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Dairy and Food Sanitation®

A Publication of the International Association of Milk, Food and Environmental Sanitarians, Inc.

NCIMS Informational Statements

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An Outbreak of *Salmonella enteritidis* in a Michigan Restaurant

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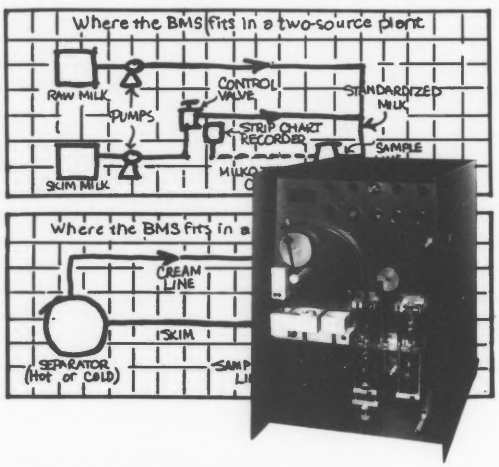

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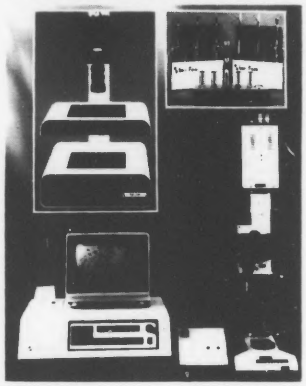

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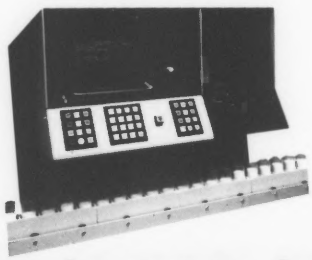

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Dairy and Food Sanitation

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NCIMS Informational Statements for Developers of Dairy Product Analysis Methods

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Developers of equipment and methodologies for performing dairy product microbiological and chemical analyses need to be aware of the procedures by which such methods gain official recognition and approval for use. New, improved methods are indeed essential to achieving the highest possible state of composition and quality control, and the dairy industry and allied organizations and regulatory agencies welcome their development and use.

It is the intent of this paper to (1) provide background information on the organizations/agencies currently involved in methods classification and approval, (2) indicate how these organizations/agencies interact in the process of classifying and/or approving methods and (3) explain how a developer should proceed in attempting to obtain a given status of recognition for a new/improved method.

Background Information

Currently three organizations play a role in validation and approval of procedures used for microbiological and chemical analysis of milk and milk products. These are: The American Public Health Association (APHA), the Association of Official Analytical Chemists (AOAC), and the National Conference on Interstate Milk Shipments (NCIMS).

At the outset it should be recognized that while each organization is committed to the need for establishing and monitoring the quality of analytical methods, the reason for granting final approval may differ somewhat. Official recognition by one of the three may or may not, therefore, lead to a similar recognition by the others. For example, a method may achieve AOAC recognition without being accepted by the APHA or NCIMS. This could happen when, for example, a procedure found to give suitable results under AOAC guidelines, does not produce data that falls within a range of values necessary for regulatory adoption for dairy industry application. Developers should be forewarned of this fact and be prepared to seek out information regarding specific applications prior to embarking on method development.

A brief review of the three United States organizations that play active roles in acceptance of methods may provide some helpful insights.

American Public Health Association (APHA)

APHA publishes "Standard Methods for the Examination of Dairy Products." This book is prepared with the assistance of a technical committee comprised of knowledgeable dairy scientists from industry, government and academia. Fifteen editions of the book have been published. Organized both by type of analytical procedure and by products, this reference provides basic chemical and microbiological procedures for the analysis of milk, cheese, frozen desserts and other dairy products. Tests for pathogenic microorganisms, pesticide analysis and

radio-active substances are not included. Procedures are classified by type as follows:

Class O: A method or procedure that has been subjected to a thorough evaluation, has been widely used, has thereby demonstrated its value by extensive application, but may not have been formally collaboratively studied. This classification will include methods that are referred to as standard methods in current APHA publications; essentially, it is a "grandfather clause."

Class A_1: A method or procedure that has been subjected to a thorough evaluation, has demonstrated its application for a specific purpose on the basis of extensive use and has been successfully collaboratively tested.

Class A_2: A method or procedure that has been subjected to a thorough evaluation and has been successfully studied collaboratively.

Class B: A method that has been used successfully in research or other situations, has been devised or modified explicitly for routine examination of samples, has had limited evaluation and has not been tested collaboratively.

Class C: An unproved suggested method not previously used but one that has been proposed by recognized laboratory workers as useful and gives promise of being suitable.

Class D: A method that previously has been placed in Classes O, A or B, but which through technological advances or significant change in numerical level of acceptable exposure or other circumstances, is being superseded by a method of a higher classification. A Class D method would probably be removed from subsequent editions of "Standard Methods for the Examination of Dairy Products."

Association of Official Analytical Chemists (AOAC)

AOAC publishes "Official Methods of Analysis of the AOAC," currently, in its 14th edition. The "Official Methods of Analysis" incorporates procedures for the analysis of food (including dairy products), pesticides, feeds, fertilizers, drugs, environmental and toxic substances, and cosmetics. All AOAC procedures have undergone a full collaborative study. The collaborative study process utilizes the analysis of at least five samples by at least six separate laboratories (30 data points), providing a known statistical estimate of the method's precision (between and within laboratory variability) and accuracy. Collaborative studies are conducted by Associate Referees using individual analysts (Collaborators). Associate Referees are guided by General Referees who, in turn, are supervised by one of eight different Methods Committees. Dairy chemistry is included under Method Committee C, while dairy microbiology is under Method Committee F. An Official Methods Board, with the assistance of AOAC staff, provides overall guidance and administration of the methods approval process. All proposals for collaborative studies must be reviewed and approved by the General Referee and method committee statisticians. All completed collaborative studies must be reviewed and approved by the General Referee, and method committee statistician, the appropriate method committee and, ultimately, by the AOAC membership.

Through a recently developed "Memorandum of Understanding" between APHA and AOAC, an agreement was reached to prevent conflicting methods classifications and duplication of development costs. This memorandum requires that all new methods classified by APHA as A1 or A2 must be classified by AOAC as either "Official First Action" or "Official Final Action." *Hence, all new methods to be petitioned for APHA classification of A1 and A2 must undergo and successfully pass the AOAC collaborative study process.*

Anyone interested in seeking one of the above classifications for any new method should contact appropriate representatives of both APHA and AOAC. Currently, these individuals are:

APHA - Seiko Brodbeck, Associate Executive Director, APHA, 1015 15th St. NW, Washington, DC 20005 (202) 789-5621

AOAC - Rita C. Bahner, Assistant Executive Director, AOAC, Suite 210, 1111 No. 19th, Arlington, Virginia 22209 (703) 522-3032

Specific requirements exist for classification by each organization. Failure to work with each will result in the failure of a method to receive classification and official usage within the dairy industry.

National Conference on Interstate Milk Shipment (NCIMS)

NCIMS is a cooperative organization of individuals representing regulatory and enforcement officials of state and federal governments as well as interested dairy industry parties. NCIMS utilizes the Grade A Pasteurized Milk Ordinance (PMO), a model regulation for use by state agencies as a means of providing uniformity in regulation and enforcement. The PMO specifies: 1) equipment and good manufacturing practices for dairy farms and processing plants, 2) product standards, and 3) methods to be used in the regulation and enforcement of the document, including laboratory procedures for the examination of Grade A milk and milk products for regulatory purposes.

NCIMS *does not generally develop or classify analytical methods*. The NCIMS relies on APHA and AOAC to perform this/these function(s), unless

otherwise approved by the NCIMS. NCIMS will selectively utilize analytical procedures classified as 0, A1 or A2 by APHA or "Official First Action" or "Official Final Action" by AOAC, unless otherwise approved by NCIMS. Therefore, methods developers will find it worthwhile, if not essential, to obtain classification of a method before petitioning NCIMS for utilization. The NCIMS relies on its laboratory committee to recommend selections for laboratory methodolgy to meet PMO requirements.

Once a classification is obtained for one or both APHA and AOAC, the method is afforded the recognition such status provides. However, the method is *not automatically* utilized by NCIMS. Of necessity, the test must first be compatible with essential requirements of NCIMS utilized methodology (providing, for example, values that fall in ranges used in NCIMS Programs). Again, it is encumbent upon the developer to understand or determine these requirements before developing a procedure for submission for NCIMS utilization.

Given an appropriate method (or to determine in an official way whether or not a method is appropriate) the process of obtaining NCIMS utilization starts with the submission of a "problem" or request for action by NCIMS.

The request must be made in writing to the Executive Secretary of NCIMS. At present, that position is held by H. H. Vaux. His address is: H. H. Vaux, Executive Secretary/Treasurer, NCIMS, 1235 Medinah Drive, Fort Myers, FL 33907. The deadline for such request for any given Conference year is announced by the Executive Secretary (normally in March or April).

If the delegates vote in favor of the recommendation, the method is then brought before FDA for concurrence with NCIMS action. If FDA concurs, the procedure may be utilized.

Those issues with which FDA does not concur will be referred to the Executive Board for further discussion. (Within 30 days if possible). If mutual concurrence is obtained, the changes shall be effective within 45 days of the FDA-Executive Board meeting unless otherwise mutually agreed upon by FDA and the Executive Board.

The key to NCIMS utilization of a method usually lies in meeting standards of accuracy, repeatability and precision in relation to accepted methods of known validity. A major mission of NCIMS is to promote uniformity of testing across the United States, hence a method must not only meet criteria of analytical acceptability, but also promote the furtherance of uniformity in the data gathering process undertaken by dairy industry and government agencies.

Dairy and Food Sanitation, Vol. 6, No. 9, Pages 380-384 (September 1986)

An Outbreak of Salmonella enteritidis Associated with Consumption of Food At a Restaurant in Marquette County, Michigan

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184 US 41 Hwy.
Negaunee, MI 49866

INTRODUCTION

On Monday, July 22, 1985, the Marquette County Health Department was notified of a culture confirmed case of salmonella by the F.A. Bell Memorial Hospital emergency room. Later that day another call was received from Bell Memorial Hospital stating that a second case of salmonella had been detected. It was also pointed out that both affected cases had recently eaten at a local restaurant in Marquette. An epidemiologic investigation of this possible foodborne outbreak of salmonella was begun.

EPIDEMIOLOGIC INVESTIGATION

Methods

Beginning on the morning of Tuesday, July 23, 1985, the individuals known to have salmonella were contacted in order to determine their illness and food intake history. The affected individuals were questioned about other people they knew who may have had a similar illness. As a result of this questioning, several other potentially ill individuals were identified and attempts were made to contact them in order to gain additional information. Concurrently, the emergency room at Marquette General Hospital was contacted to determine if individuals with a similar illness had been seen there in the recent past. This resulted in a list of five or six individuals who had been treated during the weekend of July 20 and 21st with apparent gastrointestinal infections.

At approximately noon on July 23, three individuals from the Environmental Health Division and a consultant from the Food Service Division of the Michigan Department of Public Health went to the restaurant and spoke with the owner. Two of these individuals then went on to begin the environmental investigation discussed below. The other two individuals interviewed the owner and several food service workers. The owner was given a number of fecal specimen containers to be distributed to the food handling staff, and available food samples were collected and delivered back to the Health Department for transport to the State Laboratory in Houghton by courier. The owner provided the names of a number of recent customers as derived from credit card slips and reservation lists. The remainder of Tuesday, July 23, and most of Wednesday, July 24, was spent in contacting recent customers of the restaurant under investigation determining their food intake and illness histories. By 8:00 a.m. on Thursday, July 25, approximately 40 individuals including several restaurant employees had been identified who had recently eaten at the restaurant and who claimed to have subsequently become ill within several days with gastrointestinal symptoms. The great majority of these individuals had not sought medical care during the initial phase of the investigation. All individuals who complained of having had a gastrointestinal illness after consuming food at the suspect restaurant were asked to submit a stool specimen for analysis by the State Laboratory.

As a result of an analysis of the information available, on the morning of Thursday, July 25, 1985, it was decided that the restaurant had to be closed pending further investigation of the suspected salmonella outbreak. This decision was primarily based on the realization that a large number of restaurant employees were likely infected. A meeting was held with the owners of the restaurant and they were informed of this decision. The restaurant was closed at approximately 10:00 a.m. on Thursday, July 25, 1985. Stool specimens from all restaurant employees were requested.

Because many individuals potentially affected could not be identified, a news release was prepared and a news conference was scheduled for 4:00 p.m. on Thursday, July 25, 1985. The news release requested that all individuals who had consumed food from this particular restaurant since July 17 contact the Health Department so that potentially infected individuals could be identified and receive precautionary instructions. Non-ill consumers of food from the suspect restaurant were also

urged to contact the Health Department so that data could be collected from them as controls. The news release also indicated that the Health Department would expand hours of operation to 10:00 p.m. daily in order to facilitate communication with potentially affected individuals.

At 1:30 p.m. on July 25, an informational meeting was held with county commissioners and other county officials to inform them of the situation and to gain assistance needed in continuing the investigation. During this meeting, it was decided that the Health Officer/Medical Director would be the county's spokesman during the investigation. It was also determined that additional personnel and equipment resources would be needed by the Health Department to assist them in completing the investigation. As a result, arrangements were made for temporary assignment of additional county employees to the Health Department and for the installation of five additional phone lines for the Health Department.

As a result of the news release, the Health Department received approximately 1,000 telephone calls from individuals who had consumed food from the suspect restaurant during the indicated period of time. Approximately one-third of those who responded complained of having had a gastrointestinal illness within several days of having consumed food at the suspect restaurant.

Throughout this period of time, both hospitals in the county continued to report large numbers of positive cultures for salmonella among in-patients, emergency room patients and patients seen in physicians' offices.

For the next seven days (until Thursday, August 1) a team of employees from the Marquette County Health Department with assistance from two staff members from the Michigan Department of Public Health collected, organized, and analyzed the large amount of data generated by this investigation. In addition, the state and/or local health departments having jurisdiction in areas where out-of-town people who had become ill resided, were contacted so that appropriate follow-up could occur. After the news release on July 25, numerous phone calls were received from local, state and national media concerning updates in regard to the investigation.

A case-control study was conducted on July 31 and August 1. For purposes of this case-control study, a case was defined as an individual who ate one lunch or supper meal at the suspect restaurant between 7/16/85 and 7/22/85 and subsequently within 72 hours experienced an illness characterized by diarrhea and either abdominal cramps or fever. Food consumption histories of 180 cases who met this definition were compared with the food consumption histories of 155 individuals who ate the same meals but did not become ill. Appropriate statistical tests (i.e., either chi square or Fisher's exact) were performed to determine significance of observed associations.

Results

As a result of this extensive investigation, 350 individuals were identified who complained of having developed a gastrointestinal illness after eating at the suspect restaurant. For the purpose of this investigation, a case was eventually defined as anyone who had a stool culture positive for *Salmonella enteritidis* or who had diarrhea and either abdominal cramps or fever after having consumed food at the restaurant. Based on this definition, 293 cases were ultimately identified of whom 39 were restaurant employees (all culture confirmed) and of whom 33 ate more than one meal at the restaurant. The 293 individuals reported the following symptoms: diarrhea 251 (94.7%), abdominal cramps 232 (87.5%), fever 139 (52.5%), nausea 133 (50.2%), vomiting 36 (13.6%).

Approximately 10 individuals were hospitalized with gastrointestinal illness. Overall, it is likely that close to 1,000 individuals were exposed at this particular restaurant. The incubation period ranged from 1.5 to 154 hours (median 42 hours). The epidemic curve based on the 263 cases for which the day of illness onset is known is presented in Figure 1.

Analysis of food histories indicated that cases consumed food from the suspect restaurant over a 15 day period (from 7/10 to 7/25) although most of those affected consumed food on or after 7/16/85. Over 100 separate food items were consumed by restaurant patrons during this 15 day period. Many menu items and all meal periods (i.e., breakfast, lunch and supper) were implicated, although several foods were more commonly consumed and most affected individuals consumed food during lunch and supper meal periods.

The results of the case control study comparing 180 cases with 155 controls demonstrated that consumption of several food items was significantly associated with developing subsequent gastrointestinal illness consistent with salmonellosis. Some foods were only associated with illness on one date, while others were associated with developing an illness after being consumed on several dates. Tables 1 through 4 present the foods significantly associated with becoming ill at various meals or combinations of meals. In particular, Table 1 lists those foods significantly associated with illness on a certain day and at a certain meal. Table 2 lists those foods that were significantly associated with illness when foods consumed at all lunch periods were analyzed. Table 3 lists those foods significantly associated with illness when all supper meals were combined. Table 4 lists those foods significantly associated with developing illness when all lunches and suppers were combined, as well as all food items consisting of turkey in whole or in part.

