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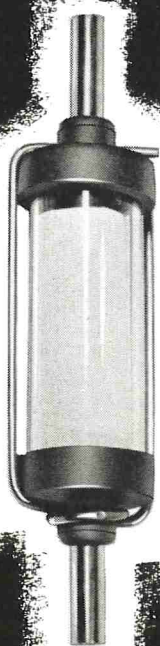
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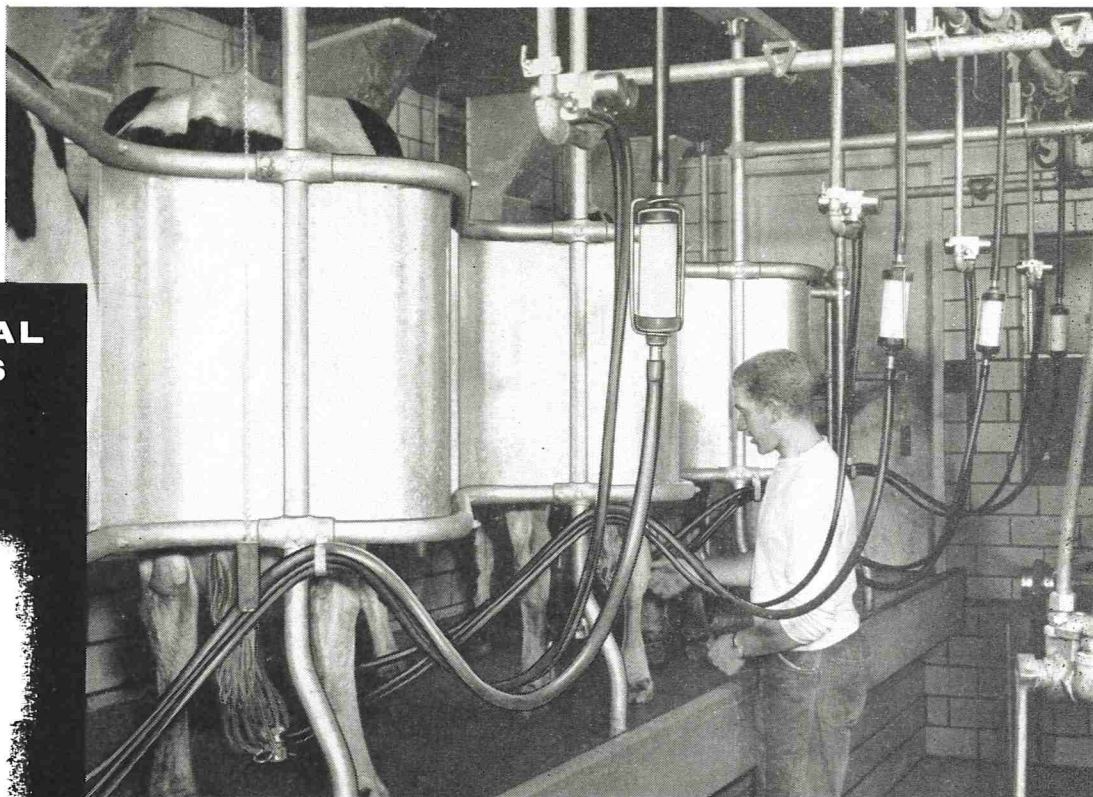
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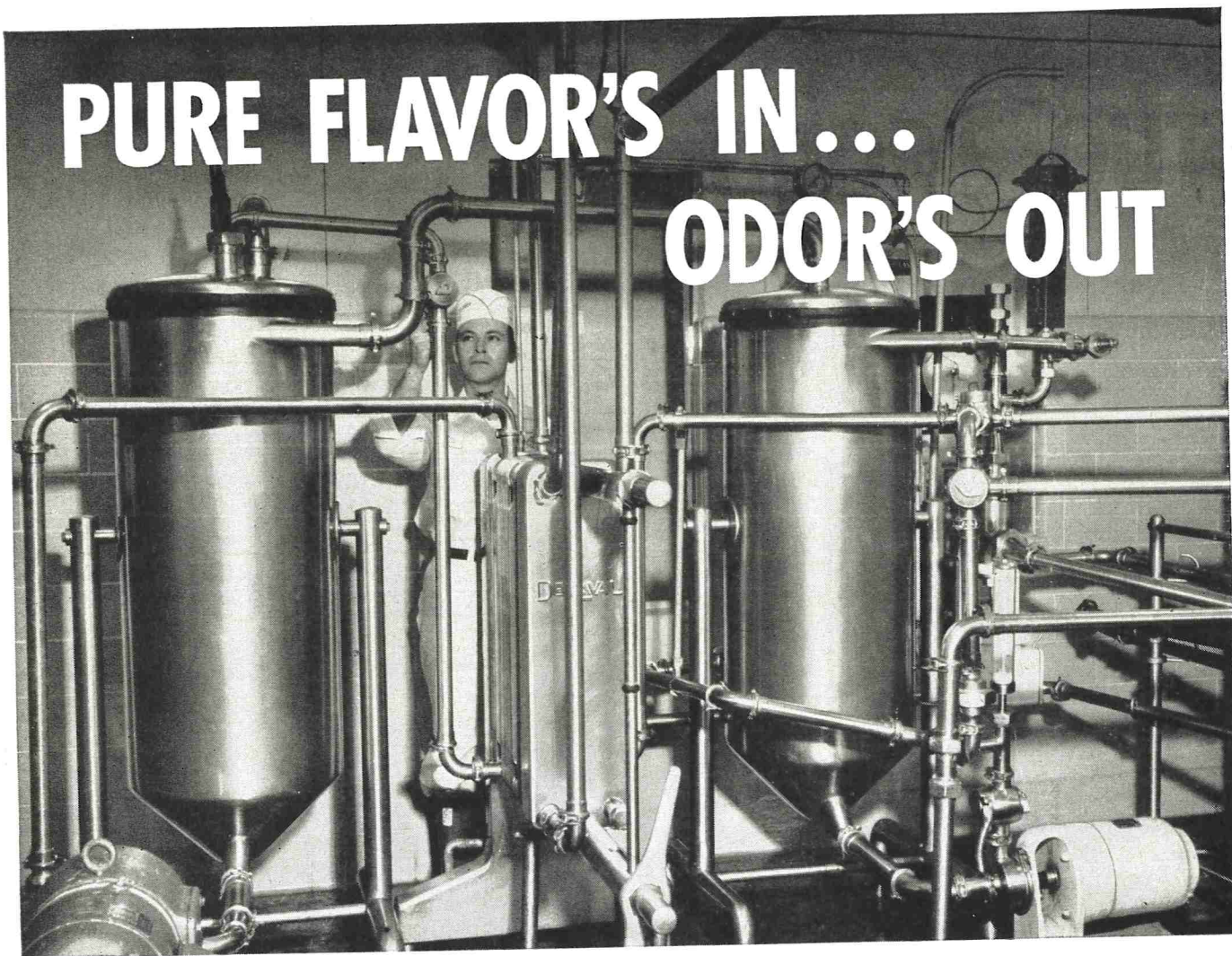
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STAPHYLOCOCCAL FOOD INTOXICATION DUE TO CHEDDAR CHEESE

II. LABORATORY EVALUATION*

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*State Hygienic Laboratory, State University of Iowa, Iowa City,
and Iowa State Department of Health, Des Moines*

INTRODUCTION

As indicated in a previous paper (13), an outbreak of food-poisoning occurred in an Iowa Institution in August 1958, and a thorough epidemiological investigation incriminated cheddar cheese as the vehicle of transmission. Approximately 900 persons ate the meal in question and 200 of these became ill 3 to 5 hours later. All who became sick had eaten cheese, but not all who ate cheese were affected. The illnesses were characterized by sudden onset, nausea, abdominal pain, vomiting, diarrhea, exhaustion and prompt recovery. The laboratory performed several important functions and aided the field investigators considerably in their efforts to uncover the probable source of contamination.

Since the literature has been reviewed rather completely in the first paper concerning staphylococcal food-poisonings of this type, literature sources will be cited only as they pertain to the laboratory findings.

Outbreaks of food-poisoning definitely related to staphylococci in milk or milk products have been reported on a number of occasions. While raw milk has been the main cause, pasteurized milk and dairy products made from pasteurized milk have been implicated in a few instances. Recently cheddar cheese has played a more important role as the contaminated agent in food-poisoning outbreaks. Most of the outbreaks have been due to the raw milk (natural) variety of cheddar cheese (13).

BACTERIOLOGICAL ANALYSIS OF SPECIMENS

Sterile instruments were used to expose an internal portion of the cheese specimen, and a quantity about the size of a small olive pit was removed and placed in a sterile mortar and pestle. After the addition of sterile alundum, the specimen was ground to a paste. Approximately 2 ml of sterile saline was added, and the paste emulsified. A drop of the saline emulsion was then placed on each of two blood agar plates, and the plates streaked with a bacteriological loop. One plate was incubated aerobically and the other

anaerobically. The next day the plates were examined and colonies exhibiting *beta* hemolysis were picked to rabbit plasma (Difco) for the coagulase test.

Cheese specimens exhibiting no hemolytic colonies were examined a second time before they were entered as negative.

BACTERIOPHAGE TYPING

Cultures were typed by the Public Health Laboratories of the Kansas State Board of Health with the human staphylococcal bacteriophages and by Dr. E. H. Coles, Department of Pathology, Kansas State College with the bovine staphylococcal bacteriophages.

PHOSPHATASE TEST AND BACTERIAL DENSITY

These tests were performed as outlined in Standard Methods for the examination of Dairy Products, 10th Edition.

KITTEN FEEDING TEST

Six kittens were obtained, vaccinated for distemper, and maintained under observation for four weeks prior to testing.

Two days before the actual feeding experiment the test culture was transferred to tryptone broth and incubated under 10 per cent CO₂ at 37°C for 24 hours. The next day one pound of lean ground beef was divided into two equal parts, placed in covered beakers, and sterilized in the autoclave at 121°C for 15 minutes. After cooling, one aliquot was inoculated with the broth culture, and then both were incubated at 37°C for 18 hours.

The kittens were divided into a test and control group of three each and fed the respective materials.

RESULTS

A total of 85 wheels of cheddar cheese were examined for the presence of *beta* hemolytic coagulase positive *Staphylococcus aureus*. The results of this survey are presented in Table I.

As will be seen from these results approximately 87 per cent of the wheels examined contained *Staph. aureus*. Commercial cheese was obtained by the field investigators, coded and placed with other

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²Iowa State Department of Health, Des Moines, Iowa

TABLE 1—SUMMARY OF AMERICAN CHEDDAR CHEESE WHEELS EXAMINED

Month of manufacture	No. of wheels sampled	No. containing <i>Staph. aureus</i>
April 1957	2	0
January 1958	5	5
February 1958	8	8
March 1958	19	17
April 1958	23	19
May 1958	8	5
June 1958	9	9
July 1958	8	8
August 1958	3	3
Total	85	74
Commercial Cheese (control)	5	0

TABLE 2—STANDARD PLATE COUNTS ON FIVE SELECTED CHEESE SAMPLES

Identity	Date of manufacture	Colonies/gm (x 10 million)
FM-6	3-17-58	9
FM-8	4-14-58	2.1
FM-11	4-21-58	2.3
FM-13	3-17-58	17
FM-22	4- 7-58	7.4

samples to be examined in the laboratory. This served as a control for the laboratory. Only after the results were obtained did the laboratory know the exact identity of each specimen.

It is entirely possible that the 11 wheels that were negative on our tests actually did contain the suspect organism. Core specimens were taken with a cheese trier from each wheel. The small portions of the cores from 11 wheels were negative, but tests on entirely different core specimens from the same wheel might have proved positive.

Total bacterial counts on each specimen were not done. It was, however, considered advisable to obtain some information as to the bacterial density. Table II presents the data from duplicate standard plate counts on five selected cheese samples. The density of *Staph. aureus* per gram of cheese was not determined.

Early in the investigation of this outbreak, field investigators were led to believe that the cheese was made from pasteurized milk. It was suspected, however, that the heating process was not sufficient to properly pasteurize the milk, so chemical tests for the enzyme phosphatase were performed on the cheese. Of 18 specimens selected at random and

tested, 14 gave very strongly positive results, and four were negative. Further checking revealed that the four negative specimens were from the five commercial cheese specimens included as controls for the bacteriological analysis. All eighteen specimens were negative when examined for inhibitive characteristics (5).

Barber, *et al.*, (2) observed that a large number of coagulase positive staphylococci possessed the ability to hydrolyze phosphoric esters by a phosphatase enzyme. In order to eliminate the possibility that the phosphatase activity in the cheese was due to the presence of *Staph. aureus*, several aliquots of sterile milk were inoculated with a pure culture of *Staph. aureus* isolated from one of the cheese specimens. After incubation at 37°C for 24 hours, the aliquots were examined for the presence of phosphatase. No detectable phosphatase was present.

In view of the phosphatase test results it was decided to return to the cheese factory and make a more extensive survey of the operational methods and to obtain samples of raw milk from the institution herd and the seven commercial herds from which milk for the cheese had been obtained. The results of the bacteriological analysis of these two groups of specimens are presented in Table 3.

Conditions in the institution farm milk house and methods of handling milk were not in accordance with present accepted practices. The milk house doors were without screens, and the result was an extremely high fly density. The milk house rooms were dirty and disorderly. Milking was done by machine. After each use teat cups were dipped in a germicidal solution (made at the institution) very briefly and then allowed to touch the floor of the milking barn, workmen's shoes, wheels of the cart that carried the germicidal solution, or the floor of the stall before being applied to the next cow. The milk was poured from the milking machine bucket into an open bucket in the barn and carried to the milk house for weighing and straining. The milk was cooled in 10 gallon cans in a concrete tank with flowing well water. As each 10 gallon can of milk was filled, a 20 ml specimen was removed using a sterile 10 ml pipette. Earlier in the day the local milk sanitarian had collected a pooled herd sample from each of the commercial herds which had supplied milk to the cheese factory.

From the data in Table 3 it will be observed that 1 out of 7 specimens from the commercial herds contained *Staph. aureus* while 7 out of 13 specimens or 53.8 per cent from the institution contained the same organism. These milk specimens were also subjected to standard plate count, thermotolerant count,

TABLE 3—ANALYSIS OF RAW MILK SAMPLES FROM COMMERCIAL HERDS AND INSTITUTION HERD

Specimen Identify	Location	Microscopic Examination	Standard Plate Count, per ml (x 1000)	Thermotolerant Count, per ml (x 10)	Inhibitive Character	Coagulase	<i>Staph. aureus</i>	Culture No.
8309	CH	EHCC; strep.	8.3	5	—		—	
8310	CH	EHCC; strep.	140	1	—		—	
8311	CH	EHCC; sporing rods	6.3	17	—		—	
8312	CH	EC; sporing rods	32	1	—	+	+	2027
8313	CH	EC	41	none	—		—	
8314	CH	EC	8.3	3	—		—	
8315	CH	EHCC; strep. sporing rods	32	780	—		—	
8316	I	EC; sporing rods	31	30	—	+	+	2011
8317	I	EHCC; strep.	55	6	+		—	
8318	I	EC	4.9	none	—	+	+	2013
8319	I	EHCC	12	none	—	+	+	2014
8320	I	EHCC	6.4	1	—	+	+	2015
8321	I	EHCC	9.6	none	—		—	
8322	I	EHCC	7.6	none	—		—	
8323	I	EHCC	6.7	none	—	+	+	2018
8324	I	EHCC	5.8	none	—	+	+	2019
8325	I	EHCC	4.7	1	—		—	
8326	I	EHCC	8.2	none	—		—	
8327	I	EHCC	19	1	—	+	+	2022
8328	I	EHCC	7.5	none	—		—	

Key: CH = commercial herd
 I = institution
 EC = excessive cells, 1 to 1.5×10^6 /ml.
 EHCC = extremely high, $>1.5 \times 10^6$ /ml.
 cell count

analysis of inhibitive characteristics and microscopic examination.

