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Journal of

MILK and FOOD TECHNOLOGY

Official Publication

International Association of Milk and Food Sanitarians, Inc.

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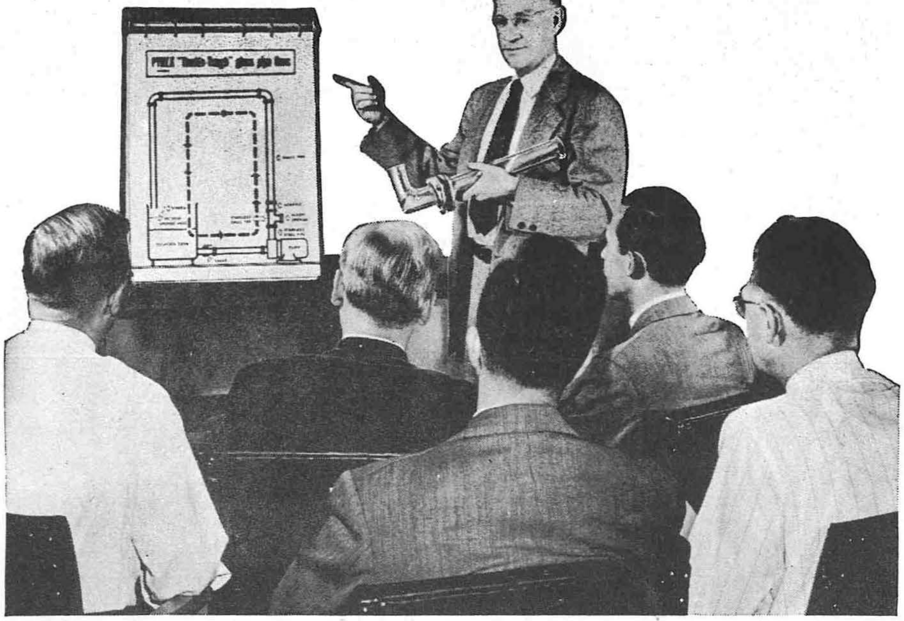

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Editorial Notes

ENVIRONMENTAL HYGIENE: SOME CONSIDERATIONS AS TO ITS SCOPE

Two food sanitarians were conversing:

The first one: "I've been impressed with the extraordinary growth in the field of environmental hygiene in general and that of food sanitation in particular. We began by cleaning up the water and milk supplies. Then we went after foods. Next we endeavored to insure clean premises, and sanitary restaurant service. Now comes design of equipment and plant, with good housekeeping. And so it goes. You fellows down in Washington have done a splendid job in this field. What underlying principles guide you? What has been your directing outlook?"

The second one: "Well, I can't say that we have ever buckled down to think this through. We've been so busy getting things done that maybe we haven't put the thought on it that we should have."

The first one again: "The public is undoubtedly benefitted by the removal of direct health hazards such as polluted water supplies, impure milk, contaminated food. Dirt constitutes a physical menace. Where does good housekeeping come in? What are the effects of 'service with a smile', music, landscaped surroundings, attractive settings?"

The second one: "These things do something to the spirit."

The public seems to like this emphasis—this "way of life."

Why?

The answer to this would seem to be signficant as pointing the way to the further development of this whole field. Specifically, where do we stand with regard to the discordant and raucous noises, the polluted atmospheres, the unsightly bill-boards, the trash-littered parks and streets, the oil-polluted beaches, the congested slums, community nuisances of all kinds? Do we have a basis for enforcing a remedy for these conditions?

We note the great expenditures on constructing our public highways. We surely must have highways. They cost a lot of money. Are we warranted in adding to the great initial expense the cost of beautifying them plus the continuing landscaping costs? The public approves. Why?

Morever, we have public playgrounds. They are expensive. To this we add golf courses, bathing beaches, sports fields. We provide out door music, music festivals and libraries. Why?

Health, highways, fire prevention, education, entertainment: all are necessary. But man does not live by these alone. One difference between him and the beast of the field is the "spirit of man". Here, among other traits, resides the aesthetic sense. Charles Darwin wrote:

> "My mind seems to have become a kind of machine for grinding out general laws . . . If I had to live my life again I would make it a rule to read some poetry and listen to some music at least once every week. The loss of these tastes is a loss of happiness, and may possibly be injurious to the intellect, and more probably to the moral character, by enfeebling the moral part of our nature."

These fine aesthetic expressions are necessary for the development of intellect and morality. Aesthetic experience enriches life. It fosters harmony between mind and environment. It is creative—it liberates the mind from the commonplace and gives it stimulus to grow. It fosters freedom of

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These fine aesthetic expressions are necessary for the development of intellect and morality. Aesthetic experience enriches life. It fosters harmony between mind and environment. It is creative—it liberates the mind from the commonplace and gives it stimulus to grow. It fosters freedom of the food, and other sources of contamination.

The value of the standard for swab tests of eating utensils lies not in the fact that the organisms present are, in any sense, representative of pathogenic bacteria and viruses, but their destruction by heat or chemical agents down to a population of 100 or less indicates that if pathogens were present they would have been destroyed. The standard is one of convenience and is not a direct measurement of public health hazard.

HEAT TREATMENT

In mechanical dishwashing procedures, hot water is used both for washing and sanitizing; hence, the following discussion on sanitization will be limited to the effectiveness of hot water as a means of rendering utensils free of health hazard.

In 1896, George Sternberg[3] reported in his book on bacteriology, a method of measuring the minimum temperature for killing bacteria by heat. The minimum temperature is called the thermal death point. This is the minimum temperature necessary to kill bacteria in 10 minutes under a standard set of conditions. Sternberg demonstrated that all common pathogens were killed at temperatures of 60°C (140°F) for 30 minutes, and irrespective of the number of tubercle bacilli that might be present, no health hazard will exist in the milk at the completion of the pasteurization period.

Milk is also pasteurized at 161° F for 15 seconds. This method is equally as effective as the long-time pasteurization. Dahlberg[4] demonstrated that the tubercle bacilli are destroyed at 160°F in 5 seconds.

These data are presented to show that the bacteriologist has known for the past five decades that the non-spore-forming pathogens that might occur on eating utensils are readily destroyed at a temperature of 160°F for 7-15 seconds.

In spite of the fact that these temperatures and time have been accepted for pasteurization, public health officials have worried about the effectiveness of heat in sanitizing dishes and silverware notably because of the difference in the means of application. As you all know, the requirement of immersion for 2 minutes in 170°F. water is still commonly in force.

Through a grant from the National Sanitation Foundation, a study was made to determine if bacteria die on dishes at the same temperatures that have been established for destroying bacteria in milk and water. The results of these studies by Mallmann and associates are published.[5]

Without entering into the minutia of these studies, suffice it to state that a temperature of 170°F was recommended for a minimum period of 10 seconds and with a flow of water of 0.375 gallon per 100 square inches of tray area (1.5 gallons per 20-inches tray) for sanitizing dishes in a dishwashing machine. These figures represent a safety factor of 10°F because actually 160°F would accomplish the results if the dishes were unsoiled. The tests were made with test organisms embedded in a soil film so that the results at 170°F really represent not a properly washed dish but a soiled dish.

It will be remembered that the temperature is recorded at the dish surface. Because a marked fall in temperature results when water is sprayed into the air, the line temperature should be 180°F.

The time of 10 seconds is the minimum time because it takes at least 7 seconds for the heat to be transferred from the water to the bacteria and dish or silverware. Actual tests for shorter periods, even at temperatures above 170°F, were unsatisfactory as far as kill of test organisms was concerned.

SANITIZING PROCEDURES

The amount of water used is as important as the time and temperature. Enough water must be passed over the surface of the dish to yield sufficient heat to the organism and the dish to attain kill. A dosage of 0.375 gallon per 100 square inches of tray area is minimum.

If a dishwashing machine is to effect proper sanitization of dishes irrespective of the cleanliness of the dishes, it is necessary that the water be at the proper temperature, be applied for the proper time, and that it be spread evenly over the dishes in the tray. If this is accomplished, there is no public health hazard on finished dishes irrespective of their appearance, such as, the amount of stain from coffee and tea or even minute food particles or waterstone.

Do the present dishwashers accomplish sanitization of the dishes? The answer depends entirely upon the type of machine under discussion. The single-tank, door-type machine can effect proper sanitization if personnel is trained to maintain the rinse for 10 seconds and the machine is supplied with the proper amount of hot water. In our initial survey of these machines we found that it was necessary to maintain a flow pressure of 30 pounds in order to supply 9 gallons of water per minute with some machines. Two machines gave excessive flows at 30 pounds pressure. We understand that most of these manufacturers have redesigned their machines so that a flow of 9 gallons can be attained at 20 pounds pressure.

The main consideration, however, is that all these single-tank, door-type machines can do a satisfactory job in sanitization if they are properly operated.

The single-tank, push-through machines never were satisfactory because it was practically impossible to operate them in a manner wherein sanitization could be effected. The manufacturers have discontinued this type of machine.

The single-tank, conveyor-type machine with a curtain rinse is physically incapable of attaining sanitization because the interval of contact in the curtain rinse is too short. If the wash operation is done at a minimum temperature of 160° F, which is lethal in the presence of the proper amount of detergent, dishes are properly sanitized irrespective of the temperature of the curtain rinse. Under this type of operation, the curtain rinse functions primarily as a flush for removing the wash water and detergent. As measured by public health hazard, these machines do a satisfactory job under the stipulated operation. Unfortunately, few of them are operated at a temperature of 160°F in the wash water.

The double-tank machines that have been checked do a satisfactory job of sanitization provided the power rinse and the final curtain rinse are operated at temperatures of 170°F at the dish surface. These machines, as presently designed, offer no health hazard as far as the final treatment of the dish is concerned.

The basket-type and conveyor-belt-type machines are both satisfactory just as long as 180°F water is supplied in the power and curtain rinses and a temperature of 170°F is attained at the dish surface.

In concluding the comments on the sanitizing action of dishwashing machines, it can be stated that there is no danger of turning out dishes carrying disease-producing bacteria or viruses in present-day dishwashing machines provided they are properly operated.

So much for the public hazards of machine-washed dishes; the second phase of this discussion has to do with the washing of dishes so that a dish is made clean as measured by sight and touch. A report on this phase of our studies appeared in both National Research Bull. Nos. 1[6] and 2[6].

MEASUREMENT OF WASHING EFFICIENCY

To clarify our discussion, it will be well to present our methods of measuring washing efficiency very briefly.

There are two ways of measuring washing efficiency, namely, field testing by actually washing dishes and observing the degree of cleanliness attained and testing with a standard soil either under laboratory or field conditions.

The first method of testing, that of field testing, is highly unreliable because there is little, if any, chance to control the variables of flow, temperature, detergent concentration, type of water and degree and kind of soil on the dishes. This method has been the one used by manufacturers for many years — a trial and error procedure, that has actually slowed improvements in design because the so-called acceptable results frequently, in fact, generally, obtained were very misleading and erroneous.

The second method, by laboratory testing, was one chosen by us for checking the action of the various machines.

In order to measure soil removal, a soil was prepared that was made up of various food products which included proteins, carbohydrates, and fats. Included was an indicator, India ink, to make possible the recording of the soil by photography and light meters. The soil was made of food ingredients, supposedly, to simulate foods found on dishes. The principal point, however, was that a standard soil, a reproducible soil, was difficult to remove. The soil was designed so it would not be removed entirely and the amounts removed could be measured easily. Irrespective of the type of soil or the amount removed, the soil would serve as a means of measuring the comparative efficiencies of various machines and to make possible a study of the various variables that enter into the design and operation of a dishwashing machines.

OPERATION STUDIES

In the work reported, interest was not in the comparative efficiencies of the various machines tested because we were interested in learning the basic principles of design and operation. However, in obtaining this information, data on comparative efficiencies of the machines were obtained. These data will be discussed later. First we were interested in data on the factors responsible for proper cleaning action.

The factors concerned in soil removal in present spray-type machines are:

1. Amount of water
2. Time of contact
3. Force of application of water
4. Wetting of the soil
5. Presence of detergents to speed wetting of soil, to aid in removal and suspending the soil in the wash water
6. Temperature of the wash water

In the early phases of our studies we were particularly interested in the first three factors: (1) amount of water, (2) time of exposure, and (3) velocity of water.

If water is moved over a surface for an extended period of time, eventually the most stubborn soil can be removed so that time and volume of water enter into varying relationship. These two factors alone could account for cleaning, but the time of exposure of contact and the volume of water would be excessive. If the water can be impinged against the soil, then a

TABLE 1. EFFECT OF WASH TEMPERATURES ON SOIL REMOVAL

Type of Soil	140° F			155° F		
	Deter. Conc.	No. of Dishes	Percent Clean Dishes	Deter. Conc.	No. of Dishes	Percent Clean Dishes
Chili	0.28	260	98.7	0.24	240	99.2
Meat Pie	0.24	263	100.0	0.24	246	100.0
Chop Suey	0.24	250	98.8	0.24	252	100.0
Spaghetti	0.26	277	99.6	0.26	285	99.3

cutting action would occur that would speed the action. In the spray-type machine all three factors, time, volume and velocity are involved.

Theoretically, if the water can strike all surfaces of dishware with the same velocity and the velocity is set at the maximum allowable, then all three factors would be constant or if one factor were either increased or decreased, then if the other two factors were adjusted accordingly the end-result would always be the same.

In the studies made on commercial machines, however, the design was different so that numerous variables were encountered, and it was impossible to evaluate any of three factors without experiencing interference for the other variables.

For example, the shape, placement, number and the orifice size of the jets varied from machine to machine.

The higher the velocity of the stream of water the more rapid the soil removal. In dishwashing operation the velocity must not be such that dishes are tossed about in the machine. A small stream of water can carry a greater velocity than a large stream. For example, the lower arm of a Hobart single-tank, door-type machine carries a velocity of 3 feet but the slot is large. If a pressure of 3 pounds were maintained at the slot opening, the dishes would be pushed from the trays. On the other hand, in machines with narrow slots, a pressure of 3 pounds at the slot opening and a velocity of 7 feet is permissible because of the smaller streams of water. Theoretically both types of machine could do an acceptable job of washing as far as these two factors are concerned.

In a recent publication[7], we have been using pressures of 100 pounds at the jet orifice. The most stubborn soils are removed nearly instantly, irrespective of whether they have been moistened previously. Such pressures could not be used in dishwashing practice, however, one of the greatest limitations to present machines is the fact that they are designed so that effective velocities cannot be used.

If the machines were redesigned so that high-velocity jets could be used, the washing operation time could be reduced and more effective washing could be done.

The amount of water used in washing is dependent upon the placement of the water on the dish surface and the velocity at which it is applied. The mere throwing of large volumes of water over dishes by cascading or showering is of little value as far as actual cleaning is concerned.

Recently a new machine has been brought to our attention that uses approximately a flow of 50 gallons per minute, but has a high velocity — 14 feet. Reports indicate good cleaning. We have not tested the machine but if the placement of water is properly done, we can see no reason why it should not do a job equal to much higher flow machines now on the market.

OTHER FACTORS

The other factors involved in the cleaning process, wetting action, temperature and presence of detergents, all play a part but are not particularly involved as far as machine design is concerned. They are essential factors in any cleaning process and without them currently designed machines do not operate very successfully.

The need of a wet soil on dishes prior to washing is a very valid criticism of the current dishwashing machines. In one of our studies, egg dishes were washed in a two-tank machine without previous soaking of the dishes prior to washing. Only 44 percent came through free of soil. When macaroni and cheese were served, only 65 percent were free of soil. This lack of capacity to clean forces operators to have soaking tanks or pre-washers in order to wet the soil sufficiently for quick removal in the machine.

Tea and coffee staining in cups perhaps can be charged in part, at least, to insufficient jet velocity properly placed. The amount of water used is definitely not involved.

The improvement in washing efficiency is demonstrated in table 1. In this case the dishes passed through a Salvajar rinse and then through a power pre-wash and finally through the wash-and-rinse system of the machine. The machine was exactly the same as the one previously discussed but had the additional pre-wash tank. It is interesting to note that the percentage of clean dishes approached 100, but rejects were still obtained. Incidentally, coffee and tea stains still occurred, forcing a hand-washing operation for the rejected dishes.

Recently in a visit to a large college cafeteria the senior author was impressed by the fact that a large tank supplied with detergent was located ahead of a two-tank dishwashing machine. Each dish was hand scraped and then washed by brushing in this tank. The cleaned dishes were then racked and put through the machine. Although the wash tank contained detergent the machine was really operating as a sanitizing bath.

TABLE 2. SOIL REMOVAL, JET PRESSURES AND FLOWS OF SINGLE TANK DOOR TYPE MACHINES USING A 30-SEC WASH

Machine	Percent Soil Removal	Jet Pressure (Feet of Water)	Flow G.P.M.
A	93.1	4.0	182.0
B	98.3	3.7	100.0
C	86.3	1.9	132.6
D	96.6	4.5	129.0
E	85.5	5.1	99.0

Why did they have a wash tank and hand washing ahead of the dishwashing machine? The answer is simple. The machine was not designed to wash dishes and silverware adequately, so hand washing was resorted to in order that clean dishes could be obtained at the end of the sanitizing procedure.

MACHINE DESIGN

In our two publications on mechanical dishwashing, no mention was made of the comparative value of the machines in effecting good washing. This was intentional even though the data presented showed some comparative values. As previously stated, we were interested in obtaining data on the basic principles involved in the cleaning and sanitizing action.

At this time when we are seriously attempting an evaluation of dishwashing design and operation we should very carefully evaluate machines. We have no desire at this time to divulge names of machines because we do not want to go on record as approving any particular machine or design of machine nor do we desire to issue any statements that would hurt any manufacturer.

We are not interested in the construction of the machine itself, the types of motors, the ease of cleaning, and the cost. We are interested primarily in the end result, namely, the value of the machine when properly operated to remove soil from dishes. We shall go one step further in that we shall limit the cleaning action to one type of utensil, the plate. In these discussions we shall also eliminate all variables as much as possible. For example, we shall use a constant temperature, a dry soil, and no detergent. The only detergency possible is that of the water. In each instance, clean water will be used so that soil build-up in the wash water will not be involved. Other than design factors, the three factors involved are: (1) volume of water, (2) velocity of water, and (3) time. In most cases time was constant, so only two factors were sometimes involved — volume and velocity.

First, the single-tank door-type machine will be considered. The results of comparative tests are presented in table 2. The machines were supplied on loan by the five leading manufacturers for test purposes.

You will note that the soil removal varied from 98.3 to 85.5 percent. Please remember in examining these data that the soil was designed so that it would not be removed in its entirety in a 30-second wash in the most efficient machine under test; however, this soil is more easily removed than is dried egg or cereal soil. Incidentally, the soil used in our studies was standardized with these machines. Our data show a variation of 12.8 percent, which is significant.

Why did these machines vary? Was it due to low jet velocities, too little water, design of the jets or the placement of the wash water?

Machine B did not have a high jet velocity nor a high-water volume, still it effected the best soil removal. Machine E, with a jet velocity of 5.1 feet gave the poorest results, although the water flow was equal to that of machine B that had the best soil removal. Machine A, with a water flow of 182 and a jet velocity of 4 feet, was less efficient than machine B with a flow of 100 gallons and a jet velocity of 3.7.

The variations in washing action are due to design. These data show that no specifications as to jet velocities and minimum flow rates are in any sense a measurement of dishwashing efficiency.

Incidentally, because these machines are manually operated, it is possible to obtain good results with all of them by washing for longer periods of time. In home dishwashing machines, where splash washing is involved, good results are always obtained provided the dishes are properly spaced and located because the wash period is, at least, 5 minutes or more in duration.

The results on the single-tank, conveyor-type, curtain rinse machines are presented in table 3. Here the variation in washing efficiency is from 0 to 91.2 percent. It will be noted that the wash period now is only 12 seconds as contrasted to 30 seconds in the previously discussed machines. In the time interval involved most of the period is taken in wetting the soil so even though a large volume of water passes over the dishes and a moving target is presented little soil removal results. It is apparent that machine E with low flow and less jet velocity cannot wash properly. Suppose the jets were redesigned without increasing the flow rate, could this machine wash equally as well as the competitive models?

In examining these data you may wonder how this machine can compete with Machine A when the price differential isn't very great. These machines are in current use, and not too much criticism results from the users because, first, most restaurant dishes carry very little soil and most of it is easily removed and, second, the operator soon

TABLE 3. SOIL REMOVAL, JET PRESSURES AND FLOWS OF SINGLE TANK CONVEYOR TYPE MACHINES. 12 SEC WASH

Machine	Percent Soil Removal	Jet Pressures (Feet of Water)	Flow G.P.M.
A	91.2	7.1	216.0
B	55.6	4.1	178.5
C	42.6	7.3	137.9
D	62.0	2.5	218.4
E	0	3.2	62.3

learns that he must pre-soak or brush heavily soiled dishes before washing in the machine. Under these conditions the machines pass, but the cost of operation is high because of the amount of labor involved in the operation.

In table 4 are presented the data for two tank machines. These are unpublished data. Both the percentage of soil removal for the wash and the wash-rinse period are presented because in this type of machine the wash cycle is generally of 8 seconds duration so the test soil is hardly wetted and little is removed. Most of the test soil is removed in the rinse tank. Actually in two-tank machines both the wash and rinse tanks serve as wash compartments because with present jet velocities and flow rates the 8 - second interval is too short for good wash action. These data, like those previously presented, show that the jet velocities and the flow rates are not, either separately or collectively, measurements of washing efficiency.

These data (tables 2, 3, and 4) show that the current dishwashing machines can be improved to a considerable extent in wash efficiency. Without the aid of pre-washers and soakers coupled with a large amount of labor, the end result would be unsatisfactory.

Summary

These studies have demonstrated both the good and bad features of dishwashing machine design and their relationship to efficiency of operation. Our observations and research data have proved that a specification of design as it pertains to rates of water flow and time of exposure is in no sense a measurement of efficiency in removing soil from dishes and silverware. The efficiency of a machine in soil removal and sanitizing action can only be measured by performance. If a machine washes and sanitizes dishes and silverware so that the utensils are clean to sight and touch and free of health hazard, the end result has been attained.

Performance can, of course, be measured roughly by actual operation. If a machine can deliver clean sanitized dishes routinely, the machine certainly is doing an acceptable job. This method is, of course, time consuming and unreliable because the soil is highly inconstant in restaurant operation.

For laboratory testing and field testing where a laboratory can prepare test plates, the standard soil used in our studies does a very satisfactory job. The accuracy of the test is well within the range of practical use. Our soil preparation and the method of preparing test plates are not difficult but do not fit into the routine program of an environmental health group.

We seriously question the need of such tests by the local sanitarian. An inspection of the dishes, a check of hot water supply, temperature of rinse and a mechanical examination of the machine probably is ample. There are so many other jobs, in producing safe food, that need inspection it seems that an attempt on the part of the local sanitarian to evaluate machine design is perhaps unwarranted knowing that if the dishes are properly sanitized there is no health problem involved.

The machine design checking must be done in the laboratory, and preferably in the experimental laboratory of the manufacturer aided by information from research laboratories. A performance test such as that presented by us in National Sanitation Foundation Bull. No. 1 can be used successfully by the manufacturer and the research or testing laboratory. We have new soils that are easier to prepare. We are engaged in research to design a very simple test soil that could be applied by the fieldman for checking machine maintenance in operation. This soil will be supplied in either stick form or in a paste pot with brush.

Conclusion

Present dishwashing machines are so designed that when properly operated, all utensils passing through the machine are sanitized.

A very marked variation in washing efficiency of present dishwashing machines exists. These variations are due to design.

Flow rates of water jet velocities and time of exposure are not measurements of efficiency per se but are responsible for washing efficiency when machines are properly designed.

The only reliable measurement of dishwashing efficiency is a performance test.

A reliable performance test suitable for laboratory use, or field use where properly equipped laboratories are available, exists. This test has made possible the studies reported in this work.

A quick field test for checking proper maintenance in the field is needed.

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(continued on page 161)

TABLE 4. SOIL REMOVAL, JET PRESSURES AND FLOWS OF TWO TANK CONVEYOR TYPE MACHINES

Machine	Percent Soil Removal		Jet Press (Ft. of Water)	Flow G. P. M.
	Wash	Wash-Rinse		
A	13.4	43.9	2.2	124.9
B	9.4	36.6	6.6	116.7
C	9.4	36.6	5.1	126.2
D	75.4	—	3.5	125.0
E	61.8	97.5	6.7	215.0

THE EFFICIENCY OF HOLDING TUBES USED IN HIGH-TEMPERATURE SHORT-TIME PASTEURIZERS

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The efficiency of a holding tube depends on the size of pipe used and the velocity of flow through the tube. Tests conducted on glass and metal pipe in sizes from one to four inches in diameter showed that, for a given capacity, highest efficiency can be obtained by constructing the holding tube of the smallest practical size of pipe. There was no difference between the efficiencies of comparable glass and metal holding tubes.

Introduction

The efficiency of a holding tube is usually defined as the ratio, expressed as a fraction or as a percentage, of the average velocity of flow in the tube to the velocity of the fastest measured particle. The average velocity is calculated from the rate of flow and the cross-sectional area of the tube; the velocity of the fastest measured particle is calculated from the length of the holding tube; and the holding time determined with a sensitive salt or dye test.

The higher the efficiency, the more nearly alike are the average velocity and the velocity of the fastest measured particle. Since much of the milk going through the tube travels at, or near, the average velocity, the amount of overholding diminishes as the efficiency increases. A holding tube with high efficiency is, therefore, desirable.