During the environmental investigation, it was determined that turkey was an ingredient in many of the implicated foods in that any foods advertised as containing chicken actually contained turkey and all soups prepared at the restaurant had a turkey base prepared from the remains

TABLE 1. *Food statistically associated with illness during particular meals.*

Date	Meal	Food	P-Value	Test
7/17/85	Lunch	Potato Mushroom Soup*	.04	Fisher's Extract
7/18/85	Lunch	Watermelon	.02	Fisher's Extract
7/19/85	Lunch	Vegetable Rice Soup*	.02	Fisher's Extract
7/19/85	Dinner	Potato Salad	.0008	Fisher's Extract

TABLE 2. *Foos statistically associated with illness for all lunches combined.*

Food	P-Value	Test
Vegetable Rice Soup*	.007	Chi Square
Watermelon	.007	Chi Square
Potato Salad	.03	Chi Square
Green Salad	.04	Chi Square

(*contains a turkey product)

TABLE 3. *Foods statistically associated with illness for all suppers combined.*

Food	P-Value	Test
Potato Salad	.0003	Fisher's Exact
Green Salad	.008	Chi Square
Vegetable Rice Soup*	.02	Fisher's Exact

TABLE 4. *Foods statistically associated with illness for all lunches & suppers combined.*

Food	P-Value	Test
Turkey or Turkey Based Product	$P<10^{-6}$	Chi Square
Vegetable Rice Soup*	.0001	Chi Square
Potato Salad	.0001	Chi Square
Watermelon	.01	Chi Square
Vegetable Beef Soup*	.02	Chi Square

(*contains a turkey product)

of the two to three turkeys roasted daily. In order to test the hypothesis that these turkey products were in fact associated with development of illness, cases and controls were compared as to their consumption of any food containing turkey. This analysis indicated that when food histories from lunches and suppers on all days between 7/16/85 and 7/22/85 were compared, consumption of products containing turkey was highly associated with developing illness ($p<10^{-6}$), see Table 4.

ENVIRONMENTAL INVESTIGATION

Methods

The inspection history of the implicated restaurant was reviewed and an on-site emergency operational review of the restaurant was conducted at 2:00 p.m. on July 23, 1985. On July 25, 1985, after additional information implicating the restaurant was available, a complete food service inspection was performed. The owner and food preparers were interviewed on both occasions.

Results

Review of the inspection history revealed that the implicated restaurant had been inspected approximately 5 months prior to the outbreak at which time a satisfactory rating was given. At the time of the emergency operational review, a number of difficulties with food storage, preparation and handling procedures were discovered. These problems included food storage problems, excessive handling, slow reheating and cooling, improper holding temperatures, and poor hygienic practices. In addition, it was noted the presence of possible cross-contamination sites such as deboning tables, where cooked turkey could have come in contact with drippings from raw poultry. No water supply difficulties were identified. Problem areas were reviewed with the owner and immediate correction was advised.

The complete inspection on July 25, 1985 revealed that many of the previously cited problem areas remained uncorrected. The rating score developed during this complete inspection was 45 (out of a total of 100). Closure of the restaurant occurred during the course of this inspection.

LABORATORY INVESTIGATION

Methods

Numerous food specimens, including samples of turkey products available at the time of the investigation were submitted for bacterial culture to the Michigan Department of Public Health Laboratory. In addition, several environmental swabs from food contact surfaces as well as tap water samples were submitted for bacteriologic culture. The Michigan Department of Agriculture investigated several local suppliers of poultry products and obtained appropriate environmental cultures.

Lab Results

All food, tap water, and environmental cultures were negative for bacterial pathogens including salmonella. During the course of the investigation, over 400 stool specimens from over 230 individuals were analyzed by local hospitals or the Michigan Department of Public Health Laboratory. Stool samples from 138 separate individuals were positive for *Salmonella enteritidis*. Many individuals, especially employees of the suspect restaurant and the attached motel, received multiple cultures in an attempt to document conversion to a stool negative state (i.e., 2 consecutive negative cultures).

DISCUSSION

In reviewing the epidemic curve, it can be seen that three individuals appear to have been infected several days prior to anyone else. Although these three individuals ate on three separate days, their food history indicates that the only foods consumed in common were coffee and poultry products which although reported as chicken, were turkey (i.e. chicken salad and chicken soup with noodles and dumplings). Because of the low numbers involved in the first several days of this outbreak, it is not possible to statistically prove that turkey was the initial food involved although the analysis of the entire epidemic presented above strongly supports that possibility.

Potato salad and turkey based products both exhibited significant P-values, therefore, a cross-reference table (Table 5) was prepared to help explain their relationship. Table 6 is a food history attack rate table. These tables were constructed using food history data from illnesses occurring up to and including July 19. July 19, 1985 was the peak of the outbreak (see Epidemic Curve).

The cross-reference table exhibits nearly equal percentage differences for attack rates of individuals eating or not eating a turkey product (difference of 29.6%) compared with eating or not eating potato salad (difference of 29.0%). In addition, the food history attack rate table shows that potato salad produced a higher attack rate (71.4%) as compared to turkey based products (56.8%), but when both foods were consumed the attack rate was greater (80.0%) than the values expressed for the individual food products. Although a higher attack rate was noted for potato salad (71.4%), only seven individuals were used to compute the value as compared with 95 individuals giving rise to the 56.8% attack rate for persons consuming a turkey product. The value of 56.8% representing turkey based products is strongly supported by the fact that up to 63% of poultry leaving slaughter house operations are contaminated with Salmonella organisms[1], and possibly as high as 80%[2].

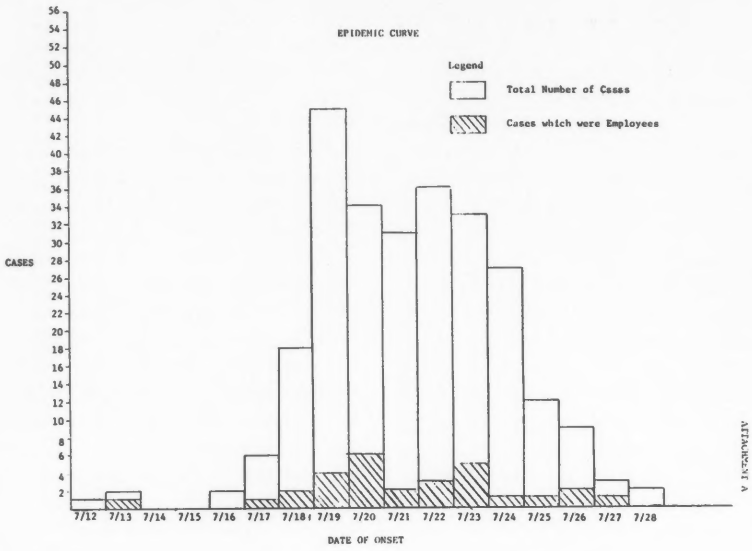
To account for the consumption of potato salad eliciting a higher attack rate than turkey products, it is hypothesized that cross-contamination of poultry products with potato salad had occurred. Proper reheating of turkey would destroy viable salmonella pathogens in that food product, thus reducing the chance of causing illness[3]. In contrast, potato salad is not heated, therefore any organisms transferred by cross-contamination would remain viable and proliferate at temperatures between 45 and 140 degrees F. Information obtained concerning food preparation and storage at this restaurant supports the possibility of cross-contamination occurring. A common use area in which raw poultry products as well as the preparation of cooked potatoes used in potato salad was identified

TABLE 5. *Food cross-reference table comparing attack rates for individuals eating or not eating a turkey product and or potato salad (July 12 - 19).*

		Ate Potato Salad	Did not Eat Potato Salad	Totals	
Ate Turkey Product	Ill	4	50	54	
	Well	1	40	41	
	Total	5	90	95	
	Percent Ill	80	55.6	56.8	Difference of 29.6%
Did not Eat Turkey Product	Ill	1	20	21	
	Well	1	55	56	
	Total	2	75	77	
	Percent Ill	50	26.7	27.3	
Total	Ill	5	70		
	Well	2	95		
	Total	7	165		
	Percent Ill	71.4	42.4		
		Difference of 29.0%			

TABLE 6. *Food history attack rate table for specific foods (July 12 - 19).*

	Number of Persons who Ate Specified Food			Number of Persons who Did not Eat Specified Food		
Food Item	Ill	Total	Percent Ill	Ill	Total	Percent Ill
Potato Salad	5	7	71.4	70	165	42.4
Turkey Product	54	95	56.8	21	77	27.3
Both Turkey Product and Potato Salad	4	5	80	20	75	26.7



and may have been a site for cross-contamination when working surfaces were not sanitized after each usage. In addition, other vegetables were prepared in this common use area. Cross-contamination is also supported in that past problems with proper food storage were identified, including uncovered food products in the walk-in cooler as well as raw meat products being stored over foods which are not cooked or reheated to 165 degrees F. or higher before serving.

Since one of the initial three affected individuals was an employee of the restaurant (a plate dresser/prep cook), and because there was a several day delay before additional cases developed, it is theorized that this initially affected employee may have in turn contaminated other foods that were subsequently implicated in the outbreak. Because many employees ate meals at the restaurant, the epidemic rapidly spread to others who played significant roles in preparing and serving food to the public. In at least one instance, an ill employee continued to work while symptomatic. Thus, the combination of many infected employees plus inadequate hygienic practices and food storage conditions and practices led to a rapid expansion of the epidemic. It should also be noted that many employees ultimately proven to have positive stool cultures for salmonella, denied symptoms.

CONCLUSION

Since salmonella organisms are heat labile and do not produce spores or toxins, the most effective control measure is heating and maintaining food at proper temperatures. Properly cooked food will be free from viable pathogens, unless subsequent cross-contamination occurs and favorable conditions such as excessive handling, slow reheating, slow cooling, poor hygienic practices and improper holding temperatures (all of which were identified within this restaurant) provide an environment for the rapid and progressive growth of these pathogens. Identification of cross-contamination sites such as deboning tables where cooked turkey could have come in contact with drippings from raw poultry and growth opportunities such as slow cooling of large masses of turkey in refrigerators and slow reheating of precooked turkey at buffet tables may best explain how this illness came to affect more victims than any previous salmonella outbreak in Michigan.

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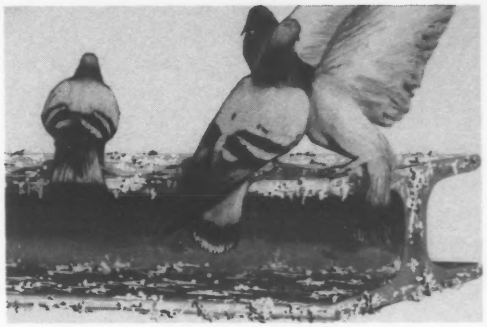

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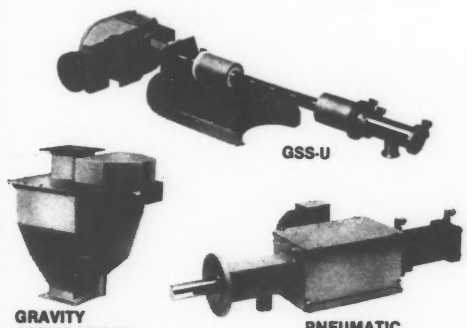

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Sulfite Food Additives: To Ban or Not to Ban?

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Sulfiting agents are food ingredients which have been used for centuries in food processing. They are applied by markets, restaurants, and food processors to a wide assortment of fresh and processed foods. Since 1958, they have been on the list of food ingredients "Generally Recognized As Safe" (GRAS) by the Food and Drug Administration. Additives on the GRAS list are assumed to be safe and allowed in certain foods because they have a long history of safe use and have been reviewed by scientific experts. Since July 1982, when FDA proposed to affirm the GRAS status of the six sulfiting agents, a storm of controversy has erupted over the continued use of these materials.

The present concern is based on the finding that sulfiting agents can produce allergic-type reactions in certain individuals. Their presence in foods and beverages may have serious implications for those persons who are intolerant of these additives. Some who are opposed to the use of sulfites are urging an immediate ban on their use in all foods and beverages.

Before a ban on sulfites can be imposed, alternatives should be found that have undergone rigorous testing and have been judged safe by the FDA. In addition to being safe, appropriate alternatives must be as technically effective as sulfites. Sulfites perform many important functions in foods and beverages. They act as inhibitors of browning of food and as controlling agents for microorganisms (Tables 1 and 2). Suitable substitutes are not readily available to cover all uses. For example, food producers are finding it very difficult to replace the use of sulfites in shrimp, dried fruit and corn syrup because safe and equally effective alternatives are not available.

Banning sulfites without utilizing appropriate substitutes would result in greater food spoilage and waste and possible increases in food costs, in addition to decreased quality of many products. These consequences must be evaluated in relation to the extent and severity of adverse reactions. There is no precedent for banning any additive which is of such value in assuring the quality of the food supply yet can have severe hypersensitive effects in only a small segment of the population.

TABLE 1
SULFITING AGENTS USED IN FOODS AND BEVERAGES

potassium bisulfite*
potassium metabisulfite (potassium pyrosulfite)
sodium bisulfite (sodium acid sulfite, sodium hydrogen sulfite)
sodium metabisulfite (sodium pyrosulfite)
sodium sulfite*
sulfur dioxide (sulfurous anhydride)

* The FDA proposed (in 1982) to revoke GRAS status as direct human food ingredients. Neither the 1970 or 1977 surveys of the food industry indicated that potassium bisulfite was used in foods. The only food use reported for sodium sulfite was as a boiler water additive.

The American Council on Science and Health (ACSH) believes that until appropriate substitutes are found, labeling of all processed foods and beverages containing de-

TABLE 2
SULFITE USES IN FOOD PROCESSING

sanitizing agents
antioxidant (prevents food spoilage)
antifermentive
preserve freshness and brightness
prevent browning or discoloration
antifungal
prevent bacterial spoilage
increase storage life
improve quality or texture of finished baked products (dough conditioner)

tectable levels of sulfites should be mandatory. In addition, those restaurants and supermarkets which have not already curtailed use of sulfiting agents on produce and in salad bars should do so. In these instances, sulfites fulfill primarily an aesthetic purpose, maintaining the appearance of fresh fruits and vegetables. Their elimination would not affect the sanitation or microbial safety of these foods.

Who is Affected?

To date, FDA has received approximately 1,200 reports of adverse reactions, including 20 deaths, purportedly linked to ingestion of sulfites. Many of these reported reactions have yet to be verified as being caused by sulfite ingestion. The reactions were thought to have occurred after the consumption of raw fruits and vegetables in restaurants, produce bought in grocery stores, wine and beer, as well as various processed and packaged foods eaten at home. The remaining complaints were less specific about the types of foods and the places of purchase or consumption. FDA is currently receiving three to four consumer complaints a day.

Reactions to sulfites range from hives and serious breathing difficulties to anaphylactic shock. A few are experienced by food service pesonnel who handle sulfites, while some are reported by persons taking certain prescription drugs. Determining that sulfites cause a person's reactions is not easy. The variety of sulfite-containing foods that a person might eat at one sitting makes it even more difficult to identify a particular item.

The number of strong allegations has prompted the FDA to reexamine whether the continued use of sulfites is safe. In January 1985, the Federation of American Societies for Experimental Biology (FASEB) concluded that although sulfites are not harmful to the majority of people, growing evidence suggests that asthmatics, particularly those who are steroid dependent, may be hypersensitive to sulfites and experience acute allergic-type reactions, ranging from mild to severe (see Table 3).

Clinical studies suggest that a wide range of people—from 80,000 to 450,000 asthmatics—may be sensitive to sulfiting agents. It is not known how many nonasthmatic, healthy individuals may be at risk. About 30 percent of the reports received by FDA involve nonasthmatics (which may include undiagnosed asthmatics) and four published medical reports involve nonasthmatic individuals.

Why the Present Concern?

Since 1977, old uses of sulfiting agents have been expanded (fresh seafood preservation) and new uses have been developed (instant tea products), although consumption remains relatively steady. In the past decade, the increased popularity of salad bars in restaurants has contributed significantly to the overall consumption of sulfites. The extent of sulfite use by manufacturers and distributors in the food chain is still under investigation.

Sulfiting agents (sulfur dioxide and certain sulfite salts) may be measured as sulfur dioxide equivalents. The FASEB study found that the total per capita daily intake of sulfites from food is about 6 mg. In addition, beer provides 0.4 mg per capita per day and wine provides from 0.8 mg to 3.7 mg. The mean daily intake of sulfur dioxide equivalents from food, wine and beer is about 10 mg. However, it is estimated that the daily intake of those who consume highly sulfited foods and beverages regularly is about 180 mg of sulfur dioxide equivalents per day.

Losses of sulfites occur during processing, in storage, and in home preparation. Sulfite can also react with a number of food ingredients. All of these factors tend to lower the amount of available sulfite in foods as eaten, but do not completely remove all sulfite residue. Rinsing with water will not wash off the agents and cooking will reduce, but not entirely eliminate, sulfite residues.

TABLE 3
POSSIBLE SYMPTOMS/ADVERSE REACTIONS OF SULFITE INGESTION

flushing
hives
low blood pressure
wheezing
generalized itching
respiratory arrest
gastrointestinal disturbances
dermatitis
nausea
diarrhea
anaphylactic shock
acute asthma attacks
loss of consciousness

What about Restaurant Use?

Of greater concern than packaged foods is restaurant and supermarket use of sulfites—to perk up salad bars, freshen produce and to maintain the white color of potatoes and the green color of fresh guacamole. A survey taken during the summer of 1984 by the National Restaurant Association (NRA) indicated that the use of sulfites by 17,000 member restaurants who responded has dropped from 15 to 3 percent.

In March 1983, the FDA advised state officials to require that sulfite-treated raw foods be conspicuously identified on signs, cards or menus which read "sodium bisulfite added" or "sulfiting agents used to preserve natural appearance and freshness." By March 1985, 19 states had not yet adopted this recommendation. Many local municipalities have taken similar action to identify sulfites in food.

The NRA has resisted the request to post notices which would draw attention to sulfite-containing foods. According to the NRA, this recommendation is an "inefficient solution to the problem," for many people do not know if they are sulfite-sensitive. In addition, it could cause alarm for customers who are not adversely affected by sulfites.

