FEBRUARY, 1966
Vol. 29 P. 35-68 No. 2

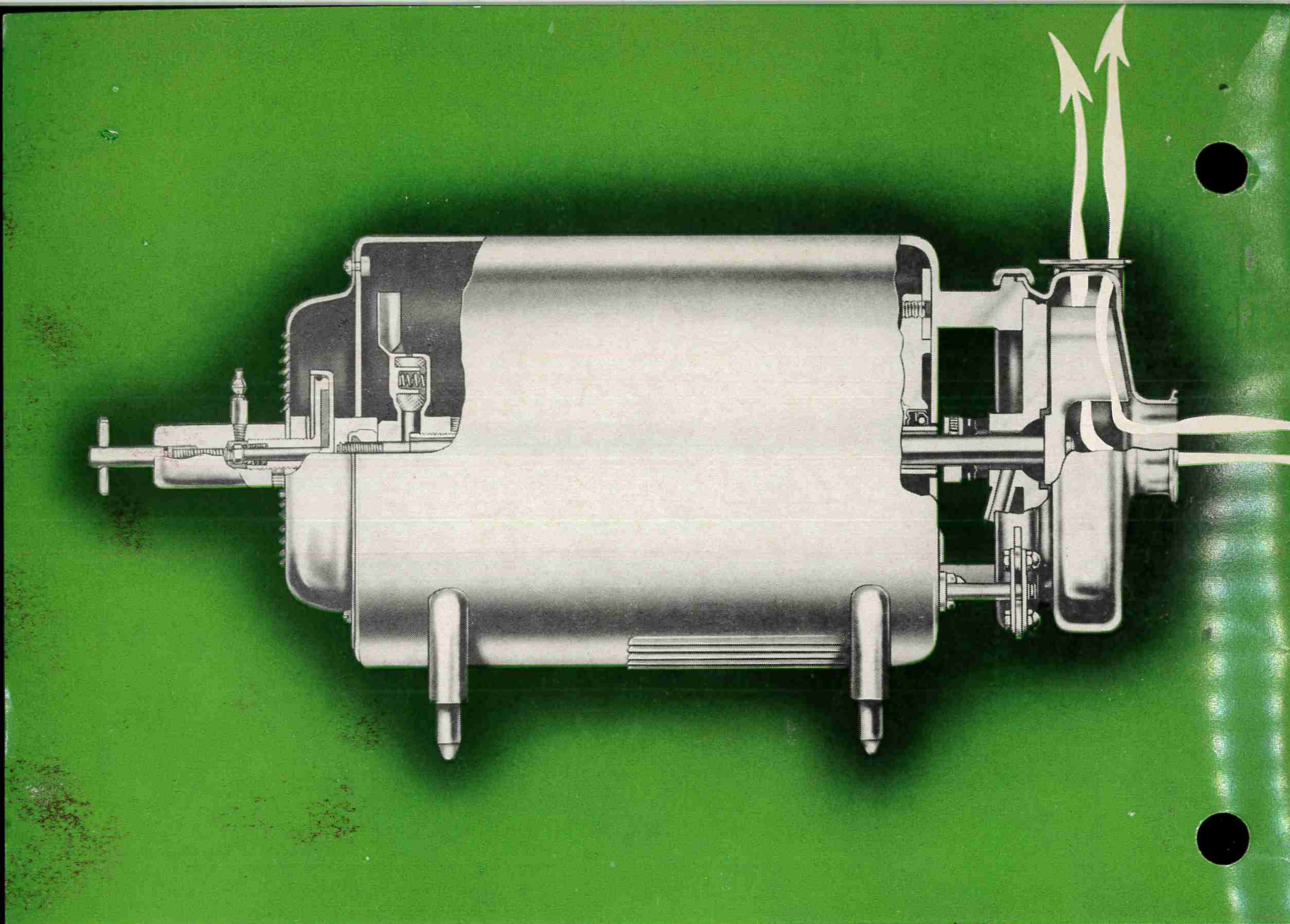
Journal of

MILK and FOOD TECHNOLOGY

53rd ANNUAL MEETING
August 15, 16, 17, 18, 1966
Hotel Radisson
Minneapolis, Minnesota

Official Publication

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



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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: J. C. Olson, Jr., Editor, Dept. Dairy Industries, University of Minn., St. Paul, Minn.; H. L. Thomasson, Managing Editor, P. O. Box 437, Shelbyville, Ind.

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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. 29 February, 1966 Number 2

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 Organiation subscription.

1 yr. .... $ 8.00

Public and Educational Institution Libraries, 1 yr. .... $ 6.00

Single Copies .... $ 1.00

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

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ENVIRONMENTAL MICROBIOLOGY AND ENVIRONMENTAL HEALTH[1]

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Any person who has an appreciation of history must stand amazed today at the phenomenal advances which have occurred and are presently taking place in public health. Within the span of our own lifetime, our original goal of simply fighting a "holding action" against disease and illness has changed to one of taking the offensive. We are talking about nothing less than the actual elimination of most infectious diseases, and the start of massive programs to deal with such dread affections as cancer, heart disease, and stroke. Although there is still some distance to go before these goals are reached, the recent history of public health suggests that they are not at all unrealistic. Indeed, any consideration of the current progress in preventive medicine, surgery, chemotherapy, mental health, nutrition, health education and environmental health leads to the recognition that such aims as those of the World Health Organization are not simple Utopian pipedreams: "A state of complete physical, mental, and social well being, and not merely the absence of disease or infirmity".

Not the least of the contributing factors to the progress of the past, and certainly one of the more important considerations in the anticipated progress of the future, is the ability of environmental health workers and sanitation specialists to evaluate and adjust their position in and potential contribution to the over-all public health program. In fact, the successful pursuit of the expanded goals of public health mentioned above depend to a large extent on a concurrent expansion of the scope and goals of environmental health.

A complex and shrinking world, a rapid and uncontrolled urbanization, a proliferating and expanded industrialization—all of these are factors which have caused environmental health specialists to take a second and third look at their specialties and society's needs. It is no accident that the simple and relatively uncomplicated job definitions for sanitarians and sanitary engineers of the past have suddenly been expanded to "the control of all of those factors in man's physical environment which exercise or may exercise a deleterious effect on his physical development, health and survival". It is no accident that we suddenly find that environmental health encompasses such diverse specialization as water supply, waste handling, insect control, rodent control, food and milk sanitation, plumbing, atmospheric pollution, heating, ventilation and air conditioning, lighting, housing, institutional sanitation, occupational health, swimming pool and bathing places sanitation, nuisance eradication, radiological protection, and accident prevention. It is also no accident that in an age of such specialties as mentioned above, there is a greater demand for environmental health "generalists"—these environmental health workers who have a broad view of community needs and a sufficiently broad spectrum of skills and knowledge to perform jobs which cross the borders of several disciplines.

Enviromental Health and Its Supporting Sciences

It is obvious to all who work in environmental health that this is a field of applied science which draws upon a wide array of basic scientific disciplines. Not only do the "generalists" cross interdisciplinary lines, but even the specialists depend upon skills and knowledge derived from other sciences. Thus, a sanitarian must be familiar with chemistry, biology, and physics; an occupational health worker must be familiar with physiology, psychology and toxicology; a health physicist must understand mathematics, chemistry, nuclear physics, and physiology; and air pollution engineers must know their particle technology, analytical chemistry, biochemistry, and meteorology. In essence, environmental health workers draw together knowledge from a great number of sciences and apply these principles toward the specific purpose of making the human environment safe and healthy.

In the past, one of the major supporting disciplines of environmental health has been microbiology. Sanitation specialists had to be familiar with the various microbial agents of disease—the bacteria, viruses, fungi, rickettsiae, algae, protozoa, and helminthic parasites. He had to have more than an academic knowledge about the transmission of these agents whether by direct or indirect contact, by inanimate vehicles, by living vectors, or by airborne dust or droplet nuclei. Above all, the environmental health worker had to know a great deal about the control of infectious disease transmission—pasteurization, disinfection, sterilization, asepsis, and so forth.

In the "good old days" of classical microbiology

[1]Presented at 52nd Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians, Inc., at Hartford, Conn., September 13-16, 1965.

and classical public health, the communication lines between environmental health and the bacteriology lab were clean and well defined. The only people interested in quantitative microbiology were the dairy, food and water workers and to this end many editions of standard methods provided answers. Sterility and disinfection concepts were nearly catechismal, and dealt usually with small units like dilution blanks, dishes, milk bottles and meat cutting boards. Air was sampled by open petri dishes and surfaces were sampled by swabs and since the significance of environmental organisms was not completely understood, the inadequacy of sampling really didn't make any difference. The difference between a pathogen and non-pathogen was clearly defined in text books, and the difference between infection and contamination was the responsibility of the medical profession. All too often the sanitarian degenerated into a sample collector for the bacteriologist and this laboratory insulated person didn't always know the difference between blood, milk and water, or between skin, tile floors, and milk cans—or at least he didn't always appreciate the significance of microorganisms in and on these materials.

However, there is no doubt that the combined efforts of environmental health workers and classical microbiologists were adequate for the job society demanded. For example, milk-borne typhoid, paratyphoid, scarlet fever, diphtheria, dysentery, and brucellosis in the United States during the last decade were responsible for less than 2 dozen cases and no deaths. Similarly, those other areas of environmental health which depend on classical microbiology have served as well. It is in some of the fringe areas of environmental health that our laboratory sources cannot provide the microbiological answers we need, mainly because of a frustrating lack of good data and no real system of theory upon which to base predictions.

For example, when the outbreaks of hospital staphylococcus infections became the subject of popular newspaper and magazine articles, both environmental health specialists and the bacteriology laboratories were embarrassed because they didn't know very much about the bacteriology of the hospital environment or about the role of the environment in the transmission of these infections. Similarly, when the National Aeronautic and Space Administration (NASA) decided to sterilize its spacecraft and turned to environmental health for help, all we knew about was autoclaving, and we didn't know how to determine the sterility of anything bigger than a gallon of water, anyway. The problems faced by workers in biological warfare defense also needed answers that should have been provided by environmental health—problems related to protective clothing, and masks, and large scale disinfection. But these answers were not forthcoming from classical bacteriology labs and the military had to develop their own answers, which incidentally, are proving most useful in other environmental health areas. The areas of deficiency in knowledge about environmental health microbiology would make a rather extensive list. The list would include things like transmission of virus diseases by fomites, the use of chlorine foot baths in army barricks, the outbreak of paratyphoid in a community water supply that had satisfactory coliform tests, the significance of airborne bacteria in food plants, and the spread of encephalitis from pet turtles.

ENVIRONMENTAL MICROBIOLOGY DEFINED

It can be seen, therefore, that although classical bacteriology has been able to provide environmental health workers with sufficient support for their routine missions, there are some grave deficiencies in our knowledge and skills which might prove critically limiting when we try to expand the scope of environmental health in response to the demands made on it. It is now being recognized that there are unique and related microbiological problems associated with environmental health endeavors that are not being considered in a systematic fashion by any other discipline. These problems, in essence, deal with the types and numbers of microorganisms in air, on inanimate surfaces and living creatures, in foods, on clothing, and in soil, and with their determination, survival, control, and significance to public health.

During the last five years, a number of formal and informal conferences have been held by people interested in the above-mentioned problems. The backgrounds of the participants ranged from epidemiology to architecture, to aerospace technology, and included representatives of university schools of public health, hospitals, microbiology departments, the National Institutes of Health, the Army Biological Labs, NASA, colleges of engineering, the Technical Development Labs of the U. S. Public Health Service, and the Robert Taft Sanitary Engineering Center.

There has never been any intention to establish environmental microbiology as an independent discipline with clean lines of demarcation between it and other subdivisions of bacteriology and public health. Rather, the participants at the conferences envisioned environmental microbiology as an interdisciplinary science, drawing together information from the fields of microbiology, engineering, statistics, chemistry, particle technology and physics and focusing this information toward the practical solution of problems in environmental health. A working definition of environmental microbiology might consequently be:

"The systematic quantitative and qualitative study of microorganisms in man's physical environment, the effect of the environment on these organisms, and the role of the environment in the transmission of infectious disease agents".

Areas of Environmental Microbiology

Although nobody has yet taken the time to do so, the broad and expanding field of environmental microbiology can be subdivided into five recognizable areas: (*a*) basic microbiology; (*b*) technology; (*c*) survey work; (*d*) control work: and (*e*) specialized applications.

Basic Microbiology

Studies in basic environmental microbiology deal essentially with such problems as the survival of different microorganisms in the environment, the influence of environmental exposure on infectivity of virulent strains, the source of microorganisms that are encountered in the environment, their generation from living and inanimate reservoirs, their dissemination and transportation, and ultimately, with their significance. It has been recognized that an organism which has been exposed to the stresses of the environment(e.g. temperature, humidity, oxygen, radiation, etc.) is not always the identical creature that was freshly isolated from a host or freshly grown on an artificial medium. Thus, the simple discovery of staphylococci in air does not necessarily mean that an epidemic is imminent. Similarly, the presence of a "carrier" of pathogenic bacteria in an operating room does not always mean that this person is shedding and transmitting the infectious agents.

As work progresses in this area, more and more is being learned about the complex interactions of environmental conditions on microbial viability and infectivity. And we are not always as sure of ourselves as we used to be when we try to incriminate inanimate surfaces and air as reservoirs of infectious disease. There still is no doubt that complete absence of bacteria will lead to absence of any hazard. On the other hand the converse of the statement, namely that presence of bacteria does constitute a hazard, must be qualified. We feel that studies of this nature will go a long way in aiding epidemiologists in assessing the significance of indirect routes of disease transmission, as well as aiding sanitary scientists in the establishment of realistic bacteriological standards.

In very recent years, a great deal of interest has been displayed in the phenomenon of virus survival in the environment. This interest encompasses such studies as the transmission of infectious hepatitis through water supplies and non-sterile syringes and, closer to home, the dissemination of bacteriophages in cheese factories. About the only thing we have learned so far is that there is a diversity among viruses, and that some are more resistant than others to drying, heat and radiations. In this field we are at about the same stage as classical bacteriology was when it found that different strains and species of bacteria displayed different degrees of resistance to environmental stress. So far, no one has found a "sporeforming" virus. But we have found some phages that are difficult to kill, and we have only scratched the surface in these studies.

Technology

A great deal of work has been done in the last decade relative to the technology of sampling. Today there are available a whole battery of instruments for quantitative air sampling of microorganisms. This includes liquid impingers, impaction devices, thermal and electrostatic precipitators, and a number of filtration devices. Instruments are available for sampling very heavily contaminated air as well as for extremely clean air; instruments are available for size classifying airborne contaminants; and instruments are available for continuous monitoring of an environment. The problem is not so much availability of a sampling device as it is of choosing the appropriate device to answer the questions one may have. Thus, certain sampling techniques which were useful in a hospital operating room might be inapplicable to a dairy plant situation, or an instrument designed for an industrial clean room might be out of place outdoors.

Concurrent with the work in air sampling has been the work on surface sampling. There are now available such devices as soluble swabs, disposable direct agar contact plates (RODAC) and "water pressure and suction rinsing" methods for assay of surface contamination.

Of greater importance than the technological advances in this field, however, has been the interest displayed by the statisticians in the problems of environmental sampling. In the last five years some very good work has been generated relative to data reliability and data interpretation in the environmental microbiology field. We will find, ultimately, that many of our previous problems became problems because we did not formulate our questions in terms meaningful to a statistician, and that consequently our answers did not really have any validity.

Some questions still remain the property of bacteriologists. Decisions about the type of media to use and the incubation conditions to choose for environmental microbiology studies never seem to disappear. These questions become more and more acute when one starts to work with smaller samples, or with expensive samples, or with very clean samples. In these circumstances it is often impossible to divide the sample and run replicates on several media or at several temperatures. The whole sample might contain just one or two organisms, and the decision about incubation is irrevocable.

In this regard, mention should be made about studies in the field of rapid detection. In certain cases (e.g. biological warfare defense and warning) the investigator does not have the luxury of a twenty-four incubation period. Similarly, he must detect extremely minute (i.e. sublethal) quantities of agent or his research becomes of historical benefit only. Unfortunately, the two conditions are mutually contradictory; low levels of contamination usually take much longer to find. Nonetheless, research in this field of rapid detection is progressing quickly and some ingenious concepts being developed in this area of technology promise us some major benefits in our routine works in the near future.

Survey Work

Although microbiological surveys of the environment are as old as microbiology itself, this activity was greatly stimulated by the above-mentioned advances in sampling technology and statistics. Surveys have been conducted and reported upon for any number of inhabited and uninhabited areas including operating rooms, classrooms, industrial clean rooms and the stratosphere. Perhaps the most pertinent surveys that concern this association were conducted in a dairy plant by several investigators at Michigan State University. It was found that the mean airborne bacterial count in packaging areas was less than 6 bacteria and 2 yeasts per cubic foot. Although this is considerably less than the contamination level of many hospital areas, similar factors seemed to influence the rise and fall of bacterial counts in both places: number of people and extent of their activity. An interesting observation made during the dairy plant survey was that flooding floor drains seemed to increase the airborne count significantly. This suggests that floor drains are an important reservoir of organisms which become displaced into the air during flooding. Application of high concentrations of chlorine sanitizer (800 ppm) to the flooding water controlled the airborne count during subsequent trials.

Control of Environmental Contamination

It is axiomatic that environmental health workers are interested in microbiology mainly because they would like to control the microbes and their dissemination. Consequently, a great deal of environmental microbiology effort is devoted to the problems of contamination control. The effort includes study of sterilization and disinfection techniques and systems; concepts of asepsis and gnotobiology; and the use of ventilation design to control the movement of airborne microorganisms from "dirty" to "clean" areas.

