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Official Publication

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

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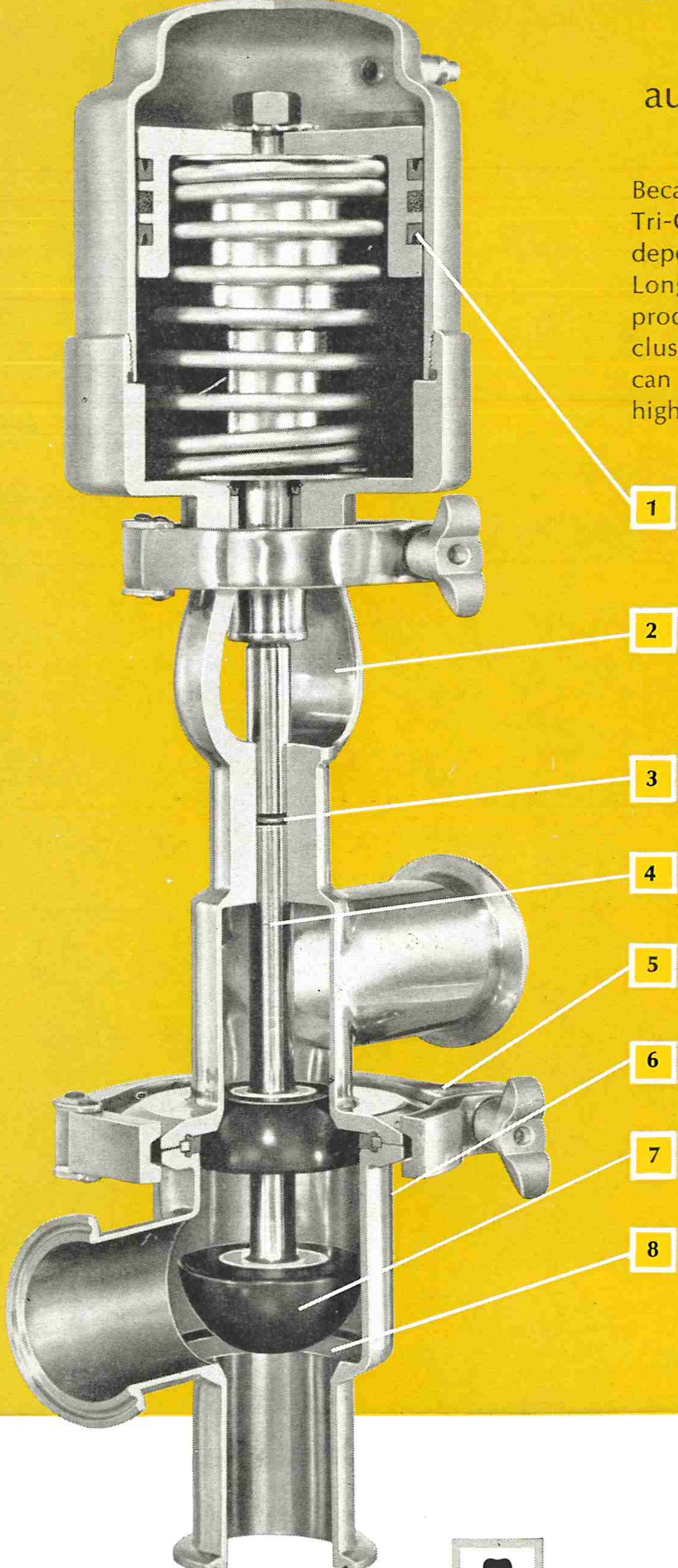

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BACTERIOLOGICAL QUALITY OF SOFT-SERVE FROZEN DESSERTS[1]

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(Received for publication October 16, 1967)

ABSTRACT

Soft-serve frozen dessert mixes and the freezer-dispensed products made from these mixes were examined for total bacteria, coliform organisms, and heat-resistant spores over a 3 yr period.

A total of 76% of all soft-serve mix samples analyzed contained less than 50,000 bacteria/ml, and 72% contained less than 10 coliform organisms per ml. These data indicate that most mix plants and retail stores could meet the above standards if adopted for soft-serve mixes.

A maximum limit of 50,000 total bacteria and 10 coliforms/ml would pose a problem with the freezer-dispensed soft-frozen product, because only 42% and 51% of the retail samples analyzed would meet these total count and coliform standards, respectively.

Spore counts were of little consequence in soft-serve mixes or frozen products, and a maximum allowable standard of 300/ml would be a reasonable figure that could be met with little difficulty by the processor and retailer.

Considerable attention has recently been focused on sanitary standards for frozen desserts. In early 1967, the U. S. Department of Agriculture published suggested standards for the sanitary quality of these products *(2)*. Most states have Standard Plate Count and coliform standards for ice cream, but specific reference to freezer-dispensed products such as soft-serve ice milk, direct draw shakes, and related products is usually missing. However, some states have acted to upgrade existing programs or to establish new sanitary standards for freezer-dispensed frozen desserts *(5)*.

Very little research has been conducted to determine the actual bacteriological quality of soft-serve frozen desserts, possibly because the number of retail soft-serve stores has grown from very few prior to World War II to a point where soft-serve products comprised approximately 10% of the total frozen dessert volume in this country in 1966. Sheuring *(3)*, in 1956 recognizing the growth potential of the soft-serve industry and the need of proper sanitation to protect the public's health, conducted a limited study on the bacteriology of soft-serve products. His results indicated that standards for these products should definitely be established. Foltz and Mickelsen *(1)* reported results obtained in 1964 from a study on the coliform content of malted milk shakes served in retail outlets. Their findings suggested that sanitary conditions deteriorated somewhere between the processing and sale of milk shakes. They concluded that some bacterial standards were definitely needed for milk shakes served in quick-serve retail stores, malt shops, and drug store fountains.

It was apparent that more extensive data regarding the sanitary quality of soft-serve dairy products were necessary before reasonable standards could be established. Therefore, this study was undertaken to determine the actual sanitary quality of soft-serve frozen desserts, and to provide data that might be useful in establishing standards for such products.

EXPERIMENTAL PROCEDURE

Arrangements were made with the management of the leading soft-serve retail outlets serving Georgia to obtain samples of soft-serve mixes and of the freezer-dispensed frozen products from the various retail stores throughout the state. The samples were obtained in sterile screw-cap sample jars, and immediately packed in crushed ice in a styrofoam ice chest. Jars were partially covered with ice and maintained in this condition until analyzed in the laboratory. The temperature of the soft-serve product in the ice chest remained at or below 3 C at all times. Samples were usually analyzed for microbial content within 36 hr after pick-up, but in a few instances involving remote locations about 48 hr elapsed.

Total bacteria, coliform, and heat-resistant aerobic spore counts were determined on the melted sample on a volumetric basis, with the necessary dilutions made from 1 ml samples of the mix or the thawed soft-serve product. Numbers of spores were determined after heating a 1:10 dilution of the product at 80 C for 15 min to destroy vegetative cells. Coliform counts were made on 1 ml samples using desoxycholate lactose agar as the plating medium. Standard Plate Count agar (Difco) was used for both total bacteria and spore counts, except that 0.1% soluble starch was added to the agar when it served as the spore recovery medium *(4)*. Incubation conditions for total bacteria and spore counts were 32 C for 48 hr, and for coliform counts 37 C for 24 hr.

RESULTS AND DISCUSSION

Total bacteria counts

Data were collected over the 3 yr period, 1961, 1962, and 1966. Many of the same soft-serve retail stores were sampled each year, and in 1966 almost

[1]Journal Series Paper No. 160, University of Georgia College of Agriculture Experiment Stations, College Station, Athens.
[2]Deceased.

TABLE 1. TOTAL BACTERIA COUNTS OF SOFT-SERVE MIXES AND FROZEN PRODUCTS

Range of Counts (per ml)	Number of Samples and Percentage in Each Range											
	1961[1]				1962[1]				1966[1]			
	Mix[2]	(%)	F.P.[2]	(%)	Mix	(%)	F.P.	(%)	Mix	(%)	F.P.	(%)
<50,000	57	80.3	31	43.7	63	92.6	35	50.7	75	62.5	44	36.7
50,000-100,000	4	5.6	4	5.6	1	1.5	4	5.8	4	3.3	12	10.0
>100,000	10	14.1	32	45.1	4	5.9	30	43.5	40	34.2	64	53.3
Totals	71	100.0	71	100.0	68	100.0	69	100.0	119	100.00	120	100.0

[1]The year in which the samples were analyzed. The data for 1961 and 1962 were obtained by J. J. Sheuring, deceased.
[2]Mix refers to the product stored under refrigeration in retail stores, and F.P. to the soft-frozen product as it was taken from the freezer.

TABLE 2. COLIFORM COUNTS OF SOFT-SERVE MIXES AND FROZEN PRODUCTS

Range of Counts (per ml)	Number of Samples and Percentage in Each Range											
	1961[1]				1962[1]				1966[1]			
	Mix[2]	(%)	F.P.[2]	(%)	Mix	(%)	F.P.	(%)	Mix	(%)	F.P.	(%)
<10	51	71.9	35	49.3	52	76.5	31	44.9	83	69.7	67	55.8
11-100	12	16.8	13	18.3	14	20.6	20	29.0	24	20.2	34	28.3
>100	8	11.3	23	32.4	2	2.9	18	26.1	12	10.1	19	15.7
Totals	71	100.0	71	100.0	68	100.0	69	100.0	119	100.0	120	100.0

[1]The year in which the samples were analyzed. The data for 1961-62 were obtained by J. J. Sheuring, deceased.
[2]Mix refers to the product stored under refrigeration in retail stores, and F.P. to the soft-frozen product as it was taken from the freezer.

twice as many stores were sampled as in either of the 2 previous years. Table 1 contains data for the total bacteria counts, tabulated in selected ranges for purposes of interpretation. The data reveal that 62.5 to 92.6% of all soft-serve mix samples contained less than 50,000 bacteria/ml throughout the 3 yr period, indicating that a 50,000/ml maximum would probably be a realistic standard for these mix formulations. However, only 36-50% of the samples of frozen product made from these mixes had total counts less than 50,000/ml, revealing that freezer sanitation in soft-serve operations must be improved if such a standard is imposed.

Less than 10% of the total counts in both mix and frozen product were in the range of 50,000 - 100,000/ml. However, from 43-53% of the counts on the frozen product were above 100,000/ml during each year of the study.

The data indicate that soft-serve frozen dessert plants and retail stores that do a good sanitation job can meet a 50,000/ml requirement as easily as one of 100,000 bacteria/ml. However, those doing a poor job of sanitizing will have trouble meeting either of these criteria for total number of bacteria in either the mix or the frozen product.

Coliform count

Coliform counts on the mixes and frozen products are compared in Table 2. In many ways, the coliform results are comparable to the total number of bacteria. If an arbitrary standard of 10 coliforms/ml were set for soft-serve mix, from 69.7 - 76.5% of the retail samples tested would have met this requirement, as well as 44.9 - 55.8% of the samples of frozen products. Only 3% to 11% of the samples of mix had more than 100 coliforms/ml, whereas 15 - 32% of the samples of frozen product contained in excess of 100 coliforms/ml.

These data indicate a maximum allowable standard of 10 coliforms/ml of soft-serve mix can be met with relative ease, and probably is within reach of most soft-serve retail store operators on the frozen product as well.

Spore counts

Because of the increased emphasis on ultra-high temperature processing of frozen dessert mixes, it was thought desirable to determine the number of heat-resistant spores in the soft-serve products collected in 1966. Data obtained are presented in Table 3. Here again, arbitrary ranges were selected

TABLE 3. SPORE COUNTS OF SOFT-SERVE MIXES AND FROZEN PRODUCTS

Range of Counts (per ml)	Number of Samples and Percentage in Each Range			
	Mix[1]	% of Total	F.P.[1]	% of Total
<100	71	59.7	61	50.8
101-300	28	23.5	39	32.5
>300	20	16.8	20	16.7
Totals	119	100.0	120	100.0

[1]Mix refers to the product stored under refrigeration in retail stores, and F.P. to the soft-frozen product as it was taken from the freezer.

to facilitate the interpretation of data. It would appear that if a standard allowing a maximum of 300 spores/ml were imposed it could be met with little difficulty. About 85% of both soft-serve mixes and frozen products contained less than 300 spores/ml. Very little difference between spore counts of mix and soft-frozen product was evident, so if there was contamination during the freezing process, it did not significantly affect the spore count.

ACKNOWLEDGEMENT

Appreciation is expressed to Mrs. Julie Moore for technical assistance in the bacteriological analyses.

REFERENCES

1. Foltz, V. D., and R. Mickelsen. 1964. Sanitary studies on malted milk shakes. J. Milk Food Technol. 27:139.

2. Manufacture of Frozen Desserts. 1967. Standards Recommended for Adoption by State Regulatory Agencies. Federal Register 32(32):2965.

3. Sheuring, J. J. 1956. The bacteriology of soft-serve. Ice Cream Trade J. 52:82.

4. Stahly, D. P. 1961. Heat related factors affecting the rate of germination and subsequent growth of *Bacillus cereus* and *Bacillus licheniformis* spores in milk. M. S. Thesis. The Ohio State University.

5. Weckel, K. G. 1966. A suggested sanitary standard for freezer-dispensed ice milk, malted milk, and shakes. J. Milk Food Technol. 29:180.

ANTACID FOUND TO BE STRONTIUM 90 ABSORPTION INHIBITOR

An antacid long used in the treatment of peptic ulcers has been found to inhibit the absorption of radioactive strontium in man.

The finding was made in investigations jointly supported by the U. S. Atomic Energy Commission and the Public Health Service's National Center for Radiological Health. The tests were conducted in the Metabolic Unit of the Veterans Administration Hospital at Hines, Illinois.

The antacid is aluminum phosphate gel, a nontoxic compound well tolerated by humans and widely used in medical practice for many years. When given immediately prior to the administration of a tracer dose of strontium-85, the compound was found to inhibit strontium absorption by an average of 87 percent.

Subsequent tests indicate that a high percentage of strontium absorption may be prevented even after the body has begun to absorb the radioactive strontium, that is, when aluminum phosphate gel is given after a half hour or after one hour.

Strontium absorption was determined by analysis of fecal excretions and plasma levels following oral administration of the tracer dose.

The tests, performed with the strontium-85 which is harmless at the dose administered, are important for their assessment of the inhibition of absorption of strontium-90 which is a hazardous product of nuclear reaction. Strontium-90 is found in fallout from nuclear weapons testing and could be introduced into the environment by a nuclear accident. Strontium-90 has a long half-life and is made especially dangerous by the fact that it lodges in bone where it can seriously damage the blood-forming bone marrow.

The absorption inhibition studies were conducted by Dr. Herta Spencer, Chief of the Metabolic Section of the Veterans Hospital at Hines; Dr. Issac Lewin, Associate Chief of the Section; and Dr. Joseph Samachson, Chief Chemist of the Metabolic Research Unit. A report on their work was published in a recent issue of the International Journal of Applied Radiation and Isotopes.

"The discovery of strontium absorption inhibition by aluminum phosphate gel would prove most useful in protecting human health against a rise in a strontium-90 levels from any cause," said James G. Terrill, Jr., Director of the National Center for Radiological Health. "While the Center has developed processes for removing radiostrontium from milk, time would be required to get a plant working in an area of strontium-90 contamination. Aluminum phosphate could be made available immediately. Moreover, the radioisotope may be ingested with contaminated well water, grain, and field-grown vegetables, as well as milk."

SANITATION IN AN AUSTRIAN MILK SUPPLY

Franz Gewessler and George M. Grimes

Stainach Milk Plant, Steiermark, Austria
and
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(The cooperative, Landgenossenschaft Ennstal is located in the Enns River valley of Austria, with its primary milk plant at Stainach, Austria. The area is surrounded by the Alps, except for narrow outlets on each end of the valley. The plant supplies fresh milk and milk products to U. S. military forces in southern Germany, Italy, Greece, and Turkey.)

In 1952, when Austrian dairy officials first expressed a desire to sell milk to the U. S. Forces, the problems seemed insurmountable. Bovine tuberculosis was present in about 11% of the cattle. Bacterial counts in raw milk were in the millions. Farm sanitation in Austria was characteristic of most of Europe at the end of the war and left much to be desired. On the farms cattle were housed together with chickens, goats, sheep, and swine. Cloth strainers were used instead of sanitary filters. Poor methods of washing, sanitizing and storage of farm milking equipment and utensils were employed. The old pasteurization plant suffered from lack of modernization during the war and was much in need of repair *(1)*.

With the aid of Marshal Plan funds to construct a new pasteurization plant, and with the incentive of selling milk on U. S. Army contracts, startling changes were about to take place in the sanitary production of milk in this area of Austria.

Requirements for Milk Supplied to U. S. Forces

There are 5 fundamental requirements for milk supplied to the U. S. Forces on military contracts: *(a)* milk must be from healthy cattle which are free of tuberculosis; *(b)* raw milk must meet U. S. standards for quality; *(c)* milk must be processed in sanitary establishments; *(d)* milk must be under continuous inspection, including laboratory testing, to assure that it is processed in compliance with specifications; and *(e)* finished products must meet U. S. standards for quality and volume. The members of the milk cooperative recognized these requirements as just and necessary. As a result, they made rapid progress in improving their milk sanitation program.

Improving Milk Quality

By June, 1953, when the plant started to supply milk on military contracts, revolutionary changes had already taken place. The milk production area, consisting of some 3,000 farms, was declared free of bovine tuberculosis. The fact that the valley is surrounded by mountains with only a few roads leading into the valley, made it easy to establish a buffer zone between the tuberculosis-free area and outside areas. Today the area is not only tuberculosis-free, but it is also brucellosis-free. The usual diseases of dairy cattle, such as mastitis, are relatively rare largely because of the personalized care that each animal receives.

An educational program, supplemented with technical improvements was established on the farms. Separate milk chambers were constructed, cooling and cleaning facilities for the milk and utensils were improved, and a program for faster delivery of milk from the farm to the plant was developed.