It was decided to select several of the cultures of *Staph. aureus* isolated from the cheese specimens and type them using both the human staphylococcal bacteriophages and the bovine staphylococcal bacteriophages. Since typing facilities were not available locally, and because of the large number of cultures, it was considered not feasible to have all the isolates typed. Table 4 presents the human and bovine staphylococcal bacteriophage patterns obtained on 21 cultures isolated from various lots and/or wheels of cheddar cheese. Bacteriophage patterns on four of the eight cultures isolated from the raw milk mentioned previously are presented in Table 5.

A kitten feeding test was also performed using one of the cultures (#1310) isolated from a specimen of cheddar cheese. Two out of three kittens which were fed the material prepared as described previously became ill with explosive vomiting and diarrhea.

Nose and throat cultures were obtained on all persons working in the cheese factory at the time of inspection as well as samples of coloring, rennet

extract, and swab specimens of the agitator shaft, cover of the agitator and milling machine motor cord. All specimens were negative with the exception of one workman who harbored *Staph. aureus* in the nose and throat; however he was only recently assigned to work in the cheese factory and was not employed during the time the cheese in question was made. Bacteriophage typing of these two cultures revealed that the culture from the nose had a pattern of 42E/70/75/47C/VA4 and the culture from the throat was type 7.

DISCUSSION

As was indicated in the first paper of this series, the clinical manifestations of the illnesses, and epidemiological findings were indicative of staphylococcal food-poisoning. The finding of *Staph. aureus* in the cheddar cheese and not in any of the other foods served at this one meal led the authors to reasonably conclude that the cheese was the contaminated vehicle. The observation that the cheddar cheese was manufactured at another state institution prompted the laboratory and field investigators to make a complete survey of the cheese manufacturing process.

The entire investigative procedure was an attempt to discover the actual point and source of contamination of the product. While the outbreak involved cheese made during the period January - April, this part of the investigation also included cheese made during the period April through August 18. No cheese was made after August 18 as all the milk was used as fluid milk.

Core samples were taken from all wheels of cheddar cheese sent to the institution at which the outbreak occurred, as well as from some scraps (unidentifiable as at lot) that remained from the wheels served at the incriminated meal. Every lot of cheese, representing one day's production, in storage at the cheese factory was sampled at least once. It was estimated that approximately $7\frac{1}{2}$ tons of cheese was involved. As was indicated earlier, 87 per cent of the specimens examined contained *beta* hemolytic coagulase positive *Staph. aureus*.

According to Hammer (12) the microbial density of cheddar cheese is highest early in the ripening process and then decreases gradually. The peak count is somewhere in the vicinity of 1,400 million organ-

isms per gram. The mean standard plate count on five determinations presented in Table 2 was 75.6 million organisms per gram. The mean value does not appear to be too different from normal cheddar cheese.

The analysis of raw milk samples from the commercial herds and the institution herd presented in Table 3 did not demonstrate abnormal standard plate counts, and the thermoduric counts appeared normal with the exception of one specimen which had a count of 7800 per ml. Extremely high cell counts were observed in 57 per cent of the commercial herd samples and in 84.6 per cent of the institution herd samples. One specimen from the institution herd demonstrated inhibitive characteristics.

The isolation of *Staph. aureus* from 53.8 per cent of the institution herd raw milk samples would seem to indicate that several cows in this herd were harboring and shedding this organism.

Typing of 21 strains of *Staph. aureus* isolated from as many different wheels of cheddar cheese with human staphylococcal bacteriophages presented 14 different patterns plus a group of non-typables

TABLE 4—BACTERIOPHAGE TYPING OF TWENTY-ONE CULTURES OF *Staph. aureus* ISOLATED FROM CHEDDAR CHEESE SPECIMENS

Date of cheese manufacture	Culture No.	Pattern	
		Human staphylococcal bacteriophages	Bovine staphylococcal bacteriophages
1-13-58	1743	52/52A	NT*
2- 3-58	1536	79/80/3A/3B/3C/ 6/7/42E/47/53/54/ 73/75/77/42B/47C/ VA4/42D/81	A8/A10/A13/87/S2
3- 3-58	1533	NT	A8/S2
3- 6-58	1544	6/VA4/42D	A8/A10/A13/87/S2
3-17-58	1362	7/42E/47/42B/VA4	A8/A10/A13/87/S2
	1363	6/42E/47/54/75/ 47C/VA4	A8/A10/A13/S2
	1365	6/42E/47C/VA4	A8/A10/A13/87/S2
	1538	NT	A8/S2
3-21-58	1546	NT	NT
3-31-58	1310	6/42E/47/54/75/ 47C/VA4/42D	A8/A10/A13/S2
4-14-58	1369	47C/VA4/42D	A8/A10/A13/87
	1374	79	A8/A13
	1532	79	A8/A13
4-21-58	1350	42D	A8/A10/A13/87
4-24-58	1744	7/42E	A8/A10/A13
4-28-48	1535	29/79/3B/6/42E/47/ 54/73/75/42B/47C/VA4	A8/A13
	1539	29/79/3B/6/42E/47/ 54/75/42B/47C/VA4	NT
5- 8-58	1733	42D	A8/A10/A13/87/S2
5-12-58	1721	VA4	A8/A10/A13/87/S2
6-26-58	1704	NT	A8/S2
7- 3-58	1708	VA4	A8/A10/A13/87/S2

*non-typable

TABLE 5—BACTERIOPHAGE TYPING PATTERNS ON FOUR ORGANISMS ISOLATED FROM RAW MILK (SEE TABLE III ALSO)

Source	Culture No.	staphylococcal Human bacteriophages	Bovine staphylococcal bacteriophages
IH	2011	54	A8/A10/A13
IH	2015	54	A8/A10/A13
IH	2019	NT*	NT
CH	2027	6/7/42E/77	A8/A10/A13/S2

*non-typable

IH = institution herd

CH = commercial herd

(Table 4). When these same strains were typed with bovine bacteriophages they could be grouped into 7 different patterns plus the group of non-typables. Only one of the cultures isolated (#1546) was non-typable by both groups of phages.

Allison (1) has reported that in 47 enterotoxin food-poisoning outbreaks in various parts of the world approximately 81 per cent of the strains belonged to phage type 6/47 or 42D. He further indicated that 42D is commonly found in raw cow's milk and is a frequent cause of bovine mastitis. Martyn (14), Saint-Martin, *et al.* (17) and Drysdale (9) also implicated staphylococci of phage type 6/47 in food poisoning outbreaks. In the 21 strains typed 11 were lysed by one, two or all three of these bacteriophages. Two strains were typable only by the 42D phage. MacDonald (15) reported that of 150 strains of *Staph. aureus* isolated from milk, 123 were type 42D and that of 34 strains isolated from cases of bovine mastitis all were type 42D.

Blair (4) has reported that there is a considerable degree of group specificity: for example cultures that are lysed by the phages of Group II are not susceptible to lysis by phages of Group I or III. He states that occasionally strains are encountered that are lysed by phages of both Groups I and III but represent only a small proportion of the typable staphylococci. In this study at least 5 of the 21 strains typed were lysed by phages from 2 or more of the groups established by Blair.

When the results of Tables 4 and 5 are compared it is readily observed that there is no correlation between the human staphylococcal bacteriophage and bovine staphylococcal bacteriophage patterns; however it is the opinion of the authors that the patterns presented by the bovine bacteriophages are of greater epidemiological significance in this poisoning outbreak.

Chapman (6), Feldman (11), and Evans *et al.* (10) have indicated that there is now general agree-

ment that only coagulase positive staphylococci are enterotoxigenic; however, Dolman (8) and Dack (7) have stated that not all coagulase positive staphylococci are capable of producing enterotoxin. One of the cultures (#1310) was selected for use in a kitten feeding experiment. This culture was isolated from a remaining portion of one of the wheels (not identifiable by lot) of cheese that was used for serving the Sunday evening meal. No experiments were performed by intraperitoneal injections of culture filtrates. As indicated previously 2 out of 3 kittens developed diarrhea and explosive vomiting approximately five hours after feeding. No human volunteers were fed either culture filtrates or cheddar cheese suspected of containing enterotoxin.

Bell and Veliz (3) reported that 67% of 37 cultures of staphylococci from 37 quarters of 27 cows were enterotoxigenic as demonstrated by the kitten test. Minett (16) tested 38 strains of *Staph. aureus* from bovine udders. Of 15 strains from udders with mastitis and 23 strains from milk of 17 normal cows, 9 and 7 strains respectively produced enterotoxin.

SUMMARY

A food-poisoning outbreak involving two hundred cases was traced to the consumption of contaminated cheddar cheese. One or more samples from each lot of the unused cheese (from about 7½ tons) was examined in the laboratory. Eighty-seven per cent of the cheese in storage was found to contain *beta* hemolytic coagulase-positive *Staphylococcus aureus*. One strain tested for enterotoxin production caused vomiting and diarrhea when fed to kittens.

Culture isolates were typed by both human and bovine staphylococcal bacteriophages. The comparison of these patterns is discussed.

Staphylococcus aureus was found in raw milk from herds serving as a source of milk from the cheese factory.

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REFERENCES

1. Allison, V. D. Discussion on Food Poisoning. *Proc. Roy. Soc. Med.*, 42: 214-220. 1949.
2. Barber, M., Brooksband, B. W. L. and Kuper, S. W. A. Staphylococcal Phosphatase, Glucuronidase, and Sulphatase. *J. Path. Bact.*, 63: 57-64. 1951.
3. Bell, W. B. and Veliz, M. O. Production of Enterotoxin by Staphylococci recovered from the Bovine Mammary Gland. *Vet. Med.*, 47: 321. 1952.

4. Blair, J. E. Public Health Aspects of Phage Typing of Staphylococci. *Publ. Hlth. Lab.*, **15**: 39-45. 1957.
5. Cerny, J., and Morris, R. L. A Modified Disc Assay Method for Detecting Antibiotics in Milk. *J. Milk & Food Tech.*, **18**: 281-283. 1955.
6. Chapman, G. H. A Suggestion for the Rapid Presumptive Examination of Foods Suspected of Having Caused Staphylococcal Food Poisoning. *Food Res.*, **9**: 377. 1944.
7. Dack, G. M. *Food Poisoning*. University Press. Chicago, Illinois. 1949.
8. Dolman, C. E. Ingestion of Staphylococcus Exotoxin by Human Volunteers, With Special Reference to Staphylococcal Food-Poisoning. *J. Infect. Dis.*, **55**: 172-183. 1934.
9. Drysdale, A. *Staphylococcus aureus* Food Poisoning: An Account of an Outbreak in Khartoum. *J. Trop. Med. Hyg.*, **53**: 12-14. 1950.
10. Evans, J. B., Beuttner, L. G., and Niven, C. F., Jr. Evaluation of the Coagulase Test in the Study of Staphylococci Associated with Food Poisoning. *J. Bact.*, **60**: 481-484. 1950.
11. Feldman, H. A. Incidence of Certain Biological Characteristics Among 'Food-Poisoning' Staphylococci. *Amer. J. Publ. Hlth.*, **36**: 55-57. 1946.
12. Hammer, B. W. *Dairy Bacteriology*. John Wiley and Sons, Inc. New York, New York. 1948.
13. Hendricks, S. L., Belknap, R. A., and Hausler, W. J., Jr. Staphylococcal Food Intoxication Due to Cheddar Cheese. I. Epidemiology. *J. Milk & Food Tech.*, **22**: 313-317. 1959.
14. Martyn, G. The Relation of *Staphylococcus pyogenes* to Infantile Diarrhoea and Vomiting. *Brit. Med. J.*, **2**: 1146-1148. 1949.
15. MacDonald, A. *Staphylococcus aureus* in Cows' Milk: Results of Phage-typing. *Month Bull. Min. Health & Emerg. Pub. Health Lab. Serv.*, **5**: 230-233. 1946.
16. Minett, F. C. Experiments on *Staphylococcus* Food Poisoning. *J. Hyg.*, **38**: 623-637. 1938.
17. Saint-Martin, M., Charest, G., and Desranleau, J. M. Bacteriophage Typing in Investigations of Staphylococcal Food-Poisoning Outbreaks. *Canad. J. Publ. Hlth.*, **42**: 351-358. 1951.

COMMENTS ON A NEW TEST FOR PENICILLIN IN MILK

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In connection with the current campaign for the elimination of penicillin from milk supplies, Arret and Kirschbaum (2) have described "a simplified and rapid method for detecting the presence of penicillin in milk in concentrations as low as 0.05 units per ml." Their method differs from the modified Difco method (1) principally in holding poured plates of seeded agar at approximately 15°C. (59°F.) for not less than three, or more than five, days. This modification is said to enable detection of penicillin in 2½ hours at 37°C.

To compare the new method with the "standard" procedure, several trials were made using both the Bacto B453 Standardized Spore Suspension of *Bacillus subtilis*, and of a spore suspension of *B. subtilis* ATCC #6633. Unfortunately, in each trial, after 3 days at 15°C., growth of the test organism was so extensive that no zones of inhibition could be expected when discs saturated with milk containing penicillin were "spotted" thereon and the plates incubated at 37°C. With two-day-old plates growth was not evident at the start, but no zone of inhibition appeared even with milk containing 0.1 unit of penicillin per ml. *Thus there is a danger that negative results will be reported from milk containing amounts of penicillin detectable by other methods.*

In the writer's experience, the method described by Arret and Kirschbaum is also less simple, less reliable and less sensitive than the modified Difco

method available for years. *It is less simple* in requiring (a) preparation of a spore suspension, when one is commercially available, (b) a low temperature incubator set at 15°C, and (c) an incubator at 37°C. (Neither of these two temperatures is usually available in dairy plant laboratories).

It is less reliable in that (a) in our hands the method, as described, failed to detect penicillin, (b) there is more likelihood of variation in sensitivity to penicillin with "home-made" spore suspension than with the commercially available ones, and (c) there is no warning that special flat-bottomed petri plates (Corning #3162) should be used, and special care taken to harden the agar layer on a perfectly level surface. *It is less sensitive* in that (a) it specifies the use of a 0.25" disc, whereas the 0.5" disc absorbs six times the volume of milk and will detect roughly one-fifth the concentration of antibiotic detectable by the smaller disc (4); the larger disc is also much easier to load uniformly by capillary absorption of 0.1 ml from a graduated 1 ml pipette held horizontally, and (b) it calls for the use of 10 ml of agar medium per plate, when the greater sensitivity of a thinner layer has been shown (4) and is generally recognized.

Speed in obtaining results in testing milk for antibiotics is desirable. However, no laboratory test will ever be as useful as a "marker" dye incorporated into the antibiotic preparation (3, 5) which would

permit instant recognition and rejection of such milk. Failing this, a difference of half an hour or so in obtaining results does not seem to be vital. Most workers would prefer a method simpler and more sensitive than that of Arret and Kirschbaum, even if it required an hour longer incubation. The writer's experience has been that using the modified Difco method (1) and heat-shocking the spores in the melted agar by holding at 70°C. for 15 minutes, zones of inhibition can be detected in less than 3 hours.

