

ISSN: 1043-3546

502 E. Lincoln Way • Ames • Iowa • 50010

July • 1992

Vol • 12 • No. 8 • Pages 481-548

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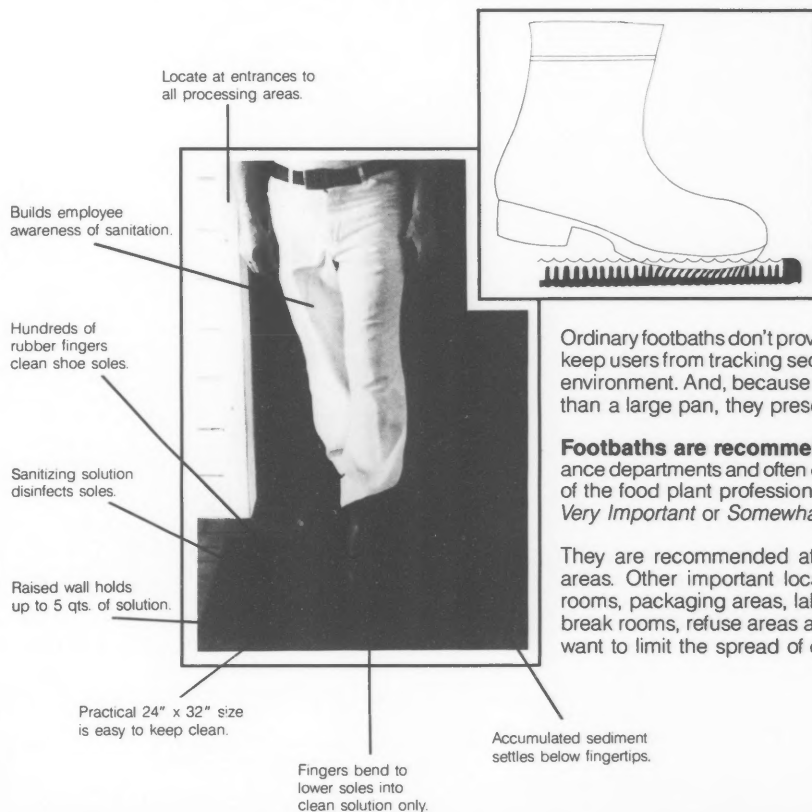
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Dairy, Food and Environmental Sanitation (ISSN-1043-3546) is published monthly by the International Association of Milk, Food and Environmental Sanitarians, Inc., executive offices at 502 E. Lincoln Way, Ames, IA 50010. Printed by Heuse Printing, Inc., 811 N. Second St., Ames, IA 50010, U.S.A. Second-class Postage paid at Ames, IA. POSTMASTER: Send address changes to Dairy, Food and Environmental Sanitation C/O IAMFES, 502 E. Lincoln Way, Ames, IA 50010-6666.

The publishers do not warrant, either expressly or by implication, the factual accuracy of the articles or descriptions herein, nor do they so warrant any views or opinions offered by the authors of said articles and descriptions.

Manuscripts: Correspondence regarding manuscripts and other reading materials should be addressed to Margaret Marble, 502 E. Lincoln Way, Ames, IA 50010-6666. 515-232-6699.

"Instructions to Contributors" can be obtained from the editor.

Orders for Reprints: All orders should be sent to DAIRY, FOOD AND ENVIRONMENTAL SANITATION, IAMFES, Inc., 502

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Business Matters: Correspondence regarding business matters should be addressed to Steven K. Halstead, IAMFES, 502 E. Lincoln Way, Ames, IA 50010-6666.

Subscription Rates: \$100.00 per year. Single copies \$10.00 each. No cancellations accepted. U.S. FUNDS ONLY.

Sustaining Membership: A sustaining membership in IAMFES is available to companies at a rate of \$450 per year, which includes \$100 credit toward an ad in the "annual meeting issue" of the Journal, the July issue. For more information, contact IAMFES, 502 E. Lincoln Way, Ames, IA 50010-6666, 515-232-6699.

Membership Dues: Membership in the Association is available to individuals only. Direct dues are \$50 per year and include a subscription to Dairy, Food and Environmental Sanitation. Direct dues and the Journal of Food Protection are \$80.00. Affiliate and International Membership include both journals for \$80, plus affiliate dues. Student membership is \$25.00

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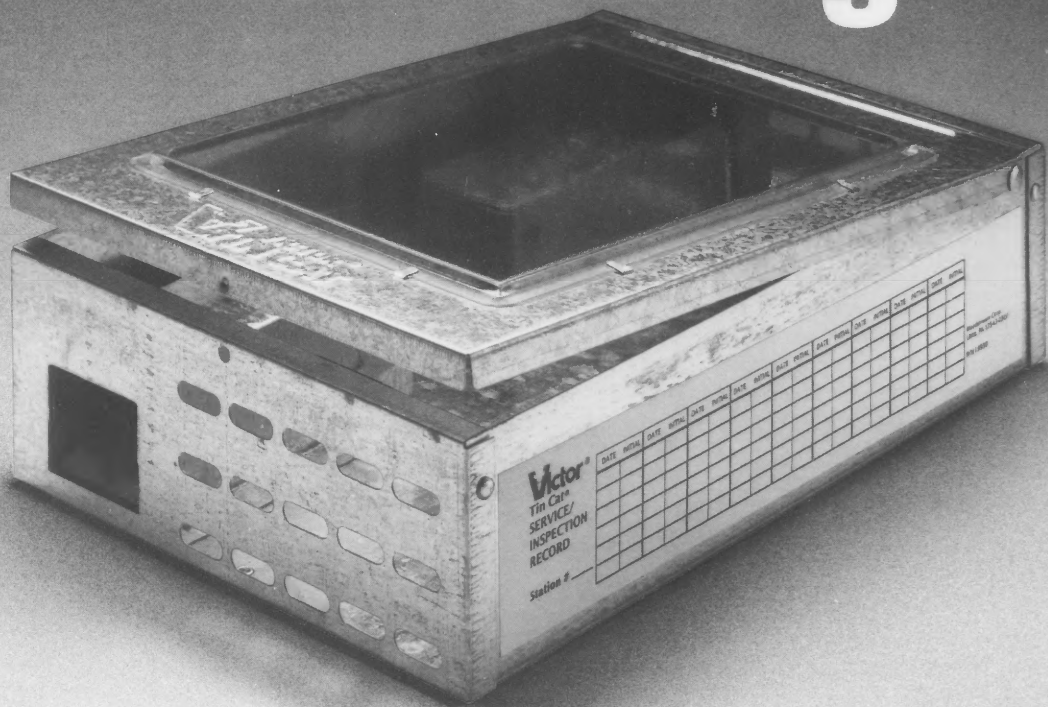
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On My Mind . . .



By
Steven K. Halstead, CAE
IAMFES
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. . . is our Annual Meeting

Talk about being in the wrong place at the wrong time! Last week the major US airlines announced drastic cuts in their airfares. The timing was right, but the place was wrong. The rates were good only in the lower 48 states - not Alaska, not Hawaii, and not Canada.

Given the economic difficulties facing many sectors, particularly the public sector, a lessening of the airfares may have been just the thing to allow more folks to attend our meeting. Several long time attendees have told me that they won't be able to attend this year. Not just because the meeting is going to be in Canada — they say they are not being allowed even out of state travel.

That is really too bad, and I believe, a false economy that will be paid back at some later time. IAMFES (I'm proud to say "we") have put together an absolutely outstanding program. The symposia on seafood safety is worth the cost of the meeting alone. But in addition, there are eleven other symposia, six technical sessions, a poster session, technical exhibits and the video theater.

Then there is the networking. I had the opportunity today to watch it in action. I was attending the annual meeting of our Texas affiliate in Austin when, over lunch, I heard a couple of attendees discussing the July 1, 1992 implementation date of certain aspects of the Interstate Milk Shippers Conference "Appendix N."

One was a state regulator, the other was with a dairy. After discussing the various aspects of qualified labs, false positives, dumping milk and screening tests (not necessarily in that order), they got down to a discussion of what the dairy

would do when they had a tanker load of milk testing positive for Beta Lactams.

They worked their way through the various requirements and mandates, settling on how to punish the farmer who sold the dairy the milk containing the residue. Appendix N calls for the producer to be suspended for two days and to undergo the 10 point Dairy Improvement program.

The question became if that was enough or if the dairy could suspend the producer longer than that. Although no firm conclusion was reached over lunch that day, the two had far more to chew on than their burgers.

This conversation took place only because both participants were in attendance at the TAMFES meeting. Well, sure, I suppose they could have met in one or the other's office, but think of the cost of that: The point is, it did happen here.

A hot networking topic everywhere this year seems to be "Total Quality Control." For those of us in the States, Canada is the place to go. They are a long ways ahead of us in this area.

It seems that nearly every affiliate meeting has had at least one speech on "Total Quality Management." The Ontario affiliate's entire meeting was devoted to the topic. Believe me, these folks are past talking about it — they're doing it. The Toronto meeting is a chance for you to network with colleagues or "TQM", but also to see it in operation.

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On My Mind . . .



By
Steven K. Halstead, CAE
IAMFES
Executive Manager

. . . is our Annual Meeting

Talk about being in the wrong place at the wrong time! Last week the major US airlines announced drastic cuts in their airfares. The timing was right, but the place was wrong. The rates were good only in the lower 48 states - not Alaska, not Hawaii, and not Canada.

Given the economic difficulties facing many sectors, particularly the public sector, a lessening of the airfares may have been just the thing to allow more folks to attend our meeting. Several long time attendees have told me that they won't be able to attend this year. Not just because the meeting is going to be in Canada — they say they are not being allowed even out of state travel.

That is really too bad, and I believe, a false economy that will be paid back at some later time. IAMFES (I'm proud to say "we") have put together an absolutely outstanding program. The symposia on seafood safety is worth the cost of the meeting alone. But in addition, there are eleven other symposia, six technical sessions, a poster session, technical exhibits and the video theater.

Then there is the networking. I had the opportunity today to watch it in action. I was attending the annual meeting of our Texas affiliate in Austin when, over lunch, I heard a couple of attendees discussing the July 1, 1992 implementation date of certain aspects of the Interstate Milk Shippers Conference "Appendix N."

One was a state regulator, the other was with a dairy. After discussing the various aspects of qualified labs, false positives, dumping milk and screening tests (not necessarily in that order), they got down to a discussion of what the dairy

would do when they had a tanker load of milk testing positive for Beta Lactams.

They worked their way through the various requirements and mandates, settling on how to punish the farmer who sold the dairy the milk containing the residue. Appendix N calls for the producer to be suspended for two days and to undergo the 10 point Dairy Improvement program.

The question became if that was enough or if the dairy could suspend the producer longer than that. Although no firm conclusion was reached over lunch that day, the two had far more to chew on than their burgers.

This conversation took place only because both participants were in attendance at the TAMFES meeting. Well, sure, I suppose they could have met in one or the other's office, but think of the cost of that: The point is, it did happen here.

A hot networking topic everywhere this year seems to be "Total Quality Control." For those of us in the States, Canada is the place to go. They are a long ways ahead of us in this area.

It seems that nearly every affiliate meeting has had at least one speech on "Total Quality Management." The Ontario affiliate's entire meeting was devoted to the topic. Believe me, these folks are past talking about it — they're doing it. The Toronto meeting is a chance for you to network with colleagues or "TQM", but also to see it in operation.

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Thoughts From the President . . .

By
Damien A. Gabis
IAMFES President



In reflecting upon my term as President of IAMFES, the recurring thought that comes to mind is the importance for IAMFES, as an organization, to aggressively expand our view of food protection beyond North America. Shrinkage of the world by technological advances and the resultant economic globalization have permitted greater exchanges of foods among the countries of the world. The great increases in imports of certain foods by the United States and Canada during the last decade are witness to these changes. IAMFES is in a unique position to focus on national and international food protection issues. Through the work of the committees, publications, and the Annual Meeting IAMFES can help to identify and resolve challenges in worldwide food protection by providing a forum to share information among workers in many countries. It is my hope that IAMFES will increase development of services to invite more participation by members from many countries outside of North America.

We have enjoyed some success in building bridges to other North American professional associations with interests in food protection. We are co-sponsoring with the National Mastitis Council and the Canadian College of Microbiologists two symposia at this year's annual meeting. IAMFES representatives have actively participated in the work of other organizations such as the Institute of Food Technologists workshops, American Veterinary Medical Workshop on Food Safety, and the Conference for Food Protection. Many IAMFES members, as individuals are active in other professional associations, and this helps to build cooperative working relationships at the organizational level.

The *Journal of Food Protection* continues to be the flagship of IAMFES' publications and our good reputation among workers in food protection largely comes from the technical quality of JFP. It is very important to encourage our colleagues to publish their high quality articles in our publications. I want to thank Dr. Lloyd Bullerman, Scientific Editor, and Dr. Robert Marshall, Chair of the Journal Management Committee, for the results of their efforts to promote JFP.

