NOVEMBER, 1968
Vol. 31 P. 335-376 No. 11

Journal of

MILK and FOOD TECHNOLOGY

56TH ANNUAL MEETING
August 18, 19, 20, 21, 1969
Brown Hotel
Louisville, Ky.

NOTICE

Page 1 and 11

National Mastitis Council Meeting

Official Publication

International Association of Milk, Food and Environmental Sanitarians, Inc.

Now, a sock filter to fit every system.

If you have a high pressure centrifugal pump pipeline system, you'll get the strongest filter on the market with new Kendall Super Socks.
If you have an average pressure or gravity pipeline system, you'll get fast filtration and superior retention with Kendall Regular Socks.
If you have a low pressure gravity or vacuum pipeline system, you'll get fast filtration at the lowest possible cost with new Kendall Thrifty Socks.

The Kendall Company
Fiber Products Division
Walpole, Massachusetts 02081

KENDALL

Please send me FREE samples of Kendall Milk Filter Socks. I need _____ size socks for a
☐ high ☐ average ☐ low pressure pipeline system.

Manufacturer of my system _____

Name _____

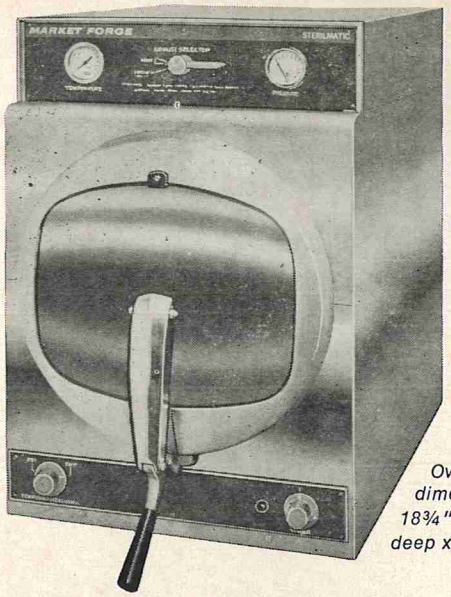
Address _____

Town _____

State _____ Zip _____

I usually buy my milk filters from _____

Dollar for dollar,
your best autoclave value today . . .



Overall dimensions: 18¾" wide x 31" deep x 29" high

STERILMATIC™!

It's compact, has a large 16" x 26" working chamber and is ½ **the price** of comparable equipment!

And Sterilmatic has all the important performance features you need.

Sterilmatic is automatic. Set the time cycle: sterilization, shut off and exhaust are all self-operating. All controls are front mounted.

Sterilmatic is compact. Straight line construction gives maximum use of space. Front access panel for service. Fits on a 24" table. Net weight only 120 lbs.

Sterilmatic is safe. Door is self-sealing and opens in seconds . . . just swing it up and in . . . cannot be opened until steam is automatically exhausted. Complete with low water cut-off valve and blow out plug. U.L. approved.

Sterilmatic is easy to install. Set on stand and wire in to 220 volt service. No skills needed to operate. Electric Sterilmatic makes its own steam, just add tap water.

Optional accessories available. Steamline operation available at slightly lower cost. Stand, trays, baskets, exhaust condenser (to eliminate external venting), recording thermometer also available.

Proven, trouble free . . . thousands of units in operation.

Will No. 25065Z (electric) Ea. $990
Write for illustrated brochure:
Will Scientific, Inc.
Dept. JMFT-11, Box 1050,
Rochester, New York 14603

Laboratory Heating Equipment from Will

This is your invitation to attend the eighth annual meeting of the National Mastitis Council at the Sherman House, Chicago, Illinois, January 28-29, 1969. All persons interested in mastitis prevention and control are cordially invited to attend. The program committee has scheduled speakers and subjects to make this the best meeting yet.

On research, the Milking Machine Manufacturers Council has arranged for Dr. W. G. Whittlestone of New Zealand to discuss milking systems from his world-wide viewpoint. Dr. L. W. Slanetz, Chairman of the NMC Research Committee, will have a report on laboratory diagnostic procedures. Dr. John S. McDonald will review research at the National Animal Disease Laboratory, Ames, Iowa and give observations on British research. Dr. J. W. Smith, USDA, will discuss standardization of screening tests and cell counting procedures.

For field application, Dr. R. B. Bushnell, California Extension Veterinarian, will discuss mastitis and high bacterial counts in problem herds. Dr. John Dahl of Clintonville, Wisconsin will discuss a practitioner's program for mastitis control. Fieldman William F. Rhudy and dairyman H. P. Richardson of Dairymen, Inc. will demonstrate a team approach to the mastitis problem.

Abnormal milk control programs will be discussed by Harold E. Thompson Jr., USPHS, and W. I. Carr, Vermont Department of Agriculture. E. E. Kihlstrum, Chairman of the NMC State Council Coordination Committee, will report on state programs on abnormal milk.

There will be informal discussion sessions Tuesday evening. One will be on herd management and milking problems. Another will deal with screening tests for abnormal milk. These sessions will provide an opportunity for everyone to take part and have their questions answered.

Plan now to attend this meeting. It will start at 9:00 A.M. on January 28 and adjourn at noon on January 29. Fill in the registration form and return it today to the National Mastitis Council, Inc., 910 Seventeenth Street, N.W., Washington, D. C. 20006. It will save time for you and the NMC if you send the registration fee with the form. *Send room reservation form directly to the Sherman House.*

CHRISTIAN J. HALLER, D.V.M.
President

Registration Form

NATIONAL MASTITIS COUNCIL ANNUAL MEETING

Sherman House — Chicago, Illinois
January 28-29, 1969

PLEASE TYPE OR PRINT *BOTH* SECTIONS OF THIS FORM

Mail the top half to: National Mastitis Council, 910 Seventeenth Street, N.W. Washington, D. C. 20006.

Register the following person(s). (Fee of $15.00 per person includes registration, January 28 luncheon, milk and coffee breaks, and proceedings.) Make check payable to: National Mastitis Council, Inc.

NAME(S) _____

_____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

I cannot attend, but wish to order a copy of the proceedings ($4.00) _____

(CUT ALONG THIS LINE)

Mail hotel request directly to: Reservation Manager — SHERMAN HOUSE
Clark at Randolph — Chicago, Illinois 60601

Please reserve for arrival on _____
Day Date Time

and departure on _____
Day Date Time

Rates guaranteed in range requested. *KINDLY CHECK TYPE OF ACCOMMODATIONS*

Singles	Doubles	Twins
____$10.00-$14.00	____$15.00-$18.00	____$17.00-$19.00
____$15.00-$17.00	____$19.00-$21.00	____$20.00-$23.00
____$18.00-$21.00	____$22.00-$25.00	____$24.00-$27.00

Alcoves and Suites

ALCOVE (Sitting Room-Bed Room Combination)
____$29.00-$31.00

SUITE (Parlor & 1 Bed Room)
____$35.00 ____$45.00
____$50.00 ____$70.00

SUITE (Parlor & 2 Bed Rooms)
____$ 80.00 ____$ 90.00
____$100.00 ____$115.00

Rooms subject to 4.1% Illinois hotel operators occup. tax.

NAME(S) _____

_____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

NATIONAL MASTITIS COUNCIL MEETING

The Journal of Milk and Food Technology is issued monthly beginning with the January number. Each volume comprises 12 numbers. Published by the International Association of Milk, Food and Environmental Sanitarians, Inc. with executive offices of the Association, Blue Ridge Rd., P. O. Box 437, Shelbyville, Ind.

Entered as second class matters at the Post Office at Shelbyville, Ind., March 1952, under the Act of March 3, 1879.

EDITORIAL OFFICES: Dr. Elmer H. Marth, Dept. of Food Science and Industries, University of Wisconsin, Madison, Wis. 53706. H. L. Thomasson, Managing Editor, P. O. Box 437, Shelbyville, Indiana 46176.

Manuscripts: Correspondence regarding manuscripts and other reading material should be addressed to Dr. Elmer H. Marth, Dept. of Food Science and Industries, University of Wisconsin, Madison, Wis. 53706.

"Instruction to Contributors" can be obtained from the editor for the use of contributors of papers.

Page Charge: Effective January 1, 1969 a charge of $25.00 per printed page will be made for all research papers which are published. See Volume 31, issues 10, 11, or 12 for details.

Journal of

MILK and FOOD TECHNOLOGY

INCLUDING MILK AND FOOD SANITATION

Official Publication
International Association of Milk, Food and Environmental Sanitarians, Inc.
Reg. U. S. Pat. Off.

Vol. 31 November, 1968 No. 11

Business Matters: Correspondence regarding business matters, advertising, subscriptions, orders for single copies, etc., should be addressed to H. L. Thomasson (address above).

Subscription Rates: One volume per year. Individual non-members, Governmental and Commercial Organization subscription.

1 yr.	$10.00
Public and Educational Institution Libraries, 1 yr.	$ 8.00
Single Copies	$ 1.00

Orders for Reprint: All orders for reprints should be sent to the executive office of the Association. P. O. Box 437, Shelbyville, Ind.

Membership Dues: Membership in the International Association of Milk, Food and Environmental Sanitarians, Inc., is $10.00 per year, which includes annual subscription to the **Journal of Milk and Food Technology.** All Correspondence regarding membership, remittances for dues, failure to receive copies of the **Journal,** changes in address and other such matters should be addressed to the Executive Secretary of the Association, H. L. Thomasson, Box 437, Shelbyville, Indiana 46176.

REVISED 1966 EDITION

Procedure for The Investigation of Foodborne Disease Outbreaks

REVISED 1966 EDITION

Recommended by

INTERNATIONAL ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL SANITARIANS, INC.

COPIES OBTAINABLE FROM

International Association of Milk, Food and Environmental Sanitarians, Inc.
Box 437, Shelbyville, Indiana

Prices: Single Copies, $1.00 each: 100 or more copies, 65 cents each.
25-100 copies, 75 cents each. Please do not send stamps.

NOTICE

Attractive Membership Lapel Button Combination Tie Tac and Lapel Pin and Decals

NOW AVAILABLE

Convolution — Blue . . . . Circle & Bar . . . . Field — Blue
Letter "S" — White . . . . Lettering — Blue

ACTUAL SIZE

No. ..... 3 1/4" Decals @ 25c each = $.....

No. ..... Lapel Buttons @ $1.00 each = $.....

No. ..... Combination Tie Tac & Lapel Pin —$2.00 = $.....

International Association of Milk, Food and Environmental Sanitarians, Inc.

Box 437, Shelbyville, Indiana 46176

MICROBIOLOGICAL CONSIDERATIONS IN LIGHT OF TODAY'S FOOD PROCESSING OPERATIONS[1]

JOSEPH C. OLSON, JR.

Division of Microbiology
Food and Drug Administration
Department of Health, Education, and Welfare
Washington, D. C. 20204

The end of World War II marked the beginning of a period of great acceleration in the development and application of technologies in the food industries. Large centralized operations—highly mechanized and often automated—are commonplace today. Some measure of the degree of centralization or concentration of food processing operations may be gained from developments that have taken place in the production of grocery products. These include such items as baby foods, baking mixes, candy, cereals, coffee, tea, condiments, crackers and cookies, packaged desserts, jams, jellies, pet foods, pickles, prepared foods, salad dressings, shortening, snacks, soft drinks, soups, and syrups. The results of a recent study *(8)* showed that the four firms achieving the largest sales volume of each item just listed usually accounted for more than 50% of the total domestic sales. Furthermore, it was estimated that the four largest manufacturers in 1965 (latest available information) sold 95% of the baby food, more than 90% of the soup, more than 55% of the coffee, 75% of the cake mixes, and 65% of the shortening. The report also called attention to the fact that a rather small number of large processors with extensive product lines transformed basic commodities such as grains and produce into most of the highly processed convenience oriented foods on the market.

These developments are largely in response to the increasing consumer demand for convenience and variety, a trend spurred by high income, more family participation in leisure time activities, and the large number of employed women, including some 15 million working wives in this country, many of whom have neither the time nor the inclination to spend hours in the kitchen preparing home cooked meals[2].

There is demand, too, for convenience foods of all types by the food service industry. Ample evidence of this is provided by the hundreds of thousands of meals served daily by our airlines, by many large and small restaurants, drive-ins, etc. (as well as in homes), where meal preparation is largely reduced to defrosting or rehydrating and, if necessary, heating to serving temperature. To provide such products, highly complex, well coordinated, and integrated processing methods often are required. Many technologies have been adopted—processes such as spray-drying, foam-drying, freeze drying, continuous mix bread making, as well as new innovations in food handling methods, in transport of foods, including air transportation of perishables, and in packaging.

IMPACT OF NEW TECHNOLOGIES

The public health implications of the rapid growth of the processed food industry and the introduction of new technologies were recognized early. Large quantities of finished products may continually emerge from production lines of large plants. A microbiological hazard, should it develop at some point, could endanger a large number of consumers. Consequently, there are many persons in industry and government who are concerned about microbiological hazards in foods. This concern has been the subject in recent years of extensive reports from several national and other high level study groups. Significant among these are: the National Commission of Food Marketing, appointed by President Johnson *(8);* the Committee on Environmental Health Problems set up by the Surgeon General of the Public Health Service *(7);* a task force on Environmental Health and Related Problems appointed by the Secretary of Health, Education, and Welfare *(9);* an International Symposium on Food Protection held at Iowa State University and supported by the Public Health Service *(1);* the Food Protection Committee of the Food and Nutrition Board, National Academy of Sciences—National Research Council *(2);* and a review by Miller, El-Bisi, and Sawyer *(5)* on microbiological and public health aspects of prepared frozen foods.

It is not intended that the results of these studies will be discussed in any detail. A few comments,

---

[1]Presented at the 55th Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians, Inc., St. Louis, Missouri, August 18-22, 1968.

[2]The proportion of the U. S. labor force made up of women rose from 28% in 1947 to 35% in 1965. Current estimates for 1968 indicate that 35% of all married women now earn paychecks—an increase of nearly two-thirds over just 10 years ago *(4)*.

however, would seem pertinent. Although the emphasis placed on the conclusions reached by each of these studies differed, there was much similarity among the studies themselves. The following will serve to illustrate the points most frequently expressed.

1. All emphasized, to a greater or less extent, the disparity between the rate at which public health problems are arising, as a result of growth and technological changes in food production, processing and distribution, and the level of effort being directed toward their solution.
2. The technology of production, processing and distribution has grown too fast for food protection practices to keep pace in terms of public health.
3. The danger of mishandling foods at some point between production and consumption represents a potential threat to the safety of foods.
4. Increasing production and popularity of precooked foods not subject to cooking by the consumer and of mildly processed products refrigerated for long periods of time involve potential microbiological risks on a substantial scale.
5. While food processing may remove or destroy pathogens and other undesirable microorganisms, the potential for subsequent exposure to environmental contamination often may be great.
6. The complexities arising from multiple ingredients, processes, and types of contamination make food protection peculiarly difficult—but challenging.
7. And finally, all emphasized the need for a broad research effort in the interest of safe and wholesome food supplies.

EXTENT OF FOOD-BORNE DISEASE

At this point it may be well to refer briefly to the rather meager objective evidence available relative to food-borne disease outbreaks. Admittedly the data are incomplete. A summary of food-borne illnesses *(6)* as reported to the National Communicable Disease Center (NCDC) for 1967 showed 273 outbreaks and 22,171 cases. In 1966, 181 outbreaks and 7,960 cases were reported. The inadequacy of these data in presenting the true picture is evident from the fact that in 1966 only 25 states and in 1967, 35 states reported outbreaks to NCDC; California alone reported almost one-half of the total. Obviously this reflects good reporting practices by California, rather than poor sanitation, poor living standards, or generally greater susceptibility of Californians to food-borne illness!

Actually no one knows the true incidence of food-borne disease in this country. Estimates by competent epidemiologists of the number of salmonellosis cases that occur annually range from one to two million. There seems to be no indication that such estimates need revision downward. In fact, reported salmonellosis cases increased sharply: 12,494 in 1967 as compared with 1,285 cases in 1966. With respect to staphylococcus food intoxication, Frazier *(3)* refers to a rather commonly accepted impression that "most of us encounter this illness a number of times during our lifetime." This could mean several million cases annually.

Thus, it is quite apparent that control of food-borne disease leaves much to be desired. It is also apparent, however, that industry and government have a real awareness of the potential for microbiological hazards in our food supply. Such awareness is encouraging—it is as it should be—for to be forewarned is to be forearmed.

The microbiological safety of foods available to consumers in retail markets and in public or other eating places is entirely dependent on industry's awareness of microbiological hazards, the integrity of its sanitation control programs, and the effectiveness of applicable government regulatory surveillance programs.

ESSENTIAL ELEMENTS OF EFFECTIVE CONTROL PROGRAMS

It may be well at this point to reemphasize the three essential elements of effective sanitary control of food processing. These will be discussed within the context of government regulatory programs; however, the analogy to industry quality control programs should be evident.

Standards

The first essential is the establishment of standards—the requirements which must be satisfied for all aspects of sanitation including methods of evaluation. Standards must be meaningful and attainable. Wherever possible a requirement should be based on the need for it in terms of its contribution to improving the overall sanitation of the operation. The meaningfulness of certain requirements is clear—others, because of lack of historical experience as to effectiveness or to lack of objective supporting data, may be less clear, at least for the time being. In the latter case, prompt effort should be made to acquire as soon as possible the data or information to either sustain or refute the need for the requirement. An example of a document which probably best exemplifies what is desirable in this regard is the Grade A Pasteurized Milk Ordinance *(10)*. The present Ordinance represents the 13th revision since its first appearance in 1924. Over the years a vast amount of knowledge has accumulated relative to the sanitary control of milk. This knowledge has been utilized in setting forth specific requirements judged to be most meaningful in terms of knowledge available at the time. Of equal significance, such knowledge also has been utilized in providing for each requirement an explanatory statement delineating what is considered to be satisfactory compliance.

Education

The second essential of effective control is education. Education must be directed at industry and consumers as well. Industry must be fully knowledgeable about the reasons for the various requirements imposed upon them and what constitutes satisfactory compliance with the requirement. Consumers have the right to expect food that is safe and that otherwise is of the best quality that can reasonably be attained. However, consumers should be well enough informed so that their demands are in keeping with what can be supplied.

Enforcement

The third essential is enforcement. Standards or requirements that may be promulgated are meaningless without enforcement. Suggestions and requests, as well as education about requirements, often are effective. However, some forceful motivation or incentive action is sometimes necessary for continual maintenance of an acceptable level of performance. Permit or license suspension, product label degrading or removal, or monetary fines are common enforcement mechanisms of regulatory agencies. In industry, comparable mechanisms may be employee reprimand, demotion, and even loss of job.

MICROBIAL CONTAMINATION AND CONTROL

Keeping in mind the above fundamentals that undergird effective food sanitation control programs the following considerations relative to microbial contamination and control seem worthy of mention in light of today's food production practices.

Contamination of foods from a variety of sources may take place before food is harvested or during handling, processing, and distribution. Without going into detail, such sources may be grouped as follows (3):

1. The natural surface microflora (rarely the interior) of fresh plants and fruits. The number and types vary with the kind of plant; furthermore, the bacterial flora may be increased by contaminants from soil, water, sewage, etc.

2. The surface microflora of meat animals including poultry and fish, and more importantly, microorganisms from their intestinal tracts.

3. Sewage, including human and animal excreta. Sewage may gain access to food through use of untreated or inadequately treated domestic sewage as fertilizer, through use of contaminated natural waters, or through direct human or animal contact.

4. Water. Surface, ground, and stored waters contain a natural microflora in addition to microorganisms from the soil, sewage and to some degree from animals and plants.

5. Soil. This source contributes the greatest diversity and frequently the largest numbers of microbial types.

6. The air. Air does not possess a natural microflora. Microorganisms cannot grow in the air. They get into the air via particulate material such as dust from various sources (lint, plant and animal residues, food ingredients, fungal growths, etc.), soil, moisture droplets from coughing or sneezing, and many other materials.

In addition, significant contamination may occur from food contact surfaces of unclean equipment, from packaging materials, and from the skin and clothing of personnel.

Foods may reach the consumer in the raw state or after being subjected to varying degress of processing. They may be grouped according to degree of processing involved, for example:

1. Raw (liquid, solid or semi-solid). No processing other than mechanical removal of gross extraneous materials—often accomplished in the family kitchen. These products may be frozen or unfrozen.

2. Pasteurized (milk and egg products). These also may be frozen or unfrozen.

3. Mildly heat treated (e.g., convenience foods, fruit juices, etc.). Also frozen or unfrozen.

4. Cured, pickled or smoked (meats, vegetables or fruits).

5. Canned sterilized (meats, vegetables, baby foods, infant formulas, etc.).

6. Dried natural products, raw or heat processed (milk, meats, fruits, nuts, vegetables, etc.).

7. Dry blended foods. These may be prepared from a variety of dried foods and food ingredients.

Raw foods, in general, present the greatest public health hazard in terms of transmitting food-borne diseases; canned sterile foods present the least. Between these two extremes are a host of food products which receive some form of processing treatment that is destructive or inhibitory in some degree to microorganisms. Each possesses a microflora consisting of those organisms that survived the processing treatments plus those contributed through post-processing contamination, largely from contact of the product with surfaces of unclean equipment, dust laden air, and personnel. Pathogens may or may not be part of this microflora. This will depend upon the effectiveness of the processing treatment in destroying any pathogens likely to be present and the extent of control exercised to avoid recontamination during post-processing handling of the product.

Recontamination of foods or food ingredients that are handled essentially in a closed system after a critical heat processing treatment can be avoided in a relatively straightforward and uncomplicated manner. Examples are non-sterile fluid milk products, juices, and many other fluid products of varying degrees of consistency. For such an operation there are three basic requirements. First, equipment, e.g., pipes, pumps, cooling plates, packaging units, etc., must be of sanitary design and construction so as to permit effective cleaning and sanitizing, in-place, if possible; second, unfailing adherence to an effective cleaning and sanitizing procedure and regimen; and

third, protection of the cleaned and sanitized food contact surfaces until used.

Monitoring such a system would include *(a)* frequent unannounced observation of cleanup operation; *(b)* automatic recording of time and temperature during each cleaning cycle, and sanitizing cycle if hot water is used as the sanitizing agent; *(c)* sampling and testing of cleaning and sanitizing (chemical sanitizers) solutions before and after each use cycle; and *(d)* frequent sampling and testing of product for coliform bacteria and/or other indicator types if appropriate, before and after each critical point during the post-heat treatment movement of the product. In many plants such sampling and testing is done hourly. A critical point is any location where contamination and/or opportunity for microbial growth is likely to occur. Two primary growth controlling factors in this regard are temperature and water availability. Samples should be obtained wherever it is suspected that temperature and moisture conditions are or may be such as to permit growth.

If the three basic requirements indicated above are fulfilled, and a monitoring system is in effect which will provide process assurance, there is little to be gained by analyzing in-line or finished products for specific pathogens, salmonellae included. The monitoring system indicated above provides for three effective mechanisms of detecting an existent or potential microbial health hazard—physical inspections, particularly of cleanup operations; review of time-temperature recording charts; and the results obtained from sample analysis. These are time honored, effective control measures.

