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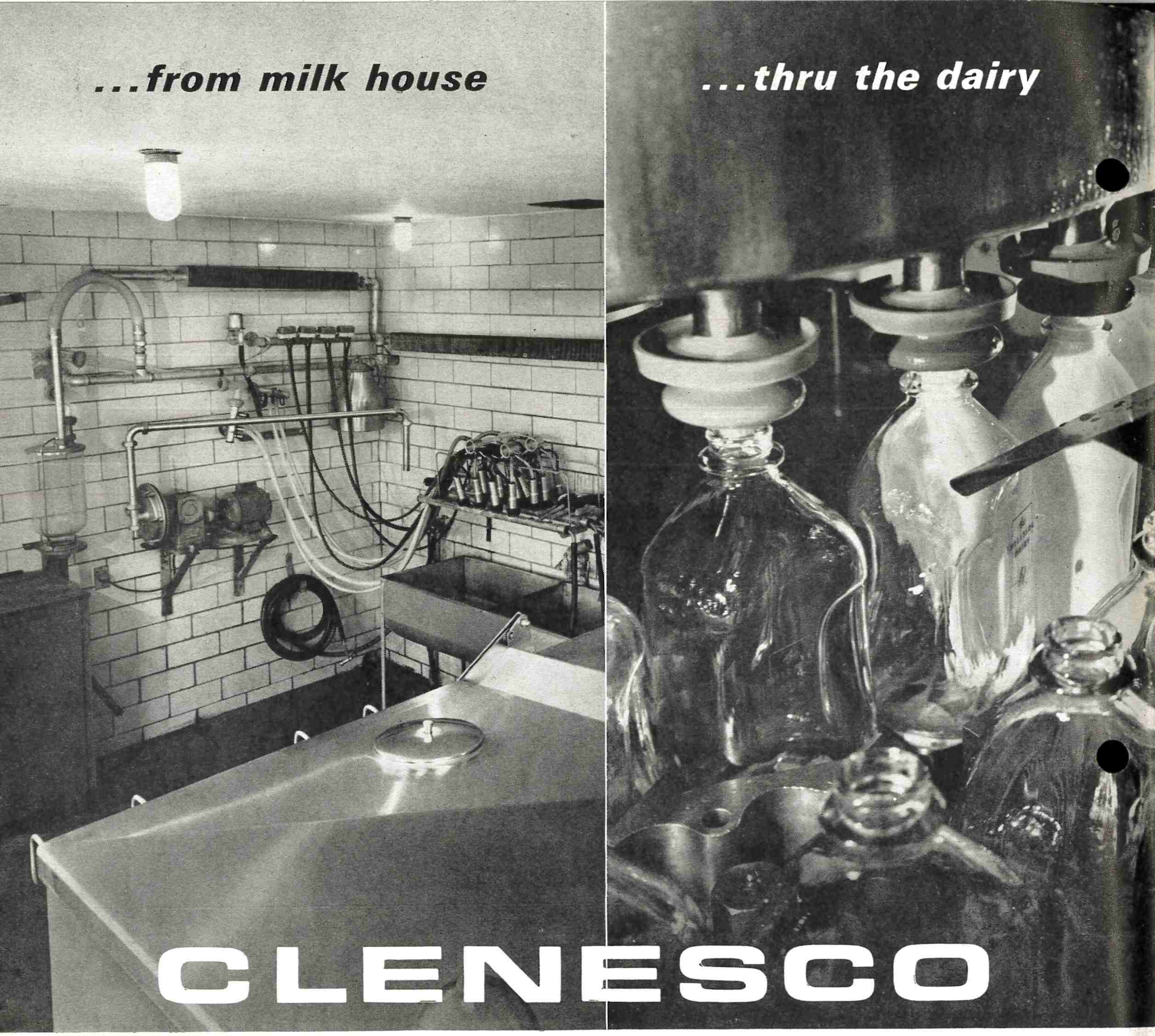

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EFFECT OF MILKER VALVE SANITIZING PROCEDURES ON BACTERIAL CONTAMINATION[1]

J. M. Jensen and W. W. Snyder

Departments of Food Science and Dairy
Michigan State University, East Lansing

(Received for publication May 7, 1964)

Cleaning in place (CIP) of glass and stainless steel milk lines has been generally accepted by milk sanitarians as being satisfactory for good results. The method has normally been effective for producing superior cleanliness when measured by visual inspection or by bacteriological assay of equipment and products handled. Occasionally situations are encountered in which contamination is higher than can be readily accounted for by appearance of equipment or conditions of cooling.

Unreasonably high standard plate and coliform counts were found regularly in milk from a stanchion barn glass pipeline system. The actual length of line from the milk room and around the stable back to the milk room measured 420 feet. Altogether 42 milk valves were spaced in the line, approximately equidistant apart. The milk hoses of teat cup assemblies were attached to these milk valves during milking.

The pipeline system was washed after each milking by circulation cleaning using vacuum, first applying a cold water rinse until the water came through clear. Next the line was washed by circulating 25 gal of chlorinated phosphate detergent solution during a 20-min period. As the cleaning solution was recirculated, the milk valves, including protruding stems, were brush-cleaned with valves in open position. The stem ends were otherwise closed by rubber caps which gave no protection to the outer area of the valve stems. The teat cup assemblies were attached to a manifold for drawing solutions into the pipeline. When the washing cycle was completed, the system was rinsed with warm water and drained. These cleaning procedures were used after both morning and evening milkings. Furthermore, inflations were changed after each week's use, replaced by sets that were stored for a week in 5.0% caustic soda solution. Details of washing were carried out by regularly employed milking attendants. The procedures following washing were carried out by the investigators.

Investigational Procedure and Results

Cleaning in place without dismantling the valves for manual washing.

The milk line was sanitized by drawing 25 gal of freshly prepared 100 ppm concentration chlorine solution through the milking system. A semidry solution soaked sponge was sucked through the line in order to remove the residual chlorine solution. Subsequently 3 liter of sterile nutrient broth (8 g per liter) was drawn into valve "A" indicated on Figure 1, or through all of the 25 valves, as in "B", feeding a small portion through each. Samples for study of bacterial contamination were taken as solutions were pumped from the accumulating jar at the end of the line. Milk samples were taken similarly but 20 to 30 min after milking was begun. All samples were held in crushed ice until plated within 4 hr for nutrient broth, 16 hr for milk. Procedures directed by *Standard Methods for the Examination of Dairy Products*[2] were followed for making the counts and for determination of *Aerobacter* or *Escherichia* species of coliforms.

Data in Table 1 show the contamination from the pipeline system using inlet valve "A" in Figure 1 and the 25 inlet valve "B" in Figure 1 as measured by growth of colonies from broth samples. Milk samples were taken from the end of the pipeline without regard to area of milking.

Bacterial contamination was high in the nutrient broth flushed through by either system even though the equipment looked very clean. Contamination, measured by standard plate counts and coliform count, was far greater in the broth admitted through the 25 valves which would be expected since the milk inlet stems extending from the valves were not exposed to germicidal treatment along with the milk line. The freshly drawn milk samples yielded high standard plate and coliform counts. The coliform counts of milk were considered unusually high in relation to the standard plate counts. It is significant that all coliforms were of the *Aerobacter* species, most

[1]Journal Article No. 3357 from the Michigan Agricultural Experiment Station, East Lansing.

[2]American Public Health Association, Inc. 1960. Standard Methods for the Examination of Dairy Products. Am. Public Health Assoc., Inc., New York.

likely to be associated with contamination from feed and barn dust.

TABLE 1. BACTERIAL COUNTS OF NUTRIENT BROTH AND MILK

Date	Sample	SPC	Coliform	Coliform species
6/26/63	"A"[a]	22,000	390	*Aerobacter* only
	"B"[b]	470,000	17,000	" "
	Milk	33,000	1,750	" "
7/ 8/63	"A"	86,000	23	" "
	"B"	510,000	1,900	" "
	Milk	21,000	250	" "
7/15/63	"A"	226,000	64	" "
	"B"	1,290,000	4,400	" "
	Milk	19,000	410	" "
7/22/63	"A"	143,000	150	" "
	"B"	860,000	730	" "
	Milk	61,000	410	" "

[a]"A" broth drawn through a single valve, most distant from sampling point.
[b]"B" broth drawn through each of 25 valves in section of line tested.

Cleaning in place and dismantling valves for manual washing.

High contamination experienced with the washing method employed for data in Table 1 indicated that the numerous milk valves in the line likely contributed high contamination unless removed for cleaning and sanitizing. Consequently the study was continued by removing each valve for manual washing.

Data of Table 2 show bacterial counts of nutrient broth per 1.0 ml from 3,000 ml admitted through each of 25 valves by the procedure used for "B" in Table 1. The data also show the subsequent bacterial counts of milk taken from the line outlet at the bulk tank.

Low bacterial counts, compared to those of "B" in Table 1, occurred in both nutrient broth and milk following dismantled washing of the milk valves.

Cleaning with valves dismantled should perhaps have been obvious to workers in charge of cleaning the milker system. However, they may have assumed the entire system was being cleaned adequately by methods outlined for them, which did not designate that the valves should be given special attention.

TABLE 2. BACTERIAL COUNTS OF NUTRIENT BROTH AND MILK FOLLOWING DISASSEMBLED WASHING AND SANITIZING

Date	Sample	SPC	Coliform	Coliform species
9/10/63	"B"[a]	1,180	10	*Aerobacter* only
	Milk	1,350	10	" "
9/17/63	"B"	19,800	70	" "
	Milk	2,800	188	" "
9/24/63	"B"	1,870	51	" "
	Milk	1,100	45	" "
10/ 1/63	"B"	1,870	3	" "
	Milk	1,300	128	" "

[a]"B" broth drawn through each of 25 valves.

Pipeline valve surface area not washed adequately by CIP.

Because of high contamination from the milk line inlet valves, calculation was made of the surface area within the valve and valve stem, making direct contact with the milk, as well as the surface area of the valve seat and plug, considered as making indirect contact.

The valve and stems measured 3 1/8 inches in length and 9/16 inch in diameter, yielding a direct milk contact surface of 185.5 square inches from 42 valves.

The valve core measured 1 1/2 inches in height and 1 1/16 inches diameter at midpoint. With the area of 9/16 diameter milk inlet holes accounted for, the total valve surface area of 42 valves amounted to 399.13 square inches which was considered indirect milk contact surface because the contamination lodged between the plug and valve seat was exposed only partially to milk as valves were turned. The area of surface known to be inadequately cleaned totaled 584.68 square inches. A striking amount of surface that is frequently disregarded by milking machine attendants.

TABLE 3. BACTERIAL COUNTS OF NUTRIENT BROTH AND MILK FOLLOWING CLEANING VALVES BY TURNING THEM IN PLACE

Date	Sample	SPC	Coliform	Coliform species
10/15/63	"B"[a]	16,300	51	*Aerobacter* only
	Milk	1,970	320	" "
10/29/63	"B"	14,400	30	" "
	Milk	11,200	2,900	" "
12/ 3/63	"B"	2,300	40	" "
	Milk	3,100	10	" "
12/17/63	"B"	32,000	10	" "
	Milk	3,300	180	" "
3/12/64	"B"	30,000	19	" "
	Milk	460	14	" "

[a]"B" broth admitted through each of 25 milk valves.

Cleaning in place with modified manual cleaning of valves.

A succeeding procedure consisted of CIP followed by turning all the valves in the valve seats, 3 left to right turns, during a period when 100 ppm chlorine solution was circulated. The bacterial contamination in nutrient broth and subsequently produced milk is shown by data of Table 3.

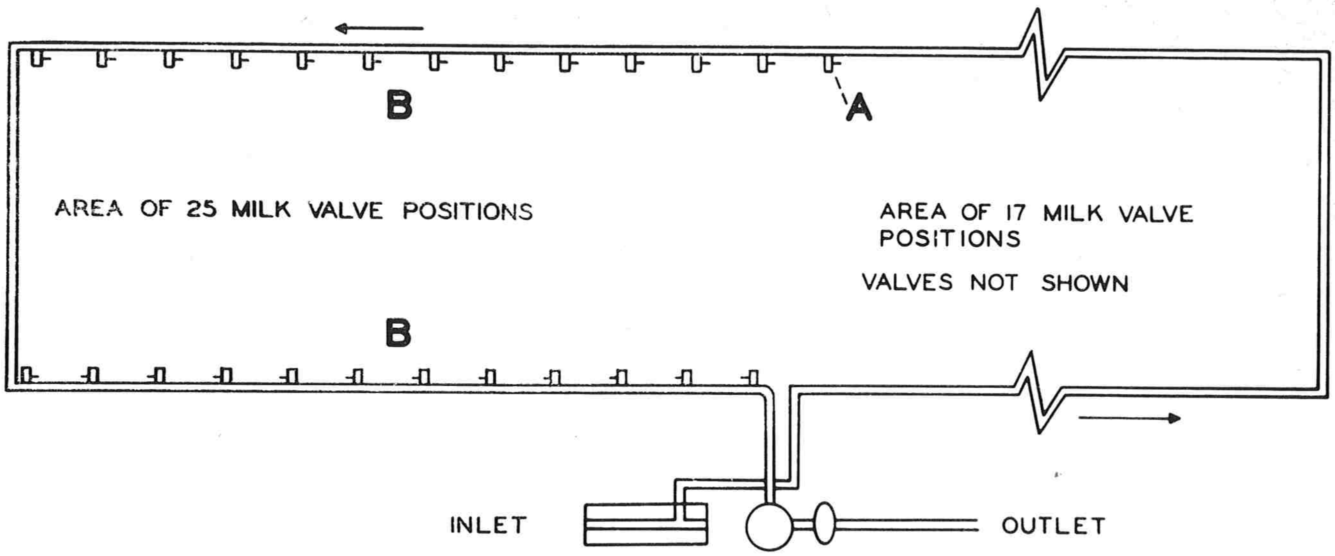

FIGURE I. SHOWING POSITION OF ENTRY VALVES FOR MILK OR NUTRIENT BROTH TEST SOLUTION

Using the in place manual valve washing procedure was less effective in achieving low bacterial counts than washing the valves completely dismantled. Counts secured were much lower than those of Table 1 where no specific attempt was made to clean the valves.

Time required for supplemental cleaning of milk valves.

While no exact data were obtained of the time required to wash the valves manually because of unavoidable interruptions, the first washing of all milk valves took approximately 90 min or about 2 min per valve. There was evidence of more milk residue on inner parts of the valves during the first washing than later. The outer area, especially the wing lever of the valve, was more soiled before the first washing than those following.

Timing the in place turning of 42 valves during sanitizing as in Table 3 showed that 16 min was required, about 0.4 min per valve.

DISCUSSION

The plug type milk valve, used in the pipeline milker studied, proved to be a major source of bacterial contamination, unless dismantled, washed, and sanitized. However, substantially lower contamination resulted from manipulating valves so as to allow chlorine solution to treat a larger amount of milk-contact surface while the solution was circulated through the lines.

Each of the manual procedures used required additional time and physical effort, both given grudgingly by many milker operators. Other styles of valves may be suggested for better sanitizing by circulation of solutions only. It is recognized some pipeline milker systems are operated without mechanical valves in the milk lines.

Some improvement in the present style of milk valve may be had by using end caps on the valve nipples which cover at least as much of the nipple as is covered by the milk hose. End caps permit the milk valves to be in the open position while washing and sanitizing.

The results from this study should be accepted as further evidence that cleaning in place is not infallible. The sanitation can only be as effective as is permitted by construction and operation know-how. Essentially all pieces of dairy equipment have areas that need to be washed more painstakingly than others. Such parts may be cleaned more expediently by dismantled washing than by CIP.

CONCLUSION

Milker line valves proved to be focal points of bacterial contamination to milk or nutrient broth test solutions.

With all lines washed by a standard recirculation procedure, best results (lowest standard plate counts and coliform counts) were secured when all valves were washed and sanitized disassembled. Next best results (relatively low bacterial contamination) were obtained following rotating all the milk valves in their respective valve seats as chlorine sanitizing solution was recirculated. By far the highest bacterial contamination occurred when no special attention was given to cleaning and/or sanitizing the milk line valves, other than brush washing the valves while in open position during recirculation washing.

All coliform bacteria found on plates were of the Aerobacter specie.

ACKNOWLEDGMENT

The assistance of Horst Goerke and Nancy Carl is gratefully acknowledged.