I have been a very fortunate beneficiary of the commitment that the Ames staff and the Executive Board have shown toward realization of IAMFES' objectives and the team spirit that exists among the Board members. I believe that we have taken advantage of this climate to focus on the work of the association. Over the long term, my goal for IAMFES has been to foster the development of our organization into the premier international professional association for food protection.

Once again it is time to pass the torch, Mike Doyle, our new President comes well-prepared and eager to lead IAMFES towards becoming the best organization for professionals in food protection. As I leave office, I welcome Ann Draughon to the Executive Board as our Secretary. I wish the best of luck to her. Ann has been very active in IAMFES. Adieu to Bob Sanders who leaves the Board as Past President. Bob will continue to serve on the 3-A Symbol Council. Bob's efforts in developing the 1993 budget are greatly appreciated.

I believe that our organization will benefit greatly from the strategic planning process that has now begun. I welcome the members who have enthusiastically accepted the Board's invitation to join the task force. The planning process will allow IAMFES to draw on the thoughts and ideas of a broad representation of the professional interests of the membership. In the end, I hope that we will have developed a new vision for our association that all members will endorse.

Lastly, I want to express my gratitude to IAMFES and the members who have made my last four years on the Executive Board a pleasurable challenge. I want to thank Kirmon Smith who first placed this opportunity on my plate. I hope that I have served to benefit the welfare of IAMFES.

A New Generation of Foodborne Pathogens

Michael P. Doyle, Ph.D.,
Professor and Department Head, University of Georgia, Food Safety and Quality
Enhancement Laboratory, Georgia Station, Griffin, GA 30223

Reprinted from *Contemporary Nutrition*, General Mills Inc., P. O. Box 5588, Stacy, MN 55079, Volume 16, Number 6, 1991.

Introduction

Prior to the past decade, foodborne illness in the U.S. was principally associated with five well-recognized pathogens. These included *Staphylococcus aureus*, *Salmonella* spp., *Clostridium botulinum*, *Clostridium perfringens* and *Bacillus cereus*. However, each year the etiologic agent responsible for foodborne disease was not identified for more than 50% of outbreaks. Many reasons may explain this frequent inability to identify organisms, including the fact that many outbreaks were caused by previously unrecognized pathogens or by known pathogens not previously recognized as agents of foodborne illness. Within the past 10 to 15 years, several other pathogens have been identified as important causes of foodborne disease. Examples include *Campylobacter jejuni*, *Yersinia enterocolitica*, *Vibrio vulnificus*, *Listeria monocytogenes* and enterohemorrhagic *Escherichia coli*. Additionally, although *Salmonella* has been recognized as a foodborne pathogen for many years, only recently has ovarian-infecting *Salmonella enteritidis* been identified as a cause of foodborne illness. This review will focus on those pathogens that recently have been recognized as important causes of foodborne disease.

Campylobacter jejuni

In the 1980s, *C. jejuni* rose from obscurity as a veterinary pathogen to recognition as being the leading cause of acute bacterial gastroenteritis in many developed countries.¹ Annual estimates indicate there are more than 2 million cases of *Campylobacter* enteritis in the U. S.² Fortunately, symptoms are usually mild and patients recover within hours to days. Deaths occur occasionally but mainly among individuals with severe underlying illness.

The organism is carried in the intestinal tract of a variety of animals and frequently contaminates foods of animal origin.¹ Epidemiologic studies have revealed that poultry is a leading vehicle of *Campylobacter* enteritis.³ Other foods associated with illness include raw milk, fresh mushrooms, raw hamburger and untreated water.⁴

Studies have indicated that the infectious dose of *C. jejuni* can be quite low with ingestion of only a few hundred cells producing illness. Hence, growth of the organism in

food is not essential for foods to serve as vehicles of illness. Fortunately, *C. jejuni* is a relatively fragile bacterium that is readily killed by heat used to cook foods.^{4,5} Food-related illness typically results from foods of animal origin that are eaten raw or inadequately cooked, or that are recontaminated after cooking by contact with *C. jejuni*-contaminated raw materials. Although *C. jejuni* is associated with animal foods, thorough cooking of poultry and meat, pasteurization of milk and proper handling of food are important measures to prevent foodborne illness by this organism.¹

Yersinia enterocolitica

First recognized as a cause of food-borne illness in the mid-1970s, *Y. enterocolitica* continues to be a concern among food microbiologists and public health authorities.¹ Only a few major outbreaks and a low level of sporadic cases have been reported in the U.S. over the past decade. Symptoms of yersiniosis can be quite severe and include diarrhea, fever, headache and intense abdominal pain which mimics acute appendicitis.¹ The appendicitis-like symptoms have resulted in unnecessary appendectomies.⁴ Furthermore, *Y. enterocolitica* occasionally causes arthritis and septicemia.^{1,6}

Unlike most foodborne pathogens, *Y. enterocolitica* can grow at refrigeration temperatures which means that cold storage is not an effective method to control growth of this organism in food.^{1,7} Cooking foods to 160°F will destroy yersiniae. Fortunately, most strains of *Y. enterocolitica* are not virulent to humans.^{1,4} Swine are the principal reservoir of virulent strains; however, these organisms are not widely occurring, likely explaining why yersiniosis is an infrequent disease in the U.S.¹

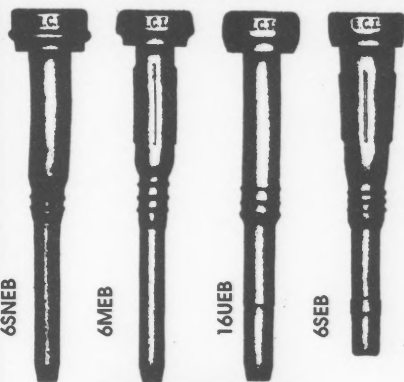
Vibrio vulnificus

The hazards of eating raw shellfish, particularly raw oysters, are exemplified by the severe consequences experienced by individuals with a *V. vulnificus* infection. This organism produces a rapid, fulminating septicemia in individuals who have a pre-existing liver disorder that results in high levels of iron in serum.^{4,8} Mortality rates are quite high, with death occurring in about 50% of cases.⁴ Raw oysters

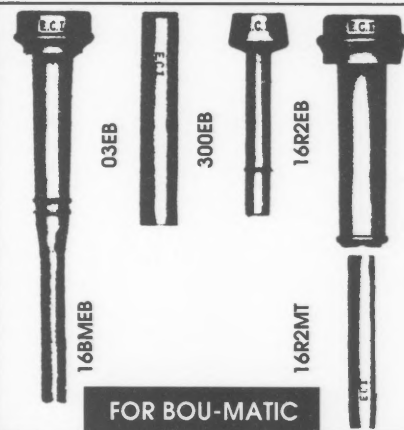
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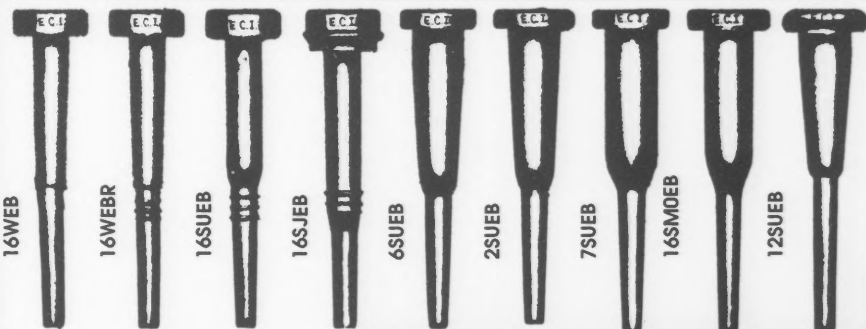
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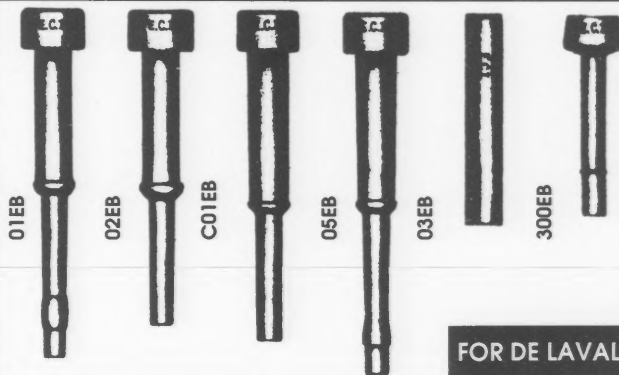


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are most frequently identified as the vehicle of infection. Surveys of marine environments have revealed evidence of the organism in oysters from Florida to Massachusetts.^{4,8} Seafoods, especially oysters, should be properly cooked before consumption to avoid risk of *Vibrio* infection.

Listeria monocytogenes

Although *L. monocytogenes* has been recognized as a human pathogen for more than 60 years, the importance of food as a transmission vehicle of listeriosis has been identified only recently.^{1,4,8-10} Studies by the U.S. Centers for Disease Control have estimated that 1600 to 1800 cases of listeriosis and about 400 deaths occur annually in the U.S.¹¹ Illness principally occurs in immunocompromised individuals, including those with conditions such as cancer, cirrhosis, transplanted organs and pregnancy. Manifestations of illness include meningitis, miscarriage and perinatal septicemia (infant is born alive but dies from infection shortly after birth).^{1,10,11} Most healthy individuals are able to overcome listeric infection by cell-mediated immunity.¹²

L. monocytogenes, a bacterium normally present in the environment, frequently contaminates many foods. Soil is a common reservoir of the organism and a variety of animals carry listeriae in their intestinal tracts.^{1,10} Surveys of humans have revealed that intestinal carriage of *L. monocytogenes* frequently occurs. Reports indicate the range of *L. monocytogenes* carriage from 0% to greater than 20% among healthy individuals.^{1,10} Home environments are often contaminated with *L. monocytogenes*: a study in the United Kingdom indicated the organism was found in 11% of kitchen dish cloths.¹³

Surveys of food have demonstrated the presence of a low number of organisms.¹⁰ For example, about 8% of ready-to-eat meats, 15% of cooked poultry, 2.5% of milk and dairy products and 5% of vegetables are contaminated with *L. monocytogenes*.¹⁰ Typically, the levels of listeriae are less than 100 cells per gram. The organism can be present in a variety of fermented, acidic foods, such as sausage and cheeses made from unpasteurized milk, that do not receive heat treatments. However, listeriae will not grow in such foods and typically are present in very low populations (less than 1 cell per gram).¹⁰ Hence, most individuals frequently ingest *L. monocytogenes* with no ill effects. There appear to be unique host factors that pre-dispose certain individuals to listeric infection but most of the population apparently is resistant.

Certain foods have been identified as special concerns for high-risk populations because of their association with great numbers of cases of listeriosis and their ability to support the growth of large populations of *L. monocytogenes*. These foods include low-acid soft cheeses such as Mexican-style cheese (also Camembert and Brie) and pâté. *L. monocytogenes* can grow in such foods at refrigeration temperature (32-40°F), and have been detected at levels of 1,000 to 1,000,000 cells per gram in retail products.^{14,15} Public health authorities in some countries advise pregnant women and immunosuppressed individuals to avoid eating low-acid cheeses.¹⁵ Fortunately, considering the widespread distribution of *L. monocytogenes* and the frequent ingestion

of the organism through contaminated foods, there are relatively few food-related cases of listeriosis reported. This may be due to differences in virulence among strains of *L. monocytogenes*. The presence of relatively low levels of the organism in most foods and the lack of susceptibility to infection by most individuals in the population are also factors. Nevertheless, individuals in high-risk groups are advised to heat foods previously associated with listeriosis to at least 160°F before eating.

Enterohemorrhagic *Escherichia coli* O157:H7

First identified as a pathogen in 1982, *E. coli* strain O157:H7 is now known as an important cause of bloody diarrhea (hemorrhagic colitis) and renal failure (hemolytic uremic syndrome) in humans.^{1,8,16,17} Since then, many food-related outbreaks of *E. coli* O157:H7 infection have been reported in the U.S., Canada and the United Kingdom.^{1,8,16,17} Undercooked ground beef has been the most frequently implicated vehicle of infection.^{1,8,16} Other infection vehicles include unpasteurized milk and person-to-person transmission.^{1,8,16} Recently, increased surveillance for *E. coli* O157:H7 infections has detected the organism in other locations of the world, including Japan, China, Mexico, Argentina and Belgium.¹⁶

Dairy cattle have been identified as a principal reservoir of *E. coli* O157:H7 and surveys of retail raw meats and poultry have detected the organism in 2%-4% of ground beef, 1.5% of pork, 1.5% of poultry and 2% of lamb.¹⁶ Although the organism has been responsible for several outbreaks associated with eating ground beef, *E. coli* O157:H7 has no unusual heat tolerance.^{8,16} Outbreaks associated with eating ground beef or drinking raw milk usually resulted because the meat was undercooked or the milk was unpasteurized.