It has been known, in general, that high velocities result in high efficiency, and it has been suspected that holding tubes of large diameter tend to have relatively low efficiencies for the conditions under which they are used in short-time pasteurizers. No specific data, however, have been published on this problem. In this study, data on the efficiency of holding tubes have been collected for the flow of water in holding tubes of 1-inch, 1½-inch, 2½-inch, and 4-inch sanitary metal pipe and of 1-inch, 2-inch, and 3-inch Pyrex brand glass pipe. The tubes were of selected lengths from 3 to 75 feet.

Experimental

Figure 1 is a sketch of the apparatus used for the tests. The set-up included a reservoir tank with hot and cold water inlets. Valves in the water lines were adjusted to give the desired flow of water at about 140°F. Water from the reservoir flowed to a constant-level tank providing a static head of about 9 inches of water at the inlet side of the pump. Depending on the capacity desired, a model 10, 25, or 100 Waukesha variable-speed, positive, sanitary milk pump was used.

The water was pumped through a multi-pass milk preheater heated by hot water, which in turn was heated by direct steam injection. The heating water was recirculated by a small centrifugal pump. The controls on the preheater were set to deliver heated water at 160°F.

After leaving the preheater the water passed through a three-way valve. This valve was used to obtain flow rates lower than those obtainable with the smallest pump (model 10) set at its lowest speed. When low flow rates were desired, this valve was set to discharge part of the water to waste and send the remainder through the holding tube. Constant flow rates as low as a few hundred pounds per hour could be obtained with this arrangement.

The water then passed through the selected holding tube which was mounted with a uniform slope of ¼" per foot. This slope was chosen as representative of those used in short-time pasteurizers. The water from the tube was discharged either to waste or to a tared receiver.

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Holding tubes of 10 feet or less consisted of a single straight run; tubes longer than 10 feet had return bends between the appropriate number of straight runs of about 10 feet each. The tubes were mounted so that the return bends as well as the straight runs, had a uniform upward slope of ¼" per foot toward the outlet end. The length of each tube was measured from a tee at the inlet end to a tee at the outlet end. Electrodes used for the salt test were mounted in each of these tees.

The electrodes used at either end of the tube were identical. They were of the type described and illustrated in the 3A standard salt test.[1] Leads from each of the electrodes were connected to an automatic Solu-Bridge Flow Timer. This timer was checked and found to respond consistently to about 5

1. 3A Standard Method for Determining the Holding Time of High-Temperature, Short-Time Pasteurizers by Means of the Salt Conductivity Test. *J. Milk & Food Technol.* **13**, 261, (1950).

ppm of sodium chloride added to tap water at 160°F.

An injection of 50 cubic centimeters of saturated salt solution was used for all holding-time tests except for small flow rates of a few hundred pounds per hour. In this case injections of 25 cubic centimeters were used.

In making a holding time test, the flow rate was adjusted to give approximately a 15-second holding time and the system was operated until equilibrium conditions were established. The salt solution was injected through the electrode at the inlet to the holder and, when the salt charge reached the electrode at the outlet end, the holding time indicated by the timer was recorded. The temperature of the water at the outlet end of the tube was recorded and the discharge was collected for a timed period and weighed. This procedure was repeated about five times with each holding tube.

The length of the holding tube was then increased and the runs repeated. The same procedure was followed for the tubes of metal and of glass pipe in each of the available diameters. No air was added to the water in any of these tests and, as could be seen with the tests on glass pipes, negligible amounts of air were liberated from the water used in the tests.

The holding-tube efficiency was calculated for each run by the following formulae:

$$\bar{v} = \frac{w}{\rho At}$$

where

$\bar{v}$ = average velocity, ft./sec.
w=wt. of water collected, lb.
ρ=density of water at measured temperature, lb./ft.^{3}
A = cross-sectional area of pipe, ft.^{2}
t = time for collecting water, sec.

and

$$vH.T. = \frac{H.\ T.}{L}$$

where

vH.T. = velocity of fastest measured particle, ft./sec.
H.T. = measured holding time, sec.
L = length of holding tube between electrodes, ft.

and

$$\text{Holding-tube efficiency} = \frac{\bar{v}}{vH.T.}$$

Reynolds number was calculated for the flow conditions in each run from the formula:

$$Re = \frac{Dv\rho}{\mu}$$

where

Re = Reynolds number
D = internal diameter of pipe, ft.
$\bar{v}$ = average velocity, ft./sec.
ρ = density of water at measured temperature, lb./ft.^{3}
μ = viscosity of water at measured temperature, lb/ft. sec. (viscosity in centipoises x 0.000672 = viscosity in lb./ft. sec.)

The graphs in figure 2 show the variation in holding-tube efficiency with Reynolds number in holding tubes of sanitary metal pipe. The graphs in figure 3 are for holding tubes of Pyrex brand glass pipe. The holding-tube efficiencies are plotted against Reynolds number since this parameter includes the diameter of the pipe and the average velocity of flow in the pipe as well as the density and viscosity of the liquid in question. In addition, the holding-tube efficiency for milk and for water is theoretically the same at the same Reynolds number in a given size of pipe. Thus, by using the appropriate values of ρ and μ for milk, the data can be applied to the flow of milk.

For water at 160°F the conversion factors which can be used to convert Reynolds number to the more familiar units of average velocity and pounds per hour, are shown in table 1.

The graphs in figures 2 and 3 indicate that holding-tube efficiency increases with Reynolds number rapidly at first, then more slowly, and becomes nearly constant at high Reynolds numbers. At each Reynolds number the efficiency decreases as the size (internal diameter) of the pipe increases. This is true for the various sizes of metal pipe and for the various sizes of glass pipe. The relationship also holds when metal and glass pipe are compared on a basis of internal diameter. The comparison cannot be made on the basis of nominal size since, with glass pipe, the nominal size refers to internal diameter, whereas the nominal size of metal pipe refers to its external diameter.

In comparing the efficiency of glass and metal holding tubes, the differences in the nature of the surfaces of these two types of pipe has no apparent effect. Nor does any apparent difference result from the sharp 90-degree elbows used in glass pipe as compared to the 90-degree sweep elbows used in metal pipe.

The data indicate that, for a given flow rate, highest efficiency can be obtained by using the smallest practical size of pipe. This means that relatively long tubes of small diameter and, hence, high velocities are most desirable.

The efficiency of a box-type holding tube was also measured. This tube consisted of seven 34 ¾-inch lengths of 2-inch metal pipe mounted one above the other. The slope

TABLE 1. CONVERSION FACTORS

Nominal size of pipe	To convert Re no. to average velocity in ft sec, divide by:	To convert Re no. to flow in lb hr, divide by:
Sanitary metal		
1-inch	17,068	17.50
1½-inch	26,517	11.26
2½-inch	44,827	6.66
4-inch	72,518	4.12
Pyrex brand glass		
1-inch	18,914	15.79
2-inch	37,836	7.90
3-inch	56,743	5.26

of the straight pipe portions of this tube was 0.15 inch per foot. The return bends between the straight lengths were in the form of machined recesses in the heads that fit over the tube ends.

Because of the design of this holding tube it was not possible to measure its total length. The length of 2-inch metal pipe equivalent to this tube was calculated from the value of the capacity of the tube supplied by its manufacturer. This length, 24.44 feet, was used in calculating holding-tube efficiency. A holding time of 15 seconds was obtained with this tube at flow rates of about 5,700 pounds per hour. This corresponds to an average velocity of 1.37 feet per second. The holding-tube efficiency for these conditions was found to be 84.4 percent. This is close to the value which might be predicted for a 2-inch metal holding tube of ordinary design.

The Effect of Air on Holding Time

The effects of air on the nature of the flow of water in the experimental short-time pasteurizer were also studied. Although this information is not directly applicable to milk because foam in milk and air bubbles in water probably do not act the same, it is felt that these data will be useful in explaining some of the phenomena observed in checking the holding time in short-time pasteurization with the salt conductivity method.

Any air present in the system comes either from leaks in the joints in lines under partial vacuum or from dissolved air liberated when the water is heated. This air affects the measured holding time in two ways.

At the pump inlet it displaces water and causes a decrease in the rate at which the pump delivers water. The magnitude of this decrease in capacity increases as the amount of air leaking into the system increases. Also, the greater the vacuum at the pump inlet, the greater is the effect of a given amount of air entering the pump inlet. This is to be expected since, at lower absolute pressures, the volume of the air is greater and it displaces more water.

In the holding tube the air continues to displace water. This causes the actual velocity of the water moving through the tube to be greater than it would be for the same flow rate with no air present.

The effect that air has on the measured holding time is the net result of these two effects. It was found that as increasing amounts of air were metered into the suction line of the system to simulate air leaks, the holding time was nearly constant at first and then always increased. This indicates that the decrease in pump capacity at a given air rate more than offsets the increase in actual water velocities in the holding tube.

The following data shown in table 2, were obtained by metering into the suction side of a model 25 Waukesha pump. The holding tube was 29 feet long, of 2-inch glass pipe, and had a uniform slope of 1 inch per foot. The vacuum at the pump inlet was 1.4 inches of mercury and water entered the pump at 140°F.

There was no restriction at the discharge end of the holding tube, and the pressure in the holding tube was, therefore, somewhat lower than the pressure which would ordinarily exist in the holding tube of a commercial pasteurizer. Hence, the air in the holding tube of the experimental setup probably had a greater volume and displaced more water than would the same amount of air in the holding tube of a commercial pasteurizer. The increases in holding time found for the same air rates in a comparable commercial pasteurizer would, therefore, be greater than those indicated here.

Similar experiments were performed with the same holding tube mounted with slopes of ¼ and ½ inch per foot. In each case the results were nearly identical, indicating that the movement of air and water through the holding tube is not influenced by the slope of the tube if it is between ¼ inch and 1 inch per foot.

Summary

Holding-tube efficiencies increase with Reynolds number rapidly at first, then more slowly, and become nearly constant at high Reynolds numbers. At any Reynolds number the holding-tube efficiency decreases as the internal diameter of the pipe increases.

For a given flow rate, highest efficiency can be obtained by constructing the holding tube of the smallest practical size of pipe.

The efficiencies of glass holding tubes and metal holding tubes are comparable. Neither the differences in their surfaces nor the differences in the types of elbows used had any apparent effect on the holding-tube efficiency.

The net result of air leaks in a pasteurizer operated on water is to cause an increase in holding time.

The slope of the holding tube, when between ¼ inch and 1 inch per foot, has little effect on the rate of change in holding time with the amount of air leaking into the pump.

Table 2. Effect of Air on Pump Discharge and Holding Time

Air rate, cu ft/hr at 160°F and 1 atm.	Pump discharge lb H_2O per hr at 160°F	Holding time, seconds
0.0	7,970	15.09
3.6	8,020	15.08
4.6	7,850	15.09
5.9	7,610	15.38
7.4	7,260	15.83
9.2	7,100	16.07
12.5	6,630	16.43
15.3	6,240	16.17
20.1	5,760	17.08

CANNING PLANT SANITATION*

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The canning industry has always had to consider sanitation, but as the result of a "spot" survey, an intensive educational nation-wide program was authorized in 1945, and the development is described. An early conclusion was the necessity of each plant having a trained man responsible for the plant sanitation. Cannery sanitation as compared with Public Health Sanitation is largely a matter of plant efficiency, product quality and esthetics. Various categories of cannery sanitation and their application are described. There is an important place for the industry sanitarian as well as the enforcement sanitarian, and there is need for a standardization of concepts between the two.

The canning industry is tremendously important to the health and economy of our country. In the last quarter century our population has tended to concentrate in urban areas which has brought more and more dependence on commercially preserved foods. Economically the canning industry gives support to hundreds of thousands of people with a payroll of $600,000,000 to $700,000,000. The average annual pack of canned foods is about 560,000,000 cases or approximately 16,900,000,000 cans a year, and is being pushed higher because of government needs for the armed forces. The value of canned products shipped in 1950 was about $2,500,000,000, and the value added by manufacture was about $1,000,000,000. These figures emphasize the importance of the canning industry to our overall economy. It is even more important when we realize canning provides an outlet throughout the year for a vast amount of our seasonally grown agriculture products, and agriculture we are told is the backbone of our country. During the last two World Wars great quantities of canned foods were used to feed the armed forces and are still being used for this purpose. In the recent struggle, canners produced two-thirds of the food supply of our fighting men. In recent years we have come to realize the importance and safety of canned foods for feeding of civilian populations that may be so unfortunate as to experience present day atomic, biological or chemical warfare. More generally appreciated, however, are their convenience, economy and indispensable role in the nutrition of the American people.

Sanitation Program of NCA

The National Canners Association is an organization of packers of canned foods, established in 1907, whose broad objective is to increase the use of canned foods and to improve the efficiency of operation of its members. The Association has members in 44 states and three territories, and its membership packs from 75 percent to 80 percent of the industry's total production. It is a non-profit association supported by dues paid by the members and contributions from can and glass manufacturers. The activities are governed by a board of directors from the membership, and standing and special committees. A large part of the Association's budget is expended in fundamental and applied research in the laboratories in Washington, D. C., Berkeley, California, and Seattle, Washington. The Sanitation Program is a part of the laboratory activities.

The canning industry has always had to consider sanitation in order to put up a product that would keep. However, it was in 1945 that the Board of Directors inaugurated an intensive sanitation program as such, both in the Washington laboratory and the Western laboratory at that time in San Francisco.

The program has had a logical development. We began by making voluntary and confidential critical sanitary surveys of as many plants as possible, which served to demonstrate our concept of sanitation to our members in a practical way and in terms of their own operations and problems. It also taught us a good deal about the industry and its sanitation problems and gave us a practical basis on which to build our program. It soon became apparent that we could not accomplish our objective through inspections alone without an unreasonably large staff. Also, we did not feel policing our member plants would be a proper function. We were convinced, and still are, that an educational program to teach the principles of good sanitation and the reasons behind them,

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would result in the most lasting benefits. It is our endeavor to have at least one trained man in each canning organization. Many of the larger organizations now have well trained and experienced men in charge of their sanitation departments. Inasmuch as the canning industry is in a large part seasonal, only a few of the smaller organizations or single plants have found it feasible to attach a full time, experienced sanitarian to their permanent year round staff. For this reason we have offered sanitation training to qualified men from the plants who are already familiar with the plant operations and personnel.

Since 1945 we have given 8 training courses in food plant sanitation varying from 8 weeks to 1 week each. They have covered fundamental and up-to-date information concerning sanitary science and its application to plant problems. Such training is sketchy, but many of the men who attended have accomplished amazing things, not because they were trained scientists, but because of their common sense, tact and practical knowledge of the plant and its personnel. These men need the cooperation of their associates and managers, and we have taken every opportunity to discuss the subject with management, and have held a number of one- and two- day conferences in various canning centers with superintendent and foreman groups. In addition, we act as consultants on sanitation problems and as a source of information. Each month we put out a brief sanitation news letter called "The Conveyor" which we try to give popular appeal. This serves to keep the thought of sanitation constantly before the industry.

ASSOCIATION OF FOOD INDUSTRY SANITARIANS

Another group you will be interested in knowing about is the Association of Food Industry Sanitarians. As the name implies, this is a group of food industry sanitarians who have incorporated for the purpose of maintaining and improving the high sanitary standards in the canning, freezing, dehydration and other food processing industries throughout the United States and its territories by fostering and encouraging research and the dissemination of information which would aid in the practical application of the most advanced scientific sanitation principles in these industries, to publish, or cause to be published, useful information related to sanitation, to cooperate with other associations in the solution of sanitation problems, etc., and to maintain a high degree of skill and efficiency among its members.

We hold annual meetings and distribute to the members only, a monthly *Bulletin*. The most ambitious project has been the writing of a book on food plant sanitation in cooperation with the National Canners Association. The complete title is *Sanitation For The Food Preservation Industries*. We have attempted to make it a practical book and as non-technical as possible. It covers all phases of sanitation applicable to food plants; in particular, canning, freezing and dehydration, although the principles are applicable any place. We have covered organization of plant sanitation programs, inspection technics, housekeeping, animal and insect pests, microorganisms, water, chlorination, construction, cleaning, employee facilities, feeding and housing, wastes, and laboratory aids to the sanitarian. The publisher is the McGraw-Hill Book Company of New York who have published it as one of their food technology series.

PRINCIPLES OF SANITATION

The principles of sanitation are the same in all fields. Public health considerations, while of the utmost importance, do not require a great deal of the cannery sanitarian's time, except the industrial hygiene and feeding phases as applied to the employees. Heat processes for commercial sterilization of canned foods of public health significance have been established by the National Canners Association and other agencies, through intensive scientific study over a great many years. Cannery sanitation therefore, becomes largely a matter of plant efficiency, product quality and esthetics, all of which are important. The industry sanitarian has the Governmental laws and regulations to guide him, but he is expected, in addition to avoiding violations, to also determine for his company how poor sanitation practices can be corrected in the most practical way. He should consider sanitation as related to product quality and production efficiency without limitation to minimum legal requirements. It is the duty of an enforcement official to specify, within his legal authority, what results must be attained and maintained, but it is up to the plant itself, to determine how to obtain these results. Suggestion will often be requested and appreciated, but the procedure should not be made a requirement. There are exceptions of course, where this is not practicable.

It is not possible to define limits of sanitation, because it is closely tied up with quality control and production. However, for discussion we can divide it into categories such as housekeeping or tidiness, control of rodents or insects, control of microorganisms, water supply, construction and maintenance of buildings and equipment, cleaning, industrial hygiene, maintenance of facilities for employee comfort and welfare, treatment and disposal of wastes, and in some plants the feeding and even housing of employees.

Tidiness means, of course, a place for everything and everything in its place. A plant that is littered with unused and unwanted machinery, scrap iron, pipe, nuts, bolts, sacks and debris, is not a place where quality and production will be at its best. A slovenly plant tends to induce poor workmanship on the part of employees. Rubbish and debris may harbor insects and rodents that may contaminate the product. The mere presence of debris, dust and dirt in a plant may in itself, be the cause of contaminating food with foreign material. In addition, the tidiness of a plant is the first impression anyone gets when visiting the plant.

Rats, mice, and other animal and bird pests, may be a source of serious contamination. The same is true of various insects such as houseflies, fruit flies (*Drosophila*), roaches and the stored product insects. Much of the insect contamination of some products originates in the field, but even with complete elimination of the field problem, failure to consider sanitation at the warehouse or plant may be disastrous.

If the control of significant microorganisms is inadequate, they may cause a a lowering of product quality, or spoilage. In canning, recontamination and spoilage may occur because of high microbial populations in can cooling water. Organisms of a heat resistant type, which may multiply in the equipment, may cause spoilage. Slime and mold on equipment and building structures grow rapidly and are problems for the sanitarian that may affect the quality of the product. The uncontrolled build-up of acid producing microorganisms on equipment and in concrete floors, may greatly accelerate corrosion. Germicidal materials and methods of their application must be such that equipment will not be damaged, and off-flavor will not result. Also, they must comply with pure food laws. An outstanding development in the last 5 years has been the continuous application of a germicidal solution of chlorine using the breakpoint method to obtain a chlorine residual in almost all of the plant water.[1] This has not proven to be a "cure-all", nor has it eliminated the necessity for clean-up but it has helped a great deal in reducing slime growths and the build-up of microorganisms in equipment. It results in a cleaner plant and a better place to work, increases efficiency, and reduces the time and cost of keeping the plant clean.

In cleaning the plant, a great deal of time and money can be wasted if the program is not properly organized. The person responsible for sanitation should make a study of the cleaning job in his plant, to eliminate lost motion. He should determine where detergents can be used to the best advantage, how they can be applied most effectively, where other cleaning aids such as high-pressure water and special brushes can be used, where germicides should be applied, and by no means the least important, what degree of cleanliness is necessary in the various equipment. Some pieces of equipment may need more frequent or more thorough cleaning than others.

Water is one of the commonest materials used in food plants. It serves as a packing medium for many products; is is used for fluming foods and waste materials; and serves for cooling, heating (steam), cleaning and drinking purposes. To obtain a high quality product, water must be of proper chemical and bacteriological quality. Certain chemicals in water have a bad effect on some products, on cans, boilers and other equipment. The hardness of the water and type of hardness will govern, to a certain extent, the type of cleaning compounds that can be used. The water must be bacteriologically safe and esthetically satisfactory for drinking and for use on the product, and it must not cause biofouling of the distribution system. The coliform presumptive test is not always a satisfactory criteria. In the face of water shortages, it may be necessary to devise ways of saving water and reusing it for various purposes. This raises many problems in determining where certain waters can be safely reused. The use of water greatly affects the problems of disposing of liquid or semi-liquid plant wastes. This is becoming increasingly important because much attention is now being given to reducing pollution so as to obtain the most economical and beneficial use of our natural waters for the greatest number of people. Many plants are having to re-evaluate their production of waste and means of its disposal, and the problem of liquid waste disposal, coupled with water shortages, may make necessary some changes in production methods. Solid wastes also present disposal problems in some areas, and the possibility of utilization of the various types of wastes to reduce disposal costs are being considered. The sanitary handling of wastes within the plant is also of importance in order that insect breeding and other insanitation is not encouraged.

PLANT

The construction of equipment and buildings is of great importance. The cost of a piece of equipment is its original cost plus the expense of maintenance and cleaning during its entire useful life. Therefore, equipment purchased or built with sanitation and ease of cleaning in mind, may be more expensive in initial cost, but will usually be more economical to keep in a sanitary condition and significant over-all savings will result. Quality losses and spoilage have, on many occasions, been traced to poorly designed and improperly constructed equipment.

The employees' health, welfare and mental attitude are also of great importance. More and more skill is being required in this period of greater production and higher quality, and it is expensive to hire new and untrained people. Much of any employee's time is spent in his working environment, and if we want to keep him healthy, happy and efficient, we should provide comfortable and sanitary facilities for his personal service. Clean toilets, locker rooms, rest rooms, warm water for washing, elimination of work hazards, etc., are of more immediate and personal interest to the individual worker than the plant production record or profit for the year.

In some plants, housing is provided for employees, and more and more plants are providing cafeterias where the employees can obtain nutritious, wholesome meals at reasonable cost. Most plants believe this is a valuable service to the workers and results in greater efficiency. However, group feeding brings the danger of transmission of communicable diseases if not operated in a sanitary manner. A poorly operated, insanitary cafeteria can result in many workers being incapacitated in a matter of hours due to food poisoning and food infections from improperly prepared or stored foods. This could be disastrous when tons of perishable raw products are waiting for processing.

Various laws and regulations apply, to food industry sanitation, but laws and regulations, by their very nature, can establish only minimum requirements. While some of these requirements may be difficult to attain, most progressive industrialist desire to conform to the greatest possible extent, and in many ways even go far beyond the minimum required. Frequent inspection by government agents and enforcement of regulations alone merely serve to maintain minimum standards. However, such inspection is necessary and of value in disclosing conditions that have been overlooked, and in keeping the recalcitrant individual, who refuses to recognize his responsibilities, from threatening the reputation of the rest of the industry. It is far better that plant managers recognize sanitation in its true relationship to their entire operations. Self inspection to find and correct insanitary conditions leading to possible trouble before it occurs is a sensible approach.

So, in practice there is an important place for the sanitarian both in private industry and in government enforcement. Fundamentally, the work is similar, but in practical application it may be quite different. Nevertheless, it is a professional obligation to standardize our thinking, concepts, interpretations and application of the sanitary sciences to as great a degree as possible. Men entering this and related fields from public health and food technology departments of our colleges and universities should have uniform training in food industry sanitation so their concepts will not vary greatly in different sections of the country. Reference books, such as the one I have mentioned, and the various published papers will all help us to progress together. And most important of all, meetings such as this, where private industry and government representatives can become acquainted and exchange views, will aid us in our mutual responsibility of assuring the public of the availability of good quality, nutritious foods.

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(continued from page 154)

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THIRD NATIONAL CONFERENCE ON INTERSTATE MILK SHIPMENT

The Third National Conference on Interstate Milk Shipment was held at the Hotel Statler, St. Louis, Missouri, June 10-12th. Representatives of various milk control authorities and industry from twenty-seven states participated in the Conference.

General agreement was reached on a number of problems and several were assigned for further study.

Maintenance of an informal type of organization was decided upon by the general assembly. An executive committee was elected which in turn chose their chairman for 1953. J. L. Rowland, of Missouri was re-elected by the committee to serve as Chairman of the Executive committee.

Remarkable progress has been made through the three conferences toward solving the many problems connected with the interstate shipment of milk. The need for better education and participation of local control authorities with regard to the interstate program is becoming more apparent. The various states were urged to expend much greater efforts toward dissemination of information. The complete report of the conference will be published in this Journal in the near future.

MILK QUALITY

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In this discussion the author attempts to show that our modern concepts of quality are the result of a slow, evolutionary process. Individual and collective viewpoints regarding milk quality are influenced by educational background, economic and social status, scientific information, and political subterfuge. Even our present standards of quality should not be regarded as fixed values.

What is Milk Quality?

Cutting through the many complicated and diverse definitions of "milk quality", it might be defined as "Those characteristics of milk which make it desired as food." Over-simplification generally leads to vagueness and ambiguity, and such criticism of the definition just given would not be entirely unfair. However, in the brief discussion to follow, the writer will not attempt so much to give in great detail a definition of what good milk *is*, but rather to suggest some of the avenues by which we approach an agreement concerning generally accepted quality standards.

