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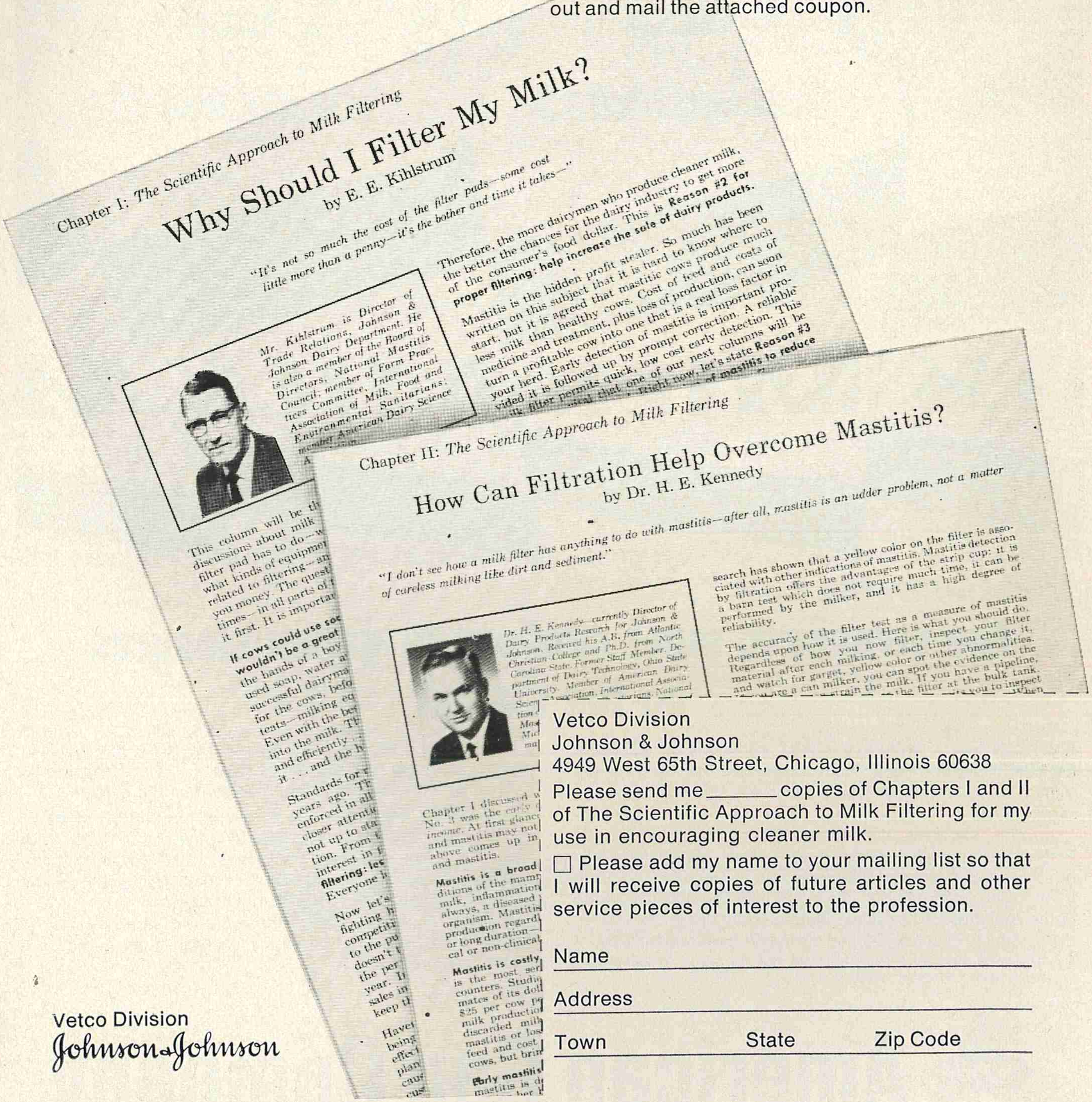
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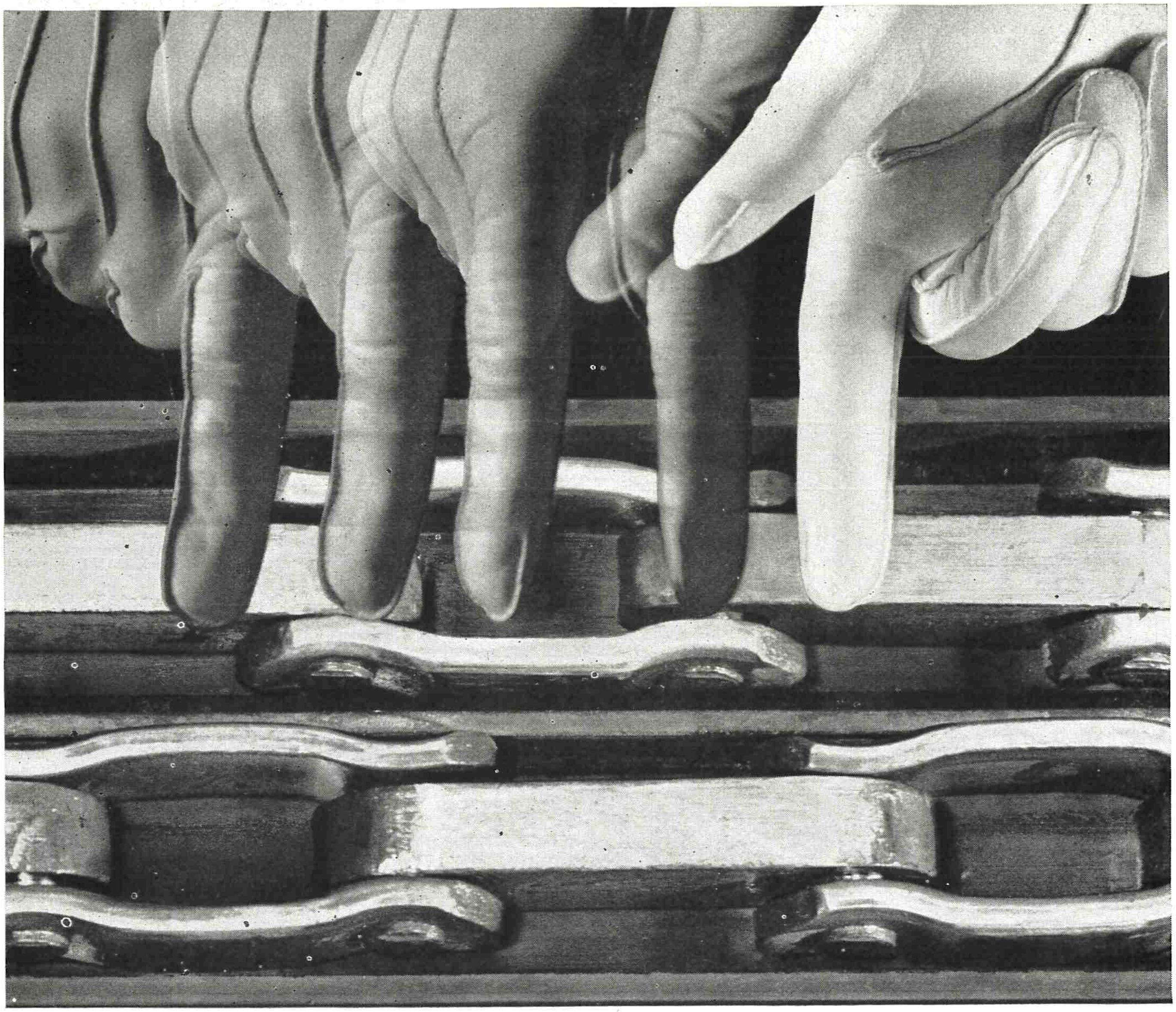

THE RELATIONSHIP BETWEEN ENTEROCOCCUS, COLIFORM AND YEAST AND MOLD COUNTS IN BUTTER[1]

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(Received for publication March 16, 1965)

Summary

Examination of butter churned from inoculated cream, line-run cream and butter samples and 486 commercially manufactured butter samples indicated the merit of the enterococcus count for microbiological sanitary control of butter manufacturing. Enterococci are known to be frequent contaminants in Iowa creameries. They are not resistant to the pasteurization commonly employed for cream used in buttermaking, but are more resistant to salting, freezing and the microenvironment of butter than are coliform bacteria. Provided that Citrate Azide agar is used as the selective medium for enumeration, a standard of not more than 10 enterococci/ml for properly manufactured butter is proposed.

The presence of coliform bacteria, yeasts and molds in butter is believed to result from inefficient or insufficient pasteurization of ingredients or from unsanitary product handling during manufacture. There have been objections to the enumeration of these microorganisms for determination of the sanitary quality of stored or salted butter *(4, 6, 11, 12)*. Even in recent years, however, there have been reports of using the coliform test as a measure of the sanitary quality of butter *(3, 9, 14, 15)*. Although *Standard Methods for the Examination of Dairy Products (1)*, discusses the meaning of the yeast and mold count in relation to freshly churned butter samples, it disregards the possibilities for either growth or death of coliform bacteria in fresh or stored, salted or unsalted butter.

Coliform organisms could serve as an index of microbiological quality in butter if it were not for differences in viability related to species and strain dissimilarity, moisture and salt content, degree of working, and storage temperature and time *(2, 4, 6, 7, 11, 12, 15)*. Therefore, the coliform test is best used to detect sources of contamination with line-run samples *(11)*. A microbiological quality test to supplement use of the yeast and mold count would be desirable.

Fecal streptococci and enterococci have been used as indices of microbiological quality and sanitary history of many different foods *(13)*. Enterococci survive environmental conditions harmful to other microorganisms of sanitary significance. Since enterococci do not survive the minimum heat treatments used in the pasteurization of cream for buttermaking, the presence of enterococci in butter could be used to indicate improper processing, poor sanitation or careless handling.

This investigation was undertaken to assess the sanitary significance of enterococci in butter. The effects of salt, working and storage were studied by inoculation of enterococcus and coliform cultures of known salt-tolerance into cream before churning. Line-run and commercial butter samples also were examined for enterococcus, coliform, and yeast and mold content at various stages of manufacture and storage.

Materials and Methods

Experimental butter.

Equipment used for churning, working and storing butter was sterilized by autoclaving at 121 C for 1 hr. Whipping cream, heated in sterile Pyrex flasks with flowing steam for 30 min, was cooled in ice water and held overnight at 3 C. This treatment was sufficient to destroy all coliforms and enterococci that may have been present. One ml each of a 24-hr culture of an enterococcus and a salt-sensitive (SS) or a salt-resistant (SR) coliform was added per kg of cream. Nine churnings of cream were inocuated as follows:

Churning	*Inoculum*
1	*Streptococcus faecalis* + *Escherichia coli* (SS)
2	*S. faecalis* + *E. coli* (SR)
3	*S. faecalis* + *Aerobacter aerogenes* (SS)
4	*S. faecalis* + *A. aerogenes* (SR)
5	*S. durans* + *E. coli* (SS)
6	*S. durans* + *E. coli* (SR)
7	*S. durans* + *A. aerogenes* (SS)
8	*S. durans* + *A. aerogenes* (SR)
9	*S. faecalis* + *A. aerogenes* (SR) + butter culture

The cream was churned in small, table-top "Daisy" churns in 1-kg amounts, with precautions taken to avoid contamination. Butter granules were washed in chilled, sterile, distilled water. An electrically driven, sterile, reversed auger was used to work the butter in sterile, stainless steel beakers. The butter from each churning was divided into two lots; 2.0% sterile NaCl was added to one lot, and the second lot was left unsalted. Half of the salted and unsalted butter from each churning was worked properly the remainder was worked insufficiently. Degree of working was determined by time,

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appearance of the butter and the presence or absence of free moisture droplets as shown by indicator paper. In the last churning, 2.0 and 3.0% butter culture, respectively, were added to the salted and unsalted portions of butter. Appropriate controls were used to assure freedom from accidental contamination. The chemical composition of each lot was determined by routine Kohman analysis *(5)*.

Immediately after working, ten 2-oz samples from each lot of butter were placed into sterile screw-capped jars. Samples were held at 3 C and examined after 4 and 24 hr, 3 days, and 1, 2 and 3 weeks. A single 1-week-old sample was placed at −20 C and was examined after 8 weeks' storage. The remaining samples, after the 3-week storage period at 3 C, were transferred to a 10 C cabinet and were examined at the end of 4, 5 and 6 weeks. These temperature and time sequences were used to approximate commercial handling during merchandizing.

The coliform bacteria used were isolated from butter and were identified and tested for salt tolerance in liquid media. Single strains of *E. coli* and *A. aerogenes* that did not grow in more than 4.0% NaCl and single strains of *E. coli* and *A. aerogenes* that grew readily in 10.0% salt were chosen. Similarly, a typical strain of *S. faecalis* and one of *S. durans*, both capable of growth in 8.0% salt, were selected.

Line-run samples.

Line-run samples were collected from 17 different churnings at seven Iowa creameries. Samples were taken aseptically and represented the following products or procedures in the processing line: raw cream; pasteurized cream; cream from the holding vat; cream from the churn at the start of churning; cream from the churn after 2 min of churning; buttermilk; unwashed butter granules; washed butter; salted, finished butter and salted, finished butter after holding at 7 C for 7 days. The samples were stored and transported according to standard procedures *(1)*.

Commercial butter samples.

In this investigation, 486 commercial butter samples were used. Most samples (375) were obtained from various Iowa butter contests. The remaining 111 were procured directly from creameries in the state.

Enumeration procedures.

All bacterial estimates were made in duplicate.

Enterococcus count. The Citrate Azide agar of Reinbold et al. *(8)*, modified by increasing the sodium azide concentration to 0.4 g/liter, was used as described by Saraswat et al. *(10)*.

Coliform count. Violet Red Bile agar, incubated at a temperature of 35 C, was employed. The medium was prepared and used as described in *Standard Methods (1)*, except that sterilization at 121 C for 12 min was used.

Yeast and mold count. Yeast and mold counts were obtained with acidified Potato Glucose agar prepared and used in accordance with *Standard Methods (1)*.

RESULTS AND DISCUSSION

Experimental butter.

Chemical analyses indicated uniform composition for butter churned in such small experimental batches. The moisture content varied from 16.00 to 17.50%; milk fat, from 80.00 to 82.80%; curd, from 0.95 to 1.35%. There was only minor variation in salt content, from 1.95 to 2.05%.

