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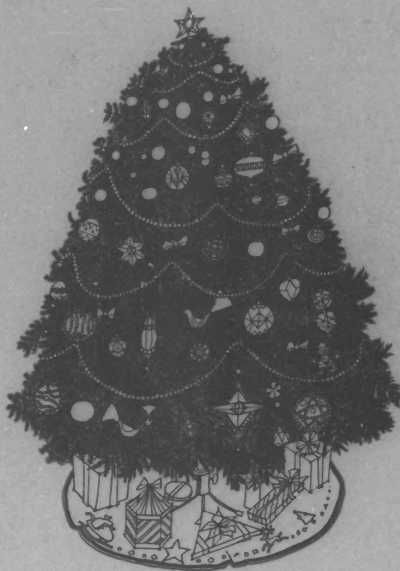
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# Using Risk Assessment as a Method of Determining Inspection Frequencies

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## INTRODUCTION

Foodservice establishments have been linked to approximately forty-nine percent of all reported foodborne disease outbreaks in the United States between the years 1979 and 1982 (7, 8, 9). Bryan (6) developed an administrative procedure designed to measure the potential risk of foodborne disease that a foodservice establishment poses to the community. Bryan's method of numerical risk was calculated by quantifying three key characteristics of foodservice operations. These three coefficients were termed: food property risk; food operations risk; and average daily patronage risk.

This risk assessment technique evolved as a result of the budget and personnel reductions affecting already understaffed health departments. The practice of scheduling a given number of inspections per year for every establishment in the community has come under critical examination. Kaplan and El Ahraf (12) proposed that the traditional set number technique was no longer acceptable as various types of foodservice establishments were shown to possess different relative risk ratios. Bryan concurred by stating that good management was the process of using personnel efficiently and not wasting it on "time honored but no longer effective" routines. He suggested identifying the establishments with the greatest potential risk and allocating manpower to these operations in an effort to increase overall community safety.

The Hunt County Health Department was established in 1945 to serve the area of Hunt County, Texas, outside

of the corporate city limits of Greenville. Approximately 33,000 people reside in the 800 sq. mile rural service area which includes the cities of Commerce (population: 8136), Wolfe City (1594), Caddo Mills (1060), Quinlan (1002), West Tawakoni (840), Celeste (716), Campbell (549), and Lone Oak (467). The environmental health services offered by the health unit are: foodservice inspections; inspections of nuisance complaints; investigation of animal bites; inspection and licensing of individual waste water systems (septic systems); and day care center inspections. All of these services are performed by two registered sanitarians.

Over the past five years, the priorities of the health unit have shifted from foodservice inspections to the inspection and licensing of septic systems. The change in the primary duties of the sanitarians was largely a result of the tremendous growth experienced by rural Hunt County and also because of the revenue produced by the septic system licensing fees. The result of this shift in priorities was the neglect of many foodservice establishments with the possibility of foodborne disease outbreaks occurring.

The city of Commerce was the exception in Hunt County. Past history has dictated that every foodservice establishment be inspected on a three month schedule. This meant a liquor store just sacking ice was inspected as often as a full-service restaurant. Intuitively, the busy restaurant should be inspected more often than the local liquor store. Bryan's system was the possible answer. By separating the low risk establishments from the high risk ones, it allowed scarce time to be used more efficiently.

The three month inspection schedule was difficult to maintain because other commitments confined the staff to perform only about twenty inspections in Commerce per month.

The purpose of this study was to use Bryan's risk assessment technique in an effort to improve or maintain operational quality of the tested foodservice establishments. On February 1, 1984, a modified version of Bryan's proposal was implemented on forty-two foodservice establishments within the city of Commerce. After one year of the plan in operation, the remaining thirty-five establishments (seven went out of business) were tested to determine if the operational quality had increased, decreased, or remained constant. The scores from the inspection reports were used as an index of operational quality. The risk assessment technique of determining inspection frequencies was feasible only if there was no decrease in the foodservice operational quality during the one year test period.

#### METHODS

The first step in implementing Bryan's technique was to quantify the three risk coefficients. The food property risk was designed to measure a food's probability of being a vehicle in the transmission of foodborne disease. Every food item served in the city of Commerce was given a value of 1 to 5 (Table 1). Low risk food items or foods seldom, if ever, connected to foodborne disease transmission were given the value of 1. A value of 5 was given to food items which were most often incriminated with foodborne illness. The intermediate values were assigned relative to the food item's potential risk. Determination of potential risk was made by gathering information about the food item's intrinsic qualities. Past history of the food item as a vehicle of foodborne illness was the primary criterion used to make the judgment. The list of foods in Table 1 was established from about twenty-five foods that Bryan recorded (6). Annual Summaries of Foodborne Disease Outbreaks (7, 8, 9) were used to gather data on food item incrimination. Bryan (4) also presented additional information on reported outbreaks over the last decade. When the food item in question was not listed in any publication, the risk value was determined by other inherent properties such as water activity and/or pH.

Bryan's original model was modified in quantifying the food operations risk. Bryan proposed assigning risk values of 1 to 5 to each food item in relation to that food's potential risk of being mishandled during storage, preparation, or serving. In other work (1, 2, 3, 5) he has shown how various foodservice operations contribute to foodborne illness outbreaks. These studies show that certain foods (roast beef, turkey, chicken, rice) are more often exposed to conditions that are favorable for micro-

TABLE 1. Coefficient 1: Potential risk values of food items.

Values	Food Items
5	Turkey, Ham, Roast Beef
4	Chicken, Potato Salad, Gravy, Bar B-Q Beef and Ribs, Sausage, Eggs (raw), Pork, Macaroni Salad, Tuna Salad, Chicken Fried Steak, Stew (soup), Egg Rolls, Fried Won-Ton.
3	Chili, Shellfish, Dairy Pastry, Beef Steaks, Rice, Steak Fingers, Refried Beans, Fish, Canneloni, Luncheon Meats (unpackaged), Tacos, Burritos, Tamales, Enchiladas, Shrimp, Chili Dogs, Tostada, Milk, Pudding, Chimichanga, Rigatoni, Meat Sauce, Chalupa.
2	Hamburgers, Hot Dogs, Frozen Pizza, Ice Cream Products, Frozen Yogurt, Salads, Cheese, Guacamole Dip, French Fries, Hot Sauces, Spaghetti, Vegetables, Lasagna, Polish Sausage, Pepperoni, Luncheon Meats (pre-packaged), Hot Links, Corn Dogs, Bacon (cured), Eggs (cooked), Hot Cakes, Manicotti, Onion Rings, Anchovies, Pasta.
1	Soft Drinks, Ice, Beer, Liquor, Peanuts, Potato Chips, Slaw (low pH), Popcorn, Snow Cones, Hush Puppies, Rolls, Bread, Cakes, Biscuits, Fruit Pies, Candy, Donuts, Sauerkraut, Pizza Toppings, Fruit Juices, Danish, Dried Fruit.

bial contamination and/or growth. There is no doubt that Bryan's method of determining the second coefficient is an excellent one; however, the time and additional calculations involved in using this method created the need for a simpler, though maybe less precise, measurement.

In this study, determination of the food operations risk was established by calculating the mean of the five inspection report scores prior to February 1, 1984. The inspection report scores were used as an index to represent an establishment's history of operational sanitation. The scores came from the standard "State of Texas Foodservice Establishment Inspection Report". The report operates on a 100 point system with each weighted violation being subtracted from the perfect score. A violation posing the greatest risk is weighted more heavily (4 or 5 points) and violations of relatively low risk are weighted less (1 or 2 points).

Since a low mean reflects a high potential risk, a value of 5 was assigned to a mean of 76.49 or below (Table 2). In contrast, a value of 1 was given to establishments with an inspection score mean of 94.50 or above. The six-point interval between risk values was totally arbitrary and could be manipulated to conform to any situation.





obtained directly from assigned risk values. The final product of the three coefficients was termed the establishment's risk potential. The risk potential of the sample establishment was 148 (Table 4). In determining risk potential, coefficient #1 is weighted most heavily. This depended on the variety of food items served and reflected the belief that the more food items served, the more food items available for mishandling and thus the greater chance of a foodborne disease outbreak. However, even with the extra weight of coefficient #1, coefficients #2 and #3 can nevertheless drastically influence the final product.

The risk potential was used to determine the inspection frequency. The foodservice establishments with the highest risk potentials were considered to pose the greatest threat of foodborne disease outbreaks to the city of Commerce. An establishment with a low risk potential was thought to pose relatively little threat. With this in mind, the inspection frequencies were set (Table 5). If an establishment's risk potential was 801 or greater, it was inspected every month. In contrast, establishments with risk potentials of 20 or below were termed "floaters." A floater was an establishment that was to be inspected twice a year, at the convenience of the inspector. This was the key to the study; if operational quality could be maintained in floaters, then perhaps operational quality could be improved in high risk establishments by increased inspections with the same amount of time being spent in the city. Risk potential ranges are arbitrary and again modifiable to any situation. These particular ranges were established (Table 5) to give Commerce approximately twenty inspections per month. Risk potentials and inspection frequencies were tabulated for each of the forty-two establishments in Commerce (Table 6).

TABLE 5. Inspection frequency based on risk potential of an establishment.

Risk Potential	Inspection Frequency
801 or greater	every month
401 - 800	every 2 months
201 - 400	every 3 months
101 - 200	every 4 months
21 - 100	every 5 months
less than 20	floater

## RESULTS AND DISCUSSION

On February 1, 1984, the inspection frequency determined by the risk assessment technique was implemented for forty-two foodservice establishments within the city of Commerce. Inspections were made routinely during the scheduled month with no prior warning given before an inspection. Inspection times varied but usually occurred between 10:00 a.m. and 5:00 p.m. After the plan was in operation for one year, the establishments were tested to determine if operational quality had improved,

TABLE 6. 1984 risk potential and inspection frequency.

Establishment Number	Risk Potential	Inspection Frequency (interval in months)
1	12	Floater (F)
2	230	3
3	1065	1
4	54	5
5	18	F
6	14	F
7	1020	1
8	14	F
9	14	F
10	650	2
11	370	3
12	126	4
13	36	5
14	2	F
15	2	F
16	870	1
17	570	2
18	620	2
19	27	5
20	14	F
21	171	4
22	324	3
23	324	3
24	192	4
25	15	F
26	12	F
27	150	4
28	18	F
29	12	F
30	408	2
31	8	F
32	360	3
33	148	4
34	3	F
35	54	5
36	780	2
37	27	5
38	228	3
39	60	5
40	7	F
41	16	F
42	400	3

declined, or remained constant. As previously noted, inspection report scores were used as an index of operational quality.

Two sets of score means were compared to the score mean used to calculate coefficient #2. The mean of the five inspection report scores prior to February 1, 1984, was compared to the mean of the five inspection report scores given prior to February 1, 1985. The mean of the five report scores before February 1, 1984, was also compared to the mean of the scores issued during the study period (2/1/84 - 2/1/85). The number of inspection report scores issued during the study period was influenced by the inspection frequency. It fluctuated between

twelve, for an establishment inspected every month, and two, for an establishment in the "floater" class. For testing purposes, foodservice establishments were grouped into four categories. Category 1 consisted of establishments inspected every month and every two months. Category 2 was composed entirely of establishments inspected on the three month schedule. Establishments inspected every four and five months were combined in Category 3. The floaters made up Category 4. A correlated *t*-test (10) was used to test for significance between inspection report score means of all four categories.

Using the correlated *t*-test a significant increase ( $p < .05$ ) was detected in both sets of score means from report scores of establishments grouped in Category 1 (Table 7). This increase in the higher risk establishment's inspection report scores was the first step in assigning validity to this method of determining inspection frequency. However, this increase must also be accompanied by either an increase or a maintenance of scores in the other three categories. Using the same correlated *t*-test, both groups of score means for the establishments in Category 2 were examined (Table 8).

Category 2 establishments were inspected every three months, as they were before the study was implemented. Therefore, one would not expect their scores to be significantly different. Although the sum of differences indicated a slight decrease in operational quality for both sets of scores means, these decreases were not significant ( $p > .05$ ). Since differences were not significant it was concluded that operational quality was being maintained. Categories 3 and 4 were tested in the same manner as the other two categories (Tables 9 and 10).

The establishments in Category 3 showed the greatest reduction in operational quality. However, the decreases in both sets of score means were not significant ( $p > .05$ ). The floaters in Category 4 also displayed no significant differences ( $p > .05$ ). Once again, the absence of significant change was interpreted as maintenance of constant quality. The maintenance of operational quality in Categories 2, 3, and 4 was the second requirement that must be met to consider risk assessment as a valid method of determining inspection frequency.

Several types of establishments were excluded from the study and left on the original three-month schedule. The

TABLE 7. Difference in score means of establishments inspected every month or two months (category 1).

Establishment Number	Mean of 5 Scores Prior to 2/1/84	Mean of 5 Scores Prior to 2/1/85	Difference	Means of Scores Obtained During Test Period	Difference
3	73.60	82.60	9.00	82.27	8.67
16	83.00	88.40	5.40	88.75	5.75
10	90.20	89.80	-0.40	90.50	0.30
17	64.80	76.60	11.80	75.33	10.53
18	70.00	83.20	13.20	82.33	12.33
30	80.00	78.20	-1.80	77.33	-2.67
36	80.20	85.40	5.20	84.34	4.14

$t = 2.795; 6df; p < .05$

$t = 2.712; 6df; p < .05$

TABLE 8. Difference in score means of establishments inspected every three months (category 2).