The American College of Allergists and the NRA have distributed a leaflet to allergists for their asthmatic patients. This booklet for physicians and health officials lists foods frequently treated with sulfites, and those usually sulfite-free. To avoid adverse reactions while dining out, asthmatics with hypersensitivity to sulfites should:

1. Read labels on all processed foods.
2. When ordering food in a restaurant ask the manager about specific foods which may contain sulfites.
3. Order items which are not sulfited such as chicken, eggs, meat or cheese, if the manager cannot help.

Over 10,000 NRA members have received this information to help them answer questions from sulfite-sensitive customers. But restauranteurs do not always know if the food purchased has been treated with sulfites prior to its arrival. Therefore, the NRA has asked its members to discontinue the use of sulfites until the FDA rules on the safety of their additives and their retention on the GRAS list.

Are Sulfites Toxic?

The biological effects of sulfiting agents are incompletely understood. In 1982 the FDA stated "there is no reason to believe that the direct, local irritating effects of sulfites, seen in high-dose acute toxicity tests, constitute a hazard from ingestion of sulfiting agents as they are presently used in foods. Orally administered, sulfite is very rapidly oxidized to sulfate in all species studied."

In animal toxicity tests the level of no observed adverse effect for sulfites ranges from 30 to 100 mg of sulfur dioxide equivalents per kg of body weight per day. The Federation of American Societies for Experimental Biology (FASEB) estimates the average per capita daily intake from food and beverages to be about 10 mg. Scientists need more information to assess any special risk factors that apply to specific groups, such as asthmatics.

The sulfiting of foods can destroy thiamin, but sufficient amounts of this vitamin are present in most varied diets. In addition, the FDA prohibits the use of sulfites in foods known to contribute more than 10 percent of the Recommended Dietary Allowance (RDA) of thiamin. The usual amounts of sulfite present in processed foods such as dehydrated fruits and vegetables do not cause significant destruction of the thiamin content of a mixed meal which includes meat and other sources of thiamin. In addition, because of possible consumer deception, sulfites cannot be used on meats. This is because sulfites will restore red color to meat, giving it a false appearance of freshness.

Are Sulfites Regulated in Foods and Alcoholic Beverages?

According to the Federal Food, Drug and Cosmetic Act, the FDA controls the regulation of sulfite additives used in foods and beverages. The Bureau of Alcohol, Tobacco and Firearms (BATF) regulates the labeling of distilled spirits, malt beverages, and wines.

In 1976, the FASEB recommended that all six sulfiting agents used in food be allowed to maintain their GRAS status. In 1982, the FDA proposed to maintain, with specific limitations, the GRAS status of sodium and potassium metabisulfites, sodium bisulfite, and sulfur dioxide, while proposing the withdrawal of potassium bisulfite and sodium sulfite from the GRAS list. To date the FDA has taken no action on the proposed rule change.

Why are Some Foods Labeled But Not Others?

According to the regulations of good manufacturing practice, the amount of sulfites that a manufacturer or food supplier can add to most food is limited to the smallest amount needed to accomplish its intended technical effect in food. When sulfites are added as a preservative to a packaged product, they must be listed. Products so labeled include lemon juice, maraschino cherries, grape juice, some packaged fresh mushrooms, dried fruits and vegetables, and some canned soups.

If sulfites are used in the early stages of processing, the manufacturer currently is not required to list them. For example, sulfites used as dough conditioners could leave a small detectable residue in cookies and need not be listed.

The BATF regulates the use of sulfiting agents in the processing of alcoholic beverages. However, alcoholic beverages, unlike other processed foods, are not required to bear ingredient labels. Therefore, consumers may not be aware of sulfites in these products. How many, for instance, are aware that all wines contain some level of sulfite?

Winemakers have historically considered the use of sulfites to be a necessary component of winemaking. In September 1984, the BATF removed sodium bisulfite, sodium metabisulfite and sodium sulfite from the list of authorized treating materials for wine and the BATF has also proposed the reduction of the maximum level of total sulfur dioxide in wines, both imported and domestic.

What Is the FDA Doing About this Problem?

Because recent scientific developments show that sulfiting agents can cause reactions in a significant portion

of the population, the FDA has taken the following actions:

- issued a statement that "fruits and vegetables or other foods for raw consumption to which the retail operator has added sulfiting agents without advising consumers are to be considered unsafe."
- formed an ad hoc Advisory Committee on Hypersensitivity to Food Constituents to review and evaluate (1) available data on allergic-type responses to foods, and (2) the effectiveness of FDA's long-standing policy of labeling to reduce the dangers from substances which can cause adverse reactions to a small proportion of the population.
- initiated a program to determine the residual levels of sulfiting agents in various selected foods purchased at retail stores.

One state (New York) has enacted a law which prohibits retailers and wholesale distributors of food from adding sulfites to any food that is sold, offered or served. Many other states have introduced similar bills to curtail sulfite use at the food service level. A final ruling by the FDA in favor of this law will pre-empt local regulations in all states.

The FDA has also issued warnings for products containing sulfites in order to encourage labeling. During 1985, the FDA warned consumers several times to avoid dried fruits, vegetables, and canned foods containing undisclosed sulfites. The particular products were voluntarily recalled for relabelling.

The FDA also announced that shrimp with sulfite residues of more than 100 parts per million would be considered adulterated and subject to removal from the market.

Read the Label!

A problem exists with the use of sulfiting agents and their exemption from labels.

Food processors must declare sulfiting agents on the label when used as chemical preservatives. A sulfiting agent may be used as an incidental additive (and exempt from labeling requirements) only if an insignificant amount of the sulfite remains in the finished food. Some manufacturers have misinterpreted, however, what constitutes an insignificant level of sulfiting agent. This is of concern since sulfites have been shown to cause reactions in sensitive individuals even when ingested at very low levels.

Scientists have not established a level below which sulfites will not cause a reaction in sensitive individuals. The only way to assure that sensitive individuals are notified of the presence of sulfites is to require labeling when sulfites are present in any "detectable amount" (defined as 10 parts per million or more). This represents the lowest level at which sulfites can be detected using currently available methods.

Although this regulation is not yet effective, the FDA urges manufacturers and distributors to declare sulfiting agents on their labels as soon as possible.

What Are the Proposed Regulations?

In view of the health concerns over the use of sulfiting agents in food, including wines, the FDA, BATF and U.S. Congress made the following proposals:

FOODS AND BEVERAGES WHICH MAY CONTAIN SULFITES

potatoes (cut-up, fresh, frozen, dried or canned)
fruits (fresh, dried or maraschino-type)
vegetables (fresh, frozen, canned, or dried), fresh mushrooms
shellfish (fresh, frozen, canned or dried, clams, crab, lobster, scallops, shrimp)
beer
cider
wine (commercial and home-prepared)
wine vinegar
salads (particularly salad bars)
salad dressing (dry mix), relishes
avocado dip, guacamole
fruit drinks
fruit juices, purees and fillings
vegetable juices
baked goods (cookies, crackers, waffles, pie crust)
processed food ingredients (gelatin, beet sugar, corn sweeteners and food starches)
sauces and gravies
jams and jellies
sauerkraut and cole slaw
soups (canned or dried)
fruit toppings, syrups and sweet sauces (molasses, maple syrup, corn syrup)
instant tea
snack foods (dried fruit snacks, trail mixes, filled crackers)

• In 1984, BATF proposed reduced levels of sulfur dioxide equivalents for wines.

• In March 1985, the "Sulfite Safety Act of 1985" proposed the elimination of sulfite use in fresh fruits and vegetables and potatoes, other than dehydrated potatoes, and reevaluation of these preservatives in other foods and beverages, including wine, dried fruit and seafood.

• In April 1985, the FDA proposed the labeling of products containing sulfiting agents in foods and non-alcoholic beverages where sulfite exceeds 10 parts per million.

• In June 1985, BATF proposed sulfite labeling of alcoholic beverages which contain 10 or more parts per million total sulfur dioxide.

• In August 1985, the FDA proposed a ban on the use of sulfiting agents in raw fruits and vegetables intended to be served raw (salad bars), or sold raw to consumers, in both food markets and restaurants.

The FDA may modify these proposals due to the comments received, and is expected to take final action on the proposals in 1986.

Recommendations

Sensitivity to sulfites undoubtedly exists. The magnitude of the problem and a determination of safe levels need further investigation before any final decisions regarding their use are reached.

The Review Panel on the Reexamination of the RAS Status of Sulfiting Agents recommends restricting the use of sulfiting agents, citing severe allergic reactions that may have led to the deaths of a number of individuals. The Ad Hoc Advisory Committee on Hypersensitiviy to Food Constituents recommends the continued search for alternatives to sulfite use in foods and pharmaceuticals, along with efforts to educate physicians and the public to the potential hazards of reactions to sulfite in foods.

Until the FDA decides on whether to ban the use of sulfiting agents, asthmatics and other sensitive individuals can protect themselves by reading labels on all commercially prepared foods. Consumers who are sulfite-sensitive should also be informed through labeling that wines traditionally contain sulfites.

Although most restaurants have discontinued the use of sulfiting agents, the agents may still be present in items purchased from suppliers. Because many food service operations are unaware of the sulfite content of foods received in bulk more states need to enact laws which prohibit retailers and wholesale distributors from adding sulfites to any food that is served outside the home. Generally foods and beverages to question when eating out are salads, potatoes, seafood, cooked vegetable dishes, wine, beer, and bakery products.

Sulfite-sensitive individuals can react to very low levels of sulfites in foods and beverages. If you suspect that you are sulfite sensitive, consult an allergist or other physician.

IAMFES Secretary Nominations Due

Nominations are open for the IAMFES Secretary. This year a regulatory representative will be elected.

Send a biographical sketch and photograph of your nominee to the Nominating Committee as soon as possible, but no later than November 1, 1986.

Send the information to: Harold Bengsch, 921 West Turner, Springfield, MO 65803.

"Arch City" to Host 1986 ACDPI Clinic

The American Cultured Dairy Products Institute has scheduled its fifth national clinic for September 30 - October 2 in St. Louis, Missouri, according to Institute Board Chairman John Allen of the Southland Corp. This two and one-half day session dealing with the "basics" of cultured dairy food manufacture is especially geared for processing plant supervisors, quality control personnel, foremen, and on-line production staff.

Clinic delegates will receive instruction in microbiology, sanitation principles, product formulations, culture programs, equipment operation, and be given "hands on" experience in recognizing defects in buttermilk, sour cream, yogurt, and cottage cheese - PLUS MUCH MORE!

Featured clinic instructors, relates Allen, will include: Dr. Ron Richter, Texas A&M University; Emeritus Professor Ed Custer, Mississippi State University; Earl Connolly, Brotech, Inc.; Fran Lavicky, Nordica International; Bill Born, Dean Foods Co.; Dr. Charles White, Mississippi State University; Dr. John Bruhn, University of California; Dr. C. Bronson Lane, Dairy and .Food Nutrition Council of Florida.

Further information pertaining to the "nuts and bolts" workshop may be obtained from Dr. C. B. Lane, ACDPI Vice President, P. O. Box 7813, Orlando, FL 32854 (305/628-1266).

Switzerland-Based Tetra Pak Acquires the Liquipak Group

The Tetra Pak Group, the world's largest and most experienced supplier of aseptic packaging systems for liquid food products, announced that it has acquired The Liquipak Group.

Liquipak specializes in developing and manufacturing filling equipment for liquid foods. Machine manufacturing and marketing are carried out by Liquipak International, Inc. of St. Paul, Minnesota, while development and licensing is the function of Liquipak International BV, a Dutch company with branches in London and Fribourg, Switzerland.

Liquipak International, Inc. will continue to operate as an independent company. Jim Moar will maintain his position as President of Liquipak International, Inc. with overall responsibility for the management of the company. Moar will report directly to Tetra Pak management in Lausanne, Switzerland, corporate headquarters of the Tetra Pak group. Liquipak machine production will remain in St. Paul.

The marketing of Liquipak's aseptic machines for low and high acid liquid food products in the United States and Canada will be handled by Tetra Pak Inc. of Shelton, Connecticut, and Tetra Pak, Inc. of Aurora, Ontario, respectively. Liquipak International, Inc. will continue to market packaging machinery for non-aseptic products in the U.S. and Canada under its own name and trademark.

In recent years, Liquipak has devoted substantial development resources to aseptic filling technology. To achieve the full impact of this development on the international market, the company's priorities were further investment in technical development and an efficient international marketing network.

"It was in the interest of both parties to evaluate the possibility of joining forces," said Lars R. Bergwall, President and Chief Executive Officer of Tetra Pak, Inc. in Shelton. "The acquisition means that Tetra Pak will soon be able to offer our customers filling machinery for aseptic packages in larger sizes up to 64 ounces."

Connecticut-based Tetra Pak, Inc. is one of 45 company members of the Tetra Pak Group which operate in over 90 countries throughout the world.

Food Pesticide Recertification Workshop

The Food Sanitation Institute, EMA, in cooperation with New York State Regulatory Lead Agencies, New York State Cooperative Extension Services, and the states of Vermont, Massachusetts, New Jersey, and Rhode Island will be sponsoring a "Food Pesticide Update Workshop" on September 21-24, 1986 at the Rochester Marriott in Rochester, New York.

The Workshop will include states recertification and certification for category 7A (structural and rodent control), 7B (fumigation), 7F (food processing), and 10 (demonstration). In conjunction with the

Workshop, an Exposition will be conducted reviewing the latest in pesticide goods, services and equipment.

Workshop educational presenters will include Dr. Roger E. Gold, Head, Department of Entomology, Environmental Programs, University of Nebraska; Dr. John V. Osmun, Professor of Entomology, Peticide Programs, Purdue University; Dr. Austin M. Frishman, President, Pest Management Services; Dr. Gary W. Olmstead, Director of Special Health Services; and Thomas J. Imholte, CPFS, Manager, Plant Services, General Mills, Inc.

For further information and a detailed workshop brochure, please contact the FSI/EMA National Executive Offices at 1019 Highland Ave., Largo, FL 33540, or call 813/586-5710.

Ingredient Technologies Corporation Expands Malt Production Capabilities

In an expansion of its capabilities, the Specialty Products division of Ingredient Technologies Corporation has completed installation of a primary malt extraction plant in Dubuque, Iowa, and a liquid malt blending station in Chicago, Illinois.

For years a supplier and blender of malt in both liquid and dry forms, ITC now becomes a primary producer, able to extract liquid malt from malted barley.

Operational earlier this year, the state-of-the-art installation in Dubuque is part of a multi-million dollar expansion program by the company to provide all segments of the food industry with a complete line of malt products.

The facility has sufficient capacity to supply all of ITC's foreseeable needs and is equipped with stainless steel equipment throughout.

The division feels the facility, centrally located in the midwest grain-growing region, will insure the ability to provide these barley-based ingredients economically.

The Chicago malt blending station, also centrally located to ITC's markets, has access to rail and barge transportation.

This installation will also manufacture invert sugar syrups, and serve as a pivotal distribution center providing ITC's customers with a full line of specialty sweeteners--including liquid and dry malt, invert sugars, liquid and dry molasses, and corn sweetener blends.

Other divisional operations include production facilities in Boston, Massachusetts; New Orleans, Louisiana; Pennsauken, New Jersey; and Montreal, Quebec.

Ingredient Technology Corporation is a major supplier of functional ingredients to the baking, dairy, beverage, meat and food processing industries. It is headquartered in Pelham Manor, New York.

Petition Filed to Allow Aspartame Use in Certain Milk Products

The Milk Industry Foundation (MIF), The NutraSweet Company and Beatrice Dairy Products, Inc. have filed a petition with the Food and Drug Administration (FDA) to allow the use of aspartame as a sweetener in refrigerated flavored milk beverages.

Aspartame, an FDA-approved sweetener, is presently used in ready-to-serve carbonated beverages, dry-based mixes for beverages (such as coffee and tea), and in dry-based mixes for addition to milks (such as hot cocoa).

The petitioners are asking that aspartame's use as a sweetener be permitted in ready-to-serve flavored milks and flavored milk drinks that are pasteurized dairy products and require sweetening. All flavoring ingredients, including aspartame, would be added prior to pasteurization. The petition is limited to those products which are distributed and sold in a refrigerated manner.

"The availability of aspartame in ready-to-serve refrigerated milk beverages will provide the consumer with an alternative beverage form," the petition states.

MIF is the national trade association for processors of fluid milk and milk products. Its 240 member companies process nearly 85 percent of the fluid milk and milk products consumed in the United States.

Foss Electric and Multispec, Ltd. Merge

A/S N. Foss Electric of Denmark and Multispec, Ltd. of England are pleased to announce the combination of the two companies. Multispec will become a wholly owned subsidiary of Foss Electric. Research & Development and production will be continued at the Multispec facility in England.

Both companies produce instruments for analysis of food and dairy products for the world market. The combined resources of both organizations will offer a formidable product line, comprehensive Service and Support, and energetic Research & Development; all aimed at providing the highest level of technology to the industry.

Foss Food Technology Corporation of Eden Prairie,

Minnesota, is the U.S. subsidiary of Foss Electric. Since its inception in October, 1985, it has built up a strong Sales & Service, Technical Support and Applications team. The company has a major commitment to the U.S. Dairy & Food Industry, as evidenced by its considerable investment.

Multispec, Inc. is the U.S. subsidiary of Multispec, Ltd., and will be integrated into Foss Food Technology Corporation, with the retention of its personnel and office facilities. Both Multispec and Foss personnel welcome the opportunity to jointly continue high technology innovation for the benefit of the U.S. Dairy & Food Industry. Likewise, they look forward to continuing support of both product lines for their many customers throughout the U.S.

