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MILK and FOOD TECHNOLOGY

Official Publication

International Association of Milk and Food Sanitarians, Inc.

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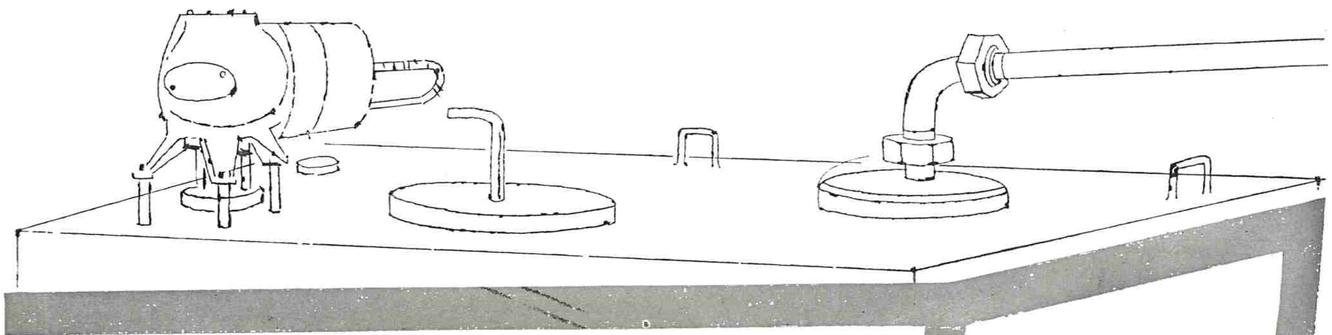

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PROFESSIONAL STATUS FOR THE SANITARIAN

The Directors of Full Time Local Health Departments of the State of Michigan, have recently endorsed and recommended to the Commissioner of Health of that State the recognition of a two year course at the technician's level for persons who may be interested in the field of environmental sanitation. This group would be known as "Sanitarian Technicians".

The training course in question is to be conducted by the Ferris Institute, a State sponsored college in Michigan which has been expanding the areas of training available to prospective students.

Surveys made by the Institute had indicated that many positions in the field of environmental sanitation in local health departments of the State of Michigan were being filled by persons having limited scholastic training. Apparently on the basis that half a loaf is better than none, the Directors of Full Time Local Health Departments are hoping to solve their personnel problems in the environmental sanitation services by advocating the acceptance of persons who have had only two years of technical training.

There is no intention here to cast aspersions on the Ferris Institute or any part of its curriculum. It is our understanding that the Institute has made exceptional strides in expanding its facilities and educational programs since it became a part of the educational system of the State of Michigan. Nor is it our desire to brush aside the difficulties with which the health officers are faced in attempting to recruit technical personnel possessing adequate professional training to meet the needs of a modern environmental sanitation program. The inadequate salary scales prevailing for this type of work and the attendant problems of filling vacancies have been with us too long to make us indifferent to the difficulties.

However, the proposed solution seems to offer only a dubious answer at best. Our highly industrialized way of life is becoming more and more complicated with each passing day, and the health problems involving our environment can be dealt with, if at all, only by those possessing the highest degree of technical skill and training. For purposes of illustration, we have but to consider the dangers resulting from the atmospheric pollution in our large industrial areas, the hazards arising from radiation in our flowering atomic age and the depletion of our potable water resources because of contamination.

It would seem obvious that solutions to such problems can be found only through the aid of the most highly trained rather than through those who have merely been granted a short introduction on a technician's level. A willingness to accept a second best expedient may be easier but it will hardly prove satisfactory in the long run.

The Executive Board of the International Association of Milk and Food Sanitarians wishes to make known its opposition to a training course for Sanitation personnel that does not encompass at least four years of academic training at the college or university level leading to a Bachelor's degree.

A report published on the "Educational and other Qualifications of Public Health Sanitarians," by a Sub-Committee on Professional Education of the American Public Health Association" substantiates this position.

The Executive Board of this Association believes that the plan now under consideration by the Ferris Institute of Michigan and endorsed by the Directors of Full Time Local Health Departments in that State is contrary to the principle of seeking better professional training of persons entering the public health field.

Futhermore, it is the Board's opinion that the current shortage of qualified professional sanitation personnel is no more acute than is the case of laboratory personnel, public health nurses, sanitary engineers or medical officers.

It is hoped that those who are responsible will reexamine the course of action which has been contemplated for we cannot believe that advancement in any professional field will be realized if basic standards are lowered.

Paul Corash, *President*, International Association of Milk & Food Sanitarians, Inc.

A BACTERIOLOGICAL SURVEY OF COMMERCIALLY FROZEN BEEF, POULTRY AND TUNA PIES[1]

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(Received for publication April 8, 1957)

The results of a bacteriological survey of commercially packed tuna, chicken, turkey, and beef frozen pies on a nationwide scale is reported. Samples were collected at the retail store level and examined for total count, enterococci, coliform and Salmonella type organisms. It is proposed that the total count be used as a sanitary index. An initial bacteriological standard of 100,000 organisms per gram is recommended on a tentative basis.

Dr. Warren Litsky received the B. A. degree from Clark University in 1945; The M. S. degree from the University of Massachusetts in 1948; and the Ph. D. degree in Bacteriology from Michigan State University in 1951. In 1951 Dr. Litsky joined the staff of the Department of Bacteriology and Public Health, University of Massachusetts, where he presently holds the rank of Research Professor. He is a member of the Committee on Research Needs and Application, IAMFS.

The manufacture of frozen "heat and serve" items is a relatively new and rapidly growing industry. Although no major outbreaks of food poisoning attributed to commercially packed frozen pot pies have been reported, the fact that these products can become easily contaminated and offer a fertile medium for bacteriologoical growth made them of particular interest. While it is true that the heating of these products according to the directions furnished by the processor will likely destroy the majority of the microorganisms present, sterility is likely not achieved. Infection from heatstable toxins formed by staphylococci always remains a possibility.

There is ample evidence in the literature (1) to show that while there is often a rapid reduction in viable cells during the early periods of exposure and storage at subfreezing temperatures, viable organisms can usually be recovered even after long storage periods. In addition, the problem of maintaining the proper low temperatures in the distribution chain between producer and consumer has been of concern to the industry and public health authorities for some time. A second aspect of the problem has been that of assessing the sanitary quality of the product in terms of the numbers and kinds of non-pathogenic types which may reflect factory sanitary conditions and subsequent handling.

With the above in mind, a survey has been conducted of the various types of frozen pot pies, beef, chicken, turkey, and tuna. Since the primary objective of this investigation was to determine the condition of these products as they are available to the consumer, the pies were purchased from the frozen food cabinets of markets in the larger cities across the country. Only the nationally advertised brands were sampled because of their volume and wide distribution.

SAMPLING AND COLLECTION

Paired samples, six pairs of each of 15 brands were purchased in different stores and in most cases in different cities of the United States. The samples were immediately packed in dry ice and shipped air express to a central point for consolidation. These samples were then repacked in dry ice and shipped to this laboratory. Upon arrival, the samples were transferred to mechanically refrigerated storage rooms where they were held (at -5°F.) until the analyses were made. Half of the samples (6 packages) of each brand were taken for bacteriological analysis while the remainder were examined for general quality and organoleptic evaluation. In all cases the samples were solidly frozen upon arrival in Amherst.

MATERIALS AND SAMPLES

Samples of the pies for the bacteriological study were obtained by the use of sterile one inch stainless steel core borers. The samples were taken at the center of the pie to insure a representative distribution of its ingredients and crust. The core was forced out of the borer by a sterile plunger and placed into a sterile counter-balanced Waring Blender container into which water was added in quantities so as to obtain a 1 to 10 dilution. This was then blended for three minutes and the resulting suspension was used for bacteriological analysis.

Standard plate counts were obtained by ordinary serial dilution plating using tryptone glucose extract

[1]Contribution No. 1100 University of Massachusetts, College of Agriculture Experiment Station, Amherst, Mass.

agar as the medium. The plates were made in duplicate and counted after 48 hours incubation at 37°C.

The number of coliforms was likewise obtained by serial plating techniques using violet red bile agar as the medium with an overlay of nutrient agar. Characteristic colonies were counted after a 24-hour incubation at 37°C. as prescribed by "Standard Methods." (3).

The most probable number (MPN) of enterococci were determined by serial dilution, using sets of five replicate azide dextrose broth tubes as the presumptive test. For the confirmation test three loops were transferred into ethyl violet azide broth tubes after 48 hours incubation.

The test for *Salmonella* was made by the primary enrichment method, using selenite-F enrichment broth. After 18 hours incubation at 37°C. streak plates were made on MacConkey's agar, bismuth sulfite agar, and desoxycholate agar from the enrichment broth. After these plates were incubated for 24-48 hours, typical colonies were picked and subjected to agglutination tests with polyvalent serum. Further bacteriological analyses were undertaken wherever the agglutination results indicated.

Results

The combined results of this survey are shown in Tables 1, 2, 3, and 4.

Tuna

Of the two brands of (six pies in each brand) frozen tuna pies tested, the total bacterial count per gram ranged from 2,200 to 14,000. The coliform count ranged from 0 to 125, and the enterococci MPN ranged from 0 to 4.5. There was no apparent correlation between the three determinations since the highest total count was accompanied by zero enterococci MPN while the highest coliform count was accompanied by zero enterococci MPN and one of the lowest total counts.

Chicken

Of the six brands of chicken pies tested, three (C-2, C-4, C-6), had total counts under 100,000 per gm. One brand, C-3, was found to have one out of six above 100,000 (C-3D). Brand C-1 showed two of the six pies above 100,000 (C-1B and C-1C). Brand C-5 showed five out of six pies having a count above 100,000, of which three (C-5A, C-5D, and C-5F) were above 1,000,000 per gram. As in the case of the tuna pies, the enterococci and coliform counts showed no correlation with the total counts. However, in brand C-5 the enterococci MPN were consistently higher than the other brands and a correlation is suggested

Table 1. Summary of Bacterial Counts Of Frozen Precooked Tuna Pies

Code	Total count	Enterococci (MPN)	Coliform count
F1A	9,500	0.3	0
F1B	7,400	0	41
F1C	9,600	0.36	0
F1D	3,000	0.36	14
F1E	5,500	0.36	41
F1F	6,400	0	0
F2A	8,900	9.3	24
F2B	14,000	0	19
F2C	5,500	0.32	12
F2D	2,600	0	125
F2E	2,200	0	93
F2F	4,000	4.50	30

Table 2. Summary of Bacterial Counts of Frozen Precooked Chicken Pies

Code	Total count	Enterococci (MPN)	Coliform count
C1A	65,000	132	19
C1B	150,000	50	22
C1C	110,000	100	91
C1D	52,000	13.2	17
C1E	54,000	116	50
C1F	21,000	85	154
C2A	48,000	8.9	50
C2B	24,000	95	20
C2C	56,000	13	0
C2D	37,000	37.5	0
C2E	16,000	15	15
C2F	26,000	36.4	14
C3A	53,000	1280	4.5
C3B	20,000	80	21
C3C	24,000	11	19
C3D	500,000	122.6	39
C3E	15,000	40	10
C3F	45,000	146	9
C4A	12,000	41	4
C4B	27,000	87	55
C4C	96,000	0	9
C4D	91,000	136	82
C4E	16,000	25	15
C4F	12,000	250	25
C5A	1,200,000	1270+	9
C5B	140,000	450	0
C5C	270,000	275	5.5
C5D	1,500,000	1270+	9
C5E	37,000	1000	23
C5F	1,500,000	1000	82
C6A	35,000	21	21
C6B	13,000	6	20
C6C	13,000	25	20
C6D	6,200	33	3
C6E	66,000	79	460
C6F	67,000	37	29

TABLE 3. SUMMARY OF BACTERIAL COUNTS OF PRECOOKED FROZEN BEEF PIES

Code	Total count	Enterococci (MPN)	Coliform count
B1A	15,000	41	14
B1B	370,000	90	0
B1C	6,600	6	50
B1D	650,000	39	0
B1E	14,000	136	54
B1F	5,000	41	5
B2A	130,000	1000	655
B2B	10,000	28	100
B2C	10,000	40	25
B2D	13,000	-21	104
B2E	59,000	210	1380
B2F	13,000	33	21
B3A	6,200,000	375	TNTC
B3B	4,200	-23	0
B3C	5,900	-25	0
B3D	480,000	680	2160
B3E	20,000	-22	7
B3F	11,000,000	14,000	695
B4A	4,000	0	0
B4B	11,000	4	0
B4C	5,000	8	0
B4D	32,000	0	23
B4E	2,200	0	0
B4F	3,000	0	5
B5A	6,400	0	0
B5B	4,100	0	0
B5C	5,000	0	8
B5D	5,700	0	0
B5E	6,600	7	0
B5F	2,000	0	0
B6A	27,000	14	36
B6B	10,000	4	73
B6C	5,000	7	0
B6D	23,000	0	220
B6E	7,100	21	17
B6F	2,000	0	0
B7A	5,900	0	0
B7B	2,100	29	0
B7C	3,200	3	0
B7D	7,400	38	0
B7E	5,000	3	4
B7F	7,800	0	17

between the MPN and the total count. It must be added that the total count of this brand was far above the total count for the average in this study.