Establishment Number	Mean of 5 Scores Prior to 2/1/84	Mean of 5 Scores Prior to 2/1/85	Difference	Mean of Scores Obtained During Test Period	Difference
2	89.60	89.00	-0.60	89.50	-0.10
11	89.00	84.40	-4.60	86.50	-2.50
22	87.20	85.20	-2.00	84.00	-3.20
23	80.00	85.60	5.60	84.50	4.50
32	82.80	84.00	1.20	84.50	1.70
38	82.60	71.40	-11.20	71.40	-11.20
42	76.40	78.80	2.40	77.00	0.60

$t = -0.639; 6df; p > .05$

$t = -0.770; 6df; p > .05$

TABLE 9. Difference in score means of establishments inspected every four or five months (category 3).

Establishment Number	Mean of 5 Scores Prior to 2/1/84	Mean of 5 Scores Prior to 2/1/85	Difference	Mean of Scores Obtained During Test Period	Difference
12	87.60	86.20	-1.40	84.00	-3.60
24	78.40	69.60	-8.80	66.67	-11.73
27	74.60	72.60	-2.00	73.67	-0.93
33	90.60	91.40	0.80	92.67	2.07
19	87.00	88.20	1.20	90.00	3.00
39	89.80	85.80	-4.00	82.50	-7.30

$t = -1.573; 5df; p > .05$

$t = -1.330; 5df; p > .05$

TABLE 10. Difference in the score means of "floater" establishments (category 4).

Establishment Number	Mean of 5 Scores Prior to 2/1/84	Mean of 5 Scores Prior to 2/1/85	Difference	Mean of Scores Obtained During Test Period	Difference
1	90.20	88.80	-1.40	86.50	-3.70
6	93.20	92.00	-1.20	91.50	-1.70
8	94.60	91.80	-2.80	91.00	-3.60
9	91.80	92.80	1.00	95.00	3.20
14	91.40	91.60	0.20	92.50	1.10
15	98.00	96.20	-1.80	95.50	-2.50
20	92.00	93.60	1.60	96.00	4.00
25	84.20	80.40	-3.80	77.00	-7.20
26	93.80	95.20	1.40	91.00	-2.80
28	94.20	94.60	0.40	95.50	1.30
29	90.80	93.60	2.80	98.33	7.53
31	92.60	96.40	3.80	98.00	5.40
34	95.60	96.20	0.60	97.50	1.90
40	95.00	94.20	-0.80	94.50	-0.50
41	93.40	90.60	-2.80	91.50	-1.90

$t = -0.335; 14df; p > .05$

$t = -0.035; 14df; p > .05$

excellent quality of hospital and nursing home kitchens resulted in very low risk potentials. Because of the low risk potentials, the projected inspection frequencies were also very low, and in fact, too low for safety in kitchens that cater to populations tremendously susceptible to foodborne disease. As a precaution, hospital and nursing home kitchens were therefore left on the original inspection schedule. Using the same rationale, school cafeterias were also left on the three-month schedule. Grocery stores were inspected every three months because the third coefficient was impossible to determine. The number of customers in grocery stores that purchase potentially hazardous foods or foods packaged on the premises was difficult, if not impossible, to determine accurately. A city of Commerce ordinance requires mobile foodservice operations to be inspected every month. Thus, these establishments were also excluded from the study. A total of seventeen establishments remained on the original three-month schedule. The means of their inspection scores were also tested, as before, and no significant changes were noted ( $p > .05$ ) over the one year test period.

New establishments were inspected every three months until five inspection report scores were on file. These establishments were included in the study as soon as coefficient #2 could be determined. On February 1, 1985, the potential risk of all establishments within the city of Commerce was recalculated (Table 11). The three coefficients were computed in essentially the same way as before. Coefficient #1 was changed only if an establishment altered its menu. The five inspection report scores prior to February 1, 1985, were used to calculate coefficient #2. In recalculating coefficient #3 for 1985, it was felt that additional time could be saved by asking establishment managers for estimates of the number of customers that frequented their businesses in a given day. Managers therefore were not requested to keep a one-week tally sheet of the number of patrons.

The system proved to be self-regulating. A large increase or decrease in coefficients resulted in a matching increase or decrease in inspection frequency. The total inspections per month were again maintained at approximately twenty. As Category 1 establishments continue to increase in operational quality and slowly drift into Category 2, a lowering of "risk potential" ranges in Table 5 could further facilitate improvement in higher risk establishments.

Health departments with computer facilities are capable of making this inspection frequency method more efficient. Sanitation Programs Information Formulator (SPIF) is a data processing system available to aid "in planning and executing daily inspectional activities" (11). It delivers inspection summaries of each establishment and provides the sanitarian a list of establishments scheduled for inspection in a given month. Along with these basic duties, SPIF is capable of typing license renewal notices and keeping various statistical information on all inspected establishments. SPIF complements the inspection frequency method but is certainly not essential. The simplicity of this method of determining inspection frequency allows small health departments, like the one in Hunt County, to compute risk potentials and implement effective food protection programs with minimal investment of time or money.

#### SUMMARY

Sanitarians have the responsibility of performing many duties essential to a community, one of which is foodservice inspections. As obligations increase and budgets remain static, the sanitarian is confronted with reducing the total number of inspections conducted per year, at the possible expense of public health. The idea of allocating manpower where it is needed most is a basic administrative task. This principle was applied to foodservice es-

TABLE 11. 1985 risk potential and inspection frequency.

Establishment Number	Risk Potential	Inspection Frequency (interval in months)
1	14	Floater (F)
2	230	3
3	639	2
4	O/B	O/B
5	O/B	O/B
6	16	F
7	O/B	O/B
8	28	5
9	16	F
10	650	2
11	555	2
12	126	4
13	O/B	O/B
14	2	F
15	2	F
16	870	1
17	304	3
18	558	2
19	30	5
20	16	F
21	O/B	O/B
22	222	3
23	324	3
24	240	3
25	264	3
26	9	F
27	150	4
28	12	F
29	14	F
30	416	2
31	4	F
32	372	3
33	216	3
34	4	F
35	O/B	O/B
36	540	2
37	O/B	O/B
38	390	3
39	60	5
40	16	F
41	18	F
42	320	3
43*	1125	1
44*	1104	1
45*	234	3
46*	243	3

O/B - out of business

\* new establishments

establishment inspections by this study. A modified version of Bryan's method of calculating a foodservice establishment's potential risk of foodborne disease was used to determine the inspection frequency of forty-two establishments within the city of Commerce. This allowed for "high risk" establishments to be examined more often by removing "low risk" establishments from the routine inspection schedule.

After the risk assessment method was in operation for one year, inspection report scores were compared to ascertain if this method of determining inspection frequencies was practical. A correlated *t*-test was used to test for significant differences between two sets of score means. The mean of the five report scores prior to the end of the study. The mean of the five report scores prior to the start of the study was also compared to the mean of report scores issued during the year-long study. The results indicate a significant increase in the operational quality of establishments inspected every month or every two months. There was no significant increase or decrease in the operational quality of establishments inspected at longer intervals. These findings indicate that a numerical risk assessment technique can be used as a valid tool in scheduling foodservice establishment inspection frequencies in under-staffed and under-financed health departments.

## ACKNOWLEDGMENTS

The authors wish to express our sincere appreciation to East Texas State University and to the Hunt County Health Department. Deepest gratitude also to Donald Ingold and Don Royce Lee for their suggestions and editing. Special recognition is given to Jay Caudle for his advice that was supported with many years experience in public health.

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# Aseptic Bulk Tank Milk Sampler

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The majority of raw milk is collected by milk tanker from refrigerated bulk milk tanks or cans at road side and collection points in some other countries. Sampling the herd milk supply is routinely performed by the milk tanker operator. Contamination of the milk sample may result in a loss of the market for the producer and subsequently loss of payment for the product. Difficulty in obtaining a representative milk sample may be due to one or more of the following: 1) the necessity for the sample to be taken at the point of the collection, 2) the variety of milk storage container types, 3) semi-skilled operators (i.e. tanker drivers) collecting the samples, 4) the use of sampling procedures which may interfere with efficient milk collection (i.e. by incurring delays and extra manipulations), and 5) conditions for collecting which are far from ideal for satisfactory results. Milk samples, obtained for analysis, are taken either manually or by tanker-mounted automatic and semi-automatic samplers. Manual sampling procedures vary and are generally successful only if adequate agitation of the milk supply is achieved.(16)

Mechanical samplers often become contaminated and when improperly cared for are unsuitable for obtaining samples used for bacteriological testing. Errors in mechanical sampling may arise from a large carry-over effect between milk supplies. The latter may be due to faulty installation and/or maintenance shortcomings inherent in the design of the sampler. Adjustment of the sampler for each milk supply may also be a potential source of serious error.(1,4,10-12).

The farmer needs to be able to aseptically collect milk samples for central laboratory bacteriological testing when complying with a mastitis surveillance program.(2,3,6,7,9,13-15) A new method of obtaining aseptic milk samples from farm milk supplies is described in this report.

## DESIGN AND FABRICATION OF THE ASEPTIC MILK SAMPLER

A standard veterinary balling gun was modified and retrofitted with a thick-wall plexiglas cylinder designed and constructed to accept a standard vacutainer tube and sterile disposable bleeding needle. (Fig 1, 2 and 3I). First, the balling gun was modified by cutting an inside thread (Fig 3D) at the open end of the reservoir part (Fig 3E) of the gun. Then, a large diameter plexiglas rod was turned to construct the receptacle (Fig 3C) for the sterile vacutainer tube and disposable bleeding needle. Outside matching threads (Fig 3D) were cut on the wall of the plexiglas rod in order to be able to attach it to the reservoir part of the modified balling gun. The clear plexiglas receptacle was designed for unobstructed vision of the sample and quick removal and replacement of vacutainer tubes and disposable needles. All materials are commercially available with the exception of the plexiglas receptacle. The latter was prepared in a standard machine shop. For each sample, one sterile, disposable, 20 ml vacutainer tube and one sterile, disposable, 19 Ga. 1.5" bleeding needle are necessary.

## METHOD OF SAMPLING

Between sampling the sampler is kept in a disinfectant solution. Prior to sampling it may be removed from the solution and wiped dry with a clean, single service paper towel. The plexiglas receptacle (Fig 3C) is removed from the reservoir and a prelabeled 20 ml. vacutainer tube (Fig 3G) is placed into the sampler (Fig 3E). The plexiglas receptacle is then replaced and secured in place by mak-

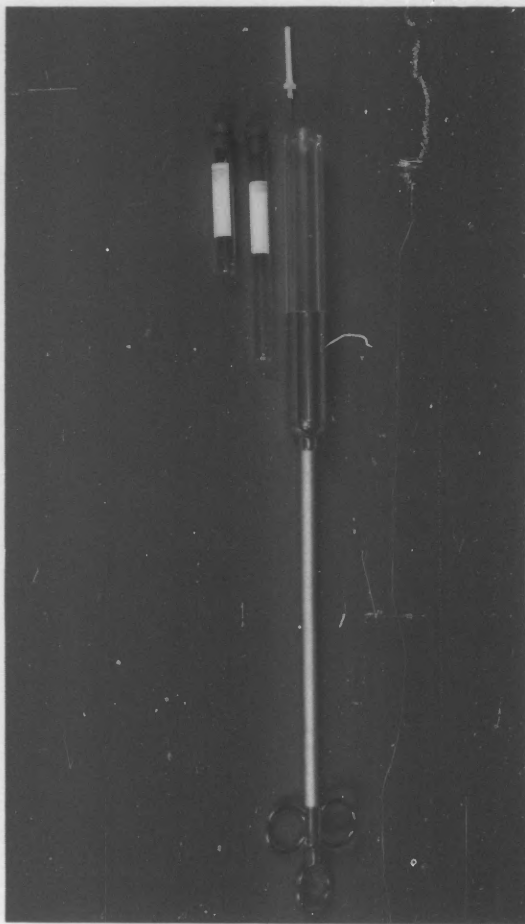


Figure 1. Aseptic bulk tank milk sampler with sterile and disposable vacutainer and needle.

ing it hand tight. Next, the sterile disposable bleeding needle with its protective cap is secured in place in the plexiglas receptacle. The sampler may be configured in this "ready" position for an extended period of time prior to sampling. When sampling, the lid of the bulk milk tank is opened and the protective cap of the sampler needle is removed (Fig 3III). The sampler is then submerged into the milk in the bulk tank and the plunger of the sampler is thrust forward engaging the vacutainer tube over the other sterile end of the bleeding needle (Fig 3IV). Care must be exercised so as not to place the sampler too deep into the milk to the extent that the milk is contaminated with the hand. Nine to eighteen ml of milk, depending upon the size of the vacutainer tube used, is drawn into the sterile vacutainer tube without any contamination of the sample. The sampler is removed from the bulk tank, the plexiglas receptacle unscrewed and the vacutainer tube containing the sample is disengaged from the protected end of the sampler needle. If

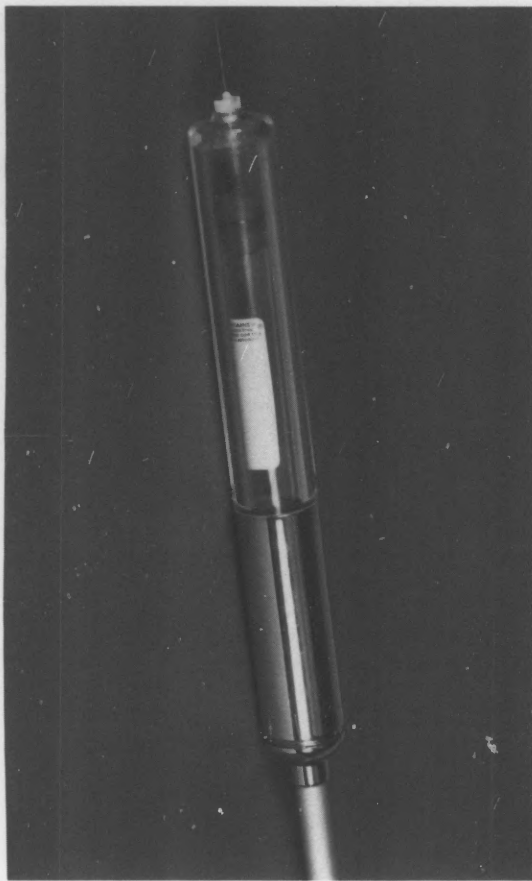


Figure 2. Aseptic bulk tank milk sampler with the tube and the needle (protective cap is removed) in place.

another sample is desired, the entire sampler is rinsed in tap water, dipped into the disinfectant solution and wiped dry with another single service paper towel. A new sterile vacutainer tube is then placed in the reservoir and a new needle placed in the plexiglas receptacle. Once again the sampler is configured into a "ready" position.

