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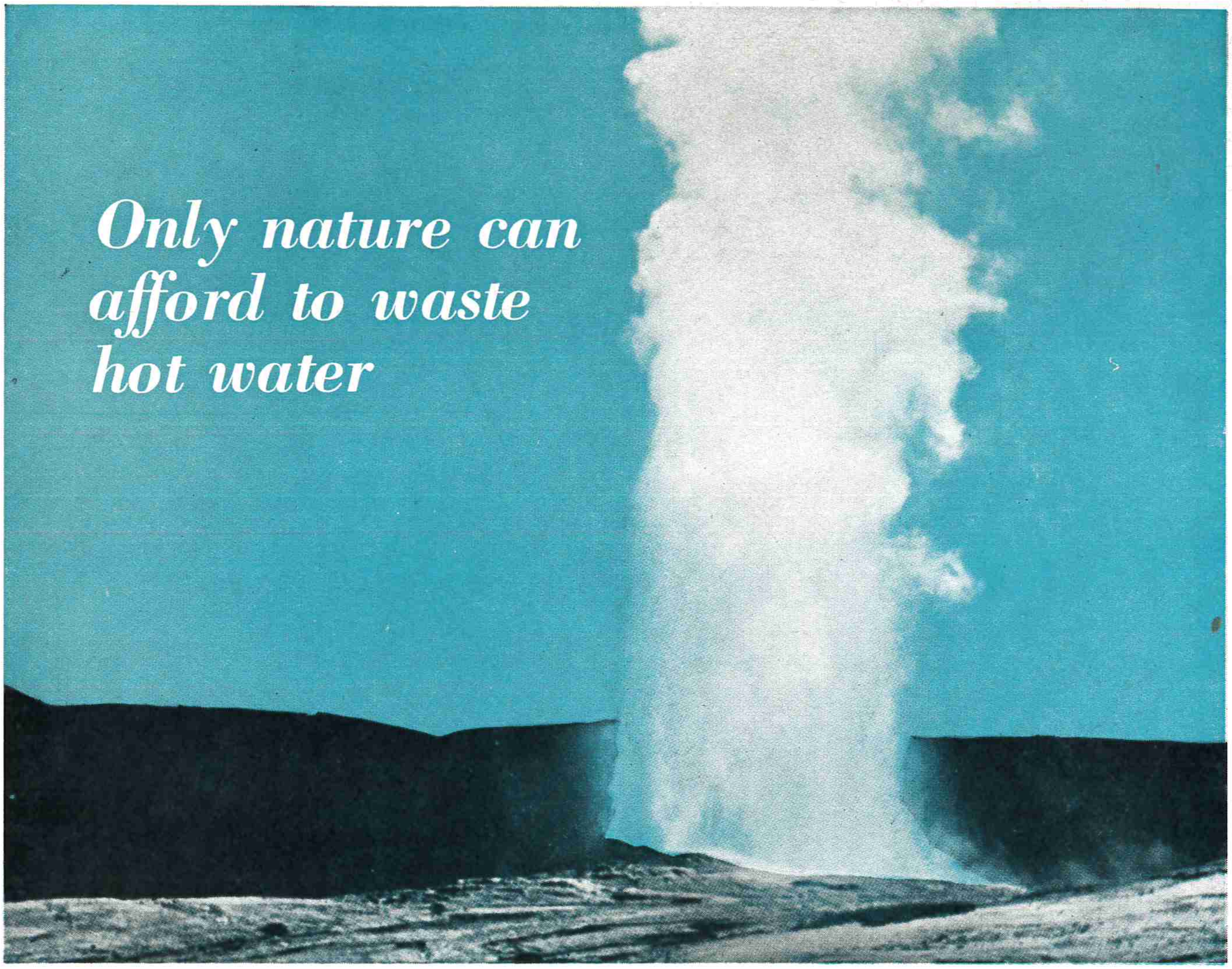

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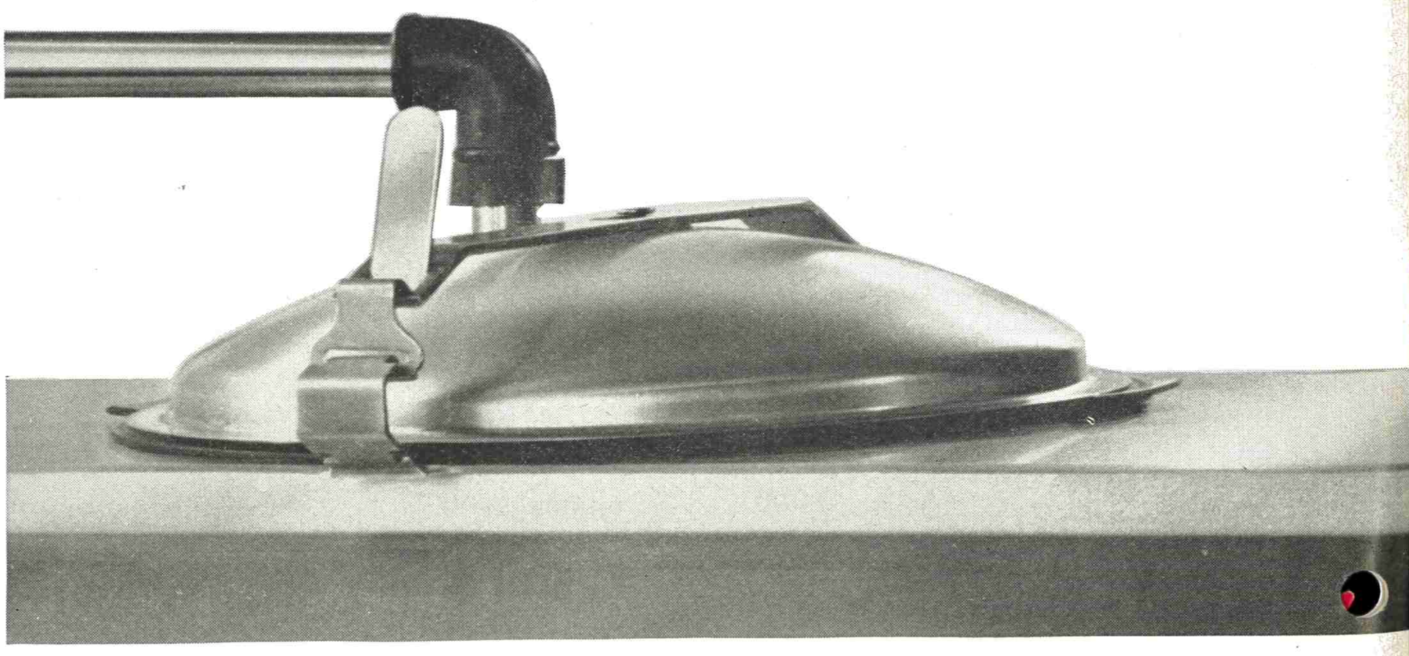

The Influence of Temperature on Activated Sludge Process[1]

It has been shown that biological reactions are significantly affected by temperature, and that the metabolic rate increases two to three times with each 10 C rise in emperature, as indicated by the Van't Hoff-Arrhenius relationships.

Literature review reveals that temperature seems to exert the same effect on the activated sludge oxidation rate, as evidence by the increase in the rate of oxygen uptake of sludges with rising temperature. But the effect of temperature on efficiency of the process, as given by % BOD removal, varies from plant to plant. This is attributed to the variability of the process and the differences in treatment plants design and mode of operation. The side effects of temperature including its influence on dissolved oxygen saturation, gas transfer, absorption and sedimentation also contribute to the net effect of temperature on the general performance and purification efficiency of the process.

Sludges may adjust to as much as 20 C temperature fluctuations with no deleterious effect. Low temperatures favor higher growth and accumulation of solids than high temperatures. Also temperature was found to exert significant effect on sludge quality and microbial predominance, resulting in better floc formation and dense sludge at higher temperatures.

Nazih K. Shammas, M.S.S.E.

Department to Assist With Guatemala Project[2]

The University of North Carolina has signed a contract with the State Department's Agency for International Development to assist with the development of a graduate program in sanitary engineering at the University of San Carlos, Guatemala. This school has been proposed as the regional facility for sanitary engineering training to meet the rapidly increasing needs for sanitary engineers in Central America. Department Head Daniel A. Okun is Project Director of the $168,000.00 contract. Mr. Richard Cole, upon receipt of the Ph.D. degree in the Department, will act as field coordinator on the San Carlos campus. He will be aided by various ESE faculty members and consultants during an eighteen-month period.

[1, 2]Reprinted from Vol. 2, No. 4 ESE Notes, Dep. of Environ. Sciences and Eng. School of Public Health, Univ. of North Carolina.

Editorial 48-hr. vs. 72-hr. Incubation for Dried Milk Counts

In the October issue of JOURNAL OF MILK AND FOOD TECHNOLOGY an editorial by C. K. Johns appears in which he comments on the restoration of the 48-hr incubation period for dry milks in the 12th edition of "Standard Methods".

When our Sub-Committee was assigned the task in 1962 of revising the chapter on dry milks, certain guiding principles were emphasized. One of these was that no new method or modification of an old method should be introduced unless verified in several laboratories and published. A second principle was that there be one "Standard Method", i.e., one incubation temperature rather than two for standard plate counts. The change made in the incubation period for dry milks in the 11th edition did not comply with either of these principles.

Since data relating to count differences were not available, the American Dry Milk Institute agreed to carry out comparative tests. The results of this work were published in the JOURNAL OF MILK AND FOOD TECHNOLOGY[1], and were verified by industry and government laboratories. Only a small percentage of samples were found to be affected by the increased incubation time. The Canadian Department of Agriculture[2] reported that the counts of 77 (4%) of 1923 samples exceeded 100,000/g, and of 31 (1.6%) exceeded 300,000/g using the 72-hr incubation period on samples of dry milk received for grading. Even if one assumes that *all* of the out-of-grade samples were undetected by the 48-hr incubation period, the total percentage affected by the test is only 5.6%. After publication of their data, the American Dry Milk Institute[3] continued its comparisons using 250 samples of instant type nonfat dry milk. Only 5 (2%) changed grades due to incubating plates the extra 24 hours. A USDA laboratory reported 1.67% of samples tested during one month in 1958, 1959, and 1960 were graded Standard or lower using the 48-hr period and 3.2% were similarly graded in 1961, 1962, and 1963 using 72-hr incubation. The difference of 1.5% may thus indicate the effect of additional incubation time on a total of 29,174 samples[4].

The only data contrary to the above are those which are quoted in the editorial by C. K. Johns. Insufficient information is included with this report to account for the discrepancy between his data and those of several other laboratories. The source of the samples, the type of dry milk, the age of the samples, compliance with other grade requirements, and number of plants represented are some of the factors which have a bearing on the evaluation of the data.

While 72-hr incubation does result in higher plate counts, the effect on the grade determination of dry milk is of little practical significance. Since both published and unpublished data by several laboratories confirm this fact, with one exception, the 72-hr period is considered to be unnecessary.

The second guiding principle followed by the Standard Methods Committee relates to "Standard Methods". In the 11th edition, for example, three staining procedures are permitted for direct microscopic counts. In the 12th edition, only one will be used. We believe that if a procedure is called a "Standard Plate Count", it should consist of one set of conditions which include incubation 48 ± 3 hr at 32 C. To refer to a 72-hr incubation period as a standard plate count as was done in the 11th edition, is contrary to the definition of a standard method. Any test deviating from the standardized set of conditions, should obviously be given another name. This is done in referring to psychrophilic or thermophilic counts. We question the wisdom, however, of a "dry milk plate count" being used only because a higher total count can be obtained.

The work of Thomas, Reinbold, and Nelson[5] clearly demonstrates that significantly higher counts will be obtained on pasteurized milk when plates are incubated 96 hr at 28 C than when incubated 48 hr at 32 C. The Standard Methods Committee, however, is not recommending a "pasteurized milk plate count" simply because higher counts can be obtained by the longer procedure—other considerations prevail.

The above cited work employed milk pasteurized in tubes to avoid post-pasteurization contamination. Yet count differences due to 48-hr and 72-hr comparisons approximated those common to dry milks. To attach public health significance to count increases due to an additional 24-hr incubation period thus appears tenuous.

The editorial in question refers to a communication from R. Pedraja[6] which indicated that organisms isolated from plates incubated 72-hr were "small Gram-negative rod-shaped bacteria". The same reference further states that these were not coliform bacteria. In addition, the reference stated that "the aforementioned 'selected samples' do not correspond to the normal pattern daily observed in samples submitted to our laboratory for analysis". The samples were 31 selected from the 1923 mentioned above. All but two of the samples showing large increases in count due to the extra 24-hr incubation period had direct microscopic counts in excess of 200 million /ml[7] and consequently would not be accepted as Extra Grade dry milk regardless of the plate count. Furthermore, these samples had been stored frozen for approximately two months, possibly resulting in further attenuation of the bacterial cells.

The standard plate count is only one of several tests used to grade dry milks. The coliform count, also used, must not exceed 90/g. Thus, if this type of post-pasteurization contamination does occur, it will be much more reliably detected by this test than by the standard plate count. Other tests also are available and useful for detecting post-pasteurization contamination, the standard plate count being the least useful in this respect.

The editorial states that "Standard Methods" were developed primarily for use by official agencies which leaves the impression that there should be two criteria for judging a method, one from an "industry" viewpoint and the other from the "control agency" viewpoint. If this implication is intended, it is indeed open to question. A method should be considered from every viewpoint and either accepted or rejected on the merits of the method. The Standard Methods Committee consists of members of Sub-Committees assigned to each chapter and includes representatives of control agencies, universities, and industry. This Committee discussed the merit of the 72-hr count at one meeting in Chicago on March 23, 1964; at a second meeting in Atlantic City on April 26, 1965; and at a third meeting in Chicago on October 20, 1965, and on each occasion decided to restore the 48-hr period. No other change in the 12th edition of "Standard Methods" has received this much consideration. Obviously, if there were public health questions involved, or if a large percentage of samples were involved, or if there were no other tests to detect inadequate sanitation control, or if the grade standard for plate count was too lenient, then most certainly another judgment would be necessary by the Committee.

Sub-Committee for Chapter 10, Standard Methods for the Examination of Dairy Products.
F. R. Smith, Greenville, Illinois; R. T. Marshall, Columbia, Missouri; B. Heinemann, *Chairman,* Springfield, Missouri.

[1]Pedraja, R. and Mengelis, A. Effect of Time and Temperature of Incubation on the Plate Counts of Dry Milks. J. Milk Food Technol. 27:241. 1964.
[2]Johns, C. K. Personal communication, January 18, 1965.
[3]Pedraja, R. Personal communication, October 27, 1964.
[4]Dizikes, J. Personal communication, December 18, 1963.
[5]Thomas, W. R., Reinbold, G. W., and Nelson, F. E. The Effect of Temperature and Time of Plate Incubation on the Enumeration of Pasteurization-resistant Bacteria in Milk. J. Milk Food Technol. 26:357. 1963.
[6]Pedraja, R. Personal communication, January 5, 1965.
[7]Pedraja, R. Personal communication, January 12, 1965.

INTERRELATIONSHIPS AMONG SOME BACTERIOLOGICAL METHODS USED FOR THE EXAMINATION OF FARM BULK TANK MILK SUPPLIES[1, 2]

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Summary

Relationships between standard plate count (SPC), laboratory pasteurization count (LPC), SPC after preliminary incubation at 12.8C for 18 hr (SPCPI), coliform count (CC), and psychrophile count (PsyC) on 758 raw farm bulk tank milk samples from a grade A supply have been determined. Linear correlation coefficients were: SPC vs. LPC, SPCPI, CC, and PsyC, r=0.39, 0.59, 0.48, and 0.56, respectively; LPC vs. SPCPI, CC, and PsyC, r=0.17, 0.24, and 0.18, respectively; SPCPI vs. CC, and PsyC, r=0.44 and 0.68, respectively; and CC vs. PsyC, r=0.55. Using an SPC standard of 100,000/ml as a reference, the following standards for the other four methods were found to be equal in terms of percentage of samples of the supply examined that exceeded the respective standards: SPCPI, 2,000,000; LPC, 3,000; CC, 1,000, and PsyC, 20,000 per ml.

If unsatisfactory samples were considered to be those that exceeded the standard by one or more of the five methods, only about one-third of these were detected by each of these methods. This percentage was increased by use of paired combinations of the five methods. Of these combinations, the LPC-SPCPI combination detected the highest percentage (63.8) of the unsatisfactory samples. An SPCPI standard of 200,000/ml or a CC standard of 100/ml, as frequently suggested, would be approximately three times more severe in grading the supply examined than the SPC standard of 100,000/ml as specified in the 1965 recommendations of the Public Health Service.

The standard plate count (SPC) and the laboratory pasteurization count (LPC) are two bacteriological methods commonly used to evaluate the sanitary quality of grade A raw milk supplies. Regulatory as well as industry standards based on maximum permissible count levels vary considerably, generally ranging from 50,000-200,000/ml by the SPC and 3,000-30,000/ml by the LPC. Industry standards, in contrast to regulatory standards, often are represented by counts in the lower part of these ranges. Generally, permissible bacterial count levels have been progressively decreased as producers have shifted from milk cans to farm bulk tanks *(3, 5, 6)*. With use of bulk tanks, prompt cooling is attained and low temperature is maintained during subsequent storage. Under such conditions, growth of bacteria is effectively inhibited during the usual 2-day storage period of milk on the farm; consequently, growth of bacteria during this period no longer is a contributing factor to high bacterial counts.

On the other hand, it is well recognized that unclean milk handling equipment, including bulk tanks, still remains as the principal source of large numbers of bacteria in raw milk supplies. However, the amount of bacterial contamination arising from this source must be very large to result in counts which approach the upper limits of standards commonly in effect. Present standards, therefore, may be met without giving proper attention to the sanitary condition of milk handling equipment *(1, 8, 9)*. In other words, effective cooling may mask poor sanitary practices. This has led to the consideration of other bacteriological methods for indicating the sanitary quality of raw milk supplies intended for consumption in the fluid form. Two such procedures are the standard plate count after preliminary incubation at 12.8 C (55 F) for 18 hours (SPCPI), and the coliform count (CC). The psychrophile count (PsyC) also has received some attention in this regard, although its usefulness is greatly limited by the prolonged time necessary to obtain such counts.

The literature is limited relative to the interrelationships among the five bacteriological methods mentioned above when used for the examination of farm bulk tank milk. Johnson et al. *(10)* and Johns and Berzins *(9)* reported little or no relationship between the SPC and the LPC on raw farm bulk tank milk samples. Chalmers *(4)* and later Johns *(7, 8)* reported that growth during preliminary incubation was generally greater in milk samples with high rather than low initial SPC's, indicating some association between the SPC and the SPCPI. Although the CC was high when the SPC was high, Johnson et al. *(10)* found no close relationship between the CC and the SPC on raw farm bulk tank milk samples. In fresh raw milk, no relationship between the SPC and the PsyC was reported by Watrous et al. *(16)*. Johns *(7, 8)* and Johns and Berzins *(9)* found little correlation between the LPC and the SPCPI, CC, or PsyC on raw farm bulk tank milk samples. Johns *(7, 8)*

[1]Scientific Journal Series Paper No. 5812, Minnesota Agricultural Experiment Station.

[2]This was supported, in part, by the Minneapolis-St. Paul Quality Control Committee.

