Changes in New Edition of Standard Methods
Of Milk Analysis

The forthcoming seventh edition of Standard Methods of Milk Analysis (published by the American Public Health Association) will carry the new title "Standard Methods for the Examination of Dairy Products." The ice cream section will be further developed by the work of the Joint Committee on Standard Methods for the Examination of Frozen Desserts as approved by the Laboratory and the Food and Nutrition Sections of the American Public Health Association.

The most important changes in the new edition are as follows:

The bacteriological methods in the first five sections cover samples, agar plate counts, direct microscopic counts, methylene blue reduction tests, and sediment tests. The four following sections describe methods for the isolation and identification of coliform bacteria, hemolytic streptococci, tubercle bacilli, and undulant fever organisms, respectively. Section 10 includes ice cream methods, and Section 11 the butter methods. The text of the bacteriological section has been rewritten, and a subject index prepared.

Beginning July 1, 1939, standard agar medium is to have the following composition:

Bacto-Tryptone .................................. 5 gr.
Bacto-yeast extract ................................ 3 gr.
Glucose ........................................ 1 gr.
Skim milk .................................. 1 cc.
(Where dilutions are greater than 1:10)
Agar ........................................... 15 gr.
Refrigeration ................................ 7.0
Preferred reaction pH 6.6 to 7.0

While incubation at 37° C. (not 37.5° C) is to be continued until laboratories doing milk work are more generally equipped with approved incubators, the variation in temperature permitted was changed to 55° - 57° C. rather than 35.5° - 57.5° C. as at present.

Agar plates must be counted under constant illumination. The Quebec Colony Counter is recommended.

The only incubators approved are the water-jacketed and anerobic laboratory types with low temperature heating units operating at temperatures only slightly in excess of 37° C. and incubator rooms of proper construction.

Specifications for glassware are drawn in greater detail than formerly.

More accurate methods are given for rinse tests from glass and paper bottles.

The direct microscopic test is described in greater detail, particularly for the examination of pasteurized milk. All agar plates must be checked frequently enough to detect the presence of excessive numbers of bacteria in milk and cream where they do not grow on the plates. Only in this way can excessive numbers of bacteria be detected.

The methylene blue thio cyanate tablets are accepted as standard.

No reference is made to the resazurin test because further study must be made before the results are accepted as significant.

Reference is made to the modified form of the methylene blue reduction technique now officially approved in England.

The description of the sediment technique has been improved.

Brilliant green lactose bile broth, sodium formate ricanolate broth, violet red bile agar, and sodium deoxycholate agar are approved for detecting coliform bacteria in dairy products.

Methods for plating on blood agar and the use of Burri agar slants are described for detecting pathogenic hemolytic streptococci. References are given to methods of identifying species of streptococci by cultural and serological procedures. Also tentative methods are included for the identification of tubercle bacilli and Brucella organisms in milk and cream.

Directions are given for making yeast and mold counts on butter, and bioassays of vitamin D in milk.

It is expected that the new (Seventh) edition will be printed early in 1939.

J. H. SHRADER.

Editorials

The opinions and ideas expressed in papers and editorials are those of the respective authors. The expressions of the Association are completely recorded in its transactions.

Order Out of Chaos

The increasing public-health mindedness of the people has been finding at least one avenue of expression through the enactment of more effective programs for the sanitary production, processing, and distribution of milk and other dairy products. As one community after another inaugurated such control, standards for product and process were established which seemed adequate for the local conditions. Milk control islands, so to speak, came into existence in scattered localities all over the country. The continuation of this sort of development has led to an increasing heterogeneity in standards of product, requirements for production, and specifications for processing. Sometimes, those of neighboring communities are contradictory, frequently they are inconsistent, and usually they are confusing in their variety and exaggerated individuality. The situation is even more confusing where the local requirements are not printed, or even if available, are interpreted by the unpredictable impulses of the local enforcement officer.

Compliance with the local requirements may be a needlessly costly undertaking. In the case of milk production on a milk shed covered by conflicting regulations, the farmer may find himself in the predicament of the fabled chameleon (a lizard which changes its color to match its environment) which got on a Scotch plaid. It is even more expensive for an equipment manufacturer to provide special, non-standard types of machinery in a territory where aggressive individualism is nonconforming, expressive, and authoritative.

In an effort to alleviate some of these conditions, the International Association of Milk Dealers organized its Committee on Simplified Practice to help in securing agreement within the organization on uniform dimensions and certain standards for equipment and appurtenances. Secretary Hibben of the International Association of Ice Cream Manufacturers has pointed out (1) the industrial hardship of arbitrary and conflicting regulations, and urged the adoption of some procedure that would make equipment available that would be approved by all health officers. He stated that some health officials refuse to approve or condemn a piece of equipment until after it has been installed. Some suddenly condemn a piece that has been in approved operation for years. He proposed that a joint committee of the ice cream manufacturers, the suppliers association, and the milk sanitarians set up a program for approval of equipment at its source of manufacture so that its stamp of approval would be acceptable to the different city, county, and state health departments.
The late President Calvert of the Dairy Industries Supply Association urged the International Association of Milk Sanitarians (2) "to join with us in an attempt to set up some forum where there will be an exchange of opinion on the details of construction and operation of dairy equipment so as to avoid the helter skelter, hit and miss method that now prevails." His association organized a Technical Committee through which they sought to establish cooperation in solving this type of problems.

To implement these reasonable presentations, the Committee on Sanitary Procedure was appointed last year by President Tolland of the International Association of Milk Sanitarians to cooperate with the industry in a more general program of standardizing details of milk plant equipment. The first report of the work of this collaboration (3) showed that it was possible to secure an agreement on the design of recessless pipe unions, tees and crosses, bends, and union nuts for connecting thermometers to vats and sanitary pipe lines, that would meet all health department regulations. This representative and highly qualified committee held that it could "accept" a piece of equipment as being of the best possible design in the light of current knowledge, but that this action did not assume that these designs were permanent. An example of the effect of this policy of acceptance of outstanding designs on the stimulus to make further improvement was the immediate invention of an ingenious recessless pipe union with all the demands on dairy equipment. They know the advantages, but that is not the point of "acceptance." The policy of the Committee on Sanitary Procedure has been to review only those designs which are submitted to it by the trade. It would seem that in the light of the above developments such conservatism is not warranted. This committee is composed of men from all parts of the country and from both the official and industrial aspects of quality and regulatory control, interested in and thoroughly conversant with the demands on dairy equipment. They know the kind of service that is required of equipment—the need of operators, the type of job that should be done, the wants of the health officer. They also know equipment, its limitations and possibilities. They are strategically situated to set up design and performance objectives for manufacturers of equipment to attain. The latter can do a more intelligent job when they understand clearly what is wanted. The old adage that a problem defined is already half solved is true in this instance also.

So it is hoped that this Committee will take the initiative, and announce sanitary and performance principles that should be incorporated in the design of every kind of equipment that is used in dairies. It should set up specifications. These should be left to individual initiative and competitive effort. The Committee should be twofold, namely, to announce desirable principles that should be incorporated in design, and to accept and publicize those designs which it considers to be satisfactory. There seems to be no sound reason why the combined intelligence of this committee, collaborating with committees from the trade organizations, should not chart the course, so to speak, of desirable development, and save the industry from futile journenings and costly groundings. Particularly valuable would be its service in facilitating the production of equipment of the kind that the industry and the health officer really needs.

2. Standardization of milk, by H. S. Calvert. Ibid. 1 (2) 10 (1938).

J. H. S.

Editors

Connecticut Association of Dairy and Milk Inspectors

It is with great pleasure that we welcome the Connecticut Association of Dairy and Milk Inspectors to the growing family of dairy associations that are affiliated with the International Association of Milk Sanitarians through the JOURNAL OF MILK TECHNOLOGY. This influential group of eastern milk inspectors took action at their annual meeting on January 10th to designate this Journal as its official organ. The field of dairy technology and supervision (both official and industrial) is broadening and becoming increasingly technical. Every person engaged in this work needs inspiration as well as information from other workers. We are sure that our new associates will make valuable contributions to knowledge in this field, and that the service rendered by the JOURNAL OF MILK TECHNOLOGY will be strengthened and improved.

J. H. S.

Bang's Disease Eradication

The plan for indemnifying owners for animals which react to the agglutination blood test for Bang's disease becomes effective under federal and state supervision on May 1, 1939. Both the tube and plate tests are being used in testing cattle under this project. The general operative plan is practically the same as that already in force for the eradication of tuberculosis and paratuberculosis, whereby the owner, the state, and the federal government respectively assume one-third of the difference between the assessed value and the salvage value at slaughter of condemned animals. Last fall, all breeding cattle over 6 months of age in 300 counties had been tested. In 4 states, more than half of the breeding cattle are under supervision in the federal-state campaign which has been in force since 1934. During the months of November 1938, the blood agglutination tests were completed on 387,529 cattle, of which 17,302 were found to be reactors. At that time, there were a total of 1,202,195 herds, and 10,280,005 cattle under supervision, and an additional 1,015,544 cattle on the waiting list. The results of the program have shown that in the high majority of herds, Bang's disease yields to systematic control efforts.

J. H. S.

Standard Methods for the Examination of Dairy Products

The American Public Health Association announces that the new 7th edition of Standard Methods for the Examination of Dairy Products should be available for purchase early in April. On July 1, 1939, we are to begin the use of the new standard agar medium in which the peptone has been changed from a meat-digest peptone to a casein-digest peptone. A small amount of glucose is to be added, and where dilutions are greater than 1 : 10, there is to be added 1 percent of skim milk or equivalent amount of milk process powder. The purpose in adding the peptone is to obtain the proper dilutions to eliminate the type of discrepancy in count that is produced by the presence of milk solids in plates made by the direct addition of milk or in dilutions as low as 1 : 100. Laboratories are cautioned to watch carefully their incubation temperatures to make sure that they do not exceed the specified standard temperature of 37° C. (98.6° F.).

The several phosphatase tests will be included in an appendix, giving the latest directions for the various types of the more promising techniques. No comparisons have yet been made concerning them, and therefore not any of them should be regarded as standard.

The new edition of this valuable book contains so many improvements and suggestions concerning the better use of laboratory methods that it should be in every laboratory engaged in milk work.

J. H. S.
Engineering Problems in Milk Sanitation*

Leslie C. Frank,
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Introduction.—Until fairly recently sanitary engineers have not considered that milk sanitation was a problem with which they should much concern themselves. Conclusive evidence of this may be seen in the past curricula of sanitary engineering courses. Practically none of the graduate sanitary engineers in the field today included a study of milk sanitation as part of their undergraduate courses.

Indeed, milk sanitation has in the past been considered to be a problem for veterinarians, bacteriologists, and epidemiologists rather than for engineers. Milk is a product of animal origin, and its sanitation is related to the health of animals. Therefore milk sanitation is a problem for veterinarians. It is advisable to make bacteriological analyses of milk. Therefore milk sanitation is a problem for bacteriologists. They can determine the extent to which the milk is contaminated with pathogenic bacteria and the steps necessary to control the contamination. However, the function of the sanitary engineer is not limited to the immediate problem of pasteurization. His work really begins at the producing farms. In milk control and processing, the more important items which the sanitary engineer should devote attention to are as follows:

Dairy barn and milk house design. One of the first items with which he should concern himself is the design of the dairy barn and milk house, the layout of the plan which will insulate that there is adequate space to prevent contamination due to overcrowding, adequate light to prevent the contamination of milk by dust or dirt, ventilation to prevent the absorption of odors and flavors of grasses and hay from the condensers, and proper arrangement to facilitate the proper sequence of operations.