BEEF

Four of the seven brands of beef pies tested indicated total counts well below 100,000 (B-4, B-5, B-6, and B-7). One brand, B-2, showed one of the six pies exceeding a total count of 100,000; brand B-1, two out of six; and brand B-3, three out of six, of which two (B-3A, B-3F) exceeded 1,000,000 per gram. It is of interest to note that in brands B-4, B-5, B-6 and B-7, the enterococci MPN and the coliform counts were extremely low, suggesting some correlation with the extremely low total counts of these samples. Also in brand B-3 the enterococci MPN and coliform count suggests some correlation with the high total count, however, in brands B-1 and B-2 there is no indication of any correlation between the three determinations.

TURKEY

Three out of the seven brands of turkey pies examined showed no total count exceeding 100,000. Two

TABLE 4. SUMMARY OF BACTERIAL COUNTS OF PRECOOKED FROZEN TURKEY PIES

Code	Total count	Enterococci (MPN)	Coliform count
T1A	53,000	14	6
T1B	83,000	38	4
T1C	31,000	41	640
T1D	6,000	25	35
T1E	43,000	8	67
T1F	390,000	1400+	120
T2A	26,000	14	0
T2B	6,000	136	136
T2C	81,000	38	41
T2D	5,400	12	0
T2E	13,000	3	71
T2F	76,000	5	21
T3A	TNTC[a]	TNTC	TNTC
T3B	36,000	-28	4.5
T3C	38,000	7900	0
T3D	33,000	6200	8
T3E	120,000	1500	5
T3F	73,000	1360	118
T4A	3,500	450	0
T4B	15,000	23	23
T4C	8,800	3	57
T4D	18,000	19	15
T4E	2,500	0	0
T4F	18,000	168	92
T5A	32,000	150	20
T5B	680,000	14,000+	20
T5C	97,000	137	5
T5D	44,000	17	7
T5E	370,000	116,000+	0
T5F	890,000	1,000+	TNTC
T6A	9,300	21	0
T6B	6,400	0	46
T6C	6,500	0	135
T6D	130,000	1,100	105
T6E	10,000	21	62
T6F	15,000	21	33
T7A	13,000	9	9
T7B	6,000	0	0
T7C	9,100	6	33
T7D	3,800	3	4
T7E	17,000	6	11
T7F	2,000	0	21

[a] Too numerous to count.

brands (T-1 and T-6) showed one exceeding 100,000 per gram, one brand (T-3) showed two pies exceeding the 100,000 count, and one brand (T-5) showed three of the six pies above the 100,000 per gram total count. It is of interest to note that of the seven individual pies which showed a total count of above 100,000, all seven pies had a correspondingly high enterococci MPN while only two had a high coliform count.

Of the 132 individual pies examined the presence of *Salmonella* could not be demonstrated. Of the thirteen cultures isolated which gave a weakly positive agglutination test, all were found to be of the paracolon group.

Discussion

By virtue of composition and pH, precooked frozen meat pies (beef, chicken, turkey, and tuna) offer fertile media for growth of many types of microorganisms. In addition, there are many possibilities of contamination during the manufacture of these products. Even under the best of sanitary conditions during manufacture, it is a fairly safe assumption that these pies are not sterile prior to freezing. While it is recognized that there is destruction of microorganisms during frozen storage, it is also recognized that sterility is usually not achieved during this process. Under ideal conditions, the pies would be held at low temperature (0° to 10°F.) until heated for serving. Under such conditions, one would expect a relatively low microbial population particularly after the recommended heating times and temperatures. If, on the other hand, the pies are allowed to thaw prior to heating for serving, one might logically expect increases in the numbers of microorganisms present, the increases being somewhat proportional to the length of time of exposure to higher temperatures. Since enterotoxigenic strains of microorganisms are prevalent enough in areas of food preparation, it is safe to assume that they may be present in any low-acid foods such as the products under discussion. Once the enterotoxin is formed, it is resistant to destruction by both freezing and cooking even though the microorganisms themselves are reduced in numbers or completely destroyed. This condition may not be detectable organoleptically. In almost all cases, organoleptic tests on duplicate samples showed no correlation with high total counts. The fact that the product has been frozen, and is then heated prior to serving, is no assurance that it is safe.

Since over 70 per cent of the pies examined had total counts under 50,000 per gram, and almost 60 per cent showed total counts of under 25,000 per gram (including crust), the indications are that pies with low total counts can be obtained under commercial conditions. Certainly, manufacture under good, sanitary conditions should permit production of such products. However, it is generally recognized by the industry that abuses in handling during distribution are fairly widespread. It is quite likely that the findings of higher counts may be largely due to this. It is the authors' contention that the manufacturer should do everything in his power to protect his product until it is consumed. This means not only preparation under optimum sanitary conditions, but also proper handling and storage during distribution. It is also suggested that a vigorous educational program be pursued on a national level to inform distributors and consumers that they are dealing with a highly perishable product and that proper precautions in handling must be exercised.

Conclusions

On the basis of the work reported herein, it was found that 84 per cent of the commercially produced pies had total counts lower than 100,000 per gram. In fact, almost 60 per cent had such counts lower than 25,000 per gram. Therefore, it is suggested that frozen meat pies can be produced and distributed having a lower count than 100,000 per gram. It is proposed that this count be chosen as a tentative standard for the present. A total count of 100,000 per gram is excessive in view of the high sanitary standards now employed in modern packing procedures. The industry must also be considered and should not be penalized too severely at the start of such a program. If a standard such as the one proposed is accepted, then eventually it could be reduced by voluntary action on the part of the industry on the basis of continued improvements. The proposed standard of 100,000 per gram appears to be reasonable and should not cause any large scale readjustment on the part of industry. Once such a recommendation is accepted and the industry has had the experience of operating under such a standard, the standards then might easily be reduced if warranted.

In support of this recommendation, Fitzgerald (*2*) as early as 1947 recommended an upper limit of 100,000 colonies per gram in frozen foods although he felt that higher counts might be permitted. Weiser (*4*) has discussed the problem and has mentioned the standard of 100,000 viable bacteria per gram of frozen precooked foods already suggested by the Quartermaster Food and Container Institute. The results of the present survey independently confirm these suggestions as realistic and workable.

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STATUS OF USE OF THE PROGRAM OF CONFERENCE AGREEMENTS IN INTERSTATE SHIPMENTS OF MILK[1]

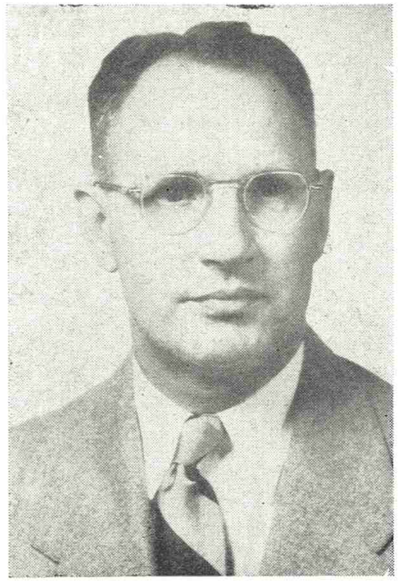
Dr. K. G. Weckel

Department of Dairy and Food Industries,

University of Wisconsin, Madison

Although the program of the National Conference on Interstate Milk Shipments was initiated some eight years ago, and some six National Conferences have been held in furtherance of its objectives, there has been to date no summary evaluation of the extent of its use. The constitutional procedure of the Conference program does not provide mechanics by which either the numbers, frequency, origin, destination, nor amounts of the shipments can be recorded for summary tabulation. In a previous study of this subject *(1)* it was ascertained that in virtually all states no provision existed whereby either the originating or received shipments were tabulated, or summary information about them recorded. It was apparent, in the current study, that extensive use of the program was being made through official knowledge and approval of shipments in origin and in receipt, and through numerous requests for survey ratings. Participation in the program is evident from the observation that the Conferences regularly have been attended by 150 to 250 persons, including 20 to 30 regulatory people representing the various states in official delegation of the Conference procedures. The current list of sources of milk in the "Sanitation Compliance Ratings of Interstate Milk Shippers" *(2)* includes approximately 530 dairy plants in 34 states and the District of Columbia. Participants to the Conference, including state and local regulatory agencies, and industry and educational groups obviously expend considerable sums of money in furtherance of the Conference program. One of the prime objectives of the Conference program is to reduce the costs of procurement of quality milk in interstate shipment. The U. S. Public Health Service currently is investing heavily in the making of survey ratings upon request of the states, and in the periodic publication of the list of sources having compliance rating.

In the light of need for information, the Executive Board of the National Conference on Interstate Milk Shipments, approved at its interim meeting in Augusta, Georgia on October 7, 1955, the making of a survey to ascertain the extent of use of the Conference program by the survey method. A questionnaire was de-



Dr. K. G. Weckel, Professor of Dairy and Food Industries, University of Wisconsin, has been associated with the University in teaching and research work since 1930. He received his B. S. and Ph. D. degrees from the University of Wisconsin. He is Past President of the Wisconsin Milk Sanitarians' Association, and of the International Association of Milk and Food Sanitarians. Dr. Weckel is past chairman, and currently member-at-large of the Executive Board, National Conference of Interstate Milk Shipments.

veloped having only but few specific objectives: *(a)* determination of the numbers of shipments actually made according to the procedures of the program; *(b)* establishing information on the amounts of milk shipped, and the periods in which it was shipped in the year 1955, and for the year 1954; and *(c)* commentary on the program.

Procedure

A questionnaire, subsequently described, was accompanied by the following statement, and sent to the plant manager of every plant in the lists of plants with sanitation compliance ratings under date of January 1, 1956.

July 10, 1956

To the Manager of the plant listed in the U. S. Public Health Service Report of January 1, 1956.

Dear Sir:

"The National Conference on Interstate Milk Shipments has been in operation since 1950. Through this program, receiving

[1]Presented at the Sixth National Conference on Interstate Milk Shipments at Memphis, Tenesee, March 23, 1957.

areas are provided with ratings of potential milk supplies in other areas. The last quarterly list issued by the U. S. Public Health Service contained the ratings of 457 dairy plants located in 34 states and the District of Columbia. The use of the Conference Agreements has facilitated reciprocal approval of interstate transfer of milk."

"The extent of use of the Conference Agreements has never been determined. A great deal of effort, time and money is regularly invested by industry, government and educational groups in the reciprocal agreement program for interstate shipment of milk. It is essential that the use of the program be known in the light of the effort invested in it."

"The Executive Board of the National Conference on Interstate Milk Shipments has requested that such an evaluation be made. A Committee has been assigned this job. It is, therefore, submitting to each plant listed in the U. S. P. H. S. report of January 1, 1956, and designated as a source of approved milk, a brief questionnaire. Your plant is listed in this report."

"Three answers are sought in this questionnaire to determine the use of the program in 1955: how many seperate interstate shipments were made; in what months were they made; and how much milk was shipped? From the replies, the results of the work of the National Conference on Interstate Milk Shipments should become known."

"A concise questionnaire is attached to this letter. The Committee will appreciate your filling it in promptly so that it may report the facts to the Board, and to the next Conference to be held in April, 1957. The information in the replies will be used only as in a consolidated report. If there should be desired information about interpreting the questions, please write to me for further clarification. Thank you for your coooperation."

Sincerely,
For the Executive Board
National Conference on Interstate
Milk Shipments

A total of 196 replies were received. In a large number of instances the individual replies represented the collective data of several of the operating divisions of an organization. Reference to the compliance list indicates a large number of multiple plant organizations. An appraisal of the responses indicates the replies included an estimated 60-70 per cent of the plants to which the questionnaire was submitted. In a few instances involving significant groups of plants, information specifically was withheld on the basis of correspondence apparently for competitive reasons.

The questionnarie form, with a summary tabulation of the data provided in the 1956 replies is presented as follows:

NATIONAL CONFERENCE ON INTERSTATE MILK SHIPMENTS
QUESTIONNAIRE

Your plant is listed in the report of the U. S. Public Health Service, under date of January 1, 1956, as having milk available for shipment in conformity with the Agreements of the National Conference on Interstate Milk Shipments. The information presented in this questionnaire is needed in order to determine the extent of use of the Conference Agreements in Interstate Shipments of Milk. Your assistance in filling out the questionnaire and returning it will be very much appreciated.