E. coli O157:H7 is unlike most known pathogenic *E. coli* of which human carriers are the principal reservoir. Because the intestinal tract of cattle and other animals used in food production are important reservoirs of *E. coli* O157:H7, raw foods of bovine origin can be vehicles of *E. coli* O157:H7 via fecal contamination during slaughter or milking procedures.^{1,16} Good manufacturing practices in processing of animal foods and proper heating of such foods before consumption are important control measures for the prevention of *E. coli* O157:H7 infections.

Salmonella enteritidis (Ovarian-Infecting)

The incidence of reported cases of salmonellosis in the U.S. continues to increase annually. During the past decade, *S. enteritidis* has become one of the dominant causes of salmonellosis and a frequent cause of foodborne illness.^{18,19} Most reported food-related outbreaks have been associated with eggs and have occurred in the northeastern part of the U.S.^{18,20} Outbreak-related eggs were typically temperature abused during preparation, increasing organism population growth.^{20,21} Hundreds of eggs cracked into large containers were held for many hours at temperatures that permitted organism growth to occur.^{20,21} Subsequently, eggs were undercooked, e.g., still "runny" after cooking, or used uncooked in foods such as mousse.

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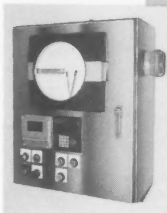
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Flocks producing outbreak-associated eggs have been investigated. A small percentage (less than 0.5%) of eggs are contaminated with *S. enteritidis* and ovarian tissue of hens producing contaminated eggs also is infected.²² Hence, the yolk of eggs laid by ovarian-infected hens is contaminated with *S. enteritidis* when the egg is produced. Precautions must be taken to properly refrigerate eggs (hold at less than 45°F) and cook eggs to avoid illness. Raw eggs should not be used in foods, such as mousse, ice cream, mayonnaise and egg nog, that do not receive heat treatments sufficient to kill salmonellae.

Conclusion

The detective efforts of epidemiologists and microbiologists in the past decade have uncovered several food-associated pathogens of public health concern. Even so, food-related outbreaks caused by these bacteria can be avoided by proper cooking and handling of food before eating. The incidence of foodborne disease can be reduced substantially if food handlers and consumers are aware of and practice proper food handling and sanitation procedures and good personal hygiene.

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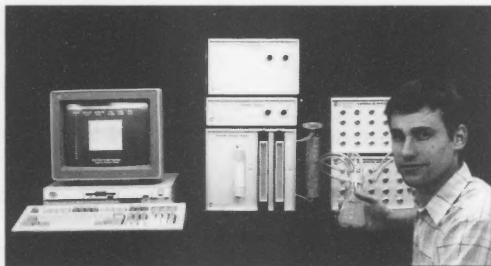
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Consumer Perceptions of Food Safety

Chung L. Huang,
Department of Agricultural and Applied Economics,
University of Georgia, Athens, GA

(This paper was presented at the Georgia Association of Food and Environmental Sanitarians, Inc.)

Food safety is a growing concern for many consumers. Americans have come to take a bountiful food supply for granted, but many are worrying about the safety of their food and its impact on their health. In early 1989, two widely publicized food safety incidents, the public outcry over use of Alar on apples and the Chilean grape tampering scare, have been thrust into national spotlight, affecting the fresh produce industry more than any other segment of the food industry. At the center of the debate is how much food safety do consumers expect from the food system. The answers to this debate are often controversial because safety is not a good that food consumers can go out to the supermarket to buy, thus revealing how much they want of it at different prices. The controversy begins with what level of risk is acceptable, the interpretation of how safe is safe, and the actions taken or not taken to achieve it.

Food safety is a characteristic of the products consumers buy, and it is a characteristic that is extremely costly and difficult to assess. It is costly to determine whether a particular food contains a substance that might pose health risks. It is costly to determine just what types of health hazards might be involved. Furthermore, it is extremely difficult, if not impossible, for consumers to assess their exposure to risks in each food product, and accurately articulate their demand for safety. This means that food producers and government regulators cannot easily ascertain how much food safety consumers want and are willing to pay for it. It is this problem of insufficient and inadequate information that market mechanisms fail to achieve allocative efficiency and to produce the level of safety or quality that is socially desired (Zellner 1988). It is precisely this information problem that provides social and political justifications for the regulation of food safety.

"Safety" determinations are culture- and technology-bound judgements, not absolutes. To the extent that consumers are necessary participants in the inherently subjective political process of risk-assessment, understanding their risk perceptions and attitudes toward food safety issues is crucial to effective decision making. Consumers' perceptions of the riskiness of an activity or product are frequently quite different from the actual hazard involved. The issue of food safety is also related to the degree of trust and confidence consumers have in the food industry and the government regulatory process. This paper first looks at the phenomenon of perception gap and the factors that contribute to it. It then

presents some results of a consumer survey which sought to understand consumer attitudes and concerns about pesticide residues and what the consumer wants from the industry and government to ensure the safe supply of fresh produce.

Perceptions of Risk

People respond to the hazards they perceive. Perceived risk is not always related to the probability of injury or health risks calculated on an actuarial basis. If perceptions are faulty, efforts at personal, public and environmental protection are likely to be misdirected. Recent surveys have found that worries about pesticide residues are topping the list of food safety concerns among consumers. In its 1991 survey, the Food Marketing Institute reported that 80% of the respondents rated residues such as pesticides and herbicides a serious health hazard. In the Packer's Fresh Trend 1990 survey, 86% of the respondents expressed similar concern about chemical residues on fresh produce (Zind 1990). Similarly, a survey of Pennsylvanian households found that 71% of respondents showed a great deal or some concern with eating fruits and vegetables sprayed or dusted with pesticides (Sachs, Blair, and Richter 1987).

In contrast, most toxicologists and food safety experts concur that microbiological contaminants followed by malnutrition, environmental contamination, and natural toxins pose far more serious hazards than chemical residues in the food supply (Lee 1989). This divergence suggests that consumers' perceptions of food related risk are often skewed from reality and at odds with scientific evidences and expert opinions, and possibly, regulatory concerns. Heart disease, cancer, pneumonia, and automobile accidents are the leading causes of deaths in the U.S. In fact, deaths caused directly from food poisoning or contamination are so rare that they produce headlines instead of being lost in mortality statistics. A person living in the U.S. is about 15,000 times more likely to die in an automobile accident than being killed by botulism. Yet botulism is big news, which typically focuses on extraordinary events that tends to skew public risk perception (Lee 1989). The smaller a risk factor is, the greater tendency is that reality will be obscured with misconception.

Why are some actions or products perceived as being so much more dangerous than they actually are, whereas the reverse holds true for others? Figure 1 presents some of the

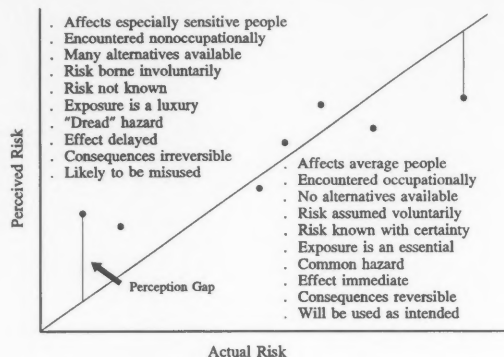


Figure 1. Factors Influencing the Perception of Risks.

factors that may influence the public's perception toward a particular risk (Lowrance 1976, p. 87). Factors on the top left-hand corner are associated with an increased perception of risk, whereas those listed on the low right-hand corner are related to lessened concern about a particular statistical probability of risk. For instance, if a risk is perceived as voluntary and an individual believes that it is controllable or reducible through personal action, the risk becomes less objectionable and the level of fear and concern diminishes. The willingness of people to bear a risk is also influenced by their perceptions of the benefits of the activity or product. The lower the perceived benefits, the lower the tolerance for the resulting risk.

A close examination of the factors that are related to an increased sense of risk can help us understand why consumers were apprehensive about risks associated with pesticide residues and reacted so strongly in particular to the Alar issue. First, the consumption of apples and apple products with Alar residue was definitely involuntary. The effect was delayed, since the risk involved the possibility of cancer, which would occur years later and was the most dreaded disease of all. There were lots of alternatives. Consumers could easily reduce their consumption of apples and apple products or give up eating them altogether. It was not viewed as essential or related to earning a living. Furthermore, the claims against Alar involved an especially sensitive group of people, namely children. The risk was said to be greater for children because of their relatively high consumption of apple products. Last but not least, the public has a very low tolerance for the risks posed by Alar because they perceived its benefits to be minor.

Georgia Consumer Survey Results

A self-administered mail survey of Georgia residents based on a random sample of 580 households stratified by income and location was conducted in the summer of 1989. The objective of the survey was to collect information on consumers' attitudes and concerns about pesticide residues, their desires for government and industry actions, and their willingness-to-pay to ensure the safe supply of fresh produce. The survey resulted in a total of 389 completed questionnaires, representing a response rate of 67%.

In general, the sample tended to be demographically upscale with older, better educated, and higher income households slightly over-represented in comparison to census statistics. The majority of respondents, or 89%, were primary food shoppers in the household. The average household size was about 2.7 persons. Respondents who were 35 years old or younger accounted for 31% of the sample. Approximately 35% of the survey participants completed or had some college education, and 52% had annual household income greater than \$25,000. Female, city residents, and people of European origin represented 68%, 54% and 77% of the survey respondents, respectively. Some of the findings are highlighted in the following sections.

Consumers' Ranking of Food Safety Concerns

Survey respondents were first asked to select their top three concerns among a list of ten food concerns. To focus on pesticide use on fresh produce, the respondents were then asked to compare the relative health risk of eating fresh produce grown with pesticides to eating foods high in saturated fat, cholesterol, sugar, or salt. As shown in Table 1, 55% of the respondents ranked foods grown with pesticides as a concern with 30% indicating it was their top concern. The average rank score for this concern was 1.29 which is significantly greater than all other rank scores at the 0.01 significance level. Food poisoning and foods high in cholesterol ranked second and third with an overall score of 0.84 and 0.8, respectively.

When asked to compare the relative health risk, the majority of respondents rated eating foods high in cholesterol (63%), saturated fats (55%), and salt (53%) as being

Table 1. Consumers' Ranking of Food Concerns.

Food concern	Level of concern			Rank score ^a
	Top concern	Second concern	Third concern	
	percent			
Foods grown with pesticides	30	14	11	1.29 ^b
Food poisoning	20	9	7	.84
Foods high in cholesterol	12	17	11	.80
Foods high in saturated fat	8	15	12	.67
Food prices	13	7	12	.66
Chemical food preservatives	4	12	11	.46
Foods high in salt	5	7	10	.40
Chemical food additives	2	9	14	.39
Foods high in sugar	3	5	6	.25
Foods too low in nutrition	2	3	6	.13

^aAverage score with top concern = 3 points, second concern = 2 points, third concern = 1 point.

^bStatistically significantly different from all other rank scores at the 1% significance level.

Source: Adopted from Ott, Huang and Misra (1991).

a greater risk than eating fresh produce grown with pesticides. The results reveal that there is an obvious discrepancy between respondents' ranking of food concerns and their comparison of relative risks. Even foods high in sugar were thought of as more of a health risk than fresh produce grown with pesticides by 43% of the respondents. While consumers should be concerned about the risks of eating certain foods with high cholesterol, fat, or salt content, there is abundant scientific evidence identifying other factors, such as heredity and lifestyle, as much greater risks that cause deaths from heart disease and cancer more directly than food. Apparently, consumers may have a greater concern about pesticide residues because it involves potential cancer risks, which are perceived to be involuntary and beyond personal controls.

Attitudes Toward Use of Pesticides

In addition to ranking general food concerns, respondents were asked to select from four statements that best describe their opinion about the use of pesticides on fresh produce production. The results suggest that the majority of respondents (51%) believed that "pesticides can be used safely, but there should be increased testing and monitoring of pesticides used on fresh produce." While 35% of the participants indicated that "some pesticides are unsafe and should be banned and greater restrictions should be placed on those pesticides remaining in use," only 10% wanted to ban "all pesticides used on fresh produce." Those who believed that "pesticides are safe to use and public fear is unwarranted" accounted for 4% of the respondents.

It is interesting to note that consumers who are less concerned about pesticide use seem to be among those respondents who are engaged in home gardening activities. For those who did not rank foods grown with pesticides as a food concern, 47% had fruits or vegetables gardens and 77% of them used chemical pesticides on their own gardens. Furthermore, among those who said that pesticides were safe to use but wanted greater testing and monitoring, 46% also reported to have home gardens and a majority of them, 72%, had used pesticides. It seems that consumers' attitudes toward pesticides, to some extent, might be related to and influenced by personal experience in using pesticides.