In contrast to those foods handled as indicated above, whereby recontamination may be reduced to insignificance relatively easily, many others are especially vulnerable to recontamination because of the manner of post-process handling. Examples are the dry foods and ingredients. Tremendous quantities of dry ingredients from one source or another, such as gelatin, dried milk, cereal grains, sweeteners, various baking ingredients, etc., must be handled. Some are packaged as consumer end-items; others are used to prepare a variety of blended foods. The latter often are manufactured and packaged in bulk in distant plants and subsequently shipped to destinations where they are blended together and packaged to form a consumer end-item. Also some of these dry products are used in the home after effective cooking; others are used directly with little or no cooking. Recontamination of the latter type of product is much more significant in creating a potential health hazard. For such products rigid control over the post-process environment of product handling is often complicated and difficult to accomplish.

Appropriate monitoring procedures should be in effect, and special attention needs to be given to sources and conditions likely to contribute to recontamination of products. For example, the drying process often cannot be assumed to be sufficiently bactericidal to render a product free of a microbiological health hazard. In general, drying equipment (spray, drum, or roller) is not constructed so as to be readily and easily wet cleaned and sanitized. Contaminating microorganisms including introduced pathogens may be eliminated from the equipment simply by passing on out with the product. On the other hand they may lodge on surfaces and increase in numbers. For the latter to occur, adequate moisture is the most critical factor. There are two common sources of sufficient moisture which permit growth or buildup of contamination. These are *(a)* condensate which may form on equipment surfaces because of a critical change in temperature, and *(b)* moisture remaining after cleaning. Regardless of source of the water, it may be retained in inadequately drained depressions, joints, pockets, etc., which may exist in the assembled equipment. Such water residues may easily contain adequate nutrients to support microbial growth. Subsequently, drying may leave encrusted material heavily laden with the progeny of the contaminants. Some encrusted material will slough off surfaces and be removed in a sifting or screening procedure often used prior to bagging or packaging. On the other hand some of this material will, by abrasion or attrition, become an integral part of the product.

Sampling and bacteriological examination of screenings, siftings, or tailings is a useful procedure. Samplings might be made of the material accumulated over several hours of operation. Examination may consist of aerobic plate counts, testing for salmonellae, and perhaps a direct microscopic examination. In addition, once each day portions or scrapings of encrusted material from accessible surfaces of drying and other accessory equipment (hoppers, fixed and portable bins, conveyers, etc.) might well be removed, appropriately pooled, and subjected to the above examinations.

When containers are opened and contents emptied into blending vats or tanks, extraneous materials adhering to the outside surfaces of the containers may easily contaminate the contents of the blenders. Such contamination may be minimized by cleaning the outside surfaces of containers. If bags are used as containers they should consist of an outer protective shell and an inner liner, both impervious to dust and moisture. Good sanitary practice would dictate that the outer shell should be stripped away before the contents are emptied into blenders; that such stripping should take place in a room apart from the mix-

ing room; and that the product should then move in a sanitary manner to the mixing room. Personnel engaged in container cleaning or bag stripping operations should not participate directly in the blending procedure prior to a personal clean-up and clothes change. Samples for monitoring the sanitary control over transfer of ingredients to blenders might consist of appropriate sampling and examinations of portions of the empty inner liners themselves.

The sanitary quality of the tremendous quantities of air used in connection with certain operations should not be overlooked. At the time of each change of air filters at air intakes of processing, blending, and packaging areas, portions of the filters might be retained and appropriately examined.

Other sampling and testing may be indicated depending upon type of operation; for example, accumulated product at or near dispensing heads of packaging machines; vacuum cleaner residues; and material or residues from built-in vacuum de-dusting lines of packaging machines.

Obviously the sampling and testing briefly indicated above for the two groups or types of products is only a part of a preventive program—a program that attempts to control the conditions surrounding the production, processing, and distribution of foods so as to render the finished product free of undesirable microorganisms, including pathogens. Final product testing has a place in such a program. The extent of such sampling and testing will depend on the product and the nature of its handling, processing and use. The level of such testing can be placed at whatever level of statistical probability of defect detection is desired. One must be cautious in this regard, however, for a level set too high may mean no product left to sell! Furthermore, it should be remembered that any stated probability level of defect detection involves at least two assumptions: one, that contamination is homogeneous; and second, that if the contaminant is present it will be detected. Neither assumption is valid in every instance. Contamination often is sporadic, and our methods of analysis are far from perfect. Consequently, sanitary control of the food handling environment is essential. Sanitation is inseparable from microbiological hazards, and is recognized as one of the paramount approaches to wholesomeness and microbiological safety of foods. Plant sanitation in storage, equipment design, and maintenance, and, of utmost importance, employee sanitation, are recognized as vital in controlling microbial contamination.

CONSUMER CONFIDENCE IN FOOD SAFETY

Regardless of the danger of food-borne illness, the American public undoubtedly has great confidence in the quality of foods made available to it. Certainly, part of this confidence stems from a belief that a high level of sanitation exists in the food industry, thereby assuring considerable protection against food-borne disease. Also significant in this regard is the extensive amount of information about foods that reaches the public through the mass communications media. Technological advances that have occurred or are developing in the industry are regularly reported. Announcements and instructions for use of new food items frequently occur and new or different uses for old items are often described. Detailed discussions on proper care and handling of foods to avoid contamination and growth of harmful bacteria frequently are heard and seen, and often are strategically timed for release near the beginning and during the warm periods of the year when danger from mishandling of foods is greatest. Such communication with the consumer serves to create confidence and a general awareness that the food industry is truly progressive, dynamic, and sensitive to its responsibility to provide safe and wholesome foods.

REFERENCES

1. Ayres, J. C., A. A. Kraft, H. E. Snyder, and H. W. Walker. 1962. Chemical and Biological Hazards in Foods. Proc. Int'l. Symposium on Food Protection at Iowa State University. Iowa State University Press. Ames, Iowa.

2. Food Protection Committee, Food and Nutrition Board. 1964. An evaluation of public health hazards from microbiological contamination of foods. National Academy of Sciences—National Research Council, Publication 1195. Washington, D. C.

3. Frazier, W. C. 1967. Food Microbiology, 2nd Ed. McGraw-Hill, Inc., New York.

4. McConnell, J. 1968. Convenience foods. The Military Market 19(4):98-102.

5. Miller, A. T., H. M. El-Bisi and M. F. Sawyer. 1964. Microbiological and public health aspects of prepared frozen foods—A review. Mass. Agr. Expt. Sta. Bull. 548. University of Massachusetts, Amherst.

6. Morbidity and Mortality Weekly Report. Public Health Service, 17(16):137-140, Apr. 20, 1968. Dept. of Health, Education, and Welfare, Washington, D. C.

7. Report of the Committee on Environmental Health Problems. 1962. Dept. of Health, Education, and Welfare. Public Health Service Publication No. 908. Washington, D. C.

8. Report of the National Commission of Food Marketing. 1966. Food from farmer to consumer. Superintendent of Documents, U. S. Gov't. Printing Office, Washington, D. C.

9. Task Force on Environmental Health and Related Problems. 1967. A strategy for a livable environment. A report to the Secretary of Health, Education, and Welfare. Superintendent of Documents, U. S. Gov't. Printing Office, Washington, D. C.

10. U. S. Department of Health, Education, and Welfare. 1965. Grade "A" Pasteurized Milk Ordinance—1965 Recommendations of the Public Health Service. Public Health Service Publication No. 229. Washington, D. C.

IMPROVED PROCEDURES FOR MEAT SANITATION[1]

R. J. Bothast[2], H. W. Ockerman, and V. R. Cahill

The Ohio State University, Columbus, Ohio 43210 and Ohio Agricultural Research and Development Center, Wooster, Ohio 44691[3]

(Received for publication April 24, 1968)

Abstract

A procedure is described for securing and maintaining rabbit carcasses at a low bacterial level during storage. The procedure consists of conventional slaughtering and dressing, a 90-sec dip in 90 C (194 F) water, packaging, and sealing in a sterile container in a sterile environment followed by storage at 3 C (37 F). The dip procedure reduced the surface psychrophilic bacterial load and, when combined with refrigerated storage, this treatment eliminated all detectable growth on the carcasses when evaluated by means of tryptone glucose extract agar. Oxidation was increased by this procedure primarily as a result of lingering peracetic acid used in equipment sterilization. Only slight visual and odor deteriorations were observed in the rabbit carcass after 35 days of storage.

The meat industry is attempting to provide the consumer with wholesome food which has a satisfactory shelf life and yet maintains the flavor of the fresh product. As the industry proceeds into the area of centralized packaging, an increase in product shelf life will become a necessity. Many investigators *(4, 5, 8, 12)* have pointed out that the skeletal muscle and edible organ tissues of healthy meat animals are essentially in a sterile condition. However, upon dressing and chilling, there are many sources of contamination of the meat surface, consequently, showing the importance of surface contamination as stressed by Sanborn *(7)*. Here is an opportunity for the meat sanitarian to minimize the load of surface contaminants through introduction of new and revolutionary techniques such as those reported by Weidemann *(11)* and Ross *(6)*. Thus, this project was planned to evaluate, on a small scale, some of the methods for reducing bacterial surface contamination of meat products and to apply the most satisfactory method on a laboratory scale.

Preliminary Procedure and Results

Eight different methods for reducing the number of surface bacteria on meat samples were evaluated to elucidate which would be the most satisfactory. In all trials, conventional supermarket beef cubes (handled aseptically) were used and these were handled with a sterile hook welded to a copper rod during the treatment. On each sample, a standard plate count was made *(1)* using tryptone glucose extract (TGE) agar (incubated at 37 C[4] for 72 hr) and standard procedures to determine the viable bacterial load. A visual evaluation was also made on each sample. These experimental samples were then compared to controls, e.g., samples originating from the same piece of meat but not exposed to the treatment. The treatments and the results of these treatments are summarized in Table 1.

After the standard plate count was determined, all treated samples and controls were wrapped and stored under retail display conditions and visually evaluated. The hot water dip of 90 C for 90 sec was determined to be the most satisfactory method tested for reducing the number of surface bacteria on meat since it would not be undesirable from a public health standpoint; since it seemed to eliminate surface bacteria; and,

Table 1. Summary of preliminary sample treatments and results

Trial no.	Type of treatment	Temperature	Time in sec	Results
1	High, dry temp	177 C to 871 C	30	1. Low temps—enhance bacterial growth; no effect on color. 2. High temp—sample charred
			90	1. 177 C to 260 C—slight reduction in bacterial load and only a slight color change. 2. 90 sec at 232 C (most desirable sample); color change was slight and viable count lowered.
2	Steam bath	12 inches from steam exit at 45 psi	90	1. Slight increase in bacterial load. 2. Darkening of the sample.

[1]Paper presented at a meeting of the Virginia Academy of Science, May 10, 1968, Roanoke, Virginia.

[2]Present address: Department of Animal Science, V.P.I., Blacksburg, Virginia 24061.

[3]Approved as Journal Article No. 26-68 by the Associate Director of the Ohio Agricultural Research and Development Center, Wooster.

[4]This incubation temperature was necessary since incubation facilities were shared with other microbiology projects in progress.

3	Ethanol dip 25, 30 & 95% concentrations	23 C	90	1. Slight reduction in bacterial growth with maximum reduction at 95% concentration. 2. All solutions caused excessive browning of the sample with maximum browning occurring at 95% concentration.
4	Hot water dip	70, 80, 90, and 100 C	90	1. Marked decrease in viable bacteria with 90 and 100 C showing no viable bacteria. 2. Higher temperature—more color change and shrinkage (loss in weight) with the maximum shrinkage approximately 5%.
5	Saturated sodium chloride dip	23 C	90	1. No effect on viable count.
6	Saturated sodium chloride dip	100 C	90	1. More desiccation of sample than hot water dip. 2. Same effect on bacteria as 100 C hot water dip.
7	10 ppm solution of chlortetracycline dip	23 C	90	1. Slight decrease in viable bacteria. 2. Sample became pale pink in color.
8	40% acetic acid dip	23 C	90	1. Marked decrease in viable count. 2. Sample turned completely black in color.

since it did not have a marked effect on color of the treated product.

RESEARCH PROCEDURE

The second stage of this research was to more conclusively evaluate the hot water dip procedure. Medium-sized white rabbits were used since they were of suitable physical size and cost. Each time the experiment was performed, at least two rabbits were slaughtered—one as a control and the other as an experimental animal. Both rabbits were slaughtered by conventional methods without any special sanitary or preslaughter treatment. The control carcass was then sectioned into 12 parts and each section was sealed in a pint glass Ball canning jar. Samples were then chilled and stored in a 3 C cooler. The experimental carcass was processed in the apparatus shown in Fig. 1.

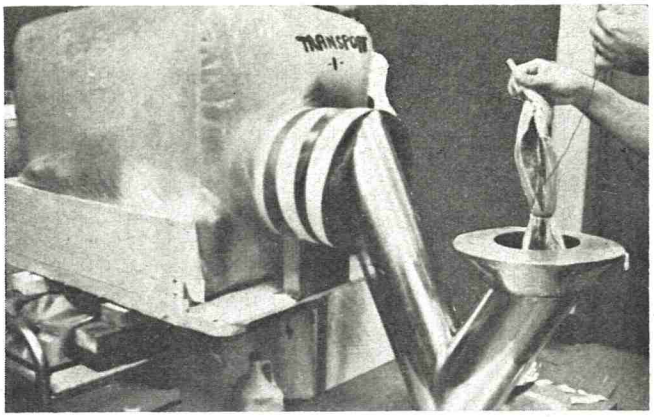


Figure 1. Rabbit carcass entering a hot water "V" trap that is attached to a sterile plastic isolator.

The carcass was dipped for 90 sec into 90 C water contained in a stainless steel "V" tube type of apparatus. The "V" tube was sprayed with peracetic acid prior to adding sterile water and heating with an electric heating element. At the opposite end of where the carcass entered the "V" tube was fastened a germ-free plastic isolator which contained equipment necessary for sectioning and packaging the experimental carcass. This equipment was steam sterilized and aseptically air-locked into the isolator. This isolator unit shown in Fig. 1 was a transparent, flexible-wall, plastic film isolator (manufactured by The Ohio State University Laboratory Animal Facilities and sterilized with peracetic acid prior to use) equipped with a sterilizing filter and an outlet floating glove exit filter similar to the one described by Ockerman et al. *(5)*. A copper wire running from inside the isolator to the outside environment, allowed passage of the experimental carcass from the normal environment into the hot water dip and then, after 90 sec, into the isolator. After the carcass was placed in the isolator, a flexible plastic door was put in place to seal the isolator from the "V" tube and its hot water trap. After the carcass was in the isolator, it was sectioned into 12 parts and sealed in pint glass Ball canning jars. The samples were then removed from the isolator, chilled, and stored in a 3 C cooler. However, in addition to storage in the cooler, two samples (an experimental and a control) from each trial were stored at room temperature and evaluated separately.

Experimental and control samples were removed (trial I) from the cooler at 3-day intervals and evaluated throughout the storage period. On each sample, a standard plate count *(1)* was made using TGE agar (incubated at 37 C for 72 hr) and standard procedures were used to determine the viable bacterial load. Acidity of the product was measured by determination of pH values *(10)* and oxidation was measured by determination of TBA (2-thiobarbituric acid) values *(9)*. The samples were visually rated and subjectively evaluated for odor. The experiment was repeated two additional times (trials II and III) with a second experimental animal added to the third trial.

RESULTS AND DISCUSSIONS

Results may be divided into four parts based on the evaluations made. The most important evaluation concerned the effect of the procedure described on reducing the total bacterial load. Average results

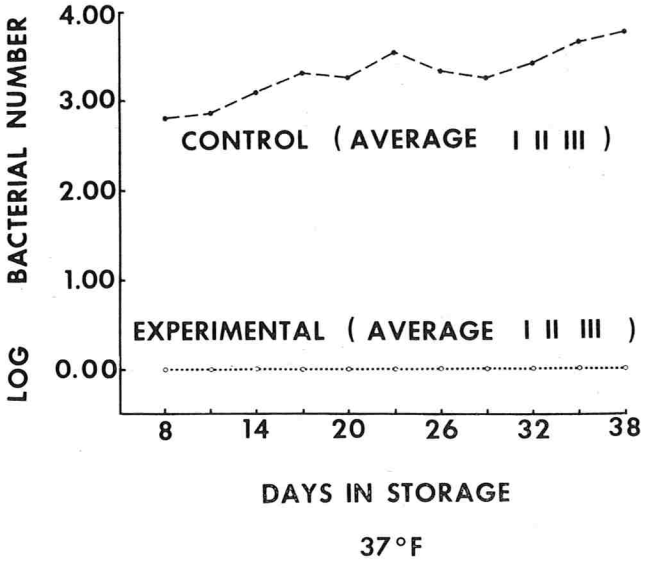


Figure 2. Bacterial comparison of control and experimental samples.

of the total bacterial count of the three trials are shown in Fig. 2.

The experimental growth line represents four animals with 11 samples per animal, whereas the control growth line represents three animals with 11 samples per animal. No measurable number of bacteria was detected on any of the experimental samples, whereas a measurable load was found on the control samples, as is shown in Fig. 2. Growth of bacteria on the control samples was not great throughout the storage period; however, this retarded growth can be attributed to the storage conditions.

The bacterial growth on the experimental samples stored at room temperature indicated that mesophilic and thermophilic bacteria were not completely destroyed by the process described. However, these types of organisms did not grow at 3 C (cooler temperature). Thus, it may be said that the procedure was effective in reducing the surface psychrophilic bacterial load. This procedure followed by adequate refrigeration was very effective at lowering and maintaining a very low bacterial count.[5]

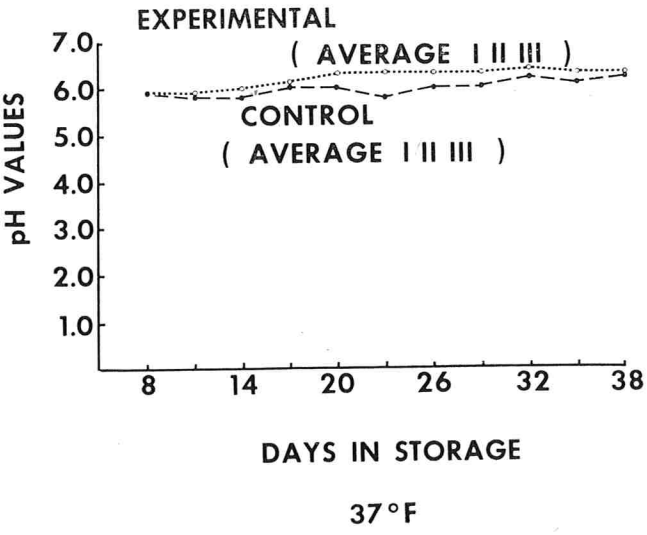


Figure 3. pH comparison of control and experimental samples.

Galton et al. *(2)* in their study on the incidence of *Salmonella* in swine have shown swab cultures from the sides of hogs being lifted from the scalding vat to be free from *Salmonella*. Consequently, this work and the present research show the effectiveness of hot water in removing surface contamination.

The method described for reducing number of surface bacteria had no significant effect on the acidity of the samples, as shown in Fig. 3. The pH

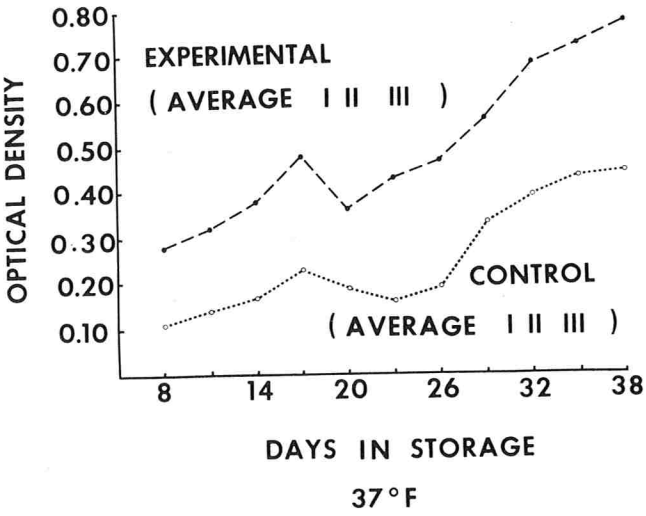


Figure 4. TBA (2-thiobarbituric acid) comparison of control and experimental samples.

of the control samples ranged from 5.8 to 6.2, whereas the pH of the experimental samples ranged from 5.9 to 6.4. Usually one expects a rise in pH with bacterial growth; however, in this work where growth was limited by the storage temperature, only a very slight rise in pH could be detected. Consequently, this rise can not be attributed to bacterial growth since there is a slight rise in pH in both the experimental and control samples.

The experimental procedure increased oxidation of the product as measured by 2-thiobarbituric acid (TBA) values. The results of this evaluation are shown in Fig. 4. Optical density (as a measure of oxidation) is plotted against days in storage. However, this increase in oxidation seems to occur initially and the difference in optical density between the experimental and control samples remained practically constant throughout the experiment. The effect

[5]Subsequent experimentation using sections of beef muscles substantiated these results.

of cooking on TBA numbers, as shown by Keskinel et al. *(3)*, and the oxidative effect of peracetic acid (used to sterilize the isolator) indicated that the increase in oxidation resulted from the combined effect of peracetic acid and the hot water dip. However, evidence obtained with increased aeration of the isolator prior to use points to peracetic acid as a greater cause of oxidation than hot water.

Visual and olfactory evaluations of the experimental and control samples showed the experimental procedure bleaching the samples slightly and causing the samples to take on a slightly sour odor, similar to that of a sterilized isolator. Otherwise, the experimental samples appeared normal and showed no signs of spoilage. The control samples were normal in color (pink) and odor at the beginning of the experiment. As the storage period progressed these samples began to darken in color, showing more and more signs of spoilage with mold and slime increasing. A very objectionable sour odor developed toward the end of the storage period.

The usefulness of undenatured tissue with a low bacterial count can be classified into three categories. First, it furnishes the meat scientist with a new research tool that will allow separation of deterioration of stored tissue into that caused by bacteria and that resulting from other reactions. Secondly, this research outlines a new procedure for obtaining meat samples with a reduced viable bacterial load. This approach may be slightly involved at the present time for commercial use but it is currently the most economic way of producing low bacterial—undenatured muscle tissue. Last, but not least, it demonstrates to processors that most of the contamination problems they encounter in meat processing result from surface contamination of the carcass introduced by men and equipment.

REFERENCES

1. American Public Health Association, Inc. 1958. Recommended Methods for the Microbiological Examination of Foods. American Public Health Association, Inc., New York, N. Y., pp. 110-119.

2. Galton, M. M., W. V. Smith, H. B. McElrath, and A. V. Hardy. 1954. Salmonella in swine and cattle and the environment of abattoirs J. Infec. Dis. 95:236-245.

3. Keskinel, A., J. C. Ayres, and H. E. Snyder. 1964. Determination of oxidative changes in raw meats by the 2-thio-barbituric acid method. Food Technol. 18:101-104.

4. Niven, C. F., Jr. 1957. A perspective of the sanitation problems in the meat industry. American Meat Institute Foundation, Circular No. 39, pp. 1-9.

