

Missouri State Milk Board

Missouri Bulk Milk Hauler-Sampler's Manual

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The Missouri Farm Bulk Milk Hauler-Sampler's Manual

Purpose

The purpose of this manual is to provide farm bulk milk hauler-samplers with the proper techniques, principles, and procedures to use on the job. It will also serve to refresh an experienced hauler with the techniques and principles required by the dairy industry.

Uniform methods are essential in agitating, weighing, sampling and the pickup of farm bulk milk to assure the producer, plant manager and quality control personnel that everyone concerned is being treated equally and fairly.

Introduction

The quality of milk delivered to the plant depends on how well the hauler identifies and eliminates all unsatisfactory milk before pumping it into the tank truck. The interval between pickups should never be longer than four days for manufacturing grade milk.

The licensed bulk milk hauler is more than a truck driver. He/she is frequently the judge of acceptable milk quality before it leaves the farm. He/she determines the amount of milk purchased and collects official samples for laboratory examination and payment. This places a great responsibility on the bulk hauler, as he/she must check the odor and appearance of the milk. He/she must also use accurate and proper procedures in measuring and sampling the milk.

Sampling and measuring milk are important duties to insure a fair and accurate transaction between the producer and buyer. Milk must always be measured accurately and a true sample obtained allowing quality and composition tests to correctly represent the contents of the farm bulk tank. If proper procedures are not strictly followed and an error in evaluation occurs, the milk may have been improperly accepted or rejected. Such an error will likely cause an economic loss for either the producer or the plant.

If there is more than one bulk milk tank located on the farm, each tank should be separately sampled, measured, and checked for odor and appearance. When a bulk tank is in use no milk shall be stored or picked up in cans.

Licensing

Only a licensed bulk milk hauler (full time, part-time or relief) can grade, sample, measure and pump milk from a farm bulk tank and deliver the milk to a dairy plant, receiving station or transfer station. In the event no licensed bulk milk hauler is available to run the route, a licensed

fieldman or licensed tester/grader/sampler must accompany the truck to take measurements and samples.

The valid bulk milk hauler license shall be kept in the hauler's place of employment or in the office where he/she most frequently delivers milk. This license shall be available for inspection upon the request of an authorized official. The hauler will also receive a wallet-sized, numbered identification card to certify his/her right to sample milk. This card shall be carried with the bulk milk hauler on the job at all times.

In Missouri, a bulk milk truck operator who picks up milk from Missouri producers must be licensed by the Missouri State Milk Board. Upon satisfactory completion of the bulk milk hauler's examination and application and payment of the license fees, a temporary hauler's license shall be issued. At the first opportunity, the temporary hauler must attend a hauler's training course to qualify for a permanent license.

The bulk milk hauler license shall be renewable yearly. It is highly recommended that every licensed hauler attend a licensing session once every five years as a refresher course. In addition to the hauler's license, a permit to haul Grade A milk is required by the Missouri State Milk Board.

Definition of Terms

1. **Farm Bulk Milk Hauler** – A licensed person who grades, samples and measures milk in a farm bulk tank; pumps milk from the tank and delivers the milk to a dairy plant, receiving station or transfer station.
2. **Milk** – The normal lacteal secretion, practically free from colostrums, obtained by the complete milking of one or more healthy cows or goats.
3. **Producer** – The person or persons who exercise the control over the production of milk delivered to a processing plant or receiving station, and those who receive payment for this product.
4. **Dairy Farm** – A place or premise where one or more milking cows or goats are kept with a part or the entire milk product delivered, sold or offered for sale to a plant.
5. **Farm Bulk Tank** – The tank located on a dairy farm in which properly cooled raw milk is stored prior to collection by a bulk milk hauler.

Appearance of the Hauler

The bulk milk hauler is a handler of human food. The hauler's appearance and sanitary habits should reflect this role. A clean, neat appearance and good personal habits create an image vital

to the dairy industry and establishes confidence in the hauler's ability to do his/her job. Cleanliness is very important.

A clean outward appearance of the bulk truck establishes confidence in the hauler's ability to handle a food product. The bulk tank truck must be of sanitary design and construction. The tank should meet the requirements of the 3-A Standard for farm pickup service.