By mid-1953, bacterial counts of the raw milk were under 500,000 per ml. The cooperative continued to improve. Today 6 fieldmen or farm sanitarians are employed as full time inspectors and advisors to the farmers. These men use a check-list based on the United States Department of Health, Education, and Welfare, Public Health Service, *Grade "A" Pasteurized Milk Ordinance*. Today bacterial counts on raw milk average between 100,000 and 120,000 per ml in the winter and between 200,000 and 250,000 per ml in the summer. The farmer in the Enns valley now takes pride in the milk he supplies the milk

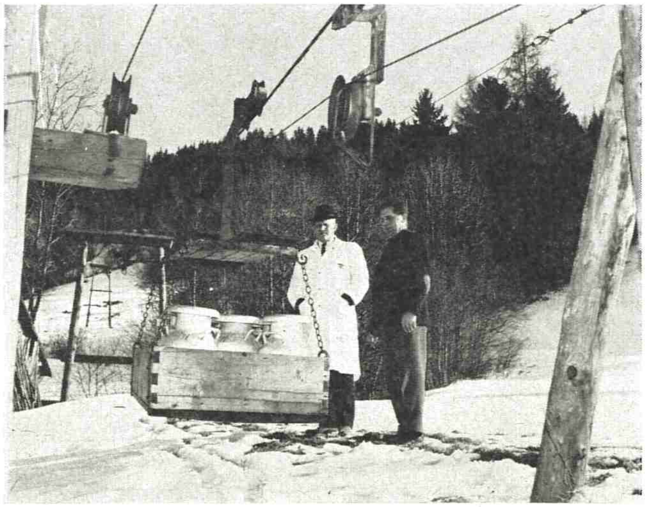

Figure 1. Raw milk delivered from inaccessible farm to Stainach plant with the aid of a cable car.

plant. He does not speak of the "milk quantity", but of the "milk quality" and is proud of the only balanced food given to man by the Divine Chemist.

Not only were advancements made on the farm, but also within the plant itself. These advancements were not without problems. Early in the program the plant employed a plant sanitarian. His task was to produce milk and milk products under such hygienic conditions as needed to meet contract and specification requirements. To do this, he was supported by the plant laboratory. With this support, the sanitarian could check for proper pasteurization, and he could search for points of contamination after pasteurization by means of coliform counts. The war against coliform bacteria is a battle against various technical deficiencies of the equipment and facilities. The valve seat in pipelines represented a source of contamination. These must be taken apart and cleaned daily. Pipeline joints with rubber gaskets were replaced with pipes welded together. "Cleaning-in-place" was adopted. Automatic tank cleaning systems were installed, and covers were placed on Cottage cheese vats. All these technical improvements helped reduce coliform counts to a minimum.

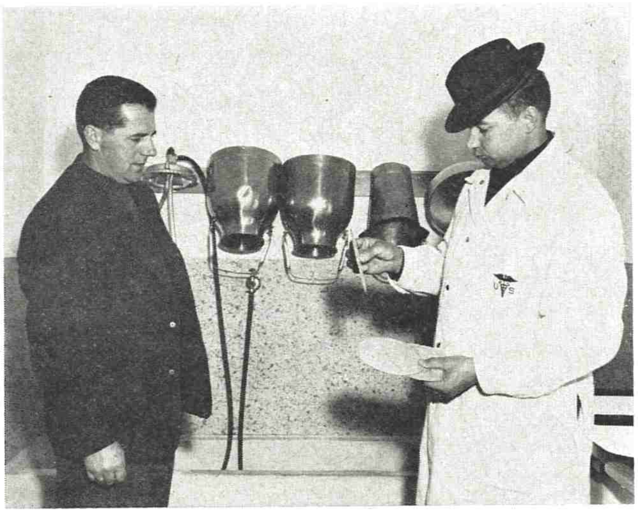

Figure 2. Milk house on an Austrian dairy farm.

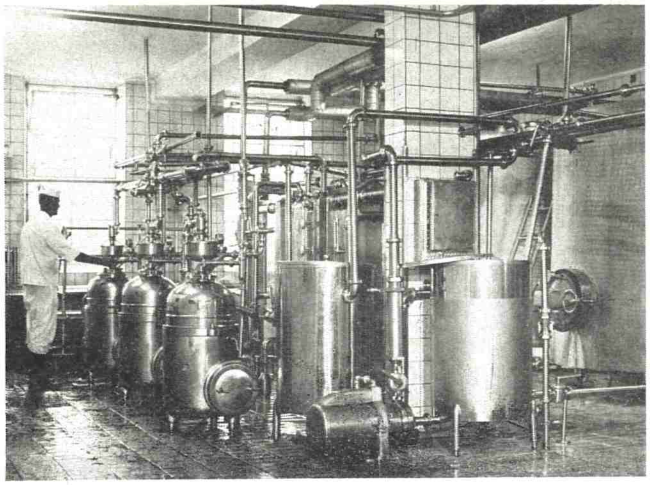

Figure 3. Processing facilities in Stainach milk plant.

Milk Plant Personnel

Technical measures alone are not enough to maintain high quality, low bacterial count milk. Milk plant personnel themselves must be convinced of the necessity for hygienic practices and must be educated to observe sanitary requirements. It is a never-ending struggle to admonish milk plant employees that they should always be on their "good behavior" as far as hygienic practices are concerned. They need to know that microscopic organisms which undermine our health thrive best in filth. Through publications employees are notified of hygienic rules that they should follow. One measurement of how well people understand and appreciate the necessity of hygiene is their use of soap and water. This is particularly true of those who work in milk plants.

The plant sanitarian must not only be well trained, he must also be a leader and be particularly alert to cleanliness and sanitation in the plant. The first sanitarian employed by the milk plant was especially fervent in his activity to improve plant sanitation. He was supported by plant management from the top. At first his findings, admonitions, and proposals for improvements were received with great appreciation. However, gradually as his frequency of complaints increased, appreciation for his position declined. Plant employees came to disregard his suggestions and open hostility grew against the plant sanitarian. He became popularly known as the "Coli-cop." The public enemy no. 1 was no longer the contaminating organisms that entered the milk, but the plant sanitarian and his "talebearers" from the laboratory. As a result of this disagreeable situation, it was necessary for the milk plant manager to look for another solution for improving sanitation within the plant.

A program was started within the plant to develop specialists from existing employees. Intelligent, industrious people with a gift for leadership were invited to volunteer for this dairy specialist sanitary training. In addition to receiving academic training, these people must rise from the ranks and work in all departments of the plant. After an apprenticeship of 3 yr, they not only know the work to be done in each department, but they are familiar with the rhythm of the entire plant. These trained individuals can then be placed at various supervisory positions throughout the plant. They are also in a position to receive a better salary than the other employees.

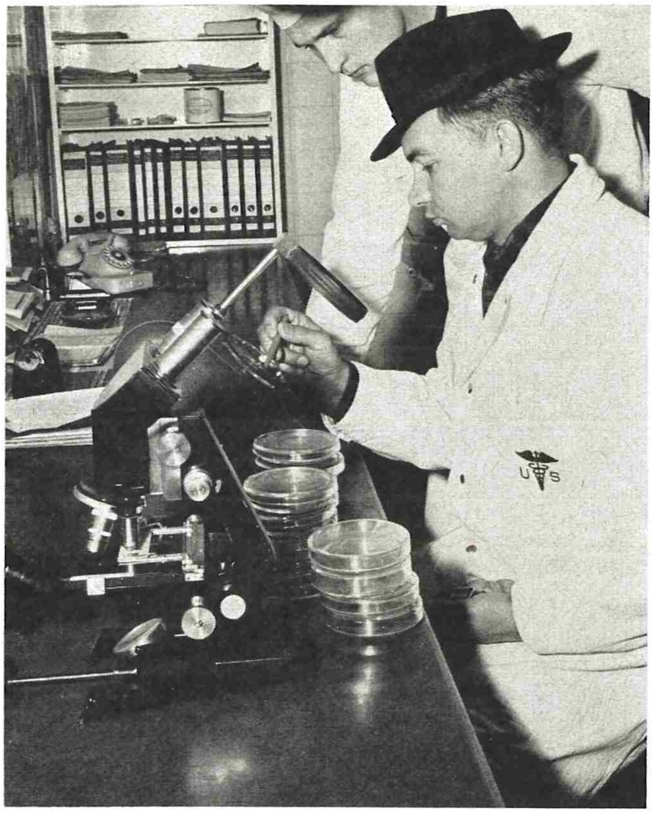

Figure 4. Laboratory in Stainach milk plant.

In the past, the habit had already been established of having dairy workers and unskilled laborers work in different departments each week. This had resulted in better workmanship and willingness to work. Since this practice worked so well, it was decided to introduce this rotation of jobs also among those holding supervisory sanitary positions. By so doing, management intends to avoid "plant blindness" and sometimes even indolence that may develop when well trained employees are kept in one position or one department too long. Rotation of supervisors also assists management in selecting individuals for more advanced training and positions of greater responsibility.

Incentive for Supervisors

As a further incentive for supervisors to perform at their best, they are granted a premium of about 10% of their monthly salary if the products for which they are responsible comply with sanitary and bacterial standards for the entire month. In order to receive the premium, teamwork is employed. For example, the pasteurizing specialist, his assistants, the laboratory technician and the plant sanitarian will not receive the premium if the fault for a substandard product is located in the filling area. Therefore, the various members of the team are allowed to observe with a critical eye the work of others resulting in a kind of "self-cleansing" for all members of the team. This has yielded the desired cooperation within the plant because no member wants to be blamed for failure to receive the premium.

Teamwork is Needed

The plant cannot be managed by 1 person; it is necessary to work as a team. In addition to the teamwork illustrated above, meetings are held weekly or biweekly among specialists of the teams to discuss mutual problems. Army Veterinary inspectors also sit in on these meetings. Explanations of failure to carry out instructions are brought out and the team discusses dairy literature and articles that are of interest in improving the operation and sanitation of the plant.

As observed in the incident of the "Coli-cop", plant sanitation also cannot result from the effort of a single individual; it too must result from teamwork. All employees are drilled in the practice of wearing only clean working clothes with proper head cover. All employees receive an annual physical examination by a physician and a stool examination quarterly. It has been long recognized that the physical examination of personnel will not preclude transmission of contagious diseases with the desired degree of certainty. As a result, the milk plant employs an additional method by making the employees themselves responsible. Each month milk plant employees sign the following statement:

> "I herewith declare to be aware of the fact that should I or a person I come in contact with daily be affected with contagious diseases such as diarrhea, dysentery, typhoid fever, diptheria, cutaneous diseases, etc., the danger exists that these diseases may be transmitted through the milk. I do not know of any persons having such a disease in my vicinity at the present time. If this happens I will immediately report it to my supervisor." (This is a direct translation.)

Inspection of Dairy Products

The inspection of milk and milk products is a joint venture between the company and U. S. Army food inspectors stationed at the plant. Continuous inspection is maintained from the receipt of raw milk to the shipment of pasteurized milk and milk products. In general the company assumes ultimate responsibility for inspection and testing of the products, whereas the military inspectors verify the results found by the company. For example, each tank of raw milk forms a "lot". There are 4 to 6 of these tanks each day, depending on the amount of products to be shipped. The company conducts a direct microscopic count on each tank, while the Army inspector will select 1 of these samples at random and carry out his own test, verifying the results obtained by the company.

Military inspectors roam throughout the plant from before the start of operations until after their completion making inspections in all areas. Some of their activities include: examination of raw products received, observation of operation of the flow-diversion valve, checking of time and temperature of pasteurization, checking of cooling temperatures, inspection for general sanitation, checking code dates on packaged products, examination of finished products for leakage, testing of weight or volume of products, examination of flavor and odor of products, and inspection of loading of finished products.

The inspectors also select samples of products and examine them using the phosphatase test, Standard Plate Count, coliform count, and acidity test. Where there are bacteriological deviations, Army inspectors work closely with plant officials in finding and correcting the cause of the deficiency. The Army inspector laboratory activities in the plant are routinely evaluated by an officer from the U. S. Army Europe Medical Laboratory in Landstuhl, Germany.

Acceptance of Products

Finally, at the time of acceptance by the U. S. Government, products must comply with standards required by U. S. contracts and specifications. Samples are routinely drawn and shipped to the Medical Laboratory in Landstuhl for testing. Inspectors are on hand at destination points wherever the product is shipped to examine it upon arrival. Routinely bacterial counts of pasteurized products are below 3,000 per ml, coliform counts are negative, the fat content is up to standard and a cold product with desirable flavor is received at U. S. military installations. Shipment of milk and milk products from Stainach, Austria, to Turkey presently constitutes one of the longest known fresh milk route in the world.

The Future at Stainach

Although the fresh milk program of the Landgenossenschaft Ennstal milk plant of Stainach, Austria, may appear to be at its best, the people of this cooperative continue to look forward to better equipment, facilities and methods. At present a number of farm bulk milk tanks are under study in various parts of the valley to determine which are best for future use. Programs for improving the breed of cattle are under way. Routine plant meetings discuss methods of improving the products being produced and improving the sanitation within the plant. Members of the U. S. Army Veterinary Service and members of the Stainach milk plant cooperative can well be proud of the high quality fresh milk program that has resulted from their efforts.

Reference

1. Grimes, G. M. 1958. The military veterinarian's role in the fresh milk supply for the U. S. armed forces in Europe. J. Am. Vet. Med. Assoc. 132:146-152.

SOLID WASTE DISPOSAL[1]

Charles C. Iglehart, Jr.

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Frankfort, Kentucky

Nearly one dollar of every ten spent by municipalities goes to store, collect, and dispose of solid waste—garbage and rubbish. Problems of solid waste disposal are growing more difficult and expensive to solve, not only because of the growing population, but also because of more rigid air, land, and water pollution control requirements. The annual three billion dollar effort by municipalities and private contractors, basic to a clean, healthy community has failed to gain enough public interest. As a result, municipalities limp along with trial-and-error approaches to their vital decisions on solid waste disposal.

The rural people living throughout the counties of the Commonwealth have no facility available to them for garbage and refuse disposal. It is no wonder highways and rural roads have their rights-of-way covered with roadside dumps. County wide disposal facilities are as important to the county as the city garbage collection and disposal is to the municipality.

Small political subdivisions lack resources to support acceptable disposal operations. Yet today, in all parts of the country, solid waste disposal responsibility still is regulated to communities too small to do much more than dump their wastes on neighboring communities. Utter chaos now exists in many places as scores of communities in a single county or metropolitan area are still left to their own inadequate devices for disposing of solid wastes.

The attitude of individual citizens and public officials contributes in great measure to the problem of solid waste management. It might be said that any material becomes a "waste" when its owner or producer no longer considers it of sufficient value to retain. Any suggestion that he should thereafter invest more money in it, for the sake of disposal or

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THE SANITARIAN'S RESPONSIBILITY IN MEAT AND POULTRY PRODUCTION AND PROCESSING[1]

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ABSTRACT

In the meat and poultry industries, efforts should be made to improve the environment of large animals just prior to slaughter. Part of the apparent problem of cross-contamination among animals is a matter of stress, not clear-cut cross infection between animals. The organisms are there all the time. Because of physiological and psychological stress caused by crowding, the animals begin to shed normal intestinal organisms more readily than before.

If sanitation is to be improved, real effort should be put into steps beyond the slaughter stage such as improving equipment design and materials, sanitizing methods, control of rodents and insects, and studying the worker's role in the transmission of contamination.

Particularly important is the control of temperature at all stages subsequent to slaughter. This includes loading rates, stacking arrangements, and other factors which may impede heat transfer and enable some portions of the food to be in a range where microbial growth can get started. Once they are already multiplying, organisms are capable of continuing for some time though the environment is then apparently unfavorable. This also applies to heating. Above the growth range of organisms, efforts should be made to be sure all portions are heated thoroughly and kept above the growth range. Equipment and procedures should be such that food moves through transitional heating-cooling operations quickly.

Essentially, the sanitarian as a professional has a responsibility to the public for general welfare. If in industry, he should use his knowledge to educate management, if that is needed, as to the importance of sanitation. This includes demonstrating the economic benefits of sanitation as well as avoidance of public health problems. Finally, whether in public health agencies, in industry, or elsewhere, the sanitarian has a duty to teach others why sanitation is essential and how it can be attained. By enlisting all who handle food to handle it properly out of knowledge—rather than mere feet-dragging compliance with public health regulations—considerable improvement could be made even with present methods and equipment.

To define the responsibility of a sanitarian in the meat or poultry processing industries is relatively simple. He has one prime obligation: to be as sure as is humanly possible that the food is free of agents likely to cause illness. Furthermore, it is his responsibility to keep the food free of avoidable contamination even though it might not cause illness. This includes filth, unnecessarily high microbial numbers, or any other substance or condition which would be esthetically objectionable to a normal consumer if he knew of the flaw.

An elementary definition of the sanitarian's responsibility having been given, now comes the more difficult task of suggesting ways to discharge the responsibility. Again, in simplified terms, the sanitarian has to: *(a)* be technically competent, *(b)* know when goals are attainable as distinguished from the ideal, and *(c)* have authority. The last point is fairly well defined for the Public Health Official. More will be said later in this paper about the matter of authority for the industrially-employed sanitarian. First, some of the particular problems the sanitarian in the meat or poultry industries faces need to be outlined.

MEAT AND POULTRY

Because of the pH of red and poultry meats, their excellence as growth substrates for microorganisms, adequate amounts of moisture, low thermal conductivity *(57)*, and the opportunities for contamination during slaughter; sanitation is particularly important in the production and processing industries. Hereafter the term "meat" will be used to encompass both red and poultry meats to eliminate the necessity of referring to each type separately except when there are real differences between them. It must be said at the outset that a distinction needs to be made between problems of the meat industry and food poisoning or intoxication outbreaks resulting from meat products. The weekly *Morbidity and Mortality Reports* of the Public Health Service contain, at fairly frequent intervals, descriptions of food poisoning outbreaks caused by meat products, but most of these outbreaks originate through ignorance or carelessness on the part of food handlers such as caterers, homemakers, or mass-feeding agencies *(1, 12, 48, 52)*, and are not directly attributable to the meat industry. Often meat and poultry firms could help to avoid such outbreaks by providing advice *(8)* for those using their products; but, generally, the actual handling and use of the meat or poultry is beyond the control of the processor.

PRE-SLAUGHTER CONDITIONS

Two serious sanitation problems in the meat processing industry revolve around holding practices for livestock and the sanitary state of some feed ingred-

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ients. The problem of salmonellae has been reviewed by Bowmer *(7)*. Galton et al. *(19)* showed that contamination increases as the animal enters holding pens or the abattoir. On the farms, 7% of 374 hogs examined by rectal swabbing were positive for salmonellae. In the holding pens, 78% of 189 specimens collected were positive. On the killing floor, 52% were positive. Extra cleaning of the de-hairing machine reduced positive cultures from 69% to 10%. The same investigators also reported that 75% of drinking water samples collected from holding pens contained salmonellae. Shotts et al.*(50)* also concluded that much carcass contamination is derived from contaminated areas in the holding pens, ramps leading to the kill room, de-hairing machines, chutes, and similar slaughter equipment. Cattle, likewise, are hosts for salmonellae *(17, 19, 59)*. Galton et al. *(21)* found salmonellae in 11% of 118 swab tests on chill tubs for chickens. Three percent of 292 birds examined carried salmonellae.

