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## EC65-633 Revised Bulk Milk Haulers Guide

T. A. Evans

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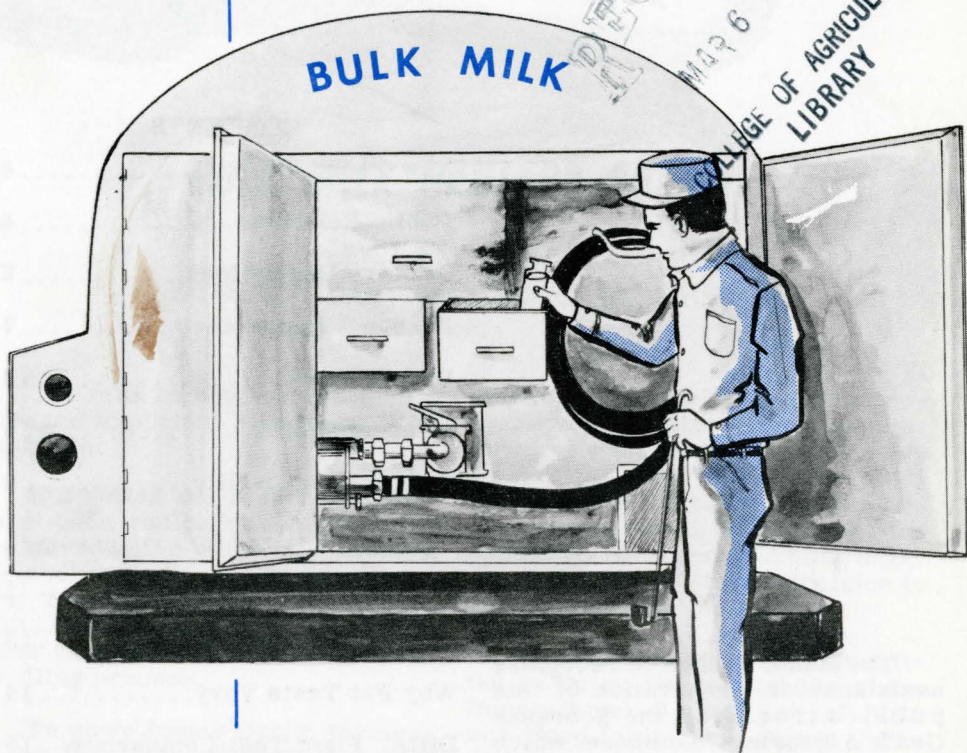
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E. C. 65-633  
(Revised)

**BULK  
MILK**

**haulers  
guide**



Extension Service  
University of Nebraska College of Agriculture and Home Economics  
and U. S. Department of Agriculture Cooperating  
E. F. Frolik, Dean E. W. Janike, Director



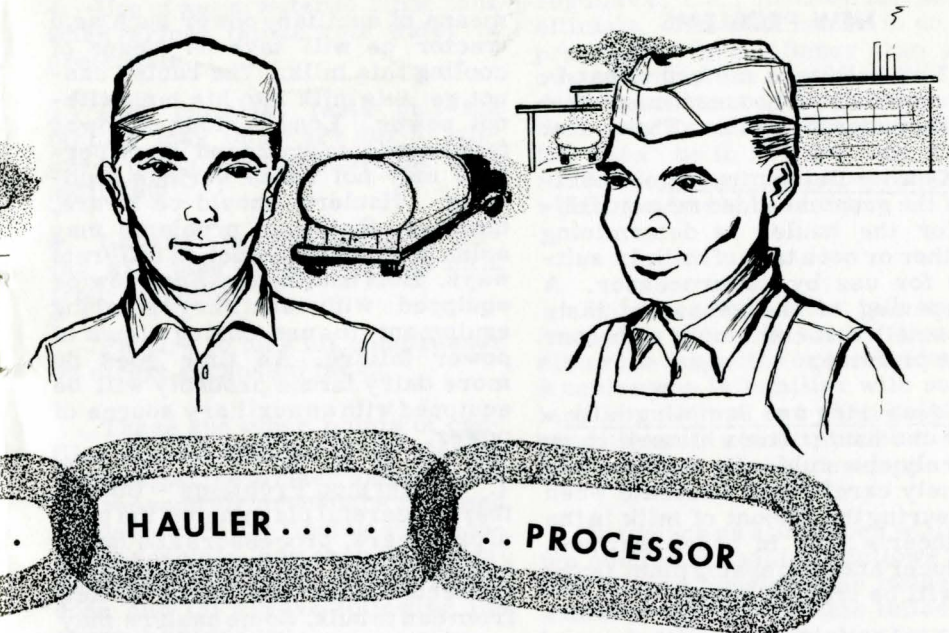
**FARMER . .**

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The author wishes to recognize assistance in preparation of this publication from the Nebraska Grade A Steering Committee, which is composed of representatives of the dairy industry, regulatory agencies and the College of Agriculture.





## **BULK MILK HAULERS GUIDE**

BY T.A. EVANS

EXTENSION DAIRY MARKETING SPECIALIST

The milk hauler has assumed a new and important role in the milk business.

His duties and responsibilities have been radically changed with the introduction of the bulk method of handling milk. A job that formerly required mostly muscular ability has now become one of the most important in the entire milk handling process.

To quote James Davis, formerly of the Dean Milk Company of Rockford, Illinois: "The hauler is the heart of your bulk handling program. He should be a top-notch receiving room man, a good truck

driver, a fine fieldman and an authority on the plant's quality program. He must have clean and tidy personal habits and wear clean clothing, preferably of a light color. By sight or smell, he must be able to distinguish non-conforming milk, since with him rests the decision to reject or accept the milk."

