cleaning-in-place station rack in or on the vat and the milking machine inflations and appurtenances are completely removed from the vat during the washing, rinsing, and/or sanitizing of other utensils and equipment.

(17) A suitable shelter is provided for a transportation truck used for cooling and storing milk. Such shelter shall be adjacent to, but not a part of, the milkroom and shall comply with the requirements of the milkroom with respect to construction, light, drainage, insect and rodent control, and general maintenance.

2.13 MILKHOUSE OR ROOM - CLEANLINESS (ITEM 6r.) (a) The milkhouse or room shall meet the following cleanliness requirements:

(1) The milkroom structure, equipment, and other milkroom facilities used in its operation or maintenance are clean at all times.

(2) Incidental articles such as desks, refrigerators, and storage cabinets may be in the milkroom, provided they are kept clean and ample space is available to conduct the normal operations in the milkroom and will not cause contamination of the milk.

(3) Vestibules, if provided, are kept clean.

(4) Animals and fowl are kept out of the milkroom.

2.14 TOILET - (ITEM 7r.) (a) Toilet facilities shall meet the following standards:

(1) There is at least one flush toilet connected to a public sewer system or to an individual sewage-disposal system or a chemical toilet, earth pit privy, or other type of privy. Such sewerage systems shall be constructed and operated in accordance with plans and instructions acceptable to the Commissioner.

(2) A toilet or privy is convenient to the milking barn and the milkroom. There shall be no evidence of human defacation or urination about the premises.

(3) No privy opens directly into the milkroom.

(4) The toilet room, including all fixtures and facilities, is kept clean and free of flies and odors.

(5) Where flush toilets are used, doors to toilet rooms are tight and self-closing. All outer openings in toilet rooms shall be screened or otherwise protected against the entrance of flies.

(6) Vents of earth pits are screened.

2.15 WATER SUPPLY - (ITEM 8r.) (a) The water supply shall meet the following requirements:

(1) Water for milkhouse and milking operation shall be from a supply properly located, protected, and operated, and shall be easily accessible, adequate, and of a safe, sanitary quality.

(2) The water supply shall contain a MPN (Most Probable Number of Coliform Organisms) of less than 2.2/100 ml. by the multiple tube fermentation method, or less than 1/100 ml. by the membrane filter technique.

(3) No cross-connection exists between a safe water supply and any unsafe or questionable water supply, or any other source of pollution.

(4) There are no submerged inlets through which a safe water supply may be contaminated.

(5) The well or other source of water is located and constructed in such a manner that neither underground nor surface contamination from any sewerage systems, privy, or other source of pollution can reach such water supply. All drilled wells constructed after the effective date of this Part shall have casings extended above the surface level of the surrounding ground.

(6) New individual water supplies and water supply systems which have been repaired or otherwise become contaminated are thoroughly disinfected before being placed in use. The supply shall be made free of the disinfectant by pumping to waste before any sample for bacteriological testing shall be collected.

(7) All containers and tanks used in the transportation of water are sealed and

protected from possible contamination. These containers and tanks shall be subjected to a thorough cleaning and a bacteriological treatment prior to filling with potable water to be used at the dairy farm. To minimize the possibility of contamination of the water during its transfer from the potable tanks to the elevated or ground-water storage at the dairy farm, a suitable pump, hose, and fittings shall be provided. When the pump hose and fittings are not being used, the outlets shall be capped and stored in a suitable dustproof enclosure so as to prevent their contamination. The storage tank at the dairy farm shall be constructed of impervious material provided with a dust- and rainproof cover, and also provided with an approved-type vent and roof hatch. All new reservoirs or reservoirs which have been cleaned shall be disinfected prior to placing them into service.

(8) Samples for bacteriological examination are taken upon the initial approval of the physical structure based upon the requirements of this Part and when any repair or alteration of the water supply system has been made, and at least every 3 years: *Provided*, That water supplies with buried well casing seals, installed prior to the adoption of this section, shall be tested at intervals no greater than 6 months apart. Whenever such samples indicate either the presence of bacteria of the coliform group, or whenever the well casing, pump or seal need replacing or repair, the well casing and seal shall be brought above the ground surface and shall comply with all other applicable construction criteria of this section: *Provided*, That when water is hauled to the dairy farm, such water shall be sampled for bacteriological examination at the point of use and submitted to a laboratory each month. Bacteriological examinations shall be conducted in a laboratory acceptable to the Commissioner.

(9) Current records of water tests shall be retained on file.

2.16 UTENSILS AND EQUIPMENT - CONSTRUCTION (ITEM 9r.) (a) Construction of utensils and equipment shall meet the following requirements:

(1) All multiuse containers, equipment, and utensils which are exposed to milk or milk products, or from which liquids may drip, drain, or be drawn into milk or milk products are made of smooth impervious, nonabsorbent, safe materials of the following types:

(i) Stainless steel of the AISI (American Iron and Steel Institute) 300 series; or

(ii) Equally corrosion-resistant, nontoxic metal; or

(iii) Heat-resistant glass; or

(iv) Plastic or rubber and rubberlike materials which are relatively inert, resistant to scratching, scoring, decomposition, crazing, chipping, and distortion, under normal use conditions; are nontoxic, fat resistant, relatively nonabsorbent, relatively insoluble, do not release component chemicals or impart flavor or odor to the product, and which maintain their original properties under repeated-use conditions.

(2) Single-service articles have been manufactured, packaged, transported and handled in a sanitary manner and comply with the applicable requirements of ITEM 11p. Section 2.39.

(3) Articles intended for single-service use are not reused.

(4) All containers, equipment, and utensils are free of breaks and corrosion

(5) All joints in such containers, equipment, and utensils are smooth and free from pits, cracks, or inclusions.

(6) Cleaned-in-place milk pipelines and return-solution lines are self-draining. If gaskets are used, they shall be self-positioning and of material meeting specifications described in (1)(iv) above, and shall be of such design, finish, and application as to form a smooth, flush interior surface. If gaskets are not used, all fittings shall have self-positioning faces designed to form a smooth, flush interior surface. All interior surfaces of welded joints in pipelines shall be smooth and free of pits, cracks, and inclusions.

(7) Detailed plans for cleaned-in-place pipeline systems are submitted to the Commissioner for written approval prior to installation. No alteration or addition shall be made to any milk pipeline system without prior written approval of the Commissioner.

(8) Strainers, if used, are of perforated metal design, or so constructed as to utilize single-service strainer media.

(9) Seamless hooded pails having an opening not exceeding one-third the area of that of an open pail of the same size are used for hand milking and hand stripping.

(10) All milking machines, including heads, milk claws, milk tubing, and other milk-contact surfaces can be easily cleaned and inspected.

(11) Milk cans have umbrella-type lids.

(12) Farm holding/cooling tanks, welded sanitary piping, and transportation tanks comply with the applicable requirements of ITEM 10p. Section 2.38 and ITEM 11p. Section 2.39.

2.17 UTENSILS AND EQUIPMENT - CLEANING (ITEM 10r.) Utensils and equipment shall meet the following cleaning requirements: The product-contact surfaces of all multiuse containers, equipment, and utensils used in the handling, storage, or transportation of milk shall be cleaned after each usage. Bulk tanks and milk cans shall be cleaned when emptied and shall be emptied at least once every 48 hours.

2.18 UTENSILS AND EQUIPMENT - SANITATION (ITEM 11r.) Utensils and equipment shall meet the following requirements for cleaning:

(a) All product-contact surfaces of multiuse containers, utensils, and equipment used in the handling, storage, or transportation of milk are sanitized before each usage by one of the following methods, or by any method which has been demonstrated to be equally effective:

(1) Complete immersion in hot water at a temperature of at least 170 degrees F (77 degrees C) for at least 5 minutes, or exposure to a flow of hot water at a temperature of at least 170 degrees F (77 degrees C) as determined by use of a suitable accurate thermometer (at the outlet) for at least 5 minutes.

(2) Complete immersion for at least 1 minute in, or exposure for at least 1 minute

to a flow of a chemical sanitizer of acceptable strength. All product-contact surfaces must be wetted by the sanitizing solution, and piping so treated must be filled. Sanitizing sprays may be used. Chemical solutions, once used, shall not be reused for sanitizing but may be reused for other purposes.

2.19 UTENSILS AND EQUIPMENT - STORAGE (ITEM 12r.) (a) Utensils and equipment shall meet the following storage requirements:

(1) All milk containers, utensils, and equipment, including milking machine vacuum hoses, are stored in the milkhouse in a sanitizing solution, or on racks, until used. Milk pipelines and pipeline milking equipment such as; milker claws, inflations, weigh jars, meters, milk hoses, milk receivers and milk pumps which are designed for mechanical cleaning may be mechanically cleaned, sanitized and stored in the milking barn or parlor provided this equipment is designed, installed and operated to protect the product-and solution-contact surface from contamination at all times. Some of the parameters to be considered in determining protection are; proper location of equipment, proper drainage of equipment and adequate and properly located lighting and ventilation. The milking barn or parlor must be used only for milking. Concentrates may be fed in the barn during milking but the barn shall not be used for the housing of cattle. When manual cleaning of product-contact surfaces is necessary, the cleaning shall be done in the milkhouse.

(2) Means are provided to effect complete drainage of equipment when such equipment cannot be stored to drain freely.

(3) Clean cans or other containers are stored in the milkhouse within a reasonable time after delivery to the dairy farm.

(4) Strainer pads, parchment papers, gaskets, and similar single-service articles are stored in a suitable container or cabinet and protected against contamination.

2.20 UTENSILS AND EQUIPMENT - HANDLING (ITEM 13r.) (a) Utensils and equipment handling shall meet the following requirements:

After sanitization, all containers, utensils, and equipment shall be handled in such manner as to prevent contamination of any product-contact surface.

(1) Sanitized product-contact surfaces, including farm cooling tank openings and outlets, are protected against contact with unsanitized equipment and utensils, hands, clothing, splash, condensation, and other sources of contamination.

(2) Any sanitized product-contact surface, which has been otherwise exposed to contamination, is again cleaned and sanitized before being used.

2.21 MILKING - FLANKS, UDDERS, AND TEATS (ITEM 4r.) (a) Milking practices shall meet the following requirements:

(1) Milking is done in a milking barn, stable, or parlor.

(2) Brushing is completed prior to milking.

(3) Flanks, bellies, tails, and udders are clipped as often as necessary to facilitate cleaning of these areas and are free from dirt. The hair on the udders shall be of such length that it is not incorporated with the teat in the inflation during milking.

(4) Udders and teats of all milking cows are cleaned and treated with a sanitizing solution and are relatively dry just prior to milking.

(5) Wet hand milking is prohibited.

2.22 MILKING - SURCINGLES, MILK STOOLS, AND ANTIKICKERS (ITEM 15r.) (a) The milking equipment cited here shall meet these requirements:

(1) Milk stools are not padded and are constructed to be easily cleaned.

(2) Milk stools, surcingles, and antikickers are kept clean and are stored above the floor in a clean place in the milking barn, stable, parlor, or milkhouse, when not in use.

2.23 PROTECTION FROM CONTAMINATION - (ITEM 16r.) (a) Protection from contamination requires compliance with the following:

(1) Equipment and operators are so located within the milking barn and milkhouse as to prevent overcrowding and contamination of cleaned and sanitized containers, equipment, and utensils by splash, condensation, or manual contact.

(2) During processing, pipelines and equipment used to contain or conduct milk and milk products shall be effectively separated from tanks or circuits containing cleaning and/or sanitizing solutions.

(3) All milk which has overflowed, leaked, been spilled, or improperly handled is discarded.

(4) All product-contact surfaces of containers, equipment, and utensils are covered or otherwise protected to prevent the access of insects, dust, condensation, and other contamination. All openings, including valves and piping attached to milk storage and transport tanks, pumps, or vats, shall be capped or otherwise properly protected.

(5) The receiving receptacle is raised above the floor (as on a dolly or cart), or placed at a distance from the cows to protect it against manure and splash when milk is poured and/or strained in the milking barn. Such receptacle shall have a tight-fitting cover which shall be closed except when milk is being poured.

(6) Each pail or container of milk is transferred immediately from the milking barn, stable, or parlor to the milkhouse.

(7) Pails, cans, and other equipment containing milk are properly covered during transfer and storage.

(8) Whenever air under pressure is used for the agitation or movement of milk, or is directed at a milk-contact surface, it is free of oil, dust, rust, excessive moisture, extraneous materials, and of odor and shall otherwise comply with the applicable standards of Appendix A.

(9) Antibiotics and medicinals are stored in such a manner that they cannot contaminate the milk or milk product-contact surfaces of the equipment, containers or utensils.

2.24 PERSONNEL - HAND-WASHING FACILITIES - (ITEM 17r.) (a) The following hand-washing facilities are required:

(1) Hand-washing facilities are located in the milkhouse and in or convenient to the milking barn, stable, parlor, or flush toilet.

(2) Hand-washing facilities include soap or detergent, hot and cold or warm water, individual sanitary towels, and a lavatory fixture. Utensil wash and rinse vats shall not be considered as hand-washing facilities.

(3) Such facilities are to be kept in good repair, clean, and shall not be used for storage.

2.25 PERSONNEL - CLEANLINESS - (ITEM 18r.) (a) All persons shall meet the following requirements:

(1) Hands are washed clean and dried with an individual sanitary towel immediately before milking, before performing any milkhouse function, and immediately after the interruption of any of these activities.

(2) Milkers and milk haulers wear clean outer garments while milking or handling milk, milk containers, utensils, or equipment.

2.26 COOLING - (ITEM 19r.) (a) Milk shall be cooled in acordance with the following requirements:

(1) Raw milk for pasteurization is cooled to 45 degrees F (7 degrees C) or less within 2 hours after milk: *Provided*: That the blend temperatures of subsequent milkings shall not exceed 50 degrees F (10 degrees C).

(2) Recirculated cold water which is used in plate or tubular coolers or heat exchanges is from a safe source and protected from contamination. Such water shall be tested semiannually and shall comply with the bacteriological standards cited in ITEM 8r. Section 2.15.

2.27 VEHICLES - (ITEM 20r.) (a) Vehicles used to transport milk must meet the following requirements:

(1) Vehicles used to transport milk from the dairy farm to the milk plant or receiving station are constructed and operated to protect their contents from sun, freezing, and contamination.

(2) Vehicles have bodies with solid enclosures and tight, solid doors.

(3) Vehicles are kept clean, inside and out.

(4) No substance capable of contaminating the milk is transported with the milk.

Note: See ITEM 9r. Section 2.16 and ITEM 10r. Section 2.15 for information on the construction of bulk milk pickup tankers.

2.28 INSECT AND RODENT CONTROL - (ITEM 21r.) (a) Effective measures shall be taken to prevent the contamination of milk, containers, equipment, and utensils by insects, rodents, and by chemicals used to control such vermin:

(1) Surroundings are kept neat, clean, and free of conditions which might harbor or be conductive to the breeding of insects and rodents. During fly season, manure shall be spread directly on the fields; or stored for not more than 4 days in a pile on the ground surface, and then spread on the fields; or stored for not more than 7 days in an impervious-floored bin, or on an impervious-curbed platform and then spread; or stored in a tight-screened and trapped manure shed; or effectively treated with larvicides; or disposed of in any other manner which controls insect breeding.

(2) Manure packs in loafing areas, stables without stanchions, pen stables, resting barns, wandering sheds, and free-stall housing are properly bedded and managed to prevent fly breeding.

(3) Milkrooms are free of insects and rodents.

(4) Milkrooms are effectively screened or otherwise protected against the entrance of vermin.

(5) Outer milkhouse doors are tight and self-closing. Screen doors shall open outward.

(6) Effective measures are taken to prevent the contamination of milk, containers, utensils, and equipment by insects and rodents, and by chemicals used to control such vermin. Insecticides and rodenticides not approved for use in the milkhouse shall not be stored in the milkhouse.

(7) Only insecticides and rodenticides approved for use by the Commissioner and/or registered with the U.S. Environmental Protection Agency are used for insect and rodent control.

(8) Insecticides and rodenticides are used only in accordance with manufacturer's label directions and are used so as to prevent the contamination of milk, milk containers, equipment, utensils, feed, and water.

PARTICIPANT'S NOTES -- Session 1b

SUMMARY

Objectives: This session is to encourage you to realize the costs associated with the current level of mastitis in your herd and to initiate thinking along the mastitis problem-solving process.

Summary of activities/exercises (time)

1. **Mini-lecture on Antibiotic Residue Avoidance (20 min)**
   With overheads and discussions, zero tolerance for antibiotic residues in milk and meat is examined. The group discusses systems for keeping "hot" milk out of the bulk tank.

2. **Cost of Mastitis Worksheet (45 min)**
   On a one-page worksheet, you estimate the monthly cost of mastitis in your particular herd. Costs are partitioned into costs of clinical cases, subclinical mastitis level, and lost quality incentives.

3. **Review Problem Solving/Goal Setting (10 min)**
   We review problem solving and goal setting, particularly in terms of mastitis control. You are introduced to the mastitis problem solving schematic which is used throughout the course.

4. **Identifying and Diagnosing a Mastitis Problem (20 min)**
   By setting goals for the level of mastitis that is tolerable, you will identify if a mastitis problem exists. To diagnose the problem, bacteriological culturing is necessary to pinpoint the causative organisms.

5. **Review Remainder of Course (10 min)**
   In outline form, you are shown what to expect from the course in the remaining three sessions.

MILK QUALITY - Session 1b

ACTIVITY 1

Mini-Lecture on Antibiotic Residue Avoidance

I. **Learning Goals of this Activity**

1. Appreciate that cows treated for mastitis are the primary source of antibiotic residue in milk and meat.
2. Learn practices used by others and those recommended in an antibiotic residue avoidance program.

II. **Key Points**

1. There is zero-tolerance for antibiotic residue in milk and meat.
2. Tests to detect antibiotics are extremely sensitive.
3. Steps need be taken to avoid antibiotic residues.

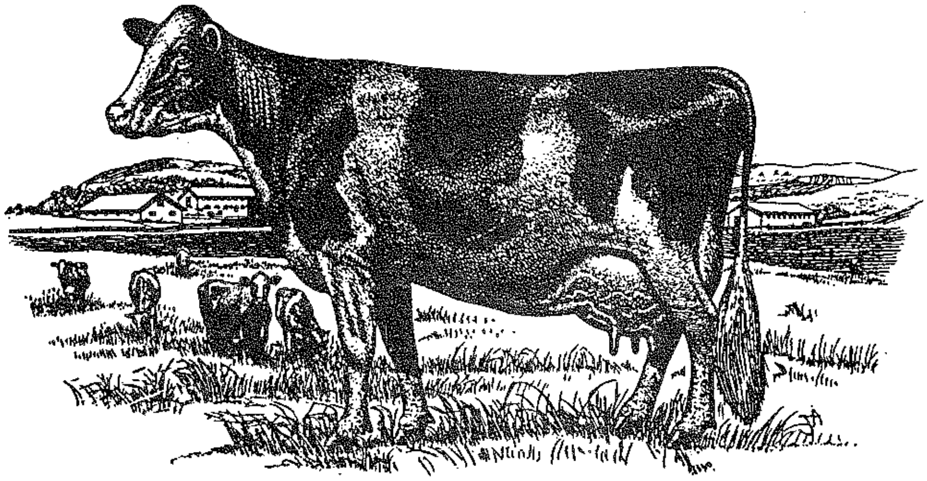
III. **Personal Notes:**

Why No Antibiotic Residue?

- Allergic People
- Cultured Products
- Resistant Organisms
- Illegal → Heavy Fines

GOAL:
Maintain healthy,
wholesome,
pure food supply.

The primary source of antibiotics in meat and milk is from cows treated for Mastitis.



Practices to Avoid Antibiotic Residue

* Dry treat > 4 weeks prepartum

* Correct withholding time

* Read medication labels

* Limit access to drugs

* Maintain written records

* Mark treated cows

* Don't contaminate milking equipment

* Discard all milk from treated cows

* Test milk if in doubt

Goals for SMART

*****

Specific

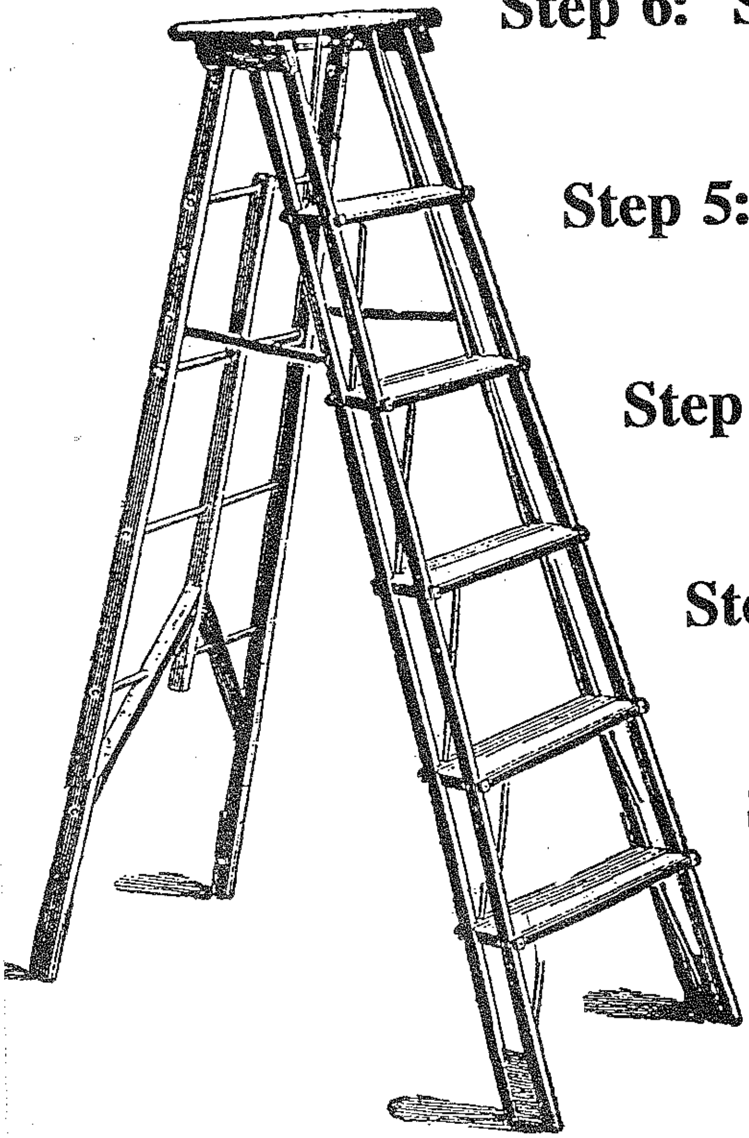
Measurable

Attainable

Rewarding

Timed

Mastitis Problem Solving Scheme



Step 6: Set SMART Goals

Step 5: Generate Plan

Step 4: Select Solutions

Step 3: Generate Alternatives

Step 2: Diagnose Problem

Step 1: Review Records

MILK QUALITY - Session 1b

ACTIVITY 2

Cost of Mastitis Worksheet

I. Learning Goals of this Activity

1. Recognize the cost of mastitis to your dairy operation.
2. Realize that subclinical mastitis results in a significant loss of income.
3. Since it is usually "unseen", the extent of income loss resulting from subclinical mastitis levels in the herd is not clearly understood.

II. Key Points

1. Mastitis is a costly problem. More so than most dairy farm managers realize.
2. High somatic cell counts associated with subclinical mastitis is a major portion of the cost of mastitis.
3. Improving milk quality by reducing herd somatic cells and incidence of clinical mastitis will increase profitability.

III. Personal Notes:

WORKSHEET

ESTIMATED MONTHLY COST OF MASTITIS

1. COST OF CLINICAL MASTITIS:

Ave. milk produced/day _ _ _ _ _

No. cases treated/mo **x**_ _ _ _ _ = __________

Hold out period (days)**x**__________

Milk dumped/month __________

Milk dumped/mo ÷ **100 x** milk price = value of dumped milk

__________ ÷ **100 x $**__________ = __________

Antibiotic treatment **x** no. cases treated = treatment cost

__________ **x** __________ = __________

Value of dumped milk **+** treatment costs = Clinical costs

__________ **+** __________ = Clinical costs__________

2. COST OF SUBCLINICAL MASTITIS

	Ave. L.S.	Numbers		Milk loss/day (Table 2)		Potential Milk loss
1st calf heifers	_ _	_ _ _ _	**x**	_ _ _ _ _ _ _	=	
Older cows	_ _	_ _ _ _	**x**	_ _ _ _ _ _ _	=	+__________

x__________**30 Days**

Potential Monthly Milk Loss = __________

Pot. mo. milk loss ÷ **100 x** milk price = Subclinical costs

__________ ÷ **100 x** __________ = Subclinical costs__________

3. COST OF LOST QUALITY INCENTIVES

Milk shipped/mo ÷ **100 x** incentive/cwt = Incentive costs

__________ ÷ **100 x** __________ = Incentive costs__________

****

(Clinical costs + subclinical costs + lost incentives)

Estimated monthly cost of mastitis = __________

Table 2

Linear Score Information Table

Somatic Cell Count (Thousands)			Milk Yield Losses			
			Per Day		Per 305 Lactation	
Linear Score	Mid-point	Range	1st[1]	2nd (+)[1]	1st[1]	2nd(+)[1]
0	12.5	0 - 17				
1	25	18 - 34				
2	50	35 - 68	<u>Pounds of milk loss relative to LS 2</u>			
3	100	69 - 136	.75	1.5	200	400
4	200	137 - 273	1.5	3.0	400	800
5	400	274 - 546	2.25	4.5	600	1200
6	800	547 - 1092	3.0	6.0	800	1600
7	1600	1093 - 2185	3.75	7.5	1000	2000
8	3200	2186 - 4371	4.5	9.0	1200	2400
9	6400	4372 or more	5.25	10.5	1400	2800

[1] 1st and 2nd (+) refer to 1st lactation and 2nd and later lactation cows

MILK QUALITY - Session 1b

ACTIVITY 3

Review Problem Solving/Goal Setting

I. Learning Goals of this Activity

1. Review of the problem solving process in relationship to mastitis.
2. Review the setting of **SMART** goals. (Goals are **S**pecific, **M**easurable, **A**ttainable, **R**ewarding, and **T**imed.)
3. Set goals for mastitis parameters (as in Step 1 of Schematic). Report goals on registration forms.

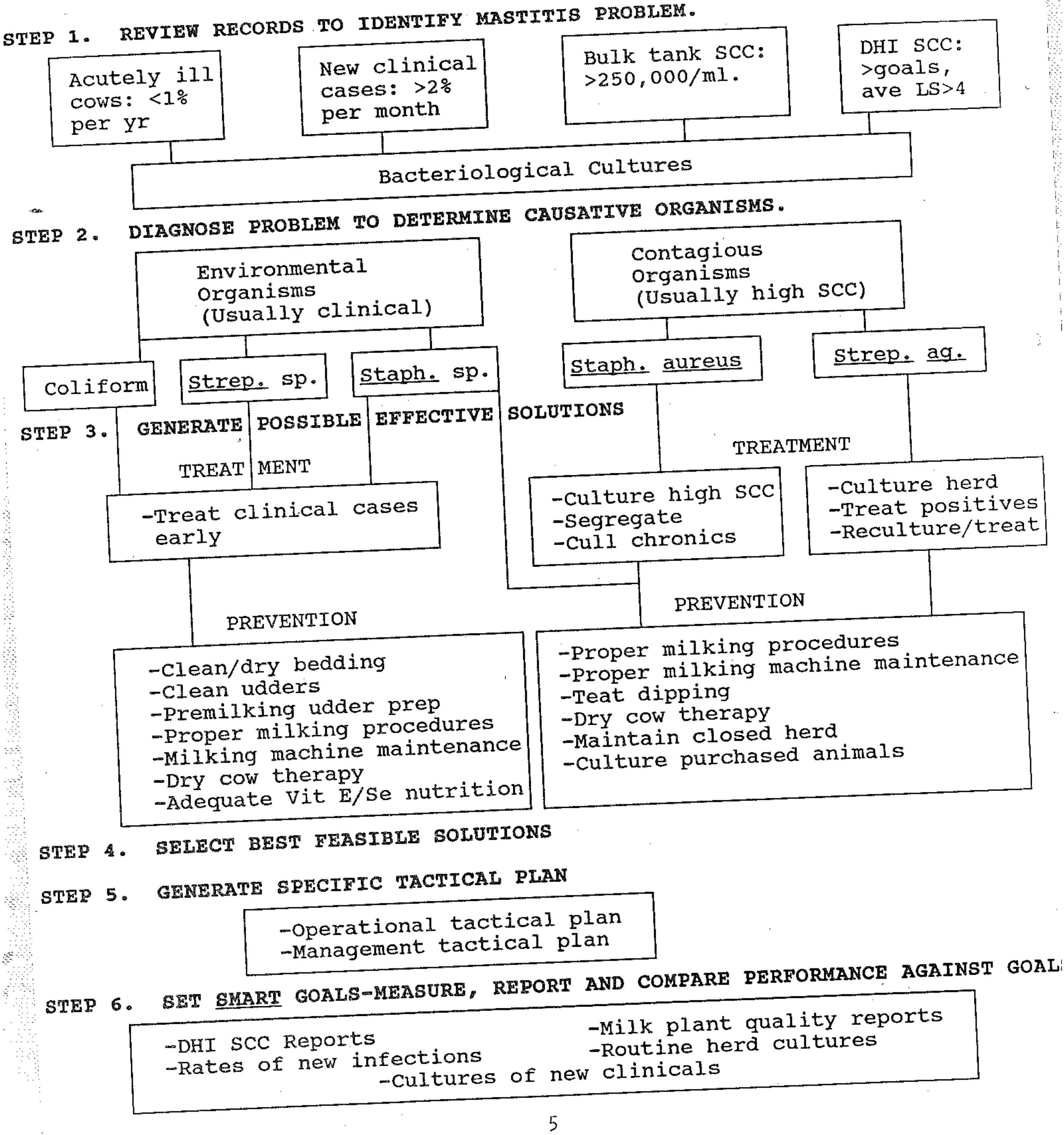
II. Key Points

1. The mastitis problem solving schematic is introduced. It is be used extensively in the case studies as well as on you own farm situation to aid in developing tactical plans for improving milk quality.
2. In setting goals for the level of mastitis you wish to achieve in your herd, you may identify a mastitis problem.

III. Personal Notes:

MANAGEMENT OF MILK QUALITY FOR FARM AND INDUSTRY SUCCESS

MASTITIS PROBLEM SOLVING SCHEME



Mastitis Problem Solving Scheme

Step 1: Review Records
to Identify Mastitis Problem

Step 2: Diagnose Problem to Determine
Causative Organisms

Step 3: Generate Possible
Effective Solutions

Step 4: Select Best
Feasible Solutions

Step 5: Generate Specific
Tactical Plan

Step 6: Set SMART Goals
Measure, Report and Compare
Performance Against Goals

MILK QUALITY - Session 1b

ACTIVITY 4

Identifying and Diagnosing a Mastitis Problem

I. Learning Goals of this Activity

1. Setting goals for level of mastitis better identifies your mastitis problem.
2. Bacteriological cultures are needed to diagnose a mastitis problem.
3. Questions about the QMPS Survey/Questionnaire will be addressed.

II. Key Points

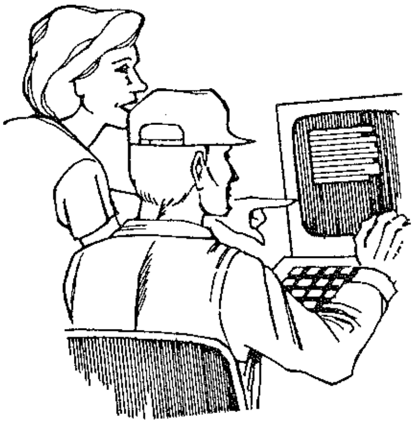
1. In the problem solving process, the setting of goals usually identifies problems.
2. Bacteriological cultures and sensitivity tests work to help diagnose mastitis problems.
3. There are different strategies on using bacteriological cultures to monitor mastitis organisms in the herd.
4. The QMPS Survey/Questionnaires compiles information of factors that may effect the level of mastitis in your herd. Requests help from the teaching team in accurately completing the form.

III. Personal Notes:

Mastitis Problem Solving Scheme

Step 1:

Review Records to Identify Mastitis Problem



Step 2:

Diagnose Problems to Determine Causative Organisms

Strategy for "B" Culturing

- ▲ Periodically, culture all clinicals
  - * ID causative bacteria
  - * ID effective therapy

- ▲ Routinely sample all clinicals
  → freeze
  - * If initial treatment fails
    → culture

- ▲ Repeat when populations shift
  - * ↑ ineffective first treatment
  - * ↑ in herd SCC
  - * ↑ in number of clinicals

Limitations of "B" Culturing

- After the Fact
- 20-40% Negatives
- Contaminated Samples
- Cost, Time, Management

MILK QUALITY - Session 1b

ACTIVITY 5

Review Remainder of the Course

I. Learning Goals of this Activity

1. To understand what to expect from the remainder of the course.
2. To collect your farm information on the Milk Quality Registration form for future use in the course.

II. Key Points

1. By explaining the topics and exercises in the remainder of the course, the teaching team wishes to ignite your enthusiasm for continued participation in the workshop.

III. Personal Notes:

Management Focus Workshop
Milk Quality

Session II

- Mastitis-Causing Organisms
- Monitoring Udder Health
- Reading DHI SCC Reports
- Mastitis Problem: Case Study #1

Session III

- Milking Procedures
  - Setting Goals
  - Prioritizing Improvements
- Cleaning/Sanitizing the Milking Machine
- Milking Machine Maintenance

Session IV

- Mastitis Problem: Case Study #2
- Own Farm Mastitis Problem
  - Develop Tactical Plans
  - Economic Evaluation of Plans

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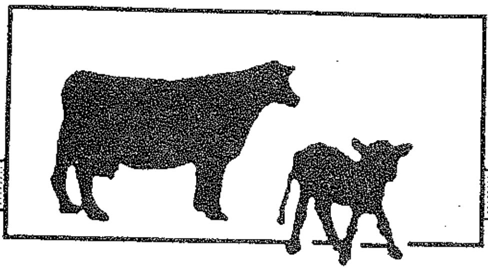

Dairy
Guidelines

PUBLICATION 404-404

1991 FEDERAL REGULATIONS FOR DRUG RESIDUES IN MILK

G. M. Jones and J. R. Bishop

The Pasteurized Milk Ordinance (PMO) establishes standards and regulations that govern the Grade A milk supply. These regulations include somatic cell counts (leukocytes), bacteria counts, and absence of drug residues. The PMO also has established regulations which mandate the proper use and storage of animal drugs on dairy farms. Changes to the PMO are considered every two years at the National Conference on Interstate Milk Shipments (NCIMS) and must be approved by delegates from state regulatory agencies and the Food and Drug Administration (FDA). Certain changes were adopted in 1991 that relate to herd health management and prevention of drug residues.

Monitoring and Testing of Bulk Tank Milk

Every bulk milk pick-up tanker will be screened by industry (milk coop or plant) for residues caused by beta lactam drugs. These include penicillin, cloxacillin, cephapirin, ampicillin, amoxicillin, hetacillin, and ceftiofur. In addition, residues caused by other drugs shall be screened by using a random sampling program on bulk milk tankers. For example, if FDA suspects that a certain drug (e.g., tetracycline, gentamicin, or sulfamethazine) is a problem in a certain area, they may specify specific drug testing. During any consecutive six months, at least four samples will be collected in at least four separate months. These tests shall be completed before the milk can be processed and samples found positive will be retained and the regulatory agency notified. At that time, individual producer samples from the positive bulk tanker will be tested to determine the farm of origin. Once the violative individual producer has been identified, further pickups will be immediately discontinued.

Penalties

On the first violation, the responsible producer's Grade A permit will be suspended for a minimum of two days or equivalent penalty as determined by the regulatory agency. For the second violation within a 12 month period, the producer's permit will be suspended for at least four days. After a third violation within 12 months, the permit will be suspended for four days and the regulatory agency shall initiate administrative procedures pursuant to revocation of the producer's permit.

The authors are Professor of Dairy Science and Associate Professor of Food Science & Technology, Virginia Tech, Blacksburg, VA.

Reinstatement

When a sample taken from the producer's farm tank is no longer positive for drug residues, the producer's permit may be restored to a temporary permit status. The Grade A permit will not be reinstated by the regulatory agency until the responsible producer and a licensed veterinarian have both signed the Quality Assurance certificate which states that the "Milk and Dairy Beef Residue Prevention Protocol" has been implemented in the responsible herd. The certificate also is to be signed by the dairy field representative from the milk plant/coop. The temporary permit would probably be restored for no longer than 25-30 days, but this may vary from state to state.

This program is to be implemented by July 1, 1992. Effective July 1, 1993, the somatic cell count will be lowered to 750,000, except for goat milk which will remain at 1,000,000.

Tolerance/Safe Levels for Drug Residues

Certain animal drugs have tolerance levels which have been established by FDA (e.g., penicillin at 0 ppb, cephapirin at 20 ppb, and cloxacillin at 10 ppb). Milk samples containing less than the tolerance level will be accepted and will not be in violation according to the regulatory level. However, the processor or milk buyer may decide not to accept milk containing less than tolerance levels if a positive test was found with a drug residue test. "Safe levels" have been established for certain other animal drugs. Examples of "safe" levels include 10 ppb penicillin (although the recommended violative level is 4.8 ppb), 30 ppb gentamicin, 30 ppb oxytetracycline, or 80 ppb tetracycline. Caution is advised in the interpretation of these levels. "Safe levels" are used by FDA as guides for prosecutorial discretion. They do not protect milk producers from court enforcement action. "Safe" has been given the following interpretation. A certain dairy farm was found on one occasion to ship milk containing less than 30 ppb oxytetracycline. Since the farm had no prior history of any residue from oxytetracycline, the milk would be accepted. The bulk tank sample was negative. However, if this farm had a history of shipping milk with 1-29 ppb oxytetracycline, the farm's Grade A permit could be suspended. In other words, "safe levels" may be in violation and may be considered as residues and its probably a good recommendation to withhold milk from any positive cow.

There also are "safe concentrations" as has been established for ceftiofur (naxcell) of 1,000 ppb, when used at the prescribed dosage by intramuscular injection for respiratory infection. When used in any other manner (e.g., intramammary), the safe concentration is no longer valid.

This leaves you with a list of drugs with the corresponding residue levels of concern (or recommended violative levels):

Drug	ppb	Drug	ppb
<u>Tolerance levels</u>			
Ampicillin	10	Neomycin	150
Amoxicillin	10	Novobiocin	100
Cephapirin	20	Sulfadimethoxine	10
Cloxacillin	10	Tylosin	50
<u>Safe levels</u>			
Chlortetracycline	30	Sulfamerazine	10
Oxytetracycline	30	Sulfamethazine	10
Erythromycin	50	Sulfamethizole	10
Gentamicin	30	Sulfanilamide	10
Dihydrostreptomycin	125	Sulfapyridine	10
Sulfacloropyridazine	10	Sulfaquinoxaline	10
Sulfadiazine	10	Sulfathiazole	10
		Tetracycline	80

Milk and Dairy Beef Quality Assurance Program

Drug residues in milk and carcasses of cull cows and calves continue to be a problem to the dairy industry. Although the incidence of positive samples is approximately .12%, drug testing costs the industry considerable amounts of money and adverse publicity. With the new testing procedures, the incidence of positive samples will probably be higher. From October, 1990, to July, 1991, 24% of FDA check ratings were debited for drug violations. Of these, 67% were cited for improperly labeled drugs, 40% violated extra label use regulations, and 27% stored drugs improperly. Of those debited, 89% were prescription drugs and 67% were obtained from a veterinarian.

Prevention of drug residues in milk and meat from cull dairy cows and calves is the objective of the "Milk and Dairy Beef Quality Assurance Program". It was developed by many representatives of the dairy industry and has been designed as an industry voluntary self-help program that, through education, will prevent or minimize drug liability to dairy farmers and veterinarians.

The Quality Assurance Program will clarify procedures for avoiding drug residues. It explains what's required of labels for prescription and extra label use drugs and how they should be stored to avoid the possibility that unapproved drugs are administered to lactating dairy cows. The program helps identify common causes of mistakes, and describes practices for assuring milker identification of treated cows. The program provides assistance in the interpretation and use of on-farm tests for determining if milk is adulterated.

Benefits of Participation to Dairy Farmers

Liability and Cost for Adulterated Milk. According to the PMO, the farm's Grade A permit will be suspended for at least two days. In addition to losing payment for this milk, the farm may have to pay for all milk on the load, a possible total of $6-8,000, as well as bonuses to other producers on the load, and transportation and handling costs associated with disposal of the contaminated load. Farm liability insurance may cover some of the costs, but all policy holders share the cost of the loss.

Meat Contamination. Drug residues in carcasses of cull cows and calves result in the farm becoming quarantined. Subsequent animals will be tested. Treatment and sales records are subject to scrutiny by regulatory officials.

Consumer Confidence. Consumers are leery of chemical contamination of foods, including herbicides, pesticides, and drugs. Three out of five consumers view drugs as a serious health hazard, while another one-third consider them a possible hazard. That's 93%! Adverse publicity, resulting from media coverage to contaminated foods or government investigations, leaves doubts in the minds of consumers and food sales suffer.

Outside Interference. Consumer activist groups, politicians, etc., are eager to become involved in establishing public policy related to food safety and quality. Regulations could result that are expensive and difficult for farmers to implement.

Why Would Veterinarians Participate?

Liability. To minimize liability associated with mistakes in using prescribed drugs, veterinarians should encourage their clients to participate in the Quality Assurance Program. The end result is greater profitability to both the veterinarian and the dairy farmer and a better working relationship between the two. A secondary advantage could be improved efficacy resulting from treatment and management.

Advantages to Milk Coops/Milk Plants

The Quality Assurance Program could increase demand for field staff time in presenting and clarifying points related to the program. In return, benefits to the coop or milk plant should include fewer loads of contaminated milk and related costs as well as assuring buyers of a better quality product. It has been estimated that drug residues cost the dairy industry $10 million annually.

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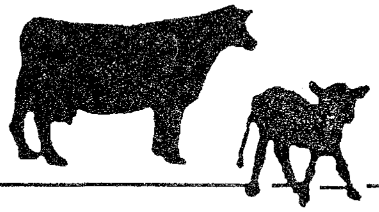

Dairy
Guidelines

PUBLICATION 404-403

PREVENTING DRUG RESIDUES IN MILK AND CULL DAIRY COWS

by

G. M. Jones

Preventing antibiotic contamination of milk and meat is the responsibility of every farm. Drug residues can be avoided by a well planned drug use program. There is no way that your milk plant can use contaminated milk. The sale of contaminated milk or meat will cause the responsible party to be subjected to severe penalties, including suspension of permits and monetary loss. Milk with drugs can adulterate a whole truckload or holding tank of milk.

The Food and Drug Administration will accept no drug residue in milk or meat. Sensitive tests can detect an antibiotic from a treated quarter even when this milk has been diluted in the tank by milk from many cows. Your milk is checked by the milk plant and by the Division of Dairy Dairy and Foods of the Virginia Department of Agriculture and Consumer Services because:

a. A small percentage of people are violently allergic to antibiotics. Extremely small doses can be fatal. Other people are sensitive to low drug concentrations that cause mild reactions that can be uncomfortable.

b. A continued low-level intake of antibiotics from food could result in a buildup of antibiotic-resistant organisms in humans who are not allergic to the drug.

c. Antibiotics interfere with growth of starter cultures used in making yogurt and cottage or other cheeses.

The major problem with drug residues is the consumers' perception that milk and dairy products, including beef, is pure and free of chemical adulteration or contamination. Consumers want a safe food supply and the image that food is free of herbicides, pesticides, and drugs is important to them.

Guidelines for an Effective Drug Use Program

1. **READ THE LABEL** when the antibiotic is purchased. It is the responsibility of the dairyman to understand and **FOLLOW DIRECTIONS** for usage of all prescriptions (℞) and over-the-counter (OTC) drugs. Prescription drug labels must include: (1) A cautionary

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statement restricting use to a licensed veterinarian, (2) name and address of the manufacturer/distributor or veterinarian, (3) directions for use and milk discard time, (4) expiration date, and (5) dosage level and date dispensed. Make sure that anyone who handles drugs on your farm understands their usage and consequences of misuse.

2. **ADMINISTER THE DRUG PROPERLY.** Always clean the teat end or injection site with alcohol. Be sure to use a sterile cannula if they aren't included with the drug. No medication can do the job right if you inject more germs and contaminants along with the drug. After infusing the udder, remember to use teat dip to help sanitize the teat ends against additional bacterial invasion.

3. **PAY ATTENTION TO WITHDRAWAL TIMES** for milk and for cows to be slaughtered. Withdrawal times are not the same for all drugs. If you use a prescription drug from your veterinarian, be sure that you understand the directions for use, withdrawal times, and safe date to market milk or animals treated.

   (a) Withhold milk from cows treated for intrauterine infections or other diseases. These drugs can reach the udder and be detected in milk.

   (b) Do not ship milk or cull cows that may contain drug residues. This includes dry cows if treated at drying off with an intra-mammary product. Wait until the withdrawal time for meat has elapsed.

   (c) Milking cows which are culled because they are unresponsive to mastitis and other treatments cannot be shipped until the withdrawal time for meat has expired. Remember, carcasses can show needle marks.

   (d) If milk from a treated animal is added to the milk tank, don't add any more milk to the tank until the milk has been checked, or dump the milk. Contact the field rep for your milk company.

4. **MARK AND IDENTIFY ALL TREATED COWS.** With expanding herd sizes and different milkers, it is necessary to identify all treated cows and the days which milk must be withheld so they can be detected by any milker. Separate treated cows from the herd and milk them last as an additional precaution to avoid a tank full of contaminated milk. Accurate observation of the withholding period requires identification at the time of treatment. A good method, which is not infallible, is to mark treated cows with baling twine, neck chains, or special tags over existing numbers; crayons, paint sticks or spray paint, or purple dye on the udder, flanks, legs, or rumps; tape, bailing twine, or plastic bracelets on tails or legs; or special leg or tail tags which have space for entering the date and time when milk can be saved or cows can be slaughtered. **KEEP A WRITTEN RECORD OF ALL TREATMENTS,** including date of treatment, diagnosis or why cow was treated, cow treated, treatment used, withholding times, date when milk can be shipped, and who administered treatment.

5. **MILK ALL TREATED COWS LAST OR USE SPECIAL PRECAUTIONS.**

6. **DISCARD MILK FROM ALL FOUR QUARTERS OF A TREATED COW.** Antibiotic infused into one quarter can reach all other quarters through the blood stream.

7. **DO NOT EXCEED RECOMMENDED DOSAGE LEVELS** for OTC drugs or follow veterinarian's directions for prescription or extra-label drugs. A double dosage does not

double the effectiveness. Administer treatment for as many times as indicated by the directions. If drugs are administered extra-label, get specific recommendations from your veterinarian regarding treatment, withholding times, and appropriate drug residue tests.

8. Do not combine several antibiotics yourself. "Home-brewed" concoctions can become contaminated by infectious organisms in the milk house. Withdrawal times would not be known.

9. If medicated feeds are used on the farm, always follow the feeding and withholding instructions. Be careful that these feeds do not contaminate the feed or water supply of the milking herd.

10. **LABEL AND STORE ALL DRUGS PROPERLY.** Drugs must be approved and labeled for use in lactating cows or properly labeled by a veterinarian for extra label use. Drugs approved for treatment of non-lactating cattle must be stored separately from drugs used to treat lactating cows and shelves identified. Many drugs require cool storage, and keeping them in a windowsill or on top of the water heater can make the product impotent. At best, they will be ineffective, and, at worst, they can promote growth of contaminants that may produce additional problems.

11. Careless use of pesticides and insecticides, as well as cleansing and sanitizing agents, can cause contaminating residues in the milk. Be aware of how and where you use them.

12. **TEST EVERY COW WITH A DRUG RESIDUE TEST** before her milk is returned to the bulk tank. Determine whether the residue test used on the farm will detect the drug(s) being used.

STOP
BEFORE USING ANY DRUG READ THE LABEL

DAIRY PRODUCER'S SAFE DRUG USE GUIDE

STOP
BEFORE USING ANY DRUG READ THE LABEL

FDA APPROVED OVER-THE-COUNTER (OTC)* DRUGS FOR LACTATING DAIRY COWS

WARNING!