The advent of adequate sampling techniques has made control work much easier, or at least has enabled us to measure adequately whether or not we are doing a good job. For example, before employing the RODAC plate and statistical controls it was extremely difficult to evaluate the effectiveness of different germicides "in use". Employing these two advantages, however, some investigators at the University of Minnesota were able to show that the type of germicide was not as important as the frequency with which it was applied. Similarly, it was difficult at one time to ascertain sterility of large volumes of fluid. This led to the anomaly of recording a count as <1/ml and presuming that every milliliter was as clean as the next. Now, with membrane filters, one can measure counts down to <1 organism per gallon or 10 gallons or any other sample which might represent a tank car.

Research in contamination control is bearing significant fruit in the field of asepsis and germ-free work. It is now possible, by combining our knowledge of ventilation and air cleaning with our knowledge of chemical and physical germicidal treatment to render an environment truly sterile and to maintain it that way for extended periods of time.

Applications of Environmental Microbiology

During the course of this dissertation, allusions have been made to the different areas of public health which require environmental microbiology answers. We have seen that there is an application of this type of information to hospitals and to food plants. We have touched briefly on the field of biological warfare defense and germ-free research. It should be pointed out that this is only a beginning. Once hospitals have solved their present problems of control of routine infections, they will want to provide a sterile environment for patients whose treatment includes destruction of all phagocytes and antibody producing mechanisms. Once food and dairy plants are done with coliform counts and mold spoilage, they will want sterile, unheated products and absolute asepsis. The detection and protection people of the biological warfare labs really have set no limit to the precision and speed of their detection devices and their rapid decontamination procedures.

And all of this is taking place on this planet. The challenge of the exobiology program literally staggers the imagination. They want to send a sterile capsule to Mars; then they want an automated sterile laboratory to sample the Martian environment and to detect any living microorganisms in it!

And, ultimately, all of these problems are problems in environmental health and environmental microbiology. Are we, as environmental sanitarians, ready to meet this challenge?

RADIATION-PASTEURIZATION OF FISHERY PRODUCTS

Based on an article in Commercial Fisheries Review, Vol. 27, No. 10, October, 1965.

The U. S. Bureau of Commercial Fisheries Technological Laboratory at Gloucester, Mass., under a contract with the U. S. Atomic Energy Commission, has conducted research on radiation-pasteurization of fresh fish as a means of extending its shelf life. Results indicate that a number of economically important Atlantic fishery products can be held refrigerated in an acceptable condition for at least one month after treatment with low doses of gamma radiation without significant nutritive losses. The method seems to be practical even when 50% of the shelf life of the fish has been used up.

The value of fishery products as a source of protein is well known and since man's dependence on them is anticipated to increase, it is inevitable that he supply his latest technology to the sea. In general, fishery products are relatively perishable and, consequently, distribution of fresh fish and shell fish is limited to coastal areas. Wider distribution is possible when those products are either heat-processed or frozen; however, in most cases fresh fish and shellfish, like fresh fruits and vegetables, command a higher consumer preference and a higher selling price than their frozen counterparts.

Since the discovery that ionizing radiations can be used to preserve food, much work has been done, especially in recent years, on the use of this energy for sterilization of many foods including fish and shellfish. The application of high levels of energy to these products resulted in significant quality loss from irradiation-induced flavors and odors. However, early research indicated that the refrigerated storage life of fishery products could be significantly extended without objectionable quality changes when irradiated with pasteurizing doses of ionizing radiations (less than one megarad).

Results of the study at Gloucester indicate that clam meats and haddock, cod, pollock, and ocean perch fillets can be held refrigerated in an acceptable condition for at least one month after treatment with low doses of gamma radiation (150-450 kilorads). The effect of irradiation on amino acids and B-vitamins was relatively insignificant and certainly not greater than the effects of cooking or of seasonal variations.

Data have been obtained to show that radiation-pasteurization of haddock fillets has practical application even when the fillets have been stored in ice for more than half their normal shelf life prior to irradiation.

It was found that the bacterial numbers in fresh haddock fillets were reduced by at least 99% by irradiation with 250,000 rads. An investigation of the chemistry of fish flavors and odors has not, thus far, uncovered any evidence that irradiation causes the formation of aberrant or unusual compounds.

The study also included a review of packaging. Because of the many advantages offered by flexible packaging materials, tests were initiated to determine the suitability of available plastics to hold irradiated fish and shellfish. Results showed that many commercially available plastic materials are suitable for packaging radiopasteurized fishery products and that in most cases unsuitability was apparently due to high oxygen permeability rates and poor sealing characterisics. Films tested (polyethlene, polypropylene, polyester, nylon-11, and others) were found to be resistant to bacterial penetration. They were also relatively free from pinholes and their seams were adequately strong.

EMERGENCY WATER MANAGEMENT MANUAL

A manual on the use of emergency water supplies and equipment in a disaster, entitled "Water Supply Management in the Packaged Disaster Hospital," has just been published by the Public Health Service Division of Health Mobilization.

This new publication covers such predisaster considerations as estimating water requirements, determining emergency sources, establishing conservation measures, and training personnel. The manual covers the use of all water supply equipment in the PHS Packaged Disaster Hospital, including a 1500-gallon water tank and 10-gallon per minute pump with pressure tank. It also gives detailed assembly instructions, illustrated with schematic diagrams and photographs.

Packaged Disaster Hospitals, pre-positioned across the country for use in national emergency or major natural disaster situations, are complete 200-bed hospitals which can be set up to replace destroyed local facilities or to expand existing hospitals.

Some state sanitarians and water supply managers are planning training seminars based on this new manual. It is designed as a guide to help community leaders in preparing emergency water supply plans and as a training tool for personnel assigned to operate Packaged Disaster Hospital emergency equipment.

The manual is available at State health departments, or may be obtained by writing the Division of Health Mobilization, Public Health Service, Washington, D. C. 20201.

SUITABILITY OF LOW TEMPERATURE VACUUM PAN EVAPORATOR CONDENSATE FOR PLANT USES

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(Received for publication July 30, 1965)

Summary

A preliminary study to investigate the possibility of utilizing condensates and tailwater from the low temperature vacuum pan evaporation of skim milk for evaporating plant uses was made. The results indicated that the utilization of these condensates and tailwaters for various plant purposes is possible and should provide a readily available, safe and sanitary water source if adequate steps such as quality monitoring and treatment are taken to insure that the highest quality of water is retained and used. The use of tailwater as a heat exchange medium on a single pass basis should require only quality control monitoring. However, condensate or tailwater which is to be used for other purposes should be aerated and may need additional treatment to prevent the development of tastes, odors, growths, corrosion, and scale formation.

During the concentration of skim milk by vacuum pan evaporation, a signifcant volume of water is driven off in the form of vapor. For example, the condensation of 100 lb. of skim milk from 9% solids to 38% solids results in the production of 76 lb. or 9 gal of water. Because of the quantity of condensate produced in the average evaporation plant, it would be desirable to utilize this water in various ways in the plant if it were of suitable quality. Several skim milk evaporating and drying plants in Michigan are presently using or desire to use the mixture of this condensate and cooling water which is called tailwater in plate heat exchangers to recover heat from the evaporation process. In addition, in some areas of the State, the existing ground water supplies have a high mineral content which makes them difficult to use without expensive pretreatment. The use of evaporator condensate for boiler feed make-up water and plant clean-up water in place of the available ground water is being given serious consideration in these areas because of its low mineral content. Although evaporator condensate was presumed to be of high quality and bacteriologically safe, little information was available regarding its physical, chemical, and bacteriological quality.

In order to obtain information relative to the suitability of vacuum pan evaporator condensate for plant usage, a cooperative study was conducted by the Michigan Department of Agriculture and the Region V office of the Division of Environmental Engineering and Food Protection of the Public Health Service. The primary objectives of the study were: *(a)* to obtain information regarding the chemical, physical, and bacteriological quality of low temperature vacuum pan evaporator condensates, *(b)* to propose a system for monitoring the quality of the condensate and selecting that of the highest quality for use, and *(c)* to determine whether the quality of the condensate would have to be improved before it would be suitable for use and which treatment processes would be suitable for this purpose.

The condensates worked with during the study were the condensed vapors given off during the condensation of skim milk in double effect vacuum pan evaporators having a first effect temperature between 155 and 165 F and a second effect temperature between 115 and 130 F during operation. The condensate is designated as being first effect or second effect depending on the effect at which it is driven off; a mixture of condensate from one or more effects with condensing water is called tailwater. The tailwater temperature varies between 100 F and 120 F depending upon the respective temperatures and the relative volume of the condensate(s) and the cooling water usually from a well supply.

Plant Water Supply Quality Requirements

The Public Health Service Recommended Milk Ordinance *(1)* under Section 7, Item 7p, states that:

"Water for milk plant purposes shall be from a supply properly protected and operated and shall be easily accessible, adequate, and of a safe, sanitary quality."

Satisfactory compliance with these requirements includes approval as safe by the State Health Authority, and, in the case of individual water systems, complies with at least the specifications of Appendix D, Standards for Water Sources, and Appendix G, Chemical and Bacteriological Tests of the Suggested Milk Ordinance. Samples for bacteriological testing of individual plant water supplies are to be taken upon the initial approval of the physical structure, semi-annually thereafter, and when any repair or alteration of the water supply system has been made.

For the purpose of this study, the physical, chemical, and bacteriological quality of the condensate was compared with the requirements of the Public Health Service Drinking Water Standards *(2)* and the suggested standards for industrial waters *(3)* to determine the acceptability of this source of water for plant uses.

In this preliminary study, only quality requirements have been given consideration and no attempt has been made to determine the accessibility of adequate quantities of water of suitable quality from this source for the desired uses.

SAMPLING

Three factors considered in the determination of water quality are the bacteriological, the physical, and the chemical characteristics of the water. Ideally, a comprehensive testing program which includes the collection of samples from a number of evaporating plants over an extended period is necessary to accurately estimate variations in the parameters of quality and the average values of these parameters for a substance with broad variations in quality such as vacuum pan evaporator condensate. However, for the purpose of stimulating interest in the possibility of utilizing this source of water, the study was limited in its extent and the results serve only as a rough estimate of the characteristics of such condensates.

Samples were collected from three evaporating and drying plants during the course of the study which was July 9-20, 1963. At two of these plants, samples were collected for bacteriological and physical examination only, including samples collected and examined in the plant laboratory by plant personnel at one of the plants. At the third plant, grab samples were collected for chemical analysis and composite sampling was conducted to detect the presence of organics in the condensate in addition to the samples collected for bacteriological examination.

Quantitative tests to evaluate the physical characteristics of evaporator condensate, other than temperature measurements, were not made during the sampling program. The determination of taste and odor is difficult to conduct and requires carefully controlled conditions to be meaningful. Tests for turbidity determinations while highly desirable were not made because the necessary equipment for this test was not readily available. However, qualitative tests were made at the time of sampling to detect the presence of visible sediment or cloudiness in the sample and any objectionable odors.

SAMPLING RESULTS

All bacteriological samples collected were examined using the test for the presence of members of the coliform group by the membrane filter technique *(4)* and the procedures for total count using the membrane filter technique *(5)* using M-enrichment broth except for those samples examined in the plant laboratory. These samples were examined for the presence of members of the coliform group using the multiple fermentation tube technique *(4)* and using the standard plate count *(4)* at 35 C. The results of the bacteriological sampling are presented in Table 1.

These results indicate that vacuum pan evaporator condensates can satisfy the requirements of the Drinking Water Standards *(2)* with a coliform density of less than one/100 ml and are bacteriologically potable. The results also indicate that the condensate can be classifed as "passable" (a water having a total bacterial count up to 500/ml) for use as dairy plant washing and rinsing purposes. There is the possibility, however, that the bacterial content of the condensates includes a signifcant density of thermophiles and/or anaerobic organisms as well as other types which were not detected by the plant count procedures used.

TABLE 1. BACTERIOLOGICAL QUALITY OF VACUUM PAN EVAPORATOR CONDENSATES

		Coliforms		Plate counts	
Source	No. of samples	Average /100	Range /100 ml	Average /ml	Range /ml
1st effect condensate	6	<1	none	100	5 to 280
2nd effect condensate	4	<1	none to 1	170	8 to 320
Condensing water	3	<1	none to 2	430	35 to 650
Tailwater	15	<1	none to 1	68	2 to 620

The results of observations and measurements made of the physical characteristics of evaporator condensates are summarized in Table 2. The first effect condensates usually contained more visible solids and were normally cloudier than second effect condensates although both appeared clear at times. Quantitative turbidity measurements are required to determine the average characteristics of the condensates at a given plant and at any given time because of turbidity variations during operation. The cloudiness can be attributed to suspended milk solids which are occasionally carried over with the water vapor during the evaporation process.

Table 3 provides an indication of the chemical quality of low temperature vacuum pan evaporator condensates when skim milk is being condensed and is based on tests conducted by the Michigan Department of Health Laboratory. As is expected, the low total solids in the condensates indicates that only a negligible amount of inorganic chemicals are present because of the nature of the evaporation process. It is desirable that water used for washing and rinsing purposes in dairy plants have an organic matter content of less than 12 mg/liter as measured by the COD or permanganate consumed test *(3)*. These results indicate that the condensates contain much higher concentrations of organic matter than is desirable for a milk plant water supply.

The organic content of condensates was anticpated and in an attempt to analyze the quantity and character of this organic material in more detail, a carbon filter adsorption test *(6)* was conducted on the combined first and second effect condensates from a low temperature vacuum pan evaporator. The following estimates of concentrations of organic matter capable of being absorbed on carbon were obtained from this test: carbon chloroform extractables, 1412 ppb; carbon alcohol extractables, 278 ppb.

TABLE 2. PHYSICAL QUALITY OF VACUUM PAN EVAPORATOR CONDENSATES

Source	No. of samples	Temperature		pH		Turbidity odor	
		Average	Range	Average	Range		
1st effect condensate	5	140	138 to 142	7.2	6.9 to 7.3	Clear to Cloudy	none
2nd effect condensate	5	97	76 to 121	7.3	6.0 to 8.1	Clear to Cloudy	sweet

TABLE 3. CHEMICAL QUALITY OF VACUUM PAN EVAPORATOR CONDENSATES

Source	No. of samples	Total solids (mg/1)		COD (mg/1)		Chlorides (mg/1)	Nitrates (mg/1)	Nitrites (mg/1)
		Avg	Range	Avg	Range	Avg	Avg	Avg
1st effect condensate	4	53	28 to 80	83	63 to 96	0	0.0	0.00
2nd effect condensate	3	57	32 to 82	73	45 to 90	0	0.0	0.00

As a basis of comparison, the recommended limit for the chloroform extractables for drinking water is 200 ppb *(2)* and the chloroform extractable concentration of surface waters is normally about 100 ppb *(3)*.

The infra-red spectropgraph of the carbon chloroform extract (without solubility separation) indicated the presence of a carboxylic acid type compound. As the odor of the extract was unmistakably that of butyric acid, it is reasonable to assume that the extract was predominantly butyric acid or butyrates. The chloroform extractables are a measure of those organic constituents of a water usually associated with tastes and odors and a water with a CCE concentration which exceeds 200 ppb is usually of poor quality from a taste and odor standpoint. Therefore, it is anticipated that taste and odor problems would result if vacuum pan evaporator condensates were used as a plant water source without proper treatment.

DISCUSSION

The evaporator condensates from the low temperature vacuum pan condensation of skim milk contain very little inorganic matter and bacteriologically are of potable water quality. However, they may contain relatively high concentrations of organic matter at times and may have some slime-forming organisms and other similar undesirable organisms. The organic matter in the condensates varies from relatively simple carboxylic acid type compounds to the more complex milk solids. The carboxylic acid type compounds are probably derived from fats remaining in the skim milk some of which are broken down and volatilized during the evaporation process. There is also the possibility that part of the butyric acid identified in the carbon chloroform extract may be a product of bacteriological action resulting from the seeding of the carbon bed with bacteria and the degradation of more complex deposited organic matter. It is anticpated that the identy of the carboxylic acid type compounds will vary considerably with the evaporation process and with the characteristics of the incoming skim milk. The more complex milk solids result from the entrainment of these solids in the water vapor and their carry-over to the condensers. The amount of these substances in the condensates and the frequency with which their carry-over occurs will vary with the evaporation process and the construction of the evaporation equipment.

SUITABILITY OF CONDENSATES FOR USE

It is anticipated that most of the organic compounds in the condensates particularly the entrained milk solids are only slightly soluble or insoluble and consequently, the condensate with the lowest organic matter content will be the clearest. This is important because the suitability of the condensates or tailwater for use in the plant will depend on the selection by some monitoring procedure of the water with the lowest organic content. The suitability of tailwater will also depend on the original quality of the condensing water.

Properly monitored tailwater will probably be acceptable without additional treatment for use as a single use heat transfer medium without being detrimental to the heat exchange system or the product being preheated. However, a number of operational problems may develop from the organic matter remaining in the monitored water and undesirable noncoliform organisms when present if tailwater or condensates are used in a recycled cooling system, as boiler feed make-up water, as plant clean-up water, or for similar purposes without additional treatment. The organic matter in the condensates could create corrosion problems in cooling systems and boilers, deteriorate timber (delignification) in cooling towers, leave harmful or taste causing residues on plant equipment when the water is used for rinsing and cleaning, or develop undesirable tastes and odors in the plant. The presence of certain organisms in the condensates could lead to the development of slimes, algae, aquatic plants and other growths with accompanying tastes and odors as a result of their use without prior treatment.