Dairy farm water supplies. The next item which should receive the attention of the sanitary engineer is the design and construction of dairy farm water supplies. The next item which should receive the attention of the sanitary engineer is the design and construction of dairy farm water supplies. The next item which should receive the attention of the sanitary engineer is the design and construction of dairy farm water supplies. The next item which should receive the attention of the sanitary engineer is the design and construction of dairy farm water supplies. The next item which should receive the attention of the sanitary engineer is the design and construction of dairy farm water supplies. The next item which should receive the attention of the sanitary engineer is the design and construction of dairy farm water supplies.
FIGURE 1
Lay-out of Milk Pasteurization Plant

FIGURE 1 (continued)
Lay-out of Milk Pasteurization Plant

NOTES:
1. Stairway treads are about 10", risers are 8", 10" = 12'-0" above floor to floor.
2. The use of pivoted or projected steel windows is urged.
3. All skylights must be equipped with ventilators.
4. All milk-handling rooms must be provided with an adequate number of water and steam outlets.
proper elevations for provals shall be obtained from the state tror.s. Pasteurizers must be installed in the floor and guarding befove construction.

Fires while Chicago, Ill.) plant is begun. All plate equipment should be reinforced with metal.

Milk pipe line from the receiving and cold storage association, the entrance of flies. Screen doors must be installed. Special considerations must be provided for the handling of milk products.

All milk piping must be at least 1\(\frac{1}{2}\) inches in size.

Equipment must conform to the specifications of the United States Public Health Service Milk Ordinance and Code.

Refrigeration equipment should be selected before construction of cold storage and complaint room.

Joints between floor and wall should be rounded to a radius of about one inch.

Floors should be reinforced with metal grid at points of heaviest service, especially in the floor and cold storage rooms and in the loading veranda.

The milk pipe line from the receiving room must be brought through the floor of the pasteurizing plant so that floor drainage will not drip down through the opening and contaminate equipment in the receiving room. A piece of 4\(\frac{1}{2}\) cast-iron pipe cast in the floor and projecting about 12\(\frac{1}{2}\) inches above the pasteurizing room floor is a good condiment.

The clarifier must be connected to the pasteurizers by sanitary milk piping and connections.

 absolutely closed elevation. High speed fans should be installed at the outside entrances to the receiving room, wash room and loading veranda. These fans should be operated so as to prevent the entrance of flies and)|

Separate equipment must be provided for the handling of raw milk products.

All milk piping must be at least 1\(\frac{1}{2}\) inches in size.

Equipment must conform to the specifications of the United States Public Health Service Milk Ordinance and Code.

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Joints between floor and wall should be rounded to a radius of about one inch.

Floors should be reinforced with metal grid at points of heaviest service, especially in the floor and cold storage rooms and in the loading veranda.

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The clarifier must be connected to the pasteurizers by sanitary milk piping and connections.

In each case the problem arises if leakage develops in the metal separating the raw from the pasteurized milk, or separating the milk from the heat transfer medium, and simultaneously the raw milk is under higher pressure than the pasteurized milk or the circulating medium, then the raw milk may contaminate the pasteurized milk. For example, such higher raw milk pressures are often encountered because of the practice of placing the milk pump upstream from the raw side of the regenerator.

The solution, obviously, is to develop design, installation, and operation specifications to insure that the pasteurized milk side of the regenerator is under higher pressure than the raw milk side whenever there is any raw milk in the regenerator, including not only the routine flow period but also at the beginning of the day's run and during interruptions, when the pressure picture may be quite different. Such specifications have been worked out in detail and described in Public Health Reports (1).

The solution involves not only the proper placing in the flow line of milk pumps and heat transfer pumps so as to take proper advantage of the differential between suction and discharge pressures but also proper elevations for the free milk levels, upstream and downstream from the regenerator so that proper relative pressures may obtain during shutdowns. In addition, in certain designs it is necessary that hot water, chloride solution, or previously pasteurized milk must, at the beginning of the day's run, be introduced into the pasteurized milk side of the regenerator before raw milk is admitted to the raw milk side. Otherwise the raw milk side may at this time be above atmospheric pressure and the pasteurized milk side at atmospheric pressure. Figure 2 shows an illustrative flow chart designed to insure that the relative pressures in the separator will always be such as to prevent contamination of the pasteurized milk by the raw milk.
Temperature was shown by a simple indicating thermometer. Shortly it was discovered that raw milk might leak through the inlet valve and recontaminate the milk in the vat while it was being pasteurized. So the Public Health Service inserted a requirement into its Milk Code that all inlet and outlet valves must be of the leak-protector type, that is, so designed as to divert to the outside, by means of leak grooves or otherwise, any leakage which attempted to pass the valve face.

Satisfactory types of valves were developed both by the Public Health Service engineering staff and by the industry and are described on pages 88 to 97 of the Public Health Service Milk Code. Figure 4 illustrates one type of leak-protector valve.

Milk foam. Approximately simultaneously with the above development, it was also found that the foam which may be formed on the surface of the milk in a vat is likely, unless preventive measures are employed, to be colder than the main body of the milk, and this fact not be evidenced from the record of the temperature shown on the recording thermometer chart. Foam temperatures as much as 10° F. below the temperature of the milk proper have been encountered during studies made by the Public Health Service. Therefore it became necessary to develop means of heating or dissipating the milk foam. Our studies developed the fact that while radiant or convection heating of the air above the milk by means of electric or enclosed steam heaters was not very satisfactory because of the tendency of the dry hot air to rise away from the foam and thus not heat it, live steam admitted to the air space above the milk tended not only to heat the foam as it was formed but also to dissipate it. It was necessary, of course, to design the apparatus so as to prevent the discharge into the milk of either steam-line sediment or a significant amount of steam condensate. Furthermore, since the amount of steam required was very small, it was necessary to in-
crease the sensitivity of the throat of the throttle valve to the maximum by placing a resistance in the line in such manner as to reduce the differential pressure on the two sides of the valve. This took the form of a small orifice placed down-stream from the valve.

Figure 5 illustrates an air space heater as developed by the Public Health Service.

Insurance of full holding time in manual vats. Further studies showed that even when the recording thermometer charts indicate that the milk in the vat had been held at the required temperature for the full holding time it might nevertheless be true that the holding time is less than the required holding time. Suppose, for example, that the milk is discharged from the pasteurization vat at the pasteurization temperature. It may take 10 minutes or longer for the descending milk level to drop to the recording thermometer bulb. During this interval the recording thermometer will continue to show the pasteurization temperature. Later, when the milk control official inspects the charts, which are required to be preserved for his inspection, he may find charts which show 145°F for the full required 30-minute period and yet some of the milk will have been discharged from the vat to the cooler after only 20 minutes holding. For this reason the Public Health Service Milk Code
now requires that if cooling is begun in the holder after the opening of the outlet valve, or is done entirely outside of the holder, the recording thermometer charts shall show not merely 30 minutes, but 30 minutes plus the emptying time down to the level of the recording thermometer bulb.

Automatic pasteurization systems. Automatic pasteurization is rapidly replacing manual pasteurization, particularly in the larger plants. This trend, as might be expected, is introducing a whole series of sanitary engineering problems. In the case of the relatively simple manually operated vats, if the design requirements previously described have been satisfied, and if the thermometers show that the pasteurization temperature has been applied for the full holding time, the operator can open the outlet valve and discharge the milk with the assurance that it has been properly pasteurized. If the recording thermometer does not show both the required temperature and the required holding time he can either increase the temperature or the holding time, or both, before opening the outlet valve. The point is that the milk is not discharged to the cooler and bottler until the operator deliberately opens the outlet valve. It is his duty and he always has the opportunity to assure himself that the process has been properly applied before he opens the valve.

In the case of automatic pasteurization, however, both admission to and discharge from the holder are automatic and unless otherwise prevented will take place even if the milk has not been brought to the proper temperature or held at that temperature for the proper time. Furthermore, since the holding time is automatically controlled, any temperature failure in the holder would require emergency manipulation of the automatic time control, or diversion of the entire supply back to the heater until the temperature failure had been corrected. This, in the case of batch type holders, would be extremely hazardous because of the quantity of milk which would be required to be repasteurized and the ever-present temptation on the part of the operator to shirk the responsibility in order to save time. In these cases it has been considered fundamentally necessary, in the formulation of the Public Health Service Milk Code, to surround all automatic pasteurizers with all necessary safeguards to insure that the likelihood of either temperature or holding time failure will be reduced to the very minimum.

Thermostatic control. Accordingly the first requirement which has been laid down in the Public Health Service Milk Code is that all automatic systems must be provided with thermostatic control of the temperature of the milk entering the holder. This requirement has further been expanded, for purposes of convenience, and in order to avoid what might be termed "hay-wire" pasteurization, to include any system in which the milk is brought to the pasteurization temperature before it enters the holder. Obviously it would be possible to have an operator continuously present at a temperature control valve as a substitute for thermostatic control, but while this might give good results most of the time, it is obvious that the slightest lapse in attention would result in the passing of unsafe milk.

Automatic milk-flow-stops. Since even the best thermostatic control occasionally fails, it was highly advisable to include an additional safeguard which would function at such times and serve as an extra factor of safety. The best such safeguard is a device which will automatically halt the flow of milk beyond the holder if the thermostat fails or if any temperature drop occurs in the holder. It was soon found that such a "milk-flow-stop" could take either of two forms:

1. An automatic milk pump stop which would automatically stop the milk pump motors whenever the milk temperature dropped below the pasteurization temperature and automatically restart the motors whenever the required milk temperature was again reached, or
(2) An automatic milk-flow diversion device which would automatically divert the milk away from all downstream points whenever its temperature dropped below the required pasteurization temperature, and automatically reestablish forward flow when the milk again reached the required temperature.

Figure 6 illustrates an automatic flow stop of the diversion valve type. The requirement that a milk-flow stop be installed immediately brought into focus two collateral problems, namely:

1. What should be included in the specifications for "milk-flow stops"?
2. Where should they be required to be located?

After careful study a set of specifications for milk-flow stops was inserted in the Public Health Service Milk Code. These include (a) the sealing of the milk-flow stop as to insure that any change in the setting will come to the attention of the health officer, (b) the prohibition of manual switches which would permit cutting out a milk-pump stop, (c) the prohibition of any by-pass, (d) required routine daily tests for cut-out and cut-in temperatures, (e) the requirement that failure of the primary motivating power will automatically stop or divert the flow, (f) the requirement of leak-protector features on all flow-diversion valves, (g) the requirement that the actuating bulb of the flow-diversion device shall be located immediately upstream from the valve, and (h) a limitation of thermometric lag, and routine tests required to determine its magnitude.

With reference to the location of the milk-flow stop, it became apparent that if the holder system is so designed that the milk may drop significantly in temperature before the end of the holding period and return to the pasteurization temperature, it is necessary that a milk-flow stop be located upstream from the holder, as otherwise milk might enter the holder below the pasteurization temperature, be raised to or above the pasteurization temperature during the holding period by the supplementary heating device, and thus pass the milk-flow stop with impunity if it were located downstream from the holder.