Some improvements probably could be made to reduce contamination in hauling-holding practices prior to slaughter. Large animals are in close confinement during hauling and holding just prior to slaughter. Holding pens frequently have earth floors. The pre-slaughter environment could be improved, but the extent to which this would lower the ultimate bacterial load on carcass meat needs to be rigorously established. Sterilization of chicken crates between loads has been suggested, but because there is no clear-cut evidence that this practice would reduce the number of organisms on the carcass, rarely is it done. Washing operations and physical contact with equipment and workers' hands following the scalding operation probably set the pattern far more than prescalding conditions. The scalding water of some commercial poultry scalding tanks has been examined in the author's laboratory. Up to 100 trillion organisms per ml of scalding water were observed, yet the broilers going through these tanks end up as chilled-out carcasses with less microorganisms than many other foods. Though scalding tanks are grossly contaminated, birds go immediately to a rough—and then a finish—picker where they are subjected to vigorous and thorough washing as a part of the picking operation. Post-scalding operations, such as intense washing, determine the bacterial load more than preslaughter conditions. The poultry industry has one advantage over the meat packing industry; there is a continual replacement of scalding water with fresh water. The exact ratio varies from plant to plant, but under Poultry Inspection Service regulation the amount must be at least one quart of water per bird per min. In general, meat packing plants do not change the water as frequently. In both instances, a heavy bacterial load is brought into the scalding water. Aside from water replacement, the poultry industry does have the advantage that the chickens go directly from crates to the shackles; thus they are not tracking as much earth and feces into the plant. Possibly good spraying systems could be worked out to wash off large animals (like automatic car washers) just as they enter the ramps. Animals could not, however, be subjected to great stress.

As indicated above, it is, perhaps, questionable whether a drastic reduction in the microbial load of scalding water would effect a substantial reduction in the microbial load of dressed carcasses. Maybe scalding tanks could be done away with entirely, but research efforts to replace them have not been successful as yet. Greater water replacement ratios might be used; water might be circulated through heat exchangers to kill organisms; and better forced circulation might be used to prevent occurrence of quiescent areas in the scalding tanks where the temperature can be below the average temperature of the scalding tank and thus be more suitable for the multiplication of mesophiles. In poultry scalding tanks, strong forced circulation is already used.

In spite of known deficiencies of the scalding operation, broilers do not end up with inordinately high bacterial loads. May et al. *(35)* observed the occurrence of approximately 100,000 organisms per g of skin tissue and 12,000 organisms per g of muscle tissue. In another study on cut and packaged chicken products, May *(34)* observed less than 10,000 organisms per g of tissue. May *(33)* pointed out that his values in 1961 were much lower than those of earlier studies, and he attributed this to improvements in poultry processing operations. Since 1961, equipment has been improved further, and broilers, in general, come out of the dressing-evisceration-chilling operations relatively low in microbial contamination. The speed with which broilers are handled also keeps counts low, for broilers go from the bleeding operation to the continuous chiller in about 30 min. Mesophilic organisms, not washed off prior to that point, have little chance to multiply.

ANIMAL FEEDS

The second major problem associated with preslaughter contamination is the sanitary state of the feed materials used. Feather meal is sometimes used in poultry rations as are rendered meat scraps and fish meal. All of these products may be contaminated with salmonellae *(4, 7, 17, 30)*. The rendering operation frees the raw ingredients of vegetative cells through the heat of rendering, but serious cross-contamination problems exist in the industry and they must be prevented. Workers going from pre-rendering to the post-rendering duties, dual use of shovels, tanks, or other containers, and the possibility of reinfestation by rodents or insects must not be overlooked. Engineering, materials handling, and sanitation studies need to be initiated to effect pronounced improvements in the sanitary state of animal feeds. The rendering industry has recognized these problems and has comprehensive educational and research programs underway.

Galton and Steele *(18)* pointed out that it is hard to break the animal-to-man and man-to-animal cycle, and it is difficult to tell whether the infected food handler is the source of infection or the innocent victim. They observed that the carrier state occurred more frequently in those who handle foods than in the general population. Edwards *(14)* considered the carrier state to be an occupational hazard of persons who handle uncooked meat and meat products. Taylor *(54)* commented that man and *Escherichia coli* usually live happily together. Williams *(61)* and Galton and Steele *(18)* have discussed healthy carriage of *Staphylococcus aureus.*

Post-slaughter Sanitation

Little needs to be said about sanitation procedures in meat and poultry plants. Equipment should be of a type which can be cleaned readily; definite schedules need to be worked out for cleaning, specifying whether hot or cold water is to be used, and the type and amount of detergent. Geister and Maack *(22)* pointed out that these details of a sanitation procedure are spelled out by the Quality Assurance Department of Swift & Co. for each of that company's plants and products. The results obtained by May et al. *(33, 34, 35)* were for broilers produced in regular commercial plants using good sanitation practices and indicate the level of contamination that can be expected. Wilkerson et al. *(60)* reported that turkey carcasses contained less bacteria than the live birds. At the end of rinsing, birds contained approximately 1,000 aerobic organisms per cm^2 and no enterococci or coliforms.

Aside from factors already mentioned, the specifics of good sanitation involve: proper design, maintenance, and cleaning of equipment; full instruction of employees as to personal hygiene and management follow up to be sure they follow correct practices; the availability of adequate water, steam and ventilation; number and placement of rest rooms; ample refrigeration and the avoidance of overloading; and adequate quality-control examination of products and equipment to be sure company or governmental standards are being met . The latter is especially important as new procedures or equipment are incorporated to be sure the new procedure—though desirable for other reasons—is not reducing the sanitary state. Even without changes in procedure or equipment, frequent testing is necessary to forestall drift toward lower quality levels. In fact, from knowledge gained through analysis, more rigid standards can often be set.

Presence of Pathogenic Bacteria

So far the discussion has revolved around total counts or salmonellae; the former because they are easy to measure and the latter because *Salmonella* contamination is probably this country's foremost food sanitation problem. Total numbers of bacteria are only one aspect of sanitation. The real crux is the incidence of pathogens. Greenberg et al. *(25)* examined 19,727 samples of raw pork, beef, and chicken in processing plants in the United States and Canada. They found *Clostridium botulinum*—Type C in one sample. This, of course, is a most encouraging finding although raw meat is not noted for being a major source of *C. botulinum* and presumably Greenberg et al. *(25)* were sampling in plants with good sanitation. The incidence of other objectionable organisms is greater. Strong et al. *(53)* found that 16.4% of raw meat and poultry samples were contaminated with *Clostridium perfringens.* Gish *(23)* observed incidences of 14-25% for the same organism. Sadler and Corstvet *(47)* examined 9,851 poultry carcasses and found 4.16% of turkeys, 1.42% fryers, and 0.67% hens were contaminated with salmonellae.

Galton et al. *(20)* observed incidences of *Salmonella* contamination for fresh sausage to range from 7.5% to 57.5% and for smoked sausage from 0 to 40.9%. Weissman *(59)*, in a recent study in Georgia, observed that 74% of cattle and 51% of hog carcasses were contaminated with *Salmonella.* He found 32% of fresh sausage and 10% of smoked sausage contained salmonellae.

The picture for some kinds of processed meats is more disturbing. Canale-Parola and Ordal *(8)* examined frozen poultry pies and found them to contain three million organisms per g before cooking, coliform numbers of up to 2,100; enterococci up to 160,000; coagulase positive staphylococci, up to 360,000; and *Salmonella*-paracolon organisms, up to 1,200 per g. Litsky et al. *(32)* examined frozen meat pies and observed that 84% of the pies contained below 100,000 organisms per g. Among 262 specimens of both raw and processed meats, Hall and Angelotti *(26)* found 43.1% contaminated with *C. perfringens.* Taclindo et al. *(55)* found one sample of turkey roll contaminated with *C. botulinum* among 113 food samples examined. Jay *(29)* reported that of 209 nonfrozen meat samples he examined, 38% contained staphylococci. Casman et al. *(10)* compared the ability of cooked and raw meat to support staphylococcal growth.

A distinction needs to be made between incidence and numbers. Some of the organisms which are pathogenic to man are so only when present in appreciable numbers. The objective of a sanitary program should be to exclude them entirely, but fortunately when they are not, there is a safety margin unless they have an opportunity to multiply. This is the great danger in converting carcass meat into ground meat or in processing meat in various ways. Even for such a simple operation as cutting up chickens, May *(34)* observed a 6-fold increase in bacterial numbers when this operation was performed in a poultry processing plant, and an 8-fold increase when done at the retail level. Such operations as grinding expose new surfaces and provide heat which, because of the low thermal conductivity of meat, requires some time for removal by refrigeration. When meat is combined with other ingredients, the additive may increase the bacterial load and offer growth substances which enable the organisms on the meat to multiply faster. Greater contamination itself will lead to faster multiplication because the lag phase of organisms is shorter the higher the initial number. Angelotti et al. *(3)* pointed out that the temperature range for the enterococci is greater than for salmonellae or staphylococci. Studies have been conducted at the University of Georgia on the ability of organisms to multiply when temperatures fluctuate from below the optimal temperature toward the optimum and back down again. Under some conditions, *S. aureus* and *Aerobacter aerogenes* could grow more readily *(42)*. Microorganisms do not have to be in suitable growth ranges at all times for growth to occur. Probably the organisms were able to multiply during the low part of the temperature cycle because of the energy momentum built up. Growth is exothermic *(46)*. Even if only a few organisms can grow, enough heat is given off to enable multiplication to proceed for some time even after the meat has been placed under refrigeration. Care needs to be exercised that the mass of food is not so great, especially with processed or mixed foods, that the rate of cooling is extremely slow.

Rigid sanitary steps need to be taken to exclude pathogens even though their number may have to increase to 1 million or more organisms per g before they are capable of infecting normal individuals or of producing toxic reactions. Unfortunately, exact levels which cause illness are not known *(23, 27, 31, 44)* and, furthermore, levels are different for children *(37)* than for adults.

TOTAL NUMBERS OF MICROORGANISMS

The total number of microorganisms should also be kept as low as possible. In the first place, such organisms as *Bacillus cereus* and others which do not normally produce clinical systems, can cause illness when present in large numbers *(37)*. Secondly, though the correlation between total numbers and pathogenic organisms is often poor, it is logical to assume that if the non-pathogenic organisms have a chance to grow, the same opportunity may exist for pathogens. The author is aware of the extensive literature which indicates just the opposite, that in associative culture, such organisms as *S. aureus* die off *(13, 24, 28, 38, 39, 40)*, but the reverse also happens. Synergism has been reported between *Proteus vulgaris* and *S. aureus (5)*, and *P. vulgaris* has been reported to grow better under some conditions in the presence of *Saccharomyces cerevisiae* than in its absence *(49)*. Shindala et al. *(49)* have discussed population dynamics. The suggestion of Litsky et al. *(32)* that a level of 100,000 per g be set for total numbers in prepared food seems appropriate. Most recently the Consumer and Marketing Service has endorsed the recommendation of the AFDOUS Advisory Committee that a limit of 100,000 organisms per g be set for imports of meats and the number of coliforms should not exceed 100 per g. Angelotti *(2)*, Elliott *(15)*, and Elliott and Michener *(16)* have discussed the significance of total numbers.

Low microbial numbers are desirable for a second reason aside from the potentiality of food poisoning. The microorganisms, of course, are using the food as a substrate and changing it. The change generally is to the detriment of the food. Furthermore, even though the organisms may be killed by heat processing, freezing, or some subsequent operation such as adjustment of acidity, there is always the possibility that their enzymes may still be active and changes can continue to occur *(41)*.

A very serious problem in the meat and poultry industries is the change which traditional curing procedures and packaging procedures are undergoing *(6, 9, 10, 11, 43, 45, 51, 55, 58)*. Cures are milder and moisture content often higher. Furthermore, with the packing of center cuts of ham instead of marketing hams themselves, surface area is greatly increased as is handling *(10, 11)*. Processors originating new procedures need to examine their practices critically to be sure that in saving time or making things easier for the consumer they have not inadvertently introduced a new possibility for microbial growth *(58)*. The botulism outbreak involving smoked fish is an excellent example of this. One area which the industry needs to control more rigidly than at present is in marketing practices for canned hams. Canned hams are intended to be refrigerated yet they are sometimes displayed on counters without refrigeration.

IMPORTED FOODS

Another problem which needs to be considered by the food industry today is the microbial load of imports. This is not said to decry the use of imports in anyway (for technological and international reasons they are desirable) but sanitation standards in foreign countries differ from those in the U. S. For some countries or for certain products, they are as good or better; for some of our sources of import, they are poorer. Taylor et al. *(56)* found that 41% of imported food samples examined in England were contaminated with *Salmonella*, and they pointed out the danger of bringing into existence international health problems from the continuous introduction of exogeneous strains of organisms. In the U. S. at least 1 billion lb. of meat is imported annually for processing, mostly for conversion into sausage products and portion-control hamburgers. Just as there can be cross-contamination between animals and humans through frequent contact, there are also the possibilities of exposing humans to new strains, of contaminating plants with new strains, and of eventually getting the strain into the animal-human chain of carriers or contaminated feeds.

AUTHORITY

Left to last has been the matter of authority. The sanitarian in industry should not be at the mercy of production. As was indicated earlier, he must recognize goals which are attainable as distinguished from the ideal, but he needs real power in a showdown. Some companies accomplish this by having plant sanitarians report not only to the Plant Manager but also to the company Quality Assurance Department. *It is most important that the knowledge and the facts possessed by sanitarians be available to individuals at the upper level of management.* Sometimes the top management level will not pay any attention. The author has seen this happen.

Several years ago an University of Georgia graduate was hired by a firm which had never hired a food technologist before. Essentially, he was hired not because the firm knew what a food technologist should do but because most of its competitors had one. Although the firm was aided by the food technologist, unfortunately it chose to ignore the advice it was paying for in regard to sanitation. The firm's sanitation program was atrocious. The food technologist ultimately came to tell the management that their building was the only one in which he had seen chocolate-coated cockroaches. Management didn't want to hear this kind of comment. It expected sure-fire means of cutting costs or developing new products, not what should have been the prosaic thing of keeping the plant clean.

The ignoring of the industrial sanitarian's advice is not confined to small companies. Large companies commit this fault, too. Upon request a sanitary survey was made for a fairly large plant which had been having erratic spoilage. There were some changes in daily or hourly cleanup which needed to be made. The local plant manager and the quality control manager recognized these and did something about them when the flaws were called to their attention. The big fault was in the design of conveyor belts, hoppers, and similar equipment, and this was a job the company's engineers needed to do. Though the survey had been authorized by a Vice-President at the behest of the Director of Research for the company, nothing was done about the faulty engineering. The Vice-President apparently felt other matters were more pressing. Within the past year this very same firm had a large seizure with a great deal of attendant bad publicity. It is true the seizure was in a different operating division of the company, but one wonders whether its attitude toward sanitation in one division is not an indication of its attitude in another division. Incidentally, the small firm referred to above likewise had to undergo a Food and Drug seizure before it, too, recognized the importance of sanitation.

The sanitarian has a responsibility to educate management, if he can. Sometimes management may not know the details or recognize the full implication of the consequences which flow from poor sanitation. Above all, the sanitarian, as a professional, has a responsibility to the public even though his particular firm may not be thoroughly sold on sanitation. In fact, sanitation should not be entered solely on the debit side of the ledger. It is true the soap, water, wages for clean-up crews, and the sanitarian's salary cost money. Properly trained and supported by management, the sanitarian should be able to turn in performance which places sanitation efforts on the credit side of the ledger. One serious food spoilage outbreak or citation by a governmental agency can cost a lot more than the sanitarian's salary for several years. Actually, the real value of a sanitarian is his day-to-day contribution to proper functioning of a company. Through his efforts, in-plant spoilage and re-working of products should be reduced. Quality should be higher. These are economic things. It is difficult to assign an exact financial value to quality, but it is well recognized that quality, and particularly uniformity of quality, is one of the attributes which determine sales and especially repeat sales.

REFERENCES

1. An outbreak of food poisoning in Little Rock. 1965. Morbidity and Mortality, 14:385-386.

2. Angelotti, R. 1964. Significance of "total counts" in

bacteriological examination of foods. In: Examination of Foods for Enteropathogenic and Indicator Bacteria, Public Health Service Pub. No. 1142.

3. Angelotti, R., K. H. Lewis, and M. J. Foter. 1963. Fecal streptococci in foods time-temperature effects on I. Behavior of refrigerated foods and at warm holding temperatures. J. Milk Food Technol. 26:296-301.

4. Anonymous. 1966. The destruction of salmonellae. U. S. Dept. of Agr. ARS 74-37.

5. Arndt, W. F. and R. E. Rieties. 1961. Synergism between *Staphylococcus* and *Proteus* in mixed infections. Proc. Soc. Exptl. Biol. Med. 108:166.

6. Botulism - Idaho. 1965. Morbidity and Mortality, 14: 225-226.

7. Bowmer, E. J. 1965. Salmonellae in food—a review. J. Milk Food Technol. 28:74-86.

8. Canale-Parola, E. and Z. J. Ordal. 1957. A survey of the bacteriological quality of frozen poultry pies. Food Technol. 11:578-582.

9. Casale, J. O., K. N. May, and J. J. Powers. 1965. Effects of three chilling methods on bacteriological, organoleptic, and physical properties of broiler chickens. Food Technol. 19:177-179.

10. Casman, E. P., D. W. McCoy, and P. T. Brandly. 1963. Staphylococcal growth and enterotoxin production in meat. Applied Microbiol. 11:498-500.

11. Christiansen, L. W. and E. M. Foster. 1965. Effect of vacuum packaging on growth of *Clostridium botulinum* and *Staphylococcus aureus* in cured meats. Applied Microbiol. 13:1023-1025.

12. *Clostridium perfringens* food poisoning - Georgia. 1965. Morbidity and Mortality, 14:187, 192.

13. DiGicicinto, J. V. and W. C. Frazier. 1967. Effect of coliform and proteus bacteria on growth of *Staphylococcus aureus.* Applied Microbiol. 14:124-129.

14. Edwards, P. R., D. W. Bruner, and A. B. Moran. 1948. Further studies on the occurrence and distribution of *Salmonella* types in the United States. J. Infect. Dis., 83:220-231.

15. Elliott, R. P. 1963. Limitation of microbial levels in chilled and frozen foods. Microbiol. Quality of Foods, 171-178.

16. Elliott, R. P. and H. D. Michener. 1961. Microbiological standards and handling codes for chilled and frozen foods. A review. Applied Microbiol. 9:452-468.