For many laboratories it would have been helpful if Arret and Kirschbaum had indicated that the agar medium they recommend is available in prepared form as Bacto Penassay Seed Agar or as B. B. L. Penicillin Assay Seed Agar, and that standardized spore suspensions and penicillinase-containing discs are commercially available. Time is money, and time can certainly be saved by utilizing these commercially available products.

There is an urgent need for a rapid method of detecting antibiotics in milk, so that such milk will not be used for human consumption. The suggested use of the Arret and Kirschbaum method for field testing, wherein a dairy technician would "trace the source of milk containing penicillin by carrying a portable incubator and refrigerator in a car or truck and testing a milk sample on the farm" (2) appears to be impracticable. Surely more would be accomplished

by testing milk on arrival at the plant by the modified Difco method (1) or some other simple method, and notifying offending producers that their milk would not be accepted for the next two days.

ADDENDUM

Since this was written, Dr. Kirschbaum, in a letter dated December 18, recommends that seeded agar plates be held under refrigeration for 3 days before using. This appears to remove any possible reason for using this test rather than the modified Difco method (1).

REFERENCES

1. American Public Health Association. Standard Methods for the Examination of Dairy Products, 10th ed. New York, N. Y. 1953.
2. Arret, B. and Kirschbaum, A. A Rapid Disc Assay Method for Detecting Penicillin in Milk. *J. Milk & Food Tech.* **22**, 329, 1959.
3. Hargrove, R. E., Plowman, R. D. and Wright, W. W. Use of Markers in Veterinary Preparations for the Detection of Antibiotics in Milk. *J. Dairy Sci.* **42**, 202, 1959.
4. Johns, C. K., and Berzins, I. Observations on the Determination of Antibiotics in Milk. *J. Milk & Food Tech.* **19**, 14, 1956.
5. Smitasiri, T., Kosikowsky, F. V., Guthrie, R. S. and Fincher, M. G. Dyes as Markers for Antibiotic-Contaminated Milks. *J. Milk & Food Tech.* **21**, 255, 1958.

FIELD PROBLEMS WITH BULK TANKS¹

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Apparently, we are to admit that there are problems with bulk tanks. As one of the earliest manufacturers of bulk tanks for the Eastern market, I would not deny that there have been many problems, some of which may not have been entirely solved. Meetings like this, where such problems can be discussed, will do much to help the manufacturer, the farmer and the fieldmen to solve these problems by better understanding their cause and possible correction.

Any new development, particularly one as revolutionary and involving the use of a completely new and complicated piece of electrical refrigeration equipment built to Sanitary Standards for the handling of a highly perishable product will create many problems due to ignorance of those involved as to the proper design, construction, operation and maintenance of the equipment and the program for which the equipment is intended.

The automobile, which a couple of generations ago took over the transportation of our masses from the carriage and the stage coach, undoubtedly experienced the same growing pains. The missile program of our government and the contractors involved in the development of the missile, in spite of their tremendous financial and technical resources are, judging from what we read in our papers, having their troubles. Therefore, it is no disgrace to have problems.

May we briefly review a few of the outstanding examples of early trouble, some of which we are still living with because most of the tanks that have been manufactured since the inception of the program, covering a period of about ten years, at least in the East, are still being used on farms, and many of those original weaknesses are still bothering their users.

One of the most common problems has been caused by temperature controllers and thermometers. These instruments are the product of large, well known instrument manufacturers and were invariably recommended to farm bulk tank manufacturers by their makers, who adapted them from other industries. We very quickly learned that these instruments were not suited to farm tank use. The controller would many times shut off at too high or too low

a temperature, permitting poor cooling or causing freezing.

Originally, some manufacturers of instruments recommended controllers without cross ambient protection. I am sure no such controllers are now being installed but even the best cross ambient protected instrument is affected by ambient temperatures. A change of 27°F in the ambient temperature will affect the most sensitive instruments by 1°F, so that cut off and cut on temperatures vary by 2° or 3°F because of this outside influence over which tank manufacturers have no control. Properly ventilated and heated milk houses reduce this problem.

Thermometers, too, have created quite a problem by not being as durable and accurate as would be desired. The 3-A Standards require a thermometer to be accurate within 2°F. This, added to the cross ambient variable mentioned above can give a reading variation of 4° or 5°F, depending on outside influences.

A controller should never be adjusted until a known accurate test thermometer has been used to check the temperature of the product. Too many times controllers have been unnecessarily adjusted.

Another cause of considerable instrument trouble has been the high humidity which, coupled with the acids and alkali from milk and detergents in the air, create a very corrosive condition under which these instruments are expected to operate and for which they at least originally were not designed. Some improvement has been made but more can be accomplished.

Another perplexing problem has been one of agitation. In the beginning agitator motors almost without exception seemed to leak grease from their gear case. This caused many service problems but fortunately the motor industry has developed several very satisfactory greaseless gearhead motors which apparently has entirely eliminated this original difficulty.

On some of the first tanks agitators were so designed that some gave excessive and others inadequate agitation to insure a correctly blended composite sample. These design weaknesses have been corrected so that today almost all tanks, when the agitator has been operated from 3 to 5 minutes, give an accurate butterfat sample, and the agitator, during the cooling cycle, will insure fast cooling without excessive agitation or air incorporation.

¹Presented at the 17th Dairy Fieldmen's Conference at Pennsylvania State University, University Park, July 8, 1959.

Many complaints are due to external causes which cast suspicion on the tank, as an example, a farmer may be milking several low testing cows which have freshened or which he has purchased at about the same time he installed the tank. Changing feed or other environmental conditions can also affect butter-fat tests. Other causes are water in the milk due to improper cleaning of the tank or milking machine pipeline, permitting water to remain in the system, or the deliberate addition of water.

Manufacturers do have frequent complaints of apparent butter balls on the surface of the milk after the agitator has been operated for sometime, but Cornell and other research stations have proved these to be an optical illusion. They are actually an air bubble with high fat milk forming the film from which the bubble is created. They occasionally found a deep yellow film on top of agitated milk but again the appearance was much worse than the fact, as almost without exception, when Babcock samples were taken from four corners and the center, the readings were found to be the same, within one to two tenths of a point.

When the tank is first being filled, some air incorporation is likely to occur as the milk comes up to the agitator, if the agitator has been put in operation at the beginning of the milking, which it must be, to realize the fastest possible cooling. However, no provable damage has ever resulted.

The covers on early model tanks often fitted so poorly that in tropical climates even frogs were able to get into the milk, and in many areas flies and other insects created a problem. Here again, manufacturers have recognized and corrected this original design weakness.

Some tanks were not properly engineered to insure the necessary rigidity of the milk lining to maintain calibration. These conditions, I believe, have been corrected and tanks today, because of their heavy steel frames, elliptical shape and other carefully designed and worked out improvements will without exception, when properly installed to maintain a level position, remain in accurate calibration.

Many tanks had a poor means to detect an out-of-level condition that might develop from a sagging or heaving milk house floor. These have been improved but there is still room for further improvement so that the fieldmen can quickly but certainly determine that the tank has been moved from its original calibration level either from natural or intentional causes.

One other condition that is not closely associated with the sanitary operation of the tank but certainly affects its appearance is the high humidity and the corrosiveness of milk acids and detergents on painted or plastic finished tanks. It has been found that

it takes about 40% humidity to support rusting. We know that many milk houses approach 100% humidity as is indicated by the great amount of condensation found on the walls and equipment in the house. Proper ventilation would greatly relieve this situation and help to preserve not only the finish on the tank, but the agitator motor, temperature controller and in fact, the entire tank and its component parts, as well as other milk house equipment.

One of the greatest single causes of farm tank problems probably comes from tanks being used for much greater milk production than they were originally intended to handle, as for instance, tanks purchased for every-other-day pickup and equipped with every-other-day capacity compressors being used for every-day pickup and being loaded to the fullest capacity of the tank each 24 hours rather than 48 hours.

We occasionally have complaints about bacterial count of the milk from a farm tank. We must remember that a farm bulk cooling tank can never improve the milk that has been placed in it. If the tank is properly operating, it will maintain good milk, better than any other method of cooling and storing the same quality milk. So, complaints about high bacterial counts in a farm tank should never be charged against the tank, if as I previously said, it is properly operating and of course has been properly cleaned. Here you fieldmen have a definite opportunity and responsibility. Most farm bulk cooling tanks today are manufactured to be readily and thoroughly cleaned, which is certainly the responsibility of the manufacturer. And, most reliable manufacturers provide cleaning instructions with every tank. However, these instructions need interpreting to the farmer and certain variable conditions such as the water available and the type of detergent that will work best under the conditions at hand, should be determined by the fieldman in cooperation with the farmer. Continued education and supervision to insure a sanitary tank to receive milk is the combined responsibility of the fieldman and the farmer, remembering at all times the milking equipment, the cleanliness of the cow's udder, the cow's health, the cleanliness of the milkers hands and clothing, the condition of the barn and many other influences can provide milk with either low or high bacteria count as it enters the tank. If it is low, it will be maintained at a relatively low count. If it is high, there is nothing the farm tank can do to correct the condition. It will, however, not increase as fast as it would under less ideal cooling and storing conditions.

Measuring has undoubtedly been one of the greatest deterrents to wider acceptance of farm bulk cooling tanks. I well remember when my parents sold cream to our local creamery by the inch, in other

words, the measuring stick was then the accepted method of determining the quantity of milk or cream being sold.

However, through many years of education, milk buyers and farmers have been taught to believe the only accurate method of determining the quantity of milk changing ownership is by weight. Ten years experience in the East and nearly 20 years on the West Coast has proven that we can accurately determine the quantity of milk by a measuring stick provided, and this is important, the tank is designed, built and installed to maintain its calibration and that the measuring stick is so made and mounted to the tank that it will always also absolutely maintain the relative position to the tank that it had at the time the original calibration was made. Experience has proven that the stick should be stored outside the tank at room temperature and dry to obtain the most accurate measurement. Of course, it is essential that the person making the measurement be conscientious and inherently honest. No device however complicated or expensive has yet been developed that will make a dishonest person honest.

There is available an electronic surface gauge or measuring device which will determine the depth of milk in the tank slightly more accurately than a calibrated metal measuring stick. However, it has other inherent weaknesses that evidently have prevented it from becoming popular. One manufacturer, a few years ago, attempted to popularize a scale mounted tank but because of the substantial extra cost of such a scale and the by then proven ability to accurately measure milk with a measuring stick, the sale of the scale never was successful.

Our entire Industry is hoping, and I for one, believe that some day we will have a metering device that will be satisfactory for the purpose of measuring milk accurately from the farm tank into the pickup truck tank. We know that extensive research and development is going on in this field. To my knowledge, one reported successful operation of such a meter is now being used on a route in Europe. There may be many others that I am not aware of.

I have previously outlined the responsibility of the fieldmen and his relationship to the farmer and the program of proper cleaning and sanitizing. There are other maintenance problems. For instance, it is not at all uncommon to have a farm tank develop an objectionable spot of rust on the interior of the milk lining. You must remember that stainless steel itself cannot rust. If the spot is small, it may be due to carbon steel that was imbedded in the stainless during fabrication and it must be removed to eliminate the re-occurrence of the objectionable condition.

More often rust comes from external causes such as rusty water pipes, pails or other contaminating conditions that permit rusty water to be used for cleaning the tank. The water that does not drain from the tank eventually evaporates, leaving rust deposited on the lowest point in the tank. Then the deposited rust builds up and to the inexperienced it would certainly look as though the stainless was rusting.

Both the imbedded steel and the deposited rust may be removed with a 4/0 sand paper used with a rubbing motion in the same direction as the grain of the stainless. If the external source of the rust has been eliminated it should not re-occur. The exterior of the tank, whether painted or stainless, must be kept clean in order to have good appearance in the milkhouse and to insure long life of the finish, particularly if it is a painted or plasticized finish.

Under the best maintained milk house conditions, painted tanks will need to be refinished frequently or whenever rust appears. This is not a difficult thing to do and it can be accomplished by the farmer if he will obtain some good automobile paint and apply it according to instructions, after thoroughly cleaning the metal to remove all rust, grease, moisture, etc. The bottom of the tank is important and many times neglected. It, too, should be kept clean and if carbon steel, painted.

Another problem that faced all farm tank manufacturers and their potential customers was an almost complete non-existence of trained sales, installation and service personnel in the rural areas to properly sell, install and maintain the necessary adjustments so that this new method of handling a delicate, perishable product can be sold, installed and maintained.

As is true in any such circumstance, manufacturers in desperation selected the best available people and did their very best to train and guide them in the job to be done. However, when it is remembered there are presently 32 manufacturers of farm bulk cooling tanks who have authorization to apply the 3-A Symbol, it is easy to understand how competitive the demand for even mediocre dealers is.

Unfortunately, many times in ignorance, such dealers, installers and service men and often manufacturers own representatives make statements about their own and competitors equipment that are so untrue that an atmosphere of great doubt is created. I recently talked with a successful and prosperous farmer who is going to buy a farm bulk cooling tank. He said to me that he was so confused by the many conflicting statements made by representatives of competing companies that he was literally unable to determine which tank he should purchase.

And, there has been, as we well know, great confusion among the ranks of our regulatory people as to the necessary finishes on the material, such as for instance, whether it should be a mirror finish, a No. 4 finish, stainless or painted exterior, the temperature to which the first milk should be cooled and the time that should be permitted to attain such temperature, the much discussed blend temperature, agitation, size of milkhouse, how much space should be provided at the back end, rear end, side and valve end of the tank, where and how many lights should be provided, where the drain should be, and on and on and on, certainly not a clear dictate to manufacturers or farmers as to type of equipment, its surroundings or operation.

Proper installation can substantially reduce the maintenance problem. Most smaller tanks, usually up to about 300 gallons, sometimes larger, have compressors mounted integrally with the tank and are of necessity located inside the milk house. The heat from these compressors, which is the heat that has been removed from the milk, serves to warm the milkhouse in the winter and if proper ventilation is provided, should substantially reduce the amount of humidity in the air and of course, create a more comfortable working condition while filling and cleaning the tank. For the same reason, this arrangement creates an excessively warm milk house in the summer. Good ventilation is essential, first to the satisfactory operation of the compressor and second for the comfort of people working in the milkhouse.

Larger tanks usually have remote compressors. Such compressors should be mounted close to the exterior wall of the milkhouse and should be enclosed in what is frequently called a "Dog House." This enclosure should be arranged so that a shutter or panel can be opened between the "Dog House" and the milkhouse to permit the entrance of warm air into the milkhouse for winter time operation, or so that by changing the panels or doors, the warm air can be directed to the outdoors during summer weather. This arrangement is preferable because it permits directing of the heat into the milkhouse for temperature and humidity control in cold weather and to the outside for more efficient operation and more pleasant working condition in hot weather. Such "Dog Houses" as well as milkhouses, when compressors are self-contained must be designed so there is adequate ventilation at all times as all of the heat removed from milk must be dissipated into the air surrounding the compressor through the condensor. The more efficient ventilation there is, the less time the compressor will need to run. It is necessary that the condensor or radiator like part of the compressor be kept clean of dust, chaff, and other ma-

terials that might reduce the circulation of air.