KEEP DRUG AND CHEMICAL RESIDUES OUT OF MILK, CULL COWS AND CALVES

NEW SCREENING TESTS ARE VERY SENSITIVE
ALL FAMILIES OF DRUGS ARE DETECTABLE
MARK AND SEGREGATE ALL TREATED ANIMALS

CLASSIFICATION	ACTIVE INGREDIENT	ROUTE OF ADMINISTRATION	WITHDRAWAL TIMES MILK (HRS.)	MEAT (DAYS)	TRADE NAME EXAMPLES	REMARKS
Antiseptic	Chlorhexidine dihydrochloride	Interuterine	NONE	NONE	NOLVASAN EFFERVESCENT UTERINE CAP-TABS NOLVASAN SUSPENSION	
Bloat Reduction	Poloxalene	Oral	NONE	NONE	THERABLOAT SWEETLIX BLOAT GUARD BLOAT GUARD DRENCH BLOAT GUARD TOP DRESSING BLOAT GUARD LIQUID	
Bloat Reduction	Oxytetracycline	Oral	SEE REMARKS		TERRAMYCIN-100 PREMIX TM-10, TM-50 PREMIX TERRAMYCIN TM-50D TERRAMIX-10Z	75MG/HEAD/DAY :BLOAT REDUCTION IF FEED DOSE > 2 g/head/day THEN: MEAT WITHDRAWAL TIME IS 5 DAYS
Diarrhea, Bacterial	Oxytetracycline	Oral	SEE REMARKS		TERRAMYCIN-100 PREMIX TM-10, TM-50 PREMIX TERRAMYCIN TM-50D TERRAMIX-10Z	75MG/HEAD/DAY :BACTERIAL DIARRHEA IF FEED DOSE > 2 g/head/day THEN: MEAT WITHDRAWAL TIME IS 5 DAYS
Eye Infection	Metycaine piperocaine hydrochloride boric acid, neomycin sulfate, tylosin	Topical	NONE	NONE	TYLAN PLUS NEOMYCIN EYE POWDER	
Eye Infection	Oxytetracycline hydrochloride	Topical	NONE	NONE	TERRAMYCIN OPTHALMIC	
Eye Infection	Nitrofuran	Topical	NONE	NONE	NFZ PUFFER	
Eye Infection	Furazolidone	Topical Sprayed powder	NONE	NONE	FUROX	
Foot Rot	Sulfadimethoxine	Oral	60	7	ALBON/AGRIBON	
Growth Promotion	Monensin	Oral	NONE	NONE	PASTURE GAINER BLOCK 37 R350	
Increased Milk Production	Iodinated casein	Oral	NONE	NONE	PROTAMONE	
Increased Milk Production	Oxytetracycline	Oral	SEE REMARKS		TERRAMYCIN-100 PREMIX TM-10, TM-50 PREMIX TERRAMYCIM TM-50D TERRAMIX-10Z	75MG/HEAD/DAY :INCREASED MILK PRODUCTION IF FEED DOSE > 2 g/head/day THEN: MEAT WITHDRAWAL TIME IS 5 DAYS
Mastitis	Erythromycin	Injectable	72	14	ERYTHRO-100/ERYTHRO-200 GALLIMYCIN INJECTABLE/GALLIMYCIN 200	MAY NOT BE PRESENTLY MARKETED
Mastitis	Penicillin G (procaine)	Injectable	48	10	PENICILLIN G PROCAINE AQUEOUS	
Mastitis	Cephapirin (sodium)	Intramammary	96	4	CEFA-LAK/TODAY INTRAMAMMARY INFUSION	
Mastitis	Erythromycin	Intramammary	36	14	ERYTHRO-36 GALLIMYCIN 36 STERILE ERYTHROMAST 36 GALLIMYCIN 36 SOLUTION	MAY NOT BE PRESENTLY MARKETED
Mastitis	Penicillin G (procaine)	Intramammary	SEE REMARKS	4	HANFORDS AQUAPEN	MILK DISCARD 3 DOSE REGIMEN-(60 ML DOSE)-84 HRS 3 DOSE REGIMEN-(10 ML DOSE)-60 HRS 2 DOSE REGIMEN-(10 ML DOSE)-60 HRS
Mastitis	Penicillin G (procaine)	Intramammary	60	3	TRUE ANTIBIOTIC FORMULA –10, FORMULA A-34	
Mastitis	Penicillin G (procaine)	Injectable	72	30	MYCILLIN V	MAY NOT BE PRESENTLY MARKETED
Mastitis, Subclinical	Dihydrostreptomycin sulfate, penicillin G (procaine)	Injectable	48	30	DISTRYCILLIN A.S.	
Mastitis, Subclinical	Dihydrostreptomycin sulfate, penicillin G (procaine)	Injectable	72	30	COMBIOTIC	
Mastitis, Subclinical	Oxytetracylcine hydrochloride	Intramammary	96	4	TERRAMYCIN FOR MASTITIS/ LIQUIMAST SOLUTION FOR MASTITIS	MAY NOT BE PRESENTLY MARKETED
Mastitis, Subclinical	Penicillin G (procaine) novobiocin	Intramammary	72	15	SPECIAL FORMULA 17900-FORTE SUSPENSION	
Mastitis, Subclinical	Sodium sulfabromomethazine	Oral	96	18	SULFABROME 2.5 GM	MAY NOT BE PRESENTLY MARKETED
Parasite Control	Coumaphos	Oral	NONE	NONE	BAYMIX FEED PREMIX BAYMIX CRUMBLES PURINA 6 DAY WORM KILL	
Parasite Control	Morantel tartrate	Oral	NONE	106	PARATECT CARTRIDGE	
Roundworm Control	Thiabendazole	Oral	96	3	E.Z.-EX WORMER PELLETS OMNIZOLE 6 WORMER SUSPENSION TBZ CATTLE WORMER DRENCH TBZ CATTLE WORMER PASTE 43% TBZ CATTLE WORMER PASTE 50% THIABENDAZOLE MEDICATED E.Z. WORMER BLONDE BLOCK FOR CATTLE	
Scar Tissue Removal	Salicylic acid	Intramammary	48	NONE	SHURJETS	
Shipping Fever	Penicillin G (procaine)	Injectable	72	10	PROCAINE PENICILLIN AQUEOUS SOLN	
Shipping Fever	Sulfadimethoxine	Injectable	60	5	AGRIBON INJECTION 40% AGRIBON/ALBON INJECTION 40%	

*FDA POLICY ON OTC DRUGS

Over the counter (OTC) drugs may be obtained by a layman without a prescription from a veterinary practitioner. The use of animal drugs in food producing animals in any manner other than in accord with the label violates Federal Law.

NOTE: This guide is based on Food and Drug Administration publications. The listing of any drug is not intended to promote any trade name compound. If you have any questions about the proper use of any drug, consult your veterinarian.

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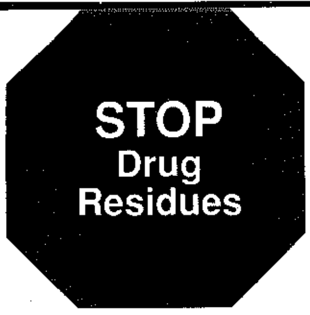

DAIRY PRODUCER'S SAFE DRUG USE GUIDE

FDA APPROVED OVER-THE-COUNTER (OTC) DRUGS FOR LACTATING DAIRY COWS

FOLLOW PROPER PROCEDURES — NEVER TAKE CHANCES WITH DRUGS

1. Place a responsible individual in charge of all drugs.
2. Store all drugs properly.
   a. Animal drugs stored in the milkhouse, milking barn or adjacent areas must be approved and labeled for use on dairy animals or be properly labeled by a veterinarian for extra label use.
   b. Approved animal drugs used for treatment of nonlactating dairy animals (calves and dry cows) must be segregated from drugs used to treat lactating animals. Separate shelves in medicine cabinets or refrigerators satisfy this requirement.
3. Be sure all OTC drugs are properly labeled. The label must include:
   a. The name of the drug and the active ingredients.
   b. The name and address of the manufacturer or distributor. In the case of extra-label use the name and address of the veterinary practitioner dispensing the drug.
   c. Directions for use including the dosage level and milk withdrawal times.
   d. Cautionary statements, if needed. Extra-label prescribed drugs should include date of dispensing and expiration date.
4. Follow label directions carefully using drugs at dosage levels appropriate for the size, age and species of the animal being treated. Overdosing and use of drugs intended for other species may cause illegal residues. Any infusion or injection of a cow with antibiotics may cause adulteration of all milk/meat of that cow.
5. Consider alternatives to drug therapy when animals need treatment.
6. Keep accurate records on all treated cows including breeding and freshening dates for proper drying off and dry cow therapy. Read the label carefully and record preslaughter drug withdrawal and milk discard times. Review records of treated cows before milking or shipping the animal. Remember, withdrawal times for dry treatment products are longer than lactation treatment products. Test fresh cows before including milk in the bulk tank.
7. Never add purchased cows to the milking herd until their milk has been tested and found residue free.
8. Segregate and mark all treated animals with a foolproof identification method. Be certain all personnel understand the procedure.
9. Discard all milk from treated cows for the specified milk withdrawal time. Cows vary in their withdrawal times. Test individual cows to be sure milk is residue free. Use an appropriate screening test at the end of the withdrawal time.
10. Allow proper withdrawal times for medicated feed. Using medicated feed and drug therapy at the same time could result in illegal residues.
11. Clean feed mixing equipment thoroughly after processing medicated feed.
12. Do not ship cull cows or calves that may contain drug residues.
13. Do not underestimate the significance and importance of eliminating drug residues in milk, cull cows and calves. Violative animals may be condemned at slaughter because of drug or chemical residues in the meat. Milk with antibiotics can adulterate an entire truckload and/or holding tank. Drug residues can be a health hazard to consumers. Publicity about residues can negatively impact the market for milk and meat products.

Violations

The use of animal drugs in treating food producing animals in any manner other than in accord with label violates the Federal Food, Drug and Cosmetic Act. Upon conviction individuals violating the Act can be fined up $250,000 and/or sentenced from one to five years in jail for each offense. Corporations can be fined up to $500,000 for each offense. In addition, the sale of contaminated milk or meat can result in the responsible party being subject to product liability suits.

Prepared by:
National Milk Producers Federation
1840 Wilson Blvd
Arlington, VA 22201
Revised December 1988

STOP
BEFORE USING
ANY DRUG
READ THE LABEL

DAIRY PRODUCER'S SAFE DRUG USE GUIDE

FDA APPROVED PRESCRIPTION (Rx)* DRUGS FOR LACTATING DAIRY COWS

STOP
BEFORE USING
ANY DRUG
READ THE LABEL

WARNING!

KEEP DRUG AND CHEMICAL RESIDUES OUT OF MILK, CULL COWS AND CALVES

<u>NEW SCREENING TESTS ARE VERY SENSITIVE</u>
ALL FAMILIES OF DRUGS ARE DETECTABLE
MARK AND SEGREGATE ALL TREATED ANIMALS

ACTIVE INGREDIENT	ROUTE OF ADMINISTRATION	WITHDRAWAL TIMES		TRADE NAME EXAMPLES	REMARKS
		MILK (HRS.)	MEAT (DAYS)		
Amoxicillin trihydrate	Intramammary	60	12	AMOXI-MAST	
Ampicillin	Injectable	48	6	POLYFLEX	
Chlorothiazide	Oral	72	NONE	DIURIL BOLUSES	
Chorionic gonadotropin	Injectable	NONE	NONE	FERTI-CEPT CHORTROPIN CHORIONIC GONADOTROPIN FOR INJECTION FOLLUTEN VETERINARY	
Cloprostenol Na	Injectable	NONE	NONE	HEIFER/ESTRUMATE	
Cloxacillin (sodium)	Intramammary	48	10	DARICLOX	
Corticotropin	Injectabl	NONE	NONE	ADRENOMONE	
Dexamethasone	Oral	NONE	NONE	AZIUM POWDER	
Dexamethasone	Injectable	NONE	NONE	AZIUM AQUEOUS SOLUTION	MAY NOT BE PRESENTLY MARKETED
Dextran	Injectable	NONE	NONE	PHARMATRAN	
Furosemide	Oral	48	2	LASIX BOL-O-TABS 2G LASIX PACKETS	 MAY NOT BE PRESENTLY MARKETED
Furosemide diethanolamine	Injectable	48	2	LASIX INJECTABLE SOLUTION	
Hetacillin	Intramammary	72	10	HETACIN K INTRAMAMMARY INFUSION	
Hydrochlorothizide	Injectable	72	NONE	HYDROZIDE INJECTION	
Isoflupredone acetate	Injectable	NONE	7	PREDEF 2X	
Isoflupredone acetate, neomycin sulfate	Otic, topical	NONE	NONE	NEO-PREDEF-EYE-EAR TOPICAL OINTMENT	
Isoflupredone acetate	Oral	NONE	NONE	PREDEF 20 MG BOLUS	MAY NOT BE PRESENTLY MARKETED
Novobiocin	Intramammary	72	15	ALBAMAST	MAY NOT BE PRESENTLY MARKETED
Oxytocin	Injectable	NONE	NONE	OXYTOCIN OXYTOCIN INJECTION VETOCIN INJECTABLE PVL OXYTOCIN INJECTABLE	
Penicillin G (procaine)	Injectable	48	4	CRYSTACILLIN—300 A.S VETERINARY	MAY NOT BE PRESENTLY MARKETED
Pituitary luteinizing	Injectable	NONE	NONE	P.L.H. INJECTABLE	
Sulfaethoxypryidazine	Oral	72	16	S.E.Z. DRINKING WATER SOLUTION 6.25% / S.E.Z. CRUMBLES S.E.Z. OBLETS	MAY NOT BE PRESENTLY MARKETED MAY NOT BE PRESENTLY MARKETED
Sulfaethoxypryidazine	Injectable	72	16	S.E.Z. INTRAVENOUS SOLUTION	
Trichloromethiazide dexasmethasone	Oral	72	NONE	NAQUASONE BOLUS	

*FDA POLICY ON RX DRUGS

Rx drugs may be used legally only by or on the order of a licensed veterinarian after the veterinarian has diagnosed the health problem and has prescribed or ordered the drug.

NOTE: This guide is based on Food and Drug Administration publications. The listing of any drug is not intended to promote any trade name compound. If you have any questions about the proper use of any drug, consult your veterinarian.

May be reprinted with credit to National Milk Producers Federation.

STOP
Drug
Residues

DAIRY PRODUCER'S SAFE DRUG USE GUIDE

FDA APPROVED PRESCRIPTION (Rx) DRUGS FOR LACTATING DAIRY COWS

STOP
Drug
Residues

FOLLOW PROPER PROCEDURES — NEVER TAKE CHANCES WITH DRUGS

1. Place a responsible individual in charge of all drugs.
2. Store all drugs properly.
   a. Animal drugs stored in the milkhouse, milking barn or adjacent areas must be approved and labeled for use on dairy animals or properly labeled by a veterinarian for extra label use.
   b. Approved animal drugs used for treatment of nonlactating dairy animals (calves and dry cows) must be segregated from drugs used to treat lactating animals. Separate shelves in medicine cabinets or refrigerators satisfy this requirement.
3. Be sure all Rx drugs are properly labeled. The label must include:
   a. The statement "Caution: Federal Law restricts this drug to use by or on the order of a licensed veterinarian."
   b. The name and address of the manufacturer or distributor. In the case of extra-label use the name and address of the veterinary practitioner dispensing the drug.
   c. Directions for use including the dosage level and milk withdrawal times.
   d. Cautionary statements, if needed. Extra-label prescribed drugs should include date of dispensing and expiration date.
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5. Consider alternatives to drug therapy when animals need treatment.
6. Keep accurate records on all treated cows including breeding and freshening dates for proper drying off and dry cow therapy. Read the label carefully and record preslaughter drug withdrawal and milk discard times. Review records of treated cows before milking or shipping the animal. Remember withdrawal times for dry treatment products are long and specified on the label. Test fresh cows before including milk.
7. Never add purchased cows to the milking herd until their milk has been tested and found residue free.
8. Segregate and mark all treated animals with a foolproof identification method. Be certain all personnel understand the procedure.
9. Discard all milk from all four quarter of treated cows for the specified milk withdrawal time. Cows vary in their withdrawal times Test individual cows to be sure milk is residue free. Use an appropriate screening test at the end of the withdrawal time.
10. Allow proper withdrawal times for medicated feed. Using medicated feed and drug therapy at the same time could result in illegal residues.
11. Clean feed mixing equipment thoroughly after processing medicated feed.
12. Do not ship cull cows or calves that may contain drug residues.
13. Do not underestimate the significance and importance of eliminating drug residues in milk, cull cows and calves. Violative animals may be condemned at slaughter because of drug or chemical residues in the meat. Milk with antibiotics can adulterate an entire truckload and/or holding tank. Drug residues can be a health hazard to consumers. Publicity about residues can negatively impact the market for milk and meat products.

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PARTICIPANT'S NOTES -- Session 2a

SUMMARY

Objective: In this session you become familiar with technical information about mastitis causing organisms and DHI Somatic Cell Reports.

Summary of activities/exercises (time)

1. **Welcome Back - Share Today's Agenda (5 min)**

   The teaching team introduces new members of the group and shares the day's agenda. A lot of technical material will be presented in today's session. Applying this technical information in a Case Study should stimulate discussion and thought.

2. **Mini-Lecture on Mastitis-Causing Organisms (45 min)**

   With a slide presentation and referring to resource material in your notebooks, information on major contagious and environmental mastitis-causing organisms is presented.

3. **Discussion on Monitoring Udder Health (20 min)**

   In group discussion, you explore the question "How do you detect mastitis?" touching on topics of forestripping, udder inflammation, abnormal milk, and CMT. The discussion leads to detecting subclinical mastitis, covering bulk tank somatic cell reports, individual cow SCC reports and CMT.

4. **Reading DHI Somatic Cell Reports (30 min)**

   The Somatic Cell Reports are probably the least understood management tool of the DHI record system. Using overheads, the SCC Report booklet, and your own SCC reports, the group reviews the sample day DHI Somatic Cell Evaluation Reports.

5. **Review Mastitis Problem Solving Scheme (10 min)**

   In light of learning about mastitis-causing organisms and reading DHI SCC Reports, the group reviews the problem-solving schematic. The divergence of possible solutions between contagious and environmental mastitis problems is emphasized. The group prepares to use the schematic in the case study.

MILK QUALITY - Session 2a

ACTIVITY 1

Welcome Back/Share Today's Agenda

I. Learning Goals of this Activity

1. Inform participants of what to expect in today's activities.
2. Introduce new members of the teaching team or participant group.

II. Key Points

1. We get down to the nuts-and-bolts of mastitis with a lot of technical information on causative organisms and reading Somatic Cell Reports.
2. Don't get bogged down in the technical information, but participate in the Case Study exercise to learn the application of problem solving and planning for mastitis control.

III. Personal Notes:

OVERHEAD
2a.1

Session II

Milk Quality Workshop

Morning

1) Mini-lecture on Mastitis Causing Organisms
2) Discussion on Monitoring Udder Health
3) Reading DHI SCC Reports
4) Mastitis Problem-Solving Scheme

Afternoon

1) Presentation of Case Study
   * Identifying/Diagnosing Problem
   * Brainstorming Possible Solutions
   * Developing Tactical Plans

MILK QUALITY - Session 2a

ACTIVITY 2

Mini-Lecture on Mastitis-Causing Organisms

I. Learning Goals of this Activity

1. Learn the differences in source and contributing factors of contagious and environmental mastitis-causing organisms.
2. Learn characteristics of the common mastitis-causing organisms.
3. Understand the strategy of mastitis control by reducing prevalence and incidence of mastitis

II. Key Points

1. Contagious bacteria usually cause subclinical infections with persistent high SCC. Environmental bacteria usually result in clinical mastitis.
2. Control measures for contagious and environmental mastitis are different.
3. Prevalence is the level of existing infections in the herd. Incidence is the rate of new infections in the herd.

III. Personal Notes:

Definitions

Mastitis:
Inflammation of the mammary gland.

Inflammation:
Response of the body to injury or to foreign agents, such as bacteria.

Bacteria:
Single-cell organism that can take up residence (infect) in animal tissue.

Somatic Cells:
Mostly white blood cells in milk; increases with inflammation.

MILK QUALITY -Session 2a

ACTIVITY 3

Discussion on Monitoring Udder Health

I. Learning Goals of this Activity

1. Monitoring clinical mastitis is relatively simple, it gives obvious signs. Subclinical mastitis requires individual records of cows SCC (or CMT).

II. Key Points

1. Clinical cases of mastitis are detectable through the clinical, obvious signs. Subclinical mastitis requires bulk tank SCC, herd average Linear Score, and Linear Score and/or on individual cows.

III. Personal Notes:

Detecting Mastitis - Clinical Cases

* Abnormal milk - forestripping

* Hot swollen udders

* Lower milk production

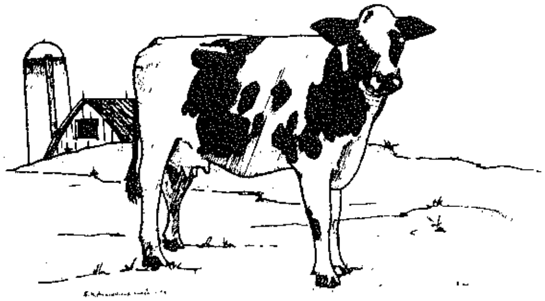
* Sudden sick cow

Goal: >2%/month

<0.5 cases/cow/lactation

Detecting Mastitis - Subclinical Cases

- High bulk tank SCC
- DHI Individual Cow SCC
- CMT



Goal:

Bulk tank SCC <250,000

Average DHI Linear Score <4

MILK QUALITY -Session 2a

ACTIVITY 4

Reading DHI Somatic Cell Reports

I. Learning Goals of this Activity

1. Become adept in gleaning information from DHI Somatic Cell Reports.
2. Understand that most uninfected cows have counts of 200,000/ml or less (LS<4).
3. Recognize that a potential benefit of routine somatic cell counting is to help identify infected cows as a basis for taking action to improve milk quality, udder health, and subsequently milk production.

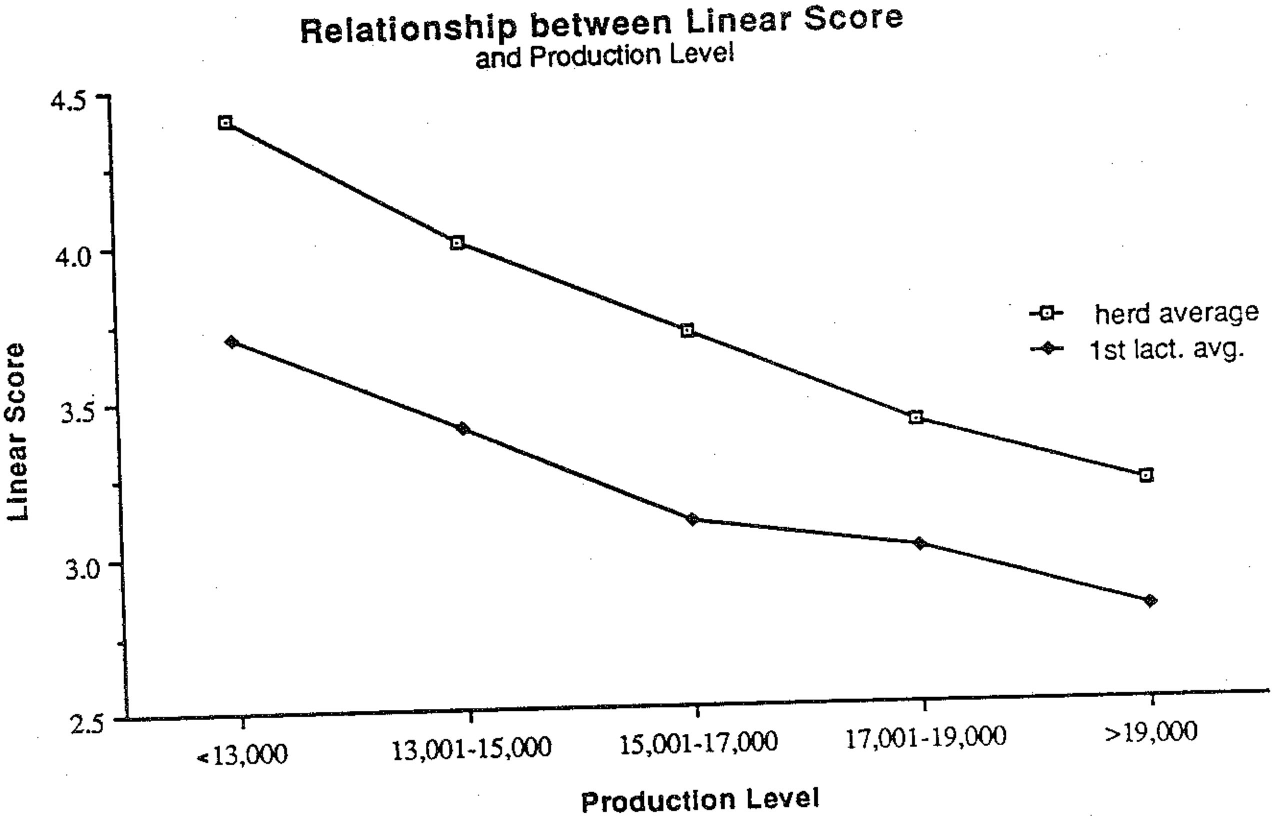
II. Key Points

1. Sample day DHI SCC Reports consists of: a) Herd Summary; b) List of High Linear Score Cows; and c) Individual Cow Linear Scores. Dairy Herd Profile information summarizes SCC data for the past 12 months.
2. Observing patterns and trends in somatic cell counts by using averages and multiple observations is a more accurate indication of mammary infection than a single observation.
3. There is a direct relationship in SCC, incidence of mastitis, and milk yield losses. Therefore, the lowest count that can be economically achieved within a herd is desirable.

III. Personal Notes:

OVERHEAD

2a.7



Relationship between Linear Score and Production Level

MILK QUALITY - Session 2a

ACTIVITY 5

Review Mastitis Problem Solving Scheme

I. Learning Goals of this Activity

1. There are distinct different strategies of how environmental and contagious mastitis problems should be solved.
2. Use of the mastitis problem-solving scheme will result in tactical plans for operations (things to do) and management (planning, controlling and directing).

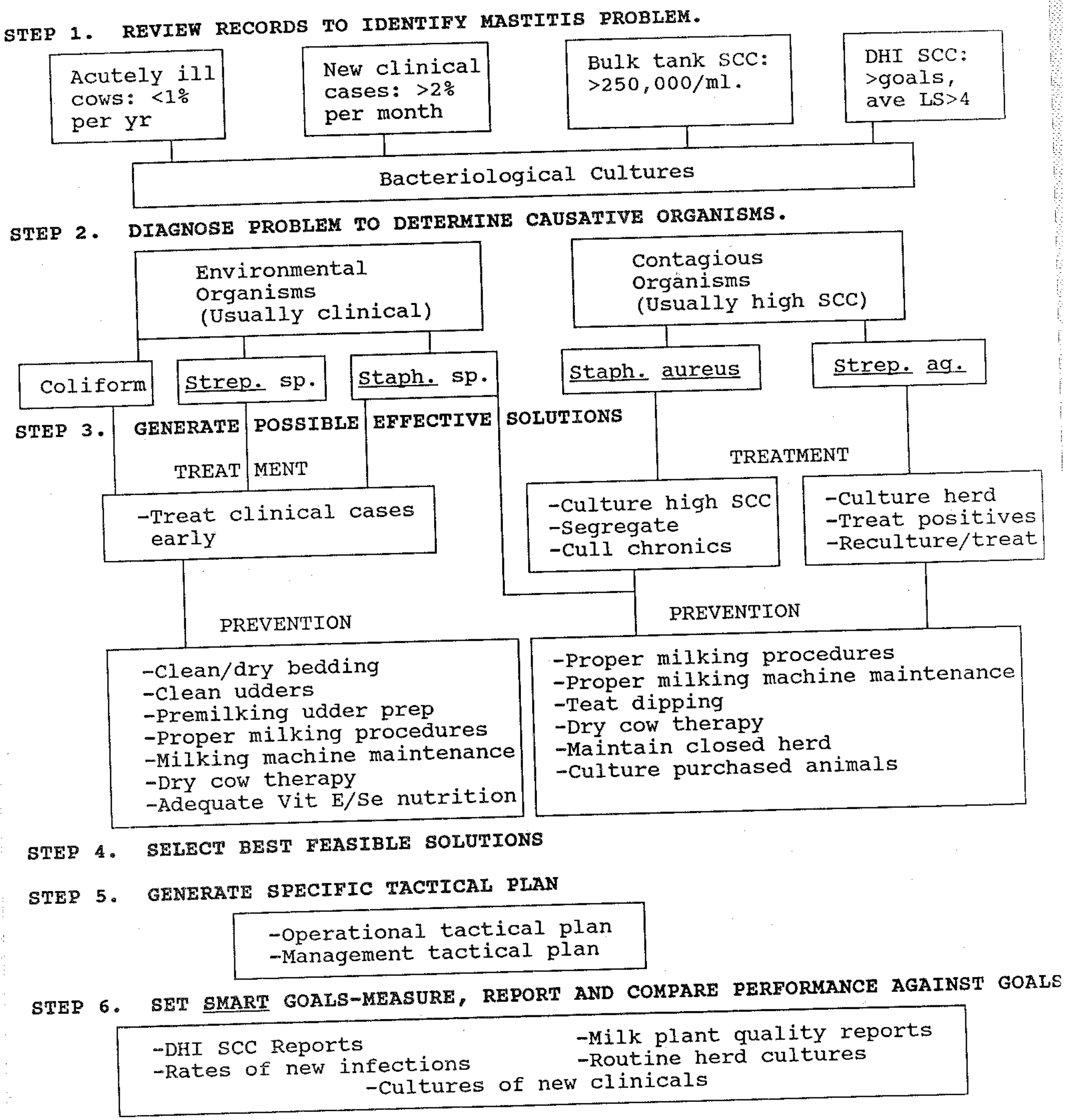
II. Key Points

1. The mastitis problem-solving scheme is a template that will be used in the case studies to develop tactical plans.

III. Personal Notes:

MANAGEMENT OF MILK QUALITY FOR FARM AND INDUSTRY SUCCESS

MASTITIS PROBLEM SOLVING SCHEME



STEP 1. REVIEW RECORDS TO IDENTIFY MASTITIS PROBLEM.

Acutely ill cows: <1% per yr

New clinical cases: >2% per month

Bulk tank SCC: >250,000/ml.

DHI SCC: >goals, ave LS>4

Bacteriological Cultures

STEP 2. DIAGNOSE PROBLEM TO DETERMINE CAUSATIVE ORGANISMS.

Environmental Organisms (Usually clinical)

Contagious Organisms (Usually high SCC)

Coliform

Strep. sp.

Staph. sp.

Staph. aureus

Strep. ag.

STEP 3. GENERATE POSSIBLE EFFECTIVE SOLUTIONS

TREATMENT

- Treat clinical cases early

TREATMENT

- Culture high SCC
- Segregate
- Cull chronics

- Culture herd
- Treat positives
- Reculture/treat

PREVENTION

- Clean/dry bedding
- Clean udders
- Premilking udder prep
- Proper milking procedures
- Milking machine maintenance
- Dry cow therapy
- Adequate Vit E/Se nutrition

PREVENTION

- Proper milking procedures
- Proper milking machine maintenance
- Teat dipping
- Dry cow therapy
- Maintain closed herd
- Culture purchased animals

STEP 4. SELECT BEST FEASIBLE SOLUTIONS

STEP 5. GENERATE SPECIFIC TACTICAL PLAN

- Operational tactical plan
- Management tactical plan

STEP 6. SET SMART GOALS-MEASURE, REPORT AND COMPARE PERFORMANCE AGAINST GOALS

- DHI SCC Reports
- Rates of new infections
- Milk plant quality reports
- Routine herd cultures
- Cultures of new clinicals

MILK QUALITY MANAGEMENT WORKSHOP

Vocabulary for Mastitis Control

1. **MASTITIS**
Inflammation of the mammary gland. The vast majority of cases are due to bacteria, which can originate from another cow or from the environment and gain access to the gland through the streak canal. Signs of clinical mastitis are clots or flakes in the milk, abnormal color or consistency of the milk, and/or swelling of the quarter. Mastitis may also be subclinical, in which none of these signs are visible.

2. **INFLAMMATION**
Response of the animal's body to injury or to foreign agents, such as bacteria. The cardinal signs of inflammation are redness, swelling, heat, and pain; these signs may vary greatly in intensity and may not be present in all cases (i.e. subclinical mastitis).

3. **BACTERIA**
One celled organisms that can take up residence in animal tissues (infection). By the nature of various products of the growth and decay of bacteria, inflammation may result with local and perhaps whole-body effects. Some examples: Streptococcus agalactiae, Staphylococcus aureus, E. coli.

4. **SOMATIC CELLS**
White blood cells in milk which originate from the cow. Somatic cells increase in cases of clinical and subclinical mastitis. Somatic cells can be counted, and their levels in milk can serve as a means of monitoring the level of mastitis in a cow or a herd. Cell count levels can be measured in the bulk tank or in the milk of individual cows by the following methods:
    a. Direct Microscopic Somatic Cell Count (DMSCC). A sample of milk is examined under a microscope and cells are counted directly. Results are reported as cells per milliliter (ml).
    b. Electronic Somatic Cell Count (ESCC). Cells are stained and counted by machine. The Dairy Herd Improvement Association uses a Fossomatic machine to perform its cell counting.
    c. California Mastitis Test (CMT). Milk from each quarter is mixed at cowside in a special well with a solution which changes color and gels in the presence of increased cell counts. Results are reported as Negative, Trace, 1, 2, or 3.
    d. Wisconsin Mastitis Test (WMT). Identical to the CMT, except that it is set up to be run on bulk tank milk samples from several herds. It is commonly used as a screening test by milk plants. Results are reported in millimeters from 1 to 35. A score of 17 corresponds to 1,000,000 cells/ml (illegal).

5. **LINEAR SCORE**
Method of reporting somatic cell counts as a decimal from 1 to 10. Linear scores are derived directly from the "raw" cell counts (DMSCC or ESCC) and are convenient because milk production loss due to mastitis varies directly with the linear score: for each increase of 1 linear score unit, a cow loses 400 pounds of milk per lactation.

MASTITIS CAUSING ORGANISMS:
Diagnosis, Source, and Factors Related to Their Control

Philip M. Sears, DVM, PhD, Director
Quality Milk Promotion Services
NYS Mastitis Control Program

Controlling mastitis begins with the understanding of cause, source and transmission of organisms. A large list of organisms has been identified from mastitic milk of dairy cattle, most of which can be categorized into two groups: **contagious or environmental.** These contagious organisms are not generally considered as highly infectious as viral infections, but are generally associated with the mammary gland, the most common reservoir for the organism and source of infection for other cows in the herd. The environmental organisms are those bacteria and other organisms which are commonly found in soil or fecal contamination which gain entrance into the gland and cause an infection. Bacteriological culturing of milk samples from a herd permits us the opportunity to identify the cause of mastitis and determine possible sources of the infection, thus providing information to identify better control measures.

Bacteriological Culture:

Sampling: In problem herds, when cows are to be sampled to identify the causative agents, the clinical cows are generally selected for culturing. These are often chronic infections and do not generally reflect the true profile of the herd. While these cows should be cultured to determine possible management decisions, they should not be used solely as the reflection of the herd. To obtain a more accurate picture, cows should be selected at random from at least 20% of the herd or from cows with linear scores above 4.0 (DHIA records). When selective sampling is elected, the bulk tank sample becomes important to identify any additional organisms present in the herd. In small herds of less than 50 cows, a total herd survey would be advised.

Sample collection, transport and storage are crucial steps in a herd evaluation. Less than aseptic sampling or delay in refrigeration can allow environmental organisms to overgrow and provide false information. Therefore, it is critical that teats are clean and dry before sampling. The teat end should be thoroughly scrubbed with an alcohol pledget. Pre-dipping of the teat and drying with a paper towel before the alcohol scrub reduces the chance of contamination and should be encouraged when dairymen are collecting samples in the veterinarian's absence.

Contagious Organisms:

There are many organisms which may fall in this group, the most common being Streptococcus agalactiae and Staphylococcus aureus. Other streptococcal and staphylococcal species found on skin surfaces are also common in mastitic milk and subclinical infections. Less common, but quite contagious, are some of the non-bacteriological organisms, such as mycoplasma. Mycoplasma can spread rapidly in a herd and be considerably more difficult to control. These organisms present a unique problem in that specialized media and skills are required to detect their presence.

Streptococcus agalactiae:

Strep ag is an obligate of the udder and colonizes the teat canal and ductal cell. It produces weak toxins, causing localized damage and swelling. Clinical signs are mild and are generally subclinical with gradual atrophy of lactating tissue, producing substantial production losses. Strep ag is usually sensitive to most penicillin type antibiotics, thus, lending itself to control and elimination from a herd. Strep ag eradication has been successful using both lactating and dry cow therapy.

Selecting cows for treatment of Strep ag by using somatic cell counts can result in some missed infections. Thus, all cows should be cultured to assure proper identification of the infected cows. If cows are in late lactation, withholding therapy until the dry period may be economically advisable. The second option lengthens the time period of Strep ag eradication and provides a potential reservoir or infections for other cows. If infected cows cannot be segregated and milked last, treating all cows at once is the best choice. Both methods have been successful in Strep ag control and eradication.

Once Strep ag has been removed from the herd, any new additions can serve as a potential source of reinfection. This includes heifers and dry cows which should be cultured at calving as well as culturing the bulk tank milk monthly for a minimum of six months to assure clearance of the infection. A closed herd is desirable.

Staphylococcal Infections:

Staphylococcus aureus is considered the most pathogenic of the staphylococcal infections. They can result in severe acute mastitis and occasionally lead to gangrene mastitis. However, most of the S. aureus infection produce less severe signs usually noted as swelling of the gland with increased tenderness and abnormal milk. Clinical flare-ups occur in about 20% of the infections. These organisms can penetrate secretory tissue producing damage leading to scar tissue and small abscess formation. Value of lactation therapy in early lactation should be considered on an individual animal and herd basis. Infections which do not respond to a single regimen of therapy are generally unresponsive to additional lactation treatment, irregardless of clinical cases and dry cows. Cows with chronic infections in one or more quarters should be reevaluated in subsequent lactations as to their production value and as a reservoir source to other cows.

Control: The use of post-hygiene practices of teat dipping and dry cow therapy have been very successful in the control of staphylococcal infections. The use of separating infected cows into segregated herds or strings and milking them after the noninfected cows can help reduce infection spread. However, the use of both of these methods without selective culling chronically infected cows will result in little change in the infection level. Cows which do not respond to therapy during lactation or the dry period should be evaluated as to their value to the herd and be considered for removal at the end of lactation. A closed herd is desirable in reducing and maintaining a low infection level.

ENVIRONMENTAL MASTITIS:

Environmental organisms isolated from clinical mastitis increase with confinement during winter months. These are often associated with inadequate bedding, improper milking procedures or improper treatment practices. Most of these mastitis organisms fall into two categories, **coliform** and **Streptococcus species**, other than agalactiae. However, many other groups of organisms must be included in this category, including yeasts and prototheca. The coliforms, which can produce severe clinical mastitis, are generally found in low levels in most herds and are not routinely express as chronic infections. The streptococcal species can become chronic, exhibiting minor clinical problems but is usually expressed as subclinical with an increased milk somatic cell count. The increased presence of these organisms generally indicates environmental problems and a potential coliform problem.

Coliforms:

The coliform group generally refers to two primary organisms associated with toxic mastitis: **Escherichia coli** and **Klebsiella pneumonia**. However, other gram negatives routinely cultured from herd problems include Enterobacter, Citrobacter, Serratia and Pseudomonas, which can produce clinical mastitis but persist in less severe forms. These organisms do not generally spread from one quarter to another as do the staphylococcal and streptococcal species, but are a consequence of environmental spread. A pathogenic organism present in the environment can produce an outbreak of clinical mastitis if its spread is not checked. The clinical problems occurring with coliforms present a wide clinical picture. The most striking form, **"peracute mastitis,"** by E. coli or Klebsiella produces a toxic, sick animal which can show these severe symptoms within hours after infection, often leading to death. These probably occur in a low proportion of the coliforms. The more common form is the **"acute mastitis,"** with systemic signs including severe inflammation of the mammary gland, fever and anorexia and respond to therapy. These infections are of short duration and are eliminated by the cow's defense mechanisms. Thus identification of the causation must be made from the culture of milk samples in the acute phase. Identification and severity of a problem in a herd is often missed when culturing a herd on a single herd survey. Chronic mastitis caused by coliforms occurs less commonly with E. coli and Klebsiella than the other species, with subclinical phases marked by recurrent clinical episodes of varying severity. Low-grade subclinical coliform infections have been described and are becoming more common. These chronic infections often remain subclinical and are detected only by bacteriologic culture.

Environmental Streptococcus:

Environmental streptococcal species are generally referred to as **esculin positive streptococci.** These organisms are usually subclinical with occasional mild clinical signs in the milk. Unlike other environmental infections, they may persist through the lactation and do not respond well to lactation therapy. Cows are more susceptible in the late dry period and early lactation. Infection is spread by poor environmental sanitation or poor premilking sanitation. Similar to staphylococcal infections, colonization of the skin and teat end may also play a role in the establishment of infection in a herd. However, unlike staphylococcal organisms, postmilking teat dipping has less of an effect on reducing the level of strep infections, since the environment is the reservoir for these organisms.

Control:

Control of environmental organisms differs from contagious infections, in that the latter can be controlled by the use of effective postmilking hygiene practices (teat dipping) and dry cow therapy. Environmental infections are not affected by teat dipping because of environmental reservoir. Dry cow therapy is least effective against the environment since most nonlactating products are formulated for the gram positive organisms. Coliforms do not generally increase in the early dry period except where septic infusion practices are used, but are greater in the late dry period just prior to and following calving. Dry cow products are not effective for these prolong periods and reinfusion just prior to calving has not proven effective in reducing new infections. The best measure is to control the environmental condition to provide a clean and dry environment. Most environmental outbreaks can be reversed by increasing the bedding in stalls and maternity areas (a clean pasture in good weather is very effective) and improving sanitary practices by milking cows with clean, dry teats and udders.

Major Pathogens From Milk - Characteristics, Treatment & Control

Organisms	Clinical signs	Diagnosis
I. CONTAGIOUS ORGANISMS		
Streptococcus agalactiae (Strep ag)	Subclinical mastitis: Mild clinical signs with slight off color of the milk. Progressive atrophy of the gland tissue with reduced milk production and a high somatic cell and bacteria count.	Culture: Blood Agar: Translucent colonies with clear hemolysis around the colony. Esculin negative when added to the agar. CAMP test positive - arrow shape hemolysis in incomplete zone of Staph aureus.
Staphylococcus aureus (Staph. aureus) "Coagulase positive staph"	Acute: Hot swollen quarters with elevated temp. of 103-106° F. Abnormal milk with clots. Sick cow with 90% recovery. Subclinical: High somatic cell count. Firm fibrotic gland on udder palpation. Gangrene: "Blue bag". Cold teat and/or gland. Toxemia may lead to death in 50%+ cases.	Culture: Blood agar. Creamy white to golden colonies. Coagulase positive 2-12 hours in rabbit plasma. Mannitol salt and media yellow colonies.

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Etiology	Treatment & Control	Prevention
Obligate of the mammary gland which can be eliminated from the herd. Introduced into the herd by infected animals. Heifers become infected from nursing each other in group pens and when fed Strep ag infected milk. Transferred by nursing. Incomplete milking may increase severity.	Lactation and Dry Cow (90%) Therapy. Sensitive to penicillin and its analogs. Treat as recommended and reculture. If nonresponsive to treatment dry off, segregate or cull. Culture bulk tank milk for six months.	Closed herd. Culture new additions to herd, including heifers at calving. Treat all cows and quarters at dry off and use post-milking teat dipping.
Injury: Teat end or other skin surfaces, including milker's hands as source of infection. Injury to trauma, weather conditions, milking procedures or milking equipment malfunction. Transferred by milking process or equipment.	Dry Cow Therapy- 60%. Lactation Therapy- 10-30%. Treatment early infections in heifers- 65%. Sensitive to ampicillin, cloxacillin, cephalosporin, amoxicillin and novobiocin. Resistance varies with each herd; perform sensitivity test on each herd. Treating gangrene: If teat is eschemic with dead tissue, amputate teat to establish drainage of gland. Fluids for supportive therapy. Antibiotic I.V. and shock suppressants may be of value.	Closed herd. Segregate and milk last. Teat dipping. Dry cow therapy. Milk heifers and clean cows first. Culture high somatic cell cows. Cull chronic infections.

Organism	*Clinical Signs*	*Diagnosis*
Staphylococcus species. (minor pathogen) (Coagulase negative staph)	*Subclinical*: Moderate somatic cell count (400,000-1,000,000 cells/ml.) Subclinical. Varies with level of infection.	*Culture*: Blood Agar Creamy to white color Non hemolytic. Coagulase test negative. Gram positive cocci.
Corynebacterium bovis (Minor pathogen) (*C. bovis*)	*Subclinical*: Low to moderate SCC 200-400,000 cells/ml. Subclinical with unapparent infection.	*Culture*: Blood Agar. Small colonies. Slow growth 24-48 hrs. Gram positive. Small crescent-shaped rods.

II. ENVIRONMENTAL ORGANISMS

Streptococcus species (Streps other than *Strep ag.*) (Non. *Ag. strep*)	*Clinical*: Mild with some clots or flakes. Slightly off color. Moderate swelling. *Subclinical*: Moderate to high cells (300,000-2,000,000 cells per ml.)	*Culture*: Blood agar. Small translucent colonies with greenish hemolysis. Esculin positive with darkening around colony (except *Strep dysgalactiae* which is CAMP test negative).

Etiology	Treatment & Control	Prevention
Associated with skin surfaces (teat ends and hands). Increase in number with injury. Infected glands.	Lactation therapy poor. Dry cow therapy-85%. Segregate if possible. Pre and post teat dipping. Culture and sensitivity. Most penicillin-like antibiotics.	Teat dipping. Dry cow therapy. Keep equipment in good working order. Avoid teat end injury and sores on milkers hands. Predipping may be of value.
Infected glands. Inhibit ductal tissue. May predispose to other infections. Not using a teat dip post-milking.	Dry cow therapy. Sensitive to penicillin.	Teat dip. Dry cow therapy.
Intestinal tract. Dirty stalls, poor housing. Infected glands. Increases with wet milking. Dirty wash sponges.	Lactation therapy 30%. Dry cow therapy 85%. Resistant to aminoglyosides. Less sensitive than Strep ag. Less effected by postmilking teat dipping.	Milking sanitation: Clean and dry teats at milking using individual paper towels. Maintain a clean and dry environment. Consider pre-milking teat dipping.

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Organism	Clinical Signs	Diagnosis
Eschericha coli (E. coli) (coliform)	Peracute: Toxic, may lead to death. Abnormal yellow to watery secretion. No swelling to hard, hot swollen quarter. Sub-normal temperature (100 F°.) Acute: Hot swollen quarters, off color. More responsive to therapy. Temp 107° F. May clear infection before able to culture milk. Subclinical: Rare. Short duration and rarely becomes chronic.	Culture: Blood agar - rapid growth. McConkey Agar: Lactose positive. Pink, dry colony with pink halo. Gram negative rods. Oxidase negative.
Klebsiella pneumonia (coliform)	Same as E. coli	Culture: Blood agar: Large mucoid colony- grayish. McConkey agar: Lactose positive with pink center. No pink halo. Gram Stain: Large negative rods. Oxidase negative. Non-motile, citrate positive.
Enterobacter (coliform)	Post-partum. Occurs early in lactation.	Culture - Blood agar: Large dry colonies. Septic infusion. McConkey agar: Lactose positive. Pink, dry or yellow. Oxidase negative. Gram stain: negative rods. Motile. Citrate positive.

Etiology	Treatment & Control	Prevention
Intestinal tract. Dirty stalls. Wet milking. Septic infusion. Susceptibility may increase with low SCC.	Supportive therapy: Fluid, steroids, antiprostaglandins, bacteriostatic drugs to reduce exotoxin release. Aminoglyosides. Culture and sensitivity.	Clean and dry environment. Increase bedding in stalls. Milking sanitized clean and dry teats. Commercial mastitis products and infusions.
Associated with soil contamination and grows well in wood products. Grows best in sawdust.	Same as *E. coli*.	Switch bedding to sand, straw, or use shavings. Can use lime to maintain a high pH. Increase bedding to keep stall clean and dry.
Soil contamination, dirty stalls. Clinical but generally less toxic.	Same as *E. coli*. Clean and dry environment.	Same as *E. coli*.

Organism	Clinical Signs	Diagnosis
Pseudomonas (*P. aeruginosa* and other species)	Clinical: Endotoxin producing varying signs. Can produce acute toxemia with high temperature. Serous secretion containing flakes and clots. Chronic: Chronic udder infections are resistant to antibiotic therapy.	Culture: Blood agar: Large, rough, translucent colonies with serrated edges. Glassy fluorescent appearance. Sweetish, grape-like odor. McConkey: Lactose negative. Metallic.

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Etiology	Treatment & Control	Prevention
Soil and water contamination. Survives high pH of 9.5 - 10.5. Isolated from various teat dips: quaternary amonia and chlorhexidines. Septic intramammary infusions. Has been isolated in warm water udder wash systems.	Resistant to most anti-biotics. May respond to Gentamicin if treated early. Organic iodine to "kill" quarter.	Aseptic intramammary infusion. Commercial products. Avoid teat dip contamination. Use clean, fresh products. Clean teat dippers. Iodinated wash water.

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Heifer Mastitis

Dr. Philip M. Sears

Clinical mastitis and/or high somatic cell counts in first calf heifers at calving can be of real concern in many herds. Most farmers realize that mastitis infections commonly occur two weeks prior to and following calving in heifers and in adult cows. It is true this is a high risk time, but calves are at high risk at least two other times: during the first month after birth, and at 3 to 9 months of age. At these two times heifers are far enough removed from the milking herd that they often do not get the attention they deserve. Since mastitis may not appear until calving, long after exposure to the organism, control may be very difficult.

The types of mastitis in heifers generally reflect the mastitis organisms in the herd. *Streptococcus agalactiae* is strongly associated with calf suckling and feeding of mastitic milk. Calves experimentally fed *Strep ag* infected milk and housed in a common pen showed high levels of *Strep ag* mastitis at calving even when the calves were exposed to the mastitic milk only during the first few weeks of life. At calving, these quarters may be subclinical or clinical, or may be observed as blind or agalactic.