As previously described, approximately eighteen ml of uncontaminated milk sample from the bulk tank is directly withdrawn into a sterile, disposable, pre-labeled vacutainer tube in just a few seconds. The entire operation does not require any additional training of the milk-hauler operator or any person using the sampler. If new disposable vacutainer tubes and needles are used each time a sample is taken, with care, it is impossible to contaminate the sample.

#### ADVANTAGES OF THE ASEPTIC BULK TANK MILK SAMPLER

1. Simple and easy to use.
2. Low maintenance of reusable parts and the incorpo-

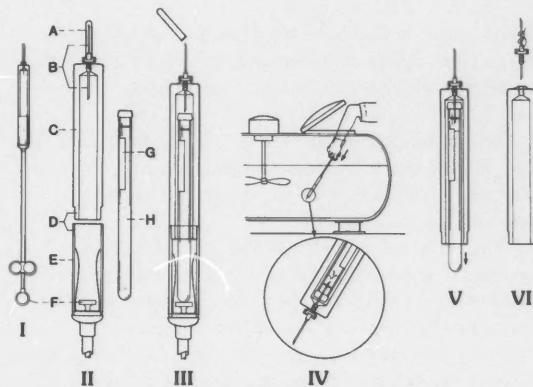


Figure 3. Details of aseptic bulk tank milk sampler and its use in bulk tank milk sampling. I. Aseptic bulk tank milk sampler. II. A. Protective cap of the sterile disposable needle., B. Sterile disposable needle., C. Sampler cap., D. Corresponding treated parts of the sampler cap and the sampler reservoir., E. Sampler reservoir. F. Plunger., G. Vacutainer label., H. Vacutainer tube. III. Assembled sampler with protective needle cap removed. IV. Sampling bulk tank milk by depressing plunger to engage vacutainer tube onto sampler needle to withdraw milk from bulk tank. V. Vacutainer containing the milk sample is withdrawn from the sampler cap. VI. Disposal of disposable needle.

ration of sterile disposable components directly in contact with the sample.

3. Samples obtained absolutely direct from any location in the bulk tank milk supply.

4. Samples (50 to 100) may be maintained in a small place during transportation and/or storage.

5. Disposable sample tubes lend themselves to pre-labeling (i.e. bar codes) eliminating the possibility of loss of identification. Bar-coded tubes will lend themselves to automated laboratory analysis.

6. Standardized sample size (i.e. standard vacutainer tubes) lends itself to automation of the laboratory analytical procedure.

7. Standardized vacutainer tubes lend themselves to the incorporation of a preservative of choice to retard rapid overgrowth of organisms if needed.

8. The modified balling gun and its plexiglas receptacle may be changed to meet the specific demands such as more or less milk being required for certain tests.

In conclusion, a simple, reliable, cost-effective and aseptic bulk tank milk sampler has been described and is being introduced to the dairy industry. Because of its suggested simplicity and reliability, this new method of

obtaining aseptic bulk tank milk samples warrants further evaluation.

#### ACKNOWLEDGMENT

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## **National Mastitis Council Meeting to be Held February 10-12, 1986**

The 25th annual meeting of the National Mastitis Council will be held February 10-12, 1986 at the Hyatt Regency Columbus in Columbus, Ohio.

The program features several outstanding speakers who will discuss topics of current interest in the field of mastitis. Included in the General Session will be a series of papers reviewing the International Dairy Federation seminar "Control of Bovine Mastitis", which was held in Kiel, W. Germany, and a panel discussion addressing the topic of diagnosing the problem herd. The featured international speaker is Dr. Frank Dodd, formerly of the National Institute for Research in Dairying, Reading, England, speaking on areas for potential progress in mastitis control and on a new concept in milking - hydraulic milking.

The meeting also features exhibits in the Technology Transfer Session along with board and committee meetings of the National Mastitis Council. All members and prospective members are encouraged to attend the meeting.

## **New Dairy Technology May Produce Low-Sodium Cheese**

Ultrafiltration technology may play an important role in reducing the sodium content of cheese, an application that could help people on low-salt diets.

Ultrafiltration uses pumps and membranes to remove water from milk, concentrating the milk and cutting refrigeration and hauling costs. University of Wisconsin-Madison food scientists have found that ultrafiltration can also remove sodium from milk before it's processed into cheese.

"If the dairy industry switches over to membrane technology, then there's a very obvious place for this process," says UW-Madison food scientist Robert Lindsay. "We want to devise methods to use either new technology or traditional methods to meet reduced sodium levels that are either suggested or demanded by government and medical authorities."

Sodium occurs in everything from table salt (sodium chloride) to processed foods. However, many nutritionists and medical scientists think sodium consumption has become excessive, and have linked excessive consumption with high blood pressure. The link has prompted research into ways to reduce the amount of sodium - especially sodium chloride - in food.

Salt is added during cheesemaking to help remove water and regulate fermentation. Because lower salt

levels allow moisture in the cheese, low-salt cheese ages more rapidly and manufacturers must adjust their aging and distribution schedules accordingly, Lindsay says.

Most efforts to reduce salt in cheese have used salt substitutes in the manufacturing process, he says. The use of ultrafiltration to reduce salt content is relatively new.

"This new information focuses on the use of membrane technology during pre-cheesemaking processing of milk," Lindsay says. "Along with the water that you remove during the concentration process, you selectively remove some salt components and let the remaining natural salts and flavor ingredients complement a modest addition of salt during cheesemaking. This departs from our earlier work on reduced-sodium cheese, where we left out some of the sodium chloride and substituted something else, such as potassium chloride, for saltiness."

The quality of low-salt cheese that is produced using ultrafiltration technology does not differ greatly from that of cheese made with salt substitutes, he says. However, this new method of making low-salt cheese may grow in significance as ultrafiltration technology spreads.

Lindsay presented a paper on this application of ultrafiltration Oct. 8 in Atlanta, Ga., at an International Dairy Federation seminar on new dairy products and cheese technology. The IDF seminar was held in conjunction with the annual Food and Dairy Exposition.

Lindsay has worked with UW-Madison food scientist Clyde Amundson on ways to reduce sodium in cheese. Amundson, who helped arrange the IDF seminar, and Carol Karahadian, graduate assistant, co-wrote and presented a paper on low-sodium cheese at the IDF meeting.

## **Candidates Sought For 1986 Harold Macy Award**

The Minnesota Section of IFT is seeking nominations for suitable candidates from all IFT sections for the 1986 Harold Macy Food Science and Technology Award.

The award, which was established in 1981, is to be given annually for an outstanding example of food technology transfer or cooperation between scientists or technologists in any two of the following settings: academic, government, and private industry. The purpose of the award is to advance the profession and practice of food technology and to honor Harold Macy, dean emeritus of the University of Minnesota and a founding member of IFT. Awardees will be invited to address the Minnesota Section. The award



consists of a \$500 honorarium and travel expenses.

Nominations for the award should be made on an appropriate form and are due by January 15, 1986. Nomination forms are available from Nancy Lane, Chairperson, Macy Award Committee, The Pillsbury Company, Research and Development, 311 Second Street S.E., Minneapolis, MN 55414.

## Paperboard Milk Carton Advertising Can Continue

Advertisements stating that paperboard milk cartons are superior to translucent plastic jugs in protecting milk's vitamins from light induced vitamin and flavor losses may continue, a Federal judge ruled in September.

U.S. District Court Judge Thomas A. Flannery denied the Society of Plastics Industry's (SPI) request for a broad injunction to prohibit the Paperboard Packaging Council (PPC) from continuing its consumer advertising and public relations campaign, following a seven-day trial. The judge required several minor changes in advertisements and public relations materials, but his order permits them to continue with the same nutritional message.

The PPC Milk Packaging Group's campaign promotes the nutritional advantages of paperboard milk cartons in protecting milk from vitamin and flavor losses caused by exposure to light, especially the fluorescent light in supermarket dairy cases.

The fact that the advertising campaign was well-designed and extremely effective in persuading consumers to switch from translucent plastic jugs to light-blocking paperboard milk cartons did not warrant an injunction prohibiting the PPC advertising, the judge declared in a 36-page opinion. The judge ruled that consumers have a right to receive the nutritional information contained in the PPC advertisements.

The judge ruled that with the required modification PPC can continue its milk carton advertising campaign which has been conducted in more than 40 market areas over the past three years.

To fully comply with the judge's ruling, PPC will modify its advertising to clarify to consumers whether certain vitamin loss figures it cites relate to whole or skim milk, and will remove references to several studies which did not reflect retail conditions.

"It's a real victory not only for PPC but for the consumer," commented Spencer A. Johnson, secretary of the PPC Milk Packaging Group. "The court has upheld the right of PPC to provide consumers with accurate information from laboratory studies about the damaging effects of light on milk," he noted.

Johnson added that a single research study commissioned by SPI did not persuade the court to

ignore the results of numerous independent laboratory studies by university scientists which show that light causes losses in the vitamin content of milk.

Johnson said that members of the Milk Packaging Group are unanimously committed to continuing the PPC advertising and public relations campaign in additional market areas.

## Natural Carcinogens Abound In Our Food Supply

Many naturally occurring carcinogens are present in the American food supply. This is not a cause for alarm, but it does show that there is a need to strike a more even balance in the evaluation of natural and man-made carcinogenic substances in our food, according to the report *Does Nature Know Best? Natural Carcinogens in American Food*, published by the American Council on Science and Health (ACSH), an independent scientific organization.

"Every time you eat a piece of toast, a mushroom, or a charcoal-broiled steak, you're eating carcinogens, substances that have been shown to be cancer-causing when evaluated by the same criteria that are used to assess man-made chemicals in food," said ACSH Executive Director Dr. Elizabeth M. Whelan.

"There's no reason to believe that natural carcinogens in food are a significant hazard to our health in the quantities ordinarily consumed, so there's no need to avoid toast, mushrooms, charcoal-broiled meat, or any of the other foods that contain naturally occurring carcinogens," she said. "In practice, natural carcinogens *can't* be avoided, since foods that contain them are so widespread that if you stopped eating all of them you would go hungry."

"Fortunately, the variety in our diets prevents us from being exposed to truly dangerous amounts of any one potentially harmful food component. There is currently no evidence that low-level exposure to any chemicals in the U.S. food supply - either natural or man-made - poses a significant risk of cancer."

"It is time for the American people and our regulatory agencies to stop acting on the presumption that *natural* is safe and *man-made* is suspect," said Dr. William R. Havender, Scientific Advisor to ACSH and co-author of the new report. "There is no scientific evidence to support this assumption. Indeed, the evidence on carcinogens in foods completely refutes it."

"Our new regulatory emphasis should be on the potency of a chemical carcinogen and the level of human exposure to it rather than on the chemical's natural versus artificial origin," he said. "It is no longer realistic to expect that we can remove every molecule of every carcinogen from our food supply. Instead, we should focus our efforts on the few

substances that pose a clear hazard to human health and try to distinguish these major risks from the multitude of tiny or hypothetical ones."

Common carcinogens in foods include hydrazines in mushrooms; allyl isothiocyanate in mustard and horseradish; pyrrolizidine alkaloids in herbs and herbal teas; ethyl carbamate in naturally fermented foods and beverages including bread, yogurt, soy sauce, beer, and wine; a variety of substances in coffee; and benzo(a)pyrene and related substances produced during the cooking (particularly charbroiling) of meats, the ACSH report states.

The American Council on Science and Health is an independent, nonprofit consumer education organization promoting scientifically balanced evaluations of food, chemicals, the environment, and health.

To obtain a complimentary copy of *Does Nature Know Best? Natural Carcinogens in American Food*, send a self-addressed, stamped (39¢ postage), business-size (#10) envelope to Natural Carcinogens Report, ACSH, 47 Maple St., Summit, NJ 07901.

### **UCLA Extension Presents Short Course on "Food Microbiology"**

Of benefit to microbiologists responsible for food safety and quality, "Food Microbiology with an Introduction to Hazard Analysis" is a five-day UCLA Extension short course emphasizing the microbial

ecology of foods. This class, meeting from January 20-24, deals with the influence of processing techniques on microflora, on safety and on the quality of various foods.

The course begins with a series of lectures on effects of physical and chemical agents on microorganisms in food, followed by a discussion of cleaning and sanitation in food operations and a lecture on the growth of microorganisms in foods. Other topics include: foodborne illnesses of microbiological origin, microbiological specifications for food, and practical aspects of microbiological control procedures.

The coordinator and lecturer is John H. Silliker, president, Silliker Laboratories, Carson, and adjunct professor, Department of Microbiology, UCLA. A consultant to the food industry for 24 years, Silliker is a member of the Salmonella Committee of the National Research Council and the FAO/WHO Expert Committee on Food Microbiology.

An additional lecturer is Elmer H. Marth, professor, Food Science and Bacteriology, University of Wisconsin, Madison. One of the country's foremost experts on mycotoxins and on the microbiological aspects of dairy products, Marth is co-author of *Staphylococci and Their Significance in Foods*.

"Food Microbiology" meets from 8:15 a.m. to 5 p.m. in Room G-33 West, UCLA Extension Building, 10995 Le Conte Avenue, Los Angeles. The fee is \$975, which includes course notes and textbooks. For further information, please call UCLA Extension at 213-825-1295.