5. Ockerman, H. W., V. R. Cahill, K. E. Davis, and C. E. Davis. 1964. Tissue storage without contaminants J. Animal Sci. 23:142-146.

6. Ross, A. I. 1958. Hygienic preparation of meat products. Food Manufacture 33:273-278.

7. Sanborn, W. R. 1963. The relation of surface contamination to the transmission of disease. Am. J. Public Health 53:1278-1283.

8. Sharp, J. G. 1963. Aseptic autolysis in rabbit and bovine muscle during storage at 37°. J. Sci. Food Agr. 14:468-479.

9. Tarladgis, B. G., B. M. Watts, and M. T. Younathan. 1960. A distillation method for the quantitative determination of malonaldehyde in rancid foods. J. Am. Oil Chem. Soc. 37:44-48.

10. Warnecke, M. O., H. W. Ockerman, H. H. Weiser, and V. R. Cahill. 1966. Quality of processed comminuted meat as affected by microbial flora of the raw constituents. Food Technol. 20:118-120.

11. Weidemann, J. F. 1960. The chemical disinfection of the hides of cattle. Research Report No. 26, Meat Research Laboratory, CSIRO, Queensland, Australia, pp. 1-16.

12. Zender, R., C. Lataste-Dorolle, R. A. Collet, P. Rowinski, and R. F. Mouton. 1958. Aseptic autolysis of muscle: Biochemical and microscopic modifications occurring in rabbit and lamb muscle during aseptic and anaerobic storage. Food Res. 23:305-326.

VPI DAIRYMAN'S SHORT COURSE

The Annual VPI Dairymen's Short Course is scheduled for December 2-4, 1968, at Blacksburg, Virginia. It will be held in the Donaldson Brown Center for Continuing Education.

The first day's program will deal with nutrition and feeding with up-to-date information on nutritional disorders, forages, silos, and economics of feeds and feed storage.

An "Information Feed-Bag" will be held Monday night to give dairymen an opportunity to quiz specialists on crop production; storage, harvesting and feed handling systems; metabolic disorders, mastitis and reproduction; and dairy farm business management.

Reproduction problems as related to nutrition and sub-fertile cows will be covered on Tuesday morning. Genetics and breeding systems and a tour of research projects under way is on schedule for the afternoon of December 3.

Large herd operation with problems, housing plans, diseases, and general operation of large herds will be discussed on Wednesday.

For more information and a copy of the program, write Dr. W. Ray Murley, Dairy Science Department, Virginia Polytechnic Institute, Blacksburg, Virginia.

DESIGN OF EYEPIECE RETICLES FOR USE IN THE DIRECT MICROSCOPIC SOMATIC CELL COUNT METHOD[1]

W. D. Schultze
Animal Husbandry Research Division, USDA, Beltsville, Maryland

(Received for publication July 19, 1968)

Abstract

Criteria have been developed for the design of eyepiece reticles to be employed in the Direct Microscopic Somatic Cell Count method. For each of several levels of somatic cell concentration in milk at which regulatory control might be exercised, we show the range of widths of the milk film strips required to maintain the desired precision of cell count. These widths are related to the actual distances between rulings on the eyepiece reticle for commonly used microscopes. The proper line spacing is determined for reticles to be used at each of certain cell count control levels, and the limitations on compatible microscope optical equipment are specified.

The Subcommittee on Screening Tests of the National Mastitis Council has specified that the Direct Microscopic Somatic Cell Count *(1)*, as used for programs of abnormal milk control, shall be performed on 2 mutually perpendicular strips observed on each of 2 duplicate milk films. Considerations of adequate cell count precision, as developed by another member of the Subcommittee *(2)* led to the conclusion that at the regulatory control limit the optimum number of cells to be counted is 100 per strip. The minimum acceptable is 80 cells per strip. To preclude unnecessary counting tedium a maximum of 120 cells per strip was chosen.

Microscope strip factor and strip width

The microscope strip factor (S.F.) is defined in the DMSCC method as that factor by which the number of cells counted in 1 strip is multiplied to calculate the concentration of cells per ml of milk sample. It is expressed by the equation:

$$\text{S.F.} = \frac{(100)\ (100)}{(11.28)\ (\text{strip width})}$$

Thus, the strip width in mm for a given microscope optical system may be calculated by dividing 10,000 by the product of S.F. and the length of the strip (11.28 mm). The values of acceptable strip widths determined for a number of possible cell count control levels are presented in Table 1. Also included in the table are the coefficient of variation (C.V.) for a 4-strip DMSCC over the range of strip widths and the actual volumes of milk observed in the course of a single strip count.

The developmental studies on the DMSCC were pursued by the Subcommittee members using an eyepiece reticle having 2 bands of different width ruled perpendicular to each other. The wide and narrow bands measure 7.848 mm and 2.616 mm, respectively, a ratio of 3:1. To meet the criteria cited above for optimal cell count precision and counting speed, new reticle specifications were required such that at a given control level the greatest possible number of microscopes might yield a strip width within the acceptable range. We agreed that for each regulatory control level a single eyepiece reticle would be specified.

Ocular micrometry and eyepiece design

An eyepiece reticle is placed in the optical train at a level coincident with the focal plane of the real image. It is this real image which is measured directly. The relation of the size of the real image to the size of the object on the microscope stage is expressed by the effective magnification. This relation can be determined experimentally by positioning a stage micrometer so that a certain marked distance on its surface is projected to coincide with the desired spacing on the eyepiece reticle. The effective magnification equals the quotient of actual reticle spacing divided by stage micrometer distance. In our use of an eyepiece reticle to define a strip of stained milk film, the stage micrometer value in mm which corresponds at a given objective magnification to the reticle spacing is the actual width of the strip.

The effective magnification is a function of the magnification of the objective lenses, and may also be influenced by the type of eyepiece used. When positive oculars are used in a compound microscope, the real image is formed below

---

[1]A contribution of the Subcommittee on Screening Tests, National Mastitis Council.

A. R. Brazis (Chairman), National Center for Urban and Industrial Health, Department of Health, Education, and Welfare, Cincinnati, Ohio 45226.

D. E. Jasper, School of Veterinary Medicine, University of California, Davis, California 95616.

D. Levowitz, New Jersey Dairy Laboratories, New Brunswick, New Jersey 08903 (deceased).

F. H. S. Newbould, Department of Veterinary Bacteriology, University of Guelph, Guelph, Ontario, Canada.

D. S. Postle, Department of Veterinary Science, University of Wisconsin, Madison, Wisconsin 53706.

W. D. Schultze, Animal Husbandry Research Division, ARS, U. S. Department of Agriculture, Beltsville, Maryland 20705.

J. W. Smith, Animal Husbandry Research Division, ARS, U. S. Department of Agriculture, Beltsville, Maryland 20705.

W. W. Ullmann, Laboratory Division, State Department of Health, Hartford, Connecticut 06115.

TABLE 1. RANGE OF VALUES FOR STRIP WIDTH WHICH YIELD ACCEPTABLE PRECISION AT VARIOUS CELL COUNT REGULATORY CONTROL LEVELS

Cell count control level	Cells counted per strip	C.V. for 4-strip count	Examined vol. of milk	Microscope strip factor	Strip width
(cells/ml)		(%)	(ml x 10^{-5})		(mm)
	80	7.07	5.333	18,750	0.0473
1,500,000	100	6.32	6.667	15,000	0.0591
	120	5.78	8.000	12,500	0.0709
	80	7.07	8.000	12,500	0.0709
1,000,000	100	6.32	10.000	10,000	0.0887
	120	5.78	12.000	8,333	0.1064
	80	7.07	10.667	9,375	0.0946
750,000	100	6.32	13.333	7,500	0.1182
	120	5.78	16.000	6,250	0.1418
	80	7.07	16.000	6,250	0.1418
500,000	100	6.32	20.000	5,000	0.1773
	120	5.78	23.998	4,167	0.2128

the eyepiece lens system. The reticle is positioned in the shell of the eyepiece from below (ruled surface up) against the diaphragm fixed at the focal point of the real image. The lenses of the eyepiece serve simply as a magnifier of this real image. Most, although not all, wide-field eyepieces are of the positive type.

The real image is formed within the lens train of negative eyepieces, below the eye lens but above the field lens. This latter lens effects some demagnification. Hence the effective magnification at the reticle is less than it would be if the eyepiece were positive. Huygenian eyepieces are of this negative type. After the eye lens has been removed from the shell, the reticle is inserted (ruled surface down) and allowed to rest on the diaphragm fixed at the focal plane of the real image.

Using the original reticle available to the Subcommittee, effective magnifications were determined for a number of microscopes of different age and manufacture. Test measurements of strip width as defined by the wide and narrow reticle bands, as well as the relationships calculated from these observations, are shown in Table 2. For a given microscope and eyepiece, the effective magnification expressed as a proportion of the objective magnification is a constant, which may be called the ocular factor.

$$\text{Ocular factor (O.F.)} = \frac{(\text{effective mag.})\ (100)}{(\text{objective mag.})}$$

The relation between the line spacing on an eyepiece reticle and the strip width can be characterized by the numerical mean value of the O.F. for the specified eyepiece as used in a given microscope. For such a system, the strip width can be determined from the reticle line spacing as follows:

$$\text{Strip width} = \frac{(\text{reticle line spacing})}{(\text{objective mag.})\ (\text{O.F.})}$$

This sampling indicates 3 categories of microscope eyepieces:

a) Huygenian negative eyepieces, for which the O.F. ranges from 67 to 80%

b) Wide-field eyepieces, for which the O.F. is in the neighborhood of 100%, and

c) Periplanatic wide-field eyepieces, which yield an O.F. on the order of 125%.

Any operable combination of microscope, objectives, and eyepiece can be characterized by a mean O.F., but substitution of any element can introduce variation. Thus, 2 new Bausch and Lomb Dynazoom microscopes, numbered respectively 5 and 6 in Table 2, yielded small but discernable differences in O.F. with the same pair of Huygenian eyepieces. The differences in O.F. calculated for systems no. 13 and 14, in which 2 pairs of 15 X wide-field eyepieces were compared in the same microscope, are also possibly significant. This is suggested by the fact that the ratios of strip widths at different magnifications rank the same for both wide and narrow reticle bands.

Calculation of O.F.'s is a simple way to detect a defective objective. When O.F.'s were determined for each objective used with 2 of the microscopes studied (systems no. 10 and 13-14), the values for the 45 or 47.5 X objective were far too divergent from those for the other objectives to be attributable to measurement error. Although in neither instance was the owner aware of any defect, we must conclude that these objectives do not perform as marked.

The Dynazoom feature on new Bausch and Lomb microscopes has potential advantages and possibly pitfalls for quantitative microscopy. Table 3 shows 4 sets of measurements made with the experimental reticle in 2 such microscopes. At each objective-eyepiece combination we made strip width measurements at intervals over the 1-2 X range of continuously variable magnification provided by the Dynazoom mechanism. It is apparent that this magnification is reflected directly in the size of the real image. Thus, the objective magnification is to be multiplied by the Dynazoom magnification, and it is the product of these which is acted upon by the eyepiece optics. The O.F. equals the effective magnification expressed as a percentage of this product. The Dynazoom feature enables close manual control of strip width. By the same token, it also permits the unwary to alter a previously determined strip width. Such maladjustment might well introduce a change in strip width so small that the resultant counting error would not be detectable on inspection.

PRACTICAL LIMITATIONS ON RETICLE BAND WIDTH

In Table 1 we show the range of optimum strip widths for a series of cell count control levels. Practical considerations, however limit the application of

TABLE 2. MAGNIFICATION RELATIONSHIPS IN SELECTED MICROSCOPE OPTICAL SYSTEMS

code	Microscope description	Eyepiece	Objective	Wide strip: strip width	Wide strip: effective mag.	Narrow strip: strip width	Narrow strip: effective mag.	Mean eyepiece mag.	Mean ocular factor
		(X)	(X)	(mm)	(X)	(mm)	(X)	(X)	(%)
1	A-O Microstar (#1)	10 H[a]	10	1.120	7.007	0.377	6.939	−3.027	
		"	45	0.254	30.898	0.084	31.143	−13.980	69.17
		"	100	0.114	68.842	0.038	68.842	−31.158	
2	A-O Microstar (#2)	7.5 H[b]	10	1.160	6.766	0.389	6.725	−3.255	
		"	20	0.578	13.578	0.192	13.625	−6.349	67.24
		"	45	0.263	29.840	0.088	29.727	−15.217	
		"	100	0.117	67.077	0.039	67.077	−32.923	
3	B&L binocular (#1)	10 H	10	0.997	7.872	0.334	7.832	−2.148	
		"	43	0.233	33.682	0.077	33.974	−9.172	79.37
		"	97	0.101	77.703	0.033	79.273	−18.512	
4	B&L binocular (#2)	10 H	10	1.110	7.070	0.3725	7.023	−2.954	
		"	45	0.255	30.776	0.085	30.776	−14.224	70.12
		"	93	0.1175	66.791	0.0395	66.228	−26.491	
5	B&L binocular (Model PB252 new)	10 H[d]	10[c]	1.135	6.915	0.381	6.866	−3.110	
		"	40[c]	0.284	27.634	0.094	27.830	−12.268	70.14
		"	100[c]	0.1095	71.671	0.036	72.667	−27.831	
6	B&L binocular (Model BB132 new)	10 H[d]	10[e]	1.167	6.725	0.388	6.742	−3.266	
		"	43[e]	0.2665	29.448	0.089	29.393	−13.579	68.11
		"	97[e]	0.1175	66.791	0.0395	66.228	−30.490	
7	Reichert (#1)	10 H	10	1.105	7.102	0.368	7.109	−2.895	
		"	40	0.289	27.156	0.0975	26.831	−13.007	69.44
		"	63	0.177	44.339	0.060	43.600	−19.031	
8	Reichert (#2)	10 H	63	0.192	40.875	0.060	43.600	−20.763	68.75
		"	100	0.115	68.243	0.036	72.667	−29.545	
9	A-O Microstar (#3)	15 WF[f]	10	0.7875	9.966	0.262	9.985	−0.025	
		"	43	0.186	42.194	0.0615	42.537	−0.635	99.43
		"	97	0.081	96.889	0.027	96.889	−0.111	
10	A-O Microstar (#4)	10 WF	10	0.800	9.810	0.270	9.689	−0.251	
		"	45[g]	0.142	55.268	0.050	52.320	+8.794	96.95
		"	100	0.079	99.342	0.028	93.429	−0.615	
11	A-O Microstar (#2)	10 WF[b]	10	0.768	10.219	0.257	10.179	+0.199	
		"	20	0.382	20.545	0.1275	20.518	+0.532	101.49
		"	45	0.1735	45.233	0.058	45.103	+0.168	
		"	100	0.0775	101.265	0.026	100.615	+0.940	
12	A-O Microstar (#2)	12.5 WF[b]	10	0.780	10.062	0.260	10.062	+0.062	
		"	20	0.387	20.279	0.128	20.438	+0.359	100.26
		"	45	0.1755	44.718	0.059	44.339	−0.472	
		"	100	0.078	100.615	0.0265	98.717	−0.668	
13	B&L binocular (#3)	15 WF	10	0.805	9.749	0.266	9.835	−0.208	
		"	20	0.400	19.620	0.134	19.522	−0.429	98.35
		"	47.5[g]	0.281	27.929	0.094	27.830	−19.620	
		"	97	0.082	95.707	0.027	96.889	−0.702	
14	B&L binocular (#3)	15 WF[h]	10	0.8125	9.659	0.271	9.653	−0.344	
		"	20	0.406	19.330	0.1375	19.025	−0.822	97.24
		"	47.5[g]	0.282	27.830	0.0945	27.683	−19.743	
		"	97	0.082	95.707	0.027	96.889	−0.702	
15	B&L binocular (Model PB252 new)	10 WF[i]	10[c]	0.770	10.192	0.258	10.140	+0.166	
		"	40[c]	0.1945	40.350	0.0645	40.558	+0.454	102.84
		"	100[c]	0.075	104.640	0.0245	106.776	+5.708	

16	B&L binocular	10 WF[j]	10[d]	0.798	9.835	0.266	9.835	−0.165	
	(Model BB132 new)	"	43[d]	0.184	42.652	0.060	43.600	+0.126	99.41
		"	97[d]	0.0815	96.294	0.027	96.889	−0.408	
17	Leitz Ortholux	10 Pk	10	0.621	12.638	0.2075	12.607	+2.623	
	(#1)	"	25	0.253	31.020	0.084	31.143	+6.082	124.31
		"	40	0.158	49.671	0.0545	48.000	+8.836	
		"	100	0.063	124.571	0.021	124.571	+24.571	
18	Leitz Ortholux	10 P	10	0.620	12.658	0.208	12.577	+2.618	
	(#2)	"	40	0.155	50.632	0.052	50.308	+10.470	125.64
		"	100	0.063	124.571	0.021	124.571	+24.571	

[a]"H" designates Huygenian eyepieces
[b]B&L eyepieces used in this microscope
[c]Flat-field Achromatic objectives used
[d]Dynazoom set at 1.0 X
[e]Standard Achromatic objectives used
[f]"WF" designates wide-field eyepieces
[g]Objective assumed to be defective; measurements excluded fr om calculation of mean O.F.
[h]A different set of 15 X WF eyepieces substituted in same mi croscope as immediately above
[i]B&L 10 X WF eyepieces marked "No. 22" — for use with fla t-field objectives
[j]B&L 10 X WF eyepieces marked "LAB" — for use with stand ard Achromatic objectives
[k]"P" designates Periplanatic wide-field eyepieces

TABLE 3. MAGNIFICATION RELATIONSHIPS IN 2 DYNAZOOM MICROSCOPES

Microscope and eyepiece	Dynazoom setting	Objective	Wide strip		Narrow strip		Mean eyepiece mag.	Mean ocular factor
			strip width	effect-ive mag.	strip width	effect-ive mag.		
	(X)	(X)	(mm)	(X)	(mm)	(X)	(X)	(%)
B&L Mod. PB252	1.0	40	0.1945	40.350			+0.350	
(10X WF #22)[a]	1.2	"	0.162	48.444			+0.444	
	1.4	"	0.1385	56.664			+0.664	101.05
	1.6	"	0.1205	65.129			+1.129	
	1.8	"	0.108	72.667			+0.667	
	2.0	"	0.0975	80.492			+0.492	
B&L Mod. BBi32	1.0	97	0.0815	96.294	0.027	96.889	−0.408	
(10X WF LAB)[b]	1.2	"	0.0665	118.015	0.0225	116.267	+0.741	
	1.4	"	0.0570	137.684	0.0195	134.154	+0.119	
	1.6	"	0.0505	155.406	0.0170	153.882	−0.556	99.76
	1.8	"	0.0450	174.400	0.015	174.400	−0.200	
	2.0	"	0.0400	196.200	0.014	186.857	−2.471	
B&L Mod. BB132	1.0	10	1.167	6.725	0.388	6.742	−3.266	
(10X H)[c]	1.2	"	0.968	8.107	0.322	8.124	−3.884	
	1.4	"	0.824	9.524	0.274	9.547	−4.464	
	1.6	"	0.722	10.870	0.241	10.855	−5.137	67.77
	1.8	"	0.642	12.224	0.215	12.167	−5.804	
	2.0	"	0.5775	13.590	0.193	13.554	−6.428	
B&L Mod. BB132	1.0	97	0.1175	66.791	0.0395	66.228	−30.490	
(10X H)	1.2	"	0.0985	79.675	0.033	79.273	−36.926	
	1.4	"	0.083	94.554	0.028	93.429	−41.808	
	1.6	"	0.073	107.507	0.0245	106.776	−48.058	68.76
	1.8	"	0.065	120.738	0.022	118.909	−54.776	
	2.0	"	0.059	133.017	0.0195	134.154	−60.414	

[a]These eyepieces designed for use with the flat-field objective s of Model PB252
[b]These eyepieces designed for use with the standard Achroma tic objectives of Model BB132
[c]These Huygenian eyepieces designed for use with both type s of objective

TABLE 4. RANGE OF RETICLE LINE SPACINGS YIELDING APPROPRIATE STRIP WIDTHS AT 3 CELL COUNT CONTROL LEVELS

Microscope[a]	Objective	1,500,000/ml control level			1,000,000/ml control level			750,000/ml control level		
		min.	opt.	max.	min.	opt.	max.	min.	opt.	max.
	(X)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)
Huygenian eyepieces										
1	100	3.2717	4.0879	4.9042	4.9042	6.1354	7.3547	6.5435	8.1759	9.8083
2	100	3.1805	3.9739	4.7673	4.7673	5.9642	7.1543	6.3609	7.9478	9.5346
3	97	3.6416	4.5501	5.4586	5.4586	6.8290	8.1917	7.2833	9.1002	10.9172
4	93	3.0844	3.8539	4.6234	4.6234	5.7841	6.9383	6.1689	7.7078	9.2468
5	100	3.3176	4.1453	4.9729	4.9729	6.2214	7.4629	6.6352	8.2905	9.9459
6	97	3.1251	3.9047	4.6844	4.6844	5.8604	7.0298	6.2502	7.8095	9.3687
8	100	3.2519	4.0631	4.8744	4.8744	6.0981	7.3150	6.5038	8.1263	9.7488
Wide-field eyepieces										
9	97	4.5621	5.7002	6.8383	6.8383	8.5551	10.2623	9.1242	11.4004	13.6766
10	100	4.5857	5.7297	6.8738	6.8738	8.5995	10.3155	9.1715	11.4595	13.7475
11	100	4.8005	5.9981	7.1956	7.1956	9.0022	10.7985	9.6010	11.9961	14.3913
12	100	4.7423	5.9254	7.1084	7.1084	8.8931	10.6677	9.4846	11.8507	14.2169
13	97	4.5124	5.6381	6.7639	6.7639	8.4620	10.1506	9.0248	11.2763	13.5277
14	97	4.4613	5.5743	6.6873	6.6873	8.3662	10.0356	8.9227	11.1486	13.3746
15	100	4.8643	6.0778	7.2914	7.2914	9.1219	10.9422	9.7287	12.1557	14.5827
16	97	4.5611	5.6990	6.8369	6.8369	8.5533	10.2602	9.1223	11.3980	13.6738
Periplanatic wide-field eyepieces										
17	100	5.8799	7.3467	8.8136	8.8136	11.0263	13.2266	11.7597	14.6934	17.6272

[a]Coded to correspond to the microscope systems listed in Table 2

these specifications to reticle design. The maximum strip width must still be less than the minimum field of view produced in the optical system. We accepted for this limit a value of 0.15 mm, the diameter of the visual field given by the usual Huygenian 10 X eyepiece when used in combination with a 93-100 X objective.

A further restriction stems from the need to see the reticle ruling as a chord of finite length within the visual field. The relation of the chord length "l" to the radius "r" and to the rise "h" of the arc subtended by chord "l" is as follows:

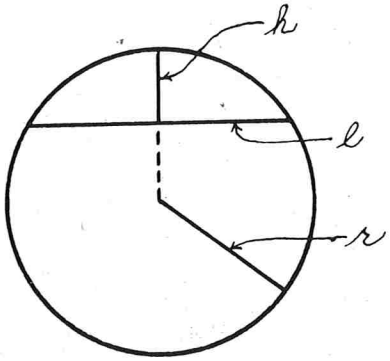


Figure 1. The visual field with "l" as the chord length, "r" as the radius, and "h" as the rise of the arc.

$$l = 2\sqrt{r^2 - (r-h)^2}$$

The strip width is thus equal to 2(r–h). A reasonable minimum chord length would seem to be equal to the radius of the visual field, considering the requirement that an object at the strip boundary be in the visual field long enough to insure its recognition as the milk film is traversed. Setting "r" at 0.075 mm, the maximum acceptable strip width is 0.1299 mm.