Staphylococcal mastitis can also be spread by suckling but infections occur more often during puberty (3-9 months of age), and is often related to teat end injury. During this period, the mammary gland is changing rapidly and cultures of the streak canals have shown these animals to harbor greater numbers of bacteria than at other times. These calves are often housed together under less than clean conditions. Flies and bedding are probably a major source of the infection; herds experiencing difficulty in controlling flies in heifer raising facilities have experienced higher levels of mastitis due to *S. aureus* and other staphylococcal organisms. Low producing and blind quarters are not uncommon in *S. aureus* infections.

It is less clear when environmental infections occur in heifers. These organisms can be detected at the teat end and in the streak canal at all risk times, but calves are probably at greatest risk prior to or at calving. The incidence of environmental infections may be related to the environmental conditions in the calving area and milking herd housing. They can produce clinical or subclinical mastitis, but unlike the contagious organisms they often clear spontaneously in the first couple months of lactation. However, these infections can be a major source of new mastitis and affect the herd somatic cell count level.

A less common organism, *Corynebacterium pyogenes*, also known in the UK to cause "Summer Mastitis", has been cultured from heifers in New York. This organism may cause mastitis in non-lactating periods and generally is an infection secondary to other bacteria. *C. pyogenes* is only sporadically isolated from milk samples at the New York Quality Milk Laboratory, but larger outbreaks have been identified in Florida and California. These infections can range from mild mastitis to complete destruction of the gland with abscesses draining from tracts in the side of the gland. Like *S. aureus*, these infections are associated with poor fly control.

Since heifer mastitis infections can occur far removed from the time the mastitis is exhibited, the source is not always easily determined. Therefore, it is important to evaluate the complete heifer program to eliminate the source which may be occurring during the first two years of life. Calves should be raised separately to avoid cross suckling, especially if raw milk is fed. Young heifers need a clean environment during the high risk period of puberty. Flies, weather and other trauma can be a major source of heifer mastitis. As with all cows, heifers should be placed in a clean area for calving and given special attention following calving. They should be milked first to avoid spreading of infections from older animals during the high risk period following calving. Heifers are the future of the herd and carry the greatest genetic potential, and deserve special attention from birth through their first lactation.

CAUSATIVE BACTERIA	HIGH RISK PERIODS	SOURCE	SIGNS	TREATMENT	CONTROL
Streptococcus agalactiae	Birth to Weaning	Feeding mastitis milk . Group housing young calves . Cross suckling . Organisms isolated in oral cavity for short period following feeding	Subclinical: . High SCC . High bacteria count Clinical: . Clots or off-color milk . Agalactiae (blind quarters)	Early lactationa: . Antibiotic therapy (i.e. penicillin IMM products) . Reculture and retreat if necessary (90%) Late Lactation: . Dry cow therapy (95%)	Individual housing or cross suckling Avoid feeding mastitis milk with infected quarters Culture heifers at calving Isolate and treat infected cows
Staphylococcus aureus	3-9 months (puberty) Breeding time Calving	Teat injuries or trauma Cold weather - chapped teats Housing conditions Flies Bedding	Subclinical: . High SCC . Reduced production Clinical: . Hard, swollen quarters . Abnormal milk . Occasional blind quarter . Gangrene	Lactation therapy: . Varies 50-80% unless chronic Dry Cow therapy: . Cull if nonresponsive to treatment (65-85%)	Clean, dry housing and bedding Fly control Milk first after calving Segregate from infected cows Culture high SCC
Staph species	3-9 months	Teat skin and ducts Bedding (straw)	Primarily subclinical Moderately elevated SCC Sporadically clinical	Dry cow therapy	Clean, dry bedding Control after calving Good premilking preparation (predipping) Early treatment if clinical
Strep species	Prior to and post calving	Housing and bedding Maternity stalls and pens Contaminated bedding	Elevated SCC Clinical Mastitic milk (Self limiting first two months)	Lactation Tx clinicals early	Clean, dry maternity pens Clean, dry milking herd housing (freestalls or stanchions)

Mastitis Control Program Series

North Central Regional
Extension Publication No. 277

Mastitis — A Closer Look

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Mastitis is a serious problem that affects many dairy farms. Approximately 30 to 35 percent of the nation's dairy cows have some form of mastitis. Mastitis can result in both direct and indirect losses to dairy farmers, including death or early culling of cows, decreased milk production, milk that must be discarded, and increased veterinary costs.

With good mastitis management practices, less than 10 percent of the cows in a dairy herd should have non-clinical mastitis infections, while the clinical infection rate should be limited to 1 case or less per 100 cows per week. This bulletin contains general information about mastitis: what it is, what causes it, how it can be detected, and some of the effects it can have on a dairy herd.

WHAT IS MASTITIS?

Mastitis is an inflammation of the udder, usually caused by microbial infections in one or more quarters of the udder. Mastitis reduces milk production and adversely affects milk quality.

TYPES OF MASTITIS

Mastitis can be classified into two main types: non-clinical (also called subclinical) and clinical. These types can be further classified as acute or chronic.

Non-clinical Mastitis

Non-clinical mastitis, which accounts for 90 to 95 percent of all cases, is the most common form of mastitis. It causes the greatest overall milk losses in most herds. Research has indicated that 30 to 40 percent of all cows in an average herd may have non-clinical mastitis.

Symptoms of non-clinical cases are not outwardly apparent. There are no signs of disease, such as swelling of the mammary gland, or abnormal milk. Milk must be tested to assess whether a non-clinical infection is present. Changes that do occur in milk must be detected through somatic cell counts, analysis of milk composition, a test of milk conductivity, or through positive bacterial cultures of milk from the affected quarter or quarters.

Clinical Mastitis

Clinical mastitis cases can be identified by abnormal conditions of the udder and milk. Milk from cows with clinical mastitis may have a watery or off-color appearance (often brown or amber) and contain flakes and clots. In severe clinical cases, the infected quarters may swell and become hot, hard, and sensitive to touch. The cow may also show signs of sickness, such as fever, depression, and lack of appetite.

Only about 5 to 10 percent of all mastitis cases are clinical (including acute and chronic cases). About 2 to 3 percent of milking cows in an average dairy herd may have clinical mastitis at any one time.

Acute Mastitis (Clinical and Non-clinical)

Acute mastitis cases have a relatively short duration. In an acute case, a cow may appear healthy, then suddenly become sick. Acute clinical cases are usually confined to just one quarter, and the infected quarter may swell and become hot, hard, and sensitive to touch. The cow may also show signs of weakness, depression, fever and loss of appetite, and have a rapid pulse. Because they tend to occur quickly, often with little or no warning, acute cases can be life threatening.

Several species of organisms can cause acute mastitis. However, because there is no way to tell which species is responsible for the infection just by looking at the milk, one or more tests must be run on a milk sample from an infected quarter to determine which organism is responsible.

Acute non-clinical cases do not show visible udder changes or signs of abnormal milk and may spontaneously resolve in a short time, ranging from a few hours to a day.

Chronic Mastitis (Clinical and Non-Clinical)

A chronic mastitis case is a persistent udder infection that exists from many days to months or even years. This type of mastitis will normally begin as a non-clinical case, then develop into a clinical case. A chronic clinical case may seem to disappear completely because of its ability to revert to a non-clinical form, but within time, the clinical form returns. During the clinical phase, milk will continue to show abnormal signs. Many times, *Staphylococcus aureus* is the type of organism responsible for a chronic case.

In chronic non-clinical cases, the infected quarter(s) will show somatic cell counts of 400,000 or higher (linear score of 5 or higher) for two months or longer. Milk from the infected quarter(s) will also culture positive for mastitis-causing organisms, but milk will look normal.

Gangrenous Mastitis (Clinical)

Some strains of mastitis-causing organisms may produce toxins (poisons) that are responsible for the development of a gangrenous form of mastitis. The toxin, usually produced by *Staphylococcus aureus* bacteria, can lead to death of udder tissue by causing blood vessels to constrict, thus preventing tissue cells in the udder from receiving a normal blood supply. The infected quarter becomes cold, off-colored, and insensitive. A line of demarcation forms, which separates the live and dead tissue. Dead udder tissue located below the line is often referred to as "blue bag" because of its dark or bluish-purple color.

A gangrenous quarter may become moist, with a constant dripping of blood-tinged serum from the teat and the skin around the base of the teat. A severe gangrenous mastitis case can result in death of the cow. A less severely infected gangrenous quarter may be sloughed or amputated and the infected cow may recover, though milk production from that cow may be limited in the future.

WHAT CAUSES MASTITIS?

Bacteria or other microorganisms cause mastitis. Bacterial numbers and their ability to infect the cow's udder are influenced by level of farm sanitation, the bacteria's ability to live, or colonize, in or on the teat end, and the susceptibility of the cow to develop mastitis.

The most common bacteria that cause mastitis are *Streptococcus agalactiae, Staphylococcus aureus,* coliform species, *non-agalactiae Streptococci* and other environmental *streptococci,* pseudomonads, and bovine mycotic (yeast) organisms. In some areas of the United States, dairy herds have problems with other types of mastitis-causing organisms, such as mycoplasma.

Streptococcus agalactiae (*Strep. ag.*)

Strep. ag. lives primarily in the cow's udder and is the most common cause of non-clinical infections. Infections are usually spread during the milking process via contaminated milkers' hands, common wash materials such as rags or sponges, and contaminated teat cup liners. *Strep. ag.* is most often brought onto a dairy farm through purchased cows infected with the bacteria.

Staphylococcus aureus (*Staph. aureus*)

Staph. aureus lives in the udder or on the udder or teat skin and causes many cases of both clinical and non-clinical, chronic mastitis. It can also cause gangrenous mastitis, which can result in the loss of a cow's infected quarter, or the death of the cow. It is usually spread from infected to non-infected cows during the milking process via contaminated teat cup liners, common wash rags or milkers' hands. In some herds, it is not uncommon to find up to 30 percent or more of lactating cows with two or more *Staph. aureus*-infected quarters.

Although *Staph. aureus* is probably the most prevalent cause of Staph-related mastitis, recent research has indicated that many other species of *staphylococcus* are capable of causing mastitis.

Coliform species

There are three main types of coliform bacteria that cause mastitis: *Escherichia coli, Enterobacteria* and *Klebsiella pneumoniae.* Coliform bacteria live in manure, polluted water, and contaminated bedding. When cows bed down in these contaminated areas, infectious coliform organisms can enter the cows' teats. Direct cow-to-cow transfer is unlikely. Coliform bacteria may cause severe outbreaks of acute clinical mastitis during periods of hot, humid weather; extensive periods of heavy precipitation; or periods of stress, such as when cows are moved to new facilities.

Research supports a theory that coliform infections increase in a herd when that herd's somatic cell count is less than 200,000 and *Strep. ag.* and *Staph. aureus* infections are present in less than 10 percent of the cows. High-producing, non-infected older cows in early lactation (first 90 days) are most susceptible to coliform invasion.

Non-agalactiae Streptococci (*Non-ag. Strep.*)

There are many forms of *non-ag.* (environmental) *Strep.* bacteria, but two of the most common forms are *Strep. uberis* and *Strep. dysgalactiae. Non-ag. Strep.* survives mainly on the cow's teat skin and belly skin and in the reproductive tract. Infections can also be associated with unsanitary dry lots and bedding areas. *Strep. uberis* and *Strep. dysgalactiae* are usually transferred from the environment to the teat between milkings, but some transfer from cow to cow can take place during milking.

These infections range from chronic non-clinical cases to very severe acute cases. *Strep. uberis* is responsible for most new infections in dry cows. Like coliform mastitis, *non-ag. Strep.* cases tend to increase as *Strep. ag.* and *Staph. aureus* infections decrease.

In addition to *Strep. uberis* and *Strep. dysgalactiae,* there are many other environmental *streptococci,* such as *Strep. bovis* and *Strep. faecalis,* that can cause mastitis.

Pseudomonads

Pseudomonads are widespread in the environment and are often found in contaminated water supplies. New infections can occur during or between milkings via transfer from contaminated sites in the environment to teat ends. Infections may range from non-clinical to acute.

Bovine Mycotic Organisms (Yeast)

Mycotic (yeast) organisms are commonly found throughout the cow's environment in soil, air, water, and even on the cow's teat and udder skin.

Sporadic cases of mycotic mastitis that occur within a herd are often attributed to environmental sources. Severe herd outbreaks, however, are often associated with treatment-related actions, such as when single-dose syringes or cannulas are reused to apply multiple numbers of intramammary medications, or when poor aseptic techniques are followed when treatments are given.

Mycotic mastitis infections are often non-clinical but may be clinical, ranging from acute severe cases to chronic cases, which may result in permanent damage to mammary tissue.

Because high concentrations of yeast organisms are infectious, it is possible for humans (i.e., milkers, veterinarians) to develop yeast infections from infected cattle. To prevent such infections, wash hands and equipment thoroughly and disinfect following contact with infected cows.

MASTITIS COSTS DAIRY FARMERS IN MORE WAYS THAN ONE

Lost Production

Most dairy farmers are aware of the obvious costs of mastitis to their herds: discarding abnormal milk, culling top producing cows, replacing infected cows before their peak production year, and doctoring a cow through a clinical infection.

What many farmers do not fully realize is that the major dollar loss resulting from mastitis is due to reduced milk production from non-clinical mastitis cases. Since the loss of milk is usually not obvious, the loss of income associated with decreased production usually goes unnoticed.

A decrease in milk production from non-clinically infected cows accounts for about 55 percent, or $100, of the $190 annual cost per cow attributed to mastitis. At current milk prices, that lost production adds up to approximately $40 million.

Clinical mastitis cases account for about 26 percent, or $50, of that $190 cost. The rest of the cost is attributed to premature culling of mastitis-infected cows. These costs are typical of an average herd in which approximately 30 to 35 percent of the cows are infected with mastitis (see Table 1).

Milk Quality

Mastitis changes milk composition. Damage to milk-secreting cells causes a decrease in lactose, casein, and fat production. Cheese yield from mastitic milk (somatic cell count = 1,000,000) is lowered 5 to 10 percent, and milk price, if established on component pricing, will also be reduced by mastitis. As tissue damage increases, blood components such as sodium, chloride and serum albumin enter the milk in amounts greater than normal. Table 2 compares composition of normal milk with that of infected milk.

HOW NON-CLINICAL MASTITIS CAN BE DETECTED/MONITORED

Non-clinical mastitis can be detected in several ways, either on the farm or in a microbiological laboratory. Somatic cell testing, culturing and other forms of tests applied to milk can assess secretory cell damage.

Somatic Cell Counts

Cells found in milk consist of epithelial cells and leucocytes (white cells) from the blood, and are called somatic cells. Normal milk from individual non-infected quarters usually contains up to 200,000 somatic cells.

Somatic cell levels increase when a cow is infected, as a cow ages (because of greater probability of infection), and when a lactation is long and production drops below 20 pounds per day. (Infection is the most common reason for somatic

TABLE 1: Estimated mastitis costs in an average dairy herd with 30 to 35 percent of cows infected.

Item	Estimated cost per cow per year
Non-clinical mastitis — 10 to 15 percent production loss per infected cow	$100
Clinical mastitis — Cost of drugs, discarded milk, labor and veterinarian service	50
Premature culling	40
Total loss to dairy farmer	$190

TABLE 2: Composition of milk from normal cows and infected cows.

	Percent	
Constituent	Normal milk	Mastitis-infected milk
Water	87.0	87.0
Lactose	4.90	3.95
Casein	2.90	2.25
Whey proteins	0.82	1.31
Fat	3.50	3.20

cell increase, however.) By monitoring each cow with a monthly somatic cell count, the dairy farmer will get a better overall picture of the entire herd and also pinpoint individual problem cows that are responsible for increasing the bulk tank cell count. Table 3 outlines the predicted prevalence of infected quarters and daily milk production losses based on increases in bulk tank somatic cell counts.

A bulk tank somatic cell count that rises to 400,000 cells/ml milk or higher is a good indicator that a rise in the infection level has occurred in the herd. Indeed, many farmers find it necessary to continuously monitor their herd's somatic cell counts, since the price per cwt (hundredweight) of milk that they are being paid will be reduced if the bulk tank somatic cell count exceeds certain levels.

The DHIA somatic cell count program, the Wisconsin Mastitis Test (WMT), and the California Mastitis Test (CMT) are all commonly used to estimate somatic cell counts in the milk. These somatic cell count programs are discussed in detail in another Extension bulletin.

Culturing

Culturing involves collecting milk samples under sterile conditions and submitting them to a qualified microbiological laboratory (such as the state animal health diagnostic lab), which then determines the type of organism responsible for the infection and increase in somatic cell count in the cow.

To help diagnose a mastitis problem within a herd, all cows, or a minimum of 10 to 20 lactating cows in the herd, should be cultured. Any individual cows with cell counts between 600,000 and 1,000,000 also should be cultured. A local veterinarian or milk cooperative fieldperson can explain the proper procedures for taking a culture and help you interpret the results.

Other Tests

Other tests that can be used to analyze milk samples for prevalence and severity of mastitis include NAGase and milk conductivity. These testing methods can be used as indirect measures of secretory cell damage.

After the level of infection in a herd is known and the bacteria causing the problem are identified, management practices can be altered to control mastitis in a herd. Changes may be as simple as improving farm sanitation, correcting milking routines, using the appropriate antibiotic treatment for lactating and dry cows, or culling problem cows to remove the source of infection. A complete mastitis control program should be implemented to reduce mastitis to acceptable levels.

SUMMARY

Mastitis can be a widespread problem among dairy farms, but the causes can usually be identified, and the dairy farmer can make management changes and implement control programs to help alleviate problems and keep them from recurring.

More information on the specific bacteria that cause mastitis and how to control them can be found in other Extension bulletins. Contact your county Cooperative Extension Service office for details on the bulletins, or your local veterinarian for help in controlling mastitis.

Mastitis Control Program Series edited by Kristen Penner.

TABLE 3: Predicted prevalence of infection and production loss based on bulk tank somatic cell counts.

Bulk tank SCC	Percentage of infected quarters	Daily milk (lb/cow)	Percentage loss
200,000	6	50.8	
500,000	16	47.5	6.5
1,000,000	32	41.8	17.7
1,500,000	48	36.2	28.7

SOURCE: Journal Series Paper 6268, The Pennsylvania State University Agriculture Experiment Station

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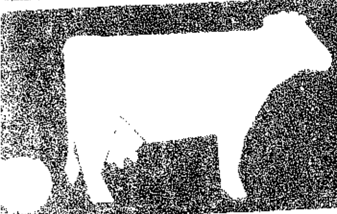

Mastitis Control Program Series

North Central Regional
Extension Publication No. 276

Mastitis Control Program for
Staph-Infected Dairy Cows

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Staphylococcus is a general name for a class of small, round bacteria capable of causing mastitis (inflammation of the udder) in dairy cows.

There are a number of primary species of *staphylococci*. Among these is *Staphylococcus aureus*, also referred to as *Staph. aureus* or "staph." *Staph. aureus* is the major cause of chronic or recurring clinical mastitis in dairy cows. Other species of *staphylococci* can be isolated from the cow's mammary gland, but their role in causing mastitis is not as well understood.

This bulletin will focus on the sources of *Staph. aureus* infections within a dairy herd, and suggest control and prevention tips for the dairy farmer.

Where can *Staph. aureus* be found on the farm?

The main sources are teat skin, teat sores and milk from infected cows. Chemical irritation, chapping and other physical damage to teats may increase the probability that staph infections will develop on the teats.

Purchased cows can be another major source of new staph infections within a herd.

How does the infection move from cow to cow once it develops?

Staph infections are usually transferred from infected cows to noninfected cows during milking via contaminated teat cup liners, milkers' hands, and common wash sponges or rags.

What kind of mastitis problems can *Staph. aureus* cause?

Because of its toxin (poison) production, *Staph. aureus* can cause mastitis problems ranging from nonclinical infections to clinical or gangrenous infections that may kill the cow. Once *Staph. aureus* gets into the mammary gland, it will invade deep into secretory cells and ductal tissue. Staph infections produce scar tissue and can cause small abscesses to form in the udder. Both may permanently limit an infected quarter's ability to produce milk.

How widespread can a staph problem be within a herd?

It is not unusual to find dairy herds in which 30 percent or more of lactating cows have two or more quarters infected with *Staph. aureus*. Cows that have been infected at least once have a greater chance of becoming reinfected, and the probability that staph infections will occur increases with cow age.

What signs might tip me off that a *Staph. aureus* problem is present in my herd?

These clues can indicate that a problem exists:

- Several cows in the herd have chronic clinical mastitis.

You should be aware that clinical cases caused by *Staph. aureus* can occur in any age cow and at anytime during lactation. Infected quarters will "flare up" at regular intervals (about every two weeks to one month). Milk produced from infected quarters will be watery or off-colored and will contain flakes and clots. Most infected cows will not run a fever. Udders will probably swell, and infections will respond very poorly to lactational antibiotic therapy.

Even with the use of good dry cow treatment products, you can expect that at least 30 to 50 percent of the cows infected during a lactation will still be infected, and possibly develop into chronic cases, during the next lactation.

- A herd somatic cell count or a DHIA weighted somatic cell count ranging from 400,000 to 800,000 (linear score of 5 to 6) during the year.

If the bulk count rises high enough, it may result in a warning from your milk cooperative.

Usually, less than 10 percent of staph-infected cows within a dairy herd will have counts higher than 1,500,000. This is one way that staph infections differ from other mastitis infections. A dairy herd that contains the same percentage of *Streptococcus agalactiae*-infected cows, for example, will generally show much higher bulk tank somatic cell counts.

- Presence of pockets of scar tissue in infected quarters that can be detected by palpating (touching).
- An increase in the rate of chronic clinical mastitis within the herd following the purchase of lactating cows.
- Appearance of gangrenous mastitis in first-lactation fresh cows, especially during colder weather.

What should I do if one or more of the situations described above applies to my herd?

First, confirm the existence of the infection in your herd. Collect sterile milk samples for culture tests from 15 percent of your herd (or at least 10 to 20 lactating cows selected at random), or from a minimum of 20 cows with somatic cell counts of 400,000 or higher (linear score of 5). Have the samples cultured by a qualified microbiological laboratory. Your veterinarian may have the proper lab facilities, or you can submit samples to your state animal health diagnostic lab or your milk producers' association. Costs for the cultures may range from $1 per cow to about $10 per culture, depending on the organism responsible for the infection and the laboratory involved.

What kind of results from the culture tests would indicate a problem?

Positive results from 50 percent or more of the milk samples you had cultured for *Staph. aureus* would indicate a significant problem within your herd. If less than 50 percent of the results are positive, but you have noticed some of the other above-mentioned symptoms, resample within two months the cows that produced positive cultures.

Assuming that I have confirmed the existence of mastitis problem caused by *Staph. aureus*, what management steps should I take to solve the problem?

Of course, the more severe your problem, the more quickly you need to put a control program into action. It is very important, however, to begin a long-term prevention program at the same time. A combination control/prevention program will keep the problem from recurring.

The urgency of your control program will depend on several things, including:

- Your bulk tank somatic cell count.
- The severity and rate of clinical mastitis within your herd.
- Your present cash flow situation.

You should begin a control program at once: If you are discarding more than 5 percent of your milk daily; if more than 5 percent of your herd is being treated for staph infections at a given time; and/or if your bulk tank somatic cell count is 400,000 or greater. Failure to act on the problem could result in a substantial financial loss.

STAPH CONTROL PROGRAM

- Cull chronically infected cows.

But which cows should I cull?

First priority for culling should be made for older cows that have these characteristics:

- Chronic clinical mastitis.
- Monthly somatic cell counts that remain higher than 400,000 (linear score of 5) over two lactations.
- More than three treatments during the present lactation.

The number of cows culled will depend on the availability of replacements and your cash flow situation.

- Segregate infected cows from non-infected cows during milking.

Which cows should be included in the segregated group?

The segregated infection group should include all cows that have been treated for mastitis during the present lactation, cows cultured positive for *Staph. aureus*, and cows that have a somatic cell count consistently above 400,000 or a linear score of 5.

What method should I use to separate the infected cows?

There are three options of free-stall housing you can use to segregate the infected and questionable cows from the non-infected cows during milking time:

OPTION 1—Establish a separate lot for staph-infected cows. Milk these cows last. Culture fresh cows before assigning them to either the infected lot or the non-infected lot. Treated cows should be included in the infected group.

Cows should leave the infected lot only through death or culling, or by producing a negative culture result following dry treatment. Because infected cows are more likely than the rest of the herd to become infected again, many farmers choose to keep the infected group separated on a permanent basis.

A cow would move from the non-infected lot to the infected lot either when a case of clinical mastitis occurs or when a milk culture is positive for *Staph. aureus*. Remember, a somatic cell count greater than 400,000 or a linear score of 5 from a cow that was previously considered non-infected indicates a need to culture a milk sample from that cow.

OPTION 2—Use separate milking equipment for treated and infected cows, if the number of infected cows is relatively low. The claw units used for infected cows should not be used to milk any non-infected cows. With this option, the infected cows would not have to be physically separated from non-infected cows, but they would need to be clearly identified at milking time.

Table 1
Backflush Routine

STEP	APPROXIMATE TIME ALLOWED
1. Running-water rinse	10-15 sec.
2. 25 ppm iodine flush	45 sec.-1 minute
3. Running-water rinse	10-15 sec.
4. Water removal from claw	

OPTION 3—Backflush all milking units between cows. Table 1 outlines a true backflush routine.

Some dairy farmers backflush claw units manually between cows, but this is time consuming (2 to 3 minutes per unit). Commercial automatic backflush units are available and are very effective at removing staph organisms from teat cup liners. Most backflush units are installed in combination with automatic-removal milking units.

Though backflushing can eliminate the need to segregate cows, you should realize that the cost of installing backflush units can range from $1,000 to $2,000 per unit, plus costs for automatic takeoffs. Therefore, each farmer should determine the cost:benefit ratio of backflush units for his or her farm.

What other management steps should I take?

- Dry off infected, pregnant cows immediately if they are within 80 to 90 days of calving, and dry treat them.
- Postpone further purchases of cows.
- Perform a total evaluation of milking equipment functions, especially pump capacity, controller function, line sizes, vacuum level, pulsator function and inflation condition.
- Evaluate milking procedures.
- If you have not already done so, establish a teat dipping program, using a germicidal teat dip, and a dry cow treatment program, using a commercially available antibiotic designed specifically for dry cows.
- Provide adequate balanced rations for your herd, with special emphasis on vitamins and selenium.
- Evaluate housing conditions for bred heifers, dry cows, cows at calving and lactating cows, checking for potential sources of teat injury.
- Consider having your milkers wear disposable plastic gloves during daily milking routines. Culture tests can indicate the presence of *Staph. aureus* on the hands, but the bacteria are often hard to eliminate.

Would vaccinating my herd help?

A good general vaccination program is recommended for any dairy herd to combat diseases, but the vaccinations that are currently available will not prevent staph infections.

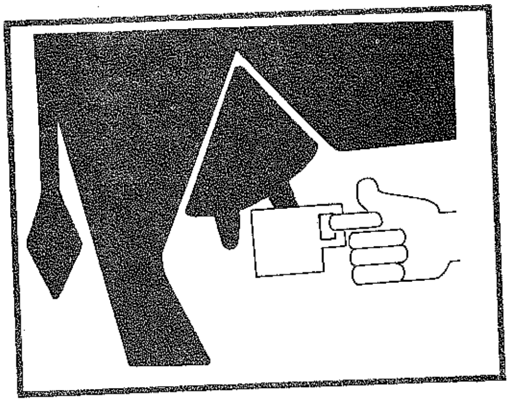
Is there anything I can do to prevent or reduce the chances of my herd becoming infected by *Staph. aureus?*

Yes. Naturally, a good prevention program begins with a dairy farmer or herdsperson who is truly interested in milking cows. The statement that mastitis is a man-made disease is true for many farms.

Important measures you can take include:

- Proper nutrition and sound general vaccination programs for heifers and cows.
- Good sanitation in housing areas.
- Properly designed and maintained milking equipment, and proper usage of the equipment.
- Teat dipping.
- Dry treatment of all cows.
- Enrollment in the DHIA somatic cell count program.
- Culling of chronically infected cows.
- Limited, managed use of veterinarian-recommended antibiotics for treatment of mastitis during lactation. Treatment of staph infections during lactation will cure only 10 to 20 percent of infections; therefore, lactation therapy should be limited to severe clinical cases.
- Maintenance of a closed herd.
- Good calf management so adequate numbers of replacement heifers are available.
- Periodic bulk tank sampling to monitor somatic cell counts once the infection problem is under control.
- Cooperating with your local veterinarian to establish *Staph. aureus* control and prevention programs.

This is one in a series of bulletins on mastitis control in dairy herds. Contact your county Cooperative Extension Service office for information on other forms of mastitis and how to control them.



Dip teats regularly after milking to reduce the risk of a Staph. aureus infection developing.

SOMATIC CELL COUNTS AND EQUIVALENT DHIA LINEAR SCORES

Average Somatic Cell Count	DHIA Linear Score
12,500	0
25,000	1
50,000	2
100,000	3
200,000	4
400,000	5
800,000	6
1,600,000	7
3,200,000	8
6,400,000	9

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Mastitis Control Program Series

North Central Regional
Publication Number 287

Coliform-Infected Dairy Cows

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Escherichia coli, Enterobacteri aerogenes **and** ***Klebsiella pneumoniae*** **are three common forms of coliform bacteria that cause mastitis (inflammation of the udder) in dairy cows. This bulletin will focus on the source of coliform infections within a dairy herd and suggest useful control and prevention tips for dairy farmers.**

Where can coliform bacteria be found on the farm?

Coliform bacteria are normal inhabitants of soil and the intestines of cows. They accumulate and multiply in manure, polluted water, and contaminated bedding. Research has shown that coliform numbers of 1,000,000 or more per gram of bedding increase the likelihood of an udder infection.

Klebsiella pneumoniae is common when farmers use sawdust bedding, especially rough-cut sawdust that contains bark or soil. Finer sawdust—especially hardwood sawdust—can increase the risk of coliform mastitis. The initial moisture level of the sawdust, however, has little effect on whether coliform numbers will exceed the 1,000,000 per gram level once the sawdust is used for bedding. *E. coli* and other coliforms are normally found in cow feces, and once the bedding (sawdust or other) becomes heavily soiled with cow manure, the coliform level will increase, and so will the chance of a coliform mastitis case occurring.

How do coliform infections start?

Many factors are involved in the initiation of a coliform infection. Unlike other major forms of mastitis, coliform infections are not usually spread from infected cows to non-infected cows during milking. Coliforms invade the udder through the teat when a cow comes in contact with an unsanitary environment between milkings.

Once coliforms enter the mammary gland, they multiply rapidly. As they multiply, coliforms produce endotoxins (poisons), which are subsequently released when the bacteria are destroyed by leucocytes (white blood cells). Once released from the bacteria, the toxins are absorbed into the bloodstream. A cow affected by the toxins will show signs of high fever, depressed appetite, rapid weight loss, abnormal milk and decreased production.

The majority of severe clinical infections occur by 70 to 90 days into a lactation. Most of the severe outbreaks of acute clinical mastitis caused by coliforms occur in highest producing, older cows. These cows typically are *Strep. ag.*- and *Staph. aureus*-free, and they have somatic cell counts below 200,000 (DHIA linear score 4). About 30 to 50 percent of these cases actually start at the end of the previous dry period or during calving. Some of these infections are spontaneously cured, while others remain non-clinical until they flare up early in the lactation.

Periods of hot, humid weather, extensive periods of heavy precipitation, and movement of cows to new facilities are often followed by periods of increased incidence of new coliform cases.

How widespread can coliform mastitis be within a herd?

Coliform bacteria are responsible for a great number of acute clinical mastitis cases in dairy cows. Coliform infections generally occur as isolated or sporadic cases, but within certain herds, 10 to 15 percent of the cows may become infected within a time period as short as one month or less.

Even though coliforms may cause a high percent of all acute clinical cases, these organisms are responsible for only 0.1 to 1.0 percent of the total infected quarters within a herd at any one time. In addition, usually only one quarter per cow is clinically infected at a time.

What are the results of coliform infections?

Results of infections range from death of a cow to near-normal recovery of milk production. In about 70 percent of coliform cases, infected cows may survive, but subsequent milk production will be below normal for the lactation. Some surviving cows may undergo a long illness, characterized by a poor appetite and weight loss. These cows should be sent to market after antibiotic residues are cleared. In about 10 percent of clinical coliform mastitis cases, cows die within one to two days after the infection becomes apparent, in spite of aggressive veterinary care. In the remaining instances (about 20 to 30 percent), cows recover quickly and return to substantial milk flow. Cows kept for another lactation usually return to near-normal production if swelling of the infected quarter returns to normal within 24 to 36 hours after the onset of clinical signs.

Few infections become chronic, and those that do are usually very mild. In rare instances, coliform bacteria have been found to cause non-clinical problems on a herd basis.

What signs might tip me off that a coliform mastitis problem is present within my herd?

Individual cow signs:

In a typical case, an individual cow with a severe coliform infection will suddenly go off feed and become depressed after being clinically normal at the previous milking. The infected quarter will swell and milk may become watery. Body temperature of the cow may rise to 104 degrees F or higher. Within the day of onset, an infected quarter generally will become edematous (swollen) and sensitive to touch, and will sometimes secrete a small amount of serum-looking fluid. At this point, the infected cow will be weak and dehydrated, and may have a below-normal temperature (about 99 degrees F). Because the infection may result in a decreased level of blood calcium, an infected cow may appear to have symptoms of hypocalcemia (milk fever).

Herd signs:

- A high proportion of clinical mastitis cases that occur in the first 90 days after calving, often at the peak of lactation.
- Infections that last for a few hours/days.
- A herd somatic cell count of 200,000 or less, and few *Strep. ag.* and *Staph. aureus* infections (less than 10 percent of the herd).

Will a monthly DHIA somatic cell count (SCC) identify coliform-infected cows?

Not usually. DHIA somatic cell counts tend to identify clinical and non-clinical mastitis infections that are relatively long in length. Coliform infections are very short in duration (a matter of a few hours to a few days).

An infected cow's SCC may be low on test day, but can rise to several million within one to two days. Subsequently, since DHIA SCCs are taken at monthly intervals, cows that recover from the infection could have a normal SCC by the next test day. However, herds in which 85 to 90 percent of cows have linear scores of 4 or lower may be more likely to develop coliform infections than herds with higher SCCs. Thus, use of the DHIA cell count is more helpful to the herdowner in identifying cows that are "at risk" in developing coliform infections than in identifying coliform-infected cows.

SOMATIC CELL COUNTS AND EQUIVALENT DHIA LINEAR SCORES

Average Somatic Cell Count	DHIA Linear Score
12,500	0
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100,000	3
200,000	4
400,000	5
800,000	6
1,600,000	7
3,200,000	8
6,400,000	9

What kind of treatment should I give infected cows?

Before treating clinically infected cows, aseptically collect a milk sample from the infected quarter so that the organism responsible for the mastitis infection can be identified. Though having a milk sample cultured may help to identify the type of organism responsible for the infection, be aware that coliform bacteria are not reliably cultured from milk of infected quarters. The numbers of coliform organisms in a milk sample from a clinically infected quarter may fall below the minimum detectable limit. This makes recognition of early clinical symptoms much more important in helping to ensure that proper treatments are initiated quickly to save the cow and her production abilities. Identifying the organism may also help you to diagnose and choose the proper treatment method for subsequent coliform

TABLE 1—Cow stall platform sizes

Use electric cow trainers. Dimensions from edge of curb to edge of gutter.

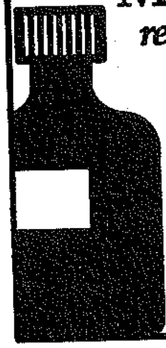
Cow weight	Stanchion stalls		Tie stalls	
	Width	Length	Width	Length
Under 1,200 lb	4′-0″	5′-6″	4′-0″	5--9″
1,200-1,600 lb	4′-6″	5′-9″	4′-6″	6′-0″
Over 1,600 lb	Not recommended		5′-0″	6′-6″

SOURCE: Midwest Plan Service (MWPS) publication #7, "Dairy Housing and Equipment Handbook" (4th Ed., 1985).

infections in other cows.

Most coliform cases require immediate professional veterinary treatment, which is likely to include use of broad spectrum antibiotics, fluid therapy, antiprostaglandin, steroids, antihistamines and calcium treatment. Aspirin is a potent antiprostaglandin that can be administered to infected cows by the herdowner, but this should be done upon the advice of the veterinarian.

A very important procedure in treatment of coliform mastitis infections involves frequent milking of the infected cow to remove leucocytes, bacteria and toxins from the mammary gland. Hourly milkings are very helpful. Injections of oxytocin following milking may also aid in removal of residual milk that contains toxins.



Make sure cows receive adequate amounts of vitamins and minerals daily, particularly selenium and vitamin E.

Besides treating infected cows, what management steps should I take to rid my herd of a coliform problem?

- Immediately clean up all areas that could be a source of bacterial growth. This may include poorly cleaned or pitted free stalls, an overused calving pen, a muddy lot, or an overcrowded shelter area used during hot or cold weather.
- Immediately remove sawdust bedding or other fine bedding (such as ground corn cobs, recycled manure or chopped straw) from beneath high-producing cows, and avoid bedding dry cows and springing heifers within two weeks of calving on these materials. In addition, do not use manure packs as bedding materials for dry cows and springing heifers.
- Increase space per cow by providing a clean area, such as a pasture, so cows can avoid manure contamination. Cow numbers should not exceed 10 percent of the number of free stalls in the barn.
- Keep cows on their feet for an hour after milking by providing fresh feed for them to eat. This will allow the teat sphincter to regain its normal patency (closure status) after milking, before the teat end has a chance to be exposed to bedding and its contaminants.

Can milking management factors influence the occurrence rate of new coliform infections?

Despite the fact that the majority of new coliform infections occur between milkings, milking time infections can occur. A rise in the occurrence rate of new infections can be influenced by the following milking factors: wet milking of cows, i.e., the use of excessive water with no drying at prep time; excessive liner slippage and the potential for wet teats at the end of milking; and badly worn inflations. In addition, the combination of malfunctioning pulsators with any of the above problems can increase the chance that teat damage will occur, which in turn could increase the probability of new coliform infections.

To help avoid these problems, you should carefully wash and dry teats before milking to prevent accumulation of dirty water on teat ends. After milking, turn off the vacuum before removing teat cups to avoid liner slippage. Check milking equipment regularly to make sure it is functioning correctly. Note, too, that the use of automatic backflushing units will not control coliform infections since most infections occur between milkings.

TABLE 2—Free stall dimensions

Age (mo)	Weight (lb)	Stall size		Neck rail	
		Width	Length	Height above stall bed	Distance from front
		inches			
6-8	360-490	30	60	28	14
9-12	490-650	33	64	30	15
13-15	650-780	37	72	34	15
16-24	780-1,200	42	78	37	16
cows	1,200-1,500	45	84	40	18
cows	over 1,500	48	90	42	19

SOURCE: "Improved Free Stall Partition Design," Agricultural Engineering Information Series #557, Michigan State University CES, August 1986.

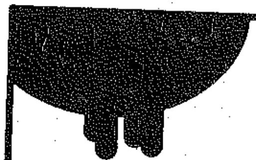
What about cementing free stalls to ease maintenance?

Cemented free stalls with a 4-inch slope from front to back, no back curb and a grooved surface, will decrease the labor cost of maintaining free stalls. A minimum of 3 to 4 inches of bedding must be maintained in the stalls to minimize feet and leg injuries. Consider using free stall mattress pads for this purpose. The use of fine sawdust or recycled manure solids for high-producing cows is still questionable on cemented free stalls.

Are there any other management steps I can take to cut down on coliform mastitis infections in my herd?

Yes. Consider adding these steps to your preventive maintenance list:

- Avoid overcrowding of free stall or loafing areas so that cows will not rest in alleyways.
- Provide well-ventilated and lighted housing areas to prevent environmental stress.
- Change feed rations and cow routines gradually to prevent stressful periods.
- Dip teats prior to milking with a germicidal teat dip. This practice has been shown to reduce the incidence of new cases of coliform and other environmental mastitis.
- Make sure that cows are receiving adequate amounts of vitamins and minerals in their daily rations, particularly vitamin E and selenium. Studies have indicated that deficiencies of vitamin E and selenium can contribute to an increase in the incidence of environmental mastitis. For lactating and dry cows, Michigan State University dairy nutrition specialists recommend a daily minimum of 300 IUs of vitamin E per cow. Additionally, in light of recent changes by the U.S. Food and Drug Administration in the amounts of supplemental selenium that dairy cattle can receive in their rations, MSU specialists recommend a daily minimum of .068 pounds of Selenium 90 (200) Premix per cow, which provides the equivalent of 6 mg per cow.



Keep udders clean and dry between milkings to avoid buildup of dirt and possible contamination.

- Clean and sanitize 12-foot by 12-foot calving areas after one or two freshenings. One box stall, bedded with long straw, should be available for every 15 to 20 cows.

Does teat dipping play any role in preventing coliform mastitis?

Germicidal teat dips are not effective against gram-negative organisms such as coliforms. Latex sealant dips may provide some physical protection against coliform invasion of teat ends between milkings, but to be effective, the latex dip must dry on the teat end before the cow lies down.

The prevalence of coliform infections decreases significantly after the first 90 days of lactation. Therefore, if your herd has had confirmed cases of coliform mastitis, try using a latex dip for high-producing cows and a germicidal dip for other production groups.

Would the use of an IMD (intramammary device) help to control coliform mastitis?

Research is continuing on the effect that inserting an IMD loop into cows' quarters has on prevention of coliform infections. Studies in Israel and at the U.S. Department of Agriculture in Beltsville, Md., indicate that the loop can stay in the gland cistern and stimulate a localized increase in leucocytes, which could help to repel invading coliform organisms.

These research trials are studying the short-term and long-term effects of IMD on somatic cell counts, clinical mastitis and milk production. Because the loops cause a localized increase in somatic cell counts, there is concern that herds on milk quality payment programs may not qualify for bonuses traditionally awarded for low SCCs. In addition, it is still not clear what, if any, the long-term effects are of IMDs on milk production.

This is one in a series of bulletins on mastitis control in dairy herds. Contact your county Cooperative Extension Service office for information on other forms of mastitis and how to control them.

Should I continue dry treating all cows?

Infusion of antibiotics specifically designed for dry cow usage at dry-off increases the cure rate and prevents most new infections in the early dry period. Most commercial dry cow therapy products are designed to cure *Strep. ag.* and *Staph. aureus* mastitis infections. Dry cow therapy should be used on every quarter and every cow to cure and prevent infections other than coliforms, and to prevent an increase in environmental streptococci infections during the first 7 to 10 days of the dry period.

Dry cow treatment will not prevent new coliform or environmental streptococci infections in the last two weeks of the dry period or at the start of the next lactation, however. Only good housing management from two weeks before and at calving will prevent the majority of new coliform infections that may tend to occur immediately after calving or during the early postpartum period.

Is there anything I can do to prevent or reduce the chances of my herd becoming reinfected with coliform infections once problems are eliminated?

Yes. A long-term prevention program should be part of any mastitis control program. For best results in the fight against coliform mastitis:

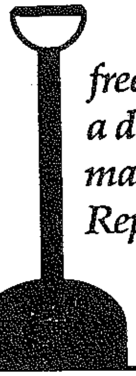
- Maintain/replace free stall bedding frequently to prevent the "hollowing out of the bedding" that allows milk, manure and urine to accumulate.
- Scrape the rear 2 to 3 feet of free stalls twice a day to prevent manure buildup.
- Make sure free stalls and comfort stalls are correctly designed for the size of the cows that will be housed in them. The right sized stalls will help to prevent teat injuries, which will lower the chances of coliform infections occurring. Tables 1 and 2 outline proper cow stall platform sizes and free stall dimensions. For more information on dairy housing guidelines, ask your county Cooperative Extension Service agricultural agent where you can get Midwest Plan Service (MWPS) publication #7, "Dairy Housing and Equipment Handbook" (4th ed., 1985).
- Avoid housing dry cows and springing heifers that are within two weeks of calving on sawdust bedding, recycled manure solids, manure packs or muddy lots.
- Consider using sand instead of sawdust or recycled manure solids as a bedding material, particularly for early-lactation cows. Cows that are more than 90 days into a lactation, however, may be housed with any type of bedding.

What if my farm uses a liquid manure system and I can't use sand bedding for high-producing cows?

Under such conditions, chopped straw or wood shavings would be preferable to sawdust as a bedding source. It is critical that the back 2 to 3 feet of each stall be cleaned two to three times a day.

What about adding lime to the backs of stalls bedded with sawdust to limit coliform infections?

Research at the University of Vermont and other universities has indicated that this is a short-term solution at best. Using sand would be preferable to adding lime to sawdust bedding. Lime may cause drying and excessive chapping of teat skin.



Scrape free-stalls twice a day to prevent manure buildup. Replace bedding frequently.

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Mastitis Control Program Series

North Central Regional
Extension Publication No. 278

Non-Ag. Strep.-Infected Dairy Cows

(Environmental Strep.)

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The term "non-*agalactiae streptococcus,*" or "non-ag. strep.," refers to all forms of streptococci bacteria other than *Streptococcus agalactiae* that are capable of causing mastitis (inflammation of the udder) in dairy cows.

Two of the most common forms of non-ag. strep. are *Streptococcus dysgalactiae* and *Streptococcus uberis.* This bulletin will focus mainly on the source of these two forms of non-ag. strep. infections within a dairy herd and suggest useful control and prevention tips for dairy farmers.

Other non-ag. strep. bacteria include *Strep. faecalis* and *Strep. bovis.* A more general classification for non-ag. strep. is "environmental streptococci."

Where can non-ag. strep. be found on the farm?

The primary sources of non-ag. strep. bacteria that cause mastitis are environmental contacts on the farm such as bedded housing and calving areas, standing water and soil. Areas such as bedded manure packs tend to be the most frequent and significant source of teat end exposure to the bacteria.

Another important source of non-ag. strep. bacteria is the cow itself, including the mouth, teat and udder skin, and the reproductive tract—especially the vagina. These bacteria readily multiply in wounds and sores on the skin. At calving, large numbers are deposited onto the bedding.

Strep. uberis bacteria from the intestinal tract have been recovered from the pasture soil where cows have grazed, while *Strep. faecalis* is a normal inhabitant of animal feces.

Because of their many environmental sources, non-ag. strep. bacteria cannot be totally eliminated from a dairy herd. Therefore, to a large extent, control must rely on prevention programs that limit teat end exposure to the various forms of the bacteria.

How can non-ag. strep. infections develop and spread within my herd?

Unlike some of the other forms of bacteria that cause mastitis in dairy herds, non-ag. strep. organisms are not completely dependent on the mammary gland for survival.

Strep. uberis infections normally are not highly contagious, and their spread from an infected cow to a non-infected cow via the milking process is not likely to happen. Most mammary gland infections occur between milkings when an uninfected mammary gland comes in contact with highly contaminated bedding or other surfaces. In contrast to coliforms, whose population is highest on sawdust bedding, non-ag. strep. populations are highest on a straw bedding. Chopped straw bedding will maintain a higher population of non-ag. strep. organisms per bedded area than long straw.

Other farm conditions that may increase the probability of non-ag. strep. infections include overcrowding; poor ventilation; poorly maintained, dirt-based free stalls; recent movement of cows to a new farm or new facilities; cow access to farm ponds or muddy exercise lots; and a general lack of farm cleanliness and sanitation.

How widespread can non-ag. strep. infections be within a herd, and what kind of problems can they cause?

Strep. dysgalactiae and *Strep. uberis* are less commonly found on a herd basis than *Streptococcus agalactiae* or *Staphylococcus aureus. Strep. uberis* is found in about 5 percent of infected cows, and is the most common bacteria isolated from heifers freshening for the first time. Infections usually disappear, however, within one to three weeks after calving.

Non-ag. strep. infections can range from mild, non-clinical cases to severe clinical cases. Research suggests that approximately 50 percent of cows infected with non-ag. strep. will exhibit clinical signs of mastitis at some time. Most infections will have a duration of only a few weeks, compared to months or years for *Strep. ag* and/or *Staph. aureus* infections. Close to 60 percent of infections generally last less than 30 days. About 18 percent of non-ag. strep. cases become chronic during lactation, however, and may be present for more than 100 days.

A major increase in non-ag. strep. infections tends to occur at either the beginning or end of a cow's dry period (see Fig. 1). Note that with appropriate dry cow treatment, you may be able to keep new infections at the beginning of a dry period down to a minimum. Regardless of whether you dry treat your cows, however, the incidence of increased non-ag. strep. cases may rise toward the end of the dry period, since the effectiveness of dry cow treatment drugs will have worn off by this time.

The probability of a new non-ag. strep. infection occurring during the dry period will also increase as a cow gets older.

Strep. uberis is responsible for many new infections in dry cows. Infections caused by these bacteria are most likely to occur during summer months or at any time when the enivronment is wet and humidity is high.

What signs might tip me off that a non-ag. strep. problem is present within my herd?

- Development of mastitis in any age cows during the first 30 to 60 days of lactation, despite dry cow treatment.
- Excessive numbers of dry cows that have mastitis during the early dry period, or dry and first-lactation cows that develop clinical mastitis immediately after calving when dry cow treatment is not used in the herd.
- A large number of cows with mastitis and/or signs of clinical mastitis in rear quarters during the first 70 to 90 days of a lactation.
- An increase in the herd's somatic cell count, with a significant increase in the number of non-chronic, clinical mastitis cases in the herd.
- An increase in clinical mastitis cases after teat dipping and dry cow treatment programs have been implemented on all cows for more than three years.

What should I do if one or more of the situations described above applies to my herd?

First, confirm the existence of non-ag. strep. infections in your herd. Aseptically collect sterile milk samples for culture tests from one, two or all of these groups of cows:

- 15 percent of your lactating herd (or at least 10 to 20 cows) selected at random;
- All cows that have a DHIA linear score of 5 or greater;
- All cows that show clinical signs of mastitis.