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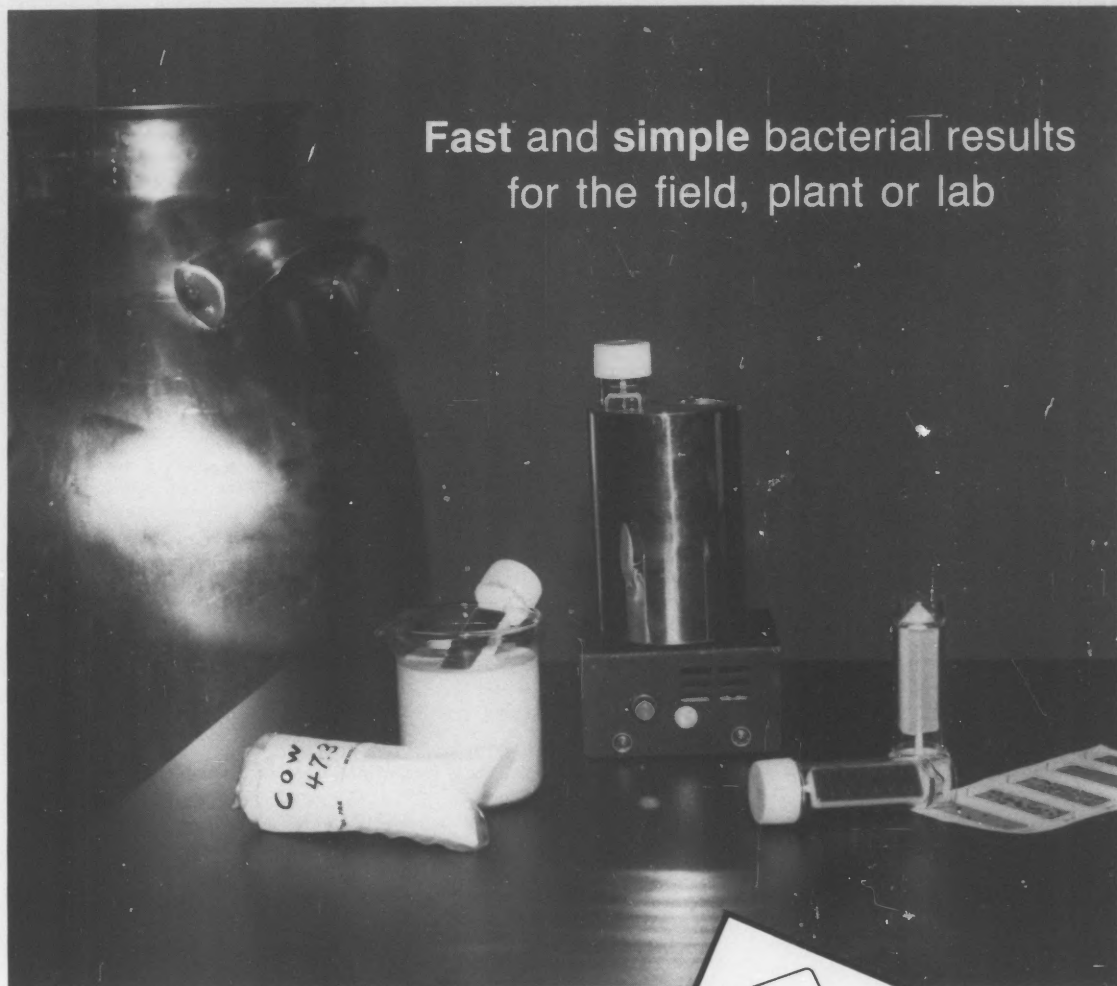
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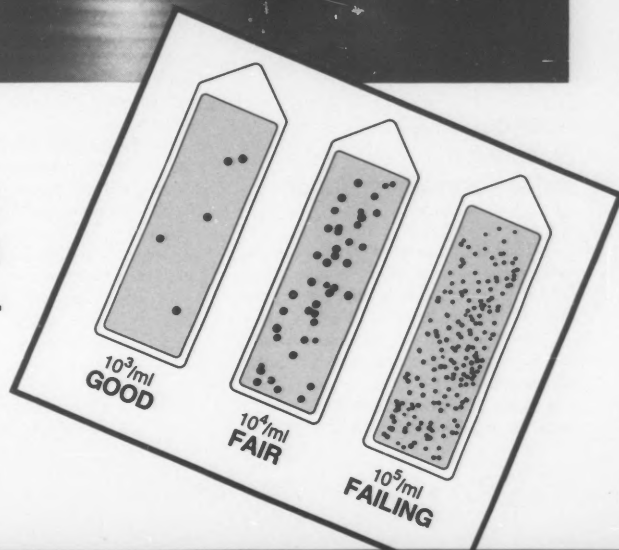


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For more information contact: The Jilson Corporation, 200 Atlantic Street, Hackensack, NJ 07601. 201-488-4646.

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### Booklet Offers Solutions to Bakery Sanitation Needs

• "Sanitation in the Bakery", an eight page guide to cleaning and sanitation in the bakery industry, is now available from Oakite Products. The booklet describes cleaners, sanitizers, and equipment for mechanized cleaning that can help the baker better meet Good Manufacturing Practices.

A variety of Oakite application equipment is described, in addition to detergents, detergent-



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• The 454 Magnum, a new Foodservice Digital Pocket Thermometer quickly checks hot or cold food preparation, processing, packaging and storage environments.

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The 454 Magnum comes with standard food liquid/food air probe, carrying case and optional surface and interior oven checking probes.

For further information contact: Testoterm, Inc., P. O. Box 468, Mount Freedom, NJ. 07970. 201-989-8869.

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sanitizers, sanitizers, brighteners, and stain and milkstone removers. The problems of milk and lime scale and corrosion are given special attention.

The booklet also includes "Sanitation at a Glance", a convenient summary table showing cleaning and sanitizing applications or deep fat frying equipment; pans, utensils, and racks; plastic trays and boxes; automatic dough making equipment; filling equipment; stainless steel; and liquid shortening tanks.

To get a free copy of "Sanitation in the Bakery", contact Oakite Products, Inc., 50 Valley Road, Berkeley Heights, NJ 07922. 201-464-6900.

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### New Food Grade Conveyor Belting

• R. J. Dick, Inc. has developed and introduced a new series of conveyor belting specifically for the food, drug, dairy, and chemical processing industries and equipment manufacturers serving them.

Fully approved by the United States Department of Agriculture, the new DIX-A-TEX Food Grade Belting is made of 100% Polyester fabric with a wide range of cover types and thicknesses. Top covers are all white polyurethane or white polyvinylchloride. Bottom sides of the belting are either uncovered polyester fabric impregnated with polyurethane, or covered like the top carrying surface. Uncovered bottom sides are excellent for slider bed applications.

Outstanding features of the new DIX-A-TEX Belting are a unique Finger-Flex Splicing method and sealed belt edges. The Finger-Flex splice eliminates the need for mechanical fasteners, although these may be used if necessary. Sealing the belt edges keeps out contaminants and eliminates edge fraying. All DIX-A-TEX Belting may be steam-cleaned or washed with water.

After installation at 3/4% to 1% initial tension, no further belt stretch occurs. Available stock widths up to 59 inches; wider belts can be made using longitudinal splicing. Roll lengths up to approximately 328 feet. Further details are provided in R. J. Dick Catalog F-851. Contact R. J. Dick, Inc., 101 Queen Drive, Box 306, King of Prussia, PA 19406. 215-265-3850.

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### B.O.D. Tester Slide Show Available

• "Better Ways of Biomonitoring Wastewater" is the title of a new slide show available free of charge from Tech-Line Instruments. It describes the application of the B.O.D. Tester/Wastewater Respirometer in short term (hours) B.O.D. testing, toxicity, treatability, process control and troubleshooting. Other applications such as anaerobic digestion testing, bioassay testing and pilot plant work are also explained. Instructions are given for interpreting the graphic results produced by the instruments and applying them to the testing and treatment of wastewater.

The 40 minute slide show consists of 84 color 35mm slides, a cassette tape and a copy of a written script.

For more information contact: Tech-Line Instruments, Tri Campus Park, P.O. Box 1236, Fond du Lac, Wisconsin 54935, or call Toll Free 1-800-328-7518. In Wisconsin call 1-800-242-3505.

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# Food Science Facts

## For The Sanitarian

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**Robert B. Gravani**  
Cornell University  
Ithaca, NY

### Food Deterioration And Spoilage Caused by Light

#### LIGHT

Almost all foods are exposed to light from natural and/or artificial sources during processing, packaging, storage, shipping and marketing. The exposure of foods to light can result in the deterioration or photodegradation of these products. This photodegradation usually occurs in food constituents such as pigments, fats, proteins, and vitamins resulting in discoloration, off-flavor development and vitamin losses. The subject of light induced changes is quite complex and will be discussed in two issues of Food Science Facts.

Light is a form of radiant energy that is usually described by a term called wavelength. The light that we can see (visible light) is only a very small part of the vast spectrum of electromagnetic energy. This spectrum includes:

- Gamma Rays
- X Rays
- Ultraviolet Rays
- Visible Light
- Infrared Rays
- Radiowaves

Most problems that occur in foods are caused by light in the visible and ultraviolet ranges.

In the past, most light-induced changes in food were caused by sunlight. The development of incandescent lights added only a few problems because these lamps emit low amounts of ultraviolet light. Innovations in marketing have led to the merchandising of foods in transparent and translucent packaging under high intensity fluorescent lights. This situation can result in the photodegradation of food constituents.

#### Sources of Light

Foods are exposed to several sources of light in their production and marketing. Some common light sources and their locations are shown below.

Light Source	Usual Location
Sunlight	Outdoors, Store Fronts, Windows and Skylights
Incandescent Lamps	Coolers, Storage Facilities
Fluorescent Lamps	Food Processing Areas, Display Cases, Food Preparation Areas

Incandescent lamps (regular light bulbs) have a metal filament that is heated to a glowing point. Fluorescent lights give off light when ultraviolet rays (resulting from the passage of electricity through a mercury vapor) strike certain materials called phosphors. These substances then give off visible light.

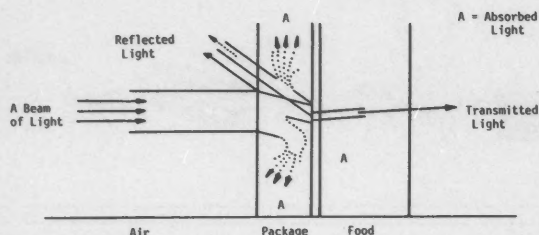
Foods are also exposed to other sources of light in the food industry. They include:

- Germicidal lamps used in walk-in coolers, food holding rooms, bakeries, and other areas to reduce bacterial and mold counts, and
- "Black lights" used to detect the presence of insects, rodent excreta and other kinds of contamination in foods.

When light strikes a package of food a number of things happen. The light is:

- Reflected off the surface of the package;
- Absorbed by the packaging material;
- Scattered and absorbed by the food; and
- Transmitted through the food

The diagram below shows this sequence of events.



The light that is absorbed by the food can cause deteriorative reactions of the food constituents. In most solid foods, the light only penetrates the outer layer of the product and photodegradation occurs in this surface layer. Discoloration on the surface of foods can certainly affect consumer acceptance of these products.

In liquid foods, light penetration can be greater and with mixing of the products due to agitation, larger portions of food constituents may be deteriorated.

The light sensitivity of a food depends on many factors including the:

- Light source strength and type of light that it emits;
- Distance of the light source from the food;
- Length of exposure;
- Optical properties of the packaging material;
- Oxygen concentration of the food; and
- The temperature

Light induced changes in food usually begin in one of two ways:

- 1) Light is absorbed by a component in the product that will directly undergo chemical reaction.
- 2) One component in a food causes some other component to undergo reaction because of light.

The deterioration of foods can occur when "light sensitive" constituents, like those shown below, are exposed to light.

Nutrients	Amino Acids	
Vitamin A	Tryptophan	
Vitamin B <sub>12</sub>	Phenylalanine	
Vitamin D	Tyrosine	
Folic Acid	Histidine	
Vitamin K		
Pyridoxine	Pigments	
Riboflavin	Anthocyanins	
Vitamin E	Carotenoids	
	Chlorophylls	
<th>Lipids</th>	Lipids	Myoglobin
Unsaturated Fatty Acids	Hemoglobin	
Phospholipids		

The next Food Science Facts will discuss light induced changes that occur in a variety of foods and how they can be prevented.

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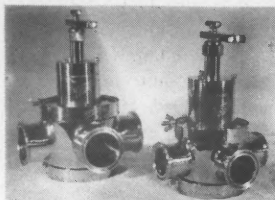
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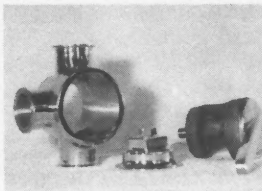
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# Dairy Quality

by Darrell Bigalke, Food & Dairy Quality Mgmt., Inc., St. Paul, MN

## PLANNING AND ORGANIZING A QUALITY MANAGEMENT SYSTEM

### Part II

Last month's *Dairy Quality Update* defined a Quality Management System (QMS) as a quality and management program designed to achieve production of quality products and improve profits. The QMS defines quality as conformance to specifications. Specifications for a QMS include product parameters that affect consumer acceptance and regulatory compliance as well as reflect quality costs. Quality costs are defined as prevention costs, appraisal costs, and product or process failure costs.

A QMS differs from conventional quality control/quality assurance programs in that personnel from the QMS group work with production and operations to achieve quality. The QMS emphasizes doing things right the first time thus reducing the cost of quality. An effectively operating QMS requires efforts, understanding, and commitment from all personnel involved in the manufacture, sales and distribution of food products. Achieving product quality and improving profits defect prevention requires effective organization and planning.