[3]Present address: Market Quality Research Service, Field Crop and Animal Products Branch, Plant Industry Station, U.S. Department of Agiculture, Beltsville, Maryland.

also reported little correclation between the CC and the SPCPI on raw farm bulk tank milk samples. Johns *(7, 8)* and Johns and Berzins *(9)* observed a well marked correlation between the PsyC and the SPCPI on raw farm bulk tank milk samples. The occurrence of psychrophilic coliform bacteria in stored milk has been reported *(11, 15)*; however, no data were found relative to the correlation between the CC and the PsyC on raw farm bulk tank milk supplies.

The purpose of this study was to determine the interrelationships among the five bacteriological methods referred to previously when applied to farm bulk tank milk samples obtained from producers within a grade A milk shed.

EXPERIMENTAL METHODS

Seven hundred and fifty-eight samples of raw bulk tank milk from 625 randomly selected individual producers within a large grade A milk shed were examined during the period from June 1961 through August 1962 by each of the five bacteriological methods. Psychrophile counts were obtained by a surface plating procedure *(14)* with incubation at 7 C (45 F) for 5 days. Coliform counts were obtained using violet red bile agar medium. Otherwise sampling, sample storage, and plating procedures, with incubation at 32 C (89.6 F) were in accordance with Standard Methods *(2)*. The bacterial counts by each method and their corresponding logarithmic values were punched on IBM cards. Linear correlation coefficients were obtained using the log bacterial counts through use of Control Data Corporation 1604 computer using an "UMSTAT" program *(12)*.

RESULTS AND DISCUSSION

Table 1 shows the linear correlation coefficients between the various pairs of the five bacteriological methods. They are listed in order of magnitude. As might be expected, the correlation between the SPCPI and PsyC was the highest (0.68). Those between the SPC and SPCPI, SPC and PsyC, and between CC and PsyC were similar in magnitude although somewhat lower than that between SPCPI and PsyC.

Table 2 shows the percentage of samples which exceeded the standards indicated for each of the five methods. One standard among those listed for each method is shown in italics; 100,000 by the SPC; 3,000 by the LPC; 2,000,000 by the SPCPI; 1,000 by the CC; and 20,000 by the PsyC. Each of these standards was exceeded by approximately the same percentage of the total samples examined. Thus, these standards might be considered equal in terms of samples which exceeded the respective standards. In this connection, a standard of 200,000 by the SPCPI has been suggested *(8)*. A standard of 100 by the CC also has been suggested by some *(13)*. Obviously, these standards, which were exceeded by 39 and 46%, respectively, of the total samples, would indeed be much more severe than even the SPC standard of 100,000 as recently recommended by the Public Health Service *(17)*.

TABLE 1. LINEAR CORRELATIONS BETWEEN PAIRS OF BACTERIOLOGICAL METHODS

Methods[a]	r
SPCPI-PsyC	0.68
SPC-SPCPI	0.59
SPC-PsyC	0.56
CC-PsyC	0.55
SPC-CC	0.48
SPCPI-CC	0.44
SPC-LPC	0.39
LPC-CC	0.24
LPC-PsyC	0.18
LPC-SPCPI	0.17

[a]SPCPI=standard plate count after preliminary incubation at 55 F–18 hr.; PsyC=psychrophile count; SPC=standard plate count; CC=coliform count; LPC=laboratory pasteurization count.

The standards shown in italics in Table 2 were used to determine the agreement between the various pairs of the five methods in detecting unsatisfactory milk samples. This is shown in Table 3. For this purpose, an unsatisfactory sample by any one method was one that exceeded the standard by that method. The standards used are shown below the respective method. For example, 98 samples exceeded an SPC of 100,000; of these 98 samples, 35.7% also exceeded the LPC standard of 3,000. Therefore, LPC detected only 35.7% of the unsatisfactory samples detected by the SPC. Similarly, the SPC detected about 42% of those samples which exceeded 2,000,000 by the SPCPI. The reverse relationship shows that SPCPI detected about the same percentage (44.9) of samples that were unsatisfactory by the SPC. With the exception of the agreement between the SPCPI and PsyC, no single method was able to detect more than about 50% of the samples that were unsatisfactory by any other method. However, a comparison of each method in detecting samples unsatisfactory by each of the other four methods shows the PsyC detected the highest percentage of samples unsatisfactory by the CC (44.1) or the SPC (51) and also a relatively higher percentage of samples unsatisfactory by the SPCPI (63.5). The SPC detected the highest percentage of samples unsatis-

TABLE 2. CLASSIFICATION OF MILK SAMPLES (758) BY FIVE BACTERIOLOGICAL METHODS

Percent of samples exceeding standards indicated for each method[a]					
SPC	%	LPC	%	SPCPI	%
200,000	5.5	20,000	2.6	3,000,000	10.7
100,000	*12.9*	15,000	3.2	2,000,000	*13.7*
75,000	20.1	10,000	5.2	1,000,000	20.5
50,000	28.9	5,000	10.3	500,000	29.2
		3,000	*14.5*	200,000	38.8

CC	%	PsyC	%
3,000	6.2	20,000	*13.3*
1,000	*13.5*	15,000	16.1
500	21.6	10,000	19.9
200	32.3	5,000	27.6
100	45.8	3,000	36.5

[a]See footnote to Table 1.

factory by the LPC (31.8) and also a relatively high percentage of samples unsatisfactory by the PsyC, CC, or the SPCPI. The SPCPI detected the highest percentage of samples unsatisfactory by the PsyC (65.3) and a considerable percentage of samples unsatisfactory by the SPC or the CC. The CC and the LPC, in general, were the least effective in detecting samples unsatisfactory by the other methods; of these two, the LPC was the poorest in this respect. The CC

TABLE 3. AGREEMENT BETWEEN VARIOUS PAIRS OF METHODS IN THE DETECTION OF UNSATISFACTORY SAMPLES

		Percent detected by method and standard indicated				
Method[a] and standard	No.	SPC >100,000	LPC >3,000	SPSPI >2,000,000	CC >1,000	PsyC >20,000
SPC >100,000	98		35.7	44.9	37.8	51.0
LPC >3,000	110	31.8		18.2	21.8	22.7
SPCPI >2,000,000	104	42.3	19.2		32.7	63.5
CC >1,000	102	36.3	23.5	33.3		44.1
PsyC >20,000	101	49.5	24.8	65.3	44.6	

[a]See footnote to Table 1.

or the PsyC detected about the same percentage of samples unsatisfactory by the LPC (21.8 vs. 22.7 respectively) while SPCPI detected the lowest percentage of samples unsatisfactory by the LPC (18.2). If only one of these five methods is to be chosen for grading raw farm bulk tank milk samples, these results indicate that priority might be given to the PsyC. However, its routine use is likely to be considered prohibitive by many due to the prolonged time necessary to obtain results. On the other hand, the SPC deserves favorable consideration, if only a single method is desired, due to the fact that *(a)* it is less time consuming than the PsyC or SPCPI; *(b)* it detected a relatively high (although not always the highest) percentage of samples unsatisfactory by anyone of the other four methods; and *(c)* there was less variation in its detection of samples unsatisfactory by other methods than was the case for the SPCPI, CC and the PsyC.

TABLE 4. PERCENT OF TOTAL UNSATISFACTORY[a] SAMPLES DETECTED BY EACH METHOD AND BY VARIOUS PAIRED COMBINATIONS OF THE FIVE METHODS[b, c] (304 UNSATISEACTORY SAMPLES)

Percent detected by each method indicated:				
SPC	LPC	SPCPI	CC	PsyC
32.2	36.2	34.2	33.6	33.2

Percent detected by paired combinations of methods:			
SPC-LPC	SPC-SPCPI	SPC-CC	SPC-PsyC
56.9	52	53.6	49
LPC-SPCPI	LPC-CC	LPC-PsyC	
63.8	61.8	61.2	
SPCPI-CC	SPCPI-PsyC	CC-PsyC	
56.6	45.7	52	

[a]Unsatisfactory samples obtained by substracting number of samples which were satisfactory by all methods from the total number of samples (758–454=304).

[b]See footnote to Table 1.

[c]Standards used: SPC, 100,000; LPC, 3,000; SPCPI, 2,000,-000; CC, 1,000; PsyC, 20,000.

It is often the practice to use more than one method in quality control programs. Table 4 shows the percentage of unsatisfactory samples which were detected by paired combinations of the five methods as well as by each method individually. For this purpose, an unsatisfactory sample was one that exceeded the standard indicated by one or more methods. The combination of SPCPI-LPC detected the highest percentage of unsatisfactory samples (63.8). Two other combinations, LPC-CC and LPC-PsyC, also detected approximately the same percentage of unsatisfactory samples. The reason the LPC appears in each of the above combinations is due to the poor agreement between the LPC and the SPCPI, CC, or the PsyC in detecting the same unsatisfactory sample. In other words, LPC, in general, placed a sample as unsatisfactory which was satisfactory by the SPCPI, CC, or the PsyC. The SPC-LPC combination detected a somewhat lesser percentage of unsatisfactory samples (56.9) than three other combinations. However, this combination of SPC-LPC is relatively simple to perform, is less time consuming than the LPC-SPSPI or the LPC-PsyC, and avoids the difficulty frequently encountered in distinguishing between coliform and noncoliform colonies on plates prepared from raw milk, as would be the case with the CC and LPC combination. The advantage of using a combination of two methods is evident from a comparison of the percentages of unsatisfactory samples detected by various combinations with those detected by each of the methods used individually.

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NEW STEEL FOIL PACKAGING

Steel foil as a packaging material is being extended to new and varied uses according to the United States Steel Corporation. New prototypes for the food and beverage industries have been developed in a special laboratory devoted to steel foil research.

The new packaging is ideal for frozen concentrates, fluid milk, confections and certain products affected by moisture, such as powdered milk, cheese and cocoa. Containers may be constructed in various forms including rectilinear and square shapes which provide for space saving, light weight for easier handling, and improved quick freezing. An easy-open top for added convenience can be provided by pulling a thread or by sliding the cover and tops are designed to be recloseable.

These lightweight, inexpensive and highly functional containers are made possible by the unique characteristics of steel foil. The foil has the strength of steel, is moisture and vapor resistant, easy to form and is adaptable to gluing, sewing, welding and soldering. It can be stock coated by a wide variety of materials by vacuum deposition processes.

Further uses of the foil include multi-wall bags, pouches, steel foil carton board and corrugated steel foil board.

OBSERVATIONS ON THE YELLOW COLOR THAT APPEARS ON MILK SEDIMENT DISKS[1]

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Summary

The occurrence of yellow color on sediment disks by filtering 100 ml of bovine quarter milk samples was more predominate when there was an increased California mastitis test reaction and the presence of a mastitis causing organism. The presence of the yellow color occurs more frequently in mastitis quarters of the Guernsey and Ayrshire, than of the Holstein breed. The yellow color does not appear to be a normal condition. The yellow color is less prevelant at the beginning of lactation, appears to increase with the age of the animal, and may be associated with hemolytic staphylococci.

In the past seven years bulk tank sediment testing has become a routine procedure among dairy plant fieldmen and public health workers *(1)*. Yellow colored disks have been observed from time to time. Among one dairy plant's producers, the color was noted in approximately 20 out of 80 herds.

The occurrence of the color was noted in all breeds of cows and had appeared throughout the year. When this color was noted in such herds as Guernseys, the owners felt the color was only the normal yellow pigment of the cows.

It was the purpose of this study to determine if a correlation exists between yellow color and any abnormal or normal condition in the animals.

Materials and Methods

In this study three herds were selected that had continually showed yellow sediment test disks. Quarter milk samples, approximately 100 ml, were collected from 40 Holsteins, 30 Guernseys and 48 Ayrshires. These samples were cultured without prior incubation on bovine blood agar plates, using 0.01 ml of milk *(3)*. Bacteriological results were classified as follows: staphylococci, hemolytic staphylococci, streptococci other than *Streptococcus agalactiae* and *Streptococcus agalactiae*. The CAMP test *(4)* was used to identify *Streptococcus agalactiae*. The California mastitis test (CMT) was run on all samples. Samples were then heated to 90 F and filtered through LINTINE 152 sediment test disks[3] using a 0.40-inch diameter head. Disks showing any yellow color were noted. Age, period of lactation, and breed were noted on all animals.

Table 1. Relationship Between Breed and Occurrance of Yellow Color on Sediment Disks on Quarter Samples

Breeds	Number of quarters	Quarters with yellow color: Number	Quarters with yellow color: %	Quarters with CMT reaction 1 or better: Number	Quarters with CMT reaction 1 or better: %
Holstein	160	26	16.2	84	52.5
Guernsey	118	18	15.3	32	27.1
Ayrshire	192	46	23.9	70	36.4

Table 2. Relationship Between C.M.T. Reaction and Presence of Yellow Color on Sediment Disks

C.M.T. Reaction	No. of quarters		Quarters with yellow color: No.		Quarters with yellow color: %	
Negative	246	280	8	10	3.3	3.6
Trace	34		2		5.8	
1	55	190	6	80	10.9	42.1
2	48		14		29.1	
3	87		60		68.9	
Total	470		90			

Results

The occurrence of yellow disks from quarter samples on the three herds examined showed the following (Table 1): Holstein, 16.2%; Guernsey, 15.3%; and Ayrshire, 23.9%. Among these same animals those showing a CMT reaction of 1 or better were as follows: Holstein, 52.5%; Guernsey, 27.1%; and Ayrshire, 36.4%.

[1]This study was supported by the Colorado Mastitis Prevention Committee.

[2]Deceased

[3]LINTINE 151 and 152 sediment test disks furnished by Johnson and Johnson Company, Chicago, Illinois.

The relationship between the CMT reaction and yellow color on sediment test disks from each quarter showed the following: negative reaction, 3.3%, yellow; trace reaction, 5.8% yellow; 1 reaction, 10.9% yellow, 2 reaction, 29.1% yellow; and 3 reaction, 68.9% yellow (Table 2).

In comparing the age of the animal with yellow color on the disks it was noted that the 5-year old group had 16 animals out of 27 with one or more quarters with yellow color (Table 3). As the age groups increased from 3 years to 11 years the percentage of animals with yellow color in each group increased from 0% for the 3 year olds to 25.9% for the 4 year olds, 59.3% for 5 year olds; 53.3% for 6 year olds, 70% for 7 year olds and 100% for 8, 10, and 11 year old animals. There were only 3 animals 10 years old and 1 animal which was 11 years old.

TABLE 3. RELATIONSHIP BETWEEN THE AGE OF ANIMALS AND YELLOW COLOR ON QUARTER SAMPLE SEDIMENT DISKS

Age group	No. of animals	Animals with one or more quarters showing yellow color	
		No.	%
(Yr)			
3	9	0	0.0
4	27	7	25.9
5	27	16	59.3
6	15	8	53.3
7	10	7	70.0
8	7	7	100.0
10	3	3	100.0
11	1	1	100.0
Unknown	19	7	36.8
Total	118	56	

The relationship between the period of lactation and the occurrence of yellow disks is shown in Table 4. It was found that milk from 39.4% of the animals in the first three months of lactation showed yellow colored disks (13 of 33 animals), milk from 47.5% of the animals in the second three-month period showed yellow colored disks (19 of 40), milk from 60.0% of the animals in the third three-month period showed yellow colored disks (18 of 30) and milk from 40.0% of the animals which lactation period was nine months or over showed yellow colored disks (6 of 15).

TABLE 4. RELATIONSHIP BETWEEN PERIOD OF LACTATION AND YELLOW COLOR ON SEDIMENT DISKS

Period	No. of animals	Animals with yellow color from one or more quarters	
		No.	%
1st Three mo	33	13	39.4
2nd Three mo	40	19	47.5
3rd Three mo	30	18	60.0
> Nine mo	15	6	40.0
Total	118	56	

Comparing the cultural results of quarters with those showing yellow color, it was found (Table 5) that 3.2% (9 of 278) of the negative quarters showed yellow colored disks while 33.6% of the quarters yielding *Streptococcus agalactiae* showed yellow disks, and 51.7% yielding hemolytic staphylococci (30 of 58) showed yellow disks.

It was noted that 2 animals of the 118 showed a yellow color from all four quarters, 6 of 118 showed a yellow color in three quarters, 14 of 118 showed a yellow color in two quarters, and 36 of 118 showed a yellow color in milk from one quarter.

DISCUSSION

One of the main concerns of this study was whether or not this color could be associated with one particular breed. As indicated in Table 1 the Aryshire herd had the highest percentage of yellow disks. This breed usually is rated lower than the Guernsey relative to the presence of the yellow pigment carotene in milk. It was also noted that the Holstein herd, which had 52.5% of the quarters with a CMT reaction of greater than 1, showed only 16.2% of the quarters with yellow color; whereas, the Guernsey herd, which had 27.1% of the quarters with a CMT reaction greater than 1, showed 15.3% of the quarters with the yellow color. From this it would appear that when there is an indication of mastitis in a quarter the milk will show a yellow color on the disks to an extent somewhat dependent upon the level of normal yellow pigments in the blood and milk of that animal. If this yellow color which appears on the sediment test disks is characteristic of the Guernsey breed, it should appear in all four quarters and not in one

TABLE 5. RELATIONSHIP BETWEEN CULTURAL RESULTS AND YELLOW COLOR ON SEDIMENT DISKS

Cultural results	No. of quarters	Quarters with yellow color	
		No.	%
Negative	278	9	3.2
Streptococcus agalactiae	119	40	33.6
Hemolytic staphylococci	58	30	51.7

quarter as occurred in the case of many of the animals. Most of the yellow disks were from only one quarter of an animal.

Yellow colored sediment disks were more predominate in those quarters showing increased CMT reactions, 42.1% of CMT 1, 2 and 3 quarters were yellow and 3.6% of the CMT negative and trace reactions were yellow (Table 2).

The possibility that the yellow color might be due to early lactation, when the animal's milk contains higher amounts of yellow material (colostrum), was considered. This does not seem to be true as indicated by the results in Table 4. The color appears to occur more frequently toward the end of the lactation.

The incidence of color appears to increase with the age of the animal. This factor is also true of mastitis and especially staphylococcic mastitis *(5)*.

An increase of carotenoid pigment, associated with mastitis, has been reported by Chanda 1953 *(2)*. In this present report the nature and source of the yellow pigment has not been investigated.

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RESPONSIBILITIES AND CHALLENGES OF REGULATORY AGENCIES AND THE FOOD INDUSTRY[1]

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If every consumer in the United States produced his own food, there would be no need for food laws or for the services which regulatory agencies and food industry perform. However, this would turn history back several centuries. I'm sure there are few among us who feel that mass production of food crops, mass processing of foods, and mass distribution of food are bad for western civilization as we know it and we hope that the trend will continue.

We can also agree that regulating traffic in food for our ever-increasing urban population is a proper function of government. This is an area where citizens are physically unable to protect themselves unless each one were raising, processing and storing his own food. Even then I wonder if the individual could be absolutely certain that his food had been protected adequately from rodents, insects, and bacterial contamination. Could he evaluate the bacterial flora and assure himself that potential hazards were insignificant? He might also wish to have some reassurance that radioactive isotopes had not contaminated his crops or that air currents or rains had not carried pesticide residues from adjacent areas.

In organized society, no one can be self-sufficient even though he may be so encumbered by prejudice that he refuses to accept what is commonly accepted. Thus, I say that governmental regulation of food is necessary to assure those who need to be assured that the food supply is wholesome and to protect ALL from the unscrupulous opportunist. Consumers are entitled to this assurance and to the confidant feeling that the food supply is wholesome. Responsible industry and government at all levels must cooperate to achieve these goals with mutual trust, mutual confidence and mutual assistance.

PROTECTING CONSUMER INTEREST

This trust, confidence, and assistance are necessary to create the proper climate in which industry and the universities and foundations may proceed with research in the knowledge that new developments can be brought to the benefit of all consumers. Industry can expand its facilities, knowing full well that initiative and capital will not be thwarted by arbitrarily restrictive regulation.