The refrigeration tubing, connecting the compressor to the tank, particularly with remote installations, should be carefully installed to prevent damage from natural working conditions in the milkhouse. It can go down and under the floor or up and across the ceiling.

As a spokesman for the farm tank manufacturers, it is my desire to be impartial about the various types of tanks. However, while all types, direct expansion, ice bank, atmospheric, vacuum, manually cleaned or automatically cleaned will, if properly designed, manufactured, installed and operated, do a good job, there are certain inherent weaknesses and advantages to each. Farm bulk coolers are an adaption of refrigerated storage tanks used for many years in the receiving stations and processing plants. These storage tanks always have been and still are direct expansion tanks. Tests conducted by many recognized experiment stations have conclusively proven that a direct expansion tank will use less electricity to cool 100 pounds of milk than an ice bank tank. On the other hand, direct expansion tanks require larger compressors running for much shorter times. The larger compressor in certain instances creates a problem for the power supplier, as rural lines are not always heavy enough to carry the additional load.

We are all familiar with the rusting milk can. Two of the things most desirable about direct expansion tanks are that they have entirely eliminated water as the cooling medium, which has caused milk cans and can coolers to rust, and also, have eliminated the potential danger of electrolysis because of the use of dissimilar metals, such as is common in water cooled tanks where stainless steel milk linings are mandatory and copper refrigeration tubing is used with stainless, copper or galvanized water tank liners.

One of the farm tank problems has been what to do when power fails. It is true with an ice bank tank there is some stored ice, however, milk cannot be cooled unless this ice is melted, which is accomplished by a circulating pump, which cannot be operated without electricity. This circulating pump is one additional mechanical part necessary on ice bank tanks. In addition two sets of controls are necessary, as one set is required to control the freezing of the ice and another set to control the melting of the ice to cool the milk. As was previously explained, controls are one of the most troublesome parts of tanks and two sets potentially double the control problem.

Direct expansion tanks, because of their heavier construction and larger compressors, are usually slightly more expensive to purchase. But the compressors because they run about one-third as long, should have much greater life expectancy.

There is in certain areas interest in vacuum tanks, one reason being the belief that they will improve the flavor and odor of the milk.

Work done by Dr. J. T. Lazar, Jr. and W. R. Belamy, at Clemson College, shows that "Equipment--is available that will remove nearly all of the off-flavors caused by feeds and weeds." However, "each of these machines utilize the principle of boiling off volatile components in milk with the use of Vacuum." If milk is to be boiled by using the available vacuum (15"), the milk must first be heated to 179°F. at 0" of vacuum and then be subjected to vacuum to lower the boiling point. Milk never is heated to this temperature in a farm bulk cooling tank!

Another contended advantage is that, because of the greater stored vacuum, the milking operation is more uniform and satisfactory. This, too, is questionable and I am not convinced that the farm tank is the proper storage for milking machine vacuum. It is true that this method of milking eliminates the need for a milking machine releaser but, because it eliminates the releaser, it requires the purchase of a pump for the circulation cleaning of the milking machine lines. This pump could just as well be used for releasing milk from vacuum into an atmospheric tank, therefore no less equipment is necessary to be purchased and cleaned.

Many times the milking operation is adversely affected by leaking gaskets, rotary seals and other com-

ponents that make it impossible to maintain uniform, adequate vacuum for proper milking.

The other advantage claimed is that the tank can be circulation cleaned, which is true, if the cleaning device is properly designed and constructed for the job. On the other hand, it has been proven that a low open top tank can many times be thoroughly hand cleaned and sanitized in about the same length of time that is required to prepare the circulation cleaning equipment to operate, so that no savings result. And, in addition, more water, both hot and cold, and more detergent is required for circulation cleaning. And, at least one more mechanical, potential trouble making piece of equipment is added to our system with but questionable advantages.

A vacuum tank, because of its necessary cylindrical shape, is most difficult to clean manually should a producer not elect to purchase circulation cleaning equipment or should his equipment break down.

California has had farm tanks for about 20 years and the Los Angeles area has had a number of vacuum farm tanks, but to day only one such tank is operating under vacuum, according to the information recently compiled.

We, the producer, processor, fieldman and manufacturer have gone a long way in ten years in the development of the farm tank and the necessary program to go with it. Continued cooperation of all parties concerned will finish the job.

RECENT PROGRESS IN CERTIFICATION OF MILK LABORATORIES

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SURVEYS

Public Health Service activities in milk laboratory certification during the two years since the Sixth National Conference on Interstate Milk Shipment include surveys of laboratory practices of 38 states, covering 31 State health departments and 10 agricultural or other State departments. These surveys included 33 of the 36 states listed on the April 1, 1959, Sanitation Compliance Ratings of Interstate Milk Shippers, as well as 5 potential interstate milk shipping states. With one exception the central laboratories of the 43 states and District of Columbia visited during the past 3 years are in substantial compliance with Standard Methods.

All 36 of the states and D. C. currently listed as interstate milk shippers have programs for certification of local milk laboratories, as do 5 of the 7 past or potential interstate milk shipping states. In addition, 1 milk receiving state and 2 other states are known to require approval of all local milk laboratories within their respective jurisdictions.

Accordingly, a map was prepared as of January 1, 1959, (Figure 1) showing the states which regulate local milk laboratories. This information was supplied by State milk laboratory certifying officials in response to a questionnaire distributed by the standing Laboratory Committee of the National Conference on Interstate Milk Shipment. To provide additional information, data were requested on the number of official, commercial, and industrial (or private) milk laboratories currently under state supervision. These figures for each state are shown in the top row of numerals on the map. The lower row gives the number of each type of laboratory reported as actually used for interstate shipment.

During the past two years 45 State milk laboratory certifying officials were visited in the 38 states in which central laboratories were surveyed or reviewed. Sanitary Engineering Center personnel accompanied State milk laboratory officials in visits to local milk laboratories in 11 states. In anticipation of the adoption of the 1953 recommendations of the Public Health Service, which requires that Standard Meth-

ods for Examination of Water and Sewage be followed in examining water supplies (initially for private plant and dairy farms, semiannually for all plant supplies, and after repair, modification, or disinfection), the water laboratory procedures of 24 State health departments were reviewed and approved.

State compliance with the provisions of the National Conference relative to certification of local milk laboratories has been charted in Figure 2. All states currently listed as interstate milk shippers have forwarded surveys of local laboratories to the Public Health Service during the past two years, and as of January 1, 1959, split sample results had been received from all states currently listed.

SPLIT SAMPLES

A pilot shipment of split milk samples was sent by the Public Health Service to several states during the summer of 1957. During the fall of that year and spring of 1958, split samples were sent to 41 states. In October 1958, one series of split samples was sent to 22 states and in November another 22 states received samples. Generally the standard plate and coliform counts were in good agreement, with the exception of one state whose materially lower plate counts resulted from use of apparently toxic distilled water. However, considerable differences were reported in phosphatase test results, particularly in the November series. Consequently these results were tabulated and graphic charts prepared, coded for each state, to show the results for each sample as reported by each analyst. The tabulations and individual charts were returned to the participating states together with two pages of explanatory comments and recommendations for improved procedures and practices. It should be noted that states differ as to the level of phosphatase considered negative.

In the past, staff members of the Sanitary Engineering Center have occasionally served as reference analysts in the bacteriology of milk. They have been unable to continue this service to State milk laboratory certifying officials, not because of lack of interest or belief in the value of the procedure, but solely because of lack of resources. Because of these limitations on technical assistance and since most State laboratories now have split sample programs, it is suggested that they further develop reciprocity by serv-

¹Substance of reports presented at the Seventh National Conference on Interstate Milk Shipments, April 20, 1959, St. Louis, Mo.

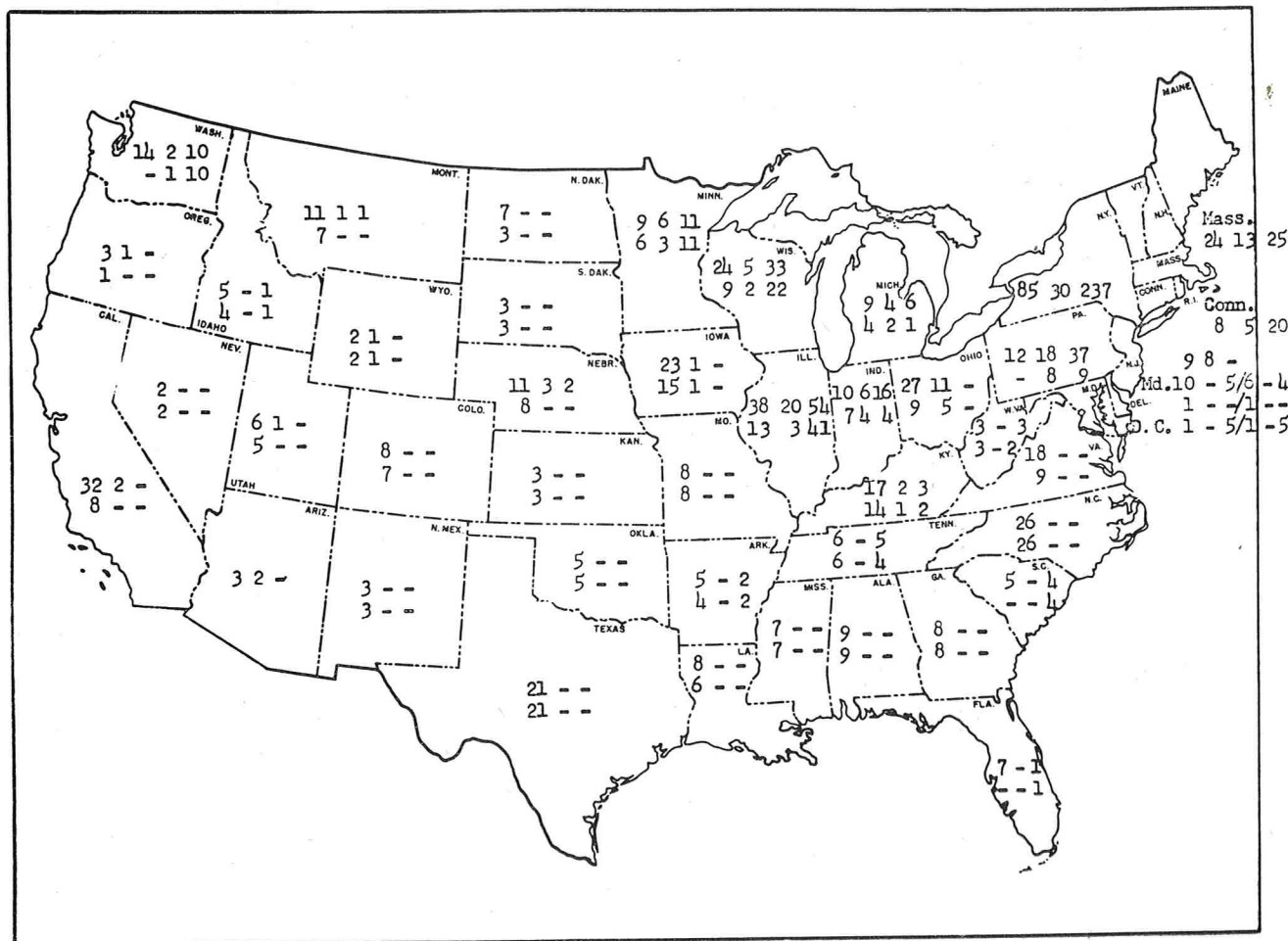


FIGURE 1—NUMBER OF OFFICIAL, COMMERCIAL, AND INDUSTRIAL (OR PRIVATE) MILK LABORATORIES

UNDER STATE REGULATION JANUARY 1, 1959

LOWER LINE GIVES NUMBER OF EACH ACTUALLY USED FOR INTERSTATE SHIPMENT

ing as reference analysts for each other in the conduct of intrastate split sample evaluations.

TRAINING COURSES IN MILK LABORATORY ANALYSES

The annual course on milk laboratory analyses at the Robert A. Taft Sanitary Engineering Center was attended in 1958 by 19 persons from 13 states, and in 1959 by 10 persons from 8 states and 1 foreign country. Center personnel assisted in conducting a course in 1957 in 1 state with 22 in attendance and in 1958 in 1 state with 44 in attendance.

GENERAL

In August, 1957, and again in June, 1958, all PHS Regions were supplied with a sufficient quantity of a list of State milk laboratory certifying officials to furnish a copy to each State Laboratory Director and to each of the other approximately 50 officials named.

During the past two years, 5 of the 8 PHS Regional Offices were visited by staff members of the Sanitary Engineering Center to review the status of milk

laboratory certification by the states concerned and to discuss special problems. Center personnel participated in 3 PHS regional conferences of State milk laboratory certifying officials and of State milk sanitation survey officers.

Discussions of the milk certification program were presented at the Texas Public Health Association meeting in 1958, and in 1959 at a conference on milk administration sponsored by the Communicable Disease Center. A report on milk laboratory certification under the interstate milk shipment program was presented at the Conference of State and Provincial Public Health Laboratory Directors in 1957 and at the Association of State and Territorial Public Health Laboratory Directors Planning Conference in 1958. Thus most State laboratory directors have been apprised of the requirements and current status of milk laboratory certification, although in the past there has been no direct channel of communication between the Secretary of the National Conference and the laboratory directors, for example, to give advance notice of the Seventh National Conference. Al-

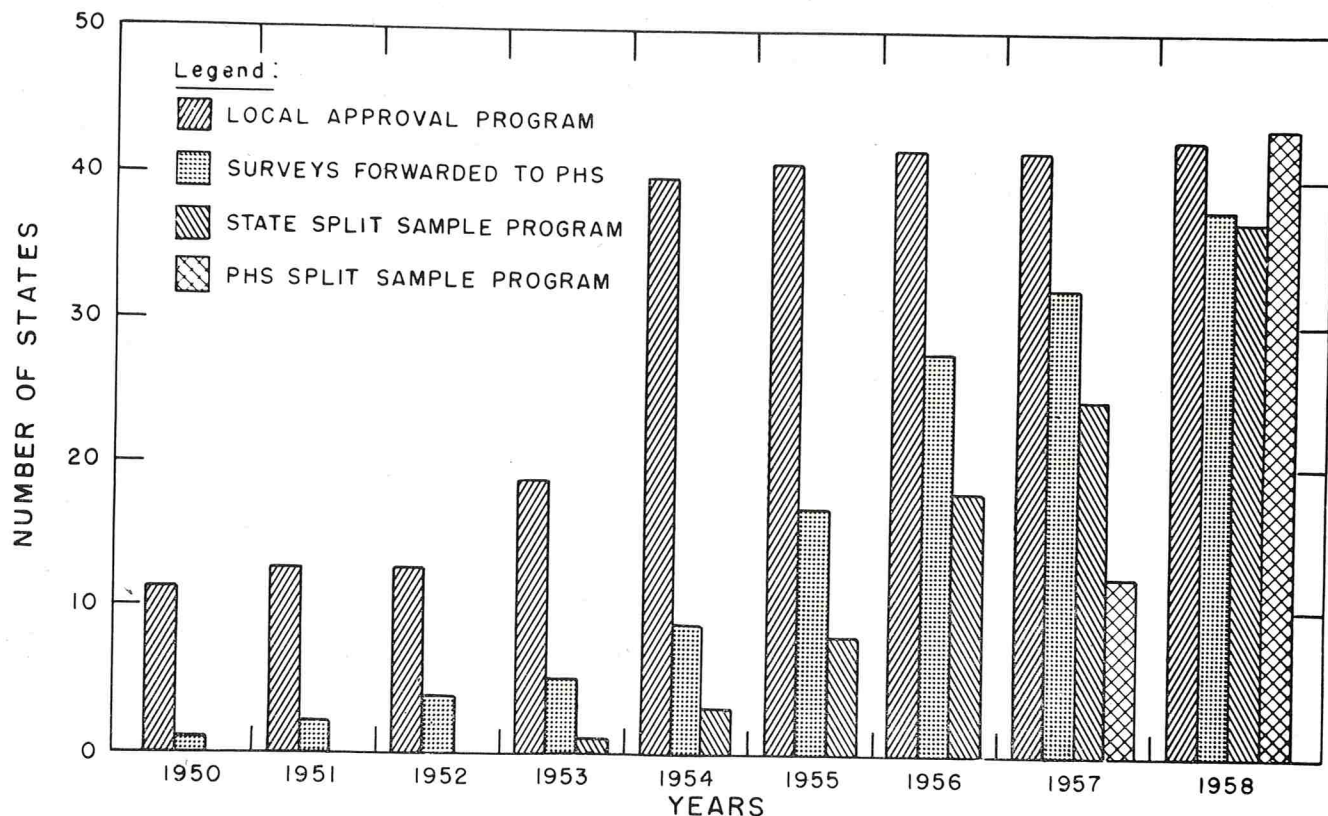


FIGURE 2—STATUS OF MILK LABORATORY CERTIFICATION

though the majority of directors may be notified by their State milk sanitation control officials, this situation is not true for all states.