Series of Seminars on Public Health and Environmental Issues Offered

In September, the National Sanitation Foundation (NSF) will launch a nationwide series of seminars on public health and environmental issues for food service regulators, equipment manufacturers, systems supervisors, and designers of all skill levels. The initial session, "Product Temperature Management," will be offered in southeastern Michigan, the Washington, D.C. area, Dallas/Fort Worth area, and San Francisco Bay area.

NSF's educational outreach provides skill development and enhanced professionalism for public health and food service managers. Sharing experience and concerns will broaden participants' perspectives and facilitate problem solving industry-wide. The seminars will stress training front line employees to improve safety and cost-effectiveness.

The program is a timely extension of the Foundation's long and reputable service mission which includes development of voluntary standards, equipment testing for listing and certification, systems assessment and research, and continuing education.

For more information write NSF, Atten. D. L. Lancaster, Manager of Education and Training Programs, P.O. Box 1468, Ann Arbor, MI, or call (313) 769-8010.

University of Wisconsin - River Falls Holds Cheese Symposium

The Second Annual Cheese Technology Symposium was held on May 1, 1986, at the University of Wisconsin-River Falls. The program was jointly sponsored by the Animal and Food Science Department, University of Wisconsin-Extension, and the UW-RF Food Science Club as part of an on-going effort to provide continuous education opportunities to the dairy and food industry personnel.

The Symposium was organized by Dr. P.C. Vasavada and included several presentations on topics related to cheese technology. Following introductory remarks by Dr. Vasavada, the program began with a presentation on Marketing Potential for New Cheese Technology by Harry Palmiter, The Cheese Reporter. Mr. Palmiter discussed the impact of changing demographics and current trends in the cheese industry on marketing of cheese.

The importance of starter cultures in cheese making and aspects of starter culture technology, strain balance and the use of internal and external pH-controlled media for starter culture growth were discussed by Dr. Steve Wright, Nordica, Inc. Dr. Wright also commented on "personalities" of lactic starter cultures.

Automation in the cheese industry was the topic of the presentation of Gordon Brown of Damrow Company. He reviewed the reasons for automation and stressed the need for proper communication between the food scientists, cheese makers, equipment manufacturers, and design engineers for the successful design and operation of automated systems.

The ultrafiltration technology in cheese manufacturing was reviewed in detail by Wayne Gielman, Ridgeview Foods. Mr. Gielman's presentation included a description of a membrane processing system at the Ridgeview plant at Whitehall, Wis., and practical considerations involved adopting the ultrafiltration processes to cheese making. The final presentation of the afternoon program was given by Glen Moses, Acutrnx, Inc. who reviewed infra-red instrumentation for cheese component analysis.

The evening program included a cheese tasting session where about 18 different cheese varieties, including those made by the ultrafiltration process, were sampled. This session was followed by a banquet dinner and presentation titled "Cheese-making: From Oak Bucket to Close Vats" by Prof. Ed Zottola, University of Minnesota. Professor Zottola's presentation included interesting slides of cheese making in European countries.

The Symposium was attended by approximately 90 people from the dairy and food industry, regulatory agencies, analytical laboratories and universities. Among those represented at the Symposium were: APV Crepaco, Inc., Damrow, Churney Cheese, Hach Company, Chr. Hansen's Lab., Pillsbury, Kraft, Inc., Land O'Lakes, Inc., Lugano Cheese Co., Mid-America Dairymen, Inc., Morning Glory Farms, Weyauwega Milk Products, Inc., Wisconsin DHI

Cooperative, Ralston-Purina, Ridgeview, Ltd., Schreiber Foods, Inc., and UW-Madison.

The third annual Cheese Technology Symposium is scheduled for May 1987. Further information is available through Dr. P.C. Vasavada, Food Science Department, University of Wisconsin-River Falls, River Falls, Wis., 54022.

Irradiated Foods on the Way

Shoppers may soon find irradiated foods in their favorite supermarkets.

The Food and Drug Administration recently approved use of low-level radiation to treat fresh fruits and vegetables for insects and to inhibit ripening to extend shelf life, points out Dr. Richard Edwards, economist with the Texas Agricultural Extension Service, The Texas A&M University System. The FDA earlier approved the use of radiation on wheat, potatoes, herbs, spices and pork.

The latest FDA rules require irradiated foods be identified with a logo and also require the processor to maintain detailed records on the treatment.

The new regulations stipulate that the logo be placed in a prominent location on the product, says Edwards. The logo must also be accompanied by a required statement--either "Treated with radiation" or "Treated by irradiation." The FDA will allow elaborations on these statements which give more details on the benefits of radiation treatments.

Within the next few months consumers may see some of their favorite produce with the radiation decal. Products which lend themselves especially well to this process are apples, citrus, tomatoes, asparagus, cherries, pineapples, mangos and papayas.

Since the radiation process is still relatively expensive, marketing of irradiated products may be relatively slow for about a year, believes Edwards.

While industry and government officials feel irradiation is an evolutionary breakthrough, a more guarded view is expressed by some consumer advocate groups. And, although the process is touted as a boon for consumers, the real question now facing the industry is consumer acceptance of irradiated products, notes the economist.

The products included herein are not necessarily endorsed by Dairy and Food Sanitation.

BBL LitrePak

BBL® LitrePak™ Dehydrated Culture Media

• BBL Microbiology Systems, Cockeysville, Maryland, announces LitrePak™ dehydrated culture media in convenient, new pre-measured packages. The special metalized film packet provides protection from light, moisture and oxygen, minimizing degradation of the medium throughout its shelf life.

LitrePak is convenient to use. It eliminates the need to weigh the medium and at the same time minimizes wastage. It is designed for any combination of quantities used in most pressure vessels and plate pouring machines.

BBL® LitrePak™ is available in a variety of formulations, both in one and three litre packets, and is conveniently offered in cartons of 20 one-litre and 10 three-litre packages.

For more information contact Dorothy Steltzer, BBL Microbiology Systems, PO Box 243, Cockeysville, MD 21030. 301-666-0100 (ext. 2304).

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New Device Makes Low Fat Yogurt Cheese From Yogurt

• The Really Creamy™ Yogurt Cheese Funnel turns yogurt into "yogurt cheese," a low fat, low sodium replacement for cream cheese, mayonnaise, and other foods.

The Yogurt Cheese Funnel selectively drains the whey from yogurt to yield a soft cheese that spreads easily. It takes only seconds to fill with yogurt and then makes the cheese overnight in the refrigerator.

Yogurt cheese offers the health benefits of yogurt in the form of cheese. It is low in calories, fat, sodium, lactose and cholesterol and high in calcium. The cheese can be used as a spread in place of cream cheese, butter and margarine and can substitute for cream cheese, sour cream and mayonnaise in many kinds of food preparation (cheesecake, potato salad, tuna salad, dips, pasta dishes, etc.).

The Really Creamy Yogurt Cheese Funnel (pat. pending) is engineer designed and is manufactured from pure plastic polymers. The funnel incorporates a special microsized mesh that creates an exclusive wicking drainage system for fast whey removal.

The Really Creamy Yogurt Cheese Funnel can be ordered by mail from Millhopper Marketing, Inc., 1110 NW 8th Avenue, Suite C, Gainesville, FL 32601.

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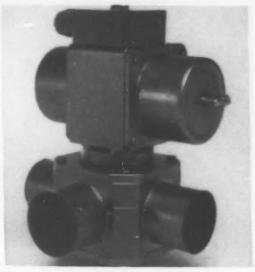

Koltek Valve

Koltek Stainless Steel Sanitary Valve

• The Koltek stainless steel sanitary valve is a highly versatile flow control valve that provides unmatched flexibility in use and has a variety of significant advantages. It is available in 2, 3, and 4-port models in l" to 4" standard sizes.

A Koltek valve can function both as a shut-off valve or divert valve in several configurations. As an example, the 3-port valve can be changed from a 2-way to 3-way or 4-way operation simply through a change of actuator, making possible the selection of 11 different automatic modes. A manual valve installation can be readily field-converted to pneumatic operation and can be actuated to different positions under pressure without shutting off the valve. One Koltek valve can replace two conventional diverter valves and takes up only about 25% of the space normally required. Single-plane port connections further minimize space requirements. Flow resistance of the valve is about 50% less than that of a comparable divert valve and indirect savings are possible through pump downsizing.

Koltek valves and products meet standards set by 3-A, DIN, IDF, SMS, & RJT.

Koltek valves and products are widely used throughout the world. The Hackman Flow Division of Finland now has established a U.S. office and warehouse to make their products available throughout the United States.

For more information contact Mr. Marcus Nymark, President, Hackman Flow Inc., Route 3, Box 28, Brunswick, GA 31520. 912-264-0950.

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Sensaphone Model 1000

SENSAPHONE® Systems

• A new high tech product, the SENSAPHONE® Monitoring System, will watch your office, processing plant, food storage facilities, or any untended property 24 hours a day. It will warn you of environmental changes and alarm conditions so you can avoid or minimize losses and damage to perishable meat, dairy, produce and frozen products.

The SENSAPHONE® System will sound an alert and call you by phone and report the alert condition in English if anything goes wrong. You can also call in from any phone world wide to check on operating conditions. For an actual demonstration of this "Status Report" feature, call 215-566-3880.

With a SENSAPHONE® Monitoring System, you can keep track of the environmental conditions of your processing, storage and preparation areas. AC power failure, temperature, fire and smoke alarms, water level, humidity and intrusion are only some of the conditions the SENSAPHONE® will monitor for you.

The unit's solid state microprocessor can monitor simultaneously up to six environmental and security conditions and is readily compatible with an extensive range of sensors and alarms.

The SENSAPHONE® units are designed for the user's convenience. They are easily installed with simple plug-in connections and need just a few minutes before the user friendly unit is fully operational. All SENSAPHONE® systems are economical to purchase, can be user installed, and eliminate monthly charges from a central monitoring service.

SENSAPHONE® Monitoring Systems are priced from $250 to $500 for business and commercial applications. The Model 1000 is an attractive desk-top unit for the office. The Model 400, in a NEMA rated steel cabinet with a lockable door, is available for industrial and commercial applications. SENSAPHONE® products and technology are also available for custom or OEM applications.

For more product information, the name of your nearest distributor, or to place your order, contact Art Silverman at 215-565-8520, Phonetics, Inc., 101 State Road, Media, PA 19063.

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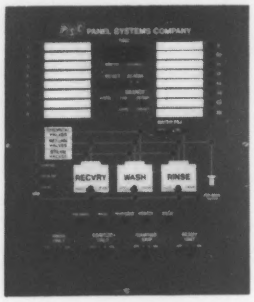

Panel Systems Co. CIP System

Easy to Program CIP Control System

• A new CIP (Clean-In-Place) control system that is totally field programmable has been introduced by Panel Systems Company. This system rids plants of the burden of bringing in outside computer programmers to initialize or make changes in the CIP control system.

Simplified programming has made this CIP control system efficient and cost effective. The system doesn't require a large capacity microprocessing unit but instead uses a General Electric Series One microprocessor. With PSC's special programming, the system has achieved the capacity of larger processors. Plant personnel can easily program CIP system output, item-by-item without specialized training.

The system cleans 16 items (tanks, lines, etc.). Each item has its own program, so item-by-item timing changes can be made independently. Plus, there are rinse-only and sanitize-only program selections available for each item cleaned.

An unlimited number of outputs for sequencing process system valves makes users' CIP systems expandable without a lot of changeover time and expense.

A method has been provided to help prevent CIP-to-product contamination. Terminals for each item are provided right in the control panel to accommodate process-to-CIP system interlocks.

A graphic display is another benefit unique to PSC's CIP control system. The display schematic and lights indicate CIP system outputs. The graphic shows pump, valve, temperature, chemical, levels and other CIP system modes. This provides users with real-time knowledge of the CIP system sequencing outputs.

PSC's microprocessor based CIP controller has also been designed for ease of retrofit into existing CIP systems.

PSC's sister company, Rolland Engineering, Inc., specializes in the design and engineering of total process control systems for food and dairy plants, beverage plants, pharmaceutical plants, chemical plants and refrigeration facilities.

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RefrigiWear Suit

RefrigiWear Receives Cold Weather Testing Center Seal of Performance

• RefrigiWear Inc. has been awarded the Cold Weather Testing Center Seal of Performance.

According to Myrna Ahlgren, Director of the center, located in International Falls, Minnesota, the testing center enjoys a reputation as "The Icebox of the Nation." Outdoor weather conditions at the center are usually more severe than any warehouse temperatures encountered in normal use of the RefrigiWear garments.

The RefrigiWear suit was found to offer warm, dry protection from head to foot. Constructed of "Iron-Tuff"® RefrigNyl® windtight outer fabric and 10 ounces of polyester fiberfill, the RefrigiWear suit provided maximum protection without hampering movement. Waist-high rustproof slide leg zippers permitted fast dressing and undressing, while the heavy-duty double slide front zipper with storm seal maintained a draft-free closure.

For more information about RefrigiWear insulated garments, contact Ron Breakstone, RefrigiWear Inc., 71 Inip Drive, Inwood, NY 11696. (516) 239-7022.

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Leco Nitrogen Determinator

Bio-Rad Laboratories Guide

Free Guide to Sample and Reagent Preparation

• A new booklet from Bio-Rad Laboratories, Guide to Sample and Reagent Preparation, provides hints which will help to perform sample preparation for almost any separation or analysis more efficiently. The booklet is a useful complement to Bio-Rad's complete line of high quality sample preparation products, which includes resins, filtration devices, disposable columns, and cartridges. The guide offers solutions to most sample preparation problems, explains techniques for sample and reagent preparation, and provides complete protocols for most sample preparation methods. Among the topics discussed are buffer preparation; metal, detergent, and particulate removal; desalting; deproteinization; sample concentration; and adsorption. If you're involved in chromatography, HPLC, electrophoresis, immunology, or molecular biology, you'll find the Guide to Sample and Reagent Preparation invaluable. Request Bulletin 1236.

For more information contact Anne Stevens, Bio-Rad Laboratories, 1414 Harbour Way South, Richmond, CA 94804. 415-232-7000.

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FP-228 Nitrogen Determinator

• The LECO® FP-228 Nitrogen Determinator represents a major breakthrough in total nitrogen determination. Preweighed samples (nominal 150 mg) are placed into the automatic sampler. Automatically every 160 seconds a sample enters the high temperature resistance furnace for sample digestion and subsequent nitrogen determination by thermal conductivity. Results are displayed and printed in terms of total nitrogen or % protein.

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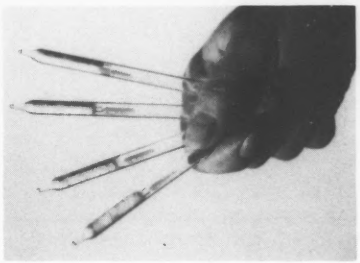

SKC Sample Tube

New Sample Tube For Acrylic Acid

• SKC introduces a new sample tube for the collection and subsequent analysis of acrylic acid. It is a significant advance in the collection of this chemical hazard. The new tube is highly accurate and suitable for both time-weighted average as well as short-term or peak values. The method is specific for acrylic acid and other chemicals do not interfere.

A known volume of air is pulled through the tube and the sorbent in the sample tube is then analyzed by high pressure liquid chromatography. The method meets specifications for OSHA Analytical Method 28.

For more information and prices, contact SKC, Inc. 334 Valley View Road, Eighty Four, PA 15330; (412) 941-9701.

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on your Reader Service Card

New Fat Measurement Procedure Brochure from UDY Corp.

• Inexpensive UDY fat and protein measurement instruments are described in a new eight page color brochure. Applications for meat and dairy products, forages, grains, oilseeds and many other products are described. Information includes operational steps and principles as well as performance capabilities.

The fat test method reduces analysis time to approximately 5 minutes and is applicable to almost all materials. The fat is measured using a variation of AOAC methods. The protein test uses the same instrument and is AOAC and AACC approved. Analysis is made practical by the fast, accurate and inexpensive methods.

To receive the free brochure, call (303) 482-2060 or write to UDY Corporation, 201 Rome Court, Fort Collins, CO 80524.

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GERMFREE Laboratories Offers Free Educational Packet

• The GERMFREE laboratories, inc. offers, free of charge, an educational packet: "The Safe Handling of Antineoplastics/ Chemotherapeutics." This comprehensive packet includes pertinent information for the wide range of health care professionals who are now involved in the handling of cytotoxic agents. Included are original materials issued by the National Study Commission on Cytotoxic Exposure and the National Institutes of Health.

It has been well documented that many antineoplastic and related chemotherapeutic drugs are potentially carcinogenic, teratogenic and/or mutagenic. Therefore, during dispensing and handling of these drugs, all personnel must be protected from contamination. A nationwide concern and awareness of these potential hazards has been sparked by studies publicized in the last few years. The educational packet offered by the GERMFREE laboratories, inc. provides a wide array of the most current information which is relevant to the safe handling of antineoplastics/chemotherapeutics.

Requests for this free packet may be sent to: "Educational Packet," the GERMFREE laboratories, inc., 7435 N.W. 41st Street, Miami, FL 33166.

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on your Reader Service Card

New Cheese Cutter Catalog From the Dairy State

• A new, colorful catalog of commercial cheese cutters is now available from General Machinery Corporation.