When asked to rate the importance of testing and certification that fresh produce is free of pesticide residues, the majority of respondents, 56%, said it was very important to have fresh produce tested and certified free of pesticide residues. Another one-third said it was somewhat important. Less than five percent indicated it was not important. The desire for testing was even greater among those concerned about pesticide use. Two-thirds of those who ranked foods grown with pesticides as a food concern, considered having fresh produce tested and certified to be free of pesticide residues very important. Similarly, more than three-quarters of those who wanted at least some pesticides banned, also indicated testing and certification as very important. None of them said it was not important.

Testing and certification apparently are important to consumers. Thus, respondents were asked to select who they would prefer to do the testing and certification. Somewhat surprisingly, most of the respondents indicated that they would prefer the independent testing laboratories (42%)

followed by the government agencies (27%), and grower associations (14%). Furthermore, the results also suggest that very few consumers considered supermarkets or retailers as a credible source for testing and certification services. Hence, it is no coincidence that many supermarkets use private residue testing programs rather than their own to advertise and promote the sale of residue-free fresh produce.

Willingness-to-Pay for Certified Pesticide Residue-Free Produce

Consumers are concerned about chemical residues on fresh produce, but have their concerns led to changes in purchasing behavior? The answers tended to be negative. The majority of respondents (56%) indicated no change in fresh produce buying habits due to recent media exposures on pesticide use. In addition, 30% of the participants said they would purchase fresh produce that is free of pesticides whenever it is available, while 11% said they were purchasing less. The results also suggest that freshness and appearance quality of the produce were the two most important factors influencing Georgia consumers' purchasing decision.

The majority of consumers (61%) also said they would prefer to buy organically grown fresh produce, if available. However, only about 25% were willing to accept organically grown produce even if it had sensory defects such as insect holes, blemishes, and soft spots. Thus, it is not surprising that 57% of the respondents indicated a preference for certified residue-free fresh produce, when asked to choose between fresh produce that is certified residue-free and produce that is grown organically without using man-made chemicals.

Although consumers indicated that they want fresh produce tested and certified free of pesticide residues, they apparently were not willing to pay a higher price for it. Overall, 45% of the respondents said they would be willing to pay up to 10% more than current price to ensure the fresh produce are free of chemical residues. While 26% of the respondents definitely would not pay any extra, 29% were undecided. The results suggest that consumers' willingness-to-pay are related to their concerns and attitudes toward pesticide use. Consumers who were concerned about pesticide use or wanted to ban at least some pesticides tend to be more willing to pay higher prices for produce that is certified residue-free. The extra amount they are willing to pay, however, is very small (Table 2). Only about one-tenth expressed a willingness-to-pay more than 10% extra. Less than 20% indicated a willingness-to-pay between 6% and 10% more. Thus, the majority of them are willing to pay extra that amounts to only 5% or less. Similar results hold true for those who said that testing and certification were very important to them. However, for those who said testing and certification were somewhat important, most of them were uncertain if they would pay extra for the services.

Concluding Remarks

Food safety can be viewed as a public good, such as national defense, which can best be ensured by government action. Within this context, it is in the interest of individual consumers and society to delegate the responsibilities of

Table 2. Willingness-to-Pay Higher Price for Certified Pesticide Residue-Free Fresh Produce.

Willingness-to-pay	Those who were concerned about use of pesticides	Those who wanted at least some pesticides banned	Testing and certification are:	
			Very important	Somewhat important
	percent			
Will pay more	54	58	57	33
≤ 5% more	29	29	32	14
6-10% more	17	18	17	15
More than 10%	8	11	8	4
Will not pay more	20	18	25	28
Don't know	27	24	18	39

Source: Adopted from Ott, Huang, and Misra (1991).

safety or risk assessments and regulations to government agencies and expect them to act judiciously. Food safety in many respects is a credence attribute, which must be accepted on the basis of trust and confidence. The health hazard or safety of a particular food item is too expensive and nearly impossible for an individual to determine. The public has to rely on scientists to provide accurate and objective information in terms of the level of risk involved. They have to depend on the government regulatory process and its ability to continuously monitor the level of hazard

and to ensure the safety of the food supplies.

In general, the Georgia survey showed that consumers are concerned about pesticide residues in fresh produce. However, for most consumers, it is still largely a latent concern which has not been activated or translated into behavioral changes in their purchasing practices. In addition, the results also suggested that the majority of consumers prefer certified residue-free over organically grown fresh produce. The message seems clear that there is no trade-off; consumers demand both safety and quality for their fresh produce. Consequently, they emphasize the needs for more testing and monitoring of pesticide use on fresh produce. Consumers therefore indicate strong implicit support for enforcement of product standards setting safety levels. To this end, many consumers are willing to pay up to 10% more than current price to ensure the fresh produce are free of chemical residues. Furthermore, the evidence seems to suggest that consumers are skeptical of the government's ability to guarantee the safety and wholesomeness of the food supplies. The survey indicated that there is a lack of government credibility and more consumers would turn to private initiatives for their own protection. The fact that they would prefer independent laboratories than government agencies to perform the testing and certification services is a manifestation of that effect.

To date, questions on what consumers want and their willingness-to-pay for safer food have received little research attention. To improve food protection and regulatory decisions, research is needed to find ways to articulate consumer demand for food safety. Further research is needed to establish the relationship between reported concerns and food purchase or consumption behavior. Without knowledge of this relationship of consumer market behavior, the benefit of future attitudinal surveys on consumer food safety concerns appears limited. Furthermore, research on consumer information and education regarding safety and healthfulness is needed to determine what information remedies and educational programs should be provided, where they should be directed, and in what forms they would be most useful and effective.

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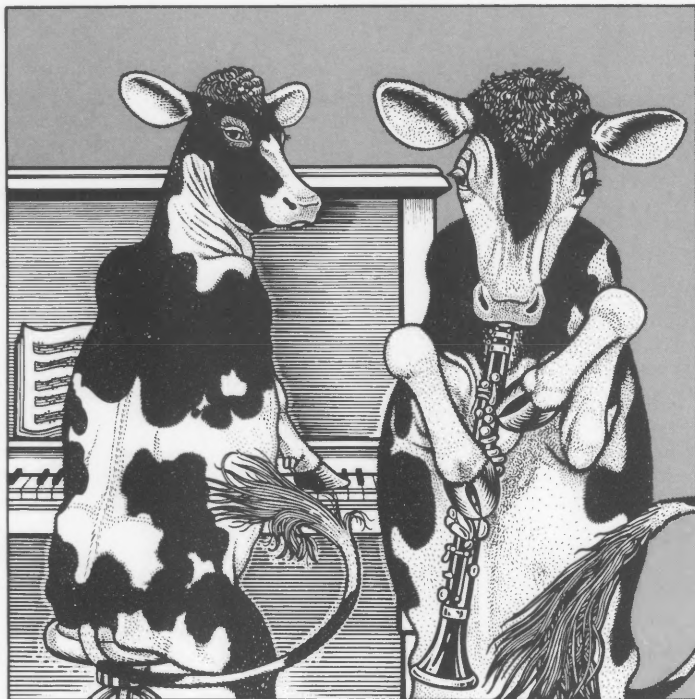


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The Role of Government in a Mandatory HACCP Based Program

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(As presented at the Ontario Food Protection Association Annual Meeting in Toronto, Ontario, November 13, 1991.)

Introduction

The Department of Fisheries and Oceans has some experience and expertise to offer on this topic. As of February 1, 1992 the Canadian fish processing industry will be the first industry world wide to be regulated through a HACCP based program. During the past 5 years the Department of Fisheries and Oceans and the Canadian fish processing industry have worked together to develop this new initiative that we call the Quality Mangement Program.

- Background information on the Canadian fish inspection program,
- Identify some of the challenges that face the food processing industry in the 1990s,

(it was these challenges that prompted the Department of Fisheries and Oceans and the Canadian fish processing industry to reexamine the way the industry was regulated and inspired us to change our approach and relationship as the regulator and the group being regulated)

- Take a look at similar initiatives that are proceeding in the United States and the European Economic Community,
- Briefly explain the basic principles of our new Quality Management Program and finally,
- Define the Government's role, as envisioned by the Department of Fisheries and Oceans, in regulating HACCP based programs.

The Inspection Services Directorate Mandate

The Inspection Services Directorate of the Department of Fisheries and Oceans is mandated through Federal legislation to inspect all fish and fish products intended for export from Canada or for inter-provincial trade, and all fish and fish products imported into Canada. Through this mandate we provide assurance that both domestic production and imported products meet Canadian and/or foreign country standards for grade, handling, identity, process, quality and safety.

For fish and fish products produced in Canada, we have a dual concern, the health and safety of Canadian consumers and the overall quality of Canadian fish and fish products and their acceptability in international markets.

The fact that 80% of the fish caught and processed in Canada is exported and in 1988 accounted for a product

value of over \$2.7 billion, attests to Canada's solid reputation as one of the world's leading exporters of fishery products.

The Inspection Services Directorate plays an important role in facilitating the trade of Canadian fishery products through its product inspection and certification programs. I will specifically address this role later on.

The Canadian Fish Inspection Program

To achieve its mandate, the Inspection Services Directorate sets standards via regulation for fish products and industry facilities and follows through with the enforcement of those regulations. This involves a variety of inspection activities which include the inspection of:

- Domestically produced fish products to determine the acceptability of these products for sale in Canada or in foreign markets,
- Domestic fish processing establishments to determine the degree of compliance with construction, equipment and operating regulatory requirements,
- Domestic fishing vessels, unloading sites and transport vehicles to determine compliance with the applicable construction and operating requirements,
- Imported product and the offshore processing operations to determine the acceptability of these products for sale in Canada,
- And the monitoring of shellfish growing waters through the Canadian Shellfish Sanitation Program.

The decisions made under the present and soon to be passé Fish Inspection Program relies on final product testing and the results of single independent inspections of processing conditions.

The implementation of the Quality Management Program will expand the sources of information used in making decisions. A new decision making process based on inter-related inspection data, gathered over time, by both Government inspectors and the processor will be established.

The Changing Environment of Fish Inspection in the 1990s

But before I focus on the specifics of our new approach, I would like to briefly comment on the changing nature of

the commercial environment of the 1990s which is making innovative approaches to food inspection so necessary.

One of the key challenges will be to endure the scrutiny of the informed consumer and demanding marketplace.

Because of the increase in contaminants, pollution and threats to the environment, there has been an increase in media and public concern regarding the safety of the food supply in general and fish products in particular.

International trends lead us to believe that there will be no let up in media attention in the next decade. Today's consumers are better educated, better informed and concerned about the safety of the food they eat. In all probability the workload of all food inspection agencies will continue to increase.

The rapid pace of changing technologies is also presenting an additional challenge to industry and food inspection agencies. As the Canadian fish processing industry develops new products and processes the Fish Inspection Program must adapt its inspection methods to continue to meet its mandate.

Another major challenge for the 90s will be responding to trade issues. The Free Trade Agreement between Canada and the United States and the developments in the European Economic Community will put additional demands on the Canadian fish processors and the Fish Inspection Program. The standards, procedures, and systems must all be harmonized with the aim to facilitate trade.

In the United States the USFDA and the U. S. National Marine Fisheries Service have teamed up to implement a HACCP based inspection regime that will be applied to imported fish products as well as to domestic products. Through the FTA the Department of Fisheries and Oceans is working to gain recognition of equivalency of the Quality Management Program with the new U. S. inspection regime. This will, we expect, result in easier access to the U. S. market.

As you are all aware the European Economic Community is eliminating many of the trade barriers between its member states. One aspect of this exercise is the harmonization of standards and the implementation of common directives concerning food and food production. They are in the process of developing a common Fish Inspection Program based upon the HACCP philosophy and as in the United States, it will also apply equally to imported fish products. In the future all food products from importing third states or companies that do not meet the EEC directives will face increased inspection scrutiny at the port of entry.

My Department is also exchanging information with the Europeans and comparing their new requirements with our Quality Management Program.

The factors that I have mentioned are all external factors that will effect both the Inspection Services Directorate and the Canadian fish processing industry; but there is also another key factor internal to government that will have an impact on the Canadian Fish Inspection Program in the 1990s. That is the question of resources.

The Canadian Government, as well as other western governments will be under constant pressure to limit spending as the aging population places more demands on services and as the Federal deficit is addressed. This means that

inspection programs cannot expect to have ever increasing resources to meet the challenges of the 1990s. Smarter and more cost effective ways must be developed to carry out their mandate.

The challenges of the 90s make it necessary for government and the food processing industries to find, develop and implement innovative and cost effective approaches to food inspection. These new approaches must be flexible and sensitive to the needs of the industry and permit industry to adapt and remain competitive in the changing markets.

