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August 18, 19, 20, 21, 1969
Brown Hotel
Louisville, Ky.
Program Page 231

Official Publication

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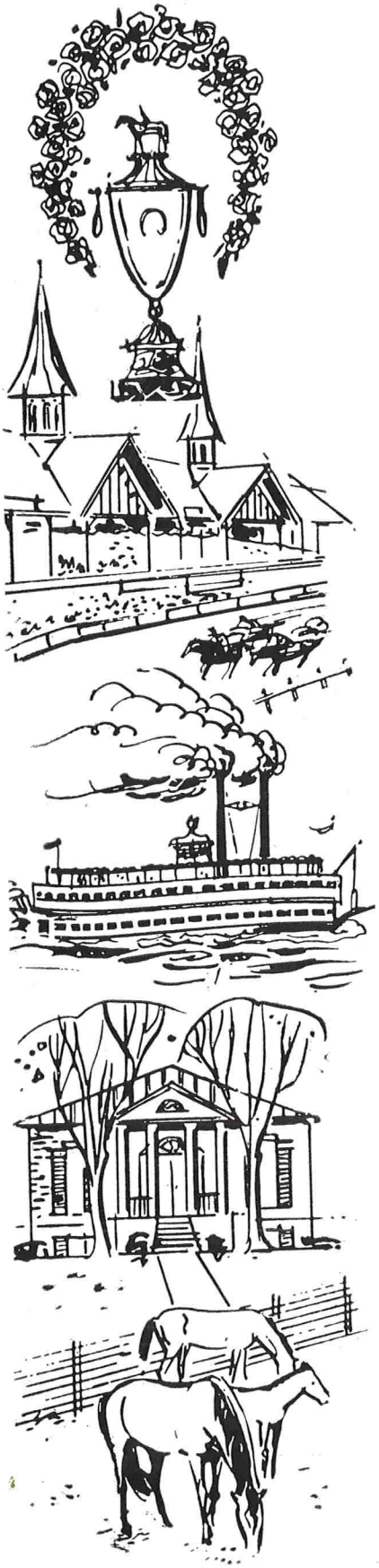

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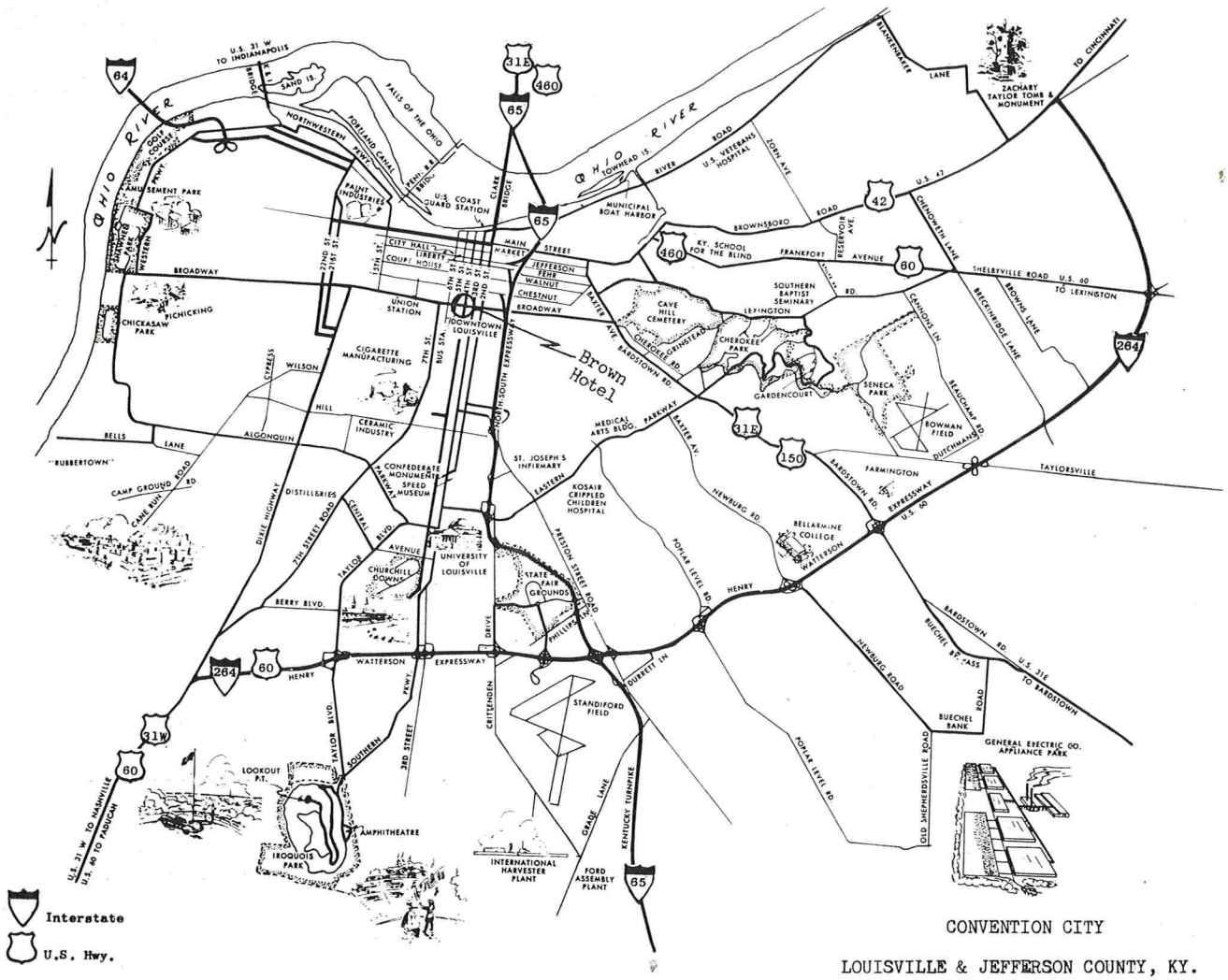

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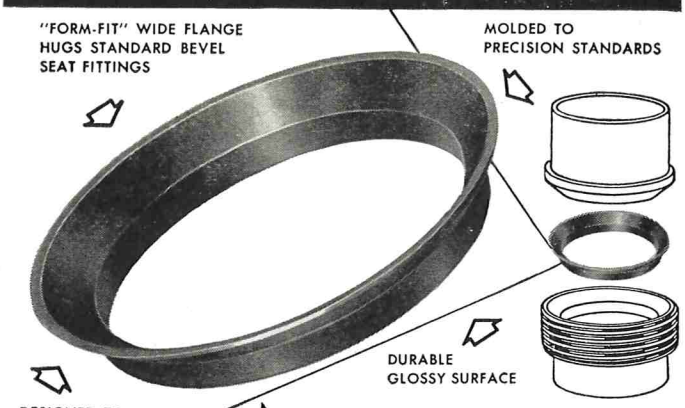

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MONITORING MILK PLANT WASTE EFFLUENT–A NEW TOOL FOR PLANT MANAGEMENT

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Department of Food Science
Cornell University
Ithaca, New York 14850

(Received for publication August 9, 1968)

ABSTRACT

A two-phase investigation of food plants consisted of field visits to 55 locations to view waste handling methods and then a single site analysis in which in-plant waste reduction was emphasized.

Phase I showed that personnel in one plant only measured waste discharge volumes. Only 16 of the 55 plant supervisors could assign a dollar value to their firm's waste handling program. The total sampling indicated that 41.7% of the sites had waste disposal systems approved by an appropriate regulatory agency, 29.3% used systems that did not have such approval, 29% utilized municipal systems, and 16.6% discharged wastes as land irrigation.

Phase II singled out one processing plant which was subjected to measures emphasizing in-plant actions to minimize waste. This plant reduced its waste volume by 50%. Segregation of product rinsings reduced the daily pounds of BOD generated by as much as 50%. In addition, data were collected to show the value of detergent reuse.

A new use for waste recording information developed from monitoring waste effluents. The performance of management and production workers can be graded by waste production indices. Inexpensive equipment such as temperature recorders, conductivity scanners, and weir measuring devices can be used to pinpoint weaknesses in plant operations. Not only can waste handling costs be reduced, but in-plant savings of raw materials can produce a new source of revenue.

While the literature in the last decade is especially voluminous on waste handling technology, it is relatively silent in giving suggestions for in-plant waste reduction. Two references are pertinent to this study.

In 1957, Morgan *(1)* published results of an experimental project on supervised and unsupervised waste control in a plant during 1955. His purpose was to gather information that would be useful in the design of waste treating systems. He showed that a capital reduction of 26% is feasible in two different types of waste handling systems if waste minimization is atempted.

In 1967, Stanton and Smith *(2)* posed the question: "Can cleaning solutions be reused?" Dollar savings which could be achieved by this practice were noted. Some bacteriological studies supported the evidence. Their article noted however, the general disfavor of many sanitarians with the concept.

MATERIAL AND METHODS

From June through August, 1967, 55 food plants were visited to view waste handling methods. Plant locations were chosen from a directory of the New York State Canners Association and a county list of industries issued by the New York State Electric and Gas Corporation. No special criteria were used to select the food plants within a geographic area except that they had fluid waste discharges. Locations visited included such operations as dairy processing, meat processing, rendering, macaroni manufacture, and chicken distribution. The sampling also involved three locations outside New York State.

The second part of the study in the fall of 1967 involved a more thorough investigation of one isolated site, the Cornell University dairy plant. A semi-permanent diversion line was constructed to move at will the dairy plant sewage into a laboratory where it could be subjected to a number of test procedures. A weir box was constructed and installed to measure the waste volume. The plant effluent was observed for color changes which indicated the kind of material being sent to the sewer as well as its time relationship to the processing operations. Samples were taken at regular intervals and analyzed for pH, conductivity, and temperature. Composite samples prepared from aliquots of the entire waste output over 24 hr periods were checked for BOD.

Continuous recording instruments were used to provide permanent records of temperature and flow across the 90° V-notch weir. Later in the experiment, modifications were made to include a pump, tanks, and an automatic sampling device that allowed collection of out-fall pipe information while the investigator was free to observe practices in use in the dairy plant where the effluent originated.

Waste in the form of rinsings from lines and equipment used in the operation of the dairy plant was partially segregated to reduce product loss to the sewer. The volume of the gathered materials and their fat and solids-not-fat contents were measured. In addition, the conductivity and pH of the rinsings were determined.

Used cleaning solutions were collected and checked for potential reuse characteristics. Titration curves to measure detergent strength were established for the specific cleaning compounds used in the dairy plant. The necessary makeup additions of fresh chemicals to the previously used detergent solutions were determined by titration. A bacteriological evaluation of the inhibitory qualities of the used cleaning compounds was done to determine the proper storage concentration range for segregated cleaning fluids.

The experimental procedure was designed to obtain information from an operating food plant before and after its personnel were aware of a waste sampling program.

---

[1]Present address: Crowley Milk Company, Binghamton, New York.

TABLE 1. ANNUAL WASTE HANDLING COSTS RECOGNIZED BY SIXTEEN NEW YORK STATE FOOD PLANTS

Type	Number of plants	Lowest individual cost	Highest individual cost	Total
Dairy	10	$1,500	$25,000	$110,000
Non-Dairy	6	$2,000	$26,500	60,000
Total	16			$170,000

TABLE 2. WASTE DISPOSAL METHOD WITH ANNUAL OPERATING COSTS REPORTED BY 16 NEW YORK STATE FOOD PLANTS, 1966-67

Dairy	
Spray irrigation	$ 1,500
Unaerated lagoon	1,500
Municipal with load billing	6,000
Aerated lagoon	8,500
Unaerated lagoon	10,000
Activated sludge	10,000
Spray irrigation[1]	12,500
Spray irrigation[1]	15,000
Trickling filter[1]	20,000
Municipal with load billing[1]	25,000
Sub-total	$110,000
Non-Dairy	
Unaerated lagoon	$ 2,000
Unaerated lagoon	6,000
Package unit	7,500
Municipal with load billing	8,000
Activated sludge	10,000
Unaerated lagoon[1]	26,500
Sub-total	$ 60,000
Total	$170,000

[1]Plant effluent includes whey.

TABLE 3. REGULATORY AGENCY APPROVAL OR DISAPPROVAL OF WASTE HANDLING METHODS USED AT 55 RANDOMLY SELECTED FOOD PLANTS; 52 NEW YORK PLANTS, 2 NEW JERSEY PLANTS, 1 FLORIDA PLANT; SUMMER 1967

Type	Plants visited	Approved system	
		No.	Per cent
Non-dairy	31	15	48.4
Dairy	24	10	41.7

RESULTS

Field survey

With the exception of one plant surveyed, personnel operating food plants did not know their waste discharge volumes. Only 16 plants were able to give figures for the cost of waste disposal. The combined total annual waste handling expenditures of these sites amounted to $170,000. The remaining 39 operators had only vague concepts of the waste handling expenses incurred by their respective firms.

Neither the physical size of a food plant nor its annual dollar sales was correlated with waste handling expenses. Factors such as soil permeability, relative elevation of plants compared to surrounding unoccupied fields, and classification of streams into which waste ultimately flowed affected costs and waste handling approaches.

Some of the information collected showed that the extent to which steps were taken to eliminate foul odors or other disagreeable factors varied from one community to another. When the bulk of the local work force is hired by the only industry in a town, it is able to operate its plant with less restrictions than a food plant located where it contributes relatively less to the economic well being of the area. Tables 1 through 4 summarize the findings of the field investigation.

Single plant study

In the detailed study of the dairy plant selected, it was evident from early trial operations that waste came in surges of contaminants rather than as a uniform flow. Observation at the out-fall pipe confirmed the suspicion of obtaining erroneous results when samples are gathered on a time basis. For example, a surge of chocolate milk waste would appear in the weir box and last less than 3 min when it was replaced with clear water or some other waste. A sampling program with 15 min cycles or even 10 min cycles could yield a composite sample that was not truly representative. Samples had to be taken continuously and in amounts proportional to flow volume to be significant.

The results of one experiment in which samples were taken at 30 min intervals showed an apparent BOD load equal to four times the value obtained by more reliable sampling methods. On the other hand,

TABLE 4. SUMMARY OF WASTE HANDLING METHODS USED BY 55 RANDOMLY SELECTED FOOD PLANTS; 52 NEW YORK PLANTS, 2 NEW JERSEY PLANTS, 1 FLORIDA PLANT; 1966-67

Method	Total plants		Dairy plants	
	No.	Per cent	No.	Per cent
Lagoon	5	9.1	1	4.2
Lagoon with aeration	2	3.6	1	4.2
Spray irrigation	11	20.0	4	16.6
Deep well injection	1	1.8	1	4.2
Package unit	2	3.6	0	–
Conventional system-private activated sludge or trickling	3	5.5	3	12.4
Municipal system with load rate in billing	4	7.3	3	12.4
Municipal system with no specific rates	10	18.2	4	16.6
No treatment	17	30.9	7	29.4
Total	55	100.0	24	100.0

sampling at 30 min intervals could have given a BOD value lower than the correct one had chance retimed the sampling to clear water periods.

Results of BOD tests on representative waste composites were as follows:

Date		Pounds of product processed[1]	BOD in waste composite (mg/l)
October	2	23,684	320
	13	23,692	400
	23	21,876	475
	25	29,060	520
November	8	25,102	500
	10	23,816	1200[2]
	13	23,644	630

[1]The major products on each of these days were milk, chocolate milk, and skim milk. On October 25 ice cream mix was also made.

[2]Small volume of waste, but no segregation. BOD higher in the smaller volume.

These figures were quite meaningless unless they were coupled with additional information indicating the volume of the waste. A high BOD figure with a low volume could have indicated less plant waste than in low BOD value coupled with a very high total volume of waste. In other words, the product of BOD and total flow is the real measure of waste. Neither value alone provides sufficient information to be of value to the plant operator.

The initial waste effluent survey of the University dairy plant indicated discharge volume flows as follows:

	Gallons
October 2, 1967	12,290
October 13, 1967	10,393
October 23, 1967	9,800
October 25, 1967	14,200

Following a waste minimization educational program designed to improve the plant worker's processing technique, the results were:

November 8, 1967	6,299
November 10, 1967	6,364
November 13, 1967	5,156

The data indicate a 50% reduction in waste discharge volume was achieved without making changes in the physical equipment of the plant. Figures 1 and 2 illustrate graphically the results that were achieved by reducing careless handling of water in the dairy plant.

Rinsings from the lines and tanks were segregated as white or chocolate rinsings. Removal of such material reduced the pounds of BOD in the effluent as follows:

	Pounds of BOD in waste (No segregation)
October 23, 1967	38.79
October 25, 1967	61.54
November 10, 1967	63.65
	(With segregation)
November 8, 1967	26.26
November 13,1967	32.48

Four different types of salvaged dairy materials were collected. Bottling operations contributed white and chocolate rinsing with approximately 2% fat and about 7% total solids. About 10 lb. of fat and 25 lb. of SNF were salvaged in the rinsings collected during the course of a day's pasteurizing and bottling operation. On days when ice cream mix was made, about 20 lb. of fat and 50 lb. of SNF in the rinse water from equipment were salvaged for reuse.

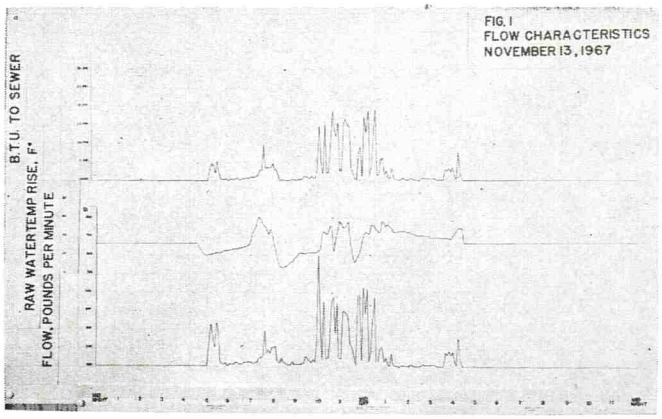

Figure 1. Flow, temperature and BTU content of plant effluent as a function of time of day on November 13, 1967.

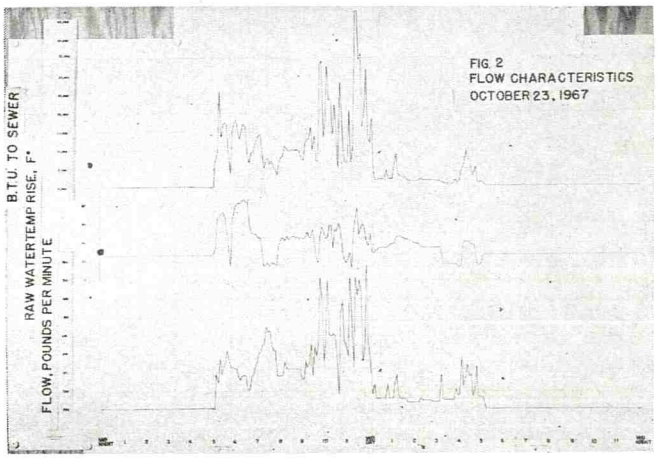

Figure 2. Flow, temperature and BTU content of plant effluent as a function of time of day on October 23, 1967.

The weights and composition of rinsings saved are listed in Table 5.

Figures 1 and 2 show the pounds of waste and the temperature of wastes above the incoming raw water temperature as a function of time of day. Plots were made at 5 min intervals over a 24 hr day.

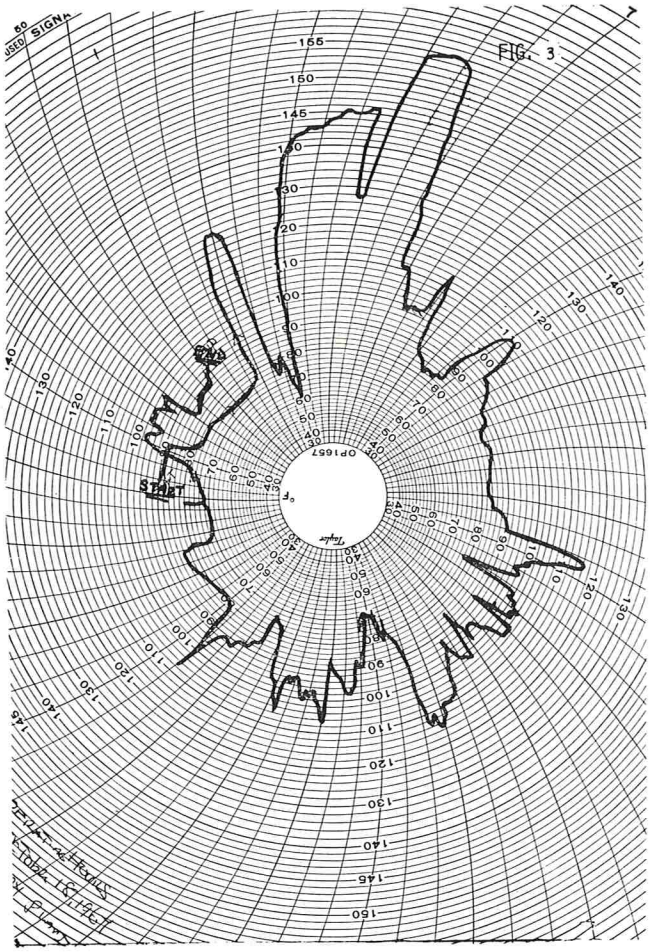

Figure 3. Twenty-four hour recorder chart of effluent temperature on typical day before conservation practices put into effect.

The significant portion of the graph is between 5 a.m. and 5 p.m., the operating hours during which plant management was able to take appropriate measures to improve the waste discharge profile. The fairly constant, low volume flow during the hours when the plant is not operating represents cooling water used for refrigeration condensers.

The average rate at which BTU's were discharged to the sewer during operating hours was calculated for each day. The results on selected days were:

October 23	9,499 BTU/min	Normal operation with no waste segregation
October 25	13,106 BTU/min	
November 8	2,901 BTU/min	Modified operating practices
November 13	3,168 BTU/min	

The results indicate that a four to one reduction was achieved.

On a simpler scale it was found that recording the temperature of the effluent can help to isolate causes of fuel waste in the plant. To use this approach, temperature records have to be obtained on a number of successive days. Comparisons of the charts will begin to indicate characteristic operations. Swings in degrees can be traced back to specific operations.

Figures 3 and 4 illustrate the fluctuations in waste water temperatures before and after recognition of the waste problem by the plant personnel. A lobe (see Fig. 3) was noted in which the temperature in the outfall pipe rose to 150 F. The unusual temperature rise was found to be caused by improper use of a 10-can cream pasteurizing vat. With simple adjustments of the steam and water valves, it was possible to completely eliminate the lobe, as shown in Fig. 4, thus reducing steam waste and water useage. In addition, a jagged erratic temperature chart was formed in Fig. 3 when waste volume was high because of careless water use. After a positive effort to reduce water use, one notes a smoothing out of peaks and valleys with creation of a more uniform temperature chart for the day's operation.

Determining dilution of products

A common practice in the dairy industry is the visual determination of dilution by the product's apparent color change. It is assumed that a plant worker can differentiate color changes quantitatively

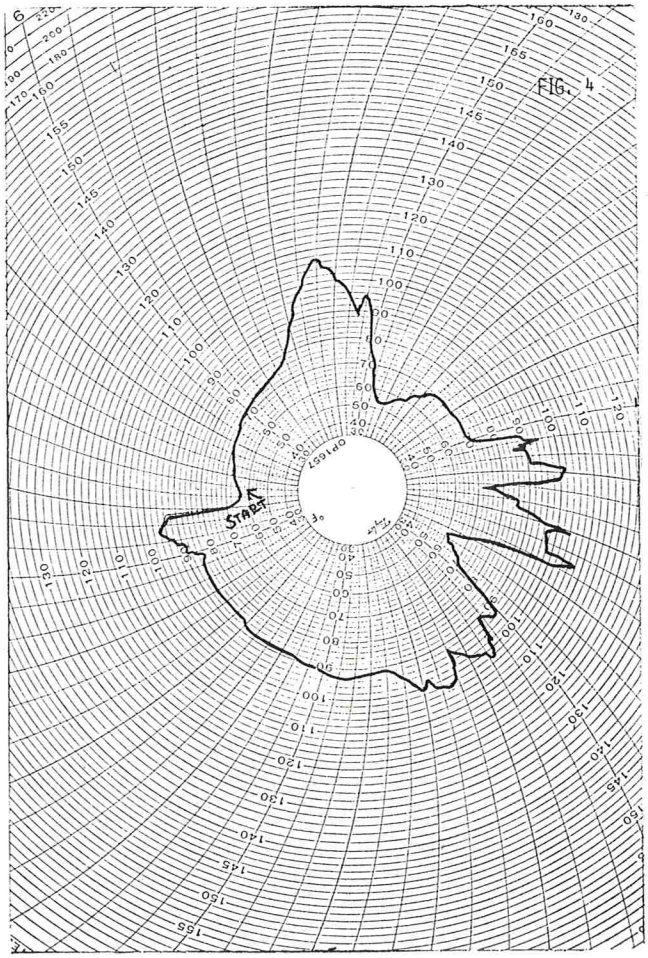

Figure 4. Twenty-four hour recorder chart of effluent temperature on typical day after conservation practices put into effect.

TABLE 5. SALVAGED DAIRY-PRODUCTS RINSINGS

Date	Weight lb.	Type	Composition % Fat	% SNF
10/30/67	688	White & chocolate	1.4	6.20
10/21/67	396	White	3.1	8.18
10/31/67	182	Chocolate	5.6	16.51
11/ 7/67	440	White	4.6	9.98
11/ 8/67	180	Chocolate	2.2	8.00
11/ 8/67	322	White	2.2	6.98
11/13/67	430	White & chocolate	2.0	7.02

TABLE 6. CONDUCTIVITY (AS GRAINS NaCl/GALLON) OF SEVERAL DILUTED MILK PRODUCTS

Concentration	White milk	Chocolate milk	12% plain ice cream mix	12% chocolate ice cream
(%)				
100	175	250	95	105[1]
50	112	150	85	140
25	75	90	55	85
12.5	42	60	30	45
6.25	30	35	22	32

[1]Rechecked results were similar. Dilution was made on a volumetric basis with plant water.