The catalog contains pictures and descriptions of cutters to quickly reduce five-hundred pound barrels to moons, half-moons or slabs; six-hundred forty pound blocks to smaller blocks and to portion blocks or daisies into chunks, wedges or slabs. It also tells of the custom cutter design capabilities of General Machinery, as well as its conveying equipment.

All General Machinery cheese cutters are built for commercial use with crevice free design for easy maintenance, stainless steel construction for easy clean-up, waist high loading tables, automatic returns and hydraulic or pneumatic power.

General Machinery has specialized in the manufacture of commercial cheese cutters for over thirty-five years.

For your free copy of the new catalog, phone toll-free 1-800-558-7582. In Wisconsin call collect 414-458-2189 or write General Machinery Corporation, P.O. Box 717, Sheboygan, WI 53082.

Please circle No. 252
on your Reader Service Card

New NULL–KOTE™ Level Control From Princo

• Princo Instruments, Inc., a leader in the design and manufacture of level controls for the process control industry, has announced a new model in its field-proven NULL–KOTE™ line of level controls.

Designated the L2502, the new unit is a solid state, RF impedance sensing, point type controller.

The NULL-KOTE circuitry makes the unit immune to conductive or non-conductive product buildup on the probe.

The L2502 boasts dual sensitivity controls and a two-color light to indicate presence or absence of product (as opposed to an output relay status indicator). It also is able to recognize whether the process being monitored is conductive or not, and will operate with virtually all liquids, granulars and powders.

It provides positive, fail-safe action on either high or low level, has rugged 7A 115VAC output relay contacts, an explosion proof and weatherproof electronics housing, and accepts a wide variety of probes.

For more information contact Princo Instruments, Inc., 1020 Industrial Hwy., Southampton, PA 18966. 215-355-1500.

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Aqua-Flo System

Acid Water Neutralizer

• New and inexpensive Acid Neutralizer System by AQUA–FLO will keep your water valves from corrosion. New up-flow design prevents "cementing" of the neutralizing material and requires no backwash controls. The system can be supplied in any size up to 50gpm. It will not create scale build-up on valves nor add any undesirable chemicals to the water.

For more information, write AQUA-FLO, INC., 6244 Frankford Avenue, Baltimore, MD 21206 or call toll free 1-800-368-2513. In Maryland, call (301) 485-7600.

Please circle No. 254
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Food Science Facts
For The Sanitarian

Dr. Robert B. Gravani
Cornell University
Ithaca, NY

Control of Cockroaches

There are three main areas to consider when discussing cockroach control; they are:

- Prevent their entry;
- Restrict shelter and food;
- Eliminate them if they do get in.

Although it is easy to talk about these three areas, they are often difficult to monitor and control. Food industry employees must first develop an awareness of the problem and then spend some time looking at the details needed to control cockroaches.

Preventing Entry

Cockroaches may enter food processing plants, warehouses, retail food stores and food service establishments in a variety of ways. Cockroach egg cases, nymphs or adults can be brought into the building with raw materials, supplies and/or foods. They can also be brought in on non-food supplies such as packaging materials, office supplies, laundry and on hand trucks, carts and pallets.

All incoming materials should be carefully inspected on arrival for the presence of insects. The tell tale signs of cockroach activity include egg cases, droppings and/or live insects. Those products which are infested should be refused and sent back to the supplier. It may be difficult to refuse a shipment of goods, but more problems may result from receiving infested products.

In addition to being brought in on regular deliveries, cockroaches can be attracted to a location by spilled product, garbage and other sources of food outside the building. Once close by, they can enter the building through cracks, crevices, openings, door junctions, sewers and a variety of other places. They can come from nearby infested buildings, homes or apartments. Action should be taken to prevent their entry.

Sometimes employees, vendors, salespeople, and customers can bring cockroaches into a facility. Cockroaches can be carried in lunch pails, clothes, samples or in sacks, cartons, shopping bags, handbags, or other personal items. Once in the building, they can usually find shelter and food.

Restricting Shelter and Food

Since cockroaches need very little in the way of shelter and food, this area is very difficult to control. Good housekeeping both outside and inside the building is the KEY to restricting shelter and food.

Outside Building. The exterior of the building should be kept neat and clean. Refuse including old equipment, rags, old cartons, pallets, boards, and any unwanted materials that might provide a breeding ground or shelter for cockroaches should be eliminated.

Spilled product around shipping and receiving areas should be picked up quickly; dumpsters, compactors and trash bins should be emptied on a regular basis and the areas around them should be kept free of litter and food debris.

The loading docks should be kept clean and free of old materials, equipment and other non-essential items. Any voids behind dock leveling mechanisms should be routinely checked for debris and cleaned. All cracks, crevices and openings around pipes, wires, doors, windows, etc. leading into the building should be sealed so that insects can not enter.

Inside Building. The interior floors, walls and ceilings should be properly maintained. All cracks and holes passing through walls or floors and crevices behind base boards, door frames, electrical outlets, sinks, etc. should be properly sealed. Depending on the repair, concrete, epoxy, grout or durable caulking materials should be used to seal these openings. Don't neglect cracks in mortar joints or wall joints. Avoid hanging shelves, cabinets, or other items on the wall unless they are securely sealed to prevent insect infestation.

Ingredients should be stored in tightly closed containers. Spilled products and food debris on floors, around equipment and on food contact surfaces should be

cleaned up quickly. Industrial vacuum cleaners should be used to minimize dry product accumulation. Food supplies should be stored off the floor in an orderly fashion. Remember that cockroaches like to hide in dark warm areas, so check motor housings, switch boxes, electrical outlets and mechanical and compressor rooms for signs of insect activity.

Water leaks and dampness provide the kind of environment that cockroaches thrive in. Repair leaks and eliminate dampness. The areas around sinks, water fountains, water coolers, hoses and mop rooms provide the right environment for cockroaches. Be sure to check these areas frequently for the presence of insects.

When looking for cockroaches, always use a flashlight and look in "hard to get to" places such as the junctions of equipment, in cracks and crevices, behind and under machinery, equipment and materials, under ledges, in hollow tubular equipment such as carts and dollies and many other areas where you wouldn't normally "expect" a cockroach problem. The office(s), employee lunch room and locker rooms are areas that should be kept clean and checked regularly for signs of insect activity.

Frequent cleaning, rearrangement of supplies and an attention to details will help restrict the shelter and food that cockroaches need to survive.

Eliminating Cockroaches

Chemical control of cockroaches is recommended only in combination with other control procedures and not as the primary method. Chemical control should be done by persons who are well trained, competent and knowledgeable in the safe use of pesticides. Professional and certified pest control operators should be consulted when considering the chemical control of a cockroach problem in any type of food facility.

To determine which areas of a food facility are infested, mechanical roach traps can be used. These traps are made of paper or metal and contain a sticky substance. Since cockroaches like to crawl in dark cracks and crevices, they are attracted to the traps and get caught in the sticky material. Roach traps are effective in determining the areas of infestation, but they will not eliminate an entire population.

Some of the chemicals most widely used to control cockroaches include pyrethins (for knockdown) as well as the residuals Diazinon, Baygon and Dursban. These pesticides come in a wide variety of forms including sprays, dusts and baits. The chemical used, as well as the form and frequency of application will depend on many factors. Safety precautions must be taken when handling these toxic chemicals in food establishments.

The control of cockroaches is not a simple task. Food industry employees need to be aware of the economic, legal and regulatory problems caused by cockroach infestations and do their part to control these insects.

SALMONELLA NIMA 28:Y:1,5

In recent weeks, 15 cases (mostly young children) of *S. nima* have been reported in 4 provinces (British Columbia 11, Alberta 1, Manitoba 1, Ontario 2), and there appears to be a strong association with the consumption of cheese. This is an extremely rare serotype in Canada: the only other isolation was reported in Ontario from a snake in 1970. Provincial authorities are alerted to the possibility of a widespread problem.

ESCHERICHIA COLI 0157:H7 IN BRITISH COLUMBIA

Verotoxin, or Shiga-like toxin, has been detected in a number of enteropathogenic serotypes of *Escherichia coli* in which the classic "heat-stable" and "heat-labile" toxins are rare. *E. coli* 0157:H7 has recently been recognized as a Verotoxin-producing pathogen, and associations have been demonstrated with diarrhea, hemorrhagic colitis, and idiopathic hemolytic uremic syndrome (HUS).

The Microbiology Laboratory at British Columbia's Children's Hospital in Vancouver primarily serves hospital in- and out-patients. All stool specimens from children with diarrhea (with or without blood), and specimens from most sites from children with HUS were screened for the presence of strains of *E. coli* 0157:H7 which do not ferment sorbitol. Such isolates were then examined for the production of classic heat-stable and heat-labile enterotoxins and Verotoxin. Stool samples from all patients were also examined by microscopy for ova and parasites and cultured for *Campylobacter, Yersinia, Aeromonas, Salmonella,* and *Shigella*.

During the 14-month period beginning 1 August 1984, stool specimens from 1425 patients were cultured and the following bacteria isolated: *Campylobacter,* 2.25%; *E. coli* 0157:H7, 1.9%; *Yersinia* spp., 1.75%; *Salmonella* spp., 1.7%; *Aeromonas* spp., 0.6%; and *Shigella* spp.,0.3%. Seven patients had more than one enteric pathogen which in 4 patients was *Aerinibas* spp.

During a 2-year period starting on 1 September 1983, there were 9 isolates of *E. coli* 0157:H7 from patients with HUS all of whom had diarrhea (7 with bloody diarrhea). The organism was isolated from a further 25 patients with diarrhea alone. All isolates produced a Verotoxin but not the classic heat-stable or heat-labile enterotoxins. Two isolates were from sites other than stool, and these patients, who both had HUS, have been described elsewhere. Two patients with HUS and *E. coli* 0157:H7 had other pathogens isolated from the stool, namely *Campylobacter jejeuni*, and *Giardia lambia* cysts. Patients from whom *E. coli* 0157:H7 was isolated included 18 girls and 16 boys, aged from 9 months to 16 years (mean 5.6 years). The mean age of patients with HUS was not significantly different from that of children with diarrhea alone.

Although it was not possible to trace all family contacts of patients from whom *E. coli* 0157:H7 was isolated, the organism was detected in stools from more than one child in 3 families. A further 3 children had family members with a history of diarrhea, but from whom specimens were not available. Of particular interest was a pair of siblings, one of whom developed HUS with diarrhea and the other bloody diarrhea alone.

During the 2-year study period, *E. coli* 0157:H7 was not detected in stools from 5 other patients with HUS. Four of these 5 individuals were already receiving antibiotic therapy and one was seen 2 weeks after onset of symptoms. The role of *E. coli* 0157:H7 or other *E. coli* serotypes is therefore uncertain in this particular group of patients.

E. coli 0157:H7, which was once thought to be an uncommon pathogen, is presently about as common as *Campylobacter, Yersinia* or *Salmonella* in this hospital. The authors suggest that other centers should routinely screen stool specimens from patients with diarrhea for sorbitol-negative strains of *E. coli* 0157:H7 and should consider culture of specimens from additional sites in patients with HUS.

Can. Diseases Weekly Report 1/18/86.

ACHING JOINTS? IT MAY HAVE BEEN SOMETHING YOU ATE!

The role of enteric microorganisms in rheumatoid diseases was discussed in the June 1985 *Journal of Food Protection*. Some common foodborne and waterborne pathogens have been linked to various debilitating arthritis-like diseases as well as to the usual gastrointestinal symptoms. Such diseases as reactive arthritis, Reiter's syndrome and ankylosing spondylitis can be linked to such enteric pathogens as *Shigella spp., Salmonella spp., Yersinia enterocolitica, Campylobacter jejuni* and possibly others.

Individuals possessing an inherited blood antigen known as Human Leukocyte antigen -B27 (HLA--B27), about 8% of the Caucasian population in the United States, appear to be predisposed to develop arthritis symptoms following enteric infections. Studies have shown up to 80% of patients with arthritic disease related to foodborne pathogens are HLA-B27 positive. For the remaining 20% of the arthritis victims, who did not have HLA-B27, some investigators believe that other genetic factors may be predisposing factors.

There are several theoretical mechanisms by which these pathogens elicit autoimmune diseases. The hypothesis that would have the most profound effect on the way we perceive disease involves the transfer or prokaryotic DNA (from the bacteria) to an eukaryotic cell (human cell). The DNA transfer, hypothetically plasmid mediated, would make the human joint cells susceptible to attack by its own immune system. If it is proven that the bacterial plasmid has truly been incorporated stably into human DNA and is able to mediate chronic disease, there will emerge an entire field of investigation into the causes of all diseases of unknown etiology and of known association with this antigen system.

Food Protection Bulletin, NY State Dept. of Health.

RAW CLAM RELATED GASTROENTERITIS - MONROE COUNTY

The Monroe County Health Department reported an outbreak of gastroenteritis linked to eating raw hard-shell clams at a large dinner party on November 15, 1985. Over 200 people attended the event which was held for the medical staff of a large hospital in Rochester. Many hospital employees failed to appear at work on the three days following the event, leading the hospital administrator to suspect an outbreak and notify the Monroe County Health Department. Health Department staff interviewed 130 of the party attendees and verified that 30 were ill. Eating raw clams was significantly ($p<.0002$, Fisher's Exact) as-

sociated with becoming ill; eating other foods was not. The mean incubation period was almost 40 hours with a range of from 10 to 51 hours. Predominant symptoms were diarrhea (87%), nausea (57%), vomiting (53%), fever (27%) and cramps (23%). Both acute and convalescent blood sera were collected from seven volunteers. Stool specimens were submited to the New York State Lab for bacterial screening. They will be held for possible viral analysis at some later date. Immune globulin shots were recommended to all who ate raw clams.

Although none of the clams were available from the restaurant that hosted the event, it was discovered that clams from the same shipment were also shipped to another restaurant in Rochester; some of these clams were collected for bacterial and viral analysis (experimental).

Unfortunately, it was not possible to conclusively identify the sources of the clams due to tagging discrepancies. The New York State Department of Environmental Conservation is investigating tagging practices used by the companies involved. Nonetheless, the evidence implicated clams from both Narrangansett Bay, Rhode Island, and Long Island, New York. For outbreaks of suspected viral etiology, a negative bacterial pathogen test of the clams are experimental at this time. Serological tests on acute and convalescent blood sera can be confirmatory for a few viruses causing gastroenteritis but are performed only by a few laboratories out of state. Some viruses can be identified in stool specimens collected in glycerol collection kits. (Reported by John Altieri, New York State Department of Health and John Campana, Monroe County Health Department).

Food Protection Bulletin, New York State Department of Health.

HACCP UPDATE: THE GOAL IS MONITORING POINTS

Some local health offices are finding it difficult to begin the HACCP program due to a variety of problems including limited resources and staffing. Compounding this problem is the perception that the HACCP program requires an extraordinary amount of time. While it is true that initial work on the HACCP program is labor intensive, this time should be viewed as initial start up costs and training of staff, and should not be considered the normal long-range cost.

The goal of the HACCP program is to have all high risk and, perhaps, many risk establishments routinely using monitoring points that health departments have jointly established with operators. In order to reach this goal, training sessions for food program staff have been held and include a few of the lengthy HACCP evaluations. Upon completion of training, the next objective is to schedule existing resources to visit high risk establishments and help operators identify and use monitoring points as soon as practical. Our HACCP experience so far has taught us that monitoring points become similar or repetitious for certain groupings of foods, i.e., (1) roasts of meat, poultry or fish; (2) fried or broiled meat, fish, poultry; (3) sauces, soups, gravies; (4) cooked vegetables; (5) raw vegetables; (6) casseroles; (7) cold salads (potato, macaroni); (8) baked goods. As experience is gained, these groups may change but the principle of grouping similar foods by the type of monitoring points will allow us to "spread the word" of monitoring points much more quickly.

Food Protection Bulletin, NY State Dept. of Health.

SURVEILLANCE DATA - 1985

During the 12 months of 1985, there were 598 investigations involving 3,939 cases of possible foodborne illness reported; for 1984, 701 investigations involving 5,178 cases were reported. When all final reports for 1984 were reviewed, 160 of the 701 investigations were sufficiently documented to be considered outbreaks of foodborne illness.

MONOSODIUM GLUTAMATE (MSG) AND "CHINESE RESTAURANT SYNDROME"

Reactions to monosodium glutamate (MSG) or "Chinese Restaurant Syndrome" are rarely reported in New York State. Since 1981, only three outbreaks involving MSG were reported; in only two of these was an actual measurement taken of MSG concentration. Fried rice was found to be 2% MSG in the first; broccoli and garlic sauce contained 1% MSG in the second. Even then, reported symptoms of vomiting or diarrhea and cramps were atypical of what is usually considered to be Chinese Restaurant Syndrome.

Many symptoms have been attributed to Chinese Restaurant Syndrome. Foremost among them are a sensation of numbness, pressure or tingling in the scalp, back of neck, face, arms or legs with flushing, dizziness, and occasionally a "pounding" headache. All of this happens within 30 minutes of consuming the suspect food, particularly on an empty stomach. Symptoms are of short duration, usually less than 3 hours. Females appear to be more susceptible than males. A review of the literature reveals that some controversy exists as to how much MSG will cause symptoms and even as to whether the symptoms can be attributed to MSG at all. One of the best studies shows wide variations in dose-response levels and in elicited symptoms, and even that symptoms were induced by placebos in many cases. It was found that with a level of 1 gram MSG per 150 ml of tomato juice, there was a lower symptom response rate than with a lightly salted placebo juice and the hypothesis was made that quantities on the order of 2 grams MSG per 150 ml serving would have no more chance of producing symptoms than juice containing no MSG. The use of "bizarre" quantities of 5 grams or more per serving did appear to produce responses in one-third of 77 persons tested in a double-blind experiment.

