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

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Vol. 23 May No. 5

Contents *Page*

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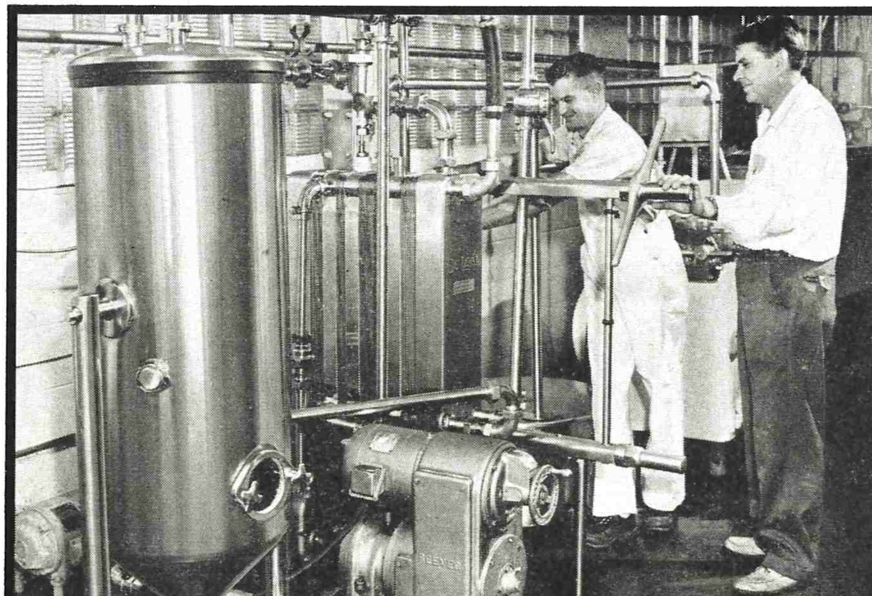

NEED FOR INDEPENDENT CERTIFICATION OF BACTERIOLOGICAL CULTURE MEDIA[1]

LUTHER A. BLACK

Robert A. Taft Sanitary Engineering Center,

Cincinnati, Ohio

As pointed out some ten years ago (*1*) the APHA Subcommittee on Standard Methods for the Examination of Dairy Products has no control over the method of commercial production of plating media, nor does the committee routinely test for uniformity individual batches of dehydrated media or ingredients used for preparation of the media. A preliminary investigation of the uniformity of batches of dehydrated media was carried out and wide variations were found among the geometric means both of different media and of different batches of the same media. There were also significant differences in productivity in the same medium prepared from dehydrated as compared to its laboratory-prepared form. Since significant variation occurred in half of the tests of variability of batches, this report recommended further study of batch variation in agar media, and exploration of methods for controlling such variation.

At a meeting in February 1951, the Coordinating Committee on Laboratory Methods of the American Public Health Association recognized the need to coordinate studies in the use of media, and authorized establishment of a Subcommittee on Approval of Culture Media. Even though the Association had adopted a plating medium for official use, no objective tests had been officially planned or conducted heretofore by the Subcommittee on Dairy Products (or by any other organized group in or outside of the APHA) to determine the uniformity of colony productivity of subsequent factory batches of plating medium (using the colony productivity given by the original batch or by other batches as a reference determination). Accordingly the Association has been placed in the position of tacitly giving its stamp of approval of each successive factory batch of medium, relying on the manufacturers to maintain uniform productivity.

Since performance testing should be an integral part of any certification program, efforts were made to develop a minimum procedure statistically valid for testing batches of media in the laboratory in comparison with a standard media (*2*). The first requirement for certification should be that manufacturers analyze batches of their own media according to such a statistical plan, thus reducing to a minimum the analyses required by any non-profit certification commission. This would also avoid unnecessary duplication of tests and make certification feasible at a reasonable cost. Based upon its own or other satisfactory test data a commission could supply labels for affixing to each bottle of culture media certifying that the particular lot had been found to be in compliance with specifications of Standard Methods for the Examination of Dairy Products, probably bearing a code number indicating the lot, manufacturer, and year certified. Proposals of the former APHA Subcommittee on Approval of Culture Media were summarized in a report presented in 1953, (*2*) together with action taken at that time by higher committees of the APHA.

In spite of the inevitable need of establishing uniformity of productivity, initial attempts to establish a certification program were delayed by the action taken by the Coordinating Committee on Laboratory Methods (CCLM) at the APHA meeting in 1955, in concluding that actual certification is not the proper function of the APHA. The following year the CCLM suggested that the Laboratory Section re-investigate the necessity for certification of culture media, although any certification program would need to be worked out by some other organization.

In spite of the claims by manufacturers that tests from batch to batch show comparable colony productivity and placing the blame for discrepancies on the treatment that dehydrated media has in the hands of operators during its rehydration and use, or other variables that may occur in different laboratories, published and unpublished evidence has continued to accumulate that variations are still occurring in plating media (*3*). Several instances have been observed during analysis of split milk samples carried out by the various states as one of the requirements for approval of local milk laboratories used for the examination of milk for interstate shipment. These anomalous results sometimes obtained between laboratories appear due to differences in culture media, rather than other factors of equipment or procedures which are already subject to periodic review by state milk laboratory certifying officials.

[1]Substance of a report on background information assembled by Standing Laboratory Committee for distribution at the National Conference on Interstate Milk Shipments, St. Louis, Missouri, April 20, 1959.

Published (*4, 5*) and unpublished results indicate similar variation in dehydrated culture media for diagnostic purposes. Similarly a new committee of the Laboratory Section of the American Public Health Association is studying what is being done and what needs to be done in the standardization of all public health laboratory reagents (*6*).

Accordingly, representatives of several national organizations potentially concerned with the reliability of bacteriological results based on culture media conferred on this subject in 1958, reviewing the background, previous recommendations of the APHA committees concerned, statistical protocols for comparative tests, split sample experiences, and results of a trial run of the recommended testing procedure carried out during 1958 in connection with the certification of the product of another manufacturer (*7*). Authorization for the optional use of another manufacturer's medium reemphasizes the present lack of independent objective review of the uniformity of different batches of any given medium. This group was unanimous as to the need for surveillance of plating media, that an independent commission distinct from any existing scientific society should be set up to handle media certification, and those present representing scientific societies were to report to their parent organization and request their endorsement of the principle of media certification.

Media to be used for quantitative work must be prepared according to definite specifications and conform to some predetermined standard of productivity. Most laboratory workers have neither the time nor knowledge to personally test media or ingredients and have had to take them on faith. This is the only item of equipment or procedure in the agar plate method not now surrounded with safeguards and controls, or subjected to scrutiny by state milk laboratory certifying officials. This is incongruous for a "standard plate count" and inconsistent with the aims of the National Conference on Interstate Milk Shipments for uniform certification of laboratory results both intrastate and interstate.

Certification becomes necessary for otherwise there is no guarantee of the quantitative performance of existing media. Accordingly, the standing Laboratory Committee of the NCIMS recommended to that Conference that only media certified as suitable by the Microbiological Media Commission be utilized by regulatory agencies for official results in the analysis of milk and other dairy products. After review by their task committee on laboratory procedures the National Conference voted to recommend that the certification of plating media be included in the next revision of the Milk Ordinance and Code. The 11th edition of Standard Methods for the Examination of Dairy Products will recommend "that only media certified by this Commission be utilized by regulatory authorities for official results."

Subsequently resolutions were passed at the 1959 annual meetings of the Society of American Bacteriologists, American Dairy Science Association, International Association of Milk and Food Sanitarians, and Association of Official Agricultural Chemists endorsing the principle of certification of bacteriological media and formation of an independent certifying commission. Such a commission was incorporated recently (*8*).

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THE EFFECT OF FARM BULK COOLER TYPE (ICE BANK OR DIRECT EXPANSION) UPON THE BACTERIOLOGICAL QUALITY OF RAW MILK

A. G. LEGGATT AND B. O. GREGERSEN

Department of Dairy Science,

Ontario Agricultural College, Guelph, Ontario

(Received for publication December 28, 1959)

Because of persistent rumors concerning the effect of type (ice bank or direct expansion) of farm bulk cooler upon the bacteriological quality of milk stored in them, certain data arising from another project were statistically analyzed to ascertain what variability might be expected from milk held in the two types under practical conditions. The data were derived from a study of nine different makes of coolers and twenty four shippers whose milk was sampled periodically during the winter and summer. This study showed that there was no statistically significant difference in the bacteriologcial qualty of the milk held in either type of farm bulk cooler.

The question as to which type, ice bank or direct expansion, of bulk cooler will give the lower bacterial counts has come to our attention from farmers weighing the advantages and disadvantages of the two types before selecting one to purchase. We have also heard of salesmen suggesting one type as yielding milk with a lower bacteriological quality than the other. Hence it was decided to find out whether there was any significant difference in the bacteriological quality of milk stored in both types of coolers under practical conditions.

During the winter of 1957 and summer of 1958 a survey of the bacteriological quality of milk from bulk producers in this area was carried out. This survey was made for another purpose without regard for the type of cooler used by the producers. Therefore it was believed that a scrutiny of the data arising out of this survey from the standpoint of the two types of cooler would probably yield an answer to this question.

The farms sampled for the survey were chosen at random from three rather indefinite groups, good, fair and poor shippers. These groups were established partly by visual inspection of the milking facilities, the milking equipment, milk house, etc., and partly on the past history obtained from the reports of the dairy to which the milk was shipped. Thus the "good" shippers were those the condition of whose equipment and facilities were considered above average and whose milk had not been criticized for any reason by the dairy for over a year. Poor shippers, on the other hand, were those whose equipment and facilities were judged below average and whose milk had been criticized occasionally.

TABLE 1—MAKE AND DISTRIBUTION OF FARM BULK COOLERS

No. of tanks	Ice bank	No. of tanks	Direct exp.
7	Champion	3	Cherry-Burrell
1	Dairy Kool	2	Creamery Package
7	Woods	1	De Laval
		1	Mojonnier
		1	Steinhorst
		6	Unico
Total 15		Total 14	

Milk from the selected farms was sampled at the time the truck operator took his sample. In all, 29 shippers were sampled. During the winter each was sampled from five to eight times, the majority were visited eight times, between the months of October and March. Each farm was sampled eleven times within the period May 1 to Sept. 1 during the summer of 1958.

The milk samples were taken aseptically into sterile bottles which were held in ice water until tested.

TABLE 2—ARITHMETIC AVERAGES OF BACTERIOLOGICAL TESTS ON MILK SAMPLES FROM EACH TYPE OF TANK

Bacteriological test	Season	No. of samples	Ice bank	No. of samples	Direct exp.
Standard plate count	Summer	99	29,000	110	23,000
	Winter	65	15,000	101	12,000
Coliform count	Summer	99	260	121	8,000
	Winter	57	59	90	96
Psychrophilic count	Summer	99	14,000	121	11,000
	Winter	46	1,000	85	1,000
Resazurin reduction time (hrs.)	Summer	99	2.75	121	2.86
	Winter	53	3.4	84	3.4

TABLE 3—ANALYSES OF VARIANCE WITHIN AND BETWEEN TANK TYPES FOR VARIOUS BACTERIOLOGICAL TESTS

Bacteriological test	Season	No. of Tanks	No. of Shippers	F value
Standard plate count	Summer	7	20	7.9
	Winter	9	24	3.9
Psychrophilic count	Summer	7	20	9.8
	Winter	8	22	8.5
Coliform count	Summer	7	20	1.3
	Winter	8	23	2.4
Resazurin reduction time (hrs.)	Summer	7	20	16.6
	Winter	9	24	13.6

5% and 1% points for the distribution of F:
Summer 5% 246 Winter 5% 248
1% 6,169 1% 6,208

The elapsed time from the taking of the samples until they were tested never exceeded 10 hours. The following tests were performed upon each sample: Standard Plate Count, Coliform Count, Psychrophilic Count and Triple Reading Resazurin Test. The coliform count was made upon Violet Bile Agar. All tests were carried out according to Standard Methods (*1*) except that the psychrophilic plates were counted at 10 days. The resazurin tests were read at half-hourly intervals up to a period of 4 hours to provide more observations for statistical purposes. However the tubes were only inverted at hourly intervals.

When the shippers were arranged into two classes according to type of cooler, it became necessary to eliminate some so that each class would have approximately the same numbers in the good, fair and poor groups. This was done on the basis of the criteria used for the original selection of the farms.

Table 2 depicts the arithmetic averages of the results of the various bacteriological tests used and the numbers of samples upon which they were based for each of the cooler types.

Because the numbers of samples varied between the two types of cooler, which may have influenced the averaged results, an analysis of variance within and between cooler types was performed. The F values derived from the analysis of variance are given in Table 3.

As five or six different makes of direct expansion coolers were sampled, and two to three makes of the ice bank type, an analysis of variance was performed to determine whether make of tank had any

TABLE 4—ANALYSES OF VARIANCE WITHIN AND BETWEEN MAKES OF TANKS FOR VARIOUS BACTERIOLOGICAL TESTS

Bacteriological test	Type of tank	Season	No. of tanks	No. of shippers	F value	Distribution F 5%	1%
Standard Plate Count	Direct exp.	Summer	5	11	2.4	6.16	15.21
	Ice bank	Summer	2	9	1.9	237	5928
	Direct exp.	Winter	6	14	1.1	3.69	6.63
	Ice bank	Winter	3	10	1.3	19.36	99.34
Psychrophilic Count	Direct exp.	Summer	5	11	1.6	6.16	15.21
	Ice bank	Summer	2	9	6.2	237	5928
	Direct exp.	Winter	6	14	1.4	3.69	6.63
	Ice bank	Winter	2	8	5.6	5.99	13.74
Coliform Count	Direct exp.	Summer	5	11	2.7	6.16	15.21
	Ice bank	Summer	2	9	10.4	237	5928
	Direct exp.	Winter	5	14	6.4	3.69	6.63
	Ice bank	Winter	3	9	1.2	19.33	99.33
Resazurin R. T.	Direct exp.	Summer	5	11	1.0	6.16	15.24
	Ice bank	Summer	2	9	4.7	5.59	12.25
	Direct exp.	Winter	6	14	2.7	4.82	10.27
	Ice bank	Winter	3	10	1.2	4.74	9.55

influence upon the results. Table 4 gives the data from this analysis.

Discussion

As will be seen from Table 1, a fairly representative lot of direct expansion type of cooler, but only three makes of the ice bank were used in this study. However the statistical results are such that it is doubtful whether the inclusion of more makes of coolers would have changed the picture at all.

The averaged values shown in Table 2 give very slight differences between the two types of cooler and the statistical analysis shows that these differences are most probably more apparent than real.

Theoretically, provided that the temperatures are comparable the type of refrigeration employed to produce and maintain the temperature should have no effect upon the bacteriological quality of the milk stored in bulk coolers. While theoretical considerations do not always apply under practical conditions, the results obtained in this study show that with ordinary farm conditions no greater variability of bacteriological quality of the milk exists between the two types of coolers than between those of the same type.

Summary and Conclusions

Because of persistent rumours concerning the effect of type of tank upon the bacteriological quality of milk stored in them, certain data arising from another project were statstically analyzed to ascertain what variability might be expected in bacteria counts from milk held in the different types under practical conditions.