TABLE 7. MILK CONSTITUENTS IN RINSE WATER SAMPLES OBTAINED AT FIVE SECOND INTERVALS AFTER START OF RINSING OF HTST PASTEURIZER

Sample no.	Time after start of rinsing	Solu-Bridge reading	Total solids IRMA	Total solids Mojonnier
1	2 min 50 sec.	200	7.27	7.33
2	2 55	180	5.91	5.63
3	3 0	120	4.21	3.45
4	3 05	90	2.95	2.60
5	3 10	30	2.08	1.69
6	3 15	22.5	1.68	0.95
7	3 20	18	1.46	0.72
8	3 25	16	1.32	0.45
9	3 30	14	1.28	—
10	3 35	13	1.19	—
11	3 40	12.5	1.18	—
12	3 45	11.5	1.17	—
13	3 50	11	1.17	—
14	3 55	10.5	1.17	—
15	4 0	10	1.16	—
16	4 05	10	1.16	—
17	4 10	9.5	1.16	—

enough to distinguish normal milk from milk containing flushing water.

To test this assumption, dilutions were made using milk, chocolate milk, 12% fat plain ice cream mix, and 12% fat chocolate ice cream mix with varied amounts of water. A number of people were asked to try, but no one could visually differentiate the samples containing 6.25, 12.5 and 25% product. These three dilutions appeared to be the same milk product, although they were lighter in color than the 100% and 50% samples.

Table 6 shows data obtained with a Solu-Bridge Model RD-4 instrument used to measure conductivity in water-diluted milk, chocolate milk, plain ice cream mix, and chocolate ice cream mix. These results should not be compared with conductivity readings in Table 7 because temperature corrections were not made in either experiment. The products were examined to determine only whether or not the Solu-Bridge instrument would give conductivity readings and if so, to what degree of sensitivity.

The results of the experiment suggested the possible application of conductivity measurement as a means to determine the degrees of dilution. An in-plant experiment was carried out in which samples of the water used to rinse the equipment after the processing of white milk were taken at 5 sec intervals from the discharge line of the high-temperature short-time pasteurizer. The samples were tested for conductivity using the Solu-Bridge, total solids using a Mojonnier tester, and an IRMA[2] for fat, protein, and lactose. The results are presented in Table 7.

Limitations of the Mojonnier test cast doubt on results below 0.5% solids. As indicated in Table 7, the IRMA tester did not show changes in the total solids of white milk rinsings taken after 2.5 min (sample 9). The Solu-Bridge readings, however, did show changes in conductivity for an additional 45 sec of dilution.

DISCUSSION

Too often personnel designing waste disposal systems have neglected the interior of the plant and have based construction design on waste handling equipment primarily on discharge data obtained from the "outfall pipe."

Frequently large volumes of waste result from the "no care" attitude of the plant worker and his supervisor. The direct effects of carelessness increase the use of water, which will become increasingly more valuable with the passage of time. When waste waters from a food plant are hot, it usually indicates that fuel has been wasted. In addition, heated waste can create operational problems in the sewage disposal system by decreasing oxygen retention of the fluid.

Very little can be done by management once waste has entered a common sewer. Managers not realizing

[2]IRMA means infra red milk analyzer. The apparatus is manufactured by Grub Parsons Ltd., Newcastle upon Tyne, 6, England.

the importance of volume reduction, complicate waste handling problems. Evaluating dairy plant practices along waste prevention lines can be utilized to minimize waste volumes.

At present it is not common to find a processing food plant collecting waste outfall pipe information unless the plant is complying with a regulatory agency's request to gather such information. Management usually does not regard waste effluent information as a tool to aid plant operation.

Evidence has been presented to illustrate the value of waste monitoring to effect changes in characteristics of the dairy plant discharge. With a modest outlay of funds, valuable guides can be obtained to combat waste within the processing plant to reduce effluent volumes, pounds of BOD, fuel consumption, and detergent uses. Simultaneously a product yield increase will occur as a function of conservation.

Table 8 itemizes the projected annual savings to be realized at the small dairy plant where waste control measures were put into effect. Larger operations could probably expect greater returns.

A new look can be given to minitoring of outfall pipe data. The plant management should employ instrumented data collection to scan the wastes being generated in the food plant on a 24 hr basis. Information such as waste volume or temperature can be a vital tool to increase plant efficiency. Recorded data can provide information not only to increase product yields but to decrease service costs for fuel, water, etc.

Motivation of personnel for promoting more care in product handling is possible. Daily routine results will find valuable use in the operation to supplement other daily compiled information required to police and control the food plant.

Imagination can lead to many more ways of using segregated wastes than may have been suggested by the investigation. New by-products may be developed which can lead the firm into other revenue producing areas.

The detailed investigation of the single plant suggests the following: Simultaneously printed data should be recorded onto a multiple copy carbon strip chart to show: *(a)* waste discharge flow on volume or weight basis, *(b)* waste discharge temperature, and *(c)* waste discharge conductivity.

The food plant should also have an automatic sampling device to regularly obtain representative composite samples for further analysis. Compiled recorded information should be reviewed by in-plant supervisors and by management to fully exploit the gained knowledge.

TABLE 8. ESTIMATED SAVINGS AVAILABLE AT CORNELL UNIVERSITY DAIRY PLANT WHEN RINSINGS ARE SALVAGED, DETERGENTS ARE REUSED, AND WATER WASTE IS REDUCED; 1967[1]

Item	Per Week	Per Year
Dairy Products:		
50 pounds of fat at 80¢/lb.	$ 40.00	$2,080.00
125 pounds of SNF at 20¢/lb.	25.00	1,300.00
Detergents:		
Circulation with used compound four times per week, results in a 30 pound saving per week	11.10	577.20
Water:		
Water savings at 15¢/1000 gallons[1] or 6000 gallons/day = 90¢/day on a 4½ day week	4.05	210.60
Waste Handling Charges:		
Waste handling charges 20¢/1000 gallons[1] or $1.20/day on a 4½ day week	5.40	280.80
Fuel:		
Fuel savings using oil at 10¢/gallon providing 140,000 BTU/gallon. 640,000 BTU can be saved per hour on the average; for a 12 hr operating day, 7,680,000 BTU can be converted to an oil saving of 54 gallons or $5.40/day on a 4½ day/week	24.30	1,263.60
Total[2]	$109.85	$5,712.20

[1]Minimum costs found in field survey of New York State food plants.

[2]These estimated savings do not consider the cost involved in recovery of the food solids. It is estimated that such costs would be well below 5% of the savings.

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COMPARISONS OF MILKFAT TESTS ON COMMERCIAL MILK SAMPLES DETERMINED BY THE MILKO-TESTER AND BABCOCK METHODS[1]

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ABSTRACT

Milk samples were collected daily from 47 producers shipping manufacturing grade milk in cans to a single dairy plant over a 31-day period. Samples were transported to the laboratory where, 24 hr later, a portion of each sample was composited, and Milko-tester and Babcock milkfat determinations made on the remainder of the sample. At the end of one 15-day and one 16-day composite period, the composite samples were tested using both procedures. The data thus collected was placed on computer cards and analyzed statistically.

The Milko-tester calibrated on "fresh" milk was found to average 0.059% lower on composite than on fresh samples. For fresh milk and composite samples, respectively, the standard error of the paired methods was 0.0482 and 0.0370, and the standard error of the difference of the mean was 0.0122 and 0.0262. These values for the 4-day random stratified samples were 0.0444 and 0.0222, respectively. On 1,457 fresh milk samples the average Milko-tester and Babcock results were, respectively, 3.788 and 3.809%; the difference being 0.0211%. The average test on 188 composite samples by the two methods was 3.8192 and 3.7979% respectively, or a difference of 0.0213%

Use of the Milko-tester for testing producer milk supplies offers certain technological advantages over other commonly used procedures. Its adoption by industry and regulatory authorities will come through assurance of the accuracy and reliability of the machine. Recently, a number of laboratories have undertaken comparative studies to check the operation and performance of Milko-tester units. Work outside the U. S. indicates reasonable agreement between the results of the Milko-tester and both Werner Schmid and Gerber tests *(2, 4, 5, 6, 7, 8, 10)* although preservatives and free fatty acids *(5)*, and milk homogenized at excessive pressures, sour milk, and abnormal milk *(10)* were found to influence results. In comparisons between the results of Milko-tester and Babcock tests, Ford et al. *(3)* found it necessary to use a different calibration setting with preserved milk than with fresh milk. The preservative used was mercuric chloride. On milk from individual cows Appleman and Laben *(1)* noted Milko-tester readings to be consistently higher than Babcock results when samples were preserved with potassium dichromate or boric acid. Shipe *(9)* studied a number of factors that might influence test results. In two trials involving several laboratories, he found the standard deviations from the results of the Milko-tester and Babcock tests to be ± 0.069 and ± 0.074, respectively. The standard deviation of the difference between the average values from these two methods for 21 samples was ± 0.045%

This study was undertaken to determine under commercial sampling and laboratory operation, *(a)* the relative accuracy and precision of the Milko-tester procedure when compared to the Babcock method, *(b)* the influence of compositing and preservation of samples with mercuric chloride, and *(c)* the efficacy of a stratified random sampling and testing program involving four fresh samples per month.

METHODS

Herd milk from 47 manufacturing grade can milk producers was sampled daily throughout the month of May 1968. A 4 oz sample was taken from the milk of each patron after dumping into the weigh tank at the creamery. Samples were placed in coded, 6 oz disposable plastic bags and were transported and stored according to the procedure for handling samples for bacterial analysis described in the 12th edition of *Standard Methods for the Examination of Dairy Products*. Twenty-four hours after collection, samples were warmed to 100 F and mixed. Each sample was divided into three parts. A 10 ml aliquot was mixed with 2 mercuric chloride tablets, each containing 0.5709 g $HgCl_2$. Another aliquot was pipetted into a standard 8 oz Babcock test bottle, while the remainder of each sample was tested using a Milko-tester manufactured by Foss Electric, Hilleroed, Denmark. Readings were made to the nearest 0.05%. All determina-

[1]Paper No. 6854, Scientific Journal Series, Minnesota Agricultural Experiment Station.

TABLE 1. SUMMARY OF MILKO-TESTER AND BABCOCK TEST RESULTS ON FRESH MILK SAMPLES COLLECTED OVER THIRTY-ONE DAYS FROM FORTY-SEVEN PRODUCERS

Test	No. Samples	Avg Test (%)	Difference	s Diff.*	s $\overline{\text{Diff.}}$**
Babcock	1457	3.7888			
Milko-tester	1457	3.8099	0.0211	0.0482	0.0122

*Standard error of the paired methods
**Standard error of the difference of the mean

TABLE 2. SUMMARY OF MILKO-TESTER AND BABCOCK TEST RESULTS ON COMPOSITE SAMPLES PRESERVED WITH MERCURIC CHLORIDE AND COLLECTED OVER TWO COMPOSITE PERIODS (15 AND 16 DAY PERIODS)

Test	No. Samples	Avg Test (%)	Difference	s Diff.*	s $\overline{\text{Diff.}}$**
Babcock	94	3.7473			
Milko-tester	94	3.6881	−0.0592	0.0370	0.0262

*Standard error of the paired methods
**Standard error of the difference of the mean

TABLE 3. SUMMARY OF MILKO-TESTER AND BABCOCK TEST RESULTS ON 4-DAY FRESH SAMPLES SELECTED ON A RANDOM STRATIFIED BASIS

Test	No. Samples	Avg Test (%)	Difference	s Diff.*	s $\overline{\text{Diff.}}$**
Babcock	188	3.7979			
Milko-tester	188	3.8192	0.0213	0.0444	0.0222

*Standard error of the paired methods
**Standard error of the difference of the mean

tions on fresh samples were made the day after pickup. Composite samples were tested after 15 days (first test period) and 16 days (second test period) by both Babcock and Milko-tester methods. During storage, composite samples were refrigerated at 35-40, F. They were warmed to 100 F prior to sampling. Babcock tests were conducted according to the procedure in A.O.A.C., 10th edition, section 15.030 except that readings were made to the nearest 0.05%.

All determinations were made by experienced laboratory personnel in the Quality Control Committee Laboratory. Records were kept; the data transferred to computer cards, and analyzed by computer. Using a stratified random sampling plan, test results of four fresh samples were selected from each producer. In the stratified sampling program at least one sample is selected from each week of the month. These data were also analyzed by computer.

After the initial calibration on fresh milk, the Milko-tester was used regularly for one month prior to initiation of this study. During that time 1,189 determinations were made. An analysis of the data showed 18 samples varied from Babcock results by more than 0.1%, 107 samples (8.99%) varied by 0.1% and the rest (1,064 samples) were either identical to or varied from the Babcock results by no more than 0.05%. This was the status of the Milko-tester at the outset of this experimentation.

RESULTS AND DISCUSSION

Computer analysis of the data is summarized in Tables 1, 2, and 3. On 1,457 fresh samples (Table 1) results from the Milko-tester averaged 0.0211% higher than those from the Babcock test. The standard error of the difference of the mean was 0.0122. For fresh milk, then, the methods appeared comparable within errors inherent in the Babcock test.

The data in Table 2 are a summary of two composite periods totalling 31 days and 94 samples. Results from the Milko-tester averaged 0.059% lower than those from the Babcock test. It should be emphasized that the Milko-tester was calibrated initially on fresh milk. No attempt was made to recalibrate the equipment during the month of experimentation. These data indicate the desirability of calibrating the Milko-tester on composite samples when composites are to be tested. The standard error of the difference of the mean was 0.0262. Additional work not reported in this paper indicated that the Milko-tester

BLE 4. EXTENT OF VARIATION OF MILKO-TESTER RESULTS FROM BABCOCK RESULTS ON (A) 1457 FRESH MILK SAMPLES COLLECTED DAILY OVER A 31-DAY PERIOD AND (B) FOUR-DAY FRESH SAMPLES SELECTED ON A RANDOM STRATIFIED BASIS

Range of Difference (%)	(A) Percent of Milko-tester Determinations	(B) Percent of Milko-tester Determinations
0.00 -0.010	22.4	14.9
0.011-0.020	21.4	21.3
0.021-0.030	14.9	19.1
0.031-0.040	12.8	21.3
0.041-0.050	9.6	8.5
0.051-0.060	9.6	0.0
0.061-0.070	4.3	4.3
0.071-0.080	2.1	0.0
0.081-0.090	0.0	8.5
0.091-0.100	2.1	0.0
0.110-0.120	1.1	2.1

TABLE 5. EXTENT OF VARIATION OF MILKO-TESTER RESULTS FROM BABCOCK RESULTS ON 188 COMPOSITE MILK SAMPLES COLLECTED OVER TWO TEST PERIODS TOTALLING THIRTY-ONE DAYS

Extent of Difference (%)	Percent of Milko-tester Determinations
0.000	4.2
0.025	12.8
0.050	38.3
0.075	23.4
0.100	12.8
0.125	8.5

when calibrated on composite milk samples, gave results comparable to analyses on fresh milk presented in this report.

Data in Table 3 show a summary analysis of 4-day fresh samples selected on a random stratified basis from each of the 47 producers. These results indicate the feasibility of a fresh sampling program utilizing four samples per month.

Tables 4 and 5 indicate the extent of variation between the two methods and the percentage of samples falling in the various ranges. Again, the Milko-tester gave results consistent with the Babcock test. These and other data seem to indicate the feasibility of the Milko-tester in a commercial milkfat testing program.

ACKNOWLEDGMENTS

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DETERMINING POST-PASTEURIZATION CONTAMINATION BY A SURFACE PLATE METHOD[1]

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Abstract

Post-pasteurization contamination constitutes a major problem for quality control and regulatory sanitarians in the market milk industry. The bacteria of most concern are gram-negative, aerobic, resistant to surface active agents, catalase-positive, and grow rapidly on the surface of solid media. Knowledge of these characteristics was utilized to provide the basis for a surface plating method to determine their numbers. Bacteria in this group account for most growth during low temperature storage and at warm temperatures.

Results with the surface plate method were available in 16 to 20 hr. Preliminary data showed the test to be useful in indicating a lapse in proper pasteurization, cleaning, and /or sanitization.

Post-pasteurization contamination is a major concern to both quality control and regulatory sanitarians. Such contamination reduces shelf life and may have public health significance.

With present sanitation and effective pasteurization, the standard plate count of pasteurized milk is commonly less than 1,000 per ml, and few, if any, of these microorganisms contribute to spoilage of the products. The total plate count fails to reflect contamination with pathogens. Though post-pasteurization contaminants may include the gamut of microorganisms, the two groups of most importance are coliform and psychrotrophic bacteria. Coliforms are indicators of public health significance and the psychrotrophic group causes spoilage during cold nonfrozen storage. The number of coliform and psychrotrophic bacteria is commonly less than 10 per ml in freshly pasteurized, packaged products.

Coliform tests are commonly used by regulatory groups for indications of post-pasteurization contamination. The results have limited relation to the post-pasteurization contamination with psychrotrophic bacteria, except that each group consists of gram-negative bacteria with some similarity of resistance and sensitivity to the microenvironment. Each is associated with an unsanitary condition.

Numerous tests have been suggested for enumerating the psychrotrophic bacteria. The primary limitation is exemplified by the present standard method *(1)*, which requires 10 days incubation at 7 C. In commercial operations results are not available until problems of high counts have disappeared or have become catastrophic. The results are needed quickly to be of maximum value in public health and quality control programs *(5)*.

The primary aim of methods that have been proposed for estimating psychrotrophic contamination has been to predict shelf life of the product before results on plate counts at a low temperature could be obtained. An example of this approach has been application of a pre-incubation period *(3)*. Another approach has been use of inhibitors in the growth medium to limit the growth of non-psychrotrophic bacteria *(2, 8)*. Still another approach has been identification of colonies from the standard plate count *(4)*, using species of *Pseudomonas* as indicators of post-pasteurization contamination. While these methods have merit, each has its limitations as for time to obtain results or spectrum of coverage of post-pasteurization contaminants.

In a recent report from our laboratory *(6)*, a broad spectrum of gram-negative rods, which were associated with post-pasteurization contamination, accounted for a major part of the increase in numbers at 5 C as well as at 30 C. A selective medium and conditions for growth to enumerate the gram-negative rods resulting from post-pasteurization contamination would be desirable. Manipulation of the method to decrease time required for incubation also should increase usefulness of a plating method. Bacteria of primary concern have common characteristics; they are gram-negative, aerobic, resistant to surface active agents, grow rapidly on the surface of solid media, and are catalase-positive. The common characteristics might serve the basis for a rapid test *(7)*. Work was therefore undertaken to utilize past observations with selective media and manipulations of plating to shorten the required incubation time.

Methods

The general approach of the methodology was utilization of simple media, incubation to provide rapid growth, surface inoculation to emphasize aerobic growth, and utilization

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TABLE 1. EFFECT OF INCUBATION TIME AND CONCENTRATION OF ALKYL ARYL SULFONATE ON THE NUMBER OF BACTERIA PER ML OF MILK AS DETERMINED BY THE SURFACE PLATE METHOD

Time hours	Concentration of alkyl aryl sulfonate	
	0.05%	0.1%
16	3.5	0
17	5.0	1.0
18	5.0	3.5
19	7.0	2.0
20	7.0	4.2

of catalase production to indicate sub-macroscopic colonies.

The basal medium was nutrient agar (Difco) to which 0.05 to 0.30% alkyl aryl sulfonate was added. Nacconol (Allied Chemical Corp., New York, N. Y.) or Ultrawet (Atlantic Refining Co., Philadelphia, Pa.) was used though previous observations had indicated any similar alkyl aryl sulfonate would have been suitable. After sterilization by autoclaving, plates were poured and allowed to dry for approximately 48 hr at 32 C. A 0.5 ml test sample of milk product was added dropwise to obtain discrete drops—approximately 11—on the surface of the plate, which was then allowed to remain undisturbed for 30 min. The adequacy of the preceding drying was judged at this point, since improper drying allowed the drops to run together and complicated the subsequent counting process.

Plates were incubated upright at 32 C for 16 to 20 hr. After incubation covers were removed and the plates were held an additional hour at 45 C. The plates were then flooded with hydrogen peroxide by adding dropwise to prevent disruption of the colonies. After 1 min the centers of ebullition of oxygen, which represented colonies, were counted with the aid of a Quebec Colony Counter.

The milk samples were freshly processed, packaged products from the dairy plant of the Department of Food Science and Technology and from two large commercial operations in this area. Limited observations also were made in a commercial plant in another geographical area.

RESULTS

Time required for incubation

To provide a controlled inoculum of psychrotrophic bacteria, packages of pasteurized milk were incubated at 5 C until the total count had increased more than 1,000-fold. Test samples of milk were then prepared by adding appropriate inocula from the incubated product to obtain a count of approximately 5 contaminants per ml. This level was chosen, because a meaningful test for post-pasteurization contamination must function with numbers of less than 10 per ml.

Replicate plates were poured and examined at hourly intervals to obtain an estimate of the time required so that the colonies had adequate catalase for production of visible bubbles of oxygen from hydrogen peroxide. Results representing an average of four trials from different sources of post-pasteurization contamination and at two levels of alkyl aryl sulfonate are given in Table 1. The results show that 18 to 20 hr were required to obtain maximum results. One additional alteration in the method later proved helpful, however, when a final hour of incubation was made at 45 C with the covers removed. An incubation time of 16 to 20 hr at 32 C plus 1 hr at 45 C was then shown to provide maximum counts.

It should be noted that the counts were on undiluted samples. This technique was possible in surface plating where the surface activity was not neutralized by the milk solids. Data in Table 1 show a variation, which should be recognized in establishing criteria for usefulness of the test.

Effect of varying concentrations of alkyl aryl sulfonate on the number of colonies on the surface plates

The concentration of alkyl aryl sulfonate represented a compromise, which was to eliminate most of the gram-positive, inert bacteria and with the least inhibition of the gram-negative bacteria. Previous work *(6)* and the data of Table 1 indicated 0.05 to 0.1% alkyl aryl sulfonate was the logical concentration. Trials with three concentrations of alkyl aryl sulfonate and two sources of pasteurized, packaged milk were made. Results in Table 2 show that major increases in alkyl aryl sulfonate decreased the number of colonies occurring on the surface plates. Adoption of a standard level of alkyl aryl sulfonate and reasonable care in preparing media should not, how-

TABLE 2. THE EFFECT OF ALKYL ARYL SULFONATE CONCENTRATION ON THE NUMBER OF COLONIES APPEARING ON THE SURFACE PLATES

Milk sample	Per cent concentration of Alkyl aryl sulfonate		
	0.1%	0.2%	0.3%[a]
U 1	10	0	0
N 1	16	6	4
U 2	12	2	0
U 3	34	23	14
N 2	45	30	22
N 3	12	16	10
U 4	13	9	3
U 5	1	0	0
U 6	13	9	8
N 4	6	3	0
U 7	5	1	1
N 4	8	3	2
N 5	4	4	0
N 6	2	0	0
U 8	3	0	0
N 7	6	4	0
U 9	19	5	0
U 10	25	6	3
U 11	5	2	0
N 8	6	3	2
U 12	4	1	1
Average	22.4	6.4	3.5

[a]Total of duplicate plates using 0.5 ml each.

ever, make a significant difference in the results of the surface plate method.

Measuring growth after storage at 5 C

A major concern of post-pasteurization contamination is the psychrotrophic group, which is capable of growing at 5 C. The effectiveness of the surface plating method to determine this growth was therefore compared to the standard plate method for total count. Freshly pasteurized milk was inoculated with the psychrotrophic culture as previously described and then stored at 5 C for daily examinations by the two methods.

Figure 1 compares the growth response as measured by the surface plating method and by standard plate count. It was apparent that the surface plating method did not include certain bacteria, the number of which were at the level expected for thermoduric bacteria. The increase in numbers resulting from growth at 5 C, however, was included in the surface plating method.

Measuring growth after storage at 32 C

Another important criterion for a test for post-pasteurization contamination is measurement of bacteria, e.g. coliforms, capable of rapid growth at warm temperatures. Samples of pasteurized, packaged milk were therefore held at 32 C for comparative examination by the rapid test and the standard plate count. Results on an average of four trials (Fig. 2) showed that the test reflected growth at warm temperatures.

Comparison of counts with surface plate method and the standard plate count

Previous results indicated that the surface plate

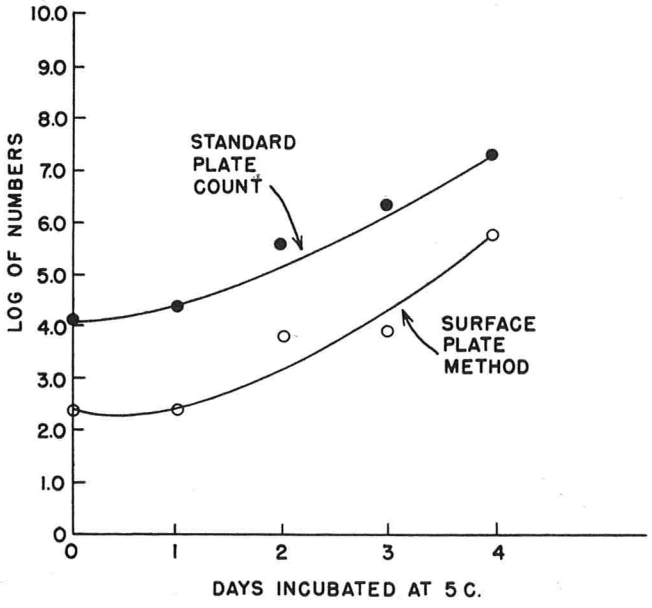

Figure 1. Growth response of bacteria in milk at 5 C as measured by the surface plate method and by the standard plate method.