MONITORING AND TREATMENT

Because of the organic matter content of condensate is quite variable and can change rapidly during the evaporation process, some method of continuous monitoring in the condensate or tailwater line will be the most practical way to minimize the organic content in these waters. The method used should measure a readily detectable parameter such as turbidity or conductivity which has previously been correlated with the COD or organic matter content of the water. Condensate or tailwater of acceptable quality could be retained in the piping system for use or treatment and unsatisfactory water could be diverted to waste automatically by flow diversion valve coupled with the monitoring device. It is recommended that condensate or tailwater having a standard turbidity greater than five units be discharged to waste because of the anticipated correlation between insoluble milk solids and turbidity.

Monitoring methods suitable for screening condensates or tailwater include the direct measurement of turbidity based on optical transmittance using a photoelectric cell and the measurement of conductivity using a conductivity bridge. Whichever method is used, the diversion setting will have to be correlated with the standard turbidty and the COD or organic matter content, and checked periodically to insure that all condensate or tailwater of unsuitable quality is diverted.

The use of tailwater with a turbidity of less than five standard units in a plate heat exchanger on a single pass basis should not result in a solids build-up in the system or product contamination. Because of variations in the ratio of condensate volume to condensing water volume, the conductivty of tailwater is highly variable and an optical method of turbidity measurement would seem to be more suitable for monitoring tailwater.

Condensates and tailwater should be aerated following the monitoring step to remove as many of the volatile organics as possible. This can be accomplished effectively through the use of a conventional cooling tower or aerator. It may also be necessary to add a corrosion-suppressing compound or in the case of some tailwaters a compound to prevent scale formation. Because of the nature of the organic matter in the condensates and the possible presence of undesirable organisms, it may be necessary to add a chemical such as chlorine with a suitable detention period to suppress the development of growths and prevent the development of tastes and odors. Whatever treatment is given to the water, it must not add substances that will prove deleterious to its use or contribute to product contamination. If the condensates or tailwater is to be used for plant clean-up water or similar purposes, it is suggested that adequate storage be provided to meet the water requirements for at least one day's operation. This would allow for diversion of water which does not meet the suggested quality requirements.

It is advisable that preliminary tests be conducted on the condensates or tailwater before it is decided to utilize this source of water in the plant. Such a testing program should be designed to: *(a)* estimate the quality of the available condensates or tailwater, *(b)* estimate the volumes of water available from these sources of suitable quality for use, and *(c)* determine whether treatment is required for the intended uses and if so what type of treatment would be necessary. Suggested tests to determine condensate quality include standard turbidity, COD, pH, and total solids. Additional hardness and mineral analyses would also be desirable when tailwater is being analyzed. Samples should be collected hourly during evaporator operation and composited into a single sample. The examination of the daily composite sample each day over a two week operation period should be adequate to obtain the desired information. In additon, hourly turbidity determinations should provide valuable information regarding the frequency of carry-over and the average turbidity of the condensates or tailwater. When chlorination is being considered as a possible method of treatment, an estimate of the chlorine demand of the daily composite would also be helpful.

The conduct of additonal bacteriological studies is also recommended. It is suggested that samples be examined daily for a two week period for evidence or coliform contamination and total plate count and weekly thereafter. It may also be desirable to conduct examinations to detect the presence of thermophilic and anaerobic bacteria in the condensates.

ACKNOWLEDGMENTS

Acknowledgment is gratefully made to Mr. W. R. McLean, Regional Milk and Food Consultant, Division of Environmental Engineering and Food Protection, Region V, who suggested that the study be undertaken, for his assistance during the study, and the writing of this report. The cooperation of the following for their part in the study is also appreciated: Mr. F. M. Skiver and Mr. Kenneth Van Patten, Michigan Department of Agriculture; Mr. Orla E. McGuire, Chief, Sanitary Bacteriology and Chemistry Section, Division of Laboratories, Michigan Department of Health; Mr. Robert C. Kroner, General Laboratory Services, Water Quality Section, Robert A. Taft Sanitary Engineering Center; McDonald's Cooperative Dairy Company, Chesaning, Michigan; Michigan Producers Dairy Company, Adrian, Michigan; and Michigan Producers Dairy Company, Sebewaing, Michigan.

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AMENDMENT TO 3-A SANITARY STANDARDS FOR PUMPS FOR MILK AND MILK PRODUCTS, REVISED

Serial #0204

Formulated by

International Association of Milk, Food and Environmental Sanitarians

United State Public Health Service

The Dairy Industry Committee

The "3-A Sanitary Standards for Pumps for Milk and Milk Products, Revised, Serial #0203" are hereby amended by adding the following paragraphs:

A. (5) Pump impellers or rotors, and cases or stators, which operate in conjunction with a metallic counterpart, may be made of or covered with plastic materials. Plastic materials used for pump impellers or rotors, and cases or stators, shall be of such composition as to retain their surface and conformation characteristics under conditions encountered in normal use and cleaning operations.

A. (6) Plastic materials, when used for specified applications shall meet the applicable provisions of the "3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Serial #2000".

B. 10) The surface of plastic pump impellers or rotors, and cases or stators, 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".

B. (11) The plastic coating of pump impellers or rotors and cases or stators (if covered) shall be bonded in such a manner that the bond is continuous and mechanically sound so that in normal service the plastic material does not separate from the base metal. The final bond shall conform in all respects to the criteria established in paragraph A. (6).

B. (12) The finish of the product contact surface at the interface juncture of the plastic and metal shall conform with the requirements of paragraphs A. (1) a. and B. (10).

This amendment shall become effective May 24, 1966.

THE AMERICAN INTERSOCIETY ACADEMY FOR THE CERTIFICATION OF SANITARIANS, INC.[1]

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In discussing the newly formed American Intersociety Academy for the Certification of Sanitarians, Incorporated, it is relevant to review briefly some of the background of events that have led to its creation.

During the past twenty years, in this country, there has been a rather steady and increasingly effective effort directed toward improving the educational, performance, and professional standards of public health sanitarians. These efforts have taken direction in several ways. State and local associations have established voluntary certification plans. Twenty-eight states now have acts for legal registration with the California Act of 1945 leading the way. The sanitarian's place as a member of the public health team was more firmly recognized by the American Public Health Association when in 1956 a report was published and given wide distribution entitled, "Educational and Other Qualifications of Public Health Sanitarians *(3)*." About 1960, within the personnel structure of the U. S. Public Health Service, the Sanitarian category was re-evaluated and restricted to those persons recognized as professional sanitarians. Such action improved the status of the Sanitarian in the Public Health Service and nationally.

In the area of graduate education, many sanitarians qualified at the baccalaureate level, have taken advantage of the scholarship and stipend plan offered through the facilities of Title I of the Health Amendments Act of 1956 *(5)* and have earned a master's or higher degree in one of the several public health specialities, and particularly in environmental health.

Brief as this summary has been, it should serve to make the point that the past twenty years have witnessed noteworthy progress toward the enhancement of the sanitarian as a professional worker in the health sciences field.

Creation of Intersociety Academy

The American Intersociety Academy for the Certification of Sanitarians was formally created on October 9, 1964 and here again there is some additional background and detail that is pertinent to its origin. Basically, the Academy stems from the out-growth of two proposals. The first of these dates to October, 1956, at which time a voluntary group was formed to become known as the Sanitarian's Joint Council. This Council as organized consists of appointed representatives from three associations: the American Public Health Association through its Engineering and Sanitation Section; the International Association of Milk, Food and Environmental Sanitarians, Inc.; and the National Association of Sanitarians, Inc.

The objectives and purposes of the Council, agreed upon at the time of the formation were, and continue to be, as follows: "To consider ways and means of solving important problems of mutual interest to sanitarians' organizations which need unified action and which may be brought to the Council by any of its members" *(4)*. From this general statement of objectives and purposes other more specific ones were set forth. However, for purposes of this paper, the one objective that is directly pertinent is one which called upon the Council "to develop a Sanitarians' Specialty Board". In essence, the present Intersociety Academy is an outgrowth and a culmination of this stated objective since the present Academy and the Specialty Board are one and the same.

The second proposal leading to its creation had its origin, to a considerable degree at least, within the Executive Board of this International Association, dating back to the period 1959-1960. Members of the Executive Board at that time were entirely in accord with the speciality board concept and wanted to launch the plan as expeditiously as possible. In 1959-1960 there was no positive assurance that such an organization would be created and the Executive Board was so strongly favorable to it that, should it be found to fail in other quarters, this Association would have been willing to underwrite its initial cost and assume administrative responsibility. It is therefore entirely fair to state that the early endorsement of this concept by IAMFES served to move the Council to prompt action and hasten agreement on the part of the other two sponsoring associations.

This background material and a review of the evolutionary steps leading to the creation of the Intersociety Academy should serve to illustrate the point that the proposal and the plan have been under consideration for a period of about five years with an ample amount of exploration, preparation and thought given to its implementation. This is one of

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[1]Presented at 52nd Annual Meeting of International Association of Milk, Food and Environmental Sanitarians, Inc. at Hartford, Conn., September 13-16, 1965.

several concrete accomplishments of the Sanitarian's Joint Council each of which has enhanced the sanitarian's professional status and image.

ORGANIZATION PURPOSE AND FUNCTION OF THE ACADEMY

In view of the fact that the Academy is the creation of the Sanitarian's Joint Council and that each Council member has played an important role in getting it launched, the Board of Directors at this point in its organization consists of the same persons who were Council members on October 9, 1964, plus three at-large members. Thus the Board of Directors consists of a total of twelve persons. A Constitution and Bylaws have been drawn and the Academy will be incorporated as a non-profit corporation in the State of Indiana.

We come next then to the purposes of the Academy. There seems no better way to delineate them than to quote directly from the Constitution *(2)*. The nature of the business of the Corporation and the objectives, purposes and the functions to be promoted and carried on by it are as follows:

1. To improve the practice, elevate the standards, and advance the professional functions and ethical standards of practice of the sanitarian in the various fields of environmental health.

2. To grant and issue to qualified sanitarians certificates indicating special knowledge, competence and proficiency in various fields of environmental health. The fields in which certificates as a Diplomate of the American Intersociety Academy for the Certification of Sanitarians may be granted are Environmental Sanitation (general), Milk and Food Sanitation, Vector and Solid Waste Control, Radiological Health, Air Pollution Control, Industrial Hygiene, Institutional Sanitation, Water Supply and Waste Disposal, Housing Hygiene and Environmental Health Administration and such other defined comprehensive fields as may be determined by two-thirds vote of the Board.

3. To receive and act upon applications for such certificates of special knowledge in environmental health for sanitarians; to establish, maintain and from time to time, alter and amend standards and qualifications for the granting or issuance of, and the retention of such certificates; to determine by examination, investigation or otherwise, the fitness of applicants for, and the holders of, such certificates; to develop application forms and diplomas of certification; to prepare, provide and conduct examinations, or to contract for the same, for the purpose of, or in connection with, a determination of fitness and to determine the results of any such examinations; to arrange for and conduct investigations as may be deemed necessary or desirable for, or in connection with, carrying out any of the above acts; and to collect and receive from each such applicant or examinee, such fees for application, examination, investigation and determination of fitness as may, from time to time, be prescribed by the Board of Directors or the Bylaws of the Corporation.

4. To purchase, rent, hire or otherwise acquire and to provide, erect, make, maintain, establish and operate offices and other facilities, and all necessary or convenient equipment for, and accessories to any or all thereof; to engage and employ such assistance as may be deemed necessary or desirable in connection with any of such purposes or objects, and to pay reasonable compensation for services rendered to the Corporation.

5. To keep and maintain a register of holders of certificates granted by the Corporation, such to be known as the Roster of the American Intersociety Academy for the Certification of Sanitarians, Inc.

6. To furnish to the public or to interested organizations lists of sanitarians having special knowledge in environmental health, as evidenced by certificates granted by the Corporation.

Now to recapitulate what has been quoted directly from the Constitution, let it be said that any sanitarian achieving the distinction of being elected a diplomate will be a person of outstanding professional qualifications and whose proficiency and competency in the field of environmental health has been amply and ably demonstrated. While registration within the framework of the registration laws of the several states is in itself a noteworthy accomplishment, certification by the Board exceeds that of registration and will establish a cadre of persons who have been tested and examined by their peers and found qualified as distinquished and outstanding practioners.

QUALIFICATIONS FOR DIPLOMATE AND MEMBERSHIP IN THE INTERSOCIETY

What then are the qualifications for a sanitarian to become a Diplomate in the American Intersociety Academy for the Certification of Sanitarians. Here reference must be made to the Bylaws of the Board *(1)* where these stipulations are set forth under General Requirements:

1. The applicant shall be of good moral character and of high ethical and professional standing.

2. The applicant must be a graduate with a baccalaureate degree from an accredited college or university with not less than 30 semester credit hours in the physical and biological sciences. In addition, the applicant must possess a master's or higher degree in public health, sanitary science, environmental health, or scientific specialization bearing upon the sub-speciality of a sanitarian for which certification is authorized by the Board.

3. The applicant by his declaration in performance must accept this concept of the sanitarian: He is a guardian of the sanitary and hygienic quality of our food, our water, our air, our shelter, the environs of our neighborhood, and our workplaces. His resources are knowledge of the biological and physical sciences and their manifestations in the environment. By his observations and tests of these phenomena, he initiates action to protect the community from disabilities and promotes its well being. His skill is observation and judgment. Through interpretation of his analysis he mobilizes his professional colleagues and fellow citizens, to correct and to create a physical environment which gives life a better and more healthful quality.

4. The applicant must be a legally registered sanitarian if residing in a state having a registration law for professional sanitarians. If registered in such state but subsequently residing where there is no registration law, the Board shall consider the applicant to be legally registered as a sanitarian. If the applicant is not legally registered because there is no registration law in his state of residence, he must meet, to the satisfaction of the Board, the criteria specified in the "Model Act for Registration of Sanitarians", as adopted by the Sanitarian's Joint Council, June, 1960.

5. Special Requirements. The applicant must have had at least nine (9) years of acceptable experience in one or more of the various fields of environmental health following completion of all requirements for the undergraduate degree. Acceptable experience shall include at least seven (7) years of responsible charge of work. Responsible charge of work is defined as responsibility for administration, management, supervision, research or teaching in one or more environmental health fields. Time spent in acquiring undergraduate and graduate degrees is not creditable as acceptable experience.

In addition to these general qualifications, there are other specifications for those persons who would be known as Founders. For certification as a Diplomate and as a Founder, the following conditions must be met:

Professional sanitarians who have at least twelve (12) years of professional experience, five (5) of which have been in responsible charge of work, who meet all other eligibility requirements for examination and who have achieved a high standing in the field of environmental health, may be excused from one or more of the examinations, provided application for certification with examination is made to the Board on the prescribed form on or before — (Date not yet established). Such applicant shall, to the satisfaction of the Board provide proper documented evidence of his professional achievement and recognition. The Board may also waive for such applicants who apply as Founders, the requirement for the graduate degree, provided that the applicant has at least 40 semester or equivalent hours in the physical and biological sciences and has a minimum of three (3) additional years of experience in responsible charge of work. Fees for candidates for examination and for Founders with or without examination shall be the same. A fee of $25.00 must be paid to the Board within 30 days from the date of notification of acceptance by the Board of the applicant for certification as a Founder. All sanitarians achieving certification as a Founder shall be so identified in the Roster.

MEMBERSHIP POTENTIAL

Having explained the requirements for election to the Academy as a Diplomate, a question which logically follows is that of potential membership. Here, of course, one moves into a somewhat nebulous area. About all that can be done, with any certainty, is to draw upon available sanitarian man power data and make some empirical predictions.

Many of you will recall that the Office of Resource Development, Division of Public Health Methods of the U. S. Public Health Service issued a "Health Man Power Source Book", Section 16, on Sanitarians in 1963 *(6)*. This represented the first national comprehensive manpower survey for this category ever completed. This publication is quite replete with interesting statistics on the sanitarian, his training and his functions. However, only salient features need be mentioned now as they relate to potential membership.

The manpower study in question revealed that there were 7,263 persons listing themselves as sanitarians. Of this number, 4,583 or approximately 63% held a college degree. So it can be said there is a raw potential of 4,583 persons who might be eligible. But of course, the use of this raw figure is not too realistic since many limitations and other unknown circumstances may preclude certification. On the other hand, from the raw potential of 4,583, some 780 or about 17% hold a master's or higher degree. It is from these ranks that the Board will undoubtedly derive a large proportion of its diplomates. Time, of course, will tell how many will become diplomates in one, two or five years, but it is estimated that with the rather steady upswing in graduate education and better professional preparation, a satisfactory level of membership can be realized and maintained.

THE VALUE OF THE ACADEMY

As has already been pointed out, the Academy will serve to recognize capable, outstanding and well qualified sanitarians. The Academy envisions a place of distinction for those who earn and merit this honor. This in itself is a highly desirable goal for many whose professional record is distinguished in the promotion of the public health and in the specialized area of environmental health.

The attainment of the diplomate status should also prove of good purpose when new positions open, when promotions are made and when employers seek to fill vacancies with men of proven capacity and ability.

In addition, Diplomates in the Intersociety should be and unquestionably will be competent to make contributions toward sound administrative decisions, more effective academic and training programs and form an authoritative voice among law and policy makers when modern concepts of public health and environmental health require analysis, promotion and support. These, perhaps, are things for the future but it would be quite futile to build a roster of sanitarian diplomates who would feel no further obligation to their profession or to society than the earning of the distinction of diplomate solely as an end in itself. The present Board of Directors know that there are constant challenges which must be faced and that the Academy through its members should be a strong force in meeting these challenges.