The 1953 report of the Committee on Dairy Farm Methods of the International Association of Milk and Food Sanitarians states: "The driver should have the same type of training and equal qualifications, and meet the same requirements as that of a receiving man at the receiving or processing plant."

## NEW PROBLEMS

The bulk tank method of handling milk has introduced many new problems for the hauler. These are:

1. Quality Determination - Doubtless the greatest added responsibility for the hauler is determining whether or not a tank of milk is suitable for use by the processor. A sharpening of the senses of taste and smell will come only with constant practice.

2. Measuring and Sampling Milk - Here the hauler finds himself in an entirely new role. He must be extremely careful and accurate when measuring the amount of milk in the producer's tank in order that both producer and processing plant (buyer) will be treated fairly.

3. Roads - During or after a rain or snow many ungraveled country roads become impassable for a truck the size and weight of a bulk milk truck. Obviously, it is not possible for a producer using the bulk method to bring his milk to a graveled or paved road where it can be loaded on the pickup truck.

4. Farmyards and Driveways - Yards and drives often present even more of a problem than public roads. They usually are not gravelled and are often poorly drained.

5. Time of Pickup - If the truck arrives at the farm during milking time it may not be possible to pick up the milk immediately. The hauler will find it necessary to decide whether he can come back later, wait until the milking is completed and milk properly cooled, or take the milk that is there, let the farmer wash and sanitize the tank and continue milking.

6. Power Failure - While the farmer may find it possible to milk by

means of auxiliary power such as a tractor he will have no means of cooling this milk. The hauler cannot get this milk into his tank without power. Long periods of power failure seldom occur and short periods may not cause serious problems. Haulers should be aware, however, that such problems may arise and must be met in different ways. Bulk hauling tanks can now be equipped with auxiliary pumping equipment to use during times of power failure. As time goes on more dairy farms probably will be equipped with an auxiliary source of power.

7. Conversion Problems - Unless there is careful planning on the part of producers, processors and haulers there will be many problems connected with converting routes from can to bulk. Some haulers may not find it possible to assume the increased investment in a bulk truck and come through the period when some producers are still selling in cans and other have converted to bulk.

## PUBLIC RELATIONS

In addition to his new duties and responsibilities, the bulk tank truck operator must continue to keep up his public relations. He must keep on good terms with the producer, the processor and the regulatory agencies.

On the farm there are many points of possible difference between the driver and the producer, most of them usually due to misunderstandings. A few of the things that might cause misunderstanding are:

1. Cutting up yard with truck during wet weather.

2. Leaving screen door on milk house open.

3. Failure to return hose to rack, close covers on bulk tank, etc.



4. Use of warm water to rinse tank when farmer thinks cold water is preferable.

5. Low butterfat tests that the farmer may think are due to failure of the hauler to agitate the milk sufficiently.

6. Loss of tank of milk due to mixing with tank of poor-quality milk from neighbor.

7. Failure to turn off compressor on direct expansion tanks.

These and other points of conflict can be avoided by (1) making certain that the farmer understands the reasons for procedure followed by the hauler, (2) finding out, insofar as possible, how each individual might wish to have certain things done and (3) always following the correct procedure.

In addition to the producer, the hauler must also satisfy the requirements of the milk plant operator. Probably the most common points of difference between trucker and milk plant are:

1. Quality of milk picked up from producers.

2. Difference between total of measurements of milk made at the producers' farms and weight or measurement of milk as delivered to plant.

3. Time of arrival at plant.

Friction on these points can be reduced by (1) knowing what quality milk will be accepted by the processor and (2) carefully following correct procedures.

The third group with which the truck driver will work is composed of those individuals who are concerned with the quality of the milk and with the enforcement of sanitary

regulation, i. e., fieldmen and health officials. The milk hauler is on the producer's farm oftener than any other person. He is able to observe daily operations and conditions as they actually exist. Without "carrying tales" he is in a position to let the fieldman or milk inspector know which producers need help.

Farmers will often talk more freely to the milk hauler than to either the inspector or the fieldman. A hauler who is familiar with sanitary regulations can often help the producer with a quality problem before serious trouble develops.

Inasmuch as a producer will often confide in a hauler it follows that he will have considerable influence with the producer. If this influence is correctly used, friction between the inspector and fieldman on the one hand and the producer on the other can be avoided.

Successful producers are interested in quality milk and maintain their equipment in compliance with sanitation regulations. The hauler should do all he can to help all producers understand this. It is human nature to resent inspection. Differences of opinion between a producer and an inspector or fieldman is at times inevitable. In such cases the hauler may be looked to by the producer for sympathy.

While it is possible that the producer may have a grievance, unwise expressions of sympathy from a third party such as the hauler may only make the situation worse. An understanding attitude on the part of the tank truck operator without taking sides and an explanation of the reasons for certain sanitary regulations may help to smooth over what could develop into a troublesome situation.

## SANITARY REGULATIONS

In order for a driver to discuss intelligently the reasons for various sanitary regulations, he must himself be familiar with them. There is a reason behind each regulation and requirement adopted by health agencies. A hauler can, over a period of time, learn what these reasons are by talking with inspectors and fieldmen. Health agencies also have available copies of the requirements which may contain the reasons for each requirement. Haulers who are interested in having all the "answers" can secure a copy of the U. S. Public Health Service Milk Ordinance and Code by writing to their U. S. Senator or Representative in Congress.

Some health agencies have adopted specific regulations that apply to bulk milk haulers. In Nebraska, the Grade A Steering Committee has adopted recommendations for satisfactory compliance of handling, storage and transportation of bulk milk from farms to plant. While all of these recommendations are important to the truck operator, the following apply directly:

1. The bulk tank transport operator shall be considered a key man in the bulk milk handling operation and shall be a locally licensed grader capable of efficiently carrying out the procedures necessary for the quality tests and sanitary transfer of milk from producers' premises to the plant.