The minimum and maximum reticle line spacings which would yield appropriate strip widths have been calculated for certain microscope optical systems at several regulatory levels of cell concentration. These are shown in Table 4. At any level of cell concentration, the maximum reticle line spacing permitted for Huygenian eyepieces is less than the minimum required for many wide-field eyepieces. Thus, our accepted criteria for a single reticle to be used in the DMSCC method at each specified cell concentration limit cannot be met without specifying also the type of the microscope eyepiece. We present data describing reticles for use with Huygenian eyepieces of either 7.5 X or 10 X magnification on the assumption that this is the more common type of equipment.

RECOMMENDED UNIFORM RETICLE SPECIFICATIONS

Inspection of the optimum line spacings shown in Table 4 indicates that reticles ruled as stated below will provide close to the optimum strip width for all types of microscope studied, except the Leitz Ortholux, when the highest power oil-immersion objective is used in combination with 7.5 X or 10 X Huygen-

ian eyepieces:

Control level (cells/ml)	Reticle band width (mm)
1,500,000	4.000
1,000,000	6.000
750,000	8.000

The possibility of future interest in a regulatory control level of 500,000 per ml has been considered, as indicated by its inclusion in Table 1. Design considerations as discussed above, however, prescribe a maximum strip width of 0.1299 mm, which is below the minimum required to include 80 cells in an average strip at this low cell concentration. The problem might be resolved by counting fewer cells and accepting considerable loss in count precision, or by increasing the number of strips to be counted.

In response to the charge given the Subcommittee on Screening Tests by the National Mastitis Council, this discussion has focused on the use of the DMSCC in laboratories participating in an abnormal milk control program. The basic procedures of counting somatic cells in stained milk films by scanning strips of defined area and of controling the precision of all cell counts through adherence to a valid statistical model are equally appropriate to other control and research applications. Information contained in this and accompanying publications *(1, 2)* points the way to a rapid single-strip screening procedure or to a high-precision cell count. Through the use of a combination of variable numbers of milk film strips and several reticle band widths, a method of counting to relatively constant precision over a wide range of cell concentrations could be designed.

REFERENCES

1. National Mastitis Council, Subcommittee on Screening Tests. 1968. Direct Microscopic Somatic Cell Count in milk. J. Milk Food Technol. 31:350-354.

2. Smith, J. W. Development and evaluation of the Direct Microscopic Somatic Cell Count (DMSCC) in milk. J. Milk Food Technol. *In press.*

PESTICIDE RESIDUES NO CAUSE FOR ALARM[1]

Less than a quarter century has elapsed since DDT began the parade of synthetic chemical pesticides. Few would deny today the benefits, both actual and potential, from their worldwide use. Pesticides have shared in providing more abundant food and fibre for man by increasing crop yields and preventing spoilage and waste. By attacking insect vectors of human disease (malaria being an outstanding example) pesticides have contributed to health and survival.

Despite these advantages to the economy and to human health and nutrition, pesticides are still regarded with suspicion by the public generally and by ecologists specifically. Anxiety reached its height following the publication of Rachel Carson's "Silent Spring" in 1962. Comprehensive studies and investigations undertaken at the request of the President and Congress resulted in the establishment of a Federal Committee on Pest Control. Its recommendations are designed to alleviate public concern and to establish controls for preventing or minimizing hazards to health from pesticides whose use is regulated after approval for safety and efficacy. Among the objectives of the government sponsored program is a broad, continuing survey of food and feed crops for residue levels.

The results of this monitoring program for the period July 1, 1963 to June 30, 1967 have been published jointly by the Department of Agriculture and the Food and Drug Administration in a monograph entitled "The Regulation of Pesticides in the United States" and, in summary form in the June 1968 issue of the *Pesticides Monitoring Journal.*

Residue date are summarized for 11 categories of foods shipped in interstate commerce or imported into the United States. The same kinds and approximate amounts of residues were found in both domestic and imported products. The average levels of individual pesticide chemicals in the various food categories were substantially below U. S. tolerance limits. The report points out that these levels are further reduced after preparation of the foods for consumption, as repeatedly confirmed by "market basket" surveys based on high dietary consumption levels.

In the following table, excerpted from the summary report, average dietary intake is expressed in micrograms (millionths of a gram) per kilogram body weight per day:

	Dietary Intake	
	U.S.	*ADI*
Aldrin + Dieldrin	0.09	0.1
Carbaryl	0.9	20.
DDT + DDE + TDE	0.9	10.
Lindane	0.07	12.5
Heptachlor + Heptachlor Epoxide	0.03	0.5
Malathion	0.1	20.

Acceptable Daily Intake (ADI) levels were conservatively estimated by FAO/WHO to insure large margins of safety. Except in the case of aldrin and dieldrin, for which U. S. tolerances have recently been lowered, the levels of dietary intake of pesticide residues are so low as to allay any fear of hazard to public health from chemical pesticides as normally used.

---

[1]Reprinted from Food and Drug Research.

DIRECT MICROSCOPIC SOMATIC CELL COUNT IN MILK

SUBCOMMITTEE ON SCREENING TESTS
NATIONAL MASTITIS COUNCIL[1]

(Received for publication July 19, 1968)

ABSTRACT

The Direct Microscopic Somatic Cell Count is a modification of the Breed technique in which 0.01 ml of milk sample is spread over a circular 1 cm^2 area on a special slide, and is dried, stained, and examined microscopically using the oil-immersion lens. The unit of area examined is a diametric strip of the milk film, traversed by manipulation of the mechanical stage controls. A special eyepiece reticle defines the width of the strip. All nucleated somatic cells within the strip are counted. The estimate of cellular concentration in the milk sample is based on the count of two mutually perpendicular strips on each of duplicate films. The method permits both determination and close control of count precision.

This technique for conducting the Direct Microscopic Somatic Cell Count (DMSCC) is recommended for estimating the number of nucleated somatic cells in unprocessed milk, and has been developed and evaluated particularly for the range of cell numbers ordinarily encountered in regulatory control laboratories. It is subject to distinct limitations in precision which must be thoroughly understood by those using and interpreting cell count results.

I. COLLECTING SAMPLES

A. Care must be taken to insure that samples are representative of the whole quantity. Samples of farm bulk tank milk for use in milk quality control programs shall be collected in accordance with standard sampling procedures and shall be taken immediately after that period of tank agitation (usually 5 min) established as sufficient to insure homogeneous distribution of the milk fat. Can shipments shall be sampled from the weigh vat.

B. Sample containers shall be filled to more than 1/2 but less than 3/4 of their capacity.

II. STORING SAMPLES

A. Samples shall be cooled immediately to 0-5 C (32-40 F) and maintained at that temperature until film preparation. Samples must not be frozen.

B. If it is necessary to perform other quality tests on the samples, a well-mixed subsample (see III.A.1.) of approximately 10 ml shall first be transferred to a clean 15-20 ml container and be refrigerated as above until used for milk film preparation.

C. Milk films shall be prepared as soon as possible after collection. In milk quality control programs, milk films must be prepared within 24 hr of sample collection.

III. PREPARING MILK FILMS

A. *Mixing samples*

1. Remove samples from refrigerated storage and mix them by agitation. Agitation shall be equivalent to that attained by making 25 complete reciprocal movements of about one foot in 7 sec when using a rigid-wall sample container.
2. Allow the samples to stand a few min (2-5) after shaking to permit the foam to disperse. Immediately before making each film, gently invert the sample container at least 4 times to redisperse the cream layer and insure uniformity of the sample.

B. *Making milk films*

1. Facilities, apparatus, and equipment
   a. Well-lighted laboratory area which is reasonably free of dust and drafts and is equipped with a sturdy level surface for slide preparation.
   b. Pipettes or spring-actuated metal syringes[2] for transfer of 0.01 ml quantities. The syringes must be recalibrated periodically.

[1]A. R. Brazis (Chairman), National Center for Urban and Industrial Health, Department of Health, Education, and Welfare, Cincinnati, Ohio 45226

D. E. Jasper, School of Veterinary Medicine, University of California, Davis, California 95616

D. Levowitz, New Jersey Dairy Laboratories, New Brunswick, New Jersey 08903 (deceased)

F. H. S. Newbould, Department of Veterinary Bacteriology, University of Guelph, Guelph, Ontario, Canada

D. S. Postle, Department of Veterinary Science, University of Wisconsin, Madison, Wisconsin 53706

W. D. Schultze, Animal Husbandry Research Division, ARS, U. S. Department of Agriculture, Beltsville, Maryland 20705

J. W. Smith, Animal Husbandry Research Division, ARS, U. S. Department of Agriculture, Beltsville, Maryland 20705

W. W. Ullmann, Laboratory Division, State Department of Health, Hartford, Connecticut 06115

c. Glass slides with clear, circular areas of 1 cm^2 (diameter approximately 11.28 mm) outlined on the upper surface by permanent marking[3]. Slides may be cleaned for repeated use.
d. Needles equivalent to No. 30 gauge wire for spreading the milk.
e. Drying surface which is draft-free, clean, insect-free and levelled. This surface may be warmed to a maximum of 45 C to dry the milk films within 5 min.

2. Procedure

Place the silde on the drying surface and transfer the milk sample as described in a. or b. below.

a. Using 0.01 ml syringe: Before use and between successive samples, rinse measuring tube in clean tepid water by dipping tip slightly beneath surface and repeatedly drawing in and expelling water. Before transferring test portions to slide, dip tip of tube not more than 1 cm beneath surface of milk and repeatedly rinse tube by drawing in and expelling portions. Holding tip beneath surface, release plunger fully and withdraw test portion. With clean paper tissue or cloth remove excess milk from exterior of tip. Holding instrument at about a 45° angle, place tip near center of area for the film and expel the 0.01 ml test portion. Do not release plunger until after removal of tip from the slide and retouching once to a dry area within the circle. Promptly spread sample over the marked area with the point of a clean needle, held vertically. Rinse needle between samples and dry with clean tissue or towel. Do not flame the needle.

b. Using 0.01 ml pipette: Before use and between samples, rinse graduated portion of pipette in clean tepid water by dipping tip slightly beneath surface and repeatedly drawing in and expelling water. Before measuring test portion, rinse traces of residual water from bore in sample from which test portion is to be removed. Withdraw portion of well-mixed sample slightly above graduation mark. Take precautions that saliva does not get into pipette to contaminate milk sample. Wipe exterior of pipette with clean, dry paper tissue or towel and, by absorbing liquid at tip, adjust length of column to graduation mark. Place tip near center of area to be covered and expel 0.01 ml test portion. Maintaining slight positive air pressure, retouch tip of pipette once to a dry area within the circle. Promptly spread sample over the marked area with the point of a clean needle, held vertically. Rinse needle between samples and dry with clean tissue or towel. Do not flame the needle.

3. Two films shall be prepared from each milk sample.

C. *Staining milk films*

Milk films shall be stained by the Levowitz-Weber modification[4] of the Newman-Lampert stain. (Also described in the 12th edition of *Standard Methods for the Examination of Dairy Products*, pp. 123-124.)

IV. Calibrating microscopes

Milk films shall be examined with an oil-immersion objective. In this procedure, all somatic cells observed in one or more defined strips across a full diameter of the film are counted. A reticle with parallel lines is inserted into an eyepiece of the microscope. The parallel lines define visible strip boundaries in the microscope field. Only those cells observed within these boundaries shall be counted. Equipment and procedures are specified as follows.

A. *Microscope*

Somatic cell counts shall be made with a compound microscope having an oil-immersion objective of 93-100 X magnification and 10 X eyepiece(s). (Note: Huygenian and wide-field eyepieces yield different working factors. In an accompanying publication[5] reticle design specifications applicable to Huygenian eyepieces are given.) On some binocular microscopes, changes in the interpupillary distance will cause measurable change in the diameter of the visual field.

---

[2]Available from Applied Research Institute, 2 E 23rd Street, New York, N. Y. 10010

[3]Manufactured for the Subcommittee by Bellco Glass, Inc., Vineland, N. J. 08360, and available as Special Slide S-58.

[4]Levowitz, D., and M. Weber. 1956. An effective "single solution" stain. J. Milk Food Technol. 19:121.

[5]Schultze, W. D. The design of eyepiece reticles for use in the Direct Microscopic Somatic Cell Count method. J. Milk Food Technol. 31:344-349.

TABLE 1. RANGE OF VALUES FOR STRIP WIDTH WHICH YIELD ACCEPTABLE PRECISION AT VARIOUS REGULATORY CONTROL LEVELS

Regulatory control level	Cells counted per strip	Microscope strip factor	Strip width
(DMSCC)			(mm)
1,500,000	80	18,750	.0473
	100	15,000	.0591
	120	12,500	.0709
1,000,000	80	12,500	.0709
	100	10,000	.0887
	120	8,333	.1064
750,000	80	9,375	.0946
	100	7,500	.1182
	120	6,250	.1418
500,000	80	6,250	.1418
	100	5,000	.1773
	120	4,167	.2128

B. *Eyepiece reticle*

The eyepiece reticle[6] of special design must be used to define parallel boundaries in the microscope field. The reticle is ruled with 2 parallel lines, the distance between the lines being dictated by the level of cell concentration to be used for regulatory purposes. For any given control level, a count of 80 cells per strip is considered the minimum required for adequate precision. A count in excess of 120 cells per strip entails more labor than is justified for the small increase in precision. A count of 100 cells per strip provides an optimum balance of speed and precision. Reticles designated for use at a given regulatory control level have been designed to define a strip width within the appropriate range when used in combination with the above-specified optical system as supplied with commonly used microscopes. Microscope factors and strip widths appropriate to various control levels are shown in Table 1. The reticle is positioned in one of the eyepieces so as to be in sharp focus. Retaining rings and collars[7] may be needed.

C. *Determining working factors*

1. In the DMSCC method, the unit of area to be examined and related to 1 ml of milk sample is a strip of the milk film. Its width is the apparent distance between the parallel lines ruled on the eyepiece reticle and its length is the diameter of the film (approximately 11.28 mm). (Note: It is essential that the strip to be counted pass through the center of the milk film since deviation from the diameter of the film will result in the examination of a smaller proportion of the milk film.)
2. Determine the apparent width of the strip between the parallel reticle rulings by placing on the stage of the microscope a micrometer slide ruled in 0.1 and 0.01 mm. Using the oil-immersion objective, focus on the fine-ruled scale of the micrometer slide. Align the pair of reticle rulings on the scale and measure the distance between them, estimating the third decimal. For use in regulatory programs, the value obtained should fall within the limits shown in Table 1 for the desired cell count control level.
3. Determine the strip area by multiplying the length by the width. Divide the area of the milk film (100 mm^2) by the strip area in mm to get the number of such areas contained in the milk film. Since the film was made from 0.01 ml of milk, the value must finally be multiplied by 100. The number obtained is the Strip Factor (S.F.) by which the number of cells counted in one strip may be converted to the number of cells per ml of milk sample. It is expressed by the equation:

$$\text{S.F.} = \frac{100 \times 100}{11.28 \times \text{strip width in mm}}$$

4. The Strip Factor must be determined for each microscope and reticle combination.
5. The Working Factor (W.F.) equals S.F. divided by the number of strips in which cells have been counted.
6. The estimated number of cells per ml of sample equals the number of cells counted multiplied by the W.F.

V. EXAMINING MILK FILMS

A. *Locating and scanning strips*

1. The horizontal and the vertical diameters of a circular milk film are scanned using a mechanical stage. They can be located with sufficient accuracy by eye. To locate the horizontal diameter, focus on the film edge in the oil-immersion field and follow it to that position at which visual judgement indicates that it is at the maximum of its horizontal excursion. Turn the eyepiece so that

[6]Manufactured for the Subcommittee by American Optical Company, Instrument Division, Buffalo, New York 14215.

[7]Obtainable from Edmund Scientific Company, Barrington, New Jersey 08007, under their catalog number P-40-141.

TABLE 2. EXPECTED 95% CONFIDENCE LIMITS FOR MEAN STRIP COUNTS. (VALID WHEN THE VARIANCE OF THE MEAN STRIP COUNT EQUALS 0.4 TIMES THE MEAN)

Mean count per strip	Standard error	95% confidence range	
		low	high
80	5.66	68.91	91.09
81	5.69	69.85	92.15
82	5.73	70.77	93.23
83	5.76	71.71	94.29
84	5.80	72.63	95.37
85	5.83	73.57	96.43
86	5.86	74.52	97.48
87	5.90	75.44	98.56
88	5.93	76.38	99.62
89	5.97	77.30	100.70
90	6.00	78.24	101.76
91	6.03	79.18	102.82
92	6.07	80.10	103.90
93	6.10	81.04	104.96
94	6.13	81.99	106.01
95	6.16	82.93	107.07
96	6.20	83.85	108.15
97	6.23	84.79	109.21
98	6.26	85.73	110.27
99	6.29	86.67	111.33
100	6.32	87.61	112.39
101	6.36	88.54	113.46
102	6.39	89.48	114.52
103	6.42	90.42	115.58
104	6.45	91.36	116.64
105	6.48	92.30	117.70
106	6.51	93.24	118.76
107	6.54	94.18	119.82
108	6.57	95.12	120.88
109	6.60	96.06	121.94
110	6.63	97.01	122.99
111	6.66	97.95	124.05
112	6.69	98.89	125.11
113	6.72	99.83	126.17
114	6.75	100.77	127.23
115	6.78	101.71	128.29
116	6.81	102.65	129.35
117	6.84	103.59	130.41
118	6.87	104.53	131.47
119	6.90	105.48	132.52
120	6.93	106.42	133.58
121	6.96	107.36	134.64
122	6.99	108.30	135.70
123	7.01	109.26	136.74
124	7.04	110.20	137.80
125	7.07	111.14	138.86
126	7.10	112.08	139.92
127	7.13	113.03	140.97
128	7.16	113.97	142.03
129	7.18	114.93	143.07
130	7.21	115.87	144.13
131	7.24	116.81	145.19
132	7.27	117.75	146.25
133	7.29	118.71	147.29
134	7.32	119.65	148.35
135	7.35	120.59	149.41

the reticle rulings are oriented horizontally. Scan across the film and count the cells, turning only the knob which controls horizontal stage travel. To locate the vertical diameter, follow the milk film edge to either of the points of maximum vertical excursion. Rotate the eyepiece until the rulings are in vertical orientation; then scan and count up or down using the vertical stage control knob.

2. During the scanning of a strip it is necessary to make continual fine focusing adjustments.
3. All somatic cells observed from one edge of the film to the other and completely within the boundary lines shall be counted. In addition, all cells touching one boundary line shall be counted; those touching the other boundary must not be counted.

B. *Recognizing somatic cells*

1. The cytoplasmic portions of somatic cells may not always be distinguishable from the background. Nuclear material will normally be stained deep blue and sometimes will appear free from the parent cell.
2. In order to be counted, nuclear particles should be judged to contain more than 50% of the estimated original nuclear material. If in doubt as to whether a fragment represents the major part of a nucleus, do not count it.
3. Non-nucleated cells shall not be included in the count.

C. *Determining the number of strips to be counted*

1. For use of the DMSCC method in milk regulatory control programs, both the horizontal and vertical strips shall be counted on each of 2 milk films, except as noted below.
2. If the number of cells counted in the first strip exceeds twice the number per strip required to indicate a count per ml above the control level, do not count the vertical strip of the first film. Instead, count only the horizontal strip on the second film. The change from a 4 strip-count to a 2 strip-count will, of course, necessitate a doubling of the W.F.

D. *Determining the expected limits of count precision*

1. The 95% confidence limits for mean counts from 2 strips across the diameter of each of 2 milk films prepared from a single milk sample are given in Table 2. The computa-

tions are based on evaluation trials of the Subcommittee, which indicated an error variance of 1.3 times the mean strip count and a film component of variance of 0.15 times the mean. These values should be used as guides until a laboratory staff has gained sufficient experience with the method and a sufficient volume of data to evaluate its own performance. A table of confidence limits specifically applicable to that laboratory should then be constructed[8].

2. In control programs, for which the reliability of a cell count is of great concern, a mean strip count is to be interpreted as indicating with 95% reliability that the actual number of cells per strip equals or exceeds that number tabulated as the lower 95% confidence limit. For example, if the S.F. is 15,000 and the regulatory control limit is 1,500,000 per ml, this cellular concentration is indicated by a mean strip count of 100. However, it can be seen from Table 2 that this minimum number of cells per strip (actually 100.77) is indicated with 95% confidence only at a mean strip count of 114.

VI. USING THE DMSCC AS A SCREENING TEST

A modification of the DMSCC method which can be used as a rapid screening test will be described in a separate publication.

[8]Smith, J. W. Development and evaluation of the Direct Microscopic Somatic Cell Count (DMSCC) in milk. J. Milk Food Technol. *In press.*

DR. SAMUEL W. SIMMONS RECEIVES GORGAS AWARD

Dr. Samuel W. Simmons, Chief of the Public Health Service's Atlanta-based Pesticides Program, received the 1968 Gorgas Award in Washington, D. C. The medal was presented by the Association of Military Surgeons of the United States for his "unique and outstanding contributions to the mission of public health in this country and throughout the world in the field of communicable disease control, particularly in the area of malaria eradication."

The work which earned Dr. Simmons the medal was accomplished while he was employed as a program director of the National Communicable Disease Center. During the 1940's he developed and directed one of the world's best known operational laboratories used for malaria control, NCDC's Technical Development Laboratories at Savannah, Georgia. Techniques developed largely under the direction of Dr. Simmons contributed to the eradication of malaria in the United States and are being used today to eradicate malaria in many other parts of the world.

Dr. Simmons left the Technical Development Laboratories to form a new branch of the Communicable Disease Center, one concerned with the human health hazards of pesticides, the control of insect and rodent carriers of disease, the initiation of city-wide communicable disease control demonstrations, and the environmental aspects of hospital infections, among many other disease control activities.

The Gorgas medal was established in memory of Major General W. C. Gorgas, whose work in preventive medicine made possible the construction of the Panama Canal. Members of the Federal medical services are eligible for this annual award which consists of a silver medal, a scroll, and an honorarium of $500. A representative of Wyeth Laboratories of Philadelphia made the award at the annual dinner of the AMS.

The Pesticides Program which Dr. Simmons currently heads was transferred from NCDC to the Food and Drug Administration on July 1 of this year, but his offices are still located at the Center, 1600 Clifton Road.

FOOD SCIENCE DAY

December 4, 1968, Food Science Day, Memorial Center, Purdue University, Lafayette, Indiana. For programs and registration forms contact: John Almon, Division of Conferences, Room 116 Memorial Center, Purdue University, Lafayette, Indiana 47906.

KENTUCKY DAIRY INDUSTRIES CONFERENCE

The 1968 Kentucky Dairy Industries Conference will be held December 4 at the Continental Inn, Lexington, Kentucky.