Again, if the holder is so designed that some of the milk may drop significantly in temperature before the end of the holding period it is considered necessary that a flow stop be located downstream from the holder, as otherwise milk may enter the holder at the pasteurization temperature, drop below it during the holding period, and thus have passed the milk-flow stop with impunity if it were located at the inlet to the holder and not at the outlet.

Finally, if the holder is so designed that the milk in it may either rise in temperature required to keep the milk throughout the holder at the required temperature.

Further study showed the necessity for a number of special requirements for systems in which the milk-flow stop is located upstream from the holder, and other special requirements for systems in which the milk-flow stop is located downstream from the holder. To give the details of these special requirements would undesirably expand this paper.

There are obviously also special requirements with reference to time control for automatic systems. These include requirements relative to the use of constant-speed motors or limited maximum-speed motors on milk pumps and timing devices, the prevention of inter-pocket flow, the prevention of air or gas accumulation in tubular or equivalent stream-flow holders, and the checking of the holding time by means of dye tests, or otherwise, immediately after installation or after any replacement or alteration in design.

Conclusion. Many details have necessarily been omitted in the above discussion, but enough has been said to demonstrate two important facts:

1. Milk sanitation is a problem which now requires and will in the future increasingly require the serious attention of sanitary engineers.

It is rapidly becoming apparent to state boards of health that their sanitary engineering divisions should be related to the problem of milk sanitation. Information collected by the Public Health Service shows that in at least 25 states milk sanitation work is now being done by the divisions or bureaus of sanitary engineering, whereas two decades ago only one or two state sanitary engineering bureaus interested themselves in the problem. A similar tendency is beginning to appear in some of our local health departments. The total number of sanitary engineers engaged in milk control in this country is now:

(a) By the state boards of health—17 full time and 75 part time, and
(b) By local boards of health—14 full time and 36 part time.

This paper should not be understood to imply that only public health engineers...
should be employed in milk sanitation. That would be as unwise as to insist that only veterinarians, or only bacteriologists, or only epidemiologists, or only dairying graduates should be employed in this field. Nor should this paper be understood to imply that all milk sanitation work must necessarily be under the administrative direction of a sanitary engineer. The capacity for administration does not reside solely in any one profession. If a state board of health employs more than one individual in milk control, the one who shows the best administrative capacity should be placed in administrative charge, irrespective of whether he is engineer, veterinarian, bacteriologist, epidemiologist, or dairy expert.

Nevertheless it seems inescapable, from the facts presented in this paper, that every state health department without exception, should employ at least one sanitary engineer full-time on milk sanitation work and, where possible, the milk control work should be a function of the state sanitary engineering division. Except in the case of large cities which employ their own sanitary engineers, no pasteurization plant should be constructed or reconstructed and no pasteurization equipment should be installed or modified without the approval of the milk sanitation engineer. His services should be available to all city health departments. Expenditure for it should be approved by the heads of the sanitary engineering division. Except in the case of large cities which employ their own sanitary engineers, no pasteurization plant should be constructed or reconstructed and no pasteurization equipment should be installed or modified without the approval of the milk sanitation engineer. His services should be available to all city health departments. Expenditure for it should be approved by the heads of the sanitary engineering division.

It has been emphasized in this paper that the sanitary engineers of this country face a grave responsibility in connection with milk sanitation. As evidence of the magnitude of this responsibility a survey conducted by the Public Health Service for the year 1936 developed the fact that in communities of more than 1,000 population, over 5,000,000 gallons of milk per day, or over 1,200,000,000 gallons of milk per year are pasteurized. To insure that no part of this ocean of milk may transmit disease is a problem of such magnitude that it is not too much to ask that the future graduate sanitary engineers who will engage in this work be properly trained for it. It is still true that most of the sanitary engineers who graduate today are without the necessary specialized training and it is believed that every institution which prepares men for the sanitary engineering field should ponder the desirability of including milk sanitation as one of the subjects of instruction.

Those sanitary engineers who have already graduated and who are now engaged in or may in the future wish to undertake milk sanitation work, should attend post-graduate courses in milk sanitation or one or more of the milk sanitation short courses or seminars which are being conducted by various state boards of health and the Public Health Service.

1. Contamination of Pasteurized Milk by Improper Relative Pressures in Regenerators. Reprint 1921 from the Public Health Reports, April 1, 1938.

The American Public Health Association considered the subject of frozen desserts of sufficient and timely interest to devote a symposium to it at the last annual meeting at Kansas City, October, 1938. These papers are devoted to bringing out the various aspects of this whole subject with a view to familiarizing health officials with the problems in the field, and thereby assisting them in coping with the situations encountered. We are indebted to the officers of the American Public Health Association for their kind permission to release the papers for publication hereafter.

In order to avoid any unnecessary duplication within the Association and with other associations engaged in similar lines of work, an explanation will be given of the organization of the work for the study of frozen desserts.

JOINT COMMITTEE FOR ANALYZING FROZEN DESSERTS

Sanitarians and public health officials have believed for some time that sufficient information was available and that there was a need for a standardized procedure for analyzing not only frozen desserts but also the ingredients from which they were made. These sentiments were crystallized at a joint session of the Laboratory Section and the Food and Nutrition Section of the American Public Health Association at the Sixty-Fifth Annual Meeting at New Orleans in 1936. Action was taken to establish a joint committee composed of members of these sections. This Joint Committee for Analyzing Frozen Desserts was placed under the supervision of and was made responsible to the Coordinating Committee on Standard Methods of the Laboratory Section, and is allocated to the Committee on Research and Standards. The work has been integrated with that of other associations working in this field, and many of the referees (committee members) and associate referees are active in committee work on frozen desserts in other associations. The organization of the Joint Committee is as follows:

Friend Lee Mickle, Chairman.
A. H. Robertson, Referee, Microbiological Examination of Frozen Desserts.
F. W. Fabian, Referee, Microbiological Examination of Ingredients.
M. J. Prucha, Associate Referee, Microbiological Examination of Flavors, Colors, and Extracts.
P. A. Downs, Associate Referee, Microbiological Examination of Condensed and Evaporated Milk.
P. S. Pickett, Associate Referee, Microbiological Examination of Dry Milk.
H. H. Hall, Associate Referee, Microbiological Examination of Sugars, and Sweetening Agents.
P. H. Tracy, Associate Referee, Microbiological Examination of Eggs and Nutraceuticals.
L. H. James, Associate Referee, Microbiological Examination of Eggs and Egg Products.

James Gibbard, Referee, Microbiological Examination of Stabilizers.

C. D. Dahle, Associate Referee, Determination of Milk Solids in Sherbets.
W. H. Martin, Associate Referee, Use of Modified Babcock Methods for Ice Cream.
What Are Frozen Desserts?

F. W. Fabian, Ph. D.

Michigan State College, East Lansing, Michigan

INTRODUCTION

The tremendous increase in the use of frozen desserts in America during the past few decades has been built around ice cream. When one goes back and analyzes the cause of the desired popularity of ice cream, it can be traced to the chemical, physical, and sanitary standardization of the product as well as to improved machinery.

Since ice cream has risen to such prominence in the frozen desserts field, naturally there are going to be many imitations, variations, and substitutions for the real product. For this reason it has been necessary for control officials to define legally not only ice cream but all frozen desserts. In this paper I shall review briefly these definitions and attempt to classify the frozen desserts according to these definitions.

The definitions given here are in no way legal definitions, but simply an attempt to set forth in a general way some of the outstanding characteristics of frozen desserts as commonly found in laws and textbooks upon the subject.

GENERAL DEFINITION OF FROZEN DESSERTS

Frozen desserts shall include ice cream, and the various kinds of ice cream such as parfait, nut, fruit, mousse, puddings, custards, as well as sherbets, ices, milkshakes, and special forms of desserts in which there is a combination of any two or more of the above kinds of desserts or any flavored and/or colored, sweetened water (such as popsicles), natural fruit, vegetable, or other juices with or without milk solids in which sufficient heat has been removed from the liquid mixture so as to convert it into a semi-solid or solid mass with or without agitation.

DEFINITION OF SPECIFIC FROZEN DESSERTS

The definitions given here must of necessity be general and condensed since the legal definitions by the various units of government in America are lengthy, and vary somewhat in their minimum requirements. However, the fundamental essentials will be considered here in outline form.

I. Ice Cream is a frozen dessert in which the freezing has been accompanied by agitation of the ingredients and which contains in the finished product:

A. Not less than: (See Table 1).
   1. 10 percentum by weight of milk fat; (1)
   2. 20 percentum by weight of total milk solids. (2)
   3. 1.6 lbs. of food solids per gallon. (see Table 2). (3)

B. May or may not contain:
   1. Eggs or egg products. (4)
   2. Approved flavoring. (5)
   3. Natural and/or synthetic certified food coloring. (6)
   4. Approved edible stabilizer (7) which if present should not be in excess of 1/2 of 1 percentum by weight. (see Table 1).

C. It should not contain any:
   1. Boric acid, formaldehyde, chlorine, or preservative of any kind.
   2. Oils, paraffin or fats, other than milk fat, except in the case of chocolate ice cream which may contain cocoa fat in an amount normal to the cocoa or chocolate used.
   3. Saccharin.
   5. Any added substance harmful to health.
   6. Fillers of any kind such as starch, flour, etc.
D. Pasteurization. 
1. All ice cream mix should be pasteurized at a temperature of not less than 150° F. for a period of not less than 30 minutes, and promptly cooled to a temperature of at least 20° F. or lower, and held at this temperature until used, for a period not exceeding seven days.

2. All products entering the ice cream mix subsequent to pasteurization should receive a germicidal treatment comparable to pasteurization before they are added to the mix.

E. Bacteriological specifications.
1. The finished ice cream or ice cream mix should not at any time after manufacture have a standard plate count in excess of 100,000 bacteria per gram.

2. The ingredients added to the ice cream mix subsequent to pasteurization should not have a standard plate count in excess of 5,000 bacteria per gram.

3. The machinery and utensils used to make and store ice cream should not contain more than 100 bacteria per ml. when rinsed in a standard amount of sterile water.

SOURCE OF INGREDIENTS

(1) Milk fat may be secured from any of the following sources: wholesome, unadulterated cream and/or sweet milk, evaporated or condensed milk, dry cream, dry milk, pure milk fat, wholesome sweet butter.

(2) Total milk solids may be secured from any of the following sources: wholesome, unadulterated cream and/or sweet milk, evaporated or condensed milk, dry cream, dry milk, pure milk fat and wholesome sweet butter.

(3) Total food solids may be secured from any of the following sources: milk solids as in (2) above, sugar (cane, beet, corn, maple, molasses), honey, eggs as in (4) below, approved flavoring as in (5) below, or coloring as in (6) below, stabilizer as in (7) below.

F. Bacteriological specifications.

1. The finished ice cream or ice cream mix should not at any time after manufacture have a standard plate count in excess of 100,000 bacteria per gram.

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II. Fruit ice cream is a frozen dessert in which the freezing has been accompanied by agitation and which contains in the finished product:

A. Not less than (see Table 1):

1. 8 percent by weight of milk fat.