OPERATIONS CALENDAR

In conclusion, something should be said about an operations calendar. Already a considerable amount of the preliminary preparation has been completed. Papers of incorporation will be filed within the next thirty days. A sub-committee is already developing an appropriate application form. Preliminary arrangements are now under discussion for the preparation and holding of certification examinations. Financial backing through loans totaling $3000 from the three sponsors has been satisfactorily arranged. Publicity and news releases will be forthcoming shortly. A reasonable amount of direct mail promotion will be done to more fully explain the program. As can be readily seen, the launching of this organization as a going concern has required time but things are moving. And it is the earnest hope of the Board of Directors that every professional sanitarian will strive for the honor of being a diplomate; and further, that the members of this Association will give wholehearted support to it and be well represented at all times on the roster of the American Intersociety Academy for the Certification of Sanitarians, Incorporated.

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FDA DEDICATES HEADQUARTERS BUILDING

The Food and Drug Administration marked a milestone in its history when its new Washington, D. C. headquarters building was officially dedicated on Tuesday, November 23, 1965. The building constitutes an initial effort to bring together in one central location FDA's scattered Washington offices.

Originally a small bureau of the Department of Agriculture the agency has grown steadily over the span of half a century to become an important and distinct consumer protection arm of the U. S. Department of Health, Education, and Welfare. FDA has district headquarters in eighteen major cities across the country.

The total cost of the new building is $13 million and approximately two-thirds will be occupied by scientific activities and one-third by administrative offices. Predominately devoted to scientific research on methods and techniques for inspecting, testing and evaluating the production and consumer use of foods, drugs, cosmetics and theraputic devices, the new building houses $6.5 million in scientific equipment and furnishings.

The dedication followed a one-day symposium on November 22 on the Safety of Food and Drugs attended by members of various national technical and professional organizations. President Fred E. Uetz was the IAMFES representative at the symposium and dedication.

THE INFLUENCE OF THE WORKING FACTOR AND CELL CONTENT ON THE PRECISION OF MICROSCOPIC COUNTS OF MILK SOMATIC CELLS[1]

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(Received for publication April 9, 1965)

Summary

Variations in precision of the Breed method for cell counts in milk were investigated by utilizing different working factors (WF) for the same smear and by using the same WF over a major portion of the probable cell count range. A significant inverse relationship was found between precision and the WF. With a constant WF on the other hand, the precision of the count increased very significantly as the actual cell count increased. Formulas showing the relationship between the expected high and low for any given cell count were computed via the least squares method for a WF of 20,000. Evidence was presented that a WF of 5,000 or below would be necessary when a good estimate of cell content is important.

The precision of the Prescott-Breed or direct microscopic cell count of milk *(5)* is dependent upon the working factor (WF). The WF is the product of a formula which utilizes the size of the sample, the smear size, the microscope field diameter and the number of fields counted *(1)*.

Prescott and Breed *(5)*, using a WF of 5,000 found that duplicate somatic cell counts agreed within 15%. Others *(9)* have reported that a ± 50% variation from the mean could be expected while using a WF of 10,000. Recent reports *(3, 4)* have indicated within sample coefficients of variation of 36% and 19%, respectively, when WF's of 15,000 and 7,500 were used. A review of the literature *(6)* disclosed that the WF used by 16 groups of investigators counting somatic cells varied within the range of 10,000 to 50,000.

Since the microscopic cell count is based on probability sampling laws, the WF selected would have a marked effect on the precision of the method. This principle is inherent in the graphic method recently published *(2)* for estimating the precision of all types of direct microscopic counting data based on the Poisson distribution. The precision of the direct microscopic method is also influenced by the number of cells in a sample *(2)*. Within the limits of good counting efficiency, higher cell counts would presumably be less affected by occasional fields which were greatly different from the mean field count.

The variations in precision when different working factors are used and the variations in precision over a major portion of the somatic cell count range using the same working factor, were the subject of this investigation.

Materials and Methods

The procedure as outlined in Standard Methods for the Examination of Dairy Products *(1)* for the direct microscopic method was essentially followed with some modifications *(7)*. Only round smears 1 cm^2 in area made with a 0.01-ml syringe[2] were utilized in these trials.

The effect of different working factors was studied by means of a series of 32 counts made on one smear from a milk sample estimated to contain 8,300,000 cells per ml. A high cell count sample was chosen to minimize the effect of abnormally high or low individual field counts. For each count, 24 fields (WF 20,000) representing a horizontal cross section through the middle of the smear were viewed, and the cells per field recorded in sequence.

Since a count of 6 fields would be required if a WF of 80,000 were used, such counts were attained by utilizing every fourth field from each 24 field count. This provided a total of 128 estimates (24 ÷ 6 x 32) for the WF of 80,000. By adding together every other 80,000 WF estimate, a series of 64 estimates with a 40,000 WF resulted. Since each original count constituted a WF of 20,000, there were 32 such estimates. Adding two 20,000 estimates in sequence produced 16 estimates with a 10,000 WF. The 10,000 WF estimates gave rise to eight 5,000 WF estimates which in turn produced four 2,500 estimates. There were 2 estimates with a WF of 1,250 and one estimate or the group mean based on a WF of 625.

The effect of using the same WF (20,000) over a large portion of the cell count range was also tested. Fifty-six samples of milk were counted. Cell counts ranged from 18,000 to 14,000,000 cells per ml in these samples. On each sample, 8 counts (WF 20,000 each) were made, 2 on each of 4 duplicate smears. The mean ($\overline{X}$), standard deviation(s) and the coefficient of variation ($C = s/\overline{X}$) were computed for each of the 56 samples.

It was found that for a WF of 20,000, 8 separate counts gave a good estimate of the expected extremes of individual counts for any given mean cell count. Hence, using the method of least squares, formulas were computed for the line of "best linear fit," relating the mean to the high, the low and the range of cell count that could be expected for counts when that WF was used. The equation for the line of "best linear fit" as reported here has the formula $Y = bX \pm a$.

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[1]This work was part of a thesis submitted by R. Schneider to the Graduate Division, University of California, in partial fulfillment of the requirements for the M.S. degree.

[2]Available from Applied Research Institute, 2 East 23rd Street, New York 10. N.Y.

TABLE 1. THE RELATIONSHIP BETWEEN THE WORKING FACTOR AND THE PROPORTION OF THE SMEAR EXAMINED

Working factor	Per cent of smear examined
1,000	10.00
2,000	5.00
5,000	2.00
10,000	1.00
20,000	.50
50,000	.20
100,000	.10
500,000	.02

RESULTS

The relationship between the WF and the proportion of the smear examined was calculated and is presented in Table 1.

The variation in the range of individual cell counts for different working factors is shown in Table 2. The range of individual counts decreased significantly as the WF grew smaller.

The relationship of cell count, standard deviation and coefficient of variation for a constant working factor of 20,000 is shown over the major part of the cell range in Table 3. It is seen that the amount of variation increases as the cell count decreases. A moderate increase in variability occurred in counts below 1,500,000 cells per ml and a marked increase occurred in counts below 500,000.

For a WF of 20,000, the formulas computed via the least squares method for the "best fit" relating the highest, lowest and range of cell count to the mean were as follows:

1. *In terms of actual cells counted before conversion to cell count*:

High $= 1.103\ \overline{X} + 5.60$
Low $= .902\ \overline{X} - 5.07$
Range $= .201\ \overline{X} + 10.67 - .9k\ (5.63 - \overline{X})$
where $k = 0$ if $\overline{X}$ is over 5.63
$k = 1$ if $\overline{X}$ is under 5.63

2. *In terms of total cell count (cells x WF)*:

High $= 1.103\ \overline{X} + 112{,}000$
Low $= .902\ \overline{X} - 101{,}000$
Range $= .201\ \overline{X} + 213{,}000 - .9k\ (113{,}000 - \overline{X})$
where $k = 0$ if $\overline{X}$ is over 113,000
$k = 1$ if $\overline{X}$ is under 113,000

The formulas for the high and low were symmetrical on either side of the mean. In a random distribution it would be expected that the high and low would be equally distant from the mean. It is noticed that the high was slightly farther away from the mean than the low. However, this variation was not significant since it is an error of only 1 to 2% of the mean.

Tables 4 and 5 indicate the accuracy of the high and low formulas in predicting the expected high and low cell counts for any mean. In table 4, multicounts were made horizontally through the central area of one low cell count smear and one high cell count smear. The cell counts were 440,000 and 8,300,000 cells per ml, respectively. It is seen with both that agreement was close.

In Table 5, a further example of the accuracy of these formulas is shown by a comparison of counts by 4 different counters on smears made by 5 different smear makers of 3 different milk samples. The cell counts of the samples were 130,000, 560,000 and 1,030,000, respectively. Although an additional variable was introduced by using smears by different smear makers, it is seen again that agreement is close.

The formulas for the range were computed from the high and low formulas. The factors .9k $(5.63 - \overline{X})$ and .9k $(113{,}000 - \overline{X})$ are needed to adjust the cell range because by the low formula, counts below 5.63 and 113,000, respectively, would give negative lows, and this is not possible. All negative lows were considered zero.

The relationship of the WF and cell count to the expected % of error can be shown graphically. Figure

TABLE 2. VARIATION IN RANGE OF CELL COUNTS OBTAINED WITH DIFFERENT WORKING FACTORS ON THE SAME SAMPLE

Working factor	No. of counts	Coefficient of variation[a]	Range of cell counts	Length of range	Length of range as % of group mean
625	1	—	8,300,000[b]	—	—
1,250	2	.0028	8,280,000 - 8,320,000	40,000	.5
2,500	4	.0141	8,150,000 - 8,420,000	270,000	3.3
5,000	8	.0210	8,100,000 - 8,580,000	480,000	5.8
10,000	16	.0377	7,640,000 - 8,740,000	1,100,000	13.3
20,000	32	.0606	7,380,000 - 9,480,000	2,100,000	25.3
40,000	64	.0939	6,840,000 - 10,160,000	3,320,000	40.0
80,000	128	.1340	5,280,000 - 11,200,000	5,920,000	71.3

[a]multiply by 100 for standard deviation as a % of the mean.
[b]group mean.

TABLE 3. THE RELATIONSHIP OF CELL COUNT TO THE STANDARD DEVIATION AND COEFFICIENT OF VARIATION FOR A WORKING FACTOR OF 20,000

Cell count ($\bar{X}$)[a]	Standard deviation (s)[a]	Coefficient of variation ($C = s/\bar{X}$)
250 - 700	25 - 36	.10 - .05
75 - 250	13 - 25	.16 - .10
25 - 75	6 - 16	.23 - .12
Under 25	Under 6	.80[b]- .23

[a]In cells, multiply by 20,000 for the equivalent in cells per ml of milk.
[b]May be exceeded at very low cell counts.

TABLE 4. AGREEMENT OF ACTUAL AND EXPECTED[a] HIGH AND LOW COUNTS (WF 20,000) WHERE MULTIPLE COUNTS WERE MADE

Number of counts	Mean in cells	Low in cells: Actual	Low in cells: Expected[a]	High in cells: Actual	High in cells: Expected[a]
22	22.2	13	15	32	30
32	415.1	369	369	474	463

[a]Expected: Low = .902 X − 5.07; High = 1.103 X + 5.60.

TABLE 5. AGREEMENT OF ACTUAL AND EXPECTED[a] HIGH AND LOW COUNTS (WF 20,000) FOR 4 COUNTERS ON 3 MILK SAMPLES, UTILIZING COUNTS ON SMEARS OF 5 DIFFERENT SMEAR MAKERS

Counter	No. of counts	Mean in cells	Low in cells: Actual	Low in cells: Expected[a]	High in cells: Actual	High in cells: Expected[a]
2	20	6.45	3	1	11	13
3	20	6.50	2	1	14	13
4	20	7.35	1	1.5	14	14
6	20	5.35	2	0	9	12
2	40	27.8	18	20	42	36
3	40	27.3	15	19	35	36
4	40	30.6	19	22	44	39
6	40	26.2	15	18	35	34
2	20	50.5	34	40	68	61
3	20	53.8	42	43	73	65
4	20	54.5	36	44	71	66
6	20	47.4	37	38	67	58

[a]Expected: Low = .902 $\sqrt{X}$ − 5.07; High = 1.103 $\sqrt{X}$ + 5.60.

1 denotes the % of errors for computing 95% confidence limits and Figure 2 the % of errors for computing 50% confidence limits (probable error) of 4 selected cell count levels for various working factors.

DISCUSSION

The precision of any Breed cell count on properly prepared smears seems to be the function of 2 factors: *(a)* the number of field counted (WF), and *(b)* the number of cells in a sample (the cell count). This function is in accordance with Poisson distribution principles *(2)*.

The effect of the WF is illustrated in Table 2. The smaller the WF, the better will be the precision. More fields are counted with a smaller WF, hence there is less influence from any individual fields having abnormally high or low counts.

The second factor that affects the precision of the cell count is the number of cells present. The higher the cell count, the more accurate will be the estimate when using a constant WF. This relationship is shown in Table 3. As the count decreases, there is an increase in the variability of individual cell counts as a function of the mean. Thus, the coefficient of variation increases. For the precision to have been the same over the entire cell range, the coefficient of variation would have had to be relatively constant at all levels of cell count.

The actual choice of a WF should be determined by the approximate number of cells in the samples and the reliability required (Figure 1 or Figure 2). A WF within the range of 2,000 to 5,000 appeared

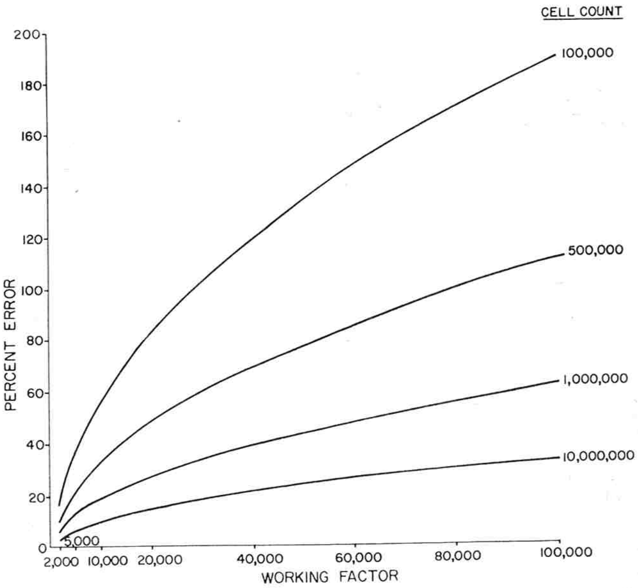

FIG. I
RELATIONSHIP BETWEEN WORKING FACTOR AND PERCENT ERROR FOR CERTAIN CELL COUNT LEVELS, 95% CONFIDENCE

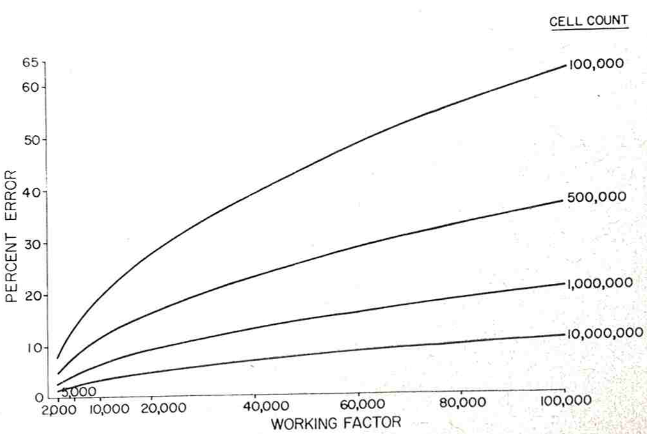

FIG. 2
RELATIONSHIP BETWEEN WORKING FACTOR AND PERCENT ERROR FOR CERTAIN CELL COUNT LEVELS, 50% CONFIDENCE (PROBABLE ERROR)

to give sufficient precision for most purposes, but use of either a higher or a lower WF may be indicated under some circumstances. A method utilizing a WF of 20,000 has been devised *(8)* for application where interest is limited to determining only whether the cell content of a given sample is above or below a certain level.

TABLE 6. THE EFFECT OF THE CONSTANT SECOND FACTOR OF THE RANGE FORMULA[a] ON DIFFERENT LEVELS OF CELL COUNTS (WF 20,000)

Mean cell count	Second factor adjusted	Total range expected	Second factor adjusted as % of mean cell count	Total range expected as % of mean cell count
10,000,000	213,000	2,223,000	2.1	22.2
1,000,000	213,000	414,000	21.3	41.4
100,000	201,000	221,000	201.0	221.0

[a]Range = .201 X + 213,000 – .9k (113,000 – $\overline{X}$)

From the high and low "best fit" formulas, the derived relationship of the range of cell count to the mean illustrates why the Prescott-Breed method does not have the same precision over a large portion of the cell count range (Table 6). Since at all levels the expected cell range is .201 or 20.1% of the mean, the main effect on the range, hence, on the precision of the method at different cell count levels, is caused by the second factor of the formula. For all cell counts, the second factor has the same constant value of 10.67 cells or, when converted, 213,000 cells per ml. The third factor of the formula, the adjustment, has only a minor effect. Thus, at the 10,000,000 cell count level, the constant second factor is merely 2.1% of the mean and accounts for only a small proportion of the expected range. At the 100,000 cell count level, however, the second factor after adjustment is 201.0% of the mean and accounts for practically all of the expected range.

CONCLUSIONS

1. The precision of a given Breed cell count on milk will vary inversely with the WF, and directly with the actual cell count of the milk assuming a constant WF.

2. A definite relationship exists between the expected high and low counts on a given sample and the "true" cell content of that sample.