The data were derived from nine different makes of farm bulk coolers and twenty four shippers whose milk was sampled periodically during two periods winter and summer giving, in all, up to 220 samples.

No significant difference in either bacteria counts or resazurin reduction times was found between either type or make of farm bulk cooler.

Acknowledgements

We must express our indebtedness to Dr. G. C. Ashton for advice in outlining the statistical treatment used in this study.

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PRELIMINARY INCUBATION FOR RAW MILK SAMPLES[1]

C. K. Johns

Canada Department of Agriculture, Ottawa, Canada

(Received for publication January 22, 1960)

Preliminary incubation (P. I.) encourages the growth of bacterial contaminants, and aids in detecting milks where good cooling masks insanitary production or handling practices.

Evidence is submitted to show the superiority of 55°F. for 18 hours for P. I. Using this procedure, a standard plate count of 200,000/ml. is suggested as a desirable standard to aim for. This would serve to emphasize thorough cleaning along with efficient cooling in the production of quality milk.

None of the bacteriological tests currently in use can distinguish between cleanly produced milk and that wherein careless practices are masked by efficient cooling. Producers with bulk tanks are discovering that they can take short-cuts in their sanitary production practices and still meet existing bacteriological standards. There is thus a growing need for a procedure which will reflect these careless practices. Johns (*6, 7*) had earlier suggested preliminary incubation (P. I.) at 55°F. for 18 hours for this purpose. In a recent paper (*8*), he reported further studies on the value of this procedure and reference was made to the work of various European investigators who had advocated different forms of P. I. Since then, several other reports have been seen. Unknown to the present writer, Chalmers (*2*) in Scotland had also suspected that efficient cooling in farm bulk tanks might cover up insanitary practices. To check on this, he held samples at approximately 60°F. for 21 hours, then ran a second set of plate counts at 37°C. He concluded that "probably about 24 per cent of the (103) samples gave initial counts (under 10,000/ml.) which did not reflect the probable true hygienic conditions of production of the milk." Other Scottish workers (*10*), following Chalmers' lead, re-

[1]Contribution No. 34 from the Dairy Technology Research Institute.

peated the analysis on similar samples after holding for 24 hours at 55°-60°F. Because certain samples with initial counts of under 10,000/ml. showed a hundredfold increase following preliminary incubation, they concluded that there would seem to be little correlation between production methods and the relative increase in count. Meany (*9*) applied P. I. at 60°F. for 24 hours to a series of samples from selected farms in the Chicago area. Differences in the degree of increase were related to conditions of production; when milking equipment was thoroughly cleaned, much smaller increases in counts were noted. Davis and Killmeier (*5*) recently reported excellent results using 55°F. for 18 hours.

It is becoming better recognized that a low initial plate count is no guarantee that the milk was produced under sanitary conditions (*2, 5, 8*). Consequently, a procedure such as P. I., which encourages the growth of bacterial contaminants, offers more hope of detecting milk which is not as good as the initial counts suggest. If such a procedure is to be accepted, it is desirable to standardize the time and temperature used.

A holding period of 18 hours has definite advantages. Preliminary incubation may be started at such an hour that bacteriological testing can be completed within normal working hours next day. Where the methylene blue reduction test (*1*) is used, this is especially important, as incubation at 35.5-37.5°C. is usually continued for at least 6 hours. With the holding period settled, it remains to demonstrate the suitability of 55°F. as the holding temperature.

In our studies in 1930 and 1939 (*6, 7*) interest was largely confined to the effect of P. I. on methylene blue reduction times. When commencing the present studies in 1957, we were primarily concerned with the effect on the "triple reading" resazurin test (*1*). As we came to work with lower count milks in 1958, the standard plate count received major attention. Before starting this phase of work, comparative counts were obtained after P. I. for 18 hours at different temperatures.

EXPERIMENTAL

Methods

After the initial standard plate count (*1*) had been determined, replicate portions of samples from producers with excellent quality records were held at various temperatures for 18 hours. Then the standard plate count was again determined. Plates were incubated at 32°C. for 48 ± 3 hours in all cases.

Results and Discussion

Preliminary incubation is based upon the theory that as the temperature of holding is lowered, a point is reached where the udder flora no longer multiply, while many of the saprophytic contaminants grow actively. The data in Table 1 confirm earlier findings that 55°F. is the most suitable temperature. They show that at temperatures above 55°F., counts jump-

TABLE 1—STANDARD PLATE COUNTS (32°C) ON MILK SAMPLES BEFORE AND AFTER PRELIMINARY INCUBATION AT VARIOUS TEMPERATURES.

		After preliminary incubation for 18 hours at:			
Sample	Initial	55°F	60°F	65°F	70°F
A	4,000	9,600			4,500,000
B	4,600	18,000			7,300,000
C	5,200	110,000	4,200,000	15,000,000	
D	6,300	410,000	10,000,000	16,000,000	
E	5,500	8,200	230,000	940,000	
F	58,000	11,000,000	26,000,000	41,000,000	
G	7,800	110,000	2,900,000	5,900,000	
H	2,500	82,000	430,000		
I	2,700	5,300	32,000		
J	4,400	11,000	93,000		
K	8,700	16,000	680,000		
L	6,700	13,000	320,000		
M	2,600	3,400	78,000		

TABLE 2—DISTRIBUTION OF STANDARD PLATE COUNTS AFTER PRELIMINARY INCUBATION (1958).

Initial count	Total samples	No. and % of samples with counts not exceeding: 100,000		200,000		500,000		1,000,000	
		(No.)	(%)	(No.)	(%)	(No.)	(%)	(No.)	(%)
10,000 or less	50	40	80.0	44	88.0	47	94.0	49	98.0
25,000 or less	74	50	67.6	56	75.7	63	85.1	69	93.2
50,000 or less	83	53	63.9	60	72.3	69	83.1	76	91.6

ed sharply, particularly between 55° and 60°F. Samples E, K, and L in particular showed marked increases at 60°F. with only modest increases at 55°F. Obviously P. I. at a temperature above 55°F. would require much higher count limits for acceptable milk. These might be misconstrued as meaning a lowering of standards. Of the 11 samples held at both 55°F. and 60°F., only two exceeded 200,000/ml. after P. I. at the lower temperature, while eight exceeded this level at 60°F. Four of these also exceeded 1,000,000/ml., and two of them reached 10,000,000/ml. or more. These results were so striking that it was concluded that our earlier choice of 55°F. had been wise. Subsequent experience has fortified this conclusion.

A temperature of 55°F. may be obtained in various ways. A low temperature incubator is undoubtedly the simplest and most precise, but is expensive. A second method is to use a refrigerated milk dispenser of the type found in restaurants, after adjusting the controls to 55°F. (*5*). A third is to run a water-bath at 55°F. in a cold room or walk-in refrigerator. This latter is the method we have used.

STANDARDS FOR ACCEPTABLE MILK

The widespread adoption of farm bulk tanks is necessitating a reappraisal of standards for acceptable milk. Standards established for milk handled in cans allowed for an appreciable growth of bacteria in the milk (*4*). With bulk tanks, cooling has virtually eliminated growth, and the usual standards are much too lenient. In several areas stiffer standards—usually 50,000/ml. standard plate count—have been established for bulk tank milk. These do not appear to be the answer, since count limits as low as 10,000/ml. give little assurance that the milk was produced under sanitary conditions. A procedure such as P. I., which encourages the growth of contaminants before testing, appears more promising. In Britain this principle has been accepted for several decades.

If P. I. is adopted, where should the standard for acceptable milk be set? Seeking an answer to this, we have analysed our 1958 results on 128 samples of milk from shippers with good quality records. The effect of P. I. on samples with various initial count levels is shown in Table 2.

The standard of 200,000/ml. standard plate count has been widely adopted on this continent (*4*). If, by applying P. I., we can continue with this standard but obtain a more reliable indication of the care taken in producing and handling the milk, the standard need not be changed[2]. As the results in Table 2 show, it is easier to meet an initial count standard of 10,000/ml. than a standard of 200,000/ml. following P. I. To meet the proposed standard, therefore, many producers who are now relying on efficient cooling will have to do a better job of *cleaning* their equipment.

While the proposed standard of 200,000/ml. after P. I. may seem quite stringent, it is considerably less so than the one of 100,000/ml. contemplated for Scotland (*3*). As will be seen from Table 2, nearly three-fourths of our samples with initial counts under 50,000/ml. and 88% of those with initial counts under 10,000/ml. met the 200,000/ml. standard.

Further evidence of what can be accomplished is shown in counts on milk from the Central Experimental Farm herd in 1958. Although there are better-than-average facilities for washing and sanitizing milking equipment, the procedure in caring for the milking machine teat-cup assemblies is anything but elaborate. Units are suction-rinsed in cold water at the end of the milking process and brought over to the Dairy Technology Research Institute. There any dirt on the outside is brushed off, and the teat-cup assemblies subjected to wet storage in 0.5% lye solution on a solution rack. The milker pails and pail-heads are brushed, rinsed and treated in a moist hot-air cabinet. Units are not rinsed before use at the next milking. After a week's service, teat-cups are disassembled and brush-washed; the inflations are stored in 5% lye solution for one week before being returned to service.

That even this simple procedure is effective in producing low-count milk is evident from Table 3. Sat-

[2]This proposal involves only a single analysis, whereas the ratio proposal of Chalmers (*2*) requires analysis both before and after P. I.

TABLE 3—SUCCESSIVE PLATE COUNT VALUES ON MILK FROM THE CENTRAL EXPERIMENTAL FARM HERD, 1958.

Date		Standard plate count A	Standard plate count B	Ratio B/A	Psychrophiles A	Psychrophiles B	Coliforms A	Coliforms B	Lab. past. count-A
Feb.	6	7,800	110,000	14.1					
	10	2,500	82,000	32.8					
	11	2,700	5,300	2.0					
	12	2,600	3,400	1.3					
	24	4,500	27,000	6.0					
	25	2,700	12,000	4.4					
Mar.	3	13,000	1,000,000	77.0					
	10	8,900	270,000	30.4					
	17	11,000	57,000	5.2					
	24	4,000	950,000	237.5					
Apr.	28	6,300	2,300,000	365.0					
	29	12,000	32,000	2.7					
May	5	12,000	170,000	14.2					
	6	3,000	22,000	7.3	200	18,000	7	140	700
	13	3,200	130,000	40.7	480	160,000	3	76	200
	19	11,000	830,000	75.5	440	640,000	58	6,100	400
	20	130,000	3,700,000	28.4	19,000	2,600,000	2,600	290,000	1,700
	26	5,600	12,000	2.1	20	100	10	290	300
	27	3,600	8,100	2.2	20	300	10	570	300
June	2	2,600	2,900	1.1	30	1,100	4	20	300
	3	2,200	5,200	2.4	<10	400	64	370	100
	9	2,900	7,900	2.7	60	5,200	33	70	400
	10	2,900	25,000	8.6	80	100	2	20	100
	16	7,300	1,000,000	137.0	1,000	6,400	170	7,000	400
	23	16,000	1,900,000	118.6	1,500	1,600,000	3	2,200	<100
	24	12,000	1,700,000	142.0	630	55,000	7	600	100
Sept.	8	7,000	130,000	18.6	60	140,000	2	<10	100

A = Initial count; B = Count after P. I. at 55°F. for 18 hours.

isfactory labor in the dairy barn is hard to obtain, and occasional slip-ups occur, especially during experimental studies with single-quarter milking machines. While these are not always reflected in the initial plate counts (e.g. April 28, June 16) they are in the counts after P. I.

In almost every case where the ratio of the count after P. I. to initial count is high, the counts of psychrophiles, both initially and after P. I., are likewise high. This is not always the case with initial coliform counts, some of which (e.g. June 23 and 24) are quite low. The same holds true for the thermoduric organisms; with a single exception, these were all well below 1,000/ml. This suggests that coliforms and thermoduric organisms are less sensitive indicators of carelessness. However, it must not be overlooked that thermoduric organisms will not be detected by P. I., since they fail to grow at 55°F.

These counts are submitted as further evidence that a standard plate count of 200,000/ml. following P. I. at 55°F. for 18 hours is not an unreasonable standard. It is more likely to ensure cleanliness and care in the production of milk than will lower initial count limits.

Experimental evidence already published (8) has indicated that the ratio of counts before and after P. I. is closely related to the cleanliness of milking equipment, especially milking machines. Additional evidence was obtained later in 1958. Through the courtesy of a local fieldman we obtained a teat-cup cluster which had merely been immersed in water between milkings. At the Central Experimental Farm, milk drawn with this unit was placed in a separate marked can at each milking; samples were quickly cooled to 40°F, then aliquots of night's and morning's milkings composited for analysis.

Table 4 shows the effects of the various treatments of the teat-cup cluster. Not only did the standard plate count, the psychrophile count and the count after laboratory pasteurization drop sharply with more adequate treatment; even more striking was the drop in the ratio of counts before and after P. I. This was true for coliforms and psychrophiles as well as for standard plate counts. These results support our

TABLE 4—RESULTS OBTAINED USING NEGLECTED TEAT-CUP CLUSTER (1958).

Date of Analysis	Standard Plate Count/ml. A Before P. I.	B After P. I.	Ratio B/A	Coliforms/ml. Before P. I.	After P. I.	Psychrophiles/ml. Before P. I.	After P. I.	Lab. past. count/ml.
Oct. 23[a]	2,600,000	40,000,000	15.4	8	560	1,100,000	TNC	820,000
24[b]	1,100,000	33,000,000	30.0	2	36	85,000	6,400,000	900,000
25[b]	900,000	35,000,000	38.9	1	370	270,000	21,000,000	230,000
26[b]	1,200,000	41,000,000	34.2	5	430	150,000	20,000,000	200,000
27[c]	41,000	46,000	1.1	<1	<1	200	1,000	26,000
28[c]	5,500	16,000	2.9	8	25	300	4,400	1,000
29[c]	7,100	17,000	2.4	7	58	100	800	1,500
30[d]	6,300	11,000	1.7	3	28	100	700	1,000
31[d]	8,600	9,200	1.1	8	16	100	<100	300

[a]Sampled at milk plant; [b]Teat-cups immersed in water between milkings; [c]Teat-cups filled with 0.5% lye solution; [d]After disassembling, brushing and boiling in 2% lye solution, 29th a.m.

published findings that this ratio is extremely low in milk drawn with clean milking machines. On the other hand, where cleaning is inadequate, wide ratios are usually encountered.

It is not contended that P. I. will detect every type of insanitary condition or practice. No person familiar with the wide variety of types of bacteria found in milk would ever expect this of any one procedure. Nevertheless, it is believed that P. I. furnishes more information regarding the care taken in production and handling than can be obtained from analysing a freshly taken sample of milk, no matter which of the several current testing methods is employed.

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THE EFFECT OF SOME SELECTED FACTORS ON THE COOLING OF FOOD UNDER REFRIGERATION[1]

LENORA MORAGNE, KARLA LONGREE, AND JAMES C. WHITE

Departments of Institution Management and Dairy Industry

Cornell University, Ithaca, New York

The purpose of this investigation was to study the effect on refrigerator temperatures and on cooling times of white sauce placed under refrigeration by using still air and circulated air, by loading the refrigerator with varying amounts of sauce (8, 16, and 32 gal.), by distributing the load in various ways in the refrigerator (4 and 8 batches), and by placing the sauce in the refrigerator at two initial temperatures (140° and 80°F.).