Data representing average enterococcus and coliform counts are summarized in Table 1. For brevity, average counts obtained after sample storage at 3 C for 1 and 2 weeks and 10 C for 5 weeks are not reported. Similarly, individual counts for separate churnings are not presented. Figures given for *S. faecalis* are the average of duplicate counts for 5 different churnings; *S. durans*, 4 churnings; *E. coli* (SS), 2 churnings; *E. coli* (SR), 2 churnings; *A. aerogenes* (SS), 2 churnings; and *A. aerogenes* (SR), 3 churnings.

The data generally indicate a gradual decline in enterococcus counts during the 3-week storage at 3 C, although growth did occur in the unsalted, poorly worked butter inoculated with *S. durans.* This decrease in count continued during the subsequent 3-week storage at 10 C, although the number of *S. durans* in the unsalted, poorly worked samples continued to exceed the original inoculum. *Streptococcus durans* was more sensitive to salt during the latter, higher-temperature storage. Both enterococcus cultures were adversely affected, numerically, by salt during the 3 and 10 C storage periods, although not as markedly as the *E. coli* cultures. Considerable numbers of enterococci were able to withstand −20 C storage for 8 weeks. Salt did not have as pronounced an effect during frozen storage as at temperatures above freezing.

The greater sensitivity of coliform cultures to salt in butter is demonstrated by the reduction in count that occurred within 4 hr after salting. Coliform organisms persisted in unsalted butter, although more erratically than enterococci. The SS strain of *E. coli* was adversely affected by the microenvironment of either salted or unsalted butter worked properly or poorly. The reduction in viable count was more pronounced in the presence of salt. The SR strain of *E. coli* tolerated storage conditions somewhat better, but with this culture, the effect of improper working was more noticeable and resulted in greater count variation. Both the SS and SR strains of *A. aerogenes* grew in the unsalted butter. Either the increase in storage temperature from 3 to 10 C or the additional time reduced the numbers of the SS strain that had been increasing at 3 C. The SR strain increased more rapidly at the higher temperature in unsalted butter and in the salted, poorly worked butter. Even though the SR strain could tolerate 10.0% salt in a liquid medium, the microenvironment of butter permitted only little, if any, growth of the SR strain in salted, properly worked butter.

Frozen storage killed many of the coliform organisms in butter. However, degree of working affected survival, since, in unsalted, poorly worked

TABLE 1. AVERAGE ENTEROCOCCUS AND COLIFORM COUNTS IN EXPERIMENTAL BUTTER

Inoculum	Treatment		Storage temperature and time							
			3 C				10 C		—20 C	
	% Salt	Degree of working	4 hr	24 hr	3 days	3 wk	4 wk	6 wk	8 wk	
			<—— (%of 4-hr count[a]) ——>							
S. faecalis	None	Proper	84,000	101	110	85	81	57	46	(39,000)
	None	Poor	72,000	94	101	108	96	69	38	(27,000)
	2.00	Proper	49,000	82	73	55	51	33	37	(18,000)
	2.00	Poor	59,000	59	68	73	51	42	42	(25,000)
S. durans	None	Proper	13,000	92	108	77	58	42	15	(2,000)
	None	Poor	9,800	142	142	285	418	204	132	(13,000)
	2.00	Proper	4,300	65	72	51	42	12	28	(1,200)
	2.00	Poor	5,500	113	76	54	45	15	47	(2,600)
E. coli (SS)[b]	None	Proper	15,000	113	107	49	51	13	—[c]	(<1)
	None	Poor	22,000	68	59	29	25	14	0.1	(20)
	2.00	Proper	26	288	81	4	—	—	—	(<1)
	1.95	Poor	57	53	19	2	2	—	—	(<1)
E. coli (SR)[d]	None	Proper	27,000	119	100	74	48	20	3	(800)
	None	Poor	40,000	98	108	58	65	125	6	(2,400)
	2.00	Proper	330	52	39	1	0.6	—	0.3	(1)
	2.05	Poor	650	18	20	0.9	2	18	0.3	(2)
A. aerogenes (SS)	None	Proper	20,000	150	115	3,000	3,800	2,050	0.1	(29)
	None	Poor	10,000	130	310	50,000	50,000	7,800	80	(8,000)
	2.00	Proper	23	191	17	7,390	3,520	196	4	(1)
	2.00	Poor	34	617	470	20,000	35,200	3,820	—	(<1)
A. aerogenes (SR)	None	Proper	110,000	109	127	76	364	909	0.02	(17)
	None	Poor	160,000	106	144	88	500	875	0.9	(140)
	2.00	Proper	500	84	88	0.8	4	6	0.2	(1)
	2.05	Poor	1,300	115	36	3	77	254	—	(<1)

[a]Figures within parentheses in right-hand column indicate avg no. of indicator organisms/ml.

[b]Salt-sensitive strain.

[c]Represents count/ml of <1.

[d]Salt-resistant strain.

butter, these organisms persisted in greater numbers than in the properly worked sample.

Addition of flavor culture did not affect either the enterococcus or coliform count of butter as prepared and stored in this study.

Little work has been reported concerning experimental butter made with coliform-inoculated cream. Comparable information on enterococci is nonexistent. Hammer and Yale *(6)* stated that, in salted butter made from inoculated cream, *Escherichia* sp. did not grow at 7 C in 10 days, although some could grow in unsalted butter. *Aerobacter* sp. sometimes grew in salted butter and grew regularly in unsalted butter. Singh *(11)* determined that species and strain, amount of salt and storage temperature affected the coliform population. This study confirms these earlier findings and demonstrates that, under prescribed test conditions, enterococci are not prone to grow in properly worked butter and are more resistant to the adverse conditions occurring at —20, 3 and 10 C in both salted and unsalted butter.

Line-run samples of butter.

Enterococcus, coliform and yeast and mold counts representing line-run samples of 17 churnings from seven different creameries are presented in Table 2. Butter samples obtained from these creameries contained approximately 2.0% NaCl.

These data clearly reflect the utility of the coliform count when used as a line-run sampling test to indicate improper plant sanitation up to the time of churning or salting. Immediately following churning, only four of the 17 different churnings contained <1/ml. The addition of approximately 2.0% NaCl to butter was sufficiently harmful to the coliform bacteria to raise the total number of churnings containing <1/ml to 13. Following the 7-day storage

TABLE 2. AVERAGE ENTEROCOCCUS, COLIFORM AND YEAST AND MOLD COUNTS OF LINE-RUN SAMPLES[a]

Point of collection	Count: Enterococcus	Count: Coliform	Count: Yeast and mold
	<—————— (No./ml) <——————		
1. Raw cream	280,000	1,800,000	5,500
2. Pasteurized cream	1(8)[b]	<1(9)	<1(12)
3. Cream from holding vat	170(5)	450(4)	8(9)
4. Cream from churn	210(4)	480(5)	17(7)
5. Cream after 2 min churning	200(2)	510(2)	19(8)
6. Buttermilk	290(2)	1,300(2)	62(7)
7. Unwashed butter granules	30(2)	63(4)	37(8)
8. Washed butter	30	46(2)	36(4)
9. Salted butter	20(3)	2(13)	35(8)
10. Salted butter after storage at 7 C for 7 days	24(6)	2(14)	33(9)

[a]Each no. represents the average count of 17 churnings from seven selected plants.

[b]Figures in parentheses represent no. of samples containing a count of <1/ml.

at 7 C, another churning had decreased in coliform count to <1/ml. In addition, further detracting from the value of the coliform count, a related and pronounced decrease in the average numbers of coliform bacteria per churning occurred after salting.

Data related to the survival of enterococci further emphasize the value of this group as a sanitary quality index for butter. Considering individual churnings, enterococci were present in comparable numbers at the same manufacturing stages as were coliforms. Upon reaching the crucial stages of gathering the butter granules, salting and storing at 7 C for 7 days, the enterococci did not decrease or fluctuate as drastically in numbers as did the coliforms. Salting reduced the average enterococcus count from 30/ml to 20/ml; the coliform count decreased from 46/ml to 2/ml after this process. Storage of the salted samples did not change the average number of enterococci present per milliliter. Although the number of churnings with an enterococcus count of <1/ml at salting increased from three to six during storage, each of the butter samples contributing to this change originally contained only 1 or 2 enterococci/ml. This may reflect the effects of random sampling at a low population level.

Nine of 11 samples obtained from creameries using metal churns and satisfactory sanitary practices were considered bacteriologically acceptable. In one plant, using exceptionally clean equipment and proper practices, none of the three types of organisms could be detected in either of two churnings at any stage of the operation tested following pasteurization.

The number of churnings used in this study was small, but samplings were selected to represent different plant conditions and practices. Our observations and pure culture studies indicate that properly manufactured butter should not contain more than 10 enterococci/ml.

Commercial butter samples.

The data presented in Table 3 show the need for microbiological sanitation indicators other than yeast and mold and coliform counts for butter.

The yeast and mold count is meaningful when used in conjunction with enterococcus and coliform counts or the enterococcus count alone. Samples containing a count of more than 20 yeast and mold/ml usually showed the presence of either coliforms and enterococci or enterococci without coliform bacteria. Only a few samples, 0.6%, contained a large number of yeasts and molds without other organisms being present. Large numbers of coliform organisms (more than 10/ml) were present only when accompanied by the other sanitary indicators. It is especially meaningful that *none* of the samples contained *only* coliform bacteria without other sanitary indicators. There was significant correlation between large numbers of enterococci (more than 10/ml) and of other organisms; only 6.4% of the samples contained more than 10 enterococci/ml in the absence of other indicator organisms.

The ubiquity of enterococci in creameries and butter, and their resistance to the unfavorable micro-

TABLE 3. OCCURRENCE OF ENTEROCOCCI, COLIFORMS AND YEASTS AND MOLDS IN COMMERCIAL BUTTER SAMPLES

Type of indicator organism(s) present	Enterococcus count/ml		Coliform count/ml		Yeast and mold count/ml		Total no. and % of samples containing organism(s):
	No. and % of samples in range of:						
	1-10	>10	1-10	>10	1-20	>20	
1. Enterococcus, coliform, yeast and mold	6[a](1.2)[b]	57(11.8)	26(5.3)	37(7.7)	13(2.7)	50(10.3)	63(13.0)
2. Enterococcus, coliform	10(2.1)	19(3.9)	23(4.8)	6(1.2)	–[c]	–	29(6.0)
3. Enterococcus, yeast and mold	33(6.8)	31(6.4)	–	–	36(7.4)	28(5.8)	64(13.2)
4. Coliform, yeast and mold	–	–	4(0.8)	3(0.6)	7(1.4)	0(0)	7(1.4)
5. Enterococcus only	123(25.3)	31(6.4)	–	–	–	–	154(31.7)
6. Coliform only	–	–	–	–	–	–	–
7. Yeast and mold only	–	–	–	–	21(4.3)	3(0.6)	24(4.9)
8. None	–	–	–	–	–	–	145(29.8)
9. Totals	172(35.4)	138(28.5)	53(10.9)	46(9.5)	77(15.8)	81(16.7)	486(100.0)
10. Combined totals	310(63.9)		99(20.4)		158(32.5)		

[a]No. of samples containing indicator organisms in indicated numerical ranges.

[b]Figures in parentheses represent % of the total sample no. (486).

[c]No indicator organisms in samples in indicated numerical range.

environment of butter, is shown by the presence of enterococci in 63.9% of the samples. Slightly more than 28% of all samples contained more than 10 enterococci/ml. The large percentage (35.4) of samples containing 10 enterococci/ml or less is rather deceptive, since many of these contained an average of only 1 or 2/ml.

Although more stringent than the use of yeast and mold and coliform counts, a count of not more than 10 enterococci/ml of butter is not unattainable, nor would it be unduly restrictive for a properly managed creamery. The use of enterococcus and yeast and mold counts should prove to be valuable correlative tests in the sanitary control of butter manufacture.

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EFFECTIVE METHODS OF TRAINING FOOD-SERVICE PERSONNEL[1]

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Progress is achieved by man's changing concepts of need and method of achieving an acceptable fulfillment of the need. The early endeavor to secure safe food handling consisted of maintaining a file of volunteer health histories on each food-handler. This program fell by the wayside for obvious reasons. A little later the emphasis was placed on the technique of the bacteriological examination of equipment and utensils. This technique is still a useful procedure in determining the effectiveness of the sanitizing procedures but cannot be depended upon as a singular effective program.

The importance of the personal hygiene concept was an outgrowth of the inadequacies of the earlier programs. As early as 1938, the Texas Health and Educational Department and the Flint, Michigan Health Department developed programs for the training of food-service employees. The underlying philosophy of these programs was to alert the employees to the hazards involved in the neglect of personal hygienic habits and to motivate the individual to change from poor to good habits in the daily routine operational procedures.

The 1943 edition of the Public Health Service Recommended Ordinance and Code Regulating Eating and Drinking Establishments *(2)* promoted food-service personnel training. Visual and audio aids were made available to the states. Demonstration courses were held throughout the United States.

By 1946, this type of program had become national in scope. Some areas made attendance mandatory by legislative action. Owners and managers were encouraged to attend, but such attendance was rarely developed to the productive stage.

Management Training

In order to promote safe food handling by employees, the management must be informed and be willing to accept the basic principles of sanitation and personal hygiene in order to motivate the compliance to these principles by the employee. It must also acknowledge and accept the economic importance of the sanitation concept. The development of this concept as a business asset is fundamental to a successful management course of training.

It is more economical for health agencies to conduct a few "top notch" courses for supervisory personnel than to attempt a large number of mediocre courses directed toward the service personnel.

Kotschevar *(1)* of Michigan State College estimates that 20 per cent of all eating establishments in the United States serve 80 per cent of all meals eaten out. Would it not be reasonable, therefore, to direct the training to the persons fully responsible, if we are to reduce the food-borne disease incidence rate attributable to the eating and drinking establishments?

A Cooperative Training Endeavor

A health department of one state has developed a cooperative training endeavor with the State University. The three-day course is divided so that one and one-half days are devoted to subjects dealing with sanitation, and the balance of time delves into the economics of food-service management. A tuition of $25.00 is charged. Attendance has been beyond expectations.