Checklist Prior to Starting on the Route

A hauler must have certain supplies and equipment to satisfactorily perform the requirements of measuring, sampling, pumping, and transporting the milk. Before starting the route, ensure the following:

1. The tank truck and transfer equipment has been properly washed and sanitized. The job of cleaning and sanitizing the tank and/or pump of the farm bulk milk truck may lie with a plant employee. However, it is the *bulk hauler's responsibility* to check the tank and pump to insure its sanitary condition. If the cleaning job is not done, the responsibility rests with the hauler to see that the truck is properly cleaned and sanitized before picking up any milk.
2. The most recent wash tag must be attached to the bulk milk truck. This wash tag should contain the following information:
 - a. Location the tank was cleaned and sanitized
 - b. Date and time
 - c. Signature or initials of the employee who washed and sanitized the tank
 - d. Type of sanitizer used
 - e. Statement that this tag must not be removed until the tank is re-cleaned
3. The following sampling equipment is present on the truck:
 - a. An adequate supply of sample containers
 - b. Sample transfer instrument
 - c. Sanitizing solution of 100-200 ppm of available chlorine, or suitable equivalent and approved test kit.
 - d. Insulated sample carrying case
 - e. Adequate ice or other refrigerant to maintain sample temperature of 32°F to 40°F
4. A dial thermometer with an adjustment for calibration which is accurate to $\pm 2^\circ$. The thermometer used must include the normal thermometer range of milk, and a dial range of 25°F to 125°F is recommended.
5. An adequate supply of sani-guide discs
6. A waterproof, indelible marker to identify samples
7. A watch or other timing device

8. Adequate supply of milk weight tickets and a pencil to record the required information
9. Single-service paper towels
10. Flashlight

Odor and Appearance of Milk

If the milk has a serious off-odor or appearance the hauler shall reject the milk. In every case, the hauler should obtain a sample of the milk and an accurate measurement of the volume in the bulk milk tank. A ticket should show time, date, measurement, and temperature of the milk and that a sample has been taken and marked “*not picked up,*” “*quality questioned,*” or a similar notation. The producer and plant should be contacted immediately so that a cause can be determined and corrected.

Any slight change in quality of milk should be immediately brought to the attention of the producer and the milk plant by making an appropriate comment on the producer’s milk weight ticket. This warning may often be the earliest indication of problems at the dairy.

The most important factor in consumer acceptance of dairy products is flavor. Milk flavor control must begin at the farm.

It is important that the hauler not taste the milk for off-flavors because of potential health problems caused by raw milk. Nevertheless, a hauler should realize that off-flavors in raw milk invariably show up as off-odors and if off-odors are detected by the hauler, off-flavors are also present.

Normal milk has virtually no odor. The hauler should have a firm impression as to what constitutes normal milk so that he/she can judge the milk collected with confidence.

Some of the more common off-odors and possible causes are:

1. **Feed.** The feed a cow eats may impart certain odors to milk. Some stronger feeds will carry through more noticeably than others. Odors resembling green grass, silage, turnips and alfalfa hay are outstanding examples. Feed odor can be minimized or eliminated by taking cows off offending feeds at least four hours before milking. Certain feeds can be detected in milk if fed to the cow as little as 15 to 30 minutes before milking.
2. **Barny.** This odor is caused by cows breathing foul air due to poor barn sanitation and ventilation. Proper ventilation, good sanitation, and proper milking procedures will correct this problem.
3. **Foreign.** Any seriously objectionable odor foreign to milk – such as sanitizers, fly spray, paint, oil, kerosene, creosote, or a medicine substance – will render the milk unacceptable

or unfit for use. Such an odor may be caused by direct contamination of the milk or it may be absorbed from the surrounding air.

Sanitizers are included in this category because the residue of sanitizers – such as hypochlorite and iodophor – if left on dairy equipment, may be absorbed by milk and impart a foreign odor. Phenolic compounds used in udder ointments may combine with iodophor or hypochlorite sanitizers to form a highly objectionable foreign odor which is detectable in a very low concentration.