Results indicated that the refrigerator air temperatures and the total cooling times of the sauces were significantly influenced by the variables used in this investigation. When the air was circulated, the air temperature in the refrigerator was drastically reduced and the total cooling times were shortened. The larger total loads of sauce gave longer total cooling times; distribution of the sauce into numerous small batches gave more efficient cooling. When the sauce was pre-cooled the refrigerator air temperatures were lowered and total cooling times were shortened.

Slow cooling rates in large batches of food cause temperature conditions favorable for bacterial growth. Increasing efforts are being made to decrease the length of time during which food remains at temperatures referred to as the "danger zone." This zone is commonly accepted as the temperature range of 120°F. to 50°F.; a 4- to 5-hour period had been reported as the maximum length of time foods could safely remain in this zone (*3*). Angelotti *et al.* (*1*) indicated that this range may have to be lowered to 42°F.

Refrigeration has long been a practice in the storage of cooked foods. Yet, this "low-temperature" storage of foods may become hazardous if the refrigerator temperature rises unduly. This might be the case when large amounts of warm foods are placed in the refrigerator (*5, 6*). With rising refrigerator temperatures, the cooling times of the foods may be increased and the food would pass very slowly through the "danger zone." It would seem that one means of reducing or eliminating the danger of unduly raising the temperature in a refrigerator is to load it with foods that have been cooled before being introduced into the refrigerator. Methods of pre-cooling large batches involving air cooling as well as water cooling have been studied in this laboratory and elsewhere (*2, 6, 7*) and their relative merits are not under discussion here.

In addition to the factor of the initial temperature of the food when placed in the refrigerator, other factors may be expected to affect the refrigerator temperature and thus, cooling of the food. Among these are the circulation of the air within the refrigerator and the total food load placed in the refrigerator (*6*).

Although air circulation is widely used in refrigeration, a search of the literature did not reveal any reports on actual studies involving air circulation and its effect on cooling rates and total cooling times of refrigerated foods. A related investigation was reported by Tracy and McGown (*10*) who studied the effect of air circulation on the hardening time of ice cream in the freezer. The authors were able to reduce the total hardening time as much as 50% by efficient movement of air. Other studies on the effects of air circulation in quick freezing have been reported by Tressler and Evers (*11*) and Nicholas (*9*).

PURPOSE AND VARIABLES

The present study was divided into two parts. The purposes of Study A were to investigate the effect on refrigerator temperature and on the cooling time of food placed under refrigeration by varying the circulation of the refrigerator air ("fan on" and "fan off"), the total load of food placed in the refrigerator (8, 16, and 32 gal.), and the distribution of the load. The 8-gal. load was distributed into eight 1-gal. batches or four 2-gal. batches; the 16-gal. load was distributed into eight 2-gal. batches or four 4-gal. batches; and the 32-gal. load was distributed into eight 4-gal. batches (see Figure 1).

The purposes of Study B were to investigate the effect on refrigerator temperature and on cooling time of food placed in the refrigerator by varying the

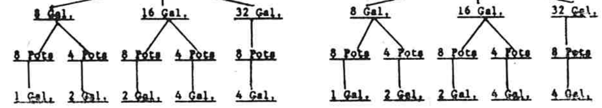

Figure 1. The plan of Study A

[1]This is part of a larger project titled "Heat Transfer in Foods Prepared and Cooled in Quantity."

initial temperature of the food when placed in the refrigerator (140° and 80°F.), the total load of food placed in the refrigerator (8, 16, and 32 gal.), and the distribution of the load. The food was distributed the same as in Study A (see Figure 2).

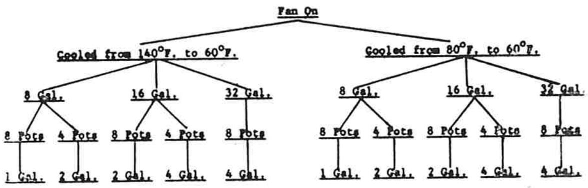

Figure 2. The plan of Study B

EXPERIMENTAL PROCEDURE

An institution reach-in refrigerator[1] was used (see Figure 3). The inside dimensions of the refrigerator were 72 in. wide, 57.5 in. high, and 23 in. deep; the capacity was 55 cu. ft. The refrigerator was divided into five sections, two upper and three lower (see Figure 3). A propeller fan[2] was located in the top center section between the two upper sections. The fan, 10 in. in diameter, operated at 1240 r.p.m. and had a rated capacity of 490 cu. ft. per min.

White sauce was used as the food medium in this study because of its consistency which is conducive of a rather slow transfer of heat, because of the ease of its preparation, and because of its relatively low cost. A low-viscosity white sauce prepared from a quantity white sauce mix (*4*) was used.

After cooking, the sauce was cooled to 140°F. and thoroughly blended before it was placed in the refrigerator. The specified load of sauce was then distributed into the appropriate stock pots for cooling.

In Study A, the sauces were cooled to a final temperature of 80°F. under "fan on" as well as "fan off" conditions. This end point of 80°F. is high but it had to be used because results of preliminary studies on the air temperature in the empty refrigerator had shown that temperatures were very high under "fan off" conditions.

In Study B, the sauces were allowed to cool to a final temperature of 60°F. It was impractical to use 50°F. as the final temperature in these studies because the sauces cooled extremely slowly from 60°F. to 50°F. (For example, approximately 3½ hr. were required for a 32-gal. load distributed into 8 batches to cool from 60°F. to 50°F., while the same number of hours were required to cool the batches from 140° to 85°F.). The air temperature in the empty refrigerator was quite low when the fan was on.

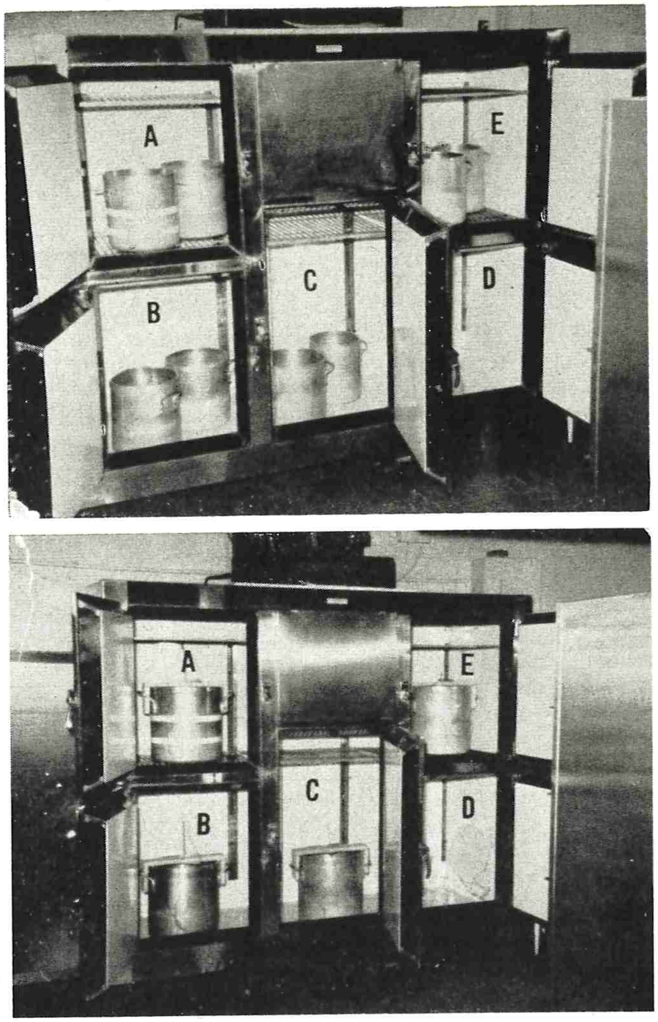

Figure 3. The refrigerator stacked with eight 15-qt. stock pots (above) and with four 25-qt. stock pots (below). Section D was not used for cooling.

Heavy-duty cast aluminum stock pots[3] were used as containers for the white sauce. The 25-qt. stock pots were 13 in. high and 12. in. in diameter; the 15-qt. stock pots were 11 in. high and 10 in. in diameter.

The sauces to be cooled were placed in Sections A, B, C, and E of the refrigerator (see Figure 3). In a preliminary study it was found that Section A and Section E were the coolest and warmest sections under "fan on" conditions. With the fan off, Sections A and E were the warmest and Sections B, C, and D the coolest. Sections A, B, C, and E were chosen for study because these sections comprised the two coolest and two warmest sections under both "fan on" and "fan off" conditions.

Continuous temperature recordings were made on a potentiometer[4]. Temperature determinations of the refrigerator air were made in Sections A and D, 1½ in.

[1]Jewett, General Electric model CS-450.
[2]Kramer-Trenton, model C11U.

[3]Wearever, model 4252.
[4]Minneapolis-Honeywell, model 153 x 64P12 - x - 41.

TABLE 1—THE TEMPERATURE RANGE OF THE REFRIGERATOR AIR RECORDED IN A REACH-IN REFRIGERATOR CONTAINING BATCHES OF WHITE SAUCE: EFFECT OF AIR CIRCULATION, TOTAL LOAD, LOAD DISTRIBUTION, AND INITIAL TEMPERATURE OF THE SAUCE.

Study A[a]

Total load	No. of stock pots[b]	Size of batch	Refrig. section[c]	Refrigerator air temperature range: Fan on, Run I	Fan on, Run II	Fan off, Run I	Fan off, Run II
(*gal.*)		(*gal.*)		(°F.)	(°F.)	(°F.)	(°F.)
8	4	2	A	33-42	33-43	60-67	63-66
			D	36-44	35-46	57-65	56-61
	8	1	A	32-41	32-42	63-69	63-61
			D	35-47	38-47	59-65	61-69
16	4	4	A	33-43	33-43	63-74	61-71
			D	35-45	35-45	55-69	56-66
	8	2	A	32-39	32-43	64-74	65-76
			D	34-45	34-50	63-89	62-75
32	8	4	A	32-51	29-53	65-82	70-89
			D	33-58	32-55	55-77	66-84

Study B[d]

Total load	No. of stock pots[b]	Size of batch	Refrig. section[c]	Refrigerator air temperature range: Sauce at 140°F.[d], Run I	Sauce at 140°F.[d], Run II	Sauce at 80°F.[d], Run I	Sauce at 80°F.[d], Run II
(*gal.*)		(*gal.*)		(°F.)	(°F.)	(°F.)	(°F.)
8	4	2	A	33-42	33-43	33-41	35-40
			D	36-44	35-46	35-41	38-43
	8	1	A	32-41	32-42	33-44	32-42
			D	35-47	38-47	33-44	35-43
16	4	4	A	33-43	33-43	33-40	33-41
			D	35-45	35-45	33-41	35-41
	8	2	A	32-39	32-43	33-41	34-41
			D	34-45	34-50	33-41	35-42
32	8	4	A	32-51	29-53	29-41	29-40
			D	33-58	32-55	33-41	31-41

[a]The sauce was cooled from 140°F. to 80°F.
[b]The sauce was distributed in 4 stock pots, each pot having a capacity of 25 qt.; or in 8 stock pots, each pot having a capacity of 15 qt.
[c]See Figure 3.
[d]The sauce was introduced into the refrigerator at two initial temperatures, 140°F. and 80°F., and was cooled to 60°F. The air was circulated.

from the roof and 1½ in. from the rear corner of each section (see Figure 4). In a preliminary study it was found that these portions, located the farthest from the warm sauce, were least affected by the heat radiating from the sauce. For measuring the temperature changes in the sauce, laboratory-made glass shield copper constantan thermocouples were placed in each stock pot in the center of the mass. In the 25-qt. stock pots, 4-gal. batches of sauce measured a depth of 8½ in. and 2- gal. batches measured a depth of 4¼ in. In the 15-qt. stock pots, 2-gal batches of sauce measured a depth of 6 in. and 1-gal. batches measured a depth of 3 in.

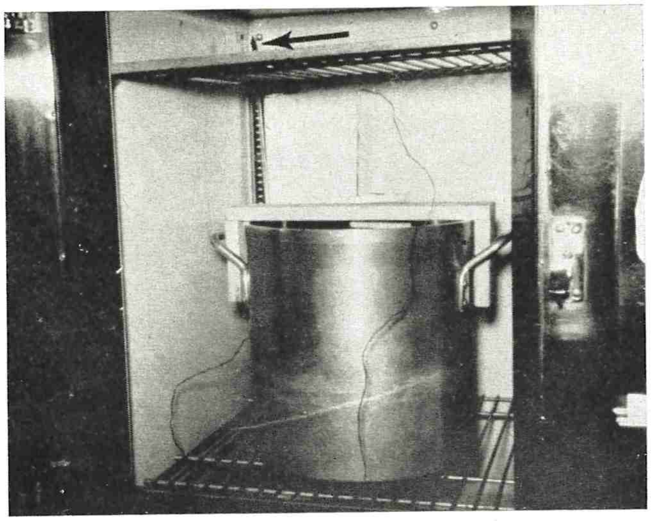

Figure 4. Location of the thermocouple in the air of the refrigerator, 1½ in. from the roof and 1½ in. from the rear corner of Sections A (pictured above) and D. The wooden frame across the top of the stock pot is holding the thermocouple in position.

Results

Refrigerator Air Temperature

With the refrigerator not loaded and the fan on, the refrigerator air temperatures ranged from 31°F. to 42°F.; with the fan off, the air temperature fluctuated from 53°F. to 63°F.

Effect of air circulation (Table 1, Study A)

With the refrigerator loaded and the fan on, the temperatures ranged from 32°F. to 58°F. When the fan was off, the temperatures ranged from 55°F. to 89°F.

Effect of total load (Table 1, Study A and B)

When the air was circulated, no consistent trend was noted in the temperature change of the refrigerator air as the total food load was increased from 8 gal. to 16 gal.; however, when the load was increased to 32 gal., there was a definite rise in the temperature range of the refrigerator air.

The effect of total load was more pronounced when the fan was off. The air temperature increased progressively with an increase in total load from 8 gal. to 32 gal.

Effect of load distribution (Table 1, Study A)

Eight-gal. and 16-gal. loads were used in this study. With either load and with the fan turned on, the distribution of the sauce into 8 batches rather than 4 batches did not affect refrigerator temperatures in a consistent way. With the fan off and with a total load of 16-gal., distributing the sauce into 8 batches rather than 4 batches tended to raise the temperature of the air and to increase temperature fluctuation.

Effect of initial temperature of sauce (Table 1, Study B)

There appeared to be a trend toward lower air temperatures and decreased temperature fluctuation of the refrigerator air when the sauce was cooled from an initial temperature of 80°F. rather than from an initial temperature of 140°F.

When the sauce was introduced at 80°F., there was little or no change in the temperature range of the refrigerator air at the three levels of total load. The air temperature remained below 44°F. throughout the cooling periods.

When the sauce was introduced at 140°F., little or no increase in the air temperature of the refrigerator was noted when the total load of 8 gal. was increased to 16 gal. However, there was a distinct rise in temperature when the total load was increased from 16 gal. to 32 gal. In one instance, the sauce of an initial temperature of 140°F. caused the temperature of the refrigerator air to rise as high as 58°F.