STATE ACTIVITIES IN MILK LABORATORY CERTIFICATION

In preparation for a progress report at the Seventh National Conference on Interstate Milk Shipment, in January, 1959, the standing Laboratory Committee wrote to 42 State milk laboratory certifying officials to request up-to-date information on their laboratory approval programs. To secure uniform records for the current report, officials were requested to tabulate their data under specified headings on an accompanying questionnaire. The response was excellent, with 100 percent returns. Detailed results for each state were entered by code number under the appropriate PHS Region on three Tables. Table 1 shows that as of January 1, 1959, the ratings of interstate milk shippers are based on the use of 407 laboratories (252 official, 32 commercial, and 123 industrial or private). Officials of 42 states receiving the original questionnaire plus those of 3 additional states from whom data were later obtained had approved 1179 milk laboratories (556 official, 142 commercial, and 481 industrial or private).

Data in Table 2 shows that 42 states reported send-

ing split milk samples to 561 laboratories, of which 518, 503, and 465 examined pasteurized milk respectively by standard plate count, coliform, and phosphatase tests, and 488, 473, and 416 so examined cream or other milk products. Split samples of raw milk were examined by 289 laboratories using standard plate counts, 161 by direct microscopic counts, and 43 in 5 states by methylene blue reduction. Liquid split samples were shipped by 27 states, frozen samples by 10 states, and in 4 states samples were occasionally or routinely split at the time State milk laboratory certifying officials visited a local laboratory. Detailed results are tabulated for each state.

The standing Laboratory Committee also obtained information, by means of the questionnaire, on other state practices in approval of milk laboratories, as detailed in Table 3. This Table shows that 22 states surveyed laboratories annually, while 20 surveyed them at more or less frequent periods. Only 13 states issued certificates annually to locally approved laboratories and 2 at some other time. With reference to the recommendation of the Fourth National Conference in 1953 that the State laboratory agency publish annually or semiannually a list of approved laboratories including the date and test or tests for which approved, as of January 1, 1959, 13 states reported

CERTIFICATION OF MILK LABORATORIES

TABLE 1—STATE ACTIVITIES IN MILK LABORATORY CERTIFICATION

Region	State	No. of labs. (a)			Tests approved for:							No. of labs. (b)			Tests approved for:							MB
		Official	Commercial	Industrial	Past. milk			Raw milk				Official	Commercial	Industrial	Past. milk			Raw milk				
					SPC	Coli	Phos	SPC	DMC	MB	Res				SPC	Coli	Phos	SPC	DMC	MB		
I	43° 44°	8 24	5 13	20 25	33	33	33	33	33	1												
II	45° 1 2 3	9 1 85 12	8 30 18	 237 37	 85 67	 85 66	 85 61	 138 67	 352 20		1			1	1	1						
III	4 5 6 7 8 9	1 17 10 26 18 3	 2 3	5 3 5 3	6 17 12 25 18 6	6 17 14 25 18 6	4 15 13 25 18 6	6 17 12 25 18 5	1 10 14 19 3		1 14 6 26 9 3		5 2 4 2	6 14 7 25 9 3	6 14 9 25 9 3	4 14 4 25 9 3	6 14 4 25 9 4	1 12 9 19 2				
IV	10 11 12 13 14 15	9 7 8 7 5 6	 4 5	 1 4 5	9 8 8 7 9 6	9 8 8 7 9 6	9 8 8 7 9 6	9 8 8 7 9 11	 5 		9 8 7 6		 1 4 4	9 8 7 4 6	9 8 7 4 6	9 8 7 4 6	9 8 7 4 6	1 8 7 4 11				
V	16 17 18 19 20	38 10 9 27 24	20 6 4 11 5	54 16 6 31 33	90 31 14 31 47	85 31 9 31 46	67 21 9 31 40	90 31 7 1 59	59 4 13 28 12	46 5 2 7		13 7 4 9 9	3 4 2 5 2	41 4 1 12 22	18 15 4 12 14	18 15 4 12 14	13 15 4 12 13	18 15 1 11 29	30 5 6 	29 1 5 		
VI	21 22 23 24 25 26 27	23 3 9 8 11 7 3	1 6 3 	 11 2 	24 3 15 8 14 7 3	24 3 15 8 14 7 3	24 3 15 8 13 7 3	23 3 9 8 14 7 3	3 17 5 1		15 3 6 8 8 3 3	1 3 3 3 2 3	1 11 2	14 3 10 8 8 3 3	14 3 10 8 8 3 3	14 3 10 8 8 3 3	9 3 6 8 5 3 2	1 3 15 8 3 2 1				
VII	28 29 30 31 32	5 8 3 5 21	 21	2 	7 6 3 5 21	7 6 3 5 21	7 6 3 5 21	7 3 5 21	 5 		4 6 3 5 21		2 	6 6 3 5 21	6 6 3 5 21	6 6 3 5 21	6 6 3 5 21	 5 	8 			
VIII	33 34 35 36 37	8 5 11 6 2	 1 1 1	 1 1 	8 6 13 6 3	8 6 13 6 3	8 6 5 6 2	8 6 13 6 2	 1 		7 4 7 5 1		 1 2	7 5 7 5 1	7 5 7 5 1	7 5 7 5 1	 5 4 5 1	 7 5 5 	 1 			
IX	38 39 40 41 42	3 32 2 3 14	2 2 1 2	 2 10	5 8 2 4 26	5 8 2 1 26	5 8 2 4 15	5 8 2 4 10	 1		 8 2 1		 1	 8 2 1	 8 2 1	 8 2 1	 8 2 1	 8 2 1	 10 1			
Total:		556	142	481	694	681	619	694	568	72	5	252	32	123	303	297	278	251	127	45		

Legend: (a) Total number of local milk laboratories approved;

(b) Number of local milk laboratories actually used for interstate shipment;

SPC = Standard plate count; Coli = Coliform tests; Phos = Phosphatase tests;

DMC = Direct microscopic counts; MB = Methylene blue reduction test; Res = Resazurin reduction test.

*Data supplementary to original survey.

issuing such an annual list, and 9 states issued lists at other more or less frequent periods. Thus 22 states now issue such certificates as compared with only 4 two years ago.

Sixteen states reported having requirements for laboratory personnel, whereas 25 reported no requirements. Thirty-four states reported reciprocity in lab-

oratory surveys and analyses, whereas 5 have no reciprocity. State milk laboratory certifying officials in 16 states reported receiving copies of the Interstate Milk Shipper Report (Form 1659) from State milk sanitation authorities, although 22 reported they did not. In 20 states milk laboratory certifying officials reported they completed the Survey Form on Samp-

TABLE 2—STATE SPLIT SAMPLE PRACTICE

January 1, 1959

Region	State	Number	Local laboratories examining split samples										No. of Samples	Liquid	Frozen	At Time of visit
			Pasteurized milk			Cream or other Milk products			Raw Milk		Reduction Res					
			SPC	Coli	Phos	SPC	Coli	Phos	Counts SPC	DMC		MB				
II	1	0														
	2	12	12	12	12	12	12	12	12	12		14	X			
	3	19	19	18	18	19	18	18	19	19		10	X			
III	4	5	5	5	5	5	5	5	5			12	X			
	5	17	17	17	15	17	17	15	17	10		10	X	X		
	6	16	14	14	13	14	14	14				6-10	X	X		
	7	26	25	25	25	25	25	25	25	19		4		X		
	8	18	18	18	18	18	18	18	18			10		X		
	9	6	6	6	6	6	6	6	6	4		10	X			
IV	10	0														
	11	8	8	8	8				8	5		10		X		
	12	8	8	8	8	8	8	8	8			10	X			
	13	7	7	7	7	7	7	7	7			8	X			
	14	9	9	9	9	9	9	9	9			6			X	
	15	11	11	6	6	11	6	6	11			10-20	X		X	
V	16	112	90	90	90	90	90	90	18	30	29	8	X			
	17	15	15	15	15	15	15	15	15			10	X			
	18	18	14	11	9	14	11	9	4	12	2	6-10	X			
	19	17	17	17	17	17	17	17		16		10+	X			
	20	61	59	53	40	59	53	40		12		5+	X			
VI	21	21	21	21	21	21	21	21	21	3		10	X			
	22	3	3	3	3				3			10		X		
	23	26	12	12	12	12	12	12	9	17		8				
	24	7	7	7	7	7	7	7	7			6-12		X		
	25	16	14	14	13						2	2	X			
	26	7	7	7	7	7	7	7	7			12	X			
	27	2	2	2	2	2	2	2	2			10	X			
VII	28	7	7	7	7	7	7	7	7			12-14			X	
	29	8	6	6	6	6	6	6	6		8	6	X			
	30	2	2	2	2	2	2	2	2			8	X			
	31	5	5	5	5	5	5	5				10	X			
	32	21	21	21	21	21	21								X	
VIII	33	8	8	8	8	8	8	8				10	X			
	34	5	5	5	5				5			variable		X		
	35	13	13	13	5	13	13	5	13			10	X			
	36	7	6	6	6	6	6	6	6	1		7	X			
	37	0														
IX	38	2	2	2	2	2	2	2	2			1	X			
	39	16	8	8	8	8	8	8	8			10		X		
	40	2										10	X			
	41	4	4	4	4	4	4	4	4			10	X			
	42	15	11	11		11	11		11	1		6		X		
Total:		561	518	503	465	488	473	416	289	161	43	317-343	27	10	4	

CERTIFICATION OF MILK LABORATORIES

TABLE 3—STATE PRACTICES IN APPROVAL OF MILK LABORATORIES

January 1, 1959

		Surveys Laboratories		Issues Certificates		Approved List Issued		Personnal Requirements		Reciprocity		Lab. Official Receives IMS Form 1659		Official Completing Sampling Form	
		Annual	Other	Annual	Other	Annual	Other	Yes	No	Yes	No	Yes	No	Lab.	Other
II	1	X						X		X			X		
	2		X		X	X			X		X			X	X
	3		X					X		X			X	X	
III	4	X							X		X		X	X	
	5		X	X		X		X		X			X		X
	6	X				X			X	X			X		X
	7	X		X		X		X		X		X		X	
	8		X			X			X	X			X		X
	9		X				X		X	X		X			X
IX	10		X						X						
	11	X							X		X		X		
	12	X		X					X	X			X		X
	13	X		X		X		X		X		X		X	
	14						X		X	X			X	X	
	15	X							X	X		X		X	X
V	16		X	X			X	X					X		X
	17	X		X		X	X		X	X			X	X	
	18		X	X			X	X			X		X	X	X
	19		X			X			X	X			X		
	20	X		X			X		X	X			X	X	
VI	21	X		X					X	X		X		X	
	22		X	X				X		X		X			X
	23	X		X						X		X		X	
	24		X				X		X	X			X		X
	25	X		X		X			X	X			X		X
	26		X						X	X			X		X
	27	X				X			X	X		X		X	X
VII	28		X						X	X		X		X	X
	29	X						X			X		X		
	30	X							X	X			X		
	31		X					X		X		X			X
	32		X					X		X		X		X	X
VIII	33	X		X		X		X		X			X	X	
	34		X			X			X	X			X		X
	35		X		X				X	X		X			X
	36		X						X	X			X		X
	37	X						X		X				X	
IX	38	X							X	X		X			X
	39	X						X		X		X		X	X
	40		X						X	X		X		X	
	41	X					X		X	X		X		X	
	42	X		X		X	X	X		X			X	X	
Total:		22	20	13	2	13	9	16	25	34	5	16	22	20	22

ling, whereas 22 states reported this was completed by milk control officials.

In conclusion it appears that the milk laboratory approval programs, split sample programs, and other

recommendations of the National Conference concerning laboratory practices are being carried out satisfactorily by states participating in the interstate milk shipment program.

THE CLEANABILITY OF MATERIALS IN CONTACT WITH DAIRY PRODUCTS

II. THE CLEANABILITY OF METHYL METHACRYLATES¹

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Plastics will probably be used extensively in the manufacture of dairy equipment of the future if they have the following qualifications: (a) meet the requirements of the Food Additive Amendment of the Food, Drug and Cosmetic Act; (b) are as readily cleanable as stainless steel having a 120 grit finish; and (c) have the desired physical properties, such as adequate strength and resistance to distortion.

Determining the cleanability of these plastics will be an important function of sanitarians. Hucker (3), Hucker, Emery and Winkler (4), Mallmann, Kahler and Butt (6), and Ridenour and Armbruster (8) used various techniques in their studies of the cleanability of plastics used for eating utensils. Although none of these data are applicable to the present problem, the radiological technique of Ridenour and Armbruster (8) are useful tools in evaluating the cleanability of the plastics that may be used in the manufacture of dairy equipment.

Hays, Burroughs and Johns (2) and, more recently, Masurovsky and Jordan (7) employed radioactive tracer techniques in studies of the cleanability of milk contact surfaces. Hays, Burroughs and Johns (2) also reported on the use of bacteriological techniques, as did Kaufmann (5). Laboratory "use-test" techniques should not be discarded entirely for the more glamorous radiological techniques.

This paper evaluates the relative cleanability of methyl methacrylates and stainless steel by both bacteriological and radiological techniques.

EXPERIMENTAL

As in the previous study (2), disks approximately two inches in diameter were used as the test specimen of each material. Since Food and Drug Administration approval is given to a specific material for use in contact with foods rather than blanket approval to all material of a general type, the trade

names of the acrylics studied will be used in this paper. The materials tested were:

1. Plexiglas II, UVA.
2. Plexiglas V, Type 607.
3. 18-8 stainless steel, 120 grit finish.

The general experimental plan consisted of soiling these disks with dairy products which had been contaminated previously with *Escherichia coli*. The products used were homogenized milk, buttermilk, cream, and chocolate milk. On each disk, 0.4 ml. of one of the contaminated products was spread evenly on one side only and allowed to air dry. The soiled disks then were cleaned by scrubbing with a circular motion for about 15 seconds with a test tube brush in a cleaning solution at room temperature. Hand scrubbing approximates the methods used in the field to clean dairy equipment. The following cleaning solutions were used: (a) distilled water (b) 0.25 per cent solution of an alkaline cleaner, (c) 0.25 per cent solution of an anionic detergent, (d) 0.25 per cent solution of a nonionic detergent, and (e) 6.7 per cent solution of an acid cleaner.