17. Ellis, E. M. 1966. Feed and food animals as sources of salmonellae. The destruction of salmonellae. ARS 74-37:8-12.

18. Galton, M. M. and J. H. Steele. 1961. Laboratory and epidemiological aspects of foodborne diseases. J. Milk Food Technol. 24:104-114.

19. Galton, M. M., W. V. Smith, H. B. McElrath, and A. V. Hardy. 1954. *Salmonella* in swine, cattle, and the environment of abattoirs. J. Infect. Dis. 95:235-245.

20. Galton, M. M., W. D. Lowery, and A. V. Hardy. 1954. *Salmonella* in fresh and smoked pork sausage. J. Infect. Dis. 95:232-235.

21. Galton, M. M., D. C. Mackel, A. L. Lewis, W. C. Haine, and A. V. Hardy. 1955. Salmonellosis in poultry and poultry processing plants in Florida. Am. J. Vet. Res. 16: 132-137.

22. Geister, R. S. and A. C. Maack. 1967. Sanitation - meat and poultry processing. J. Milk Food Technol. 30:67-70.

23. Gish, M. E. 1967. *Clostridium perfringens* as related to food poisoning. J. Environmental Health, 29:555-558.

24. Graves, R. R. and W. C. Frazier. 1963. Food microorganisms influencing the growth of *Staphylococcus aureus.* Applied Microbiol. 11:513-516.

25. Greenberg, R. A., R. B. Tompkins, B. O. Bladel, R. S. Kittaka, and A. Anellis. 1967. Incidence of mesophilic *Clostridium* spores in raw pork, beef, and chicken in processing plants in the U. S. and Canada. Applied Microbiol. 14:789-793.

26. Hall, H. E. and R. Angelotti. 1965. *Clostridium perfringens* in meat and meat products. Applied Microbiol. 13: 352-357.

27. Hartman, P. A., G. W. Reinhold, and D. S. Sarasuat. 1965. Indicator organisms—a review. II. The role of enterococci in food poisoning. J. Milk Food Technol. 28:344-350.

28. Iandolo, J. J., C. W. Clark, L. Blum, and Z. J. Ordal. 1965. Repression of *Staphylococcus aureus* in associative culture. Applied Microbiol. 13:646-649.

29. Jay, J. M. 1962. Further studies on staphylococci in meat. III. Occurrence and characterization of coagulase-positive strains from a variety of nonfrozen market cuts. Applied Microbiol. 10:247-251.

30. Leistner, L., J. Johantges, R. H. Deibel, and C. F. Niven. The occurrence and significance of salmonellae in meat animals and animal by-product feeds. Proc. 13th Research Conference, A.M.I.F.

31. Lewis, K. H. and R. Angelotti. 1964. Examination of foods for enteropathogenic and indicator bacteria. Public Health Service Publication No. 1142.

32. Litsky, W., I. S. Fagerson, and C. R. Fellers. 1957. A bacteriological survey of commercially frozen beef, poultry, and tuna pies. J. Milk Food Technol. 20:216-219.

33. May, K. N. 1961. Skin contamination of broilers during commercial evisceration. Poultry Sci. 40:531.

34. May, K. N. 1962. Bacterial contamination during cutting and packaging chicken in processing plants and retail stores. Food Technol. 16:89-91.

35. May, K. N., J. D. Irby, and J. L. Carmon. 1961. Shelf life and bacterial counts of excised poultry tissue. Food Technol. 16:66-68.

36. May, K. N. and M. K. Hamdy. 1966. Bruising of poultry—a review. World's Poultry Sci. J. 22:316-322.

37. Mossel, D. A., M. J. Kiipman, and E. Jongeries. 1967. Enumeration of *Bacillus cereus* in foods. Applied Microbiol. 15:650-653.

38. Oberhofer, T. R. and W. C. Frazier. 1961. Competition of *Staphylococcus aureus* with other organisms. J. Milk Food Technol. 24:172-175.

39. Peterson, A. C., J. J. Black, and M. F. Gunderson. 1962. Staphylococci in competition. I. Growth of naturally occurring mixed populations in precooked frozen foods during defrost. Applied Microbiol. 10:16-22.

40. Peterson, A. C., J. J. Black and M. F. Gunderson. 1962. Staphylococci in competition. II. Effect of total numbers and proportion of staphylococci in mixed cultures on growth in artificial culture medium. Applied Microbiol. 10:23-30.

41. Powers, J. J. 1963. Factors affecting the quality of processed foods. Western Canner/Packer, 132:50 A-D.

42. Powers, J. J., W. Lukaszewicz, R. Wheeler, and T. P. Dornseifer. 1965. Chemical and microbial activity rates under square-wave and sinusoidal temperature fluctuations. J. Food Sci. 30:520-530.

43. Pulliam, J. D. and D. C. Kelley. 1965. Bacteriologi-

cal comparison of hot processed and normally processed hams. J. Milk Food Technol. 28:285-286.

44. Rentein, H. A. 1966. The place of salmonellosis in food poisoning. The destruction of salmonellae. ARS 74-37:4-7.

45. Ross, A. D. and F. S. Thatcher. 1958. Bacteriological content of marketed precooked frozen foods in relation to public health. Food Technol. 12:369-371.

46. Rothbaum, H. P. and H. M. Stone. 1961. Heat output of *Escherichia coli*. J. Bacteriol. 81:172.

47. Sadler, W. W. and R. E. Corstvet. 1965. Second survey of market poultry for *Salmonella* infection. Applied Microbiol. 13:348-351.

48. Nat'l. Communicable Disease Center. 1966. Morbidity and Mortality Weekly Rept. 15:282-283.

49. Shindala, A., H. R. Bungay III, N. R. Krieg, and K. Culbert. 1965. Mixed culture interactions. I. Commensalism of *Proteus vulgaris* with *Saccharomyces cerevisiae* in continuous culture. J. Bacteriol. 89:693-696.

50. Shotts, E. B., Jr., W. T. Martin, and M. M. Galton. 1962. Further studies in *Salmonella* in human and animal foods and in the environment of food processing plants. Proc. 65th Ann. Meeting, U. S. Livestock Sanitary Assoc., Minneapolis, Minn., pp. 309-318.

51. Silliker, J. H., C. E. Jansen, M. M. Voegeli, and N. W. Chmura. 1962. Studies on the fate of staphylococci during the processing of hams. J. Food Sci. 27:50-56.

52. Staphylococcal food poisoning—Petersburg, Virginia. 1965. Morbidity and Mortality, 14:211.

53. Strong, D. H., J. C. Canada, and B. B. Griffiths. 1963. Incidence of *Clostridium perfringens* in American foods. Applied Microbiol. 11:42-44.

54. Taylor, J. 1966. Host-parasite relations of *Escherichia coli* in man. J. Applied Bacteriol. 29:1-16.

55. Taclindo, C., Jr., T. Midura, G. S. Nygaard, and H. L. 1967. Examination of prepared foods in plastic packages for *Clostridium botulinum*. Applied Microbiol. 15:426-430.

56. Taylor, W. I., B. C. Hobbs, and M. E. Smith. 1964. Comparison of two methods for the isolation of salmonellae from imported foods. Applied Microbiol. 12:52-56.

57. Walters, R. E., and K. N. May. 1963. Thermal conductivity and density of chicken breast muscle and skin. Food Technol. 17:130-133.

58. Warnecke, M. O., J. A. Carpenter, and R. L. Saffle. 1967. A study of *Clostridium botulinum* type E in vacuum packaged meat. Food Technol. 21:115A-116A.

59. Weissman, M. A. 1967. A study of the occurrence and growth of *Salmonella* in meat and meat products. Master of Science Thesis, University of Georgia Library, Athens, Georgia.

60. Wilkerson, W. B., J. C. Ayres, and A. A. Kraft. 1961. Occurrence of enterococci and coliform organisms on fresh and stored poultry. Food Technol. 15:286-292.

61. Williams, R. E. O. 1963. Healthy carriage of *Staphylococcus aureus*: Its prevalence and importance. Bacteriol. Rev. 27:56-71.

SOLID WASTE DISPOSAL

any other financially unrewarding goal, is likely to be considered absurd, however inclined he may be to object to polluted water, smog, rodents, unsightly debris, and other conditions which result from his loss of interest in ownership.

Clearly, the problem of solid wastes management is in part the result of an uninformed public with a low degree of willingness to invest in wastes management and, at the same time, a high sensitivity to the esthetic values which poor management affronts.

On the outskirts of most of our cities, virtually all of the smaller communities in fact, the festering open dumps lie in mute tribute to our past and present neglect of our environment. Open dumping is archaic, unaesthetic, hazardous to health, and destructive of property values. Often the air, the water, and the landscape are simultaneously polluted. Costs of operation may be hidden, but they are there and they are often high. Against this indictment of open dumping there seems to be only a feeble reason for their widespread use: They do not require much thinking to plan and operate.

Garbage and refuse, as well as other solid wastes, can be disposed of properly by sanitary landfilling. The sanitary landfill is a method of disposing of refuse on land without creating nuisances or hazards to public health and safety, by utilizing the principles of engineering to confine the refuse to the smallest practical volume, and to cover it with a laver of earth at the conclusion of each day's operation or at such more frequent intervals as may be necessary.

The Kentucky State Department of Health has established a full-time planning agency within the Division of Environmental Health for all solid waste activities. The main objectives of this program are to evaluate current problems relating to solid waste within the Commonwealth and to assist city, county, and other governmental agencies and industry with the development of an adequate and acceptable solid waste program, the orderly development of waste disposal sites, and determine the adequacy or inadequacy of existing solid waste disposal practices and the need for additional regulations for the enforcement of an acceptable state-wide solid waste program.

Today there are 225 land disposal sites and nine municipal incinerators where garbage, refuse, and all other types of solid waste are being disposed. This count does not include the many hundreds of promiscous dumps or roadside dumps throughout the State. Over 200 of the sites listed above can only be classified as open burning dumps, with its public health hazards of flies and rodents and the nuisances and hazards of smoke and odors.

The Kentucky Air Pollution Control Commission recently adopted a new regulation which prohibits open burning at refuse disposal sites. It is now law that all municipal and private refuse disposal sites must stop burning by March 8, 1968. If burning stops without proper planning for the use of sanitary landfills as a means of refuse disposal, the State will face a public health crisis.

An act relating to the regulation and control of solid waste disposal and solid waste disposal sites and facilities has been submitted to the 1968 session of the State Legislature. This Act states that no person shall establish or construct, or operate, maintain or permit the use of a new solid waste disposal site or facility after the effective date of this Act without first having obtained from the Department a permit to establish or construct the site or facility or a permit to maintain and operate the site or facility pursuant to rules and regulations promulgated by the Board. This same regulation covers

(Continued on Page 46)

THE POSITION OF IAMFES ON EXTENSION OF 3-A STANDARDS TO FOOD PROCESSING EQUIPMENT[1]

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Some of the opinions (or position) represented, admittedly are tinged with the author's philosophy of sanitation and quality control as it relates to *all* food-grade edible products—be they vegetable, animal or dairy products. It should also be kept in mind that any standard, regulation or practice has built into it certain esthetic features commensurate with the refinement of the society to which it relates.

Sometimes in evaluating standards it is difficult to know honestly where public health necessity merges into esthetic features. We have learned that the optimum in esthetic features motivates better care and operation of equipment by the operator.

There has been discussion among many persons in the IAMFES for the past several years in regard to the: (*a*) need for broader application of 3-A standards, (*b*) capability within our organization for implementation, (*c*) interest of the fabricators—both in and out of the dairy industry—particularly those outside, (*d*) interest of user groups not now covered, and (*e*) position of the responsible regulatory agencies having surveillance over the food industry outside of the Grade A dairy segment.

Several significant developments have occured this past year that give direction, and answers, in part, to many of the questions and concerns of IAMFES and indicate motivations for some development of standards by *somebody* (responsible organization). The most spectacular and most publicized, of course, was the sudden recognition of salmonellae in our edibles—a condition brought to light by interest and inquiry. This has created a chain reaction—some good and, in the opinion of the author, some very un-scientific and unreasonable attitudes have been developed.

There is no question that there will be more surveillance (and justifiably so) of all the food grade edibles and the environment of their preparation, treatment, and packaging. Many in IAMFES feel that they are best qualified by experience to give direction to the upgrading in design and construction that is necessary if the processing and packaging equipment is to be acceptable and cleanable. There are growing numbers of users who are looking for better designed, and constructed equipment, but there is still much apathy expressed in these words "we will do something about it when we have to." This seems rather short sighted, but a fact of life, none the less.

Fabricators of dairy equipment, for the most part, have been moving into other areas of the food industry and are carrying many of the 3-A design and construction criteria into this phase of their operation, but the economics and customer demands will have much influence until established standards are available. Fabricators of non-3-A oriented equipment would face a drastic change in the design and construction of their equipment; some of the equipment in present use is impossible to clean much less to be sanitized or inspected. There is a definite need to be met! How much can be affected thru 3-A is a question that only trial and time can answer.

Some exploratory overtures have been received from associations or organizations outside of DFISA requesting aid or offering to "lend a hand." The ability to work with or thru some of these organizations is being explored in a positive manner and it is hoped that some reasonable framework can be set up for proper participation, of the interested organizations, in 3-A activity.

The American Society of Mechanical Engineers indicate a move to develop sanitary standards for food processing equipment. It is conceivable that some could duplicate or overlap present 3-A designated equipment. Present discussion by ASME seems to be cursory in concept as they relate to sanitary design (safeguards); functional durability is of chief concern. CIP is recognized as a reasonable concept. Much work will need to be done with such a group to instill "the sanitary design concepts" as we understand them. Further meetings with this group should and must be held before progress can be made in this area.

On the surface of some situations it would seem impossible to develop standards outside of our present framework, but IAMFES is aggressive, progressive and has many times before found that "the impossible just takes a little longer." Much concern

[1]Presented at the 54th Annual Meeting of the International Association of Milk, Food, and Environmental Sanitarians, Miami Beach, Florida, August 13-16, 1967.

has been expressed as to our knowledge as it relates to the other parts of the food industry. Review of IAMFES membership indicates that the association will be able to provide a significant addition in knowledgeable manpower to committees and so will permit intelligent and constructive evaluation of equipment design and construction requirements and proposals.

We are moving into an era of technical proficiency uncontemplated even 10 yr ago. If IAMFES can not cope with the problems of these times and prepare for the future the organization will serve no purpose, and the day the association ceases to serve some useful and constructive purpose, on that day IAMFES is dead. This is one of the real challenges IAMFES has faced in these changing times.

This organization is unique in that it has no authority to enforce—it is sustained and motivated by people dedicated to accomplishment on a voluntary basis, but by its dedication to purpose and need, IAMFES has gained the respect of all within its sphere of influence. If you are not aware of it, respect is the one commodity that neither government nor corporation can control, regulate or promulgate. It is something earned by accomplishment.

One of the fastest growing and rapidly changing portions of our industry (along with aero-space and electronics) is the food industry. The growing population of the world has to be fed. It will be fed on meat, milk products, and cereals and in the future on many synthetics or bacterial proteins that may be derived from present food industry waste or petroleum. Regardless of who produces, controls or packages the food grade edibles of the future, be it food plants as we now know them, chemical plants, or petroleum by-products plants, surveillance by regulatory agencies will surely increase. Standards will be set and control regulations promulgated. It would seem reasonable to expect that the demand for better design of, and cleanability of equipment would go "hand in glove" with these developments. Sanitarians at all levels, both in Government and Industry are going to have to become more knowledgeable concerning this growing phase of our sanitation responsibility.

SOLID WASTE DISPOSAL

existing disposal sites. No person shall dispose of solid waste at any site or facility other than a site or facility for which a permit for solid waste disposal has been issued by the Department. The regulations for disposal will include compaction and daily cover. There will be no burning and no open dumps.

Proper solid waste disposal can be more economically accomplished by cooperation between county and municipal governments in order to provide service to all the people. The 1966 State Legislature made it possible to form garbage and refuse disposal districts. This law states that the fiscal court of any county may by proper order or resolution lay out, establish and maintain one or more garbage and refuse disposal districts within the county, and may cause to be made surveys necessary to establish with reasonable accuracy a proper boundry for such districts. The district may acquire, construct, improve, enlarge, replace, maintain and operate such garbage and refuse collection systems within such district and such disposal methods within or without any such district as is necessary for the protection of the public health. Although there are no construction funds available at the present time, there may be within the near future. An officially formed solid waste disposal district would be the most satisfactory method of applying for federal grants and would be eligible for a larger grant than an individual municipality.

The major problem with solid waste disposal today, however, is education. People must be shown that refuse can be disposed of without creating nuisances and public health hazards and they should expect this service from the public officials charged with this responsibility.

The general public must understand that sound solid waste management is worth whatever it costs within the framework of honest engineering and sound public health practice; and that the cost is the price man must pay for the benefits of a modern urban-industrial-agricultural society.

The Solid Waste Program has movies on sanitary landfill operations, hand out literature, and are available to provide assistance to all those people concerned with proper solid waste disposal operations. The purpose of this program is to provide those services which will lead to a sound waste disposal plan for the entire Commonwealth.

REPORT OF COMMITTEE ON DAIRY FARM METHODS, 1966-1967

SECOND SECTION

(Editors Note. This is the second part of the 1966-67 Dairy Farm Methods Committee Report consisting of the Task Committee Report on detergents and solution temperatures in CIP cleaning. The third and final part of the full committee report will follow in the next issue.)

Compatibility of Detergents to Farm Water Supplies and Effect of Solution Temperature on CIP Cleaning of Farm Equipment

Stephen Spencer - *Chairman*

The number of pipeline milkers, bulk tanks and other dairy equipment is increasing at a rapid rate. In spite of many years of experience in the CIP cleaning of farm equipment, numerous milk quality problems can be traced to less than desirably cleaned equipment. For the most part, the cleaning problems are a result of a misunderstanding of cleaning principles.

The four factors of time, temperature, strength of solution, and velocity are "old hat." However, it should be recognized that these four factors operate simultaneously and are rependent variables. Thus, there are infinite numbers of combinations of these factors which will satisfactorily clean equipment. A major problem, however, is that all of these combinations are not known precisely. Thus, cleaning programs have been developed primarily by trial and error techniques. In addition, it must be recognized that the chemical composition of each farm water supply must be considered.

In our attempts to simplify the cleaning procedures, there are a few items which both experience and scientific observation have shown to be of considerable importance in cleaning procedures.