The University provides books, reference material, visual aids, and assistance in program development. Resource personnel are obtained to supplement the members of the staff, present lectures, and evaluate the curricula attainment. One of the attainments of this evaluation program has been job performance sheets for the small, the family, and the large restaurant operator.

The health department staff cooperates with the University as co-sponsor of training programs by presenting lectures and otherwise accepting responsibility for the sanitation aspects of the course. Further service is available to the industry in the form of pilot courses as a service to management.

Advantages of Owner-Operator Training

The value of good health is a recognized commodity to the individual and to the community. This is and should be self-evident. However, a well developed agenda will emphasize the responsibility of the supervisor for the maintenance of good health for his customer, the community, his employees, as well as the economic self-interest.

[1]Presented at the 14th Annual Meeting, Indiana Association of Sanitarians, Indianapolis, Indiana, June 4, 1964.

A prime interest of management is the increase in sales. Sales appeal is dependent upon wholesome food served in an appealing manner. Food served in a progressive atmosphere in clean, wholesome dishes, by employees observing acceptable personal hygienic habits is the debit upon which "good will" is determined.

The subjects incorporated into the agenda should be aimed at increasing job effectiveness. When such topics are properly handled they should reduce the item costs, labor turn-over, and improve morale and initiative of the manager, who in turn can motivate his employees.

The cooperative effort of the university faculty, members of industry, and the regulatory official should place the health official on a consultant basis to industry rather than that of an enforcement agent.

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SANITARY DESIGN AND EVALUATION OF FOOD SERVICE EQUIPMENT[1]

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The design and evaluation of food service equipment has been a part of man's cultural evolution. The cooking of a fish, deer or some other animal over the ashes of a campfire may be pleasant memories to the modern day outdoorsman, but to our ancestors such food preparation was an advanced art. Today we enjoy the advantages of environmental progress of food sanitation in luxurious surroundings such as we are now experiencing, and tend to take for granted such progress as a part of our modern culture. There are many present here today who have had a great influence in establishing the philosophy that has brought together the forces of industry, government, and the public to develop criteria and specifications for food service equipment and operations that provide the proper environment in which to prepare, handle, and serve food.

The design of food service equipment, to be of greatest use to the operator or user, must meet a number of criteria. The operator wants the equipment to be functional, long lasting, easy to use, service and maintain, and to be as economical as possible. The Sanitarian wants it to be safe from public health hazards, easy to clean, free of built-in harborages, and built so that food protection can be attained. The designer and manufacturer is concerned with giving the purchaser as much for his money as possible and still have an attractive, functional, and public health acceptable unit. There is a possibility of conflict between the various interested parties. It is important, therefore, that the public health criteria for the design of food service equipment be acceptable to all parties concerned; otherwise the manufacturer of the equipment will experience unnecessary obstacles during the construction and installation of the equipment.

It was the recognition of these facts that led to the establishment of the Food Equipment Standards Committee of the National Sanitation Foundation. The Joint Committee on Food Equipment Standards is composed of membership from most professional public health organizations and interested associations and groups. Membership on this committee is by appointment by the specific organization being represented[2].

National Sanitation Foundation Standards

The Joint Committee on Food Equipment Standards considers all aspects of the equipment as it might affect the public health. The Standards developed by the Joint Committee encompass the recognized needs for uniformity of specifications. The lack of standard or uniform equipment specifications has been confusing and expensive to industry. For many years, health authorities have prepared regulations and ordinances governing the sanitation of food establishments. These regulations and ordinances have placed the responsibility of accepting various types of food equipment upon the health departments without definitive specifications covering the equipment. Manufacturers of equipment were often plagued with differences in requirements in the various states and were inclined to question the professional qualifications of some of the sanitation officials who freely expound with conflicting opinions on what they term "essential sanitation requirements" for food service equipment. This need for uniform Sanitation Standards was recognized by many leaders in public health and through their efforts the American Public Health Association and the Conference of State and Territorial Health Officers requested the National Sanitation Foundation to "develop Standard for various phases of Sanitation".

Design of Sanitary Food Service Equipment

Standards and Criteria for food service equipment must be based on facts and on sound engineering and sanitation practice. In many instances additional facts are needed before a particular standard can be prepared, and research is necessary to provide the factual information. Such research must be practical and must take into consideration the interests of the entire industry and the public health official and be designed to render a service to the general public.

Any effective public health standards program must be designed with the public in mind. It can also then be useful to the manufacturers of equipment, to the users of the equipment, and to the public health agencies as the responsible enforcement departments. Everyone will benefit because uniformity of design

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[1]Presented at 51st annual meeting of the International Association of Milk, Food & Environmental Sanitarians. Portland, Oregon, Aug. 18-21, 1964.

[2]Information on organization, function and programs of the National Sanitation Foundation may be obtained on request to the author.

and construction makes compliance with fundamental sanitation regulations possible.

Principals for the Sanitary Design of Food Service Equipment

Many factors must be considered in the establishment of criteria for the design of food service equipment that will be uniformly acceptable to the user and public health official alike.

Some of the general principles for the design and construction of food service equipment may be listed as follows:

1. The equipment should contain the fewest number of parts to do the required job efficiently. This should also permit the equipment to be disassembled, maintained, and easily cleaned. In some instances it is necessary that in-place cleaning be practiced due to the design of the equipment.
2. All parts of the equipment coming into contact with food products should be readily accessible for examination and cleaning or readily removable for cleaning and inspection.
3. A proper radius should be provided to permit ease of cleaning the product contact surfaces.
4. The joining of metal should be such as to effect a smooth, easily cleanable food contact surface.
5. All surfaces within the product zone must be smooth, free of pits, crevices, or other difficult-to-clean areas.
6. Food contact surfaces should be non-absorbent, non-toxic, odorless, and unaffected by the food products and cleaning compounds.
7. Toxic metals such as cadmium, lead, and (copper and its alloys and other metals which may deleteriously affect the foods) should not be used. The same consideration must be given to certain plastics which are not acceptable for food contact applications.
8. The product zones must be free of recesses, open seams and gaps, ledges, inside threads and shoulders, and bolts or rivet heads.
9. Gaskets, packing and sealing materials must be non-toxic, non-absorbent, and unaffected by food products or cleaning compounds, and so installed as to be easily cleanable.
10. Splash zone areas should be designed and constructed so as to permit frequent cleaning.

The Joint Committee has agreed that there are four basic sanitation fundamentals around which the details of NSF Food Equipment Standards are developed. These requirements specify that the construction of the equipment be of (1.) materials that are suitable, non-toxic, easily cleanable, and will not chip or crack, and get into food. The design and construction must also provide for (2) ease of cleaning, (3) the elimination of harborages of insects, dirt, or bacteria, and (4) for food protection.

Basic Criteria for Food Service Equipment

Utilizing the four basic sanitation fundamentals listed above, the Joint Committee on Food Equipment Standards has developed a general format for NSF Food Equipment Standards. In Basic Criteria C-2 the pattern of specifications for design of sanitary food service equipment is established. The Criteria, as are all NSF Standards, is divided into a number of sections which are briefly discussed as follows:

1. *General Provision*

This section sets forth the coverage of the Standard or Criteria. Exceptions that might be indicated are enumerated and applicable special requirements may be listed. The first section also indicates that the criteria or standard specifications are established as minimum requirements and that "variations may be permitted when they tend to make units more resistant to wear, corrosion, or more easily cleanable". Provision is also made for compliance, under existing NSF Standards or Criteria, of units which have components or parts covered by such requirements. Alternate Materials may be permitted when they can be "proven to be equally satisfactory from the standpoint of sanitation and protection of the product".

A provision is also established for the periodic review of all NSF Standards or criteria at intervals not to exceed three years. This policy sets a basis for revision of standards to keep them up-to-date with technological advances of industry and with progress being made in public health. The Standards therefore are not stagnant and may be revised whenever either industry or public health leaders feel there is need for revision. It is interesting to note that the majority of the requests for upgrading and tightening-up of the Standards come from industry. At the present time two Standards, No. 1 and No. 3, are being revised. Standards No. 2 and No. 7 have recently undergone extensive upgrading revisions.

2. *Definitions*

The section on definitions is designed to include words or terms used frequently throughout the specifications and with specific meaning. For example, the word "accessible" is defined as follows: "Accessible shall mean readily exposed for proper and thorough cleaning and inspection with the use of only simple tools, such as a screw driver, pliers, or open-end wrench". This definition would be specific to the standard and would not be found in a dictionary so stated. Other terms such as "zones" or "contact surfaces" are defined to be specific for use in the Standards. For example the equipment zones are divided into food zone, splash zone, and non-food zone. Each area indicates the degree of protection that must be effected by the materials used and the design and construction of the equipment.

3. *Materials*

The section on materials sets forth the general use of materials that will permit the design and construction of equipment which will withstand normal wear, penetration of vermin, the corrosive action of foods, cleaning compounds and such other elements as may be found in the use environments and will not impart an odor, color or taste to the food products. Specific coverage of materials that are suitable for product contact surfaces, splash contact, and non-product contact surfaces is outlined under the materials section.

This section also covers special materials that may be used in fabrication, such as welding or soldering compounds, plastic resin systems, sound damping materials, and any other special material that might find application in the manufacture of food service equipment.

4. *Design and construction*

Having set forth the general coverage, detailed the word usage, and established material specifications, it is now possible to specify how the equipment shall be designed and constructed to meet acceptable public health criteria. This is perhaps the most important section of a Standard. It must be adequate to assure public health protection; it must result in equipment that is functionable, usable, cleanable, and economical; otherwise the operators cannot afford to have it in their establishments.

The NSF Standards specify under design and construction the acceptable requirements in each of the zones defined under the Standard. The product contact surfaces must be designed and constructed so that they are readily accessible and easily cleanable, either in an assembled position or when removed. More critical radii and fabrication requirements are necessary for product zones in order to meet the function and cleanability requirements.

The splash and non-food contact surfaces are designed and constructed to less critical specifications, but they must be properly coordinated with the requirements for product zones.

The design and construction section must be in sufficient detail to permit the manufacturers to utilize a variety of fabrication equipment, techniques and methods of production and still comply with the Standard. In other words, one manufacturer might use body construction in which the sheet metal is so formed without general interior framing while another manufacturer might choose to use angle framing over which the sheet metal is applied. There are specific provisions each manufacturer must comply with in order to produce a comparable piece of acceptable food service equipment.

This section must detail the requirements for construction of doors, access panels, openings into tops, provide for gaskets, shelving, louvers and openings for compressors and evaporators, and take into consideration the method of mounting of the equipment whether on legs and feet, casters, or sealed to the floor or counter. There is often the necessity for temperature controls for use in heated or refrigerated equipment and consideration must be given to the protection of food from broken glass or similar contaminants from fixtures and devices within the equipment. Many items of equipment must be designed and constructed so that water and waste connections may be properly made at the time of installation. This is quite significant when related to the operation, maintenance, and cleaning of the equipment.

5. *Installation*

No sanitation equipment standard is complete without the inclusion of the best recommendations obtainable for installation of the equipment. Here again the knowledge and advice of all parties—designer, manufacturer, user, and sanitarian—are essential in order to obtain proper installation criteria.

It should be stated at this point that the NSF Joint Committee on Food Equipment Standards has implemented the development of a Manual on Installation of Food Service Equipment. A small committee of public health, industry, and design and layout experts are now engaged in the preparation of a final draft of the Manual which will be submitted to the Joint Committee for their consideration at the next annual meeting of the committee.

NSF STANDARDS IN USE

The same general format is followed in the development of all NSF Food Equipment Standards. The following is a list of such Standards now in use and against which evaluations of equipment are being made to permit the use of the NSF Seal of Approval:

1. Soda Fountain and Luncheonette Equipment.
2. Food Service Equipment and Appurtenances.
3. Spray-Type Dishwashing Machines.
4. Electric and Gas Commercial Cooking and Warming Equipment.
5. Hot Water Generating Equipment (Gas and Electric).
6. Dispensing Freezers.
7. Food Service Refrigerators and Food Service Storage Freezers.
8. Commercial Powered Food Preparation Equipment.

C-1. Vending Machines.

C-2. Special Equipment and/or devices.

A Standard on Automatic Ice Making Equipment was accepted by the Joint Committee at their annual meeting in April 1964. It is anticipated that equipment conforming with this Standard will be available early in 1966. There is agreement among the manufacturers that extensive redesign in the majority of ice making equipment is indicated which will require the additional time before NSF approved units will be available.

There are several other food equipment standards in various stages of consideration, covering such equipment at Pot & Pan Washers, Fly Repellant Fans, Filters for use in Ventilation Equipment, Wood Top Tables, and others.

A new Criteria on Continuous Cloth Towel Dispensers has just been released and equipment carrying the NSF Seal is now available under this Criteria.

EVALUATION OF FOOD SERVICE EQUIPMENT

The NSF Testing Laboratory, a totally owned corporation of the National Sanitation Foundation, was organized at the request of Industry and Sanitation Officials to provide a research and evaluation facility for the National Sanitation Foundation. The purpose of the Testing Laboratory is to perform research in environmental health, to test and evaluate equipment and products for compliance with NSF Standards, and to govern and control the NSF Seal of Approval. The Testing Laboratory can make specific charge for testing products or it can assess a "Listing Charge" for the examination and evaluation of equipment or products for compliance with NSF Standards. The administrative and professional staff of the Testing Laboratory are all professional public health sanitation personnel with many years' experience with local, state and federal health agencies, and with universities concerned with the teaching of environmental health subjects.

The Testing Laboratory does not have responsibility for the development of NSF Standards. The Executive Director of the Testing Laboratory serves as Secretary for the Joint Committee on Food Equipment Standards (as well as on other types of standards covered by the National Sanitation Foundation), and in that capacity can make suggestions to the Committee members, based on the experiences of the Laboratory Staff in using existing NSF Standards in testing and evaluating equipment or products. The primary function of the Testing Laboratory is out to govern and control the NSF Seal of Approval which is currently awarded to over 500 food equipment manufacturers for use on more than 12000 items of equipment or products.