3. Where a good estimate of cell content is important, a WF of 5,000 or below is necessary, depending upon the number of cells in the sample and the reliability desired.

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A Cornell University Symposium—"Frontiers in Food Research"—is scheduled for April 12 and 13, 1966. This symposium will feature talks on Factors Affecting Quality, Measurement of Quality and New Products and Processes. For details write to Dr. W. F. Shipe, Dept. of Dairy and Food Science, Cornell University, Ithaca, N. Y.

THE RELATIONSHIP OF YELLOW COLOR ON MILK SEDIMENT PADS TO MASTITIS[1]

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Received for publication September 6, 1965

SUMMARY

In a study of the relationship of yellow-colored material on milk sediment disks to mastitis, representative milk samples were examined from 400 individual quarters of 144 different cows in 7 dairy herds. Observations made included *(a)* California Mastitis Test (CMT) reaction, *(b)* yield of milk per quarter at one experimental milking, *(c)* leucocyte count, *(d)* catalase activity, *(e)* A-esterase activity, and *(f)* evaluation of a sediment disk for degree of yellow-colored material present. These observations revealed that the yellow-colored material was closely related to the other indices of mastitis. It was concluded that the yellow-colored material *(a)* is particulate in nature, *(b)* originates in the udder, and *(c)* the amount appearing on milk sediment disks is, in general, directly proportional to the severity of mastitis.

The apperance of flakes, clots and purulent material on milk sediment disks has always been considered as evidence of the presence of mastitic milk. Such material, however, is seldom found in raw milk as it is delivered to the processing plant. This may be because it *(a)* loses its integrity in pooled milk for one reason or another, *(b)* is removed by filtration at the source, or *(c)* dilution makes it detection unlikely.

Yellow pigmented milk sediment disks have been frequently observed in the past. Some thought the color arose from fat masses trapped by the sediment disk. Others attributed it to excessive fecal contamination, the larger particles of which had been removed by filtration. Perhaps both of these factors have been responsible, occasionally, for a yellow pigmented material on sediment disks. However, in 1961, Cole *(3)* suggested that this yellow color was associated with mastitis.

The work reported below was undertaken to investigate this suggested relationship between yellow-colored material on milk sediment disks and mastitis. Should such a relationship exist, then the sediment test could also be used as a screening test for abnormal milk.

METHODS

The work described in this report constitutes part of a study which had as its principal objective a determination of the relationship between mastitis, of different degrees of severity, and the production and composition of milk. In this study, severity of mastitis was measured in terms of the California Mastitis Test (CMT) *(9)*. The basic experimental approach was to compare the production and composition of milk from directly opposite quarters of the same udder at a single milking. The opposite quarters compared differed in reaction to the CMT, so that one quarter served as a control for the opposite quarter which produced milk with a higher CMT reaction.

Expermental herds of cows to be used in this research were selected by county extension agents from dairy herds in their areas. Selection of experimental cows within each selected herd was based on the CMT reaction in the following manner. The CMT was performed on the foremilk (after discarding the first two streams) of each quarter of each cow in the milking string. Cows which provided suitable CMT comparisons between opposite quarters were then selected for later quarter-milking. At subsequent regular milking times these selected cows were milked using a quarter-milker which milked all four quarters simultaneously, but which collected the milk from each quarter in a separate container. Following quarter-milking by machine, each cow was hand stripped and strippings and milk for each respective quarter were combined and weighed on a spring balance. The CMT was then performed on the total milk from each quarter. At this point, if a suitable CMT comparison was still evident between the milk from opposite quarters, samples of approximately 400 ml were collected in plastic bottles. These samples were immediately iced and were stored under ice until laboratory analysis was to take place (24 to 48 hr after collection).

At the laboratory, after careful mixing, a portion of about 50 ml of each sample was removed for leucocyte, catalase and A-esterase measurements. A sediment test was then performed on the remainder of the sample after warming to 104 F. The sediment tester used was of the funnel, aspirator type with an orifice diameter of 13/32 inches through which the milk flowed onto the sediment disk. Johnson and Johnson "Rapid-Flo", 1¼-inch lintine disks were used. Although the amount of milk available for the sediment test approximated 350 ml, this could not always be passed through the disk because of clogging. In some instances (where mastitis was probably more severe) less than 100 ml of the sample could be successfully passed through the disk. The sediment test disks were immediately mounted on white paper and air dried. They were then evaluated for yellow color under a 100 watt, Ken-Rad (blue), light source. The system of evaluation was as follows:

Negative: no evidence of yellow color
Trace: questionable or very slight yellow color
Positive: definite yellow color

The samples used in this work had not been strained or filtered in any manner before making the sediment test described above. As a consequence, sediment which gained entrance during the milking act, often made evalution for

[1]Scientific Paper 2712, College of Agriculture, Washington State University. Work was conducted under Project 1680, supported, in part, by a grant from Johnson and Johnson.

yellow color more difficult. This difficulty, undoubtedly, caused more trouble in the proper evaluation of some sediment disks which were finally given yellow color ratings of negative or trace.

Leucocyte counts were made according to Standard Methods *(1)* with the exception that 30 fields per smear were routinely counted. The microscopic factor was 600,000.

Catalase was determined by the method of Spencer and Simon *(10)* modified according to the suggestions of Spencer. These modifications involved *(a)* conducting the test in a 12-ml conical, graduated centrifuge tube stoppered with a one-hole rubber stopper carrying a short length of small-bore (3mm ID) glass tubing, and *(b)* adding approximately 1 ml of keorsene colored with Sudan III. The oxygen liberated in the catalase test was expressed as per cent, by volume, of the milk used.

A-esterase activity was determined by Warburg manometric techniques following the method of Forster et al. *(6)*. Activity of this enzym was expressed as A_{30}, i.e. ml of CO_2 evolved per ml milk per 30 min. of incubation under standard conditions of pH, phenyl acetate (substrate) concentration and temperature (37 C).

RESULTS

Representative milk samples were examined from 400 individual quarters of 144 different cows in 7 dairy herds. Some of the selected cows produced one and some two opposite-quarter, suitable CMT comparisons, i.e. between front or between rear quarters or between both front and rear quarters. A few cows in which all quarters produced milk negative to the CMT were also included. Suitable CMT comparisons were considered to be as follows:

1. One quarter negative with opposite quarter showing CMT reaction of trace 1, 2, or 3.
2. One quarter trace with opposite quarter showing CMT reaction of 1, 2, or 3.
3. One quarter 1 with opposite quarter showing CMT reaction of 2 or 3.

Although the cows to be sampled were selected on the basis of providing one or other of the CMT comparisons listed above, examination of the data revealed that many yellow-color comparisons between opposite quarters were also obtained. Such yellow-color comparisons were as follows:

1. One quarter negative with opposite quarter showing a yellow-color rating of trace.
2. One quarter negative with opposite quarter showing a yellow-color rating of positive.
3. One quarter trace with opposite quarter showing a yellow-color rating of positive.

Tables 1 and 2 summarize the data on milk yield and leucocyte counts, respectively, for these opposite-quarter comparisons. Similar tables were prepared summarizing the data on CMT, catalase and A-esterase for these same opposite-quarter comparisons. These data were then more concisely summarized

TABLE 1. RELATIONSHIP BETWEEN YELLOW-COLOR RATING OF SEDIMENT DISKS AND YIELD OF MILK FROM OPPOSITE QUARTERS

Yellow color comparison	No. of comparisons: Obtained	No. of comparisons: Where higher rating allied with lower yield	Average milk yield (lbs.)	Average diff. (lbs.)	t
Negative			4.51		
vs.	33	22		-0.50	2.2[a]
trace			4.01		
Negative			6.31		
vs.	44	42		-2.11	8.5[b]
positive			4.20		
Trace			4.05		
vs.	38	30		-1.08	3.6[b]
positive			2.97		

[a]Significant ($P<0.05$)
[b]Highly significant ($P<0.01$)

TABLE 2. RELATIONSHIP BETWEEN YELLOW-COLOR RATING OF SEDIMENT DISKS AND LEUCOCYTE COUNT OF MILK FROM OPPOSITE QUARTERS

Yellow color comparison	No. of Comparisons: Obtained	No. of Comparisons: Where higher rating allied with more leucocytes	Average leucocytes (per ml)	Average diff. (per ml)	t
Negative			84,000		
vs.	33	27		+278,000	3.8[a]
trace			362,000		
Negative			68,000		
vs.	44	44		+2,533,000	6.7[a]
positive			2,621,000		
Trace			239,000		
vs.	38	37		+3,447,000	14.0[a]
positive			3,686,000		

[a]Highly significant ($P<0.01$)

and are presented here in Table 3. These three Tables reveal a very consistent relationship between the yellow material on the sediment disks, on the one hand, with yield of milk, leucocyte count, CMT, catalase, and A-esterase, on the other. "Student's" t-test, for the paired values, was used to test the significance of the differences between the means for each comparison. The t values are also shown in the Tables. Most of the differences proved to be significant at the 1% point of probability.

In general, the method of selecting cows for sampling purposes, for this study, was based on providing opposite-quarter CMT, rather than yellow-color, comparisons. In addition, as indicated earlier, a few cows, with all CMT negative quarters, were included. As a result, the opposite-quarter, yellow-color comparisons shown in Tables 1 to 3, inclusive, include only 230 of the 400 samples upon which observations were made. Table 4 presents the average

TABLE 3. MEAN (X) VALUES AND "STUDENT" t VALUES FOR CMT, CATALASE, AND A-ESTERASE OF OPPOSITE-QUARTER MILK SAMPLES FOR EACH YELLOW-COLOR COMPARISON.

	Yellow-color comparison								
	Negative	vs.	trace	Negative	vs.	positive	Trace	vs.	positive
Determination	$\bar{X}_N$	$\bar{X}_T$	t	$\bar{X}_N$	$\bar{X}_P$	t	$\bar{X}_T$	$\bar{X}_P$	t
CMT (index)[a]	0.29	0.82	5.5_2	0.19	2.02	16.8_1	0.57	2.09	10.9_1
Catalase (% O_2)	9	21	4.5_2	7	52	12.3_1	17	66	11.5_1
A-esterase (A_{30})	44	51	2.3_2	51	83	6.6_1	53	91	5.8_1

[a]CMT reactions were assigned the following numerical values for purposes of calculation: Negative–0, Trace–0.5, One–1, Two–2, and Three–3.
$_1$Significant ($P<0.05$).
$_2$Highly significant ($P<0.01$).

TABLE 4. AVERAGE VALUES FOR LEUCOCYTE COUNTS, CMT INDEX[a], A-ESTERASE, AND CATALASE OF QUARTER MILK SAMPLES IN EACH YELLOW-COLOR RATING

Yellow color rating	No. of samples	Leucocytes (per ml)	CMT (index)	A-est. (A_{30})	Catalase (% O_2)
Negative	161	79,500	0.23	50	7.5
Trace	109	284,800	0.65	54	17.4
Positive	130	2,852,000	1.9	83	57

[a]CMT reactions were assigned the following numerical values for purposes of calculation: Negative 0, Trace 0.5, One 1, Two 2, and Three 3.

values obtained for leucocyte counts, CMT, catalase and A-esterase, for the entire 400 samples, by yellow-color rating. The relationships so clearly demonstrated in the previous Tables are very evident in this Table. As the yellow-color rating increased from negative through trace to positive there were corresponding increases in average values for each of the other indices of mastitis.

Tables 5 and 6 present frequency distributions by leucocyte count and catalase classes, respectively, for the samples of each yellow-color rating. These two distributions look very similar and serve to further emphasize the relationships between yellow color and these other tests for mastitis. Frequency distributions were also prepared by CMT reactions and A-esterase classes. They are not presented here, but were essentially similar to those shown in Tables 5 and 6.

DISCUSSION AND CONCLUSIONS

Leucocyte counts and catalase tests on milk samples have long been used as indices of mastitis. More recently the CMT *(9)* has been proposed as a means of detecting this udder disease and has been shown to be both sensitive and reliable *(2, 5, 7)*. The A-esterase activity of milk also has been shown to be related to mastitis *(6, 8)*. The data presented in Tables 2 to 6, inclusive, demonstrates a very close relationship between the tests for mastitis mentioned above and the degree of yellow-colored material detected on milk sediment disks. One must conclude, therefore, that the yellow-colored material is itself related to mastitis. Furthermore, one must conclude that the amount of yellow-colored material appearing on the disks is, in general, directly proportional to the severity of the mastitis. This latter conclusion, perhaps, is most convincingly demonstrated by the relationship between milk production and yellow-

TABLE 5. PERCENTAGE DISTRIBUTION OF SAMPLES BY LEUCOCYTE COUNT CLASSES FOR EACH YELLOW-COLOR RATING

Leucocyte count class	No. of samples	Yellow-color rating		
		Negative	Trace	Positive
$<2.5x10^5$	232	94	64	8
$2.5x10^5$ to $<5x10^5$	43	5	22	8
$5x10^5$ to $<7.5x10^5$	16	1	5	7
$7.5x10^5$ to $<1x10^6$	9	0	4	5
$1x10^6$ or more	100	0	5	72
No. of samples	400	161	109	130

TABLE 6. PERCENTAGE DISTRIBUTION OF SAMPLES BY CATALASE CLASSES FOR EACH YELLOW-COLOR RATING

Catalase class	No. of samples	Yellow-color rating		
		Negative	Trace	Positive
0-10	177	78	42	4
11-20	62	16	23	8
21-30	41	4	21	9
31-40	22	1	8	9
41 or more	98	1	6	70
No. of Samples	400	161	109	130

color rating shown in Table 1, however, it is quite evident from the data of the other tables as well.

The yellow-colored material appearing on the sediment disks could not have been formed by microbial action following milking because the samples were under ice from the time of collection until examined in the laboratory. Its appearance with such frequency in milk from quarters which were obviously mastitic, by other criteria (see Tables), and its absence from milk from opposite quarters of the same udder, obtained at the same milking, rule out external contamination as its source. It is concluded, therefore, that the yellow-colored material originates in the udder. Moreover, it must be particulate in nature to be retained by the fibers of the sediment disk.

Much of the mastitis of economic significance to the dairy industry does not make itself evident in milk in the form of flakes, clots or other purulent material. If one is looking for this kind of evidence, then the sediment test will not detect a high proportion of mastitic milk samples. This work demonstrates, however, that if one looks for evidence of a yellow-colored material on the sediment disk, the sediment test will reveal a high proportion of mastitic milk samples which previously have required more elaborate methods for their detection.

The work reported herein has involved use of the sediment test on unfiltered milk from individual quarters. Other workers *(4)* have observed that the yellow-colored material is evident in pooled milk even after the customary farm filtration. This observation greatly increases the potential usefulness of the sediment test in the detection of mastitic or abnormal milk.

The nature of the yellow-colored material discussed herein and its dependence on the pathological condition of the udder did not constitute a part of this study. If the relationship of this material to mastitis is to be adequately understood, both of these areas will require investigation.

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PESTICDE RESIDUE TOLERANCE PROPOSED FOR DAIRY PRODUCTS

FDA has published a proposal to establish residue tolerances for DDT and two related pesticides in milk at the request of the California Departments of Public Health and Agriculture. The California proposal would establish tolerances for residues of DDT, DDD and DDE in milk at 0.05 ppm each. If more than one of the three chemicals were present, the total could not exceed 0.10 ppm.

The proposal also would set tolerances in dairy products (such as butter, cheese and ice cream) for the three chemicals at 1.25 ppm each in the fat portion of the products; with the provision that if more than one of the three were present the total may not exceed 2.50 ppm in the fat. According to the petitioners, small amounts of these pesticide chemicals are unavoidable in milk because of widespread pest control operations. The petition does not seek to provide for the deliberate use of these chemicals on dairy animals, in their feed, or in dairy barns.

FDA Commissioner George P. Larrick said that this petition again points up the broad question of the public health significance of the presence of pesticides in our food supply and that a high-level scientific advisory committee will be appointed to take a new look at this problem, particularly from the standpoint of whether or not residues are unavoidable. The committee will also re-evaluate the long-range effects of small amounts of residues in foods.

The committee will also be asked for advice on whether proposals to establish tolerances for residues in foods, resulting from environmental or other contamination, conforms to the national policy on the control of pesticides in our environment as stated by the President's Science Advisory Committee on Use of Pesticides.

ASSOCIATION AFFAIRS

REPORT OF THE COMMITTEE ON DAIRY FARM METHODS—1965

This report was compiled by A. K. Saunders, Committee Chairman, and is presented as a series of Task or Sub-Committee reports.

Subcommittee on Dairy Cattle Housing and Its Relation to Quality Milk Production

James B. Smathers, *Chairman*

Obviously milk quality can be best maintained when housing is designed to keep cattle clean; provide comfort, protection from injury and disease; as well as provide general sanitation through management. Reports to this Sub-Committee indicate that the so-called "Loose Stall Housing" method is an advantageous housing system. This system is composed of integrated component parts, including a resting area, a feeding area, a holding area, a manure handling area, and a milking center.

All areas subjected to routine cow traffic should be paved. Design should afford straight line movement of equipment. Recommended stall sizes for small breeds are 44 inches in width and 7 ft long, and for the larger breeds, 4 ft wide by 7½ ft long. A curb of treated wood or concrete, at least 8 or 10 inches high, should be provided behind the cattle. Recommended width of concrete alleys is 10 to 12 feet. Surface of the alleys should be level from side to side and maintain a slope of at least one inch in 10 ft of alley length.

Proper handling of slurry manure is definitely a part of this housing system. Two general methods of handling include: (*a*) use of conventional scrapers, tractors, and spreaders in the so-called solid state; and (*b*) use of manure tanks, pumps, or vacuum systems for disposal in the fluid state.