The temperature of the wash water is one of these items. It can be stated with a considerable degree of confidence that the maximum temperature of the wash solution should be 165 F. Numerous reasons dictate this maximum temperature. First of all, the precipitation of temporary hardness from water occurs when the temperature exceeds 140 F. It is expected that a 20 F drop in water temperature will occur from the time that the water travels from the water heater to milk contact surfaces. It is still possible in some instances, therefore, that a practical maximum may be 140 F. Studies have also shown that heating elements burn out readily when the temperature of the heater exceeds 165 F. This temperature is also a maximum to be used on plastic tubing. The chances of baking on milk films also appear to be a factor when the temperature exceeds the 165 F point.

The minimum temperature is a factor that cannot be so precisely defined. It is generally known that the end-point temperature of the cleaning cycle is critical since re-deposition of the cleaning solution and minerals from water and milk will occur if the temperature drops too low. Many factors affect this re-deposition including the type of cleaner and water supply. The melting point of butterfat is also a factor. The temperature ranges in which this occurs may be as high as 120 F or as low as 90 F. For this reason, it appears that there can be no substitute for visual observation to determine if surfaces are clean.

The time of circulation is another factor which enters any given cleaning program. In the early days of CIP cleaning, a 20 minute circulation time was considered as "standard." This precise time is now known to be incorrect; in fact, sometimes detrimental to an otherwise adequate cleaning regime. The time of circulation is inter-related to the temperature discussed previously. Thus, re-deposition may occur simply from circulating too long because the temperature drops too low during this period of time. An absolute minimum circulation time at this writing would appear to be in the vicinity of five minutes. From a practical standpoint, a 10 minute cycle for circulation systems appears optimum. For "once through" systems and those having lower velocities, a longer time may be indicated.

The velocity of the cleaning solution is an area which is in need of review. The old standby of five feet per second is ambiguous. Velocity must be stated on specific line sizes. This is due to the fact that the flow characteristics of the cleaning solution change with different line sizes. The flow characteristic of the solution determines the cleaning efficiency and poor efficiency must be expected from laminar flow conditions. Turbulent flow naturally results in easier cleaning. Long term cleaning studies need to be made under controlled conditions to more clearly define optimum cleaning velocities.

With respect to compatibility of detergents, the committee agrees that hazards exist in the use of

SANITIZING MATERIALS

Characteristic	Liquid Sodium Hypo. Cl.	Pdr. Sod. Hypo. Cl.	Calcium Hypo. Cl. (Powder)	Chlor-amines (Powder)	Dichloro DiMethyl Hydantoin	Sodium Dichloroiso-cyanurate	Quaternaries (Liquid and Powder)	Iodophors
Germicidal Efficiency	Good	Varies with water hardness	Good to Poor	Question-able and varied	Rate Between Hypochlorites & Chloramines	Good	More effect-ive against gram-positive organisms	Very rapid on Vegetative Cells
Use Dilution Toxicity—200 ppm	No	No	No	No	No	No	Moderate	Depends on the Wetting Agent
Toxicity — Shelf Strength	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Stability — Stock	Good to Poor	Good to Poor	Good to Poor	Good	Good	Good	Excellent	Varies with temperature
Stability — Use	Good	Good	Good	Good	Poor	Moderate	Excellent	Varies with temperature
Speed	Fast	Moderate	Moderate	Slow	Moderate	Fast	Moderate **Fast**	Fast
Penetration	Same as water	Same as water	Same as water	Same as Water	Same as Water	Same as Water	Good	Good
Film (Hardness Forming effect)	None	Much	Much	Varies	None	None	Varied	None to Slight
Affected by Organic Matter	Yes	Yes	Yes	Yes	Yes	Yes	Moderately	Yes
Affected by other Water Constituents	No	No (?)	No (?)	High Alk. only	High Alk. waters adverse	No	Yes	High Alkalinity only
Ease of Measurement	Good	Good	Good	Good (?)	Good	Good (Same as hypo.)	Varied (?)	Good
Odor (Use Dilution)	High	High	High	Low	High	High	None	Slight Iodine
Taste	Object.	Object.	Object.	Object.	Object.	Object.	Bitter	Iodine
Effect on skin (Use Dilution)	Possible	Possible	Possible	Possible	Possible	Possible	Beneficial	Apparently None
Corrosiveness (Use Dilutions)	Slight — Depends Method	Slight — Depends Method	Moderate Depends on use	Slight	Worst of the Chlorines	Very Slight	None	Non-Corrosive to Stainless Steel
Cost of Active Ingredients	Low	High	Low	High	High	High	Moderate	Somewhat higher than Liquid Sodium Hypo-chlorites based on 25 ppm available iodine vs. 200 ppm available chlorine

cleaning agents formulated by two or more companies. The greatest single hazard is that of mixing acid and alkaline detergents in the cleaning regime, thus rendering the cleaning agent neutral. In addition, some cleaners are not compatible in sequence, depending upon the formulation.

Some concern has been expressed relative to a potential residue problem in milk with cleaners and sanitizers. The committee knows of no circumstances to warrant this concern provided that these compounds are used in recommended amounts.

The advantages of soft water in dairy operations is an accepted fact. However, the means by which to obtain it remains an individual farm situation. The use of water softeners is increasing on farms, but they do pose a problem from a maintenance standpoint. From a strictly economic standpoint, a water softener is of consideration when hardness reaches

30-40 grains. If properly maintained, however, they may have application under different circumstances other than hardness alone such as iron or silicate problems.

The pH of the water supply is known to affect the cleaning program. In most cases, an acid condition causes problems because of the relationships which exist to other parts of the water system. Thus, the pH can have varying influence. The pH of the water is significant only if the buffer capacity of the water is high. A water with little buffer capacity (no ability to resist change in pH) will have no influence upon the final pH of the detergent solution. When the pH of water is discussed, we should pay particular attention to the buffer capacity in addition to the absolute pH level.

It must be understood that with present dairy cleaners, we are dealing with compounds which may have an effect upon equipment. For example, the corrosive nature of chlorine sanitizers has been observed frequently. There is some concern for the use of acids and their effects. The cleaner residue and subsequent use of acid treatment are not fully known at this time. It is important to continue to emphasize the need to stress the proper use of cleaning and sanitizing compounds.

Following is a tabulation of advantages and disadvantages of various commonly used sanitizing compounds:

Liquid Sodium Hypochlorites

ADVANTAGES

1. Fast germicidal action—is non-selective.
2. No dissolving problems since it is liquid.
3. Easily dispensed in controlled amounts.
4. Uniform—entire contents of container have same strength.
5. Non-film forming — little effect by hardness or other water constituents.
6. Economical.
7. No caking or dustiness in container.
8. No "pinpoint burning" of use-solution vats.
9. Use-dilution non-toxic.
10. Use concentration easily measured by convenient field tests.
11. Reasonably high percentage of active ingredient provided, according to formulation and use requirements. (1% to 15%.)

DISADVANTAGES

1. Characteristic odor.
2. Spillage or breakage may cause staining or bleaching.
3. Should be kept in cool, dark storage area to insure stability. Comparatively short shelf-life.
4. Must be protected from freezing in very severe climatic conditions.
5. High rate of activity with organic matter decreases strength if soil is carried into sanitizing solution.
6. Variations in product alkalinity can affect germicidal action.
7. Misuse can cause rusting, pitting and corrosion.
8. Possible adverse effect on skin tissues.
9. Not acceptable because of precipitation problems in iron water supplies.

Powdered Sodium Hypochlorites

ADVANTAGES

1. Moderately fast, though variable germicidal action.
2. Non-selective against organisms.
3. Storage and handling not critical in cold weather.
4. Minimum problems from spillage or breakage of shipping containers.
5. Use dilution non-toxic.
6. Use dilution easily measured by field test.

DISADVANTAGES

1. Germicidal efficiency varies with hardness of water supply used.
2. Amount of available chlorine (if blended) in different layers of shipping drum may vary due to storage and handling conditions.
3. Must be dissolved to release chlorine to liquid solution.
4. Caking or dustiness in container complicate use.
5. Accurate measurement for use-dosage difficult.
6. Normal methods of application cause "pinpoint burning" of vat bottom.
7. Use-solution very cloudy. Severe reaction with water hardness constituents results in gross formation of film on surfaces being sanitized.
8. Encourages corrosive action due to film formation.
9. Active ingredients are high in cost.
10. Characteristic odor.
11. Strength reduced by addition of organic matter.
12. High alkalinity in use-dilution slows germicidal activity.
13. Low percentage of active ingredient inherent in this type formulation. (3.25% only).
14. Cool dark covered storage important.

Powdered Calcium Hypochlorites

ADVANTAGES

1. Non-selective against organisms.
2. Storage and handling not critical in cold weather.
3. Minimum problems from spillage or container breakage.
4. Relatively stable.
5. Use-dilution non-toxic.
6. Use-dilution easily measured by field test.
7. High percentage of active ingredient in usual formulations (15%-70%).

DISADVANTAGES

1. Germicidal efficiency varies from good to poor depending upon individual water supply used and amount of powder added to it.
2. Amount of available chlorine (if blended) varies somewhat in different layers in shipping drum according to storage and handling conditions.
3. Dissolving a problem — also, must be dissolved

before it can function as a sanitizer.
4. Dustiness in container complicates use.
5. Accurate measurement of use-dosage difficult.
6. Normal methods of application cause "pinpoint burning" of vats.
7. Accelerates and promotes gross film-formation on surfaces being sanitized; add hardness mineral to solution; use-solution very cloudy.
8. Slow germicidal action compared to other hypochlorites.
9. Encourages corrosive action due to film-formation.
10. Characteristic odor.
11. Strength reduced by addition of organic matter.
12. Cool dark covered storage important.

Chloramine-T

ADVANTAGES

1. Stability of powdered stock material good.
2. Moderate effect by organic matter.
3. Low odor characteristics.
4. Use-dilution non-toxic.
5. Use-dilutions can be measured.

DISADVANTAGES

1. Germicidal efficiency adversely affected by high-alkaline waters, alkaline detergent "carry-over" and in some cases by the amount of this material being used.
2. Releases chlorine at too slow a rate for most utensil sanitizing operations.
3. Germicidal action very slow in usual application methods.
4. Must be dissolved before it can function as a sanitizer.
5. Dustiness in containers may complicate use.
6. Accurate measurement of use-dosage difficult.
7. Normal methods of application cause "pinpoint burning" of vats.
8. Cost of active ingredients high.
9. Strong concentrations with high alkalinity are very irritating to skin.
10. Adjustment to reduce pH in order to insure germicidal efficiency may make material very corrosive and unstable so that it loses strength by "gassing off" onto air.

11. Organic matter quickly uses up active chlorine that is present.

Liquid Quaternary Ammonium Compounds

ADVANTAGES

1. No objectionable odor.
2. Very mild to skin, eyes, and clothing.
3. Non-corrosive. (This factor the same as the water in which it is used.)
4. Ease of accurate measurement and dispensing.
5. Use-dilution readily measured by practical field test.
6. Dissolved solutions "go to work" instantly.
7. Very stable to temperature changes.
8. Very stable under storage.
9. Good penetration qualities.
10. Provides a residual bacteriostatic film which is highly desirable.
11. Abilities to eliminate and prevent odors are outstanding.
12. One of the best ingredients for incorporation of "germicidal detergent" formulations.

DISADVANTAGES

1. Germicidal efficiency varied and selective, especially against "gram-negative" organisms. Different (sometimes slower) type of kill.
2. Moderate toxicity in use dilution (?)
3. Incompatibility with common detergent components complicates use: Germicidal efficiency may be reduced. Objectionable films may be formed on surfaces treated.
4. Affected by various natural water constituents.
5. Different members of the broad quaternary ammonium group vary widely in germicidal effectiveness; therefore, acceptance by official agencies is limited and varied.
6. Adversely affect rubber on repeated or prolonged exposure at normal use-dilutions.
7. Comparatively higher in cost.
8. Slow to dissipate — residual problem.
9. Foam problem in mechanical (CIP) applications.

Liquid Iodophors

ADVANTAGES

1. Fast germicidal action.
2. Non-selective
3. Well-established germicidal efficiency against vegetative cells.
4. Ease of accurate measurement and dispensing.
5. Convenient field test available.
6. Solutions "go to work instantly" because they are dissolved.
7. Good penetration qualities.
8. Pale amber color of use-solution serves as visual control.
9. Acid nature helps "con-

DISADVANTAGES

1. Not as effective against spores and phage as hypochlorites.
2. Should not be used at temperatures about 110 F. (rapid loss of strength, objectionable odor, and staining properties caused by "gassing off.")
3. Germicidal action adversely affected by highly alkaline waters or "carry over" of highly alkaline detergent solutions (depending on acid content).
4. Corrosive to several metals commonly used in food and beverage oper-

dition" hard waters—prevents film formations.

10. Wetting agents ingredient promotes fast spot-free drying.
11. Is useful as a "germicidal detergent" for *selected* light soil applications.
12. Stable under normal storage conditions.
13. Easy on skin tissues in use-dilution. Best for cow preparation.

ations.

5. Current use-cost is comparatively high.
6. Germicidal efficiency reduced by addition of organic matter (to solution being used)
7. Spillage or breakage of containers may cause staining and/or corrosion.
8. Possible residual problem.
9. Foam problem in mechanical (CIP) applications.
10. Not effective for removal of certain milk soils. (i. e. fats and greases)

The Committee has also undertaken to compare the practical aspects of various sanitizing materials. In the following table the characteristics of commonly used sanitizers are shown:

The Committee has set up a comparison of the physical aspects as characteristics of three groups of detergent sanitizers as follows:

DETERGENT SANITIZERS

Characteristic	Chlor.	Quat.	Iodophor
Germicidal Efficiency	Variable with formulae and use conditions		
Toxicity — Use Dilution	Depends on Formulation	Varies	Depends on the Wetting Agent
Toxicity — Shelf str.	Yes	Yes	Yes
Stability — Stock	Varied	Good	Good
Stability — Use	Varied	Good	Good
Speed	Variable with formulae and use conditions		
Penetration	Varied	Good	Good
Film Forming (Hardness effect)	Varied	Varied	None to Slight
Affected by Organic Matter	Yes	Limited Extent	Yes
Affected by other Water Constituents	None	Limited to None	High Alkalinity Only
Ease of Measurement	Good	Varied	Good
Odor (Use Dilution)	High	None	Slight Iodine
Taste	Object.	Bitter	Iodine
Effect on Skin (Use Dilution)	Possible	Depends on Formula	Possible
Corrosiveness (Use Dilution)	Variable	Possible Slight	Slight
Cost of Active Ingredient	Does Not Apply		

MILK SANITATION "DOWN UNDER"[1]

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Having spent nearly 5 mo in Australia and New Zealand between December, 1966, and April, 1967, does not make the author an expert on milk sanitation in these countries. Nevertheless, while milk sanitation was secondary to other interests, he did have an opportunity to visit farms and talk with those engaged in milk quality control, and some of what he saw and heard may be of interest to sanitarians and others in North America. The present paper is a report of these observations.

General Observations

In both countries dairying is definitely an "open air" activity. Cows are not stabled and the milking shed is generally open on 3 sides with the milkhouse wall making the fourth. Pipeline milkers of the releaser type, usually of Australasian make, are the general rule. Not infrequently, tinned metal parts are encountered, although new installations are of stainless steel. The older walk-through parlors are still most common in Australia, whereas in New Zealand the herringbone parlor is more popular, some with as many as 50 milking units! Extensive concrete holding areas were seen everywhere; most were semi-circular and fitted with a mechanically equipped "backing gate" operated from the milking pit.

While in New Zealand Jerseys still make up four-fifths of the milking herd, with Friesians (Holsteins) providing practically all the market milk, in Australia there is commonly more of a mixture of breeds with the Illawara Shorthorn also fairly popular. If both countries pasture is largely relied upon. However, the unusually favorable climatic conditions in the main dairying areas of New Zealand, together with superior strains of clovers and grasses encouraged by heavy applications of fertilizer, make it not only possible, but profitable, for the dairy farmer there to maintain better than 1 cow per acre and produce over 400 lbs of butterfat/acre/yr on the best farms without any supplementary feeding. In Australia, higher temperatures and periodic drought conditions necessitate more supplementary feeding so that New Zealand possesses definite advantages in producing milk at low cost. (Incidentally, the return to New Zealand manufacturing milk shippers last year averaged around $2.50 U. S., with no subsidy or support from the government, yet they appeared to be making a good living.) The New Zealand average production of 6,240 lbs. with nearly 5% fat is considerably above that for Australia, although in certain favored Australian districts production is comparable.

Because of the labor shortage, family-sized farms are the general rule. In New Zealand milking rates of 60 cows/hr/milker are not uncommon, and the average herd size is now over 90 cows. On a few farms as many as 8 and even 10 units are being operated by each milker, although 6 is considered the maximum desirable with a herringbone parlor. This "race track" milking is deplored by some, yet authorities there believe that in such herds there is a better level of sanitation than on some smaller farms. One might expect considerable udder trouble where so many units are operated, yet this did not appear to be generally true, probably because the cows are living under nearly ideal conditions and are not pushed for production by heavy feeding of concentrates.

As mentioned above, the New Zealand dairy farmer gets no government subsidy or support price as do dairymen in other countries. Consequently there is a vital concern over keeping down production costs. This is evident in the efficient layout of the milking shed and holding areas, in the continuing use of older tinned equipment, and in the development of a standardized farm bulk tank which costs less to own and to operate than those in North America. Similarly, rationalization has been applied to various aspects of both market and manufactured milk to reduce the cost of transportation, etc. Incidentally, in New Zealand 91% of the milk goes for manufactured products. While in Australia the percentage is lower, manufactured milk products are of primary importance here too.

Sanitation

Unlike North America, where market milk production has received major attention while manufacturing milk has received little or none, manufacturing milk in these countries has been of primary importance, as both countries export large quantities of dairy products; market milk has come into the pic-

[1]Presented, in part, at the annual meeting of the Minnesota Association of Milk Sanitarians, St. Paul, September 14, 1967.