RELATION BETWEEN MILK PRODUCTION CONDITIONS AND RESULTS OF BACTERIOLOGICAL TESTS WITH AND WITHOUT PRELIMINARY INCUBATION OF SAMPLES[1]

C. K. Johns, L. F. L. Clegg, A. G. Leggatt and J. M. Nesbitt

Food Research Institute, Canada Department of Agriculture, Ottawa
and
Department of Dairy Science, University of Alberta, Edmonton, Canada
and
Ontario Agricultural College, Guelph Ontario, Canada
and
Department of Dairy Science, University of Manitoba, Winnepeg, Canada

(Received for publication May 27, 1964)

Summary

The effectiveness of various bacteriological methods in detecting insanitary production conditions was studied over a two-year period at three centers. It had been planned to use the pulsating rinse test as a yardstick, but it was found necessary to supplement this with a weighted scoring system for "faults" reported on inspection. Farms were classified as satisfactory or unsatisfactory on this basis. In contrast to previous experience, preliminary incubation (PI) at 55 F for 18 hr failed to show any significant advantage. However, subsequent studies revealed that results would have been more favorable had samples been taken from full tanks, rather than of the first two milkings. Results varied markedly between the three centers in the degree to which unsatisfactory conditions were reflected by both standard plate counts (SPC) and resazurin reduction tests. Resazurin reduction times equivalent to various SPCs varied strikingly from center to center, and even between two groups of farms at a given center. All were appreciably greater than those currently in vogue. Bacteriological standards as stiff as 10,000/ml SPC failed to detect up to 32% of farms scored as unsatisfactory, emphasizing anew the importance of regular, frequent, careful inspection of farms.

Why do we run bacteriological tests on raw milk? Originally the main concern was with keeping quality. With improved knowledge and methods, keeping quality became less of a problem and these tests were relied on more to indicate unsatisfactory conditions of production and handling. Nowadays, with farm bulk tanks, cooling is so effective that bacterial growth is virtually eliminated. This has permitted cooling to mask carelessness; the dilution effect when 50 liters (110 lbs.) of milk passes through a neglected milker unit allows the latter to add nearly half a billion bacteria without raising the count of the milk more than 10,000/ml! Thus such current standards as 200,000/ml can easily be met with equipment in a shockingly insanitary state.

As a means of detecting unsatisfactory conditions that are being masked by good cooling, Johns *(4, 5)* suggested preliminary incubation (PI) of samples at 55 F for 18 hr before testing. Although the Ottawa results had been confirmed by Vermont studies *(2)* and others, it was felt desirable that the value of this procedure should be studied in different areas; consequently, a collaborative project was set up. The Departments of Dairy Science of the University of Alberta, Edmonton, the University of Manitoba, Winnipeg and the Ontario Agricultural College, Guelph, agreed to undertake these studies, with financial assistance from the Canada Department of Agriculture. A two-year project was set up starting April 1, 1961.

In the past various investigators have compared different tests with one another, but no really comprehensive study has been reported in which the usual bacteriological tests have been evaluated for their ability to reflect unsatisfactory production conditions. Consequently, the collaborative study was expanded to include a number of milk tests both before and after PI. As an objective measure of sanitary conditions, it was proposed to use a pulsating rinse (PR) test of the milker units, it having been found superior to a swab test *(6)* while Richard and Auclair *(8, 9)* subsequently showed a good correlation between milk counts and PR counts when the latter exceeded 10^8 per unit. The data would be suitable for analysis with an IBM computer and the relative merits of the various tests assessed by this yardstick.

It was felt by all but one of the collaborators that there was little point to studying farms with poor quality records. Such farms are being detected without PI. Consequently, each center was asked to select 20 farms, all with bulk tanks but without pipeline milkers, with counts generally under 50,000/ml. The investigator then visited each farm roughly every 6 weeks, on a day when the bulk tank contained milk from the two previous milkings. After the producer had sanitized his milking equipment in the usual way, a pulsating rinse *(6)* was conducted where-

[1]Contribution No. 17, Food Research Institute, Canada Department of Agriculture (Revised version of paper presented at the Annual Meeting of the International Association of Milk, Food, and Environmental Sanitarians, Inc., Toronto, Canada, October 25, 1963).

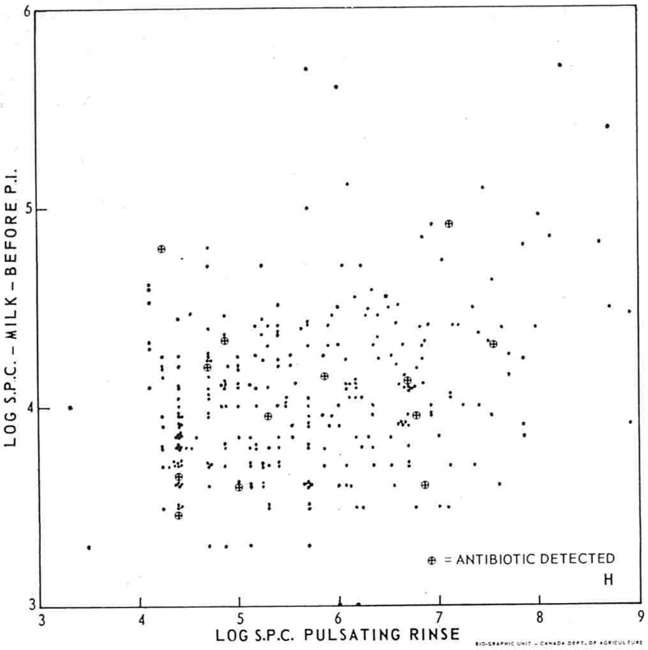

Figure 1. Relation between pulsating rinse SPC and milk SPC (Guelph, 1st group, 295 samples)

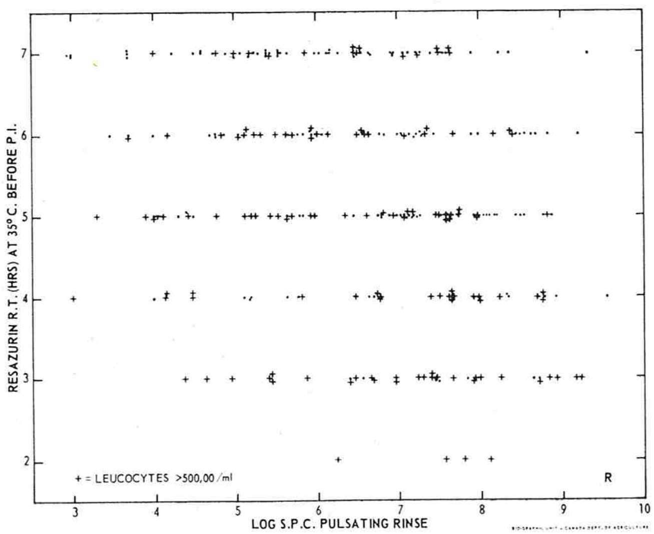

Figure 2. Relation between pulsating rinse SPC and resazurin reduction time of milk (Winnipeg, 1st group, 270 samples)

in 500 ml of sterile buffered neutralizing solution *(1)* was pulsated in each cluster for 1 min, then allowed to flow through into the milker bucket. After being swirled around to contact the inner surfaces of the milker bucket, the rinse was recovered. The same rinse was used for all units. Next, a sample of milk was taken from the bulk tank, and both rinse and milk samples refrigerated until they reached the laboratory. In addition, a farm inspection sheet, on which relevant information was recorded on 62 items related to bacterial contamination, was completed. At first this was only done about every nine months at Edmonton and Winnipeg (at Guelph it was done at each visit); later this was done at each sampling.

At the laboratory the following tests were conducted in accordance with Standard Methods *(1)*:

	Before PI	*After PI*
Milk		
Standard Plate Count (SPC) 32 C	X	X
Direct Microscopic Count (DMC) Bacteria	X	X
Direct Microscopic Count (DMC) Leucocytes	X	X
Psychrophile Count, 10 days at 7 C	X	X
Coliform Count (VRB)	X	X
Lab. Past'n Count (LPC) 32 C	X	
Resazurin Reduction Test (RRT) 35 C	X	X
Resazurin Reduction Test (RRT) 25 C	X	X
Antibiotic Residue Test	X	
Pulsating Rinse		
Standard Plate Count	X	
Psychrophile Count	X	
Coliform Count	X	
Lab. Past: Count	X	

Record sheets were forwarded to Ottawa, where they were scrutinized for anomalies, then passed on to the Statistical Research Service. After a preliminary analysis of the data for roughly the first year, it was recommended that instead of continuing with the original groups of farms it would be more valuable to extend the studies to a wider group. Consequently, each center selected a second group of 50 farms, and visited and sampled these once only.

RESULTS AND DISCUSSION

To obtain an early indication of trends, scatter diagrams were prepared to observe the relationship between various tests before and after PI, and between the various tests and the SPC of the pulsating rinse (PR). Study of the latter relationship (Figures 1 and 2) raised serious doubts concerning the suitability of the PR test as a yardstick. These doubts were further increased when the results of farm inspection were compared with the PR counts. Sometimes low PR counts were reported along with unsatisfactory equipment conditions, sometimes the reverse. As previously mentioned, Richard and Auclair *(9)* reported good correlation between milk counts and PR counts when the latter exceeded 100,000,000 per unit. Our failure to obtain such correlation may be due to a number of factors. For example, Richard and Auclair took their samples at three consecutive milkings, the pulsating rinses being taken at the first and third, while the milk sample was taken from the milker bucket at the second milking. Our samples, taken from the bulk tank and representing the two previous milkings, included contamination from sources other than the milking machine. Again, Richard and Auclair used the Claydon technic, pulsating with sterile milk for 5 min, while we pulsated in the upright position with sterile

TABLE 1. RELATION BETWEEN MILK TESTS AND EQUIPMENT CONDITION. GROUP 1 FARMS. REPEATED SAMPLING.

Method and standard	Equipment Conditions: Unsatisfactory Milk Tests: Agree No.	%	Disagree No.	%	Satisfactory Milk Tests: Disagree No.	%	Agree No.	%
Edmonton (94 samples)								
SPC >10,000	28	72	11	28	17	31	38	69
>25,000	19	49	20	51	5	9	50	91
>50,000	12	31	27	69	3	5	52	95
SPC >25,000	30	77	9	23	13	23	42	77
PI >50,000	20	51	19	49	8	14	47	86
>100,000	12	31	27	69	7	13	48	87
>200,000	7	18	32	82	4	7	51	93
Resazurin 5 hr	10	26	29	74	4	7	51	93
4 hr	5	13	34	87	2	4	53	96
3 hr	2	5	37	95	2	4	53	96
Resazurin 4 hr	12	31	27	69	7	13	48	87
PI 3 hr	6	15	33	85	4	7	51	93
2 hr	1	2	38	98	3	5	52	95
Winnipeg (165 samples)								
SPC >10,000	81	91	8	9	29	38	47	62
>25,000	66	74	23	26	12	16	64	84
>50,000	48	54	41	46	9	12	67	88
SPC >25,000	79	89	10	11	32	43	44	57
PI >50,000	71	80	18	20	23	30	53	70
>100,000	53	60	36	40	13	17	63	83
>200,000	41	46	48	54	12	16	64	84
Resazurin 5 hr	81	91	8	9	36	47	40	53
4 hr	44	49	45	51	19	25	57	75
3 hr	28	31	61	69	5	7	71	93
Resazurin 4 hr	79	89	10	11	34	45	42	55
PI 3 hr	46	51	43	49	13	17	63	83
2 hr	17	19	72	81	3	4	73	96
Guelph (231 samples)								
SPC >10,000	52	68	25	32	57	37	97	63
>25,000	32	42	45	58	10	6	144	94
>50,000	12	16	65	84	4	3	150	97
SPC >25,000	43	56	34	44	62	40	92	60
PI >50,000	29	38	48	62	31	20	123	80
>100,000	25	32	52	68	16	10	138	90
>200,000	16	21	61	79	9	6	145	94
Resazurin 5 hr	54	70	23	30	85	55	69	45
4 hr	40	52	37	48	58	38	96	62
3 hr	27	35	50	65	39	25	115	75
Resazurin 4 hr	43	56	34	44	62	40	92	60
3 hr	36	47	41	53	34	22	120	78
2 hr	13	17	64	83	19	12	135	88

neutralizing buffer solution for only one min. However, all these differences fail to explain high pulsating rinse counts accompanied by low milk counts. In any event, a more reliable yardstick was obviously required. After trying a number of approaches it was decided to score each sample for which an inspection sheet had been completed, combining the inspection picture with the PR results.

In developing the scores for unsatisfactory conditions on inspection, the weighting was based upon the frequency with which a given condition was reflected by SPC or RRT, either before or after PI. Items such as "milky residue" on inflations, or "poor" bulk tank cleanliness, were scored 8 points, while those with little or no effect, such as residues in vacuum hose or pulsator, were scored only 1 point. Pulsating rinse counts per unit exceeding 10^8 were scored 12 points; between 10^7 and 10^8, 6 points; be-

TABLE 2. RELATION BETWEEN MILK TESTS AND EQUIPMENT CONDITION. GROUP 2 FARMS. SINGLE SAMPLING.

Method and standard	Equipment Conditions: Unsatisfactory Milk Tests: Agree No.	%	Disagree No.	%	Satisfactory Milk Tests: Agree No.	%	Disagree No.	%
Edmonton (50 farms)								
SPC >10,000	12	86	2	14	15	41	21	59
>25,000	9	64	5	36	4	11	32	89
>50,000	4	28	10	72	3	8	33	92
>100,000	2	14	12	86	3	8	33	92
SPC >25,000	11	79	3	21	18	50	18	50
PI >50,000	8	57	6	43	11	30	25	70
>100,000	6	43	8	57	9	25	27	75
>200,000	4	28	10	72	5	13	31	87
Winnipeg (50 farms)								
SPC >10,000	30	86	5	14	5	33	10	67
>25,000	21	60	14	40	2	13	13	87
>50,000	16	46	19	54	2	13	13	87
>100,000	13	37	22	63	1	7	14	93
SPC >25,000	30	86	5	14	8	53	7	47
PI >50,000	27	77	8	23	6	40	9	60
>100,000	23	66	12	34	4	27	11	73
>200,000	20	57	15	43	4	27	11	73
Resazurin 5 hr	30	86	5	14	14	93	1	7
4 hr	17	49	18	51	6	40	9	60
3 hr	11	31	24	69	5	33	10	67
Resazurin 4 hr	28	80	7	20	5	33	10	67
PI 3 hr	19	54	16	46	4	27	11	73
2 hr	11	31	24	69	0	0	15	100
Guelph (49 farms)								
SPC >10,000	15	83	3	17	13	42	18	58
>25,000	8	44	10	56	4	13	27	87
>50,000	3	17	15	83	1	3	30	97
>100,000	2	11	16	89	1	3	30	97
SPC >25,000	11	61	7	39	12	39	19	61
PI >50,000	6	33	12	67	8	26	23	74
>100,000	3	17	15	83	6	19	25	81
>200,000	1	6	17	94	4	13	27	87
Resazurin 5 hr	7	39	11	61	5	16	26	84
4 hr	5	28	13	72	0	0	31	100
3 hr	0	0	18	100	0	0	31	100
Resazurin 4 hr	3	17	15	83	6	19	25	81
PI 3 hr	1	6	17	94	1	3	30	97
2 hr	0	0	18	100	0	0	31	100

tween 10^6 and 10^7, 3 points. While these are arbitrary values, it is believed they furnish a reasonably reliable assessment of equipment condition, etc. It must be admitted, however, that differences may exist in the severity of scoring equipment condition and cleanliness, and this could influence the results as between centers.

To assess the effectiveness of the various laboratory tests in detecting unsatisfactory conditions, all samples with scores of 5 or less for both inspection and PR count were classed as "Satisfactory", while those exceeding 5 on one *or* both were regarded as "Unsatisfactory".