Basic guidelines for successful manure disposal include: (*a*) complete cleaning of paved areas at least once a day; (*b*) adequate paved area for tractor operations; (*c*) machinery parking when in use should be on a paved area inaccessible to cows, provided with proper draining; (*d*) fluid tanks should be kept covered and protected by adequate hatches; (*e*) fluid tanks should be constructed to allow an even distribution of manure while loading; (*f*) waste liquid from the milking center should be the primary source of controlled liquids to fluidize manure; (*g*) fluid tanks should be adequate in size to minimize the frequency of slurry agitation; (*h*) to minimize freezing, manure storage tanks should be positioned beneath the surface of the ground.

Available information indicates that the fly problem can be controlled in the fluid tank system provided a sufficient amount of liquid is maintained and the storage pit kept covered.

Concensus of opinion of this Committee is that the above system is the best yet devised. Future information and experience will give more definite answers with respect to manure handling and the need for ventilation and insulation in cold climatic regions.

Sediment In Fluid Milk

The need for uniformity in sediment test standards and their wider acceptance is well recognized. New standards prepared by U.S.D.A. in cooperation with the Food & Drug Administration and the American Public Health Association are now available. Indications are that a number of states are including sediment testing of grade A or manufacturing grade farm bulk tank milk as a routine procedure.

There is concern over the yellow color which appears on sediment test disks. The Journal will carry two papers on this subject (December 1965 and January 1966 issues) which should help to clarify this subject.

Subcommittee on Education

Vernon D. Nickel, *Chairman*

Each member of the Educational Committee and the consultants on that committee were assigned a section of the country within which they were requested to contact all extension services of the State Universities, State Departments of Agriculture and all Health Departments to request available brochures, papers, bulletins, pamphlets, etc., on the following subjects: (Also each State affiliates having a Farm-Methods Committee were contacted by mail and requested to collect similar material.) (*a*) In place cleaning of Pipelines and Bulk Tanks; (*b*) Inhibitors in milk; (*c*) Rancidity in milk; and (*d*) Mastitis and its control.

By January of 1965 over two hundred (200) publications, articles, bulletins, pamphlets, brochures, etc., had been collected and mailed to the Educational Committee Chairman.

It is the hopes of the Educational Committee that a list of usable material for educational purposes can be passed on to the members of this Association. In all probability a listing of such material will be carried periodically in the Journal.

Subcommittee on Cleaning of Farm Bulk and Transportation Tanks

Sidney H. Beale, *Chairman*

The members of this committee cooperated 100% in answering a questionnaire which was mailed to them. As a result this committee wishes to indicate:

1. A CIP cleaner should not be used to manually clean a bulk tank. Replies indicated that most CIP cleaners require a higher temperature and turbulence which cannot be used under manual conditions. In most cases a film results.

2. Agitator shield and outlet valve gaskets and similar pieces of equipment difficult to reach are generally looked after better by the use of an itemized cleaning procedure. Emphasis should be put on hand cleaning such items, particularly where CIP cleaning is used.

3. Pitting of stainless steel and valves is gradually being overcome by the proper use of sanitizers other than chlorine.

4. Installations designed for CIP should not contain copper alloy materials.

Replies also indicated that work needs to be done on better dust covers on tankers, tighter fitting lids on bulk tanks, more ventilation in milk rooms, time on automation. The feeling is that less time is needed, 10 to 12 minutes being adequate.

The installation of Silo Tanks on farms needs investigation. It is strongly recommended that this be put in the hands of this Committee for work next year.

Due to herd expansion on dairy farms many are changing from every other day pick-up to every day or twice a day pick-up or use multiple tanks. This may create a cooling problem which may lead to a quality problem.

Subcommittee on Antibiotics, Pesticides, and Other Adulterants

Milton E. Held, *Chairman*

The problem of antibiotic contamination of milk supplies has been recognized. Educational and control programs have been inaugurated on a nationwide basis, and positive results have been attained. Progress has been so rapid and dramatic that a false sense of security could result if surveillance and control programs are not continued. It appears that in some cases occasional offenders, probably wrongly influenced by the growing emphasis on mastitis control, can associate only the so-called "miracle drugs" with its control and this committee recommends that all agencies involved be alert to this potential problem.

A more pertinent and vexing problem is presented by the agricultural use of pesticides, primarily insecticides, which, unless strict control is exercised, may find their way into milk supplies. When we consider that upwards of 350,000,000 pounds of insecticides are used annually in the United States and that residue in foods are restricted to low parts per million concentrations, the potential problems become readily apparent. Also, the lowering of legal concentrations due to improved analytical methods which allowed the lowering of the analytical zero point has complicated the control picture. Recognition of this development has been evidenced by recent developments. For example, the California Departments of Health and Agriculture have petitioned for a finite tolerance in milk for DDT and related compounds on the federal level. In addition, the National Academy of Science has, at the request of the Food & Drug Administration and the United States Department of Agriculture, appointed a committee to study the problem posed by zero tolerances of pesticides in milk. More recently the USDA announced the establishment of a "Pesticide Information Center" in line with its accelerated program of research and education in the field of pest control. The "Center" is working with the Departments of Health, Education & Welfare, Interior, and Defense, as well as other Federal and State agencies including the Federal Committee on Pest Control. This development appears to fall within the intent of a resolution adopted last year by this association relating to the evaluation of present and future recommendations for the use of a tolerance for pesticides in all foods. In addition, the House of Representatives Agricultural Appropriation Committee has recently released a report stating that no milk available in the U. S. is free of pesticides and that there is no evidence that minute traces of any pesticides in milk have either an immediate or cumulative ill effect on human health. It reported that every scientist interviewed recommended that a zero tolerance should be replaced by a finite tolerance for each pesticide residue in or on the various agricultural commodities. Along with these developments, FDA reports that a "total diet" study underway reveals that pesticide levels, found in samples of foods taken from grocery stores in various parts of the U. S. which simulate the diet of a hypothetical average 16-19 year old boy, were generally less than 1% of the safe legal tolerance. It also reports during the fiscal year of 1964 that of 4,352 samples of fluid milk examined, 315 or 7.2% contained residues in excess of the limit of sensitivity of the method used. Heptaclor or heptaclor epoxide was the offender in almost 200 of these samples. This committee urges support of the development of safe and practical limits for pesticides and a surveillance and control program based upon such standards on an integrated federal, state, and local level.

The cessation of air testing of nuclear devices has resulted in low concentrations or absence of the radionuclides of concern in milk supplies and other foods. Here again, the continuation of the national and state monitoring systems serve to keep us informed. A commercial scale milk processing operation including radionuclide removal has been successfully operated for the purpose of providing answers in the event this course will ever need to be followed. This committee recommends that the national and state monitoring systems be continued.

Milk supplies without added water have a relatively narrow range of freezing points and early data indicated that the average freezing point was − 0.550 C. More recent data shows that the freezing point of milk may vary geographically with different existing environmental conditions. This has been established by various studies and, one, conducted by the National Research Council about 14 years ago, showed that the average freezing point of 135 samples of pasteurized milk collected from eight cities showed − 0.540 C with variations between − 0.525 to − 0.555 C. The current edition of Standard Methods states that presence of added water is indicated above − 0.530 C although absence of added water is not assured below − 0.530 C. On the basis of information gathered by this committee it appears that the − 0.530 C standard is generally utilized by regulatory agencies. This committee feels that studies relating to environmental effects, if any, upon freezing points of different milks, should be aimed at providing more definitive guidelines to determine the presence of added water which can be substantiated.

Added Water

It appears that testing for added water on a routine or semi-routine basis should be a combined effort of regulatory and industry for every milk supply or market. There are many ways for water to get into the supply under modern production and transportation methods. Surveys and adequate numbers of samples should be tested in each production area to establish freezing point ranges. Any variation on samples of tanker milk or individual producers samples that depart regularly or occasionally from the range established can then be considered containing added water. It is suggested that each producer be sampled under controlled conditions perhaps during each season so that a freezing point for each producer can be established. Variations from his normal freezing point should then be used to penalize any producer when his freezing point is significantly above the point obtained under controlled conditions.

To illustrate the need and what can be accomplished we submit the following results from work done on the Denver market. One tenth of the producers on the market were inspected at milking time to make sure that no water was added or left in the equipment. From this, a range and mean was established. The mean served as a basis for judging the freezing point expected in the average tanker. The mean for 68 producers was −0.535 C. The mean for 47 transport tankers was −0.536 C. When testing was started prior to the enactment of a campaign to eliminate added water to the supply the mean on the results from 107 tankers was −0.531 C. After three months of work the mean on 47 tankers was −0.536 C. This represents the equivalent of elimination of 1% added water from the supply. It is also suggested that solids-not-fat be determined on representative samples. The 107 tanker samples during the initial work showed freezing point ranges from −0.510 C to −0.543 C. The 47 tankers showed freezing point ranges from −0.528 C to −0.543 C.

This committee has not been able to locate any sustained programs for the testing of milk for added preservatives, detergents and sanitizers. It is generally reported that no real problem exists and the rare examples are generally found through tests and odor determination. Perhaps the complexity and cost of chemical analytical procedures has been a limiting factor in the exploration of this possibility. Undoubtedly, the limitations of funds of regulatory agencies for laboratory services has delegated this activity to the background in favor of the long standing analyses which legally must be applied to milk and milk products. This committee recommends that special consideration be given to this potential problem and would welcome a study in this regard. It is believed that this could well be done by a University.

SUBCOMMITTEE ON DAIRY FARM MILKING MANAGEMENT

T. A. Evans, *Chairman*

This was a new task committee this year. It is apparent that the first job of the subcommittee should have been to define just exactly what is meant by "milking management".

At the risk of inviting severe criticism and recognizing that it is late in the game to do so, the subcommittee chairman suggests that "milking management" deals with those aspects of the milking operation that affect (*a*) the health of the cow, particularly the udder, (*b*) the amount of milk the cow produces in relation to her inherent ability, and (*c*) the quality of the milk as produced. This definition excludes any reference to the handling of the milk after production. More specifically under (*a*) we should be concerned with such things as mechanical condition of the milking equipment, including pipelines, vacuum bulk tanks, releasers, etc., procedures used by the operator, including number of units one man can operate; and detection, prevention and/or control of mastitis and other abnormal udder conditions. Under (*b*) would be included preparation of the cow for milking (stimulation) completeness of milking. Under (*c*) would be considered cleaning of udder and flanks preparatory to milking, clipping of udders and flanks, and use of strip cup.

Subcommittee members were asked to comment on five points, conforming only partially to the above outline. Following are some suggestions and recommendations:

Operation and maintenance of milking machines

The most general criticism of the milking machine was lack of maintenance on the part of the average operator. Even though a machine may be in perfect working order when installed, no machine will operate year after year without some attention and do a satisfactory job. Milking machine maintenance programs should be given top priority. Specific suggestions include:

1. Adoption of standards for installation and maintenance of milking machines.
2. Attach hour meter to milking machine and furnish maintenance chart with specific recommendations to be carried out after various elapsed times of operation.
3. Use larger diameter vacuum lines.
4. Make routine use of vacuum gauges.
5. Place pulsator in suspended position in order to keep it dry.

Effect of Bulk Tank on Milking Procedure

The principal problem here that may affect milking management is the straining of the milk. Induced filtration, either by means of pressure or vacuum, decreases the efficiency of the filtering material and causes other problems. Gravity filtration seems to be the most satisfactory method. How to accomplish this with vacuum bulk tanks is the problem.

Many other fine suggestions were received but all pertained to sanitation, cleaning, etc., of the bulk tanks.

Mastitis

Everyone had ideas and comments relative to the problem of mastitis and there is no doubt but that its occurrence and control is closely related to milking management.

Most states and regions are working on the problem of mastitis control. The many facets of these state and regional programs are beyond the scope of this report.

There seemed to be general agreement on these points:

1. Mastitis is causing dairymen a heavy monetary loss.
2. Large scale educational programs relative to causes and control and/or prevention of mastitis are needed.
3. Milking machines and related equipment are closely related to the mastitis problem.
4. We are past the "treatment" stage and should now be attempting to locate and eliminate the basic causes of mastitis.
5. Much still needs to be done before we have conquered the "condition" known as mastitis.

Preparation of the Cow

This point was inadvertently omitted from the letter that went to subcommittee members asking for recommendations and suggestions. This point definitely should be of major importance in any consideration of milking management.

It is hoped that since we had just one year on the above report that we will be permitted to continue on the work in more detail next year.

SUBCOMMITTEE ON CIP CLEANING OF PIPELINE MILKERS

Harry Stone, *Chairman*

Most of the work done by this Task Committee during the last two years has been by Bernard Saffian on Plastics. Many of the recommendations made in the 1963 report are being repeated here, for emphasis.

All milking machine inflations should be pulsated during the CIP cleaning cycle.

All CIP systems should be properly cleaned after each milking.

A procedure chart on cleaning and sanitizing should be posted in every milkhouse.

All new installations should have accompanying instructions and supervision for at least the first two use operations.

The producer should be instructed by a reliable source on how a CIP cleaner can be made compatible with his water supply, thus avoiding filming.

The use of excessively hot water is deterimental in many cases. Warm water should be used for prerinse. Hot water not only affects the hardness of the water and the pH of the water but is very likely to bake on any residues on the equipment being cleaned.

All CIP lines that are not a complete circuit should be checked as to the cleaning and sanitizing operation. In many cases where one line is used only water reaches the washer unit. Unless the line drains back completely on the return cycle only the part of the line next to the wash vat is being cleaned.

In the last few years many new mechanical developments have been introduced to the dairy farm milk house. It is hoped that every member of the International will write this Task Committee Chairman of these developments.

Recommendations on CIP Cleaning of Plastics

The committee attempted to determine proper recommendations for CIP cleaning and sanitizing methods for plastics used in the transfer of milk. The objective was to present recommendations for systems which effectively clean plastics and do not contribute to the opacity of the plastics. It is felt that cleaning methods which do an effective job on stainless steel or glass can also be used efficiently with plastics. Recommendations for cleaners to be used in a specific water source should be obtained from the cleaner manufacturer and should be based on the water analysis. No one specific recommendation on type of cleaner, concentration, temperature or time can be made to cover all types of water sources.

The opacity of plastics (especially flexible polyvinyl chloride tubings) is due principally to two causes: first, milkstone and/or waterstone residues—these deposits are also found in stainless steel and glass and are due to the use of an ineffective cleaning system. This opacity can only be removed by adjustment of the cleaning procedure to compensate for hard water conditions and other abnormalities of the water sources such as iron, etc., which cause deposits especially if cleaning temperatures are abnormally high. Secondly, presence of a minute amount of water in the surface of the plastic—this causes a disorientation of the structure and a change in the light refraction. This type of opacity is only temporary and will disappear if a line is left open to the air for drying. The latter can be prevented or corrected by the use of a warm air dryer immediately after cleaning. Warm air dryers are now commercially available and are required by some regulatory authorities. The only cause of the temporary opacity is high cleaning temperature associated with water. It has been proven that pH, detergent type, water salts, cleaning time or sanitizer type have no effect on the opacity caused by water. Instructions for proper maintenance of cleanliness and clarity of plastics can be obtained by writing to the U. S. Public Health Service in Washington, D. C.

Several cleaner manufacturers feel that plastics can be cleaned successfully with balanced detergency at lower temperatures for shorter times such as 10 minutes at 110 F. Such a cleaning cycle eliminates the prime cause of opacity in plastics. The plastics being discussed are those which meet the criteria in the 3-A Sanitary Standards for Multiple-Use Plastics Materials. Some regulatory authorities will not permit use of these lower cleaning temperatures or times, and therefore the use of a warm air dryer is indicated.

The following cleaning procedure is based on the concensus of responses plus a cleaning procedure suggested by a state association of Milk and Food Sanitarians. Due to differences in composition of cleaners and sanitizers, a specific recommendation for all cleaning conditions cannot be made.

1. Flush system with warm water (90-100 F) until discharge runs clear.
2. Use an approved cleaner in the recommended concentration based on an analysis of the available water source. Circulate the solution for 10-20 minutes at a starting temperature of 160 F (maximum). Lower temperatures (down to 110 F) should be used if permitted by regulatory authorities. Follow the recommendations of the specific cleaner manufacturer. Drain the system completely.
3. Rinse thoroughly and use acid cleaner if recommended by the manufacturer for concentration, time and temperature. Drain the system completely.
4. Remove excess moisture with a warm air dryer.
5. Sanitize the system with an approved sanitizer just before milking.

SUBCOMMITTEE ON COMPATABILITY OF DETERGENTS TO FARM WATER SUPPLIES AND EFFECT OF SOLUTION TEMPERATURE ON CIP CLEANING OF FARM EQUIPMENT

John W. Dean, Chairman

Work done by the Farm Practice Committee of the New York Association on the above subject is so well done that a summary of their report follows.