What Determines our Concept of Quality

Millions of words have been written about the general theme of milk quality, including experimental data, viewpoints, and opinions on every conceivable (and even some that appear inconceivable) aspect of the subject. Yet surprisingly enough extensive search reveals the fact that very few writers have had the temerity to give a complete yet withal definitive description of high "quality" as applied to milk. This must undoubedly be explained in large part by the multitude of details which demand consideration in any maturely developed concept of the idea of "quality". The problem is further complicated by a certain amount of contradictory scientific evidence produced by investigators. Morever, definitions and all kindred descriptions of a delimiting nature are man made and consequently almost surely are biased by certain personal characteristics and limitations of the individual giving the definition. Some of these personal factors will now be discussed very briefly.

1. *Educational background of the individual.* This applies to education in general as well as to the narrow field of dairy technology. Normally one expects persons with better education, obtained either formally or "self-taught", to have higher ideals regarding such things as nutrition, food sanitation, etc. The relatively small number of persons who have had more or less specialized training in any or all of the fields of nutrition, biochemistry, bacteriology, food sanitation, dairy manufacturing, etc., will have still different ideas of quality and will no doubt make up the most critical group of consumers. On the other end of the scale one would expect the illiterates as a group to be the least opinionated with regard to a "quality concept".

2. *Economic and social status of the individual.* Consumers with a limited food budget will definitely be economy minded, and *may* be less particular regarding quality than those who are not financially handicapped. In the vast majority of cases the social status of the individual parallels his economic condition. However, there are many exceptions to this general rule, wherein the ideals, viewpoints, and aspirations of the individual are found to be on either a higher or lower plane than his wordly possessions would suggest.

3. *Scientific information available.* This factor get virtually universal acceptance as being of prime importance in its influence on concepts of milk quality. However, only specially trained persons are qualified to distinguish between truly scientific information and pseudo-scientific "information". Much of the latter appears in mildly sensational newspaper and magazine articles prepared for popular consumption. A notorious example is the article which appeared in one of the popular pocket-size magazines[1] some 15 years ago, purporting to show a direct cause and effect relationship between the consumption of milk and the incidence of cancer. Written in a light, almost flippant vein, the author attempted to prove his point by "reasoning" based purely on rather poor circumstantial evidence. While such an article would get no credence from scientists familiar with the field of study involved, it nevertheless caused a minor furore among lay readers. The excitement has long since subsided, and the un-

substantiated hypothesis duly relegated to the limbo.

In this connection, consider for a moment Webster's definition of *scientific*: "designed to establish incontestably sound conclusions and generalizations by absolute accuracy and perfect disinterestedness of investigation". This definition of *scientific* might be described as the ultimate goal to which all scientists aspire but never quite attain. There are three elements in this definition which, when applied to any specific concept, must be looked upon as flexible and relative rather than fixed and absolute. The elements are (a) "incontestably sound", (b) "absolute accuracy", and (c) "perfect disinterestedness".

In every branch of the physical sciences many conclusions and generalizations which were "incontestably sound" 25 to 50 years ago are today untenable. All scientific investigators recognize the fact that probably no one has ever attained "absolute accuracy". The nearness with which one reaches absolute accuracy is a function of the method employed, the investigator's technique, and the limitations of the measuring instruments available. It is also questionable whether "perfect disinterestedness" is ever achieved. Complicating factors are such things as preconceived ideas, personal interest in results, personality traits, etc.

In the light of the preceding comments it seems obvious that *the best scientific information* is not necessarily the oldest nor yet the newest. Old ideas frequently require revision, whereas the newest concepts have not aged sufficiently to be proved "incontestably sound." Somewhere between these two extremes will be found an optimum ground of common thought wherein the best philosophies are generated. Thus one must arrive at the conclusion (which the writer believes *is* "incontestably sound") that concepts of norms or standards in any narrow field of science (such as milk quality) are never static. They change gradually as time brings new information into its proper perspective in the overall view of scientific knowledge.

In the writer's possession is a set of *The Domestic Encylopedia, or Dictionary of Facts and Useful Knowledge,* published in 1804. Under the heading MILK is found a description of milk and its virtues, and also this interesting precaution: " . . . if a person be debilitated, or otherwise exhausted by sickness, milk ought by no means to be used; as it is apt to generate cramps or violent spasms in the stomach, the heart-burn, etc. Corpulent and plethoric persons; those who are recovering from febrile complaints; and particularly such as are accustomed to drink wine, and spirituous liquors, cannot with advantage or safety adopt a *milk-diet*; because the fatty and viscid properties of that fluid tend to oppress the stomach, and occasion indigestion." For contrast compare above quotation with information contained in any modern elementary text book on human nutrition.

As another illustration of how viewpoints change, consider the fact that thirty or forty years ago every well-informed person "knew" that it was unsafe to eat fish and drink milk at the same meal. It has taken years to re-educate people to a realization that these conclusions are not incontestably sound in the light of modern knowledge.

Regarding the relation of milk consumption to human welfare, it is certain that conceptions must change from time to time concomitant with new discoveries concerning the nature and properties of milk, and concerning human physiology, nutrition and pathology. The interaction of these two lines of research will necessitate periodic reappraising of accepted viewpoints, with appropriate adjustments in thinking habits.

4. *Political atmosphere.* The intellectual effect on the general public of the type of political atmosphere referred to here might be likened to that of carbon monoxide: though poisonous its presence may not be known to those that breathe it. The political atmosphere(s) to be considered in this particular instance are those emanating from ordinances, laws, rulings, regulations, *et cetera,* pertaining to the market milk industry—their origins, enactments, administration, maladministration, and perversion. Great strides have been made in recent years in all phases of regulatory work, yet there remains an almost infinite amount of room for improvement. There has been real, solid improvement in certain branches of the work. For example, all would certainly agree that the professional qualifications required of sanitarians is on a much higher level than that which prevailed 25 years ago.

But in other lines of activity conditions still are often little short of deplorable. The great variability in the design of local ordinances constitutes one of the most serious deterrents to real progress in putting public health regulations of the market milk industry on a scientific, dignified, and effective basis. After examining certain community, county, and state regulations, one is forced to the conclusion that not all ordinances have been designed and adopted with the physical welfare of the consumer as the sole objective.

Perhaps an example will best illustrate this point. Is it reasonable to believe that milk pasteurized within a 4-mile radius of Main Street and Center Avenue is good, wholesome, healthful milk, whereas any that is pasteurized and bottled 5 miles from the same point is unfit for human consumption within the 4-mile circle? To all persons of average or nearly-average intelligence the question sounds puerile. Regulations of identical stupidity do, nevertheless exist, and they tend to create in the mind of the consuming public false ideas regarding standards of quality and of conditions essential to quality. This is one example of a type of political atmosphere frequently encountered. The reader could undoubtedly cite many other examples which are equally insulting to normal human intellect and self-respect.

It is encouraging to note, however, that progress is being made in the direction of incorporating some element of common sense and reasonableness into "model" ordinances. This cannot but result in greater respect for such ordinances by producers, processors, consumers, and regulatory officials. It naturally follows that such ordinances will be more easily enforced and thus more effective in accomplishing their purpose.

For instance, the 1950 report of the Committee on Milk Regulations and Ordinances (of the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS) states, in part, that ". . . the Committee has adopted a new approach, and has tentatively formulated an ordinance which places greater emphasis upon pasteurization, and greater dependence upon platform inspection than did the ordinance submitted in 1948. In drafting this tentative form of an ordinance, the Committee has considered the views of the members of the dairy industry, and others."[2].

This report gives in detail "A Suggested Minimum Milk Ordinance" which, all in all, is the most sensible, down-to-earth set of regulations (in the writer's opinion, of course) that has yet appeared in print. In this suggested ordinance appear such revolutionary—and refreshing—statements and/or provisos as the following: "A thorough initial survey of the present situation in each locality may well precede the fixing of a definite direct microscopic count standard"; "this ordinance depends upon quality tests on the product for enforcement"; "it is anticipated that when this ordinance is adopted and applied to existing dairy farm and milk plants, the requirements will be applied judiciously and sanely"; "in order to conform to local conditions and promote harmonious public relations in the communities served . . . reasonable departures from the proposed tests are not only permissible but sometimes desirable." One can indeed inhale deeply and with ecstasy in such an exhilarating atmosphere!

WHAT ARE THE PRESENT STANDARDS FOR HIGH QUALITY MILK?

It should be understood at the outset that the discussion which follows aims primarily to illustrate general principles rather than to attempt a definition of high-quality milk. Although additional attributes might be mentioned, there probably would be no disagreement with the general statements that good milk should be: (1) high in nutritive value, (2) safe from the standpoint of disease transmission, (3) palatable, and (4) in a protective package. It is in the elaboration and detailed interpretation of these statements that difficulty may be encountered.

NUTRITIVE VALUE

For instance, what should be the standard value for satisfactorily high nutritive value, with respect to the various food constituents in milk? Who should set the standard? Is Holstein milk a suitable product, or should we insist on Jersey milk? Should milk be standardized to a uniform fat content, and if so, what should be the fat standard? Or should we require that milk must be sold as the cow delivers it (with respect to fat content only; of course, it may still be necessary to remove some dirt, kill some bacteria, and add some vitamins!)? Is it old-fashioned to think that milk unfortified with vitamins is, notwithstanding, a highly nutritious food? If your doctor feels that even with a well-balanced diet you need supplementary amounts of vitamins X, Y, or Z, can you get them cheaper in milk or pills?

Milk is recognized by leading authorities in the field of nutrition as being the most nearly perfect natural food. Should we be satisfied with that, or shouldn't we devise ways of modifying its nature so that it becomes the *perfect* food? Such endeavors would, of course, result from the assumption that milk is to become the principal if not the sole source of human nourishment and that other now-popuar foods will gradually fall into disuse.

Even before Dr. Babcock devised a practical procedure for assaying the fat content of milk, it was recognized that this constituent was variable. With the advent of the Babcock test more and more emphasis was placed on the fat portion of milk. This one-sided viewpoint has become a fetish to the point of virtual disregard for the other valuable food constituents present in "nature's most nearly perfect food". The pendulum has swung wide and high in this direction, but recent indications are that the swing has about reached its deadpoint if, in fact, it has not already started in the other direction.

Occasionally, a responsible, respected authority raises the question of how far we should go in modifying the characteristics of natural milk. This usually draws scornful comments from the listeners for it is presumptious, to say the least, that any one should be so indiscreet as to belittle or suggest a doubt regarding practices which (nearly) everyone else takes for granted. But would it not have a wholesome effect if, occasionally, everybody concerned would make a vigorous effort to sweep his mind clean of all prejudicial opinions and popular ideas and to re-examine all practices in the light of up-to date scientific information? Today milk is processed in great and earnest effort. It is clarified (or filtered), may be standardized, pasteurized, homogenized, vitaminized, and "enzymized". (There may be some new processes of which the writer is not yet aware!) Is such processing thereby improving the wholesomeness and/or nutritive properties of milk, or is it primarily furnishing an advertising program for the sales manager—and at the same time increasing the cost of the product to the consumer?

HEALTH SAFETY

Consider next the statement that high quality milk should be safe from the standpoint of transmitting disease. Probably more improvement has been achieved in the last 50 years in this phase of milk quality work than in any other. Much has been accomplished, for which the dairy industry has a right to be proud — but not complacent. The incidence of milk-borne epidemics has been reduced enormously but not yet to the vanishing point.

Of course reference is made here to those diseases known to be susceptible of transmission through milk. The pathogenic organisms causing such diseases are destroyed by proper pasteurization. But do dairy and medical scientists know about *all* disease-producing bacteria that may gain entrance and survive in milk? *The American Journal of Hygiene* has published a report[3] of a polio epidemic in a U. S. Naval Receiving Station, stating that milk was considered the most likely source of infection. The report also stated that the pasteurized milk was of satisfactory quality and had consistently given negative phosphatase tests during the critical period. Faulkner[4] states: "new diseases, such as Q fever, are being added to the list of milk-borne and food-borne disease from time to time".

PALATABILITY

Take also the matter of the palatability of milk. Milk of good flavor may be no more wholesome nor nutritious than poor-flavored milk, but people, young and old, will drink more of it. Therefore one must conclude that milk of excellent flavor will contribute to better nutrition more effectively than will a product that is unpalatable.

Unfortunately there has probably been little overall improvement in the flavor of market milk during the past 50 years. It is true that improved sanitation and better refrigeration have largely eliminated off-flavors in milk resulting from bacterial action. Counterbalancing these gains, however, are certain "new" flavor defects, such as "oxidized", "activated", and "sunlight", resulting mainly from modern methods of processing. Ironically, some of those defects are aggravated by our present day high standards of sanitation. Although some progress has been made in keeping weed and feed flavors out of milk, it remains a serious problem inasmuch as no commercially practical method is yet available for removing such flavors as do gain entrance to the milk.

What is good flavor in milk? Says one authority[5], "normal freshly drawn milk tastes slightly sweet to most people and has a characteristic although not pronounced odor". Another[6] states that "the natural flavor of milk is scarcely discernable, yet is pleasant and slightly sweet", whereas a third[7] says that "the flavor of normal whole milk is pleasantly sweet, possessing neither a foretaste nor an aftertaste other than that imparted by the natural richness". Because of the personal element involved, it is not easy to established a standard "perfect" flavor with which even the experts will unanimously agree. In working with this particular aspect of high quality milk, the consumer's likes and dislikes ought certainly to receive considerable attention. The common practice is to *tell* him that homogenized milk tastes better than "regular" milk. Would it be unsound merchandising practice to ask him which he thinks has the better flavor?

PROTECTIVE PACKAGE

The last of the four attributes of high quality milk which were listed above is the protective package in which the product is delivered to the consumer. Although this is not an inherent characteristic of the milk itself, it is certainly directly related to each of the three preceding attributes. That there has been much improvement in milk containers during the past century cannot be gainsaid. Modern containers are more economical, easier to clean, more convenient to use, more attractive, and tamper proof. Paper bottles were first suggested for use as milk containers less than 25 years ago. Today a significant proportion of commercial bottled milk is distributed in paper. Although a considerable amount of discussion continues, from various merchandising and economy angles, on the question of glass versus paper, it appears rather certain that paper bottles will retain an important place in the market milk industry at least during the reasonably near future.

OTHER PROPERTIES

The preceding discussion of some of the most important characteristics of high quality milk has been concerned primarily with the consumer viewpoint. Obviously the processor-distributor is likewise much concerned about these same features of milk, but in *addition* to these requirements he must also give concerted attention to some others. For instance, is milk containing penicillin or other antibiotics "good" milk for the dairy plant operator? It definitely is not if the milk is to be used for starter propagation or for making cultured buttermilk, cottage cheese, or other fermented milk products. Whether or not the presence of antibiotics in milk is significant from a public health angle is yet to be settled.

The stability of milk protein varies at times as a result of changes in the salt balance. Is milk containing unstable protein (meaning it curdles easily) good milk from the processor's standpoint? Although such milk is perfectly "normal" in the ordinary sense of the word, it causes difficulties in certain plant operations. Under such circumstances one could not reasonably expect the plant operator to consider the milk as being of highest quality for his purpose.

As mentioned previously, oxidized and related flavors are common in market milk. This susceptibility to the development of oxidized flavors is a characteristic which, like protein stability, may vary from time to time. It is affected by feeding conditions, and it may show considerable variation among individual cows. Should "susceptible" milk be considered undesirable by the plant operator? Perhaps the question could justifiably be labeled purely academic, inasmuch as there is no practical test for nor simple method of correcting this defect in raw milk. It should be remembered, however, that other problems which were once considered academic have been solved in due time.

CAN QUALITY STANDARDS BE REGARDED AS FIXED VALUES?

The answer is an emphatic "no". The prevailing conception of quality is constantly changing, but these changes take place slowly. "Standards" which were in vogue fifty years ago would be sadly outmoded today—or so it is believed. At the beginning of the present century, pasteurization of milk was a procedure which had not yet earned the badge of respectability. Regulatory officials frowned on the procedure, considered that it was used chiefly to act as a preservative for milk of low sanitary quality, and required that pasteurized milk must be so labeled. In contrast, today the trend is more and more toward compulsory pasteurization. What will be our standards of milk quality 50 years hence — if anyone is living to discuss standards?

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"DOCTOR JONES" SAYS:*

By Paul B. Brooks, M. D.

Somebody, years ago, started the saying "Cleanliness is next to Godliness." Whether that's so or not I haven't heard of anyone criticising it on the ground there was anything sacrilegious in the idea of associating Godliness and cleanliness. So maybe I'm safe in drawing on the Apostle Paul for some words that seem to have an application to this matter of cleanliness.

The apostle's words, in his second letter to the Corinthians: " . . . the things which "are seen temporal", he said, "but the things which are not seen are eternal." Actually, of course, he was comparing the physical things, that could be seen, with the spiritual, that couldn't. But it was another way of saying it was these unseen things that were really important. Read that way it applies equally well to the things that figure in personal cleanliness.

The kid with the dirty face and hands—you can see the dirt a block away. The dirt you can see— it temporarily spoils his looks but it's relatively harmless. But supposing he's been taking turns on an all-day sucker with a pal coming down with whooping cough. The invisible virus—that may be dangerous dirt.

Caring for cases of different communicable diseases, in hospital —we used to think they had to be in separate buildings. The doctors and nurses wore gowns and caps—sometimes masks. Different diseases were in different sections. Yet we occasionally got "cross infections", like a measles patient getting scaret fever infection. Eventually we learned that one of the ways infection was most likely to be carried was on the hands of the attendants: those "unseen" germs and viruses.

At home it's "things which are seen" that're likely to start the housewives going, with mops and brooms and vacuum cleaners: mud tracks on the linoleum, dust on the furniture, a cobweb on the ceiling. But it's things not seen (not, anyway, by the housewife) that starts infections going. The commonest infectious diseases — the germs and viruses are in the nose and throat secretions. Like other underworld characters it's usually the jobs they do that finally show 'em up.

*New York State Department of Health, Albany, April 1952.

PROCTOR HEADS FOOD TECHNOLGY AT MIT

The appointment of Dr. Bernard E. Proctor to Head of the Department of Food Technology at the Massachusetts Institute of Technology has been announced by Dr. George R. Harrison, Dean of Science at the Institute. Dr. Proctor, who is Professor of Food Technology and Director of the Samuel Cate Prescott Laboratories of Food Technology at M.I.T., has been acting head of the department since January 1951.

Dr. Proctor has done valuable research in food preservation, fermentation, microbiology, electronic sterilization, and sanitation. He is president-elect of the Institute of Food Technologists and special consultant to the U. S. Public Health Service.

Currently he is Member, Board of Directors of the Associates, Food and Container Institute of the Armed Services; Member, National Research Council Subcommittee on Food Technology, under Food Protection Committee of Food & Nutrition Board; Member, Subcommittee on Dehydration of Foods, NRC Committee on Foods, Advisory Board on Quartermaster Research and Development; Member, NRC Food & Nutrition Board's Committee on Definitions and Standards of Identity for Foods; and Liason Representative, NRC Food & Nutrition Board's, Food Protection Committee.

A SANITATION STUDY OF FOUNTAIN MIXED MILK DRINKS*

FRANKLIN H. FISKE

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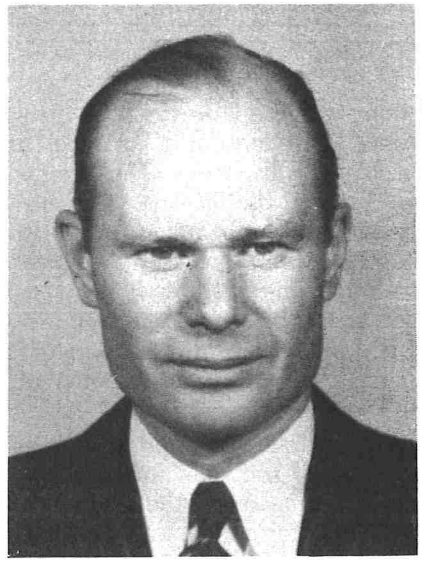

Born in Greenfield, Massachusetts. Educated in the public schools of Greenfield. Was graduated from the University of Massachusetts with a B.S. degree in 1936. Received a M.S. Public Health in 1937 from the University of Michigan.

Has successively been employed as a Sanitarian with Ann Arbor (Mich.) Health Department; the Hartford (Conn.) Department of Health; the United States Public Health Service; the Louisville and Jefferson County (Ky.) Health Department; and the Denver (Colo.) Department of Health and Hospitals. At present is Assistant Director of the Sanitation Division of the last mentioned organization.

Activities have been principally concerned with food, milk and general sanitation in both field control and administration.

A study was conducted on the sanitation problems involved in the preparation of fountain mixed milk drinks and quality determination of the ingredients and the finished product. Investigation was made of the factors involved in the control of materials and practices in the manufacture of fountain drinks. The methods of sampling and analyzing the products and the comparison of the results are presented. A great variation in the quality of the products is evident. Determination is made of the influence of substandard ingredients on the final product and the effect of poor soda fountain utensil sanitation.

INTRODUCTION

The food industry, in certain and limited phases, has made a sincere effort to produce and distribute their products in as sanitary a manner as possible. This quality effort has been accomplished by the industry, with encouragement of sanitation experts and regulatory officials, by two principal means: first, by the establishment of good quality control methods in production operations; and second, by the improvement in the design of sanitary, easily cleanable equipment. A rapid advance in the production of high quality foods has resulted. This development has been especially noticeable in the dairy industry. It is the belief of milk and food sanitarians that this desire and ability to produce high quality products should be accomplished by all phases of the food industry.

The question is often raised as to how well the dispenser of food products carries out his part in the serving of wholesome food to the public. Several years ago Krog and Dougherty[1] showed the influence of "Scoops as a Source of Contamination of Ice Cream in Retail Stores." This concern in the handling of food products throughout the chain of production and distribution should be borne both by sanitarians and by all segments of the industry involved.

A sanitation study of fountain mixed milk drinks was decided upon as a means of evaluating some of the influencing factors in the control of food quality. It was desirable to determine if the final product, such as a milk shake, was within the quality standards established for milk. It was also the intent to find out what effect the ingredients and the utensils at the dispensing outlet influenced the quality of the final product.

A product consisting principally of milk ingredients but requiring considerable processing at the dispensing point before serving to the consumer was selected. The choice of a milk product was desirable because of established quality standards and control methods. As mixed milk drinks are most commonly processed at soda fountains the studies conducted were confined to this type of retail establishment.

SAMPLING PROCEDURES

The sampling procedures were kept consistent, excepting minor deviations, with accepted practice in food sanitation activities.

(1) Swab tests were taken of all utensils used at the fountain in preparing a mixed milk drink. In order to simplify the method of swab testing a single utensil was used for each test. Otherwise the procedure of swabbing the malt cup, the ice cream dipper, the mixer arm and blades and the drinking utensil followed the technique recommended in the United States Public Health Service Publication #37[2]. Approximately 4 square inches of surface area on each utensil was swabbed with a sterile swab.

(2) Samples were taken of all the ingredients used in a standard fountain mixed milk drink. For the purpose of uniformity a chocolate flavored milk shake was the mixed drink sampled throughout the study. In sterile sample jars a sample of the ice cream used in the drink was obtained by use of a dipper. Because of the heavy bacterial contamination observed on the dipper during the early part of the study, it was decided to obtain an additional sample of ice cream with a sterile spoon. Samples of other ingredients obtained were chocolate syrup and milk. In order to determine the amount of contamination that might occur in the

*Presented at the 38th Annual Meeting, International Association of Milk and Food Sanitarians, Inc., Glenwood Springs, Col., Sept. 26-28, 1951.

finished product from the drinking utensil, samples from the mixing cup and the drinking utensil were collected. In order to avoid substitution of materials, fountain personnel were requested to make a chocolate milk shake. The sanitarian observed the method of assembly and followed the procedure in obtaining the necessary samples. Swab and ingredient samples were kept in an iced container and delivered to the Sanitation Laboratory for analysis within three hours of the sampling time.

At the time of sampling an observation of the soda fountain operation was made by the sanitarian. Detailed information was recorded on Form I on the cleanliness of utensils; utensil washing and sanitizing procedures; utensil storage; source of products; type of container and any unusual circumstance observed in the processing of the fountain mixed milk drink.

Laboratory Methods

Standard methods for laboratory tests were followed, when available, throughout the study.

(1) Swab tests were conducted in accordance with the recommendations in the United States Public Health Service Publication #37 as the standard method for the bacteriological examination of food utensils proposed by the Subcommittee on Food Utensil Sanitation of the American Public Health Association. In addition to the standard plate count, a coliform count was made on each swab test by using violet red bile agar in accordance with the recommended procedure in *Standard Methods for the Examination of Dairy Products* as published by the American Public Health Association in 1948[3].

(2) The samples of ice cream were tested for (a) butterfat content by means of the Pennsylvania Modification of the Babcock Method for Milk Fat in Frozen Desserts; (b) standard bacterial plate count using tryptone glucose beef extract agar with 1 percent skim milk added; and (c) coliform organism count using violet red bile agar. All tests were made in accordance with standard methods for dairy products.

(3) The samples of chocolate syrup were tested for (a) standard bacterial plate count using tryptone glucose beef extract agar with 1 percent skim milk added and (b) coliform organism count using violet red bile agar in accordance with the procedures normally used for dairy products.

(4) The samples of milk and the finished product were analyzed for (a) butterfat content by the standard Babcock method; (b) standard plate count using tryptone glucose beef extract agar with 1 percent skim milk added; and (c) coliform count using violet red bile agar.

Quality Standards

In order to evaluate the results of this study, standards for quality were established.

(1) Swab tests of utensils were considered unsatisfactory if the plate count per utensil exceeded 100 colonies or the coliform count per utensil exceeded 10 colonies on standard media[2].

(2) Ice cream samples were considered sub-standard if the butterfat value was less than 12 percent by weight, the plate count per sample exceeded 50,000 per gram, or the coliform count exceeded 10 per gram[4].