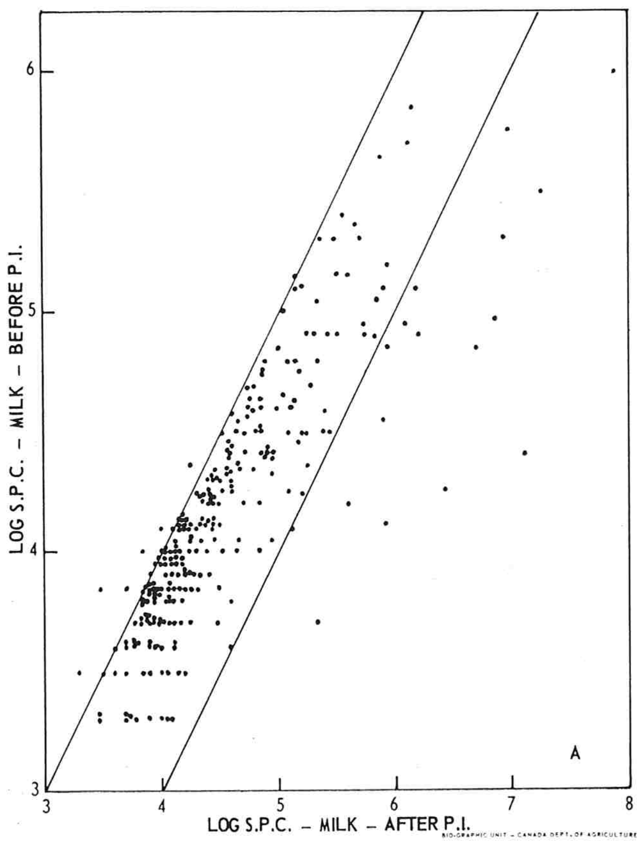

Figure 3. Milk SPC's before and after P.I. (Edmonton, 1st group, 230 samples)

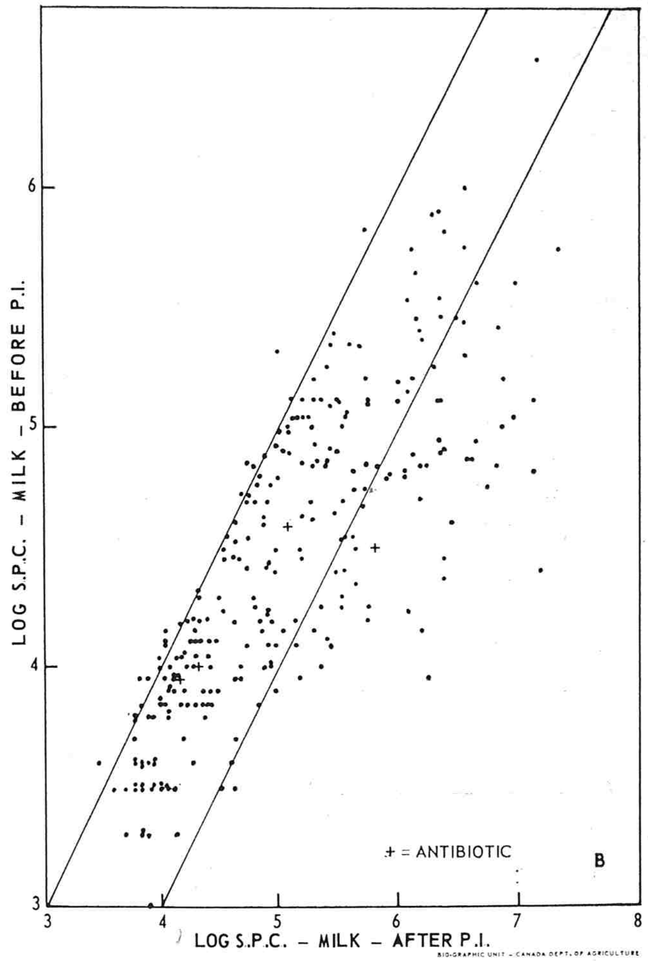

Figure 4. Milk SPC's before and after P.I. (Winnipeg, 1st group, 270 samples)

Using these criteria, the SPC's and RRT's were examined for their ability to reflect unsatisfactory conditions at various limits of count or reduction time. The results for the first groups of farms (multiple sampling) are shown in Table 1. Those for the second groups (single sampling) are shown in Table 2.

Using the criteria described, PI failed to show superiority in detecting unsatisfactory conditions on these selected farms. This is very hard to understand. In Ontario, Vermont, Michigan, Scotland and Norway, to name a few areas, PI has been found valuable for just this purpose. Furthermore, at the 16th International Dairy Congress in 1962, a resolution was passed recommending pre-incubation of samples of well-cooled milk before testing, indicating that the value of this practice is generally recognized.

As previously mentioned, in these studies an attempt was made to exclude as far as possible farms with a poor quality record. Rather, the interest was in farms where the initial count would indicate satisfactory conditions, but where bulk cooling (plus the dilution effect) might be masking insanitary conditions and practices. This is what PI was designed to do. The experience of fieldmen in a number of areas has been that farms with dirty equipment have been meeting current bacteriological standards with ease; producers could see no need to improve their cleaning procedure so long as their milk met the standard. However, PI quickly revealed a significant proportion of such farms. These farms, on improving their cleaning practices, rarely had any difficulty in meeting the standard. This has been clearly evident in Ontario, where since Sept. 1, 1963 provincial regulations have required that all fluid milk samples must be subjected to PI before testing. Many milk sheds which previously boasted of the quality of their milk supply have since suffered a rude awakening.

There is a possibility, stressed by one of us (L.F.L.C.) when the project was designed, that by restricting these studies to farms with good milk quality records we might obscure the value of PI. There is some evidence that where there has been an effective quality improvement program, with good field work, fewer low count (not over 10,000/ml) samples have increased greatly on PI. This is illustrated by the data in Table 3, which include the first year's results for Edmonton (Center 1) Winnipeg (Center 2) and Guelph (Center 3). Centers 6 and 7 are milk sheds studied by the Manitoba Department of Public Health in the summer of 1961; there, where little improvement work had been carried out, surprisingly high percentages of samples with initially low counts "blew up" on PI. Center 4, where PI had the least effect, is the Central Experimental Farm dairy at Ottawa, while Center 5 represents Ottawa commercial milk samples. It may be that as sanitary practices improve, the milk flora changes to types which fail to increase markedly on PI. Studies of the flora from these same groups of farms at Edmonton, Winnipeg and Guelph, before and after PI are being carried on under a second collaborative project started in May 1963; this may throw some light on the question.

TABLE 3. RELATION BETWEEN GENERAL QUALITY OF MILK SUPPLY AND INCREASED SPC ON PI.

	SPC when fresh			SPC - PI	
			(Samples not >10,000 SPC when fresh)		
Center	Total samples	% of samples >10,000	% >50,000	% >100,000	% >200,000
4	321	78	2	0.8	0
3	159	53	9.4	4.7	4.7
1	112	39	6.8	4.5	0
5	183	36	28	20	0
6[a]	131	29	74	52	16
2	120	27	16	9	3.1
7[a]	193	16	70	60	40

[a]Can Samples

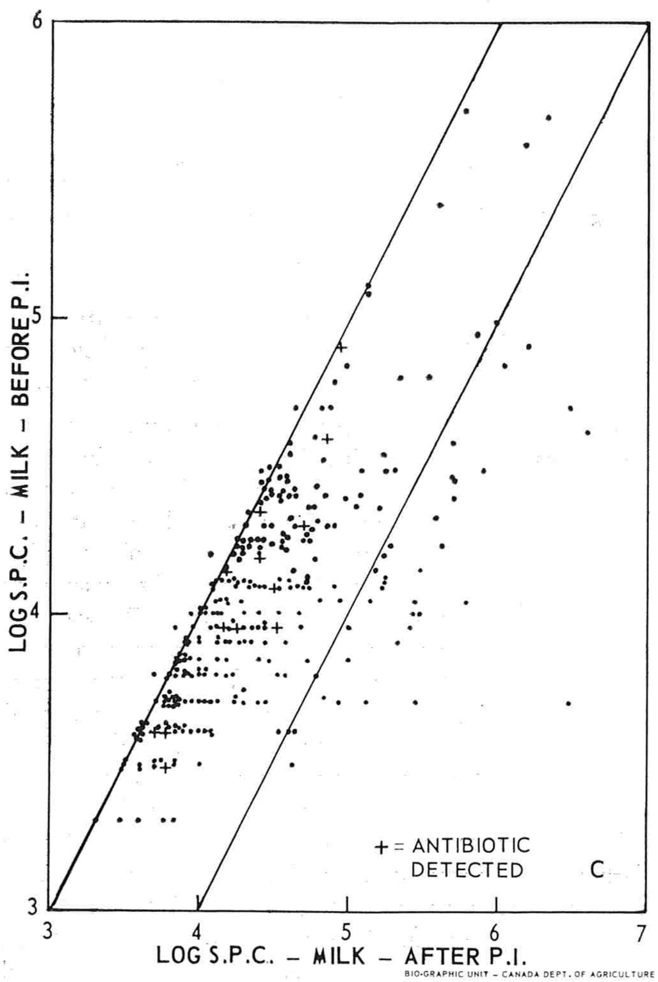

Figure 5. Milk SPC's before and after P.I. (Guelph, 1st group, 295 samples)

An even more important factor was not recognized until very late. This is the age of the sample. It will be recalled that in these studies samples were obtained from the two milkings (tank half-filled) and were roughly 24 hr old when taken. This may have influenced the results in one or both of the following ways. First, at 24 hrs the bacteria may not have become sufficiently adjusted to their surroundings for them to multiply actively during PI; whereas, when held a further 24 hr under these conditions they may have passed through the lag phase and been ready to multiply during PI. Secondly, many bacteria not destroyed by the sanitizing of the equipment may have been injured to some degree and failed to grow during PI. However, given a further 24 hr to recover (as in regular commercial practice where samples are roughly 48 hr old) many of these might multiply actively during PI.

Support for this hypothesis was furnished by studies reported from Edmonton[2]. When 48-hr samples (four milkings) from 39 farms were subjected to PI, 62% showed at least a ten-fold increase in count; when 24-hr samples (two milkings) from 18 of the 20 farms in the current study were similarly treated, only 17% showed this much increase. Following up this lead, arrangements were made to split 24-hr samples; one portion was analyzed as usual, the other held at under 40 F for 24 hr, then the analysis repeated. The results (Table 4) strongly support the opinion that PI would have shown up to much great-

[2]A Study of the Bacteria in Raw Bulk Tank Milk, by Harold Jackson, presented as a Ph.D. thesis at the University of Alberta, Sept. 30, 1963.

er advantage had samples been taken from full tanks.

The next most striking finding was the variation in effectiveness of a given test at the different centers. For example, in the main group of farms (Table 1) the SPC limit of 50,000/ml at Winnipeg detected 54% of the poor conditions as compared with only 31% at Edmonton and 16% at Guelph. Similar differences appeared at the other count limits and also after PI. With the second group of farms (Table 2), the percentages of poor conditions detected at the 50,000/ml level ranged from 46% at Winnipeg to 17% at Guelph.

With the RRT the disparity was even greater; in the first group (Table 1) an RRT of 4 hr detected 52% of the poor conditions at Guelph, 49% at Winnipeg and only 13% at Edmonton. While RRT values were not available for Edmonton for the second group of farms (Table 2), a 4-hr limit detected 49% of the poor conditions at Winnipeg and only 29% at Guelph. Such marked variations in the behavior of a test from one area to another pose a real problem for those responsible for establishing minimum standards for acceptable milk.

TABLE 4. EFFECT OF AN ADDITIONAL 24 HOURS REFRIGERATED STORAGE ON SPC AFTER PI.

SPC-PI on 24 hr old samples (000 omitted)	SPC - PI on 48 hr samples (000 omitted) <25	25 - 50	50 - 100	100 - 200	200 - 500	>500
	(Number of samples in respective groupings)					
Edmonton						
<25	8	3	—	1	—	—
25 - 50	—	3	—	1	—	—
50 - 100	—	—	—	—	2	—
100 - 200	—	—	—	—	—	3
200 - 500	—	—	—	—	1	1
>500	—	—	—	—	—	—
Winnipeg						
<25	—	—	—	—	—	—
25 - 50	—	1	1	1	—	1
50 - 100	—	—	—	1	—	—
100 - 200	—	—	—	—	—	—
200 - 500	—	—	—	—	1	—
>500	—	—	—	—	—	—
Guelph						
<25	3	1	—	—	—	—
25 - 50	—	1	—	—	—	—
50 - 100	—	—	—	—	1	—
100 - 200	—	—	—	—	—	—
200 - 500	—	—	—	—	—	—
>500	—	—	—	—	—	—
Ottawa						
<25	8	3	2	2	—	1
25 - 50	1	3	1	—	2	—
50 - 100	—	—	—	1	2	—
100 - 200	—	—	—	—	—	1
200 - 500	—	—	—	—	—	2
>500	—	—	—	—	—	—

Another point of great interest to sanitarians is that even a standard as stiff as 10,000/ml SPC failed to catch many farms where production conditions were unsatisfactory. In view of the enormous dilution factor previously mentioned, this is not surprising. In fact, studies of the first group of farms showed that at Guelph 32% escaped detection, while at Edmonton and Winnipeg the figures were 28% and 9% respectively. Similarly, with a standard of 25,000/ml SPC-PI, the percentages missed were 44% for Guelph, 23% for Edmonton and 11% for Winnipeg. While for the second group of farms the percentages missed were frequently lower, they still represented a significant proportion. This suggests that no matter how stiff the bacteriological standard may be, it is essential that it be supplemented by regular, frequent, careful inspection of milk-handling equipment.

Another interesting finding was that RRT values equivalent to various SPC levels varied widely between centers, and even more so between the first and second groups of farms, as may be seen from Table 5. This is of particular interest in Canada where the RRT is still widely used for controlling fluid, as well as manufacturing, milk supplies. It will be noted that in all cases the reduction time corresponding to an SPC of 200,000/ml is much longer than the 2 3/4 hours set out as equivalent in the Standard Ordinance and Code of the U. S. Public Health Service *(10)*, or the 3 hours suggested by the originators of the Triple Reading Resazurin Test *(7)*. The latter equivalent value was still valid in the 1957-58 studies at Ottawa *(5)*.

Analysis of data for the counts of psychrophiles and coliforms, and those after laboratory pasteurization (LPC), has not yet been completed, but scrutiny of scatter diagrams and reports suggests that none of these tests will be as useful as the SPC or RRT in indicating unsatisfactory conditions.

Perhaps a word about standards for acceptable milk may be appropriate. The ideal test would detect the maximum number of unsatisfactory conditions with the minimum number of so-called "false positives". The expression "so-called" is used advisedly, because a high count on milk when conditions are reported "satisfactory" could very well mean that the source of contamination, e.g. a poorly washed agitator in a bulk tank, could not be detected on inspection, since the tank then contained two milkings. Bearing in mind that it is customary to allow one count in four to exceed the limit *(10)*, a percentage of "false positives" as high as 25% might not be unreasonably severe. On this basis, it could be argued that a standard as stringent as SPC 25,000/ml fresh, or 50,000/ml PI, could be considered at all three centers.

TABLE 5. EQUIVALENT RESAZURIN REDUCTION TIMES FOR VARIOUS STANDARD PLATE COUNT LIMITS

Center	Average reduction time (hrs) for SPC/ml indicated				
	25,000	50,000	100,000	200,000	500,000
1 Edmonton					
Before PI	6.18	5.84	5.51		
After PI			5.14	4.74	4.20
2 Winnipeg					
Before PI	5.25 (4.29)	5.02 (4.07)	4.80 (3.86)		
After PI			4.56 (3.95)	4.24 (3.62)	3.81 (3.19)
3 Guelph					
Before PI	4.34 (6.26)	4.11 (6.03)	3.88 (5.79)		
After PI			3.96 (5.02)	3.74 (4.70)	3.45 (4.28)

Note: Values in parenthesis are for the second groups of 50 farms each.

Without any question the careful producers can meet this quite consistently. Such being the case, is there any good reason for condoning careless practices by setting more lenient standards? Even at a limit of 25,000/ml SPC a considerable proportion of farms (58% at Guelph) with "unsatisfactory" production conditions escaped detection. This is entirely apart from such undesirable features as dirty cows and stables, which are not adequately reflected by any of the usual bacteriological tests *(4)*. It should always be borne in mind that, "Milk should be produced and processed under conditions which, if observed, would be satisfactory to the consumer and would encourage consumption" *(3)*. Obviously only frequent farm inspection can assure such conditions.

Analysis of the data from the first year's work showed that PI resulted in much less bacterial increase at Edmonton than at the other two centers. It seemed most likely that differences in bacterial flora were responsible, so the new collabarative project previously mentioned was inaugurated. Although the scatter diagrams (Figures 3-5) prepared at the completion of the first project fail to show this as clearly as the earlier ones, it may be noted that only 7% of the Edmonton samples showed an increase of over ten-fold[3] on PI, as against 23% for Winnipeg. Yet the data in Table 1 fail to show that PI was any more effective in Winnipeg than Edmonton in detecting production 'faults'.

From these studies it appears that: *(a)* the pulsating rinse count alone is not a reliable yardstick for assessing sanitary milk handling conditions on the farm; *(b)* using a combination of inspection and pulsating rinse as a yardstick, PI failed to show the expected advantage in detecting unsatisfactory conditions, probably due largely to the age of the samples; *(c)* different tests varied markedly in efficiency between centers; *(d)* equivalent resazurin values varied greatly; and *(e)* even at a count limit of 10,000/ml up to one-third of the farms with unsatisfactory conditions escaped detection. This latter finding emphasizes the need to supplement laboratory tests with frequent careful inspection of milk handling equipment.