4. **Garlic/Onion.** An obnoxious flavor is imparted to milk when the cow eats garlic, onion, or leeks. A garlic/onion flavor is recognized by the distinctive odor suggestive of its name. The odor may be so objectionable as to render the milk undesirable for use.
5. **Musty.** The odor is suggestive of musty or moldy hay. It may be absorbed directly by the milk but is more likely to come from feed or stagnant water consumed by the cow.
6. **Rancid.**
 - a. **Oxidative Rancidity.** Oxidized milk gives off odors usually described as cardboardy, metallic or tallow. It is usually more noticeable during the winter months when cows are on dry feed. The most frequent cause of oxidative rancidity is by contamination of milk with small amounts of copper or iron from milk contact surfaces. Milk subjected to light may also develop oxidative rancidity.
 - b. **Hydrolytic Rancidity.** Hydrolytic rancidity found in milk will give off an odor resembling spoiled nutmeats. This odor is more noticeable during winter when cows are on dry feed or during late lactation. Agitation of warm raw milk in the presence of air, causing foaming, will result in a rancid type odor within a few hours.
7. **Sour.** Sour milk will have a malty odor and will be found when milk is poorly cooled and excessive bacterial growth results. Also, it may result from bacterial growth due to insanitary milking practices and insanitary equipment. Good sound sanitary practices and prompt cooling will prevent this problem.
8. **Weedy.** The weedy odor is not included among the usual feed odors. It may include obnoxious odors resembling such plants as ragweed, bitterweed or peppergrass. Weedy odor can be eliminated or minimized by keeping cows away from weed-infested pastures or by not offering feed containing such weeds until the cow is milked.

Checking for Odors:

Odors gather just below the cover of the bulk milk tank. To properly check for off-odor, remove a small port opening, put your nose down to the opening and smell the milk. Never open the entire lid; this will let the odors escape into the air. The detection of off-odors can be affected by a number of external factors. The hauler should strive to eliminate these factors:

1. Milk house odors
2. Gasoline fumes adhering to clothing
3. Smoking immediately prior to checking for odors
4. Eating or chewing aromatic candy, tobacco, medicine, beverages, foods, etc.
5. Highly scented shaving lotion, soap and other toiletries on the hauler

Appearance

Listed below are milk quality problems which may become evident while checking for appearance. Any of these defects would be sufficient reason to reject the tank of milk.

1. **Bloody milk.** Milk from mastitic cows may contain blood. A small amount of bloody milk can give a large quantity of normal milk a reddish tinge.
2. **Flaky Milk.** Milk from cows having mastitis may show light flakiness or pronounced stringy cud particles.
3. **Extraneous Matter.** Floating extraneous matter includes such things as insects, hair, chaff and straw. The presence of extraneous matter may result from careless handling of milk, open doors, torn screens, dusty feeding conditions and improper cleaning of the udder before milking.

Other problems which may become evident while checking for appearance include frozen and partially churned milkfat. Freezing or churning prevents accurate sampling of milk. These problems, depending on their severity, may be reasons for rejecting the milk.

Checking for Appearance:

Normal milk color ranges from bluish white to golden yellow and it is free from all foreign or clotted matter. When checking the appearance of a bulk tank of milk, be sure there is adequate lighting. After checking for odors lift the lid and observe the complete, undisturbed milk surface. Any evidence of partially churned butterfat, frozen milk, or other conditions which may alter the reliability of your sample should be indicated on the sample container. Bring this to the attention of the producer and notify the fieldman that the problem(s) must be corrected.

Measuring the Milk

Milk shall be completely motionless when measurements are made. If the agitator is running when you arrive, allow agitation to continue for at least five minutes or according to tank manufacturer's recommendation; then sample before turning off the agitator.

Turn the agitator switch to “off” to be sure the agitator doesn’t start while you are measuring. Wait at least two minutes for the milk to become completely motionless. Measuring twice will ensure accuracy.

Preparation of the Measuring Stick:

The essential steps to assure an accurate measurement of milk volume are:

1. Raise stick and wipe dry with a clean, single-service paper towel. The stick does not need to be removed from the tank. It needs to be dried only from a few inches above to a few inches below the milk level in the tank.
2. Now the stick is ready to be positioned into the milk. Lower the stick slowly into the milk until it reaches a point approximately one-fourth inch from its proper position. Wait a few seconds, and then gently lower the rod until it seats itself naturally.
3. Remove the stick and read at once. The markings should be read at eye level and in a well lit area. Make at least two readings to ensure the correct weight is obtained. The measuring stick is graduated into one thirty-second of an inch. Each graduation is equivalent to a determined number of pounds of milk posted on a conversion chart specifically calibrated for each tank. The serial number of the bulk tank, measuring stick and conversion chart must be the same.