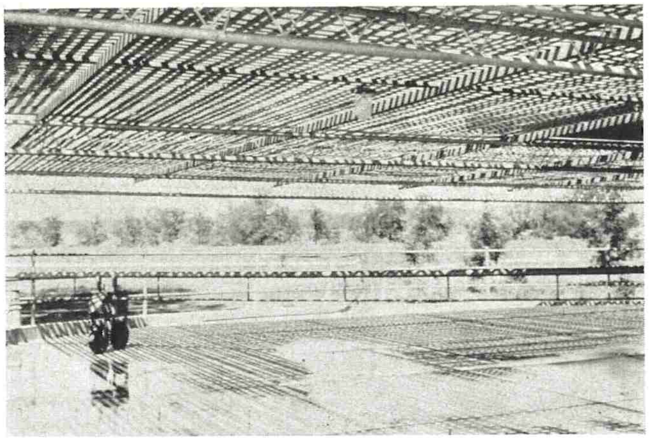

Figure 1. Shaded holding area on 140-cow farm in Hunter Valley, N.S.W. Australia. Note semi-circular concreted area and mechanically-operated "backing-gate."

ture later and, in general, sanitation has not received the attention given it in North America. It was a surprise to find that requirements for the milking shed, milkhouse, cleanliness of cows, equipment, etc., were the same for manufacturing as for market milk, the only difference being that the latter has to be cooled to a lower temperature. Consequently there is not the big difference in quality between the 2 classes of milk that is frequently encountered in North America. This emphasis on better sanitary quality of manufacturing milk is reflected in the higher quality of dairy products. (New Zealand's per capita consumption of 44 lbs. of butter per yr is not all because of its lower price!) Another matter worth mentioning is the tidy, attractive farmsteads and, particularly in New Zealand, the absence of farm machinery carelessly strewn around the farmyard. Without exception, the farms visited by the author would impress the consumer very favorably.

At milking time, udders are usually washed with cold water from a hose, using the hand rather than a rag, sponge or towel. Udders are rarely dried and use of a strip-cup is not common. Sometimes there is undue delay between stimulating "let-down" and putting on the teatcups, while overmilking is common where more than 6 units are handled per milker. It was unusual to see clusters dipped in a sanitizing solution between cows, but in Western Australia there was considerable support for "back-flushing" with plain water. There was growing interest in teat dipping after milking, probably as a result of the impressive results obtained at the National Institute for Research in Dairying in England in extensive field trials of a hygiene program to reduce mastitis infections, which included washing udders in a suitable iodine complex solution and dipping teats in an iodine product specially designed for this purpose *(2)*. Tests with several types of iodine teat dips were being conducted at Ruakura Animal Research Centre in New Zealand.

WASHING PIPELINE MILKERS

It was a surprise to learn that a "flush" type of cleaning was favored over the regular CIP process. Partly this results from the continuing use of tinned metal components in the milker, and partly from the lack of adequate velocity of cleaning solution. It was also reported that with this procedure an alkaline solution without chlorine was preferred, as use of a chlorinated alkaline detergent solution resulted in more milkstone formation and greater corrosion. The "flush" method, which incidentally is being officially recommended in each of the 6 Australian states and in New Zealand, is as follows: (*a*) Immediately after milking, draw 1 to 2 gal of cold water containing 0.03% of a *suitable* non-ionic detergent[1] through each unit; (*b*) Follow this with 1 gal of alkaline de-

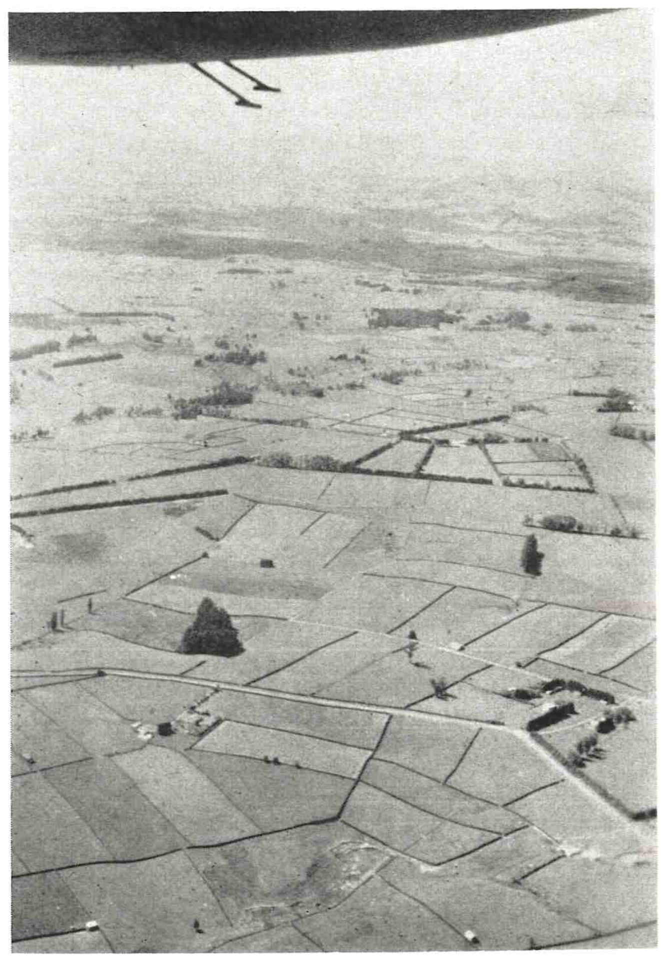

Figure 2. Bird's eye view of rich pasture area, Waikato, N.Z. Note tree windbreaks, hedges and rotational grazing.

[1]Good results have followed the recovery of the iodine sanitizing solution and using this as the initial rinse after milking. This avoids having to buy a separate non-ionic detergent for this purpose.

tergent solution at 160 F; (*c*) Next draw 1 to 2 gal of "boiling" water through each unit, then open up the pipeline and allow all parts of the system to drain and dry; and (*d*) Immediately before the next milking draw 1 gal of an approved iodine complex, containing 25 ppm available iodine, through each unit, drain, and commence milking.

In New Zealand, for many years the recommended procedure was to draw "boiling" water containing 0.05% caustic through the units and lines. This, of course, led to milkstone formation, requiring regular treatments with an acid solution. Later the Ruakura formula developed by Dr. W. G. Whittlestone superseded the use of caustic. Finally, as a result of research in Australia and New Zealand, Dr. Whittlestone developed the method described above, which obviated the need for periodic use of an acid cleaning solution, left equipment cleaner and reduced numbers of bacteria. This method was being followed on the vast majority of the farms visited in both countries.

Mention should also be made of the more scientific approach being used in the evaluation of cleaners and sanitizers in these countries. While Dr. Whittlestone was in Australia, a "Milking Simulator" was developed *(6)*. This device enables the investigator to study the efficiency and suitability of various types of detergents and sanitizers, yielding in 48 hr as much information as could be obtained in 60 milkings, with complete control of concentration, temperature, contact period, etc.

The recommended rinse with "boiling" water is apparently a carryover from earlier procedures, along with the British insistence that a periodic heat treatment is essential if milking equipment is to be kept in good sanitary condition. Its chief value probably lies in heating the equipment surfaces so that they dry out more rapidly. (Incidentally, New Zealand dairy farm water supplies average 40 ppm hardness. With hard water, the official requirement that *water heaters be set at not less than 196 F* would doubtless lead to trouble!)

Another point of difference is found in their recommendation not to brush milker inflations. They believe that brushing rubberware is unnecessary when inflations are pulsated during the washing with a suitable detergent solution; it merely roughens the surface of the rubber. This is in line with the author's observations at Ottawa nearly 40 years ago *(3)* where "suction washing" gave better results than did brushing. French workers *(4)* more recently have also recommended against brushing.

Divisions of Dairying in the various Departments of Agriculture are keenly interested in the effectiveness of the various cleaners and sanitizers being offered the farmer. At Werribee Agricultural College,

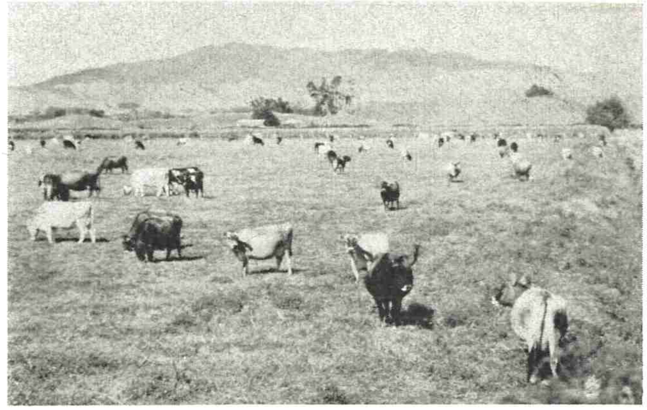

Figure 3. Typical herd on year-round pasture in Waikato area, N.Z.

Victoria, Australia, studies *(1)* have shown that only 6 of 14 farm waters tested produced a solution with a pH value of 5 or lower when made up at 25 ppm iodine. In New Zealand, the Standards Association is considering specifications for iodine complexes covering content of iodine and acid, and also specifying the maximum vapor pressure acceptable. (The vapor pressure is regarded as the most valuable index to the stability of the product.) This step should be a great aid to reputable manufacturers, who are faced with increasing competition from "backyard operators" hoping to cash in on the growing popularity of iodine products in the dairy and food fields.

COOLING

Particularly in New Zealand, the urgent necessity to keep down production costs is evident in the equipment and methods employed in cooling milk. The authorities there are not convinced that milk must be cooled as rapidly as is required in North America and Britain; they believe that if milk is cooled to 50 F in 4 hr, and to 40 F in 9 hr there has been no significant loss in bacteriological quality. Consequently, even for market milk, many farms still employ a water-cooled surface cooler to cool milk to below 65 F, then pump it into a refrigerated bulk tank to finish the cooling process. This allows use of a tank with about one-half the refrigeration capacity (and reduces the electricity requirement by one-half) ordinarily required for rapid cooling to 40 F. (A 3,800 lb tank costs about $1,280 U. S.) The New Zealand tanks are cylindrical, with a standard diameter. In place of a dip-stick, a plastic gauge tube extends up the front of the tank, where it can be easily read by the tanker driver. However, this gauge tube is frequently a source of serious bacterial contamination when not adequately cleaned and sanitized.

One very desirable feature of the farm bulk tanks

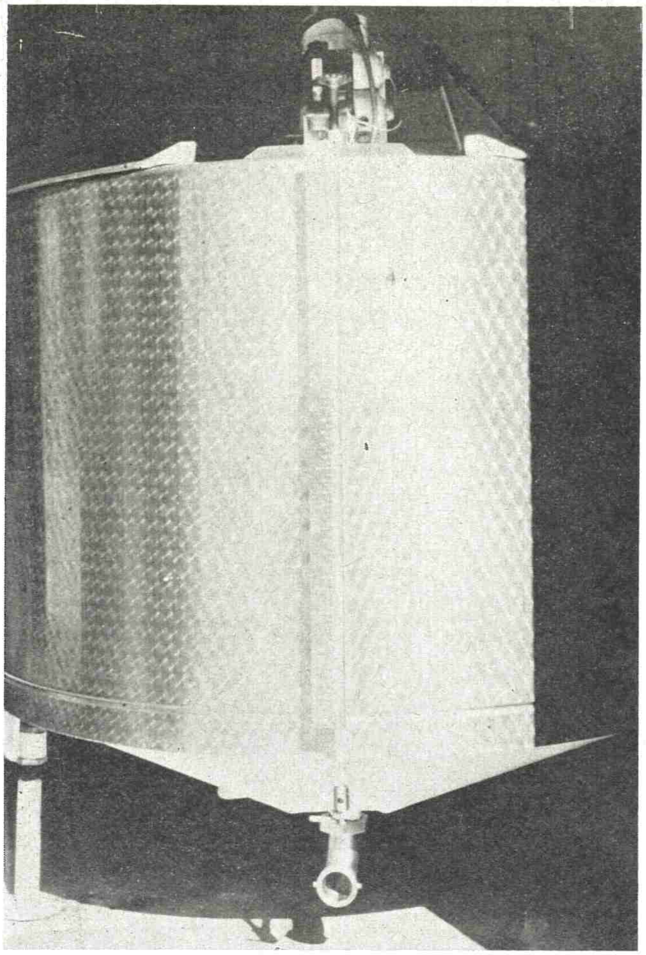

Figure 4. New Zealand-type 5,000 lb farm bulk cooling tank. These are located close to the door of the milk house so that the hauler can read the volume on the plastic gauge. Note 2.5 in. outlet.

"Down Under" is the 2.5 in. outlet valve. This allows the contents of a 5,000 lb tank to be pumped out in less than 5 min, so their tankers spend far more time on the road and less in the farmyard.

In both countries milk is generally picked up every day; no enthusiasm was encountered for every-other-day pick-up. When bulk handling was first introduced into New Zealand for manufacturing milk, non-refrigerated tanks without insulation were installed. However, this did not work out too well, requiring twice-a-day pick-up and some loss in bacteriological quality. Consequently, today insulated refrigerated tanks are recommended. For manufacturing milk the farm bulk tank is supplied by the plant, which also absorbs the cost of transporting the milk to the factory.

In Queensland, Australia, with its semi-tropical climate, all market milk shippers were required to have mechanical refrigeration even with cans. Most manufacturing milk shippers also have it. Because of this, the growth of bulk handling has been slower here than in other areas. In New Zealand some 75% of manufacturing milk is now handled in bulk; the largest single company, the New Zealand Co-operatie Dairy Company, which has 55 plants and 235 road tankers and handles about one-third of all milk produced, has all its milk shippers on refrigerated bulk tanks.

With market milk in New Zealand, a premium o faround 10¢ per cwt is paid for milk cooled to 50 F in 2.5 hr and to 40 F in 3.5 hr after the commencement of milking. Milk which is cooled to 50 F within 4 hr and to 40 F within 9 hr receives a premium of around 6¢ per cwt; this amount is also paid when milk is cooled immediately after milking to 40 F and held in a non-refrigerated vat, whether insulated or not, provided it reaches the pasteurizing plant at a reasonably low temperature and in good condition.

It was also a surprise to see uninsulated road tankers hauling market milk. However, it was contended that in New Zealand there is little justification for requiring them to be insulated as (*a*) really hot or cold weather is almost never encountered, and (*b*) the density of the cow population, often more than a cow to the acre, meant very short runs for the tanker. Likewise raw milk storage tanks in pasteurizing plants were frequently uninsulated. All this is a reflection of the pressure to maintain a competitive position by keeping down costs.

Quality Standards

In contrast to North America, local health departments appear to take little interest in milk quality other than to check its composition from time to time. In 3 of the Australian states, Western Australia, South Australia and New South Wales, and in New Zealand, a Milk Board has jurisdiction over the "town milk" supply, frequently extending to farm inspection. Farm inspection appeared to be carried out more frequently than is commonly true in North America; in New Zealand 96 Farm Instructors in the Division of Dairying of the Department of Agriculture inspect "town milk" suppliers every 6 wk and manufacturing milk shippers every 3 mo. Considerable emphasis appeared to be placed upon general cleanliness and tidiness; the extensive paved areas were hosed down after each milking, and the general impression was very pleasing. Flies were rare, despite the absence of fly screens on milk-houses and processing plants.

Drip sampling while emptying the farm tank is widely employed in both countries. While obviously very convenient, the author had some misgivings over the possible carryover of contamination from a high-count supply. It may be that "Dilution is the Dairyman's Best Friend" so that the large volume of milk picked up at the average farm dilutes any contamination so much that it has little effect.

Bacteriological standards in both countries are still based on the methylene blue test for both market and manufacturing milk. With the widespread acceptance of bulk cooling the inadequacy of this test is generally admitted. However, just what to replace it with has not yet been decided. In New Zealand, manufacturing milk cooled to 40 F in a refrigerated bulk tank is subjected to Preliminary Incubation (PI) at 56 F for 18 hr before testing; PI was also being advocated for "town milk" in New South Wales as a result of studies carried out by Dr. John McPhillips and his staff with the Milk Board there. One big problem in New Zealand in particular is that the *daily* methylene blue test is run at the factory. In very few instances are facilities or trained help available to carry out a Plate Loop Count or even a Direct Microscopic Count; however, the Director of the Division of Dairying, Mr. N. E. Briggs, is working hard to get better laboratory facilities, possibly by having several factories combine to equip and operate a more sophisticated type of laboratory where tests for pesticide residues, etc., can also be conducted. "Town milk" plants in New Zealand also conduct plate counts, laboratory pasteurized counts and coliform counts on incoming raw milk, and plate counts and coliform tests on the finished product. At one plant the pasteurized plate count results were mostly around 200 per ml even though the samples had been held at 70 F for 18 hr before testing!

Standards for the methylene blue test for "town milk" range up to 6 hr in New Zealand, whereas for manufacturing milk they may be as low as 1.5 hr for summer milk (3 hr in winter) in Queensland, Australia. However, judging by the percentages of butter, cheese and other products obtaining the highest grade, it seems evident that the quality of milk for manufacturing purposes is distinctly better than that encountered in many areas of North America.

Sediment tests are generally required on "town milk" but not so regularly on manufacturing milk. However, strainer pads examined by the author were much cleaner than average, probably because cows were out on pasture and the udders well washed with running water. In winter, when more mud is present the picture might not have been as good, but it would most likely have been better than where cattle are stabled in winter.

MASTITIS

Interest in the control of mastitis varies from one area to another. There appeared to be more concern in Australia, where a mastitis conference was held in Brisbane in February, 1967. Marker dyes are required to be present in all antibiotics used to treat mastitis in New South Wales; Victoria has required this of penicillin preparations for some time, with encouraging results. In New Zealand, where tests for antibiotic residues must be conducted every 10 days, one factory manager complained about the waste of time, having had only 1 positive result in over 13,000 tests! New Zealand is marking time on such a move because of reports that the certified food dye employed is carcinogenic.

Mention should also be made of the use in New Zealand of paper discs impregnated with bromcresol purple and *Streptococcus thermophilus* in testing for antibiotics in milk; this test is sensitive to 0.003 I.U. penicillin. Where the penicillin concentration exceeds 0.05 I.U., the producer loses from 70¢ to $1.40 per cwt. This has been a very effective deterrent.

MARKET MILK

"Town milk" is practically 100% on bulk, and practically 100% pasteurized. There is little homogenized milk; most is cream-line milk in round glass pint bottles, delivered at night 7 days a wk. Some plants, such as that of the Metropolitan Dairy at Melbourne, are highly automated and well planned. Equipment is mostly from Britain, with whom these 2 countries still carry on most of their trade. Producers receive approximately twice as much money as for manufacturing milk.

DAIRY PRODUCTS

Pressure from overseas customers, especially Japan, Israel, and the U.S.A., has resulted in marked improvements in plant sanitation in New Zealand. Unsalted butter is now being made free from coliforms and with total counts under 1,000/g and powder is being produced which is free from salmonellae and staphylococci. This does not mean that all factory managers are strong on plant sanitation; quite a few still resist any attempt to improve conditions unless it will improve the grade of the product. Cheddar cheese is now made only from fully pasteurized milk, and second grade cheeses are examined for coagulase-positive staphylococci; if the number exceeds a certain value, the cheese is condemned for human food.