2. He shall have clean hands while handling milk equipment on each farm. Clean clothes must be worn and good personal hygiene practices must be followed.

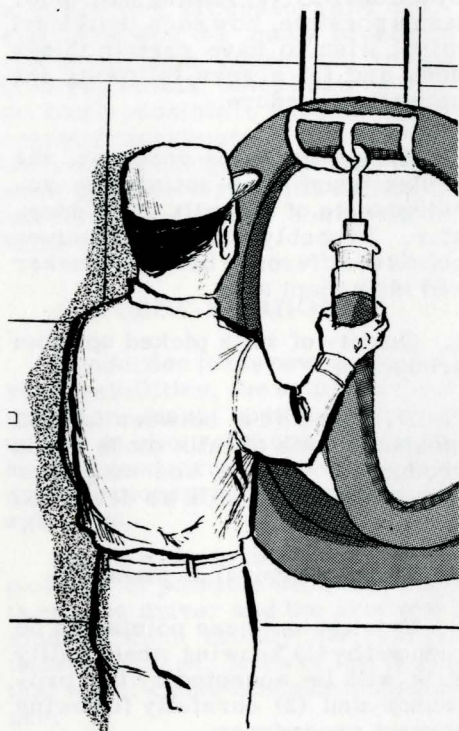
3. Multi-use equipment such as sediment tester and butterfat sampling dippers must be washed and sanitized before each use.

4. Volume reading must be done in a sanitary manner by means of a sanitary calibrated instrument.

5. Samples shall be taken in a sanitary manner after the contents of the tank are thoroughly agitated. Bacteria samples shall be taken according to standard methods.

6. Any abnormal milk shall be rejected without hesitation before any pumping begins.

7. The pumping equipment shall remain assembled during the day's run. The open end of the milk hose shall be capped between collections and the entire assembly shall be enclosed in a dust tight cabinet.



8. The hauler must make certain before loading any milk at the first stop on his route that all sanitizing solution has been drained from tank and hose.



## PERSONAL APPEARANCE

Special emphasis should be placed on personal appearance. Elimination of the handling of cans makes it possible for the truck driver to dress neatly and remain neat and clean throughout the day. Probably a light blue or gray uniform would be more practical than white and would look better for a longer time.

Anyone who handles milk in any way should always be neat, clean and have clean personal habits. This is true for two reasons:

1. Milk is a perishable and easily contaminated food and must be handled in a clean manner at all times.
2. Anyone, inspector, fieldman, or milk hauler, who may have occasion to discuss sanitation and cleanliness in the handling of milk with the farmer should set an example of cleanliness and neatness.

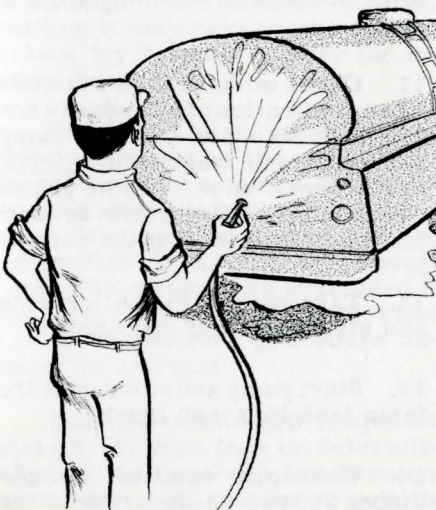
Regulations require that every Grade A milk house be equipped with handwashing facilities including a

basin, soap and sanitary towels. It is necessary that the milk hauler use these facilities since it is extremely important that anyone handling milk or milk equipment do so with clean hands.

Make handwashing a habit before measuring the farmer's milk.

Much attention should be placed on these three points -- (1) clean hands, (2) pleasing personal appearance and (3) clean personal habits.

In addition to the personal appearance of the hauler, the appearance of his truck and tank is very important. While the appearance of the outside of the tank may not seem to have any bearing on the quality of the milk hauled, the impression this appearance makes on the milk-consuming public may be of great importance. A frequent wash job and a coat of paint often enough to keep up the appearance of a vehicle used to haul a perishable food product such as milk will pay dividends in the long run by impressing upon the public the fact that every sanitary care is taken in the handling of milk.





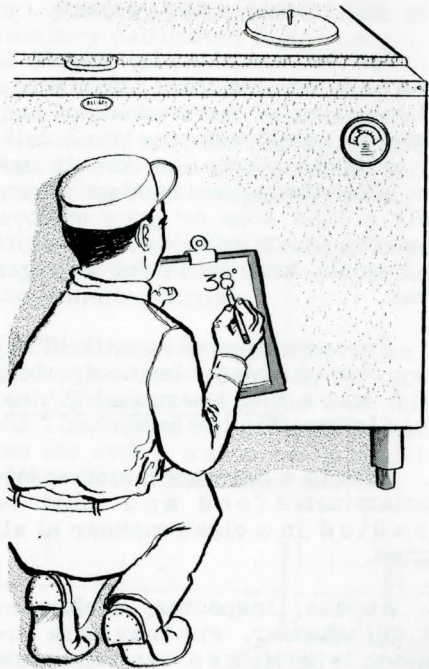
## DAILY ROUTINE

The hauler's daily routine will vary considerably between areas of the country and even between routes in the same area. Following is a general outline of the most important points to be considered in the daily routine:

1. Wash and dry hands.
2. Check milk for off-odor.
3. Check appearance of milk in tank.
4. Remove metering stick and dry with clean towel or strainer pad.