Although the techniques used in assaying the soil removal were essentially the same as were used in the previous study (2), they will be reviewed briefly.

Radiological Techniques

Dairy products contaminated with a P³² labeled *E. coli* suspension, prepared after the method of Ridenour and Armbruster (8) were used to soil the material to be evaluated by radiological techniques.

After the contaminated disks were air dried, the radioactivity of each was determined in an end-window "Sugarman" type proportional counter. The disks were marked so that they could be placed in the same position in the counter after cleaning. After the initial counts had been made, the disks were cleaned and then rinsed in tap water. After drying, the disks were examined and any residual radioactivity was recorded. All counts were corrected for background and decay.

Bacteriological Techniques

Dairy products contaminated with washed cells of

¹Presented at the 46th Annual Meeting of the International Association of Milk and Food Sanitarians, Inc., at Glenwood Springs, Colorado, August 26-28, 1959.

a 24 hour nutrient broth culture of *E. coli* were used to soil the disks which were to be evaluated by bacteriological techniques. The number of viable cells recovered from two air dried disks was determined by culturing portions of the sterile water in which the disks were soaked and swabbed. This procedure was repeated with each dairy product on each of the three materials. These recovery counts were used as the initial counts in determining the per cent removal of *E. coli* from other contaminated disks scrubbed in the various cleaning solutions.

After the contaminated disks had been scrubbed by hand in the cleaning solution, then rinsed in tap water, they were placed in either 25 ml. of sterile water or in 25 ml. of one of the following germicidal solutions; (a) a hypochlorite solution with 100 ppm available chlorine, (b) an iodophor solution with 25 ppm iodine concentration, and (c) a solution of a quaternary ammonium compound containing 200 ppm active ingredient prepared in water having a natural hardness of 200 to 250 ppm.

The germicidal solutions were inactivated after the disks had been exposed for one minute. After the cleaned disks had been in the sterile water or inactivated germicidal solutions for approximately five minutes, the liquid was cultured in 5 aliquots of 5 ml. each. The disks were also placed in petri dishes with the previously soiled side up. All plates were poured with Difco-brilliant green bile agar to which 0.5 per cent agar had been added so that the 5 ml. aliquots could be cultured in single plates.

RESULTS

The results of this study are given in the four accompanying tables. These tables show the per cent of *E. coli* removed from the surface of the test material as determined by both bacteriological techniques and the radioactive tracer method.

As noted in Tables 1 through 4, both residual coliform counts and residual radioactivity indicated that 99.80 per cent or more of the contaminating soil was removed by scrubbing the disks in any of the cleaning solutions used or even in distilled water.

All of the cleaned disks were sanitized within one minute upon exposure to the germicidal solutions.

The statistical analyses of the radiological data are given in Tables 5 through 8.

DISCUSSION

One P^{32} labeled *E. coli* suspension and one non-labeled suspension were used in this study. Although refrigerated, the number of viable cells in the non-labeled suspension gradually diminished from 420×10^6 to 57.12×10^6 before the bacteriological phase of this study was completed. This in part accounts for the variation in initial counts noted in the tables. The initial counts never approached the number of organisms observed when 0.4 ml. of the suspension was cultured. This difference may have been due to organisms becoming non-viable during drying or the cells remaining on the disks after soaking and swabbing. The latter seems improbable as the disks were

TABLE I—THE CLEANABILITY OF SURFACES SOILED WITH HOMOGENIZED MILK

Materials	Type of cleaner	Bacteriological techniques			Radiological techniques		
		Initial ^a colony counts ($\times 10^6$)	Residual colony counts	Average per cent removal	Initial ^b radioactivity ($\times 10^3$)	Residual ^b radioactivity	Average per cent removal
Plexiglas II, UVA	Alkaline	0.26, 4.00	0, 0	100.00	4.67, 4.74	0.55, 0.22	99.99
	Anionic		0, 3	99.99	4.51, 5.88	0.55, 0.44	99.99
	Nonionic		0, 199	99.99	5.46, 5.85	1.76, 6.54	99.93
	Acid		0, 24	99.99	5.04, 5.05	-0.28, 1.29	99.99
	Water		0, 2	99.99	4.79, 5.03	3.64, 1.82	99.94
Plexiglas V, Type 607	Alkaline	0.46, 2.25	0, 0	100.00	4.57, 5.29	-1.53, -3.60	100.05
	Anionic		0, 0	100.00	4.72, 5.90	-0.27, -0.72	100.01
	Nonionic		0, 9	100.00	4.81, 5.28	-0.37, 0.63	99.99
	Acid		0, 1	99.99	5.38, 5.41	1.39, -3.50	100.01
	Water		0, 103	99.99	4.85, 5.03	5.04, 2.90	99.92
18-8 (120 grit)	Alkaline	0.27, 8.90	0, 0	100.00	4.36, 5.34	6.83, 4.15	99.88
	Anionic		0, 0	100.00	5.53, 6.20	7.48, -0.09	99.93
	Nonionic		0, 0	100.00	4.60, 5.58	9.56, 8.30	99.82
	Acid		0, 0	100.00	5.71, 5.80	4.08, 2.68	99.94
	Water		1, 94	99.99	5.38, 5.43	8.37, 9.33	99.83

^aInitial colony counts are the *E. coli* colony counts recovered from the air dried disks by culturing portions of the water in which the soiled disks were soaked and swabbed.

^bRadioactivity recorded as counts/minute corrected for background and decay.

always noted to be visibly clean at the time the initial counts were made. An exceptionally poor recovery count (initial count) was noted from the disks soiled with buttermilk. In one series, less than 10 coliforms per disk were recovered although a calcu-

lated 2.36×10^6 organisms had been placed on these disks. No doubt, the acidity of the buttermilk enhanced the lethality noticed during the drying of other dairy products.

Colonies were not observed in the cultures of 99

TABLE 2—THE CLEANABILITY OF SURFACES SOILED WITH CHOCOLATE MILK

Materials	Type of cleaner	Bacteriological techniques			Radiological techniques		
		Initial ^a colony counts ($\times 10^6$)	Residual colony counts	Average per cent removal	Initial ^b radioactivity ($\times 10^3$)	Residual ^b radioactivity	Average per cent removal
Plexiglas II, UVA	Alkaline	1.10, 10.50	0, 0	100.00	4.71, 6.04	-1.35, -0.54	100.02
	Anionic		0, 0	100.00	4.75, 5.65	0.11, -0.45	100.00
	Nonionic		0, 45	99.99	4.53, 5.38	3.42, 4.15	99.92
	Acid		0, 0	100.00	5.11, 5.23	2.47, 1.29	99.96
	Water		14, 2000	99.99	5.38, 5.56	2.49, 3.94	99.94
Plexiglas V, Type 607	Alkaline	1.65, 12.25	0, 0	100.00	4.49, 5.96	-2.07, 0.44	100.02
	Anionic		0, 0	100.00	4.73, 5.42	-1.17, 0.22	100.01
	Nonionic		0, 0	100.00	4.82, 5.06	2.14, 4.90	99.93
	Acid		0, 0	100.00	5.71, 5.92	-0.46, 0.86	100.00
	Water		0, 65	99.99	5.29, 5.67	0.52, -1.04	100.00
18-8 (120 grit)	Alkaline	1.17, 5.50	0, 0	100.00	4.78, 4.82	1.76, 1.21	99.97
	Anionic		0, 0	100.00	4.49, 5.57	2.09, 0.99	99.96
	Nonionic		0, 13	99.99	4.96, 5.87	7.42, 0.63	99.92
	Acid		0, 0	100.00	4.94, 6.68	2.47, 0.75	99.96
	Water		16, 175	99.99	5.52, 5.59	3.84, 0.21	99.96

^aInitial colony counts are the *E. coli* colony counts recovered from the air dried disks by culturing portions of the water in which the soiled disks were soaked and swabbed.

^bRadioactivity recorded as counts/minute corrected for background and decay.

TABLE 3—THE CLEANABILITY OF SURFACES SOILED WITH BUTTERMILK

Materials	Type of cleaner	Bacteriological techniques			Radiological techniques		
		Initial ^a colony counts ($\times 10^6$)	Residual colony counts	Average per cent removal	Initial ^b radioactivity ($\times 10^3$)	Residual radioactivity	Average per cent removal
Plexiglas II, UVA	Alkaline	(c), 0.0037	0, 1	99.99	2.55, 7.69	-0.70, 0.37	100.01
	Anionic		0, 0	100.00	5.58, 7.71	-3.51, -3.60	100.05
	Nonionic		0, 0	100.00	1.17, 1.54	-1.19, 0.88	100.02
	Acid		0, 0	100.00	5.49, 5.62	1.82, 4.08	99.95
	Water		0, 0	100.00	5.77, 5.68	1.50, 1.50	99.97
Plexiglas V, Type 607	Alkaline	(c), 0.008	0, 0	100.00	0.96, 7.13	1.59, -0.47	99.92
	Anionic		0, 0	100.00	4.85, 6.05	-1.17, 0.00	100.01
	Nonionic		0, 0	100.00	1.83, 5.52	-1.14, -2.30	100.06
	Acid		0, 0	100.00	5.66, 6.02	-0.27, 1.10	99.99
	Water		0, 0	100.00	5.52, 5.92	1.61, 0.21	99.98
18-8 (120 grit)	Alkaline	(c), 0.0022	0, 0	100.00	4.77, 5.03	4.27, 4.88	99.91
	Anionic		0, 0	100.00	5.98, 6.70	2.09, 5.17	99.93
	Nonionic		0, 0	100.00	2.99, 3.94	1.64, -0.89	99.98
	Acid		0, 0	100.00	6.42, 6.56	2.43, 1.76	99.96
	Water		0, 2	99.99	6.47, 6.79	6.44, 3.75	99.92

^aInitial colony counts are the *E. coli* colony counts recovered from the air dried disks by culturing portions of the water in which the soiled disks were soaked and swabbed.

^bRadioactivity recorded as counts/minute corrected for background and decay.

^cInitial counts of some of the disks were less than 10 colonies per disk, although a calculated 2.36×10^6 organisms were in the buttermilk placed on these disks.

TABLE 4—THE CLEANABILITY OF SURFACES SOILED WITH CREAM

Materials	Type of cleaner	Bacteriological techniques			Radiological techniques		
		Initial ^a colony counts (x10 ⁶)	Residual colony counts	Average per cent removal	Initial ^b radioactivity (x10 ³)	Residual radioactivity	Average per cent removal
Plexiglas II, UVA	Alkaline	0.325, 0.437	0, 0	100.00	4.89, 5.04	-1.33, 0.24	100.00
	Anionic		0, 0	100.00	4.70, 4.92	-0.09, -1.98	100.02
	Nonionic		0, 0	100.00	4.82, 4.84	-1.93, -0.74	100.03
	Acid		0, 0	100.00	4.81, 5.09	3.31, 0.66	99.96
	Water		0, 11	99.99	5.23, 5.23	-2.04, 0.43	100.02
Plexiglas V, Type 607	Alkaline	0.250, 0.382	0, 0	100.00	4.88, 5.21	-0.47, -0.94	100.01
	Anionic		0, 1	99.99	4.93, 5.35	-4.05, -5.40	100.09
	Nonionic		0, 0	100.00	5.16, 5.19	-0.07, -0.15	100.00
	Acid		0, 0	100.00	5.03, 5.11	-2.45, 2.65	100.00
	Water		0, 29	99.99	5.22, 5.33	6.01, 4.72	99.89
18-8 (120 grit)	Alkaline	0.242, 0.495	0, 0	100.00	4.93, 5.22	3.78, 3.90	99.92
	Anionic		0, 0	100.00	5.39, 6.48	0.22, 0.88	99.99
	Nonionic		0, 0	100.00	5.32, 6.44	-0.22, 5.28	99.95
	Acid		0, 1	99.99	5.45, 5.75	1.65, 3.53	99.95
	Water		0, 0	100.00	5.65, 5.70	5.47, 9.76	99.86

^aInitial colony counts are the *E. coli* colony counts recovered from the air dried disks by culturing portions of the water in which the soiled disks were soaked and swabbed.

^bRadioactivity recorded as counts/minute corrected for background and decay.

of the 120 disks after scrubbing in the cleaning solutions or distilled water. Of the 21 contaminated disks, twelve were scrubbed only in distilled water. The residual counts of these disks ranged from 2 to 2000 colonies (Table 2) with only three having a colony count in excess of 100 per disk (Tables 1 and 2). Only one of the disks that were scrubbed in a cleaning solution had a count in excess of 100. The residual count of this Plexiglas II UVA disk was 199. This disk had been contaminated with 45.2×10^6 coliforms in homogenized milk and cleaned with a nonionic detergent. (See Table 1).

The initial count of radioactivity ranged from 7,710 to an unexplained low of 960 per minute. In most cases, the counts per minute for the two disks used for each treatment were within 1000 of each other.

Residual radioactivity is measured by subtracting the experimentally determined background count from a reading of the sample being investigated. When the residual radioactivity is of a very low order, this reading would be very close to the background count. Depending upon how close to zero the residual radioactivity actually is, up to half of these counts could be negative, since both the background and radioactivity counts are subject to random variation. During the period in which the radiological data were collected, the background counts varied from 34 to 41 counts/minute. The standard deviation (1) of background count was about 2 counts/minute. Under these conditions 1 per cent of the

measurements would be expected to have negative counts as large as minus 6.

The residual radioactivity of 39 of the 120 disks was noted to range from zero to minus 5.40 counts/minute. These negative values were a natural consequence of the random distribution of counts of very low order, as mentioned above.

Radioactivity was observed on 21 of the 24 disks cleaned in distilled water. The residual activity of these disks ranged from 0.21 to 9.76 counts/minute. The latter count was obtained from a stainless steel disk which had been contaminated with cream. (See Tables 2 through 4).

TABLE 5—ANALYSIS OF VARIANCE (RADIOLOGICAL DATA)^a

Source of variation	Degree of freedom	Mean square
Type of cleaner	4	124.81 ^b
Dairy product	3	70.21 ^b
Surface tested	2	523.08 ^b
Cleaner x dairy product	12	56.28 ^b
Cleaner x surface tested	8	21.01 N. S.
Dairy product x surface tested	6	43.61 ^c
Cleaner x dairy product x surface	24	19.64 N. S.
Replication	60	15.97
Total	119	

^aAfter Snedecor (9).

^bSignificant to .01 level

^cSignificant to .05 level

N. S. = Not Significant

TABLE 6—EFFECT OF SURFACE TESTED ON PER CENT CONTAMINATION REMOVED

Surface	Average per cent contamination removed
Plexiglas V, Type 607	100.00
Plexiglas II, UVA	99.99
18-8 (120)	99.83

(a)

L. S. D. (1% level) between two surface averages = 0.02%.
(a) Averages enclosed in brackets are not significantly different.

TABLE 7—EFFECT OF CLEANING AGENT ON PER CENT CONTAMINATION REMOVED

Cleaning agent	Average per cent contamination removed
Anionic Detergent	100.00
Alkaline Cleaner	99.98
Acid Cleaner	99.97
Nonionic Detergent	99.96
Water	99.94

(a)

L.S.D. (5% level) between two cleaning agents average = .02%
(a) Averages enclosed in brackets are not significantly different.