Have the samples cultured by a qualified microbiological laboratory. Your veterinarian may have the proper lab facilities, or you can submit samples to your state animal health diagnostic laboratory or your milk producers' association. The culture tests will confirm whether an infection exists, and also determine whether non-ag. strep. organisms are responsible for the infection. Costs for the cultures may range from $1 per cow to about $10 per culture, depending on the organism responsible for the infection.

Will a monthly DHIA somatic cell count (SCC) identify non-ag. strep.-infected cows?

In many cases, yes. Since many non-ag. strep. mastitis cases may last up to 30 days (or longer) and SCCs are taken at monthly intervals, many of the infected cows can be pinpointed via high somatic cell counts. You should not rely on the DHIA SCC as your only way to identify infected cows, however. The primary purpose of a somatic cell count program is to use it as a preliminary step in making further mastitis-management decisions. For best results, combine an SCC program with culturing to identify infected animals.

If I find that my herd does have a problem with non-ag. strep., what management steps should I take to correct the problem?

- Immediately clean up environments that could be a source of bacterial growth. This may include poorly cleaned or pitted free stalls, an overused calving pen, a muddy lot, or an overcrowded shelter area used during hot or cold weather. When these areas are kept clean on a regular basis, the teats are less likely to become contaminated while cows use these areas between milkings.
- Immediately remove chopped straw bedding or other fine bedding (such as sawdust, ground corn cobs, or recycled manure) from beneath high-producing cows, and avoid bedding dry cows and springing heifers within two weeks of calving on these materials. Preferred bedding materials include wood shavings, long straw or a clean grass pasture. Whenever possible, use sand for bedding material rather than finely chopped organic materials.
- Provide a dry environment for your herd. Damp, humid and wet conditions are likely to increase exposure to environmental pathogens. In addition, drier bedding materials generally contain lower numbers of environmental mastitis-causing bacteria.
- Consider housing cows in individual stalls rather than group areas. Cow numbers should not exceed 10 percent of the number of free stalls in the barn.
- Keep cows on their feet after milking by providing them with fresh feed. This will allow the teat sphincter and keratin lining (the inside of the streak canal) to close after milking—before the teat end has a chance to be exposed to bacteria in the bedding.

Should I treat lactating cows?

The response to lactational therapy for all non-ag. strep. mastitis cases is generally only about 50 to 60 percent successful. Based on this response rate, it is generally not worth the cost to treat non-clinical infections during lactation. In some instances, however, you may find it to be economically feasible to treat lactating cows. For example, some non-clinical cases have the potential of developing into clinical cases that may ultimately result in severe and long-term health effects, or even death. Early treatment of non-clinical cases (identified through high somatic cell counts) may end up saving you money in the long run. Before you decide to treat or not treat lactating cows, it is a good idea to consider all potential treatment and veterinarian expenses that may be involved.

Can milking management factors influence the occurrence rate of new non-ag. strep. infections?

Despite the fact that the majority of new non-ag. strep. infections occur between milking, milking time infections may occur. A rise in the rate of new infections can be influenced by the following milking factors: wet milking of cows (i.e., the use of excessive water with no drying at prep time); excessive liner slippage and wet teats at the end of milking; and, badly worn inflations. In addition, the combination of malfunctioning pulsators and/or improper vacuum levels with any of these situations can increase the chance of teat damage occurring, which in turn could increase the probability of new infections.

To help avoid problems associated with wet milking:

- Before milking, wash only teats with running water. Dry each teat thoroughly with an individual paper towel before attaching the milk machine.
- If your housing conditions are extremely sanitary and teats are clean, consider predipping instead of washing. Dip teats in a germicidal teat dip; allow to stand for 30 seconds, then dry thoroughly with individual paper towels.
- After milking, turn off vacuum before removing teat cups to avoid liner slippage. Check milking equipment regularly to make sure it is functioning correctly.

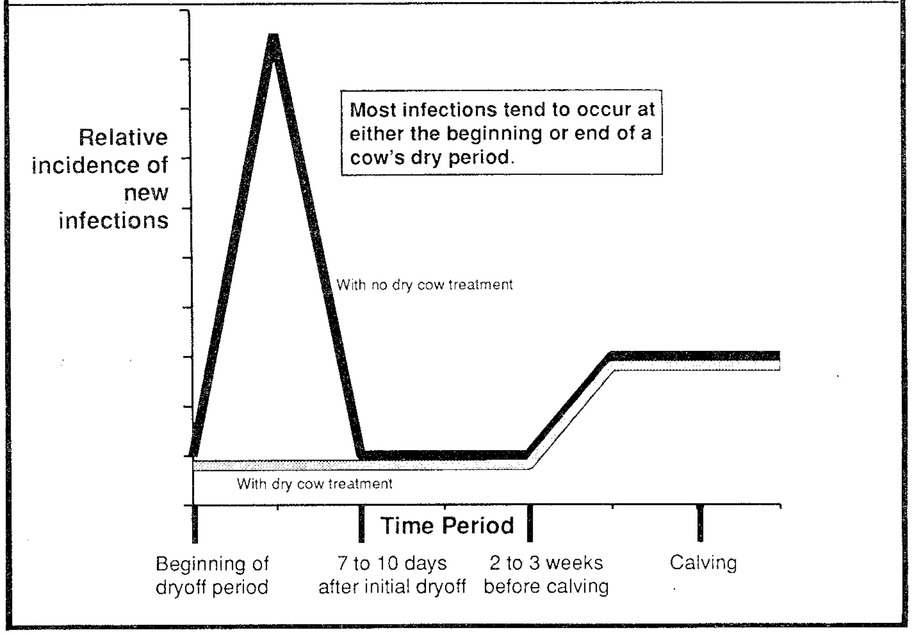
Note, too, that the use of automatic backflushing units will not prevent non-ag. strep. infections since most infections occur between milkings.

Is there anything I can do to prevent or reduce the chances of my herd becoming reinfected with non-ag. strep. infections once a problem is eliminated?

Unfortunately, environmental streptococci cannot be completely eradicated from a dairy herd. However, a long-term prevention program should be a part of any mastitis control program. For best results, consider following these suggestions:

- Maintain and replace bedding for dry cows, calving cows and milking cows to prevent the "hollowing out of the bedding" that allows milk, manure and urine to accumulate. Scrape or sweep the rear 2 to 3 feet of free stalls and comfort-type stalls twice a day to prevent manure buildup. Calving areas should be cleaned and sanitized after each freshening.
- Make sure free stalls and comfort stalls are correctly designed for the size of cows that will be housed in them. For proper cow stall platform sizes and free stall dimensions, see the bulletin in this series titled "Mastitis Control Program for Coliform-Infected Dairy Cows."
- Avoid overcrowding of free stall or loafing areas so that cows will not rest in alleyways.
- Make any changes in feed rations and cow routines gradually to prevent stressful periods.
- Provide cows with adequate daily amounts of vitamins and minerals—particularly selenium and vitamin E. Studies have indicated that deficiencies of vitamin E and selenium can contribute to an increase in the incidence of environmental

Figure 1. **The periods when new cases of non-ag. strep. (environmental) mastitis are most likely to develop.**



mastitis. For lactating and dry cows, Michigan State University dairy nutrition specialists recommend a minimum of 300 IUs of vitamin E per cow. Additionally, in light of recent changes by the U.S. Food and Drug Administration in the amounts of supplemental selenium that dairy cattle can receive in their rations, MSU specialists recommend a daily minimum of .068 pounds of Selenium 90 (200) Premix per cow, which provides the equivalent of 6 mg per cow.

- Provide well-ventilated and lighted housing areas to prevent environmental stress.
- Cooperate with your local veterinarian to establish non-ag. strep. control and prevention programs.

What about the use of teat dips on my herd?

Germicidal teat dips can be effective against gram-positive organisms such as non-ag. strep. Dipping teats after milking with latex dips, which form a protective barrier over the teat end, may help to prevent entry of bacteria into the streak canal between milkings. To be effective however, the dip must dry on the teat end before the cow lies down.

Some herds have been successful in using a latex dip for high-producing cows during the first 90 days of a lactation and a germicidal dip for cows in other lactation stages. Experiment with these dips to determine the dipping procedure that works best for your herd.

This is one in a series of ulletins on mastitis control n dairy herds. Contact your ounty Cooperative Extension ervice office for information n other forms of mastitis and ow to control them.

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Mastitis Control Program Series

North Central Regional
Extension Publication No. 275

Mastitis Control Program for
Strep. Ag.-Infected Dairy Cows

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Department of Animal Science

Streptococcus is a general name for a class of bacteria capable of causing mastitis (inflammation of the udder) in dairy cows.

Streptococcus agalactiae, also called *Strep. ag.,* is the most common cause of non-clinical mastitis infections of cows within a dairy herd. *Strep. ag.* causes approximately 40 percent of **all** mastitis infections.

This bulletin will focus on the source of *Strep. ag.* infections within a dairy herd, and suggest useful control and prevention tips for dairy farmers.

Where can *Strep. ag.* be found on the farm?

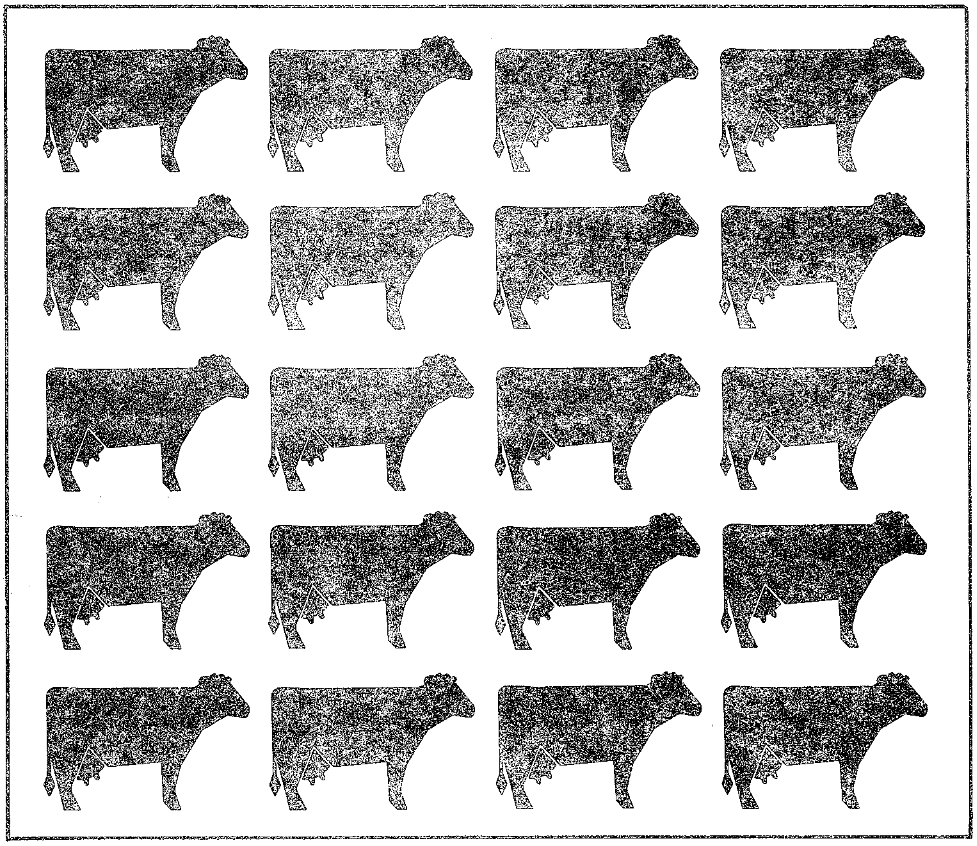
Infected cows are the source of *Strep. ag.* Though it can survive indefinitely within the mammary gland, *Strep. ag.* survives only a short time outside the mammary gland. Cows infected by *Strep. ag.* usually have at least two infected quarters.

How could *Strep. ag.* infections develop and spread within my herd?

Purchasing *Strep. ag.*-infected cows and adding them to a *Strep. ag.*-free herd can result in a majority of cows becoming infected within a few months.

Infections can also develop among group-penned heifer calves. A calf's mammary gland may become infected with *Strep. ag.* if it is suckled by a second calf that has been fed whole milk from an infected cow. The infection can then remain indefinitely in the newly infected heifer's mammary gland.

Infections are spread from infected cows to non-infected cows during milking via milking machines, contaminated milkers' hands, and common wash materials such as rags and sponges.



A dairy farmer may be treating only one clinical case of Strep. ag.-mastitis when there are actually 20 cows infected.

How widespread can a *Strep. ag.* problem be within a herd, and how severe are the results from such an infection?

It is not unusual to find 60 to 80 percent of cows within a herd infected by *Strep. ag.* The majority of these cases are non-clinical; in fact, *Strep. ag.* infections account for only 2 percent of all clinical mastitis treatments. It has been estimated, however, that a dairy farmer may be treating **only one case** of clinical mastitis for each 20 to 40 quarters or cows that are actually infected.

Strep. ag. infections are usually relatively mild when measured in terms of udder swelling, systemic health problem or quarters lost, though infections can become severe enough to result in the death of a cow. Normally, *Strep. ag.* infections do not result in acute mastitis cases.

What effects does *Strep. ag.* have on milk quality and production?

Strep. ag. is considered the leading cause of illegal somatic cell counts in bulk tank milk (counts greater than 1,000,000). In addition, some illegal bulk tank bacteria counts (greater than 100,000) can be traced to *Strep. ag.* infections.

As somatic cell counts rise, milk quality decreases, because milk solids such as lactose and casein decrease. Milk production from a cow with an infected quarter may decrease as much as 40 percent without the cow's showing apparent clinical signs of mastitis. A reduction in milk quality ultimately leads to increased income losses for the dairy farmer who bases his or her milk sales on component pricing or who is paid a premium for higher quality, lower cell count milk.

What are some indications of a *Strep. ag.* problem that I might recognize in my herd?

- Bulk milk tank or DHIA weighted somatic cell counts that are consistently between 600,000 and 1,000,000 or higher (linear score of 6 or higher) and only 60 to 70 percent of your herd showing cell counts of less than 400,000 (linear score of 5). The clinical infection rate among your herd will probably remain low (1 to 2 percent), including any cows that have linear scores of 8 or higher.
- Heifers freshening with "blind" (non-functional) quarters.
- A decrease in herd milk production, despite good general herd management.
- Illegal bacteria counts greater than 100,000 in bulk tank milk, even when you are using clean equipment, good washing procedures and proper cooling methods.
- What appears to be a good response by clinical mastitis cases treated with penicillin or synthetic penicillin.

Keep in mind that no cow is immune to *Strep. ag.* Infections can develop in cows at any age and during any stage of lactation. And because most *Strep. ag.* infections are non-clinical, there will be no visual signs that will pinpoint differences between *Strep. ag.* and another organism that may be causing a mastitis infection, such as *Staphylococcus aureus.*

What should I do if I recognize some or all of these situations within my herd?

First, determine whether your herd has a *Strep. ag.* problem. Collect sterile milk samples for culture tests from 15 percent of your herd (or at least 10 to 20 lactating cows) selected at random, or from a minimum of 20 cows with somatic cell counts of 400,000 or higher (linear score of 5). Have the samples cultured by a qualified microbiological laboratory. Your veterinarian may have the proper lab facilities, or you can submit samples to your state animal health diagnostic lab or your milk producers' association. Costs for culture tests may range from $1 per cow to $10 per culture, depending on the organism responsible for the infection and the laboratory involved.

What will the results of the culture tests from my milk samples tell me about a possible problem within my herd?

Positive results of 30 to 40 percent or more of the milk samples you had tested for *Strep. ag.* would indicate a significant non-clinical mastitis problem within your herd.

Each cow with a somatic cell count greater than 300,000 should be considered infected. If cell counts are high but the milk is negative for *Strep. ag.*, other organisms are probably responsible for the high cell counts. Culture tests will identify these organisms, and you can then begin appropriate control procedures.

If culture tests indicate that more than one type of organism besides *Strep. ag.* is responsible for mastitis infections within your herd, consult other bulletins within this mastitis control series to determine appropriate control procedures for infections caused by those organisms.

What management steps should I take to solve a herd mastitis problem caused predominantly by *Strep. ag.?*

There are several options to choose from in managing your *Strep. ag.*-infected herd. The urgency of your situation should dictate how quickly you begin an action program.

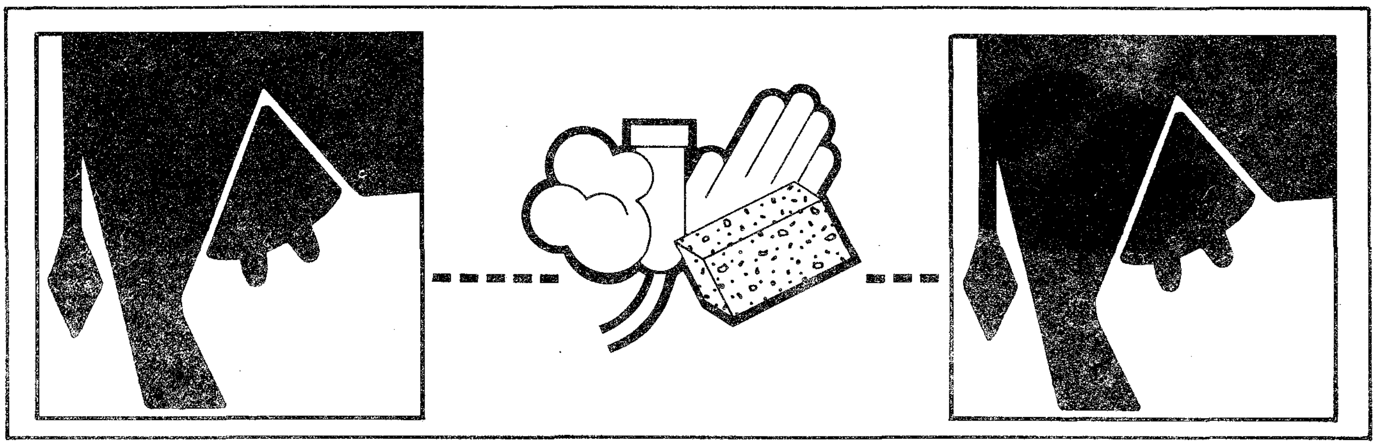
1) **Emergency Program:** If the last two out of four consecutive bulk milk somatic cell counts were 800,000 or higher, and high counts were a result of *Strep. ag.*-infected cows, you need to begin an action program immediately. Consider following action program #1 to avoid suspension from the milk market.

2) **Short-Term Program:** If your last several bulk tank or DHIA cell counts were low but there is still an indication of *Strep. ag.* infections within your herd, you may wish to implement action program #2.

3) **Long-Term Prevention/Control Program:** If you are interested in keeping a mastitis problem from recurring once it is under control, you would be wise to go with program #3 IN ADDITION to either the emergency program or the short-term program.

Action Program #1 (Emergency)

Example situation: Based on culture tests, 80 percent of your herd has *Strep. ag.* infections. Your last four bulk tank somatic cell counts



Strep. ag. is often transferred from an infected to a non-infected cow during milking routines via rags and sponges, milkers' hands, or contaminated teat cup liners.

have averaged 1,000,000. In addition, your herd production has been running at about 40 pounds or less per cow.

What should I do?

Set up an intensive *Strep. ag.* eradication program. This program will include treatment of **all cows** and **all quarters.** Be sure to contact your milk cooperative and inform them of your plans to begin treatment. Consult with your local veterinarian before beginning any treatment on your herd. In addition, start developing a long-term mastitis control program (see action program #3).

DAY 0—Cull any cows five years old and older that have these characteristics:

1) Positive culture results for *Strep. ag.* infections.

2) Somatic cell counts of 1,600,000 or higher (or linear score of 7 or higher) for three or more months.

3) A previous history of chronic clinical mastitis or cell counts that exceed 2,000,000.

In addition, dry off any cows that are within 80 to 90 days of freshening.

DAY 1—In consultation with your veterinarian, treat all quarters of all lactating cows with a commercially available, prepackaged drug formulated for lactating cows. (Penicillin is the preferred drug.) Follow directions on the drug label for proper treatment schedule. Cows that are within 80 to 90 days of freshening should be similarly treated with an approved drug that is designed especially for dry cows.

DAY 2—Continue proper treatment schedule according to label directions before beginning next step. At the end of the last treatment, begin prescribed withdrawal period. (NOTE: last treatment may not necessarily fall on Day 2.)

DAYS 4-6—Following prescribed withdrawal period (approximately 72 hours) for drugs administered Days 1-2, begin re-entering milk into tank. Have your milk cooperative collect a milk sample from the tank after the first two milkings to check for presence of antibiotics.

DAY 21—Reculture complete herd plus any heifers or cows that have freshened since Day 0.

DAYS 24-25—Based on culture results of samples taken on Day 21, re-treat (with same drug, as per Day 1 instructions) any cows that test positive for *Strep. ag.* and any cows with cell counts greater than 400,000 (linear score of 5). Keep your milk cooperative informed of the progress of your treatment program. You may ship milk from cows that were cultured negative and that show cell counts less than 400,000.

DAYS 28-31—Repeat schedule from Days 4-6 for cows that tested positive for a second time. Be sure to follow the prescribed withdrawal period.

DAY 46—Resample cows treated on Days 1 and 24-25, as well as heifers and dry cows that have freshened since Day 21. Any heifers and/or dry cows that culture positive for *Strep. ag.* should be treated according to instructions on Days 1 and 24-25.

What should I do with cows that do not respond after two series of treatment?

Based on the culture results of samples taken on Day 46, cows that culture positive for the third time and/or that do not respond to antibiotic therapy should be culled.

Culling non-responsive cows may be the best solution to eliminating a chronic *Strep. ag.* infection, but cash flow problems may require you to consider other solutions. If you must keep chronically infected cows in your herd:

- Milk them last, in a group separate from the rest of the herd.
- Dry treat them at the end of lactation, and reculture by Day 5 of the next lactation. Cows that remain positive for *Strep. ag.* for a second lactation should be culled immediately or milked last for the rest of their productive life.

Even if I carefully follow a treatment plan, is it still possible for my herd to get reinfected? If so, how?

One cow with a *Strep. ag.* infection can reinfect the majority of the herd within a few months. Thus, you really cannot afford to maintain even one *Strep. ag.*-infected cow in your whole herd.

Once *Strep. ag.* infections are eliminated from a dairy herd, the only way reintroduction can occur is through the purchase and addition of infected heifers and/or cows to the herd.

Action Program #2 (Short-Term)

Example situation: Half (50 percent) or less of your herd is infected with *Strep. ag.*, and/or your herd's bulk tank DHIA weighted somatic cell count has been ranging from 400,000 to 600,000. You have confirmed cases of *Strep. ag.* infections.

What should I do?

If you have not already done so, have your complete herd cultured to identify all infected animals. With this action program, complete herds are not treated—only cows that culture positive for *Strep. ag.* or that have somatic cell counts greater than 400,000 (linear score of 5 and above).

DAY 0—As with action program #1, identify and cull all cows that have a long-term history of mastitis and a continual cell count of 1,600,000 (linear score of 7 or higher). In addition, dry off and dry treat all cows that are within 80 to 90 days of freshening.

DAYS 1-46—Follow the same treatment program described for Days 1-46 of action program #1. In addition, begin long-term control program (action program #3).

It is extremely critical **TO SEGREGATE TREATED COWS AND MILK THEM LAST.** Do not attempt to use "blitz" therapy—treatment of the entire herd—for short-term control of *Strep. ag.* if you cannot segregate cows that need to be treated.

Action Program #3 (Long-Term Prevention & Control)

Example situation: You have several confirmed cases of *Strep. ag.*-infected cows but relatively few clinical cases. In addition, your herd's bulk tank or DHIA weighted somatic cell count has been averaging 300,000 to 400,000 (linear score of 4 to 5).

What should I do?

Begin a long-term prevention/control program that includes basic management steps and recommends lactation therapy only as needed.

In addition, this program contains valuable suggestions for preventing a *Strep. ag.* problem from recurring once it is alleviated.

Generally, the dairy farmer described in the above situation is not in trouble with the milk market, and a majority of cows in the herd are not infected. In this type of situation, *Strep. ag.* infections can be eliminated from the herd over a two- to three-year period.

Is a long-term program really that important?

As we have emphasized throughout this bulletin, a short-term program may improve a current problem, but unless a long-term program is started at the same time, the *Strep. ag.* problem you worked so hard to get rid of this year may return in full force next year.

Consider following these steps toward long-term prevention of a *Strep. ag.* mastitis problem within your herd:

- Cull chronically infected cows that continually show somatic cell counts greater than 1,000,000 (or a linear score of 6 or higher).
- House calves individually when you feed them whole milk.
- Culture newly purchased cows before adding them to the milking string.
- Culture milk from purchased, bred heifers for presence of *Strep. ag.* by six days postpartum before adding them to the milking string.
- Use well-designed milking equipment correctly, and keep it well-maintained. Overused inflations, grossly undersized vacuum pumps and malfunctioning pulsators can play a major role in aiding transfer of *Strep. ag.* infections from cow to cow.
- Follow a carefully planned milking routine to decrease the possibility of transferring infections during milking. Washing and drying teats for prepping should take a minimum of 20 to 25 seconds. Attach milking machine within 30 to 60 seconds after you finish prepping. At the end of the milk flow, use a positive vacuum-shutoff before removing the milking machine.

Teat dipping should be a regular part of your milking routine. Apply a post-milking sanitizer after removing the machine, making sure to cover at least 50 percent of each teat.

- Dry treat all quarters of all cows with an antibiotic formulated specifically for dry cows.
- Segregate known infected cows and milk them last.
- Use DHIA or a similiar somatic cell count program to monitor each cow every month.
- Culture cows that have clinical mastitis and treat according to your veterinarian's instructions.
- Sample the bulk tank periodically to monitor for *Strep. ag.* once an infection problem is under control.
- Cooperate with your local veterinarian to establish *Strep. ag.* control and prevention programs.

SOMATIC CELL COUNTS AND EQUIVALENT DHIA LINEAR SCORES

Average Somatic Cell Count	DHIA Linear Score
12,500	0
25,000	1
50,000	2
100,000	3
200,000	4
400,000	5
800,000	6
1,600,000	7
3,200,000	8
6,400,000	9

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DHI-Somatic Cell Count Linear Score Reports to Evaluate and Monitor Mastitis Control

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Table of Contents

Page

DHI Somatic Cell Evaluation Reports 1

Somatic Cell -To Monitor and Evaluate Mastitis Control 1

Somatic Cell Counts - Converted to Linear Scores 1

I. Herd Summary 4

A. Graphs: Extra Cost Option 4

1. Herd Average Linear Scores 4

2. Percent Distribution of Cows by Linear Score 5

3. Estimated Percent of Animals with New & Chronic Infections 7

4. Linear Score Distribution by Lactation Number & Stage of Lactation 8

DHI Somatic Cell Evaluation Reports - Herd Summary sample report 9

B. Printed Report 11

1. Sample Dates 11

2. Herd Average Linear Score 11

3. Distribution of Cows by Linear Score 11

4. Estimated Infections 11

5. 100 lbs. Milk Lost, Herd/30 Days 12

6. Linear Score Distribution by Lactation Number and Stage 12

II. High Linear Score Cows 14

A. Standard Report 14

1. Cow Information (Left Side Block of Information on page 1 of Part II - High Linear Score Cows) 14

a. Cow Identification 14

b. Lactation Number 14

Table of Contents

Page

- c. Days in Milk 14
- d. Milk lbs. 14
- e. 305 Day ME Milk Projected 14
- f. Days Since Last Bred 14

2. Linear Scores (Middle Block of Information on page 1 of Part II - High Linear Score Cows) 14
    - a. Current Sample Day 14
    - b Last Sample Day 15
    - c. Current Lactation Average 15
    - d. Last Lactation Average 15
    - e. Percent of Herd Somatic Cell Count 15
3. Remarks 16
4. Barn Information Action Sheet (BIAS) Option 17

III. Individual Cow Linear Score 18

- A. Cow Identification 18
- B. Lactation Number 18
- C. Sample Dates 18
    1. Current Sample Dates 18
    2. Previous Sample Dates 18
- D. Current Lactation 18
    1. 305 Day ME Milk Projected 18
    2. Average Linear Score 19

Table of Contents

	Page
E. Last Lactation	19
1. 305 Day ME Milk	19
2. Average Linear Score	19
Dairy Herd Profile Somatic Cell Information	20
Page One - Twelve Month Average Linear Scores and Distributions	21
Page Two - Twelve Month Sample Day Values	22
Analysis of Somatic Cells (LS) in Northeast DHI Herds	23
Linear Score vs. Production: Bar Graph	23
Linear Score Distribution - Production Levels: Bar Graph	24
Linear Score Table - Averages for 20 % Herd Groups	26
Linear Score Tables - Distributions for each 20 % Herd Group	26
Linear Score Distribution - Stage of Lactation: Bar Graph	28
Linear Score Table: Average for Production Levels	29
Linear Score Tables - Distributions for each Production Level	30

DHI Somatic Cell Evaluation Reports

Somatic Cells - To Monitor and Evaluate Mastitis Control

Somatic cells are a naturally occuring part of milk. They arise from two sources. The first is normal tissue or milk secretory cell turnover. The second source is white blood cells (leukocytes), which play a role in immunological protection of the mammary glands. Leukocytes occur in greatly increasing numbers in response to increasing degrees of mastitis infection and inflammation. Consequently, somatic cell information can be used to monitor the effectiveness of mastitis control, as the number of somatic cells in milk is inversely related to udder health, milk production and milk quality.

Somatic Cell Counts - Converted to Linear Scores

Somatic cells are measured as thousands of cells per milliliter of milk. Somatic cell counts (SCC) range from tens of thousands to many millions. The actual SCC are converted to linear score (LS) values for greater usefulness for herd management evaluation by grouping SCC values into ten groups (0 - 9); each group can then be divided further into ten subgroups (.0 - .9).

The corresponding values for SCC and LS are shown in Table 1 on the following page. A change of one unit in LS corresponds to a doubling or halving of SCC. For example, "LS 3" is equal to 100,000 SCC; "LS 4" is equal to 200,000; "LS 5" is equal to 400,000 SCC. *Or*, interpreting from figures within the body of Table 1, a value of 500,000 SCC falls within the range of LS 5.3 - 5.4.

There are advantages for using Linear Scores rather than SCC values:

1. **Consistent LS relationship to milk loss.** LS values are directly related to milk production losses as shown in Table 2. A change of one unit in lactation average LS corresponds to about .75 pounds milk/day loss *(or about 200 pounds/lactation)* for a first lactation cow; or about 1.5 pounds/milk/day loss *(or about 400 pounds/lactation)* for a second or greater lactation cow.

2. **Average of LS values.** When using only a single sample day measure of somatic cells, either the SCC or LS value is equally useful for analysis and interpretation. However, in most cases, an average of several somatic cell values is more effective than a single value in evaluating mastitis status, whether month-to-month during lactation of individual cows or among all cows in a group or the entire herd. Averages of LS values are more accurate and effective for mastitis management than are averages of SCC values because they offset extreme or short-term variation in individual SCC measurements (Table 3).

Table 1

Somatic Cell Counts which correspond to given linear scores for SCC

Linear Score (Units)	Linear Score (Tenths)									
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
0	12	13	14	15	16	18	19	20	22	23
1	25	27	29	31	33	35	38	41	44	47
2	50	54	57	62	66	71	76	81	87	93
3	100	107	115	123	132	141	152	162	174	187
4	200	214	230	246	264	283	303	325	348	373
5	400	429	460	492	528	566	606	650	696	746
6	800	857	919	985	1056	1131	1213	1300	1393	1493
7	1600	1715	1838	1970	2111	2263	2425	2599	2786	2986
8	3200	3430	3676	3940	4223	4526	4851	5199	5572	5972
9	6400	6860	7352	7880	8445	9052	9701	10398	11144	11944

Adapted from Shook (Wisc) ADSA, 1982

Table 2

Linear Score Information Table

Somatic Cell Count (Thousands)			Milk Yield Losses			
Linear Score	Mid-point	Range	Per Day		Per 305 Lactation	
			1st[1]	2nd (+)[1]	1st[1]	2nd(+)[1]
0	12.5	0 - 17				
1	25	18 - 34				
2	50	35 - 68	**Pounds of milk loss relative to LS 2**			
3	100	69 - 136	.75	1.5	200	400
4	200	137 - 273	1.5	3.0	400	800
5	400	274 - 546	2.25	4.5	600	1200
6	800	547 - 1092	3.0	6.0	800	1600
7	1600	1093 - 2185	3.75	7.5	1000	2000
8	3200	2186 - 4371	4.5	9.0	1200	2400
9	6400	4372 or more	5.25	10.5	1400	2800

---

[1] 1st and 2nd (+) refer to 1st lactation and 2nd and later lactation cows

Table 3

Lactation Average Linear Score and Production Loss

Sample Month	Cow					
	1		2		3	
	Count	LS	Count	LS	Count	LS
Jan	207,000	4.0	103,000	3.0	140,000	3.4
Feb	207,000	4.0	103,000	3.0	140,000	3.4
Mar						
Apr						
May						
June			1,143,000	6.5		
July			103,000	3.0		
Aug						
Sept						
Oct	207,000	4.0	103,000	3.0	140,000	3.4
Nov	DRY	DRY	DRY	DRY	DRY	DRY
Lact. Avg.	207,000	4.0	207,000	3.4	140,000	3.4
Milk Production Loss	**800 lbs.**		**560 lbs.**		**560 lbs.**	

Data from G. Shook, University of Wisconsin and C. W. Heald, VPI-SU

Table 3 contrasts SCC and LS values for three hypothetical cows showing the advantage of using LS averages over SCC averages. Cows 1 and 2 have the same lactation average SCC, but different lactation average LS's and different milk production losses for their 10 month lactations. For cow 2, a single high monthly SCC makes the lactation average SCC as high as that for cow 1, even though cow 2 had only half as many somatic cells as cow 1 for 9 of 10 months. The lactation average LS offsets the effect of extreme variation and more accurately indicates the degree of milk production loss. Cow 3 compared to cow 2 has different monthly and lactation average SCC values, but both have the same lactation average LS and, consequently, the same estimated loss in lactation milk production.

DHI Somatic Cell Evaluation Reports

The DHI-SCC-LS evaluation reports are presented by reviewing an actual set of farm records.

I. Herd Summary

Summaries of SCC-LS information on a <u>herd basis</u> are an important first step in evaluating and monitoring mastitis control.

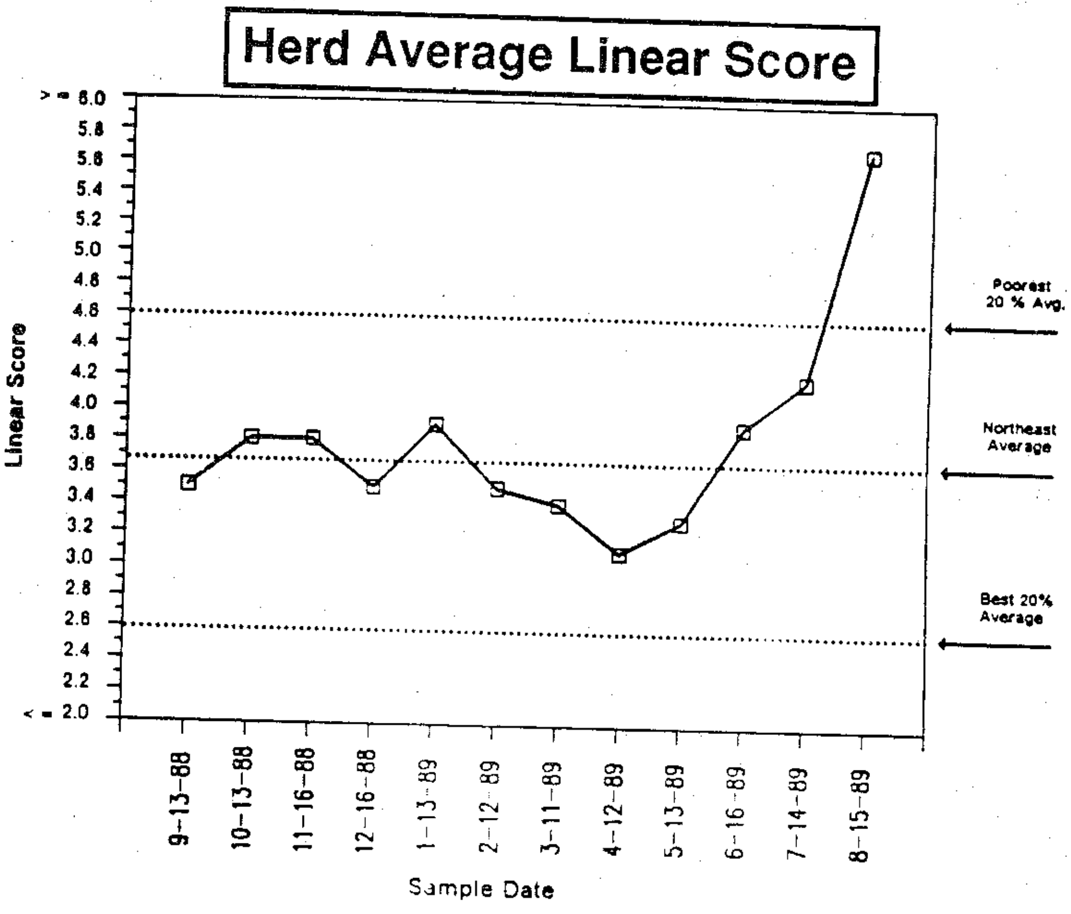
A. Graphs (Extra Cost Option):

The graphics option gives the easiest and most obvious analysis of monthly and seasonal levels and trends of LS for: (a) herd average, (b) percent distribution of cows, (c) estimated percent of infections, and (d) distribution by lactation number and stage.

1. Herd Average Linear Scores

The average of LS for all cows in the example herd is plotted for each of the last 12 sample dates; the LS average for the earliest date at the left and for the most recent date at the right. This herd's average LS, for the first 10 sample dates, has fluctuated around the current Northeast Herd Average of 3.6, ranging from 3.1 to 3.9. However, during the last 2 to 3 sample dates the trend has been upward, and dramatically so during the last sample date. Clearly, a problem has occurred.

Figure 1.



2. Percent Distribution of Cows by Linear Score

It is useful to know the distribution of values around any average. The percent distribution of cows by LS is shown in two graphs (Figures 2 & 3).

The ten LS values 0-9 have been divided into two categories, one with **HIGH LS** i.e., LS 5 and above, as shown in the top graph (Fig. 2.) and **LOW LS** i.e., LS 4 and below as shown in the bottom graph (Fig. 3) for the example herd. The mid point is 4.5, but the discussion is referred to by whole numbers for simplicity.

The **HIGH LS** graph gives the total percentage of cows within this category; it also shows the percentage of cows within LS 5, LS 6 and LS ≥7. (LS ≥7 combines all cows with LS 7,8, or 9 because all of these are at extremely high levels and indicate a severe mastitis infection).

The **LOW LS** graph gives the total percentage of cows within this category; it also shows the percentage of cows within LS 4, LS 3, and LS ≤2. (LS ≤2 combines all cows with LS 2, LS 1 or LS 0 because all of these LS are at extremely low levels and indicate a very low likelihood of mastitis infection).

Dividing the LS groups into two categories, **High** or **Low**, is useful as a general indication of cows having a **High** or **Low** probability of mastitis infectin. The higher or lower the LS within each category, the higher or lower is the probability of a mastitis infection.

Note that the example herd, within the last 5 months, (i.e. from 4-12-89 thru 8-15-89) has changed from 18 percent of all cows likely infected (and only 3 percent in the very high LS ≥7 level) to 82 percent of the cows probably infected (with 26 percent in the very high somatic cell group). It is clear that the problem is occurring in a large portion of the herd, not just a few problem cows.

Figure 2.

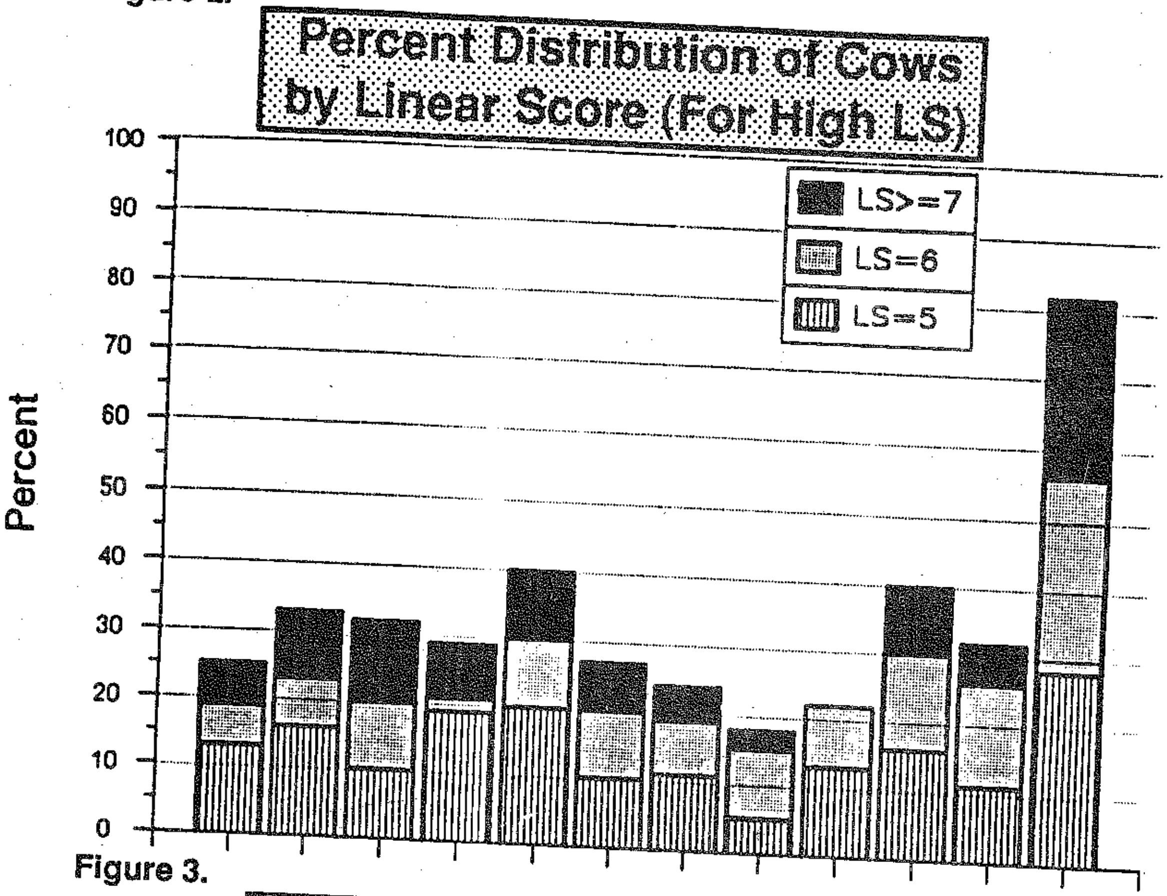
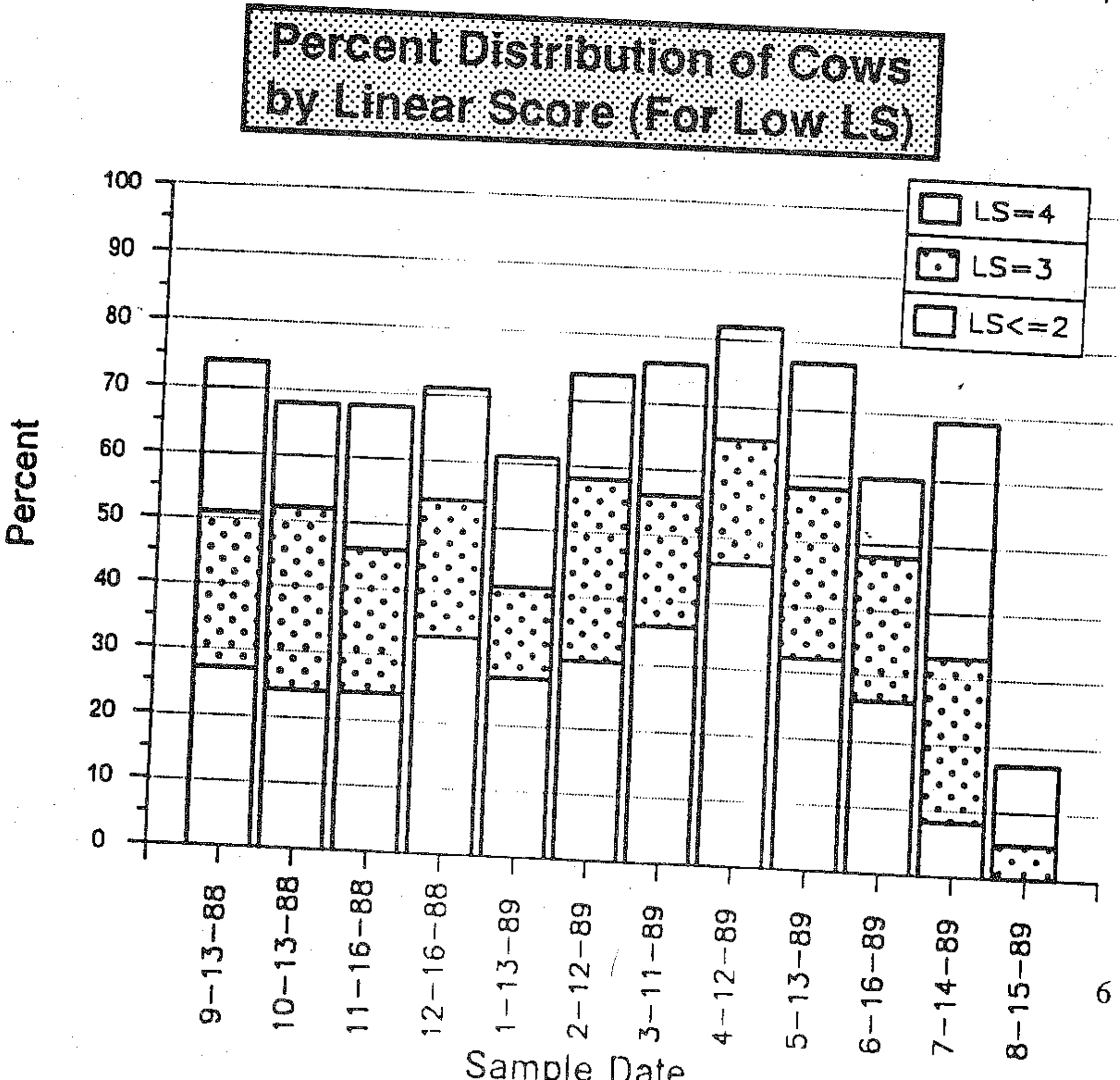


Figure 3.



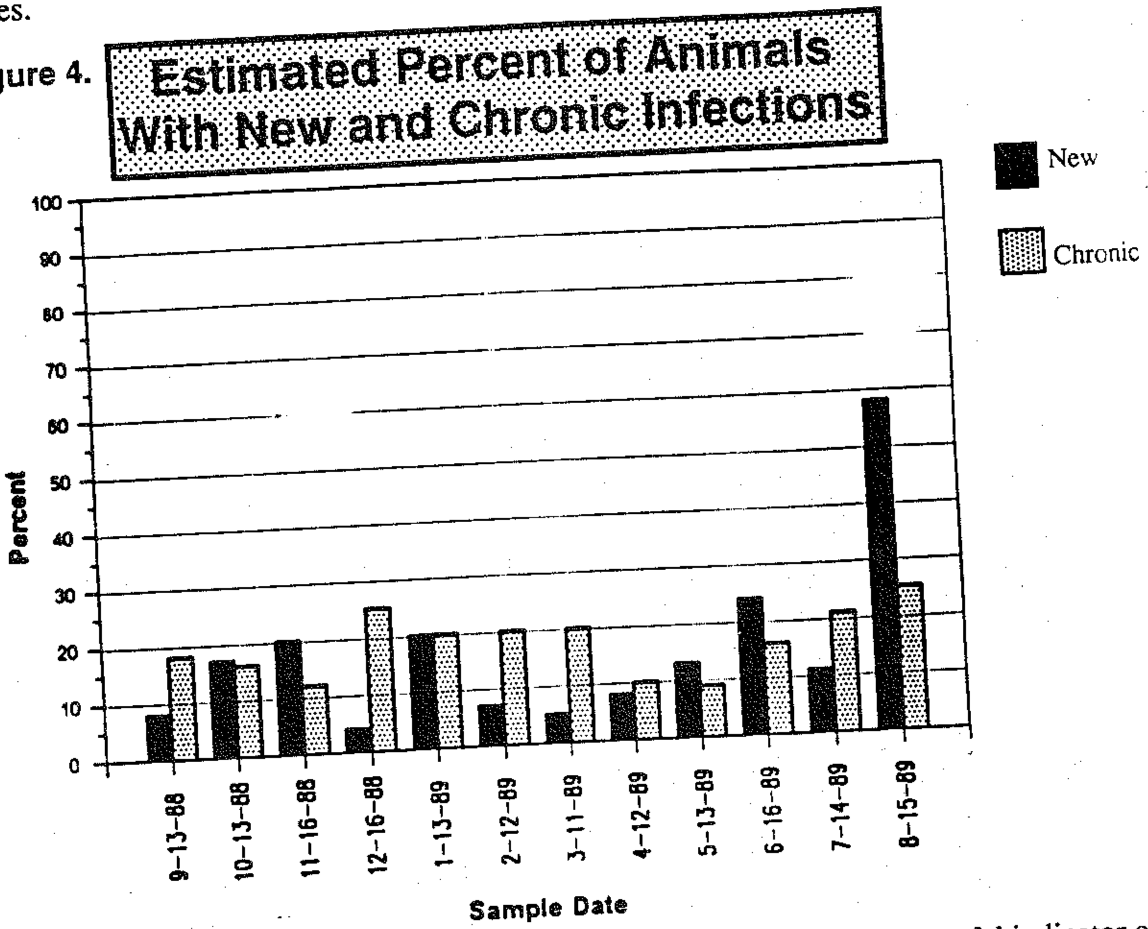
3. Estimated Percent of Animals with New and Chronic Infections

Mastitis is the result of: (1) the rate at which new infections occur, and (2) the duration of infections i.e., how long they remain as chronic infections. The estimated percentages of cows with "new" and "chronic" infections for each of the last 12 sample dates are shown in Figure 4 for the example herd.