This year's general theme is, "Marketing: Key to Survival for the Dairy Industry."

Presentations will be given on controlled dairy outlets, effect of new products and processes on marketing, new advertising concepts for dairy products, package design and displays for optimum sales, and renovating the retail route.

For further information contact C. Bronson Lane, 104 Dairy Products Building, University of Kentucky, Lexington, Kentucky 40506.

3-A ACCEPTED PRACTICES FOR THE DESIGN, FABRICATION AND INSTALLATION OF MILKING AND MILK HANDLING EQUIPMENT

Formulated by

International Association of Milk, Food, and Environmental Sanitarians
United States Public Health Service
The Dairy Industry Committee

It is the purpose of the IAMFES, USPHS, and DIC in connection with the development of the 3-A Sanitary Standards program to allow and encourage full freedom for inventive genius or new developments. Milking and milk handling equipment heretofore or hereafter developed which so differ in design, material, fabrication, or otherwise as not to conform with the following practices, but which in the fabricator's opinion, are equivalent or better may be submitted for the joint consideration of IAMFES, USPHS, and DIC at anytime.

A.

SCOPE

These 3-A Accepted Practices shall pertain to equipment used in a milking system that begins with the equipment applied to the cow to extract milk and continues only to the container in which or from which the milk is removed from the dairy farm. In order to conform with these 3-A Accepted Practices, milking and milk handling equipment shall comply with the following design, material, fabrication and installation criteria.

B.

DEFINITIONS

B.1

Product Contact Surfaces: Shall mean all surfaces which are exposed to the product and surfaces from which liquids may drain, drop or be drawn into the product.

B.2

Non-Product Contact Surfaces: Shall mean all other exposed surfaces.

B.3

Air Hose: Hose that connects (1) a milking unit to a bucket or a vacuum line or (2) a bucket to a vacuum line.

B.4

Air Tube: The short air hose between the claw, or pulsator and the teat cup.

B.5

Claw: The sanitary manifold that spaces and connects the four teat cup assemblies into a milking unit.

B.6

Cup, Milk: A reservoir adjoining the claw between the milk tubes and the milk hose.

B.7

Milk Hose: A hose that connects the claw or milker to a bucket or a milk pipe.

B.8

Milk Inlet: A nipple on the milk pipe for attaching the milk hose.

B.9

Milk Pipe (line): The pipe which conveys the milk from the milking unit to the container from which the milk is removed from the farm.

B.10

Milk Tube: A tube that connects the liner to the milk nipple.

B.11

Milk Inlet Valve: An on-off valve incorporated in the milk inlet.

B.12

Nipple: Usually a short pipe projection from the claw, pulsator, milking machine lid or other part of the milking apparatus.

B.13

Receiver (milk): A device that receives milk from the milk pipe, and is the source of vacuum for the milk pipe.

B.14

Releaser: A device that releases milk from under vacuum and discharges it to atmospheric pressure.

B.15

Sanitary Trap: A flow vessel that separates the milk side of a milking machine system from the vacuum supply side to keep milk and fluids out of the vacuum system and to prevent back-flow of moisture.

B.16
Stall Cock: The valve device on the vacuum line to which the air hose is attached.

B.17
Vacuum Pipeline: The pipe which supplies the vacuum to the milking units.

B.18
Vacuum Pump: An air pump which produces vacuum in the system.
NOTE: Definitions commencing with B.3 are taken from the American Society of Agricultural Engineers "Terminology for Mechanical Milking Systems."

C.
MATERIALS

C.1
The materials of product contact surfaces of equipment included in the milking system for which there are 3-A Sanitary Standards or 3-A Accepted Practices shall comply with the material criteria of the applicable Standards or Accepted Practices.

C.2
All other product contact surfaces shall be stainless steel of the AISI 300 series[1] or the corresponding ACI[2] types (See APPENDIX, Section H.) or equally corrosion resistant metal that is non-toxic and non-absorbent, or heat resistant glass, except that:

C.2.1
Single service gaskets may be used except in joints in permanently installed pipelines.

C.2.2
Rubber and rubber-like materials may be used in sealing applications, milk hoses, milk tubes, air hoses, air tubes, filter parts, teat cup liners, milk pump diaphragms and level sensing devices (probes).
These materials shall comply with the applicable provisions of the "3-A Sanitary Standards for Multiple-Use Rubber and Rubber-Like Materials Used as Product Contact Surfaces in Dairy Equipment, Serial #1800."

C.2.3
Plastic materials may be used in sealing applications, transparent flexible tubing for transfer stations, milk hoses, milk tubes, air hoses, air tubes, sight and light openings, filter parts, teat cup liners, milk pump diaphragms, level sensing devices (probes), claws, milk cups, metering devices and releaser dumping chambers.
These materials shall comply with the applicable provisions of the "3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Serial #2000," as amended.

C.2.4
Brazing materials may be used in permanent joints in product contact surfaces. The braze material shall be copper free, non-toxic and corrosion resistant.

C.3
Materials used for lines, fittings and filter media for air that will be in contact with the product or product contact surfaces shall comply with applicable provisions of the "3-A Accepted Practices for Supplying Air Under Pressure In Contact With Milk, Milk Products and Product Contact Surfaces," effective July 26, 1964, as amended.

C.4
All non-product contact surfaces shall be of corrosion-resistant material or material that is rendered corrosion resistant. If coated, the coating used shall adhere. All non-product contact surfaces shall be relatively non-absorbent, durable and cleanable. Parts removable for cleaning having both product contact and non-product contact surfaces shall not be coated.

C.5
Vacuum lines shall be made of materials which will withstand cleaning and sanitizing solutions.

D.
FABRICATION—GENERAL

D.1
The fabrication criteria of equipment included in the milking system for which there are 3-A Sanitary Standards or 3-A Accepted Practices shall be those of the applicable Standards or Accepted Practices.

D.2
All other equipment shall conform to the following fabrication criteria.

D.2.1
All product contact surfaces shall be at least as smooth as a No. 4 mill finish on stainless steel sheets (See APPENDIX, Section I.)

D.2.2
Appurtenances having product contact surfaces shall be cleanable, either when in an assembled position or when disassembled and be so designed as to facilitate inspection. Removable parts shall be readily demountable.

D.2.3
All internal angles of 135° or less on product contact surfaces shall have minimum radii of 1/4 inch

---

[NOTE: Numbered footnote references are assembled on page 364.]

except where smaller radii are required for essential functional reasons, such as sealing ring grooves, claw assemblies, and milking machine lids. In no case shall such radii be less than 1/32 inch.

D.2.4
Non-product contact surfaces shall have a smooth finish, be free of pockets and crevices, and be readily cleanable. Surfaces to be coated shall be effectively prepared for coating.

D 2.5
Lids or covers shall be provided for carrying pails and transfer station receptacles. Lids on transfer station receptacles shall be self closing. All ungasketed lids shall have over-lapping edges turned down at least 3/8 inch below the top of the pail or receptacle. The lids or covers on carrying pails and transfer stations shall be pitched to an outside edge(s) so as to be free draining.

D.2.6
All sanitary pipelines and other appurtenances entering through the lid or cover, and not permanently attached to the cover, shall be fitted with a sanitary umbrella deflector that overlaps the edges of the opening through the cover and is located as close as possible to the cover.

D.2.7
All permanent joints in product contact surfaces shall be welded or may be brazed if welding is not feasible.

D.2.8
Solder shall not be used as a bonding medium but may be used for fillets on non-product contact surfaces.

D.2.9
The bottom of all product containers (tanks, receivers, etc.) which have a sanitary connection outlet shall have at least a 1/4 inch per foot pitch to the outlet.

D.2.10
All product contact surfaces except those designed to be cleaned-in-place (C-I-P), shall be easily accessible, visible, and readily cleanable, either when in an assembled position or when removed. Removable parts shall be readily demountable.

D.2.11
All sanitary pipe fittings and connections shall conform to 3-A "Sanitary Standards for Fittings Used on Milk and Milk Products Equipment and Used on Sanitary Lines Conducting Milk and Milk Products," Serial #0800 as amended and Supplements thereto, and/or if intended for C-I-P, conforming to the "3-A Accepted Practices for Permanently Installed Sanitary Product-Pipelines and Cleaning Systems," effective June 9, 1966, as amended.

D.2.12
Coil springs having product contact surfaces shall have at least 3/32 inch openings between coils, including the ends when the spring is in the free position.

D.2.13
Handles and brackets shall be permanently attached to the equipment.

D.2.14
The product contact portion of the plastic or rubber or rubber-like material covering of a level sensing device of the probe type shall be bonded in such a manner that the bond is continuous and mechanically sound, and so that in the environment of its intended use the plastic or rubber or rubber-like material does not separate from the base metal.

E.
FABRICATION–SPECIFIC ITEMS
The following are requirements for specific items.

E.1
Milking machine pails
A tipping handle, located near the bottom, shall be provided on a floor type pail and a lid shall be provided for both floor and suspended type pails. Bails, handles, chimes and legs on both types of milking machine pails shall be considered non-product contact surfaces.

E.2
Milker Claws and Milk Cups

E.2.1
Nipples for the milk hoses and milk tubes shall be flush with the interior surface of the claw or milk cup.

E.2.2
The claw or milk cup shall be designed so that cleaning and sanitizing solutions will drain when the claw or milk cup is in the cleaning and sanitizing position.

E.3
Check Valves

E.3.1
A bucket type milking machine shall be provided with a check valve or other device that will prevent moisture or any contaminating substance from entering the milk from the vacuum system. A check valve or other device that will pass the text in APPENDIX K is considered to meet this provision.

E.3.2
The moveable portion of the check valve shall be

of one piece construction or the parts shall be bonded together.

E.4

Transfer Stations

E.4.1

The transparent plastic tubing used in conjunction with a transfer station shall be one continuous piece. Equipment for air drying the tubing shall be provided. The air drying equipment shall comply with the applicable provisions of the "3-A Accepted Practices for Supplying Air Under Pressure in Contact with Milk, Milk Products and Product Contact Surfaces," effective July 26, 1964, as amended.

E.4.2

Pumps, if supplied, shall comply with "3-A Sanitary Standards for Pumps for Milk and Milk Products, Revised, Serial #0203," as amended.

E.4.3

The carriage shall be constructed of smooth corrosion resistant material. Tires shall be smooth and without treads.

E.5

Filters

E.5.1

Filters shall conform to "3-A Sanitary Standards for Milk and Milk Products Filters Using Disposable Filter Media," Serial #1000 as amended except that the product contact surfaces of the filter and its parts shall be of materials listed in C.2 herein and the finish of product contact surfaces shall conform to D.2.1 herein.

E.5.2

Wire mesh or woven material shall not be used for the filter medium support.

E.6

Permanently Installed Milk Pipes Under Vacuum

E.6.1

These milk pipes shall be installed in conformance to the applicable provisions of the "3-A Accepted Practices for Permanently Installed Product-Pipelines and Cleaning Systems," effective June 9, 1966, as amended.

E.6.2

Milk pipes shall be self draining and shall have a continuous slope from a high point. (See also APPENDIX L.2)

E.6.3

Milk pipes shall be installed so that the vertical distance from the platform on which the cow stands to the center of the line does not exceed 7 feet when milk is moved by vacuum directly from the milker unit assembly to the milk line. Note: Milk pipes should be kept as low as possible and where practical, milk hoses should not exceed 9 feet in length.

E.6.4

The following must be provided in a reverse flush (vacuum-gravity) system.

E.6.4.1

Means to easily disconnect the distal receptacle from the milk pipe during the milking period.

E.6.4.2

Facilities to pre-rinse the milk pipe at the distal end.

E.6.5

Milk inlets and milk inlet valves (where provided) shall be self draining into the milk pipe and installed so that milk enters the upper half of the milk pipe. All milk inlet valves shall be supplied with closures which are readily applied and are of sanitary design.

E.6.6

Openings in walls, solid partitions, etc., through which milk pipes pass shall have sleeves in the openings. Milk pipe couplings or unions shall not be located in the sleeves. Sleeves shall be large enough to allow the pipe to be freely removed. The area between the milk pipe and the sleeve shall be protected to prevent the entrance into the milkroom of flies and other insects.

E.7

Vacuum Pumps

The exhaust pipe shall not terminate in a milking barn, stable, parlor or milkroom.

E.8

Vacuum Regulators

E.8.1

During the milking cycle a regulator shall not admit air to the milk pipe of a pipeline milking system.

E.8.2

Air may be admitted to the milk pipe for purposes of "shut down" by valves or other acceptable means located in the milk room only. A valve for "shut down" purposes may not be installed in non-product contact lines unless a check valve is installed adjacent to the moisture trap and in such a manner that will permit air to travel only to the vacuum pump.

E.9

Vacuum Lines

E.9.1

Vacuum lines shall be supported in such a manner that the lines will not sag.

E.9.2
Vacuum lines shall be pitched at least 1/2 inch in 10 feet preferably in the direction of air flow.

E.9.3
An automatic drain valve or a self draining moisture trap shall be installed at the bottom of all risers.

E.9.4
Stall cocks shall enter the upper half of the line.

E.9.5
When the vacuum circuit is looped, a shut-off valve (preferably a gate valve or one not restricting flow) should be installed in the connecting loop.

E.9.6
In a pipeline milking system, a self draining moisture trap shall be provided whenever the milk pipe is connected to a vacuum line. The trap shall be installed adjacent to the milk receiver and connected by readily disassembled sanitary piping. The vertical rise of this connection shall not exceed 12 inches including the elbow. The connecting sanitary piping shall slope toward the trap at least 1/2 inch in the first 2 feet. The trap shall be installed so that any liquid collected in the trap cannot get back into the receiver.

E.10
Milk Receiver, Pump and Releaser

E.10.1
The receiver shall be designed so that the milk enters the upper half.

E.10.2
When a centrifugal or positive rotary type milk pump is used to remove the milk from the receiver, it shall conform to "3-A Sanitary Standards for Pumps for Milk and Milk Products, Revised, Serial #0203," as amended. The pump shall be located so that it is readily accessible for cleaning.

E.10.3
The pump shall be actuated by a level sensing device and if of the probe type, the probes shall be readily demountable for inspection and shall be located so that all of the product contact surfaces are reached by the rinse and wash solutions.

E.10.4
A releasing mechanism such as a diaphragm pump or releaser shall, when provided, be of a design that will prevent flooding of the receiver.

E.10.5
The pump and interconnecting piping shall be installed so that they are self draining and pitched to drain points.

F.
MANUFACTURERS INSTRUCTIONS
The manufacturer shall furnish instructional charts and literature to the purchasers of milking systems giving the maintenance schedules and operational instructions. This shall include the daily assembly and disassembly procedures of all components. It shall also include lubrication and maintenance schedules of vacuum pumps, milk pumps, pulsators and vacuum controllers.

G.
APPLICATION TO INSTALL PIPELINE SYSTEMS

G.1
Prior to the installation of an approved milking system, the installer shall first make application on a suitable form, as prescribed by the local control authority, or in the absence of a required form, on a form as suggested herein (FORM 1). The installer shall provide the control authority with two copies of the necessary details and flow diagrams. Approval of the application should be obtained prior to the starting of installation.

G.2
Changes in an existing system, affecting capacity or arrangement, shall be submitted to the local control authority.

APPENDIX

H.
STAINLESS STEEL MATERIALS
Stainless steel conforming to the applicable composition ranges established by AISI for wrought products, or by ACI for cast products, should be considered in compliance with the requirements of section C.2 herein. When welding is involved the carbon content of the stainless steel should not exceed 0.08%. The first reference cited in C.2 sets forth the chemical ranges and limits of acceptable stainless steels of the 300 series.
Cast grades of stainless steel equivalent to types 303, 304, and 316 are designated CF-16F, CF-8, and CF-8M, respectively. These cast grades are covered by ASTM[3] specifications A296 and A351.

I.
PRODUCT CONTACT SURFACE FINISH
Surface finish equivalent to 150 grit or better as obtained with silicon carbide, should be considered in compliance with the requirements of section D.2.1 herein.

J.
MILKER CLAWS AND MILK CUPS

J.1

Air entrance opening(s), if provided, shall be in the upper half of the claw or milk cup when it is in the milking position.

K.

PROCEDURES FOR TESTING CHECK VALVE PERFORMANCE

K.1

This procedure has been devised to test the performance of the checkvalve on bucket-type milking machines using a laboratory installation of the vacuum system. The only variations in the vacuum system used in this test (See Figure 1) from that used on dairy farms are: (a) a stall cock between the vacuum pump and the controller, as a means of controlling the vacuum, and (b) location of a vacuum gauge between the two stall cocks to which the units are attached during the test. The test should be conducted in the following manner using only the facilities outlined in the accompanying drawing:

K.1.1

Set up pump, controller, trap and stall cocks as indicated on Figure 1.

K.1.2

Assemble two clean, dry milking machine units.

K.1.3

Start the vacuum pump. Attach the air hoses to the stall cocks and apply vacuum to both units. Adjust the vacuum and pulsator speed to those recommended by the manufacturer.

K.1.4

Reduce the vacuum in the system by opening the vacuum controlling valve at the pump until the needle on the gauge just starts to drop (not to exceed 1/2 inch of Mercury) below the normal milking vacuum recommended by the manufacturer (See step K.1.3).

K.1.5

While the units are under vacuum, inject 5 ml. of water with a syringe into the air hoses of each unit, approximately 4 inches from the check valve.

K.1.6

Admit air through the teat cups to one of the units to produce a momentary 4-inch drop in vacuum (or the maximum drop permitted by the design of the machine), indicated on the vacuum gauge.

K.1.7

Close the stall cock to which the air hose of this unit is attached, remove the air hose, and release the vacuum in the pail in the normal manner. (The air hose must be maintained in a position favoring drainage toward the check-valve, as is the case when a unit is routinely moved from one stall cock to another.) The pail or container lid is not to be removed.

K.1.8

Immediately attach this unit again to the stall cock, open stall cock and re-establish the normal operating vacuum.

K.1.9

Follow steps K.1.6, K.1.7 and K.1.8 with the other unit.

K.1.10

Repeat steps K.1.5 to K.1.8 inclusive, alternately with the two units, five *additional* times (so that 30 ml. of water will have been injected into each air hose). Then release the vacuum and carefully remove and examine the lid, the check valve, and the interior of the pail of each unit, separately.

The presence of moisture on the underside of the check valve, on the under side of the lid, or in the pail or container, indicate failure of the check valve to function effectively in preventing backflow of potential contamination and indicates nonconformance to the requirements of E.3.1.

L.

MILK PIPE(LINE) RECOMMENDATIONS

L.1

The number of milking units that the milk pipe(line) in a pipeline system can handle satisfactorily depends largely upon the diameter of the milk pipe(line). The following table gives the recommended maximum number of milking units that should be used on various types of installations. On a double slope line, the number of units shown in the table is the number for each slope.

Type of Installation & Size of Line	Recommended Maximum Number of Units per Slope
Milking Parlor	
1-1/2" lin, single slope	4
1-1/2" line, double slope	4
2" line, single slope	8
2" line, double slope	8
Barn or Stable Installation	
1-1/2" line, single slope	5
1-1/2" line, double slope	5
2" line, single slope	10
2" line, double slope	10

The diameter of the milk pipe(line) if less than that given in the preceeding table should be demonstrated to be adequate by a vacuum graph. See APPENDIX R.

NOTE 1: When the number of units in use indicate a double slope line, a multiple inlet receiver is required.

NOTE 2: Weigh jars shall be exempt from these size of line provisions. Weigh jars should, how-

ever, be connected by means of separate sanitary lines, one to supply vacuum, the other to carry milk.

L.2

To prevent incorporation of air in the milk, there should be no risers in the milk pipe(line). (Any upward slope encountered by the milk moving toward the receiver is considered a riser. Vertical milk pipes which do not conduct milk are not risers.)

M.

VACUUM PUMP CAPACITIES–BUCKET MILKING SYSTEM

The capacity of the vacuum pump(s) used in bucket type milking systems should be at least as large as the larger of (1) that required in the table below for the given conditions or (2) that recommended by the milking machine manufacturer.

MINIMUM VACUUM PUMP CAPACITIES
CUBIC FEET OF AIR PER MINUTE (CFM) (VACUUM LEVEL 15 INCHES MERCURY)

	ASME Standard		New Zealand Standard	
Number of units	Long tube machines	Short tube machines	Long tube machines	Short tube machines
1	4	3	8	6
2	8	6	16	12
3	11	8	22	16
4	13	10	26	20
5	16	12	32	24
6	18	14	36	28

NOTE 1: For every 2 inches reduction in the operating vacuum level, 0.5 CFM per unit can be subtracted from the above table on the American Standard. (1 CFM on the New Zealand Standard).

NOTE 2: Long tube machines refer to claw type floor type units. Short tube machines are suspended units.

N.

VACUUM PUMP CAPACITIES–PIPELINE MILKING SYSTEM

N.1

The capacity of the vacuum pump(s) used in a pipeline milking system should be (1) large enough to operate all of the milking units and all accessory components simultaneously and have a 50% reserve or (2) should have a capacity at least as large as the recommendations of the milking machine manufacturer or (3) should be demonstrated to be of adequate capacity by a vacuum graph. See APPENDIX R.

N.2

The vacuum pump should be located near the milking barn, stable or parlor in a relatively clean, dry location.

N.3

The exhaust pipe should be at least as large as the exhaust connection of the pump and be as short as possible.

N.4

A method of determining the vacuum pump capacity required for a pipeline milking system is given below. The actual requirements of various components will vary with different manufacturers. Alternate methods may be employed for determining total requirements of given systems so long as the method gives comparable CFM values. All components consuming vacuum must be listed. Specify the vacuum level and CFM standard being utilized. (ASME or New Zealand).

EXAMPLES OF VACUUM REQUIREMENTS, PIPELINE MILKERS
(VACUUM LEVEL 15 INCHES MERCURY)

Component		Requirement ASME Standard		Requirement New Zealand Standard	
Milker unit		2.0	CFM	4.0	CFM
Releaser		4.5	CFM	9.0	CFM
Pulsated vacuum line, 3/8", per 10 feet of length		1.0	CFM	2.0	CFM
Vacuum bulk tank		0.0	CFM	0.0	CFM
Milk meter		1.0	CFM	2.0	CFM
Vacuum operated door opener		.75	CFM	1.5	CFM
Sanitary couplings, per 20		1.0	CFM	2.0	CFM
Sample Calculations					
4 milker units	=	8.0	CFM	16.0	CFM
1 releaser	=	4.5	CFM	9.0	CFM
40 couplings	=	2.0	CFM	4.0	CFM
4 milk meters	=	4.0	CFM	8.0	CFM
Total requirements	=	18.5	CFM	37.0	CFM
Reserve (50%)	=	9.25	CFM	18.5	CFM
Total pump capacity for this system	=	27.75	CFM	55.5	CFM

O.

VACUUM REGULATORS

O.1

The vacuum regulator(s) should have sufficient capacity to admit air equal to the full vacuum pump capacity at operating vacuum. The sensitivity of the regulator should be such that there will be not more than 1 inch of mercury fluctuation in vacuum under any operation condition.