### 1. Objectives

Planning the implementation and operation of a QMS or any other quality program requires establishing objectives. Measurable objectives should include goals based on product specifications and timetables for completion of tasks such as establishing policies, procedures, and process control mechanisms.

Objectives must be measurable and capable of documentation. Quality improvement can only be achieved when the degree of quality is known. In this regard the degree of conformance to specifications is the key measurement. Specifications that reflect consumer acceptance and economies of operation must be measured and documented. As pointed out in last month's article, parameters that reflect consumer acceptance (shelf-life,

sensory qualities, consistency, safety, and others) can easily be measured and documented. However, parameters that reflect economies of operation are normally not easily documented. One approach to this problem is determining the "cost of quality." The "cost of quality" is defined as prevention costs, appraisal costs, and product and process failure costs. Prevention and appraisal costs include the costs associated with quality assurance and quality control. Product and process failure costs include recall costs, liability costs, scrap, reduced yields, down time, or any other cost that results from a product or process failure. Documenting the cost of product or process failures and establishing objectives of reducing these costs are essential to a properly operating QMS.

### 2. Organizational Structure

A QMS organizational structure is most effective when reporting directly to corporate management. A QMS department may function with a Quality Control group and a Quality Assurance group. The Quality Control group would be responsible for process control to assure conformance to specifications. The Quality Assurance group would be responsible for development of specifications based on safety, consumer acceptance, and economies of operation. Efforts from all operating departments within an organization are required to achieve production of products that conform to specifications. Specific responsibilities must be developed for each operational function. Table I suggests responsibilities for specific groups in an organization.

### 3. Progress Control Planning

Effective planning for the implementation and operation of a QMS requires the development of a "progress control chart." This requirement can be accomplished by development of a Gantt Chart or PERT (Program Evaluation and Review Technique) Chart or similar planning and control technique. These control techniques (1) facilitate planning and control by listing tasks to be accomplished and the time frames to complete these tasks.

TABLE 1.

1. Research and marketing determine product quality attributes critical to consumer acceptance and regulatory compliance.

2. Quality Assurance develops specifications based on safety, consumer acceptance, economies of production, and minimum tolerances identified by marketing and sales.

3. Manufacturing agrees to produce products under specifications and controls.

4. Quality Control inspects and evaluates the process to control product quality and economies of processing and distribution.

5. Management enforces policies with guidance from Quality Assurance.

6. Quality Assurance measures cost of quality, determines effectiveness of the QMS, and revises strategies to maximize profits.

Tasks that would be included on a control chart may include the following:

- (1) Establishment of product ingredient specifications
- (2) Development and implementation of procedures for determining the cost of quality
- (3) Development of policies
- (4) Development and implementation of specific process control procedures
- (5) Development of documentation and reporting systems
- (6) Development of written production, sanitation, distribution, procurement, and other manuals
- (7) Development of auditing procedures
- (8) Development of written contingency plans
- (9) Other tasks necessary to achieve production of quality products at optimum profit.

In summary, the key to an effectively operating Quality Management System is proper planning and organization. Planning starts with defining quality as conformance to specifications. Specifications must include product parameters that reflect consumer acceptance, safety and economies of operation. Measurement and documentation of conformance to specifications establish the objectives and determine their achievements necessary to operate the QMS. Organizational efforts must include clearly defining responsibilities for all departments and department members within an organization.

- (1) Koontz, H. and O'Donnell, C. (1976), *Management, A Systems and Contingency Analysis of Managerial Functions*, Fifth Edition, McGraw-Hill Book Company, N.Y.



**N.M.C.**

NATIONAL MASTITIS COUNCIL

### *When Bacteria Get into the Udder*

Mastitis-causing bacteria enter the udder during machine milking, between milkings and during the dry period. Transmission during milking occurs when contaminated milk droplets impact against the teat orifice. Impacts result from reverse air flow in the short milk tube of the inflation caused by erratic system vacuum changes and flow of air into teat cups during fall-off or teat cup squawk. Impacts of droplets containing *Staphylococcus aureus* or *Streptococcus agalactiae* may be jetted through the entire length of the teat duct into the cistern or partially into the teat duct.

During the intermilking period, bacteria colonizing the teat duct may move upward into cisternal areas by multiplication, physical movement or hydrostatic pressure. That pressure is caused by milk accumulation before milking that may dilate the teat duct nearest the udder and shorten the duct.

Between milkings, environmental streptococci and coliforms found in contaminated water, bedding and manure can contaminate teat ends and are a potential source of infection. Bacteria that are colonizing the teat duct between milkings may be moved farther up the teat during milking, possibly into the teat cistern, by impacts of sterile milk droplets.

The frequency of new intramammary infections is greatest during the early dry period. At drying off, the flushing effect of milk on bacteria in the teat duct is stopped and teat sanitization is discontinued. Therefore, not milking increases the potential source of infection. Both factors increase the changes of bacterial colonization of the teat duct which may persist for months and serve as a source of new infections when the cow freshens.

This article is one of a continuing series made available by the National Mastitis Council. For additional information contact: the NMC, 1840 Wilson Blvd., Arlington, VA 22201.

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Arlington, VA 22201  
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## TUBERCULOSIS - UNITED STATES, 1984

In 1984, 22,255 cases of tuberculosis were reported to CDC, for a rate of 9.4 cases per 100,000 population. Compared with 1983, this is a 6.7% decrease in the number of cases reported and a decline of 7.8% in the case rate.

Case rates for the 50 states ranged from 21.0/100,000 in Hawaii to 1.0/100,000 in Wyoming. The rate increased in eight states, remained unchanged in two, and decreased in 40.

The case rate for persons living in 57 cities with populations of 250,000 or more was 19.3/100,000 - more than twice the national rate. Urban rates ranged from 49.9/100,000 in Miami, Florida, to 2.3/100,000 in Omaha, Nebraska. Eight cities had rates at least three times the national rate. Miami, Florida; Newark, New Jersey; Atlanta, Georgia; San Francisco, California; Tampa, Florida; Oakland, California; Honolulu, Hawaii; and Washington, DC.

In 1984, 1,236 tuberculosis cases were reported among children under 15 years of age, including 759 cases among children under 5 years of age; in 1983, there were 1,360 and 818 such cases, respectively.

Official tuberculosis mortality statistics for the United States are compiled by the National Center for Health Statistics. Final tuberculosis mortality data for 1982 show 1,807 deaths. This is a 6.7% decrease from 1981 in the number of deaths reported.

**Editorial Note:** The 6.7% decrease in new reported tuberculosis cases in 1984 continues the downward trend noted for 1982 and 1983. Contributing factors include: (1) the participation of almost all states in a new national case reporting system requiring more accurate verification of cases and (2) a decline in the actual number of indigenous cases. During the past 3 years, health departments have implemented expanded outreach programs in high-incidence areas to ensure complete treatment of diagnosed cases and to strengthen contact investigation and follow-up activities.

When antituberculosis drugs were first introduced over 35 years ago, there was hope that the disease would soon be eliminated in the United States, even though over 100,000 new active cases and about 40,000 deaths from tuberculosis were reported annually. Given the current rate of decline, the elimination of tuberculosis appears unlikely before the year 2100. Over 20,000 new cases and 1,800 deaths still occur each year. Transmission of infection also continues, as evidenced by the continued occurrence of hundreds of cases in young children, most of whom are under 5 years of age. An accelerated rate of decline must be achieved if tuberculosis is to be fully controlled in this century.

Control of tuberculosis has been hampered by a number of factors. Unfortunately, many public and private sector health-care providers do not consider tuberculosis a problem. This perception has been fostered in part by the closing of tuberculosis sanatoriums and the institution of outpatient treatment programs.

Another problem that hampers control efforts for state and local health departments - which have the major responsibility for controlling this disease in the community - is non-compliance with prescribed therapy. Most patients require a minimum of 9 months' treatment, with monthly monitoring for drug toxicity, compliance, and response to therapy. Many patients are unwilling or unable to complete a self-administered course of therapy and may require directly observed therapy or other special assistance from the health department. An estimated

34,000 persons in health department registers are currently under medical supervision for tuberculosis, and each year, an estimated 200,000 persons exposed to new cases must be examined. Many of these persons, as well as other high-risk individuals, are placed on isoniazid preventive treatment for up to 12 months and also require monthly monitoring for drug toxicity and compliance.

A third obstacle to the effective control of tuberculosis is the emergence of tuberculosis organisms that are resistant to anti-tuberculosis drugs, especially isoniazid and streptomycin. Such resistance is relatively more common among persons from Asia, Africa, and Central and South America. However, the problem of drug resistance is not limited to the foreign-born. Community outbreaks of drug-resistant tuberculosis have occurred in Mississippi, Montana, New York, and more recently, Massachusetts and North Carolina.

Preventing the majority of new tuberculosis cases is difficult to achieve in a short period of time with currently available technology. An estimated 10 million persons in this country are infected with tubercle bacilli and carry a life-long risk of developing tuberculosis. Even if health departments could identify all the infected individuals in the country who are at high risk of developing disease and provide them with preventive therapy, tuberculosis would still occur in some infected individuals over the age of 35 years for whom preventive therapy is not recommended because the risk of isoniazid toxicity outweighs the benefits of therapy.

An acceleration of the decline can be achieved with (1) full implementation of existing prevention and control methodology, (2) development of new treatment, diagnostic, and prevention technologies; and (3) rapid implementation of these new technologies in all areas of the country as they are developed.

CDC, state and local health departments, and other public agencies and organizations will continue to work together to achieve the first step in June 1985, a small group of scientists will meet in Pittsfield, Massachusetts, to explore obstacles to tuberculosis elimination and to identify feasible new technologies that could be developed and used to accelerate the elimination of tuberculosis. This effort is sponsored by the U.S. Public Health Service, including CDC and the National Institutes of Health, the American Thoracic Society, and the Pittsfield Antituberculosis Association. Within the next few months, CDC will also identify a group of outside experts who will advise on the further development and implementation of a tuberculosis elimination plan. Successful accomplishment of the three action steps could bring about the elimination of tuberculosis in the United States a century earlier than is now projected. *MMWR* Vol. 34, No. 21, May 31, 1985.

## HELP!...AND WHERE TO FIND IT

Few individuals have the broad range of expertise to avoid or resolve every business crisis. Even with specific management and production expertise, external assistance is frequently necessitated by the sheer magnitude of regulations and dynamics of growth. Fortunately, a little digging in the right places can provide an escape from many predicaments.

The *Food and Drug Administration (FDA)*, the federal agency empowered to enforce food safety regulations, also provides assistance programs chiefly to help food manufacturers

anticipate and sidestep problems before they arise.

The programs fall into three categories:

**Industry information materials and assistance.** These are directed toward specific problem areas, such as food sanitation, or topics that have generated many inquiries. The materials, which elaborate on FDA policies, procedures, guidelines, and regulations, come in four forms: trade/industry memos and booklets; summaries of regulations and guidelines; workshops; and slide shows and table top exhibits.

**Industry quality assurance assistance.** According to FDA, "a quality assurance program is a company's principal consumer protection insurance policy." The agency provides a flow diagram that outlines procedures from receiving raw materials through production and storage of finished product. Details are available from the Industry Programs Branch.

**Foreign government assistance.** To assure conformity of imported foods to U.S. standards of safety, quality, and purity, FDA conducts this program which involves problem identification, technical assistance, certification, foreign inspections, and foreign visitor training.

Information on all programs is available from *Industry Programs Branch (HFF-326)*; Center for Food Safety and Applied Nutrition; Food and Drug Administration; 200 "C" Street, S.W.; Washington, D.C. 20204.

The *Federal Register* covers all proposed Federal regulations. Actions of the Food and Drug Administration appear in Tuesday and Friday editions. Subscriptions cost \$300 per year. Individual copies can be purchased for \$1.50. Local libraries, county courthouses, and Federal buildings generally have collections too.

Copies of the Federal Food, Drug, and Cosmetic Act; sections of the Public Health Service Act pertaining to biological products; the Radiation Control for Health and Safety Act; and the Fair Packaging and Labeling Act are compiled in a single booklet available for \$5.00 from the Superintendent of Documents, Government Printing Office (GPO), Washington, D.C. 20402.

Title 21, *Code of Federal Regulations (CFR)* contains codified regulations over which FDA has jurisdiction. General regulations for the enforcement of the Federal Food, Drug, and Cosmetic Act and the Fair Packaging and Labeling Act are available for \$6.00. Food standards, good manufacturing practice for food, low-acid canned foods, acidified foods, and food labeling are priced at \$6.50; food additives for \$6.50 also. Prepared Foods, April 1985.

#### FOOD ANIMAL RESIDUE AVOIDANCE DATABASE (FARAD)

The Food Animal Residue Avoidance Database (FARAD) is a Residue Avoidance Program pilot project that involves the cooperative efforts of research and Extension specialists in five States: California (University of California), North Carolina (North Carolina State University), Florida (University of Florida), Illinois (University of Illinois), and Idaho (University of Idaho).

FARAD is designed to serve as an information resource for the entire Residue Avoidance Program (RAP) research-education-regulation effort. Development of this database was recommended by the RAP State project leaders and representatives of animal commodity and associated industry groups. It receives funds from the Food Safety and Inspection Service (FSIS-USDA). The National Agricultural Library (NAL) has contributed literature searches and delivery of documents to the project.

The objective of FARAD is to identify, extract, assemble, review, and distribute reviewed information about residue avoidance programs throughout the United States. The types of information available through FARAD include basic drug registration information, withdrawal times, indications for use, as well as more complex technical information about pharmacokinetics and toxicokinetics of chemicals in food animals.