The Department of Fisheries and Oceans' Quality Management Program is a key component of the strategy for responding to the demands of the future marketplace and addressing both consumer and industry concerns.

The Quality Management Program - How it works

The Quality Management Program has been jointly developed by the Canadian fish processing industry and the Department of Fisheries and Oceans. The QMP is intended to protect Canada's position as a leading exporter of fish products by setting minimum requirements for an industry-wide program of in-plant quality management, with verification of compliance and enforcement by the Department of Fisheries and Oceans.

The Quality Management Program that the Canadian fish processing industry will be required to establish in their plants is based on the HACCP philosophy.

QMP is, as HACCP is, a system designed to prevent instances of public health significance. However, QMP has been designed to also prevent instances of unacceptable quality and economic fraud from occurring.

The development of an individual Quality Management Program for a fish processing operation incorporates all of the basic steps involved in developing a HACCP system for a specific food product.

A hazard assessment of the process operation is performed. Critical control points are identified. Defect definitions and tolerances, monitoring procedures, record keeping criteria, corrective action systems, and company certification measures are established for each critical control point.

The Quality Management Program is not however, purely a HACCP system. It could be better described as a Regulatory Compliance Program as it is closely linked to the Canadian Fish Inspection Regulations.

During the initial stages of the development of the Quality Management Program the industry/government working group decided that QMP would be based upon existing regulations, which are designed to ensure that fish and fish products are safe, wholesome, of acceptable quality and fairly traded.

The Quality Management Program is designed for the fish processing industry to control their processing operations within the compliance boundaries of the regulations governing the production of fish products.

By implementing the Quality Management Program the fish processing industry will be able to demonstrate that they are operating on a day to day basis with controls that ensure compliance with the regulations.

Lets look a little closer at our Quality Management Program (QMP) and how it fits into increasing industry's responsibility and accountability.

After February 1, 1992 each fish processing plant will be required by regulation to have in place and be operating under a QMP specific to it's fish processing operations.

The Department has developed the QMP Submission Guide to assist the industry in developing their programs. The Guide sets out for the fish processing industry the minimum requirements for a plant's Quality Management Program.

It is important to recognize that the scope of the Guide is limited to regulatory compliance. This means that if a fish processing plant decides to include additional requirements in their QMP to ensure that their buyer's specifications are met, these additions will not be subject to evaluation and inspection by the Department of Fisheries and Oceans.

A fish processing plant's QMP will be evaluated only against the minimum requirements that are set out in the QMP Submission Guide and the Fish Inspection Regulations.

The QMP of a fish processing plant will be required to address each of the 12 critical control points that are applicable to their operation. It is our belief that any hazards should be prevented through monitoring of these 12 points:

1. Incoming Fish
2. Other Ingredients
3. Packaging Material
4. Labelling
5. Cleaning Agents, Sanitizers, Lubricants, and Pesticides
6. Construction and Equipment
7. Operation and Sanitation
8. Process Control
9. Storage
10. Final Product
11. Recall Procedures
12. Employee Qualifications

"Critical Control Point" is defined as a point in time or a physical location in the process at which failure of preventative measures will expose the customer to unacceptable risks related to tainted, decomposed, or unwholesome fish or to economic fraud.

At each Critical Control Point the fish plant must:

- Identify the standard that is being applied to ensure compliance with regulatory requirements,
- Identify the monitoring procedures and inspection frequencies that will be followed to ensure that the standard is being met during production,
- Identify the reporting mechanism that will be used at each Critical Control Point to document the results of the inspections and,
- The fish plant will be required to develop contingency plans or corrective action plans that will be followed if and when the monitoring procedures identify an instance where the standard is not being met.

The fish processing plant will be required to have available for inspection their documented QMP that provides a written description of the program being implemented in the processing plant.

The fish processing plant will also be required to retain records of all inspections performed as part of their QMP for 3 years. These records must be made available to DFO inspectors when requested.

QMP Inspection

I will now explain how the Department of Fisheries and Oceans intends to inspect a fish processing plant against the new Quality Management Program requirements.

Individual inspectors will perform QMP Inspections that will entail:

- The verification of the written QMP to ensure the documented standards, monitoring procedures, record keeping systems and guidelines for corrective action meet the minimum requirements as set by the Department of Fisheries and Oceans,
- The confirmation that the written QMP is being followed in the plant. This will require the inspector to observe the processor's QMP activities at each critical control point in the plant, and
- The verification that the processor's records are accurate. This will require the inspector to withdraw and inspect parallel samples of the processor's products and compare the results with those of the company's.

The completion of the QMP Inspection will result in the process operation being rated as either Excellent, Good, Satisfactory, or Fail.

The QMP rating represents the degree of confidence that DFO has in the company's ability to operate within compliance of the regulations and will determine the inspection coverage to be directed at the operation in subsequent weeks.

Fail rated plants will be asked to voluntarily correct the deficiencies and augment their rating to at least a "Satisfactory." Refusal to deal with the problems voluntarily will jeopardize the Federal Certificate of Registration and therefore the ability of the processing plant to export its products.

Plants which receive a "Satisfactory" rating will be inspected on a frequent basis until they gain greater control over their process and obtain a higher rating.

Processing operations that are successful in meeting all but a few of the QMP requirements will receive an "Excellent" or "Good" rating. These plants will be qualified to apply for the use of the "CANADA INSPECTED" logo on their product labels. Also the product certification process will be streamlined and provided without delay, and the company will have more autonomy in their day to day processing operation.

As you can see the Quality Management Program will allow the Department to measure the level of compliance of the industry in an uniform manner and direct its resources to those areas where problems have been identified.

In general, QMP will involve use of the inspector's time to verify that the company's system works and that the company is maintaining compliance. The focus will not be on individual lots of product or on a day of plant operation as it now is, but rather it will be on the overall QMP system. We will have to change. Industry will have to change. But this approach should realize more impact from each inspection. The number of inspections we do in total may be

somewhat reduced, but if we can focus our efforts where it is most needed, and if we can regain control of how resources are to be spent, we will be able to realize more impact from each inspection.

QMP will use a standardized set of criteria to evaluate company performance. This will, in the future, mean that inspection decisions will be more critical. In addition to normal product or plant action, we will take action which will affect frequency of inspections, prioritize certification sample levels, impact on cost recovery, etc. based on the inspection results.

In considering placing heavy reliance on QMP and the industry, let's keep in mind the fact that the sampling plans we use now, or ones we may use in the future, all have limitations. If we can have confidence that the QMPs are in effect and working at a company, the degree of assurance that standards are met should be greater than that which can be derived from final product sampling alone. We use this approach in the offshore program for example.

We must, however, recognize that QMP monitoring will involve fairly complex inspections and that they must be consistently and uniformly performed. This will be one of the major challenges we face as we proceed with QMP.

The question has been posed, 'Why would QMP be suggested by DFO and industry?' The QMP initiative will provide industry and government with:

- A joint industry/government system with which to prevent crises and, in the event that one does occur, to better respond to that crisis.
- A better means of providing assurances that standards are met than that which can be achieved through reliance on end-of-line sampling alone.
- A better means of directing our efforts to ensure standards are met.
- It will also provide inspection managers with more discretion in the direction of efforts to areas that are of more concern and away from areas where constant monitoring is not needed.

The Role of Government in Regulating Under a HACCP System

One of the first steps any food processing operation takes in developing a HACCP based system is to perform a detailed analysis of their process, from the harvesting site through to the consumer, with the objective of identifying the "hazards".

The term "hazards" has many different interpretations depending upon the point of view. The microbiologist's primary focus will be on the presence and proliferation of pathogenic organisms during production and distribution, the Government inspector will have a more comprehensive focus and will concentrate on compliance with the regulations, and the food plant manager and owner will focus on the ultimate hazard of going broke. The food plant manager understands full well that if the processing plant produces a food product contaminated with pathogenic organisms it will go broke, if the plant operates out of control and is continually outside the government regulations it will eventually go broke, and if the plant is unable to satisfy the demands of the market it will go broke.

This indicates that depending upon who performs the analysis of the process will determine which hazards are emphasized.

The role of Government in the grand scheme is to provide guidance to the food processing industry on which aspects of the regulations should be addressed in their HACCP based program to ensure that the food processing plant operates within government regulations and therefore provides adequate assurance that it produces products that are safe and wholesome, of acceptable quality and fairly traded.

The processing plant's QMP or HACCP based program (which ever you choose to call it) should not stop here. It is important that processing plants expand their program to incorporate the controls that are necessary to ensure that they are meeting their customer's specifications. However, this aspect of their program is outside the mandate of the Government food inspection agency.

Our only concern should be, is the processing plant implementing the controls necessary to ensure compliance with the regulations and whether the processing plant can demonstrate that it is operating within those controls.

This is the philosophy and the approach that has been taken by the Department of Fisheries and Oceans.

The Government food inspection agency should not be concerned with the consistency of your sauces or crispness of your batter.

It is not the role of a Government food inspection agency to intrude into the internal management of a company.

The implementation of the Quality Management Program will mean a change in the relationship between the fish processing industry and the Department. The Inspection Services Directorate's role will shift from solely an inspection function to include an auditing function.

The inspector will continue to perform random inspections of the process operation and products but the focus will not be on individual lots of product or on a day of plant operation as now is the case, but rather on the overall QMP system. The inspector's decisions will be based upon a compilation of inter-related inspection results gathered over time by both the inspector and the processor.

The Quality Management Program - Industry's Role

The major change for industry is that they must accept more responsibility in monitoring their own performance. Fish processors will not be able to continue to rely upon inspectors to identify non-compliance items, provide solutions and then negotiate dates for corrective action.

The fish processing industry must be in control of their operations and be able to demonstrate to the Department of Fisheries and Oceans that they consistently meet the regulatory requirements.

Conclusion

We feel the Quality Management Program will provide the Canadian fish processing industry and inspection with an effective mechanism to ensure the protection and assurance needed in today's demanding markets. The price of this assurance is change.

We will have to change. Industry will have to change. But this approach should realize more impact from each inspection. The number of inspections we do in total may be somewhat reduced for some plants, but each inspection will count for more. We will be able to focus our effort on areas of higher risk and apply our resources in a more cost effective manner.

In summary, the Department of Fisheries and Oceans' new approach to quality management is a joint industry/government system which is aimed at preventing problems before they occur. Working together, through the Quality Management Program the Canadian fish processing industry and the Federal Government will be able to provide Canadian consumers and our international customers even better assurance than in the past that the high standards Canadian fish products have been known for will be met in the future.

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Myths Cleaning, Sanitation and Disinfection

David N. Kramer, Ph.D.,
The Sterilex Corporation, Haverford, PA 19401-1309

The dictionary defines the word myth as, "...a person or thing held to exist but having no actual or demonstrable existence..." being synonymous with "legend, fable and falsehood." On close inspection of the current cleaning and sanitation practices in the food processing fields, including poultry, turkey and their hatcheries and further processing operations as well as dairies and fisheries, one must conclude that there is extensive reliance on myths with respect to label claims and chemical usage for sanitation and disinfection.

Criteria for sanitation and disinfection

The criteria for sanitation, disinfection and sterilization are derived from laboratory AOAC determinations which are presumed to simulate the real world as found in operating processing plants. The procedures must decrease the bacterial counts of specified organisms by four to five log values under specified load and exposure conditions. Unquestionably, the many variables that are encountered in a plant immediately cast doubt on the assumption of similarity, between laboratory tests and plant practice. For example, sanitation and disinfection require precleaning steps but there are no measures of cleanliness except the results of the bacterial counts, product shelf-life and product marketability. In addition, every plant has a stoichiometry, which means that there is a need to address the extent and kind of contamination to be removed. Also, specific strains of organisms tested in AOAC laboratory tests may not be identical to those found in the plant and therefore may have an altered susceptibility to the sanitizer or disinfectant. Susceptibility of organisms being a function of dose (concentration times time).

Biofilms

A further concern is encountered with respect to the presence of biofilms. These persistent films are the result of the slow attachment of bacteria and fungi to surfaces with the subsequent accumulation of layers of fat, proteins, and general plant debris which ordinary cleaning measures do not remove. The sanitation and disinfection of biofilms are not given consideration in AOAC aqueous test tube procedures. It should also be noted that biofilms are not penetrated by water soluble chemical such as caustics, bleaches, iodophors, phenols and quats and therefore the organisms within them are not destroyed. There are no procedural

specifications or regulations on the sanitation and disinfection of biofilms.