Question 1. Please write in the following table the shipments of milk *made in accordance with the Interstate Milk Shippers' Conference Agreements.*

FOR 1955

Month in which shipment was made	Number of shipments made in the month	Total pounds of milk shipped in the month
January	1,654	44,973,603
February	1,633	42,071,728
March	1,726	46,585,105
April	1,627	43,740,977
May	1,563	41,497,147
June	1,574	40,476,182
July	1,928	49,970,497
August	2,610	77,416,025
September	3,458	95,050,656
October	2,941	79,500,284
November	2,777	76,543,074
December	2,136	59,508,688
Total, 1955	25,627	697,333,966

FOR 1954

Number of shipments made during entire year	Total pounds milk shipped
20,856	488,809,100

RESULTS

A total of 86 replies of the 196 received provided data on shipments made in the year 1955. A total of 110 replies indicated no shipments were made in 1955. All but 9 of the plants that shipped milk in 1955 also shipped milk in 1954. Only 2 of the plants that did not make shipments in 1955 made shipments of milk in 1954. The range in numbers of shipments made per month during 1955 was from 1,563 to 3,458, representing a volume of milk ranging from 40,476,000 to 95,050,000 pounds. The total number of shipments in 1955 was 25,627 and the total pounds of milk represented was 697,333,000.

A number of the replies received included data of intracompany shipments of milk across state borders. This information was not included in the list tabulations as representing interstate shipments. A number or replies indicated either or both raw milk and bottled pasteurized milk was shipped locally intercompany and intracompany across state borders. These data likewise were excluded from the tabulations.

The survey questionnaire requested further information on, *(a)* the effect of the Conference program on frequency of inspection of milk supplies, *(b)* on costs of inspection work, and *(c)* upon the inspection services of the company organization.

Twenty six of 93 organizations responding to the question indicated that frequency of inspections had been reduced, and that multiple inspections of various regulatory agencies had decreased. Twenty eight organizations indicated frequency of inspections had not decreased. In a number of the latter instances several factors were cited as qualifying the responses: *(a)* in the period indicated (specifically 1955) there had occurred a great shift from individual patron to bulk tank hauling of milk from farm to plant along with increased production of milk on the farms necessitating considerable supervisory work by both plant and regulatory sanitation services; *(b)* the mere consolidation and expansion of Grade A milk production and processing facilities had required even an increase in inspection activity; *(c)* although plants were listed as having compliance ratings, several receiving areas required approval of the shippers supplies by one or more of various specific local area city or state agencies thus involving multiple inspection; and *(d)* a very significant number of the responses indicated no change in frequency of inspection had been involved because the inspection previously regularly had been made by city or state agencies which had continued to be the basis of acceptance in the specific export market.

Eleven replies indicated specifically that costs of inspection work had been reduced through use of the Conference program, and 21 indicated there had been no change in inspection costs. Two replies indicated the program resulted in better quality milk, four cited improved definition of responsibility for quality in their organizations, and three cited greater efficiency in inspection work through use of the program. Others indicated no change, or offered no comment, to the question.

A very surprising result of the sending of the questionnaire to the managers of the plants was the development of a large number of inquiries as to the meaning of the program of the National Conference on Interstate Milk Shipments *(3)* *(4)*, what its procedure was, and how it functioned. This may have been due in part to continuing change in plant management personnel not otherwise informed by a parent organization. On the other hand, the inquiries were directed by several executive officials of organizations having at least several plants on the compliance list. Presumably the latter should know about the functions of the Conference. There appears to be an area of considerable scope in which informative work of the aims of the Conference better can be made known. This needs the assistance of all people interested in interstate milk shipments.

SUMMARY

In the year 1955, at least 25,000 shipments of milk were made according to the agreements of the National Conference on Interstate Milk Shipments. The shipments accounted for transfer of 697 million pounds of milk. In 1954 at least 20,000 shipments were made representing 488,000,000 pounds of milk.

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AN EVALUATION OF MILK QUALITY AS INFLUENCED BY DAILY VS. EVERY-OTHER-DAY PICKUP OF MILK COOLED IN FARM BULK TANKS[1]

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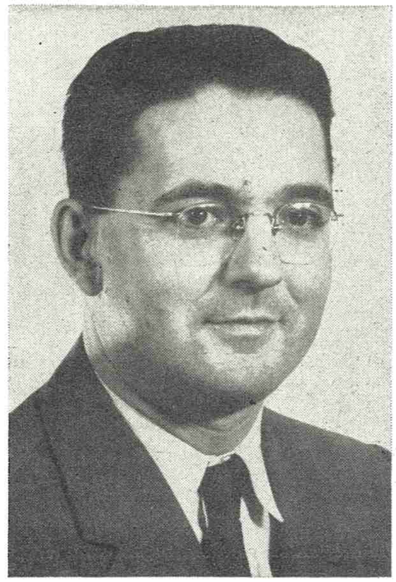
Bulk cooled milk obtained from farms using approved sanitation practices can be gathered on an every-other-day (EOD) schedule and maintain satisfactory raw quality during a normal period of holding prior to pasteurization. The quality of raw milk cooled in farm bulk tanks has been compared for daily vs. EOD pickup by several generally applied laboratory tests. Bulk cooled milk collected on an EOD schedule appears to have as good quality and as good storageability as milk obtained on daily pickup.



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Bulk milk cooling at the farm has become a firmly established practice throughout the country. The available literature, overwhelmingly of popular nature, is quite generally agreed that milk cooling has improved so markedly under the bulk handling system that it is now possible to alter can-cooling practices without lowering milk quality. The general tone of this literature from industry sources suggests that every-other-day (EOD) pickup is one of the inherent economic advantages of bulk handling and assumes that milk quality is as good or better than previously, even with less frequent collection from the farm (*6, 7, 8*).

Confirmatory evidence from non-industry sources is limited. The authors, in earlier publications (*2, 3, 4*), found improvement in over-all milk quality under bulk milk handling but that bacteria counts and flavor scores on individual farms were frequently worse than with can cooling systems. Marth *et al.* (*12*) and Smith *et al.* (*15*) showed that EOD pickup of milk did not lower bacteriological quality of the milk obtained from bulk tanks. These results, however, were obtained on samples from their University Farm as the sole source of supply. It was reported in the Proceedings of the 1954 Milk Industry Foundation Convention (*13*) that the plant at Pennsylvania State University had some farms where milk was being picked up on a 72-hour schedule with satisfactory results.

Despite industry attitudes that EOD pickup of bulk cooled milk does not lower milk quality, some Health Departments have not yet approved the principle of EOD pickup. A recent survey in Ohio (*11*) showed the 11% of the local Health Departments answering the questionnaire said their code would not permit EOD pickup. It is known that other Health Departments are now evaluating available evidence in order to take a position in the matter.

The Burlington plants of two major milk companies in the northeast receive milk from farms daily for part of the year and EOD at times when the tanks will hold at least four milkings. Since EOD pickup is considered an integral part of bulk handling by workers in industry and in view of the scarcity of pertinent information from the State Experiment Stations, a study was planned which would investigate the comparative quality of bulk tank milk under daily and EOD pickup systems.

The study has been divided into three parts. The first was a study of the quality of fresh milk samples collected after each milking of an EOD pickup system. The second was an evaluation of changes in quality during laboratory storage of raw milk samples collected on daily vs. EOD schedules. This was accomplished by taking samples at the second and fourth milkings from farm tanks on EOD pickup. The third was a determination of the ability of milk samples

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from EOD pickup to withstand several days of raw storage. In the latter study, the samples were taken at a receiving station from a tank car of milk collected from approximately 60 farms on the EOD schedule.

PART I

Experimental Procedure

Samples of well-agitated milk, from farms on an EOD pickup schedule, were collected from the bulk milk cooling tanks after the completion of cooling of each milking. Sterile dippers and sterile ground-glass stoppered bottles of approximately 250-ml. capacity were used for sampling. Samples were iced until returned to the laboratory and then immediately analyzed. Standard plate counts (32° C.), laboratory pasteurized counts (32° C.) and psychrophilic plate counts were made in accordance with *Standard Methods* (*1*) using Difco plate count agar. Test tubes holding approximately 10 ml. of milk for the laboratory pasteurized count were flamed above the milk line before being heated in a water bath at 145° F. for 30 minutes. Results are expressed as the logarithmic average of individual sample counts. Protein stability was determined by the method described by Storrs (*16*). The percent of acid-forming colonies was obtained according to the procedure of Wade *et al.* (*17*). The work of Watrous et al. (*18*) showed that the bromcresol purple and $CaCO_3$ used in this method had no effect on the total plate count. The volume percent of cream layer was divided by the Babcock fat test to give the creaming factor (*14*).

Results and Discussion

Twenty-four series of determinations made on the milk from five producers obtained during the summer and fall of 1954 are summarized in Table 1. These samples were obtained from a group of farmers using production methods representative of those used in the area. The plate counts indicated a wide range of bacteriological quality. The tanks were of two makes, both direct expansion, with capacities ranging from 60-300 gallons.

Table 1 shows that bacteria counts were almost identical for each of the four milkings. Furthermore not only did the averages for all samples remain almost constant, but the results on individual farms also showed the same uniformity. Also, the same pattern was demonstrated for the standard plate count, the laboratory pasteurized count, and the psychrophilic count and whether the milk was of excellent or poor bacterial quality. In only one instance (psychrophilic counts for farm C) was a noticeable increase shown but this increase cannot be considered significant from a bacteriological standpoint. The percentage of acid-forming colonies on the plates indicated no evident change in type of bacteria present in the samples of milk from different milkings under the EOD pickup system.

PART II

Experimental Procedure

Because the number of sources of milk was somewhat restricted in the early studies owing to the limited number of bulk tanks then in the area, a further study was planned after more tanks had been installed. Since the results of Part I showed such minor variation in bacteria counts for each milking under the EOD pickup system, it was decided to collect samples only after the second and the fourth milkings had been added to the tank and cooled. In this way, it would be possible to conduct the investigation without causing excessive use of time and materials.

Samples were obtained in the same manner as in Part I with the exception that they were collected from farms on EOD pickup only after the second and the fourth milkings rather than after each milking. Bottles holding the second milking samples were stored in the refrigerator at 38° F. (3.3° C.) so that analyses could be run on samples of the second and the fourth milkings at the same time. This was done in order that the milk from the first and the second milkings in the bottle would be the same age at plating time as the portion of milk from the first and the second milkings which was combined with the third and the fourth milkings in the tank. At the time of analyses, each sample was divided in three or five parts so tests could be repeated after three and five days of additional storage. Replicates of the first nine samples were stored at 41° F. (5° C.) In the remainder of the series, samples were divided so two replicates could be stored at 38° F. (3.3° C.) and two at 41° F. (5° C.). Laboratory pasteurized counts were determined on the fresh samples, and on the first nine samples after storage for five days at 41° F. (5° C.). Since no change was observed in laboratory pasteurized counts after holding the first nine samples for five days, this analysis was not made on aged samples during the remainder of the study.

Standard plate counts, laboratory pasteurized counts, psychrophilic counts, and protein stability tests were made on fresh and aged samples as in Part I. Resazurin dye reduction time was obtained following procedures in *Standard Methods* (*1*) with results reported as the time (hours) required for complete decolorization.

Reduced samples were held in the incubator to observe the character of the resultant curd. Flavor was recorded when sufficient sample remained for tasting by two or three judges.

Results and Discussion

Five series, comparing 60 samples (30 trials), were obtained to evaluate the keeping quality of bulk milk samples collected from the tanks after the second and fourth milkings. The results are summarized in Table 2. The 18 tanks included in this study were of six different makes, both ice bank and direct expansion, ranging in size from 150-1000 gallons capacity.