TABLE 8—EFFECT OF DAIRY PRODUCT ON PER CENT CONTAMINATION REMOVED

Dairy product	Average per cent contamination removed
Buttermilk	99.98
Cream	99.98
Chocolate Milk	99.97
Homogenized Milk	99.95

(a)

L. S. D. (5% level) between two product averages = 0.02%
(a) Averages enclosed in brackets are not significantly different.

Residual radioactivity was noted on 60 of the 96 disks which had been scrubbed in the various cleaning solutions. These counts ranged from 0.07 to 9.56 per minute. The surface showing the highest residual radioactivity was a stainless steel disk soiled with homogenized milk and cleaned in a nonionic detergent (Table 1).

To complete both the bacteriological and radiological evaluation of the cleanability of these materials, the disks had to be soiled at least twice during each phase of the investigation. The phenomenon of

soil build-up reported by Masurovsky and Jordan (7) was not observed.

SUMMARY

The relative cleanability of Plexiglas II, UVA; Plexiglas V, Type 607; and 18-8 stainless steel having a 120 grit finish has been evaluated by both bacteriological and radiological techniques.

Even with distilled water, 99.80 per cent or more of the contaminating soil was removed from the test materials.

All disks were sanitized within one minute by the hypochlorite, iodophor, and quaternary ammonium compound solutions at the concentration used.

It may be concluded from these data that Plexiglas II, UVA and Plexiglas V, Type 607 are as readily cleanable as is 18-8 stainless steel with a 120 grit finish.

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REFERENCES

1. Friedlander, G. and Kennedy, J. W. *Introduction to Radio Chemistry*. John Wiley & Sons, New York, N. Y. 1949, pp. 206-210.
2. Hays, G. L., Burroughs, J. D., and Johns, D. H. The cleanability of materials in contact with dairy products. *J. Milk and Food Technol.*, 21: 68-72. 1958.
3. Hucker, G. J. The adherence of organisms and soil to surfaces of eating utensils. *J. Milk and Food Technol.*, 17: 48-51. 1954.
4. Hucker, G. J., Emery, A. J., and Winkler, Elizabeth. The relation of soil film buildup and low surface wetting properties to plastic and china surfaces. *J. Milk and Food Technol.*, 14: 95-97. 1951.
5. Kaufmann, O. W., A suggested laboratory "use test" for comparing the cleanability of various materials. *J. Milk and Food Technol.*, 22: 35-36. 1959.
6. Mallmann, W. L., Kahler, D., and Butt, F. Studies on the cleaning and sanitizing of melamine plastic and vitreous china dinnerware. *Modern Sanitation*, 6: 20-25, 48-52 (October) 1954.
7. Masurovsky, E. B. and Jordan, W. K. Studies on the relative bacterial cleanability of milk-Contact Surfaces. *J. Dairy Sci.*, 41: 1342-1358. 1958.
8. Ridenour, G. M. and Armbruster, E. H. Bacterial cleanability of various types of eating surfaces. *Am. J. Public Health*, 43: 138-149. 1953.
9. Snedecor, G. W. *Statistical Methods*, 5th Ed. Iowa State Press. 1956.

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NEWS AND EVENTS

ANNOUNCEMENT CONCERNING THE SANITARIANS AWARD FOR 1960

Announcement is made that nominations will be accepted for the annual Sanitarians Award until May 1, 1960. Members of the International Association of Milk and Food Sanitarians, Inc., are requested to give consideration to the nomination of individuals whose professional work in the field of milk and food sanitation in their communities has been outstanding.

The Award consists of a Certificate of Citation and \$1,000 in cash, and is sponsored jointly by the Diversey Corporation, Klenzade Products, Inc., Oakite Products, Inc., Pennsylvania Salt Manufacturing Company, and the Olin Mathieson Chemical Corporation. It is administered by the International Association of Milk and Food Sanitarians, Inc., and is presented annually. The Sanitarians Award was initiated in 1952, and last year it was presented to Mr. William Kempa,

dairy and milk sanitarian for the city of Regina, Saskatchewan, Canada. The next presentation will be at the annual meeting of the Association in Chicago next September.

The Executive Board of the Association has established the following rules and procedures governing the Sanitarians Award.

Eligibility

The rules concerning eligibility of candidates for nomination are:

(1) Any living citizen of the United States or Canada who, at the time of nomination, is employed as a professional milk and food sanitarian, or both, by a county or municipality, is eligible for the Award, except members of the Executive Board and members of the Committee on Recognition and Awards of the International Association of Milk and Food Sanitarians, Inc. Employees of State or Federal agencies

and of industry are not eligible for the Award. Membership in the International Association of Milk and Food Sanitarians, Inc., is not a prerequisite of eligibility, and there are no restrictions as to race, sex, or age.

(2) A candidate shall have made a meritorious contribution in the field of milk and food sanitation to the public health and welfare of a county or municipality within the United States or Canada.

(3) The achievements and contributions on which the Award is to be based, must have been completed during the five-year period immediately preceding January 1 of the year during which the Award is to be made. Under special circumstances, consideration will be given to related work accomplished by the candidate during the seven-year period preceding January 1 of the year during which the Award is to be made.

(4) Co-workers are eligible for nomination if both have contributed equally to the work upon which the nomination is based.

(5) No person who has once received the Award shall be eligible for nomination.

Nominations

Nominations of candidates for the Sanitarians Award may be submitted by the Affiliate Associations of the IAMFS, or by any member of the Association in good standing except members of the Executive Board, members of the Committee on Recognition and Awards, and employees of the sponsoring companies. Nominations from persons who are not members of the Association cannot be accepted. No member or Affiliate may nominate more than one candidate in any given year.

Each nomination must be accompanied by factual information concerning the candidate, a resume of his work and achievements, evidence supporting his achievements and if, available, reprints of publications. A form for the submission of nominations may be obtained upon request from H. L. Thomasson, Executive Secretary, International Association of Milk and Food Sanitarians, Inc., P. O. Box 437, Shelbyville, Indiana.

Deadline for Submission of Nominations

The deadline for submission of nominations is set annually, and all nominations and supporting evidence must be postmarked prior to midnight of that date.

Selection Of The Recipient

The Committee on Recognition and Awards of the International Association of Milk and Food Sanitarians, Inc., has full responsibility for selecting from among the candidates nominated the recipient of the Sanitarians Award. In judging the contributions of

each candidate, the Committee will give special consideration to (a) originality of thought, mode of planning, and techniques employed, (b) the comprehensive nature of the candidate's achievements, and (c) their relative value as they affect the health and welfare of the candidate's community. The Committee will give consideration also to the efforts of the candidate to establish professional recognition in the community in which he serves, as well as to his research, administrative development, program operation and educational achievements. Additional information or verification of submitted information will be requested when considered necessary by the Committee. Testimonial letters in behalf of a candidate are not desired.

If, after reviewing the nominations and supporting evidence, the Committee decide that the work and achievements of none of the candidates have been significantly outstanding, the Award shall not be made. In this connection, it is fundamental that if meritorious professional achievement cannot be discerned the Award shall be omitted for a year rather than to lower the standards for selections of a recipient.

The 1960 Committee on Recognition and Awards consists of H. B. Robinson, Chairman, Milk and Food Program, Div. of Engineering Services, U. S. Public Health Service, Room 4125 South Bldg., Washington 25, D. C.; Cameron S. Adams, State Dept. of Agriculture, Old Capital Building, Olympia, Washington; James M. Doughty, Jr., Division of Foods & Drugs, State Dept. of Health, Austin, Texas; Dr. Robert Holland, Dept. of Dairy Industry, Cornell University, Ithaca, New York; Richard S. Mansfield, 125 Woodmont Circle, Clinton, Tennessee; and Dr. Franklin W. Barber, Research and Development Division, National Dairy Products Corp., Oakdale, Long Island, New York.

ANNOUNCEMENT CONCERNING THE CITATION AWARD FOR 1960 MEMBERS

Each year the International Association of Milk and Food Sanitarians awards to one of its members a citation in recognition of outstanding service to the Association and its members. Recipients must be members of the Association in good standing and have a record of constructive service on behalf of the Association and its member sanitarians. Last year's award was presented to Mr. John D. Faulkner, Chief of the Public Health Service Milk and Food Program, for his service as an officer and member of the Executive Board of the Association, for services

on Association committees and for serving as a representative on the Sanitarian's Joint Council.

The award will be presented again at this year's meeting in Chicago next September. Any member of the Association or an Affiliate Association can nominate an individual for the Citation Award.

Nominations must be accompanied by supporting evidence of an individual's past contributions and services to the Association. Nominations for the 1960 Citation Award should be sent to Harold B. Robinson, Milk and Food Program, Division of Engineering Services, Room 4125 South HEW Building, U. S. Public Health Service, Washington 25, D. C., or to H. L. Thomasson, Executive Secretary, International Association of Milk and Food Sanitarians, Inc., P. O. Box 437, Shelbyville, Indiana, not later than May 15, 1960.

Selection of the recipient of the Citation Award will be made by the Committee on Recognition and Awards.

QUESTIONS AND ANSWERS

Note: Questions of technical nature may be submitted to the Editorial Office of the Journal. A question in your mind may be in the minds of many others. Send your questions in and we will attempt to answer them.

Question: Can you provide any information on removal of radioactive materials from milk?

Answer: Three federal agencies launched a joint research program to find a commercially feasible process for removing radioactive strontium (Sr^{90}) from milk. In announcing the project the Department of Agriculture emphasized that "The levels of radioactive fall-out from past nuclear testing do not justify action to decontaminate milk supplies." Rather, the agency said, "The research is designed to provide practical answers to problems that might arise in the future." In addition to the Department of Agriculture, the Atomic Energy Commission and the U. S. Public Health Service are taking part in the research program, which will cost \$200,000 a year. The research will be done at a pilot dairy plant at the Agriculture Research Center at Beltsville, Md.

Strontium-90 a by-product of nuclear explosions, can cause leukemia and bone cancer if it is accumulated in sufficient quantities. The product gets into milk from the plants that cows eat. For more than a year the PHS has been conducting nation-wide samplings of milk to determine whether the radioactivity level is safe.

Previous laboratory tests conducted by the AEC and British and Canadian scientists have demonstrated that it is possible on a laboratory scale to remove strontium-90 from milk through the use of chemicals known as ion-exchange resins. These resins duplicate the manner in

which soil particles absorb most strontium-90. Leaves absorb from the air most of the radioactivity found in plants.

In the latest Public Health Service report on milk samplings, the count decreased in 9 of 11 testing stations during the month of July. Only Fargo, N. D., and St. Louis, Mo., showed increases, with the Fargo count of 22.1 micro microcuries being highest of all stations. However, the level was far below the 80 micro microcuries of lifetime exposure considered to be the maximum permissible concentration of strontium-90 for human beings. The levels have generally been dropping during the current nuclear test cessation by the United States and Russia.

Question: Can the polio virus be carried by flies?

Answer: Yes, for a recent article on this see, Horstmann, D. M., Niedermann, J. C., Riordan, J. T., and Paul, J. R. "The Trial Use of Sabin's Attenuated Type 1 Poliovirus Vaccine in a Village in Southern Arizona." *Am. J. Hygiene*, 70: 169-184. 1959. Large quantities of flies were caught and a great many enteroviruses were isolated. The species of flies included house flies (*Musca domestica*), green bottle flies (*Phaenecia sericata*) and other feces eating or flesh eating flies. Of 238 catches tested, 202 were positive for at least one virus. Poliovirus was isolated from 61 different fly collections. Seven of the Type 1 strains isolated have been tested for virulence by intracerebral inoculation of monkeys. Five produced lesions of the central nervous system in all test animals, and four strains induced mild paralysis in one or both monkeys. In certain areas the testing of people, privies, and the fly population can yield a considerable amount of information as to the extent of environmental contamination and infection going on within a community.

(Note: Here is another bit of evidence that in these enlightened days of electronic wizardry and automation, disease organisms are still spread by the old fashioned team of flies, fingers, filth, feces and fomites.)

BULK MILK HANDLING SYSTEM REVIEWED

At the Dairy Plant Fieldmen's Conference held at Pennsylvania State University last summer, Dr. H. L. Ragsdale, Milk Sanitarian, Abbotts Dairy Company, Philadelphia presented a discussion of the bulk milk handling system. Included were the results of a survey by questionnaire which he conducted among representatives of dairy companies doing business in Pennsylvania, New Jersey, Boston, Chicago and St. Louis. The replies were summarized and are presented below:

1. What are the chief troubles experienced with the system?

Teaching producers to operate the equipment (3)

Weights and Butterfat shrinkage (2)

- Freon Leaks (1) Agitator motor leaks (1)
 Freezing of condenser in winter (1)
 Poor agitation (2) Poor drainage (1)
 Delay in unloading at plants (2)
 Improper cleaning of transport tanker (3)
 Sediment testing (2) Improper installation (1)
 Refrigeration controls (2)
 Calibration of tanks (1) Weight and butterfat tests (1)
2. Which tank, direct expansion or ice bank type, has given the better service?
 No difference (6) Direct expansion (2)
 Ice Bank (4)
 Approximate percentage of each in your supply?
 Direct Expansion 73% Ice Bank 27%
 Which type has more milk freezing?
 Direct expansion (18) Ice Bank (1)
 Is this serious YES (6) NO (13)
 Is the demand for vacuum tanks increasing?
 YES (15) NO (4)
3. Have you experienced faulty mixing due to improper agitation?
 YES (14) NO (5)
 Is this due to speed of agitation (3)
 time of agitation (7)
 faulty design (13)
4. Have controls governing the operation of the compressor been a problem?
 YES (9) NO (10)
 If so, do you experience more trouble in winter, YES (4); in summer, YES (1)
 periods of irregular temperature change (7)
 no change (4)
5. Have you found that the thermometer attached to outer surface of inside wall indicates the correct temperature of milk in the tank?
 YES (3) NO (13)
 If inaccurate, what is the degree range of inaccuracy? 2 to 10 degrees
 Would you prefer the probe armored-type thermometer, which rests in the body of the milk supply?
 YES (14) NO (5)
6. Compressors
 Do you require that they shall be installed outside the milk room?
 YES (10) NO (5)
 Tanks exceeding 300 gallons YES (3)
 No requirement (1)
 Have you observed that many are too small
 YES (5) NO (10)
 too large
 YES (2) NO (9)
 Do you require that oil separators be installed?
 YES (1) NO (13) Recommend (2)
- Do you consider an oil separator more necessary on direct expansion than on ice bank type?
 YES (13) NO (2)
 On large compressors, YES (1) Don't know (1)
 Are wiring and compressor piping installed above the tank, on milk house wall, or in the concrete floor of the milk house?
 Above (13) On wall (1) Variable (4)
 Your recommendation: Not in concrete floor (2)
 In concrete floor (1)
7. Have you experienced leakage of grease into the milk along the agitator shaft?
 YES (13) NO (6)
 Have motors with nylon gears been satisfactory?
 YES (11) No experience (8)
8. Is milk measured with a dry measuring stick?
 YES (9) NO (1) Wiped dry (5)
 Both, wet and dry (4)
9. Do you use milk meter or any other method to check total weights given producers by the driver?
 Milk meter (7) Scales (7)
 Calibrated storage tanks (3) No (3)
 Results—Satisfactory (4) Variable (1)
 Requires frequent checking (1)
10. Any additional comment?
 Do something regarding thermometers.
 Tanks should have better design to obtain proper mixing.
 Recommend use of timer on agitators.
 Recommend stainless steel for outer shell of tanks.
 More work should be done on sediment testing.
 Continue training of driver-receivers.
 State should be more active on calibration and recalibration of tanks.
 Information on performance of tank washers needed.
 Agitator motors should be coordinated with water circulating pumps of all ice bank tanks.
 Fieldmen should work with plant management in scheduling the pick-up and unloading time of transport tankers.
 Even though many problems are involved, we would never go back to use of milk cans.