Objective responses to MSG were difficult to measure. Pulse rate, blood pressure, skin temperature and even concentration of glutamate in blood was not related to perception of symptoms.

In summary, MSG ingestion can be shown to produce a variety of mild symptoms but, when used in appropriate culinary quantities, only a very small minority of persons will be affected. Chinese Restaurant Syndrome has not been shown to be life threatening.

Food Protection Bulletin, NY State Dept. of Health.

HACCP UPDATE

As field units work with the HACCP approach, they continue to encounter the problems associated with rapid cooling of potentially hazardous foods. The New York State Health Department "Food Service Establishment Inspection Report" form

(GEN 48) includes, in item 5b, the criteria that potentially hazardous foods be cooled from 130°F to 70°F within two hours and further cooled to 45°F within six hours. These criteria were based on the best information available at the time. As many people have discovered, this criteria is often difficult to satisfy. We have since learned of some other cooling criteria in different settings.

The French government adopted criteria for the cooling of potentially hazardous foods in 1974 calling for cooling such foods from 149°F to 50°F within two hours. Refrigeration equipment must have the capacity to cool foods at this rate as well. This requirement applies only to foods that are cooked and immediately cooled for later use. Leftover portions of foods that are cooked and served the same day may not be cooled for later service. These foods must be discarded (i.e., no services of leftovers).

The United States Department of Agriculture (USDA) has adopted strict cooling requirements for processing ready-to-eat meats (particularly precooked roast beef). Their "Meat and Poultry Inspection Manuals," Section 8.55e, specifies that heat-processed products "shall not be kept between 40°F and 120°F for more than 2 hours." This standard was developed in response to a number of salmonella outbreaks and recalls involving these products. The meat processing industry has expended large sums of money in the last few years to provide adequate equipment to meet this requirement.

As our knowledge of other cooling criteria and our first hand experience with cooling of potentially hazardous foods in food service expands, we will undoubtedly refine our criteria accordingly.

Food Protection Bulletin, NY State Dept. of Health.

FDA CODE INTERPRETATION - SOILED LINEN

Question: May soiled work clothes and linens be stored in cold food storage rooms?

Discussion: Work clothes, linens and wiping cloths, because they are often soiled with food debris and frequently damp, may rapidly "sour" and become odorous. They can also serve as attractants to insects and rodents. This is especially true in warmer seasons and climates.

For these reasons, some operators have suggested storing soiled items in their walk-in refrigeration units. Such a practice would reduce growth of odor producing microorganisms and also reduce the likelihood that the items would attract vermin, since insects and rodents do not like and avoid temperatures of 45°F or below.

However, there are several public health concepts and concerns associated with such a practice:

- It is not considered good public health practice to bring contaminated articles into proximity of foods.
- Cold storage units may be full or crowded and thus containers of soiled work clothes and linens might interfere with proper cleaning, product rotation and air circulation.
- Operators might increase the storage time of soiled items, a practice contrary to good principles of hygiene.
- The presence of containers or bags of soiled work clothes and linens in cold storage units, might be construed as condoning (and thereby lend to) such practices as changing uniforms in the walk-in refrigerators or putting covered garbage containers in that unit.

The public health concerns are believed to be sufficiently significant to justify banning this practice. Problems of "souring" odors or vermin attraction can be handled by providing more frequent removal of soiled items for laundering or by other procedures acceptable to the regulatory authority.

Interpretation: Soiled work clothes, soiled linens and other articles such as soiled wiping cloths *may not* be stored in cold food storage rooms.

Food Protection Bulletin, NY State Dept. of Health.

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Abstracts of papers in the September Journal of Food Protection

To receive the* Journal of Food Protection *in its entirety each month call 1-800-525-5223, ext. A or 515-232-6699, ext. A in Iowa.

Changes in Microbial Population and Growth of *Bacillus cereus* During Storage of Reconstituted Dry Milk, Marcia H. Rodriquez and Ericka L. Barrett, Department of Food Science and Technology, University of California, Davis, California 95616

J. Food Prot. 49:680-686

Eight brands of retail nonfat and whole dry milk were reconstituted and analyzed for changes in the predominant bacterial population and for the proliferation of *Bacillus cereus* throughout storage at 30, 20, and 5°C. All brands yielded similar results. *Bacillus* and *Micrococcus* predominated in the freshly reconstituted milk. During storage at 30°C, the *Bacillus* population proliferated initially, but was gradually replaced by enterococci. At the time of spoilage, *Bacillus* counts had dropped by several orders of magnitude. The proportion of *Micrococcus* gradually declined. *B. cereus* counts reached hazardous levels as early as 10 h after reconstitution, which was before spoilage was evident. Similar changes occurred in reconstituted milk stored at 20°C, but the time course for the changes was longer, and the *Bacillus* counts did not decline as rapidly as they did at 30°C. Again, counts of *B. cereus* reached hazardous levels before the milk showed signs of spoilage. At 5°C, the milk showed no signs of spoilage for 4 to 5 weeks. *Bacillus* constituted more then 90% of the bacteria isolated after the first week. *Bacillus* counts continued to increase slowly, but the relative proportion decreased as the gram-negative rods, especially *Enterobacter*, proliferated. *B. cereus* never reached numbers great enough to cause disease. The results revealed that the microbial profile of reconstituted dry milk changed significantly over time and that the temperature of storage determined the eventual microbial composition. The results also showed that *B. cereus* is an omnipresent health hazard in reconstituted milk that is not properly refrigerated.

Detectability Levels of Four Beta-Lactam Antibiotics in Eight Milk Products Using the AOAC *Bacillus stearothermophilus* Disc Assay, Kathleen T. Rajkowski, James T. Peeler and James W. Messer, Food and Drug Administration, Division of Microbiology, 1090 Tusculum Avenue, Cincinnati, Ohio 54226

J. Food Prot. 49:687-690

The 50% dectability level (ED50) of the *Bacillus stearothermophilus* disc assay in raw, pasteurized whole, protein-fortified lowfat, lowfat, and skim milks, half-and-half, heavy cream and goat's milk was determined for penicillin G, ampicillin, cloxacillin and cephapirin. Results demonstrate a lower level of detectability with PM agar than with A4 agar for ampicillin, cloxacillin and penicillin. Ranges of detection using PM agar at 64°C were 0.0025 to 0.0042 IU/ml (0.0016 to 0.0026 μg/ml) for penicillin G, 0.0021 to 0.0042 μg/ml for ampicillin, 0.0030 to 0.0059 μg/ml for cephapirin and 0.0167 to 0.0334 μg/ml for cloxacillin. Liquid penicillinase is recommended when performing the confirmation test for beta-lactam identification.

An Evaluation of Antibotulinal Activity in Nitrite-Free Curing Systems Containing Dinitrosyl Ferrohemochrome, D. S. Wood, D. L. Collins-Thompson, W. R. Usborne and B. Picard, Department of Environmental Biology and Food Science, University of Guelph, Guelph, Ontario, Canada N1G 2W1 and Food Research Institute, Research Branch, Agriculture Canada, Ottawa, Ontario, Canada K1A 0C6

J. Food Prot. 49:691-695

The ability of the pigment dinitrosyl ferrohemochrome to mimic the cured meat color function attributed to nitrite, was evaluated in a number of nitrite-free, model meat systems. In addition, compounds with reported antibotulinal properties were compared to the antibotulinal effect of nitrite. Fifteen treatments were evaluated and compared to 50 and 150 ppm nitrite. Two processing conditions (short and extended heating) were also compared for their ability to enhance pigment color and eliminate the natural meat microbial population. Meat slurries varying in cure composition were inoculated with a composite of six different strains of *Clostridium botulinum*, types A and B. After processing, the packages were incubated at 10 and 27°C, and were analyzed for toxin. The treatment containing 3000 ppm sodium hypophosphite most closely resembled the 150 ppm nitrite control in its ability to prevent spore outgrowth and toxin production. The treatment containing 1250 ppm monomethyl fumerate also scored better than the other treatments including ethylene diamine tetraacetic acid (EDTA), potassium sorbate and tertiary butyl hydroquinome (TBHQ), but was slightly less inhibitory than sodium hypophosphite. The longer heat treatment eliminated all the natural meat flora (lactic acid bacteria) and enhanced the color production of the pigment.

Use of Milk Enzymes as Indices of Heat Treatment, Mansel W. Griffiths, Hannah Research Insitute, Ayr KA6 5HL, Scotland

J. Food Prot. 49:696-705

Methods for the assay of naturally occurring enzymes in milk were investigated and suitable techniques obtained. The effect of laboratory pasteurization at 65, 70, 75 and 80°C for 15 s on the activity of nine enzymes present in milk was studied. The activity of these enzymes remaining after heating at temperatures between 65 and 80°C with a holding time of 15 s using a plate heat exchanger was generally less than expected from the laboratory data. Four enzymes, acid phosphatase, amylase, lactoperoxidase and xanthine oxidase, were chosen for further study and holding times were varied at temperatures between 65 and 80°C in order to calculate D- and z-values. Data are also presented on the variation in the activity of the enzymes studied in raw milk. The results obtained in the present study were compared with those in the literature. Of the enzymes studied, lactoperoxidase offers the most promising method for detecting heat treatments of the order 76°C for 15 s. Commercially available strips for the detection of enzyme activity are available (API ZYM), but they are of little use in assessing the heat treatment which has been applied to milk.

Improved Media for Sporulation and Enterotoxin Production by *Clostridium perfringens*, Stanley M. Harmon and Donald A. Kautter, Division of Microbiology, Food and Drug Administration, Washington, D.C. 20204

J. Food Prot. 49:706-711

Sporulation of 24 strains of *Clostridium perfringens* isolated from stools of food poisoning patients and normal controls was improved by adding sodium carbonate to Duncan-Strong (DS) sporulation medium and replacing starch with raffinose in Taniguti's AEA medium. Viable counts of heat-tolerant spores (75°C for 20 min) were 2 to 186 times greater in modified AEA medium and 2 to 169 times greater in modified DS than in DS medium. Reversed passive latex agglutination assays revealed a corresponding increase in enterotoxin titers in supernatant fluids of the 12 enterotoxigenic strains grown in modified AEA medium and in modified DS medium.

Prevalence of *Campylobacter jejuni* in Turkey Carcass Processing and Further Processing of Turkey Products, G. R. Acuff, C. Vanderzant, M. O. Hanna, J. G. Ehlers, F. A. Golan and F. A. Gardner, Department of Animal Science and Department of Poultry Science, Texas Agricultural Experiment Station, Texas A&M University, College Station, Texas 77843

J. Food Prot. 49:712-717

Presence of *Campylobacter jejuni* was determined at various locations in turkey carcass processing and further processing of turkey products (wieners, ham and boneless breast). Contamination of turkey carcasses with *C. jejuni*, in most cases, occurred on the surface of the skin or on the surface of the abdominal cavity lining. No contamination of interior muscle tissue was observed. The percentage of turkeys containing *C. jejuni* upon entering the processing plant varied (50 to 100%). Large numbers of *C. jejuni* were killed during scalding of carcasses, but extensive recontamination occurred during mechanical defeathering. After scalding, numbers of *C. jejuni* peaked during evisceration, but dropped to lower levels after washing. Few or no *C. jejuni* were recovered from the carcasses after leaving the chill tank. No *C. jejuni* were detected on frozen turkey carcasses, including the drip, at the wholesale or retail level. However, *Campylobacter coli* was detected in the drip of a few carcasses that had been in frozen storage at the wholesale level for 2 wk and 3 months. Neither *C. jejuni* nor *C. coli* was detected on frozen turkeys at the retail level. Although, in some cases, *C. jejuni* were recovered from turkey meat during initial stages of further processing, no *C. jejuni* were recovered from heat-treated, further processed products.

Etiology of White Spot Defect in Swiss Cheese Made from Pasteurized Milk, K. R. Nath and B. J. Kostak, Research and Development, Kraft, Inc., 801 Waukegan Road, Glenview, Illinois 60025

J. Food Prot. 49:718-723

Swiss cheese made from fully pasteurized milk developed white spots during hot room stay. This cheese was bitter and eye development was generally retarded. *Streptococcus faecalis* subsp. *liquefaciens* was isolated in high numbers from the spot; it caused bitterness in milk cultures with complete dissolution of the milk clot. The isolate was inhibitory to propionibacteria and *Lactobacillus fermentum*; CO_2 production by *Propionibacterium* was depressed in broth culture in the presence of the *S. faecalis* subsp. *liquefaciens* isolate.

Comparison of Three-Class Attributes Sampling Plans and Variables Sampling Plans for Lot Acceptance Sampling in Food Microbiology, George A. Jarvis and Stephen A. Malcolm, Food Statistics and Operational Planning Division, Food Directorate, Health Proection Branch, Health and Welfare Canada, Tunney's Pasture, Ottawa, Ontario, Canada K1A 0L2

J. Food Prot. 49:724-728

Lot acceptance sampling is an established method of assessing the microbiological quality and safety of batches or consignments of food, but the choice between three-class attributes plans and variables plans is not always clear. Application of variables plans requires that the microorganism of concern be distributed normally, or log-normally. When such is not true, variables plans may place either the consumer or the producer

at increased risk. Validation of normality is therefore essential when using variables plans. However, with small numbers of sample units as are typically analyzed in microbiological testing of food, statistical tests are unlikely to detect non-normality. Three-class attributes plans do not require strong distributional assumptions for correct application, and as well they have several practical and operational advantages over variables plans. Moreover, three-class attributes plans assess lot quality in a fashion fundamentally different from variables plans, and this difference precludes the usual statistical comparisons based on relative discriminatory ability. We conclude that when selecting acceptance sampling plans for microbiological testing of food, whether the plans be for regulatory, port-of-entry or in-plant purposes, three-class plans are generally preferable to variables plans.

Variability of Milk Components in 1705 Herds, J. L. Sommerfeldt and R. J. Baer, Dairy Science Department, South Dakota University, Brookings, South Dakota 57007-0647

J. Food Prot. 49:729-733

Biweekly herd milk samples collected for a 1-year period (January 1, 1984 to December 31, 1984) from 1705 herds in eastern South Dakota, western Minnesota and northwestern Iowa were analyzed to evaluate milk components as factors considered in milk pricing programs. The average composition was 3.71% fat, 8.64% solids-not-fat (SNF), 3.28% protein, 12.35% total solids (TS) and 1.8×10^5 CFU/ml (aerobic plate count). Fat was the most variable (8.4% coefficient of variation) milk component, followed by protein, TS and SNF (6.3, 4.1 and 3.4% coefficient of variation, respectively). The concentration of fat, SNF, protein and TS in milk was lowest in July and August and highest during November through March. Correlation coefficients (r) for fat vs. SNF, protein and TS were 0.40, 0.64 and 0.84, respectively, for SNF vs. protein and TS were 0.70 and 0.83, respectively, and for protein vs. TS was 0.79. Grade A milk had lower aerobic plate counts (3.2×10^4 and 3.0×10^5 CFU/ml), higher % SNF (8.68 and 8.60), and higher % TS (12.39 and 12.31) than manufacturing grade milk. There were no differences in % fat (3.71 and 3.72) and % protein (3.28 and 3.28) between Grade A and manufacturing grade milks. Some cooperatives and milk plants are paying a SNF premium (8.75% base), stating that an 8.75% SNF is equivalent to a 3.2% protein content. This occurred in herds with $<3.0\%$ fat; however, for herds producing ≥ 3 and $\leq 4\%$ fat, 8.75% SNF was equivalent to 3.31% protein, whereas for herds producing $>4\%$ fat, 8.75% SNF was equivalent to 3.46% protein. Solids-not-fat component pricing has the potential to be compared to protein pricing if producer grade, seasonal period and fat content of herd milk are considered.

***Salmonella* Surveillance by the Food and Drug Administration: A Review 1974-1985,** Dean E. Wagner and Sallie McLaughlin, Minneapolis Center for Microbiological Investigations, Food and Drug Administration, Minneapolis, Minnesota 55401

J. Food Prot. 49:734-738

Since 1974, the Food and Drug Administration's (FDA's) Minneapolis Center for Microbiological Investigations has been responsible for confirmation and serotyping of *Salmonella* cultures originally isolated by FDA field laboratories. The data have subsequently been entered into FDA's Microbial Information System for storage and analysis. A summary of the data accumulated from 1974 to 1985 is provided as an overview of FDA's *Salmonella* surveillance activities for the period.

Assessment of Dairy Product Quality and Potential Shelf-Life - A Review, J. R. Bishop and C. H. White, Dairy Science Department, Mississippi Agricultural and Forestry Experiment Station, Mississippi State University, Mississippi State, Mississippi 39762

J. Food Prot. 49:739-753

Over the years, many tests and assays have been developed to estimate the quality and potential shelf-life of dairy products. These have ranged from simple, standard bacterial enumerations to more complex metabolite detections. This paper is a review of the parameters that have been used to estimate, or indicate the inherent quality of dairy products.