[3]Indicated on the graphs by the right-hand diagonal lines.

ACKNOWLEDGMENTS

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For aid in planning the project, and for unstinted efforts in analyzing and interpreting the data, special thanks are due to Mrs. P. M. Morse and her assistants in the Statistical Research Service, Research Branch, Canada Department of Agriculture, and to Dr. K. H. MacKay and his assistants in the Data Processing Section.

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PRELIMINARY INCUBATION OF RAW MILK SAMPLES AS AN AID IN EVALUATING BACTERIOLOGICAL QUALITY[1]

M. N. Desai[2] and T. J. Claydon

Department of Dairy Science
Kansas State University, Manhattan

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A total of 194 milk samples were obtained from 35 bulk tank grade-A milk producers in the Manhattan, Kansas, milkshed during different seasons, and examined for standard, coliform, and psychrophile plate counts both before and after preliminary incubation (P.I.). Samples also were tested for inhibitory substances. Farms were ranked I, II, or III in general sanitation on the basis of visible conditions, with rank I most desirable. Except for one doubtful sample, all tests for inhibitory substances were negative. With standard plate counts, when no consideration was given to initial count level, there was no statistically significant relation between P.I. counts and season or sanitation rank, although summer growth ratios were always lowest. When data were grouped on the basis of initial count range, P.I. counts and growth ratios increased with increased sanitation rank in the lower count ranges. In initial count ranges > 50,000/ml the relationship between growth ratio and sanitation rank declined. With coliform counts, considerable inconsistency occurred in P.I. counts among seasons and sanitation ranks. Initial and P.I. coliforms counts showed little relationship with standard plate counts (except in summer) or with psychrophile counts. With psychrophile counts, growth ratios during P.I. were influenced by season, being highest in winter and lowest in summer. P.I. counts generally increased with increase in sanitation rank. The relation between growth ratios and sanitation rank was statistically significant ($P < 0{:}05$).

Bulk tank handling of milk on producing farms has introduced certain problems relating to quality. Among them is the altered status of the standard plate count as a quality index. Efficient cooling may mask insanitary production practices by contributing to low bacterial counts *(2, 3, 4, 5, 6, 7)*. The psychrophilic flora is favored by longer holding at low temperatures. Standard bacteriological tests may fail to indicate insanitary conditions or the true bacteriological quality of the milk. As a partial solution, it has been proposed that raw milk samples be incubated prior to making initial plate counts. Johns *(4, 5)* proposed incubation of samples at 55 F for 18 hr. He contended that such preliminary incubation (P.I.) would encourage growth of contaminants and differentiate between milk that had been produced under sanitary conditions and that with bacterial numbers suppressed by efficient cooling. Hence the procedure would be a more reliable measure of care in production and handling and would contribute to better control of raw milk quality. Other investigators *(2, 6)* endorse a P.I. procedure as an index of sanitation.

Investigations of the merits of the P.I. procedure have been limited to a few geographical areas, and have included only limited information on seasonal effects. Further evaluation of the proposal is needed. Work reported here was undertaken to study effects of the procedure on standard plate, psychrophile, and coliform counts during different seasons in north-central Kansas.

Experimental Procedure

Collection of Samples

Milk samples were collected from 35 bulk tank grade-A producers in the Manhattan, Kansas, milkshed. Most samples were obtained by the county milk sanitarian and some were taken by a milk hauler trained and licensed to do such sampling. Although most of the samples were known to represent four milkings, in some cases this information was not obtained. More samples were obtained during some seasons than others. Samples were obtained aseptically after operating the bulk tank agitator for several minutes. They were iced immediately after collection and brought to the laboratory. In almost all cases, samples were analyzed for inhibitory substances and for bacteriological quality promptly after arrival. When it was necessary to hold samples, they were kept at 0-2 C for not more than 24 hr before analysis. General sanitary conditions of each producer's milk handling facilities were also judged and rated visually by the sanitarian as rank I, II and III with rank I most satisfactory.

Analyses of Samples

Milk samples were analyzed for inhibitory substances by the rapid disc assay screening method *(1)*. Standard plate counts (S.P.C.), coliform counts, and psychrophile counts were made initially as well as after incubating the milk samples at 13 C (approximately 55 F) for 18 hr. The counts made after incubation were termed P.I. counts. Plating methods used were the standard procedures recommended by the American Public Health Association *(1)*, using 35 C incubation temperature for standard plate counts.

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[1]Contribution No. 326, Department of Dairy Science, Kansas Agricultural Experiment Station. Part of dissertation submitted by the senior author as partial fulfillment of the requirements for the M. S. degree.

[2]Present address: Jalalpore, Guparat, India.

TABLE 1. INCREASE IN STANDARD PLATE COUNT DUE TO PRELIMINARY INCUBATION OF MILK SAMPLES EXAMINED DURING DIFFERENT SEASONS

Season	No. of samples	Geometric means of standard plate counts/ml Initial (A)	P.I. (B)	Growth ratio B/A
Fall	28	11,000	50,000	4.5
Winter	36	14,000	68,000	4.9
Spring	38	9,000	44,000	4.9
Summer	92	24,000	59,000	2.5
Summary	194	14,000[a]	55,000[a]	3.7

[a]Geom. avg. of seasonal means

Violet red bile agar medium was used for coliform counts. For psychrophile counts, plates were incubated at 7 C for 7 days.

In summarizing the data, standard plate counts and psychrophile counts were averaged logarithmically as recommended in the Milk Ordinance and Code *(8)* to even discrepancies. These counts are presented in results as geometric means. With coliform counts, arithmetic averages were used since the count range was much lower and some zero counts were obtained. Values reported for counts are on a per ml basis.

In studying the effect of season on preliminary incubation of raw milk samples, the different seasons were identified as follows: Fall—September, October, and November; Winter—December, January and February; Spring—March, April and May; Summer—June, July and August.

Statistical evaluations were made by analysis of variance and linear regression.

RESULTS AND DISCUSSION

Tests for inhibitory substances

All milk samples except one gave negative test results for inhibitory substances. The one exception was classed as doubtful. It was concluded that inhibitory agents, as measured by the test employed, were not a factor in influencing bacterial development during preliminary incubation of milk samples.

Influence of P.I on standard plate counts during different seasons

Data are summarized and grouped in Table 1 by season. Since the plate incubation temperature was 35 C, counts probably averaged lower, especially after P.I., than if a 32 C temperature had been used. The overall geometric average of initial counts of 14,000/ml supports the contention of Johns *(4)* that present bacterial limits (S.P.C. 200,000/ml) are not consistent with changed conditions of producing grade-A milk. Initial counts averaged highest in summer and lowest in spring. Statistical analyses of the logarithms of individual counts (analysis of variance) showed that season had a significant effect ($P<0.01$) on initial counts, with summer counts considerably higher than counts in other seasons.

After P.I., it is significant that the highest average count (68,000/ml) was obtained in winter and that relative differences in counts during different seasons tended to even out. Average growth ratios were generally similar for fall, winter, and spring but were markedly lower for summer. Apparently the P.I. treatment was less favorable for the prevailing flora in summer than in other seasons. Growth ratios on individual samples varied from slightly more than 1 to >100, and analysis of variance of the individual ratios indicated that effect of season on growth ratio was not statistically significant. Nevertheless it appears that the P.I. count is more effective in fall, winter, and spring than in summer, in revealing organisms that do not show up in initial counts.

Influence of P.I. on coliform counts during different seasons

Data on coliform counts, summarized by arithmetic means, are presented on a seasonal basis in Table 2. Relatively more seasonal variation occurred in initial coliform counts than in initial standard plate counts. This may be due partly to the use of arithmetic averages rather than geometric averages. Counts were considerably higher in summer than in other seasons and correlated with the high initial standard plate counts obtained in summer. However, the relatively low coliform counts obtained in winter raise some question as to whether initial coliform counts would be a suitable measure of bacteriological quality during all seasons.

P.I. treatment reduced the seasonal variation observed in initial coliform counts. In winter, when initial coliform counts were low, average growth ratio on P.I. was highest. This suggests that the

TABLE 2. INCREASE IN COLIFORM COUNTS DUE TO PRELIMINARY INCUBATION OF MILK SAMPLES EXAMINED DURING DIFFERENT SEASONS

Season	No. of samples	Arithmetic means of coliform counts/ml. Initial (A)	P.I. (B)	Growth ratio B/A
Fall	27	313	2,100	6.9
Winter	32	55	830	15.1
Spring	37	220	1,400	6.4
Summer	92	1,700	4,000	2.3
Summary	188	570[a]	2,100[a]	3.7

[a]Arith. avg. of seasonal means

TABLE 3. INCREASE IN PSYCHROPHILIC COUNTS DUE TO PRELIMINARY INCUBATION OF MILK SAMPLES EXAMINED DURING DIFFERENT SEASONS

Season	No. of samples	Geometric means of psychrophilic counts/ml		
		Initial (A)	P.I. (B)	Growth ratio B/A
Fall	19	1,900	45,000	23.7
Winter	36	4,000	190,000	47.5
Spring	37	1,700	46,000	27.0
Summer	92	1,600	22,000	13.8
Summary	184	2,100[a]	54,000[a]	25.7

[a]Geom. avg. of seasonal means

P.I. coliform count would be a better measure of quality than the initial coliform count, since the P.I. count correlated better with the standard plate count in winter. As with standard plate counts, the growth ratios were lowest when initial counts were highest.

Influence of P.I. on psychrophile counts during different seasons

The geometric mean of initial psychrophile counts was greater in winter than in the other seasons, which were essentially equal (Table 3). The higher winter counts are not unexpected since prevailing lower temperatures tend to favor psychrophilic types in the environment. However, analysis of variance of individual count data indicated that observed differences were not statistically significant.

After P.I., the overall average count of 54,000/ml was about equal to the standard plate P.I. count. The P.I. procedure had a much greater effect on psychrophiles than on standard plate counts. This indicates that psychrophiles multiplied more rapidly during P.I. than did other types. The high standard plate counts obtained after P.I. in winter (Table 1) probably were due to greater increases in psychrophiles. Although these obviously increased during P.I. (13 C for 18 hr), many would fail to grow at the 35 C standard plate count incubation temperature.

It is significant that the average P.I. psychrophile count was much higher in winter than in other seasons and also much higher than the P.I. standard plate count. Obviously even the P.I. standard plate count fails to measure a large part of the flora in winter. In contrast to standard plate counts and coliform counts, highest initial psychrophile counts also produced highest growth ratios.

Since the initial psychrophile counts averaged much lower in all seasons than the initial standard plate counts, initial psychrophile counts might be misleading as an index of the bacteriological quality of raw milk. However, after P.I., the psychrophile counts were about the same as standard plate counts in fall and spring and considerably higher in winter. This suggests that during winter, a P.I. psychrophile count would be a better quality index than a P.I. standard plate count. On the other hand, in summer a P.I. psychrophile count did not reflect the bacteriological condition as well as a P.I. standard plate count.

Growth ratios were much higher in winter than in other seasons and statistical analysis of individual count data showed that season had a significant effect ($P < 0.01$) on growth ratios of psychrophilic bacteria.

Relationship of sanitary rank of producing farms to P.I. standard plate counts

In Table 4, data have been grouped in an attempt to show the effect of sanitary rank of farms on P.I. counts during different seasons. Such tabulation greatly reduced the number of samples in each group.

The overall geometric means of initial counts for sanitation ranks I, II and III were 12,000, 12,000 and 24,000 per ml of milk, respectively. This suggests that the rank III farms were less sanitary. The similar overall averages for ranks I and II may reflect the fact that farms were ranked by visual inspection and that there were no real differences in sanitary conditions of milk handling equipment or that any differences were not measured by initial counts. It is of interest that in summer, geometric means of initial counts in each sanitary rank varied little.

The overall geometric means of P.I. counts increased as sanitation rank increased. However, there was considerable variation between seasons and within sanitation ranks. Growth ratios showed no consistent trend with sanitation rank or season on inspection of data grouped in the table. Analysis of variance also showed no significant relationships. However, growth ratios were lowest in summer for all sanitation ranks. This might result from the high initial counts obtained in summer since, as shown in previous tables, the growth ratios usually were lowest when initial counts were highest.

Relationship of sanitary rank of producing farms to P.I. coliform count

The data in table 5 are arranged on a seasonal basis. The overall arithmetic means for initial coliform counts indicate little difference among sanitation ranks. However, initial counts were highest in summer and lowest in winter within each sanitation rank, suggesting that prevailing seasonal temperatures affect initial coliform counts. Although the summary indicates a direct relationship of sanitation rank with P.I. count and growth ratio, the relationships on a seasonal basis are very inconsistent. Only the spring season shows consistency with initial counts, P.I. counts, and growth ratios increasing with sanitation rank. Consequently, seasonal variations involved

TABLE 4. RELATIONSHIP OF SANITARY RANK OF PRODUCING FARMS TO INCREASE IN STANDARD PLATE COUNTS DUE TO PRELIMINARY INCUBATION OF MILK SAMPLES EXAMINED DURING DIFFERENT SEASONS

	Sanitation rank I				Sanitation rank II				Sanitation rank III			
Season	No. of samples	Geom. mean of initial counts (A)	Geom. mean of P.I. counts (B)	Growth ratio B/A	No. of samples	Geom. mean of initial counts (A)	Geom. mean of P.I. counts (B)	Growth ratio B/A	No. of samples	Geom. mean of initial counts (A)	Geom. mean of P.I. counts (B)	Growth ratio B/A
Fall	10	8,600	29,000	3.3	8	10,000	140,000	14.0	8	16,000	45,000	2.8
Winter	10	14,000	63,000	4.5	17	11,000	43,000	3.9	8	25,000	130,000	5.2
Spring	12	5,800	18,000	3.1	16	8,400	39,000	4.7	8	32,000	110,000	3.4
Summer	38	25,000	63,000	2.5	39	21,000	59,000	2.3	14	26,000	73,000	2.4
Summary	70	12,000[a]	38,000[a]	3.2	80	12,000[a]	61,000[a]	5.0	38	24,000[a]	83,000[a]	3.45

[a]Geom. avg. of seasonal means

TABLE 5. RELATIONSHIP OF SANITARY RANK OF PRODUCING FARMS TO INCREASE IN COLIFORM COUNTS DUE TO PRELIMINARY INCUBATION OF MILK SAMPLES EXAMINED DURING DIFFERENT SEASONS

	Sanitation rank I				Sanitation rank II				Sanitation rank III			
Season	No. of samples	Arith. mean of initial counts (A)	Arith. mean of P.I. counts (B)	Growth ratio B/A	No. of samples	Arith. mean of initial counts (A)	Arith. mean of P.I. counts (B)	Growth ratio B/A	No. of samples	Arith. mean of initial counts (A)	Arith. mean of P.I. counts (B)	Growth ratio B/A
Fall	10	200	1,400	7.0	8	190	4,800	25.3	7	670	600	0.9
Winter	8	8	120	15.0	17	67	1,200	17.9	7	84	760	9.0
Spring	12	25	56	2.2	16	170	2,600	15.3	9	600	40,000	66.7
Summer	38	1,700	3,400	2.0	39	1,300	4,600	3.5	14	2,000	4,400	2.2
Summary	68	500[a]	1,200[a]	2.4	80	400[a]	3,300[a]	8.3	37	800[a]	11,000[a]	13.8

[a]Arith. avg. of seasonal means

make it questionable that P.I. coliform counts would be a suitable index of sanitation.

Relationship of sanitary rank of producing farms to P. I. psychrophile counts

The initial geometric average of psychrophile counts in each season increased with sanitation rank, except for sanitation rank III during fall and summer (Table 6). In summer, averages remained generally similar in each rank. However, analysis of the grouped data indicated differences in initial count due to season and sanitation rank were not statistically significant.

Overall geometric means of P.I. counts were 26,000, 35,000 and 110,000/ml for sanitary ranks I, II, and III, respectively, showing that, for the year, P.I. counts increased as sanitary rank increased. However, the relationship was not so consistent in all seasons. P.I. counts were highest during winter.

Although the overall growth ratio was not consistently related to sanitation rank, it was highest (40.7) for rank III. Seasonal growth ratios were highest in winter and highest in sanitation rank III during each season.

The effects of season and sanitation rank on growth ratios were statistically significant ($P < 0.05$). It appears that growth ratios and P.I. counts of psychrophiles are indices of sanitation. However the time involved limits their value.

Relationships among level of initial standard plate count, sanitary ranking, and P.I. counts

Summarized data are grouped in Table 7 to indicate relationships of P.I. counts and growth ratios with levels of initial standard plate count and sanitation rank.