The Testing Laboratory staff visits the manufacturing plants of all companies authorized to use the NSF Seal of Approval. This authorization is for one year only. The continued use of the Seal may be granted by the Board of Directors of the Testing Laboratory following a satisfactory report of re-examination at the point of manufacture. It is necessary therefore that the authorized staff of the NSF Testing Laboratory have access to to the various manufacturing plants at any time and without prior notification. The NSF Seal of Approval is issued to the equipment manufacturer upon an agreement that he will abide by the policies of the NSF Testing Laboratory governing the use of the NSF Seal of Approval.

PERFORMANCE TESTING

In several of the NSF Standards on food equipment there are sections setting forth specifications for performance. For example, the standards covering spray-type dishwashing machines, water generating equipment, refrigeration equipment, dispensing freezers, vending machines, and others provide for the performance testing of the equipment in addition to setting forth specifications for determining compliance with the materials, design and construction requirements of the Standards.

Let us for example consider the evaluation of spray-type dishwashing machines. Our laboratory staff visits the dishwashing machine manufacturing plant and selects the machines to be tested. In many instances, particularly with the smaller door-type machines, we prefer to have the units shipped to our laboratory where more definitive testing techniques utilizing radio-active tracer soil may be used. The large conveyor units, because of their size and cost of shipment are tested in each of the manufacturer's laboratories.

One of the requirements for the use of the NSF Seal of Approval is that the manufacturers of equipment requiring performance testing have their own quality control. We take our own recording temperature and pressure measuring equipment to the dishwasher manufacturing laboratory to determine the performance ability of the dish machines. As the testing program has progressed we have found it necessary to have each dish machine manufacturer ship to our laboratory the various pumps and motors used on all their dishwashing machines so that we could develop pump curves on all pumps used in the industry. This now permits us to take the operating pressure of any pump on a dishwashing machine in a manufacturing plant or at an installation and determine from our pump curves the volumes of water being pumped over the dishes in any machine. The volumes and pressures of final rinse water are determined and with the recording potentiometer, to which thermocouples are attached, we are able to continuously measure the temperature build-up in the dishes or on the dish surfaces as the dishes pass through a dishwashing cycle. Specially soiled dishes containing a soil which has been baked-on at 170 F for 17 hours are used to measure the ability of the dishwasher to clean dishes.

There are other performance tests such as determining the specified wash and rinse times, the area of coverage through the wash and rinse sections of the machines, and measuring the rinse water pressure at the dish machine. The revision to Standard No. 3 is removing the un-realistic rinse pressure requirement of 10 psi at the rinse jets. This amount of pressure, if attainable, would blast dishes out of the racks. The realistic pressure is 20 psi at the machine where the water line enters the rinse manifold. This can then be coordinated with the proper volume of rinse delivered through the rinse nozzles.

When performance evaluation has been completed, we then carry out the general evaluation of the dishwashing machines in the same manner as all equipment or products are measured against the NSF Standards. First we determine whether acceptable materials are used in each of the zones, (product, splash and non-product). Then the shop drawings and specifications of the manufacturer are examined to see whether there are variations from the details in the Standard. Next, the equipment is evaluated to determine compliance with the design and construction requirements of the Standard. It is preferable to start at the point where materials are received and then follow the lines of fabrication until the finished product is reached. In this way it is easy to determine whether there are hidden or built-in harborage areas for insects or vermin and whether the details of the Standard are being followed.

WHAT NSF SEAL OF APPROVAL MEANS TO PUBLIC HEALTH OFFICIALS

The NSF Seal of Approval identifies items of equipment, devices, or products meeting high standards of sanitary significance. The Seal signifies compliance with NSF Standards which have been jointly developed by all parties concerned. The NSF Seal is a copyrighted device and no manufacturer can use the Seal without proper authorization.

However, the fact that an item of equipment carries the NSF Seal does not mean that it be accepted without proper examination. For the most effective use of the Standards and Seal of Approval program, all local, state, and federal sanitation officials should make thorough examination of equipment as it is installed. Where discrepancies are noted or construction is questioned, the office of the Testing Laboratory should be notified so that it can handle the matter with the manufacturer to assure compliance with the Standards and prevent future violations.

THE BROAD SPECTRUM

Many sanitarians believe the NSF Program is concerned only with food equipment. Actually the scope of the program of the National Sanitation Foundation is as broad as the total field of environmental health. Other NSF Seal of Approval programs, involving a total of over 1200 manufacturers, include a testing and evaluation program on plastics for potable water use and for drain, waste and vent applications. Also, a swimming pool equipment and products approval program covers diatomite earth filters, skimmers, sand filters, and chemicals used for swimming pool application.

Several research studies including the development of a use and wear test for the evaluation of materials and finishes used in food contact applications may be of interest. Another study relates to sewage and drainage needs in Metropolitan Detroit. (A similar study dealing with water needs was completed several years ago by the Foundation). A study of background radiation covering a 50 mile radius around the power reactor at Monroe, Michigan is still in progress. Cleanability studies are continuing and a new research study soon to be started will deal with the problems of "packaged" sewage treatment plants.

Whether the problem relates to food, water, air, shelter, wastes, or some other environmental health concern, the National Sanitation Foundation utilizes the same proven methodology in dealing with the problem. By bringing together, on neutral ground, all the interested parties for thorough discussion of any environmental health problem, proper solutions can be found that will be of benefit to all concerned, including the public. This is Democracy in Action.

NEEDED: A RELIABLE FIELD DETERMINANT OF CLEANLINESS

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All milk and food safety and quality control statutes, ordinances, regulations and most operating instructions prescribe that the environment and the equipment in which edibles are produced must be clean prior to each use. Hence, "clean" is probably the most-frequently used word in the vocabulary of regulatory milk and food and industry sanitarians.

In spite of the frequency with which the word is used, concepts of the precise meaning of "clean" vary widely. Sanitarians are generally pragmatic and practical. The connotation of "clean", as applied to meat packing plant or fish cannery floors and walls, or to the supports and exteriors of processing or transport equipment, may differ materially from the concept of "clean" as applied to product contact surfaces of production, transport, processing, or service equipment. The widest differences in concept of "clean" occur between individuals. But varying concepts of "clean", in differing situations and at different times, are often to be noted in the same individual. Such differences in concept of the meaning of "clean" multiply the difficulties of precisely defining the term.

The concept of "clean", as the term is employed in this discussion, will be clarified if it is understood that it shall deal with means for determining the degree of cleanliness solely of equipment employed in the production, transport, storage, processing, or service of foods, beverages, dairy products, and other edibles. It is not to be misunderstood to pertain to the asepsis sought in pharmaceutical manufacturing establishments and in surgical operating rooms.

Consequently, the concept of "clean" as applied to equipment surfaces, for the purposes of this discussion, shall be: "completely free of soilage residual from any preceding use, as well as of extraneous contamination".

In the field of milk and food sanitation, "soilage" includes unremoved overflow or spillage of product; accumulation of unusable product or product parts, such as shells, husks, vines and seeds; accumulation of animal offal or excreta; results of ineffective drainage; rubbish; evidence of rodent and/or insect infestation; presence of soil or dust from the exterior. Soilage and accumulations of these natures is readily visible to those who know what to look for and where to look. In a category of cleanliness in which the objective is attained with tools such as push-brooms, shovels, and high-pressure hose streams, differences of opinion as to when or whether cleanliness has been achieved are unlikely to be pronounced.

Soilage of equipment in which milk or food are stored, transported, processed or served includes residues of product or of one or more of its ingredients or components, deposited water minerals frequently impregnated with milk solids or food particles, film of detergent or sanitizer chemical salts, human saliva and oral bacteria, and lipstick. Soilage of these types is not in all instances as readily visible as is lipstick.

Not readily visible soilage is frequently unnoted in its incipiency and tends to become cumulative. Most experienced sanitarians will probably concede that much of the milk and food equipment currently in routine service approaches technical cleanliness only in degree. In fact, a knowledgeable assay of the situation appears to warrant the conclusion that "relatively clean" is the most accurate term for the condition of much of the milk and food equipment currently in use.

After sixty or more years of progressive advancement in other phases of milk and food sanitation, what is the explanation of the absence of a standard of "technical cleanliness" in sanitation legislation, the attainment of which all regulatory and industry sanitarians aspire? Is it possible that the detergents employed are not sufficiently powerful? Are washing techniques to blame?

In the absence of widely-employed reliable field test procedures for the determination of technical cleanliness, no reference bank of experience has been accumulated to serve as the basis for concluding in the field whether the cleaning capacities of detergents or the washing techniques, or both, are to blame for the dilemma in which sanitarians find themselves. If that statement is subject to challenge, suppose we review the list of tests which have been developed for determining the cleanliness of milk and food equipment prior to use.

First, however, it is desirable that the implication that much milk and food equipment is NOT technically clean prior to use be established, as the premise for subsequent discussion. So long as the vast majority of the appraisals of the state of cleanliness, after washing, of milk and food equipment surfaces are predicated upon observations by the unaided vision of milk producers and operating or clean-up

[1]Adapted from a paper presented at the 51st Annual Meeting of the Chemical Specialties Manufacturers Association, Atlantic City, N. J., December 7, 1964.

personnel, or by the spectacle-supplemented vision of sanitarians, it must be conceded that a number of factors affect the reliability of the findings. Some of these factors are:

1. The accuity of vision (whether unaided or whether augumented by spectacles) and perceptiveness in observation vary widely among individuals.

2. The intensity of lighting — natural or artificial — is usually inadequate and appraisals of cleanliness are unreliable.

3. Films of some product residues and even light encrustations of milkstone are masked when equipment surfaces are wet. Few regulatory inspections are prolonged or postponed so as to provide an opportunity for equipment to dry.

4. Films of components of some products (proteins, for instance) are not readily detectable visually even when equipment product-contact surfaces are dry.

Every visual appraisal of the state of cleanliness of equipment surfaces is subject to reduction of its reliability by one or more of the factors enumerated. Since regulatory inspection, on the average, occurs not more than once in 200 or more uses of equipment, it is quite apparent that claims or even assumptions of routine technical cleanliness of equipment prior to its every use are unsupported and possibly untenable.

What accounts for the relative lack of emphasis, by regulatory sanitarians, upon the maintenance of a closer approach to technical cleanliness of milk and food equipment? A thoughtful review of trends during a personal experience of nearly fifty years in milk and food sanitation leads to the conclusion that at least two causes may be said to have been contributory or responsible.

First, for more than a generation (since the late 1930's) the emphasis has been upon the sanitization of equipment to keep the total bacterial content within legal limits or of beverage service glasses to prevent the spread of oral infection. The effectiveness of the equipment washing operation was relegated to the status of a relatively minor factor in sanitation while progressively higher concentrations of sanitizing solutions were recommended.

Second, no officially-accepted practical method or device for the field demonstration of technical cleanliness is available to regulatory sanitarians and quality control personnel. Without such a test procedure conveniently usable anywhere in the field, and officially recognized to be reliable so that findings are acceptable as evidence in court, sanitarians are seriously handicapped in the assay of the state of cleanliness of equipment. This situation constitutes a rather pointed commentary on the progress made in more than half-a-century in a fundamentally-important aspect of milk and food sanitation — the washing operation.

The statement that there is a lack of convenient and reliable tests for cleanliness is made on the basis of the author's acquaintance with rather considerable literature on the general subject of the evaluation of the effectiveness of detergent solutions, for which various tests or measures have been devised. An analysis of the subject matter of forty or more papers indicates it to be classifiable as follows:

(1). Means for determining the comparative effectiveness of detergent solutions, employing for each series of tests blocks or discs of the same material, surface finish, and surface area. Proposed determinants of detergent effectiveness have included: *(a)* measurement of the amount of residual soil of various suggested compositions which had been dried or baked on the test blocks or discs, *(b)* estimation of the number of residual bacterial cells, a heavy inoculum of which had been dried on the blocks, and *(c)* in one proposal, estimation of the number of residual bacterial cells after washing and sanitization of the test blocks.

(2). Methods for assaying the "cleanability" of equivalent areas of materials of various composition and surface finish after soiling with typical milk or food products and then washing by a controlled procedure with a solution of a representative formulation of a typical detergent. In several procedures findings are also predicated upon the relative total counts of residual bacterial cells, either after washing or following washing AND bactericidal treatment.

A variant of this test procedure consists of the determination of the effect of detergent and sanitizing solutions upon the surface finish, distortion, and compound stability of sample blocks of plastic materials of different compositions.

(3). Methods for determining either the comparative effectiveness of detergent solutions or the cleanability of materials and surface finishes by radiological measurement. Isotope-tagged elements or bacterial cells are added to synthetic soils or to product normally processed and, after the washing of the surfaces, the residual radio-activity is determined with a Geiger Counter.

It must clearly be apparent that, although the radiological test procedure might have limited field application for the determination of equipment cleanliness in operations in which product of very high quality or of a pharmaceutical nature is prepared in large volume, neither it nor either of the other two types of test procedure outlined has the remotest practical application to the general field-testing needs of regulatory sanitarians.

As a matter of fact, sanitarians have developed on their own initiative a number of more or less reliable tests for the cleanliness of equipment surfaces. Armbruster *(1)* lists nine such tests. A number of the tests of cleanliness employed are really observable physical phenomena which may be noted either when surfaces are clean or are not clean, as the case may be. These may be enumerated as follows: *(a)* the water break in which the degree of cleanliness is indicated by the complete sheeting off of the rinse water without separating into rivulets; *(b)* the droplet test whereby droplets adhere to unclean surfaces; *(c)* the salt test utilizing salt sprinkled on wet surfaces to render more visible the adhering moisture; and *(d)* the carbonated water test whereby gas bubbles adhere to soil films on unclean surfaces.

The presence of actual soil still may have to be proven to the satisfaction of management or to the individual responsible for the washing operation and the value of such tests as admissable evidence in court is questionable.

In contrast to observable phenomena as indices of the presence of soilage, a number of methods have been advanced for the positive determination of the presence of residual soilage on washed surfaces by means of reproducible physical or chemical tests. However, because only completely negative findings of tests of this nature provide reliable evidence of technical cleanliness, incorrect or careless test procedure may provide findings which are not only misleading, but may also result in unjustified punitive action.

One such physical test makes use of the fluorescence of some organic matter under ultraviolet or "black" light. When the test is conducted in darkness and the residual soilage consists of matter which has fluorescent characteristics, contamination which might otherwise escape inexperienced observation is revealed. However, reliable findings are dependent upon the relative absence of light from other sources, the strength of the batteries used, and the wavelength of the ultraviolet light generated.