The data presented in Table 2 indicate that the conclusions made in Part I of the study were quite valid. Standard plate counts, laboratory pasteurized counts and psychrophilic counts were nearly identical for fresh samples removed from the bulk tanks after the second and the fourth milkings of an EOD pickup system. Protein stability as judged by the Storrs stability test was equally comparable with the results in Part I. Individual samples, with fresh Total Plate Counts which ranged from a few thousand per ml. to hundreds of thousands per ml. again showed the same

TABLE 1 – RESULTS OF SOME QUALITY EVALUATIONS OF BULK TANK MILK OBTAINED AFTER EACH MILKING FROM FARMS ON EOD PICKUP

Farm		Number of milkings in sample 1	2	3	4
A	SPC	310T	360T	150T	440T
	Lab. past. count	4900	13T	8800	5500
	Psychrophiles per ml.	160	160	490	200
	% acid forming	20	20	23	17
	Storrs value	70	70	67	64
	Creaming factor	3.78	3.66	3.86	3.82
B	SPC	140T	140T	120T	110T
	Lab. past. count	1100	1300	1500	1700
	Psychrophiles per ml.	230	230	100	140
	% acid forming	17	26	29	32
	Storrs value	58	57	59	56
	Creaming factor	3.61	3.84	3.62	4.20
C	SPC	130T	80T	130T	110T
	Lab. past. count	2500	1500	1800	1500
	Psychrophiles per ml.	2400	2200	13T	8000
	% acid forming	23	19	27	20
	Storrs value	68	66	68	62
	Creaming factor	3.96	3.38	3.38	3.44
D	SPC	6600	5100	5500	6700
	Lab. past. count	35	88	74	40
	Psychrophiles per ml.	300	160	88	120
	% acid forming	42	35	45	38
	Storrs value	67	64	69	59
	Creaming factor	3.42	3.58	3.58	3.40
E	SPC	51T	44T	47T	51T
	Lab. past. count	1600	1800	2500	3000
	Psychrophiles per ml.	330	470	160	310
	% acid forming	18	20	20	23
	Storrs value	70	73	66	69
	Creaming factor	3.84	3.62	3.46	3.42
Average	SPC	71T	62T	71T	71T
	Lab. past. count	960	1300	1300	1100
	Psychrophiles per ml.	390	360	390	380
	% acid forming	24	24	29	26
	Storrs value	67	66	66	62
	Creaming factor	3.72	3.62	3.58	3.66

T = Thousands

SPC = Standard plate count per ml. at 32°C.

TABLE 2 — EFFECT OF DAILY VS. EOD PICKUP ON THE STORAGE OF BULK TANK MILK

Series	No. of trials		Milkings in tank	Storage (days and temperature) 0	3(38°F)	3(41°F)	5(38°F)	5(41°F)
3/25/55		SPC	2	40T		320T		42M
			4	56T		300T		24M
		Past.	2	420				340
	5		4	420				500
		Psychro.	2	230		310T		45M
			4	250		270T		18M
		Storrs value	2	63		54		51
			4	59		58		53
3/31/55		SPC	2	69T		3.2M		16M
			4	65T		880T		17M
		Past.	2	1900				1700
	4		4	1800				760
		Psychro.	2	190		2.2M		22M
			4	340		900T		18M
		Storrs value	2	68		62		61
			4	65		59		56
3/27/56		SPC	2	16T	39T	180T	330T	9.2M
			4	20T	28T	120T	190T	9.4M
		Past.	2	59				
	5		4	85				
		Psychro.	2	60	14T	160T	520T	17M
			4	63	13T	76T	130T	15M
		Storrs value	2	66		>60		
			4	66		>60		
8/14/56		SPC	2	24T	100T	4.8M	5.1M	90M
			4	51T	140T	5.8M	4.4M	90M
		Past.	2	43				
	7		4	50				
		Psychro.	2	1700	120T	940T	1.0M	>10M
			4	3500	120T	830T	930T	>10M
		Storrs value	2	66	68	65	65	48
			4	66	66	64	66	35
8/15/56		SPC	2	22T	110T	1.0M	1.5M	98M
			4	20T	32T	880T	540T	98M
		Past.	2	500				
	9		4	350				
		Psychro.	2	680	42T	640T	300T	>10M
			4	410	11T	510T	280T	>10M
		Storrs value	2	63	63	58	60	28
			4	66	64	57	61	36

SPC = Standard plate count per ml. at 32°C.
Past. = Laboratory pasteurized count per. ml.
Psychro. = Psychrophilic plate count per ml.

T = Thousands
M = Millions

relationship as the summary of results for all of the samples. It was demonstrated with the first nine pairs of samples that the bacteria capable of withstanding laboratory pasteurization did not multiply during five additional days of refrigerated storage. Since these results were in agreement with an earlier report (5), no further study was made of the heat resistant population in aged samples of bulk tank milk.

Milk obtained either after the second or the fourth milkings was able to withstand three days additional storage at 38° F. (3.3° C.) without extensive bacterial multiplication. The few individual samples which did not conform to this general pattern nearly always had a relatively high psychrophilic count before aging. Considerable growth was observed when milk was stored for three additional days at 41° F. (5° C.). Five of the 21 daily samples and seven of the EOD samples stored at 38° F. (3.3° C.) for five days gave counts of 200,000/ml. or lower. All samples, regardless of original bacteriological quality, had counts in the millions after five days of storage at 41° F. (5° C.).

When psychrophilic and standard plate counts on individual samples were compared there was practically no difference in samples held for three and five days at either temperature. The summaries presented in Table 2 are somewhat misleading since dilutions made for the standard plate count on the samples held for five days at 41° F. (5° C.) and for the psychrophilic counts on samples held for five days at both temperatures were frequently too low to prevent crowded plates and quite inadequate estimates. It is interesting, however, to note that when storage temperatures of 38° F. (3.3° C.) and 41° F. (5° C.) are compared, significantly higher counts were obtained on the samples held at 41° F. (5° C.) with both Psychrophilic and Standard Plate Counts.

Resazurin reduction tests were of little value in evaluating storage deterioration of these milk samples. The one sample which did show relatively rapid reduction (<3 hours) after three days storage at either 38° F. (3.3° C.) or 41° F. (5° C.) had an extremely high population of psychrophiles on the fresh sample and these had multiplied to millions per ml. by the third day at either temperature of holding. However, other samples showed equivalent psychrophilic growth but failed to show any faster reduction of the dye. Aside from the one exception mentioned above, only a few samples (9 of 30) reduced the dye in less than three hours and all these had been held at 41° F. (5° C.) for five days. Many samples gave satisfactory dye reduction time when other tests showed them unsuitable for consumption. These results agree closely with earlier studies on psychrophilic activity in com-

TABLE 3 — CHANGES DURING STORAGE OF MILK FROM A COMBINED SUPPLY OF BULK TANK MILK OBTAINED FOR FIVE CONSECUTIVE DAYS FROM APPROXIMATELY 60 FARMS ON EOD PICKUP

Date		Storage time (hours)		
		24	48	72
4/15/56	SPC	22T	22T	35T
	Lab. past. count	320	400	270
	Psychrophiles per ml.	300	2100	4700
	Flavor — Raw	39 feed	39 feed	39 feed
	— Past. (no Cu)	40	40	40
	— Past. (with Cu)[a]	40	40	39 chalky
4/16/56	SPC	26T	24T	51T
	Lab. past. count	240	220	270
	Psychrophiles per ml.	2200	2700	23T
	Flavor — Raw	39 feed	39 feed	39 feed
	— Past. (no Cu)	40	40	40
	— Past. (with Cu)[a]	40	40	39 chalky
4/17/56	SPC	24T	18T	38T
	Lab. past. count	570	520	590
	Psychrophiles per ml.	2000	4200	12T
	Flavor — Raw	39 feed	39 feed	39 feed
	— Past. (no Cu)	40	40	39 chalky
	— Past. (with Cu)[a]	40	39 chalky	40
4/18/56	SPC	21T	29T	43T
	Lab. past. count	180	310	190
	Psychrophiles per ml.	2800	4300	4500
	Flavor — Raw	39 feed	39 feed	39 feed
	— Past. (no Cu)	40	40	40
	— Past. (with Cu)[a]	39 chalky	40	40
4/19/56	SPC	29T	38T	42T
	Lab. past. count	200	140	110
	Psychrophiles per ml.	2100	3400	6000
	Flavor — Raw	39 feed	39 feed	39 feed
	— Past. (no Cu)	40	40	40
	— Past. (with Cu)[a]	39 chalky	40	40

SPC = Standard plate count per ml. at 32°C.
T = Thousands
[a] = 0.25 ppm copper added before pasteurizing sample.

mercially pasteurized and bottled milk (5). Thus it would appear that the resazurin reduction test has very limited value as a quality test for bulk cooled milk and is of no use in evaluating differences (if any) in quality between milk collected on a daily or EOD pickup system.

Only one of the 32 samples, tasted after five days storage at 38° F. (3.3° C.), failed to retain its normal flavor. This was one of the samples collected after the second milking. On the other hand, 35 of the individual samples from the 26 pairs tasted after storage for five days at 41° F. (5° C.) gave pronounced off-flavors. It is interesting to note that 18 of the 35 were collected after the second milking and 17 were obtained after the fourth milking. It was also observed that off-flavor development was frequently more pronounced on the samples taken after the second milking than on the comparative sample collected following the fourth milking.

This phase of the study was started in the spring of 1955. It was then necessary to postpone further action temporarily but work was resumed in the spring of 1956, following an investigation and study of farm utensil and bulk tank cleaning problems. Thus the data for 1955 and 1956 show a rather interesting comparison. Although many of the tanks and much of the milking equipment used on the farms had some visible accumulation of milkstone during the 1955 studies while the tanks and equipment were clean in 1956, the data in Table 2 indicate that this change had little, if any, effect on the rate of multiplication of the bacteria in the milk during storage in the laboratory. Although data were not obtained during the 1955 trials on the population increases during storage at 38° F. (3.3° C.), bacteria counts on samples held for three and five days at 41° F. (5° C.) during the spring of 1955 followed nearly the same pattern as the samples obtained during the spring and summer of 1956. This would indicate that, regardless of the state of cleanliness in the milkhouse, milk must be cooled and held at a temperature lower than 41° F. (5° C.) if the bacteria count is to remain satisfactory during several days storage of the raw milk prior to pasteurization. It would also indicate that there is some question concerning the value of bacteria counts on fresh samples of milk as a sole criterion of the sanitary quality of milk from farm bulk milk cooling tanks.

These results serve to again emphasize the importance of the work done on the effect of delayed cooling of milk more than 25 years ago by Frayer (10) in which he concluded that milk must be cooled *immediately* to 40° F. or below and held there for "the most consistently beneficial results." His further comment (9) that "the longer cooling is delayed, the poorer – bacteriologically speaking – will be the milk when it is a day or two old and this is true no matter how low was its bacterial content when fresh," is equally true of milk in the bulk tank era.

The data obtained in the second part of this study thus substantiate the results of Part I to the effect that little, if any, real difference can be noted between samples obtained after the second and the fourth milkings of an EOD collection system.

PART III

Experimental Procedure

Samples were obtained for five consecutive days from a country plant which collected milk from tanks on an EOD pickup schedule for the Boston market. Each sample was obtained from a filled tank car holding approximately 38,000 pounds of milk and represented the combined deliveries of nearly 60 farms.

Three replicate samples were obtained from the filled tank car. They were aseptically collected in half-pint milk bottles which had been washed in the plant bottle washer, then conveyed to the bottle capper and capped. These bottles were taken to the receiving station and samples collected. They were iced until delivery to the laboratory where they were stored in the refrigerator at 38° F. (3.3° C.).

One replicate was removed for analysis after storage for 24 hours, the second after storage for 48 hours and the third after 72 hours of refrigerated storage. Standard plate counts, laboratory pasteurized counts, and psychrophilic counts were made in conformity with *Standard Methods* (*1*) as in Part I. Three flavor determinations – one on raw milk, one on a portion pasteurized at 145° F. (62.8° C.) for 30 minutes, and the third on a portion to which 0.25 ppm of Cu (as $CuSO_4$) had been added prior to pasteurization at 145° F. (62.8° C.) for 30 minutes – were made by three experienced judges.

Results and Discussion

A study of keeping quality of a combined supply of milk collected from farms on an EOD pickup schedule again seems to justify this plan of operation. Samples of milk received for five consecutive days from nearly 60 farms on EOD collection were all of excellent quality, even after 72 hours of additional laboratory storage.

Table 3 shows that bacteria counts, after three days of laboratory holding, were well within established limits for fresh milk. No flavor deterioration was evident, even when copper was added prior to pasteurization.

This milk originated on farms producing for a Grade A market, but it would appear that the original quality should be readily attainable on any properly managed farm supplying bulk tank milk.

SUMMARY

The quality of the milk obtained by two local milk plants from 19 farms on an EOD pickup schedule has been evaluated by a number of generally accepted quality tests. Results support the opinion of milk plant operators that less frequent farm collection does not produce any lowering of quality.

Fresh samples of milk obtained after each milking of an EOD pickup system gave almost identical standard plate, laboratory pasteurized and psychrophilic counts. Protein stability was lowered slightly but not enough to seem important. Some changes were noted in creaming ability but this did not appear to be caused by EOD pickup.