When the milk line is very near but not exactly on a specific mark, it is read as if it were exactly on the mark. When the milk line falls exactly between two marks, read to the nearest even number. It is important to always read the stick in this manner to avoid inaccurate results. Immediately record the reading on the weight ticket.

The farm bulk milk tank installation and calibration is the responsibility of the producer, under the supervision of the plant and state regulatory agency. However, the hauler should be aware of conditions that can contribute to inaccurate weight problems:

- A tank that is incorrectly calibrated
- Errors in the weight conversion chart, or serial numbers of tank, stick and chart not in agreement
- A bulk tank that is not level
- Heaving, cracking, or settling of milk house floor causing the bulk tank to shift
- Inadequate footings under the tank legs or legs not permanently set
- A weaving or distortion of the measuring stick bracket or seat

Report any discrepancies to plant fieldman and producer.

Correct Agitation Time

Adequate agitation is necessary to obtain a truly representative sample from the milk in the tank.

A general rule is five minutes of constant agitation for a 100-900 gallon tank. For a larger tank that may require agitating time exceeding five minutes, the time should be indicated on the tank by the manufacturer. If a problem arises, the fieldman should take sufficient samples to ensure that the milk in all areas of the tank is uniformly mixed in the time specified.

Temperature

The hauler must record the temperature of milk at each pickup. Temperature determinations provide useful quality control information for both the producer and the receiving plant. A metal stem thermometer must be used. The thermometer should have a stainless steel stem, an unbreakable plastic window and an external adjustment for calibration. The thermometer must include the normal range of temperature for milk. A thermometer with a range of at least 30 °F to 212°F and be accurate within plus or minus 2°F and smallest scale range of 2°F is required.

A glass, mercury thermometer is not recommended as it presents a danger to human health.

Accuracy of thermometer tested at least each 6 months with authenticity of evaluation with date and initials on the case.

Sanitize thermometer stem in 110-200 ppm chlorine, or equivalent sanitizer with minimum contact time of one minute prior to checking milk temperature.

All bulk milk tanks shall cool the milk to a blend temperature of 45°F in less than two hours. It is recommended that milk be cooled to 34°F to 40°F for maintenance of quality.

A recording thermometer on the farm bulk milk tank will provide a history of the tank's cooling ability. If the temperature readings of milk in the tank vary from the range of 34°F to 40°F the tank is not cooling properly.

Tank thermometer to be checked monthly against calibrated thermometer with date and temperature recorded on barn sheet. All temperature devices should be checked with calibrated thermometer.

A high milk temperature can be a warning that milk may have an off-odor or be high in bacteria.

Sampling Plans

The sampling of milk from a farm bulk milk tank is an important part of a hauler's responsibilities. Regardless of the sampling plan used, extreme care should be taken to obtain a representative sample of the milk.

- A. **Universal Sampling Plan.** A sampling plan that has become very popular is the Universal Sampling Plan. The true Universal Sampling Plan provides one sample that can be used for all laboratory analyses but not all analyses need necessarily be done on the same sample. This plan eliminates the need for the hauler to collect several types of samples and simplifies the sampling equipment necessary. It also enables the laboratory to monitor the producer's quality without requesting special samples from the hauler.

The producer is unable to anticipate when bacteria tests are to be run because the same size sample is removed from his tank at every pickup. The universal sample of one, two or four ounces also require less milk, so, less milk is wasted.

- B. *Sampling for a specific Test.* The laboratory will periodically request additional samples for bacteria, antibiotic, or other specific test. The laboratory will inform the hauler and the hauler is then required to sample for the test requested.
- C. *Composite sampling* for butterfat for accuracy requires that each individual sample of the composite be of the same proportion to the volume being sampled. Storage during the sampling period must be adequate to protect the quality of the sample even where a preservative is used. Spillage must be avoided.

Results of butterfat tests on fresh milk samples tend to be very slightly higher than the results of tests on composite samples. Because of difficulties of proper proportioning, storage, and preparation of sample for testing, the accuracy of a composite sample is at greater risk.