The ultimate interests of consumers can best be served by the regulatory agency and industry acting together to curb the activities of any unscrupulous operators in their midst and to point out fallacies

[1]Presidential Address, Central States Association of Food and Drug Officials, Madison, Wisconsin, June, 1965.

in existing law or philosophy of enforcement programs. There must be a common ground where responsible industry and government can meet for the expressed purpose of eliminating misunderstandings and eliminating duplication of efforts—all for the purpose of improving standards and eliminating as far as possible all avenues of food contamination.

REGULATION AND SELF-POLICING

There must also be a common ground where governmental regulation and industry self-policing will be properly balanced to achieve the ultimate in consumer protection. Certainly there is a limit to governmental regulation, and there are areas in which government has no business trying to regulate under the guise of consumer protection. There is a vast difference between consumer health protection and fraud protection and, on the other hand, industry protection from competition. In my personal view, governmental regulation of package size falls in the category of economic legislation.

Food regulations cannot and should not be all-encompassing to the extent that private initiative is frustrated. This is repugnant to the underlying principles and basic philosophy of free enterprise. The regulation of traffic in food at either state, federal or local level should be only to the extent which can be justified on the grounds of a need to eliminate hazards to human health, to eliminate the flagrant aesthetic violations, and to protect consumers from wilful, planned fraud with the major emphasis and effort on potential hazards to health.

Self-policing by industry has its limitations also. These limitations hinge mainly on sincere desire to keep the house in order and upon each individual industry member being honest and sincere and having consumer interest ahead of private gain. With no real authority to impose the will of the majority, an industry is powerless to enforce "self-policing" beyond the limits of individual plants. Even there it will be successful only to the extent that every employee from the corporate president down to the swamper has been instilled with a sincere desire to improve plant sanitation and to keep the product and its image above reproach.

For the reason that this individual employee responsibility is very difficult to achieve, I say that self-policing needs firm supervision and it also needs an awareness that there is a clearcut reasonable law to be observed, with penalties for failing to observe.

PHILOSOPHY OF REGULATION

One of the early food laws in Wisconsin said little more than that "All foods must be wholesome." I presume this is very much the philosophy with which all food laws had their beginning. From this concept, legislative bodies have tried and are still trying to define the limits of wholesomeness and they have made grave crimes out of the performance of simple acts. Many of these have only superficial relationship to wholesomeness or unwholesomeness or have no such relationship at all.

Legislative bodies and administrative agencies, too, are sometimes swayed by hysteria, influenced by oratory on the economic facets or otherwise lose sight of the basic philosophy of "wholesome food." We find ourselves groping for the ever elusive zero tolerance, or trying to determine who has been misled and wondering if packages tell the truth. If we deviate, and I presume we must, from the path of pursuing wholesomeness in foods, then we are also pursuing truthful packages and labels which do not lie. I suggest it is very difficult for the shape, size or construction of a bottle to lie about its contents and be at all misleading, if the quantity is declared conspicuously and declared in terms that even the most mentally delinquent can comprehend.

The answer to alleged untruthful packages and labels is a simple solution of requiring what has always been required—conspicuous, truthful statements included in the large print rather than in the small. I recommend that it is time for all legislative bodies and those who promulgate administrative regulations to have another look at the original mandate, "Keep the food supply wholesome."

When we have solved the riddle of how to call the roll on bacterial flora and make such a roll call rapid and meaningful, when we have learned to apply a rule of thumb based on significant pharmacological impact of chemical residues, and when we have eliminated to a reasonable extent the conditions and practices inherently repugnant to the aesthetic senses, then I would say we may have time and facilities available for the more sophisticated details of regulating package size and shape. Then we may continue groping for that ever elusive, one last molecule of a zero tolerance substance, or imposing arbitrary total count bacterial standards which may have no physiological significance or trying to figure out the intricacies of a food definition and standard of identity which goes into far too much insignificant detail.

THE FOOD ADDITIVE SITUATION

Commissioner Larrick has recently said, "It does not seem necessary to debate any longer the need for food additives and the desirability of regulating them." I agree with the Commissioner on this point. But what he did not say on this occasion, and I am sure he must recognize this further fact, is that food additives have now been adequately regulated under the provisions of the Food Additives Amendment.

Thus, there is less need for food definitions and standards of identity which spell out to the last detail each and every permitted optional ingredient. Certainly the standard itself, and the standard-making and amending procedures, could be simplified immensely by specifying only mandatory ingredients and proportions of basic constituents with optionals specified only by class or group names. The toxicity testing and approval system provided by the Food Additives Amendment will then adequately serve to exclude those within each group or class, if there be doubts or reservations. This approval procedure adequately provides for the safety of all ingredients, whether used in standardized or unstandardized food, and thus provides legal barriers against unwholesome ingredients. Recipe-type standards are too restrictive or they are too voluminous and too difficult of interpretation and administration.

As a case in point, the federal standard for ice cream provides for just about every ingredient anyone could conceivably ever want to put into ice cream. At latest count, standard ice cream as defined can be made from as few as two ingredients, if these ingredients be chosen to provide the required solids. There would be a dairy ingredient and a sweetening ingredient. The dairy ingredient may be chosen from a list of about 26 optionals and the sweetener may be chosen from a list of 21 optionals. Now, when you talk about the entire list of optional ingredients, it includes about 84 specifically named substances plus any artificial food flavor, any artificial color, any fruit or nutmeats, any candy, cookies, cake, or glazed fruit, any cereal or any distilled alcoholic beverage. So the total list of optional and various combinations could run into thousands.

MEANINGFUL STANDARDS AND CONTROL

I don't believe any manufacturer is very greatly inhibited in his formulation and I doubt if Grandma would have recognized the recipe.

I firmly believe it would be more meaningful to set a standard which specifies the few basic ingredients by classes or groups and which sets limits on basic constituents and limits on the various classes of functional ingredients. The Food Additives Amendment will control the individual chemicals within each group.

Each of us, whether we represent a regulatory agency or a processing and marketing industry, should ask himself, "Where does my responsibility lie?" and "When are we going to accept the challenge of changing times?" We must recognize each other's role in the total consumer protection pattern.

The basic concepts of "wholesome food" and governmental control are here to stay. Therefore, I say, "Let us evaluate our expenditure of funds whether they be public or private and continuously reassure our clients, the consuming public, that the food supply is as wholesome as we working together can make it."

I believe that rather than look for other areas to regulate, government should be working toward simplification of regulation and elimination of arbitrary restrictions. In this era of science, I would like to see more scientific research to establish meaningful criteria for the effective evaluation of bacterial quality of food and for the establishment of workable tolerances for all chemical additives and pesticide residues in food. Such tolerances should be based on established and documented chronic or acute physiological effects.

I am also convinced that some provision should be made for effective and periodic updating of laws and regulations. In too many instances the laws which we are sworn to uphold and enforce, and under which industry must labor, are obsolete. They were enacted to protect consumers in a very limited area. They do not take into account the manner in which the same problem has been solved in an adjoining area. In many cases problems of 50 years ago have been resolved, yet the law remains to be enforced.

Here I would say, "We should not dissipate our energies and our funds in protecting an extinct consumer against a set of nonexistent hazards." I also caution that as the results of scientific experiments are published, we must be exceedingly careful not to "draw incorrect conclusions from unrelated facts."

FLUID FLOW RELATIONSHIPS OF IMPORTANCE IN CIRCULATION CLEANING[1]

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It has become an accepted fact that cleaning effectiveness is related to flow velocity. Frequently sanitarians and dairy engineers are called upon to evaluate the design and performance of cleaned-in-place (CIP) systems where different pipe diameters and different pump capacities are involved. The accompanying charts have been prepared to relate the factors of *(a)* Reynolds Number at varying temperatures, and *(b)* flow rate in feet per second to varying capacity in pounds per hour in pipe lines of 1½-, 2-, 3- and 4-inch nominal diameters. Values are calculated from standard engineering tables for water. Reynolds Numbers for milk are about 0.6 that of water above 100 F whereas Reynolds Numbers for acid and alkaline cleaning solutions customarily used in dairy plants will be almost identical to water.

[1]This study was supported in part by Research Grant No. EF-00317-02 Division of Environmental Engineering and Food Protection, United States Public Health Service.

Examples of the application of the charts are as follows:

Example 1. What is *(a)* the flow velocity in feet per second, and *(b)* the Reynolds Number at 110 F in 1½-inch pipe in a pipe system being circulated at 6,000 lbs per hour?

Solution: (Refer to the dotted line on the chart for 1½-inch pipe)

Follow the line from the 600 reference point on the vertical axis until it intersects the 110 F line, then drop to the horizontal axis and read the Reynolds Number as 4200. Then multiply by 10 since the actual lbs per hour is 6000 instead of 600. The Reynolds Number then, is 42,000. The feet per

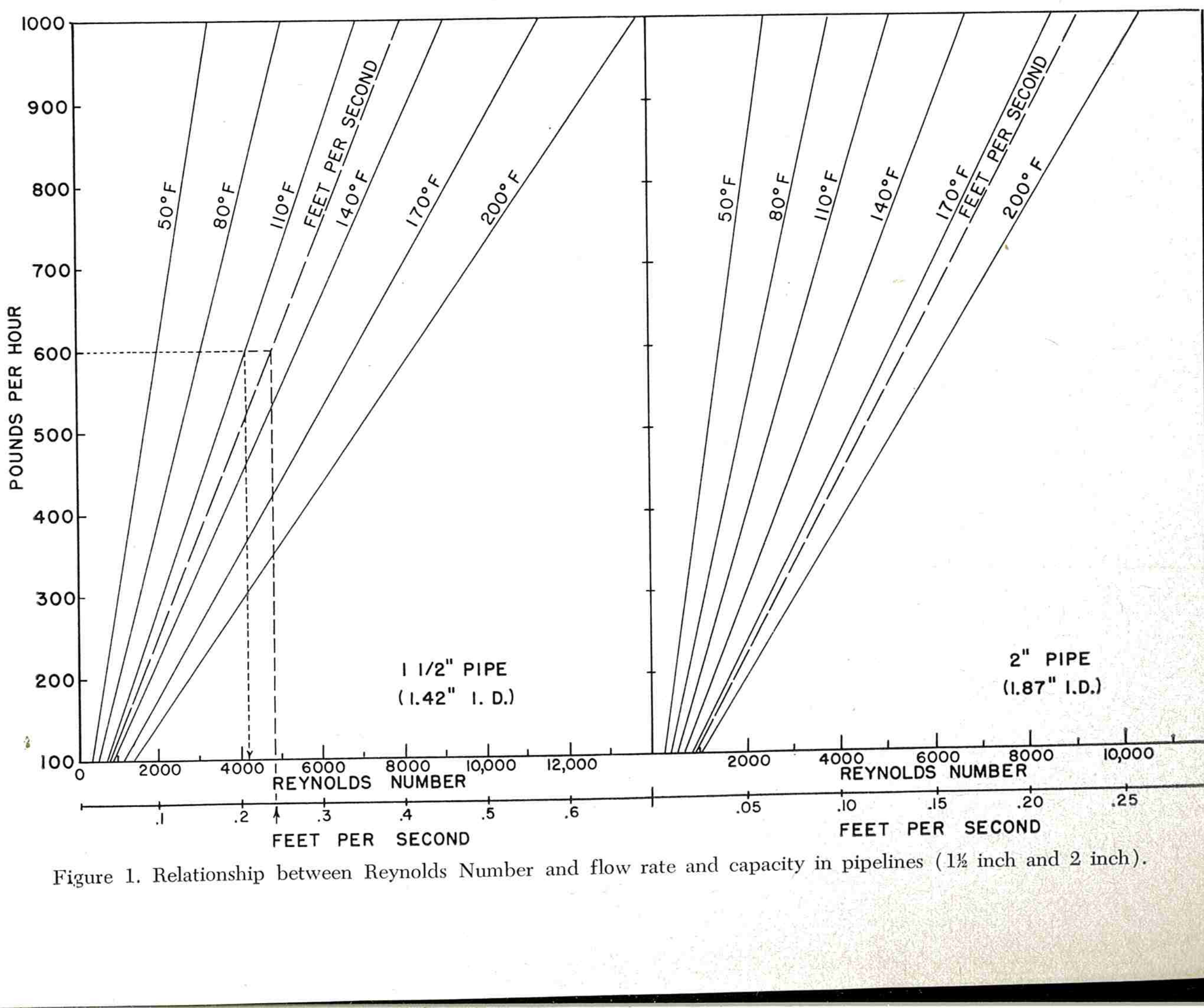

Figure 1. Relationship between Reynolds Number and flow rate and capacity in pipelines (1½ inch and 2 inch).

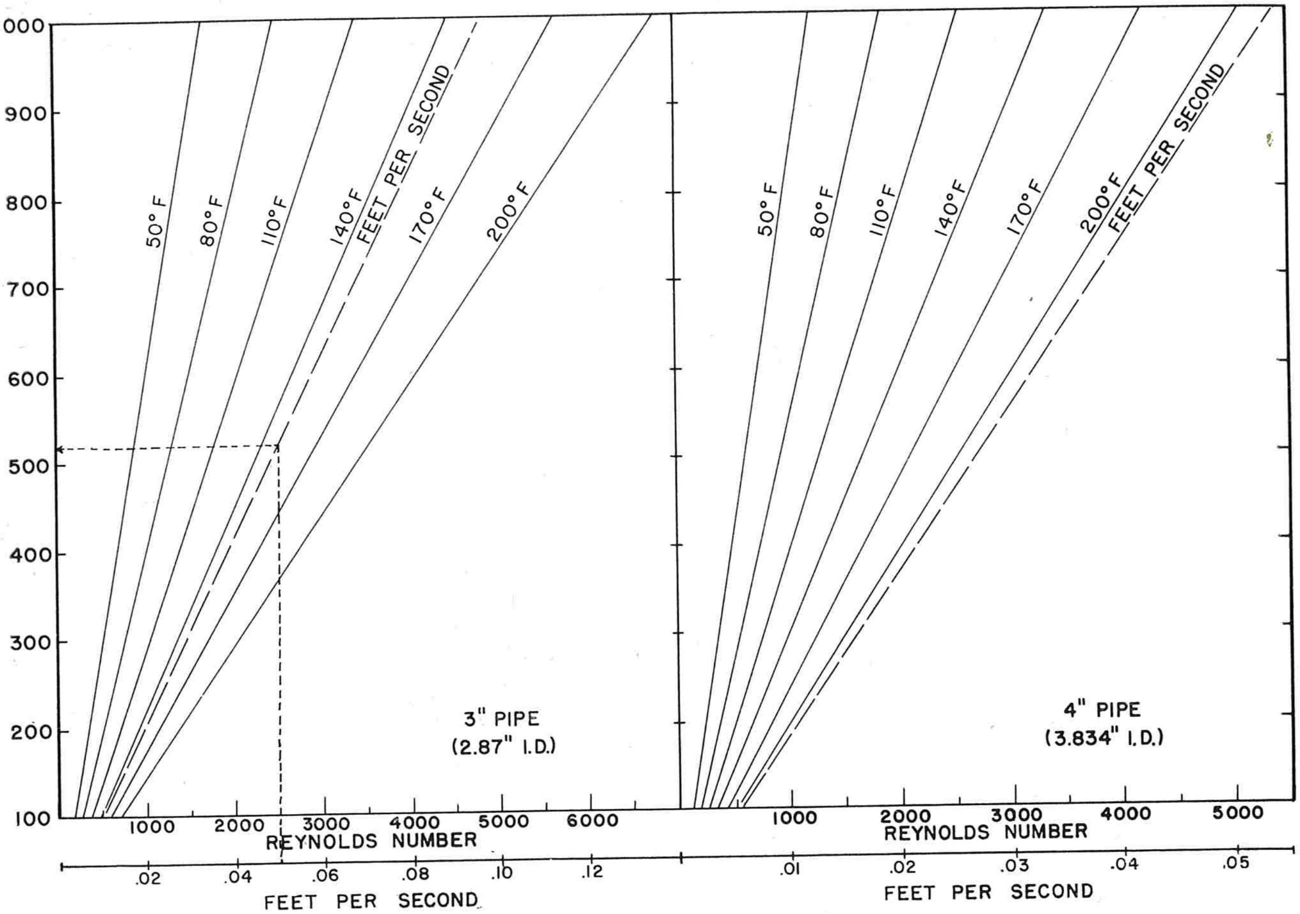

Figure 2. Relationship between Reynolds Number and flow rate and capacity in pipelines (3 inch and 4 inch).

second flow velocity is obtained by projecting the same horizontal line until it intersects with the "feet per second" line and then dropping to the horizontal axis and reading the result as 0.23. This value also must be multiplied by 10 since the capacity is 6000 instead of 600 lbs per hour, giving a final answer of 2.3 feet per second.

Example 2. To obtain a flow velocity of 5 feet per second in 3-inch pipe, what pump capacity should be provided?

Solution: (Refer to dotted line on the chart for 3-inch pipe)

Follow the line vertically from the 0.05 reference point on the horizontal axis until it intersects the "feet per second line", then follow horizontally and read the point of intersection with the vertical axis, 520 pounds per hour. Then, multiply by 100, since 0.05 is 1/100 of the desired 5 feet per second. The final answer is 52,000 pounds per hour.

Reynolds Number Interpretation.

This value is a dimensionless one represented by the following equations:

$$N_R = \frac{LV}{v}$$

L = Diameter in feet
V = Velocity in feet per second
v = Kinematic viscosity in square feet per second

Turbulent flow usually occurs at Reynolds Numbers above 3,000 and laminar flow below 2,000. The transition zone lies somewhere between. Note from the charts that laminar flow would seldom occur in commercially operated high temperature short time pasteurizers.

It provides a measure of the friction forces or shear stresses at the pipe surface in relation to inertia forces and would undoubtedly be a better basis for CIP requirements than the 5 feet per second for the largest diameter pipe as stated by the 3A Standards *(1)* which does not take into account the pipe diameter nor the temperature of the circulating medium. Studies are now underway in our laboratory attempting to relate Reynolds Number and other physical forces to cleaning effectiveness.

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THE INTERSTATE MILK SHIPPER CERTIFICATION PROGRAM– A COOPERATIVE ACCOMPLISHMENT[1]

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It is, once again, a particularly satisfying experience to review, with the Tenth National Conference on Interstate Milk Shipments, (NCIMS) the activties and comments of the Public Health Service relating to the Cooperative State-PHS Program for Certification of Interstate Milk Shippers.

The tremendous growth, prestige, and national stature which has been attained by the program during the relatively short fifteen years of its existence is but a reflection of the significant and attendant public health benefits which have accrued to the Nation. The past and continuing objective of this Conference is to "Promote the Best Possible Milk Supply for All the People." The interstate milk shipper certification program has been singularly successful in this mission and the Public Health Service is indeed gratified to have the opportunity to participate in this activity which commendably serves the milk consumer's best interests.

During the course of this report, we would like to, first, highlight the significant accomplishments of the program, particularly those accomplishments attained during this report period, 1963-1965, and second, to review Service recommendations relating to continued improvement of operating procedures and program effectiveness.

Program Accomplishments

The constantly increasing growth of the cooperative interstate milk shipper certification program, including its laboratory control activities, has been its most marked characteristic. The April 1, 1965, publication of "Sanitation Compliance and Enforcement Ratings of Interstate Milk Shippers" contains the names and ratings of 1215 shippers located in 46 States and the District of Columbia. These shippers represent the milk production of well over 150,000 dairy farms, and their commendable ratings represent literally billions of pounds of bulk raw milk, and pasteurized milk and milk products, of very high sanitary quality.