Total Cooling Time of Sauce

Effect of air circulation (Table 2, Study A)

In general, the total cooling times of batches of white sauce refrigerated in circulated air were shorter than the cooling times of comparable batches cooled in non-circulated air. The effect of air circulation became more evident as the total load of sauce was increased from 8 gal. to 32 gal. With the 32-gal. total load the average total cooling time was twice as long in non-circulated air as in circulated air.

Effect of total load (Table 2, Study A and B)

An increase in the total load placed in the refrigerator resulted in longer total cooling times. With the fan on, the average total cooling time was almost doubled as the load was increased from 8 gal. to 16 gal. When the 16-gal. load, distributed into 8 batches was changed to a 32-gal. load distributed into 8 batches, the average total cooling time was increased substantially. With the fan off, the effect of total load on the total cooling times of the sauces was similar to the effect of total load under "fan on" conditions.

It is interesting to note the effect of total load on the cooling times of batches of identical size. There were 2-gal. batches within the 8-gal. load as well as within the 16-gal. load. It was found that as the load increased from 8 gal. to 16 gal., the average total cooling time of the 2-gal. batches increased.

TABLE 2—THE TOTAL COOLING TIME OF BATCHES OF LOW-VISCOSITY WHITE SAUCE REFRIGERATED UNDER VARYING CONDITIONS: EFFECT OF AIR CIRCULATION, TOTAL LOAD, LOAD DISTRIBUTION, AND INITIAL TEMPERATURE OF THE SAUCE.

Study A[a]

Total load	No. of stock pots[b]	Size of batch	Average total cooling time, Air circulation in refrigerator: Fan on, Run I		Fan on, Run II		Fan off, Run I		Fan off, Run II	
(gal.)		(gal.)	(hr.)	(min.)	(hr.)	(min.)	(hr.)	(min.)	(hr.)	(min.)
8	4	2	3	48	3	58	5	36	4	55
	8	1	2	24	2	28	3	51	3	58
16	4	4	8	21	8	29	13	53	13	34
	8	2	4	28	4	58	8	55	9	47
32	8	4	8	42	6	48	17	30	16	2

Study B[c]

Total load	No. of stock pots[b]	Size of batch	Average total cooling time, Initial temperature of sauce[c]: Sauce at 140°F., Run I		Sauce at 140°F., Run II		Sauce at 80°F., Run I		Sauce at 80°F., Run II	
(gal.)		(gal.)	(hr.)	(min.)	(hr.)	(min.)	(hr.)	(min.)	(hr.)	(min.)
8	4	2	5	50	6	13	2	28	2	44
	8	1	3	57	3	58	1	53	3	14
16	4	4	12	4	11	59	4	49	4	6
	8	2	6	57	7	26	2	26	3	16
32	8	4	12	29	10	12	4	52	5	22

[a]The sauce was cooled from 140°F. to 80°F.

[b]The sauce was distributed in 4 stock pots, each pot having a capacity of 25 qt.; or in 8 stock pots, each pot having a capacity of 15 qt.

[c]The sauce was introduced into the refrigerator at two initial temperatures, 140°F. and 80°F., and was cooled to 60°F. The air was circulated.

There were 4-gal. batches within the 16-gal. as well as the 32-gal. load. As the load increased from 16 gal. to 32 gal., there was no consistent trend noted in the cooling time under "fan on" conditions; under "fan off" condition, the average cooling time of the 4-gal. batches increased with an increase in total load.

Effect of load distribution (Table 2, Study A)

Eight-gal. and 16-gal. loads were used in this study. With either of these loads, the distribution of the sauce into 8 batches resulted in shorter total cooling times than a distribution into 4 batches. The average total cooling time was reduced considerably when the number of batches doubled.

Effect of initial temperature of sauce (Table 2, Study B)

In the batches of sauce cooled from an initial temperature of 80° F., total cooling times were usually less than one half the total times of corresponding batches of sauce cooled from an initial temperature of 140°F.

ANALYSIS OF RESULTS[5]

The statistical analysis[6] was carried out in two parts. In Part I is presented an analysis of the data gained from experiments involving total loads of 8 gal. and 16 gal. (see Table 3). In Part II is presented an analysis of the data of the experiments involving total loads of 8 gal., 16 gal. and 32 gal. (see Table 4, Figures 5 and 6).

[5]The writers wish to express their sincere thanks to Mr. Wallace R. Blischke, Graduate Assistant in the Department of Plant Breeding, Biometrics Unit, for his assistance in the statistical analysis of these results.

[6]The analysis was based on the total cooling times.

TABLE 3—MEAN SQUARES AND F VALUES FOR THE SOURCES OF VARIATION. PART I. ANALYSIS OF THE EXPERIMENTS INVOLVING TOTAL LOADS OF 8-GAL. AND 16-GAL. DISTRIBUTED INTO FOUR 25-QT. STOCK POTS AND EIGHT 15-QT. STOCK POTS.

Study A

Source of variance	Degrees of freedom	Mean square	F value
L (Load)	1	386573.06	975.16[a]
D (Distribution)[b]	1	106439.06	268.50[a]
C (Circulation)	1	147264.06	371.48[a]
LC	1	45262.56	114.18[a]
DC	1	297.56	<1
LD	1	25043.06	63.17
LCD	1	540.56	1.36
Error	7	396.42	

Study B

Source of variance	Degrees of freedom	Mean square	F value
L (Load)	1	116622.25	168.77[a]
D (Distribution)[b]	1	65792.25	95.21[a]
T (Temperature)	1	252004.00	364.69[a]
LT	1	45156.25	65.35[a]
DT	1	24806.25	35.90[a]
LD	1	16900.00	24.46[a]
LDT	1	1296.00	1.88
Error	7	691.00	

[a]Significant at the 1% level.
[b]The main effect distribution (D) refers to the number of batches as well as the corresponding batch size.

Part I Study A (total loads of 8 and 16 gal.)

The total load (L) of white sauce placed in the refrigerator affected the cooling times of the sauces; total load had a greater influence on the total cooling times of the sauces than the other significant main effects, circulation (C) and distribution (D) (see Table 3).

There was an interaction between the total load and the circulation (LC) of the air in the refrigerator. With both the 8-gal. and 16-gal. loads, the average total cooling time was drastically reduced when the air was circulated. The difference in total cooling time due to air circulation was greater with a total load of 16 gal. than 8 gal.

An interaction was found to exist between total load and the distribution (LD) of the load. Distributing the sauce into 8 batches rather than 4 larger batches resulted in shorter total cooling times. The differences in total cooling times due to distribution were greater when the total load was 16 gal.

Part I Study B (total load of 8 and 16 gal.)

The initial temperature (T) of the sauce when placed in the refrigerator influenced the total cooling times of the sauces. The variation in initial temperature (T) had a greater effect on the total cooling times of the sauces than the other main effects, total load (L) and distribution (D) (see Table 3).

An interaction of total load with initial temperature (LT) was observed. As would be expected, the total cooling times of the sauces that were pre-cooled to 80°F. and then refrigerated were considerably shorter than the total cooling times of the sauces that were introduced into the refrigerator at an initial temperature of 140°F. This difference in cooling time due to the initial temperature of the sauce at the time when placed into the refrigerator was much greater in the 16-gal. load than in the load of 8 gal.

An interaction of the distribution of the load with initial temperature (DT) of the sauce when it was placed in the refrigerator was noted. Regardless of whether the sauces were distributed into 8 batches or into 4 batches, the total cooling times were reduced when the sauces were pre-cooled from 140°F. to 80°F. before they were placed in the refrigerator. This difference in the average total cooling time as affected by the distribution of the sauce was greater in the 4-gal. batches than in the 8-gal. batches.

The interaction of total load with distribution (LD) affected the total cooling times of the sauces. The white sauces distributed into 8 batches rather than into 4 batches gave shorter total cooling times. This was true for total loads of 8 gal. and 16 gal.; yet, the difference was greater in the larger total loads.

Part II Study A (total loads of 8 16, and 32 gal.)

The circulation (C) of the air in the refrigerator and the total load (L) of white sauce placed in the refrigerator were both significant main effects influencing the total cooling times of the sauces (see Table 4).

A significant linear relationship existed between the total load and the total cooling time. There was an interaction between this linear effect involving circulation and total load (CL_{linear}); that is, the total cooling time increased linearly under "fan on" and "fan off" conditions. This increase was greater when the fan was turned off (see Figure 5).

Part II Study B (total loads of 8, 16, and 32 gal.)

The initial temperature (T) of the white sauce

TABLE 4—MEAN SQUARES AND F VALUES FOR THE SOURCES OF VARIATION. PART II. ANALYSIS OF THE EXPERIMENTS INVOLVING TOTAL LOADS OF 8-GAL., 16-GAL., AND 32-GAL. DISTRIBUTED INTO EIGHT 25-QT. STOCK POTS.

Study A

Source of variance	Degrees of freedom	Mean square	F value
C (Circulation)	1	274518.75	121.852[a]
L (Load)	2		
L linear	1	592621.93	263.050[a]
L quadratic	1	6428.57	2.853
CL	2		
CL linear	1	102317.36	45.416[a]
CL quadratic	1	961.14	<1
Error	5	2252.885	

Study B

Source of variance	Degrees of freedom	Mean square	F value
T (Temperature)	1	171841.33	59.080[a]
L (Load)	2		
L linear	1	182820.02	62.855[a]
L quadratic	1	103.15	<1
TL	2		
TL linear	1	38462.88	13.244[b]
TL quadratic	1	4114.29	1.415
Error	5	2908.60	

[a]Significant at the 1% level.
[b]Significant at the 5% level.

when placed in the refrigerator and the total load (L) were significant main effects (see Table 4).

A significant linear relationship was observed between the total load and the cooling time. There was an interaction between this linear effect involving initial temperature and total load (TL_{linear}) of the sauce. The cooling times increased linearly as the total load increased when the sauce was refrigerated at a temperature of 140°F. and 80°F. This increase was much greater when the sauce was placed in the refrigerator at a temperature of 140°F. (see Figure 6).

The results of the research presented have pointed out several important factors to be considered in the refrigeration of foods. Firstly, the importance of determining the total load of food that can be refrigerated safely at one time in relation to the refrigerated space available. Secondly, the importance of distributing the load into numerous small batches. Thirdly, the need to pre-cool large quantities of foods quickly before they are introduced into the refrigerator. Lastly, the tremendous effect of forced air which lowers the air temperature of the refrigerator and shortens the total cooling time of warm foods placed in the refrigerator.

DISCUSSION AND CONCLUSIONS

Air circulation in the refrigerator

The fan forced the cool air into Section A and counterclockwise through the remaining sections of the refrigerator; Section A being the coolest and Section E, the warmest. In non-circulated air, the higher temperatures were noted in the top, Sections A and

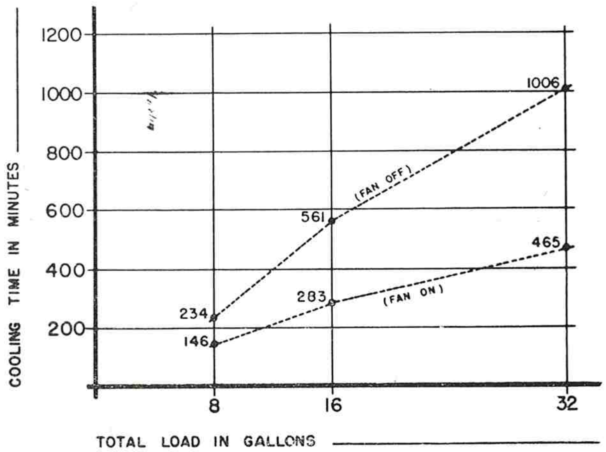

Figure 5. A graphic presentation of the significant 2-factor interaction (linear) Circulation-Load (CL). The cooling time in minutes represents the average total cooling time of two observations.

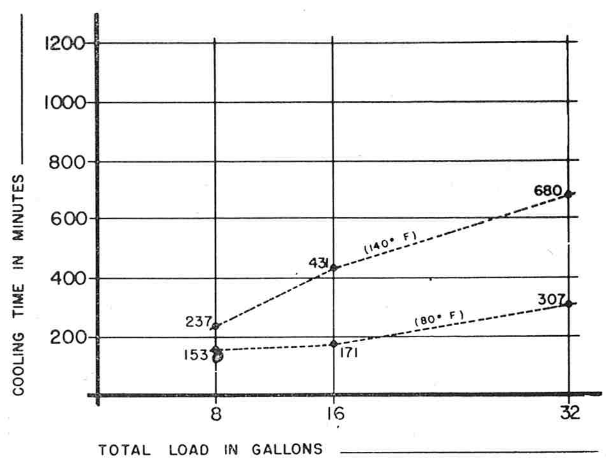

Figure 6. A graphic presentation of the significant 2-factor interaction (linear) Temperature-Load (TL). The cooling time in minutes represents the average total cooling time of two observations.

E, the cooler temperatures in the bottom, Sections B, C, and D (see Figure 3).

The strong effect of circulating the air in the empty refrigerator on the inside temperature was clearly demonstrated. The highest temperature recorded with the fan on was 42°F., while the peak temperature with the fan turned off was 63°F.

When the refrigerator was loaded, this effect was also great. With the fan on, lower air temperatures were maintained in the refrigerator, a fact which resulted in much shorter total cooling times of the sauces as compared with cooling times observed when the fan was turned off.

The limitations of this research should be pointed out; the data presented here were collected under a given set of conditions, using a particular refrigerator equipped with a particular fan.

Total load of sauce

When a total load of 8 gal. and 16 gal. were placed in the 55 cu. ft. refrigerator, there was little if any effect on the air temperature within the refrigerator when the air was circulated. With these same loads and the fan turned off, the temperatures observed in the refrigerator were again similar for the two total loads. When a total load of 32 gal. was placed in the refrigerator, there was a distinct rise in the temperature of the air of the refrigerator under both "fan on" and "fan off" conditions.

The total load of sauce under refrigeration in relation to the cu. ft. of refrigerated space has been calculated. The volume of the refrigerator (72 in. x 57.5 in. x 23 in.) used in the study was 55 cu. ft. or 95,220 cu. in. Eight gal. of sauce had a volume of 1845 cu. in. or approximately 1/50 of the volume of the refrigerator. We might conclude from this that with a total load of 8 gal., for every 1 part of sauce present in the refrigerator there were 50 parts of refrigerator space, a ratio of 1:50. With a total load of 16 gal., this ratio was 1:25 and with a load of 32 gal., 1:12 ½.

With the fan on, a ratio of 1:50 and 1:25 was sufficiently wide to allow the refrigerator air to remain low and fluctuate little. However, when the ratio dropped to 1:12 ½, there was a drastic rise in the temperature of the refrigerator. We might conclude that in this particular study somewhere between the 16-gal. and 32-gal. load the refrigerator became "overloaded." It should be emphasized again that these ratios refer to a particular refrigerator equipped with a particular fan.

Distribution of sauce

The shortened cooling time of the sauces that was observed when the total load was divided into numerous small batches again supports the recommendation to distribute large quantities of food into small batches for cooling.