Sampling the Milk

The proper analysis of a sample is dependent upon the reliability of the sampling procedure. To be satisfactory, the sample must be representative and the sampling procedure must be done in a manner to prevent contamination of the sample.

This sampling procedure should be strictly followed:

1. Wash and dry your hands
2. Identify each sample container with the producer number, hauler initials, route number, date of pickup, time of day and temperature
3. Make sure the bulk milk tank is properly agitated (see Appendix B)
4. Be sure the sampling device is clean and has been properly sanitized in a 100-200 ppm chlorine solution or other equally suitable sanitizing solution. The sampling device should remain in the solution until it is removed to sample the milk. Do not remove the sampling device prior to entering the milk house. If the dipper is stored and maintained at the farm be sure it is clean and properly sanitized before sampling the milk.

5. Open the sample container being careful not to contaminate either the interior of the container or its cap. Contamination of the sample container will alter laboratory results and possibly reduce the producer's payment. Do not dip the sample container into the milk.
6. Rinse the sampling device three times in the milk before taking the sample being careful not to put your hands in the milk.
7. The sample container should not be held over the milk in the tank while pouring the sample. The sample container should not be filled more than three-fourths full. This will enable the laboratory to properly mix the sample before testing. Properly close the sample container making sure it is sealed correctly.
8. **Immediately** place the sample in the refrigerated sample case and maintain the sample at 32°F to 40°F until delivery. Provide a method, such as the use of racks or drainage holes in the sample case, to prevent contamination of the sample.
9. After you have sampled the milk, rinse the sample dipper with tap water and return it to the sanitizing solution.
10. Always take, and properly identify, a second sample of milk at the first stop as a temperature reference sample. All information required on routine samples is also required on this temperature sample. Upon returning to the plant, check and record the temperature of this sample when the samples are delivered.

Sani-Guide Discs

The use of sani-guide discs can emphasize the importance of clean milk. The disc will show coarse sediment (flies, hair, straw, etc.) in a bulk tank of milk.

A new sani-guide disc is placed between the bulk tank valve and the transfer hose at each pickup. When pumping of the milk is finished examine the disc and notify the producer and the fieldman if excessive visible contamination is evident on the disc.

The sani-guide disc should be left at the farm for the producer and regulatory agent to review for contamination problems.

Connection of Hose

The transfer hose should be brought into the milkroom through the hoseport. Remove the cap from the bulk tank outlet and sanitize the valve fitting before connecting the transfer hose. Then, remove the cap from the transfer hose and connect it to the bulk tank valve outlet.

Sanitizing the valve fitting is necessary if valve is visibly leaking milk.

Tank valve cap is to be stored off floor and protected from contamination.

The only time the transfer hose is not capped is during loading and cleaning. If there is any evidence of the bulk tank valve leaking notify the producer.

Pumping the Milk

To aid in the removal of butterfat that adheres to the sides of the bulk milk tank, and to help protect the plant against a fat loss due to this factor, it is a good practice to leave the agitator running until the bulk milk tank is empty.

It is important to shut off the pump as soon as possible after the bulk milk tank is empty to avoid sucking air and milk house odors into the bulk milk truck tank. When the bulk milk tank is empty, shut off the refrigeration compressor on a direct expansion tank or the water circulation pump on an ice bank tank.

Do not pick up milk during milking time. Partial pickup – picking up only part of the volume in the tank – is allowed *only* by special permission.

Disconnect the Hose and Rinse the Farm Bulk Tank

After milk is pumped from the bulk milk tank and the pump shut off, remove the hose and cap immediately. Visually check the bottom of the bulk milk tank for sediment. If sediment is excessive, make note of it and notify the producer and plant fieldman.

Be sure to detach the milk hose from the tank before rinsing the tank.

To assist the producer, rinse the interior of the bulk milk tank with warm water (approximately 110°F). This rinse will make it easier for the producer to wash the bulk milk tank. Close tank covers after rinsing to prevent the bulk milk tank from drying out and to keep out foreign material.

Rinse the floor and hose port to keep them clean and free of milk. Any milk remaining on the floor will sour and develop acid which will eventually erode the concrete.