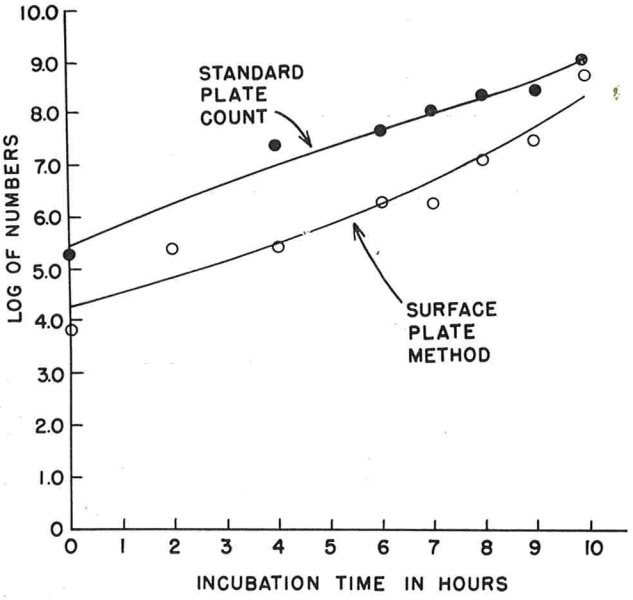

Figure 2. Growth response of bacteria in milk at 32 C as measured by the surface plate method and by standard plate method.

method included most of the bacteria that grew in pasteurized, packaged milk irrespective of the conditions of manipulation. Figure 3 was therefore prepared from the gamut of our data, plotting the results with the surface plate method against the standard plate count. The line representing the relationship was located by the method of least squares. There was a direct relationship between the two tests—correlation coefficient of 0.80. The intercept indicated a positive value for the standard plate count, which was related to the residual thermoduric population not capable of growing on the surface plate method.

Surface plate method as an indicator of shelf life of market milk

When samples of freshly pasteurized, packaged milk from the University dairy plant contained bacteria that appeared when the surface plate method was used, the milk had a shelf life of 14 days or less at 5 C. On a few samples which were heavily contaminated, the shelf life was only 7 days. Generally, the test was most helpful in recognizing that a source

TABLE 3. SOME OBSERVATIONS ON SURFACE PLATE METHOD IN PREDICTING SHELF LIFE AND EVALUATING A COMMERCIAL OPERATION

Number of results with the rapid test		Shelf life at 45 F (7.2 C)	
Negative	Positive	Less than 10 days	More than 10 days
130		15	115
	29	24	5

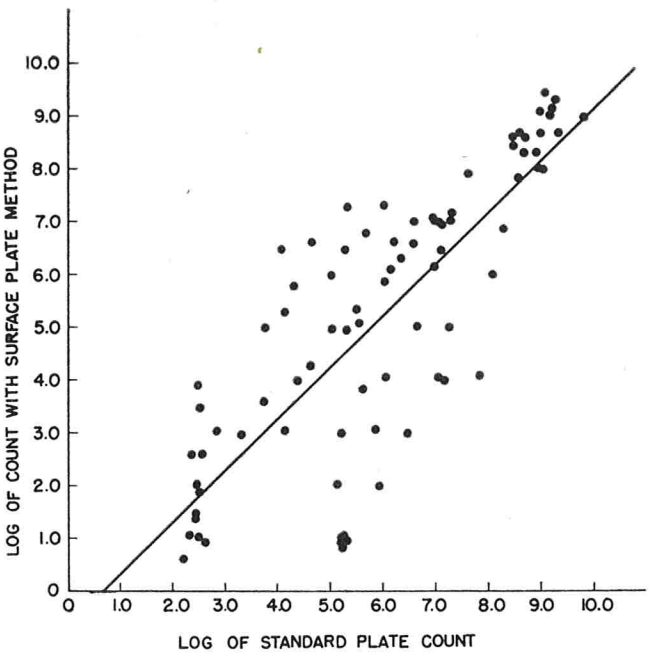

Figure 3. The general relationship of the surface plate method and standard plate method.

of trouble existed. Since this problem was one of psychrophic contaminants, the defect in the product was short shelf life under refrigerated conditions.

Some additional observations were made on the validity of the rapid test in predicting shelf life of milk in a large commercial plant. The criterion for acceptable shelf life was 10 days at 45 F (7.2 C) and was based on organoleptic examination at the end of the storage period. A single surface plate was made for each sample, and the occurrence of a single colony on the plate constituted a positive test. The results were assembled in terms of positive or negative values for the rapid test and acceptable and non-acceptable by the shelf-life test. A summary of the results based on 159 observations is given in Table 3. There were 130 samples which showed negative results on the rapid test and 15 of these samples had a shelf life of less than 10 days. There were 29 positive results on the rapid test and 24 of these samples had a shelf life of less than 10 days.

DISCUSSION

Organisms obtained with the surface plate method include more than a single group of bacteria. The results indicate the physiologically active bacteria, which account for most of the growth at 5 C and 32 C. The test also estimates a population when the count is well under 10 per ml, which is the level of common post-pasteurization contaminants.

While the rapid test appears to give a good estimate of the gram-negative bacteria, a more practical routine use of the test seems to be as an overall indicator of undesirable contamination, e.g. faulty cleaning and/or sanitizing of equipment, or from contamination after pasteurization before closing the packages. It should be remembered that colonies on the surface plate may represent either psychrotrophic or coliform contamination. A precise relation between test results and shelf-life expectancy is only possible insofar as psychrotrophic bacteria and coliform bacteria have certain common points of origin. Occurrence of more than an occasional bacterium on the surface plate should be taken as a signal of undesirable contaminants in the product being evaluated.

A real advantage of the surface plating method is that the results are available by the time the next cycle of production operation is underway. Further effort is being made to explore the usefulness of this method for evaluation of other products.

ACKNOWLEDGMENTS

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Appreciation is expressed to Mr. H. M. Barnhart, Jr. for his technical assistance in this work.

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INFLUENCE OF CHANGING FROM DRY-LOT FEEDING TO PASTURE ON THE FREEZING POINT OF MILK

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ABSTRACT

The freezing point of milk from cows on a dry-lot feeding program was −0.543 C, −0.545 C when on full pasture, and −0.542 C when changed back to dry-lot feeding. Samples from the morning and evening milkings froze at −0.542 C and −0.545 C, respectively. Milk from cows on dry-lot feeding froze at colder temperatures in times of high barometric pressure.

Previous work has indicated a relationship between the type of forage consumed by a cow and the freezing point of milk from that cow *(7, 13)*. In a winter feeding trial, cows consuming alfalfa silage (55% moisture) produced milk with a greater freezing point depression than did cows fed either RS610 grain sorghum (72% moisture) or corn silage (66% moisture) *(7)*. The shift from dry-lot feeding to pasture in the spring of the year has been reported to influence the freezing point of milk *(1, 5)*. The present investigation was undertaken to determine more precisely the influence of changes in feeding conditions upon the freezing point of milk.

EXPERIMENTAL PROCEDURE

Thirty Holstein and 15 Jersey cows, selected as to allow them to be divided into three groups of equal numbers in each breed and comparable in milk production and stage of lactation were used to study the effect of an abrupt change in the forage feeding program on subsequent milk production and on the freezing point of the milk. During Period 1 (7 days) all cows received a standard dry lot forage ration of corn silage and alfalfa hay fed ad libitum. All animals were group fed with no feed weights recorded. At the end of Period 1, one-third of the experimental animals were switched to a forage ration consisting of continuous access to small grain pasture (oats, wheat, or rye), hereafter referred to as the full pasture treatment. A second group of 15 animals was given access to pasture during the morning and the dry lot ration during the afternoon and evening, hereafter referred to as half pasture. To detect any abrupt change which might have occurred in the absence of any specific treatment, a third group of animals received the dry lot ration continuously throughout the experiment. Period II was 3 weeks in length with the last 2 weeks' data utilized in the statistical analyses. A 3-week post experimental period (Period III) followed the experimental period at which time all cows received the standard dry lot forage ration. All animals had continuous access to water at all times.

Data can be statistically analyzed in various manners. A conventional analysis of variance of the data collected in the latter part of the experimental period might be noted as an analysis of variance of Y. However, the performance of a cow (or the composition of her milk) before the experimental period might influence the nature of the data collected during the experimental period. The lactation curve as related to properties of milk from different cows is not the same. To overcome this bias, consideration should be given to the performance of the cow and her milk composition before and after the experimental period *(4)*. By this method each cow serves as her own control and the influence or response of the experimental treatment is isolated for analysis. As an example of this calculation, cow 284 during the pre-experimental period produced milk with an average freezing point depression of 0.5428 C. During the experimental period the average freezing point depression was 0.5450 C and during the post-experimental period it was 0.5409 C. The calculation $0.5428 + 0.5409 - 2(0.5450) = -0.0063$ gives a value which can then be used as one observed value in a standard analysis of variance test *(14)*. Forty-five such values (one for each cow) were obtained in these studies. The groups were shown to produce milk of different freezing points, calculated in this manner. The same procedure was followed in determining the influence of forage on the other properties noted in Table 1.

Samples from the twice-daily milkings were measured for freezing point by use of a thermistor-type cryoscope. The fat content was determined by the Babcock method; total solids by drying at 100 C; and SNF calculated by difference. Determinations for composition were made on a 4-consecutive-milking sample once per week. Body weights were determined by three consecutive daily weighings at the end of each feeding regime period.

RESULTS AND DISCUSSION

Table 1 contains the average values for the freezing point, milk production, body weight, and milk composition for the three time periods. The freezing points of milk produced during the switchback trials (dry lot-experimental-dry lot) were significantly different ($P < 0.05$). This difference is most noticeable in group three where the change from dry lot to full pasture was accompanied by an increase in freezing point depression, 0.543 to 0.545 C, and when these animals were changed back to dry lot feeding, the freezing point depression decreased to 0.542 C.

There was a significant increase ($P < 0.01$) in daily milk production on cows switched from dry lot to full pasture. However, when the milk production was converted to a 4% FCM basis, there was no significant difference ($P > 0.05$), possibly due to a reduction in fat percentage, while the cows were on pasture. However the lower fat percentage of milk while the cows were on pasture was not significant ($P > 0.05$). Other components of the milk (% total

TABLE 1. INFLUENCE OF FORAGE TYPE UPON MILK PRODUCTION, COMPOSITION, FREEZING POINT OF THE MILK AND BODY WEIGHT OF THE COW

	Group	Period I**	Period II	Period III**
Freezing Point[a]	1*	0.544	0.544	0.544
	2	0.545	0.545	0.543
(–C)	3	0.543	0.545	0.542
Actual	1	16.5	16.4	15.6
milk	2	17.1	16.9	15.4
production[a]	3	18.6	19.9	17.7
(kg/cow/day)				
Milk fat (%)[b]	1	3.78	3.62	3.79
	2	3.68	3.50	3.91
	3	3.71	3.40	3.80
Fat-corrected milk[b]	1	15.3	15.0	14.6
(kg/cow/day)	2	15.9	15.2	14.9
	3	17.5	17.6	16.8
Solids-not-fat (%)[b]	1	8.95	8.98	8.96
	2	8.90	9.29	8.83
	3	8.87	9.11	8.80
Body weight[a]	1	522	528	542
(kg/cow)	2	526	528	542
	3	510	500	520

*Group 1 received dry lot ration during period II.
Group 2 received half pasture treatment during period II.
Group 3 received full pasture treatment during period II.
**All animals received dry lot ration during periods I and III.
[a]Treatment effect statistically significant.
[b]Treatment effect not statistically significant.

solids, or % SNF) were not significantly different between the three groups ($P > 0.05$). Differences in milk composition were not significantly different, probably because of the large animal variation in these variables. Body weight changes were significant ($P < 0.01$), decreasing with the change from dry lot to full pasture.

Previous reports indicate that during times of high atmospheric temperatures, cows produce milk of a smaller freezing point depression *(6, 11)*, and lower concentrations of phosphorus, magnesium, and potassium *(8)*. However, the atmospheric temperatures during this study were not extremely high; the average maximum and minimum temperature during the first, second, and third periods were 16.5, 1.1; 17.6, 3.7; and 21.8, 10.2 C, respectively as recorded by the United States Weather Bureau Station located approximately 16 km from the dairy barn.

The average freezing point on all morning samples was –0.542 C and on all evening samples was –0.545 C, a highly significant difference as indicated by the "t" test. The morning milking took place between 2 AM and 4 AM and the evening milking between 2 PM and 4 PM. Differences in the freezing point of morning and evening milk have been noted by other workers, but not all are in agreement as to its effect *(1, 2, 3, 9, 10, 13, 15)*. Shipe *(12)* suggested that these differences might result from accessibility of water.

The average freezing point of 3,959 samples of Holstein milk and 1,977 samples of Jersey milk was –0.5430 C and –0.5440 C, respectively. These were also shown to be highly significantly different by the "t" test, although for practical purposes, a difference of only 0.001 C is not of great importance.

The correlation coefficient between week of lactation and the freezing point depression of milk for the Holsteins was 0.18, and for the Jerseys it was only –0.01. Likewise, the quantity of milk produced per milking had a correlation coefficient with freezing point depression of –0.12 for Holstein milk and 0.05 for Jersey milk.

The relationship between the freezing point depression of milk and various weather variables is shown in Table 2. Negative correlation coefficients indicate that the greater the variable the less the freezing point depression, i.e. the freezing point of the

TABLE 2. CORRELATION COEFFICIENTS BETWEEN FREEZING POINT DEPRESSION OF MILK AND VARIOUS WEATHER AND PRODUCTION VARIBLES

Variable	Amount of pasture None	Half	Full
Temperature on sampling date	<0.01	–0.14**	–0.05
Temperature one day previous	<0.01	–0.02	0.02
Relative humidity on sampling date	–0.04	0.07*	0.15**
Relative humidity one day prior	–0.01	0.06*	0.11**
Temperature-humidity index on sampling date	–0.01	–0.11**	–0.02
Temperature-humidity index one day prior	<0.01	<0.01	0.04
Vapor pressure on sampling date	–0.01	–0.03	0.07*
Vapor pressure one day prior	0.01	0.01	0.11**
Barometric pressure on sampling date	0.10**	0.04	–0.06*
Barometric pressure one day prior	0.12**	–0.03	–0.05
Week of lactation	0.04	0.21**	0.14**
Quantity of milk produced per milking	–0.09**	–0.03	–0.14**
Number of observations	3,195	630	2,111

*Statistically different from zero ($P < 0.05$).
**Statistically different from zero ($P < 0.01$).

milk is higher. The significance of each correlation coefficient was tested by the method described by Snedecor *(14)* for the estimation of confidence limits. Correlation coefficients are not a measure of cause and effect, but merely an indication of the possibility of a relationship between two factors as evidenced by data collected under the experimental conditions. With the exception of barometric pressure, the weather conditions account for very little of the difference in the freezing point of milk from cows receiving the dry lot ration. In times of high barometric pressures these cows produced milk of a greater freezing point depression. The temperature-humidity index, sometimes called the discomfort index is equal to 0.4 ($^{t}d + {}^{t}w$) + 15, where ^{t}d and ^{t}w are the dry bulb and wet bulb Fahrenheit temperatures, respectively. For those cows on half pasture, the atmospheric temperature as well as the temperature-humidity index on the sampling date had negative correlations with the freezing point depressions. The relative humidity tends to work somewhat to the contrary for those cows on part or full pasture. The greater the relative humidity, the greater the freezing point depression. With those cows on full pasture, the greater the vapor pressure, the greater the freezing point depression, possibly reflecting some of the same physiological responses as relative humidity. As cows advance in lactation, the freezing point depression becomes greater, especially for those on pasture. This has been noted earlier *(7)*. The freezing point depression and the quantity of milk produced have negative correlations, possibly reflecting somewhat the stage of lactation. No single variable measured in the present study explained more than 5% of the variation in the freezing point of milk. Inasmuch as a large number of freezing point measurements (5,936) were made, small differences tend to show statistical significance, even though from a practical standpoint, these differences are very small.

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IMPROVED PROCEDURES FOR MEASUREMENT OF AFLATOXINS WITH THIN LAYER CHROMATOGRAPHY AND FLUOROMETRY[1]

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Abstract

Optimal resolution of aflatoxins B_1, B_2, G_1, and G_2 was obtained when thin layer Chromatoplates equipped with a 0.25 mm layer of silica gel (Adsorbosil-5) were used within 2 hr after heat activation and when plates were developed in an unlined unequilibrated tank containing methanol and chloroform (1:99 v/v). Plates were further improved for fluorometric scanning by extending the distance of the solvent front from 15 to 18 cm and by scoring the Adsorbosil-5 to provide narrow bands prior to spotting the sample. Chromatoplates treated as described were accurately scanned with a fluorometer (not a modified densitometer) and concentrations of aflatoxins were indicated by areas under peaks as drawn by an attached recorder. A satisfactory linear relationship was obtained between the emitted fluorescences expresed as the area under peaks and concentration of the four aflatoxins.

Molds in the genus *Aspergillus* are able to produce highly toxic metabolites designated as aflatoxins *(10, 20)*. The four most familiar aflatoxins are identified as B_1, B_2, G_1, and G_2 on the basis of their intense blue or green fluorescences and R, values on thin-layer chromatograms *(19, 20)*. Their marked potency, unusual pathogenic properties, and possible occurrence in foods distinguish aflatoxins as agents of economic and public health significance *(10, 19, 20)*.

Most analytical procedures for qualitative and quantitative measurements of aflatoxins routinely employ thin-layer chromatography (TLC) in which aflatoxins in sample extracts are separated and resolved on glass plates coated with silica gel. Developed plates are examined with the aid of ultraviolet light (365 mμ) and aflatoxin concentrations are determined by visually comparing the intensities of fluorescence of spots in the sample with those of appropriate aflatoxin standards *(11)*. This technique was used in earlier studies in this laboratory dealing with the formation of aflatoxin in Cheddar cheese *(8)* and in a casein substrate *(9)*.

Since it is difficult to visually estimate small differences in the intensities of fluorescence, and instrumental method employing a densitometer was suggested recently for the measurement of the solid state fluorescence of aflatoxins directly on a TLC plate *(3)*. This procedure, employing a densitometer equipped with an automatic scanning thin-layer plate stage, a source of ultraviolet light, appropriate filters, a recorder, and an integrator, has been extensively studied and found suitable for accurately quantifying aflatoxins on TLC plates *(4, 17, 18)*.

Although the instrument just described serves to satisfactorily measure aflatoxins, it suffers from several minor drawbacks. The instrument lacks compactness and must be operated in the dark.

A fluorometer has been successfully used in this laboratory for the measurements of aflatoxins. This instrument is somewhat more compact than the modified densitometer and can be operated in the presence of normal laboratory illumination. Preliminary trials indicated, however, that methods suggested for preparation of TLC plates to be scanned with the modified densitometer were not entirely satisfactory for treating plates that were to be scanned with the fluorometer. Consequently, the studies reported in this paper were conducted to determine the solvent system and related conditions needed to provide optimal resolution of aflatoxins on TLC plates so that the individual aflatoxins can be efficiently measured with a fluorometer. It is possible that some of the procedures recorded in this paper may also be useful in the preparation of TLC plates prior to scanning with a modified densitometer.

Materials and Methods

Preparation of TLC plates

Standard 20 x 20 cm plates coated with a layer (0.25 or 0.50 mm) of Adsorbosil-5 (Applied Science Laboratories, State College, Pa.) were employed in these tests. Plates were activated at 110 C for 2 hr and then held in a desiccator until they were used.

Aflatoxin standards

Pure standard mixtures of aflatoxins containing 4 components (B_1, B_2, G_1, and G_2) were used throughout the study. These standards were provided by Drs. O. L. Shotwell (U.S. Dept. of Agriculture, Peoria, Ill.) and L. A. Goldblatt (U.S. Dept. of Agriculture, New Orleans, La.)

Solvent systems

The solvent systems which were compared for their suit-

[1]Published with the approval of the Director of the Wisconsin Agricultural Experiment Station.

TABLE 1. KEY TO SOLVENT SYSTEMS EMPLOYED TO SEPARATE AFLATOXINS ON THIN-LAYER CHROMATOPLATES

Key	Solvent system	Composition (v/v)	Reference
A	Acetone-chloroform	5:95	–
B	Acetone-chloroform	10:90	*4, 7, 16, 19*
C	Acetone-chloroform	15:85	*15, 17*
D	Acetone-chloroform	20:80	–
E	Methanol-chloroform	1:99	–
F	Methanol-chloroform	3:97	*2, 6, 19*
G	Methanol-chloroform	5:95	*1, 12*
H	Methanol-chloroform	7:93	*5, 8, 9*
I	Chloroform-acetone-2-propanol	825:125:25	*14, 17*
J	Benzene-95% ethanol-water	46:35:19	*11*
K	Ethyl acetate-2-propanol-water	10:2:1	*13*
L	Butanol-glacial acetic acid-water	4:2:1	–

ability to develop TLC plates in both lined equilibrated and unlined unequilibrated tanks are listed in Table 1.

Other conditions

Plates were used 2 and 8 hr after activation to determine the effect of storage on their suitability for resolution of aflatoxins. Two solvent systems (C and E) were employed in these tests. In another series of experiments the distance traveled by the solvent front was extended from 15 to 18 cm to determine the effect of this modification on resolution of aflatoxins. Both lined and unlined tanks together with solvents C and E were employed in these trials.

Examination of plates

Visual examination of plates was accomplished in the dark with the aid of ultraviolet light (365 mμ). Fluorometric determinations were made with a fluorometer (Model 111, G. K. Turner Associates, Palo Alto, California) equipped with a thin-layer plate scanner and a recorder (Model H, Leeds and Northrup). A series of TLC plates with different concentrations of standard aflatoxins were scanned to determine relationships between emitted fluorescence and concentration.

RESULTS AND DISCUSSION

Comparison of solvent systems

Twelve different solvent systems, some suggested by other investigators, were compared for their ability to separate aflatoxins on TLC plates equipped with a 0.25 mm layer of Adsorbosil-5. Tests were conducted using both lined, equiliberated and unlined, unequilibrated tanks. Results of trials using lined, equilibrated tanks are given in Fig. 1. In general, separation of the aflatoxins was unsatisfactory under these conditions. An exception was noted when methanol and chloroform (1:99 v/v) served as the solvent system (E on the figure). Markedly improved separation of aflatoxins was obtained with several solvent systems when an unlined, unequilibrated tank was used for development of TLC plates (Fig. 2). Improvements were noted with all solvents tested except methanol and chloroform (3:97, 5:95, 7:93 v/v), ethyl acetate-2-propanol-water (10:2:1 v/v) and butanol-glacial acetic acid-water (4:2:1 v/v). These results are in agreement with those of Eppley *(7)*, who earlier noted improved separation of aflatoxins when acetone and chloroform (10:90) were used to develop TLC plates in an unlined, unequilibrated tank.

Among the 12 solvent systems used in this investigation, two of them, acetone and chloroform (15:85 v/v) and methanol and chloroform (1:99 v/v) (C and E, respectively in Table 1 and Fig. 2), provided most satisfactory separation of the four aflatoxins when plates were developed in an unequilibrated, unlined tank.

Approximately 60 min were needed to complete development of a plate in an unlined tank, whereas approximately 30 min were required when the tank was lined. The slower movement of the solvent front, as reflected in the extra time required, may have served to improve resolution when plates were developed in an unlined tank. Additional support for this explanation is provided by the observations on the relationship between resolution and distance traveled by the solvent front (Fig. 3 and 4).

Distance traveled by solvent front

According to different investigtors *(6, 14, 15, 16)*, suitable separation of aflatoxins is obtained by permitting the solvent front to travel a distance of 12 to 18 cm. In these tests distances of 15 and 18 cm were compared for the effect of this condition on aflatoxin separation when methanol and chloroform

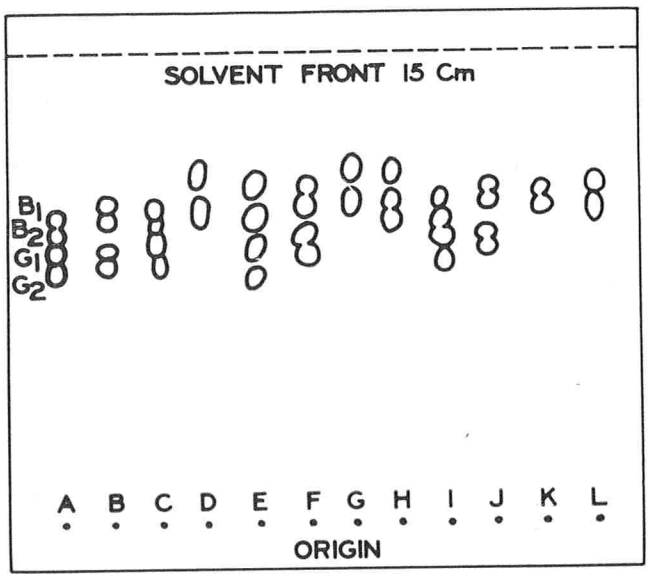

Figure 1. Resolution of aflatoxins by various solvent systems in a lined tank. For key to A through L, see Table 1.