GEORGE GRIM WRITES FROM NORTH DAKOTA —BUT IT COULD BE YOU OR I

I hung my coat on the metal rack, slid on the stool facing the lunch counter.

Taped to the wall over the stove and wooden wall cabinets with the grease-clouded glass doors were stained signs proclaiming what I could eat.

There was steak. And hamburgers, eggs, beans,

pie. Written on a slate was "roast beef." Something else was half erased.

It was early in the evening. Obviously there had been quite a few customers not too long before. The floors were proof they had come and gone. The mud had caked into dust.

A tired woman in her late 30's asked me what I'd have. She had been scraping grease off the black griddle, using a wide, flat, pockmarked spatula. I settled for eggs — and the griddle was soon at work again.

The refrigerator's freezer compartment was jammed with made-up hamburgers, the steaks.

The harried cook-and-everything-else kept trying to tidy things while the eggs fried. But the day had been long; the efforts she'd make wouldn't really seem to change things much.

In the cabinet were doughnuts that had been stared at all day. A few dejected pieces of pie waited for somebody who might come in before closing time — an hour away.

The silverware was plunked on the counter top, uncertain in its cleanliness. Four young people came in sat at one of the few tables, wanted hash browns with their hamburgers.

Everything in the place—lighting fixtures, the curtains hanging limp at the windows, the very people I had joined—seemed enveloped in a sort of fog that might have rolled in from some backwater.

I took off my glasses, cleaned them, put them back on. Nothing was any sharper.

I guess the eggs were fresh. And the coffee was probably good enough, kept warm in its rough white china mug.

But how could you tell? The act of dining had become an eat-and-get-out. At least the air would be fresher outside.

(There was the noxious gnawing towards nausea of a gas jet open somewhere on the big range. Nobody seemed to notice the odor. It did not add to the enjoyment of the eggs.)

The counter next to the lunch area was littered with gimeracks. On it, and on the wall behind it, were half empty cards from which had been torn pocket combs, sun glasses, cheap souvenirs.

How many such lunch places must there be in America? And how many solitary diners must have to eat in them?

By contrast, I'd had breakfast in another lunchroom.

Everything was crisp, bright. The girls behind the counter seemed happy to greet a stranger. The area around the grill was wiped and wiped into a continued shine. And even though the coffee was

served in a plastic cup, it didn't seem to suffer too much.

There was feeling of pride behind that counter. You saw it—felt it—and tasted the result approvingly.

Perhaps those other lunchrooms depend, too much, on one or two harassed people behind the counter. Perhaps if their owners put on aprons more often and cleaned things, it would help.

All I know is—Please, don't let me be hungry near there again!

This is so real and descriptive we wanted you to read it — Editor.



Ken Weckel all dressed up in the cowboy hat presented him by the Canadian Dairy Industry Council when he appeared at their program at Banff last September.

UNIVERSITY OF RHODE ISLAND JUNIOR GETS MILK AND FOOD SANITARIANS SCHOLARSHIP

Earl J. Maddalena, University of Rhode Island, college of agriculture, from Coventry, is the first recipient of the *Rhode Island Milk and Food Sanitarians Scholarship*. Maddalena has been awarded \$200 by the Rhode Island Milk and Food Sanitarians Association.

He was selected on the basis of his scholastic record and his interests in the dairy industry.

Maddalena is married and lives on a 30-acre rented farm, which he operates in addition to attending college. He expects to rent more land during the summer and increase his herd from ten head now owned.

A veteran, he is a member of Alpha Zeta, honorary agricultural fraternity at URI.

TYPES OF FLAVOR REMOVAL EQUIPMENT*

W. K. JORDAN

Department of Dairy Industry, Cornell University

The idea of treating a fluid dairy product to improve its flavor by removing undesirable flavoring compounds that may have found their way into the product is not a new one. Systems for treating cream for buttermaking have been in use for more than 30 years. This is true in New Zealand, in particular, where large amounts of sweet-cream butter are made from cream which, before treatment, is often tainted with objectionable feed and weed flavors. A number of patents on equipment for removing undesirable flavors from cream were issued to men from that country during the period from 1930 to 1950. Research workers there have studied the engineering and economic aspects of the operation of such equipment, and have made valuable contributions toward improving the efficiency in both respects.

The widespread interest in applying such treatments to fluid milk, on the other hand, is fairly recent. This is the result, according to some, of the better ways of handling milk in practice today. These better methods mean fewer developed flavors, as a result of bacterial action in the milk, to mask existing feed or weed flavors. The consumer has become more aware of this latter type of flavor, and it is necessary to treat milk in order to provide a clean, fresh tasting product at all times. It is known that much can be done to avoid these off flavors through selection of feeds and through appropriate feeding schedules. However, because of economic and human factors, such measures can not always be counted on, and the plant operator has turned to the use of equipment for removing feed and weed flavors as an insurance against turning out a poor product.

The equipment in use in this country is intended, in most cases, to work in conjunction with a high-temperature short-time pasteurizer. The plant in which batch pasteurization is still used can also get equipment which will do an effective job of off-flavor removal, if the flavor is not too strong. Milk with intense off flavors can best be processed by continuous

flow methods which fit in well with the high-temperature short-time pasteurizer.

Before discussing examples of the equipment used for flavor improvement, it would perhaps be worthwhile to spend some time considering what it is that the equipment is designed to accomplish. The off-flavored compounds which get into the milk may be gaseous or they may be liquids soluble in water or fat. Usually they are distributed between both the water and fat phase of milk at the low concentrations in which they are present. Those substances which are dissolved as gaseous are most easily removed, and simply drawing a vacuum over the surface of the milk will remove most of them. Purging, by bubbling air through milk, can sometimes flush substances of this nature out, although the system is not in widespread use. Substances other than gases usually require more treatment.

The taint substance in solution exerts a vapor pressure, that is, it exists to some extent in the gaseous state above the liquid in which it is dissolved. The vapor pressure is a function of temperature — the higher the temperature, the greater the vapor pressure of the taint substance. There is an equilibrium between the concentration of taint in the liquid and in the vapor above the liquid. However, if some of the vapor is removed it may take some time for the equilibrium to be re-established by material going from the solution to the vapor state. Many of the design features of flavor improving equipment are for the purpose of speeding up the establishment of the equilibrium when some of the vapor is removed. Means such as introducing liquid into a treating chamber as fine droplets, causing it to flow as a thin film down the wall of the chamber, or circulating it as a thin sheet inside the chamber are used to increase the surface area of the liquid phases. This enables the taint to leave the liquid, enter the vapor phase, and establish the equilibrium quickly. If the vapor is continually removed from the chamber under these conditions, there will also be a removal of the taint from the milk.

At elevated temperatures the mixture of vapors being removed in such processing will consist largely of water vapor because the water part of the milk exerts a considerable vapor pressure. This can result in concentration of the milk if precautions are not taken to prevent it. Some units are equipped with condensers which condense the water part of the vapors being removed and returns it to the milk while the off-flavor component remains in the vapor state and is removed by a vacuum pump. This is possible because the taint substance ordinarily has a lower boiling point than water and does not condense when conditions are adjusted to condense the

*One of a series of papers presented at the Cornell Conference on Milk Flavors, May 5 and 6, 1959 at Ithaca, N. Y.

water vapor. In other systems the milk is continually diluted by the addition of steam either just before or in the treating chamber. The amount of dilution caused by this addition of steam is adjusted to just balance the concentrating effect of the removal of vapors and the composition of the product coming out of the unit remains the same as the entering composition. In some parts of the country this type of treatment is not considered acceptable because the addition of steam is interpreted as an adulteration of the product. It is obvious that where such systems are used the steam must be absolutely pure and free from trace carryovers of the compounds used in treating boiler feed waters.

If the milk boils in the treating unit the formation of vapor takes place at a rapid rate and its removal can be accomplished quickly. It is not necessary to have the milk at very high temperatures to accomplish this. The milk can be made to boil at relatively low temperatures by reducing the pressure in the chamber in which it is being treated. This is what is done in a vacuum pan where milk is made to boil at temperatures of 140°F. or less. There are other important advantages to operating under vacuum.

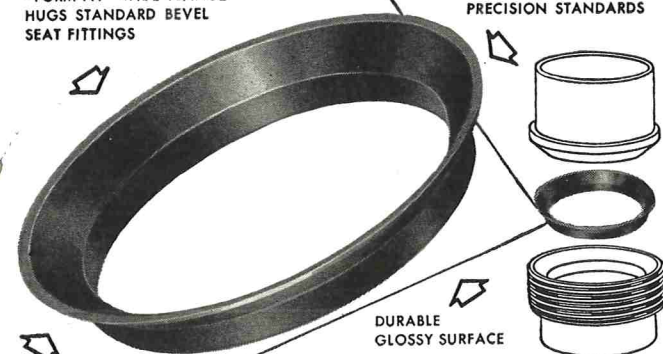
When milk at a high temperature is allowed to spray into a vacuum chamber, it will cool instantaneously to the boiling point corresponding to the vacuum being maintained. Another advantage of processing under vacuum is that at the lower temperatures the relative vapor pressures of the taint substance and water may be such that the mixture of vapors above the milk is richer in taint substance than is the mixture above milk at a higher temperature. This means that the removal of a given quantity of the vapors from above the milk under vacuum will represent a greater removal of off-flavor component than would be accomplished by the removal of a similar quantity at a higher temperature.

Equipment for treating milk to remove off flavors is available from all of the major manufacturers of dairy equipment in this country. Many manufacturers have available a variety of systems with or without steam injection, with or without the use of vacuum, and with one or more chambers in which the milk is treated. The needs of processors with mildly off-flavored milk supplies to those treating milk with tenaciously held strong off flavors can be met with equipment now available in this country.

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When used with a high-temperature short-time pasteurizer, the single treating chamber may be located between the raw side of the regenerator and the final heating section or between the flow diversion valve and the pasteurized side of the regenerator.

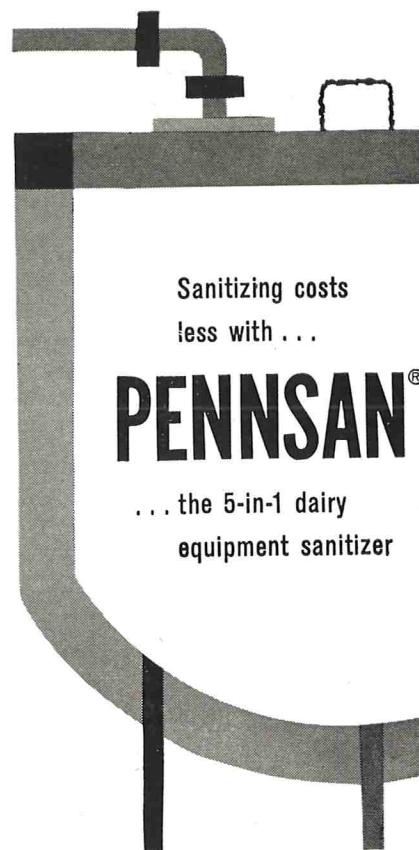
In either position steam can be introduced into the milk before it enters the chamber by means of a jet or a steam infusor. In this case the chamber would be operated under a partial vacuum to obtain some flash boiling of the milk in order to avoid composition changes. With no steam addition, the chamber can be operated under vacuum or a simple device such as a fan or a jet of water in a side-arm connected to the treating chamber can be used to remove the undesirable vapors.

Where a greater degree of treatment is necessary, units with two treating chambers are employed. These may be located one in each of the positions mentioned above or both may be between the flow diversion valve and the pasteurized side of the regenerator. The two chamber systems may be operated with or without steam injection. In either case vacuum would be used since the use of two chambers implies the need for a greater degree of treatment and an effective way of accomplishing this is through the use of vacuum. The commercial system in which steam injection is not used with a two-chamber vacuum setup returns the vapors obtained from flash boiling in the second chamber to the first chamber where the water part is condensed into the milk flowing at that point. This dilution compensates for the concentration taking place in the second chamber, thus preventing composition change in the milk being processed. The undesirable vapor is not condensed but is removed by a vacuum pump.

It is easy to see that in addition to working well as part of a standard HTST pasteurizer, many of these systems can function as part of an UHT pasteurizer system. This is particularly true of those units employing additional heating of the product by the direct introduction of steam.

ADDENDUM

Relative to the article which appeared in the November issue of the *Journal of Milk and Food Technology*, *A rapid disc assay method for detecting penicillin in milk*, by Bernard Arret and Amiel Kirshbaum (*J. Milk & Food Technol.*, 22: 329. 1959.), the authors have requested the JOURNAL to announce that in lieu of the temperature of "15°C. or less" given under the paragraph titled "Working Standard," and in lieu of "approximately 15°C" which appears in the paragraphs titled "Preparation of test organism" and "Preparation of plates" the following recommendation should be followed: The working standard stock solution, the *B. subtilis* spore suspension, and the prepared agar plates (prior to the test) should be stored in the refrigerator.



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HOWARD E. HOUGH HEADS PUBLIC HEALTH COMMITTEE OF PAPER CUP AND CONTAINER INSTITUTE

Howard E. Hough, formerly head of the Bureau of Health Education in the Illinois Department of Public Health, has been appointed Secretary of the Paper Cup and Container Institute's Public Health Committee effective January 5th.

Mr. Hough succeeds to a post created in 1934. The Committee, organized at that time, was one of the first such groups established by private industry in the United States to cooperate with public health practitioners.

Its major concern is to assist in the development of programs to improve public health and sanitation.

Each year, the Committee — through a special jury of independent professionals in the field — makes awards to local health departments which have outstanding sanitation programs. The awards are given in memory of the late Dr. Samuel J. Crumbine, prominent Kansas public health leader, who was a consultant to the Public Health Committee.

The Public Health Committee also maintains a field service headed by William V. Hickey which helps provide health officials throughout the country with current information on new health department techniques — particularly in the restaurant and other volume-feeding fields. Much of this material is also disseminated through Health Officers News Digest. Mr. Hough will also serve as editor of this monthly publication, which the Committee has published for over 20 years.

Mr. Hough first joined the Illinois Department of Public Health in 1950 as a health education consultant in the Bureau of Maternal and Child Health, being promoted to his position as director in 1953.

A native of Sullivan, Illinois, he attended elementary and high schools in Collinsville and was graduated from Southern Illinois University with a Bachelor of Education degree in 1942 with majors in health and physical education.

In World War II, he served 31 months overseas, being commissioned in the field as a lieutenant in the Medical Administrative Corps.

The new Secretary taught physical education and coached at Township High School, Harrisburg, Illinois for two years after the war and then obtained a Master of Public Health degree from the University of Michigan.

Before joining the Illinois Department of Public Health, he was a staff Public Health Educator with

the Cook County (Chicago) Department of Public Health.

Mr. Hough is married and has two sons, aged 12 and 16.

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