In the late 1940's E. Domingo *(4)* amplified the effectiveness of ultraviolet light in revealing the presence of residual soil, particularly on dishes and kitchen utensils, by first flooding the surfaces to be examined with a water-soluble fluorescent dye. Subsequently, dry powdered fluorescent dyes have been employed for dusting on surfaces to be examined under "black" light. The dye adheres to all types of contamination (after rinsing) and reveals its presence under less intensive ultraviolet light than is required when dye is not employed.

Within the past several years Armbruster and Ridenour *(2)* have devised a test procedure for determining the effectiveness of the washing-sanitizing of soda fount and tavern glasses, also making use of a dye. Washed and sanitized and drained dry glasses are dusted lightly with a mechanical mixture of talc (85%) and Safranin-O dye (15%). When wetted the dye becomes red. Dusted glasses are subjected to a gentle rinse for 5 seconds, or until runoff is no longer red. Since the dye-impregnated talc clings tenaciously to residual organic matter on the glass, the appearance of red spots or areas on drained glasses is an index of ineffective washing.

Beck *(3)*, who employed this test in a study comparing its findings with bacteriological swab counts on approximately 1300 soda fount glasses, is enthusiastic concerning the practicality of the test and its psychological and educational value. However, he warns against its use on plastic tableware or on cracked or eroded china. The 15% Safranin-O concentration of the applied powder makes the test extremely sensitive in the hands of all except colorblind individuals. The procedure is quite suitable for the testing of glasses, dishes, or other equipment or parts which can be dusted and flooded over a sewer-connected sink or wash vat. This test procedure, however, appears to be quite unsuited to field application to stationary equipment, such as farm milk cooling tanks, automotive transportation tanks, storage tanks, processing vats, and milk piping circuits. The talc-dye powder becomes air-borne in the slightest draught and adheres to all objects with which it comes in contact. Upon being wetted or becoming damp it becomes RED and this includes the hands, faces and starched shirts of test personnel and observers.

There remains for discussion only the bacteriological swab-count as a determinant of the approach of a washed surface to technical cleanliness. The bacteriological swab-count was devised as a means for approximating the numbers of micro-organisms residual on surfaces which have been washed and sanitized, and any number less than 100 per 8 in.^{2} of swabbed surface has officially *(5)* been declared to be indicative of an acceptable degree of safety.

In recent years, however, an adaptation of the above-described equipment surface swab-counts has come into quite general use as a measure of the effectiveness of only the first of the components of the successive washing and sanitizing operation. The thesis is that completely effective washing should result in a technically clean surface on which few micro-organisms should be residual or could long survive, if residual.

Although this theory is plausible and is widely held, the literature is replete with data to the effect that no fixable relationship between the degree of cleanliness and the magnitude of the bacteriological swab-count of a washed surface appears to exist. The most recent data are those of Beck *(3)*, who found that, of 722 soda fountain glasses with swab-counts of less than 100 per 8 in.^{2}, 240, or 33.2%, reacted positively to the talc-safranin-O test; and, of

525 glasses which were negative to the talc-safranin-O test, 320, or 60.9%, had swab-counts in excess of 100 per 8 in.[2].

In addition to its unreliability, the overriding drawback to the use of the swab- count as a measure of the effectiveness of washing is that, although an official standard for the acceptable magnitude of the count of a washed AND sanitized surface of specified area has been established, no such official standard has been established for the count of a like surface which has been washed only.

A number of tests or so-called tests for cleanliness, in use or proposed, have been discussed and fault has been found with all of them for field application. What, then, are the obvious desiderata of a practical field test for degree of technical cleanliness of milk and food equipment surfaces? It would appear that the desiderata should necessarily include the following:

1. Test findings must be immediately determinable and interpretable. This is fundamental, since it avoids the need for a return to report the results and to inaugurate remedial steps, if the need is indicated.

2. The test must be applicable to surfaces whether wet or dry.

3. Test findings should be indicative of the degree of the approach to technical cleanliness; i.e., they should register the presence of residual soilage, whether gross or normally invisible, of grease, oil, proteins, water minerals, or "stone".

4. Test findings should be available in a form which is subsequently demonstrable as evidence or which may be kept as a record. Milk sediment test discs are an example.

5. Re-washing of the tested area or equipment *must* be unnecessary.

6. Testing equipment must be of a size, weight, and shape to result in a minimum of inconvenience in transport and use.

7. The test procedure must be uncomplicated.

8. The initial cost of the testing equipment must be within the means of most regulatory agencies and the cost of the test indicating material or medium for each test must be nominal.

At this stage of this discussion, it should be unnecessary further to belabor the lack of a suitable and reliable means for field determination of the degree of equipment cleanliness and simultaneously, of the effectiveness of the washing operation to which it has been subjected. In an effort to find an aveune for the relief of this situation, a Task Committee created by the 3-A Sanitary Standards Committees, an organization which has been engaged for the past twenty years in the development of sanitary standards for milk and dairy equipment, is currently engaged in a study of the problem. However, as appears to be par for these studies, the emphasis again is apparently to be on the "cleanability" of various material surfaces and finishes as determined by laboratory tests rather than upon the development of a practical field test for determining the degree of "cleanness".

Meanwhile, several manufacturers of sanitation detergents are employing a recently-developed means to determine the degree of cleanliness of equipment surfaces. The technique is extremely simple. It consists of (1) the removal from the surface of any clinging water or precipitated moisture with a squeegee and of (2) the amplification of the lighting and, incidentally, the complete drying of the surface by means of the rays from a 150-watt, exterior-type, sealed-beam flood-light. All experienced sanitarians are aware that milk and hard water stone are invisible on wet surfaces. The squeegee and the flood-light quickly produce a dry surface for test purposes and the intense light makes milk or mineral deposits, if present, readily visible.

The current primary interest in the dairy industry is the presence of a film of milk proteins on equipment. Protein films, particularly on refrigerated surfaces, are the habitat in which psychrophilic bacteria multiply, sometimes to astronomical numbers. In milk and dairy products, these bacteria reduce packaged product shelf-life by producing objectionable off-flavors, such as rancidity and a fishy taste.

Protein film is generally visually undetectable, even on dry surfaces, although occasionally a bluish tinge on the surface is to be noted. But, when otherwise undetectable protein film is subjected to the heat from the flood-light, it does become visible. Hair cracks develop and the surface takes on the appearance of weathered aluminum. The precise nature of the revealed residual soil may then be determined by manually applying acid milkstone remover to one small section of the test area and a chlorinated alkaline wash solution to another.

This squeegee-flood-light test technique meets all of the desiderata set forth in the tabulation. It has negligible cost, simplicity, its findings immediately available, and, of particular significance, rewashing of the equipment because of the test is not necessary. It meets all of the criteria except that the results are not available in permanent form.

The development of a practical and reliable means for determining the degree of cleanliness of a surface which also provides a record would be of great interest and value to sanitarians in the milk and food industry. The availability of such a test for "cleanness" can surely be expected to result in wider recognition of deficiencies in equipment sanitation and a proportionate improvement in equipment cleaning techniques.

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TIPS FOR EFFECTIVE MANAGEMENT[1]

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Management, basically, is getting things done through people. People, therefore, are the most important resource available to management and the managing of people is one of the most important functions of management. The "tips for effective management" which are presented here are concerned primarily with management's dealings with subordinates. These tips, if followed, should help the manager do his job better in building an alert, effective, and responsible staff.

1. *Emphasize skill, not rules, in your organization.* Judge your own actions and those of your subordinates by their effects—effects in terms of increasing both the competitive strength of your business and the satisfaction of the human needs of the people who work in it. Go easy on pat rules for running a business. Doing it "by the book" isn't always the most satisfactory way. If an unorthodox solution works effectively and pleases the people who use it, don't discount it just because it doesn't seem exactly "according to Hoyle."

2. *Set a high standard for your organization.* If you are irregular in your work habits, late for appointments, fuzzy in expressing yourself, careless about facts, or bored in attitude, your subordinates probably will be, too. If, on the other hand, you set a high standard for the organization, in all probability your subordinates will be eager to follow your good example.

3. *Know your subordinates and try to determine what is important to each.* Continuous study of individuals is a "must" for getting things done through people. Motives and attitudes are important tools for the executive, and they can be determined only by study. Since security is the main drive in many people, giving recognition to the contribution of others and to their role in your concern is a useful starting point in getting the best from men of future executive caliber.

Individuals vary widely in their other characteristics. Well-timed praise may spur one person to new heights of achievement, but it may only inflate another. A better key to the latter's effort might be constructive criticism. A third individual may wilt under any kind of criticism and some other approach is needed. The skillful executive constantly hunts for the appropriate procedure. He also searches beyond the office for background. People's motives and attitudes are heavily conditioned by their personal situations. For this reason, tactful drawing-out of subordinates can often supply invaluable information for understanding them. Remember that people often act on the basis of emotional, nonlogical reasons, even though they try to appear completely logical.

4. *Give your subordinates objectives and a sense of direction.* Subordinates should know where they're going, what they're doing, and why they're doing it. in order to plan their time intelligently and to work effectively. Good junior executives seldom enjoy working just day-to-day. Therefore, make clear the relation between their day-to-day work and the larger company objectives.

For example, don't merely ask people to analyze the variable costs of a particular department. Tell them also that it's part of a longer-range plan to provide leeway for salary increases, and that the knowledge they provide will strengthen the operating efficiency of your company.

5. *Try to listen thoughtfully and objectively.* The executive who knows his people—their habits, worries, ambitions, touchy points, and pet prides—comes to appreciate why they behave as they do and what motives stir them. The best and fastest way to know them is to encourage them to talk freely, without fear of ridicule or disapproval. Try to understand how others actually feel on a subject, whether or not you feel the same way. Never dominate a conversation or meeting by doing all the talking yourself if you want to find out where your people stand.

[1]Reprinted from Maryland Processors Report, December, 1964.

If both you and one of your people start to say something at the same time, give him the right of way.

One objection to the idea of being a good listener is that it takes time to draw people out. The answer is that it takes time to plan, too. Both are essential in the executive's job. The time invested will pay big dividends.

6. *Be considerate.* Few things contribute more to building a hard-working executive team than a considerate boss. Try to be calm and courteous toward your subordinates. Consider the effects on them of any decisions you make. Take into account the problems they have of their own, both business and personal. Try to build up their pride in their work, and their self-respect. Start by treating personal characteristics as assets and being careful not to trample on them.

7. *Be consistent.* If you "fly off the handle" and "set off fireworks" you are likely to frighten subordinates into their shells; if you oscillate wildly in reaction, mood, and manner you will probably bewilder them. Neither sort of behavior can win you the confidence and cooperation of your subordinates, which you must have to get things done.

You and your junior executives are in the position of a leader and his followers. One wants to follow only the leader whose course is steady and whose actions are predictable.

8. *Build up subordinates' sense of the value of their work.* Most people need to think their jobs are important. Many even have to feel that they not only have an important job, but are essential in it, before they start clicking.

9. *Give your directions in terms of suggestions or requests.* If your people have initiative and ability, you will get vastly better results in this way than you will by giving orders or commands. Issue the latter only as a last resort. If you find that you *have* to give orders all the time, maybe you'd better look for some new assistants—or reexamine the way you have been handling your own job. Be sure, also, to tell why you want certain things done. Informal, oral explanations are often as good or better than written ones; let the individual circumstances be your guide here.

10. *Delegate responsibility for details to subordinates.* This is another "obvious" point that is frequently overlooked. Delegating responsibility is basic to competent management. You are not doing your real job as an executive if you do not delegate. As the chief executive, if you insist on keeping your hand in details, you discourage your subordinates by competing with them. Moreover, by doing everything yourself, you prevent subordinates from learning to make their own decisions. Sooner or later the capable ones will quit and the other will sit back and let you do all the work. Ultimately, you will have no time for the thinking and the planning that are the most important parts of your job. Think of your executives as working *with* you, not *for* you.

11. *Show your staff that you have faith in them and that you expect them to do their best.* Junior executives, and everyone else for that matter, tend to perform according to what is expected of them. If they know you have the confidence in them to expect a first-rate job, that's what they will usually try to give you.

12. *Keep your subordinates informed.* Bring them up to date constantly on new developments and let them know well in advance whenever changes are in the offing. As members of a team, they are entitled to know what is going on. If they do, their thinking will be geared more closely to reality and their attitudes will be more flexible. Give them enough information about conditions and events in your organization to let them see themselves and their work in perspective.

13. *Let your assistants in on your plans at an early stage.* It's true that many plans can't be discussed very far in advance. They should, however, be discussed with subordinates before they are in final form. It will give your assistants that all-important chance to participate. Furthermore, because they will have taken part in shaping the plan, it will be as much theirs as yours and they will feel a personal responsibility for its success. Hence, they will usually carry out the program with vigor and precision.

14. *Ask subordinates for their counsel and help.* Bring them actively into the picture. It will help to give them a feeling of "belonging" and to build their self-confidence. It will often make them anxious to work harder than ever. What is just as important, they may well have good ideas which may never be utilized unless you ask for them.

15. *Let your people know where they stand.* The day of "treat 'em rough and tell 'em nothing" has passed. A system providing periodic ratings for employees is the first step. However, the full value of such a system is realized only if ratings are discussed with each person individually so that each can bolster weak points, clear up misunderstandings, and recognize his particular talents.

A formal rating system may be worth while, but is not necessarily essential if the chief executive talks at least once a year with each assistant about his performance during the past period.

16. *Give a courteous hearing to ideas from subordinates.* Many ideas may sound fantastic to you, but it's important not to act scornful or impatient. There's no surer way to discourage original thinking by a subordinate than to disparage or ridicule a suggestion he makes. His next idea might well be the

very one you want—make it easy for that next idea to come to you.

17. *Give your subordinates a chance to take part in decisions.* When your people feel they have had a say in a decision, they are much more likely to go along with it cooperatively. If they agree with the decision, they will look at it as their own and back it to the hilt. If they don't agree, they may still back it more strongly than otherwise because of the fact that their point of view was given full and fair consideration.

18. *Tell the originator of an idea what action was taken and why.* If you do so, he'll study other problems and make suggestions on ways to solve them. If his idea is accepted, he will be encouraged by seeing the results of his thinking put into effect. If his idea is not adopted, he will accept that fact more readily and with fuller understanding if you show him that the reasons for rejection are clear and sound. In addition, knowing exactly why his idea was impractical will help the suggester analyze the next problem more clearly.