2. 18 percent by weight of total milk solids.

B. Same as I.

C. Same as I, C.

D. Same as I, D.

E. Same as I, E.

III. Nut ice cream is defined as the same as fruit ice cream except the following should be substituted in A 4:

A. Not less than:

1. 8 percent by weight of milk fat.

2. 18 percent by weight of total milk solids.

B. Same as I.

C. Same as I, C.

D. Same as I, D.

E. Same as I, E.

IV. Chocolate ice cream is defined as the same as fruit or nut ice cream except that chocolate or cocoa are used as the flavoring material. The minimum amount that can be used is not set forth in most laws since the amount is variable depending upon such factors as the quality of the chocolate or cocoa, the consumer preference, etc. The amount of cocoa most commonly used ranges from 1.0 to 2.5 percent, and for chocolate 2 to 5 percent.

V. Parfait (synonyms=French, New York, Neapolitan, or cooked ice cream) is a frozen dessert in which freezing has been accompanied by agitation of the ingredients and which contains in the finished product:

A. Not less than:

1. 10 percent by weight of milk fat.

2. 20 percent by weight of total milk solids.

3. 1.6 lbs. of food solids per gallon.

4. For each 90 lbs. of frozen product:

a. 5 dozen clean, wholesome egg yolks, or

b. 1.5 lbs. of wholesome dry egg yolk containing not to exceed 7 percent of moisture, or

c. 3 lbs. of wholesome egg yolk containing not to exceed 55 percent moisture, or

d. the equivalent of wholesome egg yolk in any other form.

5. With or without fruit or nuts.

In making a parfait, the yolks are added to milk and sugar, and the mixture is cooked for a short time. This basic mixture is sufficiently cooked when a thin film coats the blade of a knife when it is inserted into the cooking mixture.

B. Same as I.

C. Same as I, C.

D. Same as I, D.

E. Same as I, E.

VI. Bisque ice cream is a frozen dessert which may be defined the same as plain ice cream except that it contains in addition a bread or cake product. (See classification IV.)

VII. Candy ice cream is a frozen dessert which may be defined the same as plain ice cream except that it contains in addition, candy. (See classification V.)

VIII. Mousse is a frozen dessert made by whipping cream to the consistency of "whipped cream" after which sugar and the desired flavoring materials are added and to which fruits or fruit juices may or may not be added. This mixture is then placed in a hardening room or freezing mixture and hardened.

In practice it is made in either of two ways:

A. The cream is whipped and the sugar and flavoring materials are then folded in, after which soft ice cream is added and mixed with it. This mixture is then hardened.

B. Rich cream and sugar are added to the ice cream mix, and the resulting mixture frozen to a semi-solid state by agitation in the same as with regular ice cream mix. It is then drawn off and allowed to harden.

In the final analysis moose is nothing but very rich (i.e. having a high milk fat, sugar, and total solids content) ice cream.

IX. Pudding is a frozen dessert in which freezing has been accompanied by agita-
Custards were formerly made from a base containing milk, eggs, and starch, but since starch is not permitted to be used by law in most states, it is not used in commercial ice cream any more. However, the above base is commonly used in making most home-made ice creams, and if they contain starch and are sold to the public it is a violation of the law. Since commercial custards are not different from puddings, the term "custard" should be reserved for home-made ice cream to be consumed in the home and not to be sold to the public.

XII. Ice are frozen desserts in which the freezing has been accompanied by agitation of the ingredients. They are made from water, fruit, or fruit juices, sugar or honey, with or without stabilizer, which if present should not exceed 0.5 percent of one quart by weight, with or without eggs, approved coloring, and flavoring. The acidity of ices should not be less than 0.35 of one percent expressed as lactic acid, and derived in whole or in part from the fruit or fruit flavoring material or by the addition of citric, tartaric, or lactic acids.

A. Frappe is an ice which is served in a semi-solid condition. B. Panache is an ice flavored with liqueur or liquor-flavored with fruit juices or spices and are served in a semi-frozen condition at about the same consistency as when they were drawn from the freezers. They should be made and served at once or on the same day. C. Granita is an ice frozen to such consistency as to resemble broken granita and usually the color of grai.

XIII. Sherbet is an ice which in addition contains not more than 2.5 percent by weight of milk fat and not less than 30 percent by weight of total milk solids.

A. Saffron is a sherbet to which has been added whole eggs.

B. Lacto is a sherbet made from milk instead of sweet milk.

XIV. Sickles are a colored, flavored and sweetened water, frozen solid without agitation.

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<tr>
<td><strong>Butter</strong></td>
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<tr>
<td><strong>PLAIN, FRUIT, NUT, OR CHOCOLATE</strong></td>
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<td>Plain 8</td>
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<td>Fruit 9</td>
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<td>Nut 10</td>
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<th><strong>SPECIAL ICE CREAMS</strong></th>
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<tr>
<td>Parfait 10-14</td>
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<td>Mousse 12-16</td>
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<td>Custard 13-18</td>
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<th><strong>SPECIAL FROZEN DESSERTS</strong></th>
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<td>Sherbet 2-2.5</td>
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If one calculated the percentage of each ingredient present in many standard formulas for frozen desserts, he would find that there is a considerable difference in the amounts of the ingredients given. There are certain quite well defined zones governing the chemical composition of frozen desserts which influence the physical characteristics of frozen desserts, such as sandiness or smoothness of texture; viscosity; flavor; heavy, soggy, or pasty body; snowy; heavy, soggy, or pasty texture; etc. Table 1 has been prepared to give some idea of the approximate ranges used by ice cream manufacturers in making a commercial product.

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Inconsistencies in legal definitions

In reading the definitions of frozen desserts in most laws and ordinances, one finds this expression: "a combination of two or more of the following ingredients: milk products, eggs, water, sugar, etc." This is very poorly worded since it would be impossible to make ice cream to which has been added whole eggs, approved coloring, and flavoring. Our knowledge of frozen desserts has progressed sufficiently far so that it is not only desirable but possible to define minimum percentages or limits for every ingredient in all frozen desserts.
and fruits. The mixture is then frozen without agitation by placing at a low temperature.

A. Maple  C. Vanilla  B. Strawberry  D. Any other flavor

IX. Puddings usually consist of a mixture of fruits and nuts added to a mix containing whole eggs.
A. English Plum  D. Nesselrode  B. Manhattan  E. Oriental  C. Marshmallow  F. Tropical fruit diivinity  G. Any other kind

X. Custards are made from a custard base prepared from milk, eggs, with or without starch, to which are added cream, sugar, and flavoring. (For home consumption only.)
A. Caribbean  B. Frappé - frozen to slushy consistency.

XI. Ices.
A. Fruit ices-frozen to consistency of ice cream.
B. Sherbet - frozen to a fluffy consistency.  C. Puddings - in a part of which all the fruit juice has been replaced with an alcohlic liquor or spiced fruit juice.
C. Sherbets-ices in a part of which all the fruit juice has been replaced with an alcoholic liquor or spiced fruit juice.  C. Puddings-ices in a part of which all the fruit juice has been replaced with an alcoholic liquor or spiced fruit juice.

XII. Sherbets.
A. Chocolate  B. Fruit  C. Lacto-sour milk used instead of sweet milk in making the sherbet.  D. Stuffle-addition of egg yolks to a fruit sherbet.  E. Vanilla.

XIII. Special forms of frozen desserts.
A. Auffait is a layer brick ice cream with fruit between the layers.  B. Decorated slices.  C. Eskimo pie is a chocolate coated ice cream bar.  D. Fancy center bricks.  E. Individual molds.  F. Neapolitan ice cream is brick ice cream having several layers—usually three.  G. Spumoni is a combination of vanilla and chocolate ice cream with or without finely chopped fruit and/or nuts.  H. Softball roll is a roll in which the center of the roll is made of tutti-frutti ice cream and the outside of pistachio mousse.

XIV. Sickles.
A. Pop  B. Suckers

IMITATION ICE CREAM

Many states permit the sale of imitation ice cream provided it is plainly labeled as such; other states such as New York prohibit its sale. Some states require that a license be obtained for making imitation ice cream and that it be plainly labeled as such.

A good definition for imitation ice cream is: Any frozen substance, mixture, or compound, regardless of the name under which it is sold or offered for sale, in which the freezing is accompanied by agitation of the ingredients, or which is made in imitation or semblance of ice cream, or is prepared or frozen as ice cream is customarily prepared or frozen, and which fails to conform with the statutory definitions for sherbet or ice shall be deemed imitation ice cream and shall be labeled accordingly.

Such a provision permits the manufacture and sale of such products as frozen milk, frosted malted milks, and other specialties which are not ice cream but obviously would be considered as ice cream by the ordinary consumer unless they were labeled “imitation ice cream.” However, when manufacturers find that they must label such products as an imitation, they soon lose their enthusiasm for making them.

CHEMICAL REQUIREMENTS FOR FROZEN DESSERTS

When ice cream, sherbets, and ices first came into general use, it soon became apparent that legal definitions were necessary to protect both the public and legitimate manufacturers from unscrupulous manufacturers who made imitation products and sold it to the public. The first step in this direction was to establish chemical standards, and one of the first ingredients to be defined legally was the milk fat content. Within the last decade, public control officials have come to realize that there is more to ice cream than the milk fat content. Accordingly, they have in many instances defined the total milk solids and total food solids as well as the amount of stabilizer permitted. This is welcomed by both manufacturer and consumer alike.

Many control officials and the public believe that if the amount of stabilizer permitted is not carefully controlled, the manufacturer would make ice cream mostly from stabilizer. This is entirely erroneous because approved stabilizers are the most expensive food solids added to ice cream.

There is some variation in the minimum legal requirements of the chemical composition for frozen desserts in different states, and in different cities. Many factors govern these requirements. No attempt has been made to examine all the legal requirements in the United States covering frozen desserts, but a sufficient number of representative ones have been consulted to get some idea of the range of them. They are set forth in Table 2.

SANITARY REQUIREMENTS

Sanitary requirements are equally if not more important than either the chemical or physical requisites, since it would be better not to eat frozen desserts at all than to eat a product that was dangerous to health. Sanitary requirements, like physical requirements, have been slow in coming and are neglected in many places.

Time will not permit any detailed discussion here. Several outstanding things should be mentioned, however. Pasteurization should be adequately defined, the time and temperature of which should be 185°F. for 30 minutes. A bacterial standard of not more than 100,000 organisms per gram of finished product should be established. A method should be required for washing the utensils and machinery, and a method prescribed for sterilizing them, such as in flowing steam until the steam showed a temperature of 185°F. or more for one minute, or in hot water maintained at 180°F. or higher for two minutes or longer. Then a method should be prescribed for rinsing them, such as 100 p.p.m. of chlorine prior to using. The construction, equipment, and sanitation of the buildings are usually given in detail since most of them are adopted from the milk requirements, as many of the other requirements for frozen desserts. Sanitation has been considered in other works presented before this Association in past years, and will not be considered here.