O.2

The regulator should be installed close to the vacuum pump in the primary vacuum line in a place accessible for cleaning. Regulators located on horizontal primary vacuum pipe lines should admit air into the upper half of the line.

P.

VACUUM RESERVE TANK

P.1

A self draining vacuum reserve tank should be

provided and should be located close to the vacuum pump.

P.2
The inlet and outlet connections should be at least as large as the vacuum line.

Q.
VACUUM PIPE LINE

Q.1
The air hoses, air tubes, pipe and fittings used in vacuum pipe line installations should be capable of withstanding vacuums of 25 inches of mercury without collapsing.

Q.2
Flexible tubing may be used only in making end connections and head pipe linkages. The radii of tubing bends should be large enough to prevent kinking. The inside diameter of an adapter for connecting tubing should be at least as large as that of the main pipe.

Q.3
Adequate vacuum at the milking unit is essential. The minimum inside diameter of a vacuum line should be that of 1 inch sanitary tubing (approximately 0.902 inch). The minimum size of line should be that given in the table below or if smaller it shall be demonstrated to be adequate by a vacuum graph. See APPENDIX R. When four or more units are to be used and/or the length of the vacuum line exceeds 150 feet, the vacuum system should be looped to form a circuit or the header size increased. When vacuum lines are installed on more than one stall row in a stanchion type barn, the ends of the lines should be connected to form a loop.
The following table gives the recommended minimum size for main vacuum pipe lines:

Minimum Sizes for Main Supply Pipes of Pipeline Systems

Number of units	Pipe Size (IPS)
2 - 4	1-1/4 inches
5 - 7	1-1/2 inches
8 - 12	2 inches

The foregoing pipe sizes are based upon 50 feet of pipe at 5 CFM (A.S.M.E. Standard) per milking unit. When longer supply pipes or larger vacuum pumps are used in excess of the 5 CFM capacity per unit to accommodate such devices as master pulsators or vacuum operated door openers, larger pipe sizes or dual supplier pipes will be necessary. A one inch pipe for the main supply line is not recommended.

R.
MILKING VACUUM

R.1
The milk pipe(line) size recommendation (APPENDIX L.), the requirements of adequate vacuum pump capacity (APPENDIX N), and the minimum diameter of the vacuum pipe line (APPENDIX Q), should be deemed to have been met if milking vacuum fluctuation does not exceed that recommended by the milking machine manufacturer.

R.2
To demonstrate this, upon installation of a milking system, a graph of the vacuum fluctuation at the milker unit attached to the cow should be made with all of the milker units in operation simultaneously.

S.
OPERATION, MAINTENANCE AND SERVICE

S.1
Service Check
It is strongly recommended that a complete service check by an authorized milking machine dealer be performed annually for pail units, semi-annually for pipeline installations. It is highly desirable that a service report be supplied by the manufacturer and followed closely by his authorized representative during this service check. A copy of the completed report should be furnished to the owner.

S.2
Vacuum System
The following are recommendations, that if followed, should assure trouble free operation of the vacuum system.

S.2.1
Vacuum Pump

S.2.1.1
Use only oil recommended by manufacturer, and maintain it at proper level. Change oil as frequently as recommended by manufacturer.

S.2.1.2
Open one or more stall cocks before starting or stopping the vacuum pump.

S.2.1.3
Consult a qualified dealer or factory representative before adding units to your milking system. He can tell you whether your vacuum system and vacuum pump capacity is adequate to handle more units.

S.2.1.4
Keep pulleys and belts free of oil and grease. Check your operator's manual for the proper belt tension. And always keep a spare belt on hand.

S.2.2
Check the pulsator as recommended by manufacturer to see that it is properly adjusted.

S.2.3
Brush out all air hoses and air tubes weekly. Air has to move freely through hoses and tubes to assure coordination of components in the vacuum system.

S.2.4
Check air tubes and vacuum pipe lines weekly, and clean as needed. If you notice any leak in the vacuum pipe line, repair or replace immediately.

S.2.5
Look for vacuum leaks in all stall cocks, milk inlets, valves, gaskets and other fittings. Even small leaks can greatly reduce vacuum and slow down milking.

S.2.6
Check and clean vacuum controller and moisture traps weekly.

S.2.7
Be sure line voltage is correct. A drop in voltage will reduce efficiency of the vacuum pump(s) and accessory equipment.

S.3

Milker Units

S.3.1
It is recommended that an extra set of teat cup liners or inflations be kept on hand and alternated weekly, or as recommended by manufacturer. If they are cut or cracked, they should be replaced immediately.

S.3.2
Only milk hoses and tubes and air hoses and tubes of the recommended inside diameter should be used. Hoses and tubes should be kept free of obstructions and kinks.

T.

RELEASER

The operation of the releaser should not cause the vacuum in the system to drop more than 1 inch of mercury.

U.

TRANSFER STATIONS

To prevent excessive agitation and incorporation of air in the milk, pump type stations should be equipped with level sensing devices to start and stop the pump motor. Vacuum operated stations should be equipped with check or ball valves for the same purpose.

V.

MOTORS FOR MILK PUMPS

Motors for pumps should be of a type that has protection against the extrance of liquids such as that provided in the splash proof or enclosed types of motors. External electrical wiring including connections should be of a waterproof construction.

W.

CLEANING AND SANITIZING PROCEDURES

A rinsing, cleaning, and sanitizing regimen which has been demonstrated to be effective shall be employed. Because of the possibilities of corrosion, the recommendations of the cleaning compound manufacturer shall be followed with respect to the time, temperature, and the concentration of specific detergent solutions and bactericides. To insure proper strength of solution and to avoid corrosion, the cleaning compound shall be completely dissolved or dispersed prior to circulation. One regimen found to be satisfactory is as follows:

W.1
Immediately after concluding each milking, all connections between clean-in-place lines and milking equipment which are not included in the cleaning circuit are removed, the openings capped, bypass connections made, and the lines rinsed thoroughly with tempered water (90 - 95°F, entering circuit) continuously discarding the rinse water near the downstream end of the solution return line until the discarded effluent is clear.

W.2
All solution and product contact surfaces not cleanable by mechanical cleaning procedures are cleaned manually.

W.3
An effective detergent solution is circulated for a period of time at a concentration and temperature capable of effectively removing the soil residue in the circuit.

W.4
The detergent solution is thoroughly rinsed from the circuit.

W.5
Immediately prior to next milking, the line is rinsed with clean tepid water to which an approved sanitizing agent has been added. Then let drain before starting to milk.

Prior to installation, a description of the cleaning regimen that has been determined will be effective should be made available by the producer.

X.

APPLICATION TO INSTALL PIPELINE SYSTEMS

X.1

After an application has been made, as suggested in G.2, the applicant should be notified promptly of any necessary changes.

X.2

Each "type" of a manufacturer's standard unit may be made available by the dealer to the proper control authority, for general approval for installation in his jurisdiction at anytime.

It is recognized that any manufacturer's so-called standard does not fit all operating conditions of all users. Therefore if any installation requires deviations from the standard already generally approved for use in the jurisdiction, the details of all deviations must be submitted with the initial application for installation, and approval received prior to the installation. It is urged that deviation details thus submitted be acted upon by the control authority promptly after being received.

X.3

It is recommended that all milk control authorities adopt an APPLICATION TO INSTALL form.

Footnotes

[1]The data for this series are contained in the following reference: AISI Steel Products Manual, Stainless and Heat Resisting Steels, April 1963, Table 2-1, pp. 16-17. Available from American Iron and Steel Institute, 150 E. 42nd Street, New York, N. Y. 10017.

[2]Alloy Casting Institute, 300 Madison Avenue, New York, New York 10017.

[3]Available from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa. 19103.

These accepted practices become effective Feb. 3, 1969.

FORM I

PRODUCER'S APPLICATION TO INSTALL A MILK PIPELINE ON A DAIRY FARM

Name of Producer _____ Date _____

P. O. Address _____ Township _____ Tel. No. _____

Milk Dealer _____ Address _____

I HEREBY MAKE APPLICATION FOR PERMISSION TO INSTALL A MILK PIPELINE. THIS EQUIPMENT WILL BE CLEANED-IN-PLACE.

1. Pipeline System: Make _____ Type _____ No. of Milker Units _____

   Pipeline length _____ Pitch _____ Diameter _____ Material _____

   Type of Releaser: (a) Electric (b) Vacuum (c) Magnetic Type of Pump _____

2. Washing Equipment:

   A. Heater pressure type _____ No. of Gallons _____ Set at Temperature _____

   B. Equipment designed for:

      a. Washing by recirculation _____

      b. Reverse flush washing _____

      c. All washing equipment in milk house _____

3. The following is a list of items to be manually cleaned daily:

4. Water Supply: Source _____ Analysis of Hardness _____ Grains

Detailed installation plan or drawing to be submitted with this form shall show (1) each circuit to be cleaned, noting thereon the size and length of sanitary piping, fittings, pitch, drain points and relative elevations, (2) each circuit of vacuum piping noting the size and length of piping and relative elevation, (3) location and capacity of cleaning and sanitizing solution circulating unit, (4) vacuum pump(s) capacity and other pertinent facts.

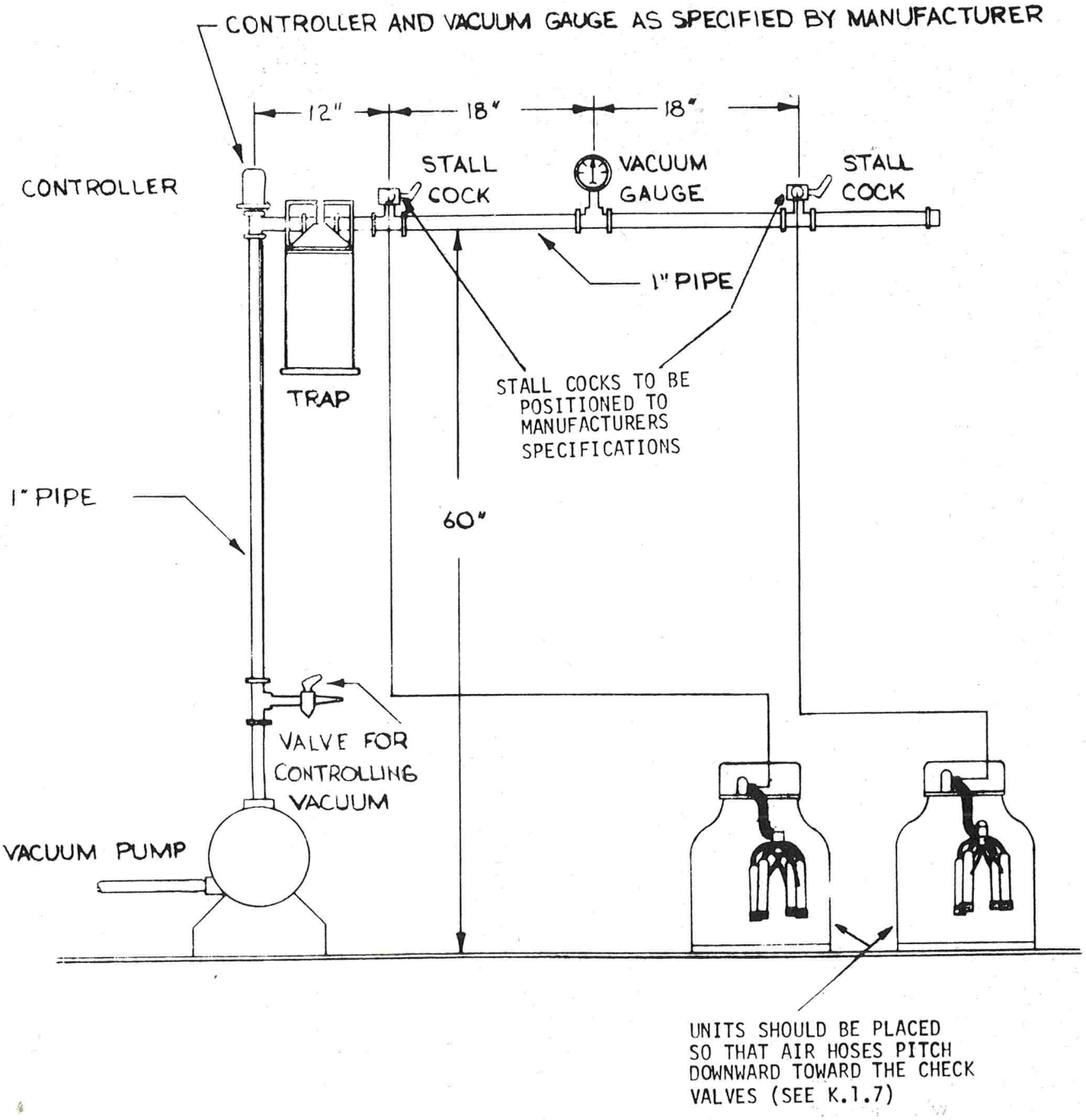
A description of the cleaning and sanitizing regimen that will be followed shall be submitted with this form.

NOTE: Any modification of this equipment must be approved.

(Signed) _____

(Owner or authorized representative)

FIGURE 1
TEST EQUIPMENT FOR
EVALUATING CHECK VALVE PERFORMANCE



3-A SANITARY STANDARDS FOR EQUIPMENT FOR PACKAGING DRY MILK AND DRY MILK PRODUCTS

Serial #2700

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

It is the purpose of the IAMFES, USPHS, and DIC in connection with the development of the 3-A Sanitary Standards program to allow and encourage full freedom for inventive genius or new developments. Dry Milk and Dry Milk Products Packaging Equipment specifications heretofore or hereafter developed which so differ in design, material, fabrication, or otherwise as not to conform with the following standards, but which in the fabricator's opinion are equivalent or better, may be submitted for the joint consideration of the IAMFES, USPHS, and DIC at any time.

A. *SCOPE*

These standards cover the sanitary aspects of equipment for performing the functions of holding, forming, dispensing, filling, weighing, closing, and/or sealing containers, and all parts which are essential to these functions when they are performed as an integral part of the packaging operation. These standards do not pertain to the container nor to a duct(s) which is not a part of the packaging equipment.

In order to conform with these 3-A Sanitary Standards, equipment for packaging dry milk, and dry milk products shall comply with the following design, material and fabrication criteria.

B. *DEFINITIONS*

B.1 *Product*: Shall mean dry milk and dry milk products.

B.2 *Container*: Shall mean a packaging enclosure holding the product, including multiwall bags.

B.3 *Holding, Opening, Forming and Dispensing Equipment*: Shall mean all equipment for holding, opening, forming, and dispensing the empty containers.

B.4 *Filling Equipment*: Shall mean the equipment for mechanically filling the container with the product.

B.5 *Closing and Sealing Equipment*: Shall mean the equipment for mechanically closing and sealing the container.

B.6 *Surfaces*:

B.6.1 *Product Contact Surfaces*: Shall mean all surfaces which are exposed to the product, surfaces from which contaminants may drain, drop or be drawn into the product or into the container, and surfaces that touch the product contact surfaces of the container.

B.6.2 *Non-Product Contact Surfaces*: Shall mean all other exposed surfaces.

B.7 *Engineering Plating*: Shall mean plated to specific dimensions or processed to specified dimensions after plating.[1]

C. *MATERIAL*

C.1 All product contact surfaces shall be stainless steel of the AISI 300 series[2] or corresponding ACI[3] types (See Appendix E.), or equally corrosion resistant metal that is non-toxic and non-absorbent except that:

C.1.1 Bearings may be made of metal covered with an engineering plating of nickel, chromium or equally corrosion-resistant, non-toxic material.

C.1.2 Those surfaces of the holding, forming, opening, dispensing, closing, or sealing equipment which touch the product contact surfaces of the container may be made of metal made corrosion-resistant and wear-resistant by covering with an engineering plating of chromium or an equally corrosion and wear-resistant non-toxic metal.

C.1.3 Welded or brazed areas and the deposited weld or braze material shall be copper free, non-toxic and corrosion resistant.

C.1.4 Rubber and rubber-like materials may be used

---

[1]QQ-C-320 - Federal Specification for Chromium Plating (electrodeposited), July 26, 1954. (Available from Supt. of Documents, U. S. Government Printing Office, Washington, D. C. 20402.

[2]The data for this series are contained in the following reference: AISI Steel Products Manual, Stainless & Heat Resisting Steels, April 1963, Table 2-1, pp. 16-17. Available from: American Iron and Steel Institute, 633 3rd Ave., New York, N. Y. 10017.

[3]Alloy Casting Institute, 300 Madison Avenue, New York, New York 10017.

for container opening, dispensing, and closing parts, filling nozzles, flexible connectors, plungers, gaskets, diaphragms, shields, filling valve members, seals and parts used in similar applications. These materials shall comply with the applicable provisions of the "3-A Sanitary Standards for Multiple-Use Rubber and Rubber-Like Materials Used as Product Contact Surfaces in Dairy Equipment, Serial #1800".

C.1.5 Plastic materials may be used for container holding, opening, forming, dispensing and closing parts, filling nozzles, flexible connectors, plungers, gaskets, diaphragms, shields, filling valve members, sight glasses, covers, seals, and parts used in similar applications. These materials shall comply with the applicable provisions of the "3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Serial #2000", as amended.

C.1.6 Sanitary single service gaskets may be used.

C.1.7 Clear glass which is shatter resistant may be used for sight and/or light glasses.

C.2 All non-product contact surfaces shall be of corrosion-resistant material, or material that is rendered corrosion-resistant. If coated, the coating shall adhere. Non-product contact surfaces shall be relatively non-absorbent, durable and cleanable. Parts removable for cleaning having both product and non-product contact surfaces shall not be coated.

D. *FABRICATION*

D.1 All product contact surfaces shall be at least as smooth as a number 4 mill finish (see Appendix F), or a number 2B mill finish on stainless steel sheets, selected so as to be free of imperfections such as chips, flakes, or pits. All joints shall be smooth and flush. All permanent joints in metallic product contact surfaces shall be welded, or may be brazed where welding is not feasible. All welded or brazed areas of product contact surfaces shall be at least as smooth as the adjoining surfaces.

D.2 The minimum thickness of engineering plating shall be 0.0002-inch for all product contact parts except that when the parts listed in C.1.2 that are to be plated are steel, other than stainless steel, the minimum thickness of the engineering plating shall be 0.002-inch.

D.3 All product contact surfaces shall be easily accessible, visible and readily cleanable, either when in an assembled position or when removed. Removable parts shall be readily demountable. Sight glasses, when provided, shall be relatively flush and easily removable.

D.4 All product contact surfaces shall be self-draining or self-purging except for normal clingage.

D.5 Product hoppers integral with the filler shall be equipped with dust-tight covers, gasketed if necessary, and have drop flanges which overlap the rim of the hoppers by at least 3/8 inch. All openings in hopper covers shall have raised rims or flanges of at least 3/8 inch, and such openings shall be provided with dust tight covers, gasketed if necessary, having a downward flange of not less than 1/4 inch so designed as to prevent contaminants from entering into the product or onto the product contact surfaces or the openings shall be equipped with sanitary fittings. Covers shall be self-draining.

D.6 The filling equipment shall be so designed that adjustments necessary during the operations can be made without raising or removing the hopper cover(s).

D.7 All internal angles of 135° or less on product contact surfaces shall have minimum radii of 1/4 inch except where smaller radii are required for essential functional reasons, such as filler nozzles, screw conveyors and sealing ring grooves as provided for in D.8. In no case shall such radii be less than 1/32 inch.

D.8 Gaskets shall be removable or continuously bonded so as to be smooth and easily cleanable. Gasket retaining grooves for removable gaskets shall be no deeper than their width. The minimum radius of any internal angle in a gasket retaining groove shall be not less than 1/8 inch, except that a 3/32 inch radius is permissable where a standard 1/4 inch O-Ring is to be used. Grooves in gaskets shall be no deeper than their width and the minimum radius of any internal angle shall be not less than 1/8 inch unless the gasket is readily reversible for cleaning.

D.9 There shall be no threads on product contact surfaces.

D.10 Covers, diverting aprons, shields or guards shall be provided to prevent contaminants from draining or dropping into the container or product, or onto product contact surfaces.

D.11 Where lubrication is required, the design and construction of the equipment shall be such that the lubricant cannot leak, drain, be forced, or be drawn into the product or onto product contact surfaces.

D.12 All sanitary pipe fittings, if used, shall con-

form with the design and construction provisions of the 3-A "Sanitary Standards for Fittings Used on Milk and Milk Products Equipment and Used on Sanitary Lines Conducting Milk and Milk Products," Serial #0800, and Supplements thereto, as amended.

D.13 Any coil spring having product contact surfaces shall have at least 3/32 inch openings between coils including the ends.

D.14 Non-product contact surfaces shall have a smooth finish, be free of pockets and crevices, and be readily cleanable.

D.15 Non-product contact surfaces to be coated shall be effectively prepared for coating.

D.16 Panels or doors shall be provided to allow easy access without tools for the cleaning and inspection of mechanical areas of the equipment which are not dust tight.

D.17 The equipment shall be mounted as follows:

D.17.1 With legs and/or casters: Legs and/or casters shall provide a clearance between the lowest fixed point of the equipment and the floor of at least 4 inches when the base outlines an area in which no point is more than 12-1/2 inches from the nearest edge, or a clearance of at least 6 inches when any point is more than 12-1/2 inches from the nearest edge. Legs shall be smooth and have no exposed threads. If legs are hollow tube stock, they shall be effectively sealed. Equipment which is portable may be equipped with casters. Casters, if used, shall be durable and of a size that will permit easy movement of the equipment.

D.17.2 Permanent Mounting: When legs and/or casters are not used, the base shall be designed to (1) permit sealing to the mounting surface and (2) to permit adequate cleaning, drainage and drying of the interior of the base.

D.18 Equipment for producing air under pressure which is supplied as an integral part of the filling equipment shall comply with the applicable provisions of the "3-A Accepted Practices for Supplying Air Under Pressure in Contact with Milk, Milk Products and Product Contact Surfaces," July 26, 1964, as amended.

APPENDIX

E. *STAINLESS STEEL MATERIALS*

Stainless steel conforming to the applicable composition ranges established by AISI for wrought products, or by ACI for cast products, should be considered in compliance with the requirements of section C.1 herein. Where welding is involved the carbon content of the stainless steel should not exceed 0.08%. The first reference cited in C.1 sets forth the chemical ranges and limits of acceptable stainless steels of the 300 series.

Cast grades of stainless steel equivalent to types 303, 304, and 316 are designated CF-16F, CF-8, and CF-8M, respectively. These cast grades are covered by ASTM[4] specifications A296-67 and A351-65.

F. *PRODUCT CONTACT SURFACE FINISH*

Surface finish equivalent to 150 grit or better as obtained with silicon carbide, is considered in compliance with requirements in D.1 of number 4 mill finish on stainless steel sheets.

These standards shall become effective January 7, 1969.

---

[4]Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa. 19103.

NEW COURSE IN GENERATING COMMUNITY ACTION FOR ENVIRONMENTAL HEALTH

The Environmental Control Administration will present the principles and techniques involved in public education in a new course in Generating Community Action for Environmental Health during the week of December 2-6, 1968, at the Administration's training facilities in Cincinnati, Ohio.