During the 9th National Conference on Interstate Milk Shipments, in April 1963, we reported that a record high number of 899 certified shippers located in 41 States and the Distict of Columbia were participating in the program. The first IMS list of 160 fluid milk shippers in 17 States, published just 15 years ago, has indeed grown at a phenomenal rate.

Currently, more than 2700 copies of the list are widely distributed, on a quarterly basis, to industry and government milk procurement agencies and to regulatory jurisdictions throughout the country. This represents a distribution increase of 500 copies in two years.

All of the 48 continental States now have programs for evaluating local milk laboratories by surveys and split sample techniques. At the time of the initiation of the IMS program in 1950, only 12 States had approval programs for milk laboratories. Currently, well over 500 laboratories, regulatory, commercial, and industry, and over 1000 analysts, are engaged in uniformly examining the milk and milk products of all listed shippers.

In 1963, we reported to the 9th National Conference that 125 certified State milk sanitation rating officers located in 44 States, formed the cadre of individuals who held the key to the integrity and success of the interstate milk shippers program. Today, two years later, this number has swelled to 152 in all 50 States; and these individuals, many of whom are present here today, continue to honor their profession by the character of the work performed in assuming major responsibility that certified supplies are under adequate and full-time supervision, and in conducting competent, accurate and dependable milk sanitation ratings.

We trust that increasing improvement in the uniform application of sanitation standards, laboratory methodology and rating procedures is related, in part, to many of the Public Health Service's activities, which are designed to facilitate communications, to expand knowledge, and to standardize technical and administrative procedures. We have annually sponsored seminars for milk sanitation rating and laboratory approval personnel in each region. We have developed an effective coding system which is used for disseminating PHS interpretations and opinions to all rating officers. We have conducted laboratory courses, and "Milk Pasteurization Controls

[1]Presented at the Tenth National Conference on Interstate Milk Shipments, Louisville, Kentucky, May 10, 1965, as a progress report of the USPHS to the Conference.

and Tests" short courses at our Sanitary Engineering Center in Cincinnati. The latter course has been presented in more than half of the States during the past two years. We continue to be engaged in State personnel standardization and certification activities, and in the standardization of the work of our own staff.

On numerous occasions, the Public Health Service has emphasized that the integrity of the NCIMS program is placed in jeopardy when published ratings are found to be no longer valid by PHS check-rating procedures. At the 9th National Conference in 1963, we reported that during the period 1961-62, 427 PHS check-ratings of listed shippers resulted in official requests for the resurveying of 17 percent of them, because of significant deviations from published ratings. We expressed deep concern, and asked the Conference to specify, in the "Procedures," a check-rating frequency. This, the Conference did. While there is always room for improvement, we are quite pleased to report that a record number of 750 check-ratings by the Service during the period, 1963-1965, revealed that the ratings of 91 percent of the shippers checked, were being adequately maintained. We know that such marked improvement is directly related to more intensive supervision by regulatory agencies and industry; to the motivating influences of milk procurement practices of increasing numbers of agencies and institutions; and, we believe, to the overwhelming impact of the 750 check-ratings conducted by the Service during this report period.

Without question, the cooperative interstate milk shipper certification program continues to improve the sanitary quality of milk shipped not only in interstate commerce, but in intrastate commerce as well; and it has stimulated a high degree of uniformity in the application of sanitary standards. It is a program which, in terms of public health benefits, has made significant contributions to milk sanitation administration and technology.

We have been very pleased that the effectiveness of the work of this Conference has resulted in relatively recent changes in the milk procurement policies of the Veterans Administration, the Division of Hospitals and the Division of Indiana Health, of the Public Health Service. Almost 300 hospitals administered by these agencies now require all milk and fluid milk products served therein to be from supplies which have been awarded a pasteurized milk sanitation rating of 90% or higher by certified State rating officers.

In addition, you are all aware that by January 1, 1966, only milk and fluid milk products of rated supplies which have been awarded a pasteurized milk sanitation rating of at least 90% will be accepted for serving on interstate carriers.

During the past year, the Conference of State Sanitary Engineers and the Association of State and Territorial Health Officers adopted a recommendation encouraging the school use of rated milk supplies of 90% or higher. Many school administrators have voluntarily adopted such procurement practices for milk served to their school children.

Many Commands of the Department of Defense are turning to the NCIMS list for sources of milk supplies for purchase by the Military.

We cannot help but believe that the accomplishments of this Conference should be a source of pride for us all.

PROBLEM AREAS AND SERVICE RECOMMENDATIONS

While the NCIMS program has been most successful in contributing to the sanitary improvement of milksheds throughout the country, certainly it is not without its operating problems, which require the attention of those attending this 10th National Conference. This is a natural state of affairs. Indeed, each of the preceding nine Conferences has been highlighted by our unique abilities to mutually apply ourselves to the resolution of many diversified problems.

At this time, it is desired to point out just a few areas relating to improved operating procedures and program effectiveness, together with our recommendations, for your consideration.

Standards

As you all know, the Public Health Service, with the assistance of milk sanitation and regulatory agencies at all levels of government, of all segments of the dairy industry, of educational and research institutions, has developed the *Grade A Pasteurized Milk Ordinance—1965 Recommendations of the U. S. Public Health Service.* This recommended Ordinance truly represents a consensus which can be uniformly and equitably translated into safe milk and milk products of high sanitary quality, without serious problems to either the regulatory agencies or the industry.

The 1965 Grade A Pasteurized Milk Ordinance is designed to meet the complex problems associated with the sanitary control of milk and milk products which have come into being because of new products, new processes, new chemicals, new materials, and new marketing patterns. *It is designed to be a performance standard.* It highlights broad guidelines for the achievement of a safe milk supply, instead of delving into specific and minute details as to how each objective is to be reached. It is a dynamic ordinance, the basic public health principles of which will remain sound, and the application of which can be subject to minor modifications, through administrative procedures, in the light of changing times.

New products are provided for in the section on definitions, and more practical and more acceptable definitions have been included for the older products.

Permit provisions have been realistically expanded to provide, in part, for suspension notices and the optional opportunity to request additional time to correct violations subsequent to such notice.

Cooperative certified industry inspection of producer dairies with specific checks and balances is provided for, with all initial inspections and punitive actions performed by the regulatory agency.

Bacterial counts, coliform determinations, and temperatures are to be enforced on a "3-out-of-5 compliance" basis. Individual producer milk counts have been reduced to 100,000/ml; commingled raw milk to 300,000/ml; and pasteurized products, except those to be cultured, to 20,000/ml "across the board." The Ordinance requires raw milk to be cooled to 50 F or less, and in recognition of new marketing and storage practices, pasteurized products must be maintained at 45 F or less. Methods of evaluating milk laboratories, requested by this Conference in 1963, are now referenced in the Ordinance.

Sanitation standards have been reorganized and updated in the light of new technology, new materials, new processes, and new milk handling methods.

Animal health requirements are contained in a separate section and are fully geared to USDA's accreditation programs.

Appendixes include updated knowledge relating to such subjects as training of milk haulers; certification procedures for industry farm inspectors; sanitization procedures; HTST pasteurization and accessory processes; culinary steam and air under pressure in contact with product; pasteurization equipment and control tests; and sanitation guidelines for the manufacture of single-service containers. Water supply requirements and sewage disposal requirements are virtually unchanged from the 1953 PHS recommended Milk Ordinance. New and improved field forms and office record reports are provided.

We ask this Conference to accept this Ordinance as its basic sanitation standard, and we defer to its good judgment as to the effective date after which all ratings for interstate milk shippers will be based thereon. A period of time from 18-24 months is not unreasonable, during which time the Service intends to make every effort, by means of specialized training courses and seminars in cooperation with the States, to fully orient all concerned with Ordinance provisions.

During the coming year, the PHS rating methods will be slightly modified to apply to the new Ordinance, and your consideration to make general reference to the PHS recommended methods of making milkshed ratings in the "Procedures" is requested.

Supervision

In the NCIMS "Procedures" relating to Supervision, we ask this Conference to consider practical abnormal milk control programs and pesticide control programs as prerequisites for shipper certification. We do believe the Conference is in a position to make some very significant contributions to consumer protection through such action.

Rating and Certification

1. Increasing numbers of multi-jurisdictional and multiregional milksheds are being rated for certification purposes. Area ratings of these multi-supervised sheds have not been too dependable, and have precipitated complex administrative problems in the conduct of surveys, check ratings, and listings. We ask that the Conference give serious consideration to this particular problem.

2. We recommend that a shipper, desiring a rating of his supply, submit his request to the State rating agency of that State in which the jurisdiction having full-time supervision of the supply, is located. It is that rating agency which should be responsible for the administration of the rating, although any certified rating officer of any State can appropriately be involved in the conduct of the rating. The "Procedures" should be amended to reflect this recommendation.

Bill of Lading and Seals

The new 1965 recommended Pasteurized Milk Ordinance contains specific references to shipping statement information, which must accompany interstate shipments of milk supplies. Reference to seals is also included. We recommend that the Conference consider deleting Section IV from the present "Procedures," entitled "Uniform Bill of Lading and Seals," since this matter is included in the new Ordinance.

Responsibilities of Participating State Agencies

1. We have been very disappointed in the lack of completion of milk sampling survey forms by the participating States. The adequacy and the correctness of sample collections are significant facets in a milk control program and must not be ignored in an evaluation procedure. Currently, 15% of these participating States are not conducting any evaluation of sampling procedures. In 30% of the States, sampling surveys are in arrears for the past two years. In 23%, only token participation exists. Accumulatively, 53% of the shipper States do not appear to be supporting the NCIMS procedures relating to sampling. Specific assignment of personnel at the State level to review and correct this problem is urgently recommended. The new PHS methods of evaluating milk laboratories provide excellent procedural guidelines in this area and will, upon implementation, contri-

bute greatly to the resolution of this marked program deficiency.

2. For improved clarity, we ask that this Conference reference the PHS recommended "Methods of Making Evaluations of Milk Laboratories" in the "Procedures" and delete matters now covered in the "Methods" from the "Procedures."

Responsibilities of the Public Health Service

Within the personnel and budgetary resources available, the Public Health Service has most conscientiously endeavored to implement those responsiblities delegated to it by this Conference. Such responsibilities include provisions for field and laboratory training; personnel standardization and certification; publication and distribution of the NCIMS list; check-ratings of individual shippers and program evaluations of State rating agencies; dissemination of interpretations relating to Conference standards; and evaluation of State laboratory agencies. Basically, our principal role is to bring about the highest degree of uniformity in attitude and performance on the part of State authorities, so that any State certification of a milk supply can be accepted with confidence. In addition to the need for greater effort on our part in the areas mentioned, a number of additional responsibilities recommended by various States will be considered at this Conference by the appropriate Task Committee. We welcome any additional responsibilities and suggestions which can improve our mutual efforts and which are endorsed by the Conference. To more adequately implement our current obligations and to encumber new delegations, in the months and years ahead, a great deal of effort must be expended to obtain the necessary resources. We ask this Conference to consider recommending the appointment by your Executive Board, of a Committee to provide guidance in such effort.

Application of Conference Agreements and Special Problems

While this Conference was originally conceived to provide dependable information on the sanitary status of milk supplies for those desiring to secure such supplies, the spirit of the Conference has, through the years, supported those administrative health practices which would facilitate the unrestricted flow of milk and milk products of high sanitary quality in interstate commerce. Such spirit, however, has received only lip-service support by far too many States and communities, and continued practice of interstate cooperation on a "one-way street" basis cannot possibly go unnoticed by this Conference in general, and by State and Federal legislators in particular. Long-held, parochial concepts concerning the sanitary control of milk must change with the times, and this Conference must decide whether it shall initiate steps to reason together as a family, in order to voluntarily assure reciprocity among the participating States, or whether the resolution of this problem will be handled by legislative methods. In any event, the problem *will* be solved.

We are most appreciative of this opportunity to highlight the significant accomplishments of the National Conference on Interstate Milk Shipments during 1963-1965, and to share with you some of our comments and recommendations concerning areas of program improvement.

UNIQUE SEWAGE TREATMENT PLANT

A new sewage treatment plant has been built near the resort town of Bijon, California, to treat sewage of the Lake Tahoe resort area near the California-Nevada border. This plant is unique in that it will provide tertiary treatment to about 15% of the resort area's sewage with techniques previously thought necessary only for producing water for drinking and food processing, and is the first waste water treatment plant of its type in the country. It was feared the continued discharge of a high phosphate-content effluent spray discharged on land from the existing secondary treatment plant would leach its way into Lake Tahoe and support algae growth. Thus, there were possibilities that the lake would become an inland sea of green algae and drive away the resort's tourist trade. Some 15,000 permanent residents will pay about 97 cents per $100 assessed valuation of their property for the new system as the cost of operation is relatively high being $50 per million gallons of treated effluent. The Public Health Service financed about 30% of the plant's $600,000 cost and hopes to gain much useful design information for possible similar pollution control facilities elsewhere. It is expected that this new tertiary treatmen plant will produce a plant effluent of the quality of drinking water.

EFFECT OF TEMPERATURE OF THE PLATING MEDIUM ON THE VIABLE COUNT OF PSYCHROPHILIC BACTERIA[1]

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Summary

Various cultures of pseudomonads reacted differently to changes in temperature of the plating medium during pouring. An increase in the temperature of the medium during pouring from 45-50 C caused a reduction of 25% or more in the viable count of six of the nine cultures at one or more of the sampling periods. With the pouring medium adjusted to 60-70 C, large reductions in count usually were observed. In a majority of the cases, the count at 40 C was similar to that observed on plates poured at 45 C. Changes in the temperature of the mixture of sample and plating medium during pouring of the plates were recorded with a thermistor thermometer. The temperature of the mixture with 0.1 ml sample was slightly higher than with a 1 ml sample. Maximum temperature of the mixture during pouring was 33 C with the medium at 40 C and 47 C with the medium adjusted to 70 C.

Numerous studies have shown that psychrophilic bacteria are frequently responsible for many undesirable changes in the flavor, odor, body and texture, and color of foods stored for extended periods under refrigeration. Even without the development of defects, they may create a problem when the viable count increases during refrigerated storage and exceeds the legal maximum. For these reasons, much attention is given to procedures for enumerating psychrophilic microorganisms. The majority of these studies is concerned with the effect of time and temperature of plate incubation on the psychrophilic bacterial count. In Standard Methods for the Examination of Dairy Products *(1)*, a plate incubation temperature of 5 to 7 C for 7 to 10 days is recommended. However, Baumann and Reinbold *(3)* reported significantly higher counts after 10 days than after 7 days of incubation at both temperatures, with greater increases in counts resulting from raising the temperature from 5 to 7 C. Highest counts were obtained with plate incubation at 7 C for 10 days. The pertinent information on the influence of conditions of plate incubation on the psychrophilic bacterial count was reviewed by Baumann and Reinbold *(2)*. Recently, Vanderzant and Fletcher *(11)* reported on the effect of various characteristics of the diluent on the viable count of certain psychrophilic bacteria.

Little information, however, is available on the effect of the temperature of the plating medium on psychrophilic bacteria. Stapert, Sokolski, and Northam *(10)* compared the viable counts of water samples obtained with the membrane filtration technique with those obtained with pour plates. They concluded that the consistently higher counts by the filtration technique probably could be attributed to the fact that the microorganisms were not subjected to the temperature of the plating medium. Gaudy *(5)* and Gaudy, Abu-Niaaj, and Gaudy *(6)* considered the more abundant air supply and the absence of temperature shock possible causes for the higher viable count with the spot-plate technique as compared with the pour-plate method. Zobell and Conn *(12)* showed that many bacteria from seawater or marine sediments are sensitive to temperatures ordinarily encountered in the pour-plate method.

On the other hand, Punch and Olson *(8)* reported that counts obtained by the surface-plate method with incubation at 6 C for 5 days were equivalent to counts obtained by the pour-plate method with plate incubation at 6 C for 7 to 8 days. Mossel and van de Moosdyk *(7)* determined the viable count of 42 fresh foods by both methods. In 90% of the samples no differences were observed between the counts obtained by the two methods. The higher counts in some samples with the surface-plate technique can, according to these workers, be attributed to the disruption of clusters by the surface-plate technique. The present study was initiated to determine (*a*) the influence of the temperature of the plating medium on the viable count of skimmilk cultures of pseudomonads, and (*b*) the changes in temperature of the mixture of cells and plating medium during the plating procedure.

Experimental Methods

Cultures P-10, F-01 and F-11 were from the stock culture collection of the Department of Dairy Science at Texas A&M University. The other cultures were selected from 51 cultures isolated at 5 C from various dairy products. The sources of the cultures were as follows: No. 1 from pasteurized milk, No. 13 from half and half, No. 17 from table cream, No. 20 from whipping cream, No. 47 from raw milk and No. 64 from condensed skimmilk. All cultures grew well at 5 C in ordinary media such as skimmilk, nutrient broth

[1]Technical paper No. 5173 of the Texas Agricultural Experiment Station, College Station.

and *Standard Methods* agar *(1)*. All cultures were examined for various cultural, morphological and physiological characteristics as outlined in the *Manual of Microbiological Methods (9)* Production of fluorescin was checked with Bacto-Pseudomonas agar F. The organisms were gram-negative rods with a single polar flagellum. All strains were oxidase positive. On the basis of various characteristics, they were tentatively identified as species of *Pseudomonas*. No attempt was made to assign a specific species designation because many isolates did not fit the characteristics of the species described by Breed, Murray, and Smith *(4)*. Selection of the cultures was based on differences in production of fluorescin, liquefaction of gelatin, action on nitrates, reaction in litmus milk, casein hydrolysis, ability to grow at 42 and 37 C and on source of origin.

The cultures were maintained on slants of *Standard Methods* agar *(1)*. They were transferred twice prior to each trial in sterile skimmilk. For the individual experiments, the cultures were incubated in skimmilk at 5 C for 3, 5 and 7 days. The inoculum consisted of 0.1% of a skimmilk culture grown at 5 C for 5 days. With the exception of variations in the temperature of the plating medium during pouring the viable count was determined according to the procedures outlined in *Standard Methods (1)* with plate incubation at 32 C for 2 days. To avoid possible undesirable changes, the medium was melted quickly in boiling water and cooled promptly to the desired plating temperature. Before pouring, it was held for a few minutes in a water bath at the desired temperature. Skimmilk was prepared by reconstitution of low-heat nonfat dry milk solids (9%) with distilled water. In the experiments on the temperature of the mixture of cells and plating medium, a thermistor thermometer (Yellow Springs Instrument Co.) was employed to determine the temperature.