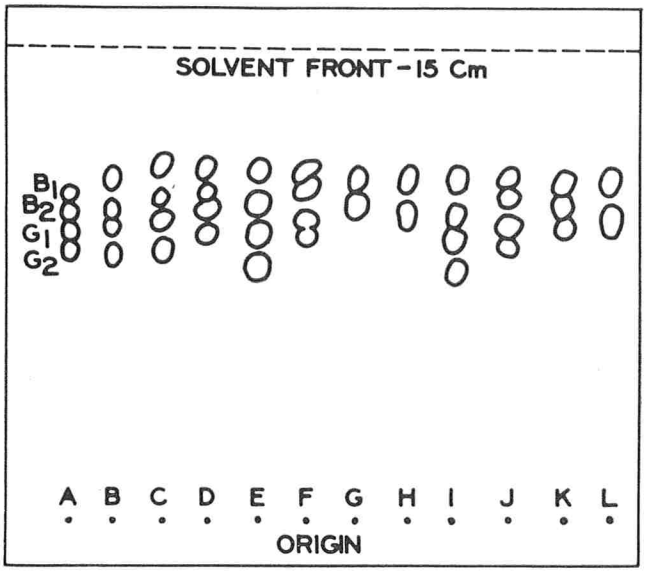

Figure 2. Resolution of aflatoxins by various solvent systems in an unlined tank. For key to A through L, se Table 1.

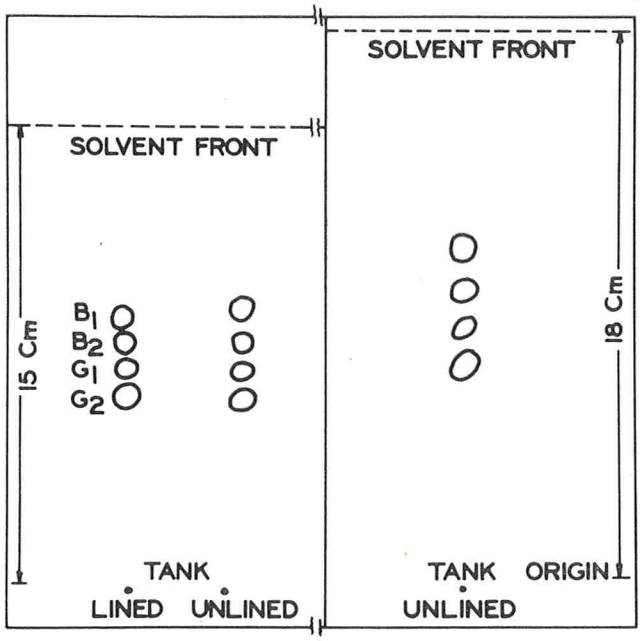

Figure 3. Comparison of solvent fronts in the resolution of aflatoxins by methanol and chloroform (1:99 v/v).

(1:99 v/v) and acetone and chloroform (15:85 v/v) served as the solvent systems. These two combinations of chemicals were used since earlier they were found to regularly bring about satisfactory separation of aflatoxins. Results obtained with both solvent systems (Fig. 3 and 4) revealed improved separation of aflatoxins when the distance traveled by the solvent front was increased from 15 to 18 cm.

Storage of heat activated TLC plates

During this study inconsistencies in aflatoxin resolution were noted when newly activated and stored plates were used. Therefore attention was devoted to the effect of storing activated TLC plates on their ability to separate aflatoxins. Most investigators indicate that the activated plates can be stored in a resiccator until they are used. In one instance *(6)* it has been recommended that plates held for more than 48 hr should be reactivated before use. In these trials improved separation of the aflatoxins was obtained when freshly activated (2 hr old) rather than stored (8 hr old) plates were used. Figure 5 pre-

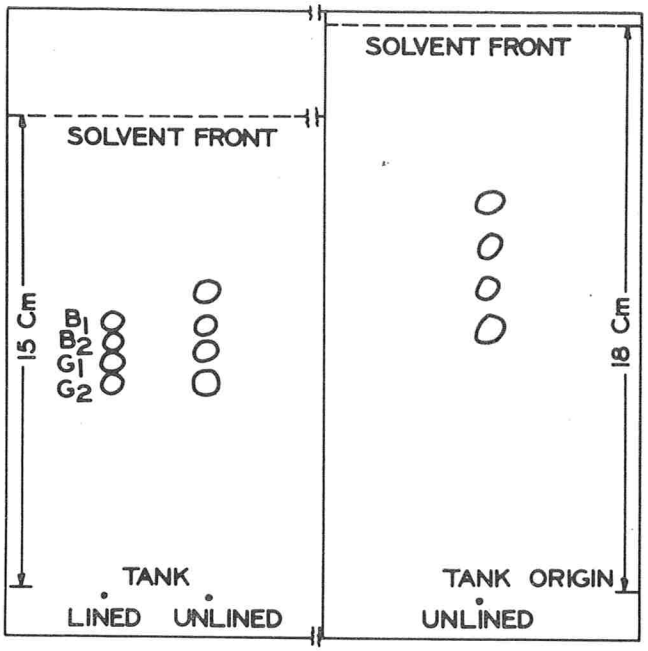

Figure 4. Comparison of solvent fronts in the resolution of aflatoxins by acetone and chloroform (15:85 v/v).

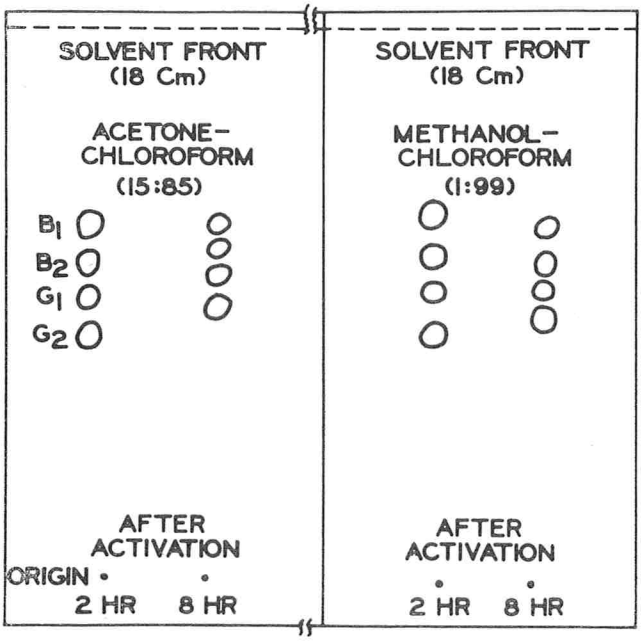

Figure 5. Comparison of freshly activated and stored TLC plates for resolution of aflatoxins when developed with two solvent systems.

sents results of the tests and shows that the improved separation occurred with both solvent systems (acetone-chloroform, 15:85 and methanol-chloroform, 1:99) on freshly activated plates.

Other conditions

Use of 0.25 mm *(1, 4, 5)* or 0.50 mm *(6, 14, 15, 16)* deep layers of silica gel on TLC plates has been recommended. Limited trials revealed that a layer of Adsorbosil-5 0.25 mm deep provided better separation of the aflatoxins than did one with thickness of 0.50 mm.

Double development of plates using the methanol and chloroform (1:99 v/v) solvent system further improved separation of aflatoxins. This technique is suggested for use if single development fails to provide adequate separation to permit "reading" of the plates by fluorometry. Plates unsatisfactory for

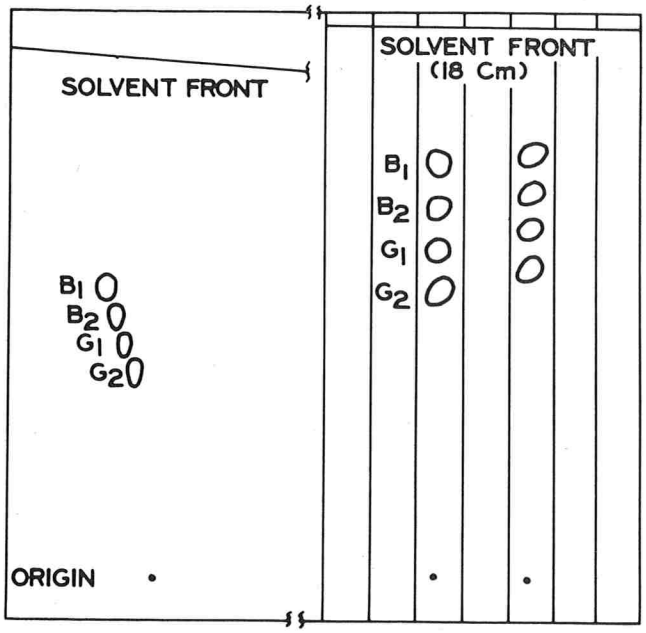

Figure 6. Comparison of aflatoxin resolution on conventional and modified TLC plates developed with methanol and chloroform 1:99 v/v).

scanning when developed with the acetone and chloroform (15:85 v/v) solvent system were not improved materially by double development in the same solvent.

Failure to obtain an even solvent front on a TLC plate during development was often accompanied by overlapping among the four spots and by a curvilinear arrangement of these spots (see left side of Fig. 6). Both of these conditions make plates unsatisfactory for scanning. To overcome these difficulties TLC plates were scored as indicated on the right side of Fig. 6. This technique also was suggested by Beckwith and Stoloff *(4)* but these authors did not describe its usefulness in preparing plates for fluorometric

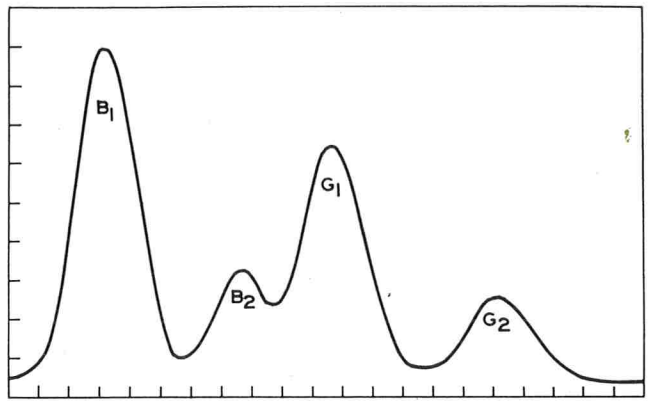

Figure 7. Separation of aflatoxins by scanning of TLC plates with a fluorometer.

scanning. Pretreating plates in this manner resulted in dividing the Adsorbosil-5 into series of narrow bands which then allowed the solvent front to travel evenly through this relatively small area. As a result, improved separation of the four aflatoxins was obtained and the spots appeared in a straight line —conditions which are both invaluable for direct scanning of the TLC plates.

Measurement of aflatoxins with a fluorometer

When properly prepared TLC plates were scanned with the fluorometer, results such as appear in Fig. 7 were obtained.

From such data obtained with various concentrations of aflatoxins B_1, B_2, G_1, and G_2, it was possible to determine the relationship between emitted fluorescence as measured by the fluorometer and concen-

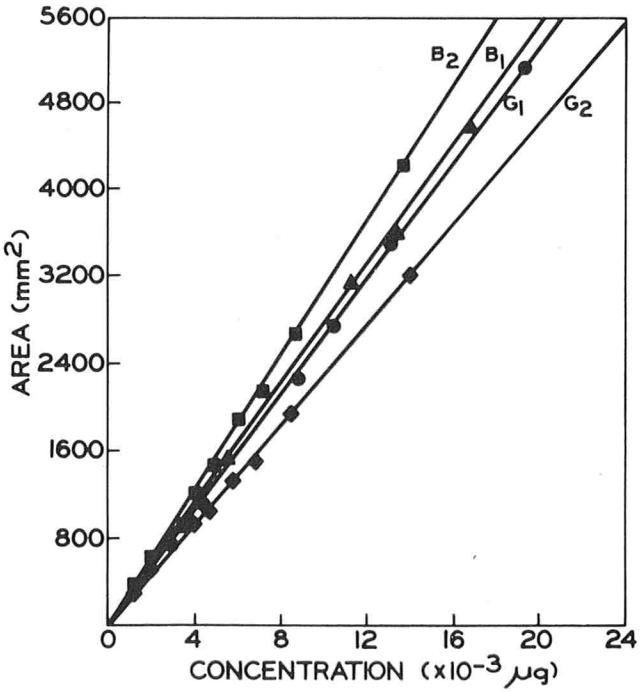

Figure 8. Relationships between areas under peaks as measured by the fluorometer and concentrations of aflatoxins.

tration of aflatoxin. Results, shown in Fig. 8, indicate that a linear relationship existed between areas under peaks and concentrations of aflatoxins (from approximately 1.0 x 10^{-3} to 20 x 10^{-3} μg for B_1, B_2, G_1, and G_2). These data indicate that scanning of TLC plates with a fluorometer provides an efficient and accurate method for measurement of each aflatoxin component when plates are prepared as described earlier in this paper.

ACKNOWLEDGEMENT

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INDIA NOW PRODUCING MODERN BREAD

Six bakeries in India now producing "modern bread," a fortified "complete" food designed to improve the diet of developing nation populations, have spurred an important development in India's fight against hunger and malnutrition. Addressing the opening session of the four-day 29th Annual Meeting of the world-wide Institute of Food Technologists here, Dr. Aaron M. Altschul, Special Assistant for International Nutrition Improvement of the USDA's Foreign Agricultural Service said that with an ultimate goal of 100 million loaves annually, modern bread production has spurred other Indian bread producers to seek ways of fortifying their own products. Modern bread is fortified with vitamins, minerals and lysine which is a biologically important amino acid containing protein.

More than 5,000 food technologists and scientists attending the IFT sessions at the Conrad Hilton Hotel heard three other talks on the relationships between food science/technology and social needs. Dr. Derrick B. Jelliffe of the Caribbean Food and Nutrition Institute, Kingston, Jamaica, discussed the food industry and child malnutrition in less developed nations. Prof. Louis Rey, of Nestle Alimentana (Switzerland), assessed industry's role in meeting present and future food needs. Mrs. Mercedes Bates, Betty Crocker Kitchens of General Mills, Minneapolis, chronicled changing food patterns with emphasis on speed and efficiency in response to the influence of social and technological changes.

PROTEIN FOR THE SPARK AND THE EXPLOSION[1]

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In this paper I would like to take you hopscotching through protein, because no topic is more timely or more worthy of discussion than the population explosion and its ultimate relation to the food industry.

Now, we know that the world population just about doubles every 40 years. If this keeps up, in 700 years there will be so many people that all will have to stand shoulder to shoulder across the globe's land surface with no room to move about—no room to lie down.

And should this growth continue for 7,000 years, our descendants will begin to be stacked tier on tier until the diameter of the earth is expanding *faster than the speed of light.*

FEEDING THE MASSES

This is a celestial phenomenon and not our problem. Our problem is how to feed these masses. In the developed countries, we seem to keep food production up with population increases and even to produce a surplus. Yet in the underdeveloped countries or—developing, if you will—food production is today lower than it was 10 years ago. It always seems to be that the 'fat cats' in each and every society have much more than they need, whereas the majority must make do with much less. For proof, consider the fact that 30% of the total U. S. food production is wasted after it leaves the table!

PROTEIN

In developing countries, the food deficiency makes itself felt in many ways—low calorie intake, lack of vitamins, and minerals. But far and away the most common diet deficiency is in protein.

What does protein make us think of? Meat, milk and eggs, cheese, fish, other animal proteins. And so it's interesting to note that 80% of proteins consumed by humans are of *plant origin.* And more than half that figure is based on protein from just three cereals: wheat, corn, and rice.

But if we are to have enough protein for that turn-of-the-century population, we'll have to go far beyond our present sources of supply. Let's look at some possibilities. We have animals—on land and in the sea. Likewise we have plants, land and sea.

In the past, land animals were in great abundance and were good suppliers of protein. Yet it took us only one century to kill off our buffalo herds, and now Santa Claus is the only soul left with adequate access to reindeer. The land needs of human civilization, added to unlimited slaughter, will not let us consider land animals as a basic protein supply for long-range population explosion.

And sea animals? The same case. How long have we allowed the descimation of whale herds for the precious oil while throwing the meat back to the sharks? The animals of the sea—the fishes in their present quantity—would be an adequate source of protein only for a short time.

PLANTS

Now that we've covered animals, what about the plants? The sea houses a fascinating flora, but how little we know of it! Our knowledge of the sea is confined practically to the first hundred feet below its surface. Think how much of our country would be unexplored if we were confined in our knowledge of land to an equal extent. We do know there is protein to be had from the plants of the sea; but what there is, in good quality and small quantity, is difficult to harvest. Our job here is to study the sea's supply of food as the Government is doing and devise means of extracting and cultivating it efficiently.

And so we have land plants, which provide much of our protein through their use as animal fodder. How long can we afford this luxury? Plant proteins convert to animal protein, via the cow for example, at 3.9 lb. of protein feed for 1 lb. of milk. That 1 lb. steak you relish required 10 lb. of feed protein in the making. So it is readily apparent that the feeding of animals to produce protein for human consumption is extremely inefficient. We cannot keep up the necessary supply of feed.

What will we find for the world's population to eat? Most of the answer lies in finding an acceptable supplementary protein source.

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[1]Presented at the 55th Annual Meeting of the International Association of Milk, Food, and Environmental Sanitarians, Inc., St. Louis, Missouri, August 18-22, 1968.

PROTEIN SUPPLEMENT

Now, just what is acceptable? In answering that question we must remember that most groups of people have followed a consistent diet for generations. We must give them something they can and will eat. This ideal protein additive would first, of course, be of good food value. It will have to be bland in flavor and light in color. Very important, this protein form must be produced cheaply and, hopefully, made where it is to be consumed. It will have to be made in powder form, for much of the world is without facilities for preserving food. And, the culture of the people to be fed must admit its use.

Knowing this, we can look for future sources of good protein to come from improved breeds of plants: corn, cotton seed, soybeans. And let's not overlook the simple plants, the yeasts and bacteria. Recent advances show us that bacteria can produce protein when fed on hydrocarbons. So much remains to be done that I have been able merely to touch on a part of this great challenge.

LETTERS TO THE EDITOR

The evils of the Standard Plate Count

DEAR SIR:

The role of the Standard Plate Count on fresh raw and pasteurized milk and milk products is well known and the results widely accepted. This procedure and the results obtained have provided the basis or standards for legal acceptance or rejection as well as the basis for judging the character and quality acceptance of the product. It has literally become a way of life in the field of milk sanitation and quality control.

During the past several years, and particularly since shelf life and age of milk and milk products have become such an important factor, many researchers, quality control directors, and health officials express the opinion that we now have reached the point where the Standard Plate Count (SPC) on raw and pasteurized milk and milk products, as it is generally used, is causing more harm than good. These people feel the time has come to take a good hard look at the whole procedure and particularly at the manner in which the results are used. They emphasize their viewpoints by reminding us of the ease by which poor practices can be masked through good refrigeration and what happens to the product when exposed to stresses of time and temperature. The results of the SPC on fresh milk are only significant when a high count is found. The problem is with the low count fresh product. There is much literature indicating that the SPC on fresh milk products provides little information on the condition of equipment and the methods used in the production or processing of the product. In practical everyday operation, sanitarians and fieldmen continuously point out the lack of correlation between the SPC results and actual conditions found on farm inspections. They argue that these low count results hinder rather than help their farm sanitation program. The same experience is typical of milk plant sanitation efforts and quality control. We have been giving the milk producer and milk processor the false idea that because his initial or fresh product SPC is good, his product is beyond reproach. The fact is that when this same product is exposed to the stress of today's marketing conditions, too often it fails to stand the test. The manner in which milk and dairy products are handled and stored in both the raw and pasteurized states demands tests and evaluations much more realistic than the Standard Plate Count.

It is not suggested that we scuttle the Standard Plate Count as we know it today. It has a place. It is argued that its place is not the elevated position it occupies. When one considers its cost as it is generally carried out, the misinformation it generates and its side line effects, there is much cause to reflect. A real evaluation of the test in line with its defects or shortcomings and its daily application is overdue.

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(Editor's Note: The comments by Mr. Barnum are particularly timely since "Standard Methods" is again undergoing revision. Other readers with opinions on this matter are invited to express them in "Letters to the Editor.")

What about the IAMFES-NAS amalgamation?

DEAR SIR:

As a member of both sanitarian's organizations, I was pleased to learn of the proposed merger or amalgamation. It has been some time since the effort began and like "pollution" we have had more talk than action. I realize that this must be a slow and orderly process to promote professionalism, efficiency, and to preclude someone's feelings getting hurt.

I received both issues of the *Journal* yesterday. Not only did they come on the same day, but the comraderie was in full bloom. This is wonderful. Both publications had articles on *(a)* professionalism and *(b)* the correspondence courses at Utah State University. Both of these subjects are very close to me because *(a)* many sanitarians haven't the foggiest idea what professionalism is all about and *(b)* I have just convinced the Correspondence Division of the Florida University system that the educational opportunities for sanitarians need to be expanded by providing courses for the sanitarians. This will help us advance professionalism to the point that we might consider ourselves as true professionals.

Since we think we are a fine bunch of fellows and the advantages of merger out-weigh without question the disadvantages, then lets get on with the show. As an officer in one of the Florida affiliates, I request that this spirit of cooperation be finalized into action. In order to promote harmony in a Florida merger, I would gladly resign—in unity there is strength.

F. W. CULBERTSON
Director
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Rockledge, Florida 32955

VECTOR CONTROL TODAY[1]

HARRY D. PRATT AND B. F. BJORNSON

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Vast changes are occurring in the United States. In the last century there has been a sixfold increase in the population, from some 31 million people in 1860 to 179 million in 1960 and to over 200 million today. Modern superhighway systems have made it possible for people to live miles from their places of work. In this generation, tremendous business, housing, and shopping areas have been developed far from the centers of cities. One suburb has been added to another until in many areas they have been fused into "strip cities." Inevitably, someone coined a term, "megalopolis," that is descriptive of such a core city with its accretion of satellite communities.

The public is inclined to think of the megalopolis as a complex of well-ordered business and residential areas surrounded by prosperous farmlands and the whole tied together by broad highways and complex interchanges—truly a product of modern technology. Yet public health workers know there are serious problem areas within this complex. They are aware of the growing slums in the older parts of the city, where there are burgeoning problems of inadequate refuse storage, collection, and disposal; of air pollution, and of insufficient water-supply and sewage-disposal facilities; and problems of low-income groups displaced by urban renewal, with consequent crowding of families and businesses into already overcrowded substandard housing—often into buildings overrun with cockroaches, bedbugs, rats, mice, and other vermin.

Moreover, the shiny new suburbs also have their own pressing public health problems. Too often housing has been built on the edges of swamps or streams, in areas where mosquitoes, sand flies, deer flies, and horseflies can breed; and new developments are often built adjacent to or surrounded by long-established farms that may produce hordes of flies and create offensive odors. Whenever these new residential or business areas are built outside corporate limits, there are the familiar problems associated with individual water supplies, and the problems of raw sewage discharged into streams, of septic tanks improperly installed or overloaded, and of refuse disposal by the open-dump and the litterbug systems.

In both urban and suburban areas, the many vector-control problems require strong control organizations with adequate planning, financing, and staff. A start has been made with the establishment of mosquito-control districts in many parts of the country. The staffs of some universities and health departments in some larger cities also are working on insect and rodent problems. However, much more needs to be done, with full-time employees working on research and operational problems in the field of vector control and with full-time staffs of vector-control workers in every State and every major city.

As the shifting weight of the population to urban areas continues, so that 70% of the people in this country will soon be living in urban communities, increasing attention is being paid to problems of water and air pollution and to the many problems of insects and rodents associated with urbanization. In many areas good land for sanitary landfills is difficult to find. Therefore, more attention should be given to incinerators and to better methods of composting refuse or other procedures for sanitary disposal of organic wastes and municipal refuse—the breeding places for flies, rodents, and mosquitoes. This is not a problem for health departments alone; it is one that should concern every citizen.

In some cities, sanitarians have been the key individuals in campaigns to reduce the sources of insects and rodents. In some States, an average of one-half to one full cubic yard of junk per premise has been hauled away. Removal of this junk—old bottles, tin cans, tires, appliances, and miscellaneous other refuse—helps reduce breeding places of mosquitoes that carry the viruses of yellow fever, dengue, and encephalitis, as well as the breeding places and harborage of disease-carrying flies, cockroaches, and rodents.

On the basis of years of cooperative control programs throughout the United States, many health authorities feel that truly effective vector control can be achieved only by the combined use of environmental sanitation and the judicious use of pesticides. However, the use of pesticides is secondary to, or supplemental to, those measures that reduce or curtail the breeding sources of insects and rodents. Good

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[1]Presented at the 55th Annual Meeting of the International Association of Milk, Food, and Environmental Sanitarians, Inc., St. Louis, Mo., August 18-22, 1968.

environmental sanitation and permanent control measures, such as reduction of mosquito breeding places, or the proper storage, collection, and disposal of refuse on a fly- or rodent-control program, make possible the initial and largest reduction in vector populations. Once this has been done, the proper pesticides should be applied to achieve the final reduction in populations of insects and rodents of public health importance.

For many years the U. S. Public Health Service has contributed to ongoing insect and rodent control by working with State and local health departments in presenting vector control courses in Atlanta or in the States; making available a variety of motion pictures, filmstrips, and other audiovisual aids on free, short-term loan; producing training literature and technical publications; and assisting in consultation and in the development of demonstration programs emphasizing the varied aspects of vector control.

Each year two major publications dealing with pesticides are issued, *Public Health Pesticides* by the National Communicable Disease Center *(4)* and *Suggested Guide for the Use of Insecticides,* U. S. Department of Agriculture *(5).* Milk and food sanitarians should be particularly interested in the information in those publications dealing with control of flies, cockroaches, rats, and mice. Following is some specific information based on the most recent issues of these releases.

COCKROACH CONTROL

In cockroach control it is important to know the species involved. The German cockroach, *Blattella germanica,* is often the most abundant species in food-handling establishments. The American cockroach, *Periplaneta americana,* the Oriental cockroach, *Blatta orientalis,* the Australian cockroach, *Periplaneta australasiae,* and the brown-banded cockroach, *Supella supellectilium,* are also abundant in many places. Because of its high reproductive potential and its resistance to insecticides, the German cockroach is generally the most difficult to control.