Data on 100 chemicals selected by FSIS as being the greatest source of residue problems have been included in FARAD the first year. North Carolina serves as the Data Analysis and Support Center (DASC). Information for FARAD is gathered from a number of sources including FSIS, the Food and Drug Administration (FDA), and drug companies; but most is from research journals. Computerized literature searches are conducted by FARAD States and by the National Agricultural Library and provided to North Carolina. The scientific papers and articles that may contain data useful to FARAD are identified. These documents are delivered to North Carolina through the auspices of NAL and are further distributed to California and Florida. These three States serve as the data extraction sites.

One unique aspect of FARAD is the extraction and evaluation of toxicokinetic information from these published literature sources. There are numerous papers published which contain residue information that have never been analyzed kinetically. FARAD extracts these usable data and converts them into parameters that can be used to predict decontamination times and other withdrawal times. This literature evaluation and analysis will also be especially helpful in identifying areas that need further research. Another unique aspect is that FARAD investigators will meet twice a year to validate all entries for accuracy and prepare summaries of the data for inclusion in FARAD.

The information for FARAD is assembled by North Carolina and is peer-reviewed by three validation sites - California, Illinois, and Idaho. FARAD consists initially of five separate files. These are: (1) Trade name, (2) Generic Drug, (3) Species, (4) Pharmacokinetic, and (5) Bibliography. A separate FARAD file also lists RAP State projects, educational materials, and project contact persons. The complete refereed, peer-reviewed database is available at three Regional Access Centers (RAC's) which are California, Florida and Illinois.

Direct computer access to FARAD, although technically available, is not planned initially but is being considered for future years for portions of the database. The complete FARAD program and data files from North Carolina will be provided to NAL and are available to Federal agencies that want the complete system for their internal use. FARAD will also provide updates to these agencies as well as to the RAC's as additions and the updates are developed. FARAD veterinary pharmacologists and toxicologists at the RAC's will use FARAD to answer questions received by telephone from veterinarians, producers, Extension specialists, County agents, and others. Use information will be developed for assessment of the effectiveness of FARAD. Telephone numbers for the three RAC's are as follows:

West - University of California - 916-752-7507  
Central - University of Illinois - 217-333-3611  
East - University of Florida - 904-392-4085

The FARAD information service is now available for use to assist food animal producers and those who work with them to avoid illegal residues in meat, milk, and eggs. - May 2, 1985, Dairy News 17 USDA-Extension Service, May, 1985.

## 1985 PA Dairy Sanitarian's - Laboratory Director's Conference

The sixth joint conference of the two groups was held at the Pennsylvania State University, May 13-15. Actually it was the 46th annual meeting for laboratory directors and 43rd meeting for fieldmen, now called sanitarians. More than 225 persons heard over 40 speakers on topics or as panel members. The six panels, having from two to four speakers each, provided the most popular and useful information. Judging from the 60 comment forms completed, the conference was well accepted. Much of this is the result of increased input by planning committees and their cooperation with Penn State. More than 60 different topics were suggested for future meetings.

The Sanitarians Award was presented to Alfred Gottfried, Hershey Chocolate Co. and the Distinguished Service Award of the sanitarians to Gene Lauver, Maryland - Virginia Milk Producer's Association. The Laboratory Director's Association presented an Honorary Life Membership Award to Harry Behney, Pennsylvania Department of Agriculture.

The 1986 meeting will be May 12-14 at the Keller Conference Center at Penn State.



Gerald Shick, left, presenting the Distinguished Service Award for 1985 to J. Gene Lauver, of Maryland-Virginia Milk Producers Association.



Gerald Shick, left, giving 1985 Sanitarians Award to Alfred Gottfried, right, Hershey Chocolate Co.



1985-1986 officers of the Pennsylvania Dairy Sanitarians Association. Left to right, Gerald Shick, Chairman Awards Committee and Vice President; Arthur Freehling, President; Audrey Throne, Secretary-Treasurer; and Donald Lerch, President-Elect.

## W.A.M.F.S. Meeting Highlights

Approximately one hundred and sixty people attended the Sixth Annual Joint Educational Conference co-sponsored by the Wisconsin Association of Milk and Food Sanitarians, the Wisconsin Environmental Health Association, the Wisconsin Association of Dairy Plant Field Representatives and the Wisconsin Dairy Technology Society held September 25 and 26, 1985 at the Valley Inn in Neenah, Wisconsin.

The meeting featured topics on dairy, food and environmental health. The keynote address, discussing Wisconsin's Economy in the 80's, was given by Dr. Jon G. Udell of the University of Wisconsin. The general session speakers were Jerri Linn Phillips of the Wisconsin Division of Health, discussing Cancer and the Environment, and Dr. P. C. Vasavada of the University of Wisconsin, River Falls, talking about Microorganisms that Cause Problems in the Food Industry.

Speakers on dairy topics included Randy Daggs, Wisconsin Division of Health; Andy Johnson, D.V.M.; John Malcheski, Morning Glory Farms and Robert Cropp, University of Wisconsin - Platteville.

Speakers featuring food topics included Charles E. Phillips, F.D.A.; Dr. Elmer Marth, University of Wisconsin, and Norm Kirschbaum, Wisconsin Department of Agriculture.

Environmental topics were discussed by Ron Buege, West Allis Health Department; Dr. Bob Nelson, University of Wisconsin - Eau Claire; Kris Hansen, RMT, Inc.; and J. Lyell Clarke, Clarke Outdoor Spraying Company.

The Wisconsin Association of Milk and Food Sanitarians presented the Sanitarian of the Year Award to Norm



Kirschbaum, Administrator, Food Division, Wisconsin Department of Agriculture, Trade and Consumer Protection.

The W.A.M.F.S. Business Meeting featured a discussion on committees and how they can be improved and made more meaningful. Dave Myers, Wisconsin Dairies, Inc., served as president the past year and was given the Past President's Plaque. Eugene Lindauer, Wisconsin Department of Agriculture, Trade and Consumer Protection, Green Bay was installed as president for the 1985-1986 term.



Norm Kirschbaum, left, presented the Sanitarian of the Year Award by Don Konsoer, right, Wisconsin Department of Agriculture.

## Anderson Named AIMFES President

Kenneth Anderson of Harold Wainess & Associates was named president of the Associated Illinois Milk, Food, and Environmental Sanitarians (AIMFES) at the association's annual business meeting. The meeting, held jointly with the Illinois Dairy Fieldman Conference, in Champaign, Illinois at the Chancellor Inn, was a two-day session held September 9-10, 1985.

Other officers moved up were: Robert Crombie, The Crombie Company, and Joe Byrnes, Dart-Kraft to president-elect and first vice-president, respectively. This is according to the AIMFES constitution.

Phil Hermesen, Associated Milk Producers, Inc., was elected as second vice-president. Clem Honer, Dairy Record, was re-elected secretary-treasurer.

Sondra Schrank, Illinois Department of Public Health, was elected sergeant-at-arms. Marlene Bordson, Illinois Department of Public Health, and Dan Biggins, McDonald Corporation were elected as auditors.

Speakers on the program included: Dr. John Nelson, Dart-Kraft, and Donald Voeller, FDA, discussing how industry and regulatory agencies can work together.

Roger Capps, Prairie Farms Dairy, Inc., and Mary Grigsby Stangel, Lorraine Cheese Company, addressed the effect of farm milk quality on plant processing.

Dr. George Muck, Dean Foods Company, described new dairy foods products in the marketplace. Robert Anderson, FDA, presented a PMO and salmonella update.

Ken Anderson, Harold Wainess & Associates, related extended product shelf life with the use of "clean filling" machines. Dr. Tony Luksas, United Dairy Industry, addressed ultrafiltration of milk at the farm level.



Associated Illinois Milk, Food, and Environmental Sanitarians (AIMFES) new Board of Directors: Front, left to right, Sondra Schrank, Sergeant-At-Arms; Robert Crombie, President-Elect; Ken Anderson, President; Jerry Kopp, Past-President. Back row, Phil Hermesen, Second Vice President; Clem Honer, Secretary-Treasurer; and Joe Byrnes, First Vice President.



AIMFES Past Presidents: left to right, Jerry Kopp, Carl Ziesemer, Dr. George Muck, and Ray Moldenhauer. Not pictured, Howard Ferreira.



Merry Christmas from your IAMFES staff, front row left to right, Suzanne Trcka, John Keninger, Julie Heim, Mary Myers. Back row left to right, Kate Wachtel, Kelm Brueschke, Jacki Parrish, and Kathy Hathaway.



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**Effect of Ionizing Radiation on Ascospores of Three Strains of *Byssoschlamys fulva* in Apple Juice**, W. B. Van Der Riet and W. H. Van Der Walt, National Food Research Institute, Council for Scientific and Industrial Research, P.O. Box 395, Pretoria, 0001, Republic of South Africa

*J. Food Prot.* 48:1016-1018

Radiation inactivation of the ascospores of three strains (M 68-79), NRRL 1125 and NRRL 2614) of the heat resistant mold *Byssoschlamys fulva* suspended in apple juice, was investigated. Whereas the ascospores of strain M 68-79 were significantly more sensitive to ionizing radiation, those of strains NRRL 1125 and NRRL 2614 did not differ significantly from one another in this respect. High numbers of ascospores of the more resistant strains required an absorbed dose of approximately 7.2 kGy (95% confidence interval 6.7 to 7.9 kGy) for inactivation; a decimal reduction dose ( $D_{10}$ ) of approximately 1.2 kGy was estimated for these strains. Ascospores of strain NRRL 2614 were confirmed as more radiation resistant when a small proportion survived an absorbed dose of 5 kGy and spoiled apple juice within a 3-month storage period. Although it was possible to inactivate *B. fulva* ascospores at absorbed doses of <10 kGy, it is probable that flavor impairment of apple juice, as well as cost currently limit the feasibility of this process.

**Medium to Culture and Differentiate Coagulase-Positive and -Negative Staphylococci from Bovine Milk**, Bruce R. Beatty, Ralph J. Farnsworth, Arnold J. Lund, Richard H. Lyon and Gilbert E. Ward, Mastitis Research Laboratory, Department of Large Animal Clinical Sciences, College of Veterinary Medicine, University of Minnesota, Saint Paul, Minnesota 55108

*J. Food Prot.* 48:1019-1021

A medium which incorporates CAMP factor produced by *Streptococcus agalactiae* (group B) into sheep blood agar was used to culture and identify coagulase-positive staphylococci from bovine milk. Of 506 staphylococcal isolates from bovine milk, 92.5% of coagulase-positive organisms produced a wide zone of complete hemolysis, whereas 98.9% of coagulase-negative organisms did not. The agreement of this one-step culture and identification test with the standard tube coagulase test was higher than that of the deoxyribonuclease test medium, Baird-Parker egg yolk medium, tellurite glycine medium and slide coagulase tests.

**Bioluminescent Standard Curves for Quantitative Determination of Yeast Contaminants in Carbonated Beverages**, Kenneth J. Littel and Kathleen A. LaRocco, Food Applications, Packard Instrument Company, 2200 Warrenville Road, Downers Grove, Illinois 60515

*J. Food Prot.* 48:1022-1024

The bioluminescent adenosine triphosphate (ATP) assay is a rapid and sensitive tool for quantitating contaminant yeast levels in beverage samples. A simple model system is described for generating standard curves relating yeast ATP to conventional colony forming units (CFUs). Bioluminescent standard curves were generated by spiking commercial cola or diet lemon-lime samples with *Saccharomyces rouxii* ATCC 36141. Yeast cells were concentrated onto filters under vacuum and ATP was subsequently extracted from the cells for analysis. Correlation coefficients for each *S. rouxii* standard curve indicated strong linear relationships between ATP and CFU levels ( $r > 0.90$ ). A composite standard curve ( $r = 0.97$ ) of data collected from all the *S. rouxii*-spiked studies predicted yeast levels from spiked cola samples in later experiments. When predicted yeast CFU values were plotted against conventional yeast CFU values for three different yeast types, a correlation coefficient of  $r = 0.82$  was obtained.

**Roles of Phosphate in Influencing Resistance to and Bacterial Uptake of Tetracycline and Streptomycin in Lactic Streptococci**, R. P. Sinha, Food Research Institute, Research Branch, Agriculture Canada, Ottawa, Ontario K1A 0C6, Canada

*J. Food Prot.* 48:1025-1027

The effect of buffering growth media with an equimolar concentration of organic phosphate ( $\beta$ -glycerophosphate) or inorganic phosphate such as  $K_2HPO_4$  or  $Na_2HPO_4$  on resistance levels of lactic streptococci to tetracycline and streptomycin was tested. Addition of 88 mM  $K_2HPO_4$  in the medium was most effective in increasing streptomycin resistance as compared to the same molarity of glycerophosphate or  $Na_2HPO_4$ . With tetracycline, the strain showed maximum sensitivity in a medium buffered with  $K_2HPO_4$  as compared to a medium with  $Na_2HPO_4$  or glycerophosphate. The uptake of  $^3H$ -tetracycline by cells increased steadily with time of incubation in the medium with  $K_2HPO_4$ , while no steady increase was found in the medium without phosphate. The increased uptake of  $^3H$ -tetracycline in the medium where cells showed maximum sensitivity suggests that in lactic streptococci, resistance to the drug develops because of a reduction in the cellular uptake which can be reversed by phosphate. The reverse may be true for streptomycin.