It should be mentioned, however, that there are now 12 states that have a minimum bacteria standard for ice cream ranging from 75,000 to 500,000 per gram whereas in 1926 there were no bacterial standards in any state. The past decade has seen a decided improvement in all sanitary requirements throughout the country.

| Table 2. Range of Minimum Legal Requirements of Chemical Composition of Frozen Desert | Milkfat | Total milk solids | Total food solids | Wt. per gal. | Stabilizer
| % by wt. | % by wt. | Wt./gal. | % by wt. | Wt./gal. | gal. | Eggs | Nuts | Fruit % by wt. | %
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<tbody>
<tr>
<td>I. Plain Ice Cream</td>
<td>8-12</td>
<td>16-20</td>
<td>0.9-1.3</td>
<td>30-33</td>
<td>1.6-1.8</td>
<td>4.25-4.75</td>
<td>±</td>
<td>0.5-1.0</td>
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<tr>
<td>II. Nut Ice Cream</td>
<td>6-12</td>
<td>16-20</td>
<td>0.9-1.3</td>
<td>30-33</td>
<td>1.6-1.8</td>
<td>4.25-4.75</td>
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<td>1-2</td>
<td>0.5-1.0</td>
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<td>III. Fruit Ice Cream</td>
<td>6-12</td>
<td>16-20</td>
<td>0.9-1.3</td>
<td>30-33</td>
<td>1.6-1.8</td>
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<td>IV. Sherbet</td>
<td>6-12</td>
<td>16-20</td>
<td>0.9-1.3</td>
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<td>V. parfait</td>
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*Maximum permitted.
+Optional where present or not.

+Required.
PHYSICAL REQUIREMENTS FOR FROZEN DESSERTS

Recently it has been recognized that to control frozen desserts adequately it is necessary to have physical as well as chemical requirements. This became necessary when control officials found that a frozen dessert could comply with all the chemical requisites and yet cheat the public. This was possible because the legal definitions pertaining to the chemistry of the product were on a percentage by weight basis while the product as actually sold was on a volume basis.

Thus, two five-gallon containers of ice cream having the same chemical composition could vary greatly in weight depending upon the amount of air that had been incorporated in each during the freezing process. This point is very important to control officials and is not generally appreciated by a great many of them as yet. Only a few states have this under control.

To correct this condition many states have placed ice cream on a definite weight per gallon basis. Some states stipulate only the weight of the total food solids per gallon, while others stipulate both weight and total food solids per gallon. In the opinion of many ice cream men, only the weight of food solids per gallon, such as 1.6 lbs., should be specified in a legal requirement, and not the weight of the ice cream per gallon, such as 4.5 lbs. per gallon, nor the percentage by weight of total food solids per gallon, such as 35 percent of total food solids. They claim that the latter two stipulations favor ice cream since the ice cream can be loaded with cheap materials such as sugar having a high specific gravity whereas milk fat has a low specific gravity. They also have other pertinent objections to these last two requirements.

However, the trend is toward a definite weight basis for food solids as evidenced by the fact that in 1936 sixteen states had some sort of law regulating the weight of ice cream. Total food solids apparently is the method preferred by most control officials since ten of the sixteen states which have a law controlling the weight have specified 1.6 pounds of total food solids per gallon.

AGITATION VERSUS NON-AGITATION

Many legal definitions do not state the manner of freezing frozen desserts. Every legal definition should contain a sentence or phrase to the effect that "during the freezing the mixture has been agitated." Unless this is done you may encounter trouble in keeping certain types of frozen desserts off the market which cannot be made without agitation.

To take care of certain types of frozen desserts such as "popsicles" and the like in which agitation is not necessary, and which are not agitated during freezing, the words or phrase "during the freezing" could be inserted into the legal definition. This would at least give a more concise legal definition and a greater degree of control.

OVERRUN IN FROZEN DESSERTS

Another physical consideration is overrun. In ice cream the overrun is usually between 80 and 120 percent. In sherberts it ranges between 25 and 50 percent, while in ice it approximates 25 percent. No man's land

As new frozen desserts have appeared on the market, it became apparent that many of them did not comply with existing legal definitions. A case in point is a product which had too much milk fat to meet the requirements of a sherbert and not enough to qualify as an ice cream. In other words, the composition of it was such that it failed to comply with any of the existing legal definitions in many states, and as a result it became an "over frozen dessert" in most states.

The question now arises, what shall be done about such types of frozen desserts? Shall we revise our existing legal definitions, or shall we exclude them entirely. Briefly, some of the arguments against expanding our present law is that it would be necessary to exercise a great deal more supervision over frozen desserts to tell whether they fell into the proper legal class or not. Furthermore, provision is now made in most laws for "imitation ice cream," or other imitation products and if any new product does not fall into any legally constituted class, then it can be labeled "imitation.

In the case of frosted malted milk the makers said that if it contained 8 or 10 percent butter fat by weight it was too rich. According to C. S. Ladd, Food Commissioner and Chemist for North Dakota, investigation showed that the richness was due to too much sugar and not too much milk fat, and that when the sugar was kept within the proper limits there were no complaints of excess richness. Thus it would seem that in this instance, the new product could be made to conform with existing laws without injuring its quality or palatability. Whether this will be the case with all new products remains to be seen.

However, the chief objection is that many of the makers of frozen desserts containing less milk fat than ice cream are hoping to capitalize on the fact that the product resembles ice cream, and, therefore, the public will think it is ice cream.

Moreover if the idea is to increase the consumption of milk products, then it cannot be done by putting less total milk solids into a product.

ANOTHER INTERESTING FACT

Another interesting fact brought out by the development of frosted malted milk was the influence of the physical state of the product being sold upon its legality. Malted milk as ordinarily made and sold in the liquid state did not need to comply with a legal definition, but as soon as a part of the heat energy was removed by refrigeration then it became subject to the frozen desserts law in many states and came under the heading of ice cream. Since frosted malted milk as commonly made only contained between 6 and 7 percent butter fat, it was clearly a violation of the law and its sale prohibited.

ICE MILK

Some states, such as Arizona, California, Connecticut, Florida, Maryland, Massachusetts, and Wisconsin, define and permit the sale of ice milk. Other states, such as Indiana, Kentucky, Michigan, New Jersey, New York, Pennsylvania, and Virginia, have no definitions covering frozen milk, but may or may not permit it to be sold as imitation ice cream.

The range in the legal definitions for the milk fat in sherberts is from 2 to 3.5 percent by weight, and if total milk solids are mentioned they range from not less than 4 percent up. The range for milk fat in the legal definitions covering ice cream starts at 8 percent by weight as a minimum and has no maximum limit. The minimum requirements for total milk solids in ice cream start at 16 percent by weight with no maximum specified. This leaves an open space between 2 and 8 percent for milk fat 4 and 16 percent for total milk solids for which there is no legally defined frozen dessert. Evidently some states believe that there is a place for ice milk and accordingly have defined and legalized the product. States legalizing products such as milk, and ice cream where the chemical composition of one product starts in where the other leaves off must of necessity do a great deal of control work to keep all the products within the prescribed legal limits, otherwise there would be a great deal of ice milk sold as ice cream. Unless frequent chemical analysis were made of the various frozen desserts being made and sold in such states, they would become a real bonanza for the "chiseler" and the unscrupulous manufacturer. In any event, legalizing ice milk would greatly increase the load of any control agent and would require a more constant vigilance to protect the public adequately.

The field of frozen desserts is a large one and is steadily increasing. Intelligent legislation and proper supervision is needed to promote properly the industry as a whole and to insure the public of a wholesome product.
Notes on Microbiological Analysis of Ice Cream
A. H. Robertson, Ph. D.

State Food Laboratory, Albany, N. Y.

The volume of frozen dessert products consumed daily, the conditions under which some of them are prepared, and the fact that all are subject to contamination somewhat similar to fluid milk, makes it pertinent in the interest of public health that the manufacture and sale of these products be under sanitary supervision. Regulatory health officials, workers at Agricultural Experiment Stations, and the organized industry have pioneered in the development and application of sanitary methods of production and sale. Both the ingredients before use and the retail products have been examined. The natural trend has been to employ methods of examination similar to those used for market milk products wherever it was practical.

Since ice cream is stored in a frozen condition and usually consumed before it has completely melted, it is natural to expect fewer food poisoning outbreaks associated with it than with fluid milk products. In spite of this, a number of serious outbreaks are traceable directly to frozen desserts. The need for pasteurization of the mix before freezing has been well established and most health codes at present specify this requirement.

It is not the province of the Laboratory Methods Committee for the Examination of Frozen Desserts to establish standards of quality. Their activity is confined to the preparation of methods of sampling and of analysis, and to such suggestions as seem essential for the interpretation of the analysis.

Ice cream placed in packages by the manufacturer for retail trade presents no sampling problem because the entire opened package serves as a sample for the laboratory. The inspector and analyst are confronted with the problem of representative sampling of bulk ice cream. Although the mix is usually homogenized before freezing, there is no assurance of the uniform distribution of the bacteria after entering the cans preparatory to storage. Contamination from the frozen dessert container, although usually slight, is not and cannot be distributed uniformly throughout the frozen mass until the latter has been melted and subjected to vigorous agitation. Similarly in opened cans from which the retailer has removed portions, surface contamination is not redistributable uniformly throughout the mass.

The prevailing custom has been to remove a surface portion from the frozen mass before taking a portion from beneath for the official sample. If either the manufacturer or the retailer have been careless, there is no justification for protecting their interests at the expense of the consumer. If careless methods are prevalent, the evidence should not be diluted or removed. It is believed that the surface portion removed with that which naturally becomes a part of it is, in most instances, representative of a portion of the frozen dessert about to be consumed as is possible to obtain under practical conditions. Certainly it might prove embarrassing in a case of food poisoning outbreak if litigation disclosed that the portion subjected to analysis had been selected to avoid surface contamination.

If the extent of contamination attributable to retailing operations is to be determined, the vendor may be asked for a serving of the frozen dessert which, after receipt, may be transferred aseptically to a sterile container for laboratory examination. Obviously, a sample from the bulk unserved ice cream taken by the inspector is essential for comparison with the former sample.

Samples may be removed from frozen dessert containers with sterile spoons, butter triers or other similar suitable instruments. Spoons and triers may be placed with handles outward in glass or metal containers and sterilized with heat. If preferred, they may be sterilized immediately before removing the sample by dipping in alcohol and burning off the alcohol remaining on them. Samples may be taken of unfrozen or partially frozen mix, from the homogenizer or the freezer, by passing the sampling bottle under the opening at intervals during the discharge. If sampling tubes are used to remove portions of mix, the same care should be exercised as when sampling milk and cream.

For retail packaged samples and for samples dipped from bulk by the merchant for the consumer, the portion vended in its original container or a representative portion consisting of not less than 50 grams after transferring it aseptically to a sterile container, may be submitted to the laboratory. All samples are to be maintained at a temperature not exceeding 40° F., and transported promptly to the laboratory. The samples are then melted, thoroughly and vigorously agitated, avoiding churning of the fat, and portions removed for the necessary tests. Usually the quantity of the bulk sample is such that it can be melted by placing the container in water at 45° C. (115° F.) for 15 minutes. Because the volume to be melted influences the time required for melting at 45° C., suitable representative portions of packaged samples may be removed aseptically at the laboratory also and prepared for analysis identically as described for bulk samples.