In many parts of the United States, effective control of this cockroach is obtained only with the organic phosphorus or carbamate insecticides, whereas the chlorinated hydrocarbon insecticides work very well in controlling the American, Oriental, and brown-banded cockroaches. The chlorinated hydrocarbon insecticides chlordane and dieldrin may be cheaper and have a longer life than the organic phosphorus or carbamate insecticides, depending upon the type of surface sprayed.

Insecticides used in cockroach control are listed in the accompanying table. In food-handling establishments, application of these toxicants is generally as a spot treatment along baseboards, at openings around pipes, and in or near other harborage areas and runways. In the initial cleanout operation, many professional pest control operators add a small percentage of pyrethrum or dichlorvos to obtain a quick kill and to "flush out" the cockroaches from their hiding places. Dust formulations are often twice as strong as sprays, as shown by examples in Table 1 (chlordane as 3% spray and 6% dust, and dieldrin and diazinon as 0.5% spray and 1% dust). Dusts should be used in such places as fuse boxes and along electrical wires where sprays may cause fires or corrode insulation. Baits containing Kepone, Baygon, or dichlorvos can be used to supplement sprays.

TABLE 1. INSECTICIDES EMPLOYED IN COCKROACH CONTROL

Insecticide[a]	Formulation	Concentration (%)
Baygon (C)	Spray	1.0
	Bait	2.0
Chlordane (CH)	Spray	3.0
	Dust	6.0
Dieldrin (CH)	Spray	0.5
	Dust	1.0
Kepone (CH)	Bait	0.125
Diazinon (OP)	Spray	0.5
	Dust	1.0
Fenthion (OP)	Spray	3.0
Malathion (OP)	Spray	5.0
	Dust	5.0

[a] (C) = Carbamate insecticide, (CH) = chlorinated hydrocarbon insecticide, (OP) = organic phosphorus insecticide.

Resistance to chlordane, diazinon, malathion, fenthion, and Baygon in some strains of the German cockroach have been reported by Grayson *(3),* Bennett and Spinks *(1),* and NCDC *(4).*

Flynn and Schoof *(2)* reported that the length of time a given residual insecticide provides effective cockroach control varies considerably, depending upon the type of surface sprayed, such as tile, painted or unpainted metal, or painted or unpainted wood.

FLY CONTROL

Effective fly control can be achieved only by maintaining a high level of environmental sanitation to reduce or eliminate fly breeding sources. These measures can be supplemented by insecticidal treatments, including residual sprays, impregnated fly cords, resin strips, fly baits, and space spraying. Larviciding, which is of such great importance in mosquito control, has been much less successful in fly-control programs.

Residual treatments. The chlorinated hydrocarbon insecticides, which were used with great success in the late 1940's, have been replaced by the organophosphorus compounds. Flies developed resistance to the chlorinated hydrocarbon insecticides such as

DDT, BHC, chlordane, and dieldrin. In addition, when the chlorinated hydrocarbons were used, residues of these long-lasting insecticides often appeared in milk or meat.

At present, 8 organic phosphorus compounds are labeled for residual treatment of dairy barns: 2% Ciodrin; 1% diazinon, dimethoate, Gardona, naled, and ronnel; and 5% malathion. The addition of sugar at 2 to 3 times the strength of these organophosphorus insecticides frequently augments the efficacy of the deposits. The 1968 *Public Health Pesticides Report* of NCDC includes the following statements about residual treatments:

"Diazinon and ronnel can be used in dairy barns including milk rooms, and in meat-packing and other food-processing plants. Malathion can be used in dairy barns and meat-packing establishments, but only premium grade material is acceptable for use in milk rooms and other food-processing plants. Naled is labeled for use in dairy barns (except in milk rooms) and in food-handling establishments. Dimethoate is accepted for treating dairy barns (except in milk rooms), meat-processing plants, and poultry houses, but animals should be removed. Fenthion is not labeled for use in dairies, poultry houses, or food-processing plants. Gardona is labeled for dairy barns and other animal shelters except poultry houses. None are accepted for complete interior treatment of houses.

"The little house fly, *Fannia canicularis,* which frequently is a pest in chicken ranches and dairies, is readily susceptible to residual applications of malathion and ronnel. Deposits of these compounds are relatively short-lived but each controls both *Fannia* and chlorinated-hydrocarbon-resistant *M. domestica.* Since both *Fannia* and *M. domestica* frequently rest out-of-doors on vegetation and exterior walls during hot weather, treatment should be applied to these surfaces as well as to the interior of the building. In making applications on interior surfaces of chicken ranches, extreme care should be taken to avoid contaminating feed and water. Dieldrin, DDT, and lindane are no longer labeled for use in poultry houses."

Spraymen should avoid contamination of human and animal food and of water containers. No spraying is permitted in milk rooms or foor processing areas during operations.

Impregnated fly cords. Commercially manufactured fly cords impregnated with parathion, diazinon, or ronnel have been labeled for use in dairy barns, chicken ranches, and food-handling, and -processing establishments. The cords are installed at a rate of 30 linear ft of cord per 100 ft² of floor space. This method has given effective fly control in dairies, chicken houses, and "pig parlors" for periods ranging from 6 weeks to an entire season. The use of fly cords has not been approved in all 50 states. Resistance to the chemicals in fly cords has developed in some areas.

Fly baits. Quick control of flies for a few days can be achieved by using dry fly baits containing Bomyl, diazinon, dichlorvos, malathion, naled, ronnel, or trichlorfon, and an attractant such as sugar. Dry fly baits can be used in dairy barns or outdoors near food-preparation areas. The baits are placed in trays, jar covers, or permanent bait stations at a rate of 2 or 3 oz. per 1000 ft² of floor surface and are renewed about twice a week. Liquid bait dispensers made from a chicken-watering device and a cellulose sponge have been used successfully in chicken houses. The liquid bait contains 0.1% dichlorvos or trichlorfon in 12.5% sugar solution.

Outdoor space sprays. Space treatments are employed against flies chiefly in problem areas where residual treatments or larviciding fail to give satisfactory control. This method is frequently used at open dumps and also in disaster areas, such as stockyards where animals have been killed by flooding, or warehouses where large quantities of food have been damaged following flooding or power failure. According to the NCDC 1968 *Pesticide Report,* three organophosphorus compounds have been labeled for outdoor space applications: malathion, dichlorvos, and naled. Three other organophosphorus insecticides: diazinon, dimethoate, and fenthion, are also effective.

RODENT CONTROL

Rat control. A permanent rat-control program must include long range improvements: *(a)* proper storage and frequent collection of refuse (garbage and rubbish), *(b)* sanitary refuse disposal, *(c)* proper storage and handling of food, including food for pets and other domestic animals, and *(d)* essential improvements to buildings. Until permanent improvements are obtained, the periodic use of poisons to kill rodents may be necessary. Red squill and the anticoagulant rodenticides such as warfarin, pival, fumarin, and diphacinone are the only poisons recommended for rat control in populated areas. They are the ones with which the untrained individual is least likely to experience difficulties.

In a killing compaign, red squill is used initially to obtain a rapid reduction of the Norway rat population. Red squill baits are normally used at 10% strength and are prepared by mixing one part of red squill (500 mg/kg) with nine parts of bait material such as meat, fish, grain, or cereals. Red squill has a natural emetic quality and a bitter taste, which contributes to its safe use in controlling Norway rats.

After the red squill has been used, anticoagulants are employed in attempting to kill off the remaining rats. The anticoagulants are available as ready-mixed baits, or they can be mixed from the commercial concentrates according to directions on the label. With Warfarin, fumarin, and pival, the proper strength of the 0.025% bait is obtained by mixing one part of

0.5% concentrate with 19 parts of bait material such as coarse-ground yellow corn meal. Zinc phosphide and other more toxic rodenticides should be used only by experts, and then only in sewers and at other locations not accessible to humans and pets.

Mouse control. Eliminating sources of food as discussed under rat control is equally important for lasting control of house mice. In addition, snap traps baited with such foods as singed bacon, peanut butter, gumdrops, raisins, rolled oats or other cereals, bread crumbs, or nut meats are effective in controlling light infestations. Fasten baits, when feasible, or place some of loose bait under the trigger to catch mice skilled at robbing traps. Anticoagulants mixed at from 0.025 to .05% by weight with a readily accepted, economical bait of good keeping qualities, such as coarse-ground yellow cornmeal, oats, or mixtures of the two, are generally used to control heavy infestations. The higher concentrations are used for infestations that are difficult to control, and sometimes small amounts of powdered or granulated sugar and attractive oils are added to increase acceptability. Strychnine-impregnated grain bait and zinc phosphide baits should be used only by experts and only in locations inaccessible to humans and pets. DDT micronized powder (50%) is lethal to mice when applied to runways or harborage areas where there is no hazard of contaminating foods.

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A BACTERIUM WHICH WITHSTANDS POTASSIUM CYANIDE

A research microbiologist at Montana State University, Bozeman, is uncovering some important information on how an uncommon strain of a common soil bacterium, *Bacillus pumilus,* can withstand the effects of and actually degrade postassium cyanide, (KCN) an extremely poisonous compound which may enter the environment as an industrial waste.

Dr. G. A. McFeters, MSU associate professor of Botany and Microbiology, has conducted experiments on how this strain of *B. pumilus* adapts to high concentrations of KCN. The organism is the only bacterium ever found which can remain viable after exposure to extremely high cyanide concentrations.

Cyanide has long been known as a potent inhibitor of cellular respiration. However, *B. pumilus,* with its obvious adaptive powers, has actually multiplied in 0.1 M concentrations of KCN. It has withstood, but not multiplied, in 3.0 M cyanide concentrations.

McFeters began his work by adding 10^{-2} and 10^{-3} M cyanide to actively growing *B. pumilus.* The oxygen uptake of this culture was compared to an identical bacterial control culture which contained no cyanide.

In the culture loaded with cyanide, the bacteria's respiration rate decreased, but not for long. After approximately 3 hr respiration returned to near that of the control culture.

And, McFeters found, the cultures exposed to cyanide grew at a slower rate than control cultures. He concluded that the per cell respiration rate of the cyanide cultures was many times that of the control cultures because there were far fewer cells in the cyanide cultures.

The microbiologist went even further and ran experiments which revealed that cells that had adapted to KCN did not have to readapt when reinoculated into fresh sterile media containing the same KCN concentrations. He noted that all cells retained a high level of respiration.

On the basis of these experiments, McFeters expects the involvement of an enzymatic process as related to synthesis of new protein(s). He feels that the bacterium is capable of developing a new enzyme which is insensitive to the respiration-killing effects of KCN.

The scientist backstops this belief with yet another test. He added streptomycin, an inhibitor of protein synthesis, to a *B. pumilus* culture and found that the bacterium could not adapt to cyanide which indicated that protein synthesis is necessary for adaptation.

McFeters' work is a continuation of experimental probes initiated by Dr. Gary Strobel and Dr. Boleslaw Skowronski, MSU microbiological researchers. Their work, done through the Montana Agricultural Experiment Station, resulted in the isolation of *B. pumilus* and the discovery that this bacterium was resistant to KCN.

The efforts of McFeters and his colleagues could lead to some practical applications aside from the biologically interesting aspects.

For example, cyanide pollution resulting from various industrial endeavors might be controlled.

It is known that cyanide pollution can occur in some industries—paint, electroplating, mining and other metallurgically related production plants.

A Research Note

INFLUENCE OF NARROW AND WIDE BORE MILKING MACHINE INFLATIONS ON ABNORMAL MILK AND UDDER HEALTH[1]

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Abstract

Routine milking in a 50-cow herd was with machines assembled so that the left half of the udder was milked with wide bore inflations and the right half with narrow bore inflations. The effect on udder health was measured by monthly individual quarter California Mastitis Tests (CMT), quarter bacteria cultures, and individual mastitis treatment records for cows leaving the herd. Udder irritation as measured by CMT was significantly ($P < .01$) reduced with narrow bore inflations. The total number of quarter milk samples showing bacteria (pathogenic or non-pathogenic) was lower on the side milked with narrow bore inflations. Clinical mastitis was more frequent ($P < .05$) on the side milked with wide bore inflations.

Many types of inflations continue to be used by dairymen *(3)* even though narrow bore inflations are widely recommended *(1, 2)*. This study was designed to compare the long-term influence of wide bore and narrow bore inflations on udder health. For 4 years, the Southern Indiana Forage Farm herd of 50 Holstein cows has been milked with a milking machine[2] assembled so that the left half of the udder was milked wide bore inflations and the right half with narrow bore inflations.

The narrow bore inflations were 1.905 cm inside diameter and the wide bore inflations were 3.175 cm inside diameter. They were used in a milking parlor that had four side-opening stalls. Two stalls were on each side of the pit with the left side of the udder near the operator on one side and the right side near the operator on the other side. One man normally used four milker units with reasonable care being taken to prevent overmilking.

Table 1 reports the reduced amount of abnormal milk associated with narrow bore inflations as measured by positive reaction to the California Mastitis Test (CMT). When only CMT 2 and 3 reactions were compared, the narrow bore inflations appear even more satisfactory. The left front quarters are consistently high and appear to cause the significant ($P < .01$) difference between inflations. This may result from the more pronounced effect of the wide bore on front quarters that tend to milk out faster. During the first year of this study, the narrow bore inflations were associated with 41 CMT 2 and 3 reactions, whereas the wide bore inflations were associated with only 32. This may result from the previous history of some of these right rear quarters causing more CMT 2 and 3 reactions on the right side. The negligible difference between the rear quarters during the last 3 years indicates the differences under study are small and may require other stress factors such as over-milking to become evident.

Table 1. Number of CMT positive scores (T, 1, 2, 3) and number of CMT 2 and 3 scores by year, quarter, and type of inflation

	All CMT reactions				2 and 3 reactions			
	Narrow		Wide		Narrow		Wide	
	R.F.[1]	R.R.[2]	L.F.[3]	L.R.[4]	R.F.	R.R.	L.F.	L.R.
1964	95	88	105	85	31	41	44	32
1965	75	69	97	76	22	24	49	26
1966	103	91	122	88	33	32	41	29
1967	135	151	200	142	46	55	108	53
Total	408	399	524	391	132	152	242	140
Total reaction	1722				666			
Total/side[5]	807		915		284		382	
Per cent/side	47%		53%		43%		57%	

[1]Right front.
[2]Right rear.
[3]Left front.
[4]Left rear.
[5]Probability of a greater Chi-square <1%.

Individual quarter milk samples were collected four times during 1966 and 1967. These were taken aseptically by following the procedure recommended on page 17 in *(2)*. These milk samples were streaked

[1]Contribution from the Purdue University Agricultural Experiment Station. Journal Paper No. 3555.

Table 2. Positive and pathogenic culture samples by quarter and type of inflation

	Positive culture samples				Pathogenic culture samples			
	Narrow		Wide		Narrow		Wide	
	R.F.	R.R.	L.F.	L.R.	R.F.	R.R.	L.F.	L.R.
June 1966	6	9	15	13	1	1	1	1
Dec. 1966	22	24	25	29	11	10	6	12
April 1967	17	17	26	22	6	8	9	11
Aug. 1967	28	28	28	27	9	14	16	14
Total	73	78	94	91	27	33	32	38
Total positive		336						
Total/side		151		185		60		70
Per cent/side		45%		55%		18%		21%

Table 3. Bacteria culture results by level of CMT reaction in 699 quarters

CMT score	Number of quarters	Culture results		
		No growth	Non-pathogenic	Pathogenic
2 + 3	100	45%	26%	29%
1	94	45%	36%	19%
– and T	505	59%	26%	15%

Table 4. Number of CMT 2 and 3 reactions and number of treatments for clinical mastitis for all cows leaving the herd for any reason

		CMT 2 + 3				Clinical treatment			
		Narrow		Wide		Narrow		Wide	
	Number culled	R.F.	R.R.	L.F.	L.R.	R.F.	R.R.	L.F.	L.R.
1964	8	9	11	10	3	2	7	3	9
1965	19	16	22	30	19	1	7	7	5
1966	13	27	17	31	21	1	1	8	5
1967	14	13	21	39	23	4	7	8	7
Total	54	65	71	110	66	8	22	26	26
Total/side[1]		136		176		30		52	
Per cent/side		44%		56%		37%		63%	

[1]Probability of a greater Chi-square <5%

on blood agar plates, incubated aerobically at 37 C for 24 and 48 hr and checked for bacteria that were considered pathogenic for the bovine udder.

Table 2 reports the tendency (Chi-square test was non-significant) for pathogenic and total bacterial cultures to be fewer with narrow bore inflations (R.F. and R.R.). These culture samples were not available during the first 2 years of this study. Complex balances between CMT reactions that estimate leucocytes and bacteria cultures that identify pathogenic micro-organisms are illustrated in Table 3. The high levels of leucocytes (CMT 2 and 3) are associated with about twice as great a chance to recover pathogenic bacteria (29% vs. 15%) as compared to a low level of leucocytes (CMT – and T).

Data on cows leaving the herd during the 4 years of this study are summarized in Table 4. The CMT reactions and clinical mastitis treatment by quarters and type of inflation are shown. CMT 2 and 3 reactions were more frequent on the left (wide bore) side of the udder. During 1964, the high number of CMT 2 and 3 reactions in the right rear as compared to the left rear may reflect damage to these quarters before the start of this experiment. Mastitis treatments for cows leaving the herd were also more frequent ($P < .05$) on the left (wide bore) side of the udder. The year to year variations shown in the tables, in part, result from cows leaving the herd because of mastitis. The summary of clinical treatments should be considered to reflect the total mastitis picture in this herd. The increased number of treatments to the left front as compared to the right front during the last 2 years of this study may indicate the long time necessary for the small difference in inflations to become important.

Mastitis has many causes and continues to be a problem in well-managed dairy herds. These data indicate that narrow bore inflations cause less udder irritation and under conditions of good milking management should contribute to improved udder health.

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THE SANITARIAN AND COMMUNITY DEVELOPMENT[1, 2]

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ABSTRACT

The thrust of this paper is the contention that the sanitarian because of the ecological systems framework within which he works has the opportunity to extend this framework to the citizen and thus help him better understand the challenges and opportunities of community development.

The sanitarian is concerned with the development and/or preservation of an ecological system having as one of its characteristics the absence of certain organisms. He may not say it this way. He may talk of preventing contamination, destroying harmful organisms, or encouraging the growth of beneficial organisms. Yet, however he refers to his work, the sanitarian is at base an ecologist who is concerned with environmental systems and how to control them. Thus the concerns and the approach of the sanitarian make him a militant ecologist. He seeks to understand environmental systems, but he also actively tries to modify (and hopefully improve) the environment. No predestinarian he, instead he takes that to which today man must adjust and tries to develop ways in which adjustment can be changed to control. In this way the ecologist is constantly extending the area in which man has choice. This is what Louis Pasteur, in essence, did, is it not? Man no longer must adjust to undulant fever. He has the power to not get it (at least from milk) and this is an extension of freedom through control over environment. In the language of the production economist, the ecologist tries to transform fixed factors into variable factors. What is more, the sanitarian has had rather considerable success in getting the job done.

It would seem probable that the ecologist because of the framework within which he works would be sympathetic to efforts "to develop the community" so that it will place fewer restrictions on man. Community Development, in its essence, is an attempt to improve the environment. The sanitarian-ecologist attacks *Brucella abortus* so why not also other things which mitigate against mans' becoming what he has the potential to become?

[1]Contribution from the Missouri Agricultural Experiment Station. Journal Series Number 5480.

[2]Presented at the 55th Annual Meeting of the International Association of Milk, Food, and Environmental Sanitarians, St. Louis, Missouri, August 18-22, 1968.

INSTITUTIONAL EVALUATION—THE NEED

To begin a treatise on resource use in the manner of the creation story of Genesis may seem strange, but it is useful. At some point, imagine surprised man finding himself alive in the universe. At this point there are two things—man and natural resources. First, man directly utilizes these resources to meet his needs. Then he becomes a thinker and a tool builder. Now he has natural resources, the man-changed and combined resources, and institutions. Change any of the three inputs and a changed pattern of output will result.

This implies a simple but useful model of both the social and economic systems today. Man has natural resources, man-made physical resources, and ways of doing things. He also has himself. Each, in a sense, is a resource. To illustrate, imagine a production function of unspecified form:

(a) $Y = F(X_1, X_2, X_3, X_4)$

where Y = ouput potential
X_1 = natural resources
X_2 = man made resources
X_3 = mans' efforts (labor)
X_4 = institutions

In the short period the relevant function is of the form:

(b) $Y = F(X_1, X_2, X_3/X_4)$

where the slash (/) is the dividing line between the variable and fixed factors. By convention the factors to the right of the slash are the fixed factors.

Indeed, much analysis depends upon the implicit assumption of this kind of production function where institutions are assumed fixed. Traditional theory of the firm certainly does.[3]

Changes in institutional patterns do affect Y (output) and this has never been denied by any important theorist. For purposes of clarifying the impact of institutional forms and their changes, it would be useful to think of the production function as stated a little differently from the form of equation *(a)* or *(b)*:

[3]For those familiar with marginal analysis in economic theory, it should be said that the purpose here is not to vilify marginal analysis but to point out that it does abstract from problems which also deserve study.

(*c*) $Y = F'_1 (X_1, X_2, X_3)$

where F' represents a union of F from (*a*) and (*b*) and X_4. Now a change in X_4 will produce a change in F'_1 to F'_2 and so on. While this is so, even this formulation oversimplifies the dynamic reality. A change in X_4 has something to do with the nature and amount of X_2 available and this has impact upon the quantity of and what is considered to be X_1. Likewise, X_4 is likely to have impact on the supply function of X_3.

The reasons for introducing the production function idea are two. The first is to provide a framework for illustrating that institutional form is relevant for study and that institutional change cannot be fruifully ignored if the intent is to study paths to growth over time. The second is to introduce the production function model so that later its output may be contrasted with that of a systems analysis model.

The need for institutional study can be developed in quite a different fashion and perhaps ought to be.

Every economic system has to have some means of guiding production and some means of distributing income. Ours does, and we characterize it as a market system. Yet, we know that the market does not do all the allocating of production or the distributing of income. The market is allowed to operate, but only within bounds set by myriads of decisions and actions not made by the market itself. We also know that the nature of the bounds set has impact upon the production and distribution decisions calculated and executed by the market. Thus the design and change of institutional bounds has an important impact upon the performance of our economic system. As such it deserves study.

The design of the bounds within which the market is allowed to operate has been at the heart of much public policy in the United States.[4] That natural resource use in the United States has long been influenced by public policy is not in doubt *(1, 3)*. What form policy and policy instruments will take in the future is less certain. Professor Milliman has argued persuasively for greater reliance on the market, but the market he has in mind is one in which marginal social cost can be more easily equated with marginal social benefit *(9, 10)*. Castle has recognized that we often did not use the market for natural resource management and seems to feel that it is likely to continue so. Both Castle and Milliman agree on the need for institutional evaluation by economics (*3*, p. 545- 553) (*10*, pp. 88-89). James Hildreth has issued a similar call (*8*, p. 1503). There seems no reason to limit the call to the economist. The ecologist has something to offer and he should offer it.

The need for institutional evaluation seems increasing: higher density population has the effect of making us even more aware of the externalities in much human action. If the democratic philosophy that a man should have some voice in what has an impact upon him is followed, then we have increasing need for the study of the means by which reasonable coordination can take place—unless we are satisfied with the present outcome.[5]

THE SITUATION

The United States is rapidly urbanizing and much of what we see begins to make sense only in that context.[6] This urbanization will continue and intelligent planning for it is needed if legitimate concern is to be given to the quality of life possible.

Some assumptions

To set the record straight, the assumptions or assertions from which this discussion will precede should be made explicit, for they are used as data. These assumptions are: *(a)* the United States population will continue to grow relatively swiftly, *(b)* urbanization will continue, *(c)* out-migration from agriculture will continue, *(d)* general population mobility will remain high, *(e)* economic growth will remain at relatively high levels, *(f)* income distribution will continue to be such that there will be both disadvantaged groups and regions, *(g)* automation will continue, perhaps even at an accelerated rate, and *(h)* the struggle to become "color blind" will be neither short or easy.

Some implications

The problems and the challenges offered by change are massive. As John Fisher pointed out, we are seeing one of the great migrations of history *(6)*. Today nearly 70% of all Americans live on 1% of our land. Thus migration already experienced has been substantial—and the end is not in sight!

A population shift of this scale is bound to throw any society out of joint—and it has. Compound it with unemployment, poor housing, low educational and skill level for many, and then add the additional problem of race and the output is at a minimum potentially explosive. Compound things further by

[4] An alternative view is possible. Harl *(7)* sees the development of many institutions and the legal framework surrounding them as attempts to develop alternatives to the market. The difference in conceptioning is, however, more apparent than real.

[5] This is no intent to imply that $X_1 \ldots X_3$ should not also be given consideration. The point made here is that X_4 also deserves study.

[6] This is not to suggest that there are no regional differences and problems. See (*5*, p. 71) and (*2*).

having a populous not yet having visceral awareness of the problems and/or their magnitude. The mixture is more than explosive. It's almost fissionable: it may be even fusionable.

In this situation there is talk of the need for community development. The model in mind is usually one in which those in the community arrive at group decisions and take actions to enhance the social and economic well-being of the community *(4)*. While community is formally defined as one or more groups of people inter-acting toward the attainment of goals in which they share a common interest, the fact is community development to most means *our* town or county. As such, it tends to be focused on the short run variables over which people locally have control. And here lies the rub. There is the tendency to underestimate the "spill over" impact of all sorts of things and thus a tendency to overestimate the degree to which destiny is in local hands.

There is, of course, the antithesis. There are those so impressed by "spill overs" that they feel the potential is more limited than in fact it is. These people either become defeatist or see all changes coming from outside. In either event, they do not do what could be done.

The conceptual model under which community development is most likely to get done is neither of these extremes. It is a synthesis of the two. Only under a synthesis is it conceptually possible to deal with the full range of environmental control.