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Little Falls, New York 13365

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210 Beaver St., P.O. Box 696
Yorkville, Illinois 60560

411 Capital Equipment Corp. (11/15/83)
2421 Darwin Road
Madison, WI 53704

82R Cherry-Burrell Corp. (12/11/57)
(A Unit of AMCA Int'l. Corp.)
2400-6th St. SW, P.O. Box 3000
Cedar Rapids, Iowa 52406

407 Continental Disc Corp. (10/14/83)
4103 Riverside NW
Kansas City, MO 64150

376 Defontaine Inc. (1/25/83)
563 A. J. Allen Circle
Wales, WI 53183

455 Flowtech Inc. (9/17/85)
120 Interstate N. Pkwy. E.#208
Atlanta, Georgia 30339-2103

271 The Foxboro Co. (3/8/76)
38 Neponset Ave.
Foxboro, Massachusetts 02035

67R G & H Products Corp. (6/10/57)
7600-57th Avenue
P.O. Box 1199
Kenosha, WI 53141

350 H&K, Inc. -Rosista Div. (1/7/82)
2365 S. 170th Street
P.O. Box 54
New Berlin, WI 53151

369 IMEX, Inc. (11/3/82)
4040 Del Rey Ave. Unit 9
Marina del Rey, CA 90292

203R ITT Grinnell Valve Co., Inc. (11/27/68)
Dia-Flo Division
33 Centerville Rd.
Lancaster, Pennsylvania 17603

454 Jensen Fittings Corp. (9/11/85)
107-111 Goundry St.
North Tonawanda, New York 14120-5998

34R Ladish Co., Tri-Clover Div. (10/15/56)
9201 Wilmot Rd.
Kenosha, Wisconsin 53141

398 Ladish Co., Tri-Clover Div. (7/29/83)
9201 Wilmot Road
Kenosha, WI 53141

389 Lee Industries, Inc. (5/31/83)
P.O. Box 688
Philipsburg, PA 16866

239 Lumaco, Inc. (6/30/72)
P.O. Box 688
Teaneck, New Jersey 07666

200R Paul Mueller Co. (3/5/68)
1600 W. Phelps St., Box 828
Springfield, Missouri 65801

374 Niro Atomizer Food & Dairy Inc. (1/25/83)
1600 County Road F
Hudson, Wisconsin 54016

416 Process Engineers, Inc. (1/11/84)
3329 Baumberg Ave.
Hayward, CA 94545

242 Puriti, S.A. de C.V. (9/12/72)
(not available in USA)
Alfredo Nobel 39
Industrial Puente de Vigas
Tlalnepantla, Mexico

149R Q Controls Subsid. of Cesco Magnetics (5/18/64)
93 Utility Court
Rohnert Park, California 94928

424 Robert-James Sales, Inc. (8/31/84)
P.O. Box 1672, 269 Hinman Ave.
Buffalo, NY 14216-0672

287 Sanitary Processing Equipment Corp. (1/14/77)
P.O. Box 178, Salino Station
Syracuse, New York 13201

334 Stainless Products, Inc. (12/18/80)
1649-72nd Ave., Box 169
Somers, Wisconsin 53171

391 Stork Food Machinery, Inc. (6/9/83)
P.O. Box 1258/Airport Parkway
Gainesville, Georgia 30503

300 Superior Stainless, Inc. (11/22/77)
611 Sugar Creek Rd.
Delavan, Wisconsin 53115

357 Tanaco Products (4/16/82)
3860 Loomis Trail Rd.
Blaine, Washington 98230

73R L. C. Thomsen & Sons, Inc. (8/31/57)
1303-43rd St.
Kenosha, Wisconsin 53140

250 Universal Cooperatives, Dairy (6/11/73)
Dairy Division
U.S. Hwy 33 East/Box 115
Goshen, Indiana 46526

449 Up-Well Enterprises Co., USA (8/1/85)

P.O. Box 5334
Grants Pass, Oregon 97527

304 VNE Corporation (3/16/78)
1415 Johnson St., P.O. Box 187
Janesville, Wisconsin 53547

278 Valex Products Corp. (8/30/76)
6080 Leland Street
Ventura, California 93003

86R Waukesha Specialty Co., Inc. (12/20/57)
Hwy 14
Darien, Wisconsin 53144

08-17A Compression Type Valves

467 Tuchenhagen North America Inc. (1/13/86)
4119 W. Green Tree Rd.
Milwaukee, Wisconsin 53209

09-07 Instrument Fittings and Connections Used on Milk and Milk Products Equipment

428 ARi Industries, Inc. (9/12/84)
381 ARi Court
Addison, IL 60101

321 Anderson Instrument Co., Inc. (6/14/79)
RD #1
Fultonville, New York 12072

315 Burns Engineering, Inc. (2/5/79)
10201 Bren Rd., East
Minnetonka, Minnesota 55343

206 The Foxboro Co. (8/11/69)
38 Neponset Ave.
Foxboro, Massachusetts 02035

418 Niro Atomizer Food & Dairy Inc. (4/2/84)
1600 County Road F
Hudson, Wisconsin 54016

367 RdF Corporation (10/2/82)
23 Elm Ave.
Hudson, New Hampshire 03051

420 Stork Food Machinery, Inc. (4/17/84)
P.O. Box 1258/Airport Parkway
Gainesville, Georgia 30503

32 Taylor Instrument Co. (10/4/56)
Div. of Combusion Eng.
95 Ames St.
Rochester, New York 14601

444 Tuchenhagen North America, Inc. (6/17/85)
4119 Green Tree Road
Milwaukee, WI 53209

10-03 Milk and Milk Products Filters Using Disposable Filter Media, as Amended

371 Alloy Products Corp. (12/10/82)
1045 Perkins Ave., P.O. Box 529
Waukesha, Wisconsin 53187

35 Ladish Co., Tri-Clover Div. (10/15/56)
9201 Wilmot Rd.
Kenosha, Wisconsin 53141

435 Sermia Equipment Limited (11/27/84)
(Not available in USA)
2511 Barbe Avenue
Chomedey, Laval, Quebec, Canada H7T 2A2

296 L. C. Thomsen, Inc. (8/25/77)
1303 43rd St.
Kenosha, Wisconsin 53140

11-03 Plate-type Heat Exchangers for Milk and Milk Products

38 APV Crepaco, INC. (10/19/56)
100 South CP Ave.
Lake Mills, Wisconsin 53551

20 APV Crepaco, INC. (9/4/56)
395 Fillmore Ave.
Tonawonda, New York 14150

458 APV International Limited (10/15/85)
(Not available in USA)
P.O. Box 4, Manor Royal
Crawley
West Sussex RH10 2QB
England

17 Alfa-Laval, Inc. (8/30/56)
2115 Linwood Ave.
Ft. Lee, New Jersey 07024

120 Alfa-Laval, Ltd. (12/3/59)
(DeLaval Agric. Div.)
11100 No. Congress Ave.
Kansas City, Missouri 64153

326 American Vicarb Corporation (2/4/80)
89 Pearce Avenue
Tonawanda, New York 14150

30 Cherry-Burrell Corp. (10/2/56)
(A Unit of AMCA Int'l. Inc.)
2400-6th St. SW, P.O. Box 3000
Cedar Rapids, Iowa 52406

14 Chester-Jensen Co., Inc. (8/15/56)
5th & Tilghman Sts., P.O. Box 908
Chester, Pennsylvania 19016

468 GEA Columbia, Inc. (2/2/86)
8940 Route 108
Columbia, Maryland 21045

362 Kroeze Dairy Equipment, Inc. (7/20/82)
14393 Euclid Ave.
Chino, California 91710

15 Kusel Equipment Co. (8/15/56)
820 West St., P.O. Box 87
Watertown, Wisconsin 53094

360 Laffranchi Wholesale Co. (7/12/82)
P.O. Box 698
Ferndale, California 95536

414 Paul Mueller Co. (12/13/83)
P.O. Box 828
Springfield, MO 65801

365 Niro Atomizer Food & Dairy Inc. (9/8/82)
1600 County Road F
Hudson, Wisconsin 54016

279 The Schlueter Co. (8/30/76)
112 E. Centerway
Janesville, Wisconsin 53545

472 Schmidt-Bretten Inc. (5/7/86)
1612 Locust Avenue
Bohemia, New York 11716

426 TCI-Superior Division, (8/31/84)
Mueller Canada Inc.
6500 Northwest Dr.
Mississauga, Ontario, Canada L4V 1K4

12-04 Tubular Heat Exchangers for Milk and Milk Products

438 APV Crepaco, INC. (12/10/84)
395 Fillmore Avenue
Tonawanda, New York 14150

248 Allegheny Bradford Corp. (4/16/73)
P.O. Box 200 Route 219 South
Bradford, PA 16701

243 Babson Bros. Company (10/31/72)
2100 So. York Rd.
Oak Brook, Illinois 60521

103 Chester-Jensen Co., Inc. (6/6/58)
5th & Tilghman Sts., P.O. Box 908
Chester, Pennsylvania 19016

307 G & H Products Corp. (5/2/78)
7600-57th Avenue
P.O. Box 1199
Kenosha, WI 53141

217 Girton Manufacturing Co. (1/31/71)
Millville, Pennsylvania 17846

238 Paul Mueller Co. (6/28/72)
P.O. Box 828
Springfield, Missouri 65801

96 C. E. Rogers Co. (3/31/64)
So. Hwy #65, P.O. Box 118
Mora, Minnesota 55051

298 Sanitary Processing Equipment Corp. (1/28/85)
P.O. Box 178, Salino Station
Syracuse, NY 13201

392 Stork Food Machinery, Inc. (6/9/83)
P.O. Box 1258/Airport Parkway
Gainesville, Georgia 30503

13-08 Farm Milk Cooling and Holding Tanks

49R A-L Stainless Inc. (12/5/56)
113 Park St., South
Peterborough, Ontario Canada K9J 3R8

240 Babson Bros. Company (9/6/72)
2100 So. York Rd.
Oak Brook, Illinois 60521

4R Dairy Equipment Co. (6/15/56)
1919 So. Stoughton Rd.
Madison, Wisconsin 53716

179R Heavy Duty Products (Preston) Ltd. (3/8/66)
(not available in USA)
1261 Industrial Rd.
Cambridge (Preston)
Ontario Canada N3H 4W3

12R Paul Mueller Co. (7/31/56)
1600 W. Phelps, P.O. Box 828
Springfield, Missouri 65801

16R Zero Manufacturing Co. (8/27/56)
811 Duncan Ave.
Washington, Missouri 63090

16-05 Evaporators and Vacuum Pans for Milk and Milk Products

254 APV Anhydro, Inc. (1/7/74)
165 John L. Dietsch Square
Attleboro Falls, Massachusetts 02763

132 APV Crepaco, INC. (10/26/60)
395 Fillmore Ave.
Tonawanda, New York 14150

277 Alfa-Laval, Inc. (8/19/76)
Contherm Division
P.O. Box 352, 111 Parker St.
Newburyport, Massachusetts 01950

356 Damrow Co. (3/10/82)
(Div. of DEC Int'l. Inc.)
196 Western Ave., P.O. Box 750
Fond du Lac, Wisconsin 54935-0750

311 GEA Wiegand Corporation (8/28/78)
8940 Route 108
Columbia, Maryland 21045

273 Niro Atomizer Food & Dairy, Inc. (5/20/76)
1600 County Rd F
Hudson, Wisconsin 54016

107R C. E. Rogers Co. (7/31/58)
So. Hwy #65, P.O. Box 118
Mora, Minnesota 55051

446 Sterner Industries, Inc. (7/8/85)
P.O. Box 70
Winsted, Minnesota 55395

299 Stork Food Machinery, Inc. (11/17/77)
P.O. Box 1258/Airport Parkway
Gainesville, Georgia 30503

427 TCI-Superior Division, (8/31/84)
Mueller Canada Inc.
6500 Northwest Dr.
Mississauga, Ontario, Canada L4V 1K4

387 Unitech Div. of the Graver Co. (5/13/83)
2720 Hwy. 22
Union, New Jersey 07083

186R Marriott Walker Corp. (9/6/66)
925 E. Maple Rd.
Birmingham, Michigan 48011

17-06 Fillers and Sealers of Single Service Containers for Milk and Milk Products

366 Autoprod, Inc. (9/15/82)
12 So. Denton Ave.
New Hyde Park, New York 11040

346 B-Bar-B, Inc. (10/21/81)
E. 10th & McBeth, P.O. Box 909
New Albany, New York 47150

192 Cherry-Burrell Corp. (1/3/67)
(A Unit of AMCA Int'l., Inc.)
2400-6th St. SW, P.O. Box 3000
Cedar Rapids, Iowa 52406

382 Combibloc, Inc. (4/15/83)
4800 Roberts Rd.
Columbus, OH 43228

324 Conoffast (11/29/79)
711 Jorie Blvd.
Oak Brook, Illinois 60521

137 Ex-Cell-O Corp. (10/17/62)
850 Ladd Rd., Bldg. "A"
Walled Lake, Michigan 48088

352 GMS Engineering (1/12/82)
1936 Sherwood St.
Clearwater, Florida 33515

473 International Paper Company (6/12/86)
Extended Shelf Life Division
4020 Stirrup Creed Drive Bldg. 200
P.O. Box 13318
Research Triangle Park, NC 27709

452 Jagenberg Inc. (9/3/85)
Freshwater Blvd.
P.O. Box 188
Enfield, Connecticut

220 Liquipak International, Inc. (4/24/71)
2285 University Ave.
St. Paul, Minnesota 55114

330 Milliken Packaging (8/26/80)
White Stone, South Carolina 29353

442 Milliken Packaging (2/21/85)
White Stone, SC 29386

281 Purity Packaging Corp. (11/8/76)
800 Kaderly Dr.
Columbus, Ohio 43228

351 Tetra Pak Inc. (1/7/82)
889 Bridgeport Ave.
P.O. Box 807
Shelton, Connecticut 06484-0807

211 Twinpak, Inc. (Canada) (2/4/70)
2225 Hymus
Dorval, Quebec, Canada H9P ,J8

18-00 Multiple-Use Rubber & Rubber-Like Materials Used as Product Contact Surfaces in Dairy Equipment

429 Bepex Corporation (9/25/84)
P.O. Box 880
Santa Rose, CA 95402

19-03 Batch and Continuous Freezers for Ice Cream, Ices, and Similarly Frozen Dairy Foods, as Amdended

141 APV Crepaco, INC. (4/15/63)
100 South CP Ave.
Lake Mills, Wisconsin 53551

146 Cherry-Burrell Corp. (12/10/63)
(A Unit of AMCA Int'l., Inc.)
2400-6th St. SW, P.O. Box 3000
Cedar Rapids, Iowa 52406

401 Coldelite Corp. of America (8/22/82)
Robinson Rd. & Rt. 17 So.
Lodi, NJ 07644-3897

286 O. G. Hoyer, Inc. (12/8/76)
201 Broad St.
Lake Geneva, Wisconsin 53147

465 Leon's Frozen Custard (12/17/85)
3131 S. 27th Street
Milwaukee, Wisconsin 53151

412 Sani Mark, Inc. (11/28/83)
5767 Dividend Road
Indianapolis, IN 46241

355 Emery Thompson Machine & Supply Co. (3/9/82)
1349 Inwood Ave.
Bronx, New York 10452

22-04 Silo-type Storage Tanks for Milk and Milk Products

262 A-L Stainless Inc. (11/11/74)
113 Park St., South
Peterborough, Ontario Canada K9J 3R8

154 APV Crepaco, INC. (2/10/65)
100 South CP Ave.
Lake Mills, Wisconsin 53551

168 Cherry-Burrell Corp. (6/16/65)
(A Unit of AMCA Int'l, Inc.)
575 E. Mill St.
Little Falls, New York 13365

160 DCI, Inc. (4/5/65)
P.O. Box 1227, 600 No. 54th Ave.
St. Cloud, Minnesota 56301

181 Damrow Co. (5/18/66)
(Div. of DEC Int'l., Inc.)
196 Western Ave., P.O. Box 750
Fond du Lac, Wisconsin 54935-0750

439 JV Northwest Inc. (1/22/85)
28120 SW Boberg Rd.
Wilsonville, Oregon 97070

155 Paul Mueller Co. (2/10/65)
1600 W. Phelps, P.O. Box 828
Springfield, Missouri 65801

460 Niro Atomizer Food & Dairy Inc. (11/4/85)
1600 County Road F
Hudson, Wisconsin 54016

312 Sanitary Processing Equipment Corp. (9/15/78)
P.O. Box 178, Salino Station
Syracuse, New York 13201

434 TCI-Superior Division, (11/9/84)
Mueller Canada Inc.
6500 Northwest Dr.
Mississauga, Ontario, Canada L4V 1K4

165 Walker Stainless Equipment Co., Inc. (4/26/65)
Elroy, Wisconsin 53929

23-01 Equipment for Packaging Frozen Desserts, Cottage Cheese, and Similar Milk Products, as Amended