The storage quality of milk also did not appear to be affected by less frequent collection of the farm supply. Results demonstrated that milk must be held below 40° F. for successful raw storage life but this was equally true for daily or EOD delivery.

Results obtained on samples of a combined plant supply gave evidence that milk, produced on farms where recommended sanitation methods are practiced, can be collected on an EOD plan and maintain satisfactory raw quality during a normal period of transportation or holding prior to pasteurization.

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PIPELINE-MILKER AND BULK-TANK MILK FILTRATION[1]

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The filtrition efficiency of various materials used in pipeline filters showed that the best filtration was secured using bonded non-woven cotton discs, followed in order by flannel fabric, muslin fabric, and flannel fabric after use in four milkings. However, bag filters of flannel and muslin gave inadequate filtration. The tests were made using a milk flow splitting apparatus, dividing milk equally between two kinds of filter materials, and by measuring the number and size of sediment particles found in one square centimeter areas of Lintine sediment testing discs after drawing samples from bulk tanks. Best uniformity in numbers of particles was secured when testing one gallon portions.

Pipeline milking installations as an accessory to bulk milk tanks are increasing. Filtration of the milk is a part of the system. The effectiveness of such filtration is not generally known. The study reported herein was made to determine the practicality of various filters for pipeline milkers and to ascertain the milk filtering ability of three different kinds of filter material used. No previous study concerning these filtering problems has been reported.

Filtering milk produced by pipeline milking systems must be confined to some kind of in-line filter. Three kinds of such milk filter systems, using several kinds of filtering material are available. These include: *(a)* cylinder, with woven fabric bag; *(b)* dome, with non-woven fabric disc; and *(c)* a unit filter either with a disc or with a non-woven square fabric wrap.

Most research shows that filtering of milk does not improve its keeping properties. However, Marquardt *(3)* reported deterioration in flavor quality with retention of dirt in milk. Other important reasons exist for removing sediment. Sommer *(4)* directs attention to a "natural and decent impulse to remove dirt promptly, if any finds its way into milk" and to the use of sediment testing as a criterion of milk quality.

The 1953 edition of the U. S. Public Health Service "Milk Ordinance and Code" *(5)* states: "When milk is strained, strainer pads shall be used and shall not be reused." The code further states: ". . . in order to maintain products of high quality, it is recommended that each plant or receiving station make tests of each producer's milk, including odor, temperature . . . sediment" and that "tests should be made monthly or oftener, and plants should reject milk of abnormal odor . . . or milk found unsatisfactory by . . . sediment tests. Follow up inspections should be made . . . to discover and correct the cause."

Filtering media serve useful purposes in revealing care in milking practices and abnormal appearing milk. Some types of filter media or filtering units make it possible to observe the amount and nature of materials removed from milk better than others. A clean and effective filter unit should indicate that no extraneous material or abnormal milk entered the milk supply.

Filtering efficiency is measured by the completeness of extraneous matter removal, which, in turn, is indirectly related to the speed of straining. As a rule, speed of milk filtration increases directly with the size of the openings of the filtering material. However, completeness of filtration increases as the size of the openings become smaller. Dahlberg and Marquardt *(1)* found that the largest particle of sand which could pass through a milk filter was 30 to 40 microns in diameter. Thus, they concluded the filter pore size should be somewhat smaller than those dimensions. Also, these investigators observed that filter pores became plugged with fat when the openings were minute, for example, the size of fat globules (10 to 12 microns).

Procedures

Milk from the university dairy barn pipeline milker was filtered using three kinds of filters; (*a*) the unit filter, *(b)* the bag cylinder, and *(c)* the dome filter with disk. Filter *(a)* was located in the milk tube near the claw of the milking machine and filters, *(b)* and *(c)* were in the pipe near the bulk tank. Filters in the unit filter consisted of a fibre-bonded non-woven fabric square, those in the cylinder of a 56 x 56 thread count muslin bag weighing 3.6 ounces per square yard, or a 46 x 42 thread count flannel bag weighing 4.1 ounces per square yard; whereas those in the dome filter were of fibre-bonded, double faced gauze non-woven fabric in disc form. The bag and unit filters, encased in cylinders, were so connected that the milk entered the filter bags through the outer wall. The single filter-disc used in the dome filter was supported by a multi-perforated stainless steel plate, with the milk flowing downward to the holding tank. Each of the filters was tested alone

[1]Michigan Agricultural Experiment Station General Article No. 2057.

[2]Presently employed by Quartermaster Food & Container Institute, 1819 Pershing Road, Chicago 9, Illinois.

TABLE 1 — THE EFFICIENCY OF VARIOUS FILTERS IN REMOVING SEDIMENT FROM PIPELINE, BULK-TANK MILK.

No. of trials	Kind and method of using filter material	Amount[a] of sediment taken from filtered bulk milk when various quantities were tested: 0.5 qt.	1.0 qt.	2.0 qt.	3.0 qt.	4.0 qt.
10	Non-woevn disc	5	8	9	12	17
3	Flannel bag only	6	26	42	77	86
3	Used flannel bag only	35	71	98	242	275
11	Muslin bag only	13	35	62	108	121
7	Non woven disc in dome and non-woven square in unit-filter	5	6	9	8	15
3	Flannel bag and non-woven square in unit-filter	12	16	15	26	29

[a]Number of particles per sq. cm. on standard 1.25 inch Lintine sediment discs.

and in combinations as shown later in Table 1.

The cows were prepared for milking by washing, massaging and drying the teats and udders just prior to milking. The cows were bedded with shavings and were milked with long-tube pipeline milker units. On occasions, teat cups dropped off during milking causing wood shavings to be drawn into the milk line.

Split-flow-testing

A special milk-flow divider was used to compare filtration efficiences of different filtering materials. As the milk was discharged from the pipeline, a milk-flow splitting apparatus (Figure 1) divided the milk so equal quantities passed through each of two kinds of filter materials described above. The apparatus was equipped with a 2.25 inch diameter Lintine sediment tester disc at each filter outlet to collect any sediment remaining in the milk filtered through the test filter media. Pressure guages were used to measure the pressure build-up on each Lintine disc. Some filter efficiency tests were made, limiting the pressure build-up to 5 p.s.i.

Other comparisons were made using the time required to filter definite quantities of milk. By calculation, 23.4 pounds of milk filtered through a 2.25 inch Lintine disc was equivalent to filtering 8.6 pounds through a standard 1.25 inch Lintine disc.

Bulk tank testing

Sediment tests of milk from the bulk tank were made by pumping portions of milk through a standard 1.25 inch Lintine disc by means of a motor-driven tubing pump fitted with a standard sediment tester disc holder. The milk was stirred continuously for at least three minutes before and during sampling. No attempt was made to control the position of the tube inlet, which thus provided a random sample from the stirred milk. To facilitate pumping the cold milk through the Lintine sediment testing disc, a portion of the coiled suction tube was submerged in a pail of hot water.

The amount of sediment collected on the Lintine discs was determined by actual count: (*a*) of the particles present on a 1 sq. cm. center area, under a binocular with 6x magnification; and/or (*b*) under a 13.2x magnification of a sightly smaller area. All data were resolved to a 1 sq. cm. area basis.

RESULTS

Comparative efficiency of muslin bag and cotton disc filters with split-flow filtering.

An attempt was made to evaluate the efficiency of filter materials according to the number of sediment particles found on Lintine sediment discs obtained from split-flow filtered milk. However, counting the particles on the sediment discs was not feasible because of their great number and minute size. Also, many of the smaller particles were actually imbedded within the Lintine discs.

The sediment discs indicated that a decided difference existed between the ability of muslin bags and gauze-faced non-woven fabrics discs to remove sediment from pipeline milk. Photographs of these sediment discs obtained after 23.4 pounds of milk had been filtered through each material, and after continuous filtration had built up a pressure of 5 p.s.i. on either of the discs, are presented in Figures 2 and 3, respectively. Here, the sediment test discs show the relative amounts of sediment in milk which had been filtered through muslin bags (series A, several trials) and through non-woven discs (series B, several trials). The amount of milk passing through each sediment test disc was identical in every case, in A discs as in B discs with the same number. The heavier discoloration of the A discs indicate efficient filtration with cylindrial muslin bags than with non-woven discs in pipeline milk filtration. Results shown in Figure 3 substantiate this observation. In this case, the sediment tests were made of the milk after an internal pressure of 5 p.s.i. had been built up on one of the filter lines. This pressure was, in all trials, reached only in the chamber in which the milk had passed through the muslin-filter. The pictures actually show pressure spots on the sediment discs taken from this milk (series A).

Obviously, the reason for pressure build-up in one unit and not in the other was the more efficient filtration obtained through the non-woven disc than

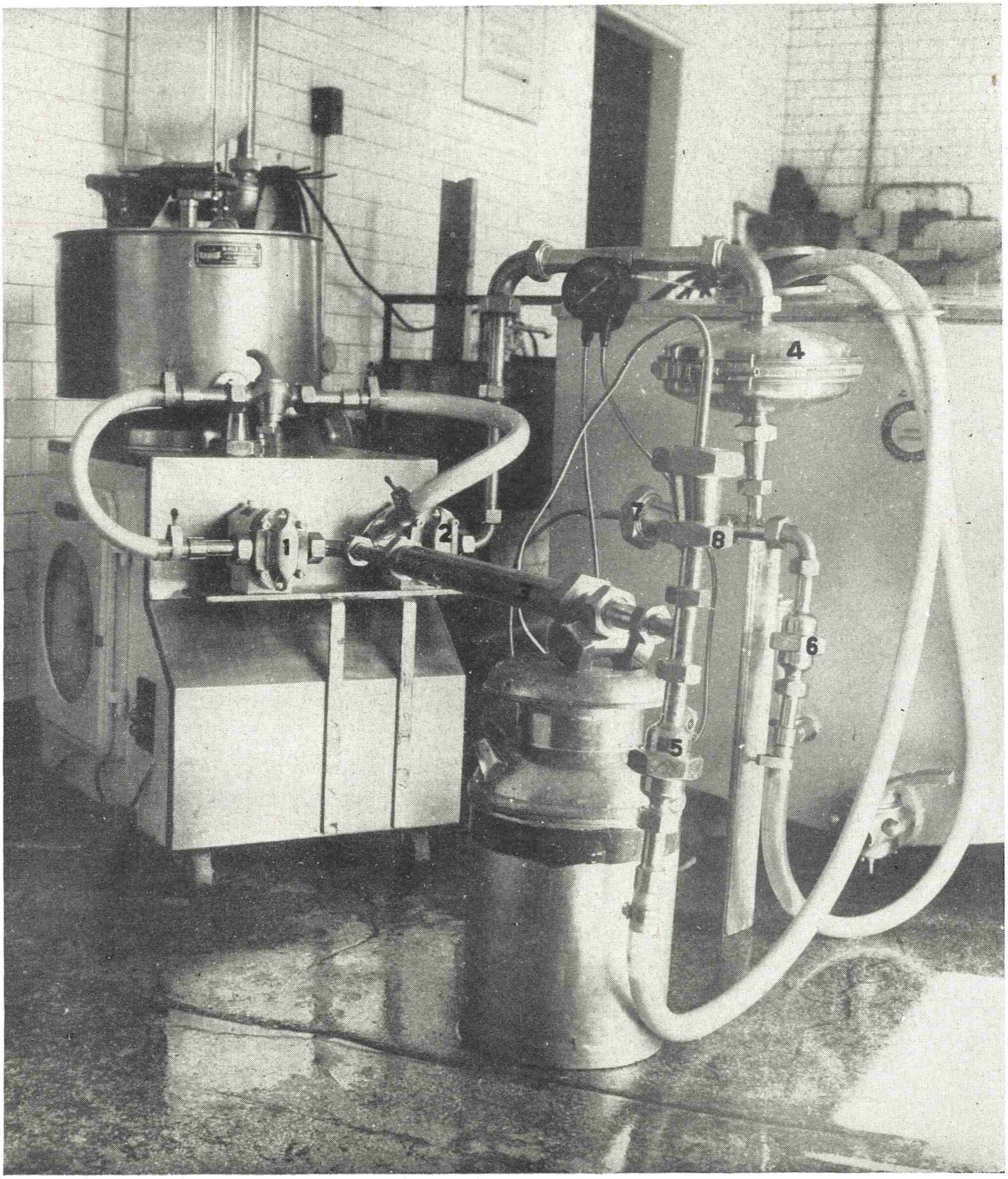

Figure 1. A milk flow splitting apparatus with pumps 1 and 2 used to divide the milk equally between two types of filters: (*a*) bag-in-cylinder; and (*b*) disc-in dome, indicated by 3 and 4. Lintine discs were placed down stream in unions 5 and 6. Pressure taps 7 and 8 indicated pressure build-up from sediment deposition on Lintines. (Provided through courtesy of Johnson & Johnson.)