Narrowly conceived community development takes place under a production function envisioned as having a large number of factors fixed. The kind that would get the job done has far fewer fixed factors. In other words, the sky is the limit and there are no sacred cows! It is fortunate, indeed, that development activities, once started, tend not to stay within the bounds originally envisioned. Thus there is a natural tendency for the concern horizon to move further and further into the distance, thereby opening up new possibilities for action.

Today's problems are frequently discussed in the context of:[7] *(a)* concentration of population packed into decaying central cities; *(b)* physical congestion, traffic snarls; *(c)* air, water, and noise pollution; *(d)* urban squalor and urban blight; *(e)* spiraling costs for city services and not enough money to go around as the affluent flee the central city; *(f)* poverty in the ghettos; *(g)* crime and long hot summers; and *(h)* insufficient employment.

If these problems are to be dealt with, they require broadly conceived community development. Such effort will bring a meshing of public activity and private response. And here lies a problem.

Over the years we have grown used to categorizing things into one or several dichotomies. It is either *public* or *private*. It is a *local* or *nonlocal* matter. It is the *concern of government* or it is *not the concern of government*.

These categories of thought, developed for a very different world from that in which we live today, are no longer appropriate. Using them despite their inappropriateness tends to make us ask the wrong questions and get the wrong answers.

In a society which has changed as rapidly as ours, it should not be surprising that the whole fabric of institutions has come under severe pressure. What served an agrarian society very well simply is no longer adequate. Yet, we still have many of the structures left from an agrarian society. It is a little bit like trying to weave a new cloth pattern on an old loom when the loom will not allow that particular cloth pattern. Were this true, the job we would have before us would be to design both a new loom and the new cloth pattern subject to the restriction that the pattern and the loom would be compatible.

Compatible is a good ecological word. Better than many groups, ecologists should understand that incompatibility sometimes means that "you can't get there from here—unless you build a new road network." Community development is getting from *here* to *there* and building whatever roads may be necessary to get *there*.

Look back at the partial list of problems above. Do the approachs to these fit the nice neat categorization of the old dichotomies? The answer must be negative.

Anyone who attempts to seriously deal with the problems of our society very quickly finds such road blocks as inadequate tax bases, overlapping governmental layers, archaic state constitutions, too little opportunity for home rule, and problems which fall between the slats because they seem to be in nobody's jurisdiction or in everybody's

Industrial development is a favorite playground of community development and—a worthy one. Those who work with industrial development groups know that getting new industrial capacity in a community solves some problems, but it can frequently raise others. The new employment may make for more houses and more houses may require more water. More water may mean the old water system is inadequate and there is a new system to build. More people may mean the schools are too small. More products to transport may overtax the transportation system. It is soon apparent that community development drives one to some sort of a systems conception of what is going on.

More and more community development and planning activity is arising because of the feeling of

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[7]This is a slight adaptation of a Schnittker listing *(11)*.

many that this nation—which has developed the technology to produce more than it can consume and can feed a large part of the rest of the world while sending a man to the moon with its left over productive capacity—ought to be able to manage its domestic affairs with more foresight and common sense than it has. As a result we are seeing better planning, more effective analysis of economic and social costs of various types of activity, and some concerted efforts to influence rate and direction of change—all this with the thought that we can create alternative living conditions which will be an improvement over those which now exist or will come to exist if we do nothing. There has been much evidence of this new thrust. Many new federal and state programs have had this as their objective.

Thwarting some of the best efforts to do something about the probelms of our society are conditions of state and local government that tie the hands of local officials and citizens groups. These things constitute road blocks to effective reform and efficient governmental machinery which is responsive to local will. The list of problems include such things as: *(a)* archaic state constitutions, *(b)* obsolete forms of government organization and procedure, *(c)* proliferation of local governments and authorities with insufficient powers and conflicting jurisdictions, *(d)* inadequate tax base and too little money, and *(e)* too few trained personnel to provide the quality of services needed and demanded by the community.

These are the kinds of problems with which local people frequently must grapple if they are to attack their main difficulties.

In many instances, if solutions to problems are to come, the framework within which these problems are viewed will have to change. The crisis of constitutional revision and political renewal in many states must be met and resolved, but it will not be unless people are able to relate a changed organizational structure to being able to accomplish things they want accomplished.

Towns, counties and even groups of counties may need to get together and organize for joint action to solve common problems that transcend any governmental boundary lines.

Local government must be staffed with well paid competent people who are trained in modern business techniques and who can utilize the latest developments, methods, and machines to provide low cost speed service to the public.

The advanced research and development capability in this country has much to offer to solve present day problems. Its potential has not yet been brought fully to bear.

The ecologist observes everything but considers nothing "sacred." He uses a system approach. So it must be for community development—if it is to succeed. We will deal with the problems of this nation when and if we adopt the systems approach which allows us to view essentially everything as a variable factor open to purposeful manipulation in the interest of creating a better environment. County lines, state lines, state constitutions, propery rights—all these and more must be open to question if we are to design a system which will allow us to get at the kinds of problems that are bothering us as a society.

The framework of the ecologist, although he has used it chiefly for observing biological activity seems particularly well adapted for conversion to the observation of social and economic systems. Then it allows asking these kinds of questions: *(a)* What are our problems? *(b)* What do we want to do about it? *(c)* How can we organize to do something about it? *(d)* What are the absolute and relative costs of each approach? If we ask these questions from the perspective of other than a systems framework we run the danger of the frustrating results. We run the danger of limiting our manipulation to some less important variables and finding that the really important elements of the equation are perceived to be fixed factors.

Thus it would seem that the sanitarian as an ecologist has a particular opportunity to help the society understand the kind of analysis it must perform if it is to deal creatively with the questions facing it. It will not do this with traditional modes of thought. The systems framework which ecologists and their disciplines can offer to social critique gives to the society a chance for it to become in fact what it is capable of becoming.

The ecologist cannot specify optimum environment. Neither can the economist or any other social scientist. The political process, religion, and philosophy must combine to specify what should be. The scientist can only provide data about the impact of important variables, institutions among them, which can help society approach its goals.

The sanitarian, because of his training as an ecologist and his predisposition to deal in systems analysis, has a special opportunity to contribute to a better understanding of man and his environment. This the ecologist can do by helping man see himself as a part of a system—a system over which man can have some control if he understands the system.

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9. Milliman, J. W. 1962. Can people be trusted with natural resources? Land Econ. 38:199-218.

10. Milliman, J. W. 1966. Economic considerations in allocating water resources. Public Policies Relating to Water. Univ. of Missouri Extension Division.

11. Schnittker, J. A. 1968. Rural development: A solution to urban problems? given to 21st Annual City Managers School, University of Kansas, April 26, 1968.

SCIENCE WORKING TOWARD ALLEVIATION OF WORLD FOOD PROBLEMS

Science is doing much to develop nutritious new foods and to fortify already existing foods toward alleviation of the world food problems of undernourishment and malnutrition.

In order to combat the world protein problem, it is necessary not only to increase the availability of edible protein, but to increase the consumption of edible protein of proper quality as well, according to M. J. Forman of the Nutritional and Child Feeding Service, Office of the War on Hunger, U. S. Agency for International Development. One approach is development of new nutritious, but low-cost, blended food products for commercial distribution in developing nations.

Among some of the new food products for such purposes are Tamunuts, a high-protein low-cost nut-like product developed from glandless cottonseed kernels by the Cottonseed Products Research Laboratory at Texas A & M University. Cottonseed, available in great quantities both in the U. S. and in many developing countries, now can be seriously considered for the first time as a major food component.

Pan breads have been developed with flour made from sorghum. And, just as important, plans for village production as well as industrial manufacture are ready.

Corn-soy-milk (CSM), a high-protein food supplement for children, has had wide acceptance in many developing nations. Now computers are at work to provide other nutritious formulations using locally available commodities such as soy flour, cottonseed meal, peanut meal, nonfat dry milk, corn grits, oats, wheat millet and sorghum. Assurance of adequate supplies of raw materials, decreasing production cost and increasing the storage stability of CSM could come from these efforts of food scientists.

PROGRAM

FIFTY-SIXTH ANNUAL MEETING

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

In cooperation with

THE KENTUCKY ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL SANITARIAN

AUGUST 17-21, 1969

Brown Hotel **Louisville, Kentucky**

REGISTRATION

Monday, August 18—1:00 P.M.—5:00 P.M.
Tuesday, August 19—8:00 A.M.—6:00 P.M.
Registration Fee $10.00

IAMFES OFFICERS

President: S. O. Noles, Jacksonville, Florida
President-Elect: M. E. Held, San Francisco, California
First Vice-President: D. B. Whitehead, Chicago, Illinois
Second Vice-President: O. M. Osten, St. Paul, Minnesota
Secretary-Treasurer: R. B. Fairbanks, Springfield, Illinois

EXECUTIVE BOARD

R. B. Fairbanks
P. R. Elliker
A. N. Myer
S. O. Noles
M. E. Held
D. B. Whitehead
O. M. Osten
H. L. Thomasson, *Ex-Officio*

JOURNAL OF MILK AND FOOD TECHNOLOGY

Editor: E. H. Marth, Madison, Wisconsin
Managing Editor: H. L. Thomasson, Shelbyville, Indiana

KENTUCKY ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL SANITARIANS

President: Dr. C. Bronson Lane
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Vice-President: Lyman Knierem, Jr.
Secretary-Treasurer: Leon Townsend

BOARD OF DIRECTORS

Charles Pirozzoli, Hubert Edds, Melvin Cloyd, Charles Belcher, Tony Foellger, Arnold Corey

PROGRAM COMMITTEE IAMFES

M. E. Held, *Chairman*
D. B. Whitehead
R. B. Fairbanks
O. M. Osten

CHAIRMEN OF LOCAL ARRANGEMENTS COMMITTEE

General: Bruce K. Lane
Assistant General: Gayle Shrader
Registration: Eugene Catron
Finance: Leon Townsend
Arrangements and Visual Aids: Dr. C. B. Lane
Publicity: A. P. Bell
Milk Break: Ed Napier
Door Prizes: Lyman Knierem, Jr.
Entertainment: Frank Osborn
Ladies' Activities: Mrs. Lyman Knierem, Jr.
Speakers Hospitality: Jim McDowell
Banquet: Dan F. Conley

AFFILIATE COUNCIL OFFICERS

Chairman: Ben Luce, Washington
Secretary: L. Wayne Brown, Wisconsin

AFFILIATE REPRESENTATIVES

Perry J. Klumph, Arizona
Wendell C. Weaver, California
Tom Dickison, Canada
R. M. Parry, Connecticut
Frank Yatckoske, Colorado
William Hastings, Del-Mar, Virginia
J. B. Boosinger, Florida
Keith Harvey, Idaho
James A. Meany, Illinois
Rick Lopez, Indiana
H. E. Hansen, Iowa
Keith Nash, Kansas
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John J. Curtin, Massachusetts
Theodore J. Kilmer, Michigan
Roy Ginn, Minnesota
Alton Miller, Mississippi
Erwin P. Gadd, Missouri
R. P. March, New York

VERGIL SIMMONS, Oregon
BERNARD E. HINISH, Pennsylvania
CLIFFORD COSGROVE, Rhode Island
HOWARD HUTCHINGS, South Dakota
RAY M. CARSON, Washington
L. WAYNE BROWN, Wisconsin
JOHN R. PATTILLO, Virginia

TOPICS FOR AFFILIATE AGENDA AT ANNUAL MEETING

1. How can International better assist the affiliates in securing new membership to International?
2. Review purposes and activities of the Council.
3. Organization of a news gathering media within each affiliate.
4. Status of consolidation, mergers, and joint meetings on state and national levels.

SUNDAY, AUGUST 17

1:30-5:30—Executive Board—Parlor A-B-C

8:00-11:00—Executive Board—Parlor A-B-C

COMMITTEE MEETINGS

Check Bulletin Board

MONDAY, AUGUST 18

1:00-5:00—Registration—Mezzanine Lobby

SPECIAL MEETINGS:

8:00-12:00 Noon—Executive Board—Parlor A-B-C

1. Report on Local Arrangements
2. Report of Executive Secretary
3. Report of Sanitarians Joint Council

1:30-5:00—Executive Board—Parlor A-B-C

1. Report of Journal Management Committee
2. Regular Agenda

1:30-5:00—Individual Committee Meetings (See Bulletin Board)

7:00-8:30—Affiliate Council—Louis XVI Room

7:00-10:00—Executive Board—Parlor A-B-C

1. Committee Chairman and Committee Members
2. Meet with Past Presidents
3. Report of Affiliate Council Chairman

TUESDAY, AUGUST 19

8:00—REGISTRATION—Mezzaine Lobby

MORNING—GENERAL SESSION CRYSTAL BALLROOM

MILTON E. HELD, *President-Elect*, Presiding

9:30—INVOCATION
REV. R. BROOKE GIBSON

9:35—ADDRESS OF WELCOME
THE HONORABLE WENDELL P. FORD

9:50—PRESIDENTIAL ADDRESS
S. O. NOLES, *President*

10:15—WORKING WITH PEOPLE TO ACHIEVE OBJECTIVES
ROBERT A. SHAW

11:00—CONSUMER AND ENVIRONMENTAL PROTECTION IN THE PHS
CHARLES C. JOHNSON

11:45—NOMINATIONS, 1970

TUESDAY, AUGUST 19

AFTERNOON—MILK SANITATION SECTION CRYSTAL BALLROOM

A. N. MYHR, *Presiding*

1:30—DOOR PRIZE DRAWING

1:45—CONSOLIDATED COOPERATIVE'S ROLE IN QUALITY ASSURANCE
BURDETTE L. FISHER

2:30—FEDERAL-STATE QUALITY PROGRAM FOR MANUFACTURING MILK
HAROLD E. MEISTER

3:15—BREAK

3:30—HEALTH-INDUSTRY APPROACH TO A SUCCESSFUL MASTITIS CONTROL PROGRAM
WALTER WILSON

4:15—SANITATION ASPECTS OF MILKING SYSTEMS AND BULK FARM TANKS
C. BRONSON LANE

TUESDAY, AUGUST 19

AFTERNOON—FOOD & ENVIRONMENTAL SANITATION SECTION SOUTH ROOM

DUDLEY J. CONNER, *Presiding*

1:30—DOOR PRIZE DRAWING

1:45–DESIGN AND LAYOUT FOR EFFICIENT, SAFE FOOD SERVICE
WILLIAM THOMPSON, DAVID POTTER, RONALD MARTIN, WILLIAM WISSING

3:15–BREAK

3:30–SANITATION ASPECTS OF AUTOMATED FOOD VENDING
DAVID E. HARTLEY

4:15–IN-FLIGHT FOOD SERVICE
HARRY HAVERLAND

TUESDAY EVENING, AUGUST 19

7:30-9:30–EVENING DISCUSSION GROUPS
These discussion groups are for the benefit of our members who have special questions for problems which they wish to discuss informally with others. Selected individuals have agreed to answer questions and otherwise assist in discussions.

7:30–FOOD AND ENVIRONMENTAL SANITATION
South Room
SHELBY JOHNSON, *Moderator*
LOUIS A. KING, JR.
DAVID E. HARTLEY

7:30–MILK LABORATORY
Bluegrass Room
ELMER MARTH, *Moderator*
JOSEPH N. MURPHY, JR.

7:30–DAIRY FARM QUALITY CONTROL
Roof Garden
R. P. MARCH, *Moderator*
A. K. SAUNDERS
WALTER WILSON

WEDNESDAY, AUGUST 20

MORNING—GENERAL SESSION
CRYSTAL BALLROOM

PAUL R. ELLIKER, *Presiding*

8:30–DOOR PRIZE DRAWING

8:45–CONTAMINATION ROUTES TO FOOD
KENNETH V. NYBERG

9:30–BREAK

9:45–DOOR PRIZE DRAWING

10:00–ANNUAL BUSINESS MEETING

1. Report of Executive Secretary
2. Report of Secretary-Treasurer
3. Committee Reports
4. 3A Symbol Council Report
5. Report of Resolutions Committee
6. Report of the Committee on Inter-Association Cooperation
7. Report of Affiliate Council
8. Old Business
9. New Business
10. Election of Officers
Announcements

WEDNESDAY, AUGUST 20

AFTERNOON—MILK SANITATION SECTION
CRYSTAL BALLROOM

ORLOWE M. OSTEN, *Presiding*

1:30–DOOR PRIZE DRAWING

1:45–INTERSTATE MILK SHIPMENT
SHELBY JOHNSON

2:15–CONTROL OF SALMONELLA IN DRY MILK PRODUCTION

3:00–BREAK

3:15–SANITARIANS RESPONSIBILITY RELATING TO CLEANING OF AUTOMATED PROCESSING SYSTEMS

4:00–COMBINING MILK AND FOOD PROCESSING OPERATION
W. J. CORBETT

WEDNESDAY, AUGUST 20

AFTERNOON—FOOD AND ENVIRONMENTAL SANITATION SECTION
SOUTH ROOM

DICK B. WHITEHEAD, *Presiding*

1:15–DOOR PRIZE DRAWING

1:30–TO BE ANNOUNCED

2:15–PERFRINGENS FOOD POISONING
CHARLES L. DUNCAN

3:00–BREAK

3:15–FOODBORNE VIRUS INFECTION
DEAN O. CLIVER

4:00–RECREATIONAL TRAVEL TRAILER SANITATION

4:45–KENTUCKY ASSOCIATION MEETING

WEDNESDAY, AUGUST 20

AFTERNOON—FOOD INDUSTRY SANITATION SECTION BLUEGRASS ROOM

LOUIS A. KING, JR., *Presiding*

1:30—DOOR PRIZE DRAWING

1:45—GOOD MANUFACTURING PRACTICES
THEODORE C. MARAVIGLIA

2:15—MANAGEMENT'S PARTICIPATION IN SANITATION
PAUL W. KAMMAN

3:00—BREAK

3:15—MICROBIOLOGY OF FROZEN FOODS
RICHARD J. MAKOWSKI

4:00—THE EGG PROCESSING INDUSTRY—PROGRESS AND SANITATION PROGRAMS
RICHARD H. FORSYTHE

WEDNESDAY, EVENING AUGUST 20

6:00—RECEPTION—South Room

7:00—ANNUAL AWARDS BANQUET
Crystal Ballroom

S. O. NOLES, *Presiding*

INVOCATION

MASTER OF CEREMONIES
BURDETTE L. FISHER

INTRODUCTIONS

PRESENTATION OF AWARDS

1. Past President's Award

2. Citation Award

3. Honorary Life Membership

4. Sanitarian's Award

The Sanitarian's Award is sponsored jointly by the Diversey Corporation, Klenzade Products, Inc., and Pennwalt Corp.; and is administered by the International Association of Milk, Food and Environmental Sanitarians.

INSTALLATION OF OFFICERS

9:00—ENTERTAINMENT
Blue River Singers, Shelbyville, U. S. A.
Winston Churchill, Director

THURSDAY, AUGUST 21

MORNING—GENERAL SESSION ROOF GARDEN

SAM O. NOLES, *Presiding*

8:30—DOOR PRIZE DRAWING

8:45—NEW PRODUCT DEVELOPMENT—INDUSTRY APPROACH

9:30—FDA ATTITUDES ON IMITATIONS
ROBERT W. WEIK

10:15—BREAK

10:30—NUTRITIONAL ASPECTS OF DAIRY PRODUCTS
LORRAINE W. HILL

11:15—NUTRITIONAL CONSIDERATIONS OF IMITATION FOODS
J. R. BREELING

ENTERTAINMENT MEN AND WOMEN

MONDAY, AUGUST 18

GET ACQUAINTED HOUR—South Room
6:70-7:30—Music by Woody Bates, Pianist

WEDNESDAY, AUGUST 20

6:00—COCKTAIL HOUR—South Room
7:00—BANQUET—Crystall Ballroom
9:00—ENTERTAINMENT—Blue River Singers

THURSDAY, AUGUST 21

1:30-4:30—Bus tour to points of interest in Louisville, "gateway to the South," with stopovers at one of our many famous whiskey distilleries and Churchill Downs, Home of the Kentucky Derby.

ENTERTAINMENT FOR THE LADIES

HOSPITALITY
Bluegrass Room—Tuesday, August 19
Parlor A-B-C—Wednesday, August 20

TUESDAY, AUGUST 19

9:00-4:00—Visit historic Fort Harrod, Shakertown and the State Capitol at Frankfort, Kentucky. (Please make reservations at your earliest convenience).

WEDNESDAY, AUGUST 20

9:30-3:30—Tour Farmington, Wakefield-Scearce Galleries, and Lincoln Income Life Building. (Please make reservations at your earliest convenience).

PROGRAM PARTICIPANTS

BREELING, DR. *J. R.*—Director, Section of Food Science, American Medical Association, Chicago, Illinois

CLIVER, DEAN *O.*, PH.D.—Food Research Institute, University of Wisconsin, Madison, Wisconsin

CONNER, DUDLEY J.—Supervisor, Milk Control, Kentucky State Department of Health, Frankfort, Kentucky

CORBETT, W. J., PH.D.—Vice President and Technical Director, Quality Control, Dean Foods Company, Rockford, Illinois

DUNCAN, CHARLES L., PH.D.—Food Research Institute, University of Wisconsin, Madison, Wisconsin

ELLIKER, PAUL E., PH.D.—Chairman, Department of Microbiology, Oregon State University, Corvallis, Oregon

FISHER, BURDETTE L.—General Manager, Dairymen Inc., Kyana Division, Louisville, Kentucky

FORD, WENDELL P.—Lieutenant Governor, Frankfort, Kentucky

FORSYTHE, RICHARD H.—Vice President, Food Research, Henningsen Research and Development Center, Springfield, Missouri

GIBSON, REV. R. BROOKE—Pastor, Central Presbyterian Church, Louisville, Kentucky

HARTLEY, DAVID E.—Public Health Counsel, National Automatic Merchandising Association, Chicago, Illinois

HAVERLAND, HARRY—Chief, Interstate Travel Branch, Public Health Service, U. S. Department of Health, Education, and Welfare, Cincinnati ,Ohio

HELD, MILTON E.—U. S. Public Health Service, San Francisco, California

HILL, MRS. LORRAINE W.—Executive Director, Dairy Council of Knoxville, Knoxville, Tennessee

JOHNSON, CHARLES C., JR.—Administrator, Consumer Protection and Environmental Health Service, Public Health Service, U. S. Department of Health, Education, and Welfare, Washington, D. C.

JOHNSON, SHELBY—Director, Environmental Services Program, Kentucky State Department of Health, Frankfort, Kentucky

KAMMAN, PAUL W.—General Bread Production Manager, American Bakeries Company, Chicago, Illinois

KING, LOUIS A., JR., PH.D.—Director of Sanitation Education, American Institute of Baking, Chicago, Illinois

LANE, C. BRONSON, PH.D.—Department of Animal Sciences, University of Kentucky, Lexington, Kentucky

MAKOWSKI, RICHARD J.—Field Sanitarian, American Institute of Baking, Chicago, Illinois

MARAVIGLIA, THEODORE C.—District Director, Food and Drug Administration, U. S. Department of Health, Education, and Welfare, Cincinnati, Ohio

MARCH, R. P., PH.*D.*—Professor, Dairy Science Extension, Cornell University, Ithaca, New York

MARTH, ELMER H., PH.D.—Department of Food Science and Industries, University of Wisconsin, Madison, Wisconsin

MARTIN, RONALD—Assistant to the Vice President, Blue Boar, Inc., Louisville, Kentucky

MEISTER, HAROLD *E.*—Deputy Director, Dairy Division, Consumer and Marketing Service, U. S. Department of Agriculture, Washington, D. C.

MURPHY, JOSEPH N., JR.—Assistant Director of Laboratories, Texas State Department of Health, Austin, Texas

MYER, A. N. PH.D.—Department of Dairy Science. University of Guelph, Ontario, Canada

NOLES, S. O.—State Milk Consultant, Florida Board of Health, Jacksonville, Florida

NYBERG, KENNETH V.—Field Sanitarian, American Institute of Baking, Chicago, Illinois

OSTEN, ORLOW M.—Minnesota Department of Agriculture, St. Paul, Minnesota

POTTER, DAVID—Architect, Jerrico Inc., Lexington, Kentucky

SAUNDERS, A. K.—DeLavel Separator Company, Chicago, Illinois

SHAW, ROBERT A.—Director of Agencies, Prudential Insurance Company of America, Jacksonville, Florida

THOMPSON, WILLIAM—Kentucky Restaurant Association, Louisville, Kentucky

WEIK, ROBERT W., PH.D.—Acting Deputy Chief, Contaminants Branch, Food and Drug Administration, U. S. Department of Health, Education, and Welfare, Washington, D. C.

WHITEHEAD, DICK B.—Consulting Sanitarian, Diversey Chemical Company, Chicago, Illinois

WILSON, WALTER—Chief, Dairy Inspection Section, Los Angeles County Health Department, Los Angeles, California

WISSING, WILLIAM—President, Contract Equipment Company, Louisville, Kentucky

PROGRAM

NATIONAL MASTITIS COUNCIL REGIONAL MEETING*

Brown Hotel—Louisville, Kentucky

AUGUST 18, 1969

in conjunction with

The Fifty-Sixth Annual Meeting of the

INTERNATIONAL ASSOCIATION OF MILK, FOOD AND ENVIROMENTAL SANITARIANS

Crystal Ballroom

CHAIRMAN
JAMES MCDOWELL, Field Supervisor, Kyana Division, Dairymen, Inc., Louisville, Kentucky

9:00—WELCOME
DR. C. E. BARNHART, Dean of the College of Agriculture, University of Kentucky

9:15—THE DAIRYMEN'S PLIGHT IN MODERN AGRICULTURE
DR. R. F. BEHLOW, N. C. State University

10:00—CHASING THE ELUSIVE LEUCOCYTE
DR. J. H. NICOLAI, University of Kentucky

11:00—THE ROLE OF THE MILKING MACHINE IN A MASTITIS CONTROL PROGRAM
DR. J. J. CROUCH, Glasgow, Kentucky

CHAIRMAN
E. P. CONYERS, D.V.M., Supervisor, Food Control, Environmental Services Program, Kentucky State Department of Health, Frankfort, Kentucky

1:30—THE UTILIZATION OF SCREENING TESTS AND CONFIRMATORY PROCEDURES TO ADMINISTER THE ABNORMAL MILK CONTROL PROGRAM
DR. JAMES W. SMITH, U. S. D. A., Beltsville, Maryland

2:30—THE MANUFACTURING MILK INDUSTRY: DYNAMIC OR DYING?
MR. TED WINBIGLER, Swift and Company, Glasgow, Kentucky

3:30—A CRITICAL LOOK AT OUR CONSERVATIVE DAIRY INDUSTRY
DR. C. BRONSON LANE, University of Kentucky

4:15—QUESTIONS AND ANSWERS

*No Registration Fee.