Recording Results

To avoid error, promptly record all results. Each of the following should be included on your bulk milk receipt:

- Date of collection
- Time of pick-up
- Producer's name
- Plant number
- Milk quality – odor and appearance
- Milk temperature
- Measuring stick reading
- Converted weight (milk weight)
- Name of buyer
- Hauler's signature

Final Farm Check

Before leaving the milk house, make note of any abnormalities to report to the producer and plant fieldman. Note the general condition of the milk house, its construction and any situations which may cause contamination of the product or incorrect results in performing your job.

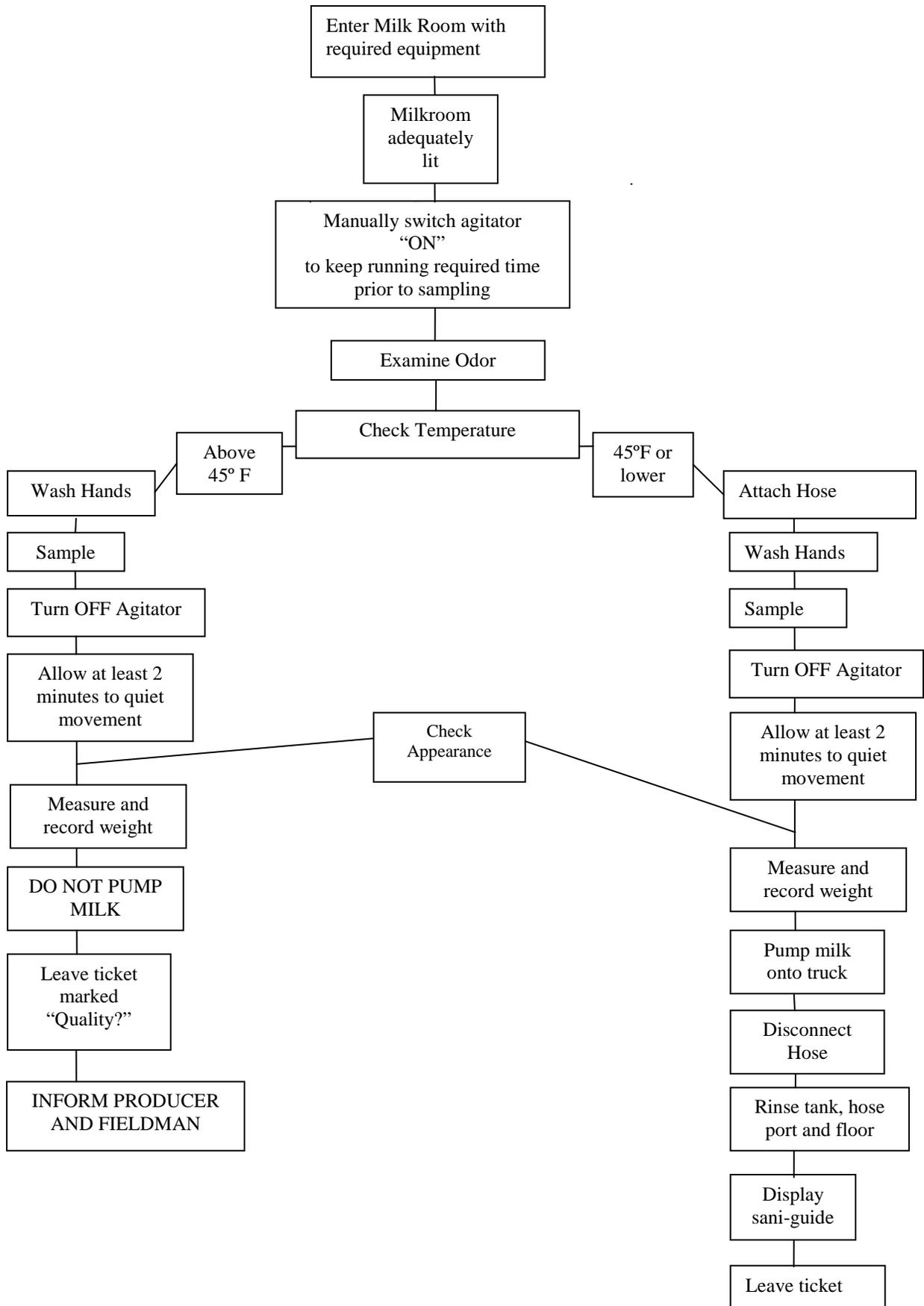
Samples shall be taken of all milk, even if it is rejected or frozen. Any off-condition milk should be noted for the laboratory.