In ranks I, II and III, 48%, 41%, and 40%, respectively, of the samples in each rank had initial counts less than 10,000/ml. Geometric mean counts of these samples were 4,900, 4,600, and 5,400/ml in sanitation rank I, II and III, respectively. Obviously milk with relatively low initial standard plate counts (<10,000/ml) was not necessarily limited to that produced on farms with sanitation rank I. Moreover, 77%, 84%, and 62.5% of the samples in sanitation rank I, II and III, respectively, had counts of 50,000 or less. This suggests that the present standard of 200,000/ml for raw bulk milk is exceptionally lenient.

In all count ranges, the P.I. count increased as initial count increased, a relationship that occurred in all sanitation ranks. However, actual growth ratios did not show a uniform relationship. It is significant that in all ranges of initial counts up to 50,000/ml, the growth ratios increased as sanitation rank increased. Statistical analysis of the logs of individual counts by linear regression also showed that as sanitation became poorer, the growth ratios became greater.

In view of the relationships of P.I. counts and growth ratios with sanitary conditions of farms, it appears that the P.I. count would be a better measure of sanitary conditions of bulk milk producing farms than the standard plate count procedure. With milk of low initial count, the P.I. procedure helps to detect undesirable sanitary conditions. However, with high count milk (>50,000/ml) there is less relationship between growth ratio and sanitation rank. Hence with such milk the P.I. count would appear to have little advantage over the standard plate count as a measure of sanitation. Nevertheless, since the initial count level seldom can be predicted, a consistent P.I. program would seem desirable. A plate incubation temperature of 32 C for standard plate counts might have indicated different relationships among the various types of counts.

TABLE 6. RELATIONSHIP OF SANITARY RANK OF PRODUCING FARMS TO INCREASE IN INITIAL PSYCHROPHILIC COUNTS DUE TO PRELIMINARY INCUBATION OF RAW MILK SAMPLES IN DIFFERENT SEASONS

	Sanitation rank I				Sanitation rank II				Sanitation rank III			
Season	No. of samples	Geom. mean of initial counts (A)	Geom. mean of P.I. counts (B)	Growth ratio B/A	No. of samples	Geom. mean of initial counts (A)	Geom. mean of P.I. counts (B)	Growth ratio B/A	No. of samples	Geom. mean of initial counts (A)	Geom. mean of P.I. counts (B)	Growth ratio B/A
Fall	5	700	14,000	20.0	7	5,000	10,000	2.0	5	1,000	21,000	21.0
Winter	10	3,000	160,000	53.3	18	3,600	140,000	38.9	8	6,000	500,000	83.3
Spring	12	700	12,000	16.1	16	1,600	36,000	22.5	9	6,600	410,000	62.1
Summer	37	1,300	16,000	12.3	39	1,900	30,000	15.8	14	1,300	29,000	22.3
Summary	64	1,200[a]	26,000[a]	21.7	80	2,700[a]	35,000[a]	12.9	36	2,700[a]	110,000[a]	40.7

[a]Geom. avg. of seasonal means

TABLE 7. RELATIONSHIP OF RANGE OF INITIAL STANDARD PLATE COUNT AND SANITARY RATING OF FARMS TO PRELIMINARY INCUBATION COUNTS

	Sanitation rank I				Sanitation rank II				Sanitation rank III			
Range of initial standard plate count	No. of samples	Geom. mean of initial counts (A)	Geom. mean of P.I. counts (B)	Growth ratio B/A	No. of samples	Geom. mean of initial counts (A)	Geom. mean of P.I. counts (B)	Growth ratio B/A	No. of samples	Geom. mean of initial counts (A)	Geom. mean of P.I. counts (B)	Growth ratio B/A
<10,000	33	4,900	15,000	3.1	34	4,600	20,000	4.3	16	5,400	31,000	5.7
10,000 to 30,000	17	16,000	52,000	3.3	27	18,000	79,000	4.4	9	18,000	91,000	5.1
30,000 to 50,000	5	39,000	79,000	2.0	6	36,000	77,000	2.1	3	37,000	310,000	8.4
>50,000	14	150,000	290,000	1.9	12	120,000	430,000	3.6	12	160,000	460,000	2.9

CONCLUSIONS

The present initial standard plate count maximum of 200,000/ml seems exceptionally lenient for raw, bulk tank, grade-A milk.

With low count milk, the P.I. standard plate count procedure is a better index of sanitary conditions of producing farms than is the initial standard plate count. When the initial count range is >50,000/ml and during the summer season, the standard plate count and P.I. count are about equal as measures of sanitation. Under practical laboratory conditions, it appears that a routine P.I. standard plate program would have merit.

The variation among seasons and sanitation ranks makes it questionable that the P.I. coliform count would be a suitable index of bacteriological quality.

Growth ratios and P.I. counts of psychrophiles appear to be the best indices of sanitary conditions. However, the time involved in incubation of plates for psychrophile counts limits the value of such procedure.

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H. L. Thomasson, Managing Editor

3-A SANITARY STANDARDS FOR EQUIPMENT FOR PACKAGING FROZEN DESSERTS, COTTAGE CHEESE AND SIMILAR MILK PRODUCTS

Serial #2300

Formulated by

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

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

A. *SCOPE*

These standards cover the sanitary aspects of equipment for performing the functions of holding, mechanically opening, forming, dispensing, filling, closing, sealing, or capping containers, or wrapping the product, and all parts which are essential to these functions. These standards do not pertain to the container, nor to other integral equipment embodied on certain machines which perform such functions as container fabricating.

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

B. *DEFINITIONS*

(1) PRODUCT: Shall mean frozen desserts, cottage cheese and products such as sour cream, yogurt, whipped butter, and whipped cream cheese, including added ingredients.

(2) CONTAINER: Shall mean a packaging enclosure, including its body, cap, cover or closure, or a wrapper, capable of holding the product.

(3) HOLDING, OPENING, FORMING AND DISPENSING EQUIPMENT: Shall mean the equipment for holding, mechanically forming, opening and dispensing the containers.

(4) FILLING EQUIPMENT: Shall mean the equipment for mechanically filling the container with the product.

(5) CAPPING, CLOSING, SEALING AND WRAPPING EQUIPMENT: Shall mean the equipment for mechanically capping, closing and sealing the container, or wrapping the product.

(6) SURFACES:

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

(b) *Non-Product Contact Surfaces*: Shall mean all other exposed surfaces.

C. *MATERIAL*

(1) All product contact surfaces shall be of 18-8 stainless steel with a carbon content of not more than 0.12 percent, or equally corrosion resistant metal, that is non-toxic and non-absorbent, except that:

(a) Those surfaces of the holding, forming, opening, dispensing, closing, capping, sealing, or wrapping equipment which touch the product contact surfaces of the container may be plated with a corrosion-resistant, non-toxic, non-absorbent metal.

(b) Welded or brazed areas and the deposited weld or braze material shall be non-toxic and corrosion resistant.

(c) Rubber and rubber-like materials may be used for filling nozzles, plungers, gaskets, diaphragms, sealing rings, drip shields, container opening, dispensing, closing or capping parts, filling valve members, seals and parts used in similar sealing applications. These materials shall comply with the applicable provisions of the "3-A Sanitary Standards for Multiple-Use Rubber and Rubber-Like Materials Used as Product Contact Surfaces in Dairy Equipment, Serial #1800".

(d) Plastic materials may be used for filling nozzles, plungers, gaskets, diaphragms, sealing rings, drip shields, container opening, dispensing, closing or capping parts, filling valve members, seals and parts used in similar sealing applications. These materials shall comply with the applicable provisions of the 3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Serial #2000".

(e) Sanitary single service gaskets may be used.

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

D. *FABRICATION*

(1) All product contact surfaces shall be at least as smooth as a No. 4 mill finish on stainless steel sheets or 120 grit finish properly applied.

(2) All permanent joints shall be welded or brazed. All welded or brazed areas of product contact surfaces shall be at least as smooth as the adjoining surfaces.

(3) All product contact surfaces shall be easily accessible, visible and readily cleanable, either when in an assembled position or when removed. Removable parts shall be readily demountable.

(4) All product contact surfaces shall be self-draining or self-purging except for normal clingage. The bottom of hoppers shall have a minimum pitch of 1/8 inch per foot toward the plane of the outlet(s).

(5) Product hoppers shall be equipped with covers having drop flanges which overlap the rim of the hoppers by at least 3/8 inch. All openings in hopper covers shall have raised rims or flanges of at least 3/8 inch, and such openings shall be provided with covers having a downward flange of not less than 1/4 inch so designed as to prevent liquid from entering the product zone, or the openings shall be equipped with sanitary fittings. Covers shall be self-draining.

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

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

(8) There shall be no threads on product contact surfaces.

(9) Covers, diverting aprons, shields or guards shall be provided to prevent liquid or other contaminants from draining or dropping into the container or product, or onto product contact surfaces.

(10) All sanitary pipe fittings shall conform with the design and construction provisions of the 3-A "Sanitary Standards for Fittings Used on Milk and Milk Products Equipment and Used on Sanitary Lines Conducting Milk and Milk Products", Serial #0800, and supplements thereto.

(11) Any coil spring having product contact surfaces shall have at least 3/32 inch openings between coils, including the ends.

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

(13) Non-product contact surfaces to be painted shall be effectively prepared for painting.

(14) The equipment shall be mounted as follows:

(a) With legs and/or casters: Legs and/or casters shall provide a clearance between the lowest fixed point of the equipment and the floor of at least 4 inches when the base outlines an area in which no point is more than 12½ inches from the nearest edge, or a clearance of at least 6 inches when any point is more than 12½ inches from the nearest edge. Legs shall be smooth with rounded ends, and have no exposed threads. If legs are hollow tube stock, they shall be effectively sealed. Equipment which is portable may be equipped with casters.

(b) Permanent Mounting: When legs and/or casters are not used, the base shall be designed to permit sealing to the mounting surface.

(15) Equipment for producing air under pressure which is supplied as an integral part of the filling equipment shall comply with "3-A Accepted Practices for Supplying Air Under Pressure in Contact With Milk, Milk Products and Product Contact Surfaces".

These standards shall become effective January 20, 1965.

MEDICAL EXAMINATIONS FOR DAIRY PLANT PERSONNEL[1]

Lewie C. Dodge[2] and T. I. Hedrick

Department of Food Science,
Michigan State University, East Lansing

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Summary

The evidence suggests that periodical medical examinations for milk and milk product handlers can be abolished without an increase in disease transmission through milk and milk products. A saving of expenses and/or time for the plant employee would result. The alternative that would benefit the dairy industry would be the establishment of specific details of the medical examination and their uniform adoption by the states and municipalities.

Reevaluation of national, state and local statutes seem appropriate periodically in a rapidly changing society. The regulations pertaining to health requirements of dairy plant personnel certainly should not be an exception. Many of the codes regulating health of dairy product handlers were promulgated a decade or more ago.

Large improvements in the technology of processing, packaging and distribution of dairy products have occurred in recent years. Mechanization of processing and packaging of dairy products has substantially reduced the opportunity for pathogenic contamination by employees. Not only is product exposure time less due to the trend to closed systems of processing and packaging, but the labor per unit of product has decreased substantially. With the increasing volume of individual dairy plants the marketing area has expanded. Thus, compliance with a larger number of regulations of local and state health agencies becomes necessary. Consequently, management has experienced a replication of inspections and the application of various codes that has presented difficulties as well as additional costs.

Some authorities question the need of health certificates for dairy product handlers. Roadhouse and Henderson *(3)* reported that physicians are not agreed on the value of health certificates that are not based upon a very complete medical examination. Furthermore, repeated examinations may be necessary to finally identify human spreaders of a pathogen. Others question the value of requiring routine periodical examinations.

The total cases of all milk-borne diseases reported by health authorities declined from 2,161 in 1945 to 48 in 1960. Deaths were 17 and 0 for the same years *(5)*. No deaths were attributed to dairy products during 1955 through 1960. The number of illnesses were 1,780. Most of these were attributed to raw milk products, improperly pasteurized products or toxins from bacterial growth.

Purpose of this paper is to present initial results of a general study on the health regulations for milk product handlers. Of pertinence were: *(a)* the extent of the dissimilarity of the specific laws and their applications among the different jurisdictional units of the government in the various sections of the U. S.; *(b)* the uniformity of factors considered in medical examinations; frequency, limitations and cost of medical examinations; the percentage of applicants who are rejected because of communicable disease requirements; and *(c)* the changes that would be beneficial for safeguarding the interests of both the industry and public and possibly the actual need for routine examinations.

The intention of this study was to consider the physical examination from only the viewpoint of public health laws on communicable (contagious) diseases. No thought was given to dairy plant requirements on other aspects of fitness either mental or physical regarding current or prospective future disabilities.

National Standards For Medical Examination

Probably the most closely regulated dairy employees are those engaged in production, processing and handling of Certified Milk *(1)*. A medical officer is appointed by the American Association of Medical Milk Commissions (AAMMC) for medical supervision of all personnel. A satisfactory medical examination is a must before employment. Specifically required are a chest x-ray, Widal and bacterial tests of stools, throat culture, Wasserman or equivalent, smallpox vaccination and complete history with emphasis on diseases that may be milk-borne. The medical examination shall be yearly. The medical officer is required to make on-the-premise monthly inspections of the employees and may conduct any medical examination he thinks necessary. He may check oftener if advisable. The employee must report any illness and the superintendent must exclude him from work and notify the medical officer. Copies of the employee's medical records are held in the dairy office and in AAMMC secretary's office.

Milk Ordinance and Code, 1953 Recommendations

[1]Michigan Agricultural Experiment Station Article No. 3380.
[2]Present address: Fairdale Farms, Inc., Bennington, Vermont.

of the U. S. Public Health Service *(4)* specified, "The health officer or a physician authorized by him shall examine and take careful morbidity history of each person connected with a pasteurization plant or about to be employed by one, whose work will bring him into contact with the processing, handling, storage, or transportation of milk, milk products containers, or equipment. If such examination or history should suggest that person may be a carrier of, or infected with organisms of typhoid, paratyphoid, or any other communicable disease likely to be transmitted through milk, he shall secure appropriate specimens of body discharges and cause them to be examined in a laboratory approved by him or the state health authorities for such examinations, and, if results justify, such person shall be barred from such employment.

"Such persons shall furnish such information, submit to such physical examinations, and submit such laboratory specimens as the health officer may require for the purpose of determining freedom from infection.

"No person with an infected cut, lesion on hands or arms shall handle milk, milk products, milk containers or milk equipment."

RESULTS

Most of the sources of information were obtained from: the printed recommendations of U. S. Public Health Service, health or dairy division of the 50 states and health department of the 18 large metropolitan areas in the U. S.; information provided by the dairy industry, the medical profession and public health officials of Michigan in 1963. The medical regulations of the various state and metropolitan codes, in general, applied to all dairy products.

Survey of all state and 18 major city codes.

All 50 states had provisions to prevent personnel with communicable disease from working in a dairy plant. Twenty-three (46.0%) of the states had adopted the medical requirements of the Milk Ordinance and Code, 1953 Recommendations of the U. S. Public Health Service, *per se*. Fifteen of the other states (30.0%) had similarly worded codes and/or the same plus additional or more specific requirements. The remaining 12 states (24.0%) apparently had developed their own codes. Much variation existed. Two states did not specify medical examinations. Three states required medical examinations only at the request of the health official. One state used a medical examination and test of knowledge of sanitary practices to grant workers permits. Another state required a yearly medical examination and a re-examination each time an employee was sick for more than 4 consecutive days. However, an examination before employment only, each 6 months, yearly or as required by health officer were the most common.

Thirteen (72.2%) of the 18 metropolitan health departments that were surveyed enforced the Milk Ordinance and Code, 1953 Recommendations of the U. S. Public Health Service. Five of these thirteen metropolitan codes also specified annual medical examinations and two required one each 6 months. Of the other five (27.8%), one required a "valid health permit", the other four did not specify a medical examination, but indicated no person infected or a carrier of communicable diseases could work in a dairy plant.

Of the total 68 state and city codes, the following requirements were observed: *(a)* 40 did not have a definite interval for repeat medical examinations after the pre-employment examination, *(b)* 17 had a compulsory yearly examination, *(c)* four specified 6-month intervals, and *(d)* one had a 2-year time limit. Six had no medical examination requirement.

Although all states and the 18 metropolitan areas had the terms, "infectious", "contagious" and/or "communicable disease" in their regulations, only one city and one state defined these terms. This city's code definition for infectious disease was, "An illness which is transmitted directly or indirectly by a person, animal, arthropod or through an intermediate host, vector or the inanimate environment to another person." The state reference was, "Communicable diseases shall include, typhoid fever, tuberculosis, septic sore throat, scarlet fever, diphtheria, undulant fever, foot and mouth disease, dysentery, all intestinal infections and any disease described as communicable or infectious in the manual of the American Public Health Association current at adoption of this chapter." One state code required, "only healthy persons can be employed", but gave no definition. Only one of the many regulations which required notification of the health officer of suspicion of employee infections clearly specified the method and time: firm must telephone immediately and confirm the notice by mail in 24 hours.