On account of variations in the density of frozen dessert, the volumetric measurement of units for analysis is not considered satisfactory. It is recommended that the desired quantity of ice cream be weighed aseptically into a sterile butter boat or directly into the dilution bottle. The butter boat is placed in a test tube plugged with cotton and sterilized by heat before use. The width of the boat may be modified to fit within the neck of the dilution bottle. When weighing the sample, the boat is adjusted so that it extends about three-fourths of an inch out of the test tube. After weighing the portion needed to the accuracy of the second decimal place on a sensitive balance, slide the boat and contents out of the tube and into the dilution bottle containing 99 ml of sterile water.

Comparisons have been made between the bacterial counts obtained at 32° C. and 37° C. both with the present standard nutrient agar and with the proposed tryptone-glucose-skim-milk agar. The results indicate that if the product is of good quality, it will meet the present sanitary regulations even if the proposed agar is used and the plates are incubated at 32° C. In addition, a standard plate count of the bacteria in frozen desserts, the value of a test for the presence of coliform organisms is of additional aid in determining the character and the source of the contamination. There is reason to believe that methods proposed for the detection of certain pathogenic, therophilic, psychrophilic, saccharophilic, and other types of bacteria that do not develop readily on standard nutrient agar as applied to fluid milk and cream, may be applied with or without slight modifications to frozen dessert products.

High bacterial counts in frozen desserts may be caused by one or more of the following:
1.Ingredients of poor quality such as cream, milk, gelatin, frozen or powdered eggs, sugar, flavoring material, etc.
2. Improper processing such as inefficient pasteurization, repasteurization, or aging too long at too high temperatures.
3. Ineffective cleaning of equipment such as storage tanks, homogenizer, pasteurizer, aging vats, pipe lines, cans, etc.
4. Careless employees who deliberately or through ignorance neglect to process
the mix properly or to clean the equipment carefully.

Excessive numbers of bacteria in frozen desserts usually indicates a neglected product. Like milk, however, a low count does not necessarily mean a safe product and a high count does not necessarily indicate the presence of disease-producing bacteria. A high count does mean general insanitation and the need for the examination of samples taken at various stages in the process to determine at what point the contamination is introduced.

Sediment Tests on Frozen Desserts

M. E. Parker
Beatrice Creamery Company, Chicago, Illinois

The sediment testing of milk as a means of determining its physical contamination with visible and insoluble foreign particles is a practice which has been efficacious in causing a reduction of dirt in any milk supply subjected to its scrutiny during the past thirty-five years. While it is a method with empirical limitations, its simplicity in application and interpretation does guarantee its understanding and acceptance. In other words, dirt particles on a sediment disc is indisputable evidence of their presence in the sample of milk being tested, and consequently the result is subject to no equivocation. There is, however, one major objection to the sediment test. This is stated fully and concisely in Standard Methods of Milk Analysis, 1934, as follows:

"With the development of efficient single service strainers for use on dairy farms, and efficient strainers, filters, and clarifiers for use in milk receiving plants, the sediment test is becoming more and more a measure of the efficiency of these sediment moving devices. In most cases, it is necessary to visit the farm during the milk operation in order to determine whether the product delivered is "clean" or "cleaned milk."

Experience has demonstrated that dirt in milk will not afford a reliable index of its influence upon the bacteria count. However, dirt in itself is sufficiently objectionable to be condemned. Generally, the sediment in milk has been associated with the dirt commonly found on the farm. As the name implies, "sediment" refers to the visible and insoluble particles which would settle out and thereby impair the attractiveness of the finished product. Undoubtedly the glass milk bottle has contributed in hastening the recognition of the sediment problem in market milk. Unfortunately, any exact measurement of the amount of sediment has not been practical on a quantitative basis such as a gravimetric determination, because appearance has been the ultimate criterion. Therefore, inasmuch as the presence of macroscopic particles of varying size, identity and distribution is the essential prerequisite of a "sediment" condition, it is probably futile to hope for precision in evaluating the degree of sediment quantitatively.

Attempts have been made to evaluate the relative amounts of sediment in milk by the preparation of standard sediment discs (4) showing definite amounts of sediment. In fact, an excellent set of standard discs has been prepared and photographed by the Connecticut State Department of Health Laboratory (3). As standards, it would appear that these photographic discs are worthy of serious consideration, if only on the basis of their relative numerical values without any regard to the Connecticut State Department's interpretation or definition of what constitutes "clean", "acceptable", "slightly dirty", "dirty", or "very dirty" milk. As a matter of fact, a numerical value considered as "acceptable" today might well become "dirty" with the passage of time and the improvement of production methods. Such a set of standard discs based upon a photographic record commends itself for consideration because the standards at least would be uniform. True, a set of standard discs can be prepared, but their application is limited because comparatively they cannot be duplicated elsewhere or even by the same worker using the same material. No such criticism can be lev-

Septic Sore Throat Spread by Bulk Milk

(EDITOR: The following report of a milkborne outbreak of septic sore throat is abstracted from a report in the Baltimore Health News, July 1938. It illustrates the hazard that exists in the sale of bulk milk when the protection of pasteurization and sanitary handling is vitiated by contamination of the milk during its dispensing.)

An explosive institutional outbreak of 75 cases of septic sore throat was traced to the faulty handling of pasteurized milk delivered in bulk to a cafeteria. The disease manifested itself by a severe sore throat in most instances, by fever ranging up to 104° F, and other characteristic symptoms. Only one case had a severe complication which was a late kidney involvement. The diagnosis of all cases was confirmed by positive laboratory findings. There were no fatalities in this outbreak, and it quite clear that the pasteurization was interrupted.

One of the employees serving in the cafeteria had been suffering with a sore throat for approximately three days prior to the sudden appearance of the first twenty cases of septic sore throat among the milk drinkers in the cafeteria. This worker was examined at the time that the first cases became ill, and was found to have a temperature of 102.8° F. He had a very severe sore throat with greatly enlarged and infected tonsils. This man was immediately isolated, and the outbreak promptly terminated. There seems to be no equivocation. There is, however, one major objection to the sediment test. This is stated fully and concisely in Standard Methods of Milk Analysis, 1934, as follows:

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The use of bulk milk in institutions is not prohibited under the city milk ordinance. This milk is intended for cooking purposes. Investigation of this outbreak indicated that in the cafeteria, pasteurized milk from five-gallon cans was poured into pitchers and then into glasses prior to each meal, and the glasses were then placed on trays in a refrigerator until meal-time. The trays were then placed on the counter for distribution among the individuals patronizing the cafeteria. At the end of each meal, any of the glasses which had not been removed from the trays were emptied back into the pitchers, and these were replaced in the refrigerator until the following meal was served. This remaining milk and additional milk were then used in the same manner as has been described.

One of the employees serving in the cafeteria had been suffering with a sore throat for approximately three days prior to the sudden appearance of the first twenty cases of septic sore throat among the milk drinkers in the cafeteria. This worker was examined at the time that the first cases became ill, and was found to have a temperature of 102.8° F. He had a very severe sore throat with greatly enlarged and infected tonsils. This man was immediately isolated, and the outbreak promptly terminated. There seems to be no equivocation. There is, however, one major objection to the sediment test. This is stated fully and concisely in Standard Methods of Milk Analysis, 1934, as follows:

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This means that ice cream will vary in solids; from 14 to 16 percent in sugar; cream will vary from 14 to 16 percent in solids; from 12 1/2 to 14 1/2 percent in sugar; cream mix weighing 90 grams. Therefore, in order to get the same yield of milk solids in an average ice cream mix of 38 percent total solids content containing 52 percent milk solids, a 280 gram sample would be necessary. Such a sample would be approximately 10 percent heavier than one-half pint of such ice cream mix weighing 9 pounds per gallon. When other types of frozen desserts other than ice cream are considered, the variations in composition indicate the difficulty of using a sample of a specific weight which will give an exact comparison with ice cream on a milk solid basis. Inasmuch as a pint sample is used in sediment testing of frozen desserts, due probably to convenience, the same principle should apply in the case of frozen desserts. Therefore, a half-pint sample of mix or a pint sample of the frozen dessert is suggested as the most practical solution to what otherwise can prove a complex mathematical problem. The greater volume of the frozen dessert sample, as compared to the mix sample, is necessary due to the fact that in approximately a 100 percent increase in volume (overrun) during the freezing of such products in order to render them palatable.

In the examination of frozen desserts we are concerned with a variety of milk products which have undergone varying degrees of processing; whereas, in market milk, we have a product of one kind only. Therefore, we should not normally expect the sediment condition of frozen desserts to be comparatively better than that of market milk. Microscopic inspection of the sediment found in frozen desserts, however, has been demonstrated to be very similar in character to that found in market milk. Incidentally, this observation has been made on ice cream samples examined from the products made in practically all sections of the United States. Accordingly, there is no reason to suspect that there is any need for different sediment standards for frozen desserts than would obtain for raw milk supplies or market milk. In other words, in comparing frozen desserts with market milk, the essential difference in sediment is one of degree and not in kind.

In the sediment testing of stabilizers, a 1/2 gram sample is recommended. This represents the maximum concentration which would ordinarily be found in a pint sample of ice cream.

Salt, sugar, inedible syrup, syrups, etc. as well as the water used in making syrups and in washing the equipment can all be tested for sediment by applying the hot water method described for the finished frozen desserts, except that 50 gm. samples are recommended instead of the pint samples recommended for frozen desserts. By using 50 gm. samples of sugars and syrups, the results obtained will be representative under all conditions of the amounts of these ingredients which would ordinarily be found in any frozen dessert.

Extracts which have been tested for sediment by applying the hot water and acid procedures, as well as in the testing of stabilizers, are recommended. The method which has been applied to milk so successfully. The suggested procedure or modifications for the ingredients so far considered have retained the essential features of the suction or pressure type of sediment tester and the use of standard limiting discs. In determining the extraneous matter in fruits, nutmeats, etc., the same principle was applied to milk in order to retain the same features, providing these samples were properly prepared. In such work, we have found the flotation procedures of B. J. Howard (1) (2) of invaluable assistance in preparing such products for the sediment test. In all the methods outlined, we have endeavored to retain the essential "modus operandi" of the sediment test as it is applied to milk, the principal difference being that it is generally recognized that the sediment test has been the means of developing a more sediment free, cleaner...
SEDIMENT TESTS

milk supply in the past thirty-five years. It is true, of course, from the derivation of the word "sediment" (L. sedimentum—a settling; fr. sedere—to sit) that we are concerned primarily with particles which settle. Webster confines the definition to "the matter which settles to the bottom from a liquid." Technically, therefore, there would be no sediment in a frozen dessert inasmuch as it is a semisolid mass whose physical state would minimize or prevent any settling of particles. On the other hand, the "sediment test" as we know it, is accurately speaking, a confusion in nomenclature. In applying the same to milk, we do not actually cause any settling of particles, but provide essentially a procedure for physically removing extraneous matter from the liquid which is collected on a filtering substance whose white character provides a contrasting medium for accentuating the dirt particles contained in the liquid being tested and which are retained on the filter surface.

Simplicity in operation and interpretation has been the major reason for the successful application of the sediment testing of milk. It is, therefore, logical to assume that similar results might be expected in applying it to frozen desserts and particularly to the ingredients of frozen desserts heretofore not so scrutinized. "Seeing is believing" or as the Chinese say: "One picture is worth ten thousand words." In such philosophy is found the virtue of sediment testing.