Initial temperature of sauce

Large quantities of warm (140°F.) sauce introduced into the refrigerator raised the air temperature in the refrigerator above 50°F. The safety of refrigerating food at a temperature above 47°F. has been questioned. Longrée and White (*5*) found that a walk-in refrigerator at a temperature of 47°F., 2-gal. batches of sauce cooled very slowly and temperature conditions favorable for bacterial growth prevailed for hours. In the present investigations batches which were refrigerated at temperatures maintained well below 47°F. usually did not cool to 60°F. within a 5-hour period. The maximum acceptable refrigerator temperature of 50°F. so frequently quoted for the storage of perishable foods (*8, 12*) should certainly be questioned, especially in the light of research reported by Angelotti (*1*).

Sauces that had been cooled to 80°F. did not raise the air temperature in the refrigerator at any level of total load. This is the important contribution that pre-cooling makes, regardless of whether or not the total cooling time of a particular food batch is actually reduced when the food is pre-cooled before it is placed in the refrigerator. The cooling times outside and within the refrigerator should be added together to arrive at this "total cooling time." According to Moragne (*7*), who cooled low-viscosity white sauce in flowing water at 35°F., 4-gal. batches of sauce cooled within a 2-hour period and 2-gal. batches within 1½ hours; these sauces were agitated every 15 min.

In the present studies, the sauces were cooled from an initial temperature of 140°F. to a final temperature of 80°F. When the time used in cooling the sauces outside the refrigerator is added to the cooling time of the sauce cooled in the refrigerator, the combined cooling times are still shorter than the cooling times of sauces that were not pre-cooled and placed in the refrigerator when hot (140°F.).

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ADDED WATER PRESENT IN OHIO MILK DURING 1959

R. H. BLACKMORE

Division of Food and Dairies,

Ohio Department of Agriculture, Reynoldsburg

The Food and Drug Laboratory, a section of the Food and Dairies Division of the Ohio Department of Agriculture, initiated a program to determine the amount of added water in raw and pasteurized milk throughout the State. This program has been accomplished by measuring the freezing point of the milk samples submitted to the Laboratory by the Division's inspectors. A Fiske Cryoscope, an electrical instrument which measures temperature accurately to 0.001°C, was used to determine the freezing point of the milk samples.

During the first few months of this program it became apparent that the base-line freezing point of -.550°C, which is used in the Association of Official Agricultural Chemists Calculations to determine the percentage of added water in milk, was too low. Furthermore, it was demonstrated through the use of authentic raw milk samples that -.530°C represented a more realistic value of the base-line freezing point of Ohio milk as measured with the Fiske Cryoscope. Thus, the amount of Added Water in a milk sample is calculated by the following formula:

$$\text{Added water} = \frac{530 - \text{obs. F. P.}^{1} \times 100}{530}$$

The calculated added water percentages determined by the formula above (Blackmore formula) are approximately 3.8 percentages lower than those obtained by the official A. O. A. C. formula. The A. O. A. C. method of calculation allows for a 3.0 percent correction due to normal variations in the freezing point of milk. No correction is necessary when the Blackmore calculation is used. (Incidently, the A. O. A. C. method will be changed to the Blackmore method and will be incorporated in the Ninth Edition of Official Methods, 1960). All samples showing added water are considered to be in violation of the Ohio Food, Drug, Cosmetic and Device Law.

[1]Freezing Point in -.001°C.

RESULTS OF ANALYSES

Table I shows the distribution of the freezing points of Ohio raw milk samples analyzed during 1959. The calculated percentages of added water, if present, are also included in this table. (If the A. O. A. C. method of calculations and the 3.0 percent correction were used, the samples whose freezing points were between -.530°C and -.534°C would also be classified as violations.) During the year a total of 16,788 raw milk samples were analyzed for added water and 10.3% were found to be in violation of Ohio law because of added water. The average freezing point of the samples not containing added water remained nearly constant during the entire year, *i. e.*, -.546°C, (well above the base-line freezing point of Ohio milk.)

Table 2 shows the distribution of the freezing points of Ohio pasteurized milk samples analyzed during 1959 (skim samples were not included). A total of 711 pasteurized milk samples were analyzed during the year for added water. Of these, 15.4% were found in violation of Ohio Law because of added water. Thus, there was a significant increase in the percentage of violations found in the pasteurized milk samples over that which was found in the raw milk samples because of added water. Even more significant is the fact that the average freezing point of the pasteurized milk samples not containing added water was -0.540°C or 0.006°C higher than the aver-

Table 1—Distribution of Freezing Points of Ohio Raw Milks During 1959 and Calculated Added Water

Freezing point x .001°C	Percent added water[a]	Jan. %	Feb. %	Mar. %	Apr. %	May %	June %	July %	Aug. %	Sept. %	Oct. %	Nov. %	Dec. %	Year No.	Total %
385 or above	over 27	0.3	0.3	0.1	0.3	0.0	0.3	0.1	0.4	0.1	0.3	0.1	0.2	31	0.2
386 to 440	17 to 26	0.8	0.7	0.5	0.5	0.2	0.3	0.3	1.1	0.7	0.7	0.2	0.2	79	0.5
441 to 495	6.6 to 16.8	2.5	2.1	1.8	2.2	1.5	1.7	1.4	1.0	0.9	1.9	0.9	1.9	287	1.7
496 to 522	1.5 to 6.5	5.9	5.0	4.7	3.0	4.8	4.5	4.5	5.5	2.7	2.3	2.9	2.8	690	4.1
523 to 529	0.2 to 1.3	3.0	3.2	4.1	3.9	7.1	3.9	5.4	5.2	2.1	2.2	2.5	1.4	647	3.8
530 to 534	None	3.0	3.2	4.1	3.8	7.5	4.8	8.3	17.9	16.9	9.5	10.9	13.4	1273	7.6
535 to 539	None	14.0	10.5	16.5	16.5	25.9	18.3	24.7	17.3	20.2	16.7	16.5	21.0	3069	18.3
540 to 544	None	18.2	18.0	21.7	23.8	24.9	22.9	22.6	23.2	21.3	23.4	21.5	27.2	3763	22.4
545 to 549	None	24.5	21.6	19.8	22.6	17.0	22.3	18.5	16.7	14.7	21.8	20.1	19.7	3390	20.2
550 to 554	None	16.2	19.3	16.2	15.6	8.1	13.1	9.2	6.6	6.4	11.8	11.7	6.3	2080	12.4
555 to 559	None	6.5	12.9	8.5	6.6	1.7	3.8	3.7	2.8	4.9	5.4	4.9	3.1	936	5.6
560 or below	None	5.1	3.2	2.0	1.2	1.3	4.1	1.3	2.3	9.1	4.0	7.8	2.8	543	3.2
Total Samples		1301	1259	2395	1763	1673	1364	1698	923	674	1282	1420	1036	16788	100.0
Percent Violations		12.1	11.3	11.2	9.9	13.6	10.6	11.7	13.2	6.5	7.4	6.6	6.6	—	10.3
Average freezing point[b]		-.547	-.548	-.546	-.546	-.544	-.543	-.544	-.545	-.546	-.545	-.546	-.543	—	546°C

[a]Calculations based on -.530°C as true freezing point of Ohio raw milk.
[b]Average freezing point not including samples whose freezing point was -.529°C or higher.

age freezing point of the raw milk samples not containing added water. This relationship was found during each month and definitely must be considered quite serious. Six one thousandth's of a degree is equal to 1.2% added water. How much of this added water is unavoidable cannot be estimated at this time, but milk processors must take every precaution not to adulterate the raw milk with added water during processing.

Possibly not enough attention has been given to the amount of non-fat solids in the final processed milk (Ohio Law specifies that milk shall contain 3.5 percent butter fat and 12 percent total milk solids). Too much emphasis has been placed on the butter fat percentage in the processed milk and not enough emphasis on the non-fat solids of the milk. Since the freezing point of milk is related to the non-fat fraction, a rapid method of determining the amount of non-fat solids in milk is now possible with the Fiske Cryoscope. It is hoped that this determination is rapidly adapted in Ohio to insure that Ohio consumers are not receiving adultered milk.

Table 2—Distribution of Freezing Points of Ohio Pasteurized Milks During 1959 and Calculated Added Water

Freezing point x .001°C	Percent added water[a]	Jan. %	Feb. %	Mar. %	Apr. %	May %	June %	July %	Aug. %	Sept. %	Oct. %	Nov. %	Dec. %	Year No.	% Total
385 or above	over 27	0	0	0	0	0	1.8	0	0	0	0	0	0	1	0.1
386 to 440	17 to 26	0	0	0	1.8	0	0	0	0	0	0	0	0	1	0.1
441 to 495	6.6 to 16.8	0	1.5	0	0	0	0	0	0	0	1.9	0	0	2	0.3
496 to 522	1.5 to 6.5	1.5	6.2	4.1	10.7	5.1	11.2	2.1	0	7.2	3.9	3.2	7.5	37	5.2
523 to 529	0.2 to 1.3	7.7	7.7	8.1	10.7	15.2	12.9	12.8	4	0	11.5	6.3	12.5	69	9.7
530 to 534	None	9.2	9.2	9.5	21.4	8.5	14.8	19.2	40	21.4	30.8	30.1	31.3	142	20.0
535 to 539	None	23.1	32.3	39.2	28.6	42.4	35.2	25.5	40	33.3	15.3	23.8	35.0	223	31.4
540 to 544	None	29.3	18.5	17.6	16.1	16.9	7.4	25.5	12	26.2	30.8	15.9	8.8	129	18.1
545 to 549	None	16.9	10.8	9.4	7.1	5.1	7.4	6.4	0	11.9	1.9	15.9	1.2	56	7.9
550 to 554	None	9.2	9.2	9.4	1.8	3.4	9.3	8.5	0	0	0	0	0	31	4.4
555 to 559	None	0.0	3.1	0.0	0.0	0.0	0.0	0.0	4	0	0	1.6	2.5	7	1.0
560 or below	None	3.1	1.5	2.7	1.8	3.4	0.0	0.0	0	0	3.9	3.2	1.2	13	1.8
Total Samples		65	65	74	56	59	54	51	50	42	52	63	80	711	100.0
Percent Violations		9.2	15.4	12.2	23.2	20.3	25.9	14.9	4.0	7.2	17.3	9.5	20.0	—	15.4
Average freezing point[b]		-.543	-.543	-.543	-.542	-.542	-.541	-.542	-.539	-.538	-.540	-.540	-.537	—	-.540°C

[a]same as Table 1
[b]same as Table 1

THE NATIONAL MILK SANITATION BILL[1]

A. C. DAHLBERG

Department of Dairy Industry, Cornell University,

Ithaca, N. Y.

The subject which I was requested to discuss is The National Milk Sanitation Bill introduced in the House of Representatives by Congressman Lester Johnson of Wisconsin as bill number H. R. 3840, February 2, 1959, and in the Senate by Senator Hubert Humphrey of Minnesota as bill S. 988, February 6, 1959.

It is unnecessary to state that the subject was not chosen by me. Even though every effort will be made to discuss the provisions of this bill without taking a stand for or against it, obviously this talk may be interpreted as a stand either for or against this bill depending upon your personal interests and convictions. This address will not make friends and influence people, but I hope it will clarify the meaning of some aspects of this proposed federal legislation.

The sponsors of this bill expect it will permit the shipment of high quality milk from the states of maximum production into distant markets where it may be sold at better prices. The assumption has been made that shipping costs from Wisconsin to eastern markets are not prohibitive; a contention not necessarily in accordance with the findings of published research (U.S.D.A., A.M.A. Marketing Res. Rpt. 98, 1955).

For some years this federal legislation received general disapproval from most parties concerned; namely, industry and regulatory officials at all levels of government. Then under date of October 24, 1958, the Official Statement and Recommendation of the Association of State and Territorial Health Officers appeared in a mimeographed report and later published (J. Milk & Food Technol., **22**: 78, 1959) entitled "Need and Recommended Principles for Federal Milk Sanitation Legislation." As the National Milk Sanitation Bill appears to follow the details of this report so closely some of the background principles behind this report should be well in mind. Several quotations are worthy of study.

"... The Association believes there is a need to strongly reaffirm that the sanitary control of fluid milk and fluid milk products is a public health matter which is primarily the responsibility of State and local governments except where interstate commerce is involved ..."

"The Association gave consideration to the practice of some states and municipalities to use health regulations as economic barriers to the free movement of fluid milk both in intrastate and interstate commerce, a practice which has resulted in several bills being introduced in the Congress to establish pre-emptive Federal control over interstate milk. The Association recognizes that states and their political subdivisions have the right to exclude milk of questionable quality, but unanimously agrees that health regulations should not be used to restrict either the intrastate or interstate movement of milk of high sanitary quality."

Then the Association enumerated the principles and points to be included in a federal milk sanitation bill and anyone interested can read these details to learn how closely they agree with the current bill under discussion.

The provisions of this sanitation bill are unique in that the current laws and ordinances of the various states and municipalities would remain in effect under local and state enforcement. The essence of the bill is that local laws and ordinances cannot prevent shipment of milk in interstate commerce when the milk is in satisfactory compliance with the provisions of The National Milk Sanitation Bill as determined by state inspectors at the point of origin of the milk supply. It should be obvious that the proposed bill if enacted into law might materially affect the public health regulation of some milk supplies. It would tend to unify and strengthen the sanitary control of the milk supplies in many areas. Surely, milk of high sanitary quality could be shipped more readily into some markets now restricted by some local milk sanitation regulations.

The Surgeon General, the chief executive officer of the U. S. Public Health Service, shall by regulation promulgate a Federal Milk Sanitation Code to be used in the supervision of the production and processing of milk and milk products of a sanitary quality at least as good as Grade A Raw and Grade A Pasteurized milk as now given in the Milk Ordinance and Code 1953 Recommendations of the Public Health Service. The bill does not state that the USPHS ordinance shall be adopted as such but that the provisions of the new federal code shall be no less rigid than this ordinance. One would assume, therefore, that the Surgeon General would establish a code based upon the existing standard ordinance after public hearings and advisory committee activities.

[1]Presented at Thirteenth Annual Meeting Dairy Products Improvement Institute, Inc. Hotel Governor Clinton, New York City February 18, 1960.

The state health department or other agency having jurisdiction in the area of milk production is permitted to take the responsibility of setting up a program for the supervision and inspection of the milk supply and of submitting the program to the Surgeon General for approval under the provisions of the Bill. I assume that this delegation of authority should have been to the state agency having the legal authority over the market milk supply of each state as this authority is delegated by state laws to either the state health department or the state agricultural department in about an equal number of instances. Either both agencies or neither one should be mentioned. The bill provides that the ratings of the milk supply shall be made at least yearly by a state rating official who is a full-time employee of the state health department or other responsible state agency and who has been approved for this work by the Surgeon General. The bill makes no provision for rating milk supplies by approved sanitarians of the city or county health departments but does authorize training of state and local personnel for this work. I assume that this was done to centralize control in the state regulatory agency with recognition of the common practice in the United States that the state may, and probably will, rely upon local sanitarians to do most of this work. The bill does not provide for the Surgeon General to inspect milk supplies not in a state program; hence, it would appear that the state must take the initiative and the leading part in approving milk supplies.