5. Reinsert metering stick, remove, read and record stick reading.
6. Turn on agitator.
7. Check calibration chart and record weight of milk.



8. Read and record milk temperature.
9. Remove hose and motor cord from rear compartment of truck.
10. Insert hose through port in milk house wall and plug cord into outlet.
11. Check milk for flavor and odor. (If any indication of off-odor is noted at either Step 2 or 11, take sample and warm with warm tap water and again check odor. Some persons can detect off-flavors or odors more easily by tasting the sample.)
12. Take sample for butterfat test and other tests, if required.
13. Start pump and pump milk from farm tank into tank truck.
14. Wash and sanitize sampling dipper and return dipper and sample to truck.

15. Disconnect hose and motor cord.
16. Turn off compressor on direct expansion tanks.
17. Rinse tank, including covers and agitator, and floor. (Preferably with warm water, 90-110° F.)
18. Close cover on farm tank.
19. Return hose and motor cord to truck.
20. Check to be sure milk house door is closed and general condition of premises same as on arrival.

## MEASURING MILK

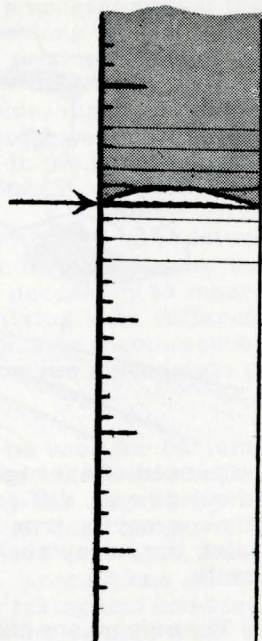
As mentioned previously, responsibility for measuring the milk becomes the responsibility of the hauler in the bulk handling of milk. In determining the amount of milk in the tank, the same method of reading the metering stick should be used by the hauler as was used by the calibrating crew when calibrating the tank.

Many haulers take three separate readings of the stick to be sure that no error has been made. If it is difficult to obtain an accurate reading it may help to warm the stick by holding it under the hot water tap.

The first line which is completely covered by the milk should be read rather than a line which the milk only touches or partly covers. This is the procedure used by calibration crews. If any change from this method has been used in any area, haulers will be informed and the measuring procedure adjusted to conform.

The hauler should frequently inspect the tank legs to determine whether or not there has been any movement of the tank due to settling

**READ  
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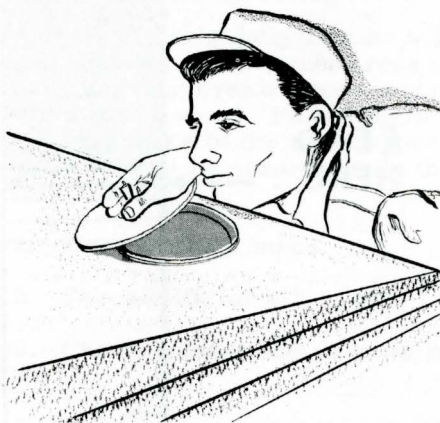
or cracking of the milk house floor. Any sign of movement of the tank should be promptly reported since any change in the position of the tank will result in an error in the measurement of the milk.

As soon as the metering stick has been read, the reading should be written down -- before turning on the agitator or performing any further steps or operations. This is very important since it is easy to forget the exact reading and once the agitator has been turned on a second reading would mean a considerable delay.

## DETERMINING QUALITY

Probably the greatest new responsibility the bulk hauler has had to assume has been the decision as to whether or not the producers' milk will be acceptable to the processing plant. Most operations in connection with the handling of milk are mechanical and can be mastered





by a person of average intelligence without great difficulty. This is not necessarily true when determining the acceptability of a tank of milk.

The only means the milk hauler has of determining whether or not a tank of milk is acceptable is through the information furnished by his senses of sight, taste and smell. A hauler can see whether there are any defects in the milk such as off-color (bloody) or presence of foreign matter such as flies, either of which makes the milk unacceptable.

Additional checks of quality or acceptability depend upon the senses of taste and smell. What we ordinarily think of as taste actually includes both taste and smell. The sense of taste can detect only sweetness, bitterness, sourness and saltiness or a combination of these. All other so-called flavors are actually odors and can be detected only by the sense of smell.

When a sample of milk is taken into the mouth it is warmed and the volatile odors, or those that evaporate, are liberated. With the mouth closed these odors find their way through the nose where they are detected by the sense of smell. In-



dividuals vary in their power to detect flavors and odors and ability comes only with practice and experience.

To determine whether or not off-odors are present in a tank of milk a check on the odor of the air above the milk after the tank has been closed for several hours and before the agitator is started or the covers opened is usually a good indication. Remove one of the port covers on the tank or open the cover and quickly check the odor before it has had a chance to mix with fresh, clean air. This will give the hauler the best chance to detect any possible trouble. After the cover has been opened for a minute and odors given a chance to get away, they may be so faint that only an especially keen sense of smell can detect them.

Off-flavors can be more easily detected in warm milk than in cold. If a check of the odor of the milk, as described above, indicates any question as to its acceptability, a sample should be taken from the tank and warmed to 90-100° F. or about body temperature. Warming the milk will cause any off-flavors that are volatile or vaporize to be more easily detected by the sense of smell.



If the hauler wishes to taste the sample the amount taken into the mouth should be large enough so that the flavor may be checked yet small enough so that the milk can be warmed in the mouth. The sample of milk should not be swallowed but spit out so that the feel of the mouth or "aftertaste" can be observed.