19. *Pass the credit on down to the operating people.* Taking for yourself credit that really belongs to one of your operating people tends to destroy his initiative and willingness to take responsibility. Giving him fair recognition for what he does has a double benefit; he gets appreciation for doing a good job, and you get the help and support of a loyal staff. If you take all the bows when somebody else played the leading role, you can rapidly lose the respect of your executives.

20. *Try to let people carry out their own ideas.* It occasionally happens that equally good suggestions on a particular problem come from two individuals at the same time, one person directly responsible in the situation the other person essentially detached from it. In such cases, it's usually desirable to choose the recommendation developed by the person who will ultimately carry it out. He will then have a personal stake in proving that his idea is, in fact, workable. It's good administrative practice, therefore, to keep subordinates constantly aware of your willingness to have them work out their own solutions to problems in their particular operating areas.

21. *Criticize or reprove in private.* This may perhaps seem obvious but administrators forget to do it every day in hundreds of organizations. Reprimands in the presence of others cause humiliation and resentment instead of a desire to do better next time. Criticizing a subordinate when people from his department are present undermines his authority, his morale, and his enthusiasm to do his best for your company.

22. *Criticize or reprove constructively.* First, get all the facts, review them with those concerned, and reach an agreement on them. Then be ready to suggest a constructive course of action for the future. When you criticize, concentrate on the method or results, not on personalities. If you can precede the criticism by a bit of honest praise, so much the better. Note, however, that some executives do this so regularly and unimaginatively that the compliments lose their value.

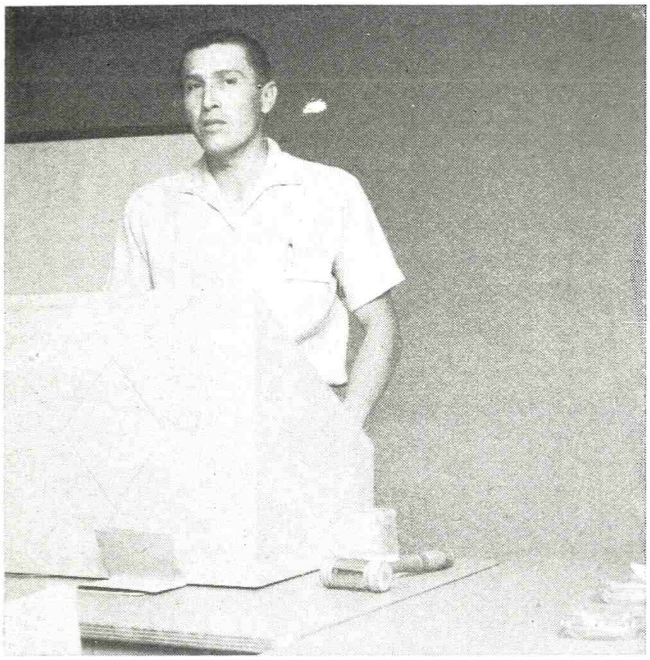
23. *Praise in public.* Most people thrive an appreciation. Praise before others often has a multiple impact. It tends to raise morale, increase prestige, and strengthen self-confidence—important factors in the development of capable junior officers. But be sure that those you praise are really the ones who deserve it, and that you don't encourage "credit grabbing."

24. *Accept moderate "griping" as healthy.* In small doses, griping can serve as a safety valve for your people. If they worked under a perfect administrator they would probably still complain, just because he was perfect. Vicious personal sniping is, of course, another matter; here, you should make every effort to have the cause discovered and rooted out. Remember, too, that without some dissatisfaction there would be little incentive to do or get something better.

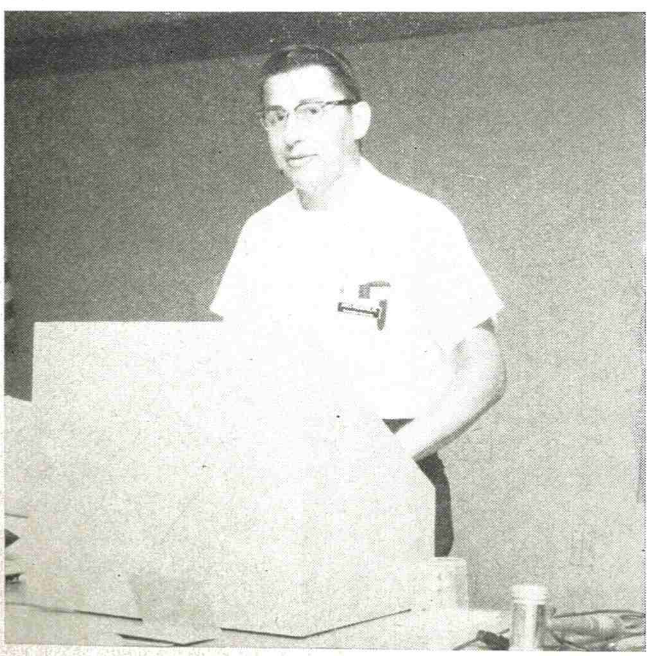
ASSOCIATION AFFAIRS

INDIAN RESERVATION SANITATION DISCUSSED AT SOUTH DAKOTA MEETING

One of the highlights at the annual meeting of the South Dakota Association of Sanitarians at Yankton on July 13-16 was a program put on by sanitarians representing various Indian reservations in the state. This interesting session was moderated by Charles Bowman, Chief of Environmental Health in the Indian Health Area office at Aberdeen.



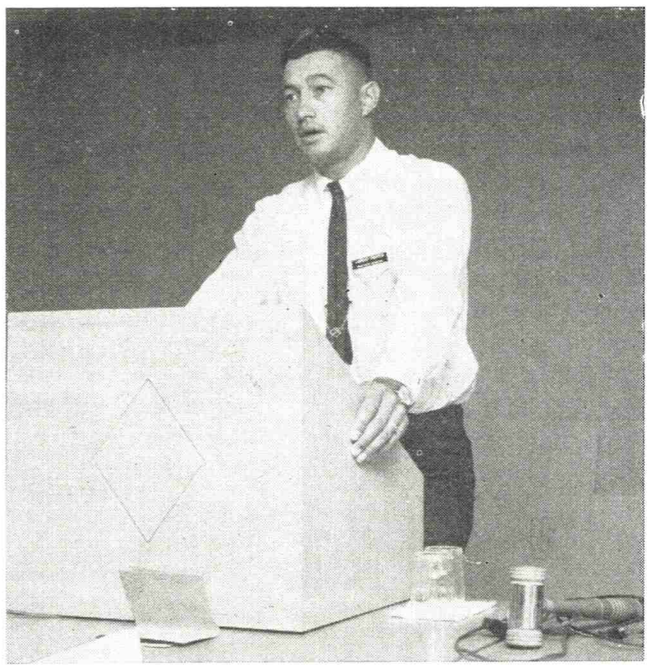
Casper Twiss, Reservation Sanitarian, Pine Ridge, S. D.



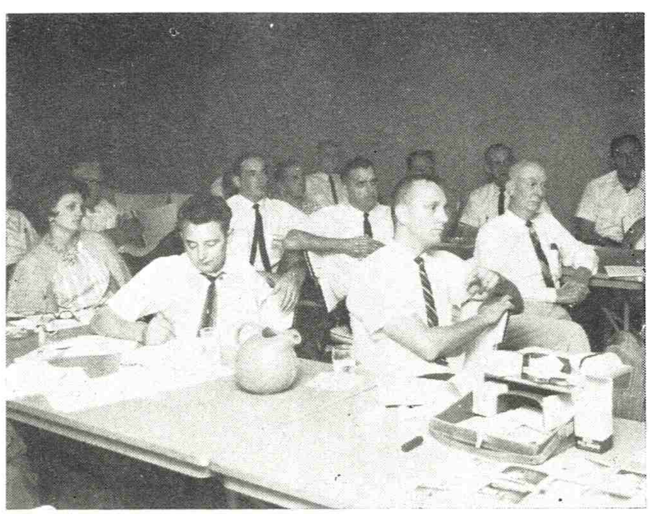
James Trechette, Reservation Sanitarian, Eagle Butte, S. D.

Problems discussed covered the field of water supplies, sewage and waste disposal, milk and food handling and a wide variety of environmental conditions. It was quite obvious that, although working under severe handicaps in attempting to bring sanitary facilities to the reservations, these sanitarians were doing an outstanding and creditable job. Their interest and devotion to the task of solving many tough problems was stimulating.

Other features of the three-day program included discussions of state-wide water supply and waste



Lawrence Thompson, Reservation Sanitarian, Chamberlain, S. D.

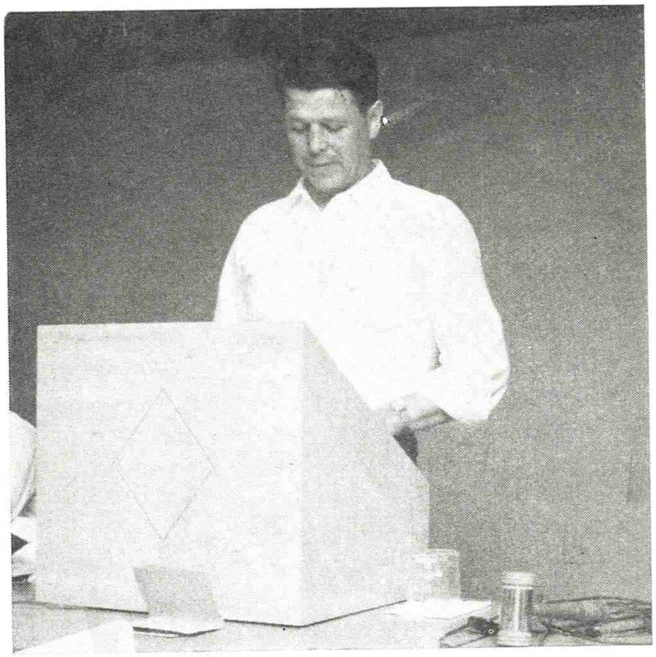


An attentive audience at one of the program sessions.

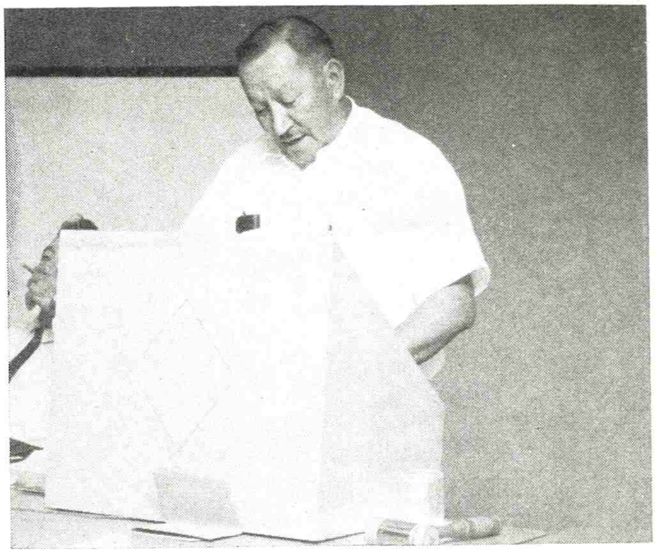
disposal systems by state health department personnel and certain aspects of dairy and food problems by representatives of the state university. The papers presented and the speakers were as follows:

Private and Semi-Public Water Supply Systems, Darrell Bakken; Private and Semi-Public Wastewater Disposal Systems, Floyd Matthew; Prevention of Accident Injury, Don Kurvink; Chromotographic Detection of Pesticide Residue in Foods, Don Mitchell; Chemistry of Cleaning, L. W. Rather; Sanitation in Beverage Plants, R. S. White; Fungus Diseases and Public Health, Gordon Robertstad; Fungal Toxins in Agricultural Products, P. R. Middaugh; Problems and Possible Solutions in Whey Disposal, E. C. Berry and Lloyd Bullerman; Radionuclides in Foods, K. R. Spurgeon; Role of the Sanitarian in Today's Society, Nicholas Pohlit; and Status of the Sanitarians Registration Law, C. E. Carl.

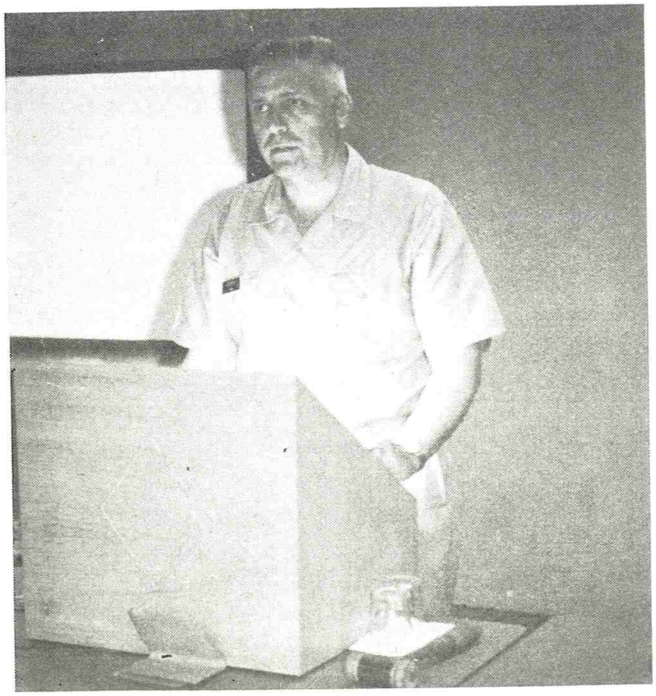
H. L. "Red" Thomasson was the featured speaker at the annual banquet. An unexpected pleasure was the presence of a well known and popular "old-timer", Charlie Halloran, who returned for the banquet and for the Friday morning closing session.