At this point it is well to reiterate that historically and at present sanitary milk regulations as applied to the public health aspects of milk for consumption as such are chiefly local and state in scope. At the local level inspection is under the supervision of the board of health. Problems in public health due to milk involve the production of a milk supply usually produced in the vicinity of and processed in the municipality in which it is consumed. The local nature of this enterprise originally was very restricted so sanitary regulations developed under conditions conducive to variations. As our cities grew in size and milk quality and handling improved, there has developed in some areas and at certain times both an economic and public health need to ship milk somewhat regularly from one producing area to an adjacent consuming one. In some instances milk has been consistently shipped for long distances.

It is self-evident that the local health department can do its best work with the least effort by supervising the production of milk on farms located near the area of consumption. The staff is convenient to all aspects of the dairy industry and the control laboratories. The time involved in handling milk should be less for local production. Problems of quality control can be checked through most readily from production to consumption.

This bill maintains the local nature of the control of milk sanitation which has been stressed on so many occasions by almost every one concerned with this problem. Disagreement lies with the use of some local public health regulations to restrict commerce in high-quality milk. This bill will prevent discrimination by local sanitation regulations against high quality milk actually shipped in interstate commerce.

The sanitary regulations of cities, counties, states, and the USPHS recommended code were all written to specify the conditions of production, processing, distribution, and quality standards to assure milk of high sanitary quality. It is certain that extra requirements are in many sanitary codes. Fortunately, a bulletin of the National Research Council (publication 250, 1953) reports that "The findings of this study indicate the need for only a limited number of basic requirements to insure a wholesome milk supply . . . " Even more important are the standards for the milk itself. A principle is stated that should not be overlooked: "There is no public health reason to increase the severity of satisfactory milk regulations, making them more detailed and rigid, when the milk industry of any market regularly complies with them. This applies to the regulations affecting milk production, processing, and distribution as well as to the standards for the quality of milk."

The Surgeon General would be given the responsibility by this bill to arrange for a rating system to be used by the states so that high quality milk supplies would rate 90 per cent or more in respect to milk production, handling, and processing, and compliance of the milk itself with sanitary quality standards. The Surgeon General shall investigate the rating plan as used by each state and shall check ratings sufficiently to assure himself that the work is done well. He shall maintain a list of all milk supplies rated within a year by the state regulatory agency. In this connection it is well to emphasize that the inspection for certification of a milk supply is done to check on the regular local milk inspection and the conditions of producing and processing the milk. It is in addition to the usual local regulatory work to control the quality of the milk.

The question arises as to whether the Federal Government has the right to establish standards for the production, processing, and handling of milk, and for the quality of the milk itself which must be accepted locally without additional requirements. I think that such regulations are generally well established in foods, except for only limited acceptance for milk.

Nevertheless, the USPHS ordinance is now used in about 70 percent of the states and municipalities. The National Milk Sanitation Bill assumes that the time has come when any milk supply in 90 per cent compliance with the standard ordinance must be accepted as high quality and satisfactory by any receiving market.

"The attributes of quality in milk are considered to be freedom from disease-producing bacteria and toxic substances, freedom from foreign material, low bacterial count, good flavor, satisfactory keeping quality, and high nutritive value." (National Research Council publication No. 250). These attributes are not all associated with sanitation regulations, but it is certain that the bacterial standard is one of the most useful of all sanitary requirements. The bacterial standard of 200,000 for Grade A raw milk for pasteurization was startled in 1912 by regulations promulgated by the New York City Board of Health. Its value lies chiefly as an aid to fieldmen or sanitarians in the program to improve sanitary conditions. For this purpose on dairy farms variations in bacterial counts need to be substantial. Surely a sanitarian familiar with conditions of the farms could not be expected to determine the cause of variations between counts of 200,000 and 100,000 and such usage is the principal value of bacterial counts. There is no proved relationship between milk conforming to a 200,000 standard and a 100,000 standard and any attribute of quality in milk. Furthermore, experience with the almost universal 200,000 bacterial standard shows that it is sufficiently low to assure safe and wholesome milk supplies. I have stressed this point to illustrate that a suitable universal bacterial standard can be established for all milk for fluid consumption; in fact, such a standard is now essentially in effect in most cities. Nevertheless, the bill provides that the Surgeon General may make these standards more rigid.

In establishing rules and regulations for rating milk supplies for interstate shipment, the Surgeon General probably will use the extensive experience of the National Conference on Interstate Milk Shipments in rating and listing milk supplies.

Provision is made in the bill for the receiving regulatory agency to make laboratory tests on the milk to ascertain whether the milk quality conforms to the standards of The National Milk Sanitation Bill. If the milk is below standard, it may be rejected; however, the milk need not comply with the standards promulgated by the state or local receiving agency. Federal standards of milk production and processing also take precedence over local standards on milk shipped interstate so that pure wholesome milk meeting federal quality standards with at least a 90 percent rating cannot be rejected if produced and processed according to the provisions of the National Milk Sanitation Code.

If the regulatory officials in the city receiving the milk question conditions of production or processing or the quality of the milk, the Surgeon General may investigate the situation. He may hold a public hearing to have evidence presented to guide him in rendering a decision. It is not celar to me whether the bill requires the Surgeon General to act upon complaints, and I believe it should be compulsory.

Should the Surgeon General render a decision not satisfactory to the regulatory agency of the state or city receiving the milk, such agency may bring suit in a United States Court of Appeals in the region of the plant shipping the milk interstate. The right to court action is essential, but I think that the location of the Court should be in the receiving state or some other place mutually agreed upon. It would be a needless burden of expense to the receiving regulatory agency and reduced opportunity toward an impartial decision from the viewpoint of milk consumers should officials of any distant city or producing area be required to try the case in a court located near the dairy farmers producing the milk. The court in the region of consumers of the milk would tend to be extra careful in interpreting the facts in favor of more rigid protection of the quality of the milk supply, a slanting of the information in the proper direction. As I understand it, the bill provides that the court can act only on the evidence submitted by the Surgeon General as the record of the hearing, and any new evidence can be presented only if the court orders the Surgeon General to obtain additional information at another hearing.

One may guess in respect to the impact of this bill, if enacted into law, upon the dairy industry and upon state and local sanitary milk regulations. In practice, I think it will be necessary to inform states and cities prior to shipment of any milk supplies intended for their markets. This action will give an opportunity for milk sanitation officials and for state and federal milk-pricing officials to study the situation to assure compliance with laws and regulations that affect the importation of milk into the market.

Then I believe that the services rendered by the Surgeon General in this program of approving supplies for interstate shipment will encourage state and local milk sanitation officials to adopt The Federal Milk Sanitation Code, which probably will be the USPHS standard ordinance already in use in 37 states and 1900 municipalities. Hence, there should be a voluntary trend toward milk shipped in interstate commerce complying with a 90 percent rating with the USPHS standard ordinance. Also, I would expect an increase in the number of cities under federal milk marketing orders so that all milk entering a fluid milk market will be purchased from producers at prices established by such orders.

The intrastate and interstate shipment of milk will be made easier in certain market areas adjacent to sources of production as restrictive public health regulations have been eliminated. It must be borne in mind, however, that it is an indirect purpose of all essential milk sanitation regulations to interfere with commerce in milk of inferior quality. By this method of rejecting milk of poor quality, the public health is protected. This proposed bill is concerned with milk of excellent quality and with some state and local public health regulations not affecting quality. Nevertheless, one must recognize that in the early years of sanitary milk control some local health regulations which led the way to advanced milk sanitation were considered as unnecessary trade barriers. I think we are past that pioneer period and have arrived at the time when essentials of sanitary milk production are well known. To stimulate progress, the bill provides for research grants to state, public, and private institutions, and to individuals to investigate new problems in the sanitary quality of milk and milk products.

The possibility of lower milk quality in a few markets must not be discounted lightly even though there is no doubt that milk of excellent high quality can be, and is being, produced under the USPHS standard ordinance and that a 90 percent compliance is reasonable assurance of such quality. The problem is not one of the sanitary code itself but of its enforcement. If a local dairy industry has a market that is particularly restricted and lucrative due to public health regulations, and if the industry has been exceptionally helpful in complying with regulations to maintain this protection, will the industry work so hard on sanitation requirements when the market is less profitable? Also, if the health department has gained a special reputation professionally and with local citizens due to its unusual sanitation regulations which restrict the source of the milk supply, will the health department be so concerned about milk quality when the local market is opened to milk over which its exceptional and unnecessary regulations do not apply? There may be a period of industry and public health readjustment, but one need have no concern about the high quality of the milk supply.

In conclusion, I wish to emphasize that a bill of such importance should be passed or rejected only after careful study and recommendations by regulatory officials and the dairy industry.

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NEWS AND EVENTS

QUESTION:

I have difficulty in answering questions to consumers in regard to the evil effect of Strontium-90 in milk.

ANSWER:

The present state of knowledge with reference to radioactive fall-out and its effect upon the human being is meager. But the evil effects of radiation upon the human being have been so stressed that commissions, committees, etc., reporting on the problem take a super-safe position. Recent literature indicates clearly that in cereal foods the ratio of Strontium-90 to calcium is far higher than in milk. The cow apparently removes much of the Strontium-90 from the forage. The calcium content of milk is much higher than these other foods and milk is the chief dietary source of calcium and hence the attention given to milk.

The general conclusions regarding the dangers of fall-out were quoted recently in the *Royal Society of Health Journal* as follows: "only a fraction of the naturally occurring genetic effects, or cases of leukemia or bone tumor, could be due to radiation from the natural background. The dose from fall-out is somewhere between a 30th and a 50th of that background." In other words, naturally occurring radiation is not a serious factor in the development of leukemia, and the increase in the radiation due to the tests with nuclear devices has only resulted in an increase of 2% to 3% over this background.

The steps being taken to protect the public are wise, but they should not cause undue concern to an individual or to a consumer of milk. It might be well to reflect that under the "Half-life Law" of radioactive materials, there is less of them in the world today than in the millions of years of past history. Our ancestors survived on earth under a far greater radiation background than exists in the 20th century.

QUESTION:

We receive occasional complaints due to tallow flavor.

Are there rules-of-thumb by which a dairy can minimize these complaints?

ANSWER:

With milk properly protected against exposure to light, the chief factor in the development of a tallow flavor is the presence of copper. A small amount of natural copper is bound by the proteins in milk and has no effect. If this quantity (less than 0.05 p.p.m.) is exceeded, a tallow flavor may be encountered. If the copper content is as high as 0.5 p.p.m. strong flavors (even at 40°F) will result. Homogenizing the milk reduces the effect of copper, and the higher the pressures (the smaller the size of the fat globules) the greater degree of protection. Every effort should be made to eliminate any copper surfaces which may contact milk either on the farm or in the plant.

CENTRAL ONTARIO MILK SANITARIANS ASSOCIATION AFFILIATES WITH IAMFS

Welcome to the Central Ontario Milk Sanitarians Association which has just completed affiliation with IAMFS.

George Hazelwood of Toronto is President and W. D. McCorquodale, 409 Huron St., Toronto, Ontario, is Secretary-Treasurer. All affiliate Secretary-Treasurers, please take note and send our new affiliate your newsletters, etc.

We anticipate many mutual benefits to be derived from this our first affiliate in Canada.

SUMMARY OF REPORT OF HEARINGS ON ENVIRONMENTAL HEALTH

Background

Aware that population growth, urbanization, and industrial expansion are rapidly and drastically changing the environment, the subcommittee of the House of Representatives Appropriation Committee which is responsible for public health appropriations has been giving increasing attention to environmental health problems for the past two years.

In 1959, during hearings on the 1960 budget, Congressman John E. Fogarty, chairman of the subcommittee, asked officials of the Public Health Service to make a thorough study of environmental health problems and to recommend an efficient organization of facilities to deal with them. This study was submitted to the subcommittee in February, 1960. To obtain additional data, before acting on the 1961 budget, the subcommittee held special hearings on environmental health on March 8 and 9, 1960.

A 203 page report, containing the Public Health Service study and the statements of non-Federal and Federal authorities who testified during the two day hearings, has been published by the U. S. Printing Office for the House Committee on Appropriations under the title "Report on Environmental Health Problems." This published report includes:

Subcommittee Findings

After hearing the evidence, the members of the subcommittee concluded that the health hazards resulting from changes in the environment are far greater than is generally realized and that all levels of government, industries, and research and educational institutions need to step up their efforts to deal with the problem.

Nature of the Problem

Whereas the old-fashioned environmental health hazards, such as bacteria in food and water supplies, caused acute illness within a short time, the new hazards, such as radiation and chemical poisons, have no obvious immediate effects but, absorbed into the body in small amounts over a long period of time, may ultimately cause chronic illnesses or premature deaths.

To learn more about these modern hazards and to control them are tasks that require many different kinds of specialists, operating in unfamiliar teamwork patterns. Moreover, the remedial measures that may need to be taken to reduce the hazards may require readjustments in th organization and work patterns of governmental bodies, industries and other segments of society.

Organizational Plan

The Public Health Service reported that it could give more efficient help to States and communities in coping with these problems if it brought together its water, air, radiological and other environmental health activities in a special environmental health unit. This unit would include centers in various parts of the Nation that would be staffed to provide technical assistance, conduct monitoring programs, carry on research, and give training courses. The Public Health Service has a task force working on the details of this organizational plan. A report of the plan will be given to the subcommittee before the end of fiscal 1961.)

Increased Hazards

The amount of radioactive material that has now been distributed in the U. S. exceeds by many orders of magnitude the radiation from all of the world's radium that had been extracted up to 10 or 12 years ago.

The number of chemical materials man is being exposed to are also increasing. Over 600 chemicals are added to food; over 600 million pounds of pesticides are used annually.

Radioactive and chemical materials are merely the newest and most rapidly increasing contaminants of air, water, land, and food. Virsues, bacteria, and other organic pollutants, insects, rodents, and other disease carriers, are older but continuing health hazards in the environment.

As the population grows to an estimated 214 million by 1970, most of them clustered in metropolitan areas, and as the gross national product increases from its present 451 billion dollars to an estimated 790 billion dollars by 1970, all these environmental hazards will become more serious.

Public Policy Decision

New health hazards inevitably accompany new technological advances. It is the task of health specialists to determine the nature and extent of these hazards and to find ways of keeping their harmful effects to a minimum.

It is the responsibility of the public and their elected representatives to decide how much progress should be paid for by how much sacrifice of harmful surroundings.

Members of House Appropriations Subcommittee on Department of Labor, Department of Health, Education, and Welfare, and Related Agencies: John E. Fogarty (R. I.) Chairman; Winfield K. Denton (Ind.), Fred Marshall (Minn.), Melvin R. Laird (Wis.), and Elford A. Cederberg (Mich.).

Witnesses who Testified at Environmental Health Hearings: Dr. Leroy E. Burney, Surgeon General and other officials of the Public Health Service; Abel Wolman, Professor of Sanitary Engineering, John Hopkins University, Baltimore, Md.; Dr. Herman Hilleboe, Commissioner of Health, New York State Department of Health, Albany, N. Y.; Dr. Boisfeuillet Jones, Vice President and Administrator of Health Services, Emory University, Atlanta, Ga.; Dr. Norton Nelson, Associate Professor of Industrial Medicine, New York University, New York City; Dr. Rolf Eliassen, Professor of Sanitary Engineering, Massachusetts Institute of Technology, Cambridge, Mass.; Herbert Bosch, Professor, School of Public Health, University of Minnesota, Minneapolis, Minn.; Dr. Ross A. McFarland, Professor of Environmental Health and Safety, School of Public Health, Harvard University, Boston, Mass.; Dr. James L. Whittenberger, Harvard School of Public Health, Boston, Mass.; and Milton P. Adams, Executive Secretary, Michigan State Water Resources Commission, Lansing, Mich.