Another observation that the hauler should make is of the amount of sediment in the bottom of the farm tank after it has been emptied. Evidence of "settlings" or a large amount of sediment indicates that something is wrong with either the milking procedure or preparation of the cows and should be called to the attention of the producer or reported to the fieldman.

### **SAMPLING MILK**

After it has been found that the milk in the tank is of acceptable quality, a sample must be taken. This sample may be used for one or more purposes such as (1) butterfat test, (2) bacteria count, (3) quality check at processing plant, (4) test for antibiotics or (5) other tests that persons at the plant who are in charge of quality control might wish to make.

Since this sample must be re-

presentative of the entire contents of the tank, it is necessary that the milk be agitated long enough to insure thorough mixing. Length of time necessary for this to be done will vary with size, make and shape of tank, type and speed of agitator, amount of milk in the tank and various other factors.

Since it is not practical to determine for each individual tank the shortest time necessary to insure complete mixing with different amounts of milk, it is recommended that the agitator run a minimum of five minutes.

Samples to be used for bacteria count should be taken and handled as directed by the regulatory or health agency that has charge. If a sample is to have any value, however, certain precautions should be observed in taking and handling, namely, (1) the sample must be representative of the contents of the tank, (2) sampling equipment must be clean and (3) samples must be refrigerated at all times.

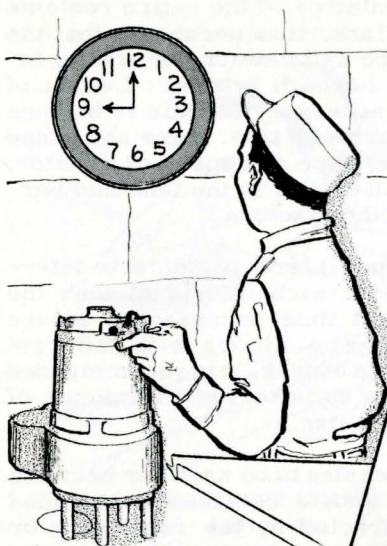
### **RINSING FARM TANK**

The hauler's responsibility in connection with cleaning the farm tank consists of rinsing the tank immediately after emptying. The reason for this immediate rinsing of the tank is that removal of milk can be accomplished very easily before it has a chance to dry on. If left for even a short period to dry, the cleaning process is made considerably harder.

Occasionally it may be several hours before it is possible for the dairyman to wash the tank. By taking one or two minutes to rinse out the tank, the hauler can greatly simplify the final washing procedure.

Recommendations vary as to the procedure the hauler should fol-



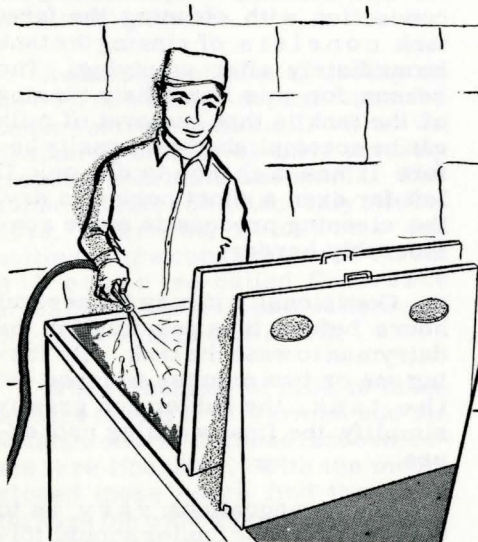


low in rinsing the tank. Manufacturers of certain types of tanks do not recommend the use of hot water on the tank immediately after it has been emptied due to the possibility of damaging the tank or losing the gas supply due to sudden expansion of any refrigerant that may remain in the tank jacket. Use of warm water (110-120° F.) should not damage a tank in any way but due to the fact that very few milk houses are equipped with reliable mixing

valves, it is sometimes difficult to adjust the water temperature with any degree of accuracy.

Hot water should never be used to rinse the tank. In addition to the possibility of damaging the tank, use of hot water for rinsing may set the milk solids on the tank surface and increase the difficulty of cleaning.

On the other hand, use of cold



water will not remove fat, or milk droplets containing fat, that have dried on the surface of the tank above the level of the milk.

The most satisfactory procedure is to rinse with water at a temperature of 110-120° F. Water at this temperature will remove most of the visible milk solids from the tank interior and if used carefully should not damage the tank.

In some cases dairymen have rather definite ideas about rinsing their bulk tank. Each hauler should determine, as soon as possible, how each of his patrons wishes to have the job done and follow a procedure satisfactory to the patron.

It is not recommended that the hauler in any way dismantle the tank such as removing covers, agitator, etc. In some cases it may be desirable to remove the valve and place in the plastic pail used for washing the tank. Care should be taken if this is done since the valve may be damaged by dropping or by coming in contact with any hard surface. A bulk tank is an expensive piece of equipment and it is not necessary that the hauler in any way risk damaging it. The hauler's responsibility is only to rinse the tank, not to completely clean it.

## CLEANING, SANITIZING TRUCK

It is the hauler's responsibility to see that his hauling tank is properly cleaned and sanitized each day. Methods of doing this vary in different areas and at various milk processing plants. As the bulk handling program progresses, better methods of washing and sanitizing tank trucks will be used.

A milk tank truck can be washed either by hand or mechanically. A simple manual process consists of the following steps:

1. Immediately after emptying the truck tank, pre-rinse with ample warm water (100-110°F.) to remove all visible milk.

2. Prepare washing solution in rubber pail, using a recommended detergent in hot water (125° F.). Brush wash entire tank by getting inside tank, (caution - be sure to wear rubber boots to prevent scratching of tank bottom) then dismantle and brush all pump parts and valves and loading hose using proper brushes for the individual parts.