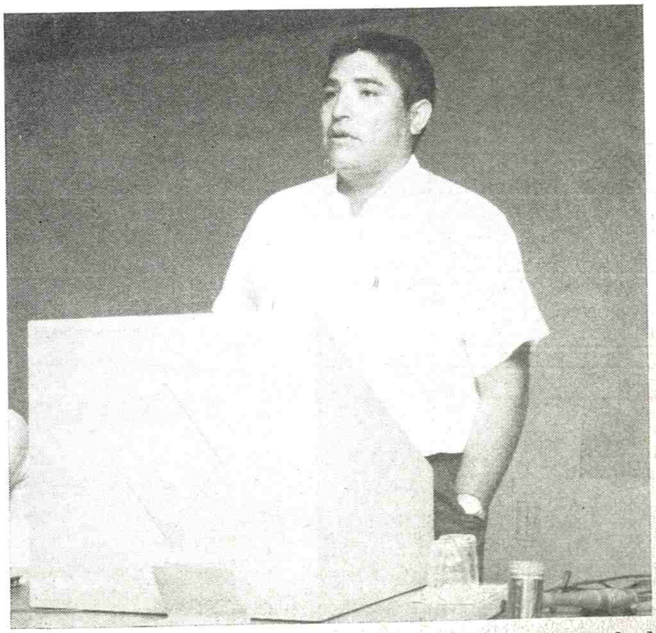
Basil Robertson, Reservation Sanitairan, Sisseton, S. D.



Lawrence Redwing, Reservation Sanitarian, Pine Ridge, S. D.



Charles Bowman, Chief U.S.P.H.S., Indiana Health Area Office, Aberdeen, S. D.



Leo Her Many Horses, Reservation Sanitarian, Rosebud Reservation, S. D.

MEETING OF TASK COMMITTEE CHAIRMEN

A meeting of the Task Committee chairmen and guests, Farm Methods Committee, IAMFES was held in connection with the 10th annual Conference on Interstate Milk Shipments. The meeting was called to order by Committee Chairman A. K. Saunders on Tuesday, May 11, 1965, at Louisville, Ky.

A moment of silence was observed in memory of Dr. R. W. Metzger who had been most active as a member and past chairman of the Farm Methods Committee.

Chairman Saunders reviewed the goals of the Committee indicating that it is and has been recognized as a working Committee. As milking practices and new devices are being introduced which effect changes in all sections of the U. S., Chairman Saunders indicated it becomes increasingly important that active Committee members be from all sections of the U. S. for the complete national picture. So that the Committee's final report to the IAMFES be all inclusive, State Farm Methods Committee affiliates chairman have been asked to contribute their suggestions to the Task Committee chairmen.

July 1st is the deadline for reports of the Task Committee chairmen to be sent to Chairman Saunders. Final editing of reports has been done by Dr. J. C. Flake and Mr. Saunders in the past. Current status of Task Committee activities were discussed as follows:

C.I.P. Cleaning of Pipeline Milkers—Mr. Harry Stone, chairman. Mr. Stone was unable to be present but a final report will be in as per target date.

C.I.P. Sub-Committee on Plastics—Mr. Bernard Saffian, chairman. A report was submitted through the mail by Mr. Saffian which has been returned for final editing. There is some difference of opinion on an acidified rinse whether using as recommended or demanded.

Cleaning of Farm Tanks and Transportation Tanks—Mr. Sydney H. Beale, chairman. Mr. Beale had contacted the members of his Committee and had their suggestions and comments on such matters as: (1) Need for better dust cover on tankers and (2) Tighter fitting lids on bulk tanks.

Mr. M. E. Held indicated that silo tanks (5,000 gal.) are being installed on West Coast farms. There is at present a need for effective cleaning procedures, etc., as the size and style are different from the average farm bulk tank. Discussion followed on farms with 2 bulk tanks and possible cleaning problems. Proper organization and timing are apparently key points.

Dr. G. D. Coffee indicated an apparent need for forced air ventilation in the milk house.

The pickup of milk from the farm is indicated as a problem in some areas. The problem apparently becomes more evident as farms get larger and use same size tank. Indications are there may be some "canning off" which is against most ordinances. Twice a day pickup can possibly create a cooling problem.

Chairman Saunders suggested that Mr. Beale contact the members of his Committee for further suggestions including the storage problem.

Antibiotics, Pesticides, and Adulterants—Mr. M. E. Held, chairman. The problem of antibiotics is apparently dormant in most areas at this time and under control. Apparently additional simple checking devices are needed for proper checking although the producer is aware of pesticides and has become more careful.

Residues from cleaners, bactericides, etc., cause some problem but more information is needed which Mr. Held is endeavoring to get. Mention was made as to quats and possible effect on cultered products.

Added water in milk is a problem and apparently different standards are used as to the freezing point according to discussion. Some comments were made as to sanitarians "letting their hair down" on added water to public health officials—a possible tendency to alibi and an absence of factual data.

Additional work is needed but no decision was made as to who will do the work—a research project, milk plant, etc. Further follow-up by Mr. Held to his Committee members was suggested to determine how they are checking for water and standards used. Mr. R. P. March indicated that California has taken a stand on DDT and derivatives (both Ag & Health).

Relation of Dairy Cattle Housing to Quality Milk Production—Mr. J. B. Smathers, chairman. Free stall information has been accumulated as well as fluid manure handling.

Sediment in Fluid Milk—E. E. Kihlstrum, chairman. Yellow color on the LINTINE Sediment test disk is causing concern in some areas. Indications are that the degree of yellow color on the pad relates to the number of leucocytes.

Education—Mr. Vernon Nickel, chairman. Mr. Nickel was not present. Mr. Saunders has heard from him and advised as to the progress of this Committee which is correlating work in several areas beneficial to farm method practices.

Relation of Farm Water Supplies to the Quality of Milk—Dr. Henry Atherton, chairman. Dr. Atherton has submitted a complete and comprehensive report. Lack of time necessitated elimination of covering at this time.

Mr. W. C. Lawton, President of IAMFES, suggested that, as the Journal needs not only the abstracts of the Committee's work but articles covering the work, both should be presented to Chairman

Saunders for publication at appropriate times. This will tend to avoid the exclusion of effective work done by a committee and of necessity deleted for the abstract. The complete report is especially needed for the working fieldman.

E. E. Kihlstrum, Sec. pro-tem

NEWS AND EVENTS

THE IMPORTANCE OF UNDERSTANDING

People who use pesticides or chemicals are constantly cautioned to "read the label." This is good advice, but two University of Wisconsin researchers say that some people won't understand many things even if they read the label.

Glenn Frederick and Richard D. Powers, agricultural journalists at the University of Wisconsin, conducted a preliminary test on understanding of insecticide terminology as a part of a long-range project on safety in use of chemicals. They asked several groups if they understood certain words found on 48 labels of common insecticides used on farms and in homes. They tested a group of farmers, a group of students and a group of housewives.

The housewives generally understood insecticide instructions and terminology better than the students or farmers interviewed. But none of the groups in the study really understood the terms well enough to make chemical manufacturers feel very comfortable.

The agricultural students were tested on their understanding of 29 insecticide terms. Eight of the 29 words were not understood by 40 per cent of the students. The farmers were tested on 25 words, and five words were missed by 40 per cent or more of their group. The housewives were tested on 23 terms and only one word was missed by 40 per cent or more of their group.

Frederick and Powers then made an analysis of total understanding based on the answers of the students, farmers and housewives. What words did the group have the most trouble with? They found that the term "wettable powder" was missed by nearly half of the students and over half of the farmers. About half of the students and two-thirds of the farmers couldn't define the word "fungicide". Likewise the word "herbicide" was not missed by the students, but three-fourths of the farmers got it wrong.

"Antidote" – the treatment to use in case of poisoning – is a crucial word on labels. However, nearly half of the students did not have a correct definition for it. Roughly 20 to 40 per cent of the farmers, students and housewives interviewed didn't know the correct meaning of the words "residue", "toxic poisoning," "residual spray" and "fumigant." Terms which were missed by less than 20 per cent of the people were "diluted," "larvae," "germinate," "agitate," and "contaminate."

The two researchers don't imply that this test means that the people interviewed did not know the meaning of many of the terms on insecticide labels. There is much room for misinterpretation in a test such as this. However, they emphasize that these results give the chemical industry reasons to put more thought into labels and directions for use of farm chemicals.

This is a preliminary phase of a long-term study, and many more results and recommendations will come out of future work on this project.

COURSE IN HOSPITAL ENVIRONMENT CONTAMINATION CONTROL

The Communicable Disease Center of USPHS in Atlanta, Georgia has announced a course in the control of microbial contamination of the hospital environment. The course will be presented in two sessions from August 30 to September 3 and from September 13 to 17, 1965.

The purpose of the course is to provide training for professional personnel and instruction and demonstrations will include techniques for assaying problems and for controlling contamination at minimum levels with existing practical technology. Among the subjects to be covered are surface and air sampling, cleaning and disinfection, laundry and waste handling, housekeeping, hospital design, and administrative problems. The course is designed for health department staff members, sanitarians, architects and engineers, infections-committee members and others concerned with hospital operation.

Information on the course can be secured from the Technology Branch, Communicable Disease Center, Atlanta, Georgia. 30333.

NATIONAL DAIRY COUNCIL EXPANDS NUTRITION RESEARCH STAFF

The National Dairy Council anounces changes in its Division of Nutrition Research staff effective June 1.

Dr. Marion F. Brink, who has been Associate Director of Nutrition Research since June 1962, now is Division Director. Before joining NDC, Dr. Brink was on the Research staff of the U. S. Naval Radiological Defense Laboratory in San Francisco. He holds a bachelor's and a master's degree from the University of Illinois, and a Ph.D. degree from the University of Missouri. As a speaker and writer, Dr. Brink is well known in both the dairy industry and the scientific community.

Dr. Elwood W. Speckmann Jr. has joined the Division as Assistant Director of Nutrition Research. He has served as science specialist with the U. S. Air Force in Dayton, Ohio, where he was Air Force liaison representative to the Food and Nutrition Board and the Space Science Board of the National Academy of Science, National Research Council, Washington, D. C. Dr. Speckmann received a bachelor's degree at Rutgers University, and a master's and a Ph.D. degree from Michigan State University, where he specialized in nutritional physiology.

Dr. Merrill S. Read, who since 1960 has been NDC Director of Nutrition Research, has relinquished that position to give full time to responsibilities as an Executive Assistant to NDC President Milton Hult. In this position he will coordinate NDC research and education programs.

The addition of Dr. Speckmann to the NDC staff provides the Dairy Council with the services of five holders of doctorates, specifically trained in nutrition science. Dr. Ardath A. Coolidge, Literature Scientist, and Dr. Ethel A. Martin, Nutrition Consultant, also are member of the Division of Nutrition Research.

The new Division of Nutrition staff arrangement will enable NDC to fulfill more effectively its wide scope of activities and objectives in behalf of the dairy industry. These objectives are:

1. To obtain new facts about the nutrients of milk and its products.

2. To supply accurate information about dairy foods and their proper place in the diet and to correct misinformation about them.

3. To obtain basic information about the nutritional needs of humans and how dairy products help meet these needs.

4. To analyze nutrition research needs of the Dairy Industry to meet problems such as diet-heart, calcium and kidney stones, dental caries, and to develop projects designed to meet these needs.

5. To maintain close working relationships with research investigators and agencies for exchange of information relating to improved public health through better food habits.

6. To interpret nutrition research findings to Dairy Council personnel and other professional people for use in health education programs, and to members of the Dairy Industry for use in their promotion programs.

MILKING PARLOR SYSTEMS SAVES MAN-HOURS

A recent survey by Prof. A. M. Meek, N. Y. State College of Agriculture, shows six man-hours a year are saved on each cow milked in a milking parlor when compared to two other systems, and 13 man-hours saved in comparison to a third method. Therefore, Meek concludes fewer men are needed with the milking parlor system.

The survey compared milking time and manpower needs in systems using milking parlors, pipelines, dumping stations, and buckets. The milking parlor system where cows are moved to a central point and two or more are milked simultaneously by machine, requires one or more men, depending on the number of cows in the parlor, to care for the machines.

The study shows 25.8 man-hours are required a year to milk each cow in a milking parlor. Projecting these figures for a 100-cow herd, Professor Meek's figures indicate 600 man-hours a year would be saved in a parlor as compared to milking into a pipeline or using a dumping station. About 1300 man-hours a year are saved when comparing parlors with the traditional bucket system.

The pipeline system is next best in total man-hours with 31.3 required for each cow. This is very close to the dumping station system which requires 31.9 man-hours a year. Meek points out there is little difference between these two systems and the dairyman would have to consider other factors in evaluating them.

The pipeline is an overhead pipe arrangement in the barn carrying milk directly from the cow to a bulk tank in a nearby milkhouse. The dairyman has to move the milker to each individual cow in the barn which takes slightly longer than in the parlor where the cows are moved to the machine. The dumping station system requires a man to move the milking machine to each cow, also, and then carry the milk to a central point nearby where it is "dumped" into a tank or container. It is then transferred automatically by pipeline to a main tank in the milkhouse.

The bucket system requires the dairyman to carry the milk from the cows to the milkhouse—involving more than one trip for many cows. This requires more man-hours than any of the methods—38.5 a year for each cow as compared to 25.8 in the milking parlor.

With the savings in man-hours, Professor Meek maintains, a milking parlor is justified for herds of 70 cows or more. Also, he says improvements in milking methods, designed for use in milking parlors, are being developed that will reduce further the man-hours needed to milk cows.

Meek says one man can handle up to 125 cows comfortably in a milking parlor. This means that a man will spend a considerable amount of time in the milking parlor so it should be well heated and lighted—even though there will be little time for the old rocking chair.

IDENTIFY CHEMICALS THROUGH MAGNETIC QUALITIES OF ATOMS

According to the June, 1965, issue of FDA Report on Enforcement and Compliance, newly developed scientific methods are being used to detect pesticide chemicals and other impurities in foods and drugs. One of the most sensitive tools in nuclear magnetic resonance (NMR) spectrometry or identification of chemical compounds through inherent magnetic properties of atoms.

This technique analyzes compounds that include specific arrangements of hydrogen atoms. It involves "flipping" the nuclei of these hydrogen atoms, or changing their direction of spin. This action is detected and reported by a NMR spectrometer which is basically a strong electromagnet, a constant frequency radio transmitter-receiver, and a pen recorder.

A chemical sample is placed in an artificially created magnetic field about 35,000 times as strong as the earth's magnetic field. This changes the magnetic properties of the hydrogen atoms, flipping or aligning the nuclei of these atoms with this new force. The radio transmits electromagnetic radiation to these nuclei at a constant frequency while the strength of the magnetic field is varied continuously. As this strength is varied, nuclei of the various hydrogen atoms absorb some of the radiation at some level of the applied strength.