The course will present the rationale behind public contact, proper attitudes toward the public, preparation of the environmental health message, including development of a visible problem, and dissemination of the message through mass media and by direct contact with the public. Those attending the course will discuss the nature of news, develop a community action program and tour a metropolitan newspaper and a television-radio station.

Application for the course may be made by writing Chief, Training Program, Environmental Control Administration, 222 East Central Parkway, Cincinnati, Ohio 45202. The telephone number for registrations is (513) 871-1820, extension 298. No tuition or registration fee is charged. Trainees are expected to provide for their own housing and transportation while attending the course.

LETTERS TO THE EDITOR

Statistics, Research, and Bacteria in Milk

DEAR SIR:

I have become increasingly concerned that the development of complicated statistical models and their rapid and easy application through computers is having a deleterious effect on research. More specifically, complex statistical treatments of data are undertaken that are available and/or popular, whether or not they are appropriate to the data and the research question.

I think an example of this phenomenon is reflected in C. N. Huhtanen's "Incubation Temperatures and Raw Milk Bacterial Counts" in *JMFT*, 31:5, May 1968, pp. 154-160.

Huhtanen suggests, "The ideal temperature (for incubating plates) should be one that permits the growth of the largest number of bacteria in a reasonable amount of time" (p. 154). This statement implies that the question to be studied is, "What is the ideal temperature?" After analysis of his data he concludes, " . . . plates held at 10, 20, 27, and 30 C could be considered to have the same number of colonies while the results from incubation at 2 and 33 C might be different" (p. 155). In my view his conclusion is incorrect; his data supports the belief that 27 C is more ideal than any other temperature studied.

As I understand the statistical model used, it assumes that any bacterial count is as valid as any other count and that all counts should therefore be given equal weight in the calculations. This assumption does not seem reasonable in the light of the following premises which I believe would be accepted by most sanitarians: *(a)* raw milk may contain many species of bacteria, *(b)* different species of bacteria grow at different rates at different temperatures, *(c)* the species of bacteria in a particular lot of milk, and the relative proportion of each species that is present will vary as a function of many factors; time, place, production techniques, etc., and *(d)* when using the standard plate count approach to estimating the number of bacteria in a lot of milk, one will never get an overestimate (except for measurement error, e.g., inaccurate pipetting), but one may well get an underestimate due to factors associated with the measuring technique: ability of the bacteria to grow in the media, incubation temperature, time incubated, etc.

Therefore: That measuring technique which results in the greatest number of colonies for a particular sample of milk is the most valid technique for *that* sample.

However: It follows from premises 1, 2, 3 & 4 that the most valid technique is different for different samples of milk. Therefore, results from less valid techniques should not be used in the analysis, or at least not given equal weight. Consequently, the statistical model used by Huhtanen is inappropriate to the problem.

Now, since it is economically feasible to use only one technique on all samples, which of several techniques should be used? Of special interest is the variable of incubation temperature.

There seem to be two slightly different ways this problem could be approached.

(a) What incubation temperatures will result in the best estimate of total bacterial populations for the *most* lots of milk?

(b) What incubation temperature will result in the least error in estimating bacterial populations in *all* lots of milk?

For answers to the first question, Table 1 shows the frequency with which the several temperatures gave the best estimates.

TABLE 1. FREQUENCY WITH VARIOUS INCUBATION TEMPERATURES RESULT IN BEST ESTIMATES

Temp. (° C)	For sample of 66[1]		For sample of 32[2]	
	Frequency[3]	% Times	Frequency[3]	% Times
2	5	7.2	3	8.8
10	6	8.7	4	11.8
20	13	18.8	7	20.6
27	28	40.6	12	35.3
30	13	18.8	7	20.6
33	4	5.8	1	2.9
37	0	0.0	0	0.0
Total	69	99.9	34	100.0

[1]I considered the data in Table 1 to represent 66 different samples of milk in this and subsequent computations.

[2]Based on the assumption that 32 different lots of milk were studied: on each day a single lot of milk was sampled, split 14 ways and 2 plates prepared and incubated at each of 7 temperatures except for the first 5 days when no plates were incubated at 37 C; on 12/12/66 four plates were incubated at each temperature from one lot and on 1/17/67 two plates were incubated at each temperature from two different lots of milk.

[3]The number of times a temperature was highest exceeds the total number of samples since when two different temperatures were equal in results, both were credited with being highest for that lot of milk.

Were it not for the operation of the laws of probability when we study samples, we would conclude without further analysis that the answer to the first question was 27 C. However, we realize the lots of milk studied were a sample from all lots of milk received at a particular plant during ten months of one year. Statistics can help us answer the question, what is the probability that one of the temperatures other than 27 C would give the highest count most often in the population of lots of milk?

An appropriate way to approach the question of generalizing from the sample to the population is to compute a confidence interval around a proportion. In percentage terms, this computation results in an interval (for 27 C) of 40.6 $\pm$ 11.6 at the .95 level of confidence. That is, there are 95 chances in 100 that the proportion of all lots of milk in the population that would give the highest count at 27 C is between 29% and 52.2%. The respective confidence intervals for 20°C and 30°C are 18.9 $\pm$ 9.2% or from 9.7% to 28.1%.

Thus, there is a very small probability that the true proportion of milks measuring highest at 27 C is lower than 29% and a very small probability that any other temperature would give the highest counts in more than 28% of all lots of milk. From this it appears clear the answer to question one is 27 C.

The second question is, in a way, the reverse or mirror image of the first. The rationale for the question might be described as follows: although 27 C was highest (most accurate) for 40% of lots of milk, that temperature may have been very inaccurate for the other 60% of lots. On the other hand, although some other temperature (20 C, for example) was only most accurate for 19% of lots, it may not have been very inaccurate for the other 81% of lots. In short, question two is related to the extent of inaccuracy associated with each temperature.

An attempt was made to answer question two as follows. For each lot the highest count was taken to represent 100% of the bacteria in the lot. The count associated with each other temperature at which that lot was incubated was then taken as a percentage of the highest count. This percentage was defined as degree of accuracy. Of course for the temperature yielding the highest count, numerator and denominator were the same indicating that the count at that temperature was 100% accurate.

TABLE 2. ACCURACY OF BACTERIAL COUNTS ASSOCIATED WITH VARIOUS INCUBATION TEMPERATURES

Temp. (C)	Mean Accuracy of Count (Per cent Correct)	95% Confidence Interval Around Mean Accuracy Scores (Per cent Correct)
2	62.4	58.0-68.8
10	73.4	68.5-78.3
20	86.4	83.1-89.5
27	90.5	88.0-93.0
30	83.8	80.2-87.4
33	66.1	60.7-71.2

Total N = 66

Again, since these data represent a sample from a larger population of lots of milk, there is a probability they do not accurately represent that larger population.

We can see that the confidence interval around the mean score for the population for 27 C at the 95% level is overlapped only by the interval for 20 C. If we treat the average per cent correct for 20 C and 27 C as two means and perform a test of significance for the difference between two means, the critical ratio demonstrates that the difference is highly significant. Thus, it appears that the answer to question two is also 27 C.

Our interest, of course, is in generalizing to the future rather than to the past. We need to consider the likelihood that future milk will have similar bacterial species distributions and relative proportions and they will react in the same way to incubation temperatures. Changes could occur, e.g., new bactericides, different cleaners or different usage of cleaners; bacterial mutations. However, statistics will not help us in generalizing to such potential situations. This potential suggests that experiments should be conducted periodically to assure the most appropriate measures continue to be used.

O. LYNN DENISTON
School of Public Health
The University of Michigan
Ann Arbor, Michigan

The Researcher Replies

DEAR SIR:

I would like to comment on the four premises made by Deniston regarding the validity of the bacterial counts reported in the paper, "Incubation Temperatures and Raw Milk Bacterial Counts", (*Journal of Milk and Food Technology*, 31:5, May 1968, pp. 154-160). These premises are quite well-taken and would not be denied by anyone who has worked with bacteria from raw milk. The fact that different species of bacteria have widely variable generation times depending on medium, temperature, antagonisms, etc., makes it imperative that a sufficient time interval elapse before counts are made. It was for this reason that the plates were incubated for 10 days at 2 C, 7 days at 10 C, 5 days at 20 C and 2 days for the rest of the temperatures. These incubation times were chosen as being approximately twice as long as the time required for the first visible colonies to form.

The premise made by Deniston that the species of bacteria in raw milk will depend on factors such as time in transit, place of production, production techniques, etc., is also valid; however, the samples used in these experiments were from the bulk-tank supply of a local dairy. Each sample represented the well-mixed supply from several hundred farmers. This would tend to decrease sampling errors.

With all due regard for the premises expounded by Deniston, it is, nevertheless, difficult to understand how they enter into any significant interplay with statistical methods. It is precisely because biological data are fraught with such uncertainties that statistical analyses are so important and so useful. The experimental conditions were defined in the paper; figures were extracted from each incubation temperature and the conclusions drawn were based on the particular time of incubation-temperature combinations used. As Deniston points out, these results would tend to be on the low side. Analysis of the results indicated that the counts were not significantly different over a wide range of temperatures. This indicates either that not enough samples were taken to establish the superiority of any one temperature or, in fact, that counts were not different.

I would like to reiterate that the temperatures around 32 C may be too close to the maximum for the psychrotrophic bacteria. In case of failure of an incubator or improper temperature measurements, the counts may be deceptively low. A temperature around 27 C would provide a much greater margin of safety.

CHARLES N. HUHTANEN
Eastern Utilization Research and Development Division
Agricultural Research Service
U.S. Department of Agriculture
Philadelphia, Penn. 19118

The Statistician Replies

DEAR SIR:

Mr. Huhtanen has asked that I respond to Mr. Deniston's letter to the editor concerning the statistical techniques used by myself in the analysis of his experiments. I do concur with Mr. Deniston's comment that there are many examples of misapplication of statistical techniques in the literature today, but the methods used in Mr. Huhtanen's article were pertinent to the question posed and were neither complex nor unusual considering the application.

Mr. Deniston is correct in assuming that each observation was given equal weight in the statistical model used. Mr. Huhtanen designed the experiment so that every sample had a sufficient opportunity to reach its full growth potential so that the count was considered as a measure, the same as a length or a weight measure. The fact that one measurement is larger than another does not make it a more valid observation than another.

The two-way Analysis of Variance was used in this evaluation to test the hypothesis that the mean counts at the several temperature levels were equal. This technique separated the effects of the different milk sample (rows) from the error term, in order to obtain the best estimate of the experimental variation. The results of the experiment indicated that several of the mean counts could not be considered different when compared to the estimate of the experimental variation. Deniston's method of analysis makes use of a class of statistical techniques which are called Non-Parametric Methods. In general these methods, although conceptually much simpler to understand, are inferior based on certain precise mathematical criteria, which are too complicated to detail here. There is no conceptual advantage in downgrading this quantitative data to adapt itself to this weaker method of analysis.

There are several serious conceptual errors in Deniston's analysis, over and above the weakness of the testing technique itself. First, in a well designed experiment a hypothesis is constructed and then appropriate test data are collected to test this hypothesis. In Deniston's analysis it would appear that a search was made to find a hypothesis which could be verified by the data.

Second, Deniston's letter contains the statement that "there are 95 chances in 100 that the proportion of all lots of milk in the population that would give the highest count at 27 C is between 29% and 52.2%." This statement is incorrect in that it implies that the proportion of all lots is a random variable; the correct interpretation is "there are 95 chances in 100 that the proportion of all lots of milk in the population that would give the highest count at 27 C is captured by the interval 29% to 52.2%. Third, Deniston calculates several confidence intervals and makes a collective comparison. The 95% confidence applies to a single confidence interval and ignores the fact that the collective confidence is $(.95)_n$ where n is the number of comparisons. There are proper statistical tests for the comparison of two or of several proportions (as attempted) and also of two or of several means (as attempted). These tests should have been used in the collective comparisons which were attempted.

W. C. STEWART
Department of Statistics
School of Business Administration
Temple University
Philadelphia, Penn. 19122

Your voice in the National Mastitis Council

DEAR SIR:

In his address to the 1968 annual meeting of IAMFES, President A. N. Myhr called for increased participation in the work of the National Mastitis Council (NMC). He noted that he had asked the NMC Secretary to write an article for the *Journal of Milk and Food Technology* on the objectives and activities of the Council. This letter is an effort to comply with the request of Dr. Myhr.

The National Mastitis Council was organized in January, 1961 to promote mastitis research, education, and control. It was an outgrowth of the Mastitis Action Committee formed in 1960 by IAMFES. NMC is the first successful attempt to coordinate all of the interests and resources that can solve the mastitis problem. It is incorporated as a non-profit organization in the state of Illinois. The NMC office is in the offices of the Evaporated Milk Association in Washington, D. C.

The Council has 33 national members, 48 state members, and 260 individual members. Policy matters are handled by a 48 member Board of Directors, and there is a 15 member Executive Committee. Officers are Dr. Christian J. Haller, Avon, New York, President; James B. Smathers, Maryland and Virginia Milk Producers Association, Vice President; and J. C. Flake, Evaporated Milk Association, Secretary-Treasurer. The Directors include Arthur E. Parker, Portland, Oregon, representing IAMFES, and Harold E. Thompson, Jr. of USPHS.

The Council publishes the *NMC Newsletter*. About 4 issues per year are mailed to all members. Another publication is *Current Concepts of Bovine Mastitis*, an authoritative booklet on the facts about the complex problem of mastitis. Over 25,000 copies have been distributed. Single copies are available from the NMC office at $1 post paid. "What Dairymen Should Know About Mastitis" was published in the August 1968 issue of the *Journal of Milk and Food Technology*. The Council has prepared "Mastitis Control Program Recommendations." This is an outline for a state mastitis control program.

Committees are important in the work of NMC. Current activities include standardization of the Direct Microscopic Somatic Cell Count by the Subcommittee on Screening Tests of the Research Committee. Results of this effort will be published in the *Journal of Milk and Food Technology*. Another subcommittee of the Research Committee is preparing a manual on *Microbiological Procedures for Diagnosis of Bovine Mastitis*. The State Mastitis Council Coordination Committee was established in 1968. This committee is compiling a roster of state councils and will attempt to coordinate the work of these councils with NMC. Other committees include the Education Committee and Programs and Procedures Committee.

NMC annual meetings serve as forums for discussion of a wide variety of subjects related to mastitis and abnormal milk. Over 400 persons attended the February, 1968 annual meeting in Chicago. The next annual meeting is scheduled at the Sherman House in Chicago on January 27-29, 1969. Regional meetings were held in Omaha, Nebraska in October, 1967, and in Raleigh, North Carolina in September, 1968.

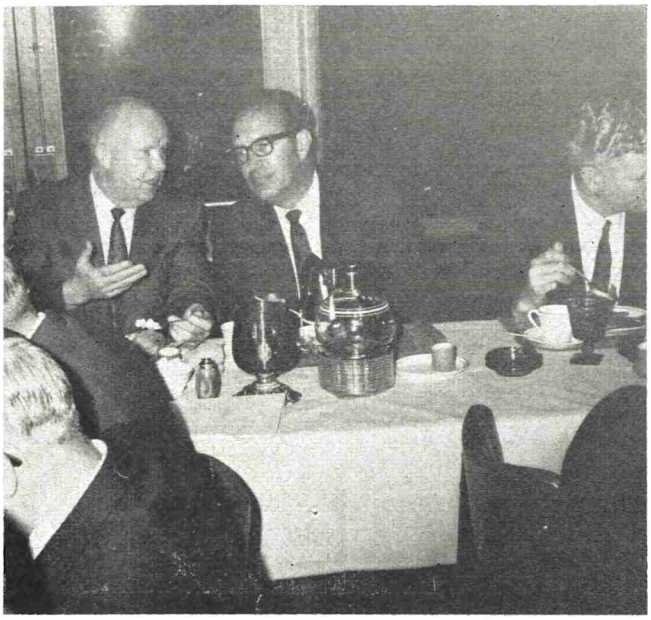
IAMFES members are urged to join the National Mastitis Council. NMC needs your membership and active support in the national drive to control bovine mastitis. Individual membership dues are $5 per year. If you represent a company, cooperative, or association that wishes to support the program, dues are $200 per year for a national or regional organization, and $50 per year for a state or local organization.

IAMFES members are welcome participants in NMC. To become a member, just send your name and address and a check for the dues to: National Mastitis Council, 910 Seventeenth Street, N. W., Washington, D. C. 20006.

J. C. FLAKE
National Mastitis Council
Washington, D. C. 20006

ASSOCIATION AFFAIRS

WASHINGTON MILK SANITARIANS ASSOCIATION ANNUAL MEETING



Washington Milk Sanitarian's Association Annual Meeting Banquet. Seated left to right are: James Lum, President Elect; Washington State Director of Agriculture, Don Moos, speaker; and Dr. F. W. Crews, President, Washington Milk Sanitarians Assoc.

The Washington Milk Sanitarians Association annual state meeting was held at Seattle on September 18. President A. W. Sturm emphazied the importance of this organization to all phases of the dairy industry and official agencies alike and complimented all Association officers, committee members and University members for their team work and cooperation in working out mutual problems.

Dr. F. W. Crews, Chairman of the Laboratory Methods Advisory Committee reported on the activities of this committee, results of laboratory surveys and split sample check testing results.

Ray Carson, Chairman of the Farm Methods Committee, reviewed the activities of his committee and discussed their reciprocal cooperation with the International Association.

Ben Luce reported on the International Association annual meeting at St. Louis.

The afternoon speaker was Roy Olson, Spokane, winner of the International Association Sanitarian Award, who spoke and showed slides of the "Worlds Scouting Jamboree" at Farragut, Idaho last summer.

Donald W. Moos, Washington State Director of Agriculture, was the dinner speaker and gave a very interesting and informative talk, spiced with natural humor, a very fitting climax to a successful annual meeting.

The following officers were elected: Dr. F. W. Crews, President; James Lum, President Elect; Ray Carson, Secretary-Treasurer; Robert Freimund and Robert Hale, Auditors.

WASHINGTON OFFICIAL RECEIVES PUBLIC HEALTH AWARD FROM NATIONAL AUTOMATIC MERCHANDISING ASSOCIATION

William C. Miller, Jr., (left) Chief of Milk and Food Programs, U. S. Public Health Service, became the second recipient of the Arthur J. Nolan Public Health Award of the National Automatic Merchandising Association (N A M A).

In honoring Miller at the banquet of the annual Convention-Exhibit of the association, President Meyer Gelfand cited him "for outstanding service to the automatic merchandising industry through his devotion and activity in public health." Miller began working with the national vending association's public health committee in 1954 and the 1957 U. S. Public Health Service model "Vending Code" was drafted and developed under his direction in cooperation with the vending industry. Since 1957 Miller has served as an observer on the association's Automatic Merchandising Health-Industry Council and has discussed the topic of vending sanitation at many industry and government programs. With offices in Arlington, Va., Miller resides at 8909 Ewing Drive, Bethesda, Md.

Established in 1966, the Nolan Award is named after an industry leader who pioneered the principle of highest sanitation standards for the vending industry. The award is intended for "individuals who have made meritorious contributions to the field of vending sanitation and public health."

GEORGE ECKHOFF— MINNESOTA SANITARIAN OF THE YEAR

George Eckhoff, right, receives "Certificate of Merit" from Orlowe Osten, member of Awards Committee.

The Minnesota Sanitarians Association's 1968 Certificate of Achievement was presented to George H. Eckhoff, Wyandotte Chemical Corporation, Minneapolis, Minnesota, at the Association's Annual Banquet.

Mr. Eckhoff graduated from the University of Saskatchewan and after graduation worked in the dairy field, including plant management. After moving to Minnesota, he was instrumental in setting up laboratory facilities for industry plants.

For the past fifteen years he has been associated with the Wyandotte Chemical Corporation and completely dedicated to the betterment of sanitary conditions in food processing plants and improvement of milk quality programs. His devotion to helping and educating his customers in the principles of good sanitation has won him the respect of industry, regulatory officials, friends and colleagues.

The Minnesota Sanitarians Association is very proud to have given the 1968 Certificate of Achievement Award to Mr. Eckhoff.

LETTER TO EXECUTIVE SECRETARY

Dear Red:

International's recent meeting in St. Louis, Missouri was one of the best organized meetings it has been my pleasure to attend.

Such well run meetings don't just happen but are the result of detailed planning and execution.

You, and John Schilling, and his associates deserve a special "thank you." It was a pleasure to attend and participate in such a well organized and educational meeting.

Yours very truly,
Vincent T. Foley
Chief, Food Section

STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION

(act of October 23, 1962; Section 4369, Title 39, United States Code)

Of The Journal of Milk and Food Technology, published monthly at Blue Ridge Rd., R. R. 6, Shelbyville, Indiana, for October, 1968.

The names and addresses of the publisher, editor, and managing editor are:

Publisher, International Association of Milk, Food and Environmental Sanitarians, Inc., R. R. 6, Shelbyville, Ind. 46176.

Editor, Dr. E. H. Marth, University of Wisconsin, Madison, Wis.

Managing editor, H. L. Thomasson, R. R. 6, Shelbyville, Ind. 46176.

The owners of International Association of Milk, Food and Environmental Sanitarians, Inc. are:

Non-profit Corp. — No stockholders.

The known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

Column one average No. copies each issue during preceeding 12 months—Column two single issue nearest to filling date.

A. Total No. Copies Printed (Net Press Run)	4400	4100
B. Paid Circulation		
1. To term subscribers by mail, carrier delivery or by other means	4200	3950
2. Sales through agents, new dealers or otherwise	32	38
C. Free Distribution (including samples) by mail, carrier delivery, or by other means	92	80
D. Total No. of Copies distributed. (Sum of lines B1, B2 and C)	4324	4068

I certify that the statements made by me above are correct and complete.

H. L. Thomasson, Managing Editor

OLSON AND SAUNDERS RECEIVE SANITARIANS AND CITATION AWARDS

The IAMFES Committee on Awards selected Mr. Roy T. Olson, Spokane, Washington to receive the 1968 Sanitarians Award. The award, consisting of a plaque and check of $1,000 was presented to Olson at the recent IAMFES meeting held in St. Louis.

Mr. A. K. "Kelly" Saunders was this year's recipient of the Citation Award which is given annually to a member who has made an outstanding contribution to the work of the IAMFES. A brief biographical sketch of these award winners is given below.

ROY T. OLSON

Roy T. Olson, Director of Sanitation, Spokane City Health Department, is best known nationally for his work in the area of mastitis control. This is reflected by the invitations he receives to speak on this subject. Olson spoke at the 1968 National Mastitis Council meeting in Chicago as well as the 1964 (Portland, Oregon) and 1968 (St. Louis) IAMFES meetings.

Roy's talents in the field of environmental sanitation are many. Through his efforts an Air Pollution District is being created for his city. He has spent much time and effort in promoting public water systems. He pioneered and personally did survey work of sewage disposal systems, water supplies, and boat sanitation on several bodies of water in northern Washington.

Recently, Spokane lost its full-time health officer. At the present time a practicing physician is acting on a part-time basis. Consequently Roy was asked and assumed the responsibility of operating the health department in preparing budgets, solving personnel problems, and carrying out many other administrative functions.

In 1965 Roy Olson was selected as Washington State Sanitarian of the year and in 1966 he was appointed by the Indian Council as member of Kalispel Indian Health Committee to aid in formulating their health services. He was appointed by the School Administration as a member of the Board of Health Sciences at Spokane Community College, 1967-1968.