174 APV Anderson Bros. Mfg. Co. (9/28/65)
1303 Samuelson Rd.
Rockford, IL 61109

209 Doboy Packaging Machinery Incorp. (7/23/69)
869 S Knowles Ave.
New Richmond, Wisconsin 54017

302 Eskimo Pie Corp. (1/26/78)
530 E. Main St.
Richmond, Virginia 23219

343 O. G. Hoyer, Inc. (7/6/81)
201 Broad St.
Lake Geneva, Wisconsin 53147

222 Maryland Cup Corp. (11/15/71)
Owings Mills, Maryland 21117

447 Mateer-Burt Co., Inc. (7/22/85)
436 Devon Park Drive
Wayne, Pennsylvania 19087

24-01 Non-coil Type Batch Pasteurizers

158 APV Crepaco, INC. (3/24/65)
100 South CP Ave.
Lake Mills, Wisconsin 53551

161 Cherry-Burrell Corp. (4/5/65)
(A Unit of AMCA Int'l., Inc.)
575 E. Mill St.
Little Falls, New York 13365

402 Coldelite Corp. of America (8/22/83)
Robinson Rd. & Rt. 17 So.
Lodi, NJ 07644-3897

187 DCI, Inc. (9/26/66)
P.O. Box 1227, 600 No. 54th Ave.
St. Cloud, Minnesota 56301

166 Paul Mueller Co. (4/26/65)
P.O. Box 828
Springfield, Missouri 65801

25-01 Non-coil Type Batch Processors for Milk and Milk Products

159 APV Crepaco, INC. (3/24/65)
100 South CP Ave.
Lake Mills, Wisconsin 53551

162 Cherry-Burrell Corp. (4/5/65)
(A Unit of AMCA Int'l., Inc.)
575 E. Mill St.
Little Falls, New York 13365

188 DCI, Inc. (9/26/66)
P.O. Box 1227, 600 No. 54th Ave.
St. Cloud, Minnesota 56301

167 Paul Mueller Co. (4/26/65)
P.O. Box 828
Springfield, Missouri 65801

448 Scherping Systems (8/1/85)
801 Kingsley Street
Winsted, Minnesota 55395

202 Walker Stainless Equipment Co. (9/24/68)
New Lisbon, Wisconsin 53950

26-02 Sifters for Dry Milk and Dry Milk Products

173 Blaw-Knox Food & Chemical Equip. Co. (9/20/65)
P.O. Box 1041
Buffalo, New York 14240

229 Russell Finex, Inc. (3/15/72)
156 W. Sandford Blvd.
Mt. Vernon, New York 10550

363 Kason Corp. (7/28/82)
1301 East Linden Ave.
Linden, New Jersey 07036

430 Midwestern Industries, Inc. (10/11/84)
915 Oberlin Rd., P.O. Box 810
Massillon, OH 44648-0810

185 Rotex, Inc. (8/10/66)
1230 Knowlton St.
Cincinnati, Ohio 45223

172 SWECO, Inc. (9/1/65)
6033 E. Bandini Blv.
P.O. Box 4151
Los Angeles, California 90051

176 Sprout-Waldron, Koppers Co., Inc. (1/4/66)
Muncy, Pennsylvania 17756

27-01 Equipment for Packaging Dry Milk and Dry Milk Products

353 All-Fill, Inc. (3/2/82)
40 Great Valley Pkwy.
Malvern, Pennsylvania 19355

409 Mateer-Burt Co. (10/31/83)
436 Devon Park Dr.
Wayne, PA 19087

28-00 Flow Meters for Milk and Liquid Milk Products

272 Accurate Metering Systems (4/2/76)
1731-33 Carmen Dr.
Elk Grove Village, Illinois 60007

253 Badger Meter, Inc. (1/2/74)
4545 W. Brown Deer Rd.
P.O. Box 23099
Milwaukee, Wisconsin 53223

265 Electronic Flo-Meters, Inc. (3/10/75)
P.O. Box 38269
Dallas, Texas 75238

359 Emerson Elec. Co. (6/11/82)
Brooks Instrument Div.
P.O. Box 450, North 301
Statesboro, Georgia 30458

469 Endress + Hauser, Inc. (3/3/86)
2350 Endress Place
Greenwood, Indiana 46142

226 Fischer & Porter Co. (12/9/71)
County Line Rd.
Warminster, Pennsylvania 18974

224 The Foxboro Co. (11/16/71)
38 Neponset Ave.
Foxboro, Massachusetts 02035

223 Invalco Measurement & Control (11/15/71)
P.O. Box 556
Tulsa, OK 74101

399 E. Johnson Engineering & Sales (8/3/83)
11 N. Grant St.
Hinsdale, IL 60521

320 Max Machinery, Inc. (3/28/79)
1420 Healdburg Ave.
Healdburg, California 95448

378 Micro Motion, Inc. (2/16/83)
7070 Winchester Circle
Boulder, Colorado 80301

431 Niro Atomizer Food & Dairy Inc. (10/11/84)
1600 County Road F
Hudson, Wisconsin 54016

270 Taylor Instrument Co. (2/9/76)
Div. of Combustion Eng.
95 Ames St.
Rochester, New York 14601

386 Turbo Instruments Inc. (5/11/83)
4 Vashell Way
Orinda, California 94563

29-00 Air Eliminators for Milk and Fluid Milk Products

340 Accurate Metering Systems, Inc. (6/2/81)
1731-33 Carmen Dr.
Elk Grove Village, Illinois 60007

436 Scherping Systems (11/27/84)
801 Kingsley Street
Winsted, MN 55395

30-01 Farm Milk Storage Tanks

421 Paul Mueller Co. (4/17/84)
P.O. Box 828
Springfield, MO 65801

31-01 Scraped Surface Heat Exchangers, as Amended

290 APV Crepaco, INC. (6/15/77)
100 South CP Ave.
Lake Mills, Wisconsin 53551

274 Alfa-Laval, Inc. (6/25/76)
Contherm Div.
P.O. Box 352, 111 Parker St.
Newburyport, Massachusetts 01950

361 BFM Machinery Corp. (7/12/82)
P.O. Box 117
Fall River, Wisconsin 53932

323 Anco-Votator Div. (7/26/79)
Cherry-Burrell Corp.
P.O. Box 35600
Louisville, KY 40232

323 Cherry-Burrell Corp. (7/26/79)
(A Unit of AMCA Int'l., Inc.)
2400-6th St., SW, P.O. Box 3000
Cedar Rapids, Iowa 52406

32-00 Uninsulated Tanks for Milk and Milk Products

397 APV Crepaco, INC. (6/21/83)
100 South CP Ave.
Lake Mills, Wisconsin 53551

264 Cherry-Burrell Corp. (1/27/75)
(A Unit of AMCA Int'l., Inc.)
575 E. Mill St.
Little Falls, New York 13365

268 DCI, Inc. (11/21/75)
600 No. 54th Ave., P.O. Box 1227
St. Cloud, Minnesota 56301

354 C. E. Rogers Co. (3/3/82)
So. Hwy #65, P.O. Box 118
Mora, Minnesota 55051

441 Scherping Systems (3/1/85)
801 Kingsley St.
Winsted, MN 55395

433 TCI-Superior Division, (11/9/84)
Mueller Canada Inc.
6500 Northwest Dr.
Mississauga, Ontario, Canada L4V 1K4

339 Walker Stainless Equipment Co., Inc. (6/2/81)
601 State St.
New Lisbon, Wisconsin 53950

33-00 Polished Metal Tubing for Dairy Products

310 Allegheny Bradford Corp. (7/19/78)
P.O. Box 200 Route 219 South
Bradford, PA 16701

413 Azco, Inc. (12/8/83)
P.O. Box 567
Appleton, WI 54912

289 Ladish Co., Tri-Clover Div. (1/21/77)
9201 Wilmot Rd.
Kenosha, Wisconsin 53141

308 Rath Manufacturing Co., Inc. (6/20/78)
2505 Foster Ave.
Janesville, Wisconsin 53545

368 Gordon J. Rodger & Sons Ltd. (10/7/82)
P.O. Box 186
Blenheim, Ontario Canada N0P 1A0

335 Stainless Products, Inc. (12/18/80)
1649-72nd Ave., Box 169
Somers, Wisconsin 53171

331 United Industries, Inc. (10/23/80)
1546 Henry Ave.
Beloit, Wisconsin 53511

35-00 Continuous Blenders

417 Cherry-Burrell (2/7/84)
Anco/Votator Division
P.O. Box 35600
Louisville, KY 40232

464 Dairy Service Mfg., Inc. (12/12/85)
4630 W. Florissant Ave.
St. Louis, Missouri 63115

415 Luwa Corporation (1/5/84)
P.O. Box 16348
Charlotte, North Carolina 28297-6348

292 Waukesha Div., Abex Corp. (8/25/77)
1300 Lincoln Ave.
Waukesha, Wisconsin 53186

36-00 Colloid Mills

293 Waukesha Div., Abex Corp. (8/25/77)
1300 Lincoln Ave.
Waukesha, Wisconsin 53186

37-00 Presure and Level Sensing Devices

318 Anderson Instrument Co., Inc. (4/9/79)
R.D. #1
Fultonville, New York 12072

405 Drexelbrook Engineering Co. (9/27/83)
205 Keith Valley Rd.
Horsham, PA 19044

423 Dynisco (6/15/84)
Ten Oceana Way
Norwood, MA 02062

459 Endress + Hauser, Inc. (10/17/85)
2350 Endress Place
Greenwood, Indiana 46142

463 The Foxboro Company (12/6/85)
38 Neponset Avenue
Foxboro, Massachusetts 02035

317 Invalco Measurement & Control (2/26/79)
P.O. Box 556
Tulsa, OK 74101

396 King Engineering Corp. (6/13/83)
P.O. Box 1228
Ann Arbor, Michigan 48106

456 Moore Technologies Inc. (10/17/85)
P.O. Box 258
Klamath Falls, Oregon 97601

419 Niro Atomizer Food & Dairy Inc. (4/2/84)
1600 County Road F
Hudson, Wisconsin 54016

328 Rosemount, Inc. (5/22/80)
12001 W. 78th St.
Eden Prairie, Minnesota 55344

285 Tank Mate Div/Monitor Mfg. Co. (12/7/76)
P.O. Box AL
Elburn, IL 60119

410 Viatran Corporation (11/1/83)
300 Industrial Drive
Grand Island, NY 14072

38-00 Cottage Cheese Vats (In Press)

385 Stoelting, Inc. (5/5/83)
P.O. Box 127
Kiel, Wisconsin 53042-0127

40-00 Bag Collectors for Dry Milk and Dry Milk Products

406 Chicago Conveyor Corporation (10/5/83)
330 LaLonde Avenue
Addison. IL 60101

381 Marriott Walker Corp. (4/12/83)
925 E. Maple Rd.
Birmingham, Michigan 48011

453 MikroPul Corporation (9/4/85)
10 Chatham Road
Summit, New Jersey 07901

456 C. E. Rogers Company (9/25/85)
P.O. Box 118
Mora, Minnesota 55051

Calendar

1986

September 15-17, IFDA ADVANCED FOODSERVICE BUYERS SEMINAR to be held at Tysons Corner Marriott Hotel. For more information contact: Chuck Brimmer. 703-532-9400.

September 16-18, NEW YORK STATE ASSOCIATION OF MILK AND FOOD SANITARIANS ANNUAL CONFERENCE to be held at the Syracuse Sheraton Inn and Convention Center, Liverpool, NY. For more information contact: Paul J. Dersam, Executive Secretary, NYSAMFS, 27 Sullivan Road, Alden, NY 14004.

September 20 - October 3, 1986 XXII INTERNATIONAL DAIRY CONGRESS, The Hague, The Netherlands. For more information contact: H. Wainess, Secretary U.S. National Committee of the IDF (USNAC), 464 Central Avenue, Northfield, IL. 312-446-2402.

September 22-23, FOOD PLANT SANITATION WORKSHOP, Rexdale, Ontario, Canada. Contact Shirley Grunder at (913) 537-4750 or write: Shirley Grunder, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

September 22-26, 70TH ANNUAL SESSIONS OF THE INTERNATIONAL DAIRY FEDERATION. For more information contact: Congress Organizing Department, c/o Netherlands Congress Centre, P.O. Box 82000, 2508 EA The Hague, The Netherlands. You may also contact: H. Wainess, Secretary U.S. National Committee of the IDF, 464 Central Avenue, Northfield, IL. 312-446-2402.

September 23-25, WYOMING PUBLIC HEALTH SANITARIANS ASSOCIATION ANNUAL MEETING, to be held at the Holiday Inn, Thermopolis, WY 82443. For more information contact: William George, 118 1/2 N. 11th, Worland. WY 82401. 307-347-2617.

September 23-26, FOOD SAFETY TRAINING COURSE to be held at the Holiday Inn-University Center, Gainesville, Florida. For more information contact: Sara Jo Atwell, ABC Research Corporation, 3437 SW 24th Avenue, Gainesville, FL 32607. 904-372-0436.

September 24-25, SEVENTH ANNUAL JOINT EDUCATIONAL CONFERENCE, to be held at the Valley Inn, West Allis, Wisconsin. For more information contact: Ron Buege, West Allis Health Department, 7120 West National Avenue, West Allis, Wisconsin 53214. 414-476-3770.

September 29-30, SANITATION THRU DESIGN, Manhattan, Kansas. Contact Shirley Grunder at (913) 537-4750 or write: Shirley Grunder, Sanitation Education Department, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

September 29-October 1, SANITATION AND FOOD DRUG COMPLIANCE WORKSHOP to be held at the Hyatt-Cherry Hill, New Jersey. For further information and/or registration, call Christine Verplank toll-free at 800-325-3371 or 314-725-2555.

September 30-October 2, AMERICAN CULTURED DAIRY PRODUCTS INSTITUTE CLINIC, St. Louis, Missouri. For more information, contact Dr. C. Bronson Lane, ACDPI, P.O. Box 7813, Orlando, Florida 32854.

October 1, OHIO ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL SANITARIANS SEMI-ANNUAL MEETING, Duff's Smorgasborg, Rt. 161, Columbus, OH. For more information contact: Don Barrett, Columbus Health Department, 6727 Deepwood Ct., Reynoldsburg, OH 43068.

October 5-9, AMERICAN ASSOCIATION OF CEREAL CHEMISTS ANNUAL MEETING, Toronto Hilton Harbour Castle, Toronto, Ontario, Canada. For more information contact: Raymond J. Tarleton, Exec. Vice President, AACC, 3340 Pilot Knob Road, St. Paul, MN 55121.

October 14-17, IN-STORE TRAINING-MANAGEMENT SECTION, Manhattan, Kansas. Contact Donna Mosburg at (913) 537-4750 or write: Donna Mosburg, Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

October 15-18, NATIONAL FROZEN FOOD CONVENTION AND EXPOSITION, to be held at Bally's in Las Vegas, Nevada. For additional information, contact the National Frozen Food Association at (717) 534-1601 or the American Frozen Food Institute at (703) 821-0770.

October 20-22, ADVANCED SANITATION PROGRAM, Alexandria, Virginia. Contact Shirley Grunder at (913) 537-4750 or write: Shirley Grunder, Sanitation Education Department, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

October 21-22, CALIFORNIA ASSOCIATION OF DAIRY AND MILK SANITARIANS ANNUAL MEETING, to be held at Holiday Inn Downtown, Fresno, CA. For more information contact: Richard C. Harrell, 1554 West 120th St., Los Angeles, CA 90047. 213-757-9719.

October 27-29, DISTRIBUTION INFORMATION SYSTEMS, Manhattan, Kansas. Contact Donna Mosburg at (913) 537-4750 or write: Donna Mosburg, Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

October 27-29, 1986 INTERNATIONAL WHEY CONFERENCE, sponsored jointly by the Whey Institute and the International Dairy Federation, O'Hare Marriott Hotel, Chicago, IL. For more information contact: Conference Secretariat, Whey Products Institute, 130 North Franklin Street, Chicago, IL 312-782-5455.

October 28-29, MISSOURI DAIRY FIELDMEN'S AND SANITARIAN'S EDUCATIONAL CONFERENCE, at the Holiday Inn West in Columbia, MO. Contact R. T. Marshall, Eckles Hall, University of Missouri, Columbia, MO 65211 (314) 882-7355.

November 1-6, FOOD SANITATION 29TH ANNUAL NATIONAL EDUCATIONAL CONFERENCE & EXPOSITION, Scottsdale, Arizona. For more information contact: Harold Rowe at 813-586-5710 or write: Jean Day, Registrar, Food Sanitation Institute, 1019 Highland Ave., Largo, FL 33540.

November 2-6, SANITATION MANAGEMENT CONFERENCE AND EXPOSITION, to be held at the Safari Conference Center Resort, Scottsdale, Arizona. For more information contact: Environmental Management Association's national executive office at 1019 Highland Ave., Largo, FL 33540. 813-586-5710.

November 6, FOOD MICROBIOLOGY UPDATE, Inn at the Park, Anaheim, CA. For more information contact Kathryn J. Boor,Food Science and Technology, University of California, Davis, CA 95616. (916) 752-1478.

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February 5-7, FOOD ADDITIVES, THE CHANGING CLIMATE? 1ST INTERNATIONAL CONGRESS, to be held at the Hilton Hotel, Vienna, Austria. For more information contact: Secretariat of the Food Additives, The Changing Climate, 1st International Congress, 30 Deane Way, Ruislip, Middlesex HA4 8SX, England.

February 11-12, DAIRY AND FOOD INDUSTRY CONFERENCE: THE OHIO STATE UNIVERSITY. For information, contact John Lindamood, Department of Food Science and Nutrition, 2121 Fyffe Road, The Ohio State University, Columbus, OH 43210-1097

February 23-25, ABC RESEARCH, 13TH ANNUAL TECHNICAL SEMINAR. For more information contact Sara Jo Atwell, ABC Research Corporation, 3437 S.W. 24th Avenue, Gainesville, Florida 32607, Phone: 904-372-0436.

March 23-27, MID-WEST WORKSHOP IN MILK AND FOOD SANITATION, The Ohio State University. For information, contact John Lindamood, Department of Food Science and Nutrition, 2121 Fyffe Road, The Ohio State University, Columbus, OH 43210-1097.

March 31 - April 1, WESTERN FOOD INDUSTRY CONFERENCE, to be held at the University of California, Davis, CA. For more information contact: Robert Pearl, Conference Chairman, 916-752-0980 or Shirley Rexroat, Conference Coordinator, Department of Food Science and Technology, University of California, Davis, CA 95616.

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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