RESULTS AND DISCUSSION

The results on the influence of the temperature of the plating medium on the viable count of the test cultures are shown in Figures 1, 2 and 3. The count obtained with the plating medium adjusted to various temperatures was expressed in terms of the

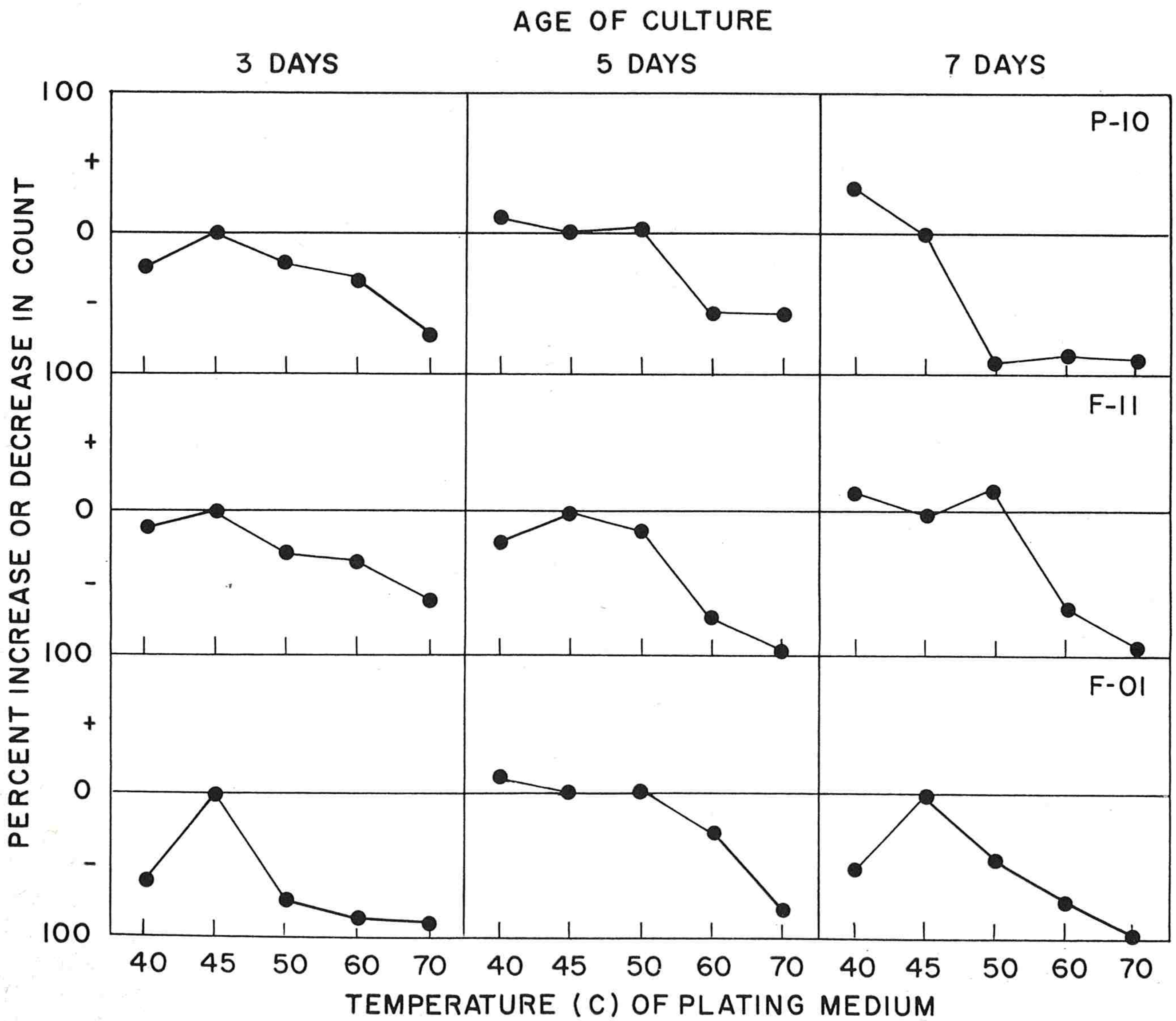

Figure 1. The effect of the temperature of the plating medium on the viable count of cultures No. P-10, F-11 and F-01.

count obtained with the plating medium adjusted to 45 C. Increases in count were recorded above the horizontal line, decreases below this line. The results show that different cultures reacted differently to changes in the temperature of the plating medium. The data also show that in some cases the pattern of influence of the plating temperature on the viable count changed with the age of the culture.

With some cultures an increase in the temperature of the plating medium from 45 to 50 C caused no marked change in the viable count. (A marked change was set at 25% more or less than the count obtained at 45 C). Among the nine test cultures, six 3-day old cultures (P-10, F-11, 1, 17, 47, 64), five 5-day old cultures (P-10, F-11, F-01, 1, 17) and four 7-day old cultures (F-11, 1, 17, 64) reacted in this manner. On the other hand, an increase to 50 C caused a marked reduction in the viable count of three 3-day old cultures (F-01, 13, 20), four 5-day old cultures (13, 20, 47, 64) and four 7-day old cultures (P-10, F-01, 13, 20). For example, with a 7-day old culture of P-10, a plating temperature of 50 C reduced the viable count 92% as compared with that obtained at 45 C. An increase in the temperature of the plating medium from 45 to 60 C did not cause marked changes in the viable count of a 5-day old culture of 1 and a 7-day old culture of 1 and 17. In general, cultures 1 and 17 were less sensitive to increases in the temperature of the plating medium than the other cultures. Marked reductions in viable count were observed in all cases when the temperature of the plating medium was adjusted to 70 C. In a majority of the cases (20 out of 27) the count at 40 C differed not markedly from that observed with the plating medium adjusted to 45 C. In 6 cases the count at 40 C was at least 25% smaller than that observed at 45 C. In a few instances (7-day old culture of F-11 and 47) higher viable counts were

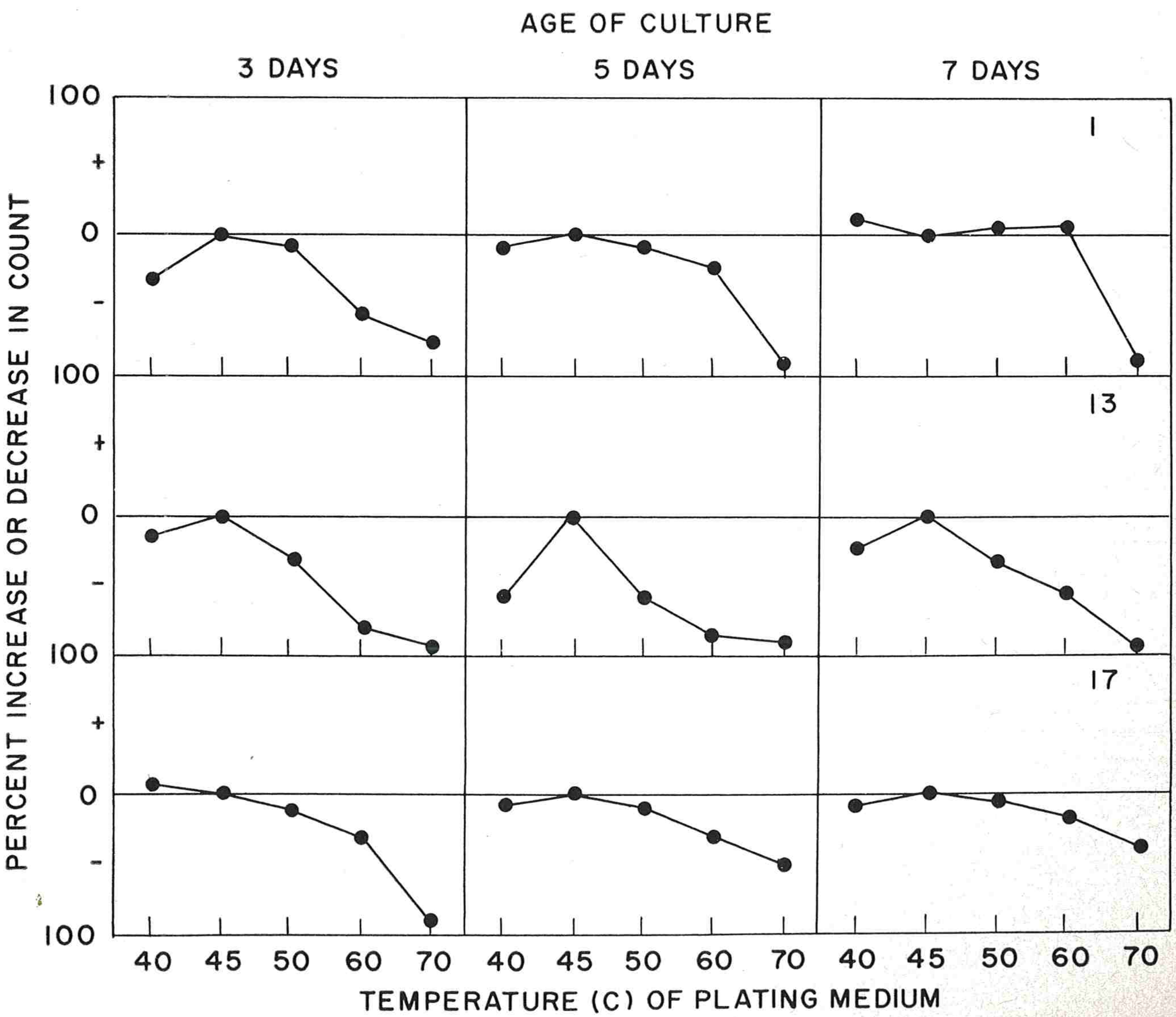

Figure 2. The effect of the temperature of the plating medium on the viable count of cultures No. 1, 13, and 17.

observed with the plating medium at 50 C than at 45 C. In general, the agreement between counts of duplicate plates was better at the lower temperatures (40 to 50 C) of the plating medium.

The results of the changes in temperature of the mixture of sample and plating medium in the Petri dish during plating are shown in Figures 4 and 5. One set of data in each Figure pertains to the mixture of 1 ml of sample and plating medium and the other to that with 0.1 ml of sample. Regardless of the temperature of the plating medium, the temperature to which the cells were subjected in an 0.1-ml aliquot was higher than in a 1-ml aliquot. This condition may explain the observation that discrepancies in counts on plates from consecutive decimal dilutions were more frequent at the higher plating temperatures than at 40 to 50 C. Zobell and Conn *(12)* also reported that the size of the sample influences the effect of the pouring temperature of the medium on the viable count. Other factors were (*a*) the temperature of the Petri dish and the surface on which the dish was located, and (*b*) the heat conductivity of the latter. Media cooled faster on a foundation of concrete, metal or soapstone than on one of wood.

The results of this study show that (*a*) in most instances the count with the plating medium at 45 C was equal to or higher than those observed at the other temperatures, and (*b*) the cultures differed greatly in their ability to withstand the effect of increases in temperature of the plating medium. Although the age of the culture had some effect on the extent of changes in viable count with increases in temperature of the plating medium, no particular pattern could be detected with the nine test cultures. The data again show that careful control of the temperature of the plating medium is necessary to ob-

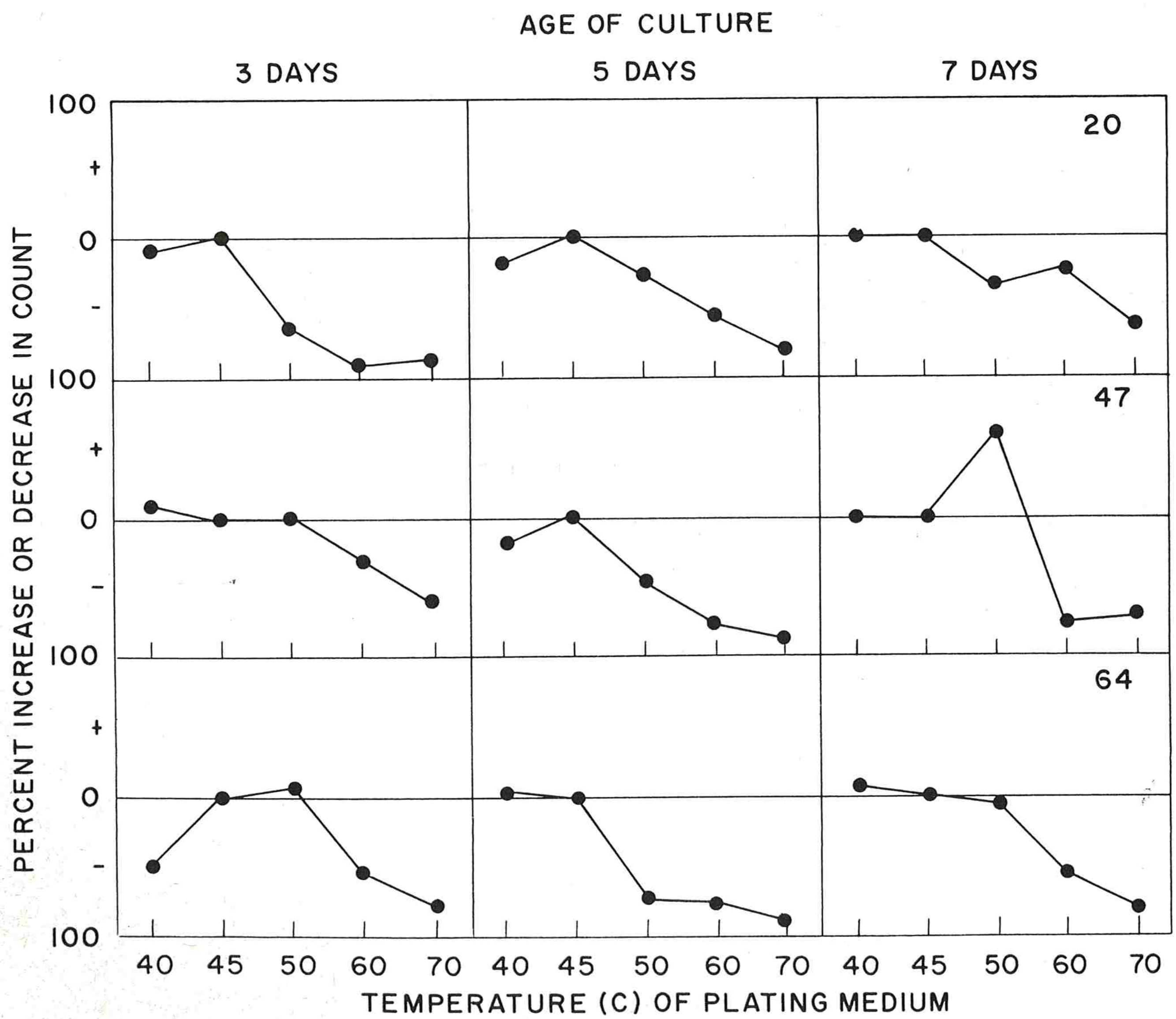

Figure 3. The effect of the temperature of the plating medium on the viable count of cultures No. 20, 47, and 64.

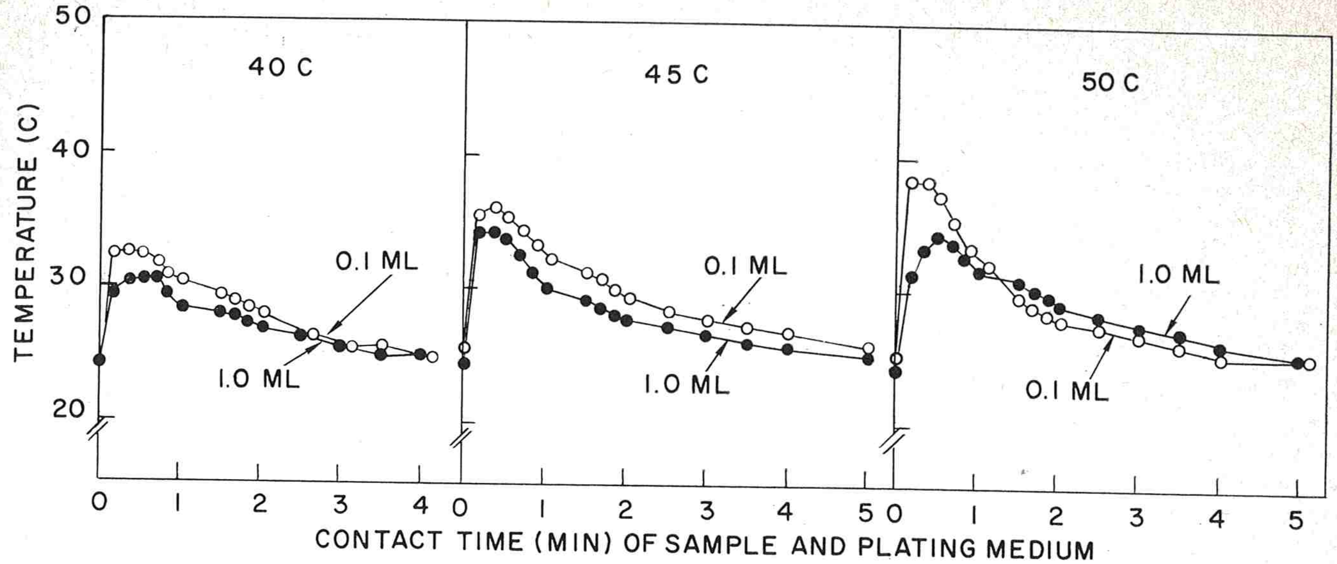

Figure 4. Changes in temperature of a mixture of plating medium and sample with the plating medium adjusted to 40, 45, and 50 C.

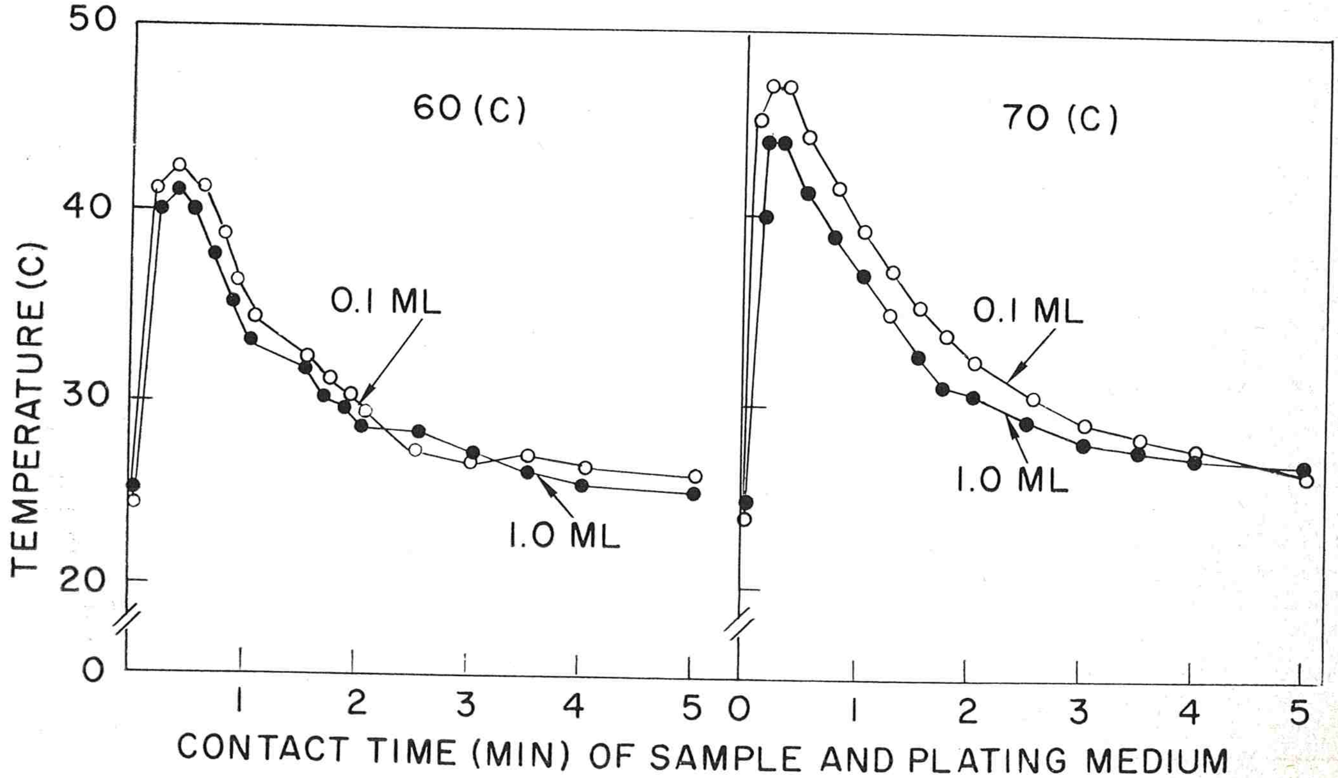

Figure 5. Changes in temperature of a mixture of plating medium and sample with the plating medium adjusted to 60 and 70 C.

tain a reliable Standard Plate Count. Hence it is necessary to (*a*) follow the recommendations of *Standard Methods (1)* not to depend upon sense of touch to indicate proper temperature of medium when pouring agar, and (*b*) employ a thermometer (checked for accuracy) in a blank for temperature control of the medium.