REFERENCES
1. Howard, B. J., U. S. D. A. Food and Drug Administration Fig Testing, July 1, 1929.
5. The Grading of Dry Milk Solids, American Dry Milk Institute, 1936.

Editor's Note: The other papers that were presented at the Symposium will be published in the May issue of this Journal.

Three Associations Standards

A ray of sunshine for those who have been decrying the lack of uniformity in the field of milk sanitation may be seen in the recent inauguration of a program by cooperating committees of three associations for the standardization of designs for commonly used items of milk plant equipment.

General recognition of these accepted standards by health officials, milk dealers, and equipment manufacturers is urged officially by these committees.

The cooperating agencies are the Committee on Sanitary Procedure of the International Association of Milk Sanitarians®, the Simplified Practice Committee of the International Association of Milk Dealers**, and the Technical Committee of the Dairy and Ice Cream Machinery and Supplies Association***.

To date the committees have accepted standards for (1) a recessless sanitary union for sanitary pipe lines, (2) threaded fittings including bends for use with this union, and (3) improved indicating and recording thermometer connections for vats and for pipe lines. Details of these accepted standards were shown in the November, 1938 issue of this journal. The above thermometer fittings are illustrated in Figures 1 to 4.

It is obvious that it will take months for manufacturers to get the new standards into production. In the interim, present standards should be accepted.

As soon as the new equipment is available, each committee will urge its constituents to produce, accept, and demand standard equipment as the case may be.

Of course it is expected that additional items will be standardized from time to time as such items are presented to the committees for consideration.

Photographs byCourtesy of Taylor Instrument Companies.

Figure 1: Temperature Tube System with 3A Type RN sanitary fittings for installation in jacketed vats and tanks.
THREE ASSOCIATION STANDARDS

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C. A. Abele, Montgomery, Ala.
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H. C. Eriksen, Santa Barbara, Cal.
Leslie C. Frank, Washington, D. C.
George W. Grim, Ardmore, Pa.
Ralph E. Irwin, Harrisburgh, Pa.
Paul F. Krueger, Chicago, Ill.
M. E. Parker, Chicago, Ill.
Sol Pincus, New York City.
Geo. W. Putnam, Chicago, Ill.
W. D. Tiedeman, Albany, N. Y., Chairman.

**MEMBERSHIP OF SIMPLIFIED PRACTICE COMMITTEE OF THE INTERNATIONAL ASSOCIATION OF MILK DEALERS.
F. E. Goldsmith, Bocchen's Farm Products Co., New York, N. Y.
F. H. Kuhlman, Jr., Bowman Dairy Co., Chicago, Ill.
H. S. VanBomel, Sheffield Farms Co., New York, N. Y.

E. R. Alling, Rice & Adams Corp., Buffalo, N. Y.
Loomis Burrell, Cherry-Burrell Corp., Little Falls, N. Y.
F. G. Cornell, Jr., Jensen Cremery Machinery Co., Inc., Bloomfield, N. J.
C. Mortensen, Standard Milk Machinery Co., Louisville, Ky.
R. E. Olson, Taylor Instrument Companies, Rochester, N. Y.
R. V. Thomas, York Ice Machinery Corp., Canton, Ohio.
Theodore Thompson, Emery Thompson Machine & Supply Co., New York, N. Y.
W. D. Tiedeman, Chairman.

FIGURE 2. Temperature Tube System with 3A Type RN sanitary fittings for installation in milk lines. These fittings are provided with special adapters for various sizes of piping.

FIGURE 3. Industrial Thermometer with 3A Type RN sanitary fittings for installation in jacketed tanks and vats.

FIGURE 4. Industrial Thermometer with 3A Type RN sanitary fittings for installation in milk lines. These fittings are provided with special adapters for various sizes of piping.
The improved indicating and recording thermometer connections are illustrated in Figures 1, 2, 3, and 4. In each instance, the union nuts are taken off over the thermometer scale case.

A newly designed union nut has been accepted for removing over the ferrule and stem of the thermometer. This is illustrated in Figure 5 and Figure 6.

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**Figure 5**
Drawings of Removable Union Nuts

**Figure 6**
Manner of Removal of Union Nut over Ferrule
Reduction of Milk Losses in Milk Plants*

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In all manufacturing plants there are certain losses in material which are inherent to the process. In the interests of economy these losses must be reduced to a minimum. The problem of milk losses in milk plants is peculiarly complicated because the value of the lost milk is only one of the involved problems. There is also the problem of stream pollution, especially in the smaller communities where most of the milk receiving plants must be located. Moreover there is the problem of sound public health inspection of the salvaging of milk which might normally be lost.

The extent of the milk losses within a given milk receiving plant may be materially reduced by proper selection and installation of equipment together with sound operating procedures. The problem of milk losses will still be present, however, in spite of the best possible construction and operation of milk plants.

The magnitude of losses which may occur within milk plants is of such economic importance and has such a direct bearing on stream pollution in many localities that it is the obligation of milk sanitarians to give special consideration to this problem in order that careful, well-balanced sanitary treatment may be utilized to reduce such losses. The importance of this problem was brought to our attention in the dairy industry. As a result of their interest, we undertook an experimental survey of the problem for the purpose of determining the extent of these losses and what might be reasonably done to reduce them to a minimum.

The extent of the milk losses
During the winter months and especially during the summer of 1938 an endeavor was made to determine the extent of the milk losses in eight milk receiving plants. The first plant was selected because it was known that the milk losses were particularly high; another plant was selected because it was known that the losses were especially low due to very few pieces of equipment; and another plant was selected because it was definitely known that the method of operation was to save all possible milk left in the vats.

There is no absolutely satisfactory manner of determining the extent of the milk losses within individual plants, and there are three primary reasons. The milk plant may be operating without much attention to these milk losses or it may be endeavoring to save all possible milk. The milk inspection through the public health departments of health may permit the milk plant to save all possible losses or it may forbid the plant to save any of this milk which cannot readily go into the usual milk supply. For these reasons the data as collected varied considerably and the variation will be pointed out for individual plants.

The procedure for collecting milk losses was to drain all equipment at the end of the day's run to secure whole milk which was left in the vats, internal tubular heaters, pipe lines, etc. Milk from faulty bottles was also collected. Following the drainage of the equipment, the dump vat was rinsed with clean warm water and this water was pumped through the equipment. The vats were rinsed with warm water and all of this water was collected for analysis. The line of demarcation of milk forced through the equipment and the water which is pumped through is definite so that it is easy to avoid much water dilution except in cases where pieces of equipment are being rinsed with water. An endeavor was made to secure all milk left in the plant and dumped by a few seconds of drainage between the dump vat and the can washer.

The first plant studied was a large one receiving approximately 96,000 pounds of milk daily. The milk losses were known to be especially high. This plant bottles milk and cream. The milk as received had a freezing point of -56°F C. and contained 3.9 percent of fat. The freezing point figures were used for calculating water dilution rather than the actual percentage of milk solids minus fat because it was soon found that the former was more accurate.

In this plant the daily drainage of milk from the cans amounted to 145 pounds testing 6 percent. This illustrates the fact that the milk which adheres to the cans after dumping is actually considerably richer in fat than the milk which is drained. There was practically no water dilution in this milk and it contained nearly 9 pounds of milk fat.

The second plant was especially selected for the purpose of determining the extent of milk losses within the plant. The total receipts of milk amounted to approximately 1,800 pounds testing 3.8 percent. The milk was dumped into the weigh tank, was run into the receiving tank, and then through an internal tubular cooler from which it ran directly into a tank car. The internal tubular cooler filled from the top and was blown out with air after the day's run. The little milk which was left in the internal tubular cooler was drained out and used by the men at the plant.

In this plant there was no opportunity to collect all of the drainage from the emptied milk cans as the installation was such that the drained cans had to be placed almost directly over the water rinse jets
in the can washer. Nevertheless 60 pounds of milk drainage containing 6.3 percent of fat were collected. This drainage milk actually contained 39 percent of added water from the spray jets in the can washer so that the fat content of the milk itself as it drained from the cans amounted to 5.9 percent. The total fat recovered amounted to 2.2 pounds daily. The water rinse from the air blown and drained equipment contained 0.8 pound of fat so that the total recovery of fat amounted to 3 pounds daily. This figure actually represents the minimum of milk plant losses and it does illustrate that a considerable quantity of milk could have been recovered from the emptied milk cans.

PLANT 3 WHICH BOTTLES MILK AND CREAM

This small milk plant received approximately 12,000 pounds of milk daily testing 4.4 percent of fat. The equipment was drained and rinsed with water as part of the regular plant process but an endeavor was made to determine the amount of milk which the plant recovered as well as the amount of milk which the plant did not recover.

In this plant the time required to dump cans into the weigh can was approximately twice that of the other plants. From two to three seconds was required to dump the cans and about two seconds were allowed for the can to drain. Under these circumstances the cans were completely dumped so that only 0.2 pound of fat was recovered daily. This illustrates that two or three seconds of drainage after dumping is ample to secure most of the milk which normally remains in the dumped cans. The internal tubular cooler for cooling the raw milk as received was found to contain one ten gallon can of milk but this milk was regularly recovered by drainage. Then too, the bottled milk amounted to 24 pounds but this was also regularly recovered. This plant therefore recovered 4.8 pounds of milk fat daily as a result of a cooperative understanding with the milk sanitarians. This milk did not go into the regular milk supply but was used for manufacturing purposes. In addition to these losses at the milk plant, there was recovered within the plant a total of 1.8 pounds of fat which was a loss even from a plant that regularly rinsed the equipment. Incidentally most of this loss occurred in the cream separator and the surface tubular cooler separating the cream.

SUMMARY OF PLANT LOSSES

The average daily milk received by the eight plants under study was 62,492 pounds containing 21.4 percent of fat. The average quantity of fat recovered from the dumped cans and which actually should have gone into the dump vat amounted to 2.5 pounds per day. If we assume there are 1500 milk receiving plants in New York State, then this daily loss from milk cans amounted to 3250 pounds of milk fat which is worth $958 per day at the rate of 25 cents per pound of fat. The total average milk lost per plant was 13.6 pounds but it should be borne in mind that a considerable part of this loss was actually recovered in some of the plants particularly in three of them. This total loss amounts to $5,000 a day for New York State which alone is sufficient to emphasize the necessity for milk sanitarians and milk plant operators to give more attention to this question of fat losses in order that this great loss may be reduced to a minimum.

From the viewpoint of sewage disposal this loss has a tremendous significance. The milk saved within the plants studied would amount to approximately 500,000 pounds daily. This milk if run into streams and lakes becomes a major problem in reducing the oxygen content of the water as a point at which fish and other aquatic life will be suffocated. Eelridge of Michigan states that milk should be diluted approximately one to twenty-five thousand in fresh stream water of excellent quality to maintain satisfactory oxygen content in the water for fish life. On this basis the daily requirement of water amounts to the equivalent of a flowing stream 10 feet deep, 1/5 mile wide, and 4 miles long.
Administration and Procedure in the Enforcement of Milk Regulations

John L. Rice, M. D.
Commissioner of Health, New York City

The enforcement of milk regulations in this State is thoroughly accepted and is a matter taken for granted. This is a clear sign that on the whole the administration of the sanitary control of milk has been reasonable and based on common sense. In the long record of freedom from milk borne outbreaks, at least as far as the larger communities are concerned, there is proof that the high standards that have been set have been fully warranted. Fortunately, we here, different from the case at present in England, are long past the stage where health officials are called upon by the producers, the dealers, or the public to present a justification for sanitary milk regulations. Our discussions concern themselves with specific aspects regarding the manner of administering the control or to particular requirements, while the main basic principles, sanitary milk production, pasteurization, and direct safeguards to eliminate contamination or the possibility of spread of disease, go forward unchalleged.