**Isolation and Plasmid Characterization of a *Lactobacillus* Species Involved in the Manufacture of Fermented Sausage**, Dennis A. Romero and Larry L. McKay, Department of Food Science and Nutrition, University of Minnesota, 1334 Eckles Avenue, St. Paul, Minnesota 55108

*J. Food Prot.* 48:1028-1035

Isolation and characterization of a *Lactobacillus* species capable of proper acid production in a sausage environment is described. The isolate from sausage, categorized as a lactobacillus in the subgenus *Streptobacterium*, was designated *Lactobacillus* sp. DR1. Growth occurred at 5 and 42°C but not at 45°C. Fructose, galactose, glucose, mannose, melibiose, N-acetylglucosamine, ribose, sucrose and trehalose were fermented. Gas production from glucose was not observed. In MRS glucose broth, D(-) and L(+) lactic acid were produced. *Lactobacillus* sp. DR1 contained a single cryptic plasmid of approximately 30 megadaltons (Mdal). In sausage fermentation trials, both *Lactobacillus* sp. DR1 and plasmid-free derivative DRIC lowered the pH to below 5.3 after 8 h in the smokehouse. Conjugation was demonstrated through the transfer of plasmid pAMβ1, which encodes erythromycin resistance, from *Streptococcus lactis* 2301β to *Lactobacillus* sp. DR1. Mutanolysin-generated protoplasts could be regenerated using 0.5 M ammonium chloride, lactose, maltose or sucrose as osmotic stabilizers. Regeneration frequencies ranged from less than 1.0% up to 35%; however, transformation of *Lactobacillus* sp. DR1 protoplasts by plasmid DNA in the presence of polyethylene glycol (PEG) was unsuccessful.

**Effects of Exercise, Electrical Stimulation and Vacuum Packaging on Bacterial Counts and Tenderness of Fresh Beef Primal Cuts**, G. L. Nortjé, H. D. Naumann, A. Laubscher, I. Grobler, L. Naudé, W. Oosthuizen, E. Jordaan and R. T. Naudé, Animal and Dairy Science Research Institute, Private Bag X2, Irene 1675, Republic of South Africa

*J. Food Prot.* 48:1036-1039

Two wholesale cuts, the silverside (*M biceps femoris*) and bolo, (outside round and clod) from 8 steers were used in this study. Four steers were artificially stressed and the right side of all carcasses was electrically stimulated. Primals were cut into 3 equal portions after 72 h post slaughter, chilling at approximately 4°C, and were vacuum packaged. No microbial differences ( $P > 0.05$ ) were found between primals within treatments. Primals from stressed carcasses had higher pH values ( $P < 0.01$ ) and psychrotrophic, lactobacillus, anaerobic and aerobic counts than from nonstressed carcasses. Lactobacilli did not dominate the microbial population. Electrical stimulation (ES) and the cuts used had an influence on shear force values ( $P < 0.05$ ). ES cuts were significantly more tender than controls. Results suggest that animals should be well rested before slaughter.

**Influence of Temperature and Water Activity on Aflatoxin Production by *Aspergillus flavus* in Cowpea (*Vigna unguiculata*) Seeds and Meal**, P. E. Koehler, L. R. Beuchat and M. S. Chhinnan, Department of Food Science, University of Georgia, Agriculture Experiment Station, Athens 30602 and Experiment, Georgia 30212

*J. Food Prot.* 48:1040-1043

Experiments were done to determine the influence of temperature (21, 30 and 37°C) and  $a_w$  (0.76 to 0.98) on aflatoxin production by *Aspergillus flavus* on cowpea (*Vigna unguiculata*) seeds, meal and meal supplemented with onion. Larger quantities of aflatoxin were produced at 21 and 30°C than at 37°C. The highest amount of aflatoxin (2777  $\mu\text{g}/20\text{ g}$ , dry weight basis) was observed in meal containing onion at  $a_w$  0.98 after 20 d of incubation at 21°C. A level of 870  $\mu\text{g}/20\text{ g}$  was detected in seeds at  $a_w$  0.95 after 14 d of incubation at 30°C. Meal at  $a_w$  0.96 supported production of 551  $\mu\text{g}$  of aflatoxin per 20 g after 20 d at 30°C. Temperature had little influence on the optimal  $a_w$  for aflatoxin production in cowpea meal. However, an increase in temperature resulted in a decreased optimal  $a_w$  for aflatoxin production on whole cowpeas. When known quantities of aflatoxin were added to cowpea meal which was subsequently steamed for 5 min, only 29% was extractable using a variety of procedures, indicating that the toxin may be bound in some manner to cowpea constituents as a result of heat treatment.

**Comparison of a Dry Medium Culture Plate (Petrifilm SM Plates) Method to the Aerobic Plate Count Method for Enumeration of Mesophilic Aerobic Colony-Forming Units in Fresh Ground Beef**, Lorraine B. Smith, Terrance L. Fox, and F. F. Busta, Department of Food Science and Nutrition, University of Minnesota, 1334 Eckles Avenue, St. Paul, Minnesota 55108

*J. Food Prot.* 48:1044-1045

Mesophilic aerobic microbial populations in fresh ground beef were enumerated with a new system, Petrifilm™ SM Plates (PSM), and with the conventional aerobic plate count (APC) method using standard methods agar (SMA). Total colony-forming units were determined in 119 fresh ground beef samples (29 extra-lean, 30 lean and 60 regular) purchased at nine different retail markets over a period of 6 wk. Linear regression analysis of PSM vs. APC counts gave a slope of 0.963, an intercept of -0.027, and a correlation coefficient of 0.951. Mean  $\log_{10}$  counts on PSM were 5.86 compared to 6.11 on SMA ( $P < 0.01$ ) or a mean  $\log_{10}$  difference of -0.25. These analyses indicate that the Petrifilm SM method would be a possible alternative for the aerobic plate count method.

**Salmonella Growth in Cooked Beef at Selected Cooling Rates**, Norman J. Stern and Carl S. Custer, Meat Science Research Laboratory, Beltsville Agricultural Research Center, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland 20705

*J. Food Prot.* 48:1046-1049

Results of this study support the present USDA Food Safety Inspection Service (FSIS) cooling requirement for cooked meat products and remind the consumer to refrigerate such products. USDA FSIS requires food processors to cool certain cooked



meat products between 4 and 49°C within 2 h. Our study evaluated the adequacy of that requirement by determining how cooling rates affected growth of salmonellae in cooked meats. Two strains of *Salmonella* sp. showing resistance to multiple antibiotics were compared with a susceptible strain, and were shown to be similar in growth capabilities. These antibiotic resistant strains were inoculated in ground beef or beef cubes. In experiments simulating precooking contamination, heavily inoculated ( $10^9$  CFU/g) ground beef meatballs were cooked to 63°C (145°F) and cooled to either 23 or 4°C (40°F) within 2 to 6 h. Increases in the numbers of the surviving pathogen were small (ca.  $0.1 \log_{10}$ /g) when the product was cooled to 4°C within 2 h. Surviving salmonellae increased greater than tenfold when the meats were cooled over intervals of 6 h. A 4-h cooling interval permitted an intermediate growth rate. *Salmonella* held in ground beef at 23°C for 6 h showed less than 1- $\log_{10}$  increase per gram. Experiments with *Salmonella* inoculated onto the surface of beef cubes after cooking also indicated that the 2-h cooling interval prevented substantive proliferation.

**Growth Inhibition of *Mycoplasma gallisepticum* following Membrane Insertion of Cholesterol Autoxidation Products**, Anne M. Herian, Noreen M. Kuehl and Ken Lee, Department of Food Science, University of Wisconsin-Madison, Madison, Wisconsin 53706

*J. Food Prot.* 48:1050-1053

A model for studying the effect of cholesterol autoxidation products on membrane function was developed. Eight cholesterol autoxidation products were tested for their effect on growth of *Mycoplasma gallisepticum*. None gave better growth than cholesterol. When substituted for cholesterol in the growth medium, 6-ketocholesterol and cholesterol triol caused significant (78%) growth inhibition after 42 h. Recovery of radiolabeled  $^3\text{H}$ -cholesterol triol ([1,2,6,7- $^3\text{H}$ (N)]) indicated that 26% was incorporated into membranes, even though minimal or no growth had taken place. Inhibitory effects may have been due to assimilation of cholesterol autoxidation products into the cell membrane.

**Estimation of Potential Shelf Life of Cottage Cheese Utilizing Bacterial Numbers and Metabolites**, J. R. Bishop and C. H. White, Department of Dairy Science, Louisiana Agricultural Experiment Station, LSU Agricultural Center, Baton Rouge, Louisiana 70802-4404

*J. Food Prot.* 48:1054-1057

A study was conducted to investigate the use of bacterial numbers and their metabolites as estimators of the potential shelf life of cottage cheese. Dry cottage cheese curd and cream dressing were obtained on the day of processing. Portions of the cream dressing were inoculated with *Pseudomonas fluorescens* P27 to result in approximate levels of 0, 1,000 and 100,000 bacteria per g in finished cottage cheese after combining the curd and cream. Samples, stored at 7°C, were senso-

rially evaluated on a daily basis and analyzed every 7 d for up to 35 d. On days of analysis each sample was subjected to preliminary incubation (PI) as follows: none, 21°C for 7 h, 21°C for 14 h, 13°C for 18 h and 18°C for 18 h. For each PI, samples were enumerated by aerobic plate count, modified psychrotrophic bacteria count and gram-negative (CVT) count. Samples were enumerated for the standard psychrotrophic bacteria count without PI. Samples were also exposed to 18°C for 18 h PI in plate count broth for impedance detection measurements. Endotoxin (lipopolysaccharide) concentration and proteolysis were determined by the *Limulus* amoebocyte lysate assay and the o-phthalaldehyde method, respectively. Bacterial enumerations proved to be of little estimative value as the highest correlation coefficient obtained was -0.61. Endotoxin, proteolysis and impedance detection methods resulted in high correlation coefficients as related to potential shelf life of cottage cheese, with values of -0.81, -0.87 and -0.90, respectively. A prediction equation was formulated from the data.

**Residue Levels of Daminozide in Apple Trees Sprayed the Preceding Spring and Summer**, W. A. Dozier, Jr., K. S. Rymal, J. W. Knowles, J. A. Pitts and R. B. Reed, Department of Horticulture Chilton Area Horticulture Substation and Research Data Analysis, Alabama Agricultural Experiment Station, Auburn University, Alabama 36849

*J. Food Prot.* 48:1058-1061

Daminozide residue levels in fruit and vegetative parts of apple trees were determined the year following foliar spray treatments with daminozide at recommended rates and times and at excessive rates and times closer to harvest than recommended. Trees were sampled in December, March and August following spraying. Daminozide residues were found in all vegetative plant parts, with the highest residue levels found in the buds, bark and xylem of spurs, and in terminal and lateral buds; the lowest residue levels were found in the bark and xylem of stems. Residue levels were affected by both rate and time of application. Residue levels increased as application rates increased, but the response to rate was less when treatments were applied 21 d after bloom (125 d before harvest) than when treatments were applied closer to harvest. The highest residue levels were from treatments applied the day of harvest. Higher residue levels were found in March samples than December samples. Residues had been dissipated to low levels by the August sampling date. No daminozide residues were found in apple fruit from trees treated the previous year with recommended levels of daminozide applied at the recommended time. However, low residue levels were found in fruit treated with 2 $\times$  and 4 $\times$  rates of daminozide at times closer to harvest than recommended.

***Salmonella typhimurium* Phage-Type 10 from Cheddar Cheese Implicated in a Major Canadian Foodborne Outbreak**, J.-Y. D'Aoust, D. W. Warburton and A. M. Sewell, Bureau of Microbial Hazards, Health Protection Branch, Health and Welfare Canada, Sir Frederick G. Banting Research Center, Tunney's Pasture, Ottawa, Ontario, Canada

Levels of *Salmonella typhimurium* phage type 10 in Cheddar cheese implicated in a major Canadian foodborne outbreak ranged from 0.36-9.3 salmonellae/100 g. Such a low level contamination likely accounted for the uneven distribution of the organism among subsamples of individual lots. Coliform and *Escherichia coli* counts were within acceptable limits, whereas three of the 11 lots tested contained  $\geq 10^5$  *Staphylococcus aureus* per gram but no staphylococcal enterotoxins. *Campylobacter* and *Yersinia spp* were not detected in any of the 12 lots examined. Ability of *S. typhimurium* to survive up to 8 months in Cheddar cheese stored at refrigerator temperature (5°C) underlines the inadequacy of current regulations requiring a 60-d storage of cheese manufactured from heat-treated (unpasteurized) milk before sale. Results underlined the greater sensitivity of selective enrichment in tetrathionate brilliant green (43°C) than in selenite cystine (35°C) for detection of *Salmonella* in cheese.

**Relationship Between Extracellular Neutral Protease Production and Appearance of Bleb-Like Evaginations in *Pseudomonas fragi***, S. S. Thompson, Y. M. Naidu and J. J. Pestka, Department of Food Science and Human Nutrition, Michigan State University, East Lansing, Michigan 48824-1224  
J. Food Prot. 48:1067-1070

*Pseudomonas fragi* is one of several pseudomonads known to produce proteolytic enzymes. During growth of *P. fragi* in brain heart infusion broth (BHI) at 10°C, the bacterial population increased from  $10^7$  to over  $10^{10}$  CFU/ml after 130 h, with a concurrent increase in pH from 7.4 to 8.5. Maximal extracellular protease activity occurred after 60 to 72 h. Ultrastructural examination of cells grown in BHI showed the presence of bleb-like evaginations of the cell wall. Similar structures were not detected when *P. fragi* was grown in Koser citrate broth, a medium which was unsuitable for supporting protease production by *P. fragi*.