When this happens at different points for each chemical combination of atoms, the particular hydrogen nuclei become "excited" or come into resonance. Each different combination causes resonance at only one intensity of the magnetic field. The pen recorder visibly notes these different resonances detected by the radio and traces them on a chart as absorption patterns. Differences in the strength of the magnetic field of as little as one part in one billion can be detected and plotted as a graph or spectrum. Each chemical compound containing hydrogen atoms traces its own unique pattern on the NMR spectrometer and can thus be "fingerprinted" for future identification.

FDA uses NMR to identify and measure the amount of each ingredient in chemical compounds and to detect impurities in drug samples. As the characteristics of additional compounds are charted by the NMR spectrometer, FDA scientists are enlarging their catalogue of known spectra and can make quick identification. They have compiled more than 150 fingerprints or spectra to date.

A recent requirement for verification analysis of a sample labeled to contain dimethyl sulfoxide, glycerol, and water was quickly completed. Two known NMR spectra were used when other methods of instrumental analysis had furnished inconclusive results because of the presence of the glycerol. Research in the division has now reached the point where NMR spectrometry can often show that certain types of chemicals are present in a sample, or that particular types of chemicals are certainly absent from a compound.

NMR spectrometry is used in pesticide detection and identification, to determine amounts of the ingredients in chemical compounds, and in research on metabolic products. By confirming or denying theories on the atomic structure of certain molecules, NMR spectrometry is complementing infrared and mass spectrometry in compiling an identification file of pesticide chemicals. FDA scientsist are also probing the changes that take place in pesticide molecules when they are in contact with animal or human tissues and the changes in the molecular structure of fats and oils when exposed to high temperatures.

NEW BROCHURE ON APV EQUIPMENT

A new, 12-page brochure covering evaporation and concentration equipment techniques is available from APV Company, Incorporated. It describes APV Plate Evaporators, Fruit Juice Essence Recovery Systems and Heat Exchangers as they apply to milk, fruit juices, wort, meat broth, glucose, tea, coffee, and other heat sensitive foods and chemical products.

The Brochure gives case history reports of specific companies including process information, feed rates, steam consumption, and operational data. The APV "Junior" Pilot Plant Unit will be of interest to persons who would like to make test runs to compare with present methods or set up pilot runs for experimental purposes. Copies are available from APV Company, Incorporated, 137-A1 Arthur Street, Buffalo, New York 14207.

NOTICE

J. C. McCaffrey, Secretary-Treasurer, National Conference on Interstate Milk Shipments, is compiling a summation of all the conferences. He has all the registration lists except the one for 1952. Anyone having a copy of this list is urgently requested to send it to Mr. McCaffrey, 1800 West Fillmore St., Chicago 12, Illinois.

NAMA LISTS APPROVED VENDING MACHINES

Over 400 machine models manufactured by 74 different companies are listed in the just-published annual "Listing of Letters of Compliance," awarded to machine manufacturers under the National Automatic Merchandising Association's vending machine evaluation program.

The 32-page booklet contains listings of every machine model which has been approved as meeting the U. S. Public Health Service Vending Code and the specifications shown in the N A M A Vending Machine Evaluation Manual, and includes both N A M A member manufacturers' and non-members' equipment. The new booklet lists 10 machine manufacturers for the first time and more than 50 new machine models.

N A M A's vending machine evaluation program has been conducted at Indiana University and Michigan State University since 1957. The testing program follows procedures recommended by N A M A's Automatic Merchandising Health Industry Council (AMHIC), an advisory group representing the vending industry, national health organizations and official government agencies.

The booklet is distributed free to N A M A members and to health and military officials in every state as an official guide in determining which machines are acceptable. Non-member vending companies may obtain the "Listing" for $1.50. Copies are available from N A M A, 7 South Dearborn Street, Chicago, Illinois 60603.

NEW BOOKLET ON SEWERAGE SYSTEMS

A new booklet entitled "Understanding the World of Sewerage", written in non-technical layman's language, is available from Can-Tex Industries.

With expanding populations, many citizens living in communities of individual septic tank systems or inadequate community sewers, face the decision of participating in the development of a modern sewerage system. The purpose of the booklet is to transmit a highly general and non-technical knowledge of how a sewerage system works, what it consists of, and what problems can arise in creating an adequate disposal system. It can be especially useful to a citizen having the additional responsibility of being an alderman or town council member in a community contemplating sewer construction or expansion.

Written in two sections, the first section tells how a system is designed and what it is supposed to do, including sewage treatment, utilization of bacterial processes and efficient operation. The second section covers more specifically sewer mains and lines, pipe materials and problems that must be anticipated in system layout.

The 24-page booklet, authored by David L. Weiner is written in an interesting fashion with illustrations and contains much useful and understandable information on an otherwise highly technical subject.

A copy of "Understanding the World of Sewerage" may be obtained by addressing Can-Tex Industries, Inc., Cannelton, Indiana, 47520.

BULLETIN DESCRIBES SHARPLES CENTRIFUGES AND APPLICATIONS

Each of the 13 basic Sharples centrifuges for virtually every area of separation are described in a new 6-page bulletin just published by the Equipment Division of Pennsalt Chemicals Corporation.

Titled simply "Sharples Centrifuges" and designed Bulletin #2010, it features an easy-to-read application chart on the front cover which shows at a glance the specific jobs for which each machine is designed. On the inside are photographs and general descriptions of each type of centrifuge, plus line drawings to illustrate their principles of operation. The bulletin also lists all basic materials, metals, abrasion-resistant materials and corrosion-resistant coating available in the construction of Sharples centrifuges to meet every process requirement.

The application chart shows five basic separation jobs which can be performed by Sharples centrifuges including dewatering of crystalline materials and plastics, dewatering of fibrous and amorphous materials, solids concentration and liquid clarification, separating immiscible liquids, and wet classification. At least four different centrifuges are listed as being applicable to any one of these jobs. However, the bulletin notes that selection of the best model and size for maximum performance at minimum cost depends on a thorough analysis of individual materials and process requirements. Such an analysis is offered by the Sharples Customer Service Laboratory.

Copies of the new Sharples Centrifuge bulletin, No. 2010, are available from the Equipment Division, Pennsalt Chemicals Corporation, 2300 Westmoreland St., Philadelphia, Pa. 19140.

MILK PRODUCTION BOOKLET BY BABSON BROS.

A helpful booklet for sanitarians, dairy technologists, and others in the dairy industry is now ready for release. Prepared by Babson Bros., manufacturers of milking machine equipment and supplies, it is called "Rules for Money Making Milking." It contains 15 pages of helpful hints for successful dairying and includes a number of photographs taken of up-to-date scenes on the dairy farm. The contents provide tips on obtaining the best milk production from each cow, feeding and milking, cleaning and sanitizing of equipment, and proper storage of dairy utensils.

Other subjects dealt with are push button cleaning of pipeline milking systems and milking system maintenance.

A copy of "Rules for Money Making Milking," may be obtained from Babson Bros. Dairy Research and Educational Service, 2100 South York Road, Oak Brook, Illinois 60523.

INSTITUTE OF SANITATION MANAGEMENT ANNUAL CONFERENCE

The general theme of the Institute of Sanitation Management's Annual National Sanitation Conference, on September 19-23, 1965 in San Francisco will be "Sanitation—Today and Tomorrow." The program will consist of discussions of environmental sanitation subjects, topics and problems, not only of today but also of the future and a feature of the program will be an actual visual trip to the moon via man-in-space travel.

The conference, which for the first time in the nine-year history of ISM is being held on the West Coast, has been planned and arranged so that all in attendance can participate in the complete schedule including three general sessions, two joint sessions, and a choice of several individual cracker barrel discussions. The first joint session will cover buildings, hospitals, department stores, schools, consultants and industrial operations and the second session will feature discussions on food processing and mill and bakery operations. The individual cracker barrel sessions will cover office, hotel, public and commercial buildings; department stores, hospitals and institutions for medical and mental care; industrial operations such as non-food manufacturing plants, pharmaceutical operations and transportation systems; flour mills, bakeries and cereal processing plants; city, district and state schools, colleges and universities; and all food processing plants other than the bakery and cereal field.

Outstanding speakers on a national, state and local level will lead the discussions at the various sessions. Also featured on the program is the annual award luncheon at which the national Member of the Year Award wll be announced. Candidates for the Award are members who have previously received Member of the Year Awards from local chapters.

This year also for the first time the conference will feature a "Literature Display Library" and a "Sanitation Film Festival." There will be no sanitation maintance show and exhibits which have been held in connection with the conference in previous years.

The new Literature Display Library format carries out one of the primary functions of the institute in bringing complete and up-to-date educational material before all conferees. Equipment manufacturers and suppliers in the sanitation field have been invited to submit their latest printed and descriptive material for display. The Sanitation Film Festival provides for showing new films which have been developed and made available during the last year.

Information concerning registration and other details may be secured from the Institute of Sanitation Management office, 55 West 42nd St., New York, N. Y. 10036.

MONTREAL TO HOST 1965 DAIRY MEETINGS

Montreal, Canada, will be the site of the 1965 meeting of five international milk and ice cream associations during the week of October 17-22. Several thousand of the continent's major dairy industrialists and their suppliers and equippers will convene in Canada for the first time since 1941.

The five associations and the dates and locations of their meetings are as follows: Dairy Society International, October 17 at the Mount Royal Hotel; Milk Industry Foundation, October 17-20 at the Queen Elizabeth; International Association of Ice Cream Manufacturers, October 20-22 at the Queen Elizabeth; National Ice Cream Mix Association, October 19 at the Windsor Hotel; and the Dairy and Food Industries Supply Association, October 17-22 at the Mount Royal.

One special highlight of the week will be the staging of the Collegiate Students' International Contest in Judging Dairy Products on October 18. This is an annual contest, sponsored by DFISA and the American Dairy Science Association, for teams of college seniors from dairy and food departments in colleges and universities all over North America. Other features of the week will include daily and evening social events, sponsored by an industry-wide Dairy Conventions Committee, to which all industrial guests are welcome.

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MILK CONCENTRATES CONFERENCE

The Seventh Milk Concentrates Conference will be held October 26 and 27, 1965, at the Benjamin Franklin Hotel in Philadelphia. This conference of dairy scientists, milk processors, and others concerned with the research and technology of producing milk concentrates is co-sponsored by the U. S. Department of Agriculture, the American Dry Milk Institute, and the Evaporated Milk Association.

For information and further details, contact Dr. George C. Nutting, Eastern Utilization Research and Development Division, Agricultural Research Service, USDA, 600 East Mermaid Lane, Philadelphia, Pa. 19118.

WALTER Z. MEYER ELECTED NADEM PRESIDENT

Walter Z. Meyer, Secretary and Sales Manager, Food Processing Equipment Division, Paul Mueller Company, Springfield, Mo., was elected President of the National Association of Dairy Equipment Manufacturers at its 20th Annual Meeting on May 25 at Bethesda, Md. Mr. Meyer succeeds Peter L. Miller, who is retiring President of NADEM. Mr. Miller is Vice-President of Chester-Jensen Company, Chester, Pa.

Clyde Monda, Sales Manager, Pump Division, Waukesha Foundry Company, Waukesha, Wis., was elected Vice-President and Marvel J. Heinsohn, Vice-President of Sales, Portersville Equipment Division, Gibson Industries, Inc., Portersville, Pa., was re-elected Treasurer. John Marshall was re-appointed as Executive Vice-President and Secretary, a position he has held for a number of years.

New directors for the association are G. F. Barnum, Division Sales Manager, Taylor Instrument Companies, Rochester, N. Y., and Mr. Monda. Other directors are James Brazee, Vice-President for Sales and Marketing, CP Division, St. Regis Paper Corporation, Chicago, Ill., and Mr. Miller.

CLASSIFIED ADS

UNITED PRESS COLUMNIST SUGGESTS LBJ SHOULD RECOMMEND MILK FOR DIPLOMATS

United Press International's Dick West did a column earlier this month based on New York Congressman Samuel Stratton's newsletter which stated, "I can't help wondering if perhaps the quality of our international diplomacy might not have been enhanced if more milk had been consumed." The congressman was commenting on President Johnson's order that U. S. embassies should serve only U. S.—produced wine.

The UPI column goes on, "Stratton may have a point there, but I rather doubt that milk will become a beverage of diplomacy until something is done about its image.

"Diplomats, you know, set great store by protocol and other social niceties. And wine-drinking is steeped in ritual, tradition, and formality.

"Milk-drinking, on the other hand, has almost no etiquette of its own. You just slop some of the stuff into a big jelly glass and gulp it down.

"The first thing to do is to stop delivering milk in thick glass jugs and unaesthetic paper cartons. It should be poured from crystal decanters by candlelight.

"A different milk should be served with each course—skim milk with the salad, homogenized with the entree, and buttermilk with dessert. With each in a different type of goblet.

"The skims and wholes are preferable chilled, but the buttermilks —both cultured and churned— should be served at room temperature.

"The next thing to do is develop milk connoisseurs—experts who can discuss in esoteric lingo the bouquet, texture, and flavor of individual milks and identify their backgrounds.

"The conversations should go something like this:

" 'I believe you will find this next buttermilk interesting. It can hardly be called noble, of course, but you have to admire its spirit.'

" 'Ah, yes, it has a spunky quality that is almost presumptuous. Judging from the tang, which is a bit on the mellow side, I'd say that it came from a 3-year-old Guernsey who grazes on clover on the shady side of a hill 45 miles northwest of Madison, Wis.'

"Once these criteria have been met, and a little alcohol is added, milk will be well on its way toward winning diplomatic recognition.

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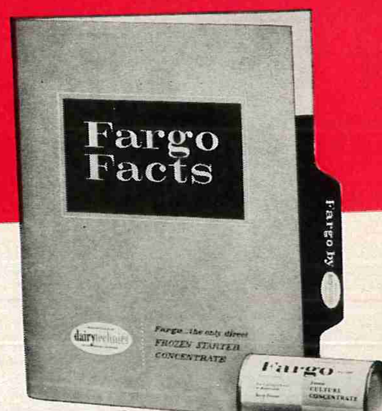

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