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SOME THOUGHTS ON DAIRY EQUIPMENT SANITATION[1]

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Why should dairy equipment be cleaned and sanitized? First, there is the need to prevent transmission of disease through milk and its products and to prevent contamination with microorganisms causing spoilage. Second, failure to remove deposits may lead to pitting of metal surfaces—even of stainless steel. Finally, there is the esthetic aspect. The house wife is entitled to some assurance that the milk or milk products she gives her family has been produced and handled in clean equipment. She must rely mainly on the processor to give her this assurance. While the dairy industry has led the field in developing equipment that can be readily kept in good sanitary condition, there are still too many farms and plants whose appearance would not encourage the consumer to use more of their products.

Today, with improved design of equipment, better materials and vastly superior cleaning aids, it is much easier to keep equipment clean. In particular, there have been spectacular advances in sanitation chemicals—cleaners and sanitizers. Formerly there were only the alkaline cleaners, which in hard water led to milkstone and other mineral deposits. Then compounds were added to keep hard water salts in solution—sequestering agents such as the polyphosphates and chelating agents. Wetting agents were introduced which lower the surface tension so that the solution wets the surface more readily and drains more freely. More recently liquid detergents have come into the picture, particularly for automated CIP cleaning systems and as household detergents. They also do the main cleaning job in "Tamed Iodine". Subsequently it was discovered that the alkaline cleaners were improved by adding chlorine compounds and now chlorinated alkaline cleaners are quite common, especially for pipe-lines. Finally came the discovery that iodine, long recognized as a superior germ-killer, could be "tamed" by complexing with non-ionic detergent compounds so that it lost many of its undesirable characteristics. The iodophors, as this class of compound are called, combine effective cleaning with excellent germ-killing and in addition the acid reaction keeps hard water salts and iron in solution, preventing the build-up of mineral deposits and actually removing such deposits from equipment. Despite statements to the contrary, "Tamed Iodine" is not an acid cleaner; it relies on the non-ionic detergent components for the removal of fats and proteins.

In the cleaning of equipment on the farm or in the plant, there are a number of factors to consider. The type of water is probably the most important single factor and the presence of hard water salts makes it most important that the right cleaner be selected. Then there is the type of soil. Cold milk is easily removed, while cooked-on milk solids present a far different problem, calling for a different approach. The type of surface is also important; stainless steel

[1]Based upon a talk given at a Conference of Fieldmen and Sanitarians, University of Kentucky, Lexington, Ky., Feb. 24-25, 1965.

is far more easily cleaned than wood or rubber. The type of equipment and of cleaning procedure must also be considered. Products which work well with manual washing may be unsuitable for CIP cleaning of pipe-lines because the wetting agent creates too much foam and interferes with the mechanical scouring action of the cleaning solution.

In addition to the factors mentioned above, the type of cleaner must be suited to the job at hand and used according to directions. For example, a hot solution is more effective than a cold. However, when the cleaning solution comes into contact with the cold wall of a farm bulk tank, it is soon a cold solution. Consequently, a stronger concentration should be used to compensate for this temperature loss. The period of contact with the surface is also a factor and bathing the surface with the cleaning solution and allowing it to stand for even a few minutes, makes it easier to remove the soil. Finally, friction is required to help remove soil. This may be applied manually as "elbow grease" or mechanically as in CIP cleaning. But above all else in importance is the desire to do a good job. Cleaning is too important to leave to the lowest grade of help, either on farm or in plant.

SELECTION OF CLEANING COMPOUNDS

Coming now to the choice of cleaner, it is possible to do a particular cleaning job with almost any product. There is such a wide variety of cleaning compounds on the market that the prospective user may well be confused by all the conflicting claims. The surest guide to staying out of trouble is the reputation of the manufacturer. The manufacturer who stands behind his products with a "money back" guarantee is a much better bet than the one who merely offers a better price. It is much cheaper in the end to use a product that will avoid milkstone or film on equipment than it is to remove such deposits. For manual cleaning it is important that the cleaning solution be easy on the skin; this eliminates strongly alkaline compounds which are superior for CIP cleaning. Again, there is a limit to the temperature the hands can stand—usually below 120°F—while for CIP cleaning much higher temperatures can be used.

While this discussion will deal mainly with farm dairy equipment, the same principles apply in the cleaning and sanitizing of plant equipment in both dairy and food industries. In all cases we are concerned with the removal of residual solids. When milk-handling equipment is rinsed with cold or lukewarm water, the lactose is removed but traces of fat, protein and minerals remain as a film. This is evident when a glass which has held milk is rinsed under the tap. To remove the fat, we can rely upon an alkaline cleaner to saponify and emulsify it or we can utilize a surface active compound, such as a non-ionic detergent with its superior wetting action and penetration to peel off and emulsify the fat. Again, for the protein component of the film, we can rely upon the alkaline cleaner—preferably with added chlorine—to dissolve it or upon the surface active compound to peel it off.

Against the mineral components of the film, however, the alkaline type of cleaner has very little effect. Here we must rely upon an acid type of cleaner, or an iodophor, to dissolve this material as well as deposits of hard water salts originating in the water supply. Incidentally, it used to be the practice to recommend rinsing, after washing, with water as hot as possible. The idea was that the rinse would heat up the metal and speed drying of the surface. More recently it has been realized that, where the water supply is hard, such a rinse leads to the depositing of hard water salts on the equipment—the so-called "waterstone". Today it is recommended that this rinse be made with cold water, preferably acidified slightly by the addition of a small percentage of an acid-type cleaner or an iodophor.

It has been claimed by some fieldmen that bulk tanks washed with an iodophor sometimes develop a greasy film. They explain this by stating that an acid-type cleaner will not remove fat or grease, overlooking the fact that an iodophor relies not on its acidity but on the non-ionic detergent components to remove milkfat. It is interesting to observe that films of grease and of protein can also be found on the walls of tanks washed with alkaline or chlorinated alkali solutions. This would suggest that failure to use the product as directed and, particularly, failure to brush the surfaces adequately, is likely to be responsible for the build-up of film regardless of the type of product used. Mineral film can also be readily developed by the practice of rinsing the milking equipment with a sanitizing solution made up from a powdered calcium hypochlorite.

For good manual cleaning of farm dairy equipment there are a number of requirements. First and foremost is the desire to do a good job. Next is the use of a high-grade cleaner, specifically compounded for this purpose. Household detergents should never be used because of the danger of the milk picking up a flavor from them *(1)*. Likewise soap should never be used; it is not as effective a cleaner and tends to leave a film. Suitable brushes designed for the particular piece of equipment, and in good condition, are a great aid; brushes with crimped nylon bristles are particularly good, as they retain their stiffness longer than fibre bristles. Rods for reaming out long milk hose, vacuum hose, etc. are also necessary. There should be facilities in the milkhouse for pulsating the inflations during cleaning. This pulsating action helps squeeze milky residue out of the tiny cracks and crevices in the surface of the rubber *(3)*, resulting in better cleaning.

Good lighting in the milkhouse is also important; unless soil can be seen it is unlikely to be removed. Too often the person doing the washing at a wash sink is standing in his own shadow from a single light bulb; there should be a lighting fixture immediately above the sink with at least a 100 watt lamp. It goes without saying there should be adequate supplies of hot and cold water under pressure, particularly where there is a bulk tank. Although many small producers of manufacturing milk lack even a milkhouse, to say nothing of proper facilities for washing equipment, those who plan to get most of their income from dairying will find it will pay to provide proper facilities. Quality standards are bound to become stiffer in the future. As an indication of what others are doing in the way of bacteriological standards, in Queensland, Australia, a semi-tropical area, milk with a plate count of over 30,000/ml is considered to be of poor quality *(5)*. Obviously we will have to raise our sights considerably, even for fluid milk.

The Final Rinse

Even after equipment has been thoroughly brushed with a suitable cleaning solution, there is still another important step. This is to rinse off the film of cleaning solution plus milk residue that still remains. If final rinsing is not done, particularly with hard water supplies, a film will gradually develop. As previously mentioned, it is now recommended to rinse with cold water, slightly acidified in order to keep hard water salts in solution and to prevent formation of waterstone on equipment surfaces. This is particularly desirable where a chlorinated alkali cleaner has been used; the acid liberates any traces of chlorine remaining and prevents the chlorine attacking any rubber parts.

The same principles discussed for manual cleaning of farm dairy equipment apply to plant equipment. However, with CIP cleaning, either on the farm or in the plant, it is possible to use much hotter solutions of stronger alkalinity. Here, after thorough initial rinsing to remove residual milk, the general practice is to circulate a strong alkali solution and then after rinsing with clear water to follow with an acid cleaning solution. However, on the Pacific Coast exceptionally good results have been obtained by using a suitable iodophor solution in place of the acid cleaner. Not only is it most effective in removing "invisible" film, but the germicidal action of the iodine brings the bacterial count down close to zero so that the final sanitizing rinse has much less to do.

In CIP cleaning there is some difference of opinion between operators as to the desirability of using alkali or acid first. "The proof of the pudding is in the eating," and a few weeks trial with both procedures will usually show which gives the best results in any plant. Where special problems arise as in the case of unusual water composition, the representative of one of the good sanitation chemical manufacturers should be called in for advice. These men have had wide experience in dealing with such problems and they are happy to make their knowledge available.

Sanitizing Treatment

If all equipment surfaces could be dried promptly after washing and rinsing, sanitizing would hardly be necessary as bacteria cannot multiply on a dry surface. However, in even a thin film of moisture bacteria grow actively when the temperature is favorable. Consequently, the practice of sanitizing all surfaces coming in contact with the milk before use has been generally required. While heat in the form of steam or hot water was formerly employed, the advantages of chemical sanitizing solutions are now universally accepted.

It has been argued that if equipment surfaces are really clean, sanitizing should not be necessary. Those who present this view are usually more concerned about the misuse of sanitizers; they believe too many users will reason that "if a little is good, more will be better" and that as a result of using excessively strong solutions the milk will pick up sufficient quantities of the germicide to affect the flavor of the milk. In this connection it should be noted that "Tamed Iodine" is recommended for sanitizing at a strength one-eighth to one-sixteenth of that recommended for chlorine or quaternary ammonium compounds. Gelda *(2)* in his studies at the University of Minnesota reported that their taste panel could detect either chlorine or iodine added to whole milk at concentrations of 10 to 14 parts per million. Consequently, so-called "chemical" flavor in milk could be expected more frequently from chlorine than from iodine where extra strong solutions were carelessly used.

It should be emphasized that sanitizing is not a substitute for cleaning, nor are sanitizers effective preservatives in milk, although in some areas producers are adding sanitizers to their milk in the mistaken impression they can keep down bacterial counts. For good results sanitizers must be used at the recommended concentration on clean equipment surfaces.

For use in sanitizing the surfaces of food-handling equipment, a product must be non-toxic, quick-acting and relatively non-corrosive. So far, only chlorine, iodine and quaternary ammonium compounds have been generally accepted, although a new type, composed of phosphoric acid and wetting agent, has recently come into the field. The hypochlorites were the first and are still the most widely used in many areas. They are cheap, widely available, and effective against a wide range of microbial life. However, disadvantages include corrosiveness of metals, even stainless steel, when strong concentrations are left in contact unduly long. Chlorine is also hard on rubber parts and is blamed for the erosion of carbon black from rubberware in CIP cleaning of pipeline milkers. It is also hard on the skin of hands and teats and the odor is objectionable to some persons. In hard water, products containing calcium hypochlorite are prone to cause mineral deposits on equipment.

About twenty years ago the quaternary ammonium compounds, commonly known as "quats", came into the picture. They were found to be particularly good against Gram-positive bacteria such as the thermoduric organisms which survive pasteurization. Unfortunately, quats are much less effective against the Gram-negative species such as the coliforms and most common psychrophiles.

As the relative significance of these types has increased, the popularity of the quats has diminished. Today they are most frequently recommended for washing udders, but even here they are less effective than the iodophors which clean the udder and kill germs more efficiently, especially in the presence of organic matter *(6)*.

As previously mentioned, the iodophors combined the properties of both cleaners and sanitizers. However, they are recommended for use in separate operations of cleaning and sanitizing, not as a "one shot" product. The iodine in an acid solution is effective against a wide range of bacteria *(4)* and is accepted by the U. S. Public Health Service for use as a sanitizer at a concentration of 12.5 ppm. It has certain advantages over the chlorine compounds, especially calcium hypochlorite, in that the acid reaction prevents deposits of mineral salts building up on equipment. Again, an iodopher is very much easier on the skin than a hypochlorite solution, a point of importance in plant operations where hands need to be sanitized before handling equipment parts, gaskets, etc., as well as on the farm in washing udders. Since an iodophor is both a cleaner and a sanitizer, it is more free-rinsing than most straight sanitizers, thus reducing the danger that significant quantities of sanitizing solution might be picked up from treated equipment by the milk. By the same token, there is not the danger of poor results because the producer has mistakenly used a sanitizer as a cleaner or vice versa, something which happens more frequently than many people suspect.

The acid type of sanitizer depends upon destroying bacteria by the strongly acid reaction of the solution, together with the better penetration resulting from the wetting agent present. While its germ-killing ability is roughly comparable to that of the hypochlorites, it is more expensive and so far has not come into general use. Like the iodophors, it has the advantage of inhibiting the formation of mineral deposits on equipment surfaces.

In summary, then, we see that today there is an array of effective cleaners and sanitizers, as well as devices for metering out liquid cleaners and sanitizers into a stream of water for taking care of a farm bulk tank or of plant equipment. It is much easier to keep equipment, both on the farm and in the plant, in good sanitary condition. However, it cannot be stressed too strongly that products should be used according to the manufacturer's directions if best results are to be obtained. A low first cost for cleaner may mean a high final cost if the product is not capable of preventing film buildup, especially of mineral salts, on equipment surfaces. The manufacturer's reputation is more important than the price and the reliable manufacturer has trained men on his staff who are keen to work with producers or processors to help overcome special problems. As a final note, don't believe everything a salesman tells you. Make him prove the value of his product under your conditions; a product that works well in one water supply will not necessarily do as good a job in another.

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DISPOSAL SYSTEMS FOR FOOD PROCESSORS[1]

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Production of an annual, nationwide pack of 750 million cases of canned foods requires about 36 billion gallons of water—an approximate average use of 50 gallons per case of food. Although much of this required volume of water is reclaimed from previous uses, the industry is entirely dependent on the availability of adequate water of good quality. Because of food quality improvements and more rigid definitions of cleanliness, it must be expected that water consumption will increase.

Of equal concern to the industry are the problems arising from disposal of food canning wastes. These problems become more complex and their solutions more costly each year. Fifteen years ago, waste disposal or treatment costs to the industry amounted to about 0.1 cent per case of canned foods. Currently the cost is in the vicinity of 0.7 cent per case. Costs as high as 4.5 cents per case are forecast within the next few years.

The disposal of liquid waste generally presents the most critical disposal problem to food processors. Large volumes of water are used to wash fruits and vegetables, move products from one operation to the next and to maintain sanitary conditions within the plant which accounts for the vast amount of liquid waste. Some form of treatment is generally necessary or will be demanded as antipollution laws are enacted and enforced.

In order to properly appraise a particular situation for liquid waste disposal, the following data should be obtained:

1. Volume and characteristics of each type of waste water produced;
2. Degree of treatment required;
3. Areas and topography of land available for a treatment plant;
4. Possibility of utilizing local municipal treatment works if any exist or are contemplated;
5. Financial considerations.

Consideration must be given to the fact that most food processors of the type being considered operate on a seasonal basis, which does not justify the capital expenditure for waste treatment that could be borne by a plant operating throughout the year. After obtaining the basic information with regard to the waste, a treatment by one or by a combination of the following methods can be considered: discharge to a municipal treatment plant, biological filtration, chemical precipitation, discharge to an impounding lagoon, or land absorption.

Need for Equalization Tank

Whatever the method for final treatment given, it is desirable to collect the screened waste in an equalization tank before treatment. Passage of the waste through such a tank will furnish emergency storage in case of equipment failure, make possible a uniform flow to the disposal area or treatment plant, and allow blending of the fluctuating organic or chemical composition of the waste. In the equalization tank, provision should be made for sludge removal and, if possible, aeration by some means to prevent septic conditions and odor production.

Discharge to a Municipal Treatment Plant

Discharge of screened raw cannery waste into a municipal sewage treatment plant is the most desirable and easiest disposal method if satisfactory arrangements can be made. However, the seasonal nature of cannery operations and the high pollutional strength of the waste may cause problems. The average liquid waste has ten times the Biochemical Oxygen Demand (BOD) than that of ordinary domestic sewage. The nature of the pollutants in the cannery waste may also upset normal sewage treatment processes.

For handling by a municipal system there usually is a charge assessed. This assessment is based on: (*a*) the volume of waste; (*b*) pounds BOD in excess of that normal to domestic sewage; and (*c*) suspended solids in excess of that normal to domestic sewage. Any one of these figures or any combination may be used in setting the charge.

Before discharge to the muncipal plant, the waste should be screened and possibly pretreated. Municipal treatment plants of both the biological filtration and activated sludge type are successfully treating food processing wastes. The financial arrangement between industry and the municipality is, in the last analysis, the determining factor.

Biological Treatment

The method commonly used for treating domestic sewage to secure a high degree of purification involves biological oxidation by one of several dif-

[1]Reprinted from Maryland Processors Report, March, 1965

ferent procedures. The principal vegetable wastes and some fruit wastes have been treated on experimental high-rate biological filters using rock, gravel, cinder and sand. Results have shown that such wastes can be treated on biological filters but that certain difficulties not associated with domestic sewage may be expected.

The purifying action on a biological filter depends upon the growth of microorganisms on the filter medium. This requires the continuous application of wastes. To attain a maximum biological growth and consequently maximum efficiency, half the time devoted to the packing of a single product such as peas or corn may be necessary.

Biological filtration on the scale necessary for a high degree of treatment of strong factory wastes can well be prohibitive in cost for the seasonal food processor. The large initial investment can be reduced somewhat by the use of highrate filters with recirculation, but only at the expense of additional operating costs. Any type of biological filter not in continuous use must be conditioned before reaching maximum efficiency. This means either that the filter is operated for several weeks inefficiently or that the filter must be artificially conditioned prior to use. Some fruit and vegetable wastes may be deficient in mineral nutrients, particularly nitrogen which is required to maintain an active biological growth in the filter.

Another biological treatment method involves the use of aeration to supply oxygen to a group of organisms which feed on the organic material in the waste. Various names are applied to this form of treatment such as activated sludge or straight aeration.

Two primary factors have been important in the slow acceptance of aeration in the canning industry—the high capital investment required and in many instances, the elaborate degree of control necessary to maintain balanced, efficient operations.

Recent experimental work with aeration has indicated that with certain limitations the method can be applied in a simplified form to obtain a high degree of purification, provided that the cost of treatment can be justified. Aeration appears particularly promising where a canner's waste admittance to a municipal sewer system is dependent on the BOD level being within the general range of normal domestic sewage. Under these circumstances the aeration would be a form of pre-treatment. At the present time the commercial use of aeration is limited to a very few installations.