3. After washing thoroughly, rinse tank and loading pump parts thoroughly in hot water, not over 145° F., to remove all washing solution.

4. Close tank, store pump parts and loading hose in protected area of truck, and allow to drain dry.

5. Before using, reassemble pump parts and loading hose, and sanitize the truck tank and loading assembly with either a chlorine solution or other approved sanitizing solution of proper strength.

In most cases the tank will be washed mechanically by means of a pressure spray. Experience shows that the milk pump should be taken apart and washed by hand each time since running wash water through the pump for relatively long periods of time will eventually cause damage.

The tank, pump and hose should be sanitized just before use. Satisfactory spray units have been designed that will reach all parts of the interior of the tank with sanitizing solution. Consult your regulatory officials as to what types of sanitizing compounds are approved in your area. Follow directions on container in making up your sanitizing solution.



Remember that it is your final responsibility to be sure your tank is clean and sanitized even though an employee of the plant or some other agency performs the actual washing operation.

## WHY FAT TESTS VARY

A frequent question a bulk hauler will be asked by a producer is: "Why does my test vary from one period to another?" There are three reasons why fat tests may vary, (1) how the sample is taken, (2) testing procedure and (3) the dairy cow. Since the latter is the most important, a few reasons for variations due to the cow are discussed here.

1. Breed - The various breeds of dairy cows vary in the average fat test of their milk. Following are average fat tests for breeds most commonly found in Nebraska:

Ayrshire	- 4.0%
Brown Swiss	- 4.0%
Guernsey	- 4.9%
Holstein	- 3.5%
Jersey	- 5.3%

These are only average tests and individual cows may vary from the average as shown below.

2. Individual Cows - Experimental work has shown that individual cows of the same breed may vary as much as:

Ayrshire	- 2.9% to 5.7%
Guernsey	- 2.7% to 7.7%
Holstein	- 2.6% to 6.0%
Jersey	- 3.3% to 8.4%

A study of two thousand (2,000) seven-day records of individual cows gave the following results:

569 or 28.5% varied	0 - 1.0%
1,091 or 54.5% varied	1.1% - 2.0%
268 or 13.4% varied	2.1% - 3.0%
72 or 3.6% varied	3.1% - 6.0%

3. Stage of Lactation - Depending somewhat on condition of the animal at time of freshening, the usual pattern is for the fat test to drop somewhat during the second and third months of the lactation period and then continue to increase during the remainder of the period.

4. Condition at Calving Time - An animal that is carrying excess body fat at calving time will produce milk with a higher fat content than one that is in average or poor condition. The effect noted in Item 3 will be more pronounced in the case of an animal in good condition, i. e., the fat test during the first four to six weeks will be relatively high, followed by a more pronounced decline than in the case of an animal in average or poor flesh.

5. Interval Between Milkings - In general, the shorter the period between milkings the higher the fat test of the milk.

6. Completeness of Milking - The last milk or "strippings" are very high in fat content. Experiments have shown that the first milk is relatively low in fat, with an increase in fat content as milking progresses. Results of one such experiment are shown below:

1st streams	- 1.1 %
1st quart	- 1.4 %
2nd quart	- 2.0 %
3rd quart	- 3.1 %
4th quart	- 4.0 %
Strippings	- 7.6 %
Composite test	- 3.26%

7. Season of Year - Fat percentage tends to increase during fall and winter and to decrease in spring and summer. Fat content of milk will vary from 0.1 to 0.3 per cent for each 10° F. change in temperature. Cows producing milk with higher fat content show greater seasonal variation.

8. Morning vs. Evening Milking - Although there is not complete agreement on this point it appears that with equal intervals between milkings, the evening milk will contain the highest percentage of fat.

9. Miscellaneous Factors - Disease, age of cow, oestrus period, excitement and change of environment may also have an effect on the fat test of milk from individual cows.

## **DHIA, PLANT TEST COMPARISON**

The hauler occasionally will be asked questions as to the reason for variations between results of DHIA fat tests and tests run by the buyer of the milk. Many instances have been reported in which there has been relatively close agreement between the two tests over fairly long periods of time. In other cases a considerable difference has been reported.

Following are some of the reasons that might cause a variation between results of the two tests:

1. Milk fed to calves or other farm animals may not be representative of entire output, being either higher or lower in test than the milk that is sent to market.

2. Milk consumed by the farm family may also not be representative of entire supply.

3. Plant result is usually obtained by testing a composite sample which is made up from individual daily samples over a 10 to 15 day period while DHIA results are for one day's milk.

4. On the day DHIA tests are made, there is a tendency for the milking to be conducted with greater efficiency and for cows to be milked more completely than on other days.

5. Interval between milkings on

test day may be somewhat different than normal due to test procedures.

6. When reading fat tests, the DHIA supervisor may tend to favor the cow while the plant tester may tend to favor the plant.

## **BACTERIOLOGY**

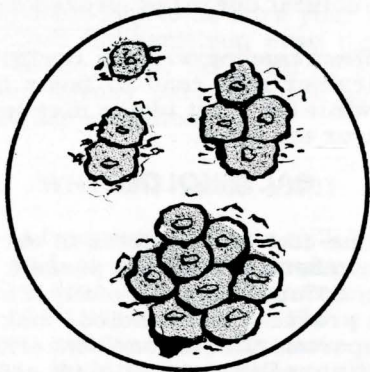
The fact that bacteria in varying numbers are always present in milk, no matter how carefully it has been produced and handled, makes it important that anyone concerned with its handling have at least some knowledge of "bacteriology."