The rate of new infections is estimated as the percentage of cows whose linear scores increased from LS 4 or less to LS 5 or greater from the previous to the current sample dates.

The percentage of cows with continuing or chronic mastitis infections is estimated as the percentage of cows whose linear scores were LS 5 or greater on both the previous and current sample dates.

Figure 4.



Monitoring month-to-month changes in the new infection rate can be a very useful indicator of the trends and effectiveness of mastitis control practices in a herd. A significant increase in the new infection rate is a warning that corrective action should be taken; *a warning that often appears before a clinical outbreak occurs.*

Changes in percentage of chronic infections are usually less variable month-to-month as a result of longer term or continuing infections or the time for somatic cells to decrease following infection or clinical cases.

Note that, in this example herd, for the last sample date, there was a dramatic increase to a new infection rate to 58 percent.

4. Linear Score Distribution by Lactation Number and Stage of Lactation

The graph in Figure 5 provides for analysis of mastitis control by age as:

- Lactation Number
  - *1st Lactation*
  - *2nd Lactation*
  - *3rd+ Lactations*

and by

- Stage of Lactation

(according to number of days in milk for the current lactation)

- *Early: less than 46 days*
- *Mid: 46 through 180 days*
- *Late: more than 180 days*

These groupings make it possible to observe LS levels and trends related to factors such as (1) heifer management and calving (Early, 1st Lact.), (2) dry cow management and calving conditions (Early, 2nd and 3rd+ Lact.) and (3) management throughout periods of lactation for all age groups such as : effects of milking procedures or equipment, environmental conditions i.e., stalls, bedding, yards, manure management, etc.

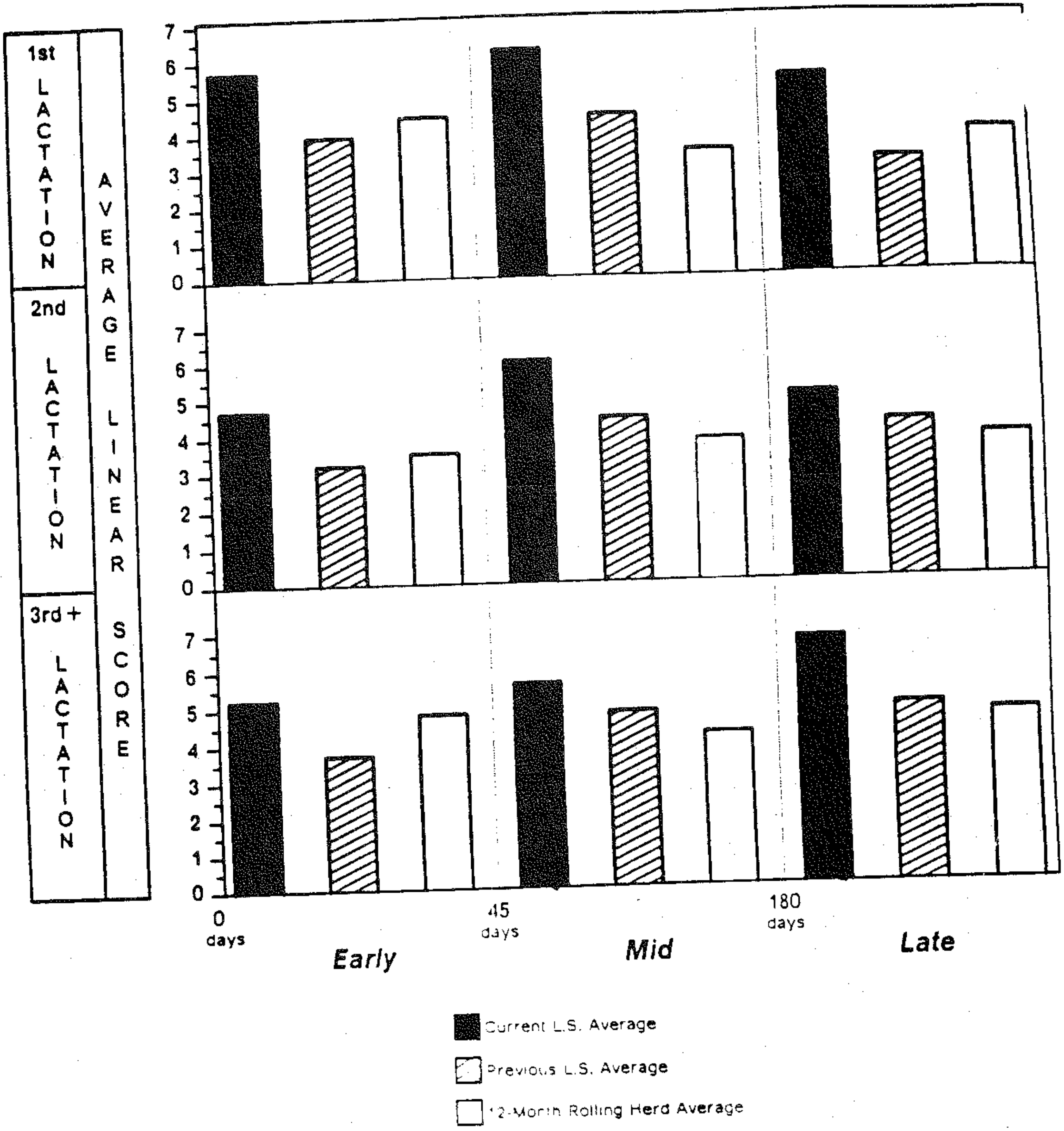
Figure 5 allows a “short term” comparison of LS between “Current” (solid) and “Previous” (cross-hatched) sample dates, and a “Long term” (open) comparison to LS for the 12 month rolling average.

For this example herd, it is apparent that all LS values for the current sample date (the black bars) are greater than for either the previous sample date or the 12 month average. Therefore, the problem does not relate to only one area, such as "Early" lactation as an indication of problems occuring from springing heifers or dry cow management and calving conditions, because the increase in LS values is also nearly as great or greater during the “Mid” or “Late” stages of all lactation groups.

Figure 5.

Linear Score Distribution by Lactation Number & Stage of Lactation

8-15-89



PAGE
1

DHI SOMATIC CELL EVALUATION REPORTS

I. HERD SUMMARY

UR0208

DATE SAMPLED
8-15-89
DATE MAILED
8-17-89

SAMPLE DATES	HERD AVG LS
8-15-89	5.7
7-14-89	4.2
6-16-89	3.9
5-13-89	3.3
4-12-89	3.1
3-11-89	3.4
2-12-89	3.5
1-13-89	3.9
12-16-88	3.5
11-16-88	3.8
10-13-88	3.8
9-13-88	3.5

DISTRIBUTION OF COWS BY LINEAR SCORE

<=2		3		4		5		6		>=7	
NO	PCT.	NO	PCT	NO.	PCT	NO.	PCT	NO.	PCT	NO.	PCT
0	0	3	5	7	12	16	28	16	28	15	26
4	8	13	25	19	36	6	11	8	15	3	6
13	26	11	22	6	12	8	16	7	14	5	10
17	32	14	26	10	19	7	13	5	9	0	0
27	46	11	19	10	17	3	5	6	10	2	3
22	36	12	20	12	20	7	11	5	8	3	5
18	30	17	28	10	16	6	10	6	10	4	7
14	27	7	14	10	20	10	20	5	10	5	10
16	33	10	21	8	17	9	19	1	2	4	8
12	24	11	22	11	22	5	10	5	10	6	12
14	24	16	28	9	16	9	16	4	7	6	10
17	27	15	24	14	23	8	13	4	6	4	6

ESTIMATED INFECTIONS

NEW		CHRONIC	
NO	PCT	NO	PCT
33	58	14	25
6	11	11	21
12	24	8	16
7	13	5	9
5	8	6	10
3	5	12	20
4	7	12	20
10	20	10	20
2	4	12	25
10	20	6	12
10	17	9	16
5	8	11	18

100 LBS MILK LOST HERD/30 DAYS
78
44
40
30
30
37
42
45
34
40
46
44

LINEAR SCORE DISTRIBUTION BY LACTATION NUMBER AND STAGE

PREVIOUS SAMPLE

	-EARLY-			-MID-			-LATE-			
LAC. NO.	NO. COWS	LS. AVG.	LS 5+ PCT.	NO. COWS	LS. AVG.	LS 5+ PCT.	NO. COWS	LS. AVG.	LS 5+ PCT.	AVG. LS.
1	6	3.9	33	10	4.4	30	3	3.1	0	4.0
2	4	3.2	0	4	4.4	25	3	4.2	67	3.9
3+	6	3.7	17	7	4.8	43	8	4.9	50	4.5
AVERAGE		3.6			4.5			4.3		4.2

CURRENT SAMPLE

-EARLY-			-MID-			-LATE-			
NO. COWS	LS. AVG.	LS 5+ PCT.	NO. COWS	LS. AVG.	LS 5+ PCT.	NO. COWS	LS. AVG.	LS 5+ PCT.	AVG. LS.
2	5.7	100	6	6.2	83	11	5.4	82	5.7
2	4.7	50	4	6.0	100	6	5.0	83	5.3
8	5.2	63	9	5.6	89	9	6.7	89	5.8
AVERAGE 5.1				5.8			5.7		5.7

B. Printed Report

All DHI-SCC herds receive the standard printed reports with tables of LS information (see page 10). The Herd Summary Report page for the example herd, gives the numerical values from which the preceeding graphs were produced. Much of the information in the previous discussion about graphs applies to this standard Herd Summary Report. In fact, the same levels and trends for mastitis status can be obtained from these tables as from the graphs, but they can be analyzed more easily and quickly from the graphic presentation.

1. Sample Dates

The current sample day information is reported across the top row; values for the previous 11 sample dates are printed below.

2. Herd Average Linear Score

This value is the overall average of linear scores for all cows in the milking herd.

3. Percent Distribution of Cows by Linear Score

The 10 linear score values are summarized as 6 LS groups in which LS 0,1,2 are combined as LS ≤ 2 (all LS less than or equal to LS 2) and LS 7,8,9 = LS ≥ 7 (all LS greater than or equal to LS 7). The number (No.) of cows in each group, and the percentage (Pct.) of the milking herd are shown.

4. Estimated Infections

As LS values increase, there is an increasing probability of a masitits infection.

a. For general evaluation, it is useful to divide the LS groups into two categories:

1. LS 4 and below indicates a relatively **LOW** probability of a mastitis infection.
2. LS 5 and above indicates a relatively **HIGH** probability of a mastitis infection. The mid point is 4.5, but discussion is referred to by whole numbers for simplicity.

b. Estimated rates of new or chronic infections are determined:

1. Estimated new infections - the number (No.) and percent (Pct.) of cows whose linear scores increased from LS 4 or less to LS 5 or greater from the previous to the current sample dates.

2. Estimated chronic infections - the number (No.) and percent (Pct.) of cows whose linear scores were LS 5 or greater on both the previous and current sample dates.

5. 100 lbs. Milk Lost, Herd/30 Days

The "*hidden losses*" of herd milk production per month (30 day period) are based on the LS for each cow according to the relationships shown in Table 2 and compared to LS 2 (midpoint 50,000 SCC; range 35,000 to 70,000) as the "*zero loss baseline*".

The "*dollar loss*" can be calculated for your herd by multiplying the number reported here by your price received per 100 pounds of milk.

Example herd:

Dollar loss = 78 x price received per 100 pounds of milk

Dollar loss = 78 x $13.50/cwt

Dollar loss = $1053.00 (30 day loss)

Average Dollar loss/day = $1053.00/30 = $35.10/day

Your herd:

Dollar loss = $______ x price received per 100 pounds of milk

Dollar loss = $______ (30 day loss)

Average Dollar loss/day = $______/30 = $______/day

6. Linear Score Distribution by Lactation Number and Stage

Information is presented for the *"Previous"* and *"Current"* sample date to allow short term comparison. The information is arranged according to the following descriptions:

a. Lactation number

This shows cows grouped by first lactation (1), second lactation (2), and third lactation and greater (3+).

b. Lactation stage

Cows are grouped within their current lactation according to days in milk:

EARLY: less than 46 days
MID: 46 through 180 days
LATE: more than 180 days

c. For each lactation number and stage, information is reported for :

i) NO. COWS: Number of cows in that category
ii) LS AVG: Average of linear scores for all cows
iii) LS 5+ PCT: Cows with LS 5 or greater (+) (likely infected) as perce of all milking cows.
iv) AVG LS: Overall average linear score of all cows in each lactatio number, and in each lactation stage.

NOTE:

Number of cows (No.) is given in several tables above as an aid or caution to interpretation when only a few cows (sometimes none) are involved. Small herds must be aware that an average or percentage based only on 0,1, or 2 cows should be considered with some caution when evaluating herd levels and trends.

II. High Linear Score Cows

A. Standard Report

This report lists cows with high linear scores for the current sample date (CURR S.D. i.e., left column of LINEAR SCORES center section- see page 16). Cows are listed from highest linear score, LS 9.9 or less, through LS 4.5 (i.e. the midpoint between the HIGH and LOW categories of linear scores of LS 5 or greater, and LS 4 or less).

1. Left Side Block of Information

The block of information on the left side of the page identifies each cow and lists some information in addition to linear scores that is useful in evaluating each cow's status.

a. COW IDENTIFICATION

a. COW CCN: Cow computer control number.
b. BARN NAME: Cow barn name or number.

b. LACT. NO. Current lactation number.

c. DAYS IN MILK Days since calving this lactation.

d. MILK LBS. Daily milk yield. (SPAN: is printed if daily milk yield is missing.)

e. 305 DAY ME MILK PROJ. Lactation milk yield projected to 305 days, mature equivalent (ME), i.e. adjusted for age and season at calving for this lactation, projected if days in milk are equal to or more than 90 days and less than 305 days. If a cow milks more than 305 days, the 305 day value remains as the ME milk yield. If there is no value in this column, it means the cow has been in milk less than 90 days.

f. DAYS SINCE LAST BRED Provides some information on reproductive status.

2. Linear Scores (Center block of information)

The center block of information includes linear scores and somatic cell values.

a. CURRENT S. D. Linear score for the current sample date. Cows are ranked in this section from highest (LS 9.9) to lowest (LS 4.5) linear score, i.e. for cows having a relatively high probability of mastitis infection.

b. LAST S.D. Linear score for the previous sample date is listed for comparison. A high probability of new infection is indicated if the last sample day LS was 4 or less(-). A chronic or continuing infection is indicated if the last sample day LS was 5 or greater(+).

c. CURR. LACT. AVG. The average linear score for all previous sample dates in each cow's current lactation.

d. LAST LACT. AVG. The average linear score for all sample dates during each cow's previous lactation. Such a linear score is, of course, not available (NA) for a 1st lactation cow.

Other indicators

i. **DRY** When "DRY" prints in the LAST SAMPLE DAY column, this indicates the cow was dry at that time.

ii. **NA** Value was not available. Applies to 1st lactation cows which have no last lactation average and/or have lost or missing samples.

iii. **TFT** Too fresh to test. This indicates that the calving date was six days or less before the sample date. No sample was taken.

iv. **THERE ARE NO HIGH LINEAR SCORE COWS TO BE LISTED**

This message prints if there are no cows with LS 4.5 or greater for the current sample date.

e. PERCENT OF HERD SCC This value is the percentage of somatic cells in the total herd milk that was contributed by each cow. This is based on each cow's SCC/ml milk multiplied by milk yield for that cow. *It is the percentage of somatic cells contributed by each cow to the bulk tank somatic cell count, **if no milk was withheld from the tank.***

A dash (-) in this column means that the somatic cells contributed by that cow were less than 1 percent of the total herd somatic cells.

For this herd, note that the first cow, number 101, contributed 13 percent of all somatic cells in the bulk tank. If the bulk tank SCC was at a critical level, such as jeopardizing a quality premium payment, withholding this cow's milk until her count could be lowered, could have a substantial effect on reducing the tank SCC.

Also note that the fourth cow on the list, number 57, contributes more somatic cells to the bulk tank (8 percent) than the two cows above her with higher LS, because her milk yield is greater.

3. Remarks

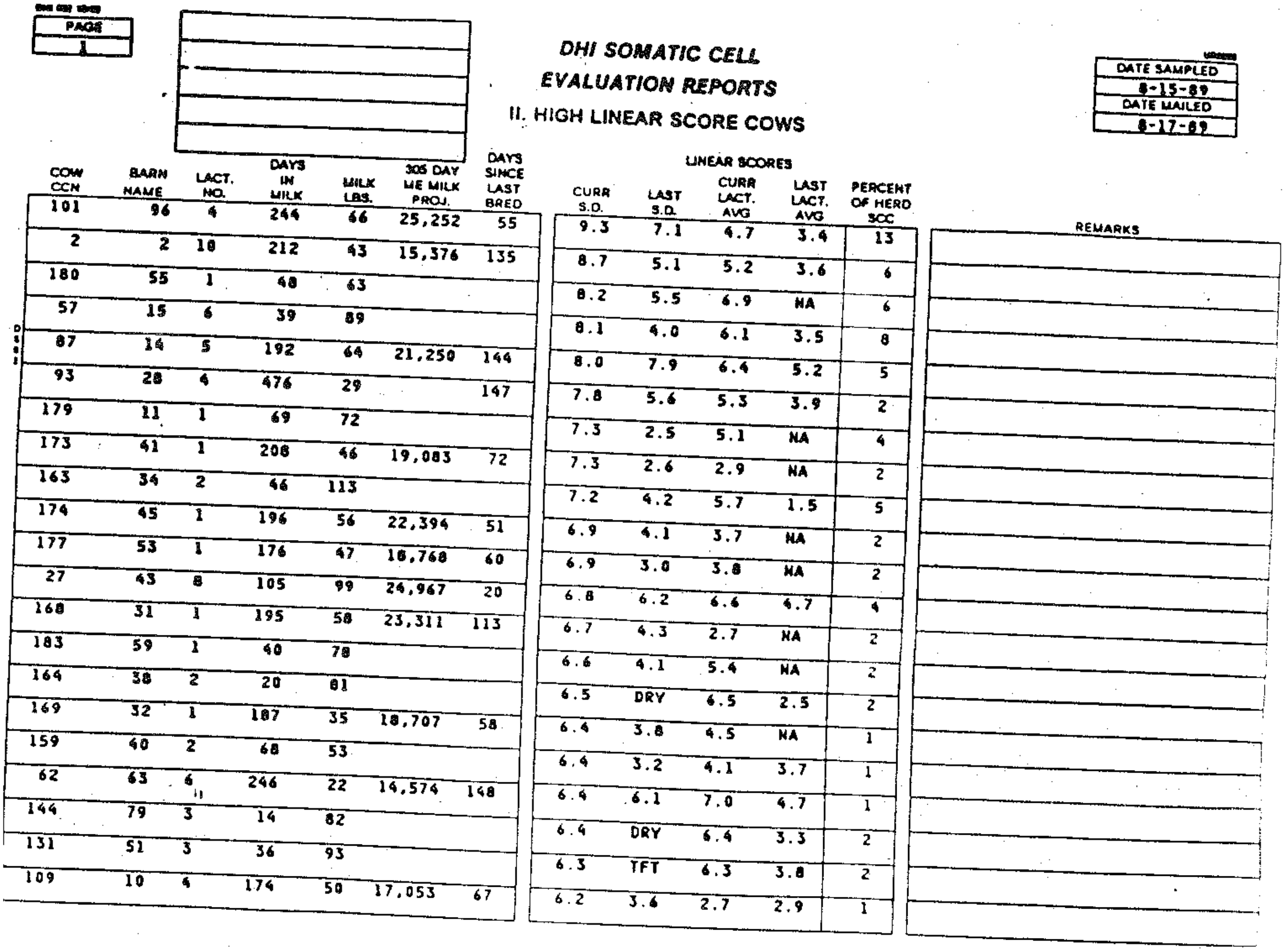
The block of space on the right side of the page is where additional information can be written.

This column, titled REMARKS, includes information such as:

a. clinical mastitis and treatments (date, quarters, frequency, antibiotic, management factors, etc.).

b. results of CMT and bacterial culture results.

c. other information to guide mangement or culling decisions.



PAGE
1

DHI SOMATIC CELL
EVALUATION REPORTS
II. HIGH LINEAR SCORE COWS

DATE SAMPLED
8-15-89
DATE MAILED
8-17-89

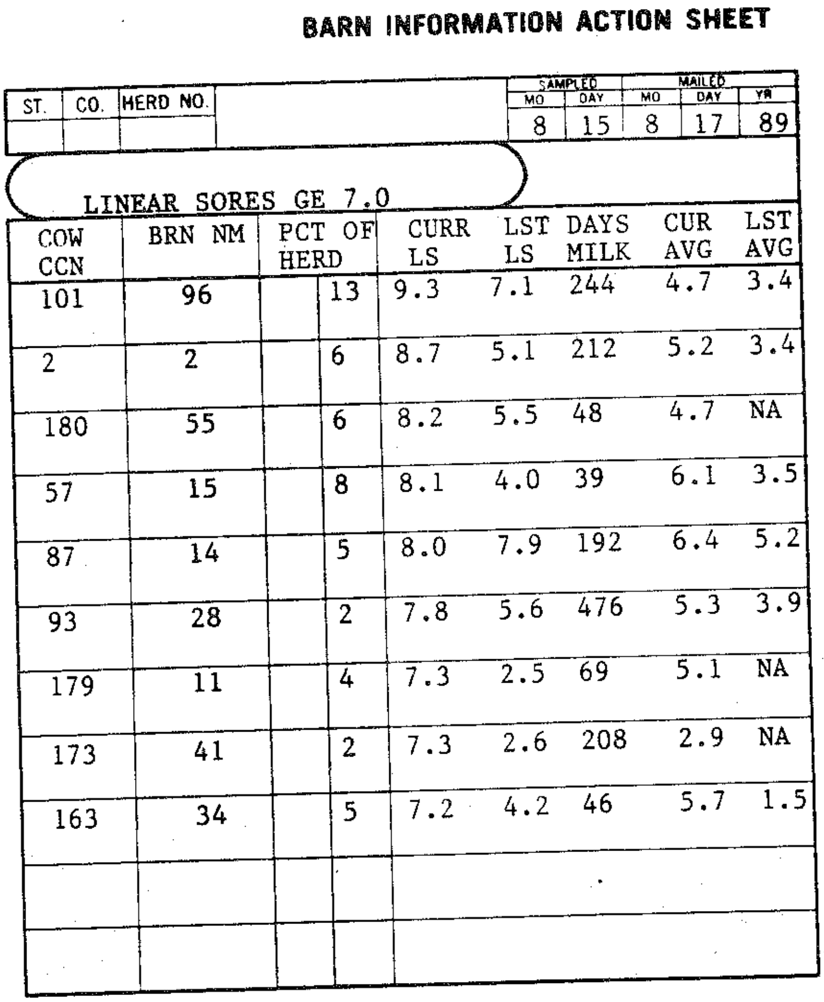
COW CCN	BARN NAME	LACT. NO.	DAYS IN MILK	MILK LBS.	305 DAY ME MILK PROJ.	DAYS SINCE LAST BRED	LINEAR SCORES					
							CURR S.D.	LAST S.D.	CURR LACT. AVG	LAST LACT. AVG	PERCENT OF HERD SCC	REMARKS
101	96	4	244	66	25,252	55	9.3	7.1	4.7	3.4	13	
2	2	10	212	43	15,376	135	8.7	5.1	5.2	3.6	6	
180	55	1	48	63			8.2	5.5	6.9	NA	6	
57	15	6	39	89			8.1	4.0	6.1	3.5	8	
87	14	5	192	64	21,250	144	8.0	7.9	6.4	5.2	5	
93	28	4	476	29		147	7.8	5.6	5.3	3.9	2	
179	11	1	69	72			7.3	2.5	5.1	NA	4	
173	41	1	208	46	19,083	72	7.3	2.6	2.9	NA	2	
163	34	2	46	113			7.2	4.2	5.7	1.5	5	
174	45	1	196	56	22,394	51	6.9	4.1	3.7	NA	2	
177	53	1	176	47	18,768	60	6.9	3.0	3.8	NA	2	
27	43	8	105	99	24,967	20	6.8	6.2	6.6	4.7	4	
168	31	1	195	58	23,311	113	6.7	4.3	2.7	NA	2	
183	59	1	40	78			6.6	4.1	5.4	NA	2	
164	38	2	20	81			6.5	DRY	6.5	2.5	2	
169	32	1	187	35	18,707	58	6.4	3.8	4.5	NA	1	
159	40	2	68	53			6.4	3.2	4.1	3.7	1	
62	63	6	246	22	14,574	148	6.4	6.1	7.0	4.7	1	
144	79	3	14	82			6.4	DRY	6.4	3.3	2	
131	51	3	36	93			6.3	TFT	6.3	3.8	2	
109	10	4	174	50	17,053	67	6.2	3.6	2.7	2.9	1	

4. Barn Information Action Sheets, BIAS (an extra cost option)

Linear score values for High Linear Score Cows can also be printed on Barn Information Action Sheets, for use at the milking center or wherever a dairy producer wishes to have such information readily available for reference or as a basis for "action". See the BIAS sheet for our example herd.

The cow's current sample day linear scores will print from high to low order. The same list of cows will be printed as on the standard report of High Linear Score Cows unless a lower limit option other than 4.5 is selected; the lower limit can be selected as any value between 9.0 and 4.0. For our example herd, the BIAS sheet shows the dairy producer chose only cows with linear scores greater than or equal to (GE) 7.0 as the lower limit he wanted to consider for "action" at the barn, for example, a close check for signs of clinical mastitis, etc.

Some of the other information on the High Linear Score Cows report is printed on the BIAS sheets, but in a different order.



BARN INFORMATION ACTION SHEET

ST.	CO.	HERD NO.	SAMPLED MO	SAMPLED DAY	MAILED MO	MAILED DAY	YR
			8	15	8	17	89

LINEAR SORES GE 7.0

COW CCN	BRN NM	PCT OF HERD		CURR LS	LST LS	DAYS MILK	CUR AVG	LST AVG
101	96		13	9.3	7.1	244	4.7	3.4
2	2		6	8.7	5.1	212	5.2	3.4
180	55		6	8.2	5.5	48	4.7	NA
57	15		8	8.1	4.0	39	6.1	3.5
87	14		5	8.0	7.9	192	6.4	5.2
93	28		2	7.8	5.6	476	5.3	3.9
179	11		4	7.3	2.5	69	5.1	NA
173	41		2	7.3	2.6	208	2.9	NA
163	34		5	7.2	4.2	46	5.7	1.5

III. Individual Cow Linear Scores

This section lists all cows that have entered the milking herd and still remain in the herd. For the current sample date, values are given for days in milk (DIM) and somatic cell count (SCC) in addition to linear score (LS) and daily milk yield (MILK). For the 11 previous sample dates, MILK and LS values are given. In addition, current and last lactation LS averages and 305 day ME yields are shown.

A. COW IDENTIFICATION

1. COW CCN Cow computer control number

2. BARN NAME Cow barn name or number

B. LACT. NO. Current lactation number

C. SAMPLE DATES

1. Current sample dates

DIM Days in milk (i.e. since calving this lactation)

SCC Actual somatic cell count (000 = thousands/ml milk)

MILK Daily milk yield, pound/day (SPAN: prints if daily milk yield is missing, NO-MLK prints if first sample is missing and cow is more than seven days in milk)

LS Linear score equivalent of SCC.

2. Previous sample dates The date, daily milk yield and linear score are listed for each of the 11 previous sample dates. Days in milk (DIM) is not listed, but can be estimated from DIM for the current sample date. Linear score values are listed on a separate (second) line for clarity and ease of observation.

D. CURR. LACT Current lactation.

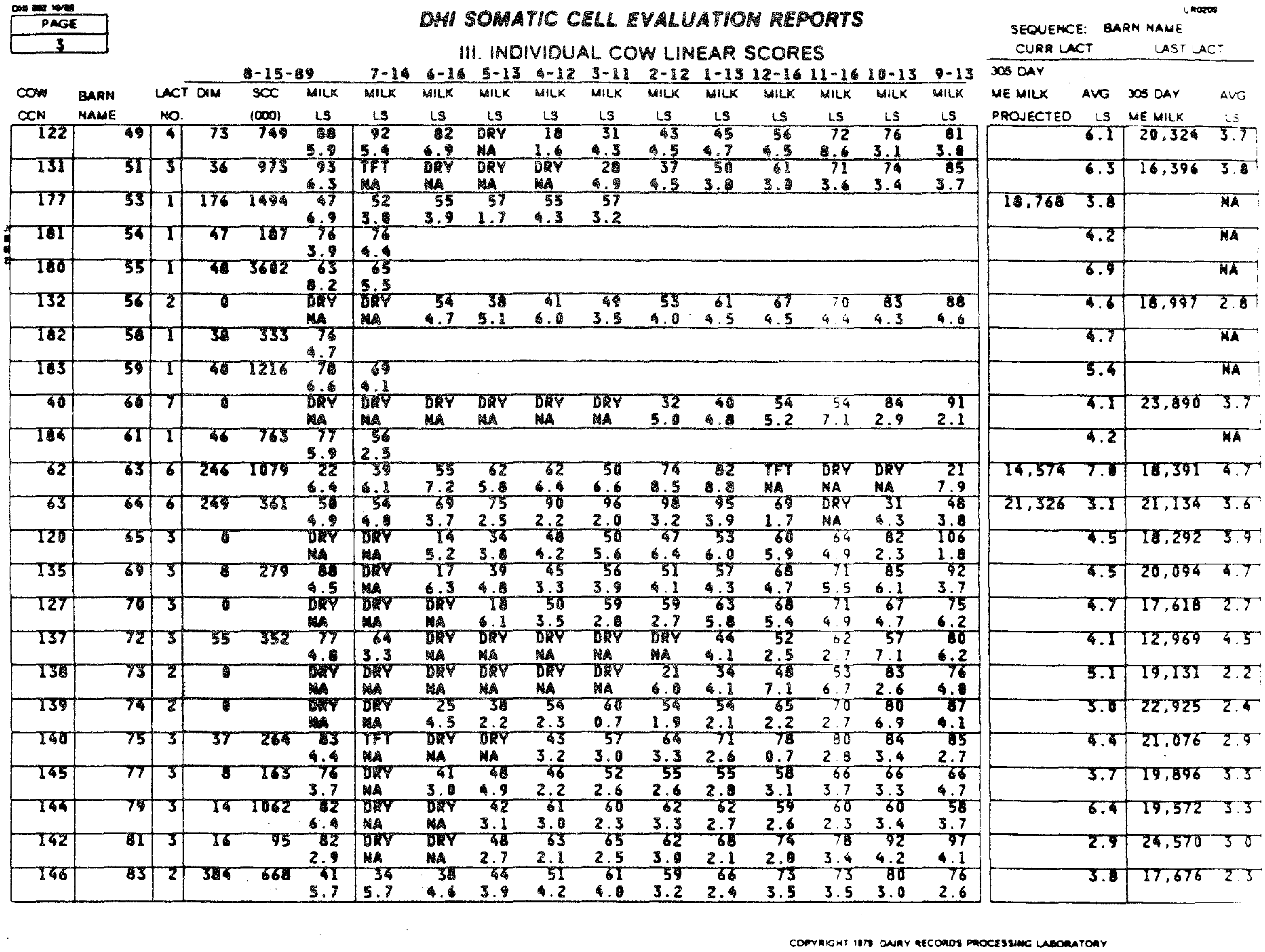
1. 305 DAY ME MILK PROJ. Lactation milk yield projected to 305 days mature equivalent (ME) i.e., adjusted for age and season at calving for this lactation, PROJECTED if days in milk are equal to or more than 90 days and less than 305 days. If a cow milks more than 305 days, the 305 day value remains as the ME milk yield. If there is no value in this column it means the cow has been in milk less than 90 days.

2. **AVG. LS** The average linear score for all sample dates in the current lactation.

E. **LAST LACT.** Last or previous lactation.

1. **305 DAY ME MILK** Total milk yield for the previous lactation of 305 days or less, on mature equivalent (ME) basis (i.e. adjusted for age and season at calving).

2. **AVG. LS** The average linear score for all sample dates during the previous or last lactation. "NA" means this value is not available.



DHI 882 10/85

PAGE 3

DHI SOMATIC CELL EVALUATION REPORTS

III. INDIVIDUAL COW LINEAR SCORES

UR0206

SEQUENCE: BARN NAME

			8-15-89			7-14	6-16	5-13	4-12	3-11	2-12	1-13	12-16	11-16	10-13	9-13	CURR LACT		LAST LACT	
COW CCN	BARN NAME	LACT NO.	DIM	SCC (000)	MILK LS	MILK LS	MILK LS	MILK LS	MILK LS	MILK LS	MILK LS	MILK LS	MILK LS	MILK LS	MILK LS	MILK LS	305 DAY ME MILK PROJECTED	AVG LS	305 DAY ME MILK	AVG LS
122	49	4	73	749	88 5.9	92 5.4	82 6.9	DRY NA	18 1.6	31 4.3	43 4.5	45 4.7	56 4.5	72 8.6	76 3.1	81 3.8		6.1	20,324	3.7
131	51	3	36	973	93 6.3	TFT NA	DRY NA	DRY NA	DRY NA	28 4.9	37 4.5	50 3.8	61 3.0	71 3.6	74 3.4	85 3.7		6.3	16,396	3.8
177	53	1	176	1494	47 6.9	52 3.8	55 3.9	57 1.7	55 4.3	57 3.2							18,768	3.8		NA
181	54	1	47	187	76 3.9	76 4.4												4.2		NA
180	55	1	48	3602	63 8.2	65 5.5												6.9		NA
132	56	2	0		DRY NA	DRY NA	54 4.7	38 5.1	41 6.0	49 3.5	53 4.0	61 4.5	67 4.5	70 4.4	83 4.3	88 4.6		4.6	18,997	2.8
182	58	1	38	333	76 4.7													4.7		NA
183	59	1	48	1216	78 6.6	69 4.1												5.4		NA
40	60	7	0		DRY NA	DRY NA	DRY NA	DRY NA	DRY NA	DRY NA	32 5.0	40 4.8	54 5.2	54 7.1	84 2.9	91 2.1		4.1	23,890	3.7
184	61	1	46	763	77 5.9	56 2.5												4.2		NA
62	63	6	246	1079	22 6.4	39 6.1	55 7.2	62 5.8	62 6.4	50 6.6	74 8.5	82 8.8	TFT NA	DRY NA	DRY NA	21 7.9	14,574	7.8	18,391	4.7
63	64	6	249	361	58 4.9	54 4.8	69 3.7	75 2.5	90 2.2	96 2.0	98 3.2	95 3.9	69 1.7	DRY NA	31 4.3	48 3.8	21,326	3.1	21,134	3.6
120	65	3	0		DRY NA	DRY NA	14 5.2	34 3.8	48 4.2	50 5.6	47 6.4	53 6.0	60 5.9	64 4.9	82 2.3	106 1.8		4.5	18,292	3.9
135	69	3	8	279	88 4.5	DRY NA	17 6.3	39 4.8	45 3.3	56 3.9	51 4.1	57 4.3	68 4.7	71 5.5	85 6.1	92 3.7		4.5	20,094	4.7
127	70	3	0		DRY NA	DRY NA	DRY NA	18 6.1	50 3.5	59 2.8	59 2.7	63 5.8	68 5.4	71 4.9	67 4.7	75 6.2		4.7	17,618	2.7
137	72	3	55	352	77 4.8	64 3.3	DRY NA	DRY NA	DRY NA	DRY NA	DRY NA	44 4.1	52 2.5	62 2.7	57 7.1	80 6.2		4.1	12,969	4.5
138	73	2	0		DRY NA	DRY NA	DRY NA	DRY NA	DRY NA	DRY NA	21 6.0	34 4.1	48 7.1	53 6.7	83 2.6	76 4.8		5.1	19,131	2.2
139	74	2	0		DRY NA	DRY NA	25 4.5	38 2.2	54 2.3	60 0.7	54 1.9	56 2.1	65 2.2	70 2.7	80 6.9	87 4.1		3.8	22,925	2.4
140	75	3	37	264	83 4.4	TFT NA	DRY NA	DRY NA	43 3.2	57 3.0	64 3.3	71 2.6	78 0.7	80 2.8	84 3.4	85 2.7		4.4	21,076	2.9
145	77	3	8	163	76 3.7	DRY NA	41 3.0	48 4.9	46 2.2	52 2.6	55 2.6	55 2.8	58 3.1	66 3.7	66 3.3	66 4.7		3.7	19,896	3.3
144	79	3	14	1062	82 6.4	DRY NA	DRY NA	42 3.1	61 3.0	60 2.3	62 3.3	62 2.7	59 2.6	60 2.3	60 3.4	58 3.7		6.4	19,572	3.3
142	81	3	16	95	82 2.9	DRY NA	DRY NA	48 2.7	63 2.1	65 2.5	62 3.0	68 2.1	74 2.0	78 3.4	92 4.2	97 4.1		2.9	24,570	3.0
146	83	2	384	668	41 5.7	34 5.7	38 4.6	44 3.9	51 4.2	61 4.0	59 3.2	66 2.4	73 3.5	73 3.5	80 3.0	76 2.6		3.8	17,676	2.3

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Dairy Herd Profile Somatic Cell Information

The Dairy Herd Profile report is another location where LS values are summarized. This report contains three sections pertaining to somatic cell information.

Page one contains two tables which are twelve month:

1) Linear score averages and distributions by lactation number and

2) Linear score values by stage of lactation and lactation number.

Page two summarizes linear scores for each of the past twelve sample periods.

These include linear scores by lactation number and stage of lactation, and average linear score. These tables are demonstrated for a John Doe herd on the following pages. This herd is different from that used earlier in the publication.

DAIRY HERD PROFILE

ST.	CO.	HERD NO.	REG	CIRC
21	69	0962 [redacted]		04

TYPE OF SAMPLING: DHIR — SPECIES: COW

HOLSTEIN

FARM NAME
DOE, JOHN
ANY STREET
ANY CITY
ANY STATE
ZIP C

MONTH	DAY	YEAR
AUG	25	1988

DATE PROCESSED: 08-30-88

HERD OWNERS TELEPHONE NUMBER: 607-255-2126

LACTATION NUMBER	NUMBER OF COWS	AVERAGE AGE AT CALVING YRS MOS	AVERAGE BODY WEIGHT AT CALVING	LTD DAYS IN MILK AVERAGE DAYS	LTD PERCENT OF COWS <90	90-180	181-305	>305	DRY
1	20	2- 5	126	255	6	6	41	18	29
2	9	3- 6	131	188	22	22	22	22	11
3	11	4- 6	149	117	45	9	36		9
4 & OVER	20	6- 7	155	167	25	25	20	15	15
ALL	60	4- 5	142	182	23	16	30	14	18
PREGNANT	35								
PREGNANT (?)	18								

1 — 7 COWS OPEN

DAYS IN MILK 1ST BREEDING AVERAGE DAYS	PERCENT OF COWS <40	40-69	70-100	>100	DAYS IN MILK LAST BREEDING AVERAGE DAYS	PERCENT OF COWS <85	85-115	116-145	>145
100		27	33	40	138	20	13	27	40
91		38	13	50	137	13	25	38	25
93		50	17	33	110	50		17	33
75		50	43	7	161	21	14	21	43
89		40	30	30	141	23	14	26	37
85		52	28	20	141	24	16	24	36
95		22	33	44	142	22	11	28	35

SERVICES PER CONCEPTION AVERAGE NUMBER	PERCENT OF COWS 1	2	3	4+	NUMBER NOT GOING TO BREED	CALVING INTERVAL PREVIOUS	PROJECTED	LACTATION NUMBER
1.7	55	36		9			13.7	1
3.0		33	33	33		12.1	13.7	2
1.7	67		33			12.9	12.8	3
3.6	45		13	[illegible]		13.[illegible]	14.[illegible]	4 & OVER
2.5	40	20	17	[illegible]		12.[illegible]	13.[illegible]	ALL
								PREGNANT
								REG (?)

COWS LEAVING HERD

LACT NO	COWS ENTERING HERD NUMBER NEW ANIMALS	% NEW ANIMAL	NUMBER OF COWS BY REASON DAIRY PURPOSES	DIED	LOW PROD.	BREEDING PROBLEMS	MASTITIS	FEET AND LEGS	UDDERS	DISPOSITION	HEALTH	ABORTION	INJURY	OTHER OR UNKNOWN	% ANIMALS LEAVING	AVERAGE ETA MILK	MILKFAT %	PROTEIN	PRODUCT VALUE
1	17	28	6											6	20	+371	-.01	.01	+46
2	NO.	NOT	1	1										6	13	+381	.06		+46
3	LACT	1	1	1										1	5	+350	.03	-.06	+70
4 & OVER	2	3												6	10	+283	.01	-.01	+26
ALL	19	32	9	2										19	48	+353			+44

EPA INFORMATION ON YOUNG STOCK

LINEAR SCORE DISTRIBUTION BY LACTATION NUMBER, LAST 12 MO. (PERCENT) 2-	3	4	5	6	7+	AVG LS	LINEAR SCORE BY LACTATION NUMBER AND STAGE, LAST 12 MO. (AVERAGE LS) EARLY	MID	LATE	LACTATION NUMBER
67	19	5	5	3	2	2.3	2.7	2.2	2.3	1
33	28	14	12	7	5	3.5	2.6	3.4	3.7	2
38	26	23	8	4	1	3.1	2.7	2.6	3.7	3
30	33	15	13	6	2	3.2	3.4	2.8	3.6	4 & OVER
44	26	13	9	5	3	3.0	2.9	2.7	3.2	ALL

HEIFERS AGE AT BREEDING (MONTHS)

LINEAR SCORE DISTRIBUTION BY LACTATION NUMBER, LAST 12 MO. (PERCENT) 2-	3	4	5	6	7+	AVG LS	LINEAR SCORE BY LACTATION NUMBER AND STAGE, LAST 12 MO. (AVERAGE LS) EARLY	MID	LATE	LACTATION NUMBER
67	19	5	5	3	2	2.3	2.7	2.2	2.3	1
33	28	14	12	7	5	3.5	2.6	3.4	3.7	2
38	26	23	8	4	1	3.1	2.7	2.6	3.7	3
30	33	15	13	6	2	3.2	3.4	2.8	3.6	4 & OVER
44	26	13	9	5	3	3.0	2.9	2.7	3.2	ALL

ETA DISTRIBUTION AND AVERAGES

LACT NO	NO. ANALYZED
1	16
2	[illegible]
3	11
4 & OVER	20
ALL	56

DAYS DRY BEFORE CALVING	2ND LACT
<30	
30-39	1
40-49	3
50-59	51
60-69	

LACT NO	
1	
2	
4 & OVER	
ALL	

CALVING MONTHS																					
JAN- MAR		6	95	104	112	100	97	95	96	91	96	79	90	83	108	[illegible]		57	110	54	95
	<3	1	59	56	96	53	95	54	102	48	90	51	107	53	104	52	98				
APR- JUN	1	4	93	91	99	83	93	76	94	79	96										
	2	6	88	99	113	98	100	89	91	100	108										
	>3	3	59	65	105	60	95	64	106	59	93	93	108	61	97	59	98	63	106	55	90
JUL- SEP	1	2	78	77	98	91	118	81	89	81	100	75	93	78	105	72	92	70	97	66	94
	2	11	86	84	112	78	98	73	93	74	102	66	90	70	107	63	89	63	101	62	98
	>3	4	56	59	106	60	102	61	103	59	96	54	92	51	97	48	96	45	98	40	114
								[illegible]	99	82	99	76	93	73	96	63	85	62	87	65	57

PRODUCT VALUE
172
215
117
156
99
93
152
50
162
123
144
43
151
82
52
49
107
60

73-H-0431	0	1	247	.11	.03	
REMAINING AI SIRES						189
15 % COWS BRED TO > 1200		9	1700	-.05	-.01	140
33 % COWS BRED TO 800-1200		20	1048	.05	-.01	130
AVERAGE WEIGHTED P.D.		39	1002	.04	.00	

WEIGHTED PRED DIFF

3 % COWS BRED — AI PROOF NOT AVAILABLE
3 % COWS BRED — NON AI SIRES
0 % COWS BRED — SIRE NOT IDENTIFIED
28 % COWS NOT BRED

100.0 % COWS WITH SIRE IDENTIFICATION
100.0 % COWS WITH DAM IDENTIFICATION

COOPERATIVE PROGRAM U.S. DEPARTMENT OF AGRICULTURE
STATE AGRICULTURE EXTENSION SERVICES AND STATE DHI COOPERATIVES
IN
CONNECTICUT DELAWARE MAINE MASSACHUSETTS NEW HAMPSHIRE
NEW JERSEY NEW YORK RHODE ISLAND and WEST VIRGINIA

05615

DAIRY HERD PROFILE

- PAGE 2

COOPERATIVE PROGRAM - U.S. DEPARTMENT OF AGRICULTURE -
STATE AGRICULTURE EXTENSION SERVICES AND STATE DHI COOPERATIVES
IN
CONNECTICUT, DELAWARE, MAINE, MASSACHUSETTS, NEW HAMPSHIRE,
NEW JERSEY, NEW YORK, RHODE ISLAND, and WEST VIRGINIA.

ST.	CO.	[illegible]	REG.	CIRC.
21	69	0963	09	04

TYPE OF SAMPLING: DHIR
SPECIES: COW
HOLSTEIN

FARM NAME
DOE,JOHN
ANY STREET
ANY CITY
ANY STATE
ZIP C

DATE LAST SAMPLED		
MONTH	DAY	YEAR
AUG	25	1988

DATE PROCESSED: 08-30-38
607-255-2126

305-DAY ACTUAL PRODUCTION PROJECTIONS

(*... PROJECTED RECORDS NOT AVAILABLE FOR 111 COWS.)

LACTATION NUMBER	NUMBER OF COWS*	MILK POUNDS	MILKFAT POUNDS	MILKFAT %	PROTEIN POUNDS	PROTEIN %	LACTATION NUMBER
1	16	17,607(15,486-22,529) 100PCT OVER 15,066	662 (495- 799) 94PCT OVER 541	3.8	569 (512- 709) 100PCT OVER 495	3.2	1
2	7	21,021(18,410-23,818) 100PCT OVER 16,835	720 (462- 879) 86PCT OVER 602	3.4	705 (579- 810) 100PCT OVER 542	3.4	2
3	6	22,627(16,346-25,317) 83PCT OVER 18,020	803 (682- 942) 100PCT OVER 644	3.6	726 (606- 798) 100PCT OVER 576	3.2	3
4 & OVER	15	22,854(15,926-27,053) 87PCT OVER 18,330	826 (558-1052) 87PCT OVER 655	3.6	727 (476- 829) 93PCT OVER 532	3.2	4 & OVER
ALL	44	20,623(15,489-27,053) 75PCT OVER 17,040	746 (462-1052) 86PCT OVER 610	3.6	666 (479- 827) 82PCT OVER 545	3.2	ALL

305-DAY ME-SEASON ADJUSTED PROJECTIONS

(*... PROJECTED RECORDS NOT AVAILABLE FOR COWS.)