Our Berkeley, California, Research Laboratory has been investigating the use of a trickling filter tower. The tower measured 33 feet high and 3 feet in diameter. The packing medium consisted of corrugated polystyrene sheets of plastic rather than rock or slag, used in the conventional trickling filters. After initially charging the filter with fresh waste, there was a delay of only five days before the unit began to give significant BOD removals when fresh waste was passed through the unit. The results indicate the possible usefulness of trickling filter equipment as a pretreatment for strong liquid wastes.

CHEMICAL PRECIPITATION

Situations have occurred where removal of suspended solids beyond that accomplished by screening would render the waste acceptable for disposal either to a body of water large enough to dilute the residual BOD of the waste or to a muncipal treatment plant. In some cases chemical treatment of cannery waste has been the most convenient method to accomplish this.

The treatment is accomplished by the use of chemical coagulants of lime followed either by ferrous sulfate or alum. This operation is conducted in either fill-and-draw (batch operation) or continuous flow systems. Successful results depend on rapid mixing of the coagulants with the waste and the resulting floc carrying down the suspended and colloidal solids when allowed to settle under quiet conditions. The resulting sludge is handled separately, usually on drying beds.

Unfortunately even with the most efficient operation, this method is limited to the removal of about 50% of the BOD in such wastes as peas, corn, and tomatoes and only 25% or less with fruit wastes. Future work must be accomplished to determine the chemical which will reduce the strength of the waste.

IMPOUNDING LAGOONS

Impounding food processing wastes in storage lagoons offers a means of disposal which eliminates stream pollution and may be less expensive than other methods of treatment. Storage of liquid wastes in earthen ponds allows for partial or complete decomposition of the waste, after which the waters may be discharged by controlled flow to a water course or to a muncipal plant for further treatment. Where soil conditions are favorable, complete absorption into the soil may be obtained.

A location for a lagoon should be selected which will not allow seepage to contaminate wells or underground sources of water supply. Gravel and limestone should be avoided unless covered with a layer of tightly packed clay at least 2 feet thick in order to prevent seepage. A sloping terrain lends itself well to the discharge of water by gravity. When pumping is required, the installation of a standby pump is recommended, preferably a steam pump which can operate during periods of power failure. All lagoons should be located so that prevailing summer winds do not travel toward inhabited places.

If topographic features permit, it is preferable to construct a single large lagoon rather than several small ones. It requires about two weeks to establish in the lagoon the desired growth of aquatic plant and animal life. Once established they act quickly upon incoming fresh waste. A shallow lagoon is preferred over a deeper one to allow better natural aeration as well as provide the stimulating effect of sunlight on biological life. If sufficient land is available, the waste depth should not be much above the practical minimum of 3 feet, while a depth of 5 feet is recommended as the maximum depth. A lagoon should be constructed in order that it can handle a volume one-fourth larger than the total seasonal volume so that a substantial amount of stabilized waste may be retained for the following year.

ODOR PRODUCTION

Odor production is the most serious problem with lagooning although measures can be taken to alleviate this condition. In the presence of free oxygen, the starches and sugars of cannery wastes are changed by bacterial action into stable inoffensive compounds such as water, carbon dioxide, nitrates and sulfates. When oxygen is exhausted from the waste, anaerobic bacteria continue the decomposition with the production of foul-smelling bases such as hydrogen sulfide or ammonia. This anaerobic condition in lagoons will occur quickly unless fresh waste is continuously added or available oxygen is supplied by other means.

The most satisfactory method for odor control in storage lagoons is by the addition of sodium nitrate. The function of sodium nitrate is three fold: (*a*) to furnish oxygen available for aerobic bacterial decomposition; (*b*) to stimulate the growth of chlorophyllaceous organisms which in turn produce additional oxygen by photosynthesis; and (*c*) to maintain an alkaline reaction.

Economically, it is not feasible to satisfy completely the oxygen demand of the waste. In practice it has been found possible to add an amount sufficient to satisfy approximately 20% of the 5 day BOD when the waste is held in shallow lagoons. With this treatment, slight odors are produced but they usually are not noticeable beyond 200 feet.

Sodium nitrate which is added to the liquid waste after screening may be applied in one of several methods. Two pounds of sodium nitrate will dissolve readily in one gallon of water which is then mixed in tanks large enough for one day's operation. This mixture may be batch fed or applied by a manually operated valve to deliver the required rate directly to the flow of waste. Sodium nitrate may also be added in the dry state at the pump sump at frequent intervals.

For proper operation of a lagoon, sodium nitrate must be added in the proper amount every day that waste is discharged. Special precautions should be exercised to see that no silage juice is added to a lagoon or that solids are allowed to by-pass the screening operation. The presence of weeds is objectionable from the standpoint of odor hazard and because they provide protected breeding areas for mosquitoes.

The minimum amounts of sodium nitrate which should be added for 1000 cases of No. 2 cans are as follows: Green beans—20 lbs; Lima beans—60 lbs; Beets, carrots, corn, peas and tomatoes—200 lbs. The amount of sodium nitrate which should be added for No. 10 can size would be 33% greater than the figures given for the No. 2 can size.

No recommendations have been given as to the distance a lagoon should be from houses, but complaints from odors have been reported for distances up to 1/2 mile.

Efforts to treat storage lagoons with lime, sodium hydroxide or cresote compounds have proved to be unsatisfactory. In recent years, there have been introduced on the market several odor masking agents to try to sweeten the air around lagoons. Some of these appear to work but the masking odor may be objectionable as well and we still have an odor problem.

Lagoons should be discharged gradually following the spring thaw. In properly constructed lagoons there is no danger from ice damage. Storage over the winter insures the discharge of a waste containing relatively little organic matter into a receiving stream under the most favorable conditions.

It frequently happens that certain wastes are best handled separately from the general factory waste. For example, in canning plants, water used for cooling cans contains so little organic material that it may safely be discharged without treatment. Its value as a diluent of stronger liquid wastes does not justify the cost and operation of a larger treatment plant. The waste from preliminary washing of certain fruits and vegetables is also weak enough to permit direct discharge after screening.

CONTINUOUS-FLOW LAGOONS SYSTEMS

Such systems have important advantages over other lagoon arrangements and are recommended in situations where available land is limited and where the cannery operation is year-around or where large daily waste flows are discharged over a period of several weeks. In addition to requiring less land per unit volume of waste, odor problems are not as serious as with storage lagoons and operation of the lagoons is considerably less complicated. Stabilization of cannery waste is much more rapid in the continuous-flow lagoon system.

In the continuous-flow lagoon system all screened fresh wastes are discharged into a flotation-sedimentation channel which may have a waste depth of 5 to 6 feet, but should have a width of only 10 to 12 feet. Sediment baffles are placed along the bottom and overflow from the channel is passed over skimming baffles. In this channel it is expected that most suspended solids will either float or settle out. This prevents the formation of sludge deposits in the oxidation ponds. If odor production occurs it is usually in the flotation-sedimentation channel.

When a year-round canning operation is planned, it is recommended that two parallel channels be installed. When one becomes choked with debris the flow is by-passed to the second channel and the sludge removed from the first.

The waste flow from the flotation-sedimentation channel passes into the first of a series of connected oxidation ponds which may be of any convenient size, but not more than 3 or 4 feet deep. The overflow from the first pond passes into the second and thus through the system. The current of water continuously moving through the ponds helps to prevent stagnation of the water and malodorous decomposition of organic material. The bacterial flora of these ponds is more varied and vigorous than that found in ordinary storage lagoons. Fresh nutrients are supplied to the microbes by the current moving through the ponds.

A prerequisite for the continuous-flow lagoon system is a means of disposal for the effluent from the system. This may be discharged to a stream or irrigation of one type or another. The strength of the effluent is dependent on the concentration of organic material in the raw waste and the retention time in the lagoon system. When discharge of the effluent to a stream is desirable, it is recommended that all clean waste waters such as that from can coolers be collected and used to dilute the effluent before its discharge to the stream.

Screened liquid wastes may be disposed of by soil absorption in localities where soil conditions will permit rapid absorption.

CONCLUSION

The canning industry must point to the fact that much of the complexity and magnitude of its water supply and waste disposal problems are not of the industry's own making. Explosive increases in population and industrialization of once rural areas have greatly influenced these problems. This nation could not support and sustain its population without the modern day food processing industries. The increased refinement and palatability of food, convenience of use, and generally lower cost to the consumer are remarkable benefits of modern food technology. All of these benefits are expected and demanded by the food consuming public. Yet one inevitable consequence has been the production of larger and larger volumes of liquid and solid waste.

APPLICATION OF A MODIFICATION OF THE BRABANT MASTITIS REACTION

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Editorial Note: Increasing interest and use of mastitis screening tests prompted publication of the following report on the application of a quantitative mastitis screening procedure based on the Brabant Mastitis Reaction (BMR) originally reported from Holland (5). Dutch workers have reported that examination of 5,000 to 10,000 samples per hour is feasible by the BMR method.

Bovine mastitis is a major problem faced by all milk producers in the country. It has been generally accepted that prevention is the best treatment and with this in mind, mastitis control programs have been set up throughout the world.

The estimation, direct or indirect, of the number of leuocytes present in milk is the criterion generally used for determining the degree of abnormality present in the udder of a cow. The direct estimation by stained smear technique *(1)* is the most reliable method but unfortunately it is laborious, time-consuming and requires fully-trained technicians.

Schalm and Noorlander's *(4)* well-known CMT has solved this problem at the barn and is excellent for testing quarter or bucket samples, but unfortunately the sensitivity is poor in the range of cells generally found in pooled milk. Being a subjective test and dependent on the judgment of the technician, results are variable and agreement is poor when used for testing pooled milks.

Seeking a more reproducible test, workers in Holland *(3)* developed the Brabant Mastitis Reaction (BMR). This measures the viscosity of a mixture of milk and reagent by the rate of flow through a 1.3 mm. orifice in a viscosity tube. In Holland, individual can samples up to 10,000 per hour may be handled by a single laboratory.

The dilution factor being low in cans, the cell count range on milk samples in Holland would be somewhat wider than that found where bulk tanks are used. We decided to try a modification of the Dutch method which would be more suitable for our laboratories in respect to numbers of examinations and to the cell count range in samples submitted. Recently, Thompson and Postle *(5)* reported a similar modification of the BMR procedure. In our investigations it was noted that the viscosity time differential on milk with cell counts from 500,000 to 1,000,000 per ml was extremely small if a viscosity tube with a rounded base was used. A flat base was fairly good for low count milks but was poor in higher counts; however, a funnel that had a base sloping at approximately 20° proved to be quite satisfactory under the conditions of test for a cell count range of from 200,000 to 3,000,000 per ml. The flow-through apparatus was designed to test the viscosity of 10 samples at a time. This was adequate for the volume of samples handled in our laboratories where a maximum would be 400 per day.

The apparatus uses the Dutch principle. Ten viscosity tubes are held securely in a stainless steel rack, the orifices of each being stopped by individual rubber-tipped flat springs fastened to a common shaft also under spring tension, and may be opened or closed simultaneously by turning a knob on the end of the shaft. Samples are set up in test tubes in 10-hole mixing racks; gel test reagent is added, mixed and then the mixture is transferred to the viscosity apparatus. The stops are opened for 10 seconds then closed and the amount of mix remaining in the viscosity tube is read from the graduations.

The gelling phenomenon is due to the DNA in nucleated body cells reacting with the surface active agent *(2)*. The enzyme DNAse is also present which progressively inactivates the DNA; this results in a steady decline in gelling effect from the time the milk is obtained from the cow. This inactivation is slowed down at refrigerator temperature and increases with heat; in three days at 40 F the activity is reduced by as much as 50%. Consequently there is no constant relationship between gel effect and cell count due to the variables of time and temperature. However, pooled milk samples have an average age of 48 hours and as handling and sampling conditions are fairly uniform, values obtained will be comparable from sample to sample.

The Milk Gel Index method outlined below is extremely simple, with high reproducibility and good agreement between technicians. The results correlate well with actual cell counts on milk samples with an average age of 48 hours. The gel test is less accurate than the stained smear cell count but is a good screening technique for examining pooled milk samples.

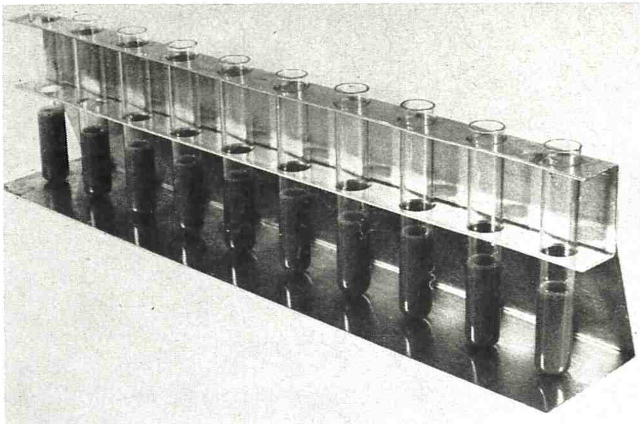

Figure 1. Mixing rack with tubes of milk + reagent.

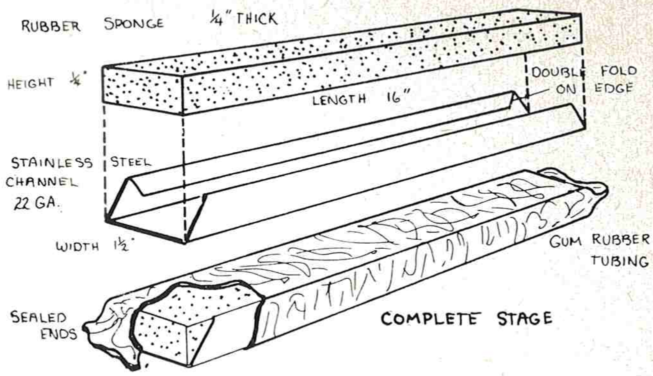

Figure 5. Mixing pad for MGI apparatus.

It has been decided to use the term "Milk Gel Index" (MGI) in expressing the result of this test which is actually the percentage of total volume of mix that remains in the viscosity tube after out-flow. This eliminates the use of the word "mastitis" on our reports and thus any inference as to diagnosis. Producers will be advised of the significance of the level of the index as it relates to abnormal milk; changes in the level in subsequent samples will be more readily appreciated than other forms of reporting gel tests.

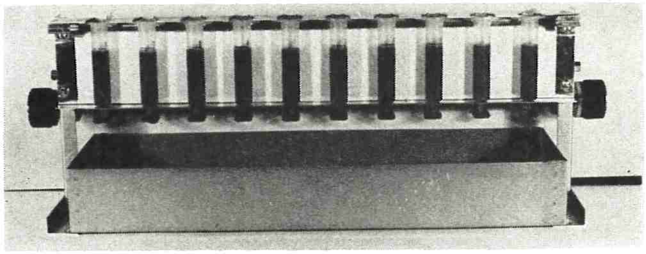

Figure 2. MGI apparatus with viscosity tubes loaded at start of test.

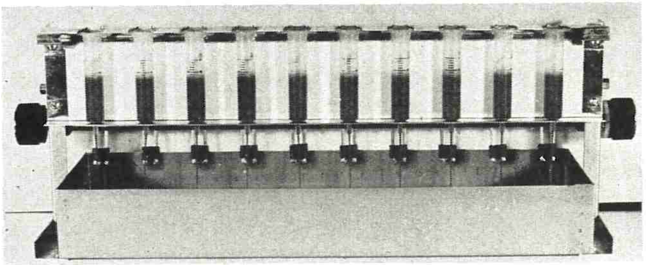

Figure 3. MGI apparatus with capillary stops open.

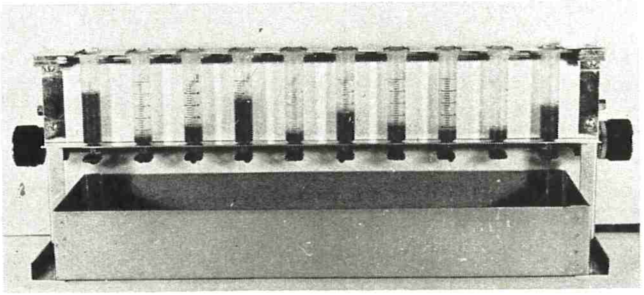

Figure 4. MGI apparatus with capillary stops closed after 10 seconds.

TEST PROCEDURE

Equipment:

MGI Apparatus (10 unit) complete with viscosity tubes and drain pan. (Fig. 2)
Mixing Racks—10 hole (quantity as required (Fig. 1)
Test Tubes—16 x 100 mm.
Mixing Pad—Diag. A (Note 6)
Drill No. 56—.046 in. dia.
Cornwall 5 ml syringe, 2 each—with metal pipetting holder.
Filling Outfit, B-D No. 1220F0, for attachment to Cornwall Syringe.
Hypodermic Needles—16 gauge.

Reagent:

Gel Test Reagent (GTR)—10% solution of Soropon SX slurry (sodium salt of Acid Dodecylbenzene Sulfonate), with 1:10,000 final concentration of bromcresol purple. Store at room temperature.

Technique

1. Check flow rate of viscosity tubes by pipetting 5.0 ml of water at room temperature into each, then open stops to allow water in first tube to flow to the 1.0 ml mark. Check reading of all other tubes. If readings are within ± one division the flow rate is satisfactory. Replace or correct faulty tubes.

2. Bring samples to room temperature. Using a 5-ml Cornwall Syringe with metal pipetting holder and a 16 gauge hypodermic needle, transfer 2.5 ml of each well-mixed sample into tubes in mixing racks. Rinse syringe twice in sample before extracting portion. A sample of pasteurized homogenized milk should be set up each day as a negative control.

3. Run 2.5 ml of GTR carefully down the side of each tube to avoid foaming. The 5-ml automatic Cornwall Pipetting Syringe or a Brewer Pipetting Machine may be used.

4. Using mixing pad to stopper tubes, mix milk and GTR by inverting rack three times, gently.

5. Rinse viscosity tubes with water at room temperature and drain thoroughly. Close capillary stops. Transfer the first set of 10 tests to the viscosity tubes in MGI apparatus, having allowed approximately 5 minutes for gelling; the gel remains for an appreciable time after formation. (Figure 2)

6. Open capillary stops for exactly 10 seconds; then close. (Figure 3)

7. Read the amount of mix remaining to the nearest 0.1 ml on the viscosity tube scale; multiply by 20 and record as MGI. (Figure 4)

8. Drain mix residue from each viscosity tube. If necessary, use a 2-in black aspirator bulb to force out remainder and rinse with a few ml of water at room temperature, then continue with next rack.

General Information

1. The viscosity tubes are the barrels of Becton-Dickinson's 5-ml disposable plastic syringes that have had the needle hole trimmed of any plastic filaments and cleared on the inside by gently reaming with a No. 56 (dia 0.46 in.) steel drill. A supply of standardized tubes should be on hand for replacements.

2. The viscosity tubes may be individually standardized by timing with a stop-watch to the nearest one-tenth of a second, the complete flow-through rate of 5-ml GTR. Agreement between viscosity tubes should be ± one second of a mean for any set, approximately 8 seconds.

3. Pasteurized homogenized milk is a good negative control. When 2.5 ml is mixed with 2.5 ml of GTR the entire mix will flow through the viscosity tubes within 10 seconds. Raw, pooled milk approximately 48 hours old with a cell count of 3,500,000 will not flow out of the viscosity tube in an appreciable amount; it drops slightly and has an MGI of approximately 98.