Bacteriology is the study of the tiny plants that are known as bacteria, germs, "bugs", etc. They are too small to be seen with the naked eye and their presence can be determined only by use of a microscope or by observing the results of their growth in milk or other food. Everyone who has worked with milk has seen these results. Souring, curdling, production of gas and off-flavors are some of the results of the growth of bacteria in milk.

Bacteria are tiny plants. Like the larger plants with which we are familiar they require food, moisture and a favorable temperature in order to grow. When bacteria grow, however, they do not necessarily increase in size. By "growth" of bacteria is usually meant a growth in numbers. Bacteria grow by dividing or splitting. One bacterium becomes two, two split into four, four into eight, etc.

Given favorable conditions, bacteria "grow" or multiply very rapidly. Under ideal conditions their numbers may double every 20 or 30 minutes. While this may not sound serious when we think of one becoming two, two becoming four, four becoming eight, etc., it is very interesting to take a pencil and piece of paper and, starting with one





bacterium and assuming that the number doubles every 30 minutes, determine how many bacteria there would be at the end of 24 hours.

Conditions for bacterial growth are seldom ideal and many of them die during a 24-hour period, but when we remember that even good quality milk has several thousand bacteria per cubic centimeter (about 19 drops) it is evident that great care must be taken to be sure that bacteria do not have a chance to "grow" or multiply.

Bacteria need three things in order to "grow" or multiply, (1) moisture, (2) food and (3) a favorable temperature. Milk being about 87 to 88 per cent water furnishes plenty of moisture. The solids of milk are an ideal food for bacteria. As a milk hauler, there is nothing you can do about removing either the moisture or food from the bacteria in milk. This leaves only one means of controlling the growth of bacteria -- temperature. This is the reason for so much emphasis being placed on (1) prompt cooling of milk and (2) holding milk at a low temperature at all times.

Bacteria can also be controlled by heat. Disease-producing bacteria held at a temperature of

143° F. for 30 minutes or 161° F. for 15 seconds or at other combinations of temperature and time will be killed. This heating process is known as pasteurization.

Pasteurization kills the disease-producing bacteria in milk but does not necessarily kill all bacteria in milk. Certain heat-resistant bacteria that can only be killed by higher temperatures or longer exposure times are present in pasteurized milk. While these bacteria do not cause disease their growth may cause the milk to spoil. This is the reason that pasteurized milk must be refrigerated the same as raw milk.

If bacteria were as large as peas or golf balls they would not be so much of a problem. They are so tiny, however, that they can be seen only with the aid of a microscope. The old saying "Out of sight, out of mind" certainly applies in the case of bacteria or germs. Since they are invisible it is easy to forget that they are present everywhere - in the air we breathe, on all surfaces we touch, on our hands and any other place we might mention. This means that we must constantly be alert in order not to add bacteria to milk. This is the reason that hands must be washed, clothes kept clean, and anything that comes in contact with the milk such as metering stick, sample dipper, etc., must be clean and sanitized.

One other fact about bacteria is of interest to milk haulers. Not all bacteria are harmful. Many are very beneficial. For instance, most types of cheese, cultured milk, vinegar, alcohol and silage are all the end result of the action of certain types of bacteria.

Sometimes bacteria are divided into two classes, (1) pathogenic or disease-producing and (2) non-pathogenic or harmless contamin-

ants. From the standpoint of quality milk however, all bacteria should be classed as harmful. While only a relatively few will cause disease, almost any type of bacteria, in large enough numbers, may cause off-flavors in milk or may result in the milk being rejected on the basis of too high a bacteria "count."

Samples for making bacteria "counts" probably will be collected by the milk hauler. Bacteria counts are commonly made by one of three methods, (1) plate count, (2) direct microscopic count or (3) reduction test.

The plate method is practically always used to determine the bacteria count of pasteurized milk and is also very commonly used for raw milk. In this method individual germs or bacteria are grown on a food on which they grow very rapidly. A small amount of milk is added, together with the bacteria food and moisture, to a sterile container called a petri dish. The milk and bacteria food are thoroughly mixed and spread in a thin layer over the bottom of the petri dish. The dish is then placed in an incubator at a temperature favorable to rapid growth of the bacteria for a certain length of time, usually either 24 or 48 hours, depending on the type of bacteria to be counted.

At the end of this period each bacterium has multiplied into many millions or billions and these bacteria form what is called a "colony." This "colony" or large group of bacteria is visible to the naked eye. Counting the colonies and multiplying by a number which depends on the amount of milk placed in the petri dish gives the bacteria count which is reported to the producer. All of the above procedure is, of course, conducted in the laboratory with special equipment by specially trained technicians.

The "direct microscopic method" of counting bacteria is just what the name says, the bacteria in a small amount of milk are counted by means of a microscope. This procedure is also carried out in the laboratory by specially trained technicians since the sample of milk to be checked must be placed on a glass slide, dried and the bacteria stained to make them more easily visible.

The main advantage of this test is that it is fast and requires less equipment than for the plate count. On the other hand, it cannot be used for determining the bacteria count of pasteurized milk and is not always entirely satisfactory for use with low count or good quality raw milk.

The third method is called the reduction method and is most commonly used as a rough indication of milk quality. It consists of adding a small amount of dye, either methylene blue or resazurin, to a small quantity of milk. The length of time required for the color to disappear from the milk is a rough indication of the number of bacteria present.

Milk from which the color disappears quickly has a high bacteria count, and vice-versa, the longer the milk remains colored, the lower the number of bacteria. The chief advantage of this test is that it requires very little equipment and can be carried out right in the milk plant. It cannot be used for pasteurized milk and is seldom used for determining the bacteria count of Grade A milk.