LACTATION NUMBER	NUMBER OF COWS*	MILK POUNDS	MILKFAT POUNDS	MILKFAT %	PROTEIN POUNDS	PROTEIN %	LACTATION NUMBER
1	16	22,308(19,164-28,161) 100PCT OVER 19,081	838 (619-1007) 94PCT OVER 686	3.8	720 (655- 886) 100PCT OVER 615	3.2	1
2	7	23,303(20,067-25,962) 100PCT OVER 19,137	798 (513- 958) 86PCT OVER 684	3.4	782 (631- 883) 100PCT OVER 615	3.4	2
3	6	23,523(18,144-26,836) 83PCT OVER 18,844	835 (757- 942) 100PCT OVER 673	3.6	755 (673- 810) 100PCT OVER 603	3.2	3
4 & OVER	15	22,913(15,607-26,727) 93PCT OVER 18,331	828 (547-1067) 93PCT OVER 655	3.6	729 (465- 832) 93PCT OVER 583	3.2	4 & OVER
ALL	44	22,838(15,607-28,161) 93PCT OVER 18,824	828 (513-1067) 91PCT OVER 674	3.6	738 (465- 886) 98PCT OVER 603	3.2	ALL

SAMPLE DATES (MONTH - DAY - YEAR)

DESCRIPTIONS (TP = THIS PERIOD)		9-24-87	10-23-87	11-24-87	12-22-87	1-22-88	2-23-88	3-23-88	4-21-88	5-24-88	6-22-88	7-26-88	8-25-88	DESCRIPTION
	COW MONTHS	62	62	61	64	65	65	65	65	62	61	60	58	
	% DAYS IN MILK	87	95	92	91	85	85	86	86	88	84	84	40	
	% DAYS 3X													
DAILY AVERAGE PER COW THIS PERIOD	MILK LBS.	52.5	56.4	55.7	52.6	48.4	50.2	54.8	57.0	55.7	55.4	56.7	58.5	DAILY AVERAGE PER COW THIS PERIOD
	MILKFAT %	3.8	3.8	3.8	3.8	3.7	3.9	3.9	3.8	3.7	3.6	3.6	3.5	
	MILKFAT LBS.	1.98	2.14	2.13	2.02	1.80	1.94	2.15	2.17	2.20	2.12	2.03	2.06	
	PROTEIN %	3.2	3.3	3.4	3.4	3.5	3.5	3.3	3.3	3.2	3.2	3.2	3.2	
	PROTEIN LBS.	1.69	1.85	1.89	1.81	1.70	1.74	1.83	1.87	1.90	1.88	1.81	1.88	

LINEAR SCORE BY LACTATION NO. AND STAGE														LINEAR SCORE BY LACTATION NO. AND STAGE
LACT. 1	EARLY	1.8	1.3	1.8	2.4	5.2	2.3	2.8	6.5				4.8	
	MID	2.5	1.7	2.4	2.7	2.0	1.8	2.0	2.1	3.4	1.2	2.3	.5	
	LATE	3.5	2.8	2.2	1.7	2.1	2.7	2.6	2.4	2.4	2.2	2.5	1.8	
LACT. 2+	EARLY	2.3	2.5	2.3	2.8	4.3	1.6	1.9	4.6	3.7	4.0	3.6	3.2	
	MID	3.5	3.2	3.5	3.0	2.4	2.1	1.9	2.2	2.8	3.0	3.4	3.9	
	LATE	3.5	3.9	3.9	3.9	4.2	3.6	3.5	3.6	3.6	2.7	3.7	3.8	

LINEAR SCORE BY LACTATION NO. AND STAGE														LINEAR SCORE BY LACTATION NO. AND STAGE
LACT. 1	EARLY	1.8	1.3	1.8	2.4	5.2	2.3	2.8	6.5				4.8	
	MID	2.5	1.7	2.4	2.7	2.0	1.8	2.0	2.1	3.4	1.2	2.3	.5	
	LATE	3.5	2.8	2.2	1.7	2.1	2.7	2.6	2.4	2.4	2.2	2.5	1.8	
LACT. 2+	EARLY	2.3	2.5	2.3	2.8	4.8	1.6	1.9	4.6	3.7	4.0	3.6	3.2	
	MID	3.5	3.2	3.5	3.0	2.4	2.1	1.9	2.2	2.8	3.0	3.4	3.9	
	LATE	3.5	3.9	3.9	3.9	4.2	3.6	3.5	3.6	3.6	2.7	3.7	3.8	
AVERAGE LINEAR SCORE		3.2	2.9	3.1	3.1	3.1	2.6	2.8	2.9	3.2	2.6	3.2	3.3	
MILK SOLD		3170	3146	3138	3000	3000	3000	3402	3532	3612	3404	3038	3132	
MILK REPORTED ON SAMPLE DAY		3293	3339	3284	3035	3089	3235	3552	3604	3699	3536	3321	3392	
MILKFAT TANK TEST		3.70	3.70	3.80	3.30	3.60	4.00	3.70	3.70	3.50	3.50	3.60	3.60	
PROTEIN TANK TEST		3.20	3.30	3.40	3.40	3.60	3.40	3.30	3.20	3.10	3.20	3.20	3.20	
AVERAGE DAYS IN MILK		135	145	158	155	179	176	184	177	192	193	[illegible]	[illegible]	

CURRENT ROLLING HERD AVERAGE
8-27-87 THRU 8-25-88

COW MONTHS	% DAYS IN MILK	% DAYS 3X	MILK LBS.	MILKFAT %	MILKFAT LBS.	PROTEIN %	PROTEIN LBS.
[illegible]	87	20	20,115	3.7	[illegible]	3.3	[illegible]

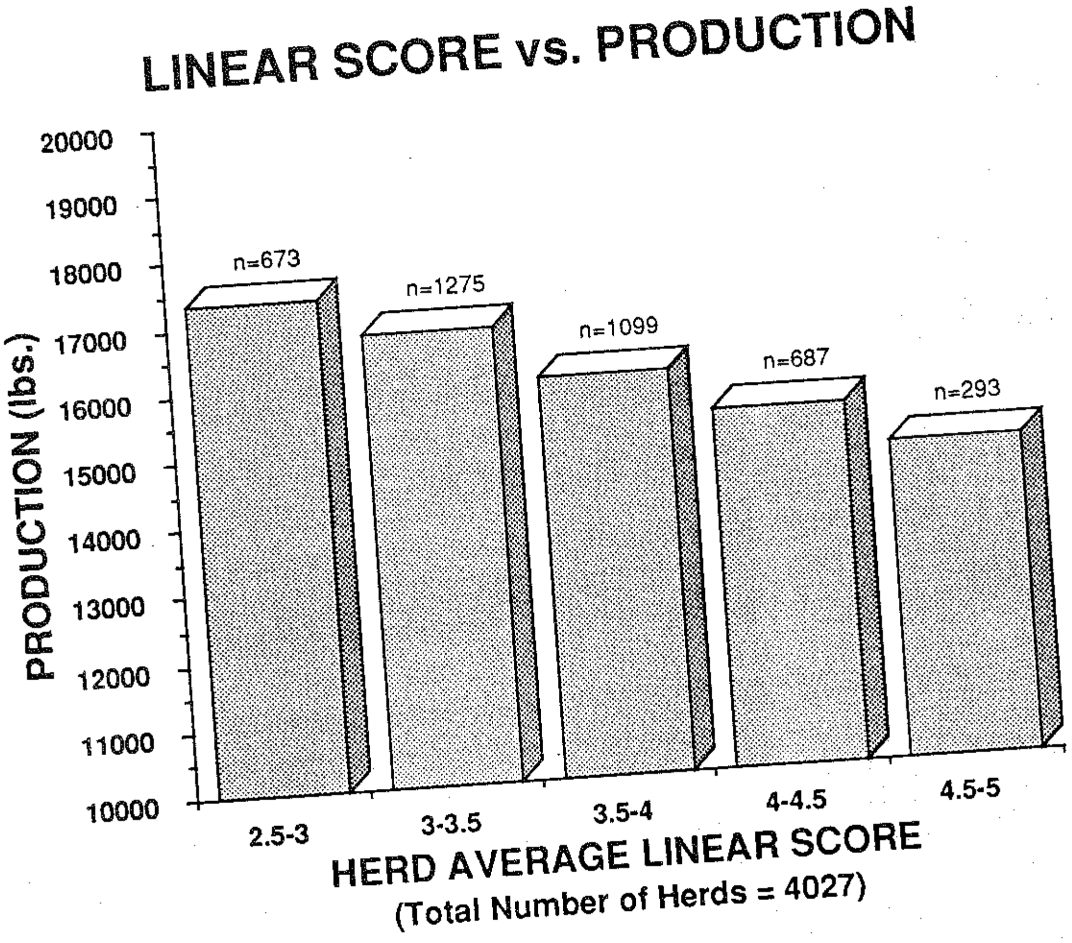
forms co. (607) 772-0734

Analysis of Somatic Cells (LS) in Northeast DHI Herds

Data for graphics summarized by Caroline Harnett

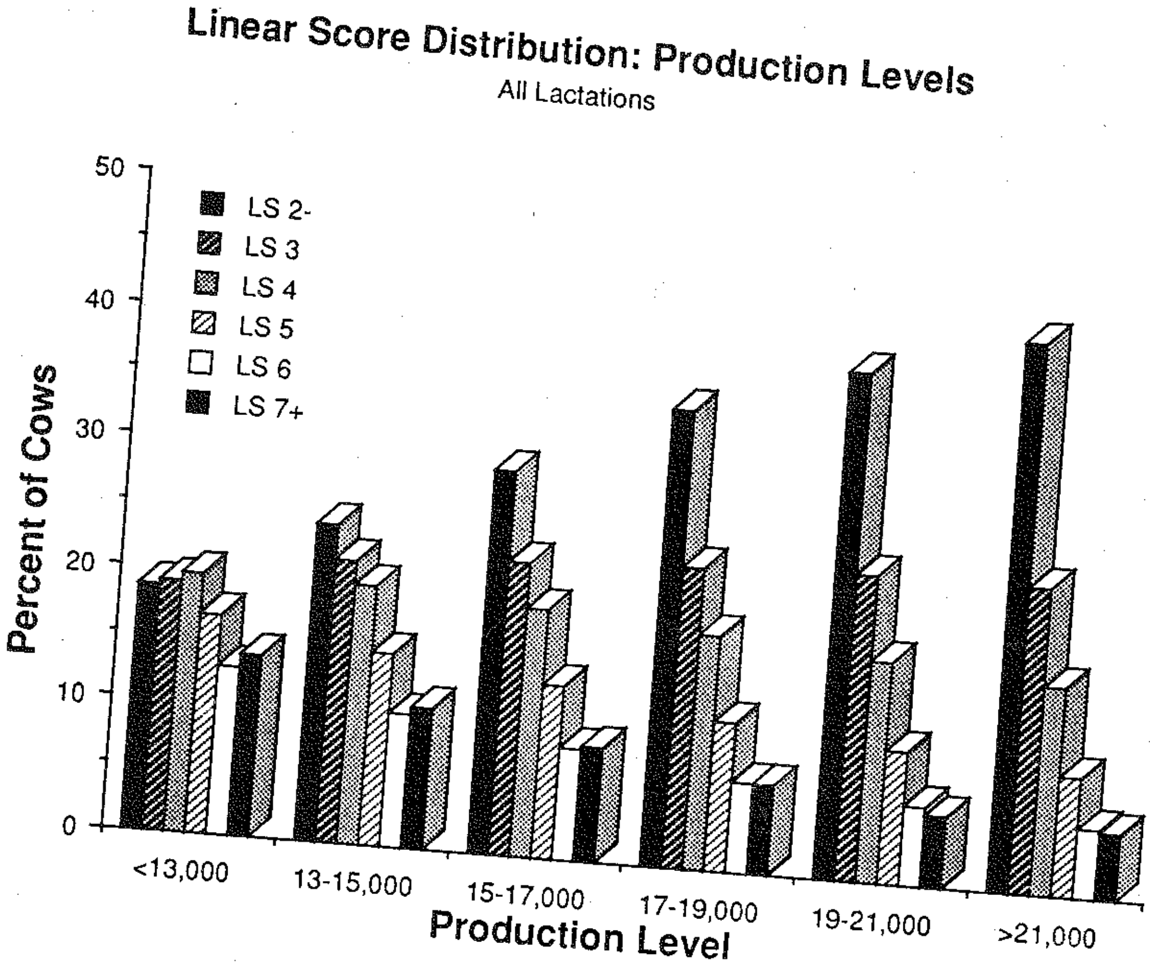
A summary analysis of the 4,312 herds in the Northeast enrolled in the SCC program was performed using the Dairy Herd Profile format to provide guidelines for comparison.

Herd average linear scores between LS 2.5 and 5 are shown below with corresponding herd average levels of milk production. Herd average LS for values outside the 2.5-5 range were excluded because they represent less than 1 percent of all herds. Values are adjusted for age and herd size, and genetic difference between herds.



Herd average milk production decreases as herd average linear score increases.

The figure below shows the distribution of cows by linear score (percent of cows) by herd average levels of production.



As herd production increases, there is a strong shift towards higher percentages of cows in the lower linear score classes. The highest producing herds had 81 percent of their cows with linear scores of 4.5 or less.

The table below shows the average LS distribution for Northeast DHI herds stratified into 5 equal classes (5 groups of 862 herds each) according to herd average linear score.

Herd Groups[1]		Linear Score Herd Average	% Cows LS<4.5	Herd Average Milk
Excellent	(Top 20%)	2.8	88	18,221
Very Good	(20 - 40%)	3.2	80	17,762
Good or Avg.	(40 - 60%)	3.6	75	17,155
Fair	(60 - 80%)	3.9	66	16,563
Poor	(80 - 100%)	4.6	51	15,545

[1] Each row represents 20% of the herds based upon herd average linear score (i.e. 20% of the herds with the lowest herd average linear score averaged 2.8, compared with the 20% of the herds with the highest herd average linear score, which averaged 4.6).

Herds in the lowest herd average linear score (2.8) group had the highest herd average milk and an average of 88 percent of cows with LS <4.5. The highest herd average linear score (4.6) group of herds had only 51 percent with LS <4.5.

The following tables show linear score values for the 4,312 herds enrolled in the NE DHI-SCC program. These are divided into five groups of 862 herds each ranked according to percentage of cows with linear score distribution less than LS 4.5. Information for each 20 percent group is by lactation number, average linear score, distribution of linear score and average linear score by stage of lactation.

These tables also show that somatic cell linear scores increases with cow age. This results primarily from effects of number and severity of previous infections.

EXCELLENT TOP 20% of HERDS

LACT NO	AVG. LS	LINEAR SCORE DISTRIBUTION BY LACTATION NUMBER, LAST 12 MO (%)						AVERAGE LS BY STAGE OF LACT.		
		2-	3	4	5	6	7+	Early	Mid	Late
1	2.4	57	23	10	4	2	2	2.5	2.2	2.4
2	2.5	51	23	13	5	2	2	2.1	2.2	2.9
3	2.7	42	23	15	7	3	2	2.2	2.4	3.1
4 & OVER	3.1	34	21	17	10	5	5	2.7	2.7	3.4
ALL	2.8	50	24	14	6	3	3	2.6	2.5	3.0

VERY GOOD 20 - 40% of HERDS

LACT NO	AVG. LS	LINEAR SCORE DISTRIBUTION BY LACTATION NUMBER, LAST 12 MO (%)						AVERAGE LS BY STAGE OF LACT.		
		2-	3	4	5	6	7+	Early	Mid	Late
1	2.8	51	25	13	6	3	3	2.9	2.6	2.8
2	3.0	43	25	17	8	4	3	2.7	2.7	3.4
3	3.3	35	24	19	11	6	5	2.8	3.0	3.7
4 & OVER	3.8	27	22	20	14	9	9	3.5	3.5	4.1
ALL	3.2	39	24	17	9	5	5	3.1	3.0	3.5

GOOD or AVERAGE 40 - 60 % of HERDS

LACT NO	AVG. LS	LINEAR SCORE DISTRIBUTION BY LACTATION NUMBER, LAST 12 MO (%)						AVERAGE LS BY STAGE OF LACT.		
		2-	3	4	5	6	7+	Early	Mid	Late
1	3.0	44	26	16	7	4	3	3.1	2.8	3.1
2	3.4	34	25	19	11	6	5	2.9	3.1	3.7
3	3.7	27	24	21	14	8	7	3.1	3.4	4.1
4 & OVER	4.2	20	19	21	16	11	12	3.8	4.0	4.5
ALL	3.6	32	24	19	12	7	7	3.4	3.3	3.8

FAIR 60-80% of HERDS

LACT NO	AVG. LS	LINEAR SCORE DISTRIBUTION BY LACTATION NUMBER, LAST 12 MO (%)						AVERAGE LS BY STAGE OF LACT.		
		2-	3	4	5	6	7+	Early	Mid	Late
1	3.3	35	28	19	10	5	4	3.2	3.1	3.4
2	3.7	26	24	21	14	8	6	3.1	3.4	4.1
3	4.1	20	21	22	17	10	10	3.4	3.8	4.5
4 & OVER	4.6	14	17	20	19	14	16	4.2	4.4	4.9
ALL	3.9	24	22	20	15	9	9	3.7	3.7	4.2

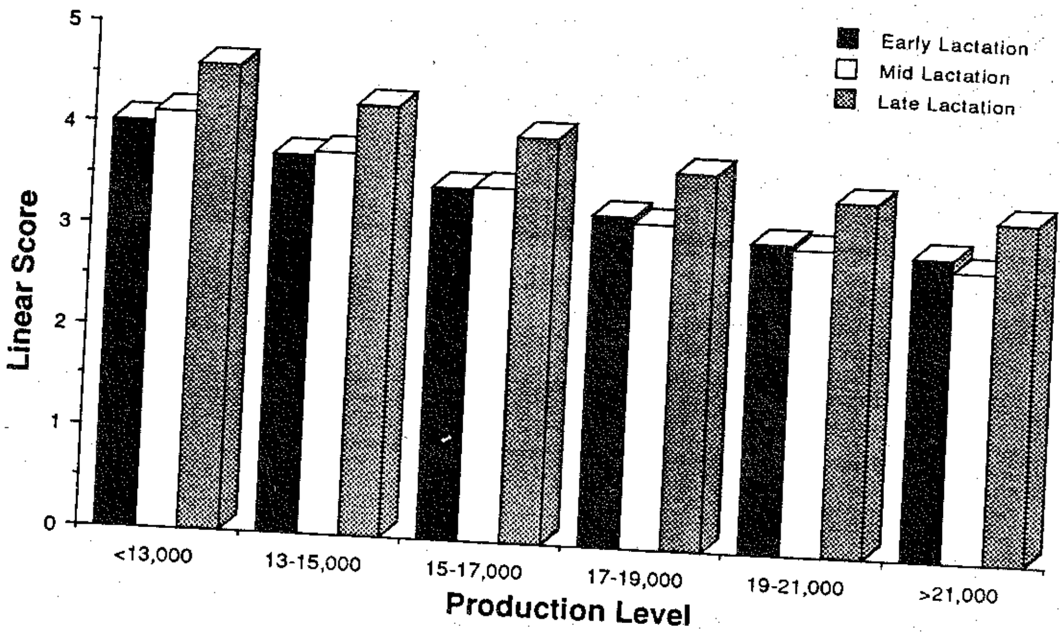
POOR BOTTOM 80 - 100% of HERDS

LACT NO	AVG. LS	LINEAR SCORE DISTRIBUTION BY LACTATION NUMBER, LAST 12 MO (%)						AVERAGE LS BY STAGE OF LACT.		
		2-	3	4	5	6	7+	Early	Mid	Late
1	3.8	23	26	22	14	8	7	3.3	3.5	3.9
2	4.3	14	19	22	19	13	11	3.6	4.1	4.6
3	4.7	10	16	21	21	16	16	3.8	4.5	5.0
4 & OVER	5.2	7	11	17	21	19	25	4.6	5.0	5.5
ALL	4.6	13	18	20	19	14	16	4.2	4.4	4.9

ALL HERDS

LACT NO	AVG. LS	LINEAR SCORE DISTRIBUTION BY LACTATION NUMBER, LAST 12 MO (%)						AVERAGE LS BY STAGE OF LACT.		
		2-	3	4	5	6	7+	Early	Mid	Late
1	3.1	42	25	16	8	4	4	3.0	2.9	3.1
2	3.4	34	23	19	11	7	6	2.9	3.1	3.7
3	3.7	27	22	20	14	8	8	3.1	3.4	4.1
4 & OVER	4.1	20	18	19	16	12	13	3.8	3.9	4.5
ALL	3.6	32	22	18	12	8	8	3.4	3.4	3.9

The graph below depicts the average linear scores by stage of lactation (based on herd average milk production).



Linear Score Distribution: Stage of Lactation

All Lactations

Higher producing herds tend to have overall lower linear scores and a decrease from early to mid lactation while lower producing herds increase from early to mid lactation. At all levels of production there is a rise of linear scores from early to late lactation.

High linear scores in early lactation are an indication of potential dry cow and/or replacement management problems. An increase in LS during lactation indicates effects from the environment, or the milking procedures and equipment.

The following tables show linear scores and distributions by herd average production level groups for the 4,312 herds enrolled in the NE DHI - SCC program.

Herd Average Production Level	Linear Score Herd Avg.	% Cows LS ≤4.5	Stage of Lactation Linear Score		
			Early	Mid	Late
<13,000	4.3	57	4.0	4.1	4.6
13-15,000	4.0	65	3.7	3.8	4.3
15-17,000	3.7	70	3.5	3.5	4.0
17-19,000	3.4	75	3.3	3.2	3.7
19-21,000	3.3	79	3.1	3.0	3.5
>21,000	3.1	81	3.0	2.9	3.4

HERD AVERAGE <13,000

LACT NO	AVG. LS	LINEAR SCORE DISTRIBUTION BY LACTATION NUMBER, LAST 12 MO (%)						AVERAGE LS BY STAGE OF LACT.		
		2-	3	4	5	6	7+	Early	Mid	Late
1	3.6	29	26	20	12	7	6	3.0	3.3	3.8
2	4.2	19	20	22	17	11	11	3.5	3.9	4.4
3	4.4	15	17	21	17	14	15	3.7	4.1	4.7
4 & OVER	4.9	12	14	18	19	17	21	4.4	4.6	5.2
ALL	4.3	18	19	20	17	13	14	4.0	4.1	4.6

HERD AVERAGE 13-15,000

LACT NO	AVG. LS	LINEAR SCORE DISTRIBUTION BY LACTATION NUMBER, LAST 12 MO (%)						AVERAGE LS BY STAGE OF LACT.		
		2-	3	4	5	6	7+	Early	Mid	Late
1	3.3	34	26	18	10	5	5	3.1	3.1	3.4
2	3.7	25	23	21	14	9	8	3.1	3.5	4.1
3	4.1	19	20	21	17	11	10	3.4	3.8	4.4
4 & OVER	4.5	14	16	19	17	14	17	4.1	4.3	4.9
ALL	4.0	24	21	20	15	10	11	3.7	3.8	4.3

HERD AVERAGE 15-17,000

LACT NO	AVG. LS	LINEAR SCORE DISTRIBUTION BY LACTATION NUMBER, LAST 12 MO (%)						AVERAGE LS BY STAGE OF LACT.		
		2-	3	4	5	6	7+	Early	Mid	Late
1	3.1	39	26	17	8	4	4	3.0	2.9	3.2
2	3.5	31	24	20	12	7	6	3.0	3.2	3.9
3	3.8	24	21	20	15	9	9	3.2	3.5	4.2
4 & OVER	4.3	18	17	19	17	13	15	3.8	4.1	4.6
ALL	3.7	29	22	19	13	8	9	3.5	3.5	4.0

HERD AVERAGE 17-19,000

LACT NO	AVG. LS	LINEAR SCORE DISTRIBUTION BY LACTATION NUMBER, LAST 12 MO (%)						AVERAGE LS BY STAGE OF LACT.		
		2-	3	4	5	6	7+	Early	Mid	Late
1	3.0	45	25	15	7	4	4	3.0	2.8	3.0
2	3.2	37	24	18	10	6	5	2.8	2.9	3.6
3	3.6	29	22	19	13	8	7	2.9	3.3	4.0
4 & OVER	4.0	23	19	19	15	11	12	3.7	3.8	4.4
ALL	3.5	35	23	18	11	7	7	3.3	3.2	3.7

HERD AVERAGE 19-21,000

LACT NO	AVG. LS	LINEAR SCORE DISTRIBUTION BY LACTATION NUMBER, LAST 12 MO (%)						AVERAGE LS BY STAGE OF LACT.		
		2-	3	4	5	6	7+	Early	Mid	Late
1	2.8	49	25	14	6	3	3	2.9	2.6	2.8
2	3.1	41	24	17	9	5	4	2.6	2.8	3.4
3	3.4	33	23	19	11	6	6	2.8	3.0	3.8
4 & OVER	3.8	26	20	19	14	9	10	3.4	3.5	4.1
ALL	3.3	38	23	17	10	6	5	3.1	3.0	3.5

HERD AVERAGE >21,000

LACT NO	AVG. LS	LINEAR SCORE DISTRIBUTION BY LACTATION NUMBER, LAST 12 MO (%)						AVERAGE LS BY STAGE OF LACT.		
		2-	3	4	5	6	7+	Early	Mid	Late
1	2.7	52	23	13	5	3	3	2.8	2.5	2.8
2	2.9	44	23	15	8	4	4	2.5	2.7	3.2
3	3.2	36	24	17	10	5	4	2.8	2.9	3.6
4 & OVER	3.8	26	20	19	14	8	9	3.3	3.5	4.0
ALL	3.1	42	23	16	9	5	5	3.0	2.9	3.4

ALL NORTHEAST DHI-SCC HERDS

LACT NO	AVG. LS	LINEAR SCORE DISTRIBUTION BY LACTATION NUMBER, LAST 12 MO (%)						AVERAGE LS BY STAGE OF LACT.		
		2-	3	4	5	6	7+	Early	Mid	Late
1	3.1	42	25	16	8	4	4	3.0	2.9	3.1
2	3.4	34	23	19	11	7	6	2.9	3.1	3.7
3	3.7	27	22	20	14	8	8	3.1	3.4	4.1
4 & OVER	4.2	20	18	19	16	12	13	3.8	3.9	4.5
ALL	3.6	32	22	18	12	8	8	3.4	3.4	3.9

PARTICIPANT'S NOTES -- Session 2b

SUMMARY

Objective: As a group, you use the mastitis-problem solving scheme to work through a case study and practice developing tactical plans.

Summary of Activities/Exercise (time)

1. **Presentation of Case Study #1 Data (30 min)** After going through the case farm's DHI Reports, bacteriological culture results and Farm Survey and Questionnaire, the group uses a worksheet to diagnose the mastitis problem.

2. **Brainstorm possible solutions in Case Study #1 (20 min)** The group identifies possible effective solutions to the case farm mastitis problem and brainstorm criteria for deciding which solutions to develop further.

3. **Develop tactical plans for operations (30 mins)** As a group, you develop tactical plans for what needs to be done to implement effective solutions.

4. **Develop tactical plans for management (30 min)** While studying an example management tactical plan, discussions of the intricate nature of this level of planning may illustrate the value of the Farm Management Planner as a management tool.

MILK QUALITY - Session 2b

ACTIVITY 1

Presentation of Case Study #1 Data

I. Learning Goals of this Activity

1. Given a specific farm's information, you become familiar with identifying if a mastitis problem exists, and diagnosing the problem as to the causative organisms.
2. The case study used in this session introduces the process you will use to analyze your own farm data.

II. Key Points

1. Records on somatic cell count, numbers of clinical cases, and bacteriological culture data are needed to identify and diagnose mastitis problems.

III. Personal Notes:

DHI 502 1/89

PAGE
1 of 1

Case Farm #1

DHI SOMATIC CELL
EVALUATION REPORTS
I. HERD SUMMARY

UR0208

DATE SAMPLED
DATE MAILED

SAMPLE DATES	HERD AVG LS	DISTRIBUTION OF COWS BY LINEAR SCORE												ESTIMATED INFECTIONS				100 LBS MILK LOST HERD/30 DAYS
		<3		3		4		5		6		>6		NEW		CHRONIC		
		NO.	PCT.	NO.	PCT.	NO.	PCT.	NO.	PCT.	NO.	PCT.	NO.	PCT.	NO.	PCT.	NO.	PCT.	
9/2/88	5.7	1	2	6	13	9	17	13	22	12	20	19	27	8	13	27	42	
8/2/88	5.4	0	0	6	10	13	22	13	23	13	23	22	13	7	12	20	31	
7/1/88	5.1	2	3	9	15	12	20	14	25	9	16	12	21	8	14	24	37	
6/4/88	5.2	3	5	10	16	13	23	12	21	9	15	12	21	5	9	25	39	
5/3/88	5.0	5	8	9	15	13	22	10	17	8	14	14	24	3	5	26	40	
4/2/88	4.9	3	5	12	20	10	18	15	26	9	15	10	17	4	7	18	31	
3/2/88	4.9	5	9	11	19	9	16	15	26	9	16	8	13	8	13	14	25	
2/2/88	4.7	2	3	10	17	17	30	14	24	8	14	6	11	4	7	14	25	
1/4/88	4.9	3	5	10	16	14	24	15	26	9	16	8	13	5	9	15	25	
12/4/87	4.8	1	2	10	17	17	29	12	21	11	19	7	12	2	4	15	26	
11/3/87	5.1	4	7	6	10	11	19	9	16	13	22	15	26	7	12	15	25	
10/6/87	4.6	6	10	10	18	10	17	12	20	10	17	10	18	2	4	17	29	

LINEAR SCORE DISTRIBUTION BY LACTATION NUMBER AND STAGE

PREVIOUS SAMPLE											CURRENT SAMPLE									
-EARLY-				-MID-			-LATE-			AVG. LS.	-EARLY-			-MID-			-LATE-			AVG. LS.
LAC. NO.	NO. COWS	LS. AVG.	LS 5+ PCT.	NO. COWS	LS. AVG.	LS 5+ PCT.	NO. COWS	LS. AVG.	LS 5+ PCT.		NO. COWS	LS. AVG.	LS 5+ PCT.	NO. COWS	LS. AVG.	LS 5+ PCT.	NO. COWS	LS. AVG.	LS 5+ PCT.	
1	4	2.8	25	3	5.3	30	5	5.6	42	5.4	4	3.1	25	5	5.3	20	6	5.7	15	5.2
2	5	4.8	35	7	6.1	48	8	5.6	25	5.3	4	3.8	25	6	6.1	31	10	6.8	38	6.2
3	9	3.5	30	5	5.7	50	12	5.5	38	5.5	9	3.7	35	7	5.6	35	11	6.3	40	6.2
Average		3.9			5.7			5.6				3.5			5.8			6.2		

QUALITY MILK PROMOTION SERVICES
NEW YORK STATE MASTITIS CONTROL PROGRAM

Acc. #

DATE

OWNER CASE FARM #1 ADDRESS Co.

PRACTITIONER ADDRESS

Survey: Initial X, Resurvey, Research, Extension, Miscellaneous

Sample type: Quarter, Composite X, Bulk Tank only Myco only

Number cows sampled 58, Cows in herd 64 Percent sampled

SURVEY DATA:

	Cows		Quarters		Abnormal Secretions			
	No.	%	No.	%	DC	CL	FL	PUS
NEGATIVE	22	38						
1 - Strep agalactiae	26	45						
2 - Strep species								
3 - Staph aureus	1	2						
4 - Staph species	6	10						
5 - E. coli	1	2						
6 - Klebsiella								
7 - Pseudomonas								
8 - Pasteurella								
9 - Proteus								
10 - Serratia								
11 - Gram — bacillus								
12 - Yeast								
13 - Mold								
14 - Nocardia								
15 - Prototheca								
16 - C. pyogenes								
17 - C. bovis	2	3						
18 - Gram + bacillus								
19 - Others								
ABNORMAL SECRETIONS	3	5						

20 ctm.

BULK TANK: DMSCC CULTURE 1, 4

COMMENTS:

Prepared by NYSMCP Veterinarian

PRODAIRY MILK QUALITY MANAGEMENT FOCUS WORKSHOP
MILK CULTURE AND CLINICAL MASTITIS RECORD
Quality Milk Promotion Services

Farm Case FArm #1 Number of milking cows 64

Average number of cases of clinical mastitis per month over the last 6 months 2

Most recent bulk tank cell count 750,000

CULTURE RESULT

Vial	Cow ID	Clinical?	SCC	Culture Results
1	BULK TANK			strep ag. staph sps.
2	103	✓		strep ag.
3	78	✓		staph sp.
4	3		high	strep ag.
5	32		high	strep ag
6	19		high	Neg.
7	166	just Purchased		staph aureus
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				

Form #2

Date

Person Interviewed On the Farm

Technician(s) Completing Questionnaire

QUALITY MILK PROMOTION SERVICES
Farm Survey and Questionnaire

Producer Case Farm #1 Phone No.

Address

Vet. Practitioner Milking Times AM PM

Breed Holstein Average Annual Production/Cow 14,300 lbs.

No. Milking 64 No. Dry 3 No. Bred Heifers 10

Bulk Tank DMSCC/WMT 650,000 Herd Average L.S. 5.5 SPC/PI

Milk Sold 6000 lbs for 2 days. Name of Milk Plant

DHI ☑ Y ☐ N Herd Code No. SCC Service ☑ Y ☐ N

Survey Type

☑ Initial
☐ Resurvey

☐ Required
☑ Voluntary

☑ Full
☐ Extension

MILKING SYSTEM

Overall make of System Boomatic

How long ago was the original system installed 16 yrs

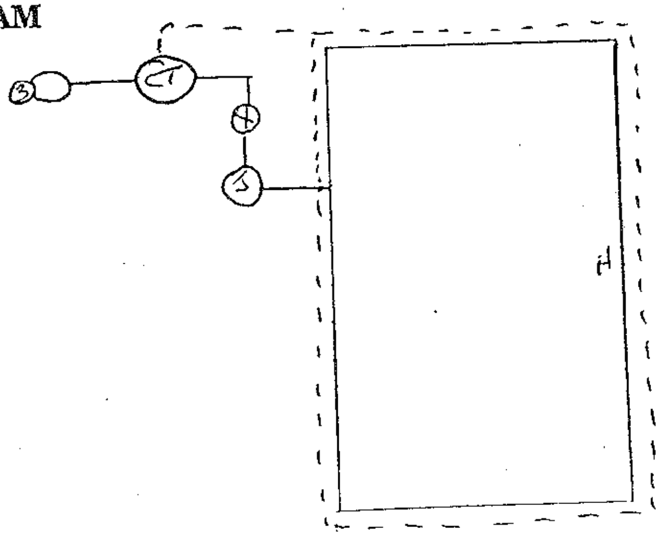
Dealer maintain the system at least once a year? ☐ Y ☑ N

☐ Bucket
☑ Round the Barn Pipeline
Maximum height 7 ft

☐ Parlor
☐ High Line
Maximum height ft
☐ Low Line
☐ Weigh Jar
☐ Automation
☐ Backflush

SYSTEM DIAGRAM

Controller Ⓒ
Cushion Tank (CT)
Receiver Jar Ⓙ
Distribution Tank (DT)
Vacuum Line (RED)
Vacuum Pump ① ②
Weigh Jar (WJ)
High Point Ⓗ
Trap Ⓣ



VACUUM SYSTEM

Pump
Make Boomatic

Model

Vacuum Pump a. 3 hp 32 cfm
b. hp cfm

Vacuum level tested [✓ Y] N
Milk Line 14.5 in.Hg
Pulsator Line 14.5 in.Hg
Teat end 10-13 in.Hg
Farm gauge 14.5 in.Hg

Reserve airflow tested? [✓ Y] N
Reserve airflow 30 cfm
Recovery time 5" Hg drop 3 sec
Observable air leaks? [✓ Y] N
Cushion tank? [✓ Y] N
Vacuum operated accessories? Y [✓ N]
☐ Doors
☐ Dumping station
☐ Other

Comments

CONTROLLER

Make Boomatic

Model

Number of controllers 1
Tested? [✓ Y] N
Airflow to 1/2" Hg drop 18 cfm
Meets standards? [✓ Y] N
Good location [✓ Y] N
Clean? Y [✓ N]
Vacuum over-ride Y [✓ N]

Comments

Controller was dirty

MILK and VACUUM LINES

Pulsator line size 1 1/2 in.
☑ looped
☐ deadended

Milk line size 1 1/2 In.
☑ looped
☐ deadended

Pitch/slope > 1"/ 10ft Y [✓ N]
Abnormalities in slope? [✓ Y] N
Pulsator line clean? (if observed) [✓ Y] N
Stall cocks leak? [✓ Y] N
Inlets in top 1/3 of line? Y [✓ N]

Comments

PULSATORS

Make Boomatic

Model

Type: ☐ pneumatic ☑ electric
Action ☑ single ☐ double
☐ side to side
☑ front to back

Tested? [✓ Y] N
if yes, with Detco

Pulsation rate 50 /min.

Pulsation ratio 60 : 40

:

Abnormal pulsators [✓ Y] N

Comments

Incomplete closure on one pulsator

MILKING UNITS

Number of operators 1
Total number of units 4
Greatest number of units/slope 4

Claw
Make Boomatic

Model Flo-star

Vacuum shut off [✓ Y] N
☐ Automatic ☐ Clamp
☑ Valve ☐ Other

Inflations
Make Boomatic

Model

Diameter ☑ Narrow ☐ Medium ☐ Wide
Type ☐ Rubber ☑ Synthetic ☐ Silicon

Collapse differential 4 in. Hg
Massage force adequate [✓ Y] N
Change inflations after 1600 I.C.M
Hose support [✓ Y] N

Comments

MILKING PROCEDURES

MILKING OBSERVED [✓ Y] N

UDDER PREPARATION [✓ Y] N
DRY MASSAGE [✓ Y] N
Individual paper towels [✓ Y] N
WASHED Y [✓ N]
☐ Water alone
☐ Detergent
☐ Sanitizer
Individual paper towels Y N
Spray hose Y N
PRE-DIP Y [✓ N]
Product used
DRIED Y N
Individual paper towels Y N
OTHER

Average time between stimulation and milking
(if observed) ☑ < 3 minutes
☐ > 3 minutes
Is the time consistent? [✓ Y] N
Examine for abnormal milk Y [✓ N]
How?

MILKING
Units sanitized between cows Y [✓ N]
Cows machine stripped Y [✓ N]
Hose aligned [✓ Y] N

Liner Slip?

☐ FEW ☑ SOME ☐ MANY

Vacuum shut off on removal [✓ Y] N
Milking time/ cow 7 mins.
Heifers/fresh cows milked first Y [✓ N]
Problem cows milked last [✓ Y] N
with a separate unit Y [✓ N]
Cows handled gently [✓ Y] N

TEATS DIPPED [✓ Y] N
Product used Chorox 1-4
How long has dipping been practiced?
☐ < 6 months ☑ > 6 months
Applied with
☑ Dipper cup
Cleaned daily [✓ Y] N
☐ Spray
☐ Hand ☐ Mechanical
Immediately after milking [✓ Y] N

Comments
Not consistent with teat dipping

HEALTH AND TREATMENT

% COWS WITH:

Dirty udders	☑ <10%	☐ 11-50%	☐ >50%
Unhealthy teats	☑ <10%	☐ 11-50%	☐ >50%
Injured teats	☑ <5%	☐ 5-20%	☐ >20%

\# Clinical cases seen 1 /month
\# Cows treated 1 /month
\# Cows culled last year due to mastitis
\# Cows died last year due to mastitis

LACATING TREATMENT
Product Today
☑ OVER THE COUNTER
☐ VET MIX
☐ HOME MIX
Treatment Procedure Dip, dry, clean with Alcohol pad - full insertion
Comments

DRY COW MANAGEMENT

Are cows dry treated [✓ Y] N
☑ ALL COWS
☐ SELECTED COWS
Cows dried off abruptly Y [✓ N]
Cows treated at the last milking [✓ Y] N
How long has dry treatment been used
☑ < 6 months ☐ > 6 months
Dry Cow Treatment
Product Tomorrow
☑ OVER THE COUNTER
☐ VET MIX
☐ HOME MIX
Treatment Procedure Dip, dry, clean with Alcohol pad, full insertion
Comments
Changed Dry cow treatment 2 months Ago on Vet Recommendation

REPLACEMENTS

Closed herd Y [✓ N]
Purchase replacements [✓ Y] N
☒ HEIFERS
☒ COWS
Comments

ENVIRONMENT

Housing for Lactating Cows

☑ STANCHION/TIESTALL
Platforms clean and dry [✓ Y] N
☐ FREESTALL
Stalls clean and dry Y N
Stalls maintained Y N
Stalls adequate size Y N
Alleys cleaned regularly Y N
☐ LOOSE HOUSING
Clean and dry Y N
Overcrowded Y N
☐ PASTURE 2-6 hrs/day
☐ EXERCISE YARD ____ hrs/day
Clean and Dry [✓ Y] N
VENTILATION ADEQUATE [✓ Y] N
Comments

Housing for Dry Cows

Housed with milking cows [✓ Y] N
☑ STANCHION/TIESTALL
☐ FREESTALL
☐ LOOSE HOUSING
☐ PASTURE
☐ OTHER
Area clean and dry? [✓ Y] N
Housing in good repair? [✓ Y] N

Comments

Bedding for Lacating Cows

Adequate [✓ Y] N
☐ SHAVINGS/SAWDUST
☐ STRAW
☑ HAY
☑ MATS
☐ SAND
☐ CLAY
☐ OTHER ____
Interval between bedding
☑ 1-2 days ☐ 3-7 days ☐ >7 days
Comments
Cows kept clean

Maternity Area

Cows separate from milking herd? [✓ Y] N
☑ PEN
☐ PASTURE
☐ STALLS
☐ OTHER
Area clean and dry [✓ Y] N
Comments

FINANCIAL INFORMATION

Premium Bonus	Cell Count Level	Payment Level	Received
1	300,000	15 cents/cwt	Y [✓ N]
2		cents/cwt	Y N

Comments

MASTITIS PROBLEM DIAGNOSIS SHEET--DETERMINING PRIORITY OF ACTION

	Contag.	Environ.	Low Masti.
If bulk tank SCC <250,000 0 0 1 >250,000 1 1 0			
If bulk tank cultures Strep ag. and/or Staph aureus 1 0 0			
If DHI estimated infections >15% New 1 1 0			
If DHI estimated infections >15% Chronic 1 0 0			
If DHI estimated infections <15% (New + Chronic) 0 0 1			
If clinical cases <2% per month 0 0 1			
If clinical cases >2% per month and Bacteriological culture Strep ag. and/or Staph aureus 1 0 0			
If clinical cases >2% per month and Bacteriological culture Strep sp., Staph sp. and/or coliforms 0 1 0			
If high SCC cows culture Strep ag., Spaph aureus, and/or C. bovis 1 0 0			
If high SCC cows culture Staph sp. 1 1 0			
If high SCC cows culture Strep sp., coliforms, and/or other bacteria 0 1 0			
If whole herd culture shows >0% Strep ag., >5% Staph aureus, and/or >10% C. bovis 1 0 0			
If whole herd culture shows >10% Staph sp. 1 1 0			
If whole herd culture shows >10% Strep sp., >2% coliforms, and/or >5% other bacteria 0 1 0			
If whole herd culture shows less than above % of each bacteria listed 0 0 1			
Priority Total			

MILK QUALITY - Session 2b

ACTIVITY 2

Brainstorming Possible Solutions in Case Study #1

I. Learning Goals of this Activity

1. To identify effective solutions to a contagious mastitis problem.
2. Practice brainstorming criteria with which to select best solutions and make decisions.

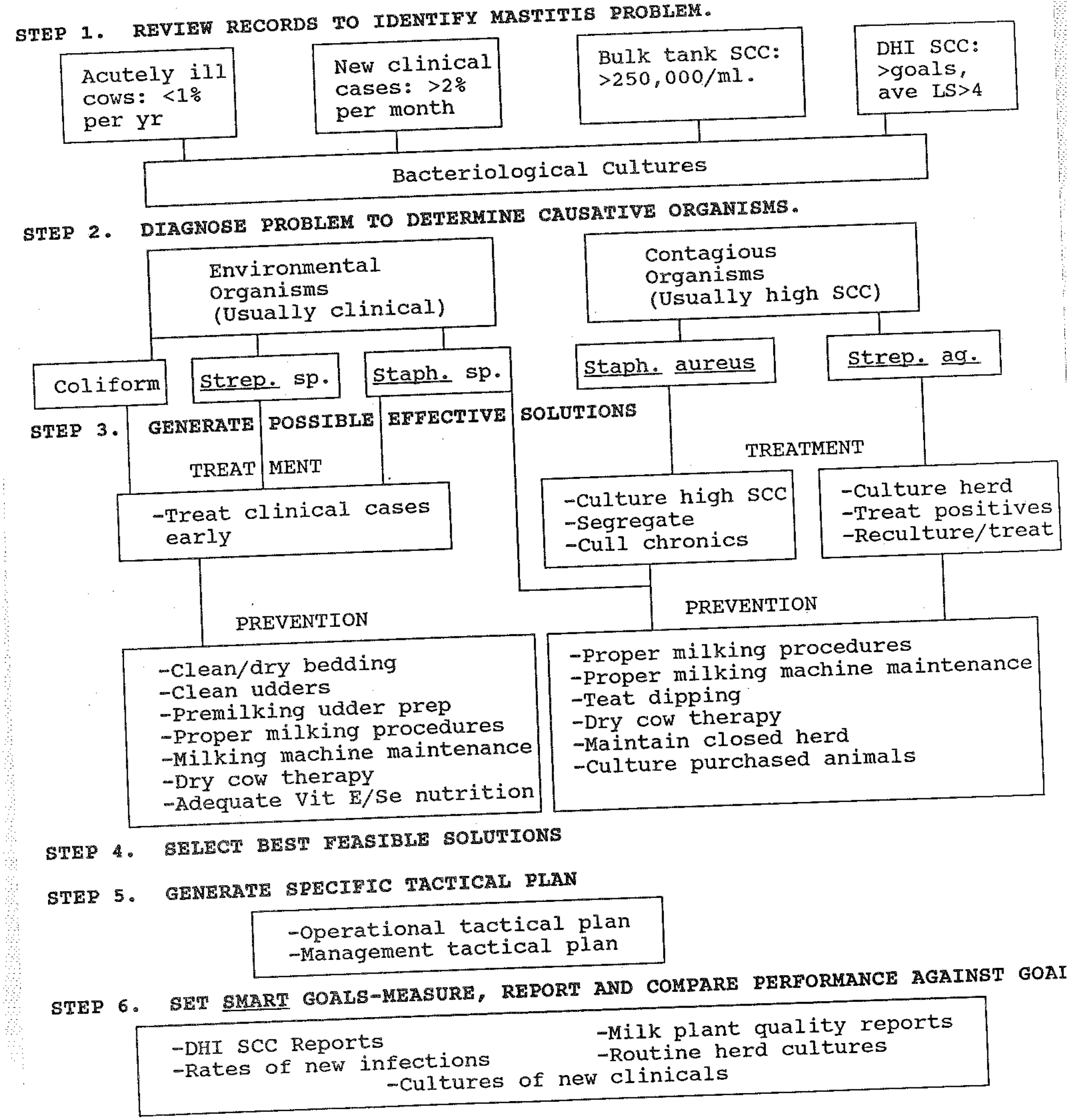
II. Key Points

1. Several different factors contribute to a mastitis problem.
2. Personal values, behaviors, and management styles affect the decision-making process.

III. Personal Notes:

MANAGEMENT OF MILK QUALITY FOR FARM AND INDUSTRY SUCCESS

MASTITIS PROBLEM SOLVING SCHEME



CASE FARM #1

OWN FARM WORKSHEET - DECISION MAKING GRID

Ratings: 3 = Good rating for criterion
2 = Fair rating for criterion
1 = Poor rating for criterion

Problem: High SCC Resulting from Contagious Mastitis -- mostly STREP. Ag. *

Alternatives Rating Criteria	Treat Positives And Re-culture	Improve milking equipment maint	Consistent Teat Dipping	Culture Purchased cows	Improve udder prep	
Eliminates Strep. ag from herd						
Reduces cow-cow spread						
CAN be started immediately						
Acceptable to manager						
(Totals) ---->						
Ranking ----> (Order 1 to 6)						

MILK QUALITY - Session 2b

ACTIVITY 3

Develop Tactical Plans for Operations

I. Learning Goals of this Activity

1. To state SMART goals for a contagious mastitis situation. (Goals are **S**pecific, **M**easurable, **A**ttainable, **R**ewarding, and **T**imed.)
2. Expand effective solutions to a mastitis problem into operational tactical plans.
3. Operational tactical plans contain tasks that need to be done on a technical level.

II. Key Points

1. Operational tactical plans define what is to be done on a technical (labor) level.
2. Tactical plans answer the Who, What, When, Where, and How questions of what actions are to be taken.

III. Personal Notes:

OPERATIONS PLAN

OWN FARM WORKSHEET - TACTICAL PLAN for: Contagious Mastitis
(Opportunity Area)

Goal: To control spread immediately and eliminate contagious organisms from herd by JAN., 1991

What task or activity is to be done?	Who is responsible?	How and/or where should the task be done?	When to perform task or activity (deadline, frequency, under what conditions)
Treat All strep. Ag. cows	me	Those identified by culture	Friday
Reculture whole herd	QmPs Tech	Call to verify date	End of Feb.
DiP every teat every time			

MILK QUALITY - Session 2b

ACTIVITY 4

Develop Tactical Plans for Management

I. Learning Goals of this Activity

1. Show how the functions of management interact with operational plans.
2. Initiate a thought process of planning management activities in support of operational activities.

II. Key Points

1. Management tactical plans involve the functions of management.
2. Generally, to implement an operational tactical plan involves quite a bit of activity involving the functions of planning, directing and controlling.

III. Personal Notes:

MANAGEMENT PLAN

OWN FARM WORKSHEET - TACTICAL PLAN for: Planning
(Opportunity Area)

Goal: Gather ideas on reducing spread and eliminating contagious organisms by March 1

What task or activity is to be done?	Who is respon-sible?	How and/or where should the task be done?	When to perform task or activity (deadline, frequency, under what conditions)
Have questions ready for next QMPS visit	me	List in TO-DO Book	Breakfast by Feb. 20
Get opinions on improving milking system	me	Contact QMPS, equip dealer, extension	by Feb. 15
Get suggestions on handling Purchased cows	me	Same People	by Feb. 15

MANAGEMENT PLAN

OWN FARM WORKSHEET - TACTICAL PLAN for: Directing
(Opportunity Area)

Goal: Everyone involved in effort to control contagious mastitis aware of goal by end of week

What task or activity is to be done?	Who is respon-sible?	How and/or where should the task be done?	When to perform task or activity (deadline, frequency, under what conditions)
TALK About Teat dipping	me wife	Discuss iodine, spray bottle	DINNER TONight
ImProving milking equipment	me	TALK w/ dealer Discuss schedule maintenance	Day of service call

CONTROL PLAN

CONTROLLING

is measuring and reporting actual performance at prescribed intervals, comparing that performance to set standards, and taking appropriate corrective action when events are not conforming to plans.