4. Viscosity tubes should be rinsed with water at room temperature. Never use hot water for this purpose.

5. Periodically check MGI's against cell counts made from stained smears as test control.

6. The mixing pad is not included with the apparatus. It is made from 22 gauge stainless steel, 16 in. long, 1½ in. wide, with a channel ¼ in. deep, the sides of the channel having a double fold for rigidity and to eliminate the sharp edge. A 16 in. x 1½ in. strip of ¼ in. thick foam rubber is placed in the channel and a piece of 1½ in. flat gum rubber tubing (uncut elastic band tubing) 16 in. long is drawn over the channel from end to end.

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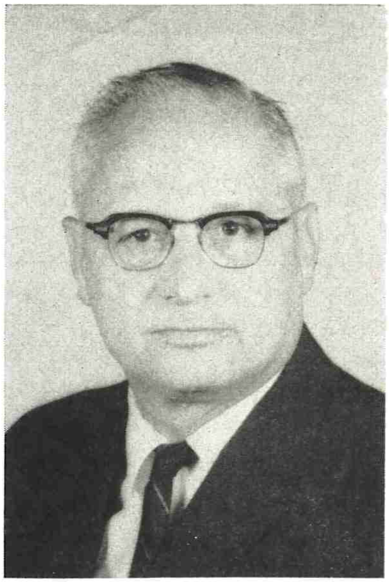
ASSOCIATION AFFAIRS

DR. JOHN J. SHEURING DIES AFTER SHORT ILLNESS



Dr. John J. Sheuring, Professor of Dairy Science at the University of Georgia, died at Athens, November 5, 1965 after an illness of five days.

Before coming to the University of Georgia in 1948, Dr. Sheuring had been a public school teacher in Illinois for seven years, a dairy technologist for the Borden Company in Chicago, and a dairy assistant and instructor of dairy technology at the University of Illinois. He received his B.S., M.S., and Ph.D., degrees from the University of Illinois.

Dr. Sheuring was the author of approximately 100 published articles and his memberships in professional organizations included the International Association of Milk, Food and Environmental Sanitarians, past president; American Dairy Science Association; Southern Association of Agricultural Workers; Institute of Food Technologist; Atlanta Dairy Technology Society, executive secretary; State Examining Board of Registered Professional Sanitarians, chairman; and Georgia Society of Registered Professional Sanitarians, secretary-treasurer.

John Sheuring had long been an advocate for establishment of professional rank for persons active in the field of milk, food and environmental sanitation. At the Georgia Society's annual meeting last August he was voted a special award in recognition for his leadership in securing passage of the State Sanitarian Registration Act in 1957 and for his major participation in university and state programs for better milk and food quality.

Because of his interest in sanitation Dr. Sheuring was largely responsible for the founding of the state affiliate of the International Association of Milk, Food and Environmental Sanitarians in 1952 which ultimately became the Georgia Society of Registered Professional Sanitarians. His activities won him international recognition leading to his election as president of IAMFES in 1961-1962. Through his continued dedication to his profession he brought dignity and accomplishment to the dairy science field as well as to environmental health.

Dr. Sheuring is survived by his wife, Mrs. Cosette Sawwill Sheuring, and two sons, James Bruce and John R. Sheuring, of Athens.

M. PALMER WELSH WISCONSIN SANITARIAN OF THE YEAR

The Wisconsin Association of Milk and Food Sanitarians 1965 Award for Sanitarian of the Year was given to M. Palmer Welsh, Head Fieldman, Pet Milk Company, New Glarus, Wisconsin.

Mr. Welsh graduated from the University of Nebraska Dairy Department and after graduation worked as a County Extension Agent in Nebraska. In 1939 he moved to Wisconsin and worked as a dairy plant fieldman for the Pet Milk Company and in 1944 was made head fieldman, the position he now holds.

Under his direction, an excellent quality program was developed with much emphasis placed on the importance of education as a means of developing sanitation consciousness among the dairy farmers. This was accomplished by holding many meetings with the dairy farmers and young people in cooperation with county agents, vocational agriculture teachers, FFA and 4-H Club programs. Also, Mr. Welsh publishes a very outstanding newsletter which is sent to the dairy farmers periodically.

Among Mr. Welsh's most outstanding attributes in the field of sanitation is his very favorable attitude, sincerity, and cooperation with regulatory agencies in introducing and promoting quality improvements at the dairy farm. The Wisconsin Association of Milk and Food Sanitarians is very proud to give the 1965 Award to M. Palmer Welsh.

NRA SPONSORS SECOND FOOD SERVICE MEETING WITH PUBLIC HEALTH ORGANIZATIONS

Representatives of nine sanitation and public health organizations interested in national uniformity of food protection and in mutual problems of food service operations met with officers of the National Restaurant Association in Chicago on October 16, 1965.

The stated purpose of the conference was three-fold. It was proposed that the group as a whole recommend holding state and local sanitation requirements and enforcement at substantiated levels sufficient to assure adequate protection to the public. It was urged that the group recommend and implement the adoption of the USPHS model ordinance as an important step in reaching uniformity in food protection. It was also proposed that the group coordinate in keeping the public informed on the cooperative accomplishments of public health agencies and the food service industry in continued improvement in equipment and food preparation methods and services in the interests of the dining public.

During the discussions it was pointed out that the pace of life, the changing pattern of man's living, tremendous population increases and rapid technological developments have created increasingly difficult environmental problems. This coupled with the fact of greatly increased costs of operations is resulting in very considerable changes in the food service industry and its performance to meet the public requirements. It is imperative that problems be approached cooperatively to achieve effective food protection and public health through a mutually understood and uniformly applied program.

This was the second meeting of the group of representatives, the first having taken place on April 13 and 14, 1964 to explore the feasability of joint efforts to open lines of communication and to reach a uniformity of purpose. A summary of the discussions and accomplishments at the second conference will be available later.

Representatives attending the conference are as follows (clockwise): Kenneth J. Haines, NRA Public Relations Director; John Andrews, Conference of State Sanitary Engineers; L. E. Starr, NRA Public Health and Safety Committee; Billy H. Elmore, National Society of Professional Sanitarians; William F. Clements, Chairman, NRA Public Health & Safety Committee; M. B. Crabill, Conference of Municipal Public Health Engineers; H. L. Thomasson, International Association of Milk, Food and Environmental Sanitarians, Inc.; Edwin L. Ruppert, U. S. Public Health Service; Ward Duel, National Association of Sanitarians; Thomas S. Gable, National Sanitation Foundation; J. O. Engebretson, NRA Public Health & Safety Committee; John H. Fritz, U. S. Public Health Service; Vernon E. Cordell, NRA Public Health & Safety Director; Lee D. Stauffer, American Public Health Association; Dr. Edward F. Gliwa, Association of State & Territorial Health Officers; Dr. Jesse B. Aronson, Association of State and Territorial Directors of Local Health Services; and Donald Greenaway, NRA Executive Vice President.

NEWS AND EVENTS

NATIONAL MASTITIS COUNCIL MEETING

The fifth annual meeting of the National Mastitis Council will be held February 3-4, 1966 at the O'Hare-Sahara Inn in Chicago.

The program for this year's meeting is directed towards the problem of how to accomplish the job of mastitis control or prevention. How one state is approaching this problem will be discussed in detail from the standpoint of a veterinarian, a dairy plant fieldman, a dairy farmer and an extension dairyman.

What promises to be an interesting session will be a symposium on mastitis from the standpoint of the dairy fieldman. This will be discussed by fieldmen from different areas in the country and representing both fluid and manufacturing milk operations.

Papers on various research projects, reports on progress in many states and several other items pertaining to the problem of mastitis are scheduled for discussion at this meeting.

Details on registration and on the program may be obtained from the National Mastitis Council, 118 W. First Street, Hinsdale, Illinois 60521.

NAS-NRC PEST CONTROL SYMPOSIUM

A public symposium on the scientific aspects of pest control will be sponsored by the National Academy of Sciences—National Research Council January 31-February 3 in Washington, D. C. in the auditorium of the U. S. Department of State.

The program will provide a comprehensive review of the present status of pest control in modern life. It will encompass the methods of pest control—biological, chemical, and genetic—presently in use, their development and regulation, and the multiplicity of ways in which pest control measures interact with the physical environment, with plant and animal life and with man. Special emphasis will be given to the advances, problems and future needs in pest control research.

The symposium was requested by the U. S. Department of Agriculture acting on behalf of the Department of Health, Education and Welfare, the Department of Interior, and other interested federal agencies. Attendance will be open to persons involved in every aspect of pest control, including scientists from federal and state agencies, colleges and universities, and industrial organizations, as well as conservation specialists, legislators, administrators, regulatory personnel and interested laymen.

A registration fee of $5 will cover the cost of the published proceedings of the symposium. Further information can be obtained from the Agricultural Board, NAS-NRC, Constitution Ave., Washington, D. C. 20418.

C. B. SHOGREN DIES AFTER EXTENDED ILLNESS

Clair Baker Shogren died on Friday, December 17 at his home in Windermere, Florida after a long illness. Until his retirement in 1963 he had resided near Beloit, Wisconsin..

Born in Oshkosh, Wisconsin in 1903 he was educated at Lawrence College at Appleton, Wisconsin and at the University of Wisconsin. In 1936 with his brother, A. L. Shogren, he founded Klenzade Products, Inc. a major manufacturer of sanitation chemicals serving the dairy and food industries. The company in 1961 was merged with Economic Laboratories Inc. and at the time of his retirement C. B. Shogren was Vice-President and member of the Board of Directors.

Long interested in the betterment of milk and food production and quality "C. B." actively promoted and participated in many improvement programs. One of his accomplishments which gave him much personal pride was the establishment of the Klenzade Educational Seminar which brought together leaders in education, public health and industry in the interest of better sanitation methods. The high quality and professional status of these programs was recognized internationally.

"C. B." was a member of a number of trade and professional organizations, including IAMFES in which he took great interest and had many friends. At its 1964 annual meeting, in recognition of his active support of its program, he was awarded a Life Membership in the Association.

Surviving are his wife, Eleanor Colter Shogren; three sons, Richard K. of Los Angeles, James C. of Williams Bay, Wis. and William S. of Golden, Colo.; two brothers, Cyril K. of Ft. Meyers Beach, Fla., and Arthur L. of Beloit and 12 grandchildren.

Consideration is being given to the establishment of a memorial fund in Mr. Shogren's honor for scholarship or special research. Details will be made known later.

tower spanning all four levels of the building.

Intended to serve all segments of Michigan's food and allied industries, the facility is financed by state appropriations and a grant from the National Institute of Health.

SURGE SANITATION PRODUCTS ARE BIODEGRADABLE

Surge Sanitation compounds for the dairy farm have been changed to meet the biodegradable or "soft" requirement well in advance of the industry-set December, 1965, deadline, according to Babson Bros. Co., Oak Brook, Ill.

As early as July of this year, Surge sanitation products for cleaning milking equipment, pipe line milking systems, and bulk tanks were being shipped that met the biodegradable requirements in U.S. Senate Bills 1118 and 1183, according to H. B. Yuen, chemist in charge of Babson Bros.' Chemical research. The change is in keeping with voluntary action taken by the detergent industry as a whole after the Senate Bills were introduced.

"Surge detergent products have been lab-tested and field-tested and meet all the detergent standards of our laboratory, besides being biodegradable," according to Yuen. Materials used are those which the chemical industry calls "linear surface-active." In other words, they lower the surface tension at the soil-solution interface and immediately bring about wetting, penetrating, dispersing and emulsifying action which cleans equipment.

NEW FILM ON FOOD HANDLING SANITATION

"Sanitation in Food Handling – Danger a la Carte" is a new 35 mm color film strip presentation designed for showing to employees of restaurants and other food handling institutions to promote safe, healthful pratices among those who handle or prepare food. The presentation, which has accompanying tape narration, has gone through several stages of development in practical use with restaurant personnel and has been praised highly by a group of cafeteria managers who have had occasion to view it.

Prepared under the direction of John L. Norris, M.D., Associate Medical Director, Eastman Kodak Company, and past-president of the Industrial Medical Association, the film has been produced as a 3-part series for which the running time is 20, 25 and 27 minutes per part. It is recommended that the parts be shown on separate occasions and that the series be re-run periodically to assure that all new employees receive the film's educational benefits.

Equipment needed for projection includes a 35 mm film strip projector and a tape recorder. Sold in complete sets only, the series is priced at $45 for members of the Industrial Medical Association and $75 for non-members. It is distributed by the Occupational Health Institute, non-profit educational affiliate of the Industrial Medical Association, 55 East Washington St., Chicago, Illinois 60602.

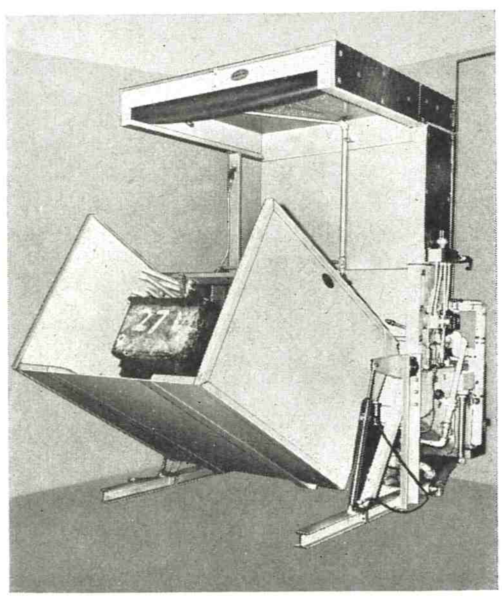
BULLETIN ON USPHS TECHNICAL COURSES

A Public Health Service bulletin describes the Environmental Health Sciences and Engineering Training Program courses scheduled for the period from July, 1965 to June, 1966. The courses cover activities in Radiological Health, Air Pollution, Water Supply and Pollution Control, Occupational Health, and Environmental Engineering and Food Protection. Activities include technical and orientation courses, training institutes and technical seminars held at Cincinnati and at various other locations.

A copy of the bulletin and other information may be obtained from James P. Sheehy, Director, Training program, R. A. Taft Engineering Center, 4676 Columbia Parkway, Cincinnati, Ohio 45226.

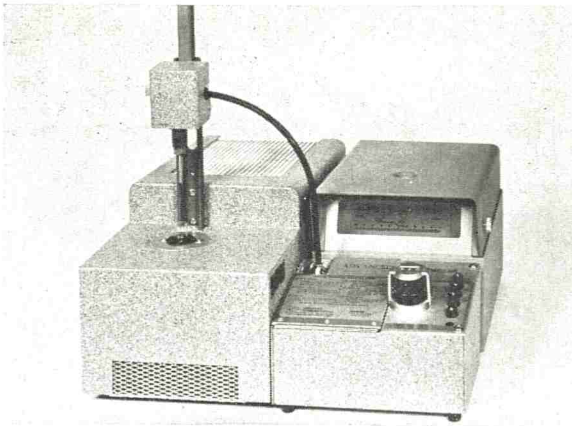
INFORMATION FROM INDUSTRY

Editorial Note: Following are items of information on products, equipment, processes and literature based on current news releases from industry. When writing for detailed information, mention the Journal.



TRUCK WASHING MACHINE

A new automated washing machine for floor trucks in meat packing and similar plants is designed to provide detergent washing, hot water and fresh water rinses in a cycle which can be varied from 2 to 6 minutes. Each individual stage can also be adjusted according to needs. The unit, offered by Alden Engineering Co., Inc., 43 Field St. Quincy, Mass., 02169, will handle floor trucks of practically all sizes and, operating automatically, allows operator to perform other duties simultaneously.



AIR-COOLED CRYOSCOPE

The Advanced Milk Cryoscope has been improved by the addition of a new air-cooled refrigerator to give greater cool-down ability. Other improvements to provide greater portability and convenience and increased efficiency in determining the water content of milk are described in a new bulletin available from Advanced Instruments, Inc., 45 Kenneth St., Newton Highlands, Mass.

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POSITIONS AVAILABLE

PUBLIC HEALTH SANITARIAN

Sanitarian must have at least a baccalaureate degree, and have completed at least thirty semester hours of academic training in the basic physical, chemical, biological or sanitary sciences. Beginning salary will be $6000 per year plus necessary travel expense. Write or contact for an interview: Lloyd S. Terry, M.D. Director, Hendricks County Health Department, 138 West Marion St., Danville, Ind.

SANITARIAN—FEMALE

Conduct sanitation inspections in food establishments. Travel required. Requirements: Degree in Science or related field; self-reliant; pleasing personality; related experience advantageous. On the job training; salary commensurate with background; expense account; group insurance; retirement plan. P.O. Box 437, Shelbyville, Indiana 46176.

FOR SALE

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

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from Johnson & Johnson

an educational contribution toward the production of cleaner milk

as a step toward our mutual goal of cleaner milk, Johnson & Johnson is presenting to the dairy farmer a series of educational articles under the general heading The Scientific Approach to Milk Filtering. These articles are intended to provide simple, practical answers to everyday questions concerned with the production of better milk, and to help educate the dairy farmer to the need for and value of proper milk filtration. If you are interested in obtaining the first two articles, already in print in leading dairy farmer journals, simply fill out and mail the attached coupon.

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by E. E. Kihlstrum

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Chapter II: *The Scientific Approach to Milk Filtering*

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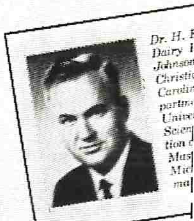
"I don't see how a milk filter has anything to do with mastitis—after all, mastitis is an udder problem, not a matter of careless milking like dirt and sediment."



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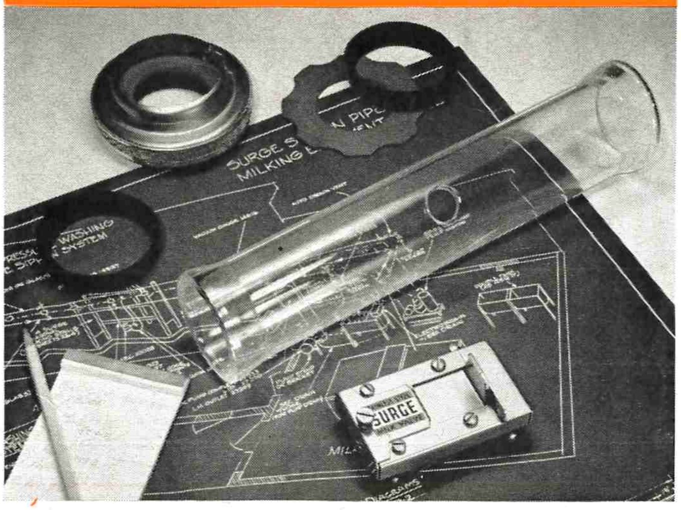

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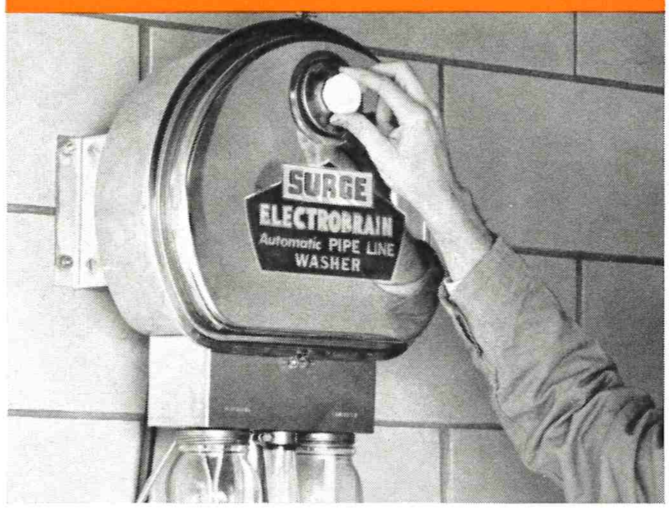

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