(3) As no bacterial standards for chocolate syrup have been established, for the purpose of this study the accepted standards for milk

TABLE 1

DEVIATION FROM STANDARDS OF MIXED MILK DRINK

	BUTTERFAT CONTENT			STANDARD PLATE COUNT			COLIFORM COUNT		
Type of Sample	Number of Samples	Number Below Standard	% Below Standard	Number of Samples	Number Above Standard	% Above Standard	Number of Samples	Number Above Standard	% Above Standard
#9 Mixed Milk Drink From Malt Cup	118	29	25%	117	59	50%	117	49	42%
#10 Mixed Milk Drink From Drinking Utensil	118	29	25%	115	61	53%	114	50	44%

were adopted. Any sample of chocolate syrup having a bacterial count of over 30,000 per milliliter or a coliform count of over 10 per milliliter was considered unsatisfactory.

(4) Milk samples were considered below standard if the butterfat value was less than 3.25 percent milk fat per milliliter of sample, the plate count exceeded 30,000 per milliliter, or the coliform count was over 10 per milliliter[6].

(5) Although no standards have been established for mixed milk drinks, the quality standards for milk were adopted for the purpose of this study. Because the finished product has taken the name of milk in its identification the product should be equivalent to milk in butterfat content and bacterial quality.

RESULTS AND DISCUSSION

A review of the laboratory results and the field observations was made to determine if the milk shake complied with milk standards. The compilation of results in table 1 shows the degree of deviation from the standards for fountain mixed milk drinks tested in this study.

The butterfat content of the finished product samples tested was found to be below the standard of 3.25 percent for a total of 29 samples or 25 percent. The sub-standard samples had a range of 1.3 percent to 3.2 percent butterfat. On checking the individual laboratory results for the ingredients of these sub-standard samples it was evident that the practice of using defatted milk and low fat frozen dessert, either singly or collectively was common in the preparation of milk shakes.

Seventy-five percent of the samples above standard had a range of from 3.25 percent to 10.5 percent butterfat. The above standard samples were from a combination of whole milk or defatted milk and ice cream or low fat frozen dessert, in addition to the syrup. The wide range of butterfat content of the samples tested indicates no uniformity of quality in this respect.

No attempt was made to determine the amount of fat added by the chocolate syrup. The addition of chocolate syrup may account for a small increase in fat content of the finished product.

A wider variation from the standard was noted in the bacterial quality of the finished product. Of the samples taken from the malt cup, 50 percent were above the standard of 30,000 bacteria per milliliter. In addition, 42 percent of the samples were above the standard for coliform organisms. By comparison, samples of the finished product from the drinking utensil showed 53 percent above the bacterial standard and 44 percent above the coliform standard. On the basis of the results shown on this table it would appear that the finished product was deviation from the standards to a considerable extent.

In order to determine influencing

TABLE 2
DEVIATION FROM STANDARDS OF INGREDIENTS

Type of Sample	BUTTERFAT CONTENT Number of Samples	BUTTERFAT CONTENT Number Below Standard	BUTTERFAT CONTENT % Below Standard	STANDARD PLATE COUNT Number of Samples	STANDARD PLATE COUNT Number Above Standard	STANDARD PLATE COUNT % Above Standard	COLIFORM COUNT Number of Samples	COLIFORM COUNT Number Above Standard	COLIFORM COUNT % Above Standard
#5 Ice Cream Taken With Dipper	119	79	66%	119	36	30%	119	58	49%
#6 Ice Cream Taken With Sterile Spoon	119	79	66%	93	21	23	93	32	34%
#7 Choc. Syrup	–	–	–	115	39	34%	115	6	5%
#8 Milk	119	50	42%	119	34	29%	119	34	29%

factors on the quality of the finished product, the quality of the ingredients was considered. Table 2 shows the degree of deviation from the standard of the ingredients.

In respect to butterfat content, 66 percent of the ice cream samples were below standard. These samples had a range of from 2.9 percent to 14.0 percent butterfat. By the same token, 42 percent of the milk samples were found to be below the standard of 3.25 percent butterfat content with a range from zero to 3.25 percent. Evidently the practice of using low butterfat ingredients is quite common but does not necessarily result in a substandard final product.

A review of the bacterial quality of the ingredients by deviation from the standard was also made. From the samples of ice cream collected with a dipper or scoop, 30 percent were above the standard plate count of 50,000 bacteria per gram, and 49 percent were above the standard of 10 coliform organisms per gram. That some of the contamination came from the equipment was evident from the results of ice cream samples taken with sterile equipment. In this case 23 percent of the samples were above standard for bacterial count and 34 percent were above standard for coliform count. These results are in agreement with the findings of Krog and Dougherty. Numerous cases of improperly stored, dirty and corroded scoops were observed by the sanitarians at the time of sampling.

In the case of chocolate syrup, it was surprising to find that 34 percent of the samples exceeded a bacterial count of 30,000 but only 6 percent of the samples were above standard for coliform organisms. The presence of excessive bacterial counts in chocolate syrup offers a source of contamination to the final product which was not anticipated. A check back by the sanitarian on the establishments with high bacterial counts in the chocolate syrup often resulted in the detection of poor storage containers or corroded and unclean pumps.

The quality of milk used in the processing of the fountain mixed milk drink was also considered. 29 percent of the samples of milk were above the standard of 30,000 bacteria per milliliter. The same percentage of samples were found to be above standard for coliform organisms.

The deviation from standard of the ingredients warranted further study of their effect on the final product. Table 3 shows the logarithmic averages of bacterial counts for the ingredients and the finished product. It is interesting to note that the bacterial average for the ice cream samples taken with the dipper or scoop used in the processing of the milk shake was nearly double the average for the ice cream sampled with a sterile spoon. In spite of the contamination to the ice cream from the dipper, the average was still within the standard of 50,000 organisms per gram. The logarithmic averages for the other ingredients, chocolate syrup and milk, were within the limits for the respective items. In comparison the logarithmic average for the finished product both from the malt cup and from the drinking utensil were two and one half times the standard for milk. As the averaging method of coliform counts is still being considered, no attempt was made to evaluate this factor.

The actual influence of individual ingredients was studied further by the use of scatter diagrams (dot charts). By plotting the logarithmic values for each sample of milk against the respective logarithmic values for the finished product from the malt cup, it is possible to observe the actual influence of the high bacterial quality of the milk on the finished product. In 24 instances a high bacterial value for milk was a direct contributor to the bacterial value for the finished product. From the same chart it is possible to see that 42 samples of milk with low bacterial values had comparable low values for the finished product. It is possible to

TABLE 3

LOGARITHMIC AVERAGES OF BACTERIA COUNTS

Type of Sample	Number of Samples	Logarithmic Average
#5 Ice Cream Taken With Dipper	119	27,000
#6 Ice Cream Taken With Sterile Spoon	93	14,000
#7 Chocolate Syrup	115	19,000
#8 Milk	119	23,000
#9 Finished Product From Malt Cup	117	75,000
#10 Finished Product From Drinking Utensil	115	75,000

show the influence of the other ingredients by the same method. Although it is also possible to review the influence of utensils on the finished product by this method, the greater dispersion reduced the reliability of the technique for the number of samples in this study.

Table 4 shows the deviation from the standard for swab tests on the utensils used in the processing of a fountain mixed milk drink. 66 percent of the malt cups, 86 percent of the ice cream dippers, 75 percent of the mixer arms and blades and 26 percent of the drinking utensils were found to be above the swab test standards of 100 organisms per utensil. From these results it would appear that soda fountain utensils are seldom properly sanitized.

Sanitation control personnel often find it difficult to determine the effectiveness of utensil washing and sanitizing by observation. This is brought out in this study by comparing the field observations with the laboratory results. Too often utensils appeared clean but were found to have high bacteria counts by the swab test method.

CONCLUSIONS

A total of 119 chocolate milk shakes were analyzed in a sanitation study of fountain mixed milk drinks, with the following conclusions:

(1) The finished product was below the standard for butterfat in 25 percent of the samples.

(2) One half of the milk shake samples were found to be above standard in bacterial quality.

(3) Chocolate syrup showed excessive bacterial contamination in 34 percent of the samples.

(4) The influence of sub-standard ingredients in the final product was demonstrated.

(5) Soda fountain utensils were generally found to be poorly sanitized.

(6) The contaminating influence of the dipper on the ice cream was established.

SUMMARY

In this sanitation study of fountain mixed milk drinks it was evident that the soda fountain industry has failed to protect the quality of the food product within reasonable standards. Greater effort should be made by the industry and by control officials to correct this situation. Additional study is also warranted to answer some of the questions raised in this problem.

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2. U. S. P. H. S. *Publication* #37 (Formerly U.S.P.H.S. Bulletin #280).

3. American Public Health Association, *Standard Methods for the Examination of Dairy Products, Ninth Edition,* 1948, *New York, N. Y.*

4. Proposed Frozen Desserts Ordinance, City and County of Denver, 1951

5. U. S. P. H. S. Bulletin #220

6. *Ordinance #65,* Series 1951, City and County of Denver.

TABLE 4

DEVIATION FROM STANDARDS OF UTENSILS

	STANDARD PLATE COUNT			COLIFORM COUNT		
Type of Sample	Number of Samples	Number Above Standard	% Above Standard	Number of Samples	Number Above Standard	% Above Standard
#1 Swab of Malt Cup	118	78	66%	119	15	13%
#2 Swab of Dipper	118	101	86%	119	36	30%
#3 Swab of Mixer	119	89	75%	119	20	17%
#4 Swab of Glass	114	30	26%	115	9	8%

FOUNTAIN MIXED MILK DRINK SAMPLE FORM

Name of Establishment ....Address ....

Date .... Time .... Room Temperature ....

Sample collected by: ....

		B. F.	Plate Count	Coliform Count
1. Swab	malt cup			
2. Swab	dipper			
3. Swab	mixer arm and blades			
4. Swab	glass or paper cup			
5. Sample	ice cream (dipper)			
6. Sample	ice cream (sterile spoon)			
7. Sample	chocolate syrup			
8. Sample	milk			
9. Sample	product (malt cup)			
10. Sample	product (glass or paper cup)			

Observations

1. Malt cup clean? ....
   Malt cup storage? ....
   Malt cup condition? ....
   Washing and sanitization method ....

2. Dipper clean? ....
   Dipper storage? ....
   Dipper condition? ....
   Dipper cleaning procedure ....

3. Mixer arm clean? ....
   Cleaning procedure? ....
   Washing and sanitization method? ....

4. Glass or paper cup clean? ....
   Glass or paper cup storage? ....
   Washing and sanitization method? ....

5 & 6.
   Ice cream source? ....
   Ice cream storage? ....

7. Syrup source? ....
   Pump condition? ....

8. Milk source? ....
   Milk storage? ....
   Type of container? ....

9. Remarks ....
   ....
   ....
   ....

SUPPLEMENT #2 TO THE 3A SANITARY STANDARDS FOR FITTINGS USED ON MILK AND MILK PRODUCTS EQUIPMENT AND USED ON SANITARY LINES CONDUCTING MILK AND MILK PRODUCTS

Formulated by
International Association of Milk and Food Sanitarians, Inc.
United States Public Health Service
The Dairy Industry Committee

In keeping with the provisions of the 3A Sanitary Standards for Sanitary Fittings and Connections used on milk and milk products equipment, this supplement hereby incorporates the following fitting into this standard:

PART NAME	PAGE NO.	3A DRWG. NO.
13SH Hex Nut (Used with flared tubing and standard sanitary fittings with gasket seats)	15	3A-100-13

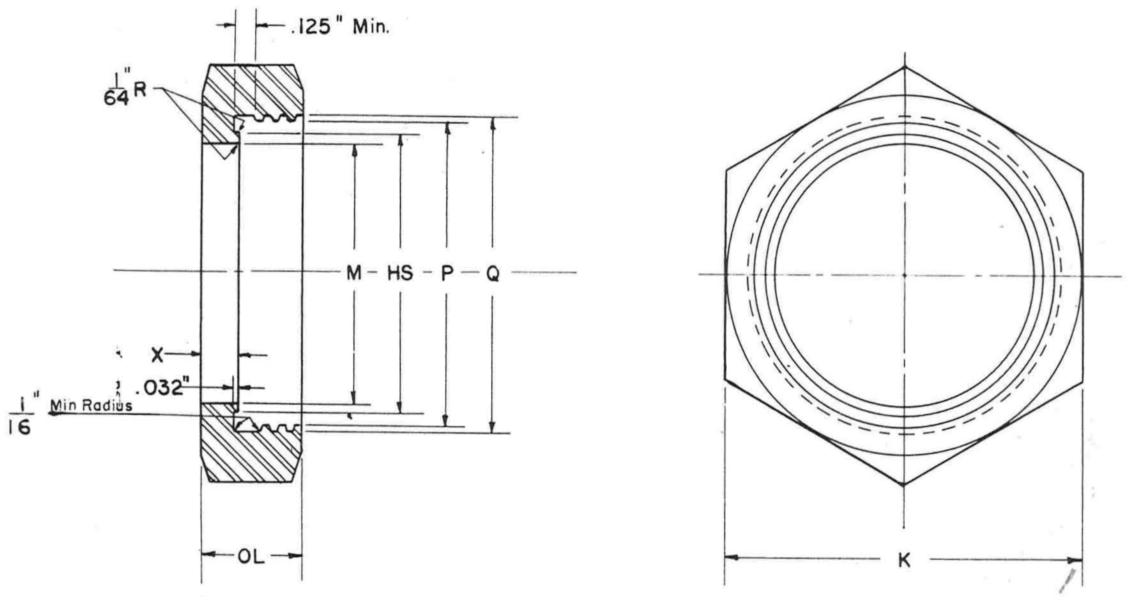
APPROVED BY:

C. A. Abele, Chairman - CSP of IAMFS — 6/7/52 Date

J. D. Faulkner, In Charge - MF-USPHS — 5/29/52 Date

E. H. Parfitt. Chairman - SSS-DIC — 5/21/52 Date

H. S. Fielder, Chairman - Tech. Committee DISA — 6/6/52 Date



SIZE	Acme Thds Per In.	OL	HS	K	M	P	Q	X
1"	8	.750	1.187	1.812	1.015	1.352	1.497	.312
1 1/2"	8	.812	1.703	2.407	1.515	1.884	2.029	.343
2"	8	.875	2.203	3.001	2.015	2.416	2.561	.406
2 1/2"	8	.968	2.703	3.595	2.515	2.948	3.093	.406
3"	8	1.015	3.203	4.191	3.015	3.480	3.625	.406
4"	6	1.156	4.203	5.420	4.015	4.544	4.730	.500

13 SH HEX NUT

3A STANDARD
SANITARY FITTINGS

3A-100-13

MILK and FOOD SANITATION

THE BEST SANITARIANS ARE GOOD SALESMEN

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A parallel is drawn between the role of a salesman and that of sanitarians. The author discusses some of the principles of salesmanship and education which the sanitarian may profitably apply in his work. It is suggested that human relations can be approached in a scientific manner as well as the physical problems involved in sanitation.

Failure in human relations is equivalent to failure as a sanitarian. The key to success is a liking for people.

Once there were two salesmen. They worked in adjoining territories and sold the same product, sanitation. One of these men took this job of selling just as it sounded. He went out and sold sanitation as a part of modern homes, as an essential in new water systems, as part of a good meal, as an extra feature of ice cream, and as a part of quality living. He liked people and believed in their ability to do things for themselves.

The second salesman was different. He decided that since certain items were on the critical list, he should delete the others from his catalogue and concentrate on the "important" items. Since only a part of the population needed the critical product, he dealt with only a part of the people. His prospective clients were usually the less-progressive portion of the population with little money, and the salesman soon found himself in quite a bad situation. He had a limited territory involving a small line, selling only to the less-progressive people, and had no budget for advertising. To make matters worse, he tried to force people to take his product, "like it or not," because it was "for their own good." Things went from bad to worse. When the product was mentioned, people thought of a policeman or of the bad situations which the salesman sought to correct. Industries that needed this salesman's product never mentioned it to the people they knew.

From time to time this man went to meetings and listened to new selling techniques or to better ways of pushing the items which he was already selling. He thought that the high-sounding ideas were fine but knew that they did not apply

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to his situation. In the first place, he was too busy with his routine work; in the second place, his boss kept him busy answering complaints; and in the third place, he expected someone to hand him a set of rules that would apply in every situation.

Meanwhile, other agencies were stealing his territory, though he didn't know it. One organization published attractive bulletins and had discussion on "convenient kitchens." Another had movies and demonstrations on how to get running water. A third organization offered a prize for the most community improvement. The paint-up-fix-up campaign, with its public participation and publicity, encroached still further on the territory. The agencies were using good selling techniques and, in no case, was their program hampered by lack of imagination. Their programs varied with the needs of the people.

SELLING SANITATION

But, we are interested in the first salesman, who like the sanitarian, has a good product, a necessity for all the people. He may have a few "must" items in his catalog, but in general they are all important. How does he merchandise this product, sanitation?

Let us try to forget that the term sanitation is often used in connection with the word "control" and think of the word in a little different light. We might say that sanitation is the science of a healthful environment and that it involves both material and methods. With that thought in mind, it follows that we are selling or promoting better methods— scientific methods. At the same time, we are selling or promoting equipment—scientifically designed equipment, that will promote or protect the health of the people.

"Health" is a nebulous word. At best, it is hazy and vague. We must be sure that sanitation and its relation to health is described to people in terms that mean something to them.

Imagine how difficult it would be to sell pasteurization if the customer had no interest in milk. Or, the difficulty of selling septic tanks without the conveniences of plumbing and running water. Our task is one of adding to, or modifying, the methods and facilities which people must have and want, in such a way that the former will contribute to healthful living. A deep well pump and pressure water system are convenient, but if the well is properly located and protected and the pump safely installed, water from that system is safe and a feeling of security and comfort can be also obtained.

Some health workers will not agree that a parallel exists between the task of the sanitarian and that of the salesman. They will contend that the sanitarian must be more scientific and selective in his approach to the alleviation of conditions which have been proven to cause disease. By this, they mean that the sanitarian is required to select his activities principally on the basis of need, as determined by proven health hazards, and proceed step by step to eliminate problems in an orderly manner. With the first part of this requirement there is little argument. It is believed, however, that there is need for discussion when the sanitarian or his superior undertakes to select scientfic methods of carrying out his improvement program. The promotion of certain types of facilities and methods required for sanitation constitutes a change in the life of a community. Such an undertaking is a long-term educational problem. It requires the application of scientific principles which are more demanding though less understood than chemistry, bacteriology, and physics. These principles do not lend themselves to an unvarying pattern but require a constant shift to meet different personalities of individuals and groups.

WHAT DOES SANITATION MEAN TO ME?

ESSENTIAL FACTORS IN SELLING

While the sanitarian would not wish to be compared with the type of "high pressure" salesman who uses unorthodox methods, the two professions require the application of similar scientific principles.

Perhaps the first essential in any selling campaign is selling yourself. Abraham Lincoln once said, "Live, think and act so as to arouse trust and to create confidence. If you are to win a man to your cause, first convince him that you are his true friend. Therein is a drop of honey that catches his heart, which, say what he will, is the greatest highroad to his reason. Once gained, you will find but little trouble in convincing his judgment of the justice of your cause. On the contrary, assume to dictate to his judgment or to command his action — and he will retreat within himself, close all avenues to his head and heart; and though your cause be naked truth itself, transformed into a spear harder than steel, and though you throw it with more force than Hercules, you shall be no more able to pierce him than to penetrate the shell of a mud turtle with a rye straw."

One need not enumerate the characteristics of personality and character required of a sanitarian. It is assumed that these are prerequisites to employment.

A second fundamental to selling sanitation is a knowledge of the details and scope of products to be sold. The hardware salesman who sells only hammers would be inefficient even if he sold more hammers than anyone else — especially if his customers needed nails quite badly, also. He would be more accurately named a hammer salesman. By the same token, some sanitation men could well be titled inspectors or privy salesmen.

The salesman concerned with farm equipment should certainly know something about farming and should be particularly well acquainted with the situation which his product fits. Each citizen might well ask how your product fits into his home, farm, neighborhood and community. You should be able to approach him in such a way that he will want sanitation.

APPLICATION TO PUBLIC USE

What is usually in the sanitarian's catalogue? What does he have to offer that the man, woman and child want to buy? One would expect to find material and methods affecting water supplies, sewage disposal, milk, food, schools, industry, housing, *et cetera.* One would further expect to find the featured points of these items pictured in detail along with sources of further information as to how one goes about securing these items. One would expect his material to point out that the product, sanitation, is essential to health and that it contributes to convenience, beauty, comfort and security. Most sanitarians, unfortunately, have quite a distance to go before their catalog will become attractive enough to be an asset. Salesmen have pictures, prices, attractive folders and movies which picture their products in a favorable light. What does the sanitarian have to show to his public besides an inspection pad?

In few cases is sanitation a complete package. It is sold as an accessory. The accessory without the main item is as worthless as a car without a motor or the light bulb without electricity. Understanding this relationship is of utmost importance. It is demonstrated in a pamphlet issued recently by the U. S. Department of Agriculture entitled *Tools For Food Preparation and Dishwashing.* Integrated into this bulletin were numerous methods contributing to health but they were sold as a part of the kitchen and not as sanitation.

Dr. Haven Emerson declared, "It's not only the product that is sold but also each wise precaution, each cooperative endeavor, each refinement of cleanliness." Those precautions and refinements are *sanitation* but they have no market without the product.

An understanding of government, religion, education, politics, family relations, family history, farming, finances, industry, and entertainment is just as important to achieving health as knowing the cause and distribution of typhoid or dysentery — perhaps more important. The existence of disease is a scientific fact but the solution to the problem can be attained only by working with the variable factor, people.

While a sanitarian should know the intricate details of the sanitary sciences such as chemistry, engineering, physics, bacteriology, etc., such knowledge is of little value if it cannot be translated into public use. By the same token, simply learning about the people in his territory itsn't enough unless he also learns to interpret the facts which such a study can provide. He must know the basic motives which affect people, such as personal and social recognition, romance, and desire for a long life, money, and comfort; how to work effectively with individuals and groups; and the factors involved in changing habits and behavior. We can accomplish little as sanitarians unless we are able to use the physical sciences as our base and social sciences in our methods. We are often inclined to dismiss the latter as being common sense but we never cease to look for the key to better methods of convincing people of the justness of our cause. The key is to be found in the application of a scientific knowledge of people.

Having gathered and analyzed sound knowledge of the people he will work with and how they live, the sanitarian should begin inquiry into the status of community sanitation. Industry would call this market research. Such information as can be gathered from public records and agencies or officials certainly should be accumulated as soon as possible. Usually this is not enough information on which to start a

POOR PLANNING RESULTS IN RESENTMENT

sales campaign or a sanitation program. It only tells what the need appears to be based upon the best information available.

Since need does not indicate interest, the sanitarian cannot assume that he is ready to start selling immediately after he determines the greatest needs. People have a peculiar characteristic of wanting to think for themselves. Why not endeavor to include people in the study of their own community, arouse interest and educate them at the same time?

Community Cooperation

In Clinton County, Ohio, in 1949, citizens, with the help of state health and extension service representatives, surveyed their entire county in order to find just what their problem was. They found, among other things, that brucellosis was an immediate problem in the area and that many rural and urban families do not drink pasteurized milk. The advantage of such a survey is that the people become interested in the solutions to problems by participation in their discovery and in the planning of a solution. Other groups have successfully used this survey plan in their areas.

Practically every community has organizations that are interested in improving their way of living. Whether or not they are willing to participate actively in studying their sanitation status, enlisting their interest is worthwhile. There are numerous books and pamphlets on how to work with community organizations. They include such topics as finding the community leaders, stimulating interest, organizing meetings, group discussions, etc. These are worthwhile "how-to-do it" articles which are worth reading.

In the absence of community self-study, local health departments may wish to evaluate the schools, dairies, restaurants, home sanitation, community house-keeping, or other phases of community health with their own or state health personnel.

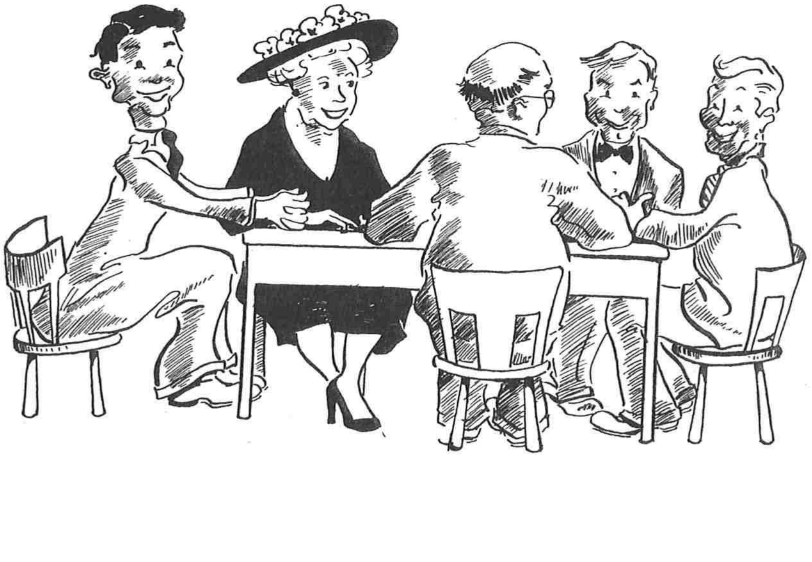
In any case, industries such as the milk and food industries and representatives of other concerned branches of government such as education and agriculture should be consulted and invited to assist in planning the study as well as in publicizing results.