1. Research has demonstrated that materials are available for cleaning in water at temperatures lower than those currently recommended. However, not every operator can be depended on to use these materials in an effective manner.
2. "Cold-water" cleaning requires a hot-water supply. Starting temperatures are not important and may be very misleading. Temperatures at the end of the cleaning cycle should be above the solidifying range of milk fat. For practical purposes, temperature at the discharge should be above 110 F.
3. Temperature control is very difficult for a number of reasons. Few installations maintain temperatures above 110 during a 20-minute wash cycle. Satisfactory results were obtained in a variety of systems when cycling time was terminated at less than 20 minutes. There has been some problem in getting adjustable timers but these should be acquired and proper conditions established for each installation. Many hot-water heater thermostats are faulty and the water heater does not deliver water at temperatures indicated. The human factor is an ever-present variable.
4. Total counts can be very misleading. Generally, counts have been suitable on at least seven of the nine farms studied. However, this study could not evaluate milking practices and thus occasional high counts on some farms and routine high counts on two or three farms should not be blamed on cleaning faults. The effectiveness of any cleaning system can be evaluated only by careful visual inspection.
5. Many equipment malfunctions were noted. Commonly these become apparent through visual inspection prior to any effect being noted in the bacterial picture. Water heaters, water softeners, automatic cycling systems had malfunctions frequently. It should be recognized that any CIP system needs considerable supervision.
6. There are many sources of human error in a dairy sanitation system. Lack of knowledge of cleaning chemistry, neglect, poor use of time, ideas of false economy all contribute to these errors. Proper instruction is essential.
7. Sanitarians should be made aware of the importance of water composition and water temperature in any CIP operation. The compatability of sanitation chemicals with water supplies is something which needs a lot of study.
8. Some serious sanitation problems can be expected in certain installations because, in some CIP systems, the cleaning solution is not completely discharged and rinse water may contain considerable amounts of milk solids.
9. Residues of sanitation chemicals were observed occasionally.
10. The use of a sanitizing rinse should be recommended as a standard procedure. Likewise, pulsating units should be installed for proper inflation care.
11. These studies have pointed out many errors in our concept of milkhouse sanitation. We have made many assumptions in the past which are not justified on routine inspections. Sanitarians and inspectors need to make themselves more familiar with the components of a suitable sanitation system in order to properly evaluate the results obtained in a CIP installation.

12. Research of this nature is time consuming and expensive in terms of personnel and product costs.

The Relation of Farm Water Supplies to the Quality of Milk

Some comments on information received to date follow. Perhaps one of the most significant trends in the evaluation of the role of the farm water supply in the production of high quality milk is the awareness that the dairy industry can no longer consider potability and total hardness as the only criteria of water quality. Another common problem which must be met is the fact that primary water sources, which have been adequate for generations of farm families, now must be supplemented by secondary water sources which need, almost without exception, some treatment (filtration, sedimentation, chlorination, etc.) before they are suitable for use in the milkhouse.

Many have waited eagerly to see what changes would be brought about by the revision of the USPHS milk ordinance. The revised ordinance is now available in final form and several observations can be made which are pertinent to the interests of this sub-committee:

1. Rules for proper construction of springs, wells, etc. differ little from those appearing in the 1953 ordinance.

2. The standards for water purity (potability) according to the remain at $>$2.2 coliforms per 100 ml of water. This standard seems suitable for public health reasons but there is considerable evidence that the dairy industry must know more about the physical, chemical, and bacteriological properties of a water supply than the limited criterion of potability.

3. The 1965 ordinance recognizes the need for water from secondary sources for farm use. This is evidenced by the statement that the water supply for the milkhouse and milking operations must be from an approved source. It is stated that water for stock use, gardening, etc. does not have to come from a protected source.

4. It is noted also that the 1965 ordinance recognizes that permanent water supplies sometimes fail due to drought or freezing. The ordinance requires that tanks used in hauling water to farms must be sealed and protected from contamination; they must be cleaned and sanitized before use, and the temporary water supply must be a potable source if used in the milkhouse or milking system.

The committee also recognizes that activity has taken place in other areas which is of interest to sanitarians. A letter survey of committee interest in 1964 indicated that potability of water sources must be assured. Reports indicated very little controlled research being conducted in the area of water quality as it relates to milk quality. Replies from regulatory agencies indicated acceptance of the validity of requiring potable water supplies, but indicated also that these agencies are unaware of or uninterested in the relationship of water quality to milk quality.

In addition to the two committee activities noted above, mention should be made of other work of interest to this subcommittee. The observations of Harold O. Clark, Milk Flavor Specialist for the Vermont Department of Agriculture, that copper and iron in the dairy washwater may cause serious problems with oxidized flavor in the milk and discoloration of stainless steel equipment is of considerable interest. The problem was prevented when the lines received an acidified rinse prior to milking. Mr. Clark has recommended that plastic pipe should be used to conduct water from the supply to the milkhouse.

Subcommittee sentiment seems to suggest that we should be a clearing committee for information relating to farm water supplies and should attempt to evaluate this information for distribution to interested parties in the dairy industry. Secondly, we should encourage study of the compatability of sanitation chemicals with the water supplies with which they will be used. It appears potability is well under control by the several agencies and we will best serve the industry by confining our efforts to the areas of water availability and water composition as they relate to dairy sanitation and the ultimate quality of our milk supply.

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ACKNOWLEDGMENT IS MADE TO THE FOLLOWING REPRESENTATIVES OF AFFILIATE ASSOCIATIONS

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MILTON HELD

"Milt" was born and reared on a farm near Sioux City, Iowa where he graduated from high school. He attended Iowa State University and graduated with a B.S. degree in Dairy Science. He then spent four years in the market milk processing and four years in the market milk production industries in Iowa.

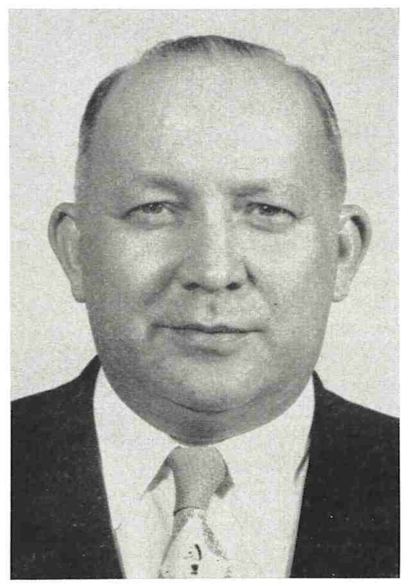
He has been in public health work on the local, state, and federal levels for the past 25 years beginning in St. Louis, Missouri in 1940. He then served as Chief Milk Sanitarian in the Sioux City, Iowa Health Department until accepting a position as Milk Sanitarian for the Iowa Department of Health in 1943. In 1945 he was placed in charge of milk and food sanitation in that department.

In 1950 he left the Iowa Department of Health to participate in a research study sponsored and conducted by the National Research Council of the National Academy of Sciences, Washington, D. C. This involved a detailed study of milk sanitation programs in Birmingham, Alabama; Boston, Massachusetts; Houston, Texas; Louisville, Kentucky; Minneapolis, Minnesota; Rochester, New York; Sacramento, California; and Washington, D. C. The report of this research project was published in 1953 as "Sanitary Milk Control—It's Relation to the Sanitary, Nutritive, and Other Qualities of Milk."

Since 1951 he has been employed by the U. S. Public Health Service, first in Washington, D. C., followed by eight years as Regional Milk and Food Consultant in the Kansas City, Missouri Regional Office, and for the past five years in the same capacity in the San Francisco, California Regional Office.

Milt has been a member of the International for 25 years and is a Charter member and was the second president of the Iowa affiliate. He then served as secretary-treasurer until leaving Iowa. He has been a member of the Farm Methods Committee of the International for a number of years.

He is married, has three sons, one in his second year of dental college, one in his second year of college, and one a junior in high school; and lives in San Carlos, California.



W. R. McLEAN

"Mac" as he is commonly known by his associates is a native Iowan.

He attended Iowa State University at Ames, Iowa, and received his Bachelor of Science degree in Dairy Technology from the University of Idaho in 1933. He spent a number of years in the fluid milk, ice cream and evaporated milk industry on the West Coast and Northwest states.

At the end of World War II he continued his formal education at the University of Michigan, Ann Arbor where he received his Masters degree from the School of Public Health. After graduating from the University of Michigan in 1948, he returned to his former position in the State of Idaho as a state milk and food sanitarian.

In 1949 he was commissioned in the U. S. Public Health Service and has been stationed in the regional offices at Kansas City, Missouri; Atlanta, Georgia; and is currently assigned to the Chicago regional office as Associate Program Director of Environmental Engineering and Food Protection.

In the past 15 years he has represented the Public Health Service in formulating baking industry sanitation standards, food equipment standards and 3-A sanitary standards for milk equipment.

SECRETARY-TREASURER

KARL K. JONES

Karl K. Jones, Public Health Sanitarian, is Chief of the Retail Food Section of the Division of Food and Drugs, Indiana State Board of Health. Mr. Jones attended public schools in Indiana and Indiana University where he received a B.S.P.H. in 1950 with an option in Sanitary Science.

Mr. Jones has been in public health work for 15 years, beginning as a regional sanitarian in the Southwestern area of Indiana. He then served as the State Retail Survey Officer from 1952 to 1957 at which time he was appointed to his present position of Chief of the Retail Food Section.

For a number of years, Mr. Jones has been active in professional and technical organizations. He is a member of the International Association of Milk, Food, and Environmental Sanitarians, Inc., Charter member of the Indiana Association of Sanitarians, a member of the American Public Health Association and the Indiana Public Health Association. He is also a member of the Indiana State Board of Registration for Professional Sanitarians and has been active for several years in developing information and standards for sanitarians; and in 1958, a paper by Mr. Jones on the "Current Status of Sanitarian Registration Legislation in the United States" was published in the Journal of Milk and Food Technology.

Mr. Jones is married and lives in Indianapolis, Indiana.

Nominating Committee

Kelly Saunders, Chairman	Shelby Johnson
Ben Luce	Harold Barnum
M. W. Jefferson	C. K. Johns
James Meany	

ANNOUNCEMENT CONCERNING THE SANITARIANS AWARD FOR 1966

Announcement is made that nominations will be accepted for the annual Sanitarians Award until June 1, 1966, and the members of the International Association of Milk, Food and Environmental Sanitarians, Inc. are requested to give consideration to the nomination of individuals whose professional work in the field of milk, food, or environmental sanitation in their communities has been outstanding.

The Award consists of a Certificate of Citation and $1,000 in cash, and is sponsored jointly by the Diversey Corporation, Klenzade Products, Inc., Pennsalt Chemical Corporation, and the Olin Mathieson Chemical Corporation. It is administered by the International Association of Milk, Food and Environmentla Sanitarians, Inc., and is presented annually. The next presentation of the Sanitarians Award will be made at the 53rd annual meeting of the Association which is to be held at Minneapolis, Minnesota, in August 1966.

The Executive Board of the Association has established the following rules and procedures governing the Sanitarians Award.

Eligibility:

1. *General Criteria*
   To be eligible for nomination the Sanitarians Award offered annually by the International Association of Milk, Food and Environmental Sanitarians, candidates must:
   a. Have been a member of IAMFES in good standing for a period of five years prior to the date when the Award is to be presented;
   b. Be a living citizen of the United States or Canada who, at the time of nomination, is employed as a professional sanitarian in the field

of milk, food, and/or environmental sanitation by a county or municipality; provided that any sanitarian employed by a higher political subdivision, up to and including a State, who works in a capacity and is assigned duties comparable in scope and responsibility to those normally expected of county or municipal sanitarians, shall also be deemed eligible to receive this Award.

Member of the Executive Board, members of the Committee on Recognition and Awards of the International Association of Milk, Food, and Environmental Sanitarians, employees of Federal and State agencies (except as provided above), and industry members shall not be eligible for the Award. Race, sex or age shall not enter into the selection of the Award recipient.

c. Have made a meritorious contribution in the field of milk, food or environmental sanitation, to the public health and welfare of a county, counties, district or municipality within the United States or Canada.

d. Have completed the achievements and contributions on which the nomination is based during the seven-year period immediately preceding January 1, of the year in which the Award is to be made.

2. *Additional Criteria*

a. Co-workers are eligible for nomination if both have contributed equally to the work which the nomination is based and each independently meets the other qualifications for nomination.

b. Where co-workers are selected to receive the Award, each shall receive a certificate and share equally in the cash accompanying the Award.

c. No person who has received, or shared in receipt of the Award, shall be eligible for renomination for this Award.

Nominations

Nominations of candidates for the Sanitarians Award may be submitted by the Affiliate Associations of the IAMFES, or by any member of the Association in good standing except members of the Executive Board, members of the Committee on Recognition and Awards, and employees of the sponsoring companies. Nominations from persons who are not members of the Association cannot be accepted. No member or Affiliate may nominate more than one candidate in any given year.

Each nomination must be accompanied by factual information concerning the candidate, a resume of his work and achievements, evidence supporting his achievements and if available, reprints of publications. A form for the submission of nominations may be obtained upon request from H. L. Thomasson, Executive Secretary, International Association of Milk, Food and Environmental Sanitarians, Inc., P. O. Box 437, Shelbyville, Indiana.

Submission of Nominations

The deadline for submission of nominations is set annually, and all nominations and supporting evidence must be postmarked prior to midnight of that date. The deadline this year is June 1, 1966. Nominations should be submitted to Mr. John H. Fritz, Chairman, Committee on Recognition and Awards, 5904 62nd Ave., Riverdale, Maryland.

Selection of the Recipient

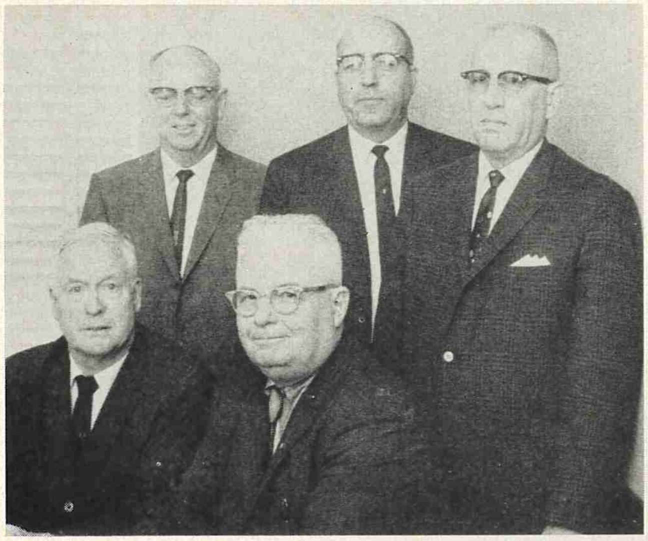
The Committee on Recognition and Awards of the International Association of Milk, Food and Environmental Sanitarians, Inc., has full responsibility for selecting from among the candidates nominated the recipient of the Sanitarians Award. In judging the contributions of each candidate, the Committee will give special consideration to (*a*) originality of thought, mode of planning, and techniques employed, (*b*) the comprehensive nature of the candidate's achievements, and (*c*) their relative value as they affect the health and welfare of the candidate's community. The Committee will give consideration also to the efforts of the candidate to establish professional recognition in the community in which he serves, as well as to his research, administrative development, program operation and educational achievements. Additional information or verification of submitted information will be requested when considered necessary by the Committee. Testimonial letters in behalf of a candidate are not desired.

If after reviewing the nominations and supporting evidence, the Committee decides that the work and achievements of none of the candidates have been significantly outstanding, the Award shall not be made. In this connection, it is fundamental that if meritorious professional achievement cannot be discerned the Award shall be omitted for a year rather than to lower the standards for selections of a recipient.

1966 Committee on Recognitions and Awards

J. H. Fritz, Chairman; A. B. Freeman, Massachusetts; R. M. Perry, Connecticut; W. C. Lawton, Minnesota; D. B. Whitehead, Mississippi and Wm. Kempa, Canada.

KANSAS ASSOCIATION HONORS HILGENDORF AND DUKE



New Kansas Association Officers. Front row: David Monk and Perry Uhl. Back row: Lowell Venis, Frank Kelley and C. H. Corwin.

The Kansas Association of Public Health Sanitarians at its 36th Annual Meeting at Hutchinson on October 27-29, 1965 selected Robert Hilgendorf and Dean Duke for the distinction of Kansas Sanitarians of the Year. Both are members of long standing and have actively supported the Association in its state-wide programs.

Bob Hilgendorf is Acting Director of the Food Service and Lodging Board of the State Department of Health and has 26 years experience in the field of regulation and enforcement. Among his many honors is the Distinguished Jayhawker award for outstanding operation of his department. Dean Duke, Sanitarian-Administrator of the Marion County Health Department for 15 years, has been a consistant leader in the Grade A milk program of the state. He is a past president of the Kansas Association.

At the meeting new officers for the coming year were elected as follows: President, Perry Uhl, Food Service and Lodging Board, State Department of Health, Topeka; 1st Vice President, David Monk, Wichita City-County Health Department; 2nd Vice President, C. H. Corwin, Sanitarian, McPherson; and Past President, Lowell Venis, State Board of Agriculture, Lyons. Frank Kelley, State Department of Health, Topeka, was reelected Secretary-Treasurer.

About 100 members and guests participated in the interesting three-day program. Topics discussed included: Surveys Under the New Food Ordinance; The Law Applied to Natural Disasters; The Sanitarian as a Department Administrator; The State Bangs, T-B and Ring-Test Programs; Investigating Food Poisoning Outbreaks; Public Announcement of Degrading or Closing Food Establishments; and Dieldrin, Aldrin and other Insecticides in Milk.

ILLINOIS ASSOCIATION GIVES FIRST PETE RILEY AWARD TO JIM MEANY

At the 24th Annual Conference of the Associated Illinois Milk Sanitarians in Chicago on December 13, 1965, the first Pete Riley Award for Illinois Sanitarian of the Year was presented to James A. Meany. The Award honors the memory of P. E. Riley, former milk survey rating officer for the Illinois State Department of Health, who died in August 1962. Pete had served the Illinois association as its secretary for 17 years and had achieved distinction in his profession as a hard-working, dedicated idealist whose life interest was greater improvement in milk sanitation. Pete's contributions toward the present high standard of milk quality in the middle west are widely recognized.