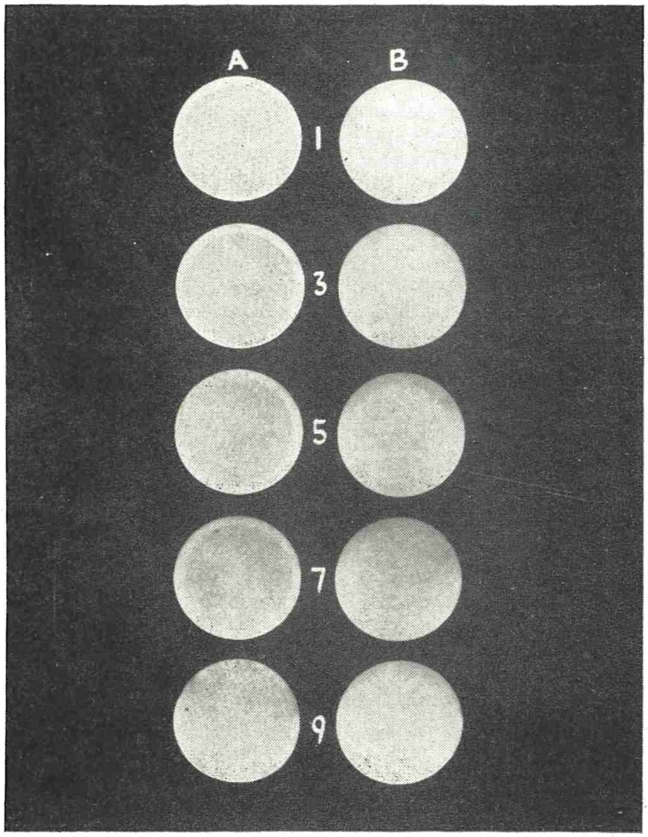

Figure 2. Differences in sediment density between discs in series A, after filtering through muslin fabric, and in series B after filtering through bonded gauze discs, after several 24.7 lb. runs per strainer.

that through the muslin-bag. Thus. the partially churned or clustered fat globules and sediment particles were screened from the milk, leaving it in a condition to flow through the Lintine discs without building up pressure. Incidently, the most rapid pressure build-up after filtering through muslin, occurred when conditions favored churning in the line. Prominent among these conditions were, exposure of the pipelines to cold air, thereby partially cooling the milk, and turbulence of milk at risers in the milk line. For these and other reasons (2) most of the risers were omitted from the line.

Comparative efficiency of various materials routinely used in pipeline, bulk-tank production.

The materials used in this phase of the study included cotton flannel, gauze faced non-woven fabric discs, and muslin with some variants as shown in Table 1. From three to eleven trials were made on each material. The filtering abilities of these materials were evaluated on the basis of their respective abilities to render the milk free of sediment. Data relative to the number of sediment particles found on a specific area of standard sediment discs obtained from various quantities of filtered milk are presented in Table 1. A single filter of each of the types studied was used in the first four test series, whereas double filtration with two filters were used simultaneously in the last series as shown.

Non-woven discs filtered the milk more effectively than did other materials tested, regardless of the quantity of milk examined. Flannel and muslin bags were second and third best, respectively. However, reused cotton flannel was ineffective as a filter, judged by the comparatively high numbers of sediment particles retained in the milk.

The data show a consistent relationship between the size of sample tested and the sediment particle count, the highest count being observed in tests from the 4-quart samples and the lowest from those taken from the 1-pint sample. Better consistency in the number of particles per square cm. of area was obtained when 3 and 4 quart samples were used than with lesser quantities.

The most complete filtration was obtained using the bonded non-woven disc either with or without the unit filter. Only 15 and 17 sediment particles, respectively were noted per sq. cm. on sediment discs

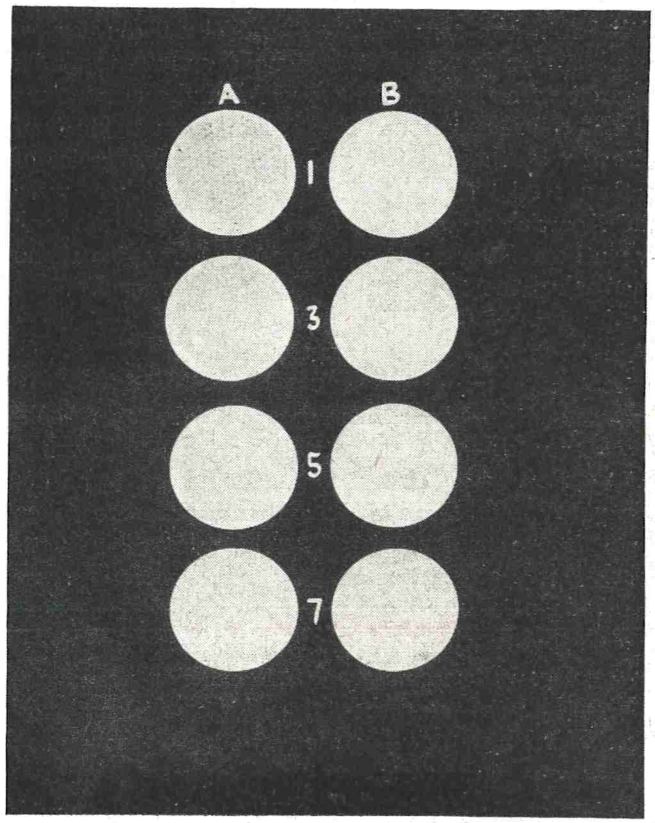

Figure 3. Differences in sediment density between discs in series A after filtering through muslin fabric and in series B after filtering through bonded gauze discs, after several runs when flow was continued until 5 p.s.i. was reached on one of the discs.

taken from four quarts of milk so filtered. Flannel bag plus non-woven square in unit-filters yielded a sediment particle count of 29 from the same quantity of milk, thus rating under the cotton discs in effectiveness. The flannel and muslin bags, yielding 86 and 121 sediment particles per sq. cm. in four quarts of milk, respectively, were even less effective as filters than the flannel.

Reuse of the cotton flannel bag gave poor filtration. A sediment test of four quarts of milk filtered through a cotton flannel bag used four times showed an average count of 275 sediment particles per sq. cm.

Size of sediment particles found in milk filtered through different filter materials

Sediment particles on Lintine test discs, taken from 4-quart samples of milk filtered through various materials, were selected at random and measured. The particles found in milk filtered through the non-woven disc filter were smaller on the average, 45 x 60 microns, than those from milk going through the flannel and muslin bag filters. The largest particle noted in tests from the non-woven disc filter measured 116 x 125 microns, whereas those examined from milk filtered through a new and a 4-time used cotton-flannel bag measured 125 x 249 and 71 x 1273 microns, respectively. The largest particle found in the milk filtered with the muslin bag were of the dimensions of 400 x 1600 microns. These data seem to be consistent with those showing the relative efficiencies of filter material (Figs. 2 and 3, Table 1). There were more particles of a larger size in the milk in the tank when flannel or muslin were used in the in-line filters than when the non-woven disc filter was used.

Discussion

During this investigation, day-to-day sediment contamination of the pipeline milk varied considerably. Apparently, some contamination could never be entirely avoided. Despite more-than-usual care taken to have the stables clean and the udders and teats washed free of soil immediately before milking, some foreign particles did get into the milk.

As pointed out under "Procedure" teat cups dropped off cows occasionally during milking permitting the entrance of wood shavings. This condition should be avoided by supporting the teat cup assembly when cups drop off the teats.

Even under the finest conditions of pipeline milk production, some sediment will find its way into milk. Filtration is desirable to remove the sediment particles as rapidly and completely as possible.

The choice of filtering material should be made on the basis of the completeness of sediment removal rather than on the speed of filtration. High-speed filtration is usually associated with high porosity and inadequate removal of sediment particles. This study proved bonded non-woven fabric disc filters superior to muslin or flannel bags for pipeline filtration of milk. Flannel, used once in in-line bags or in unit filters gave much better sediment removal than muslin bags. Cotton flannel bags, used, then washed and reused as many as four times, were ineffective in sediment removel. Obviously, the filtering efficiency decreased as the downy cotton flannel nap became compacted or removed with wear.

Sediment testing of bulk-tank milk must be done under conditions which are quite different than those which are encountered in sediment testing of milk received in cans. The bulk-tank milk represents a larger volume of milk at a lower temperature, usually, around 40° F. This temperature is not conducive to quick tests by the present methods of sediment testing. If the present sediment standards, based on bottom-of-can samples, are to apply to bulk tank milk, then it is necessary to test a much larger mixed-milk sample than now used. For that reason, quantities of mixed milk ranging from one to four quarts were tested for sediment. The data from Table 1 show that the sediment particle count was very consistent when three and four-quart portions of the stirred milk were tested. Such consistency was absent when the pint, quart and 2-quart portions were tested. It is therefore suggested that testing equipment should be employed that will rapidly sample 1-gallon portions of milk.

While unit filters, inserted in the milk line between the individual milker and the main pipeline, have the advantage of immediate filtration of cow-warm milk and of excluding sediment particles that enter milk at the point of milking, they do not exclude particles that may enter from within the line. This latter may be quite objectionable. In one instance during this study, pipeline contamination consisted of rubber particles from the diaphragm pump. In other instances, churned butter granules, resulting from excessive agitation caused by air intake and pipeline risers, were noted. Thus, a filter at the inlet to the bulk tank would appear to be advisable, in addition to unit filters.

Counting sediment particles on Lintine discs obtained in split-flow milk filtration was not satisfactory. Too many particles were present and too many were imbedded deeply in the fabric to make this measurement of filtration efficiency feasible. Rather, viewing the overall discs and noting the dark discoloration which reflected density of sediment was preferred.

One of the striking observations made during this study was the rapid build-up of pressure against the Lintine sediment test filter after the milk was filtered through muslin, without a similar rise in pressure against the Lintine when non-woven filters were used. One apparent reason for the higher pressure build-up was inadequate filtration of the partially churned butter granules by the muslin strainer. When conditions responsible for churning in the pipeline were removed, the pressure build-up on the muslin-filter side of the split flow was not so rapid, but still occurred, even though no butterfat granules were present. Thus, it was obvious that the greater number of particles of sediment deposited on the Lintine, downstream from the muslin, accounted for the more rapid rise in pressure on the Lintine than on the Lintine downstream form the non-woven fabric.

Bag filters were inadequate for the removal of the sediment particles normally found to enter milk during milking, shown by filtration tests involving the use of milk flow-splitting apparatus, as well as by counting sediment particles from tank-drawn samples. Reuse of bags for filtration appeared to add greatly to this inefficiency while also adding to the hazard of bacterial contamination.

SUMMARY AND CONCLUSION

The quality of four milk filtering materials was measured by filtering milk through these materials, then refiltering through standard Lintine sediment testing discs. The materials tested were: (*a*) bonded non-woven discs, (*b*) flannel fabric (*c*) muslin fabric, and (*d*) flannel fabric reused four times, each use followed by washing. Differences in quality of filtration were secured by observing the density of sedimentation on Lintine discs when using two of the filtering materials in a flow-splitting apparatus, and by measuring the size of sediment particles and the number of particles that were found in one square centimeter areas when various sized samples were drawn from a bulk tank. Best performance was secured with the bonded non-woven discs, followed in order by flannel fabric, muslin fabric, and flannel fabric after four times used. Bag filters of flannel and muslin fabric gave inadequate filtration.

Sediment testing of bulk tank milk required the filtering of one-gallon portions in order to secure the best uniformity of particle counts from stirred milk.

The dome filter disc made possible the means for an immediate observation of the cleanliness of the milking operation.

ACKNOWLEDGEMENTS

Acknowledgement is due E. V. Painter and G. L. Weir of Johnson and Johnson Company, Chicago, Illinois, for assisting in operating apparatus used in this study and the Johnson and Johnson Company for a grant for this study, for the use of a milk flow-splitting machine, and for a bulk tank sediment test device.

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PROGRAM

FORTY- FOURTH ANNUAL MEETING

INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, INC.

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SPECIAL ACTIVITIES PROGRAM

Kentucky and Indiana State Associations

MONDAY, OCTOBER 7, 1957

9:00 *A.M.*–12 *Noon*–Meeting of Executive Board with Local Arrangements Committee
1:30 *P.M.*– 5:00 *P.M.*–Individual Committee Meetings
1:30 *P.M.*– 3:00 *P.M.*–Meeting of Journal Editors with Executive Board
3:00 *P.M.*– 5:00 *P.M.*–Meeting of Council with Executive Board
2:00 *P.M.*– 7:00 *P.M.*–Registration
7:00 *P.M.*– 9:00 *P.M.*–Informal Reception South Room – Brown Hotel.