Following a survey to determine the needs in an industry or community there must be an analysis of significant facts before a report can be released. The planners should have a voice in the use which is to be made of such a report. Generally, it is used to arouse interest and as a basis for planning an improvement program. Care must be used in publicizing some types of surveys since they may involve the destruction of public confidence in an industry or agency. An example of this is the publicizing of milk survey results in a small community without first giving industry an opportunity to work out its own problems. Farmers who are supplying milk to the best of their knowledge and ability will seldom react favorably when their scores are made public property before they know what constitutes good practice. The same is true of restaurants or other groups. The best yardstick in determining good practice is to consider how one would handle such a campaign if he were hoping to improve the industry by selling them new products and methods. The complete sanitary survey, whether done by the people themselves, by a sanitarian, or jointly, following consultation with interested groups, can also serve as a basis for program planning.

Again, sanitarians should not forget that any program of sanitation involves people. These people should have the privilege of helping to plan a program if they are expected to participate. There are many skills involved in working effectively with such groups and common sense and good judgment are essential. Basically, the sanitarian must believe in people, and their ability to do things for themselves. He must help people to arrive at their own decisions even though he might save time by giving expert advice.

Each activity is a tool and each situation may require a change in sequence. A sanitarian's success or failure will not be judged by how frequently he makes inspections or speeches, but by the improvement in methods and facilities which his efforts stimulate the people to provide. The credit will go to the people in every case, but to the sanitarian goes the feeling of satisfaction that he has been a part of achieving sanitation as a way of life.

PROPER PLANNING RESULTS IN COOPERATION



THE MILK PLANT FIELDMAN

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"The Milk Plant Fieldman" is a summation of studies and observations made over a period of several years throughout the United States and Canada. These studies were made in butter, cheese, evaporated milk, and fluid milk marketing areas, and covered a large number of fieldmen and field programs. The conclusions reached as a result of the observations and studies are presented to the dairy industry to encourage the formulation of more practical, sincere, and sound field programs.

The role of the milk plant fieldman in the dairy industry is becoming one of the more important, but least understood, of the industry's many activities. This lack of understanding is evident on the part of the management, the producer, and the fieldman himself.

What is the status of the milk plant fieldman? What are his qualifications? What are his duties? What can management expect from him, and he from the management? What can the producer expect from him, and he from the producer? These and many more questions have long been unanswered in the relationship between the management, the fieldman, and the producer in regard to field programs. The success of any field program calls for a complete understanding of the fieldman's status, Too often this has not been clarified to a point where any one of these groups has an understanding of the real objective.

Duty of Fieldman

The milk plant fieldman's duties are to keep the plant adequately supplied with good quality milk from satisfied producers. While this may seem to be a very general statement, it does specifically define his role in the industry. Unless the fieldman can fulfill that role, he is a failure to management, to the producer, and to himself.

A complete analysis of the qualifications of the fieldman to perform his duties should be thoroughly checked by management in the formulation of a sound field program. Can he buy milk as it should be bought; or does he resort to cutting corners on quality or price commitment? Can he trace down quality trouble and bring about proper correction? Can he gain and hold the complete confidence of the producers as well as that of the management? Is he capable of planning his work systematically to avoid duplication and other waste?

Too often the fieldman attempts to solicit milk from a producer who is dissatisfied with his present buyer simply because he is experiencing quality trouble. In doing this, he is being unfair to management, the producer, and himself; and trouble usually is forthcoming as soon as he buys that producer's milk. The fieldman should determine through proper and thorough investigation, just why the producer is interested in changing buyers. If the reason is honest and sincere, he should buy the milk with an understanding as to what is expected from, and what must be supplied by, each party. If, on the other hand, the fieldman finds that the producer is desirous of changing buyers simply because of quality trouble, he must not, and cannot afford to, cut corners by misleading the producer on the quality program.

A large number of fieldman will have to admit that they have condoned that practice. Many have used different angles and approaches but definitely performed with the same intention and concluded with the same resulting failure. These practices on the part of a fieldman will do more to destroy a a good field program that years of honest and sincere efforts can build up.

Another factor to be closely checked by management is the determination of whether or not the fieldman is qualified to do proper quality control work when called upon to do so. Can he do a systematic job of analyzing the cause of quality trouble and work with the producer to permanently correct it; or will he be content timidly to call upon the producer and vaguely hint that there is something wrong and suggest that the producer try and find it? Does the fieldman have the ability and desire to trace down quality trouble? Does he know where and why to look for the source of quality trouble? Can he gain the cooperation of the producer in correcting quality trouble without creating ill will?

Desirable Qualifications

To perform his duties properly, the fieldman must possess these several esential qualifications: He must be a saleman, able to sell himself and his employer to the producer on a high level without misleading statements. He must know milk and milk quality. He must be alert and abreast of the times: familiar with the most recent trend of the economics of the industry as well as the latest and most up-to-date information on sanitation. He must be able to trace quality trouble to its source and determine its cause and correction. He must have the confidence of his producers as well as that of his management. He must be firm, but not headstrong or arrogant. He must conduct himself with dignity, and in such a manner as to avoid adverse reflection upon his employer or himself. He must have full respect for the producer's property rights, and refrain from smoking or other habits which might be considered undesirable while on the producer's farm. He must be able to make full use of his time, planning his work systematically to avoid duplications and to allow for concentrated effort. He must possess a thorough understanding of the problems of the producer as well as those of the plant, and never sacrifice one at the expense of the other. He must at all times be fully aware of his duties "to keep the plant adaquately supplied with good quality milk from satisfied producers", and conduct himself accordingly.

Duty of Management

The milk plant manager, in an effort to evaluate the efficiency of his fieldman, would do well to study these more common failures to determine where and why his fieldman is not performing:

1. He does not plan his work systematically. Too often, the fieldman is inclined to use less than 50 percent of his time to advantage. He drives needless miles to see a single producer, while he could have made several worthwhile calls on that same trip.

2. He is not sure about himself or his field program. Many times a fieldman will make several calls on a producer to trace down and correct quality trouble, when he could have done it properly on the first call had he been qualified to perform that branch of the field work. There is no better way to lose the confidence of the producer than to fail on a quality call. Systematic and thorough check of all possibilities by a competent fieldman will avoid this and build up confidence.

3. The fieldman is inclined to sell himself on the idea that he has no right to make an inspection of the producer's dairy unless he is asked to do so by the producer. Technically, this might be correct in some cases and in some milksheds, but any fieldman who cannot gain this right when he buys a producer's milk, or upon his first call upon that producer, fails in his duty. With proper application and conduct, this right will not be questioned at any time.

4. The fieldman is inclined to create confusion in the mind of the producer through lack of a solid and determined program. He must be sure of his program, then stick to it, and present it to the producer in a manner that will leave no doubt.

5. The fieldman must be kept abreast of the times. The milk industry is adaquately supplied with trade magazines and papers which are continually bringing out the latest information regarding the industry. These should be studied by every fieldman.

6. The management should study and analyze its own conception of the field program. Too often, management is not sure of its own program, and consequently cannot properly clarify it with the fieldman.

During the past several years, it has been this writer's good fortune to work with fieldmen from most of the major milksheds in the United States and Canada, studying their attitudes, their qualifications, their shortcomings, and their failures. During this period of study, it has been a pleasure to work with some fieldmen who fulfill every requirement to a maximum; others who possess some of the qualifications which enable them to perform only a part of their duties; and others who display no qualifications or abilities to perform any of their duties to a satisfactory degree. It is regretful that the number in this third group is surprisingly large. Management, by careful analysis and screening, can select fully qualified fieldmen. With complete understanding between management, the fieldman, and the producer, a sound field program can be made to function properly. be considered as nothing more than Without it, a field program must be considered as nothing more than a token gesture.

Milk & Food Sanitarians Invited To Attend Meeting Of International Association of Ice Cream Manufacturers

The International Association of Ice Cream Mfrs. invites the members of the International Association of Milk and Food Sanitarians to attend the International Ice Cream Convention in Chicago on September 21st to 24th inclusive.

The convention opens with a reception in the Conrad Hilton Hotel on Sunday, where all of the sessions of the convention will be held with the exception of the Joint Sessions of the milk dealers and ice cream manufacturers on September 24th, which will be held in the Sherman Hotel.

While there is a registration fee for members of the Ice Cream Association, there will be no registration fee for sanitarians who register and attend the convention sessions, as the associations guests.

Those who desire hotel accomodations should write to the International Association of Ice Cream Mfrs. 1105 Barr Building, Washington 6, D. C. for hotel application blanks.

SOME FACTORS WHICH CONTRIBUTE TO THE PSYCHROPHILIC BACTERIAL COUNT IN MARKET MILK*

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Results indicate the mesophilic counts were approximately three times greater than the psychrophilic counts in raw milk. No psychrophiles were ever found in 4.1 ml of pasteurized milk taken from the vat (LTLT) or from the HTST pasteurization system. Psychrophiles were found in some of the bottled milk, taken at the start of bottling operations.

Psychrophiles were found in all samples at the end of one week storage at refrigeration temperatures, and almost invariably the psychrophilic count at this time was higher than the mesophilic count.

Results indicate the psychrophilic bacteria were not thermoduric and probably were facultative rather than true psychrophiles. They were mostly cocci or non-spore forming bacilli, inert or acid forming.

The presence in milk of psychrophilic bacteria, i.e. those bacteria which grow at low temperatures, is of considerable interest to market milk technologists and quality control officials because of the general trend toward less frequent delivery of milk. An example of this trend is the adoption in many cities of the three-day-a-week delivery, or of the every-other-day delivery, practices which require the milk to have excellent keeping properties when stored at normal refrigeration temperatures.

Bergey's Manual[1] shows that there are relatively few bacteria that have an optimum temperature between 15° and 20°C. Morris[9] reported that in some samples of milk held overnight in a refrigerator at 4°C, *Pseudomonas* types predominated, and the same organism isolated from farm water supplies would grow in milk stored at 4°C. Morgan[8] studied the contamination of milk churn (cans) in winter caused by the growth of *Vibrio undula. Psychrophilic* organisms in water and butter were studied by Jezeski and Macy[7]. They isolated and identified *Pseudomonas, Flavobacterium, Alcaligenes,* and *Achromobacter.* Some cultures were able to survive pasteurizaion.

Fay[5] found that psychrophilic organisms gained entrance to cream after pasteurization, and usually were traced to contamination from water used in rinsing equipment. None of the organisms isolated were spore-formers, and none survived pasteurization. Thomas *et al.*[11] reported that pasteurization destroys bacteria which grow at low temperatures.

The coliform group also is capable of growing at relatively low temperatures. This was demonstrated by Dahlberg[3,4], Burgwald and Josephson[2], and Wilson[12].

Burgwald and Josephson[2], studying the effect of refrigeration storage on the keeping qualities of pasteurized milk, found that the more extensive the period of warming before storage, the poorer was the bacteriological keeping quality. Psychrophilic bacteria were found to multiply slowly up to four days, but to increase more rapidly thereafter. After one week storage, the psychrophilic counts usually exceeded the mesophilic counts.

The present study was undertaken to determine the relationship of the number of psychrophilic and mesophilic bacteria in both raw and pasteurized commercial milks when fresh and after one week storage in a refrigerator, and to determine the effect of certain plant practices on the psychrophilic count of market milk.

Experimental Procedure

Samples of raw, pasteurized, and bottled milk representing the same original milk were taken from several milk plants for a period of about one year. Certain of the plants were equipped for vat pasteurization, (143°F for 30 minutes), and others utilized the high temperature short time system (161°F for 16 seconds).

Bacterial analyses were made on the following:

1. Raw milk: sample taken in sterile bottle from receiving or storage tanks.
2. Pasteurized milk: sample taken in sterile bottle from the vat at end of holding period, where LTLT (vat pasteurization) was used, and from the pasteurizing system where HTST was used.
3. Bottled milk: sample taken in a plant-washed bottle from the bottle filler.
4. Bottled milk: sample taken in a sterile bottle from the bottle filler.

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5. Empty half pint bottles from the bottle washer.

6. Where samples were obtained at the start of plant operations, they were taken at the bottle filler in sterile half pint bottles (a) of the first milk reaching the filler, and (b) of the last of that same lot of milk which reached the filler.

Samples were iced and transported immediately to the laboratory where bacterial counts, acidity, and phosphatase tests were made. Standard procedures[10] were followed in every instance. The phosphatase test used was the New York City[10] field test with 30 minutes incubation.

The samples were plated out in suitable dilutions in TGE skimmilk agar, and incubated at 35°C for 48 hours for the mesophilic count, and at 4° to 7°C for 12 days for the psychrophilic count. On the fresh pasteurized and bottled samples for psychrophilic counts 3.0, 1.0, and 0.1 ml of samples were used. To the clean empty half pint bottles, 10.0 ml of sterile buffered distilled water containing sodium thiosulphate were added at the time the bottles were taken from the washer in the plant, and the bottles shaken as described in Standard Methods. This rinse solution was analyzed for mesophilic and psychrophilic bacteria.

Following the bacterial analyses, all samples, including the bottles of rinse solution, were stored in a refrigerator at 4°–7°C and kept undisturbed for seven days. The samples were then submitted to the same analyses as before.

Special attention was given with the view of establishing whether or not the psychrophilic organisms were true psychrophiles or facultative psychrophiles. To determine this, well isolated colonies from plates incubated for 12 days at 4°–7°C were inoculated into two sets of tubes of litmus milk. (These colonies were also Gram-stained and examined microscopically.) One set was incubated at 4°–7°C for 12–30 days, and the other at 35°C for one to five days. (In the case of the tubes incubated at 4°–7°C, if no visible change had taken place in the litmus milk at the end of 12 days, they were further incubated up to 30 days. In the case of the tubes incubated at 35°C, if no change occurred at 1 day, they were further incubated up to 5 days.)

EXPERIMENTAL RESULTS

Bacterial counts on fresh milk:

Results obtained from the examination of raw and pasteurized fresh milk are illustrated in figure 1. The pasteurized milk represents that processed by both the low temperature and high temperature procedures under commercial conditions. Phosphatase tests conducted on all pasteurized samples yielded negative results.

Results reveal no significant difference between the milk processed by the two procedures. The raw milk was of comparable quality and the final results are similar. The average mesophilic count of the raw milk was approximately 160,000 per ml with extremes of 35,000 to 300,000 per ml. The count was reduced to approximately 15,000 by pasteurization and this value was increased slightly by post-pasteurization contamination.

The psychrophilic count of the raw milk was approximately 48,000 per ml with extremes of individual milk shipments ranging from 4,000 per ml to 130,000 per ml. It was noted that the higher psychrophilic counts were present in the samples having the higher mesophilic counts.

A fact of major importance revealed by figure 1 is that pasteurization by either method completely eliminated all psychrophilic bacteria, at least insofar as they could be detected by the procedure used. In no case were psychrophilic bacteria found in the 4.1 ml of milk from samples taken in sterile bottles directly from the vat or holding tube, and treated in accordance with the procedure used in this study. Furthermore, the figure reveals that the bottled milk contained small number of psychrophiles, indicating post pasteurization contamination of the milk with this type of organism. The psychrophilic count in the bottled milk (samples taken direct from the bot-

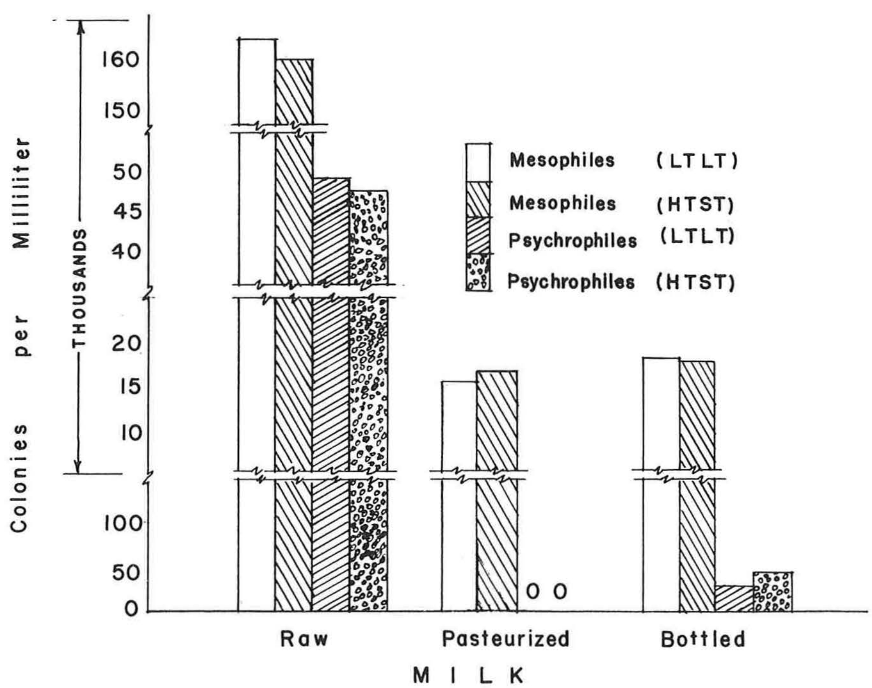

FIG. 1. Relationship between the mesophilic and psychrophilic bacteria in raw, pasteurized and bottled fresh milk obtained from commercial sources. (The pasteurized bottled milk was that taken in plant-washed bottles.)

tler in plant-sanitized bottles) ranged from 0 to 170 per ml, averaging about 30 per ml. Twenty-one of the 30 samples obtained from the bottle filler in this series of experiments exhibited the presence of psychrophiles.

Bacterial Counts on Week-Old Milk

Results obtained from the examination of the same samples after one week storage in a refrigerator at 4-7°C are illustrated in figure 2.

Both mesophilic and psychrophilic counts increased during storage, but the psychrophilic counts increased to the greater extent. In the fresh milk the mesophilic counts were consistently higher than the psychrophilic counts, but after one week storage the opposite was true.

Although there was little difference in the mesophilic fresh milk counts for the two different pasteurizing systems, after one week storage the counts were lower for the low temperature, long time system.

Although none of the pasteurized samples taken at the vat (LT LT) or pasteurizing unit (HTST) showed the presence of psychrophiles when fresh, all samples showed some psychrophiles after one week storage in a refrigerator. The psychrophilic count of milk processed by the LTLT method after seven days storage ranged from 10,000 to 100,000 per ml with an average of 50,000 per ml, whereas for the milk pasteurized by the HTST method the counts ranged from 11,000 to 80,000 per ml, with an average of 59,000 per ml.

The mesophilic counts of the milk after seven days of storage were as follows: from 7,000 to 94,000 per ml with an average of 26,000 per ml for the vat pasteurized milk, and from 12,000 to 85,000 per ml with an average of 50,000 per ml for the HTST pasteurized milk.

The samples taken at the bottle filler in plant-washed bottles were higher in almost every instance than were the samples taken at the vat or from the pasteurizing unit. Again the results were lower for the LTLT method. The psychrophilic counts for the LTLT samples ranged from 17,000 to 130,000 per ml with an average count of 68,000 per ml, whereas for the HTST samples the counts ranged from 30,000 to 130, 000 per ml, with an average count of 72,000 per ml.

TABLE 1. MILK TAKEN FROM BOTTLE FILLER IN STERILE CONTAINER

	Mesophiles per ml		Psychrophiles per ml	
	First milk	*Last milk*	*First milk*	*Last milk*
	65,000	8,400	13	0
Fresh	190,000	15,000	12	0
Milk	25,000	12,000	2	0
	8,000	7,500	2	0
Average	72,000	10,700	7	0
	85,000	35,000	90,000	70,000
Week	300,000	30,000	540,000	350,000
Old	102,000	100,000	37,000	30,000
Milk	27,000	20,000	28,000	17,000
Average	128,500	46,300	173,800	116,800

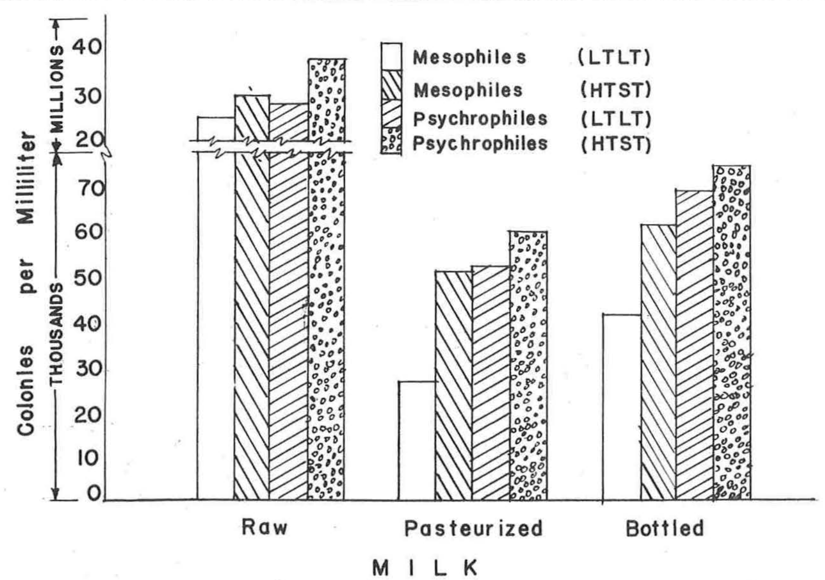

FIG. 2. Relationship between the mesophilic and psychrophilic bacteria in raw, pasteurized and bottled milk from commercial sources following storage for seven days.

Post-Pasteurization Contamination

Since milk samples obtained directly from the vat or pasteurization system did not exhibit any psychrophilic bacteria, whereas the bottled milk often contained appreciable numbers of these organisms, it appears that post-pasteurization contamination of the milk is an important factor to consider in controlling the psychrophilic count of market milk. Counts of first and last milk taken from the bottle filler in sterile bottles (same lot of milk) indicate that equipment contamination is a factor, and that generally the greater the contamination the greater the number of psychrophilic organisms present (table 1). Invariably the first milk over the equipment had higher mesophilic counts than the last milk of the same lot, and psychrophiles were always detected in the first milk through the system but were not found in last milk.

The finding of psychrophiles in the first milk but not in the last is indicative of contamination by the pipe lines and equipment.

Another factor in accounting for psychrophiles in market milk is bottle contamination. In a study of

34 freshly washed half pint bottles, 15 showed psychrophilic bacteria (table 2). The number of psychrophiles ranged from 0-70 with an average of 16, and the mesophilic count ranged from 20-490 with an average of 119. At the end of one week storage in the refrigerator all of the bottles showed the presence of psychrophiles with the counts ranging from 10-1900 with an average of 292. The mesophilic count at this time ranged from 40-1800 with an average of 363.

Types of Psychrophilic Bacteria Found

Psychrophiles were isolated from all groups of samples. A total of 167 colonies was isolated and inoculated into litmus milk tubes. Their growth at 4-7°C showed the following results: 28.14 percent were acid-forming organisms, 17.36 percent were alkaline-forming, and 54.43 percent were inert.

The incubation of the same strains at 35°C showed that 69.46 percent were acid-forming, 17.36 percent were alkaline-forming, and 13.17 percent were inert. The organisms isolated were 63.45 percent cocci and 36.52 percent bacilli. No spore formers were found.

The same strains incubated at 35°C produced different results: the percentage of inert organisms decreased, the percentage of the acid-forming ones increased, and a few of the inert organisms became alkaline-forming. This may mean that many bacteria did not grow in litmus milk at 4-7°C in sufficient numbers to change its reaction. Some of the alkaline-forming organisms isolated from milk (4.19 percent), grew only at low temperature, and may be classified as true psychrophiles.

DISCUSSION

Although psychrophiles are found in appreciable numbers in raw milk, none were detected to survive the commercial pasteurization processes by methods used. Examination of these samples after one week storage at refrigerator temperatures resulted in the finding of appreciable number of psychrophilic bacteria. This indicates either that (a) not all psychrophiles are destroyed, but the number surviving is so low as to prevent detection in amount of milk used, or (b) some mesophiles develop psychrophilic tendencies. Further work along this line is being continued.

Results indicate that post-pasteurization contamination is an important consideration in regard to psychrophilic bacteria in the pasteurized milk supply. Contamination from pipe lines, coolers, fillers, and bottles may contribute sufficient numbers of these organisms as to greatly affect the keeping quality of the pasteurized milk. Consequently, thorough cleansing and sanitizing is essential in modern operations where the milk is subjected to storage periods in the plant and in the home. It would appear that particular attention should be directed to the bottle-washing operation to insure uniformity of sanitation.

Although results are not presented in this paper, the milk was observed organoleptically and was analyzed for phosphatase and for acidity. None of the samples showed any change in phosphatase test during the week of storage. The raw samples were all positive at start and finish, and the pasteurized samples were all negative at both periods. The acidity of the raw samples increased appreciably (average of 0.033 percent) during storage, but this change did not occur in the pasteurized samples. Likewise, the raw samples were the only ones that developed a flavor

TABLE 2. BACTERIAL COUNTS OF PLANT WASHED HALF PINT BOTTLES

No.	Fresh washed bottle — Colonies per bottle		Week old bottle — Colonies per bottle	
	Mesophiles	*Psychrophiles*	*Mesophiles*	*Psychrophiles*
1	40	0	50	10
2	20	0	30	10
3	100	20	150	200
4	4C	10	50	20
5	20	0	40	10
6	30	0	40	10
7	200	70	1,800	1,900
8	60	0	80	10
9	60	0	100	10
10	30	0	40	20
11	90	0	110	30
12	200	60	400	500
13	300	60	600	700
14	180	10	480	220
15	60	0	400	300
16	200	50	700	120
17	490	60	1,000	1,500
18	120	10	360	60
19	70	0	400	20
20	270	50	800	900
21	20	0	100	20
22	340	40	1,500	1,000
23	70	0	200	90
24	20	0	40	10
25	300	50	540	900
26	230	40	800	920
27	80	0	200	80
28	60	0	170	80
29	90	10	160	180
30	70	0	550	40
31	60	0	170	10
32	30	0	70	10
33	30	0	50	10
34	90	10	250	40
Average	119	16	363	292

change, indicating that extremely high counts are necessary before flavor defects are noted.