Plan for Controlling: Contagious Organisms

Input or Output to Monitor	Number of Strep. ag and Staph. Aureus cows in herd
Monitoring Procedure including measuring, reporting and (who)	Bacteriological cultures Annual whole herd and monthly high SCC cows.
Monitoring Time Interval	Two within 6 weeks Then annually
Control Standards	Eliminate both organisms by JAN. 1991
Corrective Actions to Bring System Back to Standard	Treat all strep ag. cows Segregate or cull staph. Aureus cows. Consider closed herd

CONTROL PLAN

CONTROLLING

is measuring and reporting actual performance at prescribed intervals, comparing that performance to set standards, and taking appropriate corrective action when events are not conforming to plans.

Plan for Controlling: Milk Equipment Function

Input or Output to Monitor	
Monitoring Procedure including measuring, reporting and (who)	
Monitoring Time Interval	
Control Standards	
Corrective Actions to Bring System Back to Standard	

PARTICIPANT'S NOTES -- Session 3a

SUMMARY

Objective: This session encourages you to review the milking procedures on your farm in comparison to recommended procedures and principles.

Summary of activities/exercises (time)

1. **Welcome and Agenda Sharing (5 min)**
   New teaching team members are introduced. Today's agenda includes workshop exercises on your own farm's situation.

2. **Proper Milking Procedures (50 min)**
   You define objectives for each activity of your current milking procedure. Then, while viewing a video on proper milking procedure, you analyze your current milking practices to identify areas of improvement.

3. **Prioritizing Improvements in Milking Practices (20 min)**
   Based on personal criteria and technical principles, you prioritize the identified needed improvements in milking practices on your farm.

4. **Developing an Operational Tactical Plan (30 min)**
   Applying what has been presented on milking procedures, you formulate operational tactical plans for improving milking practices on your farm.

MILK QUALITY - Session 3a

ACTIVITY 1

Welcome and Agenda Sharing

I. **Learning Goals of this Activity**

1. Introduce new members of the teaching team.
2. Understand that today's activities will include working on operational tactical plans for improving milking procedures and milking equipment maintenance on your farm.

II. **Key Points**

1. Today's agenda will contain a considerable amount of workshopping on your own farm situation.

III. **Personal Notes:**

MILKING PROCEDURES IMPROVEMENT EXERCISE

IDENTIFYING AND PRIORITIZING PROBLEM AREAS

By comparing the practices in the milking management videotape with your current milking practices, you may identify problem areas in your milking procedures that may need improving. Using a decision-making grid, these problem areas may be prioritized in order of importance.

Instructions

1. Before viewing the videotape, describe in a few words your objectives for each of the listed milking activities/practices on the Milk Activity Analysis Worksheet.

2. As you view the videotape, check whether your objectives for each activity/practice follows the principles illustrated in the video or needs improving.

3. Transfer those milking activities/practices that need improving onto a decision-making grid in order to prioritize the needed improvements and determine which practices should be addressed first.

MILKING ACTIVITY ANALYSIS WORKSHEET

	Activity or Practice	Primary Objective	Done Well	Needs Improving
a)	cow handling	____________________	______	______
b)	forestripping	____________________	______	______
c)	teat preparation	____________________	______	______
d)	machine attachment	____________________	______	______
e)	liner slips	____________________	______	______
f)	machine stripping	____________________	______	______
g)	overmilking	____________________	______	______
h)	machine removal	____________________	______	______
i)	teat dipping	____________________	______	______
j)	(others)	____________________	______	______
k)	____________	____________________	______	______

MILK QUALITY - Session 3a

ACTIVITY 3

Prioritizing Improvements in Milking Practices

I. Learning Goals of this Activity

1. Formulate personal criteria for decision making based on technical knowledge and principles of milking procedures.
2. To become more familiar with using a decision-making grid.

II. Key Points

1. Decisions to improve milking procedure should consider technical information and, as a manager, your perceptions of your own farm situation.

III. Personal Notes:

MILK QUALITY - Session 3a

ACTIVITY 4

Developing an Operational Tactical Plan

I. **Learning Goals of this Activity**

1. Practice formulating operational tactical plans for your own operation.
2. Use technical information to guide the planning process.

II. **Key Point**

1. The planning process is unique to each farms' situation and managers' style.

III. **Personal Notes:**

OWN FARM WORKSHEET - DECISION MAKING GRID

Ratings: 3 = Good rating for criterion
2 = Fair rating for criterion
1 = Poor rating for criterion

Problem: Prioritizing Milking Practices
Improvements

Alternatives Rating Criteria						
Likely to reduce SCC						
Likely to reduce contagious infections						
Likely to reduce environmental infections						
(Totals) ---->						
Ranking ----> (Order 1 to 6)						

OPERATIONS PLAN

OWN FARM WORKSHEET - TACTICAL PLAN for: Improving Milking Practices
(Opportunity Area)

Goal: ______________________________

What task or activity is to be done?	Who is responsible?	How and/or where should the task be done?	When to perform task or activity (deadline, frequency, under what conditions)

OPERATIONS PLAN

OWN FARM WORKSHEET - TACTICAL PLAN for: Improving Milking Practices
(Opportunity Area)

Goal: ______________________________

What task or activity is to be done?	Who is responsible?	How and/or where should the task be done?	When to perform task or activity (deadline, frequency, under what conditions)

MILKING TECHNIQUES AFFECT MILK QUALITY, YIELD, UDDER HEALTH AND MILKING PERFORMANCE

W. G. Merrill and D. M. Galton
Department of Animal Science
Cornell University

Milking techniques that dairymen practice every day should be based on principles as we know them. Dairymen will vary in methods used, but the principles and their application must be combined to achieve the objectives of good milking techniques which are: PRODUCE HIGH QUALITY MILK, ACHIEVE HIGH MILK YIELD and MAINTAIN GOOD UDDER HEALTH in combination with labor and equipment for an efficient and economical milking system.

MILKING TECHNIQUES

COW HANDLING

Dairymen need to remember that proper handling of cows prior to and during milking is important to help ensure an adequate release of the milk ejection hormone, oxytocin, for maximum milk removal. Milking routines will vary among farms; however, moving or handling cows at milking time should be a consistent routine that cows favorably associate with milking. Both people actions and physical facilities should be considered in relation to cow handling.

Why?

It is well known that cows respond best to consistent and gentle handling. Rough treatment, fright or other stress will cause release of adrenalin which interferes with oxytocin. This is especially true prior to milking where the detrimental effects of adrenalin release have been shown to interfere with complete milk removal for up to 15 to 30 minutes. This can increase machine-on time and cause incomplete removal of total milk.

FOREMILK STRIPPING

A few streams of milk should be removed from each teat at the beginning of premilking preparation. Milk should be stripped into a strip cup, or in parlors onto a clean portion of the cow platform where the milker can observe the milk for abnormalities. The strip cup and the stripping process must be such that milk does not become a source of contamination in transmitting mastitis bacteria. Never strip onto hands, wash towel or stall bed.

Why?

Milk should be checked for abnormalities and to detect clinical mastitis at early stages. If mastitis is detected, milk should be discarded and the cow considered for management action. If possible, the cow with clinical mastitis should be milked last or with a milking machine that is not used in milking the rest of the herd. Dairymen need to remember that a major source of mastitis bacteria is from infected quarters, therefore foremilk contains higher numbers of bacteria and somatic cells. Thus there is an advantage in removing this milk from the teat canal and cistern to improve milk quality and reduce the potential for organisms moving up into the secretory tissue.

TEAT PREPARATION

Some changes in teat preparation procedures have occurred in recent years due to better understanding of their relationships to milk quality and new infection rate during milking. Wetting without drying can increase bacterial contamination of the teat and milk; however, use of a liquid (water and sanitizer, or pre-dip) is the best procedure if properly done and dryness and removal of residue are assured. The scrubbing effect of hand action in washing and drying teats is important. Teats only, and not udder surfaces should be cleaned and dried. Dry teats are essential.

Alternative teat preparation procedures are:

1. (a) Wet towel (sanitizer) to clean teats; wipe dry with separate dry towel.

   (b) Or in parlors only: Water hose (sanitizer), carefully directly toward teats only, and hand action to clean teats; wipe dry with separate dry towel.

2. Premilking teat dipping with postmilking disinfectant teat dip; wipe dry with separate dry towel (must be done thoroughly to wipe off residue!).

Individual towels should be used for each cow to eliminate transfer of bacteria from cow-to-cow. Multiple use towels soaked in, or impregnated with disinfectant may reduce number of organisms to some degree, but have not been proven to eliminate bacterial transfer from teat-to-teat or cow-to-cow. Proper cow handling plus manipulation of teats during forestripping and teat preparation is adequate to initiate the desired milk ejection response.

Why?

Teats should be clean and dry at time of machine attachment to minimize sediment and bacteria that are detrimental to milk quality and udder health. Bacteria at the end of the teat canal, or on teat skin, or moved to these areas because of inadequate drying of teat or udder surfaces can increase contamination and mastitis infection during milking. Number of bacteria exposed to the teats during milking, as well as between milkings is directly proportional to the rate of new udder infections.

Udders should be dry, and as clean as possible as a result good stall and environmental management. Occasionally, a few cows may require washing of udder surfaces; if so, they should be thoroughly dried.

MACHINE ATTACHMENT

Attach the machine unit at a consistent and relatively short interval after premilking preparation. With many milking systems and effective routines, this can be done best immediately after preparation is complete (i.e. 15-30 sec after beginning of prep.). Longer intervals, preferably not more than 1-2 min., are equally effective; consistent timing is an important factor.

Usually, the best organization is for the same milker to perform all functions of preparation and machine attachment for a given cow. If not, special attention should be given to the routine so that a second person attaches the machine within the recommended time after preparation. Units should be attached with minimum amount of air admitted into the teat cups.

Why?

Timing of machine attachment should be as consistent as possible within the range 1/3 to 3 min. after the beginning of premilking preparation. The longstanding recommendation of a 1 min. interval is still appropriate, but a consistent routine of immediate attachment after forestripping and premilking preparation, or a longer interval within the above limits is possible. Type of milking system (stall barn pipeline or parlor type and mechanization) plus milking procedures used will affect the average time interval for machine attachment.

Excessive admission of air during machine attachment can cause this air to rush toward the other teats with attached teat cups. This "reverse flow" can increase bacterial contamination or impacts against the teat ends, and thereby increase the risk of mastitis infections. However, this effect is decreased at the beginning of milking because of subsequent milk flow washing away the bacteria.

MINIMIZE LINER SLIPS

Machines should be supported and adjusted to minimize liner slippage during milking.

Why?

Liner slips result in air entering the slipping liner and rushing toward the teat ends. Milk aerosols or droplet impacts carrying bacteria can contaminate other teats or a reverse pressure gradient across the teat canal can assist in moving bacteria through teat canals to increase mastitis infections. Operators should give high priority to correcting liner slips during milking.

MINIMIZE MACHINE STRIPPING

Machine stripping (downward pressure on the claw and massaging each quarter to remove "stripping milk") near the end of milking should not be a routine procedure; it should be used in the fewest possible instances; the exceptions being "problem" cows due to udder shape, injury, mastitis or fresh cows in certain cases.

Why?

Machine stripping increases the occurrence of liner slips and risk of mastitis infections: the greatest risks are near the end of milking.

With normal cows and properly operating milking machines there is no detrimental effect on milk yield or udder health from not machine stripping which results in leaving a total of about one-half pound of milk in the udder cisterns as stripping milk.

AVOID EXCESSIVE OVERMILKING

When manual removal of the milking unit occurs at or soon after the end of milk flow there is no problem from overmilking. Even a minute or two of overmilking has not been considered a major threat -- but the risk of cross-contamination increases with extent of overmilking. Overmilking is avoided by use of properly operating automatic take-off units.

Why?

It is difficult to manually remove milking machines exactly at the endpoint of milk flow. If one is overly concerned about slight overmilking there is a tendency for routine machine stripping; this can be detrimental in causing liner slips, impacts and infections.

It often has been thought that the primary problem from overmilking was teat tissue damage which predisposes to mastitis infections. Though this may happen to some degree, it has been shown experimentally only with gross overmilking by 10 min. or so when using properly operating milking machines. Leaving the machine on twice as long as required for milking has been shown to increase mastitis infections by cross-contamination in cows with at least one infected quarter. It has been shown that this can occur due to liner slips.

If the effects of overmilking are proportional to the length of overmilking; slight overmilking has only slight negative consequences. However, if overmilking cannot be controlled to low levels, too many milking machine units are being used, or poorly organized milking routines are being followed.

MACHINE REMOVAL

All four teat cups should be removed simultaneously at or near the end of milk flow after teat cup vacuum has been shut off. If detachers are used, then machines should be allowed to be removed automatically. Milkers should check udders for completeness of milk removal. Machine stripping should be reduced to the fewest possible instances, the exceptions being for "problem" cows due to injury, udder shape, mastitis, fresh cows in certain cases.

Why?

Machines should not be removed while vacuum is applied to the teats. This results in rapid pressure changes at the teat end which can cause milk to impact against teat ends or a reverse pressure gradient across the teat canal; these conditions increase the risk of mastitis infections. Detachers are designed to remove the machine when milk flow has nearly stopped; thus, the operator does not have to take time or make decisions about machine removal. Quarters should be checked to determine if they are milked out. Machines should be reattached only if a quarter(s) is not milked completely. If more than one to two pounds of milk is not removed, then future milk production will be reduced. Machine stripping (removal of less than one pound of milk) and overmilking should be minimized as routine procedures, so milking routine can be shortened and more of the operator's time used for more essential techniques.

TEAT DIPPING (high priority)

All teats of all cows should be dipped (at least halfway) with an effective teat dip as soon as possible after every milking.

Why?

This is one of the most important techniques in preventing mastitis. Disinfectant dips reduce bacteria on teats to minimize bacterial penetration into the teat canal between milkings. The rate of new infections is directly related to the number of bacteria on teats. If the teats are sprayed with a teat dip instead of being dipped, then the operator should make sure that the teat end and the lower half and all sides of the teats are saturated with dip after spraying. Foaming of dip during spraying should be minimized, because it is less effective than a complete dip saturation. Contaminated teat dip should be discarded in order to prevent possible bacterial transmission.

PARTICIPANT'S NOTES -- Session 3b

SUMMARY

Objective: This session illustrates the importance of proper milking machine function/operation and encourages you to develop plans for milking equipment maintenance.

Summary of activities/exercises (time)

1. **Mini-lecture on Cleaning/Sanitizing (30 min)**
   Information about removal of milk fat, protein and minerals from milk contact surfaces is delivered. A discussion of common areas of problems in CIP systems leads to ideas on methods of monitoring the cleaning of equipment.

2. **Milking Machine Maintenance and Operation (50 min)**
   A slide presentation illustrates the risk involved in neglecting the maintenance of a milking system. Proper operator action to reduce teat end impacts is also emphasized. Operation of the different components of milking systems is explained.

3. **Developing Your Farm's Maintenance Program (30 min)**
   You develop a tactical plan for reducing risk from milking equipment malfunction with a routine maintenance schedule.

4. **Preparing for Final Session (5 min)**
   You are reminded to bring necessary information to work on your own farm's milk quality problems in the final session of this course.

MILK QUALITY -- Session 3b

Activity 1

Mini-lecture on Cleaning and Sanitizing Milk Equipment

I. Learning Goals of this Activity

1. Recognize components of milk soil and factors effecting their removal from equipment.
2. Understand the steps of a CIP cleaning cycle and factors that affect proper cleaning of equipment.

II. Key Points

1. Milk fat, protein and minerals require unique conditions for their removal.
2. The CIP cleaning cycle substitutes the vigorous circulation of cleaning solutions for the "elbow grease" of manual cleaning. Wash water temperature and adequate solution velocity are common problem areas.
3. Low milk plant bacterial counts and routine visual inspection of the cleaning process ensures minimum problems with milk inspectors.

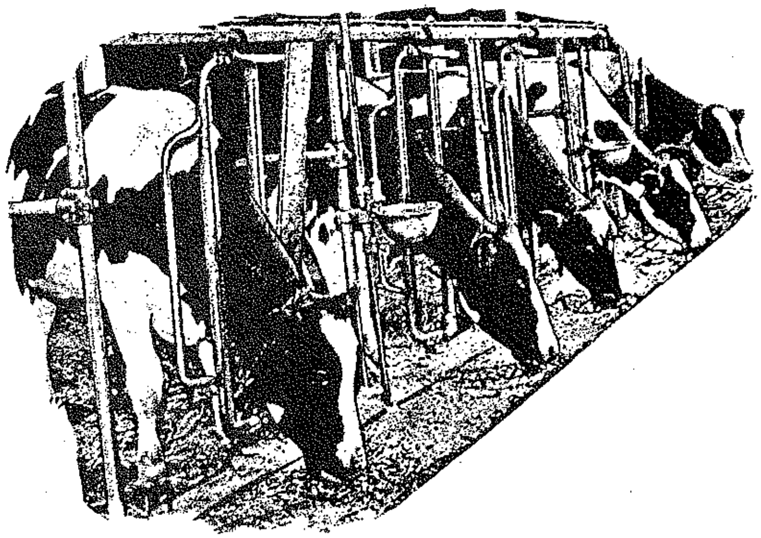
III. Personal Notes:

Overhead
3b.1

MILK AS A "SOIL"

1. MILK FAT

- Requires very hot water
- Solidifies below 93°
- Melts above 140°
- Emulsified by alkaline cleaners



MILK AS A "SOIL"

2. MILK PROTEIN

- forms shiny bluish film
- chlorine denatures and dissolves

3. MINERALS (MILKSTONE)

- Ca and Mg percipitate
- dissolves in acid cleaners
- foundation of milkstone

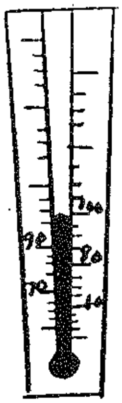
CLEANING ROUTINE OF CIP SYSTEMS

1. PRE-WASH RINSE
2. ALKALINE WASH CYCLE
3. ACID RINSE
4. SANITIZE - BEFORE NEXT MILKING

Overhead

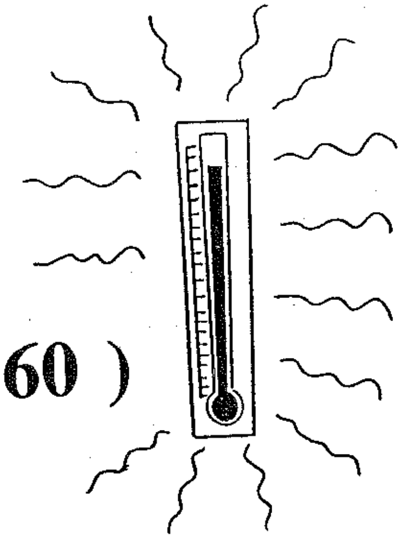
3b.4

1. PRE-WASH RINSE



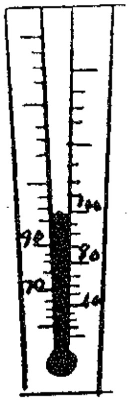
- **tepid (95-100°)**
- **removes bulk of milk soil**
- **hot water bakes-on soil**
- **avoid recirculating rinse**

2. WASH CYCLE



- initial hot (>160) water
- chlorinated alkaline cleaner
- vigorously circulated for 8-10 minutes
- maintain above 120

Overhead
3b.6



3. ACID RINSE

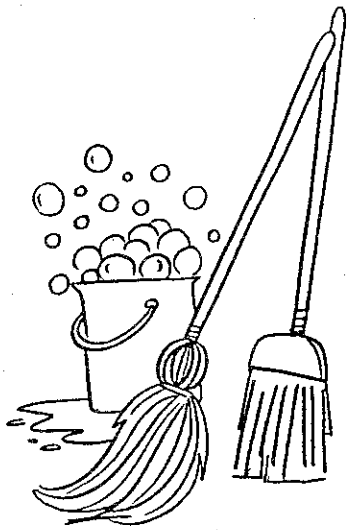
- tepid (95-110^{0}) rinse water
- prevents mineral deposits
- neutralized chlorine residue
- inhibits bacterial growth

4. SANITIZING

- before each milking
- circulate 200 ppm chlorine solution
- difference between sanitizers and bleach
- iodines and quaternary ammonium also used

Overhead
3b.8

FACTORS EFFECTING EQUIPMENT CLEANING



1. Time
2. Temperature
3. Volume
4. Detergent Balance
5. Velocity
6. Complete Drainage

MILK QUALITY -- Session 3b

ACTIVITY 2

Milking Machine Maintenance and Operation

I. Learning Goals of this Activity

1. The milking machine is used more than any other piece of equipment on your dairy farm.
2. A routine milking machine maintenance program reduces the risks of negative consequences due to worn-out, dirty or malfunctioning components of the milking system.
3. Operator action may cause irregular vacuum fluctuations which may result in milk droplet impacts on the teat end.

II. Key Points

1. Risks vs. negative consequences should be the basis of a milking equipment maintenance program.
2. There are certain maintenance functions the operator can do and certain maintenance functions a service professional must do.
3. Reverse flow of air and milk droplets toward the teat occur under conditions that allow air to enter the teat cup. Impact that results may force organisms into the teat canal.
4. Milking machine maintenance is a sound insurance investment.

III. Personal Notes:

MILK QUALITY -- Session 3b

ACTIVITY 3

Developing Your Farm's Maintenance Program

I. Learning Goal of this Activity

1. Properly maintained milking equipment involves details that you as the farm manager must bring under management.

II. Key Points

1. The operator uses the milking equipment daily and needs to be aware of its proper function in order to identify when the equipment is malfunctioning.
2. Developing regular habits of checking, cleaning, and replacing components of the milking equipment will minimize service calls and major breakdowns.

III. Personal Notes:

TACTICAL PLAN FOR MILKING EQUIPMENT MAINTENANCE

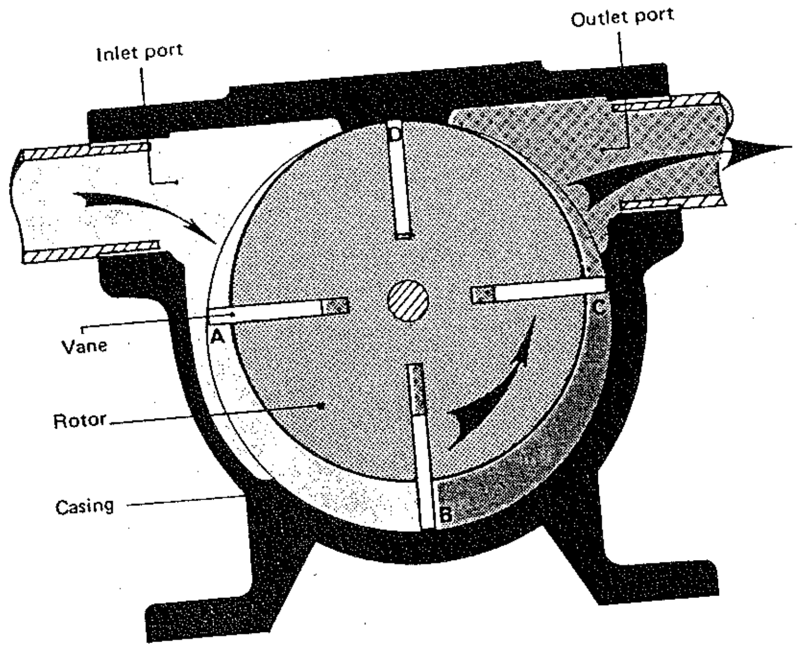
Goal: Reduce risk of improper milking equipment function.

Step 1: Determine interval for scheduled maintenance by service personnel. _____ months
Step 2: Determine interval for liner change: _______ days
Step 3: Determine maintenance needs, frequency and assign responsibility.

Activity	**Who**	**When**
check vacuum oil		
inspect milk/air tubes		
observe vacuum gauge		
listen for pulsators		
check teat sanitizer		
test vacuum pump belt tension		
check system for thorough cleaning		
test wash water temperature		
clean vacuum regulator		
clean pulsators		
clean air injector screens		
drain water from compressor tank/lines		
change liners		
replace milk hoses		
replace air/milk tubes		
replace check valve in transfer pump		
replace milkline gaskets		
replace diaphragms on vacuum valves		
clean oil reclaimer		
________________		
________________		
________________		
Arrange Scheduled Maintenance with Dealer		

MILKING MACHINE SCHEDULED MAINTENANCE

Hours Run/Day	Days to 1250 Hours	Schedule Months
3.5	357	12
7.0	179	6
10.5	119	4
14.0	89	3



Overhead
3b.10

CALCULATING LINER CHANGE INTERVAL

Recommended cow milkings per liner

over

No. of cows x milkings per day

÷

No. of milking units

****

Example: 90-cows, 2X milking with 6 units

1200 / 90 x 2 ÷ 6 = 40 days

MILK QUALITY -- Session 3b

ACTIVITY 4

Preparing for Final Session

I. **Learning Goal of this Activity**

1. It is important to come to the next session of the course with the listed information in order to participate in developing tactical plans for your own farm situation.

    a. Most recent DHI SCC Reports
    b. QMPS Farm Survey and Questionaire
    c. Bacteriological results of samples
    d. Tactical plans developed in today's session on milking procedures and equipment maintenance

II. **Key Points**

1. After practice on a case study, you will work with your own farm situation in the next session to develope tactical plans for improving milk quality.

III. **Personal Notes:**

CLEANING AND SANITIZING OF DAIRY FARM MILKING EQUIPMENT

Terry Mitchell
Babson Brothers, Co.
Chemical Division

Cleaning and sanitizing of dairy farm equipment has been well documented for years. Recommendations on procedures and cleaning routines have been recommended by dairy field personnel and equipment and route suppliers. Specific recommendations for each dairy can be made only after a complete evaluation of the water quality, system type, and management practices at the farm.

Water

Water quality is often taken for granted; yet water impurities often can be the greatest cause of cleaning problems. Raw water on the farm can contain minerals such as calcium and magnesium. These minerals, called "hardness" minerals, precipitate easily and interfere with the cleaning action of detergents. Hardness minerals also precipitate in water heaters and drive up energy costs to heat water. Efficiency losses can also result in inadequate supplies of hot water required for cleaning.

Other minerals, such as iron, can also interfere with cleaning. Ferrous iron in solution is oxidized by the chlorine present in cleaners and sanitizers. Oxidized or ferric iron then precipitates and causes staining. Mineral elements present in raw water supplies can be removed through ion exchange (water conditioners and filters) or can be "tied up" or sequestered through chemical action. The most cost effective approach is to remove the mineral elements from the water so detergents and sanitizers can perform efficiently.

Cleaning

The cleaning of any surface involves a basic three-step procedure:

1. Lift the soil from the surface,
2. Break the soil down into smaller parts, and
3. Disperse the soil in solution.

These "steps" are provided by employing the right detergent for the specific soil which is to be removed.

Milk as a Soil

Milk components include fats, proteins, and minerals. Each of these "soils" present unique conditions which require attention during cleaning. Milk fats solidify at temperatures below 93°F. and require temperatures above 140°F. in order to melt once they do solidity. High alkaline cleaning agents emulsify milkfat into smaller parts so they can be removed during the cleaning cycle.

Milk proteins are very tenacious soils, and they tend to form adhesive-type films. Chlorine denatures or peptizes these proteins, rendering them more soluble.

Minerals normally found in milk are held in suspension; however, insoluble calcium and magnesium can precipitate during water rinsing. These minerals form films which then become the foundation for milkstone, which is a compound soil of fats, proteins, and minerals.

Cleaning Routines

Manually cleaned surfaces must use mechanical force (elbow grease) through the action of a brush. A sudsing detergent is used to provide a visual check and increase the vertical surface contact time. Automatic cleaning of C.I.P. systems requires certain criteria in order to perform. Since the elements involved in a manually cleaned surface are absent, certain requirements for C.I.P. systems include:

1. Time
2. Temperature
3. Volume
4. Detergent Balance
5. Velocity
6. Drainage

<u>Time</u>. Length of the was cycle should be ten minutes. This is often accomplished with an automatic washer. If the wash cycle greatly exceeds ten minutes, water temperatures may drop to a level that may cause redeposition of soils.

<u>Temperture</u>. Adequate amounts of hot (160°F.) water must be supplied. Ideally, wash temperatures should not drop below 120°F. on the return side of the system; however, some detergent formulations will exhibit better cleaning performance and sequestering power than others at temperatures below 120°F. Some "low temperature" detergents contain more active cleaning ingredients to compensate for loss in temperature.

Volume. Adequate water volume is essential in C.I.P. systems. A table of equipment capacities should be made available by the equipment manufacturer. The proper amount of water should then be calculated. A good rule of thumb is that the wash vat should never be emptied before return water reenters the vat. In addition, if maintenance of 120°F. water is required, water volume can be increased. This will help maintain temperature at 120°F.

Detergent Balance. Proper amounts of detergent must be added to insure adequate cleaning. Directions should be provided on labels so the proper concentration can be attained. Keep in mind that less detergent is required in soft water. A water conditioner will remove the hardness ions (calcium, magnesium) and the resultant soft (zero grains per gallon hardness) water will allow the phosphates and sequesterants in the detergent to perform more efficiently. In areas where iron concentrations exceed 1 ppm, additional detergent is required.

Velocity. Proper physical action is a must in a C.I.P. system. Since the brush and elbow grease in a manual cleaning operation are absent, "scrubbing" action must be provided through air injection. Alternate air admission at timed intervals provides a slug of water which scrubs the surface. Length and diameter of milk line, plumbing design, and types of automated equipment greatly effect the amount of air which must be supplied. Electronic air injectors provide the capability of selecting time length and frequency of air admission. Trial and error is required in order to achieve proper action. The equipment dealer should provide the necessary adjustments to assure proper washing action.

Drainage. The system must be adequately sloped, and secondary drains must be provided to assure proper drainage after completion of each cycle. Automatic washers provide time intervals for complete drainage.

The classic steps in cleaning as applied to a C.I.P. system are as follows:

Pre-wash Rinse. A clear, clean, potable, tepid (95°F.-100°F.) water rinse is flushed through the system to remove the bulk of the gross soil. In addition, the equipment wall surface is warmed. Care must be exercised to never exceed 115°F. because soils can actually be "baked" on the equipment wall surface. A recommended procedure is to dump the initial rinse water directly down the drain. This will prevent recirculation of the heavy soil. This can be performed automatically with a diverter valve.

Wash Cycle. A hot (160°F.) solution of a chlorinated alkaline cleaner is circulated for ten minutes. Chlorines will aid in soil removal by peptizing proteins while the high alkalinity (pH 10+) emulsifies fats. Water temperature should be maintained above 120°F. to prevent redeposition of milk soils.

5. Check pH of wash solution. For best results, pH should be in the range of 11-12. If the pH falls outside this range, and a De Laval Liquid Automatic Washer is used, adjust pH level in the washer. If the pH is outside this range and another type automatic washer or manual procedures are used, note the correct amount of detergent to use on the inspection form. (Refer to the cleaning section for the correct procedure.) If a De Laval Liquid Automatic Washer or Powder Automatic Washer is used, check for correct dispensing of acid and sanitizer.

6. Check temperature of the wash solution. The temperature should be above 120°F. at the end of recirculation period. If lower than 120°F. at the end of the wash cycle, adjust hot water heater for higher starting temperature or provide for some type of equipment, such as a Booster Heater or heat exchanger to maintain the temperature during the wash cycles.

7. Check the Air Injector for correct operation and adjustment. Observe the washing action, and adjust the Air Injector according to the Service Manual (SNF-7170, section SC7) so that all surfaces are being washed with sufficient turbulence.

8. Check the local water analysis and determine if the washing solutions being used, are correct as indicated in the Dairy Cleaners Manual (SNF-7170 section SC10).

Milkhouse Cleaning Chart

Water Test Results:

pH_____ Total Hardness_____grains/gallon Iron Content____ppm

Check the Recommended Cleaning Procedures:

1. **Rinse** Immediately after each milking, circulate lukewarm water through entire system, continuously discharging until water runs clear.

2. **Wash** Wash system by recirculating the following solution 10 minutes:
____ gallons water at ____ degrees F. with
____ ounces chlorinated alkaline cleaner Cleaner

3. **Rinse** Final rinse by circulating once through the system
____ gallons clear lukewarm water with
____ ounces acid rinse

4. **Sanitize** Just prior to each milking, circulate once through the system a solution of:
____ gallons clear lukewarm water with
____ ounces of chlorinated sanitizer

Always follow local health department regulations regarding cleaning and sanitizing of dairy equipment and utensils.

Be certain that a cleaning chart (above) is properly filled out and is conspicuously posted for reference during cleaning procedures.

SURGE

HOUR 002500

STANCHION PIPELINE SYSTEM
SCHEDULED MAINTENANCE

For: ______________________________ Date: __________

Hour Service*

500 1500 3000 6000

MILKING UNITS

Check condition of milker unit.

Replace gaskets and check for proper seal.

Inflations matched to shells.

Inflations checked for condition.

Air Tubes checked for condition.

Vacuum Hose checked for condition.

Milk Hoses checked for condition.

Air Leak of unit checked

Check glass bowls for chips.

Milk with diaryman at milking time.

Check for milking vacuum fluctuations at milker unit, with levograph.

Check condition of Surcingles. Repair or replace as necessary.

PULSATION SYSTEM

Inspect operation and condition of pulsator control.

Clean air-ports & screens of pulsators and/or activators. Service as needed.

Number of pulsations p/min. p/pulsated ratio ___/___

Test pulsators w/Levograph ___ milk ____/massage _____
(File Tape for future reference)

Clean and rebuild pulsators with new diaphragms.

Rebuild pneumatic pulsators.

Check coils of pulsators (40-80 Ohms Non-Direct) (37-42 Ohms Direct)

Check voltage at input pulsator(s) (12-14 Volts Non-Direct) (16-24 Volts-Direct)

Replace armature in pulsators.

Replace micro-switches in early model pulsator control.

VACUUM LINE(S)

Automatic drains checked for proper operation.

Vacuum lines cleaned (pulsator lines and between receiver and vacuum pump).

Check hangers and slope of line.

Check vacuum gauge setting against test gauge.

Lubricate stall cocks and check for leaks.

Automatic stall cocks checked for operation and leaks.

Vacuum line checked for drainage.

Vacuum line checked for leaks.

Hour Service*

500 1500 3000 6000

VACUUM REGULATORS

(Update systems with current Regulator)

Disassemble and clean vacuum regulators.

Replace air filter

Calibrate vacuum level for 12" at teat end.
Milk Line _____ Hg.

Change cushion control fluid (Early Model)

Replace Brass valve and sleeve. (Early Model)

Vacuum Control Check (See flow meter instructions)

VACUUM PUMPS (Size No.1 ____ No.2 ____)

Inspect lubrication system.

Check belt, alignment, or direct drive coupling.

Change air filter in the vacuum tank. Replace seal as necessary.

Start pump and observe operation and oil temperature.

Check oil flow at sight glass.

Use flow meter and check pump only
CFM No. 1 ____ No. 2 ____

Attach lines to pumps and check CFM
No. 1 ____ No.2 _____

Check operation of flapper, exhaust and tank drain.

Using VOM, Test vac. pump motor(s) and record:
Run Amps _____ Run Volts _____

With VOM on Ohm's X-1 check for proper ground between pump and established ground.

Check physical condition and cleanliness of pumps.

Check for possible obstruction in pump exhaust.

Check air temp. at pump (above 32° F, below 120° F

Check oil and filter in reclaimer.

Check micron filters.

Replace motor drive belts.

Recondition electric motor.

Recondition vacuum pump with new bearings and vanes.

GROUND TO EARTH VOLTAGE

Check vacuum line_____ Check milk line_____

Check stanchion ____ Check drinking cups ____

Check electrobrain ____ Check milk tanks ____

Check milking units ____ Check milk pump ____

Check vacuum pumps ____ Check pulsator case ground _____ Check wash tank _____

Notify dairyman of test results.

Hourly Service should be based on Surge Hour Meter or months of service (whichever occurs first) 500 hrs = 6 mos. service, Hour Service

MILK HANDLING EQUIPMENT

500	1500	3000	6000	
☐	☐	☐	☐	Check and tighten all fittings for leaks
☐	☐	☐	☐	Check milk pump cycling and operation
☐	☐	☐	☐	Using VOM, test Milk Pump motor and record: Run Amps. _____ Run Volts _____
		☐	☐	Adjust graphite seal on milk pump (as needed)
		☐	☐	Change milk pump gaskets (as needed)
			☐	Replace graphite seal and rubber spring
			☐	Recondition milk pump motor and check capacitor
	☐	☐	☐	Check operation of milk pump timer
		☐	☐	Check and reset timer relay & micro switch. (early model)
			☐	Replace timer micro-switch (early model)
☐	☐	☐	☐	Check milk pump receiver for slope
☐	☐	☐	☐	Check milk pump receiver for cleanliness
☐	☐	☐	☐	Check vacuum wash assembly for proper operation.
	☐	☐	☐	Lubricate piston seal of vacuum wash assembly
			☐	Rebuild control, replace coil gaskets and adjust valve of vacuum wash assembly.
☐	☐	☐	☐	Test pipeline with flow meter for possible leaks

MILK LINE

500	1500	3000	6000	
☐	☐	☐	☐	Observe slope and condition of milk line.
	☐	☐	☐	Check condition of milk valves and repair.
		☐	☐	Change all pipe line gaskets.

COOLING SYSTEMS

500	1500	3000	6000	
☐	☐	☐	☐	Check starting of condensing unit – slow starting, false starts and/or humming indicate trouble.
☐	☐	☐	☐	With VOM Test & Record motor: Start Amps ____ Running Amps ____ Running Voltage ____
☐	☐	☐	☐	Inspect Milk Tank interior for cleanliness
☐	☐	☐	☐	Check Ice thickness (Instant Cooling Systems)
☐	☐	☐	☐	Check system for refrigerant leaks using halide torch
☐	☐	☐	☐	Install test gauge manifold to determine operating pressures.
☐	☐	☐	☐	Check refrigerant charge
☐	☐	☐	☐	Check and adjust fan controls as required
☐	☐	☐	☐	Check low pressure control and adjust for proper pump down.
☐	☐	☐	☐	Tighten all electrical connections and spray with LPS-2
☐	☐	☐	☐	Check tank level position
☐	☐	☐	☐	Check all automatic washer connections, pump seal and water inlet screens.
☐	☐	☐	☐	Inspect sprayball, clean all openings.
☐	☐	☐	☐	Check Tube Cooler gaskets (Instant Cooling Systems)
	☐	☐	☐	Check crankcase heater
	☐	☐	☐	Check all refrigerant line hangers and supports. Adjust as required to eliminate tubing rattle.
	☐	☐	☐	Check thermometer & temp. control calibration.
			☐	Check manhole gasket and agitator shaft shield. Replace if necessary.
	☐	☐	☐	Check room temp. (above 32° F., below 120° F.)

Hour Service*

ALTERNATOR

500	1500	3000	6000	
☐	☐	☐	☐	Encourage dairyman to operate alternator under running load (every 6 months)
		☐	☐	Check oil level
		☐	☐	Use LPS-2 on all Switches and electrical contacts.

WATER CONDITIONER

500	1500	3000	6000	
☐	☐	☐	☐	Check automatic cycling of complete regeneration of unit.
		☐	☐	Analyse hardness and iron of conditioned water.
☐	☐	☐	☐	Check salt supply in brine tank, refill if necessary.

SANITATION EQUIPMENT

500	1500	3000	6000	
☐	☐	☐	☐	Check cleanliness of milking system and make necessary recommendations.
☐	☐	☐	☐	Check in-parlor manifold for proper operation and condition of cover.
☐	☐	☐	☐	Check Electrobrain operation and cycling.
☐	☐	☐	☐	Clean Electrobrain screens.
☐	☐	☐	☐	Check Electrobrain flow rate and water temperature. (On earlier models, test element of mix valve).
		☐	☐	Replace Electrobrain gaskets of product jars.
			☐	Test Electrobrain water solenoid coil and armature.
			☐	Replace Electrobrain water inlet & inner water hoses.
			☐	Replace air filter on S-30 valve hose.
☐	☐	☐	☐	Check Diverter operation.
			☐	Replace Diverter hoses, check solenoids and armatures
☐	☐	☐	☐	Check tank drain for proper operation and adjust seal.
			☐	Replace large tank drain ball (pressure wash).
			☐	Replace tank drain stopper and diagraph and spring.
☐	☐	☐	☐	Check secondary drain operation, seal & cleanliness.
		☐	☐	Lubricate piston seal of Secondary Drain.
		☐	☐	Rebuild Secondary Drain. Replace drain tube.
	☐	☐	☐	Check in-parlor manifold for complete draining and cleanliness.

WATER GUN

500	1500	3000	6000	
☐	☐	☐	☐	Check for proper operation
☐	☐	☐	☐	Recondition as needed

____

Serviceman's Signature

Rev. 5-80 F-11822

PRINTED IN USA

***Hourly Service should be based on Surge Hour Meter or months of service (whichever occurs first) 500 hrs = 6 mos. service,** 1,500 hrs = 9 mos., 3,000 hrs = 18 mos., 6,000 hrs = 36 mos.

MILKING EQUIPMENT SCHEDULED MAINTENANCE CHECKLIST

Vacuum System

Warm up the pump & check vacuum level
Check C.F.M. at 15"Hg vacuum
Check condition of pump housing, wings and bearings
Check belt condition, pulley alignment & belt tension
Check pump motor wiring
Service oilers or Lubriclaim unit
Check & clean vacuum controllers
Inspect vacuum lines for size, cleanliness, slope & drain
Inspect distribution and/or balance tank
Check vacuum pump speed
Determine desired milking vacuum level
Compare C.F.M. of pump at 15"Hg vacuum & milking vacuum level
Determine minimum C.F.M. requirements for system
Compare C.F.M. requirements with pump output at milking vacuum
Perform vacuum system leak test
Check vacuum level of milking system & adjust if necessary
Run vacuum controller performance test
Check effective vacuum reserve
Check amperage of vacuum pump motor

Washing System

Check water level adjustment
Check diversion valve
Check filter system
Check wash rack or unit washers
Check pH & temperature of wash solution
Check air injector for operation & adjustment

Milker Units

Inspect all plastic & rubber components
Check teat cup shells for leaks
Inspect air valve & claw shut-off
Inspect claw milk inlet nipples
Inspect claw air nipples
Inspect claw bowls
Test assembled units using the Alfatronic Tester
(record on pulsator test form #22-001)

Pulsation System

Disassemble & clean pulsators--Inspect for wear
Check & clean stall cocks
Perform timer convertor checks

Receiver Group

Inspect for cleanliness
Check for correct installation of trap
Check couplings for cleanliness and tightness
Disassemble & inspect milk pump (reassemble)
Check milk pumps for leaks
Check grounding & electrical connections of liquid level control
Check amperage draw of milk pump motor
Check probes for cleanliness & tight connections
Check discharge pipe
Check secondary drain
Check filter for size & condition

Sanitary Milk Lines

Check that milk lines meet size requirements
Check sanitary clamps, couplings & ferrules
Check inlets for proper positioning, wear & leaks
Check that hangers are tight & lines are straight
Check height of line from cow platform
Check line slope

Weigh Device

Check entire weigh device for cleanliness and function
Check all rubber parts
Check that wash deflectors are correctly positioned
Check brackets for tightness - plumb
Check that drains are correctly located & functioning

Automation

Consult automation section of service manual (SNF-7170)

Transient Voltage

Perform stall - manager check
Perform milker unit check
Perform cow hoof to grate check
Perform wash vat check
Perform milk cooler check

Milking System Inspection Guide

This reference sheet is intended to serve as a guide in performing the free milking system inspection (Form SNF-7497).

IMPORTANT NOTE TO DEALER: **Refer to the Scheduled Maintenance Instructions (SNF-7171) for detailed instructions. This form should only be used after serviceman is completely familiar with the detailed instructions.**

A—VACUUM SYSTEM

☐ Warm up the pump and check vacuum level.
☐ Check CFM at 15" Hg vacuum.
☐ Check belt condition, pulley alignment and belt tension.
☐ Check oilers or Lubriclaim™ unit.
☐ Check and clean vacuum controllers.
☐ Inspect vacuum lines for cleanliness, slope and drain.
☐ Inspect distribution and/or balance tank.
☐ Determine desired milking vacuum level.
☐ Perform vacuum system leak test.
☐ Check vacuum level of milking system and adjust if necessary.

B—MILKER UNITS
C—PULSATION SYSTEM

☐ Inspect air valve and claw shut-off.
☐ Inspect claw milk inlet nipples.
☐ Inspect claw air nipples.
☐ Inspect claw bowls.
☐ Test assembled units using the Alfatronic® tester. (Record on pulsator test for SNF-7442.)

D—RECEIVER GROUP

☐ Inspect for cleanliness.
☐ Check couplings for cleanliness and tightness.
☐ Check milk pumps for leaks.
☐ Check grounding and electrical connections of liquid level control.
☐ Check discharge pipe.
☐ Check Automatic Drain

E—SANITARY MILK LINES

☐ Check sanitary clamps, couplings and ferrules.
☐ Check inlets for proper positioning, wear and leaks.
☐ Check that hangers are tight and lines are straight.
☐ Check line slope.

F—WASHING SYSTEM

☐ Check water level adjustment.
☐ Check diversion valve.
☐ Check filter screens.
☐ Check wash rack or unit washers.
☐ Check pH and temperature of wash solution.
☐ Check air injector for operation and adjustment.

G—WEIGH DEVICE

☐ Check entire weigh device for cleanliness and function.
☐ Check all rubber parts.
☐ Check that wash deflectors are correctly positioned.
☐ Check brackets for tightness and plumb.
☐ Check that drains are correctly located and functioning.

H—AUTOMATION

☐ Consult Automation section of Service Manual (SNF-7170).

I—TRANSIENT VOLTAGE

☐ Perform stall and manger check.
☐ Perform wash vat check.
☐ Perform milk cooler check.

This is to certify that the above inspections have been performed

at ______________________________ on ______________________________
(Name of farm) (Date)

____
(Certified Dealer's Signature)

DE LAVAL

SNF-7498 8/86

Original—Return to De Laval Service Dept.
Yellow—Dealer's Copy
Pink—Dairyman's Copy

DE LAVAL Alfa-Laval Agri, Inc.
Kansas City, Missouri

Milking System Inspection Form

Name (Dairyman) ________________ Hour Meter Reading ________ Date ________

Address ________________ Dealership ________________

________________ Serviceman ________________

System Data

1. Vacuum supplier model ________.
2. Vacuum supplier motor (h.p.) ________. Voltage ________. Amperage ________.
3. Total C.F.M. at pump(s) (before service) ________ @ 15" Hg vacuum.
4. Min. C.F.M. required ________.
5. Total C.F.M. at pump(s) (after service) ________ @ 15" Hg vacuum.
6. Total C.F.M. at pump(s) ________ @ milking vacuum.
7. C.F.M. leakage ________.
8. Effective vacuum reserve ________ C.F.M.
9. Vacuum level, before service ________ after service ________.
10. Main vacuum line, size ________ material ________.
11. Pulsator vacuum line, size ________ material ________.
12. Pulsator, type ________ designed ratio ________ designed rate ________. Voltage end of line ________.
13. No. of milker units ________ claw model ________ liner model ________.
14. Type of receiver group ________ (low or high line) milk pump motor size ________. Volts ________. Amps ________.
15. Line sizes, milk ________ vacuum/wash line ________.
16. Type of weigh device ________ (Flo-Master, Weigh Jar, Waikato Meter, Mini-Meter, other).
17. Type of automation ________ (DV300$^{\text{T.M.}}$, A.R.M.$^{\text{T.M.}}$, A.R.M.$^{\text{T.M.}}$II, S.S.T.$^{\text{T.M.}}$, S.S.T.$^{\text{T.M.}}$II, Autocord$^{\text{T.M.}}$, Autoflush$^{\text{T.M.}}$, other).

System Condition	**Satisfactory**	**Corrections Req'd**		**Satisfactory**	**Corrections Req'd**
A. Vacuum System	☐	☐	E. Milk Lines	☐	☐
B. Pulsation System	☐	☐	F. Washing System	☐	☐
C. Milker Units	☐	☐	G. Weigh Devices	☐	☐
D. Receiver Group	☐	☐	H. Automation	☐	☐

Recommendations/Corrections ________________________________

hite—Dairyman's Copy, Yellow—Dealer's Copy, **Pink—Milk Plant Or Regulatory Copy**

Bou-Matic Route Service Checklist

Date ____________________

Dear ______________ As part of my route service, I have checked, cleaned, adjusted, added or replaced items as indicated.

Checklist			J	F	M	A	M	J	J	A	S	O	N	D
Vacuum System:	Pump belts	Monthly												
	Oiler	Monthly												
	Oil	Monthly												
	Vacuum setting	Monthly												
	Vacuum regulator	Monthly												
	Vacuum regulator filters	Monthly												
	Flow meter check	Annual												
Pulsation:	Clean pulsator metal cover	Monthly												
	Flush pulsator with water	6 Months												
	Record pulsator milk/rest ratio	Annual												
	Check pulsation module voltage	Annual												
Pipeline:	Clamps, fittings, gaskets, and valves	Monthly												
	Units: Air vent	Monthly												
	Hoses	Monthly												
	Inflations	Monthly												
Washing System:	Air injector	Monthly												
	Pipeline and bulk tank washer	6 Months												
	1. Run complete cycle	Annual												
	A. Record temperature wash cycle	Annual												
	B. Protecto spray cabinets	Annual												
Bulk tank:	Condensor unit	Monthly												
	Cooling temperature — record	6 Months												
	Bulk tank washer	Monthly												
	Fittings	Monthly												
Other:														
		Routeman's Initials												

Code: X — Checked
A — Adjusted
Add — Add
C — Cleaned
R — Replaced

Bou-Matic route service combined with Bou-Matic scheduled service optimizes the performance of your milking system.