TUESDAY MORNING — OCTOBER 8, 1957

HAROLD B. ROBINSON, *President-Elect* IAMFS Presiding

8:00 *A.M.*–Registration
10:00 *A.M.*–Invocation
10:05 *A.M.*–Address of Welcome:
HON. ANDREW BROADDUS, *Mayor*
Louisville, Kentucky
Introduced by RUSSELL E. TEAGUE, M. D.
Commissioner of Health, Commonwealth of Kentucky

10:20 *A.M.*–Presidential Address:
MR. PAUL CORASH, *President*
New York City Department of Health
New York, N. Y.
Appointment of Nominating Committee
Charge to the Committee

10:45 *A.M.*–"The International Association of Milk and Food Sanitarians, Inc., Its Youth, Adolescence, and Maturity, with the Twentieth Anniversary of the Journal of Milk and Food Technology"
DR. JOHN H. SHRADER
Waterville, Vermont
Introduced by MR. F. C. BASELT
American Can Co., New York, N. Y.

11:15 *A.M.*–"The Report of the Committee on Applied Laboratory Methods"
MR. J. C. MCCAFFREY, *Chairman*
Illinois Department of Public Health
Chicago, Illinois

11:30 *A.M.*–"Containers, Insulation and Refrigeration for Split Milk Samples"
MR. CECIL B. DONNELLY and DR. LUTHER A. BLACK
U. S. Public Health Service

Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio

12 *Noon* – Announcements

LUNCHEON RECESS

TUESDAY AFTERNOON — OCTOBER 8, 1957

A. P. BELL, *Director of Sanitation*
Louisville – Jefferson County Health Department
Presiding

1:45 *P.M.*–Film

2:00 *P.M.*–Door Prize Drawing

2:15 *P.M.*–"Report of Committee on Research Needs and Applications"
DR. SAM H. HOPPER, *Chairman*
University of Indiana Medical Center
Indianapolis, Indiana

2:30 *P.M.*–"The Clean Milk Program of the Food and Drug Administration"
MR. ROBERT S. ROE, *Director*
Bureau of Biological and Physical Sciences, Food and Drug Administration
U. S. Department of Health, Education & Welfare Washington, D. C.

3:00 *P.M.*–"The Report of the Committee on Dairy Farm Methods"
DR. ROBERT METZGER, *Chairman*
Dairymen's League Cooperative Assoc., Inc., New York, N. Y.

3:15 *P.M.*–"Virginia's Tourist Establishment Sanitation Program"
MR. JAMES W. SMITH, *Director*
Tourist Establishment Sanitation
Commonwealth of Virginia Department of Health, Richmond, Va.

3:45 *P.M.*–Local Tours

7:00 *P.M.*–Smorgasbord

7:00 *P.M.*–Tri-Cities Dairy Technology Society Monthly Dinner Meeting:
Plantation Room –Sheraton-Seelbach Hotel
Speaker: Dr. C. K. Johns, Ottawa, Canada
Subject: "Some Observations on Milk Sanitation in Europe"

WEDNESDAY MORNING — OCTOBER 9, 1957

F. W. BARBER, 1st *Vice President IAMFS*
Presiding

9:00 *A.M.*–Film

9:15 *A.M.*–Door Prize Drawing

9:25 *A.M.*–Report of Nominating Committee

9:30 *A.M.*– "The Responsibility of the Dairy Industry to the Consumer"
DR. J. C. FLAKE
Evaporated Milk Association
Chicago, Illinois

10:00 *A.M.*–"Report of the Committee on Food Equipment"
MR. DAVID E. HARTLEY, *Co-Chairman*
Indiana State Board of Health
Indianapolis, Indiana

10:15 *A.M.*–"Some Forms of Adulteration in Dairy Products."
DR. A. H. ROBERTSON
State Food Laboratory
Department of Agriculture and Markets
Albany 1, New York

10:45 *A.M.*–"Report of the Committee on Sanitary Procedure"
MR. C. A. ABELE, *Chairman*
Diversey Corporation
Chicago, Illinois

11:00 *A.M.*–"The Use of Plastics in the Milk and Food Industry
DR. D. F. SIDDALL, *Director*
Research and Development
U. S. Stoneware Co.
Akron, Ohio

11:30 *A.M.*–"The Cleanability of Materials in Contact with Milk"
MR. G. L. HAYES, *Supervisor*
Bacteriological Group
Technical Service Division
American Can Company
Maywood, Illinois

12 *Noon* – Announcements

LUNCHEON RECESS

WEDNESDAY AFTERNOON — OCTOBER 9, 1957

SARAH VANCE DUGAN, *Director*
Food and Drug Division
Kentucky Department of Public Health
Presiding

1:45 *P.M.*–Film

2:00 *P.M.*–Door Prize Drawing

2:15 *P.M.*–"Strontium 90 Measurements in Food"
DR. MERRILL EISENBUD, *Manager*
New York Operations Office
U. S. Atomic Energy Commission
New York, N. Y.

2:45 *P.M.*–"Report of the Committee on Frozen Foods"
MR. FRANK E. FISHER, *Chairman*
Indiana State Board of Health
Indianapolis, Indiana

3:00 *P.M.*–"Radiation Processing of Food"
MR. G. F. GARNATZ, *Director*
Kroger Food Foundation
Cincinnati, Ohio

3:30 *P.M.*–"Report of the Committee on Communi-

cable Diseases Affecting Man"
DR. R. J. HELVIG, *Chairman*
U. S. Public Health Service
Washington, D. C.

3:45 *P.M.*—"Report of the Committee on Education and Professional Development"
DR. JOHN J. SCHEURING, *Chairman*
University of Georgia, Athens, Georgia

4:00 *P.M.*—"Useful Techniques in the Development of a Food Sanitation Program"
MR. CLYDE ELLER, *Director*
Sanitation Division
Tulsa City-County Health Department
Tulsa, Oklahoma

4:30 *P.M.*—"Current Status of Sanitarian Registration Legislation in the United States"
MR. KARL K. JONES
Indiana State Board of Health
Indianapolis, Indiana

7:00 *P.M.*—Banquet
Crystal Ballroom — Brown Hotel
Master of Ceremonies, DR. C. K. JOHNS
Dairy Technology Research
Canadian Dept. of Agriculture
Science Service Bldg.
Ottawa, Ontario, Canada
Banquet Speaker: HON. A. B. CHANDLER, *Governor*, Commonwealth of Kentucky
Presentation of Past President Certificate to H. S. ADAMS by PAUL CORASH, President
Presentation of Citation Award and Sanitarian's Award* by IVAN E. PARKIN, *Chairman*, Committee on Recognition and Awards
*The Sanitarians Award is supported jointly by the Diversey Corporation, Klenzade Products, Inc., Oakite Products, Inc., Olin Mathieson Chemical Corporation, and Pennsalt Chemical Co. and is administered by the International Association of Milk and Food Sanitarians, Inc.

THURSDAY MORNING — OCTOBER 10, 1957

WILLIAM V. HICKEY, *2nd Vice President IAMFS*
Presiding

8:45 *A.M.*—Film

9:00 *A.M.*—Door Prize Drawing

9:15 *A.M.*—"Report of Committee on Membership"
MR. HAROLD WAINESS, *Chairman*
Harold Wainess and Associates
Chicago, Illinois

9:30 *A.M.*—"Development and Present Status of Dairy Waste Disposal"
DR. H. G. HARDING
Research Laboratories Division
National Dairy Products Corp.
Oakdale, L. I., New York

10:00 *A.M.*—"Report of the Committee on Baking Industry Equipment"
MR. VINCENT T. FOLEY, *Chairman*
Kansas City Health Department
Kansas City, Missouri

10:15 *A.M.*—"Food Sanitation at the 1957 Boy Scout Jamboree"
MR. ARCHIE B. FREEMAN
U. S. Public Health Service
New York, New York

10:45 *A.M.*—"Report of the Committee on Ordinances and Regulations"
MR. DON H. RACE, *Chairman*
Dairy Products Improvement Institute
Ithaca, New York

11:00 *A.M.*—"The Sanitary Aspects of Automatic Vending of Foods and Beverages"
MR. DAVID E. HARTLEY, *Chief*
Retail Food Section
Indiana State Board of Health
Indianapolis, Indiana

11:30 *A.M.*—"Current Status of 3A Symbol Utilization"
MR. C. A. ABELE, *Secretary*
3A Symbol Administrative Council

11:45 *A.M.*—"Driver Training and Laboratory Problems in the Bulk Tank Pickup Operation"
DR. W. C. LAWTON, *Director*
Quality Control Laboratory of Minneapolis-St. Paul
St. Paul, Minnesota

12:15 *P.M.*—Announcements

LUNCHEON RECESS

THURSDAY AFTERNOON — OCTOBER 10, 1957

PAUL CORASH, *President* IAMFS
Presiding

1:45 *P.M.*—Film

2:00 *P.M.*—Door Prize Drawing

2:15 *P.M.*—Business Meeting
Election of Officers
Report of Executive Secretary, MR. H. L. THOMASSON, Shelbyville, Indiana
Report of Secretary-Treasurer
DR. HOWARD H. WILKOWSKE, Gainsville, Fla.
Report of Resolution Committee:
MR. H. S. ADAMS, *Chairman*
University of Indiana Medical Center
Indianapolis, Indiana
Installation of Officers

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NEWS AND EVENTS

AUTHORIZATIONS TO USE THE 3-A SYMBOL

The concerns the names of which are listed below have been granted authorization to affix the 3-A Symbol to the models of equipment listed, by the 3-A Sanitary Standards Symbol Administrative Council. The Council emphasizes that this is not to be considered a complete roster of concerns which offer equipment conforming to pertinent 3-A Sanitary Standards.

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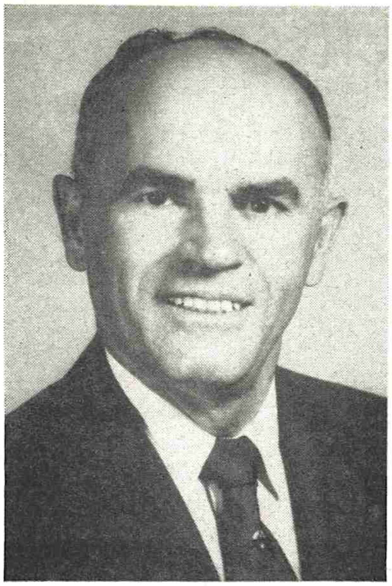
Blackburn Stainless Steel Products
Models: Oval Holding—150-2500 gals.
Bottom Refrigerated
Full Refrigerated

Pumps for Milk and Milk Products —0201
No. 65 Kenosha, Wisconsin
G. S. H. Products Corporation,
Model Nos: 135, F-135, FH-135, 136, F-136, FH-136, F-140, FH-140, F-141, and F-142.

Fittings for Sanitary Piping — 0800-0806
No. 67 Kenosha, Wisconsin
G. S. H. Products Corporation,
Model Numbers on file. List too voluminous for publication.

Inlet and Outlet Leak Protector Valves - 1400
No. 69 Kenosha, Wisconsin
G. S. H. Products Corporation,
Model Nos: 10F, 10FL, 10CL, and 11 CL.



KRIENKE RETURNS FROM COSTA RICA ASSIGNMENT

Walter A. Krienke, associate dairy technologist with the University of Florida Agricultural Experiment Station and Sec.-Treas. Florida Association of Milk and Food Sanitarians, has returned recently from a tour of duty in Costa Rica, where he spent seven weeks advising with a milk producers' cooperative and small plants near San Jose.

He was awarded a medal of recognition for technical assistance to La Cooperativa de Productores de Leche. His trip was under the technical assistance agreement between the University of Florida and Servicio Tecnico Interamericana de Cooperacion Agricola at San Jose.

Krienke consulted on size, arrangement, types of equipment and new products for a milk plant soon to be constructed. The present plant is bottling milk and making a small amount of ice cream. Pasteurization of milk was started only about 5 years ago, and it now constitutes about one-third of all milk being sold. Milk sanitation work is in need of technical assistance right from the cow to the consumer.

The Florida technologist suggested making chocolate milk bottling cream in more convenient containers, starting a cottage cheese operation and expanding ice cream manufacture.

The Costa Ricans plan to make variegated ice creams under a process developed by Krienke at the Florida station.

To help balance the dairy program for the Central American republic, the cooperative is planning small cheese plants in outlying areas. Krienke advised on equipment, methods and varieties of cheese.