**Foodborne and Waterborne Disease in Canada - 1979 Annual Summary**, E. C. D. Todd, Bureau of Microbial Hazards, Food Directorate, Health Protection Branch, Health and Welfare Canada, Ottawa, Ontario K1A 0L2, Canada  
J. Food Prot. 48:1071-1078

Data on foodborne disease in Canada in 1979 are compared with data for 1978. A total of 825 incidents, comprising 650 outbreaks and 175 single cases, causing illness in 5503 persons was reported for 1979. The number of incidents and cases decreased by 1.3% and 7.7%, respectively, from 1978 to 1979. Like the previous year, *Salmonella spp.* were responsible for more incidents (62) and cases (1754) than any other agent. Other incidents were caused by *Staphylococcus aureus* (29),

suspect mold and yeast (18), *Bacillus cereus* (16), *Clostridium perfringens* (11), *Bacillus subtilis* (1) and *Hafnia alvei* (1). No *Clostridium botulinum* cases were reported. Five incidents of trichinosis, three of paralytic shellfish poisoning, two involving insect infestation and one each of scombroid, lupin alkaloid and broom tea poisoning and an allergic reaction from beef adulterated with pork were reported. Chemicals implicated in causing illness included tin, rancid compounds, monosodium glutamate and extraneous matter. The deaths of three persons were attributed to salmonellosis and probable mushroom poisoning. About 33% of incidents and 38% of cases were associated with meat and poultry. Vegetables, fruits, bakery products and marine products were also important vehicles in causing foodborne disease. Mishandling of food took place mainly in food-service establishments (38.9% of incidents, 59.3% of cases) and homes (13.3% of incidents, 7.0% of cases). However, mishandling by manufacturers caused some problems including salmonellosis from a cake and staphylococcal intoxication from canned fish and sausages. Over 53% of reported foodborne disease incidents occurred in Ontario and more than 18% in British Columbia, but the number of incidents per 100,000 population was highest in the Northwest Territories. Narrative reports of selected foodborne incidents are presented. Four waterborne disease outbreaks were reported in 1979 with a total of 73 cases. Lack of adequate water treatment led to the illnesses in at least three of the outbreaks.



A Happy Halloween was had by all at the Ames office. Tradition calls for everyone to dress up on that day. Winners were the witch (Suzanne) and the bag lady (Julie).

Front row, left to right, Mary Myers, clown (3-A Standards, DAIRY AND FOOD SANITATION); Kathy Hathaway, Minnie Mouse (Executive Mgr);

Back row, left to right, Suzanne Trcka, witch (Assoc. Editor, DAIRY AND FOOD SANITATION); Kate Wachtel, just weird (Advertising Manager); John Keninger, woman (Advertising Sales); Julie Heim, bag lady (part time office help); Jacki Parrish; invisible ghost (Membership Services as well as answering the phone). Hope you all had a good Halloween!

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110	130	150	170	190	210	230	250	270	290	310	330	350
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112	132	152	172	192	212	232	252	272	292	312	332	352
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114	134	154	174	194	214	234	254	274	294	314	334	354
115	135	155	175	195	215	235	255	275	295	315	335	355
116	136	156	176	196	216	236	256	276	296	316	336	356
117	137	157	177	197	217	237	257	277	297	317	337	357
118	138	158	178	198	218	238	258	278	298	318	338	358
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Holsum Foods  
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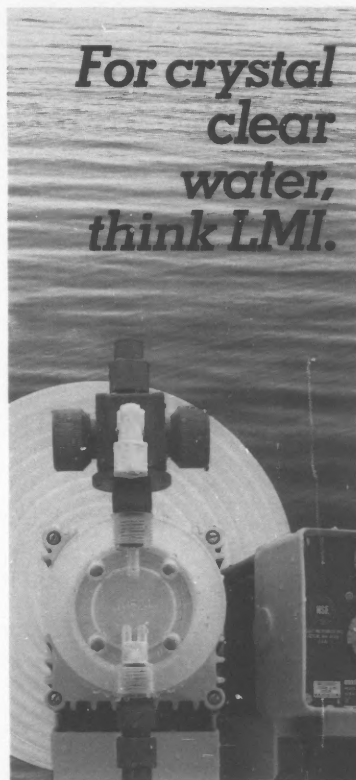
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January 14-16, 11TH ANNUAL MEETING TROPICAL AND SUBTROPICAL FISHERIES TECHNOLOGISTS, to be held at Holiday Inn, International Airport, Tampa, FL. For more information contact: John Koburger, 449 Food Science Building, University of Florida, Gainesville, FL 32611: 904-392-1991.

January 20-24, FOOD MICROBIOLOGY WITH AN INTRODUCTION TO HAZARD ANALYSIS, to be held at the UCLA Extension Building, Los Angeles, CA. For more information contact: UCLA Extension, 10995 Le Conte Avenue, Los Angeles, CA. 213-825-1295.

January 27-29, BAKING PRODUCTION TECHNOLOGY SEMINAR, to be held at the Sheraton Anaheim, Anaheim, CA. For more information contact: Mrs. Donna Mosburg, Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

February 5-6, FOOD PROCESSORS' SANITATION WORKSHOP, Presented by the University of California Cooperative Extension, Food Processors' Sanitation Association, and Golden Gate Chapter of the Environmental Management Association, along with representatives of various food trade associations. For more information contact: Kathryn Boor, Food Science and Technology, University of California, Davis, CA 95616. 916-752-1478.

February 10-12, 25TH ANNUAL MEETING OF THE NATIONAL MASTITIS COUNCIL, to be held at the Hyatt Regency Columbus, Columbus, OH. For more information contact: John Adams, National Mastitis Council, 1840 Wilson Blvd., Arlington, VA 22201. 703-243-8268.

February 12-13, DAIRY AND FOOD INDUSTRY CONFERENCE, to be held at Ohio State University. For more information contact: John Lindamood, Department of Food Science and Nutrition, 2121 Fyffe Road, The Ohio State University, Columbus, OH 43210.

February 24-26, 12TH ANNUAL TECHNICAL SEMINAR, to be held at the Holiday-Inn University Center, Gainesville, FL. For more information contact: ABC Research Corporation, 3437 SW 24th Avenue, Gainesville, FL.

February 27, MEAT PROCESSING CONFERENCE, to be held at the Hyatt Regency, Oakland, California. For more information contact: A. W. Brant or Shirley Rexroat, Department of Food Science & Technology, University of California, Davis, CA. 95616. 916-752-2191.

March 16-19, AMERICAN CULTURED DAIRY PRODUCTS INSTITUTE ANNUAL MEETING AND CONFERENCE, to be held at Hilton Palacio Del Rio, San Antonio, TX. For more information contact: Dr. C. Bronson Lane, ACDPI, P. O. Box 7813, Orlando, Florida 32854. 202-223-1931.

March 19, INDIANA DAIRY INDUSTRY CONFERENCE, to be held at Stewart Center, Purdue University, West Lafayette, IN. For more information contact: James V. Chambers, Food Science Department, Smith Hall, Purdue University, West Lafayette, IN. 47907. 317-494-8279.

March 24-28, MID-WEST WORKSHOP IN MILK AND FOOD SANITATION, to be held at Ohio State University. For more information contact: John Lindamood, Department of Food Science and Nutrition, 2121 Fyffe Road, The Ohio State University, Columbus, OH. 43210.

March 25 & 26, WESTERN FOOD INDUSTRY CONFERENCE, to be held at University of California, Davis, CA. 95616. For more information contact: J. C. Bruhn or Shirley Rexroat, Department of Food Science & Technology, University of California, Davis, CA. 95616. 916-752-2191.

April 14-18, FRUIT AND FRUIT TECHNOLOGY RESEARCH INSTITUTE INTERNATIONAL CONFERENCE to be held at the CSIR Conference Centre, South Africa. For more information contact: Symposium Secretariat S.341, CSIR, P.O. Box 395, Pretoria 0001, South Africa. Telephone: 012 869211 x 2063. Telex: 3-630 SA.

April 23, SANITATION WORKSHOP FOR THE FOOD PROCESSING AND FOOD SERVICE INDUSTRIES, to be held at Inn at the Park, Anaheim, CA. For more information contact: Kathryn Boor, Food Science and Technology, University of California, Davis, CA 95616. 916-752-1478.

April 29-May 1, WORKSHOP ON TRACE ANALYSIS OF FOODS. For more information contact: G. Reineccius, Department of Food Science and Nutrition, University of Minnesota, 1334 Eckles Avenue, St. Paul, MN 55108. 612-373-1438.

May 5-7, 6TH INTERNATIONAL FOOD & WINE SHOW, to be held at the Civic Auditorium and Brooks Hall, San Francisco, CA. For more information contact: Sandra Call, National Fairs Inc., 1902 Van Ness Avenue, San Francisco, CA 94109. 415-474-2300.

May 12-15, ASEPTIC PROCESSING AND PACKAGING WORKSHOP, to be held at Purdue University, West Lafayette, IN. For more information contact: James V. Cham-

bers, Food Science Department, Smith Hall, Purdue University, West Lafayette, IN 47907. 317-494-8279.

May 12-14, PENNSYLVANIA DAIRY SANITARIANS ASSOCIATION MEETING, to be held at Pennsylvania State University. For more information contact: Sidney Barnard, Pennsylvania State University, 8 Borland Lab, University Park, PA 16802. 814-863-3915.

May 26-31, 2ND WORLD CONGRESS FOODBORNE INFECTIONS AND INTOXICATIONS will take place in Berlin (West) at the International Congress Centre (ICC). For more information contact: FAO/WHO Collaborating Centre for Research and Training in Food Hygiene and Zoonoses, Institute of Veterinary Medicine (Robert von Ostertag-Institute), Thielallee 88-92, D-1000 Berlin 33.

June 29-July 2, 29TH CONFERENCE OF THE CANADIAN INSTITUTE OF FOOD SCIENCE AND TECHNOLOGY, to be held in Calgary, Alberta, Canada. For more information contact: Terry Smyrl, Ph.D., Alberta Horticultural Research Center, Brooks, Alberta, Canada, T0J 0J0. 403-362-3391.

July 12-19, SIXTH INTERNATIONAL WORKSHOP ON RAPID METHODS AND AUTOMATION IN MICROBIOLOGY, to be held at Kansas State University. For more information concerning Program contents contact: Daniel Y.C. Fung, Call Hall, Kansas State University, Manhattan, KS. 66506. 913-532-5654. For registration information contact: Joe Pittle, Conference Center, Wareham building, Anderson Avenue, Manhattan, KS 66502. 913-532-5575.

July 15-19, PURDUE CANNERS TECHNICIANS MOLD COUNT SCHOOL. For more information contact: Dr. James V. Chambers, Food Science Department, Smith Hall, Purdue University, West Lafayette, IN 47907. 317-494-8279.

AUGUST 3-7, IAMFES ANNUAL MEETING to be held at the Radisson South, Minneapolis, MN. For more information contact: Kathy R. Hathaway, IAMFES, Inc., P.O. Box 701, Ames, IA 50010. 515-232-6699.

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AUGUST 2-6, IAMFES ANNUAL MEETING to be held at the Disneyland Hotel, Anaheim, CA. For more information contact: Kathy R. Hathaway, IAMFES, Inc., P.O. Box 701, Ames, IA 50010. 515-232-6699



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components, or devices that are outside the scope of other NSF standards or criteria. These devices are used in handling, treatment, or disposal of wastewater. The purpose of *C-9* is to evaluate the performance of devices such as grinder pumps, package wastewater treatment plants, septic solids retainers, etc.

If you wish any of the publications illustrated, or more information about our testing and Listing programs, please write to National Sanitation Foundation, P.O. Box 1468, Ann Arbor, MI 48106 USA. Telephone: (313) 769-8010; Telex: 753215 NATSANFND UD.

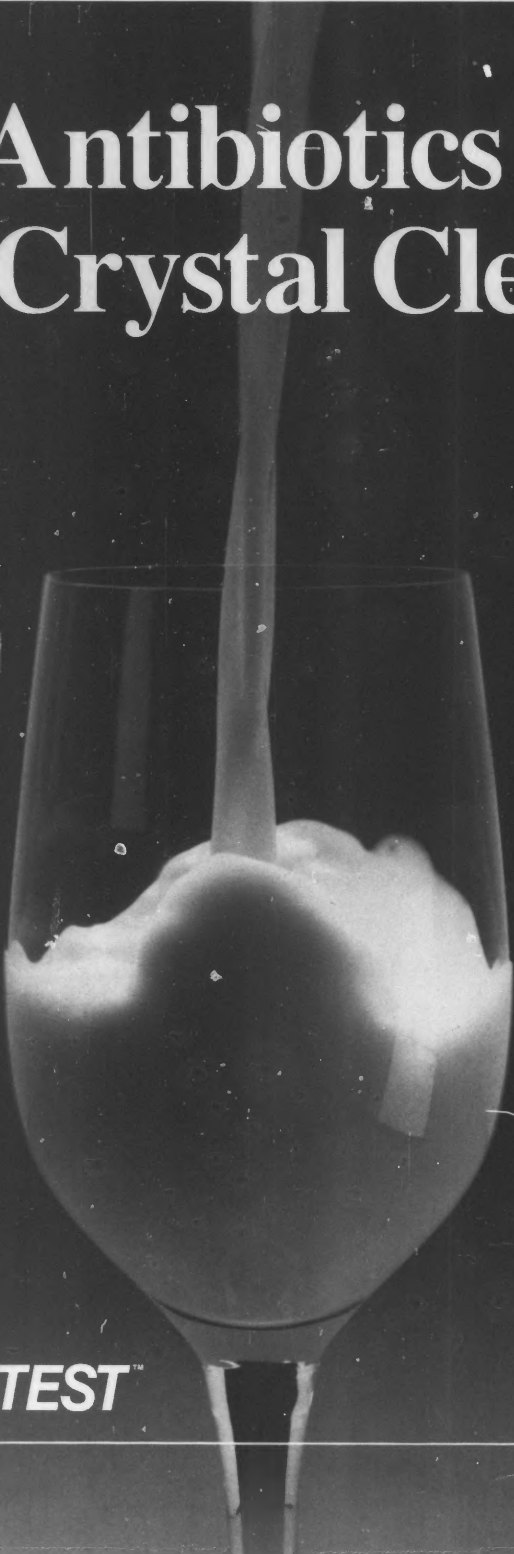


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