Analysis of the data for the various periods of the year indicate no appreciable difference between the bacterial counts for the spring, autumn or winter periods, but the counts for the summer period were generally higher for both mesophilic and psychrophilic bacteria.

SUMMARY AND CONCLUSIONS

Bacteriological results obtained on fresh raw milk obtained from various sources in the Columbus market for one year, reveal the mesophilic counts were approximately three times greater than the psychrophilic counts. This relationship did not hold for the pasteurized samples. No psychrophiles were ever found in 4.1 ml of pasteurized milk taken from the vat (LTLT) or from the (HTST) pasteurization system. Psychrophiles were found in some of the bottled milk, particularly those samples taken of the first milk bottled.

Psychrophiles were found in all samples at the end of one week storage at refrigeration temperatures, and almost invariably the psychrophilic count at this time was higher than the mesophilic count.

There was a definite difference between the bacterial counts of the milk taken at the bottle filler at the beginning and at the end of the operation. Invariably the mesophilic count of the first milk bottled was higher than the last, and psychrophilic bacteria were found in the first milk but not in the last.

Evidence indicates the bottle to be a factor in introducing psychrophilic bacteria into milk.

The experimental data reveal that the psychrophilic bacteria in this study were not thermoduric. They were mostly cocci or non-spore-forming bacilli, inert or acid producing, facultative rather than true psychrophiles.

Psychrophilic organism isolated from the various milk samples and clean empty bottles, and inoculated into litmus milk and incubated at 4-7°C showed 54.49 percent of the organisms isolated were inert, 28.14 percent were acid-forming, and 17.36 percent were alkaline-forming. When the same strains were incubated at 35°C, only 13.17 percent were inert, 69.46 percent were acid-forming, and 17.36 were alkaline-forming.

Only 4.19 percent were true psychrophiles. These were all alkaline-forming Gram negative bacilli.

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FLORIDA LABORATORIANS HOLD SHORT COURSE, ORGANIZE AND JOIN ASSOCIATION

BY W. A. KRIENKE

Associate Professor of Dairy Manufactures University of Florida

The Dairy Products Laboratory on the Campus of the University of Florida accomodated a group of 26 Technicians in discussions and laboratory practices of several chemical tests. The 5-day course was held the second week of June.

Principal speaker, covering all phases of the Babcock Test and its modifications, was Dr. E. O. Herreid, Professor of Dairy Technology, University of Illinois. Another guest speaker was Mr. Wm. Uselman, Chemist, Borden Galloway-West Company, Fon-du-Lac, Wisconsin, Dean C. V. Noble of the University's College of Agriculture and Dr. E. L. Fouts, Head, Department of Dairy Science, welcomed the group.

Other tests that were reviewed and studied were: pH, titratable acidity, chlorine, phosphatase, lactometer, alkali and total solids methods. Other speakers were H. F. Butner of the State Board of Health, W. N. Butler of Southern Dairies and the following of the Department of Dairy Science: H. H. Wilkowske, L. E. Mull, Dale Dahlberg and W. A. Krienke.

A few of the Technicians are members of the Florida Association of Milk Sanitarians. The remainder will join the Association and form the Laboratorians Section. The Section will have a committee to arange its program and to correlate the program with that of the Association so that greater benefits may be realized by those now able to attend only one of the two meetings.

THE USE OF GLASS SANITARY PIPES IN THE MODERN DAIRY*

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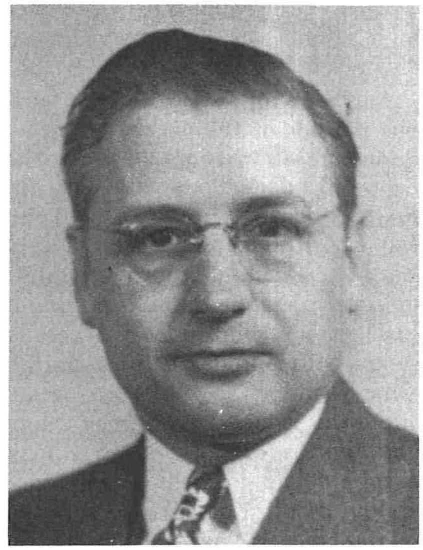

Dr. John J. Sheuring received his B.S. degree in 1940, his M.S. in 1942, and his Ph.D. in 1950, from the University of Illinois, majoring in dairy technology. He has been industrially employed, seen aviation military service with discharge as captain, served on the faculty of the University of Illinois, and has been Associate Professor of Dairying at the University of Georgia since 1948.

A permanent installation of glass pipes has been used in the University of Georgia Creamery for receiving raw milk for a period of two years. The pipes are installed in such a manner that they are washed and sterilized by continuous recirculation of the washing and sterilizing solutions. Bacteriological data were given which showed that the pipes can be adequately cleaned and sterilized by the recirculation method. After two years of daily use under normal operating conditions, the pipes contained practically no milkstone, were clean and shiny in appearance, and no breakage was experienced. A recommendation was made that milk sanitarians and health officials approve the glass pipe installations for receiving raw milk. The research is being continued.

One of the most expensive and time-consuming tasks in the operation of a modern dairy is the complete daily disassembling, washing, reassembling, and sterilization of sanitary pipes. Frequently, a complete crew of men are hired to perform this job. Not only is the cost of the labor a major item of expense, but the sanitary pipes soon become dented and often need replacing, depending upon the amount of care they receive during the daily cleaning operations.

Although tinned copper pipes are still used in some dairies, they are gradually being replaced by stainless steel and glass installations. Stainless steel pipes have the advantages of good appearance, durability, relatively corrosion resistance, and are non-catalytic in the chemical reactions of milk. Stainless steel has the chief disadvantage of being rather expensive.

During World War II, stainless steel and most other metals were not only expensive but were also difficult to purchase due to the priorities established for critical war goods. As a result, the dairy and other related industries sought other sources of materials to replace stainless steel. One of the most pleasant surprises was finding that glass or Pyrex could be used extensively in the dairy.

Glass dishware, bottles, and glass-lined vats have been used in the testing, processing, and the distribution of milk for many years. No serious attempts had been made, prior to World War II, to extend the use of glass to other plant operations. Some of the reasons that glass was not used more extensively were regulations in some states and cities which required the daily disassembly of sanitary pipes, the fact that glass is rather easily broken, and unsatisfactory gaskets which would not meet some of the sanitary standards and withstand severe processing procedures.

The glass industry, through research, has made great improvements in the strength, durability and adaptability of glass for commercial uses. From this industrial viewpoint, glass has the advantages of being corrosive resistant, transparent, and light in weight. Glass will not contaminate fluids, can be used over a wide range of temperatures, and possesses hard smooth surfaces which have poor adhesion characteristics for most fluids.

At the present time there are more than forty commercial and college dairy processing plants in the country using permanent glass pipe lines. Glass pipe lines are being used for raw cold milk, hot pasteurized milk, cold pasteurized milk, ice cream mix, skim milk, and whey. Through these various commercial and experimental installations, information is being obtained which is giving the dairy and glass industries a better knowledge of how glass can be used more extensively.

Some of the problems which immediately arose when the dairy industry first became interested in using glass sanitary pipes were the following:

(1) Can glass sanitary pipes withstand sudden and extreme changes in temperature?

(2) Can glass pipes be installed in such a manner that they can be washed and sterilized without the need of complete disassembly?

(3) Will glass pipes break easily under the conditions of daily use in the modern dairy?

(4) Can gaskets be made which will satisfactorily withstand big changes in temperature, prevent leaks, and be easily sanitized?

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(5) Is the expense of glass pipes prohibitive?

(6) How great a stock of replacement parts is necessary?

(7) Should glass be confined to only long pipes or is it also adaptable to shorter lengths?

(8) Are glass sanitary pipes adaptable to the processing of both hot and cold milk?

(9) What is the most satisfactory arrangement of glass pipes in the dairy?

(10) Does continued washing and sterilizing of the glass pipes cause any discoloration?

(11) Will the milk inspectors and sanitarians approve of the use of glass pipes for permanent installations?

PRELIMINARY TRIALS

In order to try to answer some of the above questions, the Corning Glass Company, Corning, New York, established a cooperative research project with the University of Georgia Dairy department in April, 1948. The purpose of the project was to test the use of glass sanitary pipes for receiving cold, raw milk. The point should be stressed that the project was specificially designed to secure information under normal commercial dairy plant operational procedures. This is a progress report of the information that has been obtained concerning the use of glass pipes after eighteen months of daily use.

During this phase of the study no attempt was made to subject the glass pipes to any extreme physical and chemical conditions which could be classified as abnormal in modern dairy procedures.

The glass or Pyrex pipes that were used in this study were 1½ inches in diameter. Sulphur-free gum rubber gaskets were used for all the joints. The Pyrex piping was connected to standard sanitary fittings by means of standard adapters.

The pipes were so arranged that the cold milk could be pumped directly from the weigh tank through the glass pipes to a holding vat. By

TABLE 1

A BACTERIOLOGICAL STUDY OF GLASS "PYREX" PIPE INSTALLED IN THE UNIVERSITY OF GEORGIA CREAMERY

Amount of sterile rinse water (gallons)	10	10	10	10	10	10	10	10
Temperature of water (°F)	82	83	83	81	50	52	50	72
Time rinse water circulated (min)	2	2	2	2	3	3	3	3
Bacteria count before circulating (per ml)	0	20	0	20	25	0	0	0
Bacteria count after circulating (per ml)	6000	7000	14000	17000	1140	TNC	12000	1200
Amount of luke warm water (gallons)	15	12	10	15	15	20	15	15
Temperature of luke warm water (°F)	125	118	128	131	110	120	110	113
Amount of washing powder (oz.)	4	4	4	7	5	5	5	5
Time luke warm water circulated (min)	5	5	5	5	5	5	5	5
Amount of luke warm rinse water (gallons)	10	10	10	10	15	30	30	30
Temperature of luke warm rinse water before circulation (°F)	124	125	130	125	120	120	120	128
Time of circulation (min)	3	2	2	2	5	5	5	5
Temperature of water after circulation (°F)	122	115	126	112	114	110	116	123
Amount of chlorine rinse water (gallons)	10	10	10	10	10	15	15	15
Strength of chlorine solution before circulation (ppm)	98	101	102	98	101	91	94	110
Strength of chlorine solution after circulation (ppm)	92	89	88	88	91	80	82	102
Temperature of chlorine rinse water (°F)	82	83	83	80	50	60	62	72
Time of chlorine rinse circulation (min)	2	2	2	2	5	5	5	5
Temperature of chlorine rinse after circulation (°F)	83	85	84	83	54	68	68	70
Amount of cold sterile rinse water (gallons)	10	10	10	10	10	10	10	10
Temperature of cold rinse water before circulation (°F)	82	83	83	80	50	50	58	72
Time of cold rinse water circulation (min)	2	2	2	2	5	5	3	3
Temperature of cold rinse water after circulation (°F)	83	86	88	84	57	56	64	71
Bacteria count before circulation (per ml)	0	0	0	0	0	0	0	0
Bacteria count after circulation (per ml)	0	1000	1000	0	10	60	0	3

changing one connection, a return system of glass pipes could be used to make a closed circuit for recirculation of cleansing and sterilizing solutions. Care was taken to install the pipes in such a manner that the following conditions existed: (a) glass pipes were not in direct traffic areas, (b) gaskets were installed in order that lines never extended from one rigid connection to another when 90° elbows were used, (c) the lines were pitched to facilitate drainage, and (d) at least one rubber padded hangar was used to support each pipe. No pressure relief safety devices were necessary in the installation.

One of the first problems that was studied was to determine a method of washing and sterilizing the pipes satisfactorily. Again, no attempt was made to go to extremes but normal commercial procedures were used.

The data in table 1 give some typical results that have been obtained in washing and sterilizing the pipes, using trisodium phoshate and chlorine. This procedure has been used for the past eighteen months and the results reported in the last column of table 1 are the latest information that we have available.

RESULTS OF CURRENT TRIALS

From the results of our study made under normal plant conditions over a period of eighteen months of daily use, the following statements seem logical:

(1) Glass pipes will easily withstand sudden changes of temperature from 40°F to 130°F. Higher temperatures have been used for wash water in some instances.

(2) The glass pipes were not completely disassembled for eighteen months, when the gaskets were removed in order to show them at this meeting. Data are given in table 1 that indicate the glass pipes can be washed and sanitized effectively by washing with a solution of trisodium phosphate and sterilizing with chlorine.

(3) After eighteen months of use, no glass pipes have been broken and no replacements have been necessary.

(4) One set of sulfur free rubber gaskets were used for eighteen months. No trouble was encountered at any time with leaky gaskets. No evidence was obtained that indicated any seepage occurred between the gaskets and the glass.

(5) Glass pipes are certainly adaptable for receiving cold milk in the modern dairy.

(6) The expense of installing glass pipes is less than for stainless steel. The labor involved in washing and sterilizing the pipes is almost negligible.

(7) In this study, no breakage has yet occurred so the replacement factor has been insignificant.

(8) Glass pipes should be so arranged, especially in the small dairy, that a closed circuit is obtained for washing and sterilizing.

(9) The longest pipe in the installation does not exceed 10 feet in length. Short pipes are satisfactory for use in small dairies.

(10) Continued washing and sterilizing of the pipes, as used in this study, does not discolorize the glass pipes.

(11) After eighteen months of use, practically no milkstone exists on the glass pipes.

A few recommendations concerning the use of glass pipes for receiving raw milk include the following:

(1) Install the pipes in such a manner that twisting can be avoided.

(2) A replacement stock of one spare for each twelve standard parts is sufficient.

(3) Standardize the pipe lengths as well as possible.

(4) Have at least one support for each length of pipe.

(5) Pitch the pipes in order to facilitate draining.

(6) Wash the pipes immediately after using them.

(7) Sterilize the pipes after washing and again before using them.

(8) Arrange the pipes to be out of traffic areas.

(9) Install pressure relief valves if necessary.

(10) Have a pump with sufficient capacity to completely fill the pipes while in use.

In closing, certain conditions should be kept in mind by milk sanitarians, dairy plant operators, and health officials. The dairy industry is being subjected to more controls every year. In many instances, the regulations are contradictory and frequently unnecessary. As a result of the increased regulatory costs and high prices of milk, many dairies are operating on a very narrow margin of profit. In order to provide a market for the farmer and a good product to the consumer, the dairy plant owner must make a profit or get out of business. He is continually trying to find methods of reducing costs.

I would like to recommend at this meeting that the milk sanitarians and public health officials try to make a sincere effort to standardize the system of milk inspection and approval of specific types of equipment that are sanitary, economical, and commercially reliable. I would like to recommend that the use of glass pipes, properly installed and operated, be accepted and approved for the receiving of raw milk in dairy plants. I think such a step would be a progressive move by the dairy sanitarians.

MILK COOLING — AS YOU FIND IT*

C. S. Springstead

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A study was made of the factors influencing the temperature of milk delivered to Erie County, New York, processing plants under existing local conditions. One of the most interesting facts developed was that even with ideal transportation facilities there were wide changes in the temperatures of 40-quart cans of milk and these changes could be predicted for any market. It also re-emphasized that low quality milk needs lower cooling temperatures than high quality milk.

This study was a practical approach to the problems of the cooling of milk at the farm and temperature changes during transportation to the milk plant. It was undertaken: (1) To determine, under practical conditions, the most effective temperature for the cooling of milk at the farm; (2) To gain further information on the factors influencing the temperature of milk as delivered to the milk plant under existing conditions in the Erie County market.

Although legal requirements for the cooling of milk vary in the maximum allowable degree of temperature to which milk must be cooled at the farm, there is general agreement that the maximum temperature should be from 50°F to 60°F. There also appears to be general agreement among health authorities that maximum allowable temperatures above 60°F or below 50°F are not feasible. For that reason this study emphasized the temperatures within the 50-60°F range.

A study by Bruckner[1] in 1938 indicated that good sanitary quality milk need only be cooled to 60°F to preserve its quality, while milk of lower sanitary quality should be cooled below 50°F to prevent marked bacterial growth.

Bruckner concluded in his study "that within certain limits cooling is not as important with good milk as it is with milk that contains a comparatively large number of bacteria before cooling is started. He also stated, "It is fairly safe to assume that when counts get above 50,000 to 100,000, improper cooling is indicated in addition to perhaps poorly washed and sterilized equipment." Since many of the bacterial counts in the Erie County study exceed these counts, it would be logical to expect that some of the temperatures encountered in this study would have a direct effect on the bacterial population.

A study of "The effects of farm cooling methods and transportation on the temperature of night's milk" was made by S. Abraham and C. H. Outwater[2] of the New York City Department of Health in 1942. In this work temperature changes during delivery were found to produce an overall rise in the average temperature. They reported the average temperature of all night milk at the farm was 47.8°F with an average rise in temperature on uniced trucks of +4.4° to 52.2°F during delivery. Similar data was also compiled when ice was used during transportation. These data showed an overall average rise in temperature of +0.1°F during transportation with a range of –4°F to +7°F. It should be emphasized that the New York City study dealt with various types of truck bodies.

Methods

In this study 385 dairy farms on 18 different loads of milk were selected at random for study. The maximum legal temperature for cooling in the district .is 60°F. Morning milk is cooled as well as night milk, inasmuch as a considerable portion is delivered after a 10 a. m. deadline. 97 percent of the milk producers in the area use mechanical coolers and a like percentage are equipped with milking machines. The study was carried on during the "warm weather" period of June, July, and August, with the temperatures during delivery hours ranging from 49° to 80°F.

In this study only closed-type truck bodies without refrigeration (in general use in the market) were used, and all milk was presumably "cooled" milk These conditions of course minimized or eliminated some of the variable factors you would encounter such as icing, type of truck body, outside tempera-

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tures, and cans of warm morning milk in contact with cold night milk.

Complete data were collected on each load of milk studied. Temperatures of night and morning milk were taken as the milk was picked up at the farm. Other data collected at the time of pickup included air temperature, cooling medium temperature and time of day. The load of milk was then escorted to the milk plant and temperatures of night and morning milk were retaken, and samples collected for direct microscopic examination. In order to minimize errors in comparisons between individual farms, each farm was given a good, fair or poor rating on the basis of cleanliness of milk contact equipment. This rating was made by the inspector regularly assigned to the inspection of each farm. In this way, we avoided comparing good farms with farms in the other two classifications (fair and poor) where such comparisons might be affected by the thoroughness of cleaning. Although this method of classification of dairy farms may not be absolutely accurate, it may be considered generally good since the ratings were made by individuals in intimate contact with the sanitation on each farm over a considerable period of time.

No attempt was made to compare the temperature of the cooling medium with milk temperature because the temperature of the cooling medium was found to depend on the elapsed time between milking time and time of pickup. It was noted that morning milk picked up within an hour after milking was not cooled as much as milk collected later on. The temperature of night milk in the cooling vat was also affected in varying degrees by the elapsed time between milking and pickup.

Comparative figures in this study showed the average temperature of all milk at the farm to be 47.84°F; the average delivered temperature being 50.66°F, thus giving an overall average increase in temperature of +2.82°F rather than an increase of +4.4°F found in the New York City study. The following temperature groupings of the milk in this study were as follows:

8.9% all cans 61.°F. or higher at farm
5.5% all cans 61°F. or higher at plant
22.5% all cans 56°F. or higher at farm
24.0% all cans 56°F. or higher at plant
36.0% all cans 51°F. or higher at farm
50.0% all cans 51°F. or higher at plant

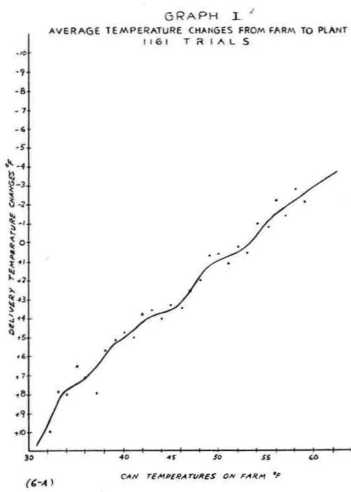
These figures show that with a legal maximum temperature of 60°F. when temperatures are taken on deck, only 5.5 percent of the cans would have been rejected, although 8.9 percent of the cans were above 60°F. when they left the farm. Obviously no dairy farmer would have milk rejected on the platform which had been cooled to 60°F or lower at the farm. This condition does not hold true with legal maximum temperatures of 55°F or 51°F, since a greater percentage of milk were above those temperatures when received at the plant. Using a 55°F temperature limit the plant inspector would find 24 percent rejectable at the plant although 22.5 percent was actually cooled within that limit when the milk left the farm. Likewise with a 51°F temperature limit the efficiency of cooling on the farm would not be properly reflected by the can temperatures at the receiving plant.

STUDIES

A comparison of the temperature changes on milk trucks with varying amounts of time consumed during delivery showed little difference. The average elapsed delivery time for the 18 truckloads studied ranged from 2½ hours to 4½ hours. The shortest haul showed the same average temperature changes as the longest haul. In other words the usual temperature changes took place within the 2½ hour period.

In this study of the rise and fall in milk temperatures beween the farm and milk plant, all cans of milk were included. No segregation of a. m. and p. m. milk or good or poor farms is made since these factors do not affect the temperature changes of the milk during delivery.

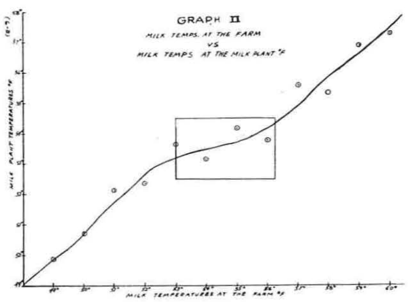
In Table 1 the actual number of all 40-quart cans of milk picked up at the farm at each degree of temperatures from 35° to 65°F is listed together with the average temperature of that milk upon delivery at the plant. For example, there were a total of 20 cans of milk which tested 35°F at the farm and the average delivered temperature of all those cans of milk at the milk plant was 41.5°F or an average rise of 6.5°F. for each can of milk. In examining this table you find that 45°F milk on the farm rose an average of 3.4°F with corresponding increases in temperature until a point between 53° and 54° where an end point is reached and the milk starts to decrease in temperature. Milk at 55°F when picked up at the farm shows an average decrease in temperature of 0.8°F upon delivery, while milk at 60°F shows an average decrease in temperature of 2.7°F.



Graph No. 1, on separate sheet, depicts this relationship between temperatures on the farm and the change in temperature during delivery. Since outside factors have been eliminated or, at least, minimized, it is our belief these temperature changes are almost entirely due to the transfer of heat between the cans as they stand in the truck. From this graph we can predict, with some accuracy, the temperature of a can of milk upon delivery when the farm temperature is known.

Under the conditions of this study, we can, for instance, forecast that 60°F milk on the farm will reach the plant at 57 + °F and 65°F milk will deliver at 60°F. This means that under the present conditions, poor cooling will be covered up during transit by the transfer of heat to well-cooled cans of milk.

With a 60°F temperature regulation (as in Erie County) 94.5 percent of the milk reaching the milk plant was of legal temperature, but of the temperatures taken at the farm only 91 percent of the same milk was of legal temperature.



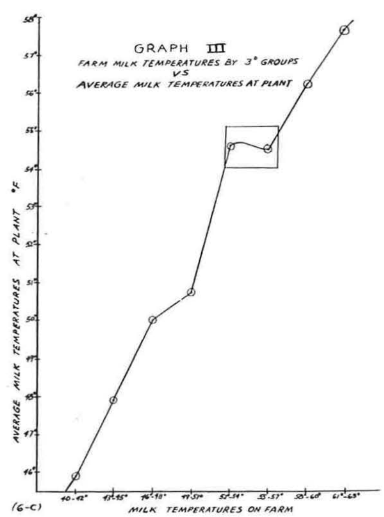
You will note in Graph No. 1 there is a tendency toward a leveling off of the curve in the vicinity where decreases in temperature change to increases (53-54°F). In order to obtain a magnified picture in the critical area, Graph No. 2, was prepared. This graph deals with farm temperatures of 49° to 60°F plotted against the average delivered temperatures. You will notice that part of the curve in the critical area is boxed off.

TABLE 1 — MILK TEMPERATURE CHANGES FROM FARM TO PLANT

Milk Temp. at Farm °F	Number trials	Av. Milk Temp. on deck °F	Aver. Temp. Change	Milk Temp. at Farm °F	Number trials	Av. Milk Temp. on deck °F	Aver. Temp. Change
35	20	41.5	+6.5	51	15	52.1	+1.1
36	34	43.2	+7.2	52	30	52.3	+0.3
37	37	45.0	+8.0	53	38	53.6	+0.6
38	56	43.7	+5.7	54	33	+53.1	–0.9
39	20	44.2	+5.2	55	45	54.2	–0.8
40	79	44.8	+4.8	56	38	53.8	–2.2
41	43	46.0	+5.0	57	41	55.6	–1.4
42	64	45.8	+3.8	58	54	55.3	–2.7
43	38	46.6	+3.6	59	23	56.9	–2.1
44	45	48.0	+4.0	60	32	57.3	–2.7
45	80	48.4	+3.4	61	21	55.7	–3.3
46	46	49.5	+3.5	62	13	58.5	–3.5
47	36	49.5	+2.5	63	8	61.4	–1.6
48	47	50.0	+2.0	64	7	61.3	–2.7
49	24	49.8	+0.8	65	11	60.0	–5.0
50	62	50.7	+0.7				

TABLE 2 — MILK TEMPERATURE GROUP CHANGES DURING TRANSPORTATION FROM FARM TO PLANT

	Pcnt. of Each Grp.	No. each group	No. group increases	increases % Group	No. group decreases	decreases % Group	Number no. chang.	% No. change
Group I 50	63.9	507	131	25.8	0	0	376	74.2
Group II 51-55	13.5	107	35	32.7	21	19.6	56	47.7
Group III 56-60	13.7	109	7	6.4	31	28.4	71	65.2
Group IV 60	8.9	70	0	0	35	50.0	35	50.0
Totals		793	173	21.8	87	11.0	533	67.2



In Graph No. 3, 3° temperature groups were used in order to avoid the distortion of extremes in temperatures, which are more pronounced in 1° temperature groups. As in Graph No. 2, farm temperatures are plotted against the average delivered temperatures. This graph magnifies the leveling off portion of the curve in the 53° to 55° area.