The state and city codes were quite general as to the nature of the medical examination. Apparently, the specific details were left to the discretion of the physician conducting the examination. Laboratory tests may or may not be specified. Codes requiring laboratory tests varied from a single test such as a chest x-ray, Widal, Wasserman, to combinations of these and others. Frequently, tests for a disease(s) or on a body discharge were required without indicating a standardized method or the laboratory eligible to perform the laboratory tests. The interpretation of results was left to the judgment of the examining officer.

Of interest was the fact that many codes did not specify who shall keep the medical records on each employee. Of the 16 states and 10 cities that had regulations for this factor, 14 required the dairy plant to maintain the medical record; six specified each employee carry a permit or health certificate and one provided for the employee to carry the permit or place it on file with the employer. The other five codes assigned the record to a designated government official usually the local health officer.

None of the state or city codes provided guidelines for the examining physician if the applicant had an illness on the day of examination. The presumption was that the applicant would be reexamined after apparent recovery. However, the possibility of an employee voluntarily reporting for an examination to obtain a certificate while ill is remote. Only one state had a provision for a right to appeal. This applied to employees whose permit had been revoked. He (or she) could apply for a review by the local or state health board. The appeal must be in writing and within 10 days of revocation.

The question of a minor illness such as a mild cold, sore throat, diarrhea, etc., is likely to be overlooked or adherence to the code less strictly applied. Only one of 68 codes mentioned these ailments specifically. However, Section 14 of Milk Ordinance and Code, 1953 Recommendations of the U. S. Public Health Service and the similar worded regulations were definitely assumed to include all communicable diseases including those of minor effects and symptoms regardless of the actual practice of plant management and the health officer.

Codes of two states and two cities apparently include all plant employees in the health provisions. The others limit the regulation to individuals in contact with the product, containers and/or equipment. The application of these medical requirements to office employees was not clear. Supposedly, they were exempt.

The state and city codes, patterned closely to the Milk Ordinance and Code, 1953 Recommendations of the U. S. Public Health Service, maintain an implied joint responsibility of the employee and employer. A few were specific in naming a joint obligation. Nine states and two city codes assigned the employer the duty of adherence to the medical regulation. Several codes placed the burden on the employee by requiring that he have a valid permit.

The penalities usually were limited to revoking the permit or license. Other codes placed violations in the misdemeanor class with a fine of $100.00 to $500.00 and/or 10- to 90-day sentence to jail.

Survey of dairy plant managers.

The manager of 250 market milk and milk product manufacturing plants in Michigan received a survey in 1963 regarding communicable disease aspects of medical examination. Seventy-nine replies were sufficiently complete to be usable. Incidentally, the state code specified that only healthy persons could be employed, but did not stipulate a medical examination before or during employment. Consequently, management had a choice unless the local city or county codes required medical examinations.

Fifty-one (64.6%) of the 79 respondents required the employees to pass a medical examination. The breakdown was as follows: annually, 17 (21.5%); before employment only, 15 (19.0%); x-ray check only without a stated frequency, 7 (8.9%); before employment plus annual x-ray, 6 (7.7%); miscellaneous requirements, 3 (3.8%); and 3 failed to answer the appropriate subquestion.

Approximately 1,100 applicants for employment in the 51 plants had been given medical examinations during the last 5 years. Not one of these applicants had been rejected for failure to pass the communicable disease portion of the medical examination. Most managers, who required an examination that was not demanded by a code, did not list specific medical tests. The local regulations occasionally included a chest x-ray and less often tests on blood and urine. Presumably the details of the examination were the volition of the physician and thus varied markedly among physicians or health officers.

Costs of the medical examination ranged from $2.00 to $25.00. When the company paid the cost of the initial examination it averaged $6.02. The employees had to pay an average of $6.64 initially. Subsequent fees averaged $4.69 for the firm and if employee paid, his average cost was $5.70. In a few localities the city or county incurred the expense of the medical examination. Also, in a few firms the expense was shared by plant and employees. The survey indicated the ratio was 2 to 1: company policy of payment versus obligating the employee to pay the examination fee.

Report of 10 physicians administering medical examinations.

Ten physicians gave the following answers in checking for freedom from communicable disease to permit a person to handle dairy products: eight obtained the history of the applicant's health; four requested a record of immunization; nine required a laboratory test for tuberculosis; one required a laboratory test for typhoid; six required one of the tests for syphilis; one suggested that laboratory tests be required if history indicated a need; and none of the physicians required a laboratory test for diphtheria, paratyphoid or dysentery.

One of the 10 physicians was not sure that the communicable disease portion of the employee medical examination served a useful purpose. Another volunteered that the present examination was not adequate. Comments regarding important health precautions to control transfer of communicable diseases were predominately to give close attention to cleanliness and sanitation. Other comments included: "sick employees should stay home"; "sterilization and processing by machine methods to eliminate human contact".

DISCUSSION

The study of numerous state and city codes on the communicable disease section of medical examination for milk product handling indicates a serious lack of uniformity. The required frequency of these examinations differ from none, occasionally, each two years, one year or every six months.

Particularly noteworthy as additional evidence in the lack of uniformity is variation in specific details considered necessary by the examining physician or health officer to determine freedom from communicable disease. The variability also applies to the number and nature of the laboratory tests and the method used.

The range in cost of $2.00 to $25.00 for medical examinations reported in the survey implied that the thoroughness varied greatly. In addition to the possibility of the fees, the savings in time are worth consideration when examinations plus travel are incurred by the plant.

The responsibility for adherence to the medical regulations may be directed to management, the employees or both, depending upon the code in effect.

Presumably in view of several factors, some health officers as well as authorities in the dairy industry question the value of medical examination for communicable diseases and seriously recommend its abolishment. In addition to the questionable value because of variability of medical examination details, several supporting reasons are given below. Improved methods and equipment have drastically reduced the possibility of a dairy plant employee induced contamination. The decrease in number of employees per unit of dairy product processed and merchandised has been substantial the last 15 years. As the trend continues, automation will eliminate direct human contact. Generally improved medical practices of personnel have decreased opportunity for serving as a source of communicable diseases. This fact is verified by the exceedingly low number of employees who failed to pass the medical examination requirements. Fifty-one dairy plant managers reported that not one of more than 1,000 applicants failed to pass the medical examination during a recent five-year period. Obviously a prospective employee does not apply for an examination unless he is reasonably certain of passing it. Records do not indicate a greater problem of disease transmission through dairy products in areas where the health officers do not require medical examinations except upon suspicion or symptoms of disease. Further substantiation is that most of the reported illnesses from dairy products were due to raw products, improper pasteurization or toxins from microbiological growth prior to pasteurization.

The dubious value of the periodical medical examination is not only being recognized, but is influencing code revision. In New York City the annual medical examination was recently deleted *(2)* because "It gave a false sense of security and detracted from the observance of the basic requirement —free from communicable diseases at all times." The effect of this change will be interesting to observe.

The proposed revision of the U. S. Public Health Service, Third Draft, Part III, Pasteurized Milk Ordinance (August 1964) appears to have eliminated routine medical examinations. Section 12 excludes handlers with any communicable disease from contact with all phases of production through distribution of milk and immediate notification of health officer upon suspicion or occurence of disease or contacts with disease by any handler. Section 13 provides for immediate exclusion of the person and the milk supply and adequate medical and bacteriological examination of the person and his body discharges and the same of his associates if reasonable cause for suspicion of infectious transmission exists.

Obviously another course of action for various local and state public health agencies is to officially adopt uniform requirements. However, unless specific details of the medical examination including laboratory tests are provided as a guideline for the medical officer, very likely little standardization would materialize. Current variations in the actual routine periodical medical examinations for food handlers that are given by different officials indicate that standardization may be a difficult task.

The data lead to the conclusion that effective and most efficient protection against human transmission of communicable diseases through dairy products will result by codes that require freedom from these diseases. Logically the responsibility for compliance should be placed upon both employee and management.

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Public Health Service. Milk Ordinance and Code. U. S. Government Printing Office, Washington, D. C. 1953.

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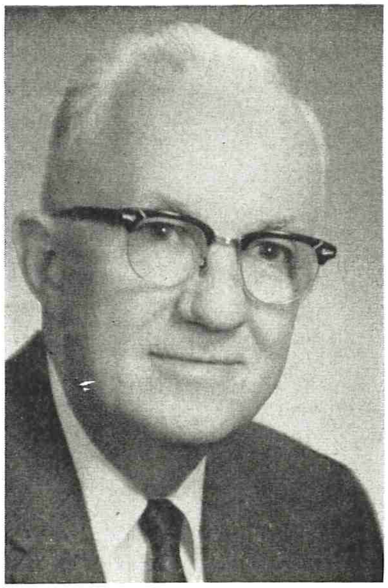
NEWS AND EVENTS

WILLIAM J. DIXON JOINS EDITORIAL STAFF OF JOURNAL OF MILK AND FOOD TECHNOLOGY



William J. Dixon

The Journal Management Committee is pleased to announce the addition of William J. Dixon to the Editorial Staff of the Journal of Milk and Food Technology. He joins the staff on a part time basis, January 1, 1965 as an Assistant Editor responsible for obtaining non-technical papers of general interest in the areas of milk, food and environmental sanitation, "grassroot" articles, and for a News and Events Section containing information regarding the affairs and activities of the association and its affiliates.

Bill Dixon, a long time member of the International Association of Milk, Food and Environmental Sanitarians is well known by many of our members. But just for the record and to properly introduce him we present:

William J. Dixon, a graduate of the University of Kansas with a BS degree in Civil Engineering, Sanitary Option; eight years experience in design and construction of water purification and sewage treatment systems and other engineering activities; eighteen years in the public health field at state and local levels including supervision of milk and food sanitation programs, environmental sanitation, plumbing inspection, mosquito control, housing, rodent control and industrial hygiene. From 1940 through 1948, he was Commissioner of Public Health Engineering with the Kansas City, Missouri Health Department, supervising an extensive municipal program.

For the last sixteen years, Bill has been with Klenzade Products of Beloit, Wisconsin, now a division of Economics Laboratory, Inc. His responsibilities have included management of National Accounts and Food Processing sales activities, development of sales promotion programs, sales training and technical writing. Since 1950, he has organized and managed the well-known Klenzade Educational Seminar including procurement, editing and distribution of the many, many fine technical papers presented at these meetings.

Not only is he a member of our Association, but also of the American Public Health Association, Conference of Municipal Public Health Engineers, Association of Food and Drug Officials of the United States, Institute of Food Technologists and a number of state and local public health and industry organizations.

On January 1, 1965, Bill Dixon retires from Klenzade but will continue as consultant on a part time basis with various assigned responsibilities. We are indeed fortunate that Bill has agreed to join our staff on a part time basis. You will be seeing and hearing more from him in the future, but for now, we all join in welcoming Bill Dixon to the Editorial Staff of the Journal.

The Journal Management Committee
Franklin W. Barber, Chairman

EMBASSY REPRESENTATIVES HEAR DSI PROGRAM OUTLINING PROSPECTS FOR GREATER MILK USE

Representatives from Embassies and consulates of 17 nations were guests at the 18th Annual Meeting of Dairy Society International, held at the La Salle Hotel in Chicago, Ill., on October 4.

They heard Richard W. Reuter, special assistant to President Lyndon B. Johnson and Director, Food For Peace, characterize the program as "the greatest nutritional and development scheme in history", and Gordon R. Schublatis, retired Agricultural Attache, tell how cooperation can build markets overseas for dairy products.

Reuter, with whom the Society works closely through an Advisory Committee to Food For Peace, pointed to the great impact which his program under P.L. 480 has had upon the health and economic development of the world.

"Under this program, which started out as surplus disposal," he said, "whole generations — literally millions — have first tasted milk." Currently 40 million children a day in all parts of the world are receiving milk, largely through school lunch programs.

"Is this just surplus disposal?" Mr. Reuter asked. "Or is this a new techique, a modern technique of sampling, which is developing in nearly every child a lasting desire for the product."

He paid tribute to the work which the Society is doing to develop commercial markets for dairy products around the world, and said that he had faith that government and industry, working together, would use the great asset of milk's wholesomeness and nutritional value to at last combat ignorance, ill health and poverty.

Mr. Schublatis, who in his last post in Turkey, had helped arrange the stage for cooperation between DSI and a leading milk cooperative in Turkey which may lead to a milk utilization project under Public Law 480 (Food For Peace), also stressed the need for a wide cooperation which cuts across national lines and which brings industry and government into a working partnership.

He was particularly interested, for areas such as Turkey, in seeing use made of "toning", developed by the Bombay Milk Scheme in India to stretch high fat buffalo milk by adding reconstituted nonfat dry milk. The major originator of this scheme, D. N. Khurody, is now the Society's regional coordinator for the Middle East.

"I believe that DSI, through Khurody, is on the right track in suggesting a Bombay Milk Scheme type of development," he said. "Means must be found to provide milk at a price level suited to the pocketbooks of the millions in the middle and low income groups. Interest in providing such a milk supply is growing." He said in concluding: "I am sure we can look with confidence to the building of programs through cooperation of a nature which will put dairy products on tables of millions in new areas of the world."

The addresses followed the business session of the Society at which the Society's managing director, George W. Weigold, its projects coordinator, George C. Warner, and "Dairy Ambassadors" who had completed overseas missions for the program during 1963-64 gave a résumé of the year's activities, illustrated wth colored slides.

The meeting saw the premiere of "Small World — the Story of Dairy Society International", a motion picture donated to the dairy industry by the Ex-Cell-O Corporation, through its vice president, George L. Huffman, a member of the DSI Board. It will be used to build support for the Society's program of widening markets for dairy products.

Among the Embassy and Consulate guests were: Chamnong Phahulrat, First Secretary, Embassy of Thailand; Steve McDonogh, Agricultural Attache, Embassy of Ireland; Sr. Gonzalo Blanco, Agricultural Attache, Embassy of Mexico; Sr. Antonio Bermejo, Agricultural Attache, Embassy of Spain; Mr. Stefanos Louvaris, Commercial Attache, Embassy of Greece; all of Washington, D. C. and Col. Horacio Porres, Consul General of Guatemala; Mr. Mario Scioloja, Acting-Consul General of Italy; Mr. S. Simizu, Consul-General of Japan; Mr. Salith Diler, Consul-General of Turkey; Sr. Alfonso Godoy, Consul-General of Venezuela; Mr. Robert Van Overberghe, Vice-Consul of Belgium; Sr. Jose Viviani Telles, Vice-Consul of Brazil; Mr. Jyrki Tuukkanen, Vice-Consul of Finland; Mr. Finn Sonberg, Vice-Consul of Norway; Miss Sieglinde Fraenznick, Asst. Commercial Officer, Consulate of Germany; Mr. Oded Shemberg, Regional Trade Commissioner, Consulate of Israel; Miss Mira Mundkur, Midwest Tourist Office, Govt. of India; all of Chicago.

NOTICE

Equipment manufacturers interested in obtaining permission to use the 3-A Symbol on silo-type storage tanks for milk and milk products and equipment for packaging frozen desserts, cottage cheese and similar milk products, batch pasteurizers, and batch processors should contact Mr. C. A. Abele, Secretary-Treasurer, 3-A Symbol Administrative Council, 2617 Hartzell St., Evanston, Illinois.

CHARLES E. WALTON ACCEPTS POSITION WITH WYOMING STATE DEPARTMENT OF AGRICULTURE

Charles E. Walton, Past President of IAMFES, has resigned his post with the Laramie, Wyoming Health Department to accept a position with the Wyoming Department of Agriculture. Mr. Walton will be Chief of the Food and Drug Division and will be headquartered in Laramie.

Mr. Walton came to Laramie from Pueblo, Colorado and has had an intensive program in restaurant and grocery store grading, dairy inspections and mosquito and insect control.

'CLEAN-IT-YOURSELF' SENTENCE

Litterbugs in a growing number of states are facing a new and persuasive punishment.

Judges, losing patience with the purveyors of trash, are sentencing offenders to clean-up stints along state highways in lieu of fines and terms in the jail house, according to Keep America Beautiful, the national organization dedicated to elimination of littering through public education.

Highway "clean-up sentences" have been levied by judges in New Jersey, California, Missouri, South Dakota, Maryland and Michigan.