SHORT COURSE ON RADIONUCLIDES AT TAFT SANITARY ENGINEERING CENTER

A two-week course entitled "Radionuclides in Foods" will be presented September 12-23 by the Training Program of the Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, major research and engineering laboratory of the Public Health Service. The course is designed for professional personnel responsible for the surveillance of radioactive materials in milk and food. It provides technical training in methods for the sampling and assay of radioactive contaminants and discussions on procedures for data interpretation and on problems in this environmental area.

Introductory sessions are devoted to radiation fundamentals and instrumentation. They provide a foundation for later discussion of: (1) sources of radionuclides in foods; (2) aquatic food chains; (3) terrestrial food chains; (4) milk and dairy products; (5) sampling procedures; (6) radiochemical procedures; (7) maximum permissible concentrations; and (8) public health significance of radionuclides in foods.

Approximately half of the course time is devoted to laboratory sessions. Because of the specialized equipment and facilities required for presentation of this course, the number of trainees is limited.

Applications or requests for information should be addressed to the Chief, Training Program, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, Ohio, or to a PHS Regional Office Director.

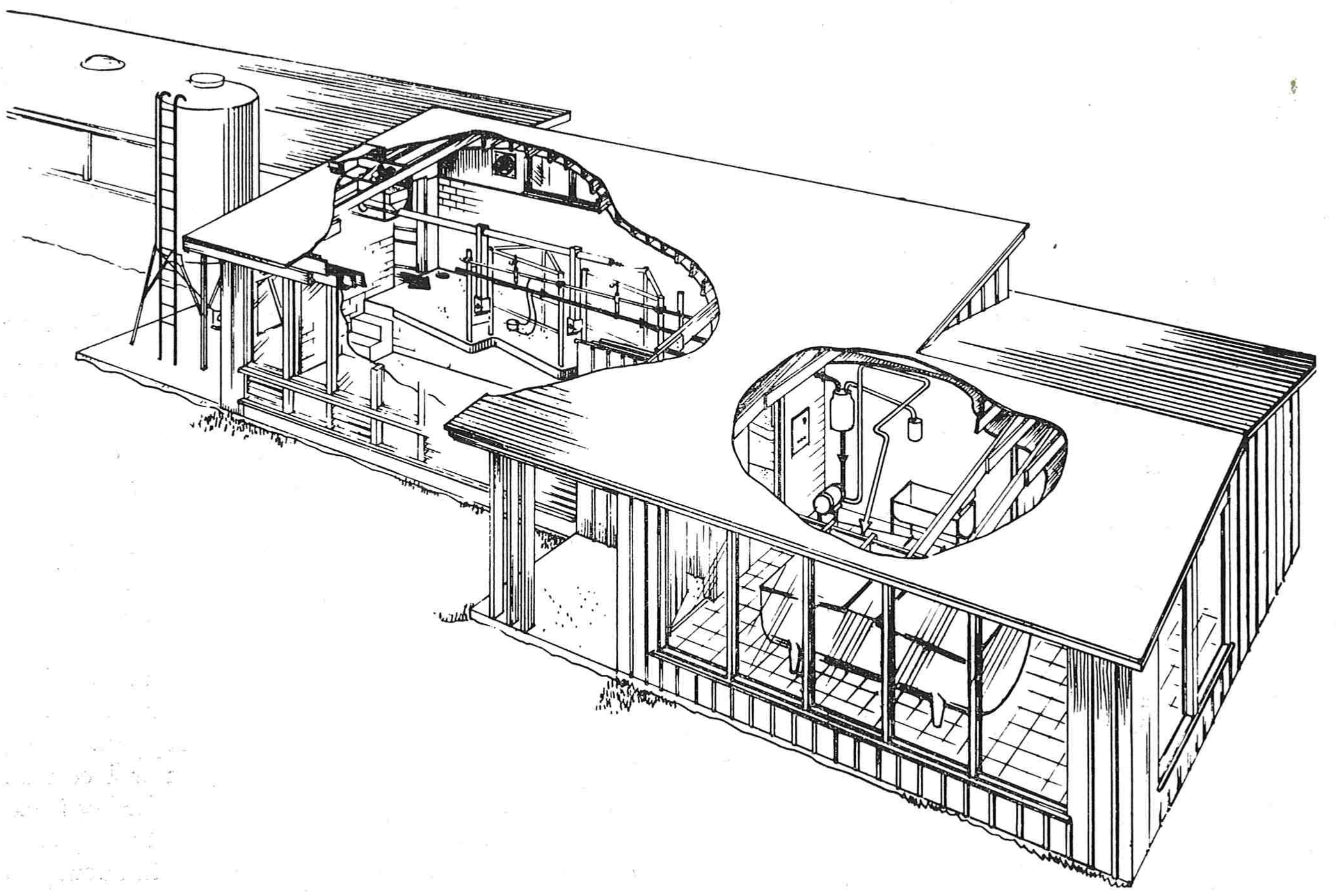
WORK TO CONTINUE ON RADIATION FOOD PROCESSING

A revised six-year Army program of research on food preservation by ionizing energy (radiation) was approved on March 11, 1960, and reviewed at a public hearing by a subcommittee of the Congressional Joint Committee on Atomic Energy on March 31. The Army will emphasize high-dose treatment of foods for sterilization, primarily pork, smoked ham, chicken and beef. The location of the needed research facility has not yet been selected, but the facility will include a megacurie cobalt 60 gamma irradiator, a variable voltage linear electron accelerator to be used at up to about 5 MEV and a small food sampling, preparation, and testing annex to provide the minimum amount of laboratory support. Over the six-year period, the Army program will cost an estimated $5,000,000, while the research facility is expected to cost an additional $1,800,000. It is expected that the new facility will be operational in about two years.

Low-dose radiation processing of perishable foods to extend their storage life will be the aim of a five-year program being initiated by the AEC, which feels this area holds the most immediately useful civilian application of ionizing radiation for food processing purposes. Preliminary experiments on marine products have revealed that low-dose radiation may successfully extend the refrigerated storage life of flounder, ocean perch, halibut, shrimp and crab. For example, the normal seven-day refrigerated storage life of cooked crab might be extended to 30 days. Another area of prime interest in the AEC program is retardation of fruit spoilage by mold and the application of radiation to slow down the rate of fruit ripening. It may be that mobile irradiators using 50 to 150 thousand curies of cobalt 60 will be required to test process the selected foods at the points of harvesting and packaging for transportation to markets. The AEC expects to spend about $5,000,000 on this project during the next five years.

PICTURE WINDOW MILKING PARLOR REVOLUTIONIZES DAIRYING IN 1960!

Imagine milking cows in a light, comfortable room where you can watch the milk as it surges from each cow and enjoy the benefits of automatic feeding,



Cutaway view of the Picture Window Milking Parlor shows where the cow milking and milk handling equipment is located for the ultimate in convenience, sanitation and appearance.

closed circuit TV, solar lighting, radiant heat, and, yes, even a snack bar!

Sounds like a pipe dream or perhaps cow milking in the year 2000, doesn't it?

Yet, due to advanced planning and expert engineering, such a setup is made a reality iin 1960. It's called the Picture Window Milking Parlor!

This latest system of dairying is specially designed to milk 75 cows per man . . . with each cow handled as the individual which she is . . . and milked properly.

The Picture Window Milking Parlor takes fullest advantage of the latest in automatic equipment. It lets a good man better utilize his valuable time and also permits him to milk more cows than he could ever do before. Besides, he has comfortable, tiled quarters in which he can actually enjoy milking cows and take the fullest pride in his work. Milking equipment is cleaned in place automatically.

A glass front puts to work nature's solar principle and lets in all the brilliant, natural daylight. Electric heating cable in cow platform and exit ramp floors helps solve the ice problem in cold climates.

A closed circuit TV unit lets the operator watch his cows before they enter the milking parlor. For free copy of the new booklet, "Surge Picture Window Parlor," write Dept. JM, Babson Bros. Dairy Research Service, 2843 W. 19th Street, Chicago 23, Illinois.

NOTICE OF FILM RELEASE

Introduction To Swimming Pool Sanitation (M-402)
Motion picture, 16mm, color, sound,
23-½ minutes, 846 feet — 1959

Audience: Public Health personnel, pool operators, environmental hygienists, and others who are responsible for swimming pool sanitation.

Summary: An introductory lecture for courses in swimming pool sanitation for pool operators, or environmental hygienists. It follows the introductory lecture given on pages 15 through 21 of the manual, "Swimming Pools—Disease Control through Proper Design and Operation." It previews the course by summarizing the field that will be dealt with, i.e., design, layout, and operation.

May be used as an aid for organizing scheduled lectures. Shows how to use the set of charts—"Swimming Pool Sanitation Color Charts," and suggests training aids for the presentation.

Available: Purchase—United World Films, Incorporated, 1445 Park Avenue, New York 29, New York, List Price $179.17.

Short-term loan—(United States only) Communicable Disease Center, Public Health Service, Department of Health, Education, and Welfare, Post Office Box 185, Chamblee, Georgia.

SECRETARY FLEMMING TO ADDRESS FOOD AND DRUG OFFICIALS

Secretary of Health, Education and Welfare, Arthur S. Fleming will head the list of speakers at the 64th annual national conference of the Association of Food and Drug Officials of the United States to be held June 5 through June 9 at the Baker Hotel, Dallas, Texas.

Harold Clark, Hartford, Connecticut, of the Connecticut Food and Drug Commission and president of the Association, announced that the conference will also hear expert discussions of the narcotics problems in the various states. In addition, he said that authorities would present papers on current developments in connection with the food additives and color amendments, on means of making safer the use of hazardous substances in homes and in industry, and on problems in regard to the frozen food code.

A special event will be the fifth annual presentation of the Harvey W. Wiley Award to a food and drug official for outstanding service, devotion to duty and leadership in his field both locally and nationally.

The Association of Food and Drug Officials is the professional society of food and drug enforcement officers in all levels of government—federal, state and municipal.

The annual conference, according to Mr. Clark, gives members an opportunity to study new technological and legal developments relating to improved protection for consumers of foods, drugs and cosmetics. In addition, the officials are able to examine mutual problems, review activities and exchange points of view.

Evan Wright, of the Kansas State Board of Health, vice president of the Association and program chairman of the conference, said the Dallas meeting is expected to draw more than 200 food and drug officials and industrial associates from all parts of the nation. Many of them will be accompanied by their wives, for whom a special program is being arranged.

The host state is represented among the national officers by Secretary-Treasurer J. F. Lakey, Director of the Division of Food and Drugs of the Texas State Department of Health.

ENZYME FOOD ADDITIVES RECEIVE FDA APPROVAL

Production and sale of enzymes for use in foods and beverages has been given approval by the Food and Drug Administration. Certain enzyme products which are offered for use in the preparation and processing of food products are not deemed food additives within the meaning of the Food Additives Amendment of 1958. Consequently, it is not necessary to obtain a regulation specifically approving the use of the products, according to information received from E. T. Wulfsberg, FDA.

The ruling was a direct result of a joint presentation by major enzyme manufacturers concerning sources, production methods and food uses of enzymes submitted to the FDA.

These preparations involve the uses of carbohydrase and protease enzyme preparations derived from Bacillus Subtilis strains; carbohydrase and protease enzyme preparations derived from the Aspergillus Flavus Oryzae group ;and carbohydrase, cellulase, glucose oxidase-catalase, pectinase, and lipase enzyme preparations derived from the Aspergillus Niger group. These preparations are normally used for many types of food processing and preservation.

The ruling stated, *The enzyme preparation identified above, when derived from strains shown to be non-pathogenic for man and animals and prepared in accord with good manufacturing practices, would be generally recognized by qualified experts as safe for use in foods. As such, it is not necessary to file a petition covering them under the Food Additives Amendment.*

Another enzyme in question was bromelain which is extracted from the pineapple plant. The pertinent ruling was that as the product is prepared from clean, sound and wholesome raw material and in accord with good manufacturing practices, it is recognized as safe for use in foods.

NEW MANUAL OF PAPER FOOD SERVICE AVAILABLE

A 60-page, well illustrated manual has been published for those in the quantity food service field. Prepared by the Paper Cup and Container Institute, the manual gives public health officials and others concerned with food service sanitation an over-all view of many new ideas and proven techniques relating closely to the establishment of sound sanitation and public health practices.

The assurance of sanitation is a built-in feature of many of the suggestions involving paper food servive. The case histories and examples, drawn from hundreds of food service operations throughout the country, show how paper food service is being and can be used to improve sanitation, ease maintenance, simplify operations, and reduce costs in each segment of the mass-feeding industry.

The manual is divided into 13 chapters, covering special situations in hospitals, inplant feeding, restaurants and drive-ins, and schools, as well as many food service problems common to all types of volume food service. Summaries of current trends and modern methods of interest to sanitarians and health officers in dealing with food service people are included on such subjects as electronic cooking, freezing, vending, water service, take-out, packaging, portion control, storage and disposal.

The manual summarizes not only many years of field research, but also a number of studies conducted by the Institute in the quantity food service field.

The Manual of Paper Food Service may be obtained by sending 25c to cover handling and mailing to the Paper Cup and Container Institute, Inc., 250 Park Avenue, New York 17, N. Y.

Copies in bulk are available without charge to associations, educational institutions, and Health Departments which wish to distribute them.

TRIP TO HAEGER POTTERIES PLANNED FOR LADIES AT ANNUAL MEETING

"A day to be remembered" has been planned for the ladies for Thursday, October 27 – it will be an all day trip to the famous Fin and Feathers Farm with a delicious luncheon at the "Milk Pail." You will have time to browse in their interesting shops and then go on to the Haeger Potteries, the world's largest art pottery, where you'll be taken on a special tour. In the afternoon you will see an hour's demonstration of flower arranging in Haeger containers by well known floral artists. This will be complete with door prizes and time to shop at the potteries. You will then return by bus through the Fall colored countryside and suburbs to Chicago's loop. The trip back will also include a sight seeing route, as time permits, including Maxwell Street, Skid-Row, foreign neighborhoods and Chinatown.

47TH ANNUAL MEETING PROGRAM TO OFFER GOOD SUBJECT COVERAGE

The program for the 47th annual meeting of the Association, to be held at the Hotel Morrison, Chicago, October 26-29 will offer a good variety of subject matter of technical interest to the membership.

The first general session will open at 1:30 P. M. on Wednesday, October 26 with an address of welcome by Dr. Samuel Andelman of the Chicago Department of Health. This will be followed by two papers, the first by Dr. D. F. Sondag of the Illinois Department of Health who will speak on the subject, *Sanitation – More or Less in the Sixties.* Following Dr. Sondag will be J. W. Bell of the National Canners Association who will speak on, *Protection of Food Processing Plants During National Emergencies.* Also, at this opening session President William Hickey will address the meeting to give the membership a review of progress within the Association, future plans and needs.