Form No. 11P-70

Pipeline Scheduled Service

Name: ______________________ Date________ Job#______
Address: ______________________ Total Hours__________
Next Service Scheduled: __________________ Mo.________ Yr.

Dealer Stamp

Vacuum System

- ______ Capacity of vacuum pump(s) at inlet ______ CFM
- ______ CFM at milk receiver ______ CFM
- ______ Pulsator line capacity at far end ______ CFM
- ______ Milk line capacity at far end ______ CFM
- ______ Air reserve with units operating ______ CFM
- ______ Pump belts/couplings — wear and adjustment.
- ______ Check oil flow rate — clean and service oiler.
- ______ Service inlet — vacuum check valve.
- ______ Check and clean vacuum line drains.
- ______ Calibrate vacuum gauges with U-tube manometer
- ______ Adjust vac. regulator for 12" to 13" unit milking vacuum
- ______ Inspect stallcocks for wear, leaks, damage, electrical connections.
- ______ Check vacuum lines for cleanliness. Clean if necessary.
- ______ Inspect vacuum lines for proper slope and drainage.
- ______ Correct vacuum line air leaks.

Milk Transport System

- ______ Test milk lines for proper slope.
- ______ Inspect milk line for leaks.
- ______ Check milk valves/nipples for leaks and proper location.
- ______ Test milk pump, trap, receiver for air leaks.
- ______ Inspect pump gasket and seal for wear, alignment, leakage.
- ______ Inspect milk pump check valve and replace if worn.
- ______ Test float probe assembly for proper operation.
- ______ Check vacuum-operated drain.

Milker Units

- ______ Check rubber goods for leaks and excessive wear.
- ______ Inspect and repair shells and air forks.
- ______ Inspect and replace worn visi-nipples and gaskets.
- ______ Check and repair damaged claw nipples.

Pulsation System

- ______ Replace plunger bumpers, gaskets and clean pulsators.
- ______ Replace worn or damaged stallcock insulators and contactors.
- ______ Inspect wire for shorts.
- ______ Test output voltage of pulsation controller.
- ______ Graph each pulsator F and R with a vacuum recorder.

Electrical

- ______ Test the system for stray voltage ______ volts.
- ______ Test, inspect, clean electrical grounds.
- ______ Check and tighten screws and connections in electrical boxes.

Cleaning Equipment

- ______ Check and clean pipeline washer screens.
- ______ Check and adjust drain for efficient operation.
- ______ Inspect and spray electrical parts with moisture-repellent spray.
- ______ Tighten clamps and replace worn hoses.
- ______ Run washer through complete cycle.
- ______ Check and adjust air injector.
- ______ Current cleaning instructions posted? ______
- ______ Does the installation meet current 3-A Standards ______

Recommendations: ______________________________
____
____

Additional work requested by dairyman: ______________
____
____
____

Parts Used

Qty.	Part#	Description	Each	Total
		Total		

Serviceman ______________________________

Form No. 11R-65

PARLOR SCHEDULED SERVICE

NAME:________________________ DATE __________ JOB #__________

ADDRESS: ________________________ TOTAL HOURS __________

NEXT SERVICE SCHEDULED: ________________________MO. __________YR.

Dealer Stamp

Serviceman ________________________________

Vacuum System

________ Capacity of vacuum pump(s) at inlet ________ CFM

________ CFM at milk receiver ________ CFM

________ Pulsator line capacity at far end ________ CFM

________ Milk line capacity at far end ________ CFM

________ Air reserve with units operating ________ CFM

________ Pumps belts/couplings—wear and adjustment.

________ Check oil flow—clean and service oiler.

________ Service inlet—vacuum check valve.

________ Check and clean vacuum line drains.

________ Calibrate vacuum gauges with U-tube manometer.

________ Check vac. regulator for 12" to 13" unit milking vacuum.

________ Inspect stallcocks for wear, leaks, damage, electrical connections.

________ Check vacuum lines for cleanliness. Clean if necessary.

________ Inspect vacuum lines for proper slope and drainage.

________ Correct vacuum line air leaks.

Pulsation System

________ Replace plunger bumpers, gaskets and clean pulsators.

________ Replace worn or damaged stallcock insulators and contactors.

________ Inspect wire for shorts.

________ Test output voltage of pulsation controller.

________ Graph each pulsator F and R with a vacuum recorder.

Milk Transport System

________ Test milk lines for proper slope.

________ Inspect milk line for leaks.

________ Check milk valves/nipples for leaks and proper location.

________ Test milk pump, trap, receiver for air leaks.

________ Inspect pump gasket and seal for wear, alignment, leakage.

________ Inspect milk pump check valve and replace if worn.

________ Test float probe assembly for proper operation.

________ Check vacuum-operated drain.

Milker Units

________ Check rubber goods for leaks and excessive wear.

________ Inspect and repair shells and air forks.

________ Inspect and replace worn visi-nipples and gaskets.

________ Check and repair damaged claw nipples.

Electrical

________ Test the system for stray voltage ________ volts.

________ Test, inspect, clean electrical grounds.

________ Check and tighten screws and connections in electrical boxes.

Stalls

________ Grease gate, wand and cylinder linkages and pivots.

________ Wipe air cylinder rods with oiled cloth.

________ Drain & clean moisture traps in air system.

________ Clean and oil feeder bearings. Grease feeder gears.

Cleaning Equipment

Pipeline Washer

________ Check and clean pipeline washer screens.

________ Check and adjust drain for efficient operation.

________ Inspect and spray electrical parts with moisture-repellent spray.

________ Tighten clamps and replace worn hoses.

________ Run washer through complete cycle.

________ Check and adjust air injector.

________ Current cleaning instructions posted?________________

________ Does the installation meet current 3-A Standards________________

Cooler Washer

________ Check the water fill hoses.

________ Clean the hot and cold water strainer screens.

________ Check all hose clamp connections to see that they are tight.

________ Check the detergent and acid jar gaskets, and replace if necessary

________ Check the automatic drain valve on the pump to see that it is opening and closing fully, and that the rubber seal is not deteriorated.

Milk Cooling System

________ Clean air cooled condensors.

________ Check and/or replace anodes in Therma-Stor H.R.S.

________ Check for water leakage on Therma-Stor & Relief valve.

________ Check cooler vent placement, clean if necessary.

________ Check refrigerant charge in system.

________ Agitator Lubrication level & leakage.

If equipped with detachers see back of forr

Form No. 11P-7

Meters

________ Replace rubber parts: spade "O" ring (must lubricate), meter cover "O" ring, motor cover "O" ring, check valve.

________ Inspect rotor and meter for cleanliness and wear.

________ Inspect mounting for levelness and rigidity.

________ Check meter motor current draw. (below 150 mA)

________ Flow rate is ________ .

Flow Sensor

________ Check for cleanliness.

________ Check mounting, must be rigid and vertical

________ Check setting at board, ________ ohms.

Backflush

________ Check pivot valve for cleanliness.

________ Check "O" ring seal for wear.

________ Grease cylinders.

________ Check PPM of chemical cycle, ________ PPM.

________ Check pH of chemical cycle, ________ .

________ Check releaser and any riser drains for proper operation.

________ Inspect filters for cleanliness; water filters and screen in iodine supply.

________ Check for plumbing leaks.

Little Champs

________ Check flow sensor orifice for obstructions.

________ Check float and valve seat for leaks.

________ Clean air holes on flow sensor top.

________ Check condition of rope and cylinder.

________ Clean and lubricate rubber piston cap.

E, EP and Junior Champ detachers refer to maintenance in service manual.

Power Supply

________ Incoming voltage ________ VAC (109-132 VAC).

________ Green wire (ground) to white wire ________ VDC (9.5-13 VDC).

________ Green wire (ground) to black wire ________ VDC (23-33 VDC).

________ Voltage suppressors 130V, 47V, 18V are not damaged.

Air Supply

________ Drain air compressor and air line moisture drop.

________ Check compressor oil level.

________ Check regulator air pressure (70-80 PSI).

________ Check F-F-R, if prefilter is dirty, wash it; if coalescing filter is dirty, replace it.

________ Check milk valve hoses — replace if not sound.

________ Check for air leaks.

Detachers

________ End of milk delay is ________ seconds.

________ Grease arm pivots on 2100 and forward positioning cam on 2700.

________ Inspect chain and chain path for wear.

________ Lubricate chain and cylinder ram.

________ Check smoothness of retract; adjust speed if necessary.

________ Check friction clutch adjustment.

________ Function test detacher with System 2000 Test Module.

PARTICIPANT'S NOTES -- Session 4a

SUMMARY

Objective: Practice of mastitis problem solving and tactical planning with a second case study prepares you to work on your own herd situation.

Summary of Activities/Exercises (time)

1. **Review Mastitis Problem Solving Scheme (5 min)**
   You become reacquainted with the mastitis problem solving scheme to be used in identifying and diagnosing mastitis problems in the case study and for your own farm situation.

2. **Presentation of Case Study #2 Data (20 min)**
   With another case study example, you practice evaluating farm information used to identify, diagnose and solve mastitis problems.

3. **Develop Tactical Plans for Case Study (60 min)**
   In small groups, you practice the thought process for developing detailed tactical plans for operations and management using the case study situation. This is rehearsal of skills to be used for your own farm situation.

4. **Own Farm Economic Evaluation (15 min)**
   A spreadsheet prepared from information you supplied on the course registration form is an incentive to encourage you to put your mastitis control program under management.

MILK QUALITY -- Session 4a

ACTIVITY 1

Review Mastitis Problem Solving Scheme

I. Learning Goal of this Activity

1. To become proficient with using DHI Records, bacteriological culture results, and the QMPS Farm Survey information to identify and diagnose a mastitis problem.

II. Key Points

1. Information on somatic cell status in the herd, bacteriological cultures and management of housing, milking and milking equipment is needed in order to identify and diagnose mastitis problems.

2. Possible effective solutions differ in contagious and environmental mastitis situations.

III. Personal Notes:

MILK QUALITY -- Session 4a

ACTIVITY 2

Presentation of Case Study #2 Data

I. Learning Goals of this Activity

1. Remind you of the type of information needed to identify and diagnose mastitis problems.
2. Acquaint you with the printout of the Econmast spreadsheet for an economic analysis of a herd's mastitis situation.

II. Key Points

1. Information on herd somatic cell count, number of clinical cases of mastitis, and bacteriological cultures are needed to identify and diagnose a mastitis problem.

III. Personal Notes:

HI 502 1/89

PAGE 1

Case Farm #2

DHI SOMATIC CELL EVALUATION REPORTS

I. HERD SUMMARY

UR0208

DATE SAMPLED 11/23/88

DATE MAILED 12/01/88

SAMPLE DATES	HERD AVG LS
11/23/88	5.1
10/26/88	4.9
9/30/88	3.8
8/26/88	3.5
7/01/88	3.5
6/27/88	3.4
5/31/88	3.3
4/26/88	2.4
3/31/88	3.6
3/01/88	4.0

DISTRIBUTION OF COWS BY LINEAR SCORE

<3		3		4		5		6		>6	
NO.	PCT.	NO.	PCT.	NO.	PCT.	NO.	PCT.	NO.	PCT.	NO.	PCT.
8	8	11	11	23	23	19	19	18	18	21	21
10	10	13	12	22	21	20	20	16	17	19	20
17	17	14	14	20	20	18	18	13	13	18	18
22	25	18	20	29	32	16	17	3	4	2	2
25	29	19	22	22	26	11	13	3	4	6	7
26	30	24	28	14	16	10	12	4	5	8	9
22	25	28	31	15	17	17	19	4	5	3	3
25	24	27	25	24	23	11	12	7	7	9	9
29	29	20	20	23	23	12	12	5	5	11	11
18	17	19	17	23	21	18	16	10	9	20	18

ESTIMATED INFECTIONS

NEW		CHRONIC	
NO.	PCT.	NO.	PCT.
31	31	10	10
27	26	11	11
27	27	7	7
17	17	4	4
17	20	3	4
16	18	6	7
14	16	10	11
14	14	13	13
18	18	18	18
22	20	19	18

100 LBS MILK LOST HERD/30 DAYS
121
120
70
57
50
48
46
16
59
88

LINEAR SCORE DISTRIBUTION BY LACTATION NUMBER AND STAGE

PREVIOUS SAMPLE

	-EARLY- 27			-MID- 45			-LATE- 32			
LAC. NO.	NO. COWS	LS. AVG.	LS 5+ PCT.	NO. COWS	LS. AVG.	LS 5+ PCT.	NO. COWS	LS. AVG.	LS 5+ PCT.	AVG. LS.
1	6	5.2	50	16	4.6	41	9	4.4		4.7
2	8	5.5	30	10	5.0	27	8	4.9		5.1
3+	13	4.8	37	19	4.7	24	15	4.6		4.7
Average		5.2			4.8			4.7		

CURRENT SAMPLE

-EARLY- 26			-MID- 44			-LATE- 30			
NO. COWS	LS. AVG.	LS 5+ PCT.	NO. COWS	LS. AVG.	LS 5+ PCT.	NO. COWS	LS. AVG.	LS 5+ PCT.	AVG. LS.
7	5.8	52	12	5.0	40	8	4.9	42	5.4
6	5.7	42	10	3.8	19	4	5.1	38	5.0
13	5.1	30	22	4.4	22	18	4.6	18	4.6
Average	5.5			4.6			4.9		5.1

302 10-88

PAGE 1

CASE FARM #2

DHI SOMATIC CELL
EVALUATION REPORTS

II. HIGH LINEAR SCORE COWS

1208

DATE SAMPLED
11-23-88
DATE MAILED
12-01-88

COW CCN	BARN NAME	LACT. NO.	DAYS IN MILK	MILK LBS.	305 DAY ME MILK PROJ.	DAYS SINCE LAST BRED	LINEAR SCORES CURR S.D.	LAST S.D.	CURR LACT. AVG	LAST LACT. AVG	PERCENT OF HERD SCC	REMARKS
12	14	6	12	51			9.3	DRY	9.3	2.0	7	
126	303	7	72	47			9.3	6.2	6.7	4.5	7	
60	100	8	167	0	22,879	17	9.2	1.4	3.1	3.9	-	
185	347	2	136	41	16,425	76	9.2	2.0	3.7	NA	5	
72	130	7	312	0	23,924	144	9.1	4.8	5.0	NA	-	
155	341	6	177	24	12,299	7	9.0	3.2	4.5	NA	3	
217	106	2	49	53			8.9	8.4	8.7	4.3	6	
79	141	3	251	26	16,536	197	8.8	3.1	4.1	NA	3	
34	53	7	185	37	14,897	1	8.7	6.9	6.5	NA	4	
62	104	3	7	47			8.7	DRY	8.7	3.8	5	
162	354	2	52	0			8.7	6.1	7.4	4.7	-	
49	82	5	177	49	18,555	7	8.4	7.9	6.2	6.6	4	
135	316	2	69	57			8.4	3.1	4.4	2.4	4	
250	116	1	17	24			8.3	NA	8.3	NA	2	
171	365	8	59	47		14	8.1	5.2	6.7	5.4	3	
150	333	2	23	39			8.0	DRY	8.0	3.8	2	
8	8	2	219	22	13,890	129	7.6	2.6	2.6	NA	1	
186	311	3	131	43	15,247	39	7.6	3.2	4.6	NA	2	
226	123	3	52	61			7.5	4.2	5.9	3.6	2	
200	45	4	251	47	20,602	86	7.4	8.7	4.8	3.9	2	
17	24	5	130	49	17,438	27	7.3	1.9	3.7	6.4	2	

DHI SOMATIC CELL EVA ATION REPORTS

II. HIGH LINEAR SCORE COWS

COW CCN	BARN NAME	LACT. NO.	DAYS IN MILK	MILK LBS.	305 DAY ME MILK PROJ.	DAYS SINCE LAST BRED	LINEAR SCORES CURR S.D.	LAST S.D.	CURR LACT. AVG	LAST LACT. AVG	PERCENT OF HERD SCC	REMARKS
216	105	3	29	51			7.3	DRY	7.3	4.9	2	
247	41	1	43	47			7.1	6.7	6.9	NA	1	
87	153	2	121	43	14,524	13	7.1	3.5	4.2	1.4	1	
165	357	3	236	47		101	7.1	6.0	5.9	NA	1	
238	154	3	30	67			7.0	TFT	7.0	2.7	2	
46	74	7	303	12	17,619	6	6.9	5.2	5.4	NA	-	
27	44	3	282	24	17,319	150	6.8	3.0	3.3	NA	1	
2	2	3	219	39	14,320	11	6.7	3.1	4.0	NA	1	
69	124	4	356	8	10,680	173	6.7	4.2	4.5	NA	-	
123	17	1	172	32	13,951	100	6.6	3.7	4.9	NA	1	
59	99	2	180	26	17,278	39	6.6	5.3	5.6	4.5	1	
90	160	2	304	26	17,941	227	6.6	3.9	5.0	NA	1	
244	21	1	70	39			6.4	4.7	4.5	NA	1	
187	345	5	133	47	15,236	1	6.1	3.1	4.9	NA	1	
4	4	3	267	10	14,456	33	6.0	5.2	4.8	NA	-	
77	138	4	306	34		49	6.0	7.1	6.2	NA	1	
213	98	1	247	28	21,602	7	5.9	3.7	2.1	NA	-	
80	142	4	249	22	13,718	145	5.9	4.5	4.2	NA	-	
11	13	6	408	20	13,152	210	5.8	4.9	4.1	NA	-	
20	33	7	137	57	18,920	43	5.8	8.3	3.9	3.7	1	
231	136	5	16	20			5.8	DRY	5.8	4.5		
129	306	2	164	20	10,341	123	5.8	4.6	4.5	NA		
253	372	1	7	30			5.8	NA	5.8	NA		

502 10/88

PAGE
3

DHI SOMATIC CELL EV ATION REPORTS

II. HIGH LINEAR SCORE COWS

COW CCN	BARN NAME	LACT. NO.	DAYS IN MILK	MILK LBS.	305 DAY ME MILK PROJ.	DAYS SINCE LAST BRED	LINEAR SCORES CURR S.D.	LAST S.D.	CURR LACT. AVG	LAST LACT. AVG	PERCENT OF HERD SCC	REMARKS
195	28	2	252	16	18,560	142	5.7	3.4	2.1	2.3	-	
164	356	3	79	71			5.6	2.7	4.2	5.9	1	
53	88	3	110	53	17,665	13	5.5	5.4	4.9	3.5	1	
215	103	3	63	53		13	5.5	2.0	3.4	2.2	1	
101	181	3	219	37	14,731	147	5.5	3.0	2.6	NA	-	
112	199	2	64	81			5.5	1.7	3.4	2.0	1	
65	118	6	99	39	11,608	12	5.3	4.5	5.3	4.9	-	
145	327	3	207	37	16,421	102	5.3	2.4	2.5	NA	-	
206	79	1	103	53	19,179	27	5.2	4.1	4.7	NA	-	
63	112	8	207	28	15,101	77	5.2	2.6	3.1	NA	-	
130	307	3	162	41	16,578	75	5.2	7.4	4.9	NA	-	
117	215	6	29	49			5.1	DRY	5.1	2.8	-	
194	25	1	248	30	18,237	174	5.0	6.3	5.8	NA	-	
67	121	5	232	26	14,364	173	5.0	4.6	3.7	NA	-	
157	346	2	61	69			5.0	2.4	4.2	7.0	-	
18	29	4	140	51	18,965	72	4.9	4.0	4.1	4.1	-	
21	34	4	167	30	16,251	13	4.9	4.0	3.3	NA	-	
51	84	3	301	32	20,184	162	4.9	6.5	3.1	NA	-	
75	133	5	395	20	12,629	158	4.9	5.5	3.8	NA	-	
138	319	1	164	28	12,483	190	4.9	3.8	3.7	NA	-	
152	337	3	236	26		77	4.9	5.5	5.3	NA	-	
161	352	2	63	61			4.9	6.1	4.7	3.9	-	
249	101	1	30	37			4.8	NA	4.8	NA	-	

DHI SOMATIC CELL EVALUATION REPORTS

II. HIGH LINEAR SCORE COWS

COW CCN	BARN NAME	LACT. NO.	DAYS IN MILK	MILK LBS.	305 DAY ME MILK PROJ.	DAYS SINCE LAST BRED	LINEAR SCORES CURR S.D.	LAST S.D.	CURR LACT. AVG	LAST LACT. AVG	PERCENT OF HERD SCC	REMARKS
86	152	6	187	67	23,661	97	4.8	4.4	3.1	NA	-	
98	175	2	280	39	14,745	187	4.8	3.4	3.5	NA	-	
143	325	2	164	41	12,672	105	4.8	5.4	4.0	NA	-	
252	59	1	10	26			4.6	NA	4.6	NA	-	
212	97	1	88	24		23	4.6	4.8	3.8	NA	-	
97	174	2	299	30	18,203	143	4.6	2.1	4.2	NA	-	
133	313	3	156	43	16,965	25	4.6	3.2	4.9	NA	-	
136	317	1	164	24	10,089	98	4.6	3.9	4.3	NA	-	
166	358	2	164	30	13,036	6	4.6	3.9	4.3	NA	-	
170	364	2	242	24	12,540	4	4.6	4.0	3.9	NA	-	
172	366	2	164	18	8,971	168	4.6	4.1	4.2	NA	-	
199	43	8	144	34	14,324		4.5	2.7	3.5	2.2	-	
115	206	6	173	34	16,573	1	4.5	3.7	2.7	2.6	-	

PRODAIRY MILK QUALITY MANAGEMENT FOCUS WORKSHOP
MILK CULTURE AND CLINICAL MASTITIS RECORD
Quality Milk Promotion Services

Farm CASE FARM #2 Number of milking cows 100

Average number of cases of clinical mastitis per month over the last 6 months 3 (3% clinical)

Most recent bulk tank cell count 400,000

CULTURE RESULT

Vial	Cow ID	Clinical?	SCC	Culture Results
1	BULK TANK			Strep sp., Staph Sp.
2	201	✓		Staph. sp.
3	68	✓		Neg.
4	93	✓		E Coli
5	5	✓		Staph sp., Strep sp.
6	19	✓		Neg.
7	198	✓		Strep sp.
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				

Form #2

NEW YORK STATE MASTITIS CONTROL PROGRAM

Acc. #

ATE

WNER CASE FARm #2 ADDRESS Co.

RACTITIONER ADDRESS

Survey: Initial, Resurvey X, Research, Extension, Miscellaneous

Sample type: Quarter, Composite X, Bulk Tank only Myco only

Number cows sampled 100, Cows in herd 105 Percent sampled

SURVEY DATA:

	Cows		Quarters		Abnormal Secretions			
	No.	%	No.	%	DC	CL	FL	PUS
NEGATIVE	45	45						
1 - Strep agalactiae								
2 - Strep species	10	10						
3 - Staph aureus								
4 - Staph species	38	38						
5 - E. coli								
6 - Klebsiella								
7 - Pseudomonas								
8 - Pasteurella								
9 - Proteus								
10 - Serratia								
11 - Gram — bacillus								
12 - Yeast								
13 - Mold								
14 - Nocardia								
15 - Prototheca								
16 - C. pyogenes								
17 - C. bovis	6	6						
18 - Gram + bacillus								
19 - Others								
ABNORMAL SECRETIONS	4	4						

20 ctm.

BULK TANK: DMSCC 450,000 CULTURE 2, 4

COMMENTS:

Prepared by NYSMCP Veterinarian

SUMMARY REPORT FORM #1905

Date ____________

Person Interviewed On the Farm ____________

Technician(s) Completing Questionnaire ____________

QUALITY MILK PROMOTION SERVICES
Farm Survey and Questionnaire

Producer CASE FARM #2 Phone No. ____________

Address ____________

Vet. Practitioner ____________ Milking Times ______ AM ______ PM ______

Breed Holstein Average Annual Production/Cow 17,000 lbs.

No. Milking 100 No. Dry 5 No. Bred Heifers 15

Bulk Tank DMSCC/WMT 402,000 Herd Average L.S. ____________ SPC/PI ____________

Milk Sold 11,560 lbs for 2 days. ______ Name of Milk Plant ____________

DHI [✓ Y] N Herd Code No. ____________ SCC Service [✓ Y] N

Survey Type

☐ Initial
☒ Resurvey

☐ Required
☒ Voluntary

☒ Full
☐ Extension

MILKING SYSTEM

Overall make of System Delaval

How long ago was the original system installed 5yrs

Dealer maintain the system at least once a year? Y [✓ N]

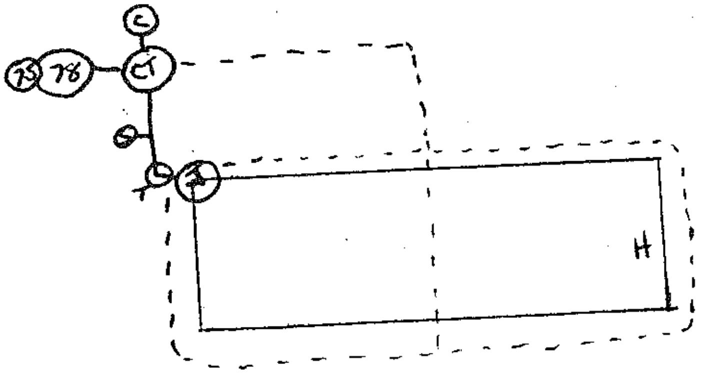
☒ Parlor
- ☐ High Line
  Maximum height ____ft
- ☒ Low Line
- ☐ Weigh Jar
- ☐ Automation
- ☐ Backflush

☐ Bucket

☐ Round the Barn Pipeline
Maximum height ____ft

SYSTEM DIAGRAM

- Controller Ⓒ
- Cushion Tank (CT)
- Receiver Jar Ⓙ
- Distribution Tank (DT)
- Vacuum Line (RED)
- Vacuum Pump ① ②
- Weigh Jar (WJ)
- High Point Ⓗ
- Trap Ⓣ



MILKING PROCEDURES

MILKING OBSERVED [✓ Y] N

UDDER PREPARATION Y N
DRY MASSAGE Y N
Individual paper towels Y N
WASHED [✓ Y] N
☒ Water alone
☐ Detergent
☐ Sanitizer
Individual paper towels Y N
Spray hose [✓ Y] N
PRE-DIP Y [✓ N]
Product used
DRIED Y [✓ N]
Individual paper towels Y N
OTHER

Average time between stimulation and milking (if observed)
☒ < 3 minutes
☐ > 3 minutes

Is the time consistent? [✓ Y] N
Examine for abnormal milk [✓ Y] N
How? strip on floor

MILKING
Units sanitized between cows Y [✓ N]
Cows machine stripped [✓ Y] N
Hose aligned [✓ Y] N

Liner Slip?

☒ FEW ☐ SOME ☐ MANY

Vacuum shut off on removal Y [✓ N]
Milking time/ cow 8 mins.
Heifers/fresh cows milked first Y [✓ N]
Problem cows milked last [✓ Y] N
with a separate unit Y [✓ N]
Cows handled gently [✓ Y] N

TEATS DIPPED [✓ Y] N
Product used Iodine .5%
How long has dipping been practiced?
☐ < 6 months ☒ > 6 months
Applied with
☒ Dipper cup
Cleaned daily [✓ Y] N
☐ Spray
☐ Hand ☐ Mechanical
Immediately after milking [✓ Y] N

Comments
milker leaves parlor
to get cows in

HEALTH AND TREATMENT

% COWS WITH:

Dirty udders	☐ <10%	☒ 11-50%	☐ >50%
Unhealthy teats	☒ <10%	☐ 11-50%	☐ >50%
Injured teats	☒ <5%	☐ 5-20%	☐ >20%

\# Clinical cases seen 3 /month
\# Cows treated 3 /month
\# Cows culled last year due to mastitis 5
\# Cows died last year due to mastitis 0

LACATING TREATMENT
Product today
☒ OVER THE COUNTER
☐ VET MIX
☐ HOME MIX
Treatment Procedure Treat 2-4 times for each case

Comments
clean with alcohol
at teat after milking

DRY COW MANAGEMENT

Are cows dry treated [✓ Y] N
☒ ALL COWS
☐ SELECTED COWS
Cows dried off abruptly [✓ Y] N
Cows treated at the last milking [✓ Y] N
How long has dry treatment been used
☐ < 6 months ☒ > 6 months
Dry Cow Treatment
Product Tommorow
☒ OVER THE COUNTER
☐ VET MIX
☐ HOME MIX
Treatment Procedure Clean with alcohol + treat at last milking

Comments
Cows are observed for
several days past
treatment

REPLACEMENTS

Closed herd [✓ Y] N
Purchase replacements Y N
☐ HEIFERS
☐ COWS
Comments Herd eradicated
Strep ag infection in
Spring '88. Then closed
herd.

VACUUM SYSTEM

Pump

Make Delaval

Model 75

Vacuum Pump a. 7.5 hp 76 cfm

b. ____ hp ____ cfm

Vacuum level tested [✓ Y] N

Milk Line 14.5 in.Hg

Pulsator Line 14.5 in.Hg

Teat end 14.0 in.Hg

Farm gauge 15 in.Hg

Reserve airflow tested? [✓ Y] N

Reserve airflow 62 cfm

Recovery time 5" Hg drop 3 sec

Observable air leaks? Y [✓ N]

Cushion tank? [✓ Y] N

Vacuum operated accessories? Y [✓ N]

- ☐ Doors
- ☐ Dumping station
- ☐ Other

Comments ____

CONTROLLER

Make Delaval

Model Servo

Number of controllers 1

Tested? [✓ Y] N

Airflow to 1/2" Hg drop 51 cfm

Meets standards? [✓ Y] N

Good location [✓ Y] N

Clean? [✓ Y] N

Vacuum over-ride Y [✓ N]

Comments ____

MILK and VACUUM LINES

Pulsator line size 2 1/2 in.

- ☒ looped
- ☐ deadended

Milk line size 2 In.

- ☒ looped
- ☐ deadended

Pitch/slope > 1"/ 10ft [✓ Y] N

Abnormalities in slope? Y [✓ N]

Pulsator line clean? (if observed) [✓ Y] N

Stall cocks leak? Y [✓ N]

Inlets in top 1/3 of line? [✓ Y] N

Comments ____

PULSATORS

Make Delaval

Model Black Cap

Type: ☐ pneumatic ☐ electric

Action ☒ single ☐ double

☐ side to side

☐ front to back

Tested? [✓ Y] N

if yes, with Detco

Pulsation rate 60 /min.

Pulsation ratio 70 : 30

____ : ____

Abnormal pulsators Y [✓ N]

Comments ____

MILKING UNITS

Number of operators 1

Total number of units 8

Greatest number of units/slope 4

Claw

Make Delaval

Model FLO-VUE

Vacuum shut off [✓ Y] N

☐ Automatic ☐ Clamp

☒ Valve ☐ Other

Inflations

Make Delaval

Model 01

Diameter ☒ Narrow ☐ Medium ☐ Wide

Type ☐ Rubber ☒ Synthetic ☐ Silicon

Collapse differential 5 in. Hg

Massage force adequate [✓ Y] N

Change inflations after 1300 I.C.M

Hose support [✓ Y] N

Comments ____

ENVIRONMENT

Housing for Lactating Cows

☐ STANCHION/TIESTALL
Platforms clean and dry Y N

☒ FREESTALL
Stalls clean and dry Y [✓ N]
Stalls maintained Y [✓ N]
Stalls adequate size [✓ Y] N
Alleys cleaned regularly [✓ Y] N

☐ LOOSE HOUSING
Clean and dry Y N
Overcrowded Y N

☐ PASTURE ____ hrs/day
☐ EXERCISE YARD ____ hrs/day
Clean and Dry Y N
VENTILATION ADEQUATE [✓ Y] N

Comments Clean stalls daily but many are dugout and hard to maintain. Heifers don't use stalls well.

Housing for Dry Cows

Housed with milking cows [✓ Y] N
☐ STANCHION/TIESTALL
☒ FREESTALL
☐ LOOSE HOUSING
☐ PASTURE
☐ OTHER
Area clean and dry? Y [✓ N]
Housing in good repair? Y [✓ N]

Comments Some stalls in need of repair - uses sawdust bedding

Bedding for Lacating Cows

Adequate [✓ Y] N
☒ SHAVINGS/SAWDUST
☐ STRAW
☐ HAY
☐ MATS
☐ SAND
☐ CLAY
☐ OTHER ____

Interval between bedding
☐ 1-2 days ☒ 3-7 days ☐ >7 days

Comments

Maternity Area

Cows separate from milking herd? Y [✓ N]
☐ PEN
☐ PASTURE
☐ STALLS
☐ OTHER
Area clean and dry [✓ Y] N

Comments Only one large calving area, periodically cleaned

FINANCIAL INFORMATION

Premium Bonus	Cell Count Level	Payment Level	Received
1	300	5 cents/cwt	Y [✓ N]
2	100	10 cents/cwt	Y [✓ N]

Comments

```
                                          TOTAL LOSSES        LOSSES ABOVE GOAL
MASTITIS ECONOMICS                        herd      cow       herd      cow       %
CASE FARM #2                             ---------------      *********************
===========================
 Subclinical mastitis milk loss          $20,668    $197      $7,186    $68       64%
                  Culling and death       $2,325     $22      $1,349    $13       12%
                 Clinical treatment       $2,600     $25      $1,781    $17       16%
               Lost quality premium         $855      $8        $855     $8        8%
                             TOTAL:      $26,448    $252     $11,171   $106      100%
                                         ---------------      *********************
17,145   Rolling herd average
   105   Total cows in the herd (lactating and dry)
     5   Cows culled in the last year due to mastitis
     0   Cows dead in the last year due to mastitis
    40   Mastitis cases treated in the last year
$1,000   Ave market price for replacement   $535  Sale price for cull cow
   $25   Ave. cost for treating a clinical case, incl. drugs & vet fee
     7   Average days milk withdrawal, including treatment days
   20%   Value of discard milk fed to calves: % of market milk's value
    2%   Goal for mastitis culling:    (%/year)  Goal for death:           0%
    1%   Goal for clinical cases of mastitis per month (% of herd/mo)
 $0.15   Quality premium ($/cwt)          4  Months last yr no premium paid

                                                      YEARLY EXPENSES
COST OF CONTROL                                       herd      cow          %
                                                      $350      $3.33       19%
*Teat dip                                             $462      $4.40       26%
*Dry cow treatment
*Monitoring and diagnosis                             $236      $2.25       13%
             DHIA SCC reporting: cost/yr
                                $35.00 Service fee
       QMPS HERD SURVEY            100 Cultures
          $2.50 Per culture            /survey
              1 Surveys/yr                            $325      $3.10       18%
            $40 Ext survey fee      12 Cult/yr        $126      $1.20        7%
         $10.50 Indiv. cult/sens.
*Milking machine checks              2 Chks/yr        $300      $2.86       17%
           $150 Cost per check                          $0      $0.00        0%
*Hygiene        Paper towels                            $0      $0.00        0%
                Water sanitizer                         $0      $0.00        0%
*Other                                                  $0      $0.00        0%
                                                    ------------------------------
                                  TOTAL             $1,799     $17.14      100%
*************************************************************************************
PROFIT FROM CURRENT LEVEL OF MASTITIS CONTROL:        Cows in herd:       105

Assume loss of     $350  per cow per year without any control program.

Potential loss   $36,750  |  AVOIDABLE LOSSES     herd        cow         %
Actual loss      $26,448  |  ***************  ***************************
                 -------- |  Subclinical loss   $7,186       $68        64%
                          |  Culling & death    $1,349       $13        12%
Loss avoided     $10,302  |  Treatment          $1,781       $17        16%
Cost of control   $1,799  |  Lost quality         $855        $8         8%
                 -------- |  premium
CONTROL PROFIT    $8,502  |                   ----------------------------
                 *********|  PROFIT AVAILABLE: $11,171      $106       100%
PROFIT ON INVESTMENT      |  ******************************************
IN CONTROL          473%  |
```

```
LOST MILK PRODUCTION DUE TO SUBCLINICAL MASTITIS:
CASE FARM #2                      MILK PRICE/CWT  $12.50
                SSC SCORE--GOALS VS ACTUAL              LOSSES PER DAY
lbs.         *******************************     ***********************
loss/day     CODE   goal %        %      cows     lbs.     total     >goal
     0         1        0%       0%        0        0      $0.00     $0.00
     0         2       10%       8%        8        0      $0.00     $0.00
   1.5         3       30%      11%       11       17      $2.06   ($3.56)
     3         4       30%      23%       23       69      $8.63   ($2.62)
   4.5         5       20%      19%       19       86     $10.69   ($0.56)
     6         6        5%      18%       18      108     $13.50     $9.75
   7.5         7        3%      10%       10       75      $9.38     $6.56
     9         8        2%       6%        6       54      $6.75     $4.50
     9         9        0%       5%        5       45      $5.63     $5.63
              ---     ----               ---      ---     ------    ------
 AVG SCORE    5.1     100%  TOTALS:      100      453     $56.63    $19.69
 GOAL AVG.    4.0         NOTE: IF DHI SCC NOT AVAIL., TYPE "ALT C".
                                       total            over goal
         HERD LOSSES PER MONTH:       $1,722              $599
         HERD LOSSES PER YEAR:       $20,668            $7,186
```

MASTITIS PROBLEM DIAGNOSIS SHEET--DETERMINING PRIORITY OF ACTION

	Contag.	Environ.	Low Masti.
If bulk tank SCC <250,000 0 0 1 >250,000 1 1 0			
If bulk tank cultures Strep ag. and/or Staph aureus 1 0 0			
If DHI estimated infections >15% New 1 1 0			
If DHI estimated infections >15% Chronic 1 0 0			
If DHI estimated infections <15% (New + Chronic) 0 0 1			
If clinical cases <2% per month 0 0 1			
If clinical cases >2% per month and Bacteriological culture Strep ag. and/or Staph aureus 1 0 0			
If clinical cases >2% per month and Bacteriological culture Strep sp., Staph sp. and/or coliforms 0 1 0			
If high SCC cows culture Strep ag., Spaph aureus, and/or C. bovis 1 0 0			
If high SCC cows culture Staph sp. 1 1 0			
If high SCC cows culture Strep sp., coliforms, and/or other bacteria 0 1 0			
If whole herd culture shows >0% Strep ag., >5% Staph aureus, and/or >10% C. bovis 1 0 0			
If whole herd culture shows >10% Staph sp. 1 1 0			
If whole herd culture shows >10% Strep sp., >2% coliforms, and/or >5% other bacteria 0 1 0			
If whole herd culture shows less than above % of each bacteria listed 0 0 1			

MILK QUALITY -- Session 4a

ACTIVITY 3

Develop Tactical Plans for Case Study

I. Learning Goals of this Activity

1. To practice brainstorming solutions, identifying criteria for evaluation and the decision making process while working through the case study example.

2. To further learn the thought process behind the formation of operational and management tactical plans.

II. Key Points

1. Identifying solutions for a mastitis problem must meet the personal criteria of the manager.

2. Tactical planning involves an intricate thought process. This skill can be learned and must be practiced.

III. Personal Notes:

OWN FARM WORKSHEET - DECISION MAKING GRID

Problem: High incidence of
Environmental Mastitis

Ratings: 3 = Good rating for criterion
2 = Fair rating for criterion
1 = Poor rating for criterion

Alternatives Rating Criteria						
(Totals) ---->						
Ranking ----> (Order 1 to 6)						

OPERATIONS PLAN

OWN FARM WORKSHEET - TACTICAL PLAN for: Lower Environ. Mastitis
(Opportunity Area)

Goal: Reduce incidence of mastitis to 1 case/mo.; ave DHI LS < 4.5 within 3 months

What task or activity is to be done?	Who is responsible?	How and/or where should the task be done?	When to perform task or activity (deadline, frequency, under what conditions)
Sanitize and dry teats thoroughly	Tim	Sanitizer in wash water Individual paper towels	Every milking
Refill freestall base	me + Allen	Fill holes with clay, level and tamp	All stalls by end of 2 weeks

MANAGEMENT PLAN

OWN FARM WORKSHEET - TACTICAL PLAN for: Directing
(Opportunity Area)

Goal: Everyone aware of goals and plan to improve herd Somatic cells by Wednesday

What task or activity is to be done?	Who is respon-sible?	How and/or where should the task be done?	When to perform task or activity (deadline, frequency, under what conditions)
meeting of farm crew	me	House (tell Peg!!)	Lunch meeting on Tuesday
Improve milkers habits and knowledge	Tim & Allen	Extension's milking video	viewed on Wed after Lunch Discuss.

MANAGEMENT PLAN

OWN FARM WORKSHEET - TACTICAL PLAN for: Planning
(Opportunity Area)

Goal: All supplies to implement operational plan by Friday.

What task or activity is to be done?	Who is responsible?	How and/or where should the task be done?	When to perform task or activity (deadline, frequency, under what conditions)
Purchase sanitizer, Paper towels and dispenser.	me	Estimate Amount for 3 months. Price thru dealer	Phone calls - Monday Install by wednesday

CONTROL PLAN

CONTROLLING

is measuring and reporting actual performance at prescribed intervals, comparing that performance to set standards, and taking appropriate corrective action when events are not conforming to plans.

Plan for Controlling: Clinical Mastitis Cases

Input or Output to Monitor	Number of cows treated for mastitis
Monitoring Procedure including measuring, reporting and (who)	Design treatment form to be placed on clip board in parlor
Monitoring Time Interval	End of each month
Control Standards	1 case / month average
Corrective Actions to Bring System Back to Standard	Consult with vet, extension on problem

CONTROL PLAN

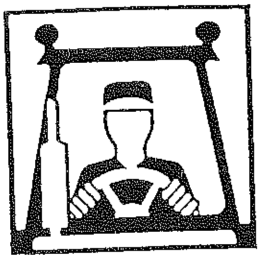
CONTROLLING

is measuring and reporting actual performance at prescribed intervals, comparing that performance to set standards, and taking appropriate corrective action when events are not conforming to plans.

Plan for Controlling: Freestall MAintenance

Input or Output to Monitor	Number of dirty udders entering the parlor
Monitoring Procedure including measuring, reporting and (who)	
Monitoring Time Interval	
Control Standards	
Corrective Actions to Bring System Back to Standard	

CONTROL PLAN



CONTROLLING

is measuring and reporting actual performance at prescribed intervals, comparing that performance to set standards, and taking appropriate corrective action when events are not conforming to plans.

Plan for Controlling: Freestall MAintenance

Input or Output to Monitor	Amount of bedding in stalls; stall use; number of cows lying in the alley
Monitoring Procedure including measuring, reporting and (who)	
Monitoring Time Interval	
Control Standards	
Corrective Actions to Bring System Back to Standard	

MILK QUALITY -- Session 4a

ACTIVITY 4

Own Farm Economic Evaluation

I. Learning Goals of this Activity

1. To show an economic evaluation of the your farm's current mastitis situation.
2. Demonstrate that the money spent on the current mastitis control program is a sound investment.
3. To have you realize that further planning and controlling in your mastitis control program has potential to return profit.

II. Key Points

1. If a farm is not meeting its goals in mastitis control there is probably money to be made in further management for high milk quality.
2. Losses from subclinical mastitis is the majority of loss profits due to mastitis.
3. Money spent on mastitis control has a high rate of return.

III. Personal Notes:

PARTICIPANT'S NOTES -- Session 4b

SUMMARY

Objective: Using knowledge and skills learned in this course, you formulate tactical plans for improving milk quality on your farms.

Summary of activities/exercises (time)

1. **Own Farm Analysis (60 min)**
   In small groups, you help each other to diagnose priorities and brainstorm possible effective solutions for each other's milk quality situation. Goal setting and development of tactics may require an individual effort.

2. **Sharing Examples of Tactical Plans (30 min)**
   Several participants present results of their planning for improved milk quality on their farms.

3. **Fiscal Evaluation of Tactical Plans (30 min)**
   With a spreadsheet, you can have the estimated costs of implementing your tactical plans for improving milk quality evaluated.

MILK QUALITY - Session 4b

ACTIVITY 1

Own Farm Analysis

I. Learning Goals of this Activity

1. To diagnose and plan for implementing effective solutions to your own farm's milk quality problems.

II. Key Points

1. Small group interaction may aid in correctly identifying and diagnosing priorities in planning solutions for a farm's milk quality problems.
2. Goal setting and tactical planning may require individual effort.
3. Operational tactical plans tend to be easier to develop that the more intricate tactical plans for management.

III. Personal Notes:

MASTITIS PROBLEM DIAGNOSIS SHEET--DETERMINING PRIORITY OF ACTION

	Contag.	Environ.	Low Masti.
If bulk tank SCC <250,000 0 0 1 >250,000 1 1 0			
If bulk tank cultures Strep ag. and/or Staph aureus 1 0 0			
If DHI estimated infections >15% New 1 1 0			
If DHI estimated infections >15% Chronic 1 0 0			
If DHI estimated infections <15% (New + Chronic) 0 0 1			
If clinical cases <2% per month 0 0 1			
If clinical cases >2% per month and Bacteriological culture Strep ag. and/or Staph aureus 1 0 0			
If clinical cases >2% per month and Bacteriological culture Strep sp., Staph sp. and/or coliforms 0 1 0			
If high SCC cows culture Strep ag., Spaph aureus, and/or C. bovis 1 0 0			
If high SCC cows culture Staph sp. 1 1 0			
If high SCC cows culture Strep sp., coliforms, and/or other bacteria 0 1 0			
If whole herd culture shows >0% Strep ag., >5% Staph aureus, and/or >10% C. bovis 1 0 0			
If whole herd culture shows >10% Staph sp. 1 1 0			
If whole herd culture shows >10% Strep sp., >2% coliforms, and/or >5% other bacteria 0 1 0			
If whole herd culture shows less than above % of each bacteria listed 0 0 1			
Priority Total			

WS

OWN FARM WORKSHEET - DECISION MAKING GRID

Ratings: 3 = Good rating for criterion
2 = Fair rating for criterion
1 = Poor rating for criterion

Problem: ______________________________

____

Alternatives Rating Criteria						
(Totals) ---->						
Ranking ----> (Order 1 to 6)						

OWN FARM WORKSHEET - TACTICAL PLAN for: ______________________________
(Opportunity Area)

Goal: ______________________________

____

What task or activity is to be done?	Who is responsible?	How and/or where should the task be done?	When to perform task or activity (deadline, frequency, under what conditions)

OPERATIONS PLAN

OWN FARM WORKSHEET - TACTICAL PLAN for: ______________________________
(Opportunity Area)

Goal: ______________________________

____

What task or activity is to be done?	Who is responsible?	How and/or where should the task be done?	When to perform task or activity (deadline, frequency, under what conditions)

MANAGEMENT PLAN

OWN FARM WORKSHEET - TACTICAL PLAN for: ______________________
(Opportunity Area)

Goal: ______________________

____

What task or activity is to be done?	Who is responsible?	How and/or where should the task be done?	When to perform task or activity (deadline, frequency, under what conditions)

MANAGEMENT PLAN

OWN FARM WORKSHEET - TACTICAL PLAN for: ______________________
(Opportunity Area)

Goal: ______________________

____

What task or activity is to be done?	Who is responsible?	How and/or where should the task be done?	When to perform task or activity (deadline, frequency, under what conditions)

MANAGEMENT PLAN

OWN FARM WORKSHEET - TACTICAL PLAN for: ______________________
(Opportunity Area)

Goal: ______________________

What task or activity is to be done?	Who is respon-sible?	How and/or where should the task be done?	When to perform task or activity (deadline, frequency, under what conditions)

CONTROL PLAN

CONTROLLING

is measuring and reporting actual performance at prescribed intervals, comparing that performance to set standards, and taking appropriate corrective action when events are not conforming to plans.

Plan for Controlling: ______________________

Input or Output to Monitor	
Monitoring Procedure including measuring, reporting and (who)	
Monitoring Time Interval	
Control Standards	
Corrective Actions to Bring System Back to Standard	

CONTROL PLAN

CONTROLLING

is measuring and reporting actual performance at prescribed intervals, comparing that performance to set standards, and taking appropriate corrective action when events are not conforming to plans.

Plan for Controlling: ______________________________

Input or Output to Monitor	
Monitoring Procedure including measuring, reporting and (who)	
Monitoring Time Interval	
Control Standards	
Corrective Actions to Bring System Back to Standard	

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MILK QUALITY - Session 4b

ACTIVITY 2

Sharing Examples of Tactical Plans

I. Learning Goals of this Activity

1. Demonstrate how different participants plan to achieve the common goal of improving milk quality on their farms.

II. Key Points

1. Mastitis problems may be common to all participants, but individual ways of planning to solve these problems may differ.
2. Having others question your thought process generates higher levels of thinking that can improve one's planning abilities.

III. Personal Notes:

MILK QUALITY - Session 4b

ACTIVITY 3

Fiscal Evaluation of Tactical Plans

I. Learning Goals of this Activity

1. Provide you an estimate of return on the costs required to implement the tactical plans for meeting goals in mastitis control.

II. Key Points

1. Most improvements designed to reduce mastitis and increase milk quality are sound investments.
2. All farms should strive for a level of mastitis control that is realistically within its resources.

III. Personal Notes:

Participant: ____________________

ADDITIONAL COSTS OF IMPLEMENTING A TACTICAL PLAN FOR MILK QUALITY

	YEARLY EXPENSE	
	HERD	PER COW
SUPPLIES (dips, liners, sanitizers, etc.)		
____________________	________	________
____________________	________	________
____________________	________	________
____________________	________	________
____________________	________	________
MATERIALS (equipment, facilities, etc.)		
____________________	________	________
____________________	________	________
____________________	________	________
____________________	________	________
SERVICE (b. cultures, maintenance, etc.)		
____________________	________	________
____________________	________	________
____________________	________	________
LABOR (technical choretime)		
____________________	________	________
____________________	________	________
____________________	________	________
____________________	________	________
____________________	________	________