Residual Activity

The no-rinse sanitizers claim to possess residual activity, if reliably used after scrupulous cleaning and biofilm removal. However, if one calculates the sanitizing capacity of a 200 ppm quat solution on a belt having grams of potential contamination (fat, protein and hydrocarbons), it becomes obvious that the no-rinse concept is untenable. This is universally recognized by the need to continuously sanitize belts, floors, drains, hands etc. Unprocessed meat and poultry contribute to bacterial contamination of the workers and plant equipment and thereby overcome almost immediately the anti-microbial effectiveness of a "residual" quat. In a deboning operation, steel mesh gloves bear a heavy load of cfu's and should be constantly sanitized but certainly not with quats or bleach which are readily inactivated.

Sanitation and Disinfection Operations

CIP units for delivery of cleaning, sanitizing and disinfecting chemicals have gained wide acceptance in plants since they afford convenience, automation, decreased labor and time as well as economy of chemicals and water. If vigilance is relaxed, contaminated areas are missed especially those areas that are not readily accessible, e.g., interlocking belts, cracks, ball bearings and edges and lips in equipment.

Mobile high pressure units and foamers have limitations of reliability especially when the chemicals being dispensed are toxic, irritating, and corrosive necessitating donning of heavy protective suits and hoods. The sanitation teams are placed at a disadvantage due to inability to work efficiently under these visual and physical constraints. The result is that the plant retains background cfu's with high incidence of residuals of *Salmonella* and *Listeria*.

Foam

High pressure units and foamers are not capable of removal of biofilms with water soluble chemical systems. Hand scrubbing is required where access to obstructed sites exist on belts, equipment, etc.

Sanitation teams prefer foam during cleaning. A stable foam (like shaving cream) has a practical value in that it

indicates where the cleaner/sanitizer has been dispensed. Also, it is useful in allowing the chemical to cling to a vertical wall or ceiling. However, the active chemical available to the surface is at the interface of the foam and the surface, whereas the upper foam layers do not diffuse to the target organisms and are therefore wasted.

Foot Baths

Another prominent source of contamination in plants is derived from footwear. The commonly employed foot bath sanitizers are iodophors, bleaches and quats. If the footwear is not adequately pre-cleaned, the sanitizers are not reliable. The currently employed chemicals do not remove protein or fat film from the boots. The floors are then contaminated by the boots which in turn contaminate the drains. The foot baths must have an effective fat-penetrating cleaning and anti-microbial solution that is not inactivated by the boot contaminants.

Background Counts

While each plant has its own particular hazard areas with respect to bacterial contamination, there has been no reliable method to monitor the reliability of the sanitation procedures, other than to take random bacterial samples. Randomness is a probability concept and therefore the determination of what constitutes a reliable measurement depends on obtaining a sufficient number of unbiased samples. Realistically, this is a logistic burden as well as a labor intensive effort with time constraints, since where to sample can not be determined visually beforehand. Random sampling cannot be relied upon as an accurate measurement of background counts.

If the total cfu's in an area do not exceed a preset normal level, plant sanitation is considered acceptable. This is a compromise between what exists and what should be (0 counts). However, the problem of obtaining a reliable audit lies in the method of sampling of surfaces that have been presumably cleaned and sanitized with aqueous chemical systems. Where biofilms exist, superficial swabbing or Rodac tests (pressure plates) yield inaccurate sampling and therefore do not give reliable bacterial results.

Bacterial Sampling

After a plant has been cleaned, sanitized or disinfected with aqueous chemical products, the practice is to take random bacterial samples either by means of bacterial swabs or press plates. The bacterial counts that are obtained do detect the contamination of the surfaces. However, should there exist fatty films as in the case of biofilms, the condition of the surface is no measure of the subsurface contamination which in fact is associated with the presence of *Listeria* and *Salmonella*. In addition, where there are cracks and crevices on belts, which are inaccessible to swabs and pressure plates, the reliability of the sampling procedures is in question and another impediment to accurate sampling are those areas of corrosion which strongly adsorb to contaminants.

Halogens

Chlorine and iodine are widely used in plants to sanitize and disinfect. Since these elements are highly toxic and

corrosive, their use is limited to low aqueous concentrations. Also, because they have a significant vapor pressure and volatility, there is an inhalation toxicity. If, in the process of use, microscopic droplet aerosols are produced that remain suspended in the atmosphere for a long period; and then inhaled, these droplets penetrate the depths of the lungs and cause severe damage to the linings of the lungs. The allowable limit of exposure is 0.1 ppm (part per million) for 8 hours. Continuous exposure to chlorine vapors dulls the olfactory sense so that the individual is unaware that he is in a hazardous environment.

Chlorine and iodine are most effective as anti-microbial when used in solutions on the slightly alkaline side (pH 7.2-7.6). When mixed with caustic, pH 13-14, the chlorine is rapidly converted to chlorate and chlorite and acquires less oxidation or bleaching properties and is therefore less anti-microbial. Alkaline bleach cleans water soluble contaminants primarily due to its alkalinity but since it is not soluble in fatty films under practical conditions, is not effective against biofilms.

Halogens are also not compatible with phenols and quats. In the presence of phenols, chlorinated phenols are formed, inactivating the chlorine but also producing products related to the toxic dioxins.

Further, Halogens are also incompatible with ammonia and amines reacting to form chloramines which are cancer producing. The most widely used quats are not crystalline and are aqueous solutions of mixtures with amine impurities since purification and crystallization would greatly increase their cost. Therefore, it would be wise to avoid the use of halogens in the presence of quats.

Hypo-chlorite must never be used with acids, because chlorine vapor is rapidly formed and diffuses from solution and creates extremely toxic gases. Plants that wash surfaces with acids to remove calcium and magnesium salt deposits create toxic chlorine vapors if bleach has been previously applied to the surface.

CIP Systems

CIP (clean-in-place) Systems have been sold to the plants on the basis of savings on material, labor costs, greater ease, and shorter time in dispensing of chemicals. CIP units are generally preset by the installer wherein the dilution settings are predetermined by the specific concentration requirements of the chemicals to be dispensed. Generally, the plant sanitation supervisor has no knowledge of the setting, and if a new chemical system is used, the delivered dilutions are unknown and may be inaccurate. Since the dilution ratios are high, a slight change in the dilution setting can result in a significant change in the delivered concentration. There is no practical way to detect these changes during clean-up operations.

For example a CIP System may be designed to deliver chemicals downward so the chemical solutions most readily reach top surfaces such as in cookers, extruders, slicers, etc. The lower parts of the equipment are inadequately covered and may not be cleaned satisfactorily. Since CIP chemicals are delivered under relatively high pressure, any residual contamination may be scattered and transmitted to inaccessible sites in the equipment or the plant. In any case careful

monitoring should be exercised to ensure effective surface application of solutions.

Solving the Problems

There is no single solution to the diverse problems encountered in facilities. However, it must be recognized that eternal vigilance is required with respect to every detail that may contribute to less than satisfactory conditions from the beginning through to the end of the production process.

Extreme care must be taken to prevent the introduction of contamination by personnel, equipment, and environmental factors. The first step in any sanitation protocol is cleaning, to remove the excess burden of gross matter by brushing, sweeping, vacuuming, high pressure steam and heated water. The next step is the use of a cleaner-sanitizer which can penetrate proteinaceous and fatty deposits.

A novel system has been marketed which utilizes a combination of reactants which are now both water and fat soluble. The basic ingredient is a hydrolyzing salt which is an aggressive hydrolyzer of fat and protein, and even more effective than caustic under equivalent concentrations. It replaces the caustic. In addition, upon penetrating fatty and protein films, it renders these films water soluble. Caustics are not soluble in fatty films and will not penetrate them to reach the bacteria lodged therein. It should be noted also, that bleaches and quats are likewise insoluble in fatty layers and do not partition into biofilms.

The success of the HACCP program is dependent on the reliability of sampling and detecting the microorganisms in a plant. Without guidance with respect to reliable sampling, inadequate cleaning, sanitizing and bacterial detection methods, useful and meaningful data will not be generated.

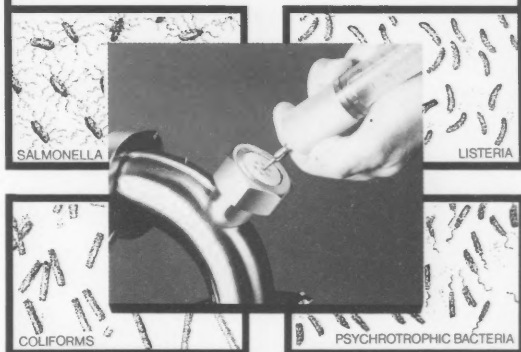
A final word on label claims is in order. Claims of sanitation and disinfection must be verified by in-plant studies. Each plant must be titrated and there is no *a priori* reliable protocol without factoring in water hardness, temperature, equipment type, competence of the sanitation teams, type of products made and supervision.

Summary

This paper deals with the practical problems encountered in poultry plants, hatcheries, slaughtering and further processing facilities. While water-based cleaners and sanitizers are effective in the removal or superficial microorganisms, hydrophobic biofilms are not effectively removed so that they are a continual contamination source and hazard. A novel chemical system has been developed which is both water and lipid soluble which has been shown to remove biofilms resulting from microbial attachment to surfaces. Though unaffected by caustic, quats, bleach and formaldehyde vapors, biofilms are penetrated by the system and are rendered water-oil-soluble for ease of removal.

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Bacterial Quality of Vanilla Ice Creams Purchased at Stores in Pennsylvania

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As presented at the Dairy Symposium at the 77th IAMFES Annual Meeting, August 7, 1990, Arlington Heights, Illinois

Abstract

This study evaluated the bacterial quality of vanilla ice creams purchased at stores throughout Pennsylvania. Coliform and standard plate counts were enumerated from 210 vanilla ice cream samples which were plated according to SMEDP (Standard Methods for the Examination of Dairy Products). Analyses revealed that 91.4% of these samples met the bacterial limits set by most states, including Pennsylvania, of less than ten coliforms per gram. Of these 210 samples, 95.7% had less than the bacterial limit of 50,000 standard plate count per gram. In fact, the majority of the samples contained less than one coliform and less than 1,000 standard plate count per gram. These results indicate that ice cream manufacturers were following recommended sanitation practices which leads to a product of good bacterial quality.

Introduction

In Pennsylvania, representative samples of each type of frozen dessert must be tested at least monthly. In the case of new or seasonally produced frozen desserts, bacterial tests shall be made at least weekly until three samples are analyzed, followed by monthly testing. The bacterial limit of vanilla ice cream is 10 coliform/g and 50,000/g for SPC. In ice cream to which fruits, nuts or bulky flavor are added after pasteurization, the counts shall not exceed 20 and 50,000 per gram for coliform and standard plate count, respectively¹. In order to rule out variables such as other flavorings and ingredients, vanilla ice cream samples were used in this study. The goal of the program, which is funded by Pennsylvania's dairy industry, is to continually improve the quality of dairy products manufactured in Pennsylvania and surrounding states by providing individual processors with bacterial and other test results.

¹Senior Research Technologist

²Professor of Food Science

Materials and Methods

The ice creams, purchased at stores throughout Pennsylvania, were transported to the Penn State Dairy Research Laboratory via insulated ice chests with dry ice. The samples were maintained at 0°C until the testing was completed within 72 hours. Weights, plant codes, and code dates were recorded in order to supply results to the manufacturer.

The samples were plated according to SMEDP (Standard Methods for the Examination of Dairy Products²). Using a sterile spatula, the surface portion of the sample was removed and discarded to a depth of 20cm around the area to which the sample was taken. Dilutions of 1:1 and 1:10 were prepared for coliform and 1:10 and 1:100 for standard plate count (SPC). These were plated using the pour plate method (Violet Red Bile agar for coliform and Plate Count agar for SPC) and incubated at 32°C for 24 and 48 hours for coliform and SPC, respectively. The plates were enumerated using a Quebec Colony Counter.

Results and Discussion

The coliform counts, divided into 3 categories, of the 210 vanilla ice cream samples are shown in Table 1. The data indicate that 8.6% of the samples did not meet bacterial limits of less than 10 coliforms/g. However, 77.1% of the samples fell into the less than 1 coliforms/g category.

TABLE 1. Coliform counts of 210 vanilla ice cream samples.

Coliforms/g	Number of samples	%
<1	162	77.1
1-10	30	14.3
>10	18	8.6

The standard plate counts, divided into 4 categories, of the 210 vanilla ice cream samples are shown in Table 2. The data indicate that 4.3% of the samples did not meet bacterial limits of less than 50,000 SPC/g, while 88.1% were less than 1,000 SPC/g.

TABLE 2. Standard plate counts of 210 vanilla ice cream samples.

SPC/g	Number of samples	%
<100	79	37.6
100-1,000	106	50.5
1,000-50,000	16	7.6
>50,000	9	4.3

Based on the bacterial results presented, it should be evident that ice cream manufacturers were following sanitation practices which resulted in a product of good bacterial quality.