AUGUST 19, 1969

PARLOR A-B-C

9:00-11:00—N.M.C. EXECUTIVE BOARD MEETING

IAMFES—LIST OF COMMITTEES 1969-1970

Committee on Dairy Farm Methods
(appointments expire 1969)

A. K. Saunders, *Chairman,* De Laval Separator Company, 5724 N. Pulaski Road, Chicago, Illinois 60646.

A. E. Parker, *Western Asst. Chairman,* Chief Milk Section, City of Portland Health Dept., Portland, Oregon 97204.

J. B. Smathers, *Eastern Asst. Chairman,* Maryland and Virginia Milk Producers Association, Inc., 1530 Wilson Boulevard, Arlington, Virginia 22209.

William L. Arledge, Director Quality Control, Southeast Milk Sales Assn., Inc., 283 Bonham Road, Bristol, Virginia.

Dr. Henry Atherton, Dairy Science Department, University of Vermont, Burlington, Vermont.

Glen Cavin, Cedar Valley Coop. Milk Assn., 1936 Hawthorne, Waterloo, Iowa 50704.

Dr. Clifford J. Cosgrove, University of Rhode Island, Woodward Hall 212, Kingston, Rhode Island 02661.

Dr. J. C. Flake, Evaporated Milk Association, 910 17th Street, N.W., 11th Floor, Washington, D. C. 20006.

Clarence C. Gehrman, Field Supervisor, Dairy Inspection Section, Dairy and Food Division, Department of Agriculture, Olympia, Washington.

Dr. W. J. Harper, Department of Dairy Tech., Ohio State University, Columbus, Ohio 43200.

Kenneth Harrington, Babson Bros. Company, 2100 S. York Road, Oak Brook, Illinois.

M. W. Jefferson, Chief Dairy Products, Sanitation Section, 1308 Franklin Street, Richmond, Virginia 23219.

C. O. Johnson, 2831 Iron St., Bellingham, Washington 98225.

Elmer E. Kihlstrum, Johnson and Johnson, Dairy Division, 4949 West 65th Street, Chicago, Illinois 60638.

William McCorquodale, Ontario Milk Marketing Board, 31 Wellesley St. E. Toronto 5, Ontario, Canada.

Vernon Nickel, Milk Control Section, St. Louis Dept. of Public Health, 416 Tenth Street, Crystal City, Missouri.

William Pickavance, Universal Milk Machine Division, Albert Lea, Minnesota 56007.

D. G. Raffel, Wisconsin State Department of Agriculture, Dairy, Food and Trade Division, Hill Farms State Office Bldg., Madison, Wisconsin 53702.

Richard Rintelman, Manager Farm Department, Klenzade Products, Beloit, Wisconsin 53512.

Bernard Saffian, Chamberlain Laboratories, P. O. Box 624, Fishcreek Road, Stow, Ohio.

Stephen B. Spencer, Extension Dairyman, Pennsylvania State College, University Park, Pa. 16802.

Mr. D. K. Summers, Public Health Service, Regional VIII Office, Federal Office Building, 19th & Stout Streets, Denver, Colorado 80202.

Leon Townsend, 2205 Brent Drive, Madisonville, Kentucky.

Ben Luce, Director, Milk Sanitation Division, Washington State Health Department, P. O. Box 1122, Olympia, Washington 98501.

Farm Methods Committee Consultants

C. G. Ashe, 215 Mott Road, Kendal-Fiber Products Division, Fayetteville, New York 13066.

Sydney E. Barnard, Extension Dairy Specialist, 213 Borland Laboratory, The Pa. State University, University Park, Pa. 16802.

Sydney H. Beale, Michigan Milk Producers Assn., 24270 West Seven Mile, Detroit, Michigan 48219.

Albert R. Perncie, 355 Benton Street, Stratford, Connecticut 06497.

William Trobaugh, Denver Milk Producers, Inc., 945 11th Street, Denver, Colorado 80204. c/o Field Department.

State Affiliates with Farm Methods Committee

Ray Carson, Washington Milk Sanitarians Assn., State Department of Agriculture, 2505 S. McClellan Street, Seattle, Washington 98144.

Verne Cavanaugh, Indiana Milk Sanitarians Assn., Public Health Sanitarian, Indiana State Board of Health, 205 Harrison Street, La Porte, Indiana 46350.

Dean Potter, Oregon Farm Methods Committee, Carnation Milk Company, 3342 S.E. Morrison, Portland, Oregon 97214.

Dr. Charles W. Livak, Pennsylvania Assn. of Sanitarians. Penn. Dairies, Inc., 1801 Hempstead Road, Lancaster, Pa. 17601.

David Monk, Supr. Environmental Health Service, Kansas Association of Sanitarians, Wichita-Sedgwick County, Public Health Department, 1900 East Ninth Street, Wichita, Kansas 67214.

Albert R. Pernice, Connecticut Assn. of Sanitarians, 355 Benton Street, Stratford, Connecticut 06497.

Don Race, New York State Association of Milk Sanitarians, Dairymen's League, 402 Park Street, Syracuse, New York 13208.

Emmett Fincher, Wisconsin Association of Milk and Food Sanitarians, 2614 Waunona Way, Madison, Wisconsin 53713.

James F. Kennedy, Missouri Association of Milk and Food Sanitarians, Missouri Division of Health, Poplar Bluff, Missouri.

William D. McCorquodale, Ontario Milk Sanitarians Assn., 31 Wellesley Street, East, Toronto 5, Ontario, Canada.

H. E. Hansen, Iowa Milk Sanitarians Assn., Milk Sanitation Department, State Office Building, Des Moines, Iowa 50319.

Committee on Sanitary Procedure
(appointments expire 1970)

Dick B. Whithead, Chairman, Diversey Chemical Company, 212 West Monroe Street, Chicago, Illinois 60606.

Kenneth Carl, Chief, Dairy Consumer Service Division, Oregon Dept. of Agriculture, Salem, Oregon.

Dudley J. Conner, State Milk Inspector, Div. of Environmental Health, 275 East Main Street, Frankfort, Kentucky.

P. J. Dolan, Bureau of Dairy Service, State Building, Room 3051, 2550 Mariposa Street, Fresno, California 93712.

F. E. Fenton, Chief, Standardization Branch, Dairy Div., Agricultural Marketing Service, U. S. Dept. of Agriculture, Federal Center Bldg., Hyattsville, Maryland 20781.

Harold Irvin, Omaha-Douglas Health Dept., 1202 S. 42nd. Street, Omaha, Nebraska.

M. W. Jefferson, Chief, Dairy Inspection Service, Virginia Dept. of Agriculture and Commerce 1444 East Main Street, Richmond, Virginia 23219.

W. K. Jordan, Associate Professor, Dept. Dairy and Food Service, Stocking Hall, Cornell University, Ithaca, New York.

Joseph S. Karsh, Chief, Milk and Food Division, Allegheny County Health Department, 40th Street and Penn Avenue, Pittsburgh, Pennsylvania 15224.

Louis A. King, Jr., Director of Sanitation Education, American Institute of Baking, 400 East Ontario Street, Chicago, Illinois 60611.

C. K. Luchterhand, 240 City-County Building, Madison, Wisconsin 53701.

J. C. Olson, Jr. Director, Div. of Microbiology, Bureau of Science, Food and Drug Administration, Washington, D. C. 20204 (FDA observer on Committee).

O. M. Osten, Assistant Director, Food Inspection Division, Minnesota Dept. of Agriculture, State Office Building, St. Paul, Minn. 55101.

R. M. Parry, Chief, Dairy Division, State Dept. of Agriculture, State Office Building, Hartford, Conn. 06115.

John C. Schilling, Chief of Milk Control, City of St. Louis Division of Health, St. Louis, Missouri 63103.

H. L. Thomasson (ex-officio), P. O. Box 437, Shelbyville, Indiana 46176.

Committee on Food Protection

(appointments expire 1969)

Objectives:

To provide international leadership in the prevention and control of foodborne diseases through:

1. Identification and evaluation of microbial, chemical, radiological and physical hazards associated with the processing, transportation, storage, handling and service of foods and animal feeds;

2. Encourage the conduct of research to provide data needed to develop effective, practical control measures;

3. Promote improved reporting of foodborne disease outbreaks;

4. Encourage development of improved methodology for detection of foodborne pathogens and hazardous chemicals in market foods;

5. Encourage the development of model laws and regulations for the control of food hazards, and promote their uniform adoption and application by State and local regulatory agencies.

6. Promote the development of regional and/or national certification programs designed to assure the safety of foods moving in interjurisdictional shipments;

7. Study exisiting and new processing and serving practices and techniques to assure the incorporation of new and improved food protection measures;

8. Lend support to agencies and groups concerned with the training of industry and regulatory agency personnel;

9. Assist any agency or group engaged in the eradication of foodborne hazards from market foods; i.e. Salmonellae in eggs, dry milk, cake mixes, etc.;

10. Provide technical and consultative assistance to any segment of the food industry and to regulatory agencies in matters of food protection.

David Kronick, Chairman, Chief, Milk and Food Section, Division of Environmental Health, Philadelphia Department of Public Health, Philadelphia, Pennsylvania 19146.

William V. Hickey, Vice Chairman, Public Health Commitee, Paper Cup and Container Institute, New York, New York 10017.

W. A. Fountain, Chief Food Technologist, General Engineering-Sanitation Service, Georgia Department of Public Health, Atlanta, Georgia 30334.

A. E. Abrahamson, Acting Assistant Commissioner, Environmental Health Services, New York City Department of Health, New York, New York 10013.

Dr. James C. White, Department of Food Science, Cornell University, Ithaca, New York 14850.

Dr. K. G. Weckel, Department of Food Science and Industries, University of Wisconsin, Madison, Wisconsin 53706.

Elmer D. McGlasson, Milk and Food Branch EEEP, Public Health Service, Washington, D. C. 20202.

Robert Beck, Chief Food Technology Division, District of Columbia Department of Health, Washington, D. C.

Paul E. Poitras, Supervising Sanitarian, Div. of Environmental Health, Denver Dept. of Health and Hospitals, 659 Cherokee Street, Denver, Colo. 80204.

Dick Jolley, Chief, Milk and Milk Products Inspection, Div. of Dairy Industry, Florida Dept. of Agriculture, Mayo Building, Tallahassee, Florida 30304.

Baking Industry Committee

(appointments expire 1970)

Objectives:

The objectives of the Baking Industry Equipment Committee are to cooperate with an provide consultative assistance to the baking industry in the development of standards for bakery equipment.

Vincent T. Foley, Chairman, City Health Dept., 21st Floor, City Hall, Kansas City, Missouri 64106.

A. E. Abrahamson, City Health Dept., 125 Worth Street, New York 13, N. Y.

Louis A. King, Jr., Director of Sanitation Education, American Institute of Baking, 400 E. Ontario Street, Chicago, Ill. 60611.

Fred R. Vitale, Continental Baking Co., Inc., P. O. Box 731, Rye, New York 10580.

Harold Wainess, Wainess & Associates, 510 N. Dearborn Street, Chicago 10, Ill. 60610.

Committee on Environmental Health

(appointments expire 1969)

Paris, B. Boles, R. S., Co-Chairman, Wayne County Health Department, Monticello, Kentucky 42633.

R. L. Cooper, A. A., Co-Chairman, Calloway County Health Department, 701 Olive Street, Murray, Kentucky.

Richard Clapp, Community Services Training Section, Training Branch, Communicable Disease Center, Atlanta 22, Georgia 30333.

Cameron Adams, Department of Agriculture, Dairy and Food Division, P. O. Box 120, Olympia, Washington.

James Barringer, 1703 Oncida Street, Joliet, Illinois.

Maxwell Wilcomb, Professor of Sanitary Science, University of Oklahoma, Norman, Oklahoma.

David S. Reid, Department of Environmental Sanitation Control, The Clinical Center, Room 1S-230, National Institutes of Health, Rockville Pike, Bethesda, Maryland 20014.

R. A. Belknap, 118 Robinwood Drive, Terrace Park, Ohio 45174.

Committee on Frozen Food Sanitation

(appointments expire 1970)

Objectives:

1. Stimulate both industry and governmental agencies to establish bacteriological standards for frozen foods.

2. Stimulate and encourage additional study of the freeze dry processes.

3. Encourage the adoption of Equipment Standards for the frozen food industry.

4. Compile a list of reference materials and publications related to Frozen Food Sanitation.

5. Provide an exchange of information between state regu-

latory agencies concerned with frozen food legislation and strive for uniformity between all agencies.

Eugene C. Viets, Chairman, Chief, Food Sanitarian. Division of Health of Missouri, Bureau of Veterinary Public Health and Welfare, Jefferson City, Missouri 65101.

Stephen J. Palmer, National Association of Frozen Food Practices, 919 18th Street, Washington D. C. 20006.

Charles P. Orr, T 12-2, Associate Environmental Health Consultant, General Foods Corporation, White Plains, New York 10602.

Frank E. Fisher, Director, Division of Food and Drugs, Indiana State Board of Health, 1330 West Michigan Street, Indianapolis, Indiana 46207.

Eaton E. Smith, Food Division, Department of Consumer Protection, Hartford, Connecticut.

E. R. Wolford, Fruit and Vegetable Products Laboratory, WU Western Washington Research and Ext. Center, U. S. Dept. of Agriculture, Puyallup, Washington 98371.

Committee on Communicable Diseases Affecting Man

(appointments expire 1969)

E. R. Price, D. V. M., Chairman, Director, Bureau of Veterinary Public Health, Division of Public Health of Missouri, Dept. of Public Health and Welfare, Jefferson City, Missouri 65101.

Stanley L. Hendricks, D.V.M. State Department of Health, Des Moines, Iowa 50319.

John Andrews, State Board of Health, Raleigh, North Carolina 27602.

Robert K. Anderson, School of Veterinary Medicine, University of Minnesota, St. Paul, Minnesota 55101.

Frank L. Bryan, Chief, Food-Borne Disease Unit, Community Services Training Section, NCDC Atlanta, Georgia 30333.

P. N. Travis, Jefferson County Health Dept., Birmingham, Alabama 35302.

Charles A. Hunter, 121 Fairfield Oaks, 3820 Fairfield Avenue, Shreveport, Louisiana 71104.

John H. Fritz, 1612 Rockhurst Lane, Cinn., Ohio 45230.

Committee on Food Equipment Sanitary Standards

(appointments expire 1970)

Objectives:

The objectives of the IAMFES Committee on Food Equipment Sanitary Standards are to participate with other health organizations and industries in the formulation of sanitary standards for food equipment, including preparation of related educational material. Specifically, the functions of this Committee include:

1. Cooperation with other health agencies and industry, under the auspices of the National Sanitation Foundation, in the joint development of NSF Standards for Food Equipment.

2. Cooperation with other health agencies and industry, under the auspices of the Automatic Merchandising Health Industry Council, in the joint development of an Evaluation Manual for Food and Beverage Vending Machines.

3. When directed by the Executive Board to cooperate with other health groups and industry in the development of sanitary standards for food equipment.

4. To present to the membership at the annual meeting those equipment guidelines and educational materials which the Committee recommends be endorsed by the Association.

Karl K. Jones, Chairman, Environmental Health Officer, Student Health Center, Purdue University, Lafayette, Indiana 47907.

Irving L. Bell, Assistant Director, Environmental Services Program, Division of Environmental Health, State Department of Health, 275 East Main Street, Frankfort, Kentucky 40601.

Carl Henderson, Director, Milk and Food Sanitation Section, New Mexico Department of Public Health, 408 Galisteo Street, Santa Fe, New Mexico 87501.

Lloyd W. Regier, Associate Professor, Environmental Chemistry, School of Public Health, University of North Carolina, Chapel Hill, North Carolina 27515.

Jerome Schoenberger, Supervisor, Equipment Section, Wholesale Division, City Department of Health, 125 Worth Street, New York, New York 10013.

Harold Wainess, Harold Wainess and Associates, 510 North Dearborn Street, Chicago, Illinois 60610.

Committee on Applied Laboratory Methods

(appointments expire 1970)

A. Richard Brazis, Chairman, Senior Scientist, Milk Sanitation Research, Department of Health, Education and Welfare, USPHS, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati, Ohio 45226.

Donald I. Thompson, Wisconsin State Laboratory of Hygiene, Madison, Wisconsin.

J. C. McCaffrey, Chief, Bureau of Sanitary Bacteriology, Illinois Department of Public Health, 1800 West Fillmore Street, Chicago 12, Illinois.

F. E. Nelson, Department of Dairy Science, University of Arizona, Tucson, Arizona.

Laurence G. Harmon, Department of Food Science, Michigan State University, East Lansing Michigan.

J. J. Jezeski, Department of Food Science and Dairy Industries, University of Minnesota, St. Paul, Minnesota 55101.

Earl W. Cook, Quality Control Laboratory, Pine Road, Philadelphia, Pennsylvania.

Robert Angelotti, Deputy Chief, Milk and Food Research, Department of Health, Education and Welfare, USPHS, Robert A. Taft Sanitary Engineering Center, 4676, Columbia Parkway, Cincinnati, Ohio. 45226.

Herbert F. Hall, Chief, Food Microbiology, Department of Health, Education, and Welfare, USPHS, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati, Ohio 45226.

William L. Arledge, Southeast Milk Sales Association, P. O. Box 1099, 283 Bonham Road, Bristol, Virginia.

E. H. Marth, Department of Food Science and Industries, University of Wisconsin, Madison, Wisconsin 53706.

E. A. Zottola, Department of Food Science and Industries, University of Minnesota, St. Paul, Minnesota 55101.

Charles Huhtanen, Eastern Regional Laboratories, U. S. Department of Agriculture, Philadelphia, Penns. 19118.

Roy E. Ginn, Director, Quality Control Laboratory, Quality Control Committee, 2274 Como Ave. W., St. Paul, Minnesota 55108.

D. Q. Anderson, Utah State Department of Health, 44 Medical Drive, Salt Lake City, Utah 84113.

H. E. Randolph, Dept. of Animal Science, Texas A & M University, College Station, Texas 77843.

Professional and Educational Development Committee

(appointments expire 1970)

John R. Patillo, Chairman, Division of Housing and En-

vironmental Sanitation, Department of Public Health, Richmond, Virginia 23219.

Harold S. Adams, Professor, Department of Public Health, Indiana University Medical Center, Indianapolis 7, Indiana.

E. M. Causey, Jr., South Carolina State Department of Health, Columbia, South Carolina.

Francis M. Crowder, Sanitation Consultant, South Carolina State Board of Health, J. Marian Sims Bldg., Columbia, South Carolina 29201.

Carrol E. Despain, State Sanitarian Supervisor, Engineering and Sanitation Division, Idaho Department of Health, Boise, Idaho.

Ernest S. Kopecki, American Iron & Steel Institute, 633-3rd Ave., New York, N. Y. 10017.

Roger L. Stephens, 176 West 6th St., North, Logan, Utah 84321.

Mrs. Helene Uhlman, R.P.S., Milk Coordinator, Calumet Region Milk Sanitation Dept., 1429 Virginia Avenue, Gary, Indiana 46407.

I.A.M.F.S. Representatives to Sanitarians Joint Council

John H. Fritz, 1612 Rockhurst Lane, Cinn., Ohio 45230 (app't. expires 12-31-72).

Ray A. Belknap, 118 Robinwood Drive, Terrace Park, Ohio 45174 (app't. expires 12-31-70).

Representative to National Mastitis Council

A. E. Parker, City Health Department, Portland, Oregon.

Advisory Committee to Representative

Leon Townsend, 2205 Brent Drive, Madisonville, Kentucky.

Ben Luce, State Dept. of Agriculture, Dairy Division, P. O. Box 128, Olympia, Wash. 98501.

David Monk, Public Health Department, 1900 East 9th Street, Wichita, Kansas.

Glenn Cavin, Cedar Valley Cooperative Milk Association, 1936 Hawthorne Street, Waterloo, Iowa 50704.

M. W. Jefferson, Virginia Dept. of Agriculture, Div. of Animal Health and Dairies, 1444 East Main Street, Richmond, Virginia 23219.

Journal Management Committee

F. W. Barber, Chairman, Director of Regulatory Compliance, Research and Development Division, National Dairy Products Corporation, Glenview, Illinois.

J. C. Olson Jr., Director, Division of Microbiology, Bureau of Science, Food and Drug Administration (HEW), Washington, D. C. 20204.

E. H. Marth, Department of Food Science and Industries, University of Wisconsin, Madison, Wisconsin 53706.

K. G. Weckel, Department of Food Science and Industries, Babcock Hall, University of Wisconsin, Madison, Wisconsin 53706.

C. K. Johns, 2284 Braeside Ave., Ottawa 8, Ontario, Canada.

H. L. Thomasson, P. O. Box 437, Shelbyville, Ind. 46176.

The Nominating Committee for The Year 1968-69

Richard P. March, Chairman, Cornell University, Ithaca, New York 14850.

William L. Arledge, Dairymen, Inc., Southeast Division, P. O. Box 1099, Bristol, Virginia 24201.

Richard F. (Dick) Jolley, Chief, Dairy Products Inspection, Florida Dept. of Agriculture, Mayo Building, Tallahassee, Florida 32304.

James C. White, Food Science Department, Cornell University, Ithaca, New York 14850.

Earl O. Wright, Iowa State University, 116 Dairy Industry Bldg., Ames, Iowa 50010.

Ambrose P. Bell, 240 East Madison, Louisville, Kentucky 40202.

M. F. Reece, Jr., 4616 East 15th, Tulsa, Oklahoma 74112.

ASSOCIATION AFFAIRS

REGIONAL NATIONAL MASTITIS COUNCIL MEETING IN CONJUCTION WITH IAMFES ANNUAL MEETING

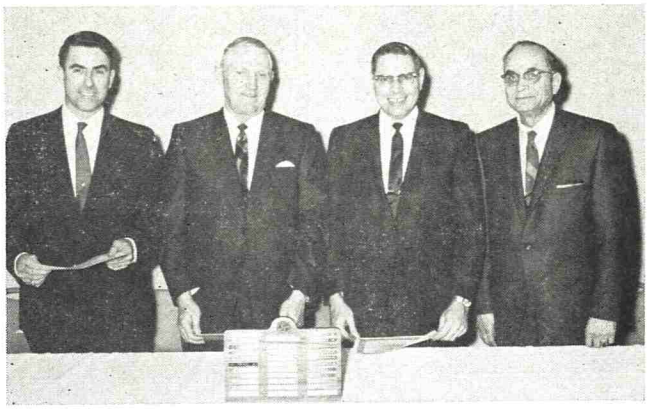
A regional National Mastitis Council meeting will be held in conjunction with the International Association of Milk, Food and Environmental Sanitarians annual meeting in Louisville, Kentucky, on August 17 and 18.

Speakers for the general session on August 18 include: Dr. James W. Smith, Animal Husbandry Research Division, Beltsville, Maryland; Dr. Robert F. Behlow, Etexnsion Veterinarian at North Carolina State University, Raleigh, North Carolina; Dr. James Jarrett, practicing veterinarian, Rome, Georgia; Dr. John Nicolai, Extension Specialist in Dairy Science at the University of Kentucky, Lexington, Kentucky; Mr. Ted Winbigler, Swift and Company plant manager, Glasgow, Kentucky; Dr. C. Bronson Lane, Extension Specialist in Dairy Technology at the University of Kentucky, Lexington, Kentucky; and Dr. William Schneider, Associate Director of Extension at the University of Kentucky, Lexington, Kentucky.

For further information, contact Dr. C. Bronson Lane, 104 Dairy Products Building, University of Kentucky, Lexington, Kentucky 40506.

28TH ANNUAL MEETING OF THE IOWA ASSOCIATION OF MILK AND FOOD SANITARIANS

The 28th Annual Meeting of the Iowa Association of Milk, Food and Environmental Sanitarians, Inc. was held at the Holiday Inn, Ames, Iowa on March



RECEPIENT OF 20 YEAR SERVICE AWARD. L to R Ernest Haupt, (also received Dr. Merle P. Baker award), Farris Biggart, Lyle Cunningham, C. D. Lee.

OFFICERS FOR 1969. L to R, Alvin Grey, Second Vice-President; Farris Biggart, First Vice-President; Arthur J. Roth, Jr., Past President; Duane Hegedon, President; Don Jaeger, President Elect.

29, 1969. Well over 160 members and guests were present for the meeting.

The annual banquet was held at the Holiday Inn with 121 attending. At this time the Dr. Merle P. Baker award for meritorious contributions in the field of milk and food sanitation was presented to Ernest Haupt. 20 Year Continous Service Awards were presented to Lyle Cunningham, Farris Biggart, C. D. Lee and Ernest Haupt.

The officers elected for 1969 are: President, Duane Hagedon; President-Elect, Don Jaeger; First Vice President, Farris Biggart; Second Vice President, Alvin Grey; Secretary-Treasurer, Hale Hansen; Faculty Advisors, Earl Wright, W. S. LaGrange and Immediate Past President, Arthur J. Roth, Jr.