The significance of any of these tests depends largely on the sample that is delivered to the laboratory. Whether this sample is collected by the milk hauler, sanitarian or fieldman it must be representative of the milk delivered to the



processing plant. This means essentially three things, (1) the milk in the tank must have been thoroughly agitated so that the sample collected is representative of the entire contents of the tank, (2) care must be taken to be certain that no additional bacteria are added from the sample bottle, sampling dipper or tube, hands, clothing or any other source and (3) the sample must be kept below 40° F. at all times in order that the bacteria in the sample will not multiply any more rapidly than those in the milk delivered to the plant. (Refrigeration of bacteria samples is not required when direct microscopic test is used and a preservative is added to sample bottle.)

It is rather generally accepted that for complete mixing of all sizes and shapes of tanks of varying fullness the milk should be agitated at least five minutes. For collection of samples for determining bacteria count, sterile sample containers will be furnished. These may be either jars, vials or plastic bags. Care should be taken that they are not contaminated in any way before being used. Covers should not be removed from bottles or bags opened until ready for use.

Likewise, sampling dippers or tubes will have been sterilized and should not be allowed to touch anything except the milk being sampled. It is important, of course, that hands and clothing be clean at all times when sampling or handling milk.

Samples can be refrigerated by various means. Newer tank trucks can be equipped with a refrigerated compartment at time of purchase. In other cases, an insulated box is used with dry ice, chunk or crushed ice or ice cubes, or "perma-cold pads," "cold dogs," etc., used as a refrigerant. In some cases where a direct microscopic count-

ing procedure is used, formalin may be added to the bottles in which case no refrigeration is needed. The formalin kills and preserves the bacteria and the samples reach the laboratory with approximately the same number of bacteria as when collected at the farm.

The main point to keep in mind is that the sample should be treated and handled in such a way that when it is delivered to the laboratory it will contain approximately the same number of bacteria per cubic centimeter as the milk that is delivered to the processing plant.

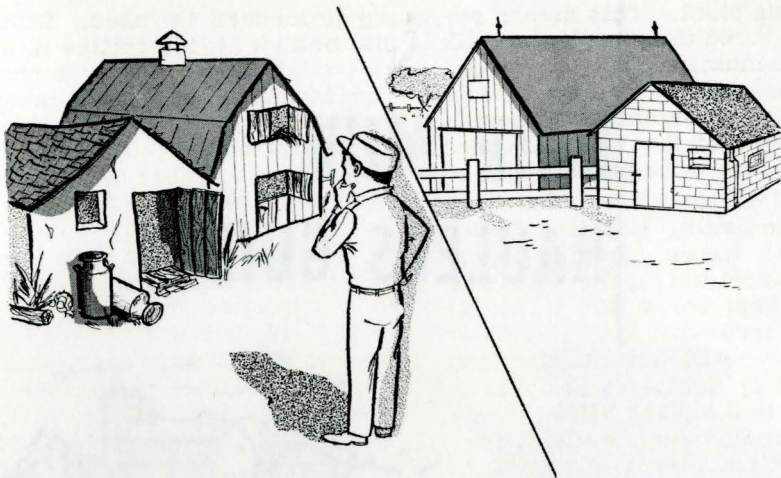
## DANGER SIGNALS

The milk hauler will contact the producer more often than any other individual. Being on the producing farm at least every other day he will have an excellent opportunity to observe conditions which may lead to possible sources of trouble. General appearance of the farm yard, milk house, etc., will give the alert hauler a clue as to how the producer handles his milk. A neat, orderly, well kept farmyard usually indicates an individual who is conscientious about the way he handles and cares for the milk.

Any sign of carelessness around the milk house is a danger signal indicating that the producer, or whoever is responsible for handling the milk, is becoming lax. Sometimes individuals who are constantly about the premises do not recognize these "danger signals" as quickly as someone coming in from the outside.

Whatever may be causing the condition, the milk hauler is in a position to be of assistance to the producer before quality of the milk is endangered and a loss occurs to both producer and hauler.

Situations of this type can be



met by the hauler in different ways. If he is well enough acquainted with the producer he may be able to point out to him the conditions he has observed and the possible effects on quality of the milk. In cases where the hauler notes even a slight off-flavor in the milk he should not leave the premises without talking to the producer or some member of his family and trying to determine what has caused the condition. Oftentimes in this way the cause of the trouble can be found and corrected before it becomes necessary to turn down a tank of milk.

In some cases it may be more desirable for the hauler to speak to the fieldman or the milk sanitarian about conditions he has noted on a certain producer's premises. This is not to suggest that a hauler should be a "bearer of tales" but a tip to one of these people may sometimes be the only means of preventing quality trouble and economic loss for both producer and hauler.

Some advocate that a bulk milk hauler confine his activities strictly to hauling of milk, leaving to others the decision as to whether a tank of milk should be accepted or rejected and keeping to himself any opinions he may have formed relative to

dairy management and feeding, sanitation, etc.

Such a course will probably tend to keep a hauler out of trouble. On the other hand, it will probably also mean that the producers on his route will lose the benefit of advice and assistance from an alert individual and will certainly mean that the buyer of the milk constantly will be asked to make decisions that usually could be made by the hauler himself.

This does not mean that a hauler should not ask for advice and assistance from others but he should also learn to make observations and decisions of his own that will benefit both the producer and the processor of the milk.

In conclusion, two points should be kept in mind, (1) the quality of milk which any bulk tank operator will consistently deliver to the processing plant will depend to a large extent on his relations with his producers and how well he is able to keep them on their toes following quality practices and (2) the bulk tank truck operator must be more than a "truck driver" -- with all of his added duties and responsibilities he is truly a key man in the milk handling operation.



# Bulk Milk HAULERS GUIDE