Stephen M. Bailey, Member, Chicago Board of Health, and Dr. Samuel L. Andelman, Health Commissioner, congratulate James Meany for the first Pete Riley Award.

Mrs. Riley presented the first Award in the form of a plaque to Jim Meany, present secretary of the Associated Illinois Milk Sanitarians and Chief of Dairy Inspection for the Chicago Board of Health. The plaque reads as follows: "For your contributions in time and leadership, not only in our organization but in the Council of Affiliates of the International Association of Milk, Food and Environmental Sanitarians. For your patience and work with the abnormal milk program in the past year, we bestow on you this Pete Riley Award as Illinois Sanitarian of the Year".

A Special Award was also presented to C. A. Abele for his long and outstanding service to the State and International Associations and for his valuable work on behalf of the 3-A Sanitary Standards program. Joseph Peterson, president of the State Association, presented the Special Award also in the form of a plaque. "Abe" Abele is Director of Public Health Research for the Diversey Corporation and is a past president of both the State Association and IAMFES.

The Annual Conference was well attended by some 300 members and guests and an interesting program was presented. Dale Seiberling of Klenzade Products reviewed new developments in CIP cleaning and Professor O. W. Kaufman of Michigan State University discussed new research studies on the cleanability of stainless steel. John C. Watson, Director of the Illinois Department of Registration and Education, outlined the principles and requirements of the new state law covering the registration of sanitarians and sanitary engineers.

H. L. "Red" Thomasson, Executive Secretary of IAMFES, reviewed some of the current programs of International and explained in detail the need for a dues increase to be proposed at the next annual meeting. The afternoon session was devoted to a discussion of problems of abnormal milk with Dr. G. W. Meyerholz of the University of Illinois and Enos Huffer of the Illinois Department of Health leading the discussions.

PAPERS PRESENTED AT AFFILIATE ASSOCIATION MEETINGS

Editorial Note: The following is a listing of subjects presented at recent meetings of Affiliate Associations. Copies of papers presented may be available through the Secretary of the respective Affiliate Association.

CALIFORNIA ASSOCIATION OF DAIRY AND MILK SANITARIANS

47th Annual Educational Seminar
Palo Alto, Calif.
October 4, 5 & 6, 1965
(*Secretary,* Jack S. Gould, 18520 VanNess Ave., Torrance, Calif.)

New Developments in Milk Plant Construction—*Ted Brunner*
Fabrication of Stainless Steel for the Milk Industry—*A. P. Terrile*
Mastitis Control—A Many Splendored Thing—*John Dahl*
Post-Pasteurization Contamination and its Control—*P. R. Elliker*
The National Picture of Market Milk Supplies—*Darold Taylor*
New Product Research for the Dairy Industry—*D. H. Jacobsen*
Experiences with Small Water Supplies and Waste Disposal Facilities—*R. P. Hayward*
Removal of Strontium 90 from Milk—*M. E. Held*

INDIANA ASSOCIATION OF SANITARIANS

15th Annual Program
Indianapolis, Ind.
October 5, 6 & 7, 1965
(*Secretary,* John M. Schlegel, State Board of Health, 1330 W. Michigan St., Indianapolis, Ind.)

Sanitary Control of the School Environment—*Robert Leech*
Private Waste Disposal—*Don Ort*
Private Water Supplies—*Dick Ortman*
New Developments in the Painting of Retail Food Establishments—*Ivar Thomasson*
Procedures for Evaluating Food Service Sanitation Programs—*G. W. McElyea*
Salmonellosis Related to Eggs and Egg Products—*R. N. Collins*
Liquid Manure Handling System—*James Wilson*
Putting a Local Health Department in Gear—*James McCoy, James Goodpasture*
New Methods of Waste Disposal by Deep Well Injection—*J. M. Heckard, R. A. Woodley*
Industry Looks at the Sanitarian—*T. T. Thompson*
A Physician's Opinion of Public Health—*O. R. Bowen*

FLORIDA ASSOCIATION OF SANITARIANS

Milk and Food Sanitarians Conference
Gainesville, Florida
October 19-21, 1965
(*Secretary,* Howard B. Young, Agricultural Extension Service, University of Florida, Gainesville, Fla.)

Recent Research on Fats in the Diet as Related to Heart Disease—*G. K. Davis*
Biodegradable Detergents—*A. T. Nielsen*
The Food Additive Program of the Florida Agricultural Extension Service—*Dick Matthews*
Epidemiology Trends in Milk and Food—*Charlton Prather*
Lagooning of Manure on Dairy Farms—*Tom Skinner*
Comparison of Different Bacteriological Tests—*K. L. Smith*
Importance of the Laboratory to Management and Quality Control—*Milt Gelbman*
New Innovations in Equipment and Packaging of Laboratory Supplies—*Kem Young*
Acidified Sanitizers and Rinses—*C. A. Abele*
New Innovations in the Drying of Foods—*Hal Johnson*
Quality and Standards of Dry Milk Solids—*L. E. Mull*
Laboratory Problems on Screening for Mastitis—*Dave Frye*
Methods Used for Testing Welded Sanitary Lines and Large Holding Tanks for Proper Sanitation—*Leon Kemp*
Research in Foods—*John Taylor*
Screening Tests Used in Detecting Mastitis—*Wayne Kirkham*
Acidified Dairy Products—*R. W. Dolan, Jr.*
Quality Control Problems as Related to the Chocolate Industry—*Milford Bonner*

KANSAS ASSOCIATION OF PUBLIC HEALTH SANITARIANS

36th Annual Meeting
Hutchinson, Kansas
October 27-29, 1965
(*Secretary,* Frank L. Kelley, 1216 Ohio St., Lawrence, Kan.)

The Law—Applied to Natural Disasters, Wrecks, etc.—*Evan Wright*
The Bangs Program Under the 1965 Milk Ordinance and Code—*David Manley*
The TB Program Under the 1965 Milk Ordinance and Code—*A. G. Pickett*

Ring-Testing Program—*Miss Tony Garton*
Procedures in Food Poisoning Outbreaks—*Dr. Rosemary Harvey*
Laboratory Procedures in Food Poisoning Outbreaks—*Dick Ripper*
Future Trends in Public Health—*Jim Aiken*
Panel: Should the Degrading or Closing of Cafes be Publicly Announced—*Don Cross, Robert Meeker and Melvin Lynch*
Dieldrin, Aldrin and Other Insecticides in Milk—*Alfred Barnard*

VIRGINIA ASSOCIATION OF SANITARIANS

20th Annual Conference
November 17-18, 1965
Roanoke, Virginia
(*Secretary,* John D. Bartnik, 4125 Walmsley Blvd., Richmond, Va. 23234)

Environmental Health Problems Among the American Indians—*R. P. Haywood*
Stream Pollution—*H. G. Jepson*
Ultrasonic Bird and Rodent Control—*Cecil G. Yeatts*
Progress Notes for 1965 in Insect Control—*Thomas Wilson*
Panel: What Next in Mastitus Control?—*Seymour Kalison, W. L. Arledge and M. W. Jefferson*
Sewage Disposal—*C. G. Knick*

ASSOCIATED ILLINOIS MILK SANITARIANS

24th Annual Conference
Chicago, Illinois
December 13, 1965
(*Secretary,* James A. Meany, 8948 S. Laflin St., Chicago, Ill.)

Principles and New Developments in CIP Operations—*Dale Seiberling*
Cleanability of Stainless Steel—*O. W. Kaufmann*
How the Illinois Sanitarian Registration Act Effects You—*John C. Watson*
Comments on a Research Study of Abnormal Milk—*G. W. Meyerholz*
Let's get Rid of Abnormal Milk in Illinois—*Enos Huffer*

NEWS AND EVENTS

TOP FDA MEN RETIRE

The U. S. Food and Drug Administration in December announced the retirements of Assistant Commissioner for Regulations Malcolm R. Stevens and Division of Microbiology Director Dr. Glenn G. Slocum.

Mr. Stephens, 58, appointed assistant commissioner in 1964, has been responsible for final administrative approval of regulations to complement the Food, Drug, and Cosmetic Act. Born in Fort Smith, Ark., Mr. Stephens holds the record as the youngest man ever to become an FDA district director—at the age of 31 in the St. Louis "station" in 1938. He served as FDA inspector, chief inspector, district director (St. Louis and Chicago), associate commissioner, director of the Bureau of Enforcement, and assistant commissioner for regulations during his 35 years with the agency.

Dr. Slocum, 59, has been with FDA for 35 years and is widely recognized as an expert in the fields of food and drug microbiology. He has served on scientific committees with the World Health Organization, National Academy of Sciences, and the Association of Food and Drug Officials of the United States. Dr. Slocum also served as an adviser to the U. S. Pharmacopoeia and the National Formulary.

The retirement of George P. Larrick, Commissioner, U. S. Food and Drug Administration, expected for some time, took effect on December 27. He had been Commissioner for 11 years and had been with FDA for 42 years, having started as an inspector in the Bureau of Chemistry, USDA, predecessor of FDA. Under Commissioner Larrick's administration FDA expanded greatly both in personnel and in departmental activities. The FDA National Advisory Council commended Larrick for his outstanding contributions to the protection of the public health.

MARKET MILK AND ICE CREAM CONFERENCES AT PURDUE

Two one-day meetings on market milk and ice cream are scheduled to be held in March 1966 at Purdue University. The Market Milk Conference will be held on March 23 and the Ice Cream Conference on March 24, at the University Memorial Center, Lafayette, Indiana. The conferences are an annual affair sponsored in cooperation with the Indiana Dairy Products Association.

The Market Milk Conference will include discussions on Recommendations of The Mastitis Committee for 1966, Public Health Inspections of Bovine Mastitis, Proposed New Directions for Federal Milk Marketing Orders, Trends in Merchandising Dairy Foods, Milk Concentrates, and Quality Control in Fluid Milk Processing.

There will be a joint meeting of the Dairy Technology Clubs from Indianapolis, Fort Wayne and South Bend on the evening of March 23. These groups along with the dairy conference members and the Indiana Dairy Products Association are planning a special recognition event for W. K. "Bill" Moseley of Indianapolis for his long-time service to the Dairy Industry.

The Ice Cream Conference will feature discussions on Quality Control for Ice Cream Plants, Controlled Outlet Marketing, Formulations for Soft Serve Accounts, Quality Judgments and Other Considerations in Using Nuts, and Ice Cream Flavorings.

Further information may be obtained from Mr. H. F. Ford, Smith Hall, Purdue University, Lafayette, Indiana.

PHILADELPHIA SEMINAR ON SALMONELLOSIS

Salmonellosis was the subject of a full day seminar held in Philadelphia on January 11, 1966. The seminar was co-sponsored by the Philadelphia Department of Public Health, the Philadelphia Chapter of the Institute of Food Technologists, and the Communicable Disease Center of the U. S. Public Health Service.

The seminar provided an opportunity for people from institutions and government to review the lastest knowledge about the control of the disease and covered epidemiological operations, methods of investigation, laboratory procedures and recommendations for control. The program was arranged by Mr. David Kronick, Chief of the Milk and Food Section, Philadelphia Department of Public Health. Dr. Louis D. Polk, Deputy Health Commissioner for Community Health Services, presided as seminar chairman.

Subjects and speakers included "A Perspective of Salmonellosis", by James H. Steele, D.V.M., Chief, Veterinary Public Health Section, Epidemiology Branch, Communicable Disease Center, Atlanta, Georgia; "Hosts, Reservoirs, and Vehicles of Infection", by Phillip S. Brachman, M. D., Chief, Investigations Section, Epidemiology Branch, Communicable Disease Center, Atlanta, Georgia; "Food Processors and Manufacturers View of Salmonellosis", by M. F. Gunderson, Ph.D., and A. C. Peterson, Ph.D., of the Campbell Soup Company; and "Feed Supplement Industry's View of Salmonellosis", by D. M. Doty, Ph.D., Fats and Proteins Research Foundation, Des Plaines, Illinois, and "The Laboratory Problems Associated with Salmonellosis" by Martin Goldfield, M.D., Director of Laboratories, New Jersey Department of Health.

A panel on Problem Solving was moderated by Mr. Fred Jacobson, Consultant in Foods and Sanitation. The panel consisted of John Walker, D.V.M., United States Department of Agriculture, Mr. Irwin Berch, Philadelphia District Director of the Food and Drug Administration, George Turner, Ph.D., Dean of the Delaware Valley College, and Walter Obold, Ph.D., Drexel Institute of Technology.

Over 200 people attended the seminar representing industry, institutions, and all levels of government. Every state in the Middle Atlantic region was represented.

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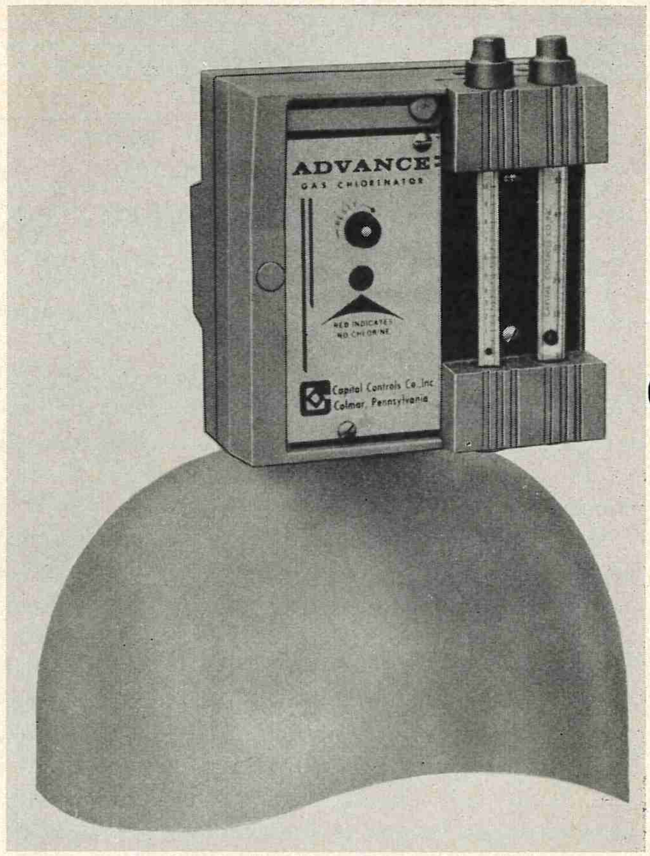

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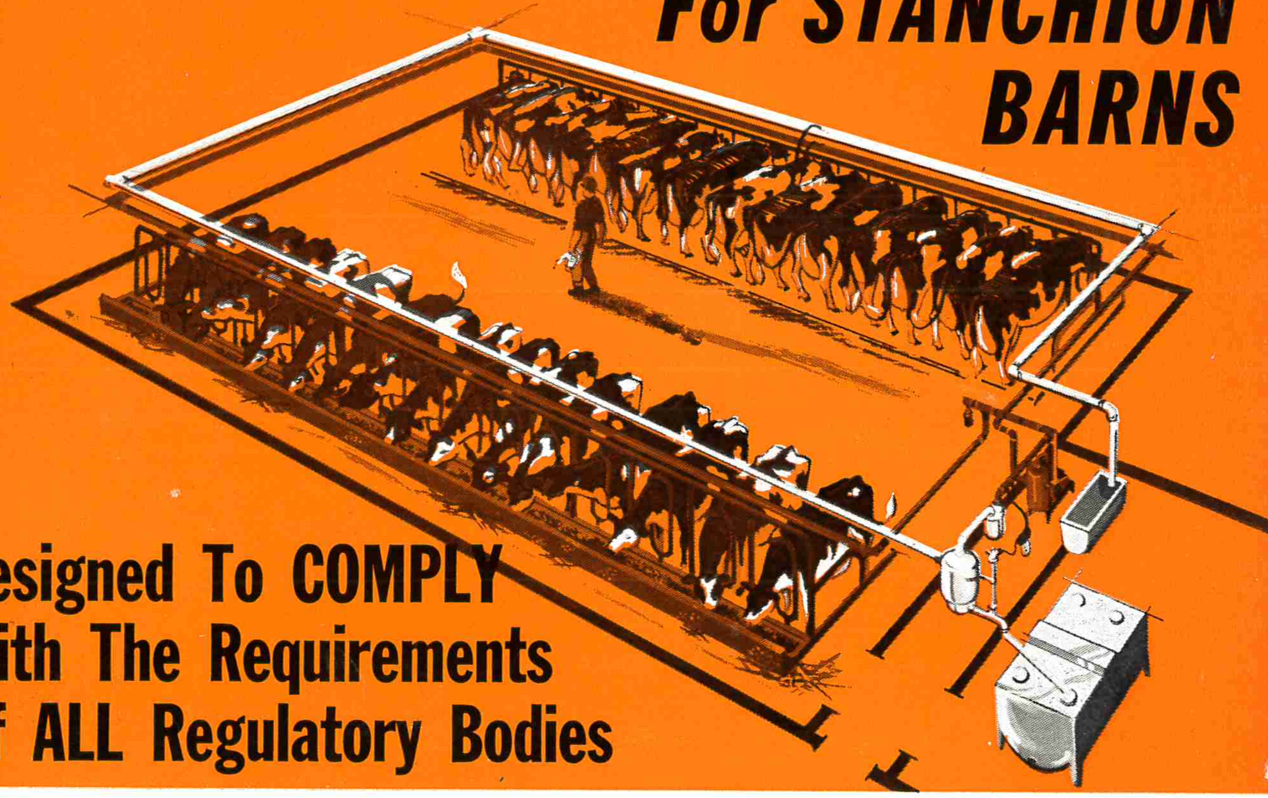

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