Before you leave, make sure the milkroom is in as good or better shape than when you arrived. Rinse the floor, hang up the hose, turn out the lights and close the door.

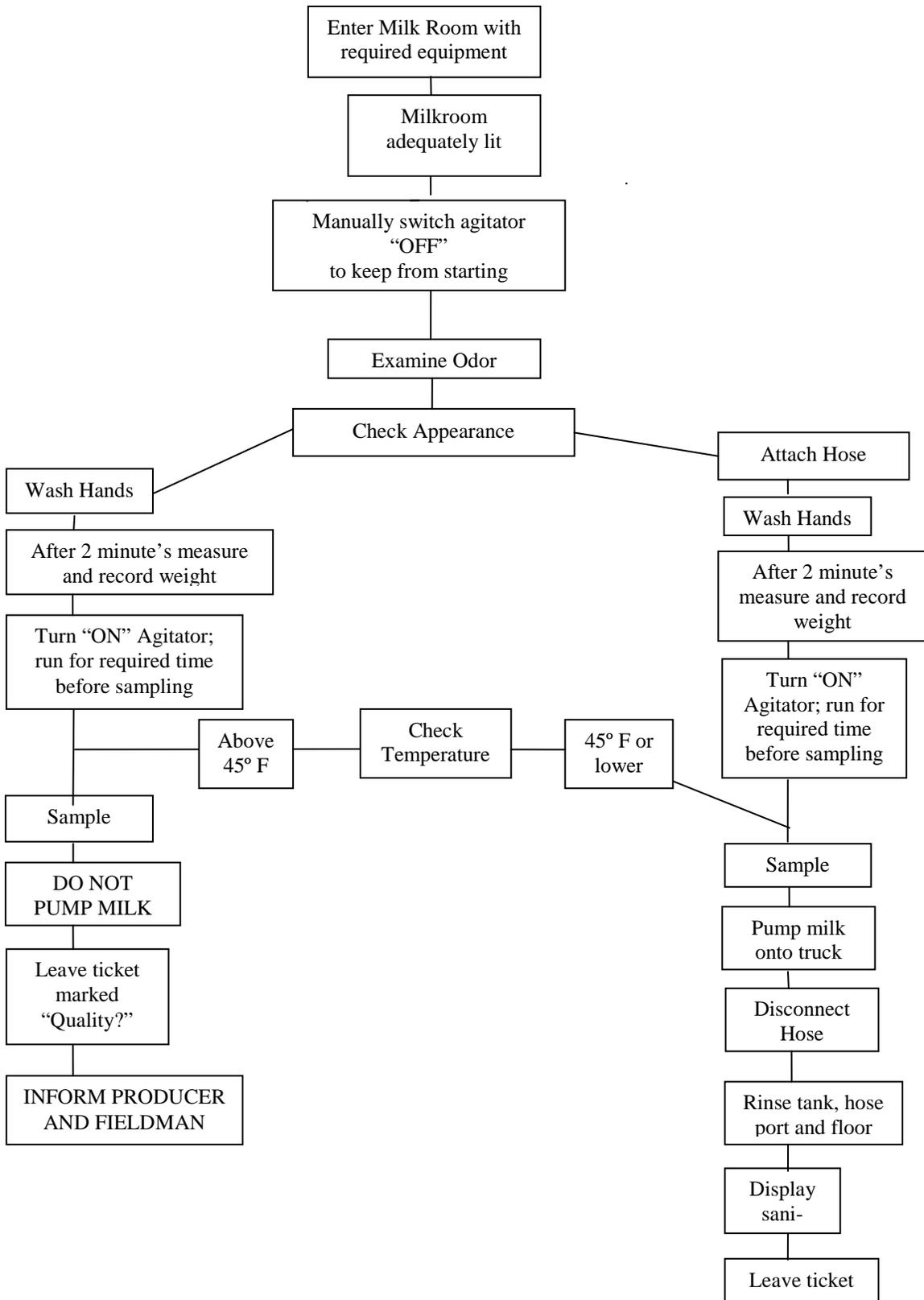
Recap of Proper Procedures

Charts A & B provided to assist you in establishing a routine. If the agitator is running when you enter the milk room, follow Chart A. If the agitator is not running when you enter the milk room, follow Chart B.