A GUIDE FOR EVALUATING DAIRY EQUIPMENT

A new guide for evaluating the sanitary construction of milk and milk product equipment has been issued by the Public Health Service, U. S. Department of Health, Education, and Welfare.

The guide is designed to assist milk regulatory officials in evaluating milk and milk product equipment for compliance with the sanitary ordinances and codes relating to milk and frozen desserts developed by the Public Health Service.

"Milk and Milk Product Equipment — A Guide for Evaluating Sanitary Construction", PHS Publication No. 1216, has been developed by the Milk and Food Branch of the Service's Division of Environmental Engineering and Food Protection.

The first Milk Ordinance and Code recommended by the Public Health Service was established in 1924. At the present time it serves as a basis for milk sanitation laws or regulations in 37 States and in over 1,900 counties and municipalities.

Single free copies of the new guide are available from the Public Inquiries Branch, U. S. Public Health Service, Washington, D. C., 20201. Larger quantities of the publication can be purchased from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., 20402, at 15c per copy, or $11.25 for lots of 100 or more.

REDUCTION OF FOODBORNE ILLNESS IN THE UNITED STATES

If present levels of foodborne illness in the United States are to be reduced, new and improved methods to recognize, investigate, and report foodborne outbreaks are needed, an official of the Public Health Service, Department of Health, Education, and Welfare, said today.

Edwin L. Ruppert of the Public Health Service's Division of Environmental Engineering and Food Protection, speaking before the American Public Health Association in New York City, said that improved methods of detecting and reporting outbreaks of foodborne diseases by State and local health departments could permit a better definition of these health hazards and a more direct attack on the problem.

Describing presently emerging methods of food preparation as complex new systems of production, manufacturing, distributing and serving, representing an 80-billion dollar segment of our economy, he said that expanded research is urgently needed to prevent unsafe foods from reaching the consumer. Research is also needed to assess the chronic effects on people of repeated exposure to chemicals and microorganisms found in foods today, he noted.

Mr. Ruppert said today's changing technology has taken a large part of the production of food away from local health department control. It has also increased the importance of establishing broad nationally accepted criteria to assure health officials that food has been produced, processed, stored, and distributed under acceptable standards.

Existing programs and practices of food sanitation, for the most part, were developed before World War II and have not kept pace with technological or socioeconomic changes, he reported.

Mr. Ruppert pointed out that not all causes of foodborne disease are well known. Recent research suggests that the aflatoxins of spergillus flavus, the enteric viruses, enteropathogenic E coli and other foodborne microorganisms may cause illnesses that have not previously been considered foodborne. The basis for assessing health effects of numerous foreign chemicals in foods are also lacking, he said.

"Although the United States probably has today the most plentiful and varied food supply on earth, the means to protect the public from unsafe innovations has not kept pace with industrial developments," he said.

Public Health laboratories can lend reliable assistance to those health departments operating food protection programs, he said, adding that the Public Health Service has just published a volume of laboratory aids to the detection of pathogenic and indicator bacteria in foods. The publication, "Examination of Food for Enteropathogenic and Indicator Bacteria," is both a review of methodology and a manual of selected procedures. Single copies are available free to health departments from the Public Health Service or at 50c a copy from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

BIO-CONVERSION PROGRAM COMPLETE AT SEP-KO CHEMICALS, INC.

The complete conversion to biodegradable detergents in Monarch Quality Products has been announced by Sep-Ko Chemicals, Inc. of Minneapolis.

Mr. Steve Schmidt, president of the firm stated, "The intensive research, development and product testing has resulted in noticeable over-all product improvement. Our primary goal of making the biodegradable feature available to all users at no extra cost has been accomplished through programmed conversion. Each product had to meet or exceed its present cleaning power, effectiveness and rigid rinseability standards."

Sep-Ko Chemicals, Inc. manufactures a complete line of specialized cleaning and sanitizing products for the specific needs in dairy farming, dairy and food processing plants, hospital and plant laboratories as well as industrial and commercial building maintenance.

For more information write Sep-Ko Chemicals, Inc., 3801 N.E. Fifth Street, Minneapolis, Minnesota 55421.

TRAINING COURSE ON PESTISIDE RESIDUE ANALYSIS OF FOOD

The Public Health Service will conduct the 1-week course, Pesticide Residue Analysis of Food, February 1-5, 1965, at the Robert A. Taft Sanitary Engineering Center, Cincinnati, for professional personnel in control and regulatory laboratories. Instruction enables the trainee to characterize the pesticides used in food protection and processing, and to identify the physical and chemical procedures for residue analysis. The course is conducted by personnel of the Division of Environmental Engineering and Food Protection.

A more complete description of the course is given in the new *Bulletin of Courses* which is available on request. Applications or requests for information should be addressed to the Director, Training Program, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati, Ohio, 45226, or to an appropriate PHS Regional Office. No tuition or registration fee is required.

AMERICAN ASSOCIATION FOR ADVANCEMENT OF SCIENCE ANNUAL MEETING IN CANADA

For the first time in 26 years, the American Association for the Advancement of Science annual meeting will be held in Canada.

Montreal will be the site, on 26-31 December, of the 131st meeting of the 90,000-member AAAS. Meeting headquarters will be the Queen Elizabeth Hotel, but because of the large number of concurrent sessions many events will be held at the Sheraton-Mt. Royal, Windsor, Laurentien and Ritz Carlton hotels.

A unique role is played by the AAAS meeting which regularly draws 6,000 to 10,000 people, scientists and nonscientists, members and nonmembers alike. (AAAS counts among its members not only research scientists but also science teachers, students and laymen. In fact, AAAS is the one large U. S. all-science society which welcomes as a member anyone interested in science.)

The two major functions of the meeting are: as a forum for presenting new *interdisciplinary* developments in science, and as a means for improving the *public understanding* of science.

To accomplish the first goal, several dozen symposia and speeches of interdisciplinary interest will be presented. The meeting fills the second role by welcoming the public, and by attracting a large number (about 140 last year) of science writers and editors. Thus the meeting gets outstanding coverage in the North American mass media.

Symposia and speeches are not the only feature. The AAAS Exposition of Science and Industry will feature dozens of exhibits of scientific instruments and science books. And the AAAS Science Film Theatre will show some of the year's best new semi-technical and popular science films.

SHIFFMAN ADDED TO N. CAROLINA SCHOOL OF PUBLIC HEALTH STAFF

The Department of Environmental Sciences and Engineering, University of North Carolina, is proud to announce the appointment of Dr. Morris A. Shiffman as Associate Professor in the field of environmental sanitation. Dr. Shiffman has had long experience in the field of milk and food protection and with health agencies in environmental health programs. Most recently he held the position of Chief, Milk and Food Sanitation, Philadelphia Department of Health. Nationally, he has given leadership through the National Academy of Sciences National Research Council where he is a member of the Committee on Sanitary Engineering and the Environment and is Chairman of its Subcommittee on Food Sanitation. He is also a consultant to the World Health Organization in the area of food hygiene. He has also served with A.P.H.A. committees on food protection, evaluation and standards.

Dr. Shiffman's education background includes the degrees of Master of Governmental Administration (University of Pennsylvania), M.P.H. (University of Michigan), D.V.M. (Middlesex University), and a doctorate in Veterinary Medicine from the Ecole Nationale Veterinaire, D'Alfort, France. In addition he is earning a doctorate in political science at the University of Pennsylvania with a research concentration in the development of criteria for the administration of regulatory programs.

"STANDARD METHODS" REVISION PROGRESSING

Proposed changes for the 12th edition of "Standard Methods" were approved recently by the Coordinating Committee on Laboratory Methods and the Governing Council of the American Public Health Association. Thus the Sub-Committee on "Standard Methods for the Examination of Dairy Products," headed by Co-Chairmen, Dr. W. G. Walter, Dr. F. E. Nelson and Mr. J. C. McCaffrey, moves into the final stages of the work involved in preparation of the 12th edition. While several drafts of each chapter have been prepared during the course of the past 18 months, the final revised manuscript for each chapter is scheduled for receipt by the Co-Chairmen on Nov. 15, 1964. Following this each chapter will be reviewed, retyped and mailed to all committee members sometime during January 1965 for their review and comments.

The order of chapters presently favored is as follows:

Historical

Chapter 1—Philosophy of Standard Methods and Quality Tests.

Chapter 2—Significant Pathogens in Dairy Products.

Chapter 3—Collection of Milk and Cream Samples.

Chapter 4—Agar Plate Method.

Chapter 5—Coliform Tests.

Chapter 6—Thermoduric, Thermophilic and Psychrophilic Bacteria.

Chapter 7—Detection of Inhibitory Substances in Milk.

Chapter 8—Microbiological Methods for Concentrated and Dry Milk.

Chapter 9—Microbiological Methods for Butter.

Chapter 10—Microbiological Methods for Cheese and Cultured Products.

Chapter 11—Microbiological Methods for Ice Cream and Related Frozen Products.

Chapter 12—Direct Microscopic Method.

Chapter 13—Reduction Methods.

Chapter 14—Microbiological Tests for Equipment, Water and Air.

Chapter 15—Sediment in Fluid Milk.

Chapter 16—Phosphatase Methods to Determine Pasteurization.

Chapter 17—Miscellaneous Chemical Methods.

Chapter 18—Radionuclides in Milk.

Appendix A—Miscellaneous Microbiological Methods.

Appendix B—Miscellaneous Chemical Methods.

Appendix C—Reagents and Culture Media.

NEWS FROM NATIONAL MASTITIS COUNCIL

Annual meeting of the National Mastitis Council will be held February 18, 19, 1965 at the Sahara Inn, Chicago, Illinois. Complete details about program will be announced later.

News from the States

We have learned of the formation of new mastitis council in Minnesota to coordinate the activities of all groups dealing with bovine mastitis. One of the first projects of the Council will be to encourage the organization of an extension program. Officers of the Minnesota Mastitis Council are: Dr. H. H. Hoyt, head, Veterinary Medicine Department, U. of Minnesota, President; Hugh Munns, Twin City Milk Producers Association, Vice President; and Orlow Osten, Minnesota Department of Agriculture, Secretary-Treasurer.

Reports from the Indiana Mastitis Committee indicate that they are moving ahead towards developing an effective mastitis program for the state. At the summer meeting there was considerable discussion of mastitis control programs that are presently in operation in other localities. Following the discussion, a three man committee was appointed to draw up a program for action that could be recommended by the Indiana Mastitis Committee.

In Iowa, the Mastitis Council is encouraging all processors in the State to adopt their recommended testing program. At the September Council meeting, it was reported that 58% of the Grade A plants representing about 70% of the Grade A milk were using the plan. Of the manufacturing plants, 23% were using a testing program to detect abnormal milk. There was considerable discussion about getting mandatory enforcement of the testing program in Iowa. It was the consensus that good progress is being made on a voluntary basis and that the Council should proceed with the voluntary program until milk producers are involved. Then, if necessary, a mandatory program could be adopted.

A State Mastitis Council has been formed in Missouri and a 12 man group was named to head up the organization at the industry meeting held in Columbus recently. Officers of the organization are C. R. Johnston, Springfield, chairman; Don Hegeman, Cosby, vice chairman; and Gene Viets, Sedalia, secretary. Heads for four Council sub-committees were named and the date for the next meeting was set for December 15, when the group will start developing a program.

At Mastitis Council meetings in both Vermont and Indiana, it was suggested that schools be established to give special training to milkers.

The New York State Farm Bureau has recently distributed a discussion guide on mastitis under the heading, A Proposed Program to Improve Milk Quality. The discussion guide is to be used at what the Farm Bureau calls Kitchen Konferences. Emphasis in the proposed program is towards detection and control of mastitis. The Board of Directors of the New York Farm Bureau has asked members to consider the proposed program and make recommendations which will help determine the Farm Bureau position on this subject.

INDEX TO ADVERTISERS

CONSTITUTION AND BY-LAWS

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

CONSTITUTION*

ARTICLE I.

Association

There is hereby created the International Association of Milk, Food and Environmental Sanitarians, Inc., not for pecuniary purposes, which shall hereinafter be referred to as the Association.

ARTICLE II.

Objectives

1. To foster efforts designed to improve the professional status of the Sanitarian.

2. Develop uniform and proper methods of supervision and inspection of dairy farms, milk and milk products plants, and food-handling establishments, including restaurants, warehouses, and transportation equipment.

3. Develop uniform and proper methods for the examination of milk, milk products and other foods.

4. Encourage improvements in sanitary methods of production of milk and related food products.

5. Encourage the development of equipment and supplies to improve the sanitary handling of dairy and food products.

6. Assist members in their technical work and development.

7. Cooperate with other professional groups in advancing the public health through improved milk and food-handling technology.

8. Disseminate information concerning sanitary milk and food-handling technology and administration through its official publication and/or by other means.

9. Cooperate with other professional groups in the development of general and environmental sanitation.

ARTICLE III.

Membership

Section 1. There shall be two classes of membership in this Association: Members and Honorary Members.

Section 2. The qualifications of the several classes of members, the dues of each, the manner of their election to membership, and their respective rights and privileges shall be prescribed in the By-Laws, except as otherwise provided in this Constitution.

***Amended by vote of members in session at the 50th Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians in Toronto, Canada, October 24, 1963.**

Approved by mail ballot of eligible paid members on March 1, 1964.

ARTICLE IV.

OFFICERS, EXECUTIVE BOARD & COUNCIL

Section 1. The officers of this Association shall be a President, a President-Elect, a First Vice President, a Second Vice President, and a Secretary-Treasurer who shall hold these offices for one year or until their successors are elected or appointed, as provided in the By-Laws. At the termination of each Annual Meeting the President-Elect, First Vice President, and Second Vice President shall automatically succeed into the offices of President, President-Elect, and First Vice President, respectively. A Second Vice President and Secretary-Treasurer shall be elected by majority ballot of votes cast.

Section 2. The Executive Board shall consist of the President of the Association, the President-Elect, the two Vice-Presidents, the Secretary-Treasurer, and the immediate two Past Presidents. The Executive Board shall direct the affairs of the Association. A majority of the Executive Board shall be composed at all times of members who are officially connected with Federal, State, County, or Municipal Government or with an educational institution. If the status of any member of the Executive Board changes after election, or during his term of office, or after protem appointment as provided in Article II, Section 5, paragraph F of the By-Laws, so that a majority of members officially connected as stated herein, is not maintained in the Executive Board, then such member shall be deemed ineligible without prejudice for his office and such office shall be declared vacant.

Section 3. There shall be created a Council which shall consist of the Secretary or other authorized delegate from each Affiliate Association, and the immediate two Past Presidents of the Association. Each Affiliate Association shall have one vote at Council meetings. The Council shall select its Chairman and Secretary, shall keep a record of its proceedings, and shall, at each Annual Meeting of the Association submit its recommendations to the Executive Board.

Section 4. It shall be the duty of the Council to recommend to the Executive Board programs or activities for the Association; provided, that no recommendation of the Council is binding upon the Executive Board.

ARTICLE V.

AFFILIATE ASSOCIATIONS

Section 1. Members of this Association residing in the same geographical area, and also functioning organizations of milk and food sanitarians or closely related groups whose objectives are consonant with those of this Association, may apply for a Charter as an Affiliate Association under condition stipulated in the By-Laws.

Section 2. Each Affiliate Association shall have one representative on the Council. The representative shall be the Secretary or other duly authorized delegate of the Affiliate Association.

ARTICLE VI.

MEETINGS

Section 1. Each year when possible, the Association shall hold an annual meeting, and such other meetings as the Executive Board deems necessary.

Section 2. In all meetings of the Association, a quorum shall consist of at least twenty-five members.

Section 3. In case there is no quorum present to transact necessary business, the Executive Board is authorized to act for the best interests of the Association, and the elective officers will continue in office until their successors are duly elected.

Section 4. The Executive Board shall meet at each Annual Meeting of the Association and at such other times as the President shall deem necessary. A quorum for Executive Board meetings shall consist of at least five members and decisions shall be by a majority vote of those present.

ARTICLE VII.

AMENDMENTS

Section 1. Any member may propose amendments by submitting them in writing to the Secretary-Treasurer at least 60 days before the date of the next announced meeting, and the Secretary-Treasurer shall promptly notify all members that the proposed amendments will be open for discussion at that meeting. Such proposed amendments, upon a majority affirmative vote of the members present shall be, within 90 days, submitted to the entire membership of the Association by the Secretary-Treasurer. All members voting on such amendments shall, within 60 days after issuance of such notification, register their vote in writing with the Secretary-Treasurer on blanks furnished by the Association. These ballots shall be opened, recorded and filed, and the results shall be reported by the Executive Board to the membership of the Association. If the proposed amendments are passed by a two-thirds affirmative vote of those members who register their votes with the Secretary-Treasurer, they shall become a part of the Constitution from the date of such report and notice by the Executive Board.