PAPERS PRESENTED AT AFFILIATE ASSOCIATION MEETINGS

Editorial Note: The following listing of subjects presented at meetings of Affiliate Associations is provided as a service to the Association membership. Anyone who desires information on any subject is encouraged to write to the Secretary of the Affiliate Association concerned for the address of the speaker. Information desired then may be requested from the speaker (a copy of the paper presented may be available for the asking.)

ASSOCIATED ILLINOIS MILK SANITARIANS
(Spring Conference, May 21, 1956)

Mr. P. Edward Riley, *Sec.-Treas.*, Illinois Dept. of Health, 1800 W. Fillmore Street, Chicago, Ill.

High Coliform Counts, Why? C. A. Abele, Director of Educational Programs, The Diversey Corporation.

Insect and Rodent Control for Dairy Plants. Dr. Edward L. Holmes.

You Can't Miss It! William E. Skadden

Comparative Merits of Four Tests for Determining Bacterial Quality of Raw Milk.

Panel discussion—Moderator, J. C. McCaffrey

Panel members: William Moseley, Dr. Harold Calbert, Robert Smith, Richard M. Hoyt.

CONNECTICUT ASSOCIATION OF DAIRY AND FOOD SANITARIANS, INC.
(Spring Meeting, May 9, 1956)

Mr. H. Clifford Goslee, *Sec.*, 256 Palm St., Hartford, Conn.

Flavors Associated with Milk Production. Professor Alec Bradfield

Flavors Associated with Milk Processing and Distribution. Dr. A. C. Fay

A Plan for Scoring Milk and Milk Products. Professor Leonard R. Dowd

SOUTH DAKOTA ASSOCIATION OF SANITARIANS

Louis Remily, *Sec.-Treas.*, State Dept. of Helath, Pierre, S. D.

Suburban Developments and Environmental Sanitation. Edward R. Mullaly

Recent Consideration in the Bulk Milk Enforcement Program. Milt Held

Sanitation in Disaster. Gerald Ferguson

Rural Health Program. Dr. Donald DeValois

Public Health Significance of Antibiotics in Milk. Dr. Edward Berry

Consideration in the Development of Standards in the Food Industry. John R. Fritz

Current Recommendations for Fly Control for the Milk and Food Industries. C. E. Garhardt

Radiclogical Hazards Associated with Shoe Fitting Devices. Paul F. Woolrich

State Institutional Sanitation Program. R. S. Wallace

Carmelized and Aged Milk-Milk Quality Control. Dr. G. Shadwick

Trends in Public Health Legislation in South Dakota. A panel discussion.

Moderator – Loren Carlson

Panel members – *A Milkman's Interest in State Legislation.* Gus Rachetto

A Restaurant Operator's Interest in Food Laws. Carl Burgess

A Senator's View of Milk and Food Laws, Alfred D. Roessler

A Representative's Views of the Milk and Food Laws. Albro Ayres

Trends in Milk and Food Laws in Our Bordering States. Milt Held

Organization of County Health Department. A panel discussion.

Moderator – Louis Remily

Panel members – Dr. G. J. VanHeuvelen, Harlan Stricklett, Dr. T. E. Eyres.

Experiences in the Rapid City Vector Control Program. R. J. Morgan

VIRGINIA ASSOCIATION OF MILK AND FOOD SANITARIANS

(Eleventh Annual Conference, March 15-16, 1956)

J. F. Pace, *Sec-Treas.,* State Health Dept., Richmond, Va.

New Laws and Regulations Relating to Food and Milk Inspection Program. Mark I. Shanholtz and Parke C. Brinkley

Laboratory Approval and Practical Bacteriology in Milk and Food. Dr. M. J. Eggert, W. F. Skinner and George Sooy

How the Restaurant Industry and Public Health Officials Are Accepting Their Responsibility in Elevating the Standards of Sanitation of Food Establishments in Virginia, As Well As Nationwide. Walter D. Tiedeman

Relationship of N. S. F. Standards to the Manufacturing Cost of Food Service Equipment. W. P. Swartz, Jr.

The Affairs of the International Association of Milk and Food Sanitarians. H. L. Thomasson

Proposed Laws for Registration of Milk and Food Sanitarians. C. F. Hanger

Approved Equipment for Dispensing Milk. James W. Smith

The Milk Ring Test for Brucellosis. Dr. W. L. Bendix

IDAHO SANITARIANS ASSOCIATION

(Milk Plant and Dairy Farm Sanitarians Short Course, March 26-30, 1956)

Jack C. Ross, *Sec.-Treas.,* Panhandle Dist. Health Unit, Sandpoint, Idaho.

Butter Manufacturing; (1) *What happens when we make butter,* (2) *Problems of butter plants in Idaho,* (3) *Sanitation problems of butter plants.* Prof. H. A. Hartley

Evaporated Milk and Milk Powder; (1) *What happens when we make evaporated milk and milk powder,* (2) *Problems of evaporated milk and milk powder plants,* (3) *Sanitation problems of evaporated milk and milk powder plants.* Dr. J. C. Boyd

Cheese Manufacturing Panel; (1) *What happens when we make cheese,* (2) *Problems of cheese plants in Idaho,* (3) *Sanitation problems of cheese plants.* Prof. H. A. Hartley

Ice Cream Manufacturing Panel; (1) *The manufacture of ice cream,* (2) *Problems of ice cream plants in Idaho,* (3) *Sanitation problems of ice cream plants.* Dr. R. A. Hibbs

Problems Involved in the Bulk Handling of Milk. Prof. C. C. Prouty

Some New Cleaning Techniques on the Farm and in the Dairy Plant. Dale Garner

Processing Bottled Milk Dr. R. A. Hibbs

Informal Discussion of Kitchen Construction and Dishwashing. Bob Green

How to Write Better Business Letters. Prof. Sherman

Practical Dairy Rations. Dr. R. H. Ross

What a Good Dairy Cow Looks Like. Prof. D. L. Fourt

Labor Utilization in Milk Receiving Rooms. Dr. J. C. Boyd

Speech Craft. Prof. Whitehead

MISSOURI ASSOCIATION OF MILK AND FOOD SANITARIANS

(Twenty-fourth Annual Milk and Food Sanitation Conference, April 16-18, 1956)

John H. McCutchen, *Sec. Treas.,* Mo. State Health Dept., Jefferson City, Mo.

Bulk Milk Handling. A panel discussion.

Moderator, George Bauer

Panel Members – *Problems of the Tank Truck Driver.* Larry Davis

Milk Producer Viewpoint. Kermit Linebarger

Health Department Viewpoint. C. W. Dromgold

Flavor Problems. J. E. Edmondson

Stump the Panel. Moderator – Milton R. Fisher

Panel members – John McCutchen, Milton E. Held, Webster Scott, Louis Blattner

Comparison of DMC, SPC, and Laboratory Problems. R. G. Jensen

Inhibitors–

The Laboratory Determination of Bacterial Inhibitors in Milk. Jerry Skopek

Raw Milk Positive to Inhibitors and Farm Inspection. C. W. Dromgold

Care of Rubber Parts – Sanitation Problems. R. S. Guthrie

Present Status of Brucellosis and Tuberculosis Eradication Problems in Missouri. L. A. Rosner, R. E. Omohundro

Status of Poultry Sanitation. Joe Atkinson, Samuel Alfend, B. L. Durben

Hot Water Heating for Dish Machine Use. T. C. King

Stainless Steel in the Milk and Food Industry. (Speaker to be announced)

SANITATION MAINTENANCE SHOW & CONFERENCE SCHEDULED FOR CHICAGO, OCTOBER, 1957

The expanding importance of sanitation maintenance will receive National recognition this coming Fall when the second annual Sanitation Maintenance Show and Conference takes place at Navy Pier, Chicago. Produced by Orkin Expositions Management, nationally known exposition and trade show producers, the Show will be held from October 14-16, 1957, inclusive.

Sponsored by the Industrial Sanitation Management Association, Association of Food Industry Sanitarians, and the National Association of Bakery Sanitarians, the Show scored a strong success in New York this past October when 3500 sanitation maintenance executives from 30 states and 10 foreign countries attended.

Based on this strong recognition of the industry's only show and conference for the actual buyers and users of sanitation maintenance products and services, the sponsors expect attendance at the 2nd Show to double last year's turnout.

The producers state that manufacturers' inquiries since the past Show also indicate a substantial increase over the 86 exhibitors who displayed in New York.

Under the chairmanship of J. Lloyd Barron, Manager of the Sanitation Department of National Biscuit Company, an important series of conferences on sanitation maintenance problems will again be held concurrently with the Show at the Navy Pier. Experts will speak on various phases of the field; the popular "clean-up" session will provide an industry-wide forum for the exchange of ideas. The full program will be announced later.

Orkin Expositions Management has produced many of the nation's top expositions, including the National Electrical Industries Show, Armory Furniture Show, International Housewares Show, the famous Do-It-Yourself Shows, and other industry events.

Information about the Sanitation Maintenance Show & Conference can be obtained by writing to Orkin Expositions Management, 19 W. 44th Street, New York 36, N. Y.

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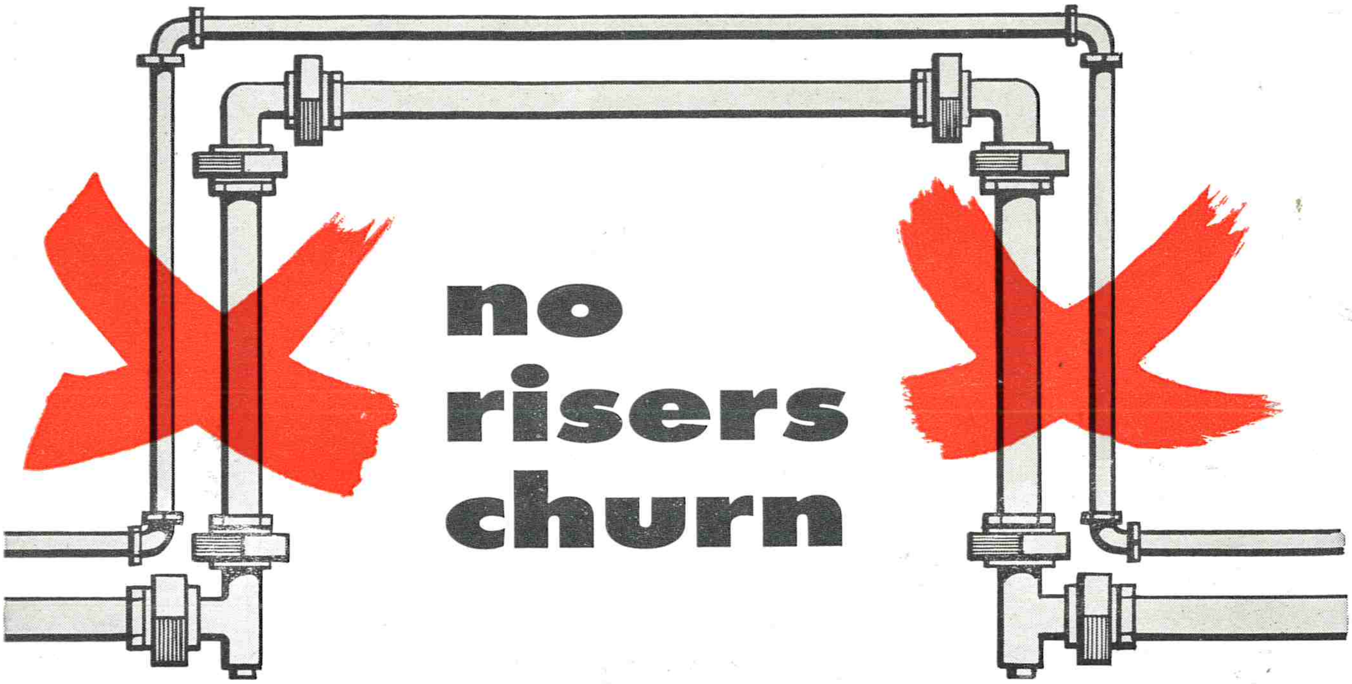

SURGE CLEAN MILK

A long time ago, someone around here was wise enough to write these words:

"DO NOT install a pipe line with a riser, as that almost certainly will lead to trouble . . . it always has . . . it seems to us that it always will. If there is just no possible way to install the line without a riser, then don't sell or install it."

Since then, people who have made a study of pipe lines tell us how right we were . . . how milk churns up and down in risers . . . how rancidity and off-flavors result . . . and how nearly impossible it is to get a pipe line with risers really clean.

That's why we still walk away from a job rather than install a riser. No risers churn Surge clean milk . . . ever.

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