References

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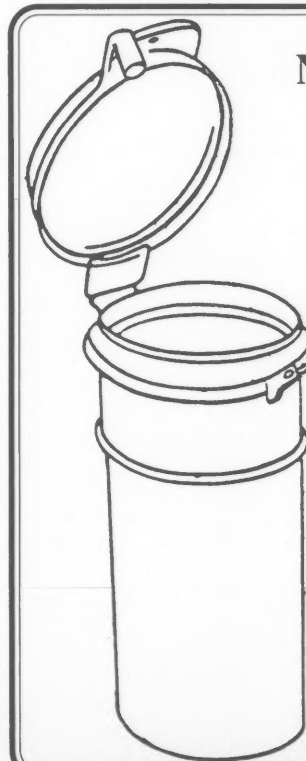
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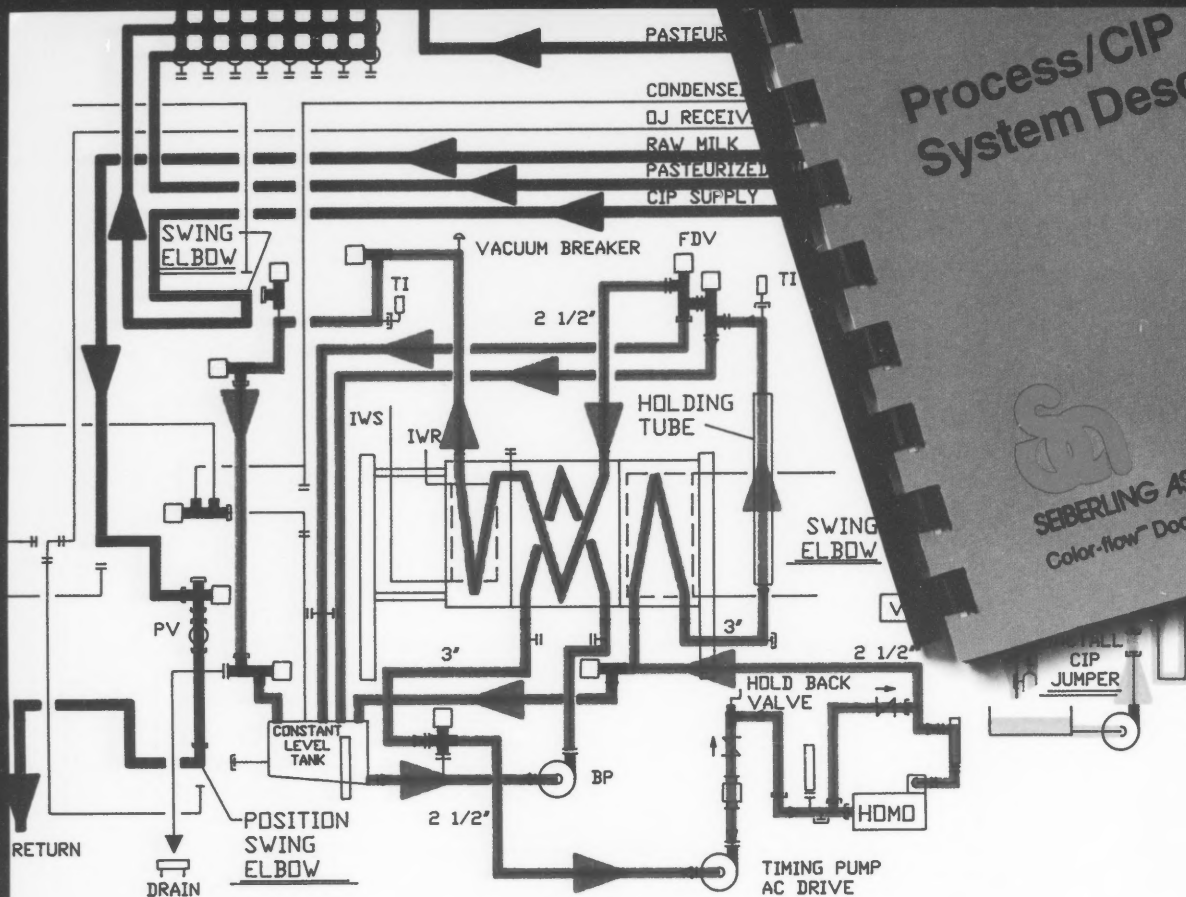
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*American Veterinary
Medical Association
Food Safety Workshop
Participants Debate
Veterinarians' Role in Food Safety*

March 11, 1992
Arlington, Virginia

Report by
Dr. Alfred Fain
IAMFES Representative
Director, Silliker Laboratories of Georgia, Inc.
Stone Mountain, Georgia

On March 11, 1992 American Veterinary Medical Association president Gerald L. Johnson convened a Food Safety Workshop at the Key Bridge Marriott Hotel in Arlington, VA. The meeting objective was to consider recommendations for the involvement of some 52,000 AVMA members in food safety issues. Issues cited were microbial foodborne illness, drug residues in meat and poultry, meat and poultry inspection procedures, mandatory fish inspection, and irradiation of meat and poultry products. IAMFES was invited to send a representative to the meeting.

The first of the three workshop days consisted of a general session during which twelve distinguished speakers from government, industry, consumer interests, and the news media gave their views and concerns on the issues. Views of eight of the twelve speakers including Representative Stenholm of Texas, H. Russell Cross of FSIS, Lester M. Crawford of the National Food Processors Association and Daniel M. Puzo of the Los Angeles Times were outlined in Food Chemical News, Volume 34(3):64-67. Workshop participants (over 100 strong) were divided into seven groups which focused on food safety issues involved in production (four groups), processing, marketing and distribution, and preparation and consumption. The second day was spent by these smaller groups in discussion and preparation of position statements on the issues. The workshops

were reconvened in general session on Friday, March 13. Group moderators presented workshop recommendations to the general session.

Among significant conclusions and recommendations of the workshops are the following:

- Veterinarians must become proactively involved in food safety education, legislation, and public relations.
- Veterinarians must be involved in the education of food animal producers regarding food safety issues.
- Veterinarians must be involved in changing public perception about the safety of foods of animal origin.
- Expanded educational efforts were recommended beginning with grade school classes and extending to reestablishment of formal courses dealing with food safety issues in leading veterinary schools.
- Establishment and extensive communication (eg. including clear labeling) of "tolerable risks" of consumption of foods of animal origin was recommended.
- Veterinarians have a moral obligation to assume a leadership role and a role as a credible third party in debates concerning food safety issues, assuring the public of wholesome, affordable food from healthy, well cared for animals.
- The group recommended that the AVMA pursue codification of extra label drug use to allow flexibility and accountability in veterinary clinical practice.
- Wider application of the Hazard Analysis Critical Control Points concept from production through processing and distribution was recommended.
- Development of microbiological standards for processors was advocated.
- Public abstinence from consumption of raw products of animal origin (eg. raw shell fish) should be promoted by veterinarians.
- Better residue testing methods should be developed and deployed for testing of animal products.
- Veterinarians should serve as part of a team of discipline specialists in a total quality management system.

Additional information concerning the AVMA Food Safety Workshop appears in Food Chemical News 34(4):9 & 10. The final report of the workshop committee will be published in the July 15, 1992 edition of the AVMA Journal.

Attention IAMFES Annual Meeting Attendees

Charles Otto, FDA, will present a hands-on demonstration of the
FDA "Prime Connection" on Saturday, July 25, 1992
7:00 - 10:00 pm in the Kent Room, The Sheraton Centre, Toronto, Ontario

FDA Prime Connection, through toll-free or local calls, provides electronic access to retail food protection, milk safety, shellfish sanitation and other technical materials issued by the Center for Food Safety and Applied Nutrition.
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Dr. Ann Draughon

IAMFES Secretary Winner

Dr. Ann Draughon through the vote of the IAMFES membership will begin her term on the IAMFES Executive Board in July, 1992.

Dr. Ann Draughon is a Professor of Food Microbiology for the Department of Food Technology & Science at the University of Tennessee in Knoxville. She directs 8 graduate students, several undergraduates and a technician in research concerning *Salmonella*, *Listeria* and Aflatoxins in food and dairy products. Ann teaches courses in Food Microbiology, Advanced Food Micro and Food Toxicology at the University of Tennessee. She has been active in the area of Food Safety for almost 20 years. Ann received her B.S. in Microbiology from the University of Tennessee in 1973 and worked as a clinical microbiologist until beginning her Master's degree. She received her M.S. in Food Tech. & Science from UT in 1976. Ann received her Ph.D. from the University of Georgia in Athens in Food Science/Food Microbiology in 1979.

Ann has been active in IAMFES for many years. She has served on the Editorial Review Board of the *Journal of Food Protection*. She is currently chair of the Applied Lab Methods committee. She has chaired the Developing Scientist Awards committee twice and currently serves on the IAMFES Program Advisory Committee. Ann will chair the IAMFES Program Advisory Committee in 1992-93. She is also the vice-chair of the Tennessee affiliate of IAMFES.

Ann has been involved in many other professional organizations serving as chair of the Food Science Division of the Southern Association of Agricultural Scientists (SAAS) in 1989. She currently serves on the Executive Board of SAAS. She has served on numerous committees for the Institute of Food Technologists and has chaired the Vice-President's Agricultural Advisory Board twice at the University of Tennessee.

Ann has presented numerous papers at IAMFES meetings and is the author of over 50 research articles. She is a frequently requested speaker and has presented over 125 technical and invited papers. Ann has been elected or selected to participate in numerous national and regional committees in the food safety area. She is currently involved in a regional effort to increase interaction of research and extension in food safety and to begin education at the K through 12 level on food safety.

Ann is 40 years old and is a widow with two sons. They live in Knoxville, Tennessee.

New State Milk Law Could Hurt Minnesota Producers

The long term effect of Minnesota's new Minimum Milk Pricing Law could make Minnesota farmers less competitive with those in neighboring states, a University of Minnesota agricultural economist says.

In addition, the new law, which takes effect Aug. 1, 1992, could have Minnesota consumers paying higher prices for fluid milk and subsidizing manufactured dairy products—butter and cheese—in other states, said Jerry Hammond.

Hammond, who conducts research for the university's Agricultural Experiment Station, has calculated what the law's effect would have been on farm and consumer milk prices for the 12-month period from April 1991 through March 1992.

The maximum monthly increase at the farm level was 34 cents per hundred-weight, assuming milk assemblers returned all proceeds from higher fluid use prices to farmers through price pooling.

Retail milk prices could have increased by as much as 24 cents per gallon in some of the months. But in four of the 12 months, there would have been no price increase for farmers or consumers.

Hammond said the potential impact for 1992 and 1993 milk prices is likely to be "insignificant or zero" for two reasons:

- Milk prices already are rising and are expected to rise above the state minimum.
- Cooperatives in Minnesota have recently formed a collective bargaining agency that is establishing fluid prices above the state minimum.

The law sets a minimum price of \$13.20 per hundred-weight on milk used for fluid products in Minnesota. But a large share of Minnesota's fluid milk comes from Wisconsin, and Hammond said the volume of Minnesota milk that would be affected by the minimum price is uncertain.

Hammond is worried that the law may make Minnesota dairy farmers less competitive with those in neighboring states. Only 17 percent of the Grade A milk in Minnesota is required to meet Minnesota's fluid beverage milk needs. The other 83 percent is used to manufacture cheese, butter and skim milk powder, much of which is marketed outside Minnesota.

"If the law brings a price increase in Minnesota, it will stimulate more milk production in the state," Hammond said. Since a large portion of Minnesota-produced milk is marketed as manufactured products in other states, "Minnesota consumers will be asked to subsidize manufactured milk prices for the rest of the U.S."

And if milk prices increase in Minnesota because of the state law, processors could opt to locate plants across the border in neighboring states. "Milk processors may find it advantageous to bring lower priced milk into Minnesota from Wisconsin, Iowa and South Dakota," Hammond says.

Hammond said Minnesota producers will be hurt if more states adopt minimum milk pricing laws. "That could drive prices of manufactured milk products down by 15 cents or so per hundred-weight. And that would reduce returns to Minnesota producers by at least as much as Minnesota's law would raise prices in some months."

FDA to Set New Regulations and Guidelines for Recycled Plastic Food Packaging

Consumer and food industry interest in recycling packaging materials is giving the Food and Drug Administration reason to form new regulations and guidelines, according to Dr. Alan M. Rulis, Director of the Division of Food and Color Additives.

"No one was thinking about recycling when indirect additive regulations (which cover plastic food packaging materials) were originally written 20 years ago," Rulis explained to participants at the NCFST Research Reporting Conference in January. "And no one wants to face the unhappy prospect of rewriting all the regs."

"However, the agency believes that the time has come to move ahead to establish a set of generic principles for recycled polymeric food-contact materials," Rulis continued.