In order to depict the changes which occur between the temperatures in common use as legal maximums, Table 2 was prepared. It shows the number of temperature group changes which resulted from transporting the milk from farm to plant. Group 1 50°F or less; Group 2 51-55°F; Group 3 56-60°F; Group 4, over 60°F. In the lowest temperature group (No. 1 50° F or less) there were the fewest group changes, while the greatest number of changes were found in Group No. 2 (51-55°F). This was to be expected inasmuch as this temperature group includes the critical temperature area where we have both increases and decreases in temperature. In Group 4 (over 60°F) the number of changes was also large. This reflects the marked cooling effect on high temperature milk, a major portion of which was within a 61-65°F range.

FARM TEMPERATURES COMPARED WITH BACTERIAL COUNTS OF MILK DELIVERED TO MILK PLANT

In this study the good, fair, and poor classifications of dairy farms based on cleanliness of equipment was used in order to make comparisons between farms of equal quality.

In Table 3 the group temperatures of milk on the farm are compared with the direct microscopic counts. This comparison is broken down to show the effect in good, fair and poor dairy farms. The direct microscopic counts are grouped as follows: Group I, 200,000; Group II, 200,000 to 500,000; Group III 500 M to 1,000,000; Group IV over 1,000,000. You will note that in Group I temperatures (50°F or less) over 76 percent of the bacteria counts were under 200,000 per ml while fair and poor farms show only 58 percent and 40 percent respectively. The same relationship exists in temperature groups II and III. These results indicate that the bacterial counts are more closely related to the farm classifiication than the actual milk temperature under the conditions of the experiment. A summary of the Group I direct miscroscopic counts is contained in Column 1 of Table 3. These figures show clearly that the percent of direct microscopic counts in Group I (below 200,000) remain constant regardless of the temperature group. However the percent of bacterial counts for temperatures over 60°F (Group IV) are higher than for temperatures below 60°F.

Further compilations were made to determine the effect of comparing temperature of milk as delivered to the plant (rather than the farm temperatures) with the bacterial counts. It was found that no significant differences existed in this comparison that were not shown by the comparisons of farm temperature vs. bacterial counts.

TABLE 3

Comparison of Milk Temperatures with DM Bacterial Counts of Nights and Mornings Milk

Farm Temperature		DMC Group I 200M	DMC Group II 200M-500M	DMC Group III 500M-1,000,000	DMC Group IV Over 1,000,000	TOTAL
Group I	pm Milk	84	14	7	3	108
50°F	am Milk	60	13	5	2	80
Group II	pm Milk	15	1	1	1	18
51-55°F	am Milk	16	6	1	2	25
Group III	pm Milk	11	4	2	1	18
56-60°F	am Milk	21	5	1	1	28
Group IV	pm Milk	3	2	0	0	5
Over 60°F	am Milk	7	2	3	4	16

TABLE 3 — MILK TEMPERATURE ON THE FARM COMPARED WITH D. M. BACTERIAL COUNT

Farm Temp.	Farm Cleaning Rating	No. in DMC Grp. 1 200,000	Pcntg. in DMC Grp. 1	No. in DMC Grp. 2 200M-500M	Pcntg. in DMC Grp. 2	No. in DMC Grp. 2 500M-1000M	Pcntg. in DMC Grp. 3	No. in DMC Grp. 4 over 1000M	Pcntg. in DMC Grp. 4	TOT. GRPS.
Group No. 1	Poor	12	40	10	33.4	3	10.0	5	16.6	30
50-F	Fair	96	58	34	20.5	16	9.7	20	12.0	166
	Good	144	76.6	27	14.4	12	6.4	5	2.6	155
Group No. 2	Poor	2	28.6	2	28.6	1	14.2	2	28.6	7
51-55-F	Fair	22	58.0	9	23.7	3	10.5	4	7.8	38
	Good	31	72.0	7	16.2	2	4.7	3	7.1	43
Group No. 3	Poor	6	50.0	2	16.6	0	0	4	33.4	12
56-60-F	Fair	21	61.7	10	29.4	0	0	3	8.9	34
	Good	32	69.6	9	19.6	3	6.5	2	4.3	46
Group No. 4	Poor	6	50.0	2	16.7	1	8.3	3	25.0	12
Over F.	Fair	12	52.0	3	13.0	4	17.4	4	17.4	23
60 Deg.	Good	10	47.7	4	19.0	3	14.3	4	19.0	21
TOTALS		394	63.5%	119	19.2%	48	7.7%	59	9.6%	620

COMPARISON OF THE TEMPERATURES AND BACTERIAL POPULATION

For this comparison, only farms rated as "good" were used inasmuch as this was the largest single classification. These results are shown in Table 4.

You will note the direct microscopic groupings for each temperature group are about the same regardless of the temperature. Hence, no significant rise in bacterial counts can be traced to the higher temperatures encountered in this study. This may, in part, be explained by the fact that morning milk temperatures were generally higher, but the age of this milk on delivery was not great enough to permit appreciable bacterial growth.

CONCLUSION

1. Within a temperature limit of 60°F the bacterial counts of milk as delivered to the milk plant were not materially affected by the temperature of the milk. Milk cooled to 50° or below, and milk cooled to 55° did not show any improvement in bacterial count over milk cooled only to 60°F.

2. Dairy farm ratings of good, fair, and poor classifications made by the dairy farm inspector and based on the efficiency of cleaning and disinfection of milk utensils are directly related to bacterial population. Generally speaking bacterial counts increased as farm ratings decreased.

3. Under the conditions of this study, milk at 53°F or lower on the farm will increase in temperature during transportation, while milk at 54°F or higher will decrease in temperature during transportation.

4. Temperatures of milk taken at the receiving plant do not necessarily reflect the efficiency of cooling on the farm.

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ANNUAL REPORT OF THE COMMITTEE ON COMMUNICABLE DISEASES AFFECTING MAN*

THE PERSISTENCE of food-borne diseases among people of the United States and Canada is emphasized by the almost daily reports in the newspapers and the annual summarizations of the U. S. Public Health Service. In such reports one notes an increase in epidemics due to foods other than milk and a decrease in epidemics which are milk-borne. The explanations of these trends are not readily available, but it is hoped that increases are due to better investigating and reporting in case of general foods and are due to more protective methods in the case of milk.

The nature of food-borne disease makes complete study and solution difficult. As a consequence, many outbreaks occur which are not investigated and many occur which are not reported to a health agency. Unfortunately, foods of all kinds are sometimes incriminated on insufficient evidence, and illness involving only two or three people may be reported as a food-borne disease.

It seems appropriate for this Committtee to call attention to some well-recognized characteristics of a food-borne disease, with the hope that compliance with these fundamentals will result in accurate determination of such outbreaks.

1. Food-borne disease is explosive in nature and affects definite groups of consumers who have consumed one article of food in common. Exceptions to this rule may be explained by individual susceptibilities, varying quantities of food consumed and different batches of the same type of food.

2. Symptons of the disease are quite uniform in the group affected. Exceptions to this may be due to amount of food consumed and to individual susceptibilities. For example, a milk-borne streptococcal infection outbreak may be characterized as scarlet fever or septic sore throat, depending on the recency of exposure of the population affected to scarlet fever. In staphylococcal enterotoxemia symptoms are surprisingly uniform, but a few individuals may be less severely affected due to the small amount of food consumed.

3. Symptons of food-borne disease are usually of sudden onset and more severe than natural contact disease. This is considered to be due to the relatively large infecting dose of the organisms involved.

4. The source of food-borne infection or intoxication can be determined in most cases. Obviously, there are exceptions to this rule. For example, in *Salmonella* infection, the source of the organism may have been discarded in the interval between exposure and appearance of symptoms.

5. Types of food which support bacterial multiplication are most commonly involved. This means that milk and foods prepared from milk—such as gravies and custards, meat and meat-food products and alkaline vegetables—are usually incriminated.

6. The origin of most food-borne disease can be traced to an infected or carrier man or animal.

It is urged by this Committee that health departments provide more personnel and better facilities for the investigation of food-borne diseases. In reviewing the numerous reports for 1949, it is apparent that many reports of food-borne diseases were based upon inadequate data to give a complete story. Food producers and processors may well complain about the incrimination of foods upon insufficient evidence.

In addition to the basic characteristics of food-borne diseases, given above, it is well to base conclusions on two fundamental facts.

1. Epidemiological evidence, which includes type, source, methods of preparation, storage and distribution of food, as well as the area and group affected, should be carefully collected and analyzed.

2. Complete bacteriological, parasitological and chemical examinations must be made of the sample of food incriminated, as well as the vomitus and feces of those affected, if at all possible.

Trends in food-borne diseases are noted in the two tables appended to this report which have been prepared by the U. S. Public Health Service.

I. A. MERCHANT, *Chairman*
R. G. FLOOD
R. J. HELVIG
STANLEY HENDRICKS
C. H. MADER

*Presented at the 38th Annual Meeting of the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, Glenwood Springs, Colo., September 26-29, 1951.

OLD TIMERS' CLUB OF BOWMAN DAIRY

Six hundred forty-two members of the Bowman Dairy Old Timers' Club were honored at a recent (April 21) dinner meeting in the Grand Ballroom of the Lake Shore Club, Chicago. The annual get-together sponsored by the Company was attended by Bowman employees with continuous service records of twenty-five years or more and by Company officials.

Highlight of the evening was a vaudeville entertainment featuring stars of the movies and television. Harry Hysen of Harvard, Illinois, a member of the company's dairy inspection staff with twenty-eight years service, was elected President of the Old Timers. Arthur Eklund, a wholesale salesman with forty-two years service is the new First Vice President. Second Vice President is Walter Schwabe of the Building Maintenance Department with thirty years service. Miss Irene Carroll of the General Office Accounting Department with an employment record of thirty-three years is the honor group's new secretary. Carl Anderson, who has been employed forty-two years is the new Sergeant-at-Arms.

Practical Ideas

A "YARDSTICK" FOR CLEANLINESS

C. W. Weber
Milk Sanitarian, New York State Department of Health
Albany, N. Y.

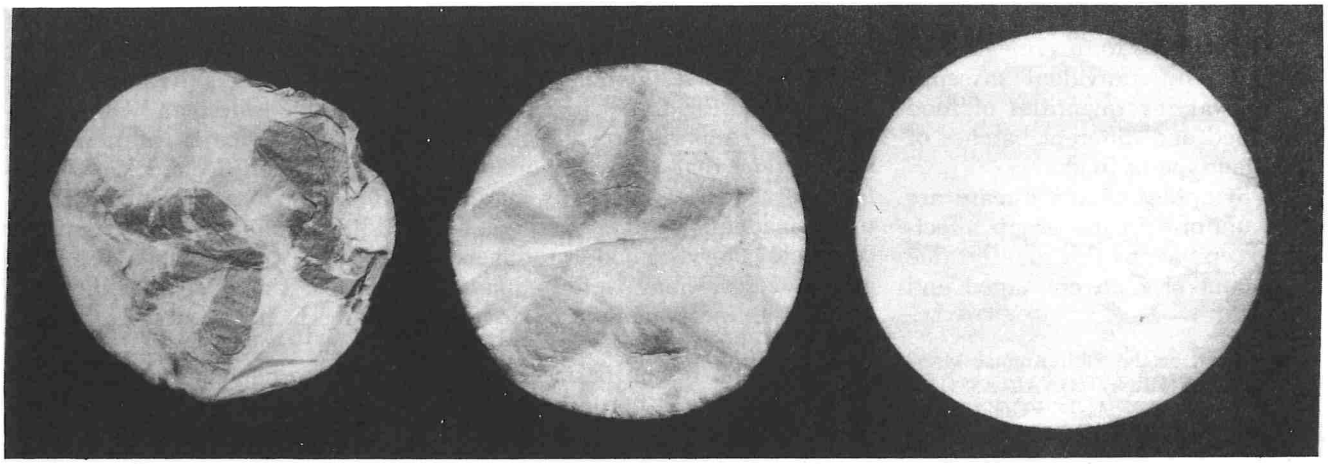
How clean is clean? All sanitation laws and regulations specify that surfaces with which milk or other foods come in contact shall be thoroughly cleaned or clean. But the law does not define cleanliness. The interpretation is left to the good or poor judgment or "opinion" of the sanitarian. We have tried, and to a certain extent succeeded, in taking the guesswork out of measuring the cleanliness of milk by means of the sediment test.

The milk contact surfaces of all well designed dairy equipment are subject to both *sight* and *touch*, with one exception: namely, the interior surfaces of metal or glass piping. When the surface can be both seen and touched, a personal opinion as to its relative cleanliness can be ascertained. Even this weak yardstick cannot be applied to the interior surfaces of pipes. Bacterial tests are often used to measure cleanliness, but they are only estimates or numbers of microorganisms and are not a measure of misplaced matter or dirt.

Recently, during our cold New York winter months, I had an opportunity to examine some pipes installed in a milking parlor and used in conjunction with a combine milker. The temperature in the parlor was below freezing. Looking through the long gun barrel pipe, the surface looked bright and shiny. Warm water was run over the outside of the pipe to melt the ice before swabbing the interior surface to a depth of six inches. The swabs were coated with old milk solids and fat but the bacterial counts were excellent. I had been looking for a reproducible yardstick of cleanliness and here it was right before my eyes. It has been used for centuries in one manner or another but because it is so simple, it has never been called a test and no effort made to improve and standardize it.

Using the simple facilities on hand at this dairy, I made a test of the cleanliness of these pipes and had permanent evidence to confirm my opinion. A white six-inch diameter farm type strainer pad was placed over the pipe brush and pushed through the milk pipe. The pad was loaded with soil, dirt, junk or whatever you want to call it. Will this test be of any value on pipes that appear to be clean or on pipes soiled with a tenacious type milkstone?

Let me answer the first part of that question from actual experience. Four sanitarians from two states and two practical dairy farmers were examining about 430 ft. of glass pipe line installed in a stanchion type stable. All agreed that the glass lines looked clean and acceptable. But when the white filter pad was pushed through only eight feet of pipe, it came out black. What was the black dirt and where did it come from? It was a metallic deposit which came from a galvanized tank used for circulating cleaning solution. Other clean appearing glass pipes revealed the presence of iron oxide which apparently came from iron pipes and pump used in the circulatory system. In a study of cleaned-in-place milk pipes being carried on at one of our institution of higher learning, bacterial results were excellent and visual cleanliness was acceptable.



The snow-white filter pad inserted at one end of a six-foot pipe looked as if it had been dragged through the mud when it came out the other end. The greenish brown soil turned out to be high in wetting agent used in the detergent. It is translucent, shiny and very difficult to detect by sight, particularly when deposited on metal surfaces. Hard stone deposits may not show up well on the pad but they can be detected by visual inspection. If the pad is first moistened and pushed through under fairly high pressure, the milkstone deposits will not be missed.

The test has been applied to manually washed pipes using a power brush and although they may pass visual and bacterial inspection, some showed the presence of soil on the pads. After thorough and effective brushing and rinsing the pads came through lilly white.

No attempt has been made to standardize the technic and I do not believe the results should be standardized. The cleanest pad obtainable from pipes washed under practical conditions should serve as a guide. In order to have comparable results, the technic should be standardized and the standard should be followed. But before this can be done, considerable more experience by a large number of sanitarians is needed. There are still many unanswered questions. Would a black cloth or pad be better than a white one? Maybe one-half white and one-half black would be the best. Often white detergent powders or precipitates remain as soil in the pipes. What pressure should be applied to the pad against the pipe wall? I have used a nylon sponge in place of the bristle brush with good results. For a brush handle, I use a ¾" 3 feet long wood dowling, coupled by means of short pieces of rubber hose. They are cheap, strong, clean, easily asembled and dismantled. A light weight plastic garden hose also works well. A heavy self-winding spring steel similar to a steel rule may be even better. The square area to be swabbed should be standardized which would mean different lengths for different size pipes. Consideration is being given to impregnating the pads with colorless dye, which will change color in the presence of fats or proteins.

The test can be applied to unlimited lengths of pipes cleaned in place by placing the pad on a torpedo brush and forcing through the system by hydraulic or air pressure. It can be applied to surfaces other than interior of pipes and suggestions and comments on your experience, trials, tribulations, success or failure with the "Weber test for cleanliness" will be appreciated.

RETENTION OF MILK AND MILK-PRODUCT FILMS ON GLASS SLIDES DURING STAINING, DEFATTING AND RINSING FOR MICROSCOPIC EXAMINATION

NICHOLAS A. MILONE
School of Public Health
University of Michigan
Ann Arbor, Michigan

OF PRIMARY IMPORTANCE to the retention and uniform distribution of milk and milk-product films, as well as of other kinds of films, on glass slides for subsequent defatting, staining, and rinsing for microscopic examination is that the glass surface be *absolutely clean* prior to use. Slides cleaned and stored prior to use may collect dust and various other substances from the air and from other sources, rendering them unsuitable for the preparation of films. A rather common experience for many sanitarians and laboratories has been the washing off of such films, in whole or in part, from an apparently clean slide during the various steps of the staining process, as well as uneven distribution of the film over the specified area. Such happenings result in the loss of time, sample, labor and even affect the accuracy of the method if counts are made on the unsatisfactory film.

A simple procedure which if properly performed promotes wetting of the glass surface by the material, thereby assuring uniform distribution and preventing the washing off of the film during the staining steps, which has been proven worthwhile in the preparation of thousands of films made while the writer was with the New York State Department of Health, is to apply a uniform coating of Bon Ami or similar product to both sides of the glass slide after it has been washed, to allow it to dry, and prior to use to wipe the coating off the slide completely with a piece of clean cheesecloth. The slide is then ready for use. The coating, for protective purposes, should be left on the slide during storage and removed only when the slide is needed. It is obvious that care should be exercised, once the coating is removed, not to touch the glass surface with the hands.

Immersion of the slide in alcohol, flaming, or other disinfection treatments after the coating has been removed and prior to making the smear are not advocated. Such attempts usually result in soiling the slide and defeating the purpose intended. With ordinary care the probability of chance contamination of the slide prior to use is remote and not significant within the limits of accuracy of this method of examination.

Association News

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Sergeant-at-Arms D. V. Fitzgerald, ... Elgin, Illinois
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H. B. Richie .... Chicago, Illinois
Auditors
E. G. Huffer .... Springfield, Illinois
P. W. Scherschel ...... Gary, Indiana

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S. T. Chalker, Jacksonville Dairy Sanitarian, Jacksonville
J. D. Robinson, State Dairy Supervisor, Plant City
H. H. Rothe, State Dairy Supervisor, Gainesville
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Vice-President, H. W. Lehmkuhl ....Rochester
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Vice-President, M. L. Strommer, ... Aberdeen
Secretary-Treasurer, L. O. Tucker, State Department of Health, Seattle, Washington.

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Phillipp C. Newman ...... Beaver Dam
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2nd Vice-President, Wm. Whitton, 996 E. Flower St., Bellflower, Calif.
Secretary-Treasurer, R. L. Van Buren, P. O. Box 184, San Diego 12, Calif.
Junior Past President, B. Q. Engle, Dept. of Public Health, 101 Grove St., San Francisco 2, Calif.
Auditors:
F. L. Turner
J. A. Hobson

ROCKY MOUNTAIN ASSOCIATION OF MILK AND FOOD SANITARIANS

(Colorado, New Mexico, Utah, Wyoming, Nebraska, Montana)
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President-Elect., James Doughty, New Mexico Dept. of Public Health, Santa Fe, New Mexico.
1st Vice-President, Eugene Tuttle, Weber-Central Dairy, Ogden, Utah
2nd Vice-President, Ray E. Iiams, Wyoming State Dept. of Agric., Cheyenne, Wyoming
Secretary-Treasurer, Howard M. Weindel, Rock Mtn. Training Center, U. of Colorado Medical School, Denver, Colo.
Auditors: Hugh L. Templeton, Technical Director Fairmont Foods Co., Omaha, Nebr.; Thomas A. McMasters, Dairy Div., Montana State Dept. of Agriculture, Helena, Montana

SOUTH DAKOTA ASSOCIATION OF SANITARIANS

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Vice-President, Ira DeHaai, 721 3rd St., Spearfish, South Dakota
Secretary-Treasurer, J. F. Tinker, State Dept. of Health, Pierre, South Dakota
Executive Board:
Past President, Don Wilson, City Health Dept., Mitchell, South Dakota
Elected Member, Charles Halloran, State Dept. of Health, Pierre, South Dakota

Dairy Sanitarians Association of North Central Pennsylvania

President, James H. Eck, 1304 W. Southern Ave., South Williamsport, Pa.

Vice-President, Galen Furry, Martinsburg, Pa.

Treasurer, Earl F. Hack, Mexico, Pa.

Secretary, C. D. Herbster, 325 Orange St., Selinsgrove, Pa.

Executive Committee: Dr. S. M. Ross, V. M. D., 1828 E. Third St., Williamsport, Pa.

I. E. Parkin, 213 Dairy Bldg., State College, Pa.

G. C. Kern, Milton, Pa.

Harry T. Daddario, New Berlin, Pa.

New Affiliates

Connecticut Association of Dairy and Food Sanitarians

President, Fred K. Armstrong, Branford, Conn.

Vice-Pres., Alfred H. Jackson, Hartford, Conn.

Secretary, H. Clifford Goslee, Dept. of Farms & Markets, State Office Bldg. Hartford, Conn.

Treasurer, Curtis W. Chaffee, Dept. of Farms & Markets, State Office Bldg., Hartford, Conn.

George A. West Resigns As Secretary-Treasurer

The Executive Board regrets to announce that George A. West has resigned as Secretary-Treasurer, effective July 1st.

Due to heavy duties in his new work, George, felt that he could no longer properly discharge the duties of the Secretary-Treasurer.

The Executive Board on behalf of the Association wishes to extend their thanks for his long and faithful service.

H. H. Wilkowske, Secretary-Treasurer of the Florida Association has been appointed to fill the unexpired term.

The Executive Board
H. L. Thomasson, *President*

Washington State Milk Sanitarians Association Holds Annual Meeting

Washington State Milk Sanitarians Association meeting was held at the 21st annual State College of Washington Institute of Dairying, Pullman, Washington on March 12, 1952.

An important feature of the meeting was a report on the recommendations of the Laboratory Methods Committee appointed August 1951 by L. E. Jenne, President. The purpose of the committee was to review the existing variations in laboratory procedures employed in the bacteriological examination of milk and milk products and submit recommendations that will lead to the standardization of procedures in the official and industry laboratories throughout the state.

Composition of Committee

Dr. W. R. Geidt, Washington State Department of Health.

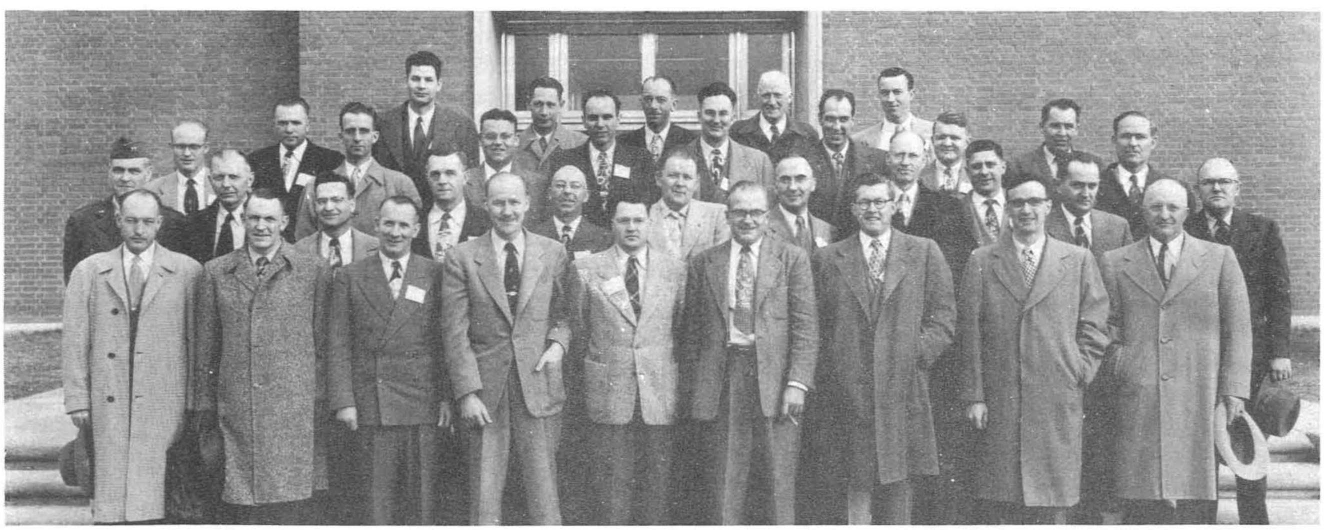
Rodney Olson, Skagit County Dairymen's Association.