In conclusion, it may be said that in the main dairying areas milk production and processing is carried on very efficiently; this is particularly true for New Zealand. Depending as these countries do upon the export market, much more emphasis is placed upon the quality of manufacturing milk and this is reflected in the quality of dairy products. In market milk they have concentrated upon providing milk at as low a price as possible, and have not gone in for the multiplicity of products with which we are familiar. Certainly the farms and processing plants seen by the author are nearly all a credit to the dairy industry.

REFERENCES

1. Burt, R. A., and L. J. Erwin. 1966. The influence of farm water supplies on pH and available iodine in acid iodophors. Austral. J. Dairy Technol. 21:55-57.

2. Johns, C. K. 1966. Use of sanitizers in preventing intra-mammary infections. J. Milk Food Technol. 29:309-312.

3. Johns, C. K., and A. G. Lochhead. 1929. Bacteriological studies of milking machines. J. Hygiene (Britain) 29:35-50.

4. Richard, J. and J. Auclair. 1962. Comparaison de deux méthodes de nettoyage des machines à traire. Lait 42 (411/412):1-21.

5. Whittlestone, W. G. 1964. The principles of mechanical milking. New South Wales Milk Board. October.

6. Whittlestone, W. G., L. Fell, B. O. E. Calder, and R. H. Galvin. 1963. Apparatus for the accelerated testing of materials and detergents in milking machines. Austral. J. Dairy Technol. 18:179-183.

ASSOCIATION AFFAIRS

ILLINOIS MILK SANITARIANS HONOR LOUIS WEINER

Louis H. Weiner was named the 1968 winner of the Pete Riley Award given each year by the Associated Illinois Milk Sanitarians in recognition of outstanding and meritorious service as a sanitarian in the dairy or food industry.

Louis Weiner, recently retired from the Borden Company and is now presently employed by the Evanston-North Shore Health Department, Evanston, Illinois, received the Award from Joseph Peterson, former president of AIMS and chairman of the AIMS Committee on Awards at the recent annual meeting of the association at the Pick-Congress Hotel in Chicago.

In making the announcement of the Award Committee's selection, Joe Peterson read the following statement:

Our selectee was born on a farm in Wisconsin, graduated from the University of Wisconsin and on January 7, 1929 was employed by the Borden Company as a laboratory assistant, and in 1931 was made laboratory manager. Eventually, our nominee was involved in raw milk procurement and country plant supervision. Few people in industry, or even in the various government services were acquainted with as many officials in the various sanitation programs throughout the country as our nominee. His knowledge of the laws of the various governmental agencies was impressive. Needless to say, our candidate was a member of many advisory and technical committees.

He retired from the Borden Company on March 31, 1966 after 37 years of service, and not content to be a house body, he went to work with the Perry Laboratory in Villa Park, Illinois. But the spell of the milk business was hard to shake and shortly afterward he went to his present position of Sanitarian with the Evanston-North Shore Health Department under the direction of Allen A. Filek, M. D., M.S.P.H., Public Health Director. It gives me great pleasure to announce this year's winner of the Pete Riley Award to my old friend and colleague, Louis Weiner.

Louis Weiner is the third recipient of the award, with Enos Huffer, Illinois Department of Public Health receiving it in 1967 and James A. Meany, Chicago Board of Health, being the first recipient in 1966. The Pete Riley Award was so named in honor of the late P. Edward Riley, sanitarian with the Illinois Department of Public Health for many years, a faithful and devoted public servant, who made many contributions to the Illinois milk sanitation program.

KENTUCKY SANITARIANS PLAN CONFERENCE

The 1968 annual Kentucky Fieldmen's and Sanitarians' Conference will be held at Mammoth Cave State Park, Mammoth Cave, Kentucky, on February 27and 28. The conference discussions will include such topics as: Economical facilities for milk production; Problems and potentials relating to bulk milk storage; Efficient forage production and utilization; Pesticide tolerances in food and feed; The control of mastitic reinfections within the herd; The potential for freeze dried dairy products; and Quality control procedures for the carbonated beverage industry.

Among those listed to speak are: M. E. David, Diversy Corp., Chicago; William Fleig, Freeze Dry Products, Evansville, Ind.; Richard Lambert, DeLaval Separator Company, Indianapolis, Ind.; Dr. D. J. Wood, Lazarus Laboratories, Toronto, Can.; Robert Haygood, Kraft Foods Co., Lawrenceburg, Ky.; and staff members of various departments of the University of Kentucky.

In addition to the formal presentations, there will be an annual meeting of the Kentucky Association of Milk, Food, and Environmental Sanitarians, an open forum on dairy problems, and awards for outstanding fieldman, sanitarian, and industry man.

Those interested in further information should contact Dr. C. Bronson Lane, Dairy Products Building, University of Kentucky, Lexington, Kentucky 40506.

REPORT OF THE COMMITTEE ON FOOD EQUIPMENT SANITARY STANDARDS—1967

The IAMFES Committee on Food Equipment Sanitary Standards, known hereafter as the Committee, is charged with the responsibility of cooperating with other interested organizations and industries in the formulation of sanitary standards and educational materials for the fabrication, installation, and operation of food equipment and to present to the membership those standards and educational materials which the Committee recommends be endorsed by the Association.

The purpose of this cooperative program is to aid industry in improving the design, construction and installation of equipment so that it will lead to easy cleaning and proper functioning when placed into service in food establishments. It is the Committee's further purpose to cooperate with industry in the preparation of standards or guidelines which public health agencies will accept, thereby securing uniformity in the manufacture and nationwide acceptance of such equipment.

The following report will outline the Committee's activities during the past year in working with two health and industry organizations (National Sanitation Foundation's Joint Committee on Food Equipment Standards and the National Automatic Merchandising Association's Automatic Merchandising Health-Industry Council) and progress in meeting its purposes and objectives. It is expected these organizations will be the two groups that the Committee will work with during the coming year.

NATIONAL SANITATION FOUNDATION (NSF)

The Committee was represented at the 1967 meeting of the National Sanitation Foundation's Joint Committee on Food Equipment Standards, where appropriate action was taken on several proposals, and prior to the meeting reviewed and submitted comments on each draft of these proposals. Since the meeting, the Committee has also reviewed and submitted comments on proposed changes to existing standards.

Proposed Revision of Basic Criteria C-1 and C-2. According to the NSF Staff, recent steps have been taken by the National Sanitation Foundation and the National Automatic Merchandising Association to cooperate in the development of a uniform standard for the evaluation of vending machines. It was further reported that a NSF Standard Task Committee composed of representatives of both of these organizations and of industry and public health had already developed a rough draft of a proposal which is to be submitted in the near future to the organizations represented on the Joint Committee.

According to the NSF Testing Laboratory, the present NSF requirements for louvers for food service equipment are not uniform throughout the various standards. Consequently, the Joint Committee requested that the Foundation appoint a special committee to study this matter and to make recommendations to the Joint Committee to resolve the problems created by these variations.

Proposed Revision of Standard Number 2. An NSF Standard Task Committee conducted a study of wood top tables to determine if the current manufacturing processes of the wood industry had overcome the previous objections of public health personnel to the use of wood for food contact surfaces, because of its inability to maintain original surface characteristics. The study revealed little, if any, improvement in the ability of currently manufactured wood top tables to withstand moisture from the use environment or from processing meats and other moist foods thereon. The Joint Committee, after considerable discussion and debate and objections from some members, instructed the NSF to initiate the development of a standard for wood top bakers tables and to continue and extend the wood top table study to bakers tables (at that time) using stainless steel bakers tables as controls.

The Joint Committee heard a report that wire shelving, supposedly complying with NSF specifications, rusted shortly after being placed in service under normal use conditions. The Joint Committee recommended that the NSF appoint a special task committee to investigate this matter and to submit a report at the 1968 meeting of the Joint Committee.

It was recently brought to the attention of this Committee that cold pans usually associated with cafeteria display counters are not covered in the applicable sections of Standards 1, 2, or 7 on Specifications for Construction and Performance Testing of Refrigerated Equipment. This oversight has been brought to the attention of the NSF Staff and it is hoped that the Joint Committee will take action at its next meeting to rectify this important matter by requiring cold pans to meet the same requirements as other refrigerated equipment.

Proposed Revision of Standard Number 4. The proposed revision of Standard Number 4, relating to commercial cooking and warming equipment, was the first major revision of a standard carried out under the direction of a special standards task committee appointed by the Foundation, as recently provided for in the NSF Organization and Procedures Manual. Such task committees, composed of public health and industry representatives, should expedite the work of standards development, and, therefore, perform a valuable service to the Joint Committee, providing that they are not allowed to pre-empt the standards development and revision responsibilities of the Joint Committee and member organizations of the Joint Committee.

The proposed revision of Standard Number 4 has been approved by the Joint Committee, but it is hoped that before the effective date (January 1, 1969) for compliance with these revisions that the Joint Committee would have re-evaluated and amended Basic Criteria C-2 and the Foundation would have reflected all applicable changes in C-2 in Standard Number 4, as well as in all other standards.

Proposed Revision of Standards Number 5 and Number 6. The Joint Committee requested the NSF Staff to initiate a comprehensive review of Standard Number 5, "Hot Water Generating Equipment", and Standard Number 6, "Soft Ice Cream Dispensing Freezers", during the next year. There have been numerous changes in these two fields within the past five years which have necessitated another look at these two standards.

As an illustration, the NSF Testing Laboratory reported that some of the current freezers approved by the NSF are equipped with integral or remote storage containers in which the mix is not maintained at 45 F or below. This matter will be considered by the Task Committee for Revision of Standard Number 6. However, pending the revision, the

Joint Committee instructed the NSF to interpret Standard Number 6 as applying not only to the dispensing equipment but also to the mix storage and supply systems, if integral with the dispensing freezer.

Proposed Revision of Standards Number 18 and Number 20. This Committee and a number of other public health committees has recommended that the previously adopted definition of portable be reconsidered. The Joint Committee again thoroughly reviewed this matter and amended the definition to read as follows: "Portable: The unit shall be small enough and light enough to be easily moved by one person, and shall have no utility connection, or have a connection that can be easily disconnected without tools, or have a utility connection of sufficient length to permit the unit to be moved for cleaning." This definition has been incorporated in Standards 18 and 20, relating respectively to Manual Food and Beverage Dispensing Equipment and Bulk Milk Dispensers, and will be subsequently submitted to the NSF Standards Task Committee for Revision of Standard Number 8 as a proposed amendment to this Standard. The Joint Committee anticipated some difficulties for industry in effecting the same change in Standard Number 8 and, therefore, used this procedure rather than immediately revising the section on portable equipment in Standard Number 8.

Proposed Plans for New Standards and/or Criteria. The public health members of the Joint Committee reviewed another request to initiate the development of a standard for mobile food service equipment which would include mobile restaurant facilities such as soft ice cream, pizza, popcorn, industrial catering trucks, etc. A similar proposal was considered by the Committee in 1965, and it was the feeling of this Committee and a large number of the other public health committees represented on the Joint Committee that the NSF should not be developing standards for an entire food service establishment, as the development of sanitation standards on such a broad scale was a function of official public health agencies. However, at the 1967 meeting, after considerable discussion, a majority of the public health members voted in favor of initiating the development of a standard for such equipment.

The Joint Committee for the past two years has been interested in the development of a standard for refrigerated equipment for use in grocery stores, meat markets, and similar retail food markets and the NSF Staff has encouraged the industry manufacturing this equipment to work with the Foundation in the development of such a standard. Instead of developing a standard in cooperation with the NSF, it was learned that the industry was developing a voluntary construction standard and plans for testing and rating retail food store refrigeration. The Joint Committee felt that implementation of the industry's proposal would probably improve this type of equipment; but for the sake of uniform specifications and acceptance by public health personnel, it instructed the NSF Staff to proceed with the development of a standard for such equipment.

The Joint Committee again expressed a desire that a standard or criteria be developed in cooperation, if feasible, with the detergent and chemical dispensing equipment industry. It was reported that repeated efforts to interest this industry in such a cooperative venture had failed. Therefore, the Joint Committee recommended that the NSF proceed to develop a set of specifications for construction and installation of such equipment, hopefully, in cooperation with the manufacturers.

There has been some prolonged interest in the development of specifications for laminated plastic coatings for food service equipment, and the manufacturers of such coatings recently met with the NSF Staff and developed a suggested set of specifications. However, since the initial meeting, the manufacturers have expressed no further interest in this project. Consequently, the Joint Committee, to satisfy a need for such materials, instructed the Foundation to proceed with the development of specifications for laminated plastic coatings.

NATIONAL AUTOMATIC MERCHANDISING ASSOCIATION (NAMA)

The National Automatic Merchandising Association's Automatic Merchandising Health-Industry Council (AMHIC) held its eleventh annual meeting during October 1966, and this Association and other public health organizations and the affected industries were represented and participated in AMHIC's discussions. The afternoon of the first day was reserved solely for the public health representatives and was used by them to discuss public health objectives and policies to be followed in their work with the entire membership of AMHIC.

Proposed Revision of the Vending Machine Evaluation Manual. The Automatic Merchandising Health-Industry Council, comprising 22 representatives of national health organizations, military and industry groups, heard progress reports on industry and public health programs and deliberated at length on several continuing projects. Among these, and probably the most urgent, was the proposed revision of the Evaluation Manual.

The Council reviewed numerous proposed changes or additions to the Manual (these were received from this and other committees and collated and presented by the AMHIC Committee on Manual Revision) and appropriate action was taken on each one. Two matters demanding additional study before final action by the Council were referred to new special AMHIC committees for further consideration and recommendations; these concerned (1) machine elevation and movability and (2) temperature cut-off controls.

In addition to the above two unresolved matters, an AMHIC Committee on Ice Making Equipment for Vending Machines submitted a proposed ice-maker criteria for design, materials and fabrication of food contact materials; access for manual cleaning of food contact parts; in-place cleaning and means for periodic visual inspection of food contact surfaces; reuse of melt water providing that it is maintained in an enclosed system at 40 F or less; and type and detail of cleaning instructions to be provided with each machine. In the opinion of the members, the Ice-Maker Committee had rendered a valuable service to the Council in exploring this matter and submitting the initial proposed criteria and felt that the Committee's findings should now be referred to an Industry Task Committee for further study and recommendations.

With these three exceptions, the 50 page standard for testing food and beverage vending machines and equipment was brought to a completed draft, reflecting the 1965 Recommendations of the Public Health Service for the Vending of Foods and Beverages and also those recommendations of the members of AMHIC for improvement of the construction and operation of vending machines.

Proposed Evaluation Checklist. The Evaluation Checklist to be used in conjunction with the Manual in evaluating vending equipment was revised during the year by a special AMHIC Committee to reflect current changes in the Manual. It too has been color coded and cross-referenced to correspond with the Manual and to provide for maximum usefulness, and should soon be ready for final approval and printing along with the Manual.

Proposed Policy for Evaluating Reconditioned Machines. There has been a concerted effort during the past two years by a special AMHIC committee and all members of the Council to develop a workable policy covering other than new machines. This action was stimulated by a demand from industry and public health for an evaluation program for such machines, as the purchase, renovation, and sale of used vending machines in interstate commerce is a rapidly growing practice in the vending industry.

The purposes of establishing an NAMA Evaluation Program for other than new machines are twofold: (1) to provide the necessary sanitation guidelines, evaluation of machines and certification to those companies who conform to established public health standards in their reworking of machines; and (2) to provide a means whereby buyers and health or military officials can identify those machines which, after renovation, continue to meet the nationally accepted public health requirements. This committee should soon have an opportunity to review and offer comments on the third draft of this important new proposed NAMA Evaluation Program.

A Service to Public Health and Industry. At the request of the members of the Council, NAMA sent the following timely communique to the members of the vending industry. "Don't act before consulting your local or state public health department. If you are going into food vending, or if you are building new or enlarged commissary facilities, a knowledge of equipment, plumbing, and building requirements *beforehand* can save you money. It would be wise to consult your local or state Public Health Department *before* making final commitments."

At the 1966 meeting of AMHIC, the Chairman of the IAMFES Food Equipment Committee was re-elected Co-Chairman of AMHIC to represent the public health group.

RECOMMENDATIONS

1. The Association reaffirm its support of the National Sanitation Foundation and the National Automatic Merchandising Association and continue to work with these two organizations in developing acceptable standards and educational materials for the food industry and public health.

2. The Association urge all sanitarians to obtain a complete set of the National Sanitation Foundation's Food Equipment Standards and Criteria and a copy of the National Merchandising Association-Automatic Merchandising Health-Industry Council's Vending Machine Evaluation Manual; to evaluate each piece of food equipment and vending machine in the field to determine compliance with the applicable sanitation guidelines; and to let the appropriate agency know of any manufacturer, installer, or operator failing to comply with these guidelines.

3. The Association urge all sanitarians and regulatory agencies to support the work of the Association's Committee, and subscribe, by law or administrative policy, to the principles represented by the Standards, Criteria, and Evaluation Manual for food equipment and vending machines.

COMMITTEE MEMBERS

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(Indiana Association)
Purdue University
West Lafayette, Indiana

Lloyd W. Regier
(International Association)
University of North Carolina
Chapel Hill, North Carolina

Irving L. Bell
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National Canners Association
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Carl Henderson
(International Association)
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of Public Health
Santa Fe, New Mexico

Jerome Schoenberger
(New York Association)
City Department of Health
New York, New York

Harold Wainess
(Illinois Association)
Harold Wainess and Associates
Chicago, Illinois

NEWS AND EVENTS

PENN STATE CONFERENCE ON SALMONELLA IN FOODS

A four day conference on Salmonella in Foods has been scheduled by Pennsylvania State University for March 18-21, 1968. All sessions will be held at the J. O. Keller Conference Center at University Park.

The meeting will be open to producers, processors and distributors of food products, persons who serve the processing industry and regulatory agency personnel. The increase in salmonella outbreaks indicates the needs for dissemination of information concerning importance, sources, and cycles of salmonellae outbreaks, sanitation programs, detection of salmonellae in foods, and procedures for eliminating or decreasing salmonellae in specific foods.

In addition to providing information for enrollees, the conference will suggest an evaluation of present detection and control procedures, and encourage a revision in order to provide the most effective protection against salmonellae.

The program will cover the public health aspects and economic impact of salmonellae food infection as well as discussion of basic factors on the growth and survival of salmonellae in foods. Sanitation programs in hospitals, restaurants and food plants will be reviewed and problems in special areas such as meat and meat products, poultry and eggs, fish and fish products, dairy products, confections and cereals and grain products will be studied.

Speakers and discussion leaders have been selected from a wide field and will represent food industry, research and teaching staffs of state universities and local, state and federal health and agricultural agencies. Program and registration information is available from the Agricultural Conference Coordinator, J. O. Keller Bldg., Pennsylvania State University, University Park, 16802.