**Chart A
Milk Pickup Procedure
Agitator Running**



**Chart B
Milk Pickup Procedure
Agitator Not Running**



Composition of Milk

A general knowledge of the composition of milk will prove useful in your contact with producers. The main constituents of milk are water, protein, lactose (milk sugar) and ash.

The average composition of milk is:

Water	87.0%
Milkfat	4.0%
Lactose	5.0%
Protein	3.3%
Ash	0.7%

Variation in the percent of milkfat has the greatest effect on a producers' milk check. The bulk milk hauler must provide an adequately mixed, reliable sample for milkfat analysis. This is done by following the proper sampling procedure outlined in this manual. There are, however, some reasons for milkfat variations the hauler cannot control. These variations in milkfat are commonly due to:

- Breed of cow
- Age of cow
- Genetic potential of individual cows
- Stage of lactation
- Seasonal changes
- Udder infection
- Kind, quantity and quality of feed
- Milking procedure
- Health of cow
- Heat periods
- Excitement

Milk Quality

Dairy producers frequently ask the hauler about the quality tests performed by the laboratory. The following summary will help you explain the reasons for the tests and your responsibility as the official sampler.

A. Bacteria Count

Bacteria are microscopic, one-celled organisms which are found on and in all living animals, in the soil, water, ponds, and even wells. Manure, flies, insects, rodents, utensils and equipment are sources of many types of bacteria. Because of the widespread presence of bacteria, contamination of equipment which comes in contact with milk must be avoided.

The amount and kind of bacteria found in a sample of milk is an indication of the sanitary conditions and practices occurring on the farm and the extent of milk cooling. Contamination can occur when measuring, sampling, and transferring milk. Therefore, extreme care must be taken by the hauler to prevent contamination.

B. Inhibitor Test

The presence of antibiotic residues can cause violent allergic reactions in some individuals. These residues are of medicine and drugs used to treat infections of milking animals (especially udder infections). Therefore, tests are run periodically to determine inhibitor presence in milk.

Excessive residues of sanitizers used on milk handling equipment will also show up in these tests.

C. Added Water

The temperature at which milk freezes is a relatively constant factor and can easily be determined by laboratory tests. If water is added either deliberately or by accident, the freezing point will then be closer to that of pure water. Adding water to milk is illegal. The hauler must exercise care and make sure the transfer hose is disconnected before the bulk milk tank is rinsed in order to prevent the addition of water.

Sample Questions

The sample questions below may help you prepare for the licensing examination.

True or False – In the space provided, place an “X” in the correct column:

	TRUE	FALSE
1. The Bulk Milk Hauler’s license is renewable every other year.	_____	_____
2. Normal milk color ranges from bluish white to golden yellow and may contain limited amount of foreign or clotted matter.	_____	_____
3. A milk temperature above 45°F can be a warning that the milk may have an off flavor or be high in bacteria.	_____	_____

Fill-in-the-blank – In the following questions, fill in the blank with the correct word or words:

- _____ is a serious off-odor that is sufficient reason to reject a farm bulk tank of milk.
- The detection of off-odors can be affected by external factors including _____, _____, _____, and _____.

Multiple Choice – Each question is followed by a series of answers. Check the answer or answers which are correct. More than one answer may be correct.

- The only time the transfer hose is not capped is:

- a. during loading
- b. between stops
- c. while the farm bulk tank is being rinsed
- d. during tank truck cleaning

2. The Somatic Cell Count determines:

- a. level of white blood cells in the milk
- b. percentage of milk fat
- c. amount of added water
- d. amount of sediment in the milk

3. The hauler should be aware of the following conditions which could contribute to inaccurate weight problems:

- a. a tank that is incorrectly calibrated
- b. amount of milk in the tank
- c. improper footings under the tank legs
- d. heaving, cracking, or settling of the milk house floor causing the bulk tank to shift

Acknowledgement:

Much of the material used in the section on Causes of Butterfat Variation is from Special Report 29, *Dairy Plant Fieldman, Hauler Grader and Tester's Manual*, University of Minnesota, St. Paul, 1973.