W. J. Oldenburg, Universal Laboratories.

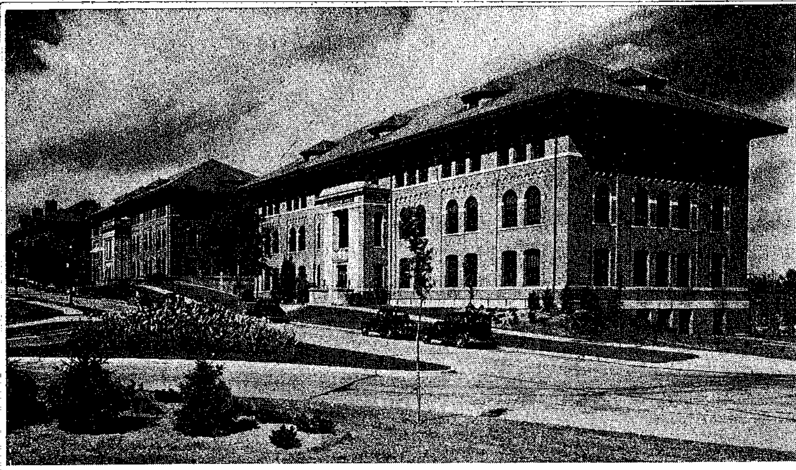
Professor C. C. Prouty, Washington State College.

F. W. Crews, Chairman, State Department of Agriculture.

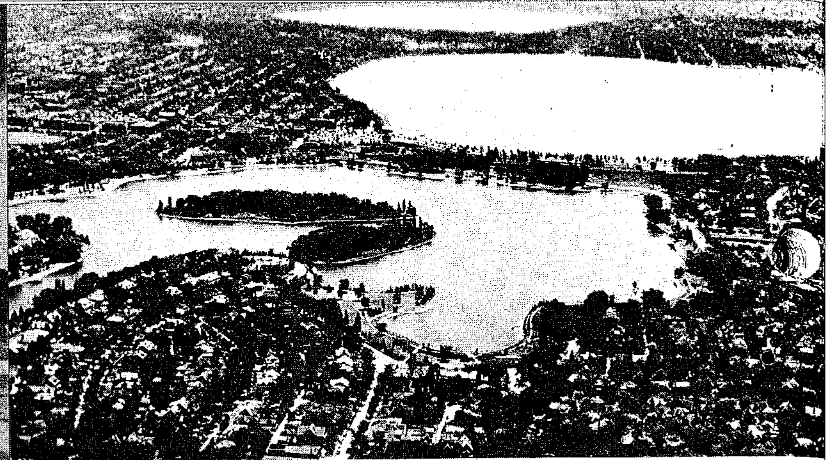
There were three meetings of this committee which agreed upon the recommendations presented.



1st row: L. O. Tucker, John Ostrom, Leslie Taschner, Wm. Knutzen, Reid Greethurst, Harold Janzen, Rob't. Freimund, Leslie Jenne and Harold Hyatt. (Hyatt is not a member)
2nd row: G. R. Darnell, George Lund, Frank Logan, A. D. Stocking, Fred Willoughby, Roy McDonald, Ray Carson, C. C. Prouty, A. J. Duris, Wm. Dubois, M. L. Strommer.
3rd row: Fred H. Troemmel, Jr., Roy Olson, L. C. Manley, Elmer Morgan, Bender Luce, Clayton Gustafson, Harry Johnson, Arnold Sersland, Jay Gano and Fred Herrington.
4th row: F. W. Crews, W. J. Oldenburg, Cameron Adams, Edward Soper and Charles Meach.



Three of principal buildings, University of Minnesota



Airview of three of Minneapolis' 22 lakes

PROGRAM

Tuesday, September 16

10:00 A.M.—Meeting of Executive Board

Wednesday, September 17

9:00 - 12:00—Meeting of all Committee members with their respective committees — Meeting of Executive Board with Associate Editors

1:00 P.M.—Advanced Registration

1:30 to 4:30 P.M.—Meeting of all Committees with Executive Board of the Association

6:30 to 8:30 P.M.—Meeting of the Council

8:30 P.M.—Smoker - Local Arrangements Committeee

Thursday, September 18

GENERAL SESSION, MORNING

Chm.—H. L. Thomasson, *President, IAMFS, Shelbyville, Indiana*

8:00 A.M.—Registration

8:30 A.M.—Movie "Dishwashing Dividends"

9:00 A.M.—Address of Welcome - Governor C. Elmer Anderson, Governor of Minnesota

9:20 A.M.—Welcome, Owen Owens, President, Minnesota Association of Milk Sanitarians

9:30 A.M.—Presidental Address, H. L. Thomasson, President, IAMFS

9:45 A.M.—"Changing Responsibilities in Milk and Food Technology", Harry G. Hanson, Executive Officer of the Public Health Service, Washington, D. C.

FOOD SECTION MEETING

Chm.—John H. Fritz, *Chief Food Sanitarian, Kansas City Health Department, Kansas City, Missouri*

10:15 A.M.—A "Report of the Epidemological Investigation of a Gastroenteric Outbreak, Occurat Glenwood Springs, Colorado, 1951 Annual Meeting, IAMFS". Dr. George W. Stiles, Chief, Laboratory Section, Colorado State Health Department, Denver, Colorado

10:45 A.M.—Discussion

11:00—"Principles of Food Microbiology"
Dr. H. O. Halvorson, Head, Department of Bacteriology, University of Illinois, Urbana, Illinois

11:45—Discussion

MILK SECTION MEETING

Chm.—George A. West, *Genessee Cooperative Dairies, Rochester, New York*

10:00 A.M.—"High-Temperature Short-Time Pasteurization of Ice Cream Mix", Dr. Marvin Speck, North Carolina State College, Raleigh, North Carolina

10:45 A.M.—Discussion

11:00 A.M.—"Practical Sanitary Aspects of Pipe Line Milking"
Mr. G. E. Gordon, Extension Dairyman, University of California, Davis, California

11:45 A.M.—Discussion

12:00 Noon—Luncheon Meeting - Minesota Milk Sanitarians Association

Thursday, September 18

AFTERNOON SESSION

Chm.—H. L. Thomasson, *President, IAMFS, Shelbyville, Indiana*

1:15 P.M.—Business Meeting including reports of Committees: Advisory Committee on Milk Regulations and Ordinances, C. J. Babcock, Chairman; Applied Laboratory Methods, Dr. L. A. Black, Chairman; Communicable Diseases Affecting Man, Dr. R. J. Helvig, Chairman; Dairy Farm Method, James M. Doughty, Chairman; Educational, J. L. Rowland, Chairman; Food Handling Equipment, C. W. Weber, Chairman; Frozen Food Sanitation, Dr. Marvin Speck, Chairman; Membership, Hugh Eagan, Chairman; Professional Development, H. B. Robinson, Chairman; Sanitary Procedure, C. A. Abele, Chairman

4:30 to 8:30 P.M.—Tour, Dinner and Entertainment, Courtesy Land O' Lakes Creameries, Inc., Minneapolis, Minnesota

Friday, September 19

GENERAL SESSION

Chm.—Harold J. Barnum, *Pres.-Elect, IAMFS, Denver, Colorado*

8:30 A.M.—Movie "Triple Threat"

9:00 A.M.—"Public Relations in the Sanitarians Profession", L. A. Zahradka, Munson Associates, Oconomowoc, Wisconsin

9:45 A.M.—Report of Nominating Committee

FOOD SECTION MEETING

Chm.—C. W. Weber, *New York State Health Department, Albany, N. Y.*

10:00 A.M.—"Status of Sanitation Knowledge Among Food Service Workers", H. S. Adams, Assistant Professor Dept. of Public Health, Indiana University, Medical Center, Indianapolis, Ind.

10:45 A.M.—Discussion

11:00 A.M.—"The Development and Administration of a Broad Program of Restaurant Sanitation in an Average Urban Area", Herbert J. Dunsmore, Public Health Engineer, Pittsburgh Department of Public Health, Pittsburgh, Pennsylvania

11:45 A.M.—Discussion

MILK SECTION MEETING

Chm.—Ben Zakarison, *Director of Laboratories, Land O' Lakes Creameries, Inc., Minneapolis, Minnesota*

10:00 A.M.—"Pen Stabling", E. L. Richards, International Harvester Co., Buffalo, New York; Dr. F. L. Schacht, New York State Board of Health, Albany, New York; Dr. Stanley Witzel, University of Wisconsin, Madison, Wisconsin

10:45 A.M.—Discussion

11:00 A.M.—"Q Fever", Dr. John Enright, School of Veterinary Medicine, University of California, Davis, California

11:45 A.M.—Discussion

1:15 to 6:00 P.M.—Conferences, Open Houses and Field Trips

6:30 P.M.—Banquet
Presentation of Citation Award
Presentation of Sanitarians Award*, Dr. K. G. Weckel, Chairman, Recognition & Awards Committee
Presentation of Past Presidents Certificates, H. L. Thomasson, President
Entertainment —
Courtesy Minnesota Dairy Industry

Saturday, September 20

GENERAL SESSION, MORNING

Chm.—John D. Faulkner, *First Vice-President, IAMFS, Washington, D. C.*

8:30 A.M.—Movie "Yours is the Land"

9:00 A.M.—"The Application of Food Sanitation Practice in Emergency Feeding Operations" Jerome B. Trichter, Assistant Commissioner,** New York City Health Department, New York, N. Y.

9:45 A.M.—Election of Officers

FOOD SECTION MEETING

Chm.—T. A. Evans, *Chief, Milk and Food Section, South Dakota State Health Department, Pierre, South Dakota*

10:00 A.M.—"Sanitary Problems Related to Poultry Plant Operations", Dr. Hugh L. Templeton, Technical Director Fairmont Foods Company, Omaha, Nebraska

10:45 A.M.—Discussion

11:00 A.M.—"Vending Machines" (Speaker to be announced at a later date.)

11:45 A.M.—Discussion

MILK SECTION MEETING

Chm.—C. H. Holcombe, *Supervisor, Dairy and Food Inspection, State Department of Agriculture, St. Paul, Minnesota*

10:00 A.M.—"Sanitary Problems in the Bulk Handling of Milk on the Dairy Farm," A. C. Woodruff, Mojonnier Brothers Company, Chicago, Illinois.

10:45 A.M.—Discussion

11:00 A.M.—"Factors Influencing the Efficiency of In Place Cleaning of Pipe Lines", Dr. John Sheuring, Dairy Department, University of Georgia, Athens, Georgia

11:45 A.M.—Discussion

Saturday, September 20

AFTERNOON SESSION

Chm.—H. L. Thomasson, *President, IAMFS, Shelbyville, Indiana*

1:15 P.M.—Installation of Officers,

GENERAL SESSION

Chm.—Ivan E. Parkin, *2nd Vice President IAMFS, State College, Pennsylvania*

1:30 P.M.—Effect of Institutional Food Preparation and Storage Procedures on the Cooling Rate of Large Quantities of Food and on the Growth of Certain Types of Food Poisoning Bacteria," Prof. Mary L. Smull, Kansas State College, Manhattan, Kansas

2:00 P.M.—Discussion

2:15 P.M.—"Sanitary Aspects of Feeding in Logging Camps in Outlying Districts", Dr. D. L. Gibson, Head, Dairy Division, University of Saskatchewan, Saskatoon, Saskatchewan, Canada

2:45 P.M.—Discussion

3:00 P.M.—"Factors Influencing the Keeping Quality of Pasteurized Milk", Dr. Joseph C. Olson, Associate Professor Dairy Bacteriology, University of Minnesota, St. Paul, Minnesota

3:30 P.M.—Discussion

4:00 P.M.—Adjournment

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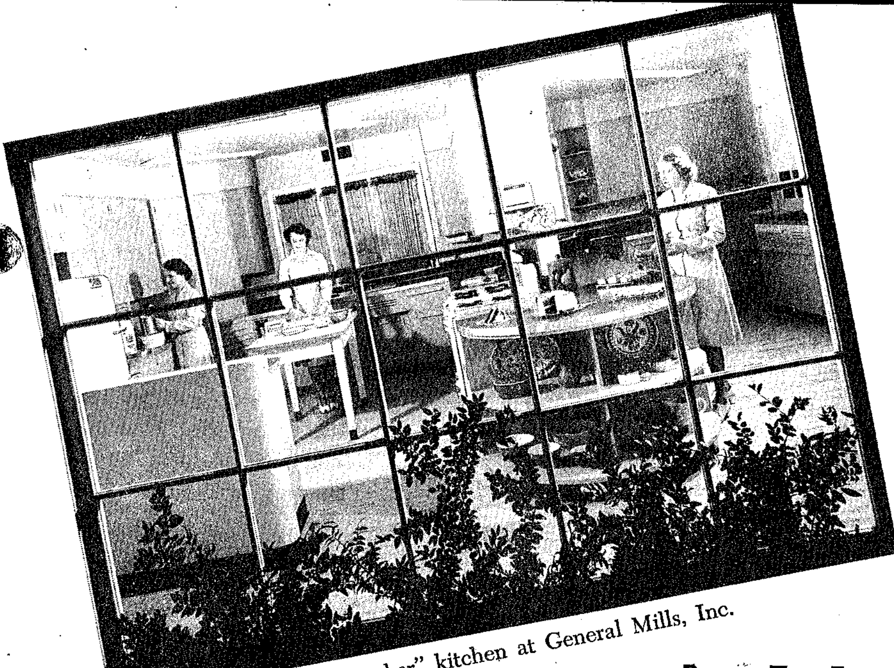
*The Sanitarians Award is sponsored jointly by The Diversey Corporation, Klenzade Products, Inc., Mathieson Chemical Corporation, Oakite Products, Inc., and the Pennsylvania Salt Manufacturing Company.

**Tentative



"Betty Crocker" kitchen at General Mills, Inc.

Minneapolis

THE CITY OF LAKES, TOURISTS & CONVENTIONS

Easy To Reach

The convention city, Minneapolis, is served by three major airlines, nine railroads, twelve bus lines and a famous highway system. Convention goers will have little trouble in making their plans for travel. Many will likely wish to visit the Dairy Industry Exposition in Chicago the following week. Unusually fine air, rail or bus service is available or fine direct highways for those wishing to drive.

Accommodations Plentiful

Minneapolis is a leading convention city, being host to over 300 groups yearly. The headquarters hotel is the famous Hotel Nicolett with 500 rooms. Over 20 other hotels are to be found in the downtown area with a range of accommodations and prices.

Vacationland

Many sanitarians and their friends may wish to combine a vacation with this trip in Minnesota. Over 1900 resorts are located on Minnesota's eleven thousand lakes. Often fishing is at its best in late September in the northland of Minnesota.

Special Features at Convention

Wednesday evening the local committees are planning a get acquainted smoker for the members their wives and friends.

Some of the midwest's finest cheese and other refreshments will be on hand for the enjoyment of the group.

On Thursday evening the group will be guests of Land O'Lakes Creameries for dinner and a tour through their Minneapolis facilities and plant.

On Friday evening a banquet is planned with some excellent entertainment and plenty of tasty food.

Open House will be held by many of the industries, laboratories and educational institutions on Friday afternoon.

Bring The Family

A special committee has made arrangements for the ladies. On Thursday a scenic bus trip will take the ladies along the St. Croix and Mississippi Rivers and other beauty spots with lunch at the World Famous Lowell Inn at Stillwater and a chance to view their gift and antique shop at this lovely inn.

On Friday there will be a chance to visit General Mills and a tour through Betty Crocker kitchens. At noon a luncheon and style show at the Radison Hotel.

Shopping in the many fine stores and smart shops of Minneapolis is an adventure the ladies will not want to miss.

The Minnesota Milk Sanitarians and the local committees wish to extend a hearty welcome to attend this year's convention in Minneapolis, Minnesota.

39TH ANNUAL CONVENTION - THURSDAY THROUGH SATURDAY - SEPT. 18, 19 & 20, 1952

Nicollet Hotel, Convention Headquarters

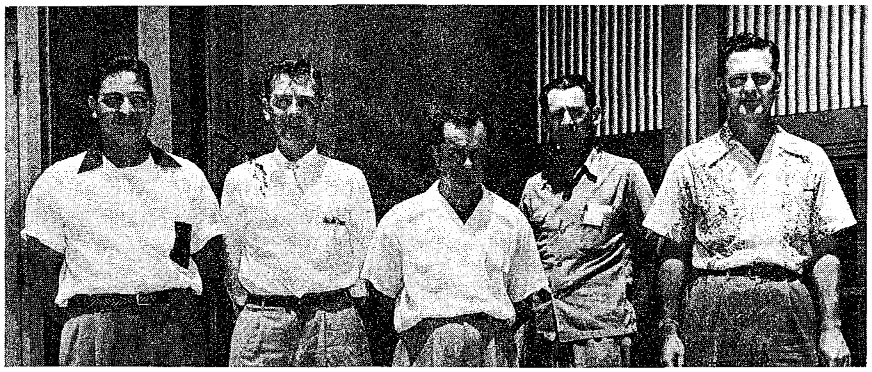
U. of Minnesota Campus — Mississippi River in Foreground

Second Annual Meeting of the Indiana Association of Milk and Food Sanitarians

The Indiana Association of Milk and Food Sanitarians met in Rice Hall, Indiana State Board of Health, June 24-26. An excellent address of welcome was given by Robert Yoho, Director of the Bureau of Health, Physical Education and Vital Statistic. Dave Hartley, Div. of Food and Drugs, Indiana State Board of Health, read President James McCoy's very excellent address, since "Jim" was unable to to attend due to illness. George White, President-Elect very capably handled the duties of the President throughout the meeting.

The program was divided into general sessions, milk section and food section meetings. The many good papers and discussions were highlighted with talks by Dr. W. L. Mallmann, Michigan State College, Dr. F. R. Nickolas Carter, City, Health Officer, South Bend, Indiana, and Dr. Joe Greene, State Veterinarian, State Live Stock Sanitary Board.

The association voted to pay the expenses of Joe Holwager newly elected Secretary-Treasurer to the International Association meeting in September and to provide an affiliate prize to be presented at this meeting.



Newly Elected Officers of the Indiana Association of Milk and Food Sanitarians. Left to right: Auditor Ralph Potesta, Hammond; Sec.-Treas. Joe Holwager, Indianapolis; President, George White, Evansville; Pres.-Elect. Russell Cunningham, La Porte; Auditor Ronald Brown, Richmond; Wm. Geller of Ft. Wayne, Sec.-Vice-Pres., and John Schlegel, Indianapolis, 1st Vice-Pres. are absent.

CALENDAR

- July 21-26—Industrial Microbiology Institute, Purdue University, Lafayette, Ind.
- Aug. 12-15—Poultry Science Association, University of Connecticut, Storrs.
- Sept. 2-5—National Association of Sanitarians, Denver, Colorado.
- Sept. 18-20—International Association of Milk & Food Sanitarians, Nicolett Hotel, Minneapolis, Minn.
- Sept. 22-27—Dairy Industries Exposition, Navy Pier, Chicago.

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We are glad to honor these men whose aggregate service now totals over 200 years. And we are pleased to inform the dairy industry that they are still rendering the fine service and scientific research to plants and farmers that has been their practice in the 40 years since 1912.

Our work has been—and continues to be—making products for and rendering services to all levels of the dairy industry. We are grateful to the members of the industry for their warm friendship and hearty support of the idea which started in such a small way many years ago.

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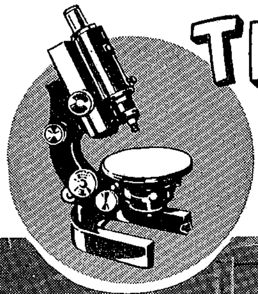
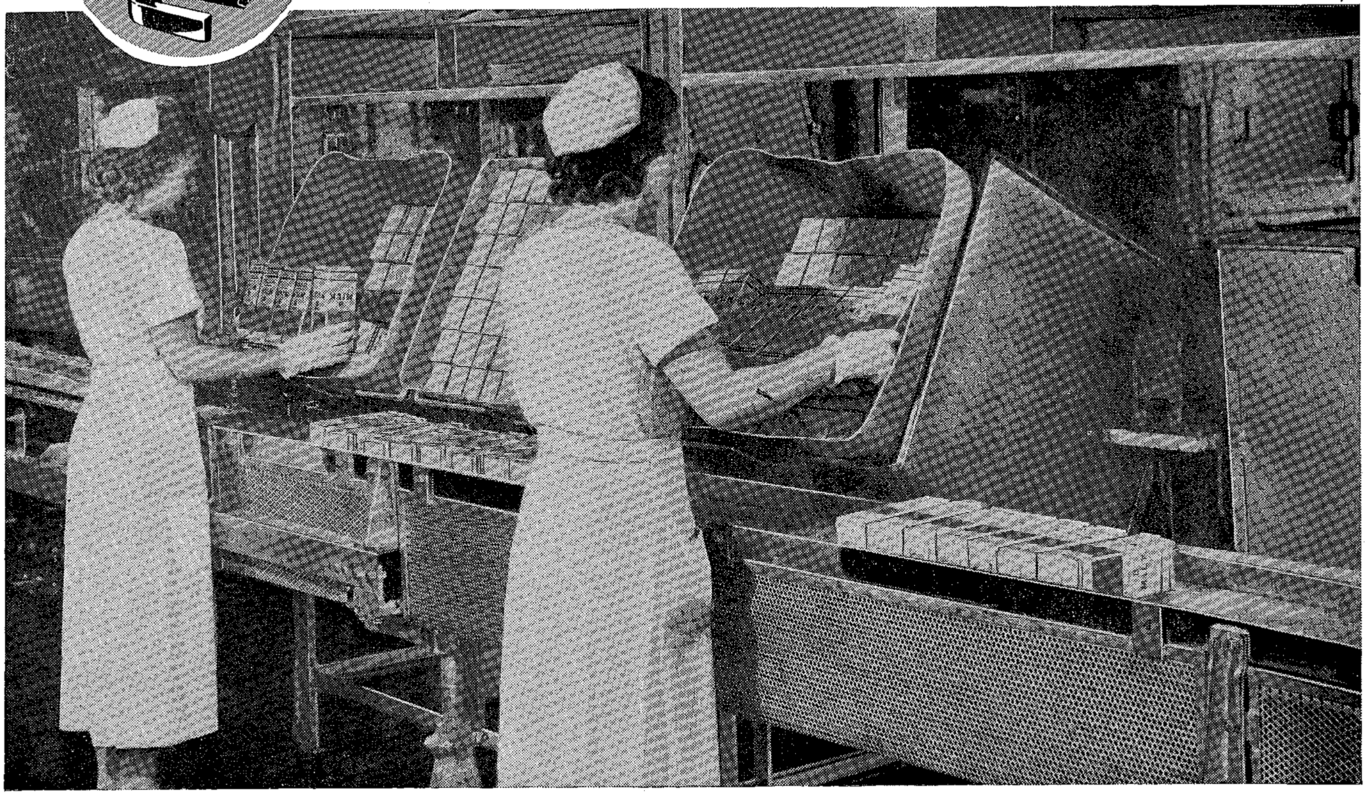


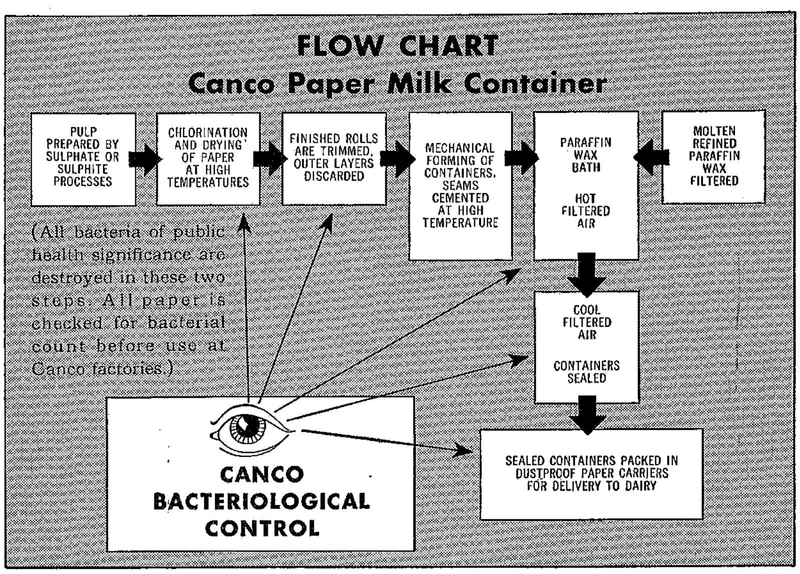
(Crucial Points in Bacterial Control of Canco Milk Containers)



The inspection and packing of Canco milk containers occur immediately after the sealing operation.

As the sealed containers emerge from the filtered air of the cooling chamber, they are rigidly inspected by white-clad attendants, who then place them in dustproof containers for delivery to the dairy.

"Data that has accumulated over the years permit the clear-cut conclusion that Canco containers are supplied to dairies in a practically sterile condition."



One acknowledged advantage of the Canco milk containers is that the sealed containers are not opened until they reach the consumer, except for a few seconds required to open, fill, and reseal them mechanically at the dairy. Pertinent suggestions from Public Health people have helped Canco to deliver an essentially sterile container to the dairy. Rinse tests reveal *no bacteria* at all in 80% of the cases.[1] The remaining 20% show an average of .007 organisms per cc.

1. The Journal of the Texas Public Health Association, Vol. 2, No. 1, Pages 10-12, February, 1950.

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