In 1947 Olson was President of the Washington State Association of Sanitarians and served as either Chairman or member of every State Committee in both the IAMFES and NAS groups over the years.

Mr. Olson, has displayed leadership and a progressive attitude in the food and milk program for many years. His actions have been a significant influence for progressive changes and needed revisions on a state wide basis.

Roy is a very dedicated person who talks and lives with his work. He always is willing to accept responsibility for dealing with health hazards even though they may not be a part of traditional or existing programs. Roy is one of the most highly respected sanitarians in the State of Washington and a most worthy recipient of the coveted Sanitarians Award.

A. K. SAUNDERS

A. K. "Kelly" Saunders was born in Canada where he attended grade school. He completed his high school education at Bowen, Illinois. After attending Northern Illinois State University at DeKalb, Illinois, he taught in a rural school for 8 years in DeKalb County, Illinois. Since 1935, he has specialized in detergents for dairy farm sanitation.

Saunders became a charter member of the Illinois State Affiliate of IAMFES which was organized in the 1930's and has since been a continuous member of the affiliate as well as of the IAMFES. In 1955, Kelly became a member of the IAMFES Farm Methods Committee and in 1962, became Chairman of the Committee. His outstanding contributions to IAMFES through these committee activities were recognized by the Citation Award.

Mr. Saunders and his wife, Alice, live in Mundelein, Illinois. They have a married daughter, Diane, living in Libertyville, Illinois. A son, Richard, is a career man in the U. S. Navy and is presently serving as a warrant officer at the submarine base in Rota, Spain. During the past 20 years, Mr. and Mrs. Saunders have sent 10 foster daughters and four foster sons through high school. Kelly is an employee of The De Laval Separator Company, managing their detergent division.

NATIONAL DAIRY ENGINEERING CONFERENCE

The National Dairy Engineering Conference will be held February 25-26, 1969. The conference will be held at the Kellogg Center for Continuing Education at the Michigan State University campus.

Each year the leading engineers, scientists, and administrators from the dairy and food industry, the processing equipment industry, education and government participate in this conference. For further information contact D. R. Heldman, Department of Agricultural Engineering, Michigan State University, East Lansing, Michigan 48823.

NEWS AND EVENTS

NEW BOOKLET DISCUSSES HOW STAINLESS STEEL CUTS COSTS, UPGRADES SANITATION IN MEAT PLANTS

How stainless steel helps the meat industry hold down labor and equipment costs while meeting increasingly strict sanitary standards is the subject of a new 20 page, two-color booklet issued by the Committee of Stainless Steel Producers, American Iron and Steel Institute.

"Stainless Steel: Problem Solver in Meat Packing and Processing" is designed to provide management and plant operators with useful information on practical stainless steel applications in meat processing operations. The booklet points out that stainless steels are best for a wide variety of processing operations, and they also are the most economical material for many other applications when costs of installation, maintenance and production are considered.

The introduction discusses some of the problems facing the meat industry—increasing labor, equipment and distribution costs, and increasingly strict sanitary standards. It describes how, in many instances, stainless steel has helped provide solutions for specific applications. Also included are U. S. Department of Agriculture recommendations regarding materials used to fabricate food handling equipment, and a summary of the stainless steel alloys most commonly used for different types of meat processing equipment.

Other section describe in text and photographs typical stainless steel applications in meat plants—from the slaughterhouse to final packaging operations—with specific examples of the substantial economic benefits realized by many packers. Suggestions are also given on ways to further reduce plant maintenance costs through the use of stainless for such applications as railings, kick plates, stair treads, drain grills and platforms. In addition, the text also covers the use of stainless steel piping for more efficient and sanitary product transfer, and stainless "clean rooms" which have doubled the shelf life of many packaged meat products.

Final sections of the booklet give recommendations for economical in-plant design and fabrication of stainless, and cleaning and maintenance suggestions which will help extend the already long life of stainless steel equipment.

Copies of "Stainless Steel: Problem Solver in Meat Packing and Processing" may be obtained without charge by writing to the Committee of Stainless Steel Producers, American Iron and Steel Institute, 150 East 42nd Street, New York, New York 10017.

HOT-AIR SEALING SYSTEM FOR FOOD PLANTS

Bulky glue pots and dielectric heat sealers are gone from a new package sealing system reported by Georgia-Pacific. The new hot-air sealing system for food packaging utilizes poly-two-sides foodboard for cartons and was unveiled at the Dairy Industries Exposition in Chicago recently. It also eliminates the "moisture-proofing" coat of varnish and is said to cut a high percentage of package-sealing rejects as well as packages that become unsealed in supermarket freezers.

The packaging is made from the company's white bleached foodboard with a polyethylene resin coating on both sides. During the sealing process, hot-air warms the inside of one flap and the outside of the matching flap with no heat penetrating the package. Touched together, the flaps form a strong bond that resists separation under freezing and thawing conditions.

SELF-ADJUSTING MILK VALVE INTRODUCED BY SURGE

A self-adjusting, clean-in-place milk valve with only two moving parts has been developed by Babson Bros. Co., Oak Brook, Ill.

The milk valve is designed for stanchion dairy barn pipeline milking systems. The dairyman uses the nipple end of the milk hose to slide the carriage assembly aside and open the valve. As the assembly slides open, the milk hose is connected to the pipeline. Removal of the nipple allows the valve to snap shut and reseal the pipeline. The valve never needs adjusting because the carriage assembly is spring loaded. A cylindrical ball that seats in the valve opening always returns to the same secure position after the valve has been opened. Spring tension compensates for wear to prevent leaks.

The internal area cleans-in-place. External parts can be quickly and easily washed. For additional information on the new Surge self-adjusting milk valve, contact your Surge Dealer or write to Babson Bros. Co., 2100 S. York Rd., Oak Brook, Ill., 60521 or Babson Bros. Co. Ltd., Rexdale, Ontario.

FOOD AND DAIRY INDUSTRIES EXPO OCTOBER 13-17, 1968

Higher capacities, more refined operation, more sophisticated construction, and flexibility of use characterized the multiplicity of products displayed at Food & Dairy Industries Expo in Chicago.

According to Mr. D. H. Williams, technical director of Expo's sponsoring organization, the Dairy and Food Industries Supply Association, much of the equipment reflected "improved engineering, fitting more readily into total processing systems." Designing a product as an integral unit of a continuous system, says Mr. Williams, is a very evident continuation of an earlier trend. Sensational this year was the introduction of ingredients and bases for non-dairy and "filled" frozen desserts and beverages.

Aseptic processing systems claimed much attention with demonstrations of sterile packaging in laminated paper and paperboard. "Packaged" sterilizing systems were shown, including aseptic homogenizers, pumps, and surge tanks for temporary holding of sterile product prior to packaging.

Reverse osmosis for concentration of fluids—an entirely new and imaginative process for the food industry—was a first for Expo. Solutions such as whey, industrial wastes, juices, beverages, salt water, sugars and broth are passed under pressure through semi-permeable tubes in which water is forced from the product, leaving a highly concentrated material. To date, reverse osmosis has its most dramatic application in wastes disposal; however, use in the food industry is a promising potential for application to heat and flavor sensitive products.

Egg breaking and freezing equipment for liquid eggs processing were on display for the first time. Outstanding feature of the fully-automatic egg breaker is immediate identification of contaminated or suspect eggs. Eggs are carried in separate units and are not transferred after breaking, as in previous machines.

Abundantly evident were new applications of conventional equipment. For example, containerization for refrigerated consumer foods in which truck containers are carried from the plant and deposited at a distribution point where the load is picked up by route vehicles. This method reduces handling and storage, conserves refrigeration and requires fewer trucks and drivers.

More sophisticated materials handling equipment with emphasis on automation and programming drew attention, such as the automatic case stacker for canning application.

Packaging systems were more automatic and offered higher capacities. One system was fully automatic from forming through casing, eliminating hand loading of flat cartons.

Proportioning equipment for controlled batching and metering of components spelled more sophisticated batching and process control; also, weighing devices for exact weight, and a central monitor for complete machine operation. Continuous weighing and automatic check-weighing were shown in applications of specific interest to food packaging and labeling.

Entirely new in equipment was a vertical rotary-type heat exchanger with an automatically removable agitator for easy and effective cleaning.

A horizontal centrifuge for handling viscous products and especially adaptable to rapid and continuous separation and collection of suspended materials was also new.

Interest in plastic continues with introduction this year of a returnable, multiple use, five gallon sanitary food container.

ICE CREAM SHORT COURSE

The annual Ice Cream Short Course of The Pennsylvania State University will be held January 13 to 24, 1969. Any individual sixteen years of age or older is welcome to attend. Included in the instruction will be: Industry trends, composition of milk, testing for fat and acidity, composition of ice cream, ingredients, processing the mix, acidity standardization, freezing the mix, hardening ice cream, refrigeration, ice cream flavors, stabilizers and emulsifiers, sherbets, ices, ice milk, defects, judging ice cream, bacteriology, ice cream mix concentrates, cleaning dairy equipment, soft ice cream, and fancy ice cream.

Approximately 12 hours will be devoted to comprehensive coverage of the principles involved in calculating ice cream mixes.

Fourteen hours of laboratory practice will be given in the testing, processing, and freezing of ice cream mix. More than 30 different ice cream formulas will be used in evaluating the effects of variations in fat, serum solids, sweetener, stabilizer, emulsifier, and flavoring on the texture, body, and flavor of frozen desserts.

A field trip will be taken to commercial ice cream plants in the central Pennsylvania area.

The staff will be available for consultation on individual problems.

The course will not be offered unless at least 12 persons have registered by Monday, January 6, 1969.

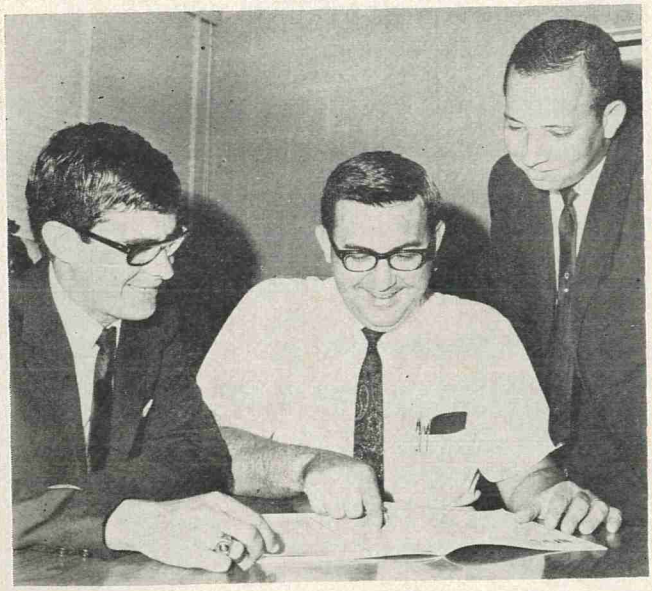
The registration fee is $25.00 for Pennsylvanians and $35.00 for non-Pennsylvania residents.

Application blanks and further information can be secured from the Director of Short Courses, Room 208 Armsby Building, The Pennsylvania State University, University Park, Pennsylvania 16802.

TEXAS A&M DAIRY MANUFACTURING STUDENTS VISIT DAIRY PLANTS

Two Texas A&M University students from the Dominican Republic visited six dairy plants in three states during late August and early September for the purpose of studying the organization and operations of major dairy plants. The students, Mr. Juan E. Villar and Mr. Ramon G. Bejaran, both junior Dairy Manufacturing majors, are attending Texas A&M University on scholarships sponsored by the U. S. Agency for International Development (AID). Dr. H. E. Randolph of the Dairy Section of the A&M Animal Science Department handled the arrangements for the trip which was sponsored by the Office of International Programs. The plants visited were as follows: Dean Milk Company, Kyana Milk Producers, Inc., Louisville, Kentucky; Armour Creameries, Springfield, Kentucky; Borden Milk and Ice Cream Plants in Columbus, Ohio and the Borden Plant in Woodstock, Illinois.

This trip provided these students with the opportunity to observe many of the latest developments in equipment and processing technology in some of the very best and most modern operations in the United States. This experience will supplement Mr. Villar's and Mr. Bejaran's academic training and will be helpful to them when they join the Dominican Republic Department of Agriculture upon graduating from Texas A&M University.



Texas A&M Dairy Manufacturing Students, Mr. Juan E. Villar (left) and Mr. Ramon G. Bejaran (right) discuss plans with Dr. H. . Randolph, Associate Professor in Dairy Science (center) concerning their visits to some major dairy plants.

NOTICE OF PAGE CHARGE FOR PUBLICATION OF RESEARCH PAPERS

The Journal Management Committee recommended and the Executive Board voted to establish a page charge for research papers published in the Journal of Milk and Food Technology. Institution of the page charge is necessary to compensate for higher publication costs, to insure a continually expanding journal which will be of maximum benefit to its readers, and to make possible continued prompt publication of research papers.

A charge of $25.00 per printed page will become effective for all research manuscripts received after January 1, 1969. Most institutions accept the page charge as a necessary cost of conducting research and communicating the results. Nevertheless, it is realized that some authors may not have funds available for this purpose and hence exceptions can be made when necessary. Inability to pay the page charge shall not constitute a bar to publication of an acceptable manuscript.

CLASSIFIED ADS

PLANT SANITARIAN: Excellent opportunity for a man who has a degree in Biological Science. A degree in Entomology with sanitation experience is preferred. This position will be available at our new facility in Georgia. Please send resume to: Mr. R. T. Hansen, Pabst Brewing Co., 917 West Juneau Ave., Milwaukee, Wisconsin 53201. An Equal Opportunity Employer.

WANTED: Public Health Sanitarian for two-county District Health Department. Annual salary $7200 to $7500, leased car program, retirement, and twenty days paid vacation, plus holidays. Food establishments and vending machines will be major part of work. Contact Mr. Kenneth Copeland, Acting Director, Branch-Hillsdale District Health Department, 35 South Sprague Street, Coldwater, Michigan 49036.

FOR SALE

Single Service milk sample tubes. For further information and a catalogue please write, Dairy Technology Inc., P.O. Box 101, Eugene, Oregon.

INDEX TO ADVERTISERS

Application for Membership

INTERNATIONAL ASSOCIATION OF MILK, FOOD & ENVIRONMENTAL SANITARIANS, INC.

Box 437, Shelbyville, Indiana 46176

Name _____ **Date** _____

Please Print

Address _____ ☐ **Renewal**

_____ **Zip Code** _____ ☐ **New**

Business Affiliation _____ ☐ **Re-instatement**

Annual Dues $10.00 ☐ **Check** ☐ **Cash**
Membership Through An Affiliate—$8.00 Plus Affiliate Dues
(Membership Includes Subscription to Journal of Milk & Food Technology.)

Please Print

Recommended by _____

Shelbyville, Ind.
Box 437

Subscription Order

JOURNAL OF MILK & FOOD TECHNOLOGY

(Monthly Publication)

Name _____ **Date** _____

Please Print

Address _____ ☐ **New**

_____ ☐ **Renewal**

Educational Institution & Public Libraries (Annually) $8.00 ☐ **Check** ☐ **Cash** **(Please Print)**

Individual Non-Member Subscription (Annually) $10.00
Government Agencies, Commercial Organizations

I.A.M.F.E.S. & J.M.F.T.
Box 437, Shelbyville, Ind.

Change of Address

FROM

Name _____ **Date** _____

Please Print

Address _____

TO

Name _____

Please Print

Address _____

I.A.M.F.E.S. & J.M.F.T.
Box 437, Shelbyville, Ind.

Order for 3A Standards

Name _____ **Date** _____

Please Print

Address _____

( ) Complete Set @ $4.50 = _____ ( ) Complete set bound (durable cover) @ $6.00 = _____
( ) Revised HTST Std.—without cover = $1.00 F.O.B. Shelbyville, Ind.

3-A Accepted Practices For Milking Machines
1-100 = 25c ea.; 100-1000 = 20c ea.; 1000 or more = 15c ea.
5 Year Service on Standards as Published = $3.50 additional

Order for Reprints of Articles

Amt. _____ **Title** _____

Schedule of prices for reprints F.O.B. Shelbyville, Indiana

	1 Page	2 Pages	3 & 4 Pages	6 & 8 Pages	12 Pages	Cover
100 or less	$16.25	$19.50	$27.30	$39.00	$65.00	$28.00
Add'l 100's	2.00	2.50	4.00	5.50	9.00	4.50

THE ONLY *Approved*
SANITARY METHOD OF APPLYING
A U. S. P. LUBRICANT
TO DAIRY & FOOD
PROCESSING EQUIPMENT

Haynes Spray

U. S. P. LIQUID PETROLATUM SPRAY

U.S.P. UNITED STATES PHARMACEUTICAL STANDARDS

CONTAINS NO ANIMAL OR VEGETABLE FATS. ABSOLUTELY NEUTRAL. WILL NOT TURN RANCID—CONTAMINATE OR TAINT WHEN IN CONTACT WITH FOOD PRODUCTS.

SANITARY—PURE

ODORLESS—TASTELESS

NON-TOXIC

This Fine Mist-like
HAYNES-SPRAY
should be used to lubricate:

SANITARY VALVES
HOMOGENIZER PISTONS — RINGS
SANITARY SEALS & PARTS
CAPPER SLIDES & PARTS
POSITIVE PUMP PARTS
GLASS & PAPER FILLING
MACHINE PARTS
and for ALL OTHER SANITARY
MACHINE PARTS which are
cleaned daily.

The Modern HAYNES-SPRAY *Method of Lubrication Conforms with the Milk Ordinance and Code Recommended by the U. S. Public Health Service*

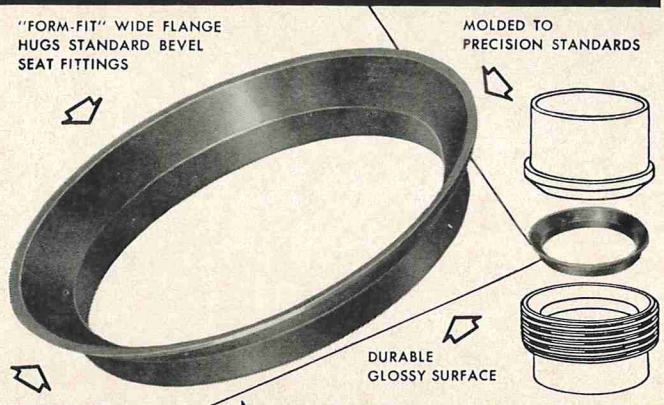
The Haynes-Spray eliminates the danger of contamination which is possible by old fashioned lubricating methods. Spreading lubricants by the use of the finger method may entirely destroy previous bactericidal treatment of equipment.

PACKED 6-12 oz. CANS PER CARTON
SHIPPING WEIGHT—7 LBS.

THE HAYNES MANUFACTURING CO.
4180 Lorain Avenue • Cleveland 13, Ohio

HAYNES-SPRAY INGREDIENTS CONFORM WITH FDA REGULATIONS AND CAN BE SAFELY USED AS A SANITARY LUBRICANT FOR FOOD PROCESSING EQUIPMENT WHEN USED IN COMPLIANCE WITH A EXISTING FOOD ADDITIVES REGULATION.

HAYNES SNAP-TITE GASKETS



LOW COST...RE-USABLE

LEAK-PREVENTING

NEOPRENE GASKET for Sanitary Fittings

Check these SNAP-TITE *Advantages*

Tight joints, no leaks, no shrinkage
Sanitary, unaffected by heat or fats
Non-porous, no seams or crevices
Odorless, polished surfaces, easily cleaned
Withstand sterilization
Time-saving, easy to assemble
Self-centering
No sticking to fittings
Eliminate line blocks
Help overcome line vibrations
Long life, use over and over

Available for 1", 1½", 2", 2½" and 3" fittings.
Packed 100 to the box. Order through your dairy supply house.

THE HAYNES MANUFACTURING CO.
4180 Lorain Avenue • Cleveland 13, Ohio

HAYNES
SELF-CENTERING
SNAP-TITE® *Gaskets*

SIZES 1" - 1½"
2" - 2½" - 3"

*MADE FROM
TEFLON®

"The Sophisticated Gasket"

THE IDEAL UNION SEAL FOR BOTH VACUUM AND PRESSURE LINES

Gasket Color. . .
slightly off-white

SNAP-TITE self-centering gaskets of TEFLON are designed for all standard bevel seat sanitary fittings. They SNAP into place providing self-alignment and ease of assembly and disassembly.
HAYNES SNAP-TITES of TEFLON are unaffected by cleaning solutions, steam and solvents. They will not embrittle at temperatures as low as minus 200° F. and are impervious to heat up to 500° F.

FOR A FITTING GASKET THAT WILL OUT-PERFORM ALL OTHERS...

Specify . . . HAYNES SNAP-TITES of TEFLON

- *TEFLON ACCEPTED SAFE FOR USE ON FOOD & PROCESSING EQUIPMENT BY U. S. FOOD AND DRUG ADMINISTRATION*

*Gaskets made of DuPont TEFLON® TFE-FLUOROCARBON RESINS

THE HAYNES MANUFACTURING COMPANY
4180 LORAIN AVENUE • CLEVELAND, OHIO 44113

A HEAVY DUTY SANITARY LUBRICANT

Available in both
SPRAY AND TUBE

All Lubri-Film ingredients are approved by F.D.A. and can be safely utilized as a lubricant for food processing equipment when used in compliance with an existing food additive regulation.

ESPECIALLY DEVELOPED FOR LUBRICATION OF FOOD PROCESSING AND PACKAGING EQUIPMENT

For Use in Dairies — Ice Cream Plants — Breweries — Beverage Plants — Bakeries — Canneries — Packing Plants

SANITARY • NON TOXIC • ODORLESS • TASTELESS

SPRAY — PACKED 6 — 16 OZ. CANS PER CARTON
TUBES — PACKED 12 — 4 OZ. TUBES PER CARTON

THE HAYNES MANUFACTURING CO.
CLEVELAND 13, OHIO

Rugged on the outside

Jet smooth on the inside

The new Surge Jet-Flo . . . It's a whole new concept in inflations. A new shape to give you faster and safer cow milking. A new formulation with extra flexibility for longer life.

Jet-Flo interior design is completely smooth, free of everything that might slow down the flow of milk. No "shoulders" to cause agitation, whirlpooling or backflooding around teat. Jet-Flo speeds up evacuation of milk, gives a more stable milking vacuum.

The Jet-Flo inflation is another new dimension in better cow milking from Surge, the people who take dairying seriously . . . like you.

Your Surge dealer has special transparent Jet-Flo inflations to let you see the gentle massaging action . . . faster milk flow of new Surge Jet-Flo inflations. Contact him today or fill in the coupon for a demonstration on your farm.

SURGE

Please have my local Surge dealer give me a "See-through" demonstration of the new Jet-Flo inflations.
Mail to: Babson Bros. Co.
2100 S. York Rd., Oak Brook, Ill. 60521

NAME

ADDRESS TOWN

STATE (OR PROVINCE) ZIP MF-4

BABSON BROS. CO., OAK BROOK, ILL. • BABSON BROS. CO. (Canada) LTD., REXDALE, ONT.