DAIRY MANUFACTURING SHORT COURSE AT PURDUE

The Department of Animal Sciences and the Food Sciences Institute at Purdue University have announced plans for a one-week short course in Dairy Manufacturing to be held March 31 thru April 6, 1968. The purpose of the short course will be to give plant foremen and supervisors a better understanding of the Dairy Industry and the basic principles of dairy technology. The course will emphasize proper processing techniques of fluid milk, cultured products, ice cream and cottage cheese manufacture, sanitation, and quality control as well as good management and personnel practices.

The short course will be conducted by Emeritus Professor Dr. G. Malcolm Trout, Michigan State University; Emeritus Professor Dr. E. O. Herreid, University of Illinois; Dr. F. J. Babel, Dr. B. J. Liska, Dr. C. E. Parmelee, and Dr. T. W. Keenan, Purdue University; as well as other members of the Purdue staff and guest lecturers from Industry.

For further information or registration forms, write Mr. H. F. Ford or Mr. P. J. Muldoon at Purdue University, Department of Animal Sciences, Smith Hall, W. Lafayette, Ind. 47907.

CORNELL SCHEDULES FOOD SCIENCE SYMPOSIUM

New products and processes, food quality, food lipids, and convenience and specialized foods will be the subject matter areas covered at the second biannual Frontiers in Food Science Symposium sponsored by Cornell University's Graduate School of Food Science and Technology. Tuesday and Wednesday, June 11 and 12, 1968, have been chosen as the dates for the symposium. Cornell's New York State Agricultural Experiment Station at Geneva and its Department of Food Science and Technology will serve as hosts for the meeting.

The two-day symposium is geared to presenting latest research knowledge to food scientists. More than 20 papers in the four subject matter areas will be presented.

Dr. W. B. Robinson, Head of the Geneva Station's Department of Food Science and Technology, and Dr. Donald Downing, Extension Food Processing Specialist for Cornell, are serving as co-chairmen of the symposium.

IN MEMORIUM ALBERT V. MOORE 1906-1967

Dr. A. V. Moore, retired Professor of Dairy Manufacturing in the Department of Animal Science at Texas A&M University, died December 8, of an apparent heart attack, in his home at Bryan, Texas. Dr. Moore joined the Texas A&M dairy staff in 1937, was advanced to the rank of full Professor in 1944, and because of ill health, retired on September 1, 1966.

He received his B.S. degree at Purdue University in 1927 and his M.S. degree at the same University in 1933. In 1948 he completed the Ph.D. degree program at Michigan State University.

Dr. Moore was professionally trained as a Dairy Bacteriologist and served as chairman of the Curriculum Committee for Food Technology from the time it was established until shortly before his retirement. In addition, he served on other University committees including the one responsible for organization of the electron microscope program at the University. He was a member of the American Dairy Science Assn., the Institute of Food Technology and has served as secretary of the Texas Society of Food Technologists. While assigned to only 25% research time, he has published a number of research papers and has presented research reports at the annual meetings of the American Dairy Science Assn., the So. Sectional Meetings of this Assn., and the Texas Society of Food Technologists.

In 1946 he spent several months working at the National College of Agriculture in Capingo, Mexico, in the organization of a dairy department there. In 1966 he spent 2 wk in the Dominican Republic as a consultant to the Ford Foundation making a study of the food processing potential of that Country. For a number of yr he has served as Editor of a special column in *Industrias Lacteas*, a dairy magazine published in Houston by Tunnell Publications for Central and South America.

Dr. Moore was a popular teacher and has many former students working in the dairy and related industries in this area. He was in considerable demand by the dairy industry as a consultant and at the time of his death was actively working with a number of companies in Texas, New Mexico, Oklahoma, Arkansas and Louisiana.

He was a member of the Bryan Lions and later a charter member of the College Station Lions Club, and was active in a number of church activities including choir and orchestra work.

SANITARY FOOD SERVICE COURSE

A course entitled "Sanitary Food Service" is to be given at the National Center for Urban and Industrial Health in Cincinnati, Ohio on April 8-12, 1968.

This course is designed for dietitians, food service managers responsible for food service operations in hotels, restaurants, catering firms, the transportation industry and others engaged in large scale food service operations.

The scope of the course is extended through lectures, conferences and problem sessions covering such topics as: Management Responsibilities in Disease Control, Communications in Management, Time-temperature Relationships in Food Sanitation, Food Service Layout and Equipment Design, Pre-cooked and Pre-proportioned Foods, Personnel Training, Automation, The Economics of Sanitation, New Developments in Food Service, Evaluation and Control, and Food Service Sanitation Ordinance and Control.

For further information or applications, write: Chief, Training Program, National Center for Urban and Industrial Health, 222 E. Central Parkway, Cincinnati, Ohio 45202.

THE DAIRY FIELDMAN[1]

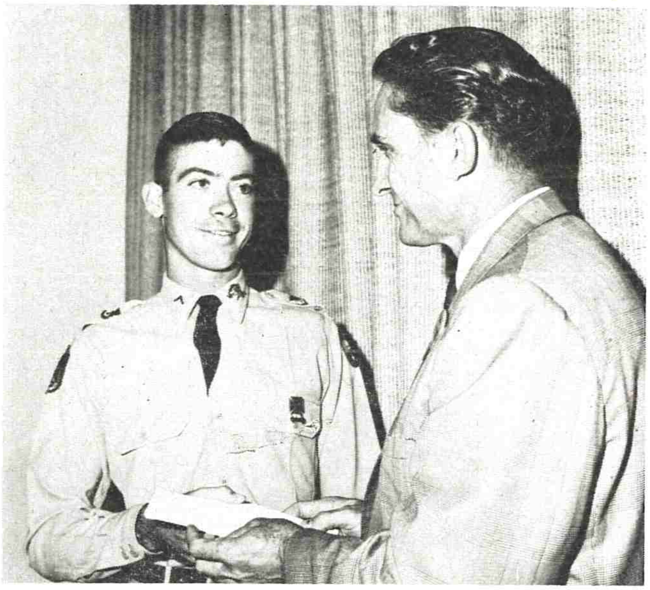
The dairy fieldman must be capable of handling many problems. He must be something of a bacteriologist, veterinarian, businessman, sanitarian, farmer, mechanic, and politician. He must be dedicated, liberal while being strict, versatile, ambitious, a morale booster, a cleaning expert and a self-starter.

The fieldman works long hours, responds when called no matter what the hour, and is often the underrated man on the milk plant organization chart. He must constantly study and read to keep abreast of changes in equipment, quality control, and the milk industry as a whole. His very appearance is traditional to his profession. The cap on his head, lightweight jacket, shirt pocket filled with pens and thermometers, and car loaded with supplies and testing equipment emphasize his dedication to his exacting, important job.

Our hats are off to the dairy fieldman, the seemingly tireless fellow who goes from farm to farm asking, pleading and cajoling the producer to improve his milk quality. Frequently rebuffed, sometimes abused, he continues his patient work for a better milk supply. Like the postman,"Neither snow nor sleet nor dark of night stay him from his appointed rounds."

[1]From *Sanifacts*, a publication of Wyandotte Chemicals Corporation, Wyandotte, Mich.

DALLAS-FT. WORTH DAIRY SOCIETY ANNUAL SCHOLARSHIP



The Dallas-Ft. Worth Dairy Society presented their Annual Scholarship Award to H. Larry Lane, sophomore Dairy Science Student at Texas A&M University. The Award was presented at the Annual Texas Dairyman's Short Course Banquet held at College Station on November 16, 1967, by Mr. Phil Porter, Vice President of the Dallas-Ft. Worth Dairy Society, and Director of Information of North Texas Producers Association.

Identified in the accompanying photograph are Mr. Larry Lane, Stephenville, Texas, recipient of the Annual Award, and Mr. Phil Porter.

PHS TO STUDY FREQUENCY OF FOOD POISONING

A national study to determine the frequency of a mild food poisoning seldom recognized in this country until seven years ago is being conducted by the U. S. Public Health Service in cooperation with state and local health departments. This was announced by Jerome H. Svore, Director of the Service's new National Center for Urban and Industrial Health in Cincinnati, Ohio. The Service's National Communicable Disease Center in Atlanta also is cooperating in the study.

The food-borne illness, caused by a bacterium called *Clostridium perfringens,* is characterized by acute abdominal pain and diarrhea. Symptoms of this type of food-borne disease usually begin eight to twenty-four hours after eating the contaminated food with complete recovery within 24 hours. "The ailment", Mr. Svore said, "usually is caused by eating food that has been cooked and allowed to cool slowly. The combination of cooking and lack of immediate refrigeration allows the growth of enough bacteria to cause illness. The contaminated food is usually a meat, meat dish, or gravy."

The illness was first studied in Great Britain as early as 1945. It was not until 1960 that researchers, in what is now the National Center for Urban and Industrial Health in Cincinnati, began developing a simplified method to isolate and identify the bacteria in food-borne disease outbreaks in this country.

Robert C. Novick, Chief of the Center's Environmental Sanitation Program said: "We still have no idea of the extent of this illness in the United States, but British experience reveals this type food poisoning to be more prevalent than available American statistics indicate." Mr. Novick said the way to prevent this type of food poisoning is as follows: Food should be cooked at a temperature above 140 F and, unless eaten immediately, cooled quickly to below 40 F, and kept cold. If the meat or meat dishes are reheated for subsequent use, they should be reheated rapidly to boiling, where possible, before they are served or placed in steam tables.

Many strains of *Clostridium perfringens* have heat resistant spores that will withstand boiling or survive roasting. These spores grow rapidly at relatively high temperatures (optimum growth temperature 113 F). Uncovered foods can become recontaminated by strains of the bacterium in dust. Chilling adversely affects the survival and growth of the organism.

According to Dr. Keith H. Lewis, Chief, Food Protection Activity, the national study of *Clostridium perfringens* food poisoning has been developed through interest and collaboration of two experienced microbiologists, Dr. H. E. Hall, Food Protection Research Section, NCUIH, and Dr. V. R. Dowell, Jr., Bacteriology Section, NCDC. These two scientists will not only coordinate the work of the participating state and local health departments, but also conduct research on the bacterial cultures provided by these departments.

NEED MORE TRAINED PERSONNEL IN THE FOOD INDUSTRY

Scores of high paying jobs in the world's largest industry are being left unfilled, according to Michigan State University.

The world's largest industry is food. The jobs are those requiring education and training in food science—food processing, quality control, research and development, food engineering, food chemistry and food microbiology.

"We average at least 25 inquiries from industry for every student graduating in food science," reports Prof. L. G. Harmon, academic advisor for Michigan State University's Department of Food Science. "It's not unusual for me to get three or four telephone calls a week from people looking for food scientists. At present, we have only 25 students in our undergraduate programs. If job availabilities are any indication, we ought to have 10 times as many."

Dr. Harmon points out that MSU is one of the few universities offering special training and education in food science. The recently completed $4.5 million food science facilities are considered to be among the best and most complete in the nation. Right now, the food industry is being forced to operate without all the trained people it needs.

The shortage of personnel is reflected in the number of scholarships available to MSU food science students. Various food industry organizations have provided over 30 scholarships of $354 to $1,000 per year for undergraduate students. And many of the scholarships receive no applicants, simply because there aren't enough students majoring in food science.

"The food processing industry is the most stable business in the United States," says Dr. Harmon. "There always have been and there always will be jobs in this industry. Starting salaries for graduates with B.S. degress have ranged from $7,500 to $8,400 during the last three years. Jobs have included production; supervision and management of commercial food plants; control of food quality; research and development of new and improved food products; and regulatory work for state and federal agencies."

HOW TO FRACTURE RELATIONSHIPS[1]

The following ten commandments for wrong-way public relations were developed by Robert Florzak, P. R. Manager, Automotive Division, Maremont Corporation: (1) Don't admit anyone is better authority than you; talk and act superior: (2) Don't bother to praise others or say anything nice about them: (3) Don't allow others to escape your criticism, especially in front of people: (4) Don't pay attention to your appearance, your taste is always right: (5) Don't be friendly to subordinates, it lowers your status: (6) Don't smile at people in general, it might breed familiarity: (7) Don't allow anyone else to state an opinion, your ideas are what counts: (8) Don't concern yourself with the interest and problems of others: (9) Don't help others to get ahead or to build up their self-esteem: (10) Don't allow anyone else to receive any credit, you deserve it all.

[1]From the *Hoosier Sanitarian,* Newsletter of the Indiana Association of Sanitarians, October, 1967.

PLAN FOR THIRD INTERNATIONAL CONGRESS ON FOOD SCIENCE AND TECHNOLOGY

The Third International Congress on Food Science and Technology is being planned for Washington, D. C. in 1970. About 3,000 U. S. and foreign food scientists and technologists are expected to attend this conference. Since the inauguration of the First Congress (London—1962) the International Committee voted to hold these Congresses every four years. Following the close of the Second Congress in Warsaw, Poland in 1966, the Committee accepted the invitation of the Institute of Food Technologists to host the 1970 Congress in the United States. Following the tradition established by previous hosts, Washington, D. C., our nation's capital, was selected as the site of this meeting.

More than fifty (50) countries will be represented by scientists, technologists, engineers, nutritionists, educators and executives who are concerned with the preservation, processing and development of appealing and nutritious foods. All facets of the food industry, including government scientists and officials, and educators will participate in the meeting. In addition to the plenary and technical sessions, it is planned to present an educational, interesting and relatively non-commercial series of exhibits.

The plenary sessions will be devoted to general lectures by outstanding speakers on topics of worldwide importance. The technical program is to consist of symposia and specialized sessions such as: World Food Challenges (protein foods — food safety — food resources — village processing — emergency feeding — nutritional problems); Quality Evaluation (sensory evaluation — nutritional quality); Food Processing and Preservation (engineering — packaging); Food Laws and Regulation (national policies — standards of identity and quality—food safety); Transportation, Storage and Distribution of Food (artificial barriers to trade); Information Exchange and Documentation of Food Science Literature and Education and Training in Food Science and Technology.

Dr. Richard L. Hall, Director of Research and Development, McCormick & Co., Baltimore, Maryland, is the Chairman of the Congress III Executive Board that has assumed the responsibility for organizing and planning the Congress. Dr. D. J. Tilgner, Politechnia Gdanska, Gdanska, Poland, is the Chairman of the International Committee and Dr. George F. Stewart, Director, Food Protection and Toxicology Center, is Secretary General of the International Committee and President of the Institute of Food Technologists.

CHICAGO IS SITE OF 1968 DAIRY AND FOOD INDUSTRIES SHOW

Three major dairy associations have announced they will again hold their annual conventions concurrently with the Food and Dairy Industries Expo in Chicago next October.

The associations which will meet during the week of October 13, 1968, are the International Association of Ice Cream Manufacturers, Milk Industry Foundation and Dairy Society International.

Formerly the Dairy and Food Industrial Exposition, the Expo will open at the International Amphitheatre Sunday, October 13 and will run through Thursday, October 17. It is sponsored by the Dairy and Food Industries Supply Association and is held every two years.

Some 350 exhibitors will display supplies, equipment and services useful to the food and dairy processor in gathering, preparing, packaging, storing and selling his line of products. Attendance during the week of the conventions and Show is expected to exceed 20,000

FDA PARTICIPATES IN NUTRITIONAL STUDIES ON ROLE OF ZINC IN DIET

Scientists at the Food and Drug Administration in Washington baked cookies this past Christmas season—10,500 of them. But these particular cookies didn't turn up at any holiday parties. They were destined for Iran.

The scientists, Dr. M. R. Spivey Fox and Dr. Leon Hopkins, of the Division of Nutrition, baked the cookies, packaged an orange-flavored drink, and prepared mineral capsules as FDA's part in a Veterans Administration study of malnutrition among boys in a village school near Shiraz, Iran. The purpose of the study is to establish the role of zinc in the delay of growth and sexual development that is widespread among teenage children in the villages of Iran. A lack of zinc is believed to be the major factor.

In earlier studies, the addition of zinc to the diet of Iranian children produced little change, but scientists believe this was probably due to a lack of other essential nutrients. This is why the FDA prepared diet supplements for the new study. The cookies are high in protein, the orange-flavored drink contains all required vitamins and two minerals, and the mineral capsule contains nine trace elements.

These will supplement the diets of 60 boys at the Iranian school for a five-month period started in January. The boys, divided into three groups, will receive controlled amounts of zinc. By the differences in response of groups, scientists expect to show how zinc affects growth and maturation.

The supplements are being prepared in FDA laboratories because even minerals from the air could be a distorting factor in a trace-element study. Staff members of the Pahlavi Medical School will direct the study at the school in Iran.

MICHIGAN TIGHTENS MEASURES AGAINST HOOF AND MOUTH DISEASE

With 200,000 animals already victims of the worst outbreak of foot and mouth disease in England in 44 years, Michigan animal health regulatory officials are tightening surveillance at airports and other points where the disease might enter.

Because the epidemic in England is a highly virulent form of the disease, animal losses are great. These are having an impact on the humans. In infected areas livestock markets have been closed, traffic has been curtailed, races have been canceled, and hunting grounds have been restricted to prevent contaminating deer. Strict quarantines prevent movement of animals.

Vigilance has been stepped up at American ports where people and cargo enter from Europe. Since the disease is most often carried by meat or meat products, custom officials are especially watchful of persons attempting to bring in sausage or uncanned meats, said Dr. C. L. Hendee, USDA veterinarian in charge of Michigan.

At Detroit Metropolitan Airport, garbage is removed from planes from overseas. This is incinerated immediately. The navigation season is about finished for 1967 on the Great Lakes so the hazard from this source is reduced. Passengers arriving at airports are checked closely about uncooked meat or sausage they might have along.

State Veterinarian J. F. Quinn of the Michigan Department of Agriculture is sending information to all practicing veterinarians in the state, reviewing symptoms of foot and mouth disease which few of them have seen since Michigan has not had a case since 1924. He is also urging veterinarians to report unusual symptoms in susceptible animals to the department's Animal Health Division.

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UNIVERSITY OF SASKATCHEWAN, Department of Dairy Science—Applications are invited for a new staff postion in Food Microbiology. Duties will include the teaching of undergraduate and graduate students and responsibility for initiating and conducting research in this area. Applicants must have or be completing a Ph.D. degree. Appointment will be made at the rank of Assistant Professor, current (1967-68) salary minimum: $8,700. Address inquiries and applications, inculding curriculum vitae and the names of three referees, to Dr. D. L. Gibson, Head, Department of Dairy Science, University of Saskatchewan, Saskatoon, Sask.

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