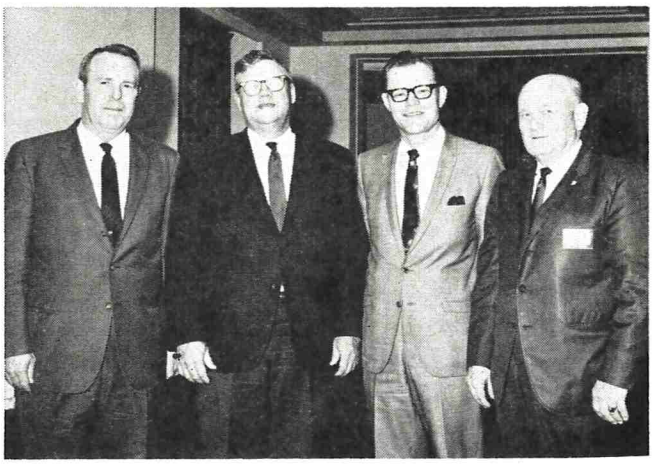
The ballot vote to change the name and objectives of our Association to correspond to those of the International Association was unanimously in favor of the change. This changes the name of our Association to the Iowa Association of Milk, Food and Environmental Sanitarians.

DIRECT MICROSCOPIC SOMATIC CELL COUNT

The Subcommittee on Screening Tests, Research Committee, National Mastitis Council, would like to bring to the attention of those who are using or are about to use the method published by this committee (*J. Milk Food Technol.* 31:350-354. 1968) that the reticles manufactured for the Committee by American Optical Co. are designed for use with Huyghenian eyepieces (oculars) only and should NOT be used in combination with Wide Field eyepieces.

F. H. S. NEWBOULD
Chairman
Subcommitte on Screening Tests
University of Guelph
Guelph, Ontario, Canada

OFFICERS MISSOURI ASSOCIATION OF MILK AND FOOD SANITARIANS



Mr. Jack Newman, 1969-70 President, Acting Director of the Springfield City Green County Health Department; Mr. William McCown, 1st Vice-President, Milk Sanitation Supervisor in the St. Louis County Health Department; Mr. Erwin P. Gadd, Secretary-Treasurer, Missouri Division of Health Central Office as Acting Director of the Bureau of Milk, Food, and Drugs; Mr. C. W. Dromgold, past President, Dairy Farm Superintendent by the St. Louis City Health Division, St. Louis, Missouri. Mr. Charlies Gillilan, 2nd Vice-President, Missouri Division of Health as a Hospital Sanitarian was unable to attend and as a result is not included in the photograph.

CITATION FOR SANITARIAN'S AWARD— 1969 MISSOURI ASSOCIATION OF MILK AND FOOD SANITARIANS

The recipient of the 1969 Sanitarian's Award has been a quarantine officer, a dairy sanitarian and a food sanitarian for the past 24 years. In fact, he has worked in every section of his local health department. This work has involved significant contributions of professional knowledge, sound judgment, thorough inspection and investigation, and, very importantly, the application of understanding, diplomacy and fairness in dealing with the many people with whom he works.

His greatest effort and amount of time has been devoted to milk sanitation. He participated in the establishment of a large Grade A milk shed which expanded from about 50 to some 1400 producers during his time in it. Obviously, conditions and regulatory methods changed rapidly as well. The recipient was a leader in making appropriate changes. For example, he coordinated inspection within his area and with several out-of-state areas which were receiving milk from Missouri in the days before the Interstate Milk Shipper's agreement. Removing sanitary regulations as trade barriers was a real accomplishment, and this year's recipient contributed greatly to this end. Additionally, he helped initiate work on a bill introduced in the 1955 State Legislature permitting cities to enter into agreements for interstate milk shipment.

The awardee has been a leader in developing strong lines of communications among sanitarians in the various city, county and state organizations and among representatives of allied fields such as field men. Notably, he helped charter the Southwest Missouri Sanitarian's Association.

He strongly believes that knowledge of the job and circumstances which affect its performance are imperative to proper job performance. In this respect he has supported the further professionalization of the sanitarian occupation. He attended an Oklahoma meeting to gain facts about a sanitarian's registration bill and came back promoting a similar bill in this state. He helped gain support of his local sanitarian's organization which then recommended it to the Missouri Association of Milk and Food Sanitarians.

These accomplishments make him admired but those which have made him a true friend to dairymen are even more important. Mr. L. E. "Dutch" Potts has won the respect of the subjects of his inspection work. This does not mean he has been tolerant of laxity in sanitation. Contrariwise, he has sought excellence and has obtained high standards because of the admiration and respect he was able to obtain. His philosophy of life which permeates his work has been summed up as follows by his nominators:

"Always be fair. Attempt to understand the circumstances. Be complete with investigations. Encourage doing the best and expect and insist upon it. Be firm but patient and take action only as a last resort."

Dutch Potts has shown that with the proper combination of judgment, understanding, respect for people and the ability to explain sanitation to the operator one can make outstanding accomplishments in promotion of milk and food sanitation.

46TH ANNUAL CONFERENCE OF NEW YORK STATE ASSOCIATION MILK AND FOOD SANITARIANS*

Committee Chairmen are progressing well with their plans for the 1969 Convention to be held September 17-19 at the Hotel Syracuse.

Mr. Francis Brennan, as President-elect, has the responsibility of finalizing the plans with Dick March. Caryl DuMond has consented to be Chairman of the Local Arrangements Committee this year.

Your Executive Board invited representatives of the Institute of Food Technology to a meeting, January 24, 1969, at the Country House, Syracuse, New York. This meeting was set up to explore the possibilities of their participating in our 1969 joint Cornell—Sanitarians annual conference. Dr. R. Holland presented the history of all interested groups to the combined group representatives as well as the pros and cons of holding a joint session at our 1969 annual conference.

We are all pleased to be able to tell you that a decision was reached at a subsequent meeting held February 28, 1969 to hold a joint session this year.

The Institute of Food Technologists group will hold a one day session in conjunction with our regular annual meeting. In addition, the Food Protection Committee will also schedule a half day session. The total food program is being developed by Chairman of the Food Protection Committee, Charles Gimbrone and his Committee members in cooperation with IFT representatives.

The General Session will begin at 1:30 on Wednesday, September 17 in the Ballroom of the Hotel Syracuse. One of our keynote speakers will be Mr. C. C. Johnson, Administrator of Consumer Protection & Environmental Health Service. The Lab Committee will hold a session on Monday evening and the regular Lab, Fieldmen, Plant and Food Sessions will be scheduled as usual.

An increase in the number of people attending our annual conference, above the usual 500-600, is expected with IFT people participating.

The above will also necessitate a change in our program title. It will be worded as follows: 46th Annual Conference of New York State Association Milk & Food Sanitarians and Cornell University, Food Science Department, and Central, Western, Mohawk, New York City, Nutmeg. IFT cooperating.

Make your plans now—plan to attend the Annual Conference!

FRANCIS BRADY
President

*Reprinted from New York Association Newsletter.

NEWS AND EVENTS

TWELFTH NATIONAL CONFERENCE ON INTERSTATE MILK SHIPMENTS

The twelfth National Conference on Interstate Milk Shipments was held May 25-29, 1969 at the New Albany Hotel, Denver, Colorado with 400 in attendance. Chairman Shelby Johnson, Kentucky State Department of Health, Frankfort did a most outtanding job of directing the Conference and the local arrangements committee, Harold Barnum, Chairman, C. Dunlap, J. Baghott, D. Summer and C. Wilheim handled local affairs with dispatch and efficiency. Roy L. Cleeve, Executive Director, Colorado Dept. of Health gave the address of welcome.

Mr. Charles C. Johnson, Jr. Administrator Consumer Protection and Environmental Health Service of the U. S. Dept., of Health, Education and Welfare gave a most interesting and informative keynote address. K. G. Weckel, University of Wisconsin, gave a Review of Accomplishments and Problems of NCIMS and Harold E. Thompson, of the U. S. Public Health Service reported on responsibilities and accomplishments of the Public Health Service in the functions of the Conference.

The remainder of the meeting was taken up by reports of Committees, and meetings of the various task force committees. A complete report of the action taken on task force recommendations will be published in the Journal of Milk and Food Technology at a later date.

FOOD SCIENCE AND TECHNOLOGY JOURNAL ABSTRACTING FOOD LITERATURE

A monthly international food science and technology journal now is abstracting the world's important technical food literature and is offering full-paper retrieval services.

Food Science and Technology Abstracts is published by the International Food Information Service under the joint direction of Commonwealth Agricultural Bureaux, Farnham Royal, Bucks, England; the Institute for Documentation, Frankfurt, Germany; the Institute of Food Technologists, Chicago; and Pudoc Agricultural Information Service, Wageningen, Netherlands. The journal contains approximately 1,000 technical abstracts each month prepared from about 1,000 of the world's most important scientific and technical periodicals by an international team of experienced specialists. It covers world food patents from 20 nations; carries reviews on text books on food science and technology from all parts of the world. IFIS offers technical information on magnetic data processing tape as well as full-text retrieval services either by photocopy, microfilm or microfichs at cost rates.

E. J. Mann is editor and all technical inquiries should be sent to him c/o IFIS Editorial Office, Commonwealth Bureau of Dairy Science and Technology, Shinfield, Reading, England. Dr. U. Schutzsack is German Manager and is in charge of the data processing for the publication. The basic annual subscription rate is $195 for 12 monthly issues of approximately 200 pages; monthly author and subject indexes are included as is an annual author and monthly index.

The publication, which began publication the first of 1969, abstracts food science and technology literature: basic food science (chemistry, physics, biochemistry, biophysics); food microbiology; food hygiene and toxicology; food economics (including standards and legislation); food engineering; food packaging; alcoholic and non-alcoholic beverages; fruits, vegetables and nuts; cocoa and chocolate products, sugars, syrups, starches and candy; cereals and bakery products; fats, oils and margarine; milk and dairy products; eggs and egg products; fish and marine products; meat, poultry and game; food additives, spices and condiments; prepared, systhetic and dietary foods.

ANNUAL AWARDS PRESENTED AT IFT MEETING

Annual awards for outstanding professional work in food technology and food science were presented to four university professors and a food manufacturing firm at the 29th Annual Meeting of the Institute of Food Technologists in Chicago on May 13, 1969.

Dr. Edwin M. Foster, Professor of Bacteriology at the University of Wisconsin and Director of the Food Research Institute, received the Nicholas Appert Award for pre-eminence in and contributions to the field of food technology. The award honors Dr. Foster's outstanding research in food microbiology, especially into the roles of microorganisms in processing of meat and dairy products and in spoilage of foods, and more recently his direction of work which led to practical methods for detecting salmonella and for detecting and characterizing bacterial and viral toxins in foods.

The award, which was originated by the Chicago Section of the Institute of Food Technologists, con-

sists of a bronze medal and a $1,000 honorarium.

Dr. Samuel A. Goldblith, Professor at the Massachusetts Institute of Technology and Deputy Head of M.I.T.'s Nutrition and Food Science Department, received the 1969 Babcock-Hart Award which is sponsored by The Nutrition Foundation, Inc., to recognize individuals for significant advance of the nutritional well-being of the public through advanced application of food technology. Dr. Goldblith was cited specifically for a wide spectrum of research, application and education in advancing the nutritional excellence of foods subjected to processing especially by radition of freeze drying as well as microwave heating.. The award is administered by the Institute of Food Technologists and consists of an engraved plaque and a $1,000 honorarium.

Dr. Nevin S. Scrimshaw, Professor of Nutrition and Head of the Department of Nutrition and Food Science at the Massachusetts Institute of Technology, received the IFT's annual International Award for outstanding efforts to promote international exchange of ideas in the field of food technology. Dr. Scrimshaw was recognized for effectively championing the participation of scientists native to developing countries in all programs designed to help build needed food producing and marketing capabilities.

Dr. Scrimshaw's award consists of an engraved silver salver furnished by the Australian Institute of Food Science and Technology, and a $1,000 honorarium.

Dr. Harry Y. Yamamoto, Associate Professor of Food Science and Technology at the University of Hawaii, received the IFT's 1969 Award For Research which is presented annually for outstanding ability in food science and technology by a scientist 35 years of age or younger. Dr. Yamamoto was honored for his efforts in broadening fundamental knowledge of the biochemistry of carotenoids and providing practical new methodology in that field, and, more recently, his research on processing and quality of macadamia nuts. The award was an engraved plaque and a $1,000 honorarium.

Thomas J. Lipton, Inc., Englewood Cliffs, N. J., received the IFT's 1969 Food Technology Industrial Achievement Award established to recognize a significant advance in the application of food technology to food production. The award specifically cited the firm's development, commercial production and application, as components of new casserole dishes, of dehydrated meat or seafood prepared by a new process that yields food pieces at least equal in quality to products obtained by freeze drying, yet producible at lower cost.

Specifically cited was Norman S. Creswick, senior scientist at Thomas J. Lipton, who was credited with the concept as well as the laboratory and pilot plant development work that led to commercialization; and Dr. Richard J. Coleman, formerly with Lipton but now with Florasynth Inc. Both received personal award plaques; the firm was presented a large plaque which was accepted by W. Gardner Barker, President, Thomas J. Lipton. Other members of the Lipton staff prominent in process and product development of the concept were Dr. Ramo Franceshini, Holt Andrews, Richard Henderson and Miss Shih.

NEW DOCUMENTARY SERVICES PROVIDED BY THE FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, ROME (ITALY)

The wealth of technical, economic and social information, contained in some 25,000 publications and documents produced by FAO since its creation in 1945, is now readily available through the services provided by the FAO Documentation Centre.

Published indexes (Monthly "Current Index" – since January 1967 – and retrospective "Special Indexes" – for the period 1945-1966) permit the selection of documents of interest in the field of agriculture, fisheries, forestry, nutrition, rural economy, etc., through thousands of subject matter, author and title references in each field.

A Question and Answer" service provides, on request, ad hoc bibliographies on specific subjects.

Documents of interest can be obtained in original form (printed or mimeographed) or, if out of stock, in the form of photocopies or microfiches.

The "Current Index" is sent, free of charge, on request. Details on other services (Retrospective Indexes, "Question and Answer" service, Reproduction Services) will be obtained by writing to the: FAO Documentation Centre (Ref. P. 69) FAO Headquarters, Via Terme di Caracalla, 00100-Rome-Italy.

NEW BULLETIN ON PLASTIC MILKING MACHINE INFLATIONS

Publication of a new bulletin covering Transflow clear plastic "See-Through" milking machine inflations and shells is announced by Norton Plastics & Synthetics Division, Akron, Ohio 44309. Designated Bulletin TI-100, the new publication describes the unique design advantages of Transflow inflations and shells and explains why up to 33% faster milking can be expected with their use.

A copy of Bulletin TI-100 will be sent on request to Mr. James E. Petit, Dairy and Food Manager, Tubing & Molded Products, Norton Plastics & Synthetics Division, Akron, Ohio 44309.

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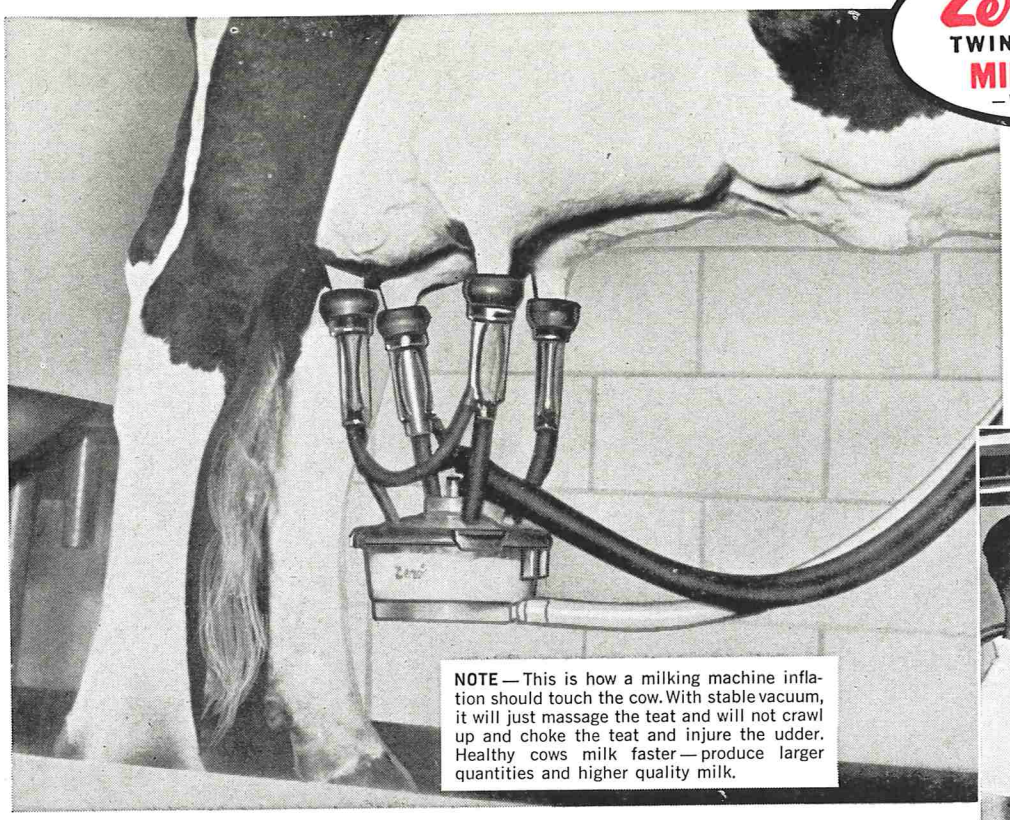
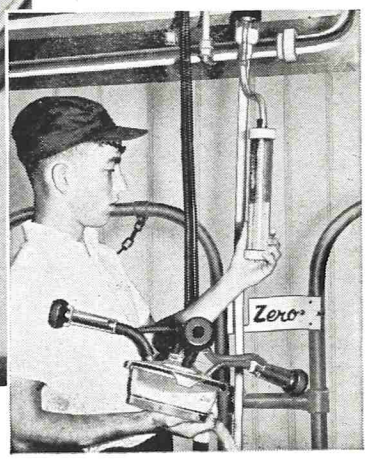
MILKING SYSTEM
—WITH COW MONITOR



NOTE — This is how a milking machine inflation should touch the cow. With stable vacuum, it will just massage the teat and will not crawl up and choke the teat and injure the udder. Healthy cows milk faster — produce larger quantities and higher quality milk.

● **ANOTHER NEW ZERO INVENTION! COW MONITOR!** Reports each cow's production and health at each milking. Now part of complete ZERO CONCORD Milking System. Mail Coupon for full information!



OPERATES BY A NEW, SCIENTIFIC PRINCIPLE . . . TWIN-VACUUM!

The ZERO CONCORD TWIN-VACUUM PIPELINE MILKING SYSTEM is a combination of a new, revolutionary milking machine pipeline, and the ZERO Completely-Automated Vacuum Bulk Milk Cooler. It's for both parlor and stanchion barn. And it's the first major breakthrough in milking since the introduction of the pulsator in 1902 — because it operates by a new, scientific principle . . . TWIN-VACUUM. One vacuum milks the cows. The other vacuum moves the milk into the bulk tank.

ZERO's TWIN-VACUUM Operation Does Away with the Need of Injecting Air into the Milker Units to Move the Milk, as is necessary with conventional milking systems. This provides low, stable vacuum at each cow for safe, fast milking. Prevents air agitation and foaming of the milk in the pipeline — a cause of rancidity. And keeps contaminating air out of the milk.

In Addition, the ZERO CONCORD Gives You Automatic, Mechanical C.I.P. Cleaning of the Entire System — including bulk tank, milking vacuum lines, milk conveying vacuum lines and even the pulsator. And as milker units and shells are made of a new, lightweight, transparent material — you have visual milking and clean-up of the milker units for the most up-to-date, good milking care and sanitation.

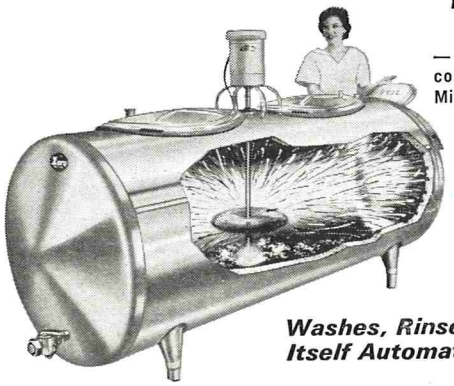
You'll Be Pleasantly Surprised at How Much Money You Save — as this new kind of milking system, operating by vacuum, does away with the milk pump, releaser and other costly items.

See Your ZERO Dealer — or Mail Coupon — for more detailed information and name of your nearest ZERO Dealer!

ZERO MFG. CO. 813-CS Duncan Ave. Washington, Mo. 63090

GO Zero Concord . . . . FROM TEAT—TO TANK!

C-13



Zero COMPLETELY-AUTOMATED VACUUM BULK MILK COOLER — is an important unit of the complete ZERO CONCORD Milking System.

We'll See You At The Meeting!

Washes, Rinses and Sanitizes Itself Automatically!

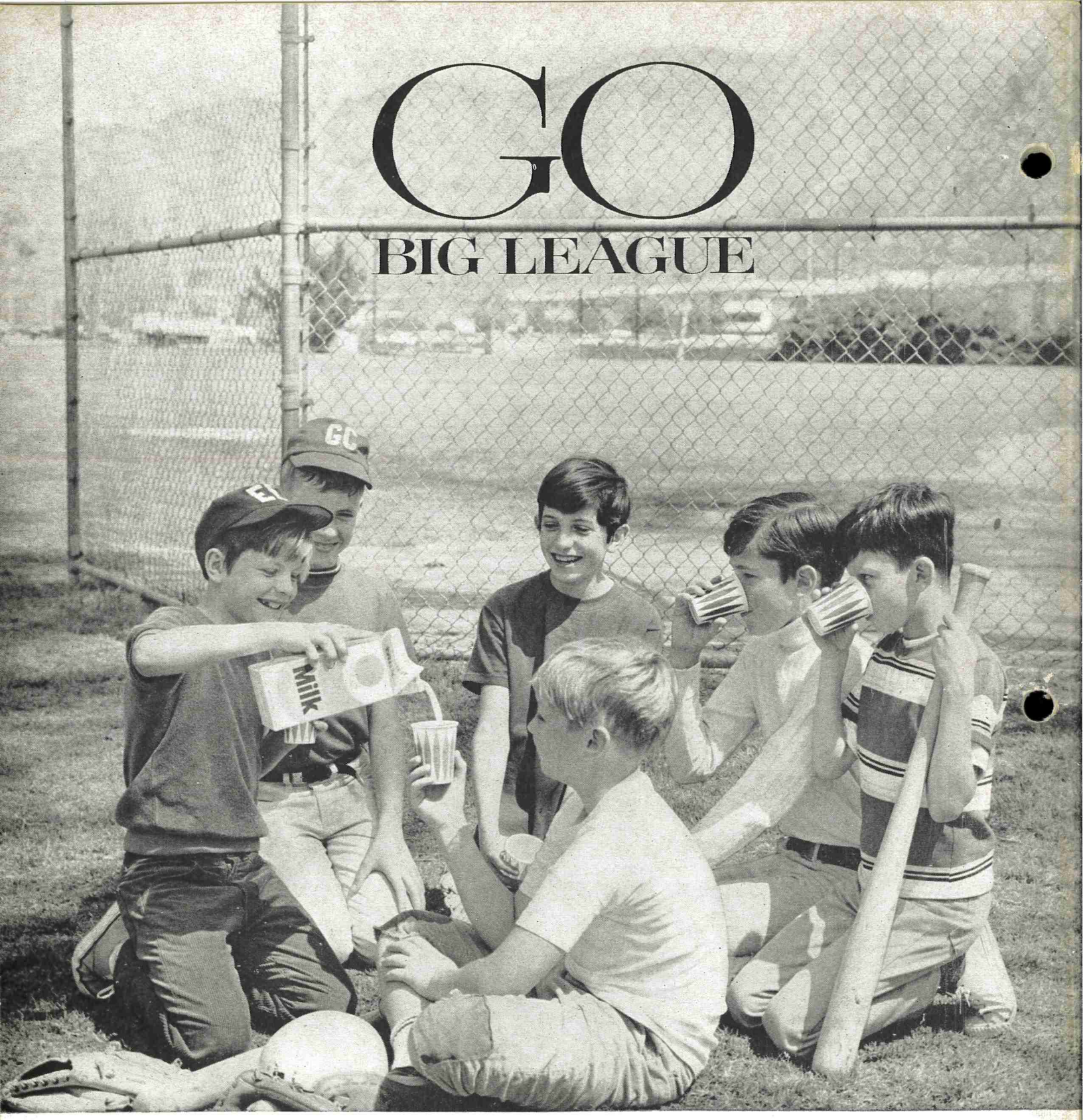
MAIL COUPON FOR FULL INFORMATION!

ZERO MFG. CO. 813-CS Duncan Ave. Washington, Mo. 63090

Please send me FREE Brochure containing full information about the new ZERO CONCORD Twin-Vacuum Pipeline Milking System with Cow Monitor, and name of my nearest ZERO Dealer. I am interested in this system for a:

☐ Parlor ☐ Bulk Tank
☐ Stanchion barn ☐ I am interested in a Dealer Franchise

Name .....
Do you have a bulk tank? ..... Its age .....
What make bulk tank do you have? .....
Size of your Herd .....
Address ..... Phone .....
Town ..... State .....



Milk! For little leaguers. Big leaguers. Young kids. Old kids. Milk gives everyone big league *go-power.*

Milk tastes good. No other food offers so much nutrition for everyone. Every glass of milk you drink is brimming with vitamins, minerals, protein and energy . . . at a real bargain price.

Make milk your healthy drink.

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