Rulis noted the scientific question which the FDA must ask is this: "What are the appropriate testing methods, and the appropriate level of analytical detectability needed to determine that a recycled polymeric material is substantially identical to virgin materials, and the safety of a recycled material that is different from one that is currently regulated?"

For the last several years, the agency has been developing a policy for exempting certain uses of materials from the food additive petition process that result in negligible or "de minimis" dietary exposure, Rulis explained.

"This 'Threshold of Regulation' policy would allow the FDA to consistently determine when migration of food-contact materials to food is negligible from a public health perspective," he said.

Because the technology of food package recycling is evolving so rapidly, Rulis said, the FDA wants to work with industry throughout the process of establishing regulations and guidelines. "This process would maximize the level of cooperation and take advantage of the expertise on this issue which is possessed by outside organizations."

Reprinted from Food Safety Watch, January/February 1992, Volume 2, No. 1, National Center for Food Safety and Technology, Illinois Institute of Technology, Moffett Campus, Summit, IL 60501-9998.

AFFI Develops CFC Education Program for Retailers

Recognizing the phaseout of chloro-fluorocarbons (CFCs) as one of the most challenging issues facing the food industry, the American Frozen Food Institute (AFFI) has developed a CFC Education Program for retailers. One component of the program is *CFC facts*, a newsletter providing retailers with up-to-date information on technological and legislative developments on the CFC issue.

"AFFI's Public and Trade Relations Council created the education program, which shows the retail segment that the frozen food manufacturers understand the dilemma they face," stated AFFI President Steven C. Anderson. "We want to help make the transition away from CFCs as painless and cost efficient as possible for all segments of the food industry. Addressing the retailers is a step in the right direction."

AFFI debuted the newsletter as an insert in the May/June issue of *Frozen Food Report* magazine at the Food Marketing Institute convention. The cover story of the magazine is "The Industry and CFCs."

The newsletter will be produced on an as-needed basis and mailed to approximately 2,000 retailers, large and small. AFFI expects to expand the program beyond the retail community to the warehousing and distribution segments.

AFFI is the national nonprofit trade association that has represented the interests of the frozen food industry for 50 years. AFFI'S membership accounts for 90 percent of the total frozen food produced in the U.S.

For more information contact Traci D. Vasilik at (703)821-0770.

Kessler Assures NFI Board of Safety of Seafood

Members Focus on Seafood Inspection Legislation

The National Fisheries Institute (NFI) Board of Directors met in Washington, D.C. from April 30 to

May 2, 1992 to set policy and programs for the organization for the remainder of the year. Among the issues considered were the Senate's Consumer Seafood Safety Act of 1992 (S. 2538), a comprehensive communications program, the impact of the recession on the industry, and whether to add new "districts" for Hawaii and Alaska to the NFI Board of Directors.

NFI President Bob Brophy, president of Icicle Seafoods, urged members not to lose sight of the industry goal of 20 pounds per capita consumption by the Year 2000. To accomplish this goal, issues like seafood inspection must be brought to closure once and for all and consumer confidence in seafood restored. He further reminded members that they alone have been shouldering the burden for the entire industry and that NFI must increase membership to more equitably share the responsibilities for industry growth.

The highlight of the board meeting was a speech by Dr. David A. Kessler, Commissioner of the Food & Drug Administration, who stated emphatically that "the perception that seafood is unsafe is untrue." He credited industry members with having been important contributors to the safety of seafood products and the success of the existing seafood inspection programs. He described the very positive results of the first-ever nationwide survey of domestic seafood processing plants which awarded 95.2 percent of all facilities "a clean bill of health."

Dr. Kessler attributed the public's concern about seafood safety, in part, to the fact that the FDA is in the business of ensuring the safety of these products, but not in the business of publicizing these results. However, he did say that "seafood safety is serious business at the FDA—and the seafood program is a top agency priority." He concluded his remarks by saying that the existing program is more than adequate, and that the Bush Administration has demonstrated its commitment to seafood safety by increasing the FDA budget for seafood substantially for the past two years.

NFI arranged to have Dr. Kessler's remarks videotaped for inclusion in a video news release (VNR) on seafood safety. Combined with footage of Lee Weddig, executive vice president of NFI, discussing the new seafood inspection legislation and Dr. William Castelli of the Framingham Heart Study on the dietary benefits of seafood consumption, the VNR was distributed by satellite that afternoon. Preliminary results indicated major market coverage of the "seafood is safe" message.

Presentations by Dr. Kessler, other Administration officials and Members of Congress set the stage for debate about seafood inspection legislation. "The NFI Board of Directors held extensive discussions about the Consumer Seafood Safety Act of 1992," said Lee Weddig. "There are areas where we believe the legislation might be changed and we will work with Congressional staff to develop the most effective program possible."

The Board adopted a communications and education campaign that will concentrate on increasing seafood consumption. "Right now, with the recession only

beginning to abate, we felt it was essential to maintain our presence in the marketplace," said Roland M. Chambers, Louis Kemp Seafoods and Chair of the NFI Communications and Education Committee. "The programs approved by the Board include continuation of the award-winning newsletter *Seafood Source*, sponsorship of seminars and workshops at food and health professional conferences, and special media outreach efforts focusing on recipes, issues, and consumer education. The *SeafoodService* supplement will be completed this summer which we expect to be a very positive product for the retail and foodservice trade."

Board meeting attendance was high, with members actively debating issues and setting the 1992-93 policy agenda. "The seafood industry is currently faced with several pressing policy concerns," continued Weddig. "We must look at how U.S. environmental policy is affecting our seafood supply and we must address these continuing allegations about seafood safety to the satisfaction of the consumer. We also must try to achieve the best possible inspection program for consumers and industry alike."

NFI is a non-profit trade association of 1,000 companies involved in all aspects of the U.S. fish and seafood industry — producers, processors, wholesalers, distributors, brokers, importers, exporters, and members of allied supportive industries. The Institute provides government relations, technical, promotional and public relations services in support of industry objectives and goals.

For more information contact the National Fisheries Institute, Communications Department, 1525 Wilson Boulevard, Suite 500, Arlington, VA 22209 or call 703/524-8881.

New Food Plants Yearbook and Directory Now Available

Food Plant Strategies, sponsors of the popular FOOD PLANTS conference series is pleased to announce the availability of a new publication, the 1992-93 *Food Plants Yearbook and Directory*. For the first time, a publication is available to assist the food company engineering executive with resources and decisions on his food plant.

Available in October, 1992, the book includes alphabetical listings of architectural and engineering firms, as well as full-page company profiles providing detail on a company's experience in the varied aspects of planning a food production facility. The "Gallery of Food Plants" provides an opportunity to see facilities that have been completed by the various participating firms and includes details of square footage, etc.

Every company responding to a detailed survey is also listed in the "blue pages," a listing of just who has direct experience in specific areas of food production. For instance, firms specializing in dairy plant design are listed under the "Dairy" section for facility planning.

A special section will be dedicated to state and regional economic development agencies.

More than merely a listing of names and contacts, articles to assist the food company engineering executive are also included. Not only is a reference section of varied associations within the food industry included, but articles are also featured, discussing topical issues such as *Who Will Build the Packaging Lines of the Future*, *Practical Advice For Food Companies Seeking The Best Location for Their Plant*, and more.

This new publication, *Food Plants Directory and Yearbook*, will become a truly valued reference piece for food companies throughout the world...all for only US \$95.00.

For more detailed information or to order the directory, please don't hesitate to call Annette LeMaire, Directory Coordinator, Food Plant Strategies, 122 S. Church Street, West Chester, PA 19382. Telephone: 215/436-5347. Fax: 215/436-6277.

American Farmland Trust, Northern Illinois University Establish Center for Agriculture in the Environment

The American Farmland Trust (AFT) and Northern Illinois University today announced an agreement to establish a major new facility for the study of agricultural conservation issues.

Located in Northern Illinois University's Social Science Research Institute in DeKalb, Ill., the new facility, called the Center for Agriculture in the Environment, will be a focal point for all AFT public policy research efforts. It also will house AFT's national sustainable agriculture on-farm research and demonstration program.

Founded in 1980 by a group of conservationists and farmers, the American Farmland Trust is a non-profit membership organization that works to stop the loss of productive farmland and to promote farming practices that lead to a healthy environment.

AFT President Ralph Grossi and Northern Illinois University (NIU) President John LaTourette signed the memorandum of understanding creating the facility. "The Center for Agriculture in the Environment will give our organization an ever-expanding source of information on ways to protect the long-term productivity and viability of America's farmlands," said Grossi. "We

believe this added capability will help us develop practical, environmentally sound recommendations for future farm conservation policy and allow us to expand our assistance programs to farmers and local communities."

The center's establishment follows a decade of cooperative research work between AFT and NIU. The projects generated information for AFT to successfully develop and advance improved public policies at the local, state and federal levels.

Grossi hailed the continued association between his organization and NIU. "Northern Illinois has excellent programs in geography, rural studies, public administration and environmental law and policy," he said.

"Our agreement will allow us to more fully benefit from these and other university resources and provide even better services to farmers and local communities."

The new facility was made possible by a grant from The Ford Foundation. That grant includes funding for a director and two graduate assistants. The director, who is now being recruited, will develop a multi-year research agenda and supervise the center's activities including AFT's Sustainable Agriculture Program. Last fall, that program, which will continue to be directed by Bryan Petrucci, earned a Presidential Environment and Challenge Award.

In addition to improving its research capabilities and expanding the Sustainable Agriculture Program, AFT will increase its land and water conservation activities with local communities. It will develop model ordinances, review land use plans and undertake costs analyses of the fiscal impact of farmland conversion.

Additional funding support for such projects is now being sought. To date, the Charles Stewart Mott Foundation, the Wallace Genetic Foundation, Inc., the Virginia Environmental Endowment and the Robert W. Woodruff, Inc., Foundation have all made commitments to a variety of new initiatives. The Joyce Foundation is also providing support for policy-related issues in sustainable agriculture.

The American Farmland Trust is a private, non-profit membership organization that works to stop the loss of productive farmland and to promote farming practices that lead to a healthy environment. Minimum annual membership dues are \$20. AFT meets all the current guidelines of the National Charities Information Bureau. Its national offices are at 1920 N. Street, NW, Suite 400, Washington, DC 20036.

For more information contact Gary Kozel of the American Farmland Trust at (202)659-5170.

A Glance at the Past

A column of IAMFES happenings from bygone days. Written and presented by IAMFES Past Presidents. This column will present some of the interesting highlights and accomplishments of IAMFES over its past years.

This month's column

1942

By Henry Atherton

The IAMFES Officers for this year were:

President: F. W. Fabian, East Lansing, MI
1st Vice President: C. A. Abele, Chicago, IL
Secretary-Treasurer: C. S. Leete, Albany, NY
2nd Vice President: R. R. Palmer, Detroit, MI
3rd Vice President: R. G. Ross, Tulsa, OK

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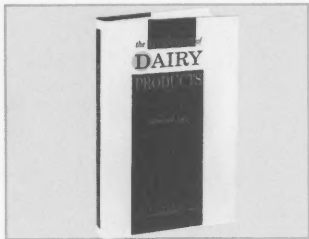
Annual Meeting: 31st Annual Meeting
In: Hotel Jefferson, St. Louis, MO
October 30-31, 1942

Journal of Milk Technology
W. B. Palmer, Managing Editor
J. H. Shrader, Editor

The highlights for this year included:

- 304 active members, 921 Associate members, 1253 total. 183 new members.
- Dr. Fabian appointed a committee at the requests of the Chief of the Dairy Section, Food Supply Branch, War Production Board to confer with that organization 'on matters pertaining to milk sanitation.'
- The Secretary was asked to secure from outstanding milk sanitarians for comments and criticisms of proposed specifications for milk for the Army.
- 15 Associations have designated *Journal of Milk Technology* as their Official Organ.
- Committee on Communicable Diseases Affecting Man reported 175 outbreaks traced to milk and cream, plus 25 outbreaks from "other milk products."
- The Dairy Industry prepares for war. Great concern about shortages of gas and replacement machinery.
- Introduction of every-other-day delivery of milk.
- Pittsburg, PA celebration of the 50th anniversary of the 1892 paper by Sedgwick and Batchelder on "A Bacteriological Examination of the Boston Milk Supply." "This story, the very first published in this country, at least, which related bacterial content to the sanitary quality of market milk."
- Dairy Industry Supplies Association Exposition cancelled because of war, Dairy Industry Association Meeting cancelled also.
- Sanitary glass piping developed to relieve metal shortage in dairy industry.

3 Indispensable Food Science References Filled With A Wealth of Information



Emphasizes Technologies Effecting Dairy Products

.....
THE TECHNOLOGY OF DAIRY PRODUCTS

Editor: Ralph Early, Dairy Crest Foods, United Kingdom

Written to illustrate the diverse methods of milk product manufacture within