ARTICLE VIII.

BY-LAWS

Section 1. The parliamentary procedure of the Association shall be governed by By-Laws adopted by majority vote of voting members in attendance at a duly called meeting of the Association.

BY-LAWS*

ARTICLE I.

MEMBERSHIP AND DUES

Section 1. The membership of this Association shall be composed of any persons who are interested in the objectives of this Association and those engaged in milk or food inspection, or the laboratory control of, or the administration of any such function, or engaged in research or educational work relating to any aforesaid function.

Section 2. The annual membership dues payable to the Association, January first of each calendar year shall be seven dollars ($7.00) for each member paying dues directly to the Association, and five dollars ($5.00) for each member paying dues through an Affiliate Association.

Section 3. Honorary Members:

A. The Honorary Membership shall be composed of persons who, on account of their substantial contributions to the objects of this Association, have been nominated by the Executive Board and elected by the members of this class of membership.

B. Honorary Members shall not be required to pay dues, shall not be entitled to vote, or to hold office, but may attend the meetings of the Association and be accorded the privilege of the floor.

Section 4. Any person desiring membership in this Association will submit his application on a form supplied by the Secretary-Treasurer and endorsed by a member. The Membership Committee, by majority vote, will determine eligibility and acceptability as a member.

Section 5. Any person having once become a member may continue membership in the Association so long as the annual membership dues are paid, except insofar as provided in Section 6 of this Article. Any member who shall fail to pay annual dues within three months after first notification by Secretary-Treasurer that said dues are payable shall be placed on the inactive list. Any such member may be reinstated within 90 days thereafter, by the Membership Committee upon notification by the Secretary-Treasurer that the dues in arrears have been paid. Any member who is delinquent in dues for one year will be dropped from membership, and can be reinstated only by filing reinstatement application in due form and accompanied by the annual membership dues for that year.

***Amended by vote of members in session at the 50th Annual Meeting of the Association in Toronto, Canada, October 24, 1963.**

Section 6. A member of the Association may be expelled for due cause upon recommendation of the Executive Board after opportunity for hearing by the Board, as provided below in Article II, Section 5G of the By-Laws, and a majority vote of the members at any Annual Meeting. Any member so expelled shall have refunded such prorata part of his membership dues as may not be covered by his term of membership.

Section 7. Each paid-up member of the INTERNATIONAL ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL SANITARIANS, INC., in good standing, shall receive at no extra cost, the regular issues of the Official Publication of the Association and such other publications as the Executive Board may direct for the year in which his dues are paid.

Section 8. A. The Secretary-Treasurer of the Association shall collect annual membership dues of seven dollars for each member paying directly to the Association, and five dollars from the Secretary-Treasurer of each Affiliate Association for each member paying membership dues through an Affiliate Association as provided in Article I, Section 2, of these By-Laws.

B. Members of the Association who pay local dues as members of one or more Affiliate Associations will pay Annual Membership Dues only once to the Association through an Affiliate Association, and shall receive only one annual subscription to the Journal so long as dues are paid to the Association.

ARTICLE II.

DUTIES OF OFFICERS, EXECUTIVE BOARD, AND COUNCIL

Section 1. The President shall preside at all meetings of the Association and the Executive Board. He shall appoint all committees unless otherwise directed by vote of the Association or by the Constitution and By-Laws, and perform such other duties as usually devolve upon the presiding officer or are required of him by the Constitution and By-Laws.

Section 2. The President-Elect shall perform the duties of the President in the latter's absence, shall succeed the President when the latter's term will expire, and shall be Chairman of the Program Committee which will be responsible for planning the program for the Annual Meeting.

Section 3. The Vice-Presidents, in order of their elected office, shall perform the duties of the President and President-Elect in their respective absence, and shall serve on the Program Committee.

Section 4. The following shall be the duties of the Secretary-Treasurer:

A. The Secretary-Treasurer shall record the proceedings of the Association and, unless an Executive Secretary has been appointed in accordance with the provision of subdivision B of this Section shall keep a list of the members, and collect all moneys due to the Association, giving his receipt therefor. He shall record the amount of each payment, with the name and address of the person so paying. He shall faithfully care for all moneys entrusted to his keeping, paying out the same only with the approval of the President and taking a receipt therefor. Unless the Association employs an Executive Secretary he shall, immediately after his election to office, file with the President of the Association a bond in the sum of Five Thousand Dollars ($5,000) the expense of which shall be borne by the Association and shall, at the Annual Meeting, make a detailed statement of the financial condition of the Association.

B. The following prescribed duties of Secretary-Treasurer may be delegated to an Executive Secretary appointed by the President upon approval of the Executive Board:

1. To keep a list of the members, and collect all moneys due the Association, giving his receipt therefor.
2. To record the amount of each payment, with the name and address of the payor.
3. To faithfully care for all moneys entrusted to his keeping, paying out the necessary expenses of the Association and giving an accounting thereof to the Board Members.
4. To file a surety bond with the President of the Association in the sum of Five Thousand Dollars ($5,000), the expense of the bond to be borne by the Association.
5. To give a detailed statement of the financial condition of the Association at the Annual Meeting.
6. The Executive Secretary will hold office until the Executive Board authorizes the President to appoint a successor, but the status of the Executive Secretary will be that of any employee of the Association.

C. The Secretary-Treasurer will serve as a member of the Membership and Publications standing committees.

D. The Secretary-Treasurer will be responsible for assembling and transmitting to the Editors of the publications of the Association all papers, addresses, and other matter worthy of publication as soon as possible after the Annual Meeting, and keep currently listed with the publications management the names and addresses of all members of the Association and Affiliate Associations entitled to receive the publications.

E. The Secretary-Treasurer will record and keep accurate minutes of the proceedings of all meetings of the Association and the Executive Board and prepare and keep them for permanent reference. He shall issue notices of all meetings, conduct correspondence pertaining to the affairs of the Association, and perform other duties incident to the office as the Executive Board may authorize.

Section 5. The full management of the affairs of the Association shall be in the hands of the Executive Board, as provided in the Constitution. The duties of the Executive Board shall be:

A. To direct the administrative work of the Association including all matters connected with its publication, its standardization work, its collaboration with other groups and institutions, and its professional development;

B. To act as trustee of Association property;

C. To recommend names for Honorary Membership;

D. To fix the time and place for the Annual Meeting;

E. To act for and in behalf of the Association in any administration, financial, legislative, educational, or other capacity as the Association may direct, or act on its own initiative between meetings and report such action at the next Annual Meeting.

F. To make protem appointments to fill any vacancy that may occur among the officers between meetings of the Association in the interest of the Association, and to recommend the replacement of an officer at the Annual Meeting, because of inability or inactivity or for other causes which may be in the interest of the Association;

G. To recommend expulsion from membership for cause by two-thirds vote of all votes cast, but in no case will revocation be recommended without giving the member written notice of reasons for the contemplated action at least one month before action is taken and an opportunity be given for a hearing in person and/or a rebuttal in writing;

H. To employ personnel, as the situation demands, and fix their compensation and duties;

I. To execute the policies of the Association and report to the Association at its Annual Meeting any action taken that was not specifically authorized;

J. The amount of the registration fee for the Annual Meeting shall be fixed annually by the Executive Board and shall be used for defraying the expenses of the Annual Meeting;

K. To authorize the issuance or revocation of a Charter to an Affiliate Association;

Section 6. The duties of the Council shall be:

A. To act as an advisory body to the Executive Board;

B. To serve as the means for the interchange of ideas and recommendations on programs, activities, and procedures among and between the Affiliate Associations and the Executive Board;

C. To aid in putting into effect policies and programs authorized by the Association and by the Executive Board;

D. To convey to the respective Affiliate Associations information on the activities of the Association;

E. To make a report of its activities to the Executive Board at the Annual Meeting;

F. The Chairman shall preside at all meetings of the Council. He shall appoint all Council committees unless otherwise directed by vote of the Council, and perform such other duties as usually devolve upon the presiding officer or are required of him by the Constitution and By-Laws.

ARTICLE III.

AFFILIATE ASSOCIATIONS

Section 1. The conditions for authorizing the issuance of a Charter to an Affiliate Association are as follows:

A. When a regional group of members of this Association want to form an Affiliate Association, a group of at least ten members of this Association will sign the application and forward it to the Secretary-Treasurer of this Association, accompanied with a list in duplicate of the names of the members of this Association suggested by the applicants for allocation to the Affiliate Association and also a definition of the area desired to be covered.

B. When an already-existing organization wants to become an Affiliate Association the Secretary or other duly authorized officer of the applicant organization will make written request for affiliation status, giving the name of the organization, a copy of the Constitution and By-Laws, an attested copy of the minutes authorizing said application, the names and addresses of its officers, the number of members, a statement as to the area now covered, and also the area that it desires to embrace.

Section 2. Upon affirmative majority vote of the number of votes cast, by the Executive Board, the Secretary-Treasurer of this Association will notify the responsible officer of the applicant organization concerning the action taken. Upon receipt of any further information requested by the Secretary-Treasurer and receipt of remittances to cover the amount of the membership dues, as per provisions in the By-Laws, Article I, Section 2 and Section 8, he will execute a Charter to the Affiliate Association in form and substance as approved by the Executive Board. After the granting of the Charter by this Association, the Secretary of the Affiliate Association or other duly authorized officer shall submit the names and addresses of each member, dues, and other official business to the Secretary-Treasurer of this Association as may be required in keeping with the Constitution and By-Laws.

Section 3 Any Affiliate Association may use the expression "Affiliated with the INTERNATIONAL ASSOCIATION OF MILK, FOOD, AND ENVIRONMENTAL SANITARIANS, INC." or an equivalent legend that is approved by the Executive Board.

Section 4. An Affiliate Association Charter may be revoked by the Executive Board upon recommendation by the Council on two-thirds vote of the total number of votes cast by the Council, after due and reasonable notice has been given in writing at least three months before such intention and a reasonable opportunity is given for a hearing, for the following causes:

A. When the affairs of the Affiliate Association are not conducted consonant with the Constitution and By-Laws of this Association, or

B. When the Affiliate Association has ceased to function for two years.

ARTICLE IV.

COMMITTEES

Section 1. Standing committees of this Association shall consist of the following: Program, Membership, and Publications.

A. The Program Committee shall consist of the President-Elect who shall serve as Chairman, the two Vice-Presidents and the Executive Secretary.

B. The Membership Committee shall consist of a Chairman appointed by the President, the Secretary-Treasurer, one member from each Affiliate, and such other members as are deemed desirable by the Executive Board.

C. The Committee on Publications shall consist of the Editors of the Association's publication and the Secretary-Treasurer of the Association who will report all matters pertaining to the publications to the Executive Board at least once every year and whenever so requested by the Executive Board. This Committee will handle all editorial matters concerned in publishing the Journal of Milk & Food Technology, with the approval of the Executive Board.

Section 2. Each year the President-Elect shall appoint a Nominating Committee at the Annual Meeting prior to next year's election, in ample time for them to meet at that meeting. This Committee shall consist of seven members other than officers of the Association. At least one member shall have been a member of the Nominating Committee of the previous year. The name of the Chairman of the Nominating Committee shall be published in the next issue of the Journal together with a date for submitting candidates for nominations for each office. The Nominating Committee shall submit the names of at least two nominees for the office of Second Vice President and at least one for Secretary-Treasurer to the Executive Secretary, as directed by the President-Elect. These names, with pictures and biographical sketches of the nominees, shall be published in the Journal not later than April 1 following the meeting. The next issue of the Journal shall contain a ballot listing the nominees. All ballots must be in the hands of the Executive Secretary by July 1 for checking against the eligible voter list and then forwarded to the Tellers Committee for counting. The person receiving the greatest number of votes for each office shall be certified to the President at least one month in advance of the Annual Meeting.

Section 3. Other special committees and regular continuing committees may be authorized by the Executive Board or by the President for special work or assignment. The need for continuation of such committees shall be subject to annual review of the Executive Board. All appointments to continuing committees shall be made by the President-Elect prior to the Annual Meeting.

Section 4. The terms of office of all members shall expire at the end of the Annual Meeting next following their appointment, except as provided in Section 1, Paragraphs A, B, and C, above.

ARTICLE V.

MEETINGS

Section 1. The Annual Meeting of the Association shall be held at such time and place as shall be designated by the Executive Board. Twenty-five of the members registered at the Annual Meeting shall constitute a quorum for transaction of business.

Section 2. Special meetings of the Association may be called by the Executive Board, but in such cases due notice shall be given to the members by the Secretary-Treasurer.

Section 3. The Executive Board and the Council shall meet at the Annual Meeting and at all special meetings of the Association. A quorum of the Council shall consist of a majority of its members. When, in the discretion of the Executive Board it is considered advisable to conduct a vote on a question by mail vote, a majority of the votes cast will be necessary to carry the proposition.

Section 4. Robert's Rules of Order shall govern the procedures at all meetings. Voting by proxy shall not be permitted.

ARTICLE VI.

PUBLICATIONS

Section 1. All publications of the Association will be issued under the direction of the Executive Board, but any Affiliate Association may publish its own material if it assumes full responsibility therefore and obligates the Association in no way.

Section 2. The Journal of Milk & Food Technology will be the official organ of the Association. The Journal will be the property of the Association which will own the copyrights to the Journal and all articles published therein. The Editors will serve at the pleasure of the Executive Board.

Section 3. Any other publications of the Association will be produced and handled as the Executive Board will direct.

ARTICLE VII.

AMENDMENTS

Section 1. Any member may propose amendments to these By-Laws by submitting them in writing to the Secretary-Treasurer at least 45 days before the date of the next announced meeting, and the Secretary-Treasurer shall promptly notify all members that the proposed amendments will be open for discussion at the meeting. These By-Laws may be amended by a majority affirmative vote of the members present.

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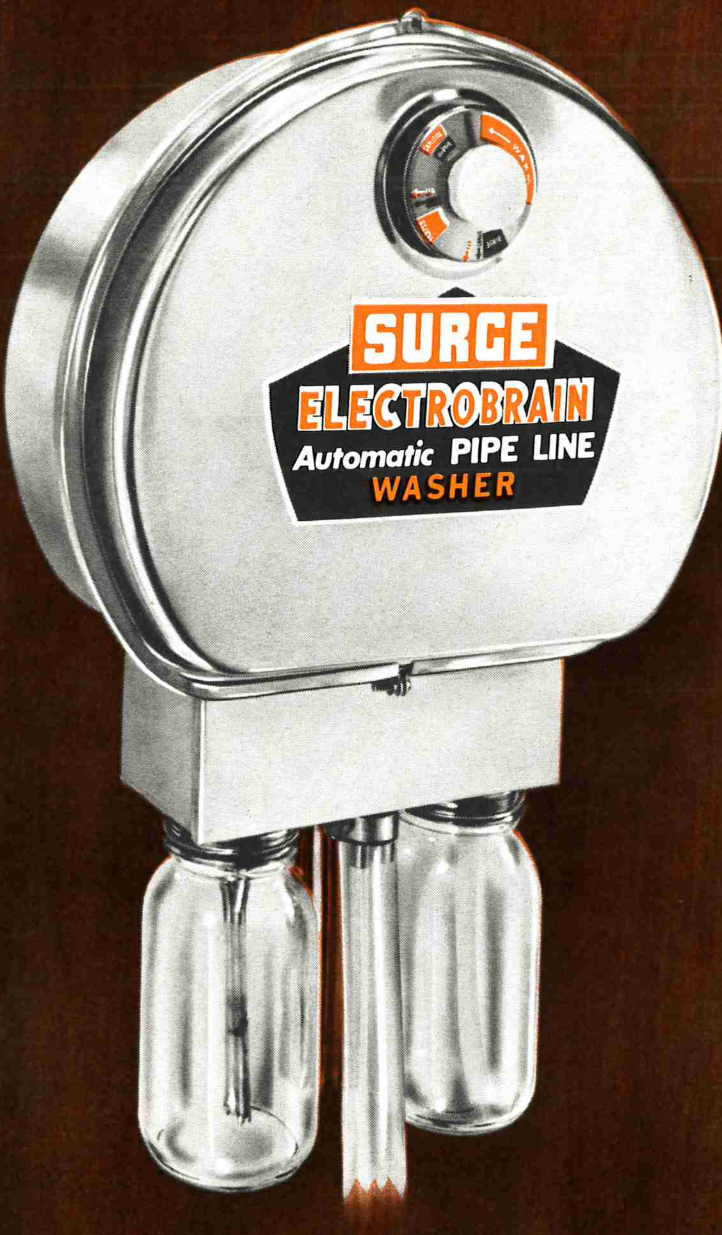

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