In the evening, at 8:00 P. M. the Associated Illinois Milk Sanitarians will be hosts at a reception for IAMFS members and guests.

Thursday's program, beginning at 9:00 A. M. will be divided into three sections covering Milk Sanitation, Food Sanitation and General Sanitation. These will operate simultaneously. In the Milk Section meetings, *Blend Temperatures of Mixed Milk in Bulk Tanks*, and *Operation of Cow Pools* will be two papers of interest to milk and dairy specialists. In the Food Section meeting, *Application of Food Sanitation Practices in Industry* will be the opening paper, followed by, *Food Sanitation and Control — Facts and Fallacies.* In the General Environmental Sanitation Section problems of suburban sanitation will be discussed as will sewage disposal by the lagoon method and hospital sanitation problems.

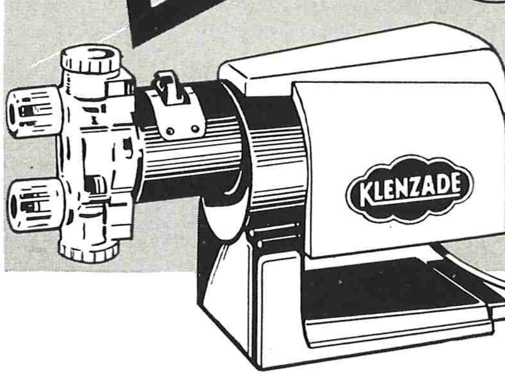
On Thursday afternoon the membership will convene in the hotel's grand ballroom for the second general session. At this time the report of the nominating committee will be heard. Following this will be papers on, *Administration of the Grade A Milk Program,* and *Current Trends in Interstate and Intrastate Shipments of Milk and Their Impacts on Local Milk Sanitation Programs.* At 3:30, the annual report of the Executive Secretary and the election of new officers.

At 8:00 P. M. the annual banquet will be held at which time both the annual sanitarian's award and the citation award presentations will be made.

On Friday, October 28, two general sessions will be held, the first in the morning, beginning at 9:00 A. M. and the second and concluding session beginning at 1:30 P. M. At the morning session will be a panel discussion with three discussion leaders on the subject of, *Industrial Uses of Welded Pipelines* . This is a subject of real current interest and the panel should be of real help to all engaged in milk and food plant sanitation. Following the panel, two other papers will be given. One will deal with research and inspection programs of the Quartermaster Food and Container Institute of the Armed Forces and the second, will be a discussion of *Ethical Standards for Sanitarians.*

Two papers of pertinent current interest will be given at the last general session in the afternoon. The first will deal with the problem of spray residues on fruits and vegetables by T. E. Sullivan of the Indiana State Board of Health, and the second will be a paper by L. S. Stuart of the USDA covering the subject of the Regulation of Bactericides under the provisions of the Federal Act.

The wide variety of technical subject matter to be



offered at the 47th Annual Meeting serves as a real incentive to Association members to begin now to make plans to attend. In addition to the formal presentation, panels, committee reports and business meeting, there is always the opportunity to discuss problems with friends and colleagues and experience a stimulating exchange of ideas.

Chicago is strategically located and easily accessible by all modes of transportation. The program committee is making every effort to put on a top-notch program and one which you cannot afford to miss. There will be a ladies program too, so plan to bring your wife. There are scores of interesting places in the Windy City and of course immediately following the Association meeting is the Dairy Show.

Details concerning reservations, hotels, and the complete program will be published in a later issue of the Journal. However, don't wait for this – PLAN NOW TO BE AT THE 47th Annual Meeting.

MEMPHIS AND SHELBY COUNTY TENNESSEE HEALTH DEPARTMENT ADOPT POLICY ON ADULTERATION

STANDARDS AND POLICY FOR ADULTERATION OF MILK

Memphis has maintained high standards for quality milk products to protect the Consumer, and with continued cooperation from the Producers, Processors, and Distributors the excellent record will be maintained. The Policies as set forth in this Memorandum are intended to be self-explanatory and detailed information is available at the Milk Division.

The Memphis Milk Ordinance, the U. S. Public Health Service Code, Pure Food and Drug Laws, and the Tennessee Dairy Law prohibits the sale or the offer for sale of milk or milk products which have been adulterated. Milk or milk products are deemed to be adulterated if any foreign material such as antibiotics (including Penicillin) sanitizers (including chlorine), added water, pesticides, etc. are present. It is assumed that all Milk Producers, Milk Processors, and Milk Distributors have been warned of the fact that adulteration of milk products is a violation of Local, State, and Federal Laws and in many cases a serious health hazard to milk consumers, therefore further warnings will not be made prior to penalties for violations.

Samples of raw milk, pasteurized milk, ice cream, and other milk products will be collected by Health Department Sanitarians for the purpose of chemical analysis and physical examination to determine if these products have been adulterated.

In order to eliminate additives from the Memphis Grade A Milk Supply, Producers are required to abide by the following regulations:

1. Milk from cows being treated for Mastitis must not be shipped for a period of at least 72 hours or longer if necessary. Milk from cows being treated for

Mastitis should not be sold or used for human consumption.

2. Cows being treated for Mastitis must be isolated from the milking herd.

3. Antibiotics, pesticides, and medicines used for the treatment of cows shall not be kept in the milkroom. A cabinet in the barn or utility room must be provided.

4. It is recommended that the treatment of cows for Mastitis be done only by a licensed Veterinarian.

STANDARDS

Antibiotics (including Penicillin)	Zero Tolerance
Pesticides	" "
Sanitizers (including Chlorine)	" "
Washing Compounds	" "
Added Water	" "
	3% test tolerance will be allowed due to variations in normal freezing temperatures.

VIOLATION PENALTIES FOR GRADE A PRODUCERS HOLDING MEMPHIS PERMITS

First Violation

1. If a Producer's milk is found to be adulterated, by laboratory analysis, the Producer's permit will be suspended for ten (10) days or more.

2. Previous to the end of the ten day period, the producer must come to the Milk Division office and make an application for reinstatement of his permit. At this time he shall show cause why his permit should be reinstated.

3. The Health Department will request an investigation be made by the Producer's Fieldman and the Sanitarian, and a certification concerning the Producer's ability to ship good milk and disposition of his milk while suspended.

Second Violation

1. The second time a Producer's milk is found to be adulterated the penalty will be for at least 30 days. The procedures for reinstatment of permit shall be the same as for the first violation.

PASTEURIZED PRODUCTS

When adulteration is found in Pasteurized Products, the Processor and/or Distributor will be notified. It shall be the responsibility of each Processor or Distributor to see that his product is free from adulteration. Milk Plants, Ice Cream Plants, and Producer Groups are encouraged to adopt Standards and Procedures and analyze samples in their own laboratories for adulteration. Laboratory procedures should be those recommended by "Standard Methods for the Examination of Dairy Products." Tennessee Health Department Laboratory has consented to assist Private Laboratory Personnel in setting up recommended procedures and techniques.

MILK & MILK PRODUCTS IMPORTED FROM OUTSIDE ESTABLISHED MILKSHED.

1. Samples will be collected on milk and milk products coming into the area from markets not under the direct supervision of the Memphis Health Department. These products must be free from adulteration.

2. In case of violations, warnings will be issued. Repeat violations will call for suspension of permit.

3. A certification regarding the Adulteration Program in effect in Importing Markets will be required.

Comment on this memorandum is requested and additional information will be released when available.

S/R. R. Perkins, Director
Food & Milk Processing Division
S/Everett C. Handorf, B. S., C. E.
Engineer Director

Classified Ads

Index To Advertisers

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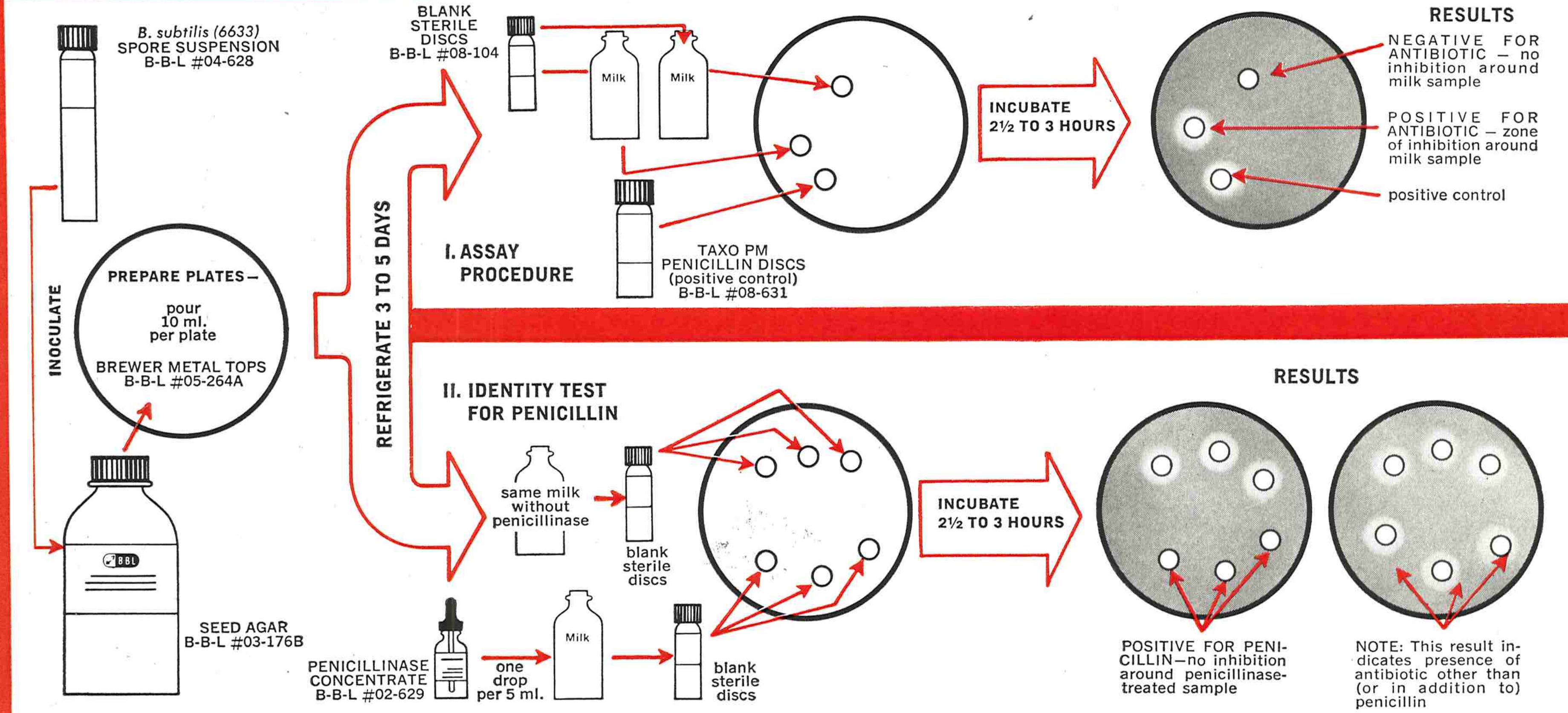
DETECTION OF PENICILLIN IN MILK



The presence of antibiotics in milk following mastitis therapy in cows has created serious public health problems and caused technical difficulties within the dairy industry. A rapid, practical laboratory procedure to assist regulatory agencies and the dairy industry in solving these problems was described by Arret and Kirshbaum.* This procedure employs rapid growth of a sensitive strain of *B. subtilis* for assaying the presence of antibiotics in milk and for determining its identity with penicillin. Inhibition of growth by the presence of as little as 0.05 unit of penicillin per ml. of milk sample is detectable within 2½ hours.

In answer to many requests for information about the availability of B-B-L products for this simplified procedure, the B-B-L Development Laboratory has prepared this TECHNICHART. It graphically illustrates the basic procedure, showing the materials necessary—**all of which are available from B-B-L.** A complete brochure with detailed technique and product listing is available upon request.

*Arret, B., and Kirshbaum, A.: J. Milk and Food Technol. **22**:329, 1959.

we'll never get GOOD SANITATION

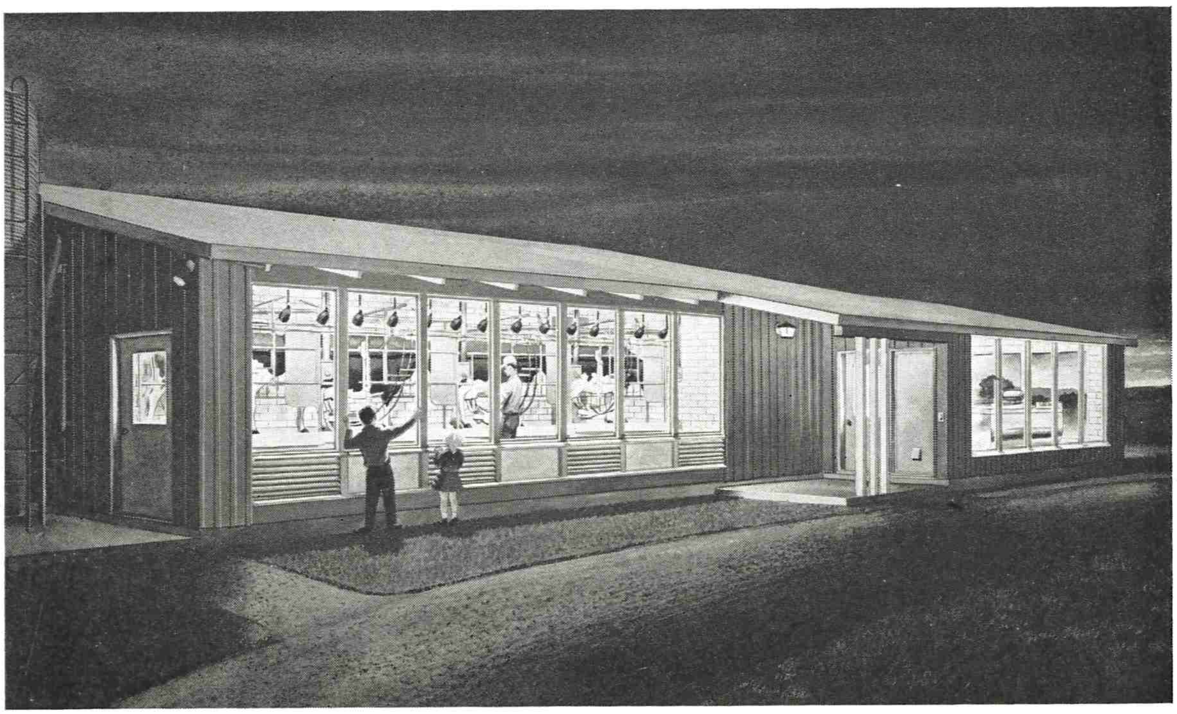
...until we get good cow milking

we'll never get GOOD COW MILKING

...without milking conditions that enable dairymen to take pride in their job

we'll never put PRIDE back in DAIRY FARMING

...without a milking setup that's built for the man...as well as for the milk and the cow



UNLESS the cow milker can take pride in his job, no dairy farm or milk plant can count on the kind of milk we all want for our children. For a free book, "SURGE Picture Window Parlor," write Dept. 78, Babson Bros. Dairy Research Service, 2843 W. 19th St., Chicago 23, Ill.

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