The machinery set up at the beginning of milk control in some respects was crude and hazardous. Pasteurization control was very inefficient. A great portion of the work was directed toward detection of frauds, such as the addition of water and chemical preservatives. However, with the advancement of knowledge and experience, greater emphasis was placed on the more direct health aspects of the milk control program.

Our experience in the enforcement of milk regulations has caused us to divide the work roughly into three distinct phases: (a) country or source of supply control, (b) city or point of distribution control, and (c) laboratory control. Of course, the size of New York City necessitates a large staff for the work, but the principle of checking the three phases mentioned also holds good for smaller municipalities, even though one man may take care of more than one of the phases involved.

Milk control should primarily be directed to the field examination of the product itself for safety and sanitary quality, and to the supervision of the production, processing, and distribution of the milk; and secondarily, to the physical condition of establishments and equipment. The improvement brought about through the field examination of the product is well illustrated in our own City of New York where following the introduction of the eck test in 1936, the logarithmic averages of standard plate counts of Grade B raw milk were reduced from 140,400 per ml in 1933 to 85,600 in 1937. We all know the many improvements brought about in the efficiency of pasteurization after the recent introduction of the phosphate test. Such field tests not only make it possible to exclude unfit and unsafe products from channels of trade and consumption, but they also have educational and psychological value. These tests convincingly illustrate to the producer or dealer the fitness or unfitness of the product. The fact that any inspector, through the use of field equipment, can in a few minutes determine gross irregularity, this tendency to discourage violations of the regulations or attempts to deliver poor quality milk.

Of course, it is necessary to adhere to specifications governing physical condition of establishments and their equipment, in order to make possible sanitation and satisfactory operation, and also to guide the industry and to provide a means of uniform enforcement for the inspectorial personnel.

It might be well to mention at this point that we have found it advisable to require plant operators to submit for our approval blue prints of all proposed new construction or major alterations. This eliminates the necessity for future expensive modifications due to failure of compliance with our regulations. We specify that written approval be obtained from us before installing new equipment in plants, etc. Many insanitary features which had hitherto been carried from year to year have thus been corrected, and it is very gratifying to note that we have received a high degree of cooperation from both the milk dealers and the equipment makers in this program.

Such procedure not only aids the Department of Health in predetermining that the plant or equipment will be satisfactory, but it also serves to assure the operator that he can safely proceed with the construction work and installation of equipment without fear of having new changes forced upon him soon after completion of the work.

To carry out efficiently such a program, it becomes increasingly apparent that the milk inspector has to be a person of highly specialized ability and training who must devote full time to the problem of safeguarding the milk supply. The inspector has to be enough of an architect to give advice on the construction and layout of a milk plant, and enough of a mechanical engineer to pass judgment on the sanitary construction and proper operation of milk equipment. He should be enough of an expert on water supply and sewage disposal, at least to have sufficient ability to detect irregularities, and to understand the operation and sanitary precautions to be taken in the relatively simple water or sewerage plants. He must to some extent be a bacteriologist and chemist in order to make microscopic counts and simple field tests and interpret the results, and to understand laboratory reports of analyses. He should be a psychologist and educator of sufficient ability to sell himself and his milk control program to producers and dealers of milk. He must have poise, alertness, and at times a knowledge of court procedure in the event that court action becomes necessary.

Among other matters to be considered in the administration of a sound milk program is the necessity of having sufficient personnel and facilities to do the work properly. Dr. Wilson G. Smith, in his book on "Public Health Administration in the United States," says that a municipality of 100,000 people would require two milk inspectors. Due to the large concentration of population in New York City, we are able to carry on by having two milk inspectors per 225,000 population.

I know of no official city budget that carries an item for milk inspection that is large enough to assure by itself, complete, satisfactory supervision of a milk supply. The operators themselves have a real responsibility in supervising the production and handling of their own products. Veterinary examination, dairy inspection, laboratory examination of milk, and bacteriological control of products can be cited as examples of this self-supervision. Since the operators and their supervisory employees are essential factors influencing milk quality, it is important that careful consideration be given by the dealers to the qualifications of their personnel and the character of operator or manager.

It is frequently necessary to carry on educational activities among producers and dealers to get them to adopt procedures and methods found advisable by enforcement authorities. Every minute matter cannot be made the subject of legal regulation and there has been considerable success in having dealers voluntarily adopt procedures upon our recommendation. We generally find it desirable to hold meetings with the milk and associ-
Today, as in the past, the primary task of health departments in their milk control activities is concerned with the assurance of a safe and wholesome milk supply, and yet the time has arrived when we must realize and be sensitive to the point, that in the whole milk picture there is an economic phase that is very troublesome and important. We should be quick to understand that the producer has to make a living, and the consumer's ability to buy is not unlimited. Health department personnel should be eager to cooperate whenever possible with other agencies who have the main responsibility for this phase. More than ever in carrying forward our activities for safety and wholesomeness of milk, we should have in mind economics. While we should never compromise with adequate standards for safety and wholesomeness, we should always be sure that our regulating administration and our control procedures are free from fancy work that is expensive and cannot be justified.

I wish to emphasize one of my early statements concerning the application of common sense in the enforcement of milk regulations. Strict adherence to the letter of the law combined with rigid policing is one method of procedure, but the procedure which obtains results with a minimum of hardship and without sacrificing principles is the better one to follow.

The retardation of changes (peroxide formation and development of tallowy flavor) induced by copper contamination of butter was found to apply to ascorbic acid and ethyl tyrosine while common antioxidants such as vegetable lecithin, nicotinic acid, and oat oil were found to be of no value. Oat flour, maleic acid, and aqueous extracts of oat flour completely retarded peroxide formation but introduced characteristic off-flavors which render them of doubtful value.

The exposure of cream to copper particularly in forewarning vats (which appears to be the most common source) is indicated to be a doubtful production practice. Isolated samples of butter have been found with a copper content of as high as 8 ppm, such butter incidentally developing tallowy flavors rapidly although no bleaching or sandiness occurred. Initial churnings invariably show more copper than later churnings of as high as 8 ppm, such butter incidentally developing tallowy flavors rapidly although no bleaching or sandiness occurred. Initial churnings invariably show more copper than later churnings of as high as 8 ppm, such butter incidentally developing tallowy flavors rapidly although no bleaching or sandiness occurred. Initial churnings invariably show more copper than later churnings of as high as 8 ppm, such butter incidentally developing tallowy flavors rapidly although no bleaching or sandiness occurred. 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**Association News**

**INTERNATIONAL ASSOCIATION OF MILK SANITARIANS**

The 28th annual meeting of the International Association of Milk Sanitarians will be held in Jacksonville, Florida, on October 25, 26, and 27. Mr. H. H. Parker of Jacksonville has been appointed chairman of the local committee. The headquarters hotel will be announced later.

The program of this meeting will contain some items of unusual interest. No milk sanitarian can afford to miss it. Plan now to attend.

Back copies of the annual reports of the International Association of Dairy and Milk Inspectors for the years 1927 and 1929 to 1936 inclusive may be purchased, as long as the present supply is available, at a price of $5.00 plus postage for the set, or for single copies $1.00 including postage.

C. S. Leete, Secretary-Treasurer

**NEW YORK STATE ASSOCIATION OF DAIRY AND MILK INSPECTORS**

President Kern expects to call a meeting of the Executive Committee in the near future to discuss the program for the next annual meeting. Suggestions from members as to subjects they would like to hear discussed are invited and should be forwarded to the secretary.

W. D. Tiedeman, Secretary-Treasurer

**MASSACHUSETTS MILK INSPECTORS’ ASSOCIATION**

At the annual meeting held in Worcester, Mass., on January 4th and 5th, the following officers were elected:

- President, Edward J. O’Connell, Holyoke, Mass.
- Vice-president, John B. Enright, Litchburg, Mass.
- Secretary-Treasurer, Robert E. Berni, Cambridge, Mass.

Executive Committee:

- George A. Planagan, Lynn, Mass.
- Patrick C. Bruno, Revere, Mass.
- R. E. Berni, Secretary-Treasurer

**Certain Dairy Products Exempted from Immediate Formulation of Federal Standards**

Under the provisions of the new Federal Food, Drug, and Cosmetic Act, the Secretary of Agriculture is authorized to promulgate reasonable definitions and standards of identity for any food under its common or usual name. In the absence of such definitions, any food that contains two or more ingredients may declare them on its label. Inasmuch as the Secretary has not yet had time to formulate standards for all such foods, he has announced exemption for a period of two years to a number of foods including the following dairy products:

- Evaporated milk
- Cheese
- Sweetened condensed milk
- Oleomargarine
- Sweet milk chocolate
- Malted milk
- Milk bread

During this period, the above foods are exempt from a declaration of each ingredient although it does not exempt them from stating the presence of any artificial flavoring, artificial coloring, or chemical preservative.

J. H. Sheppe

**An Institute to Appraise Equipment Performance**

Many papers and committee reports have been presented at meetings of milk dealers, ice cream manufacturers, milk sanitarians, public health engineers, and health officers, describing the application of new control procedures or the performance of new dairy plant equipment. A survey of any milk equipment exposition reveals the great differences of opinion as to the kinds of equipment that are believed to be the best for handling certain operations. Manufacturers of dairy machinery, concerns furnishing laboratory apparatus and materials, and producers of various supplies make strong claims as to the excellence of their products in the fields of their respective applications. However, the determination of compliance is left to the individual judgment of each purchaser, interested milk sanitarian, or control official.

The Committee on Sanitary Procedure of the International Association of Milk Sanitarians, in collaboration with the trade associations, is expected to reduce much of the confusion (1, 2, 3). However, its work as now projected lies in the field of only designating the principles that should be incorporated in design. It calls attention to needed developments. It accepts designs of construction. However, it does not attempt to specify details. It is unable to determine performance and degree of compliance with claims of manufacturers. The judgment of experts is highly desirable to point out existing needs, to indicate where new developments are necessary, and to generalize on design. Their work would be greatly facilitated, however, and their findings far more authoritative if physical means were provided for determining whether particular equipment and supplies actually do comply with the claims of their products.

Such a service should not in any way conflict with the work of laboratories engaged in research on dairy equipment, as for example, the engineering laboratory for dairy equipment research in the National Institute of Health. These latter serve as valuable sources of information for the above committee. When these laboratories are governmental, they usually are not authorized nor are they interested in undertaking performance studies on all pieces of equipment that are offered, and in issuing certificates showing the degree of compliance with published standards. The same principle which now is used in certifying colors for use in foodstuffs should be more widely applicable in certification of bacteriological culture media, incubators, and other laboratory supplies. The service would show whether any product does or does not meet accepted standards. The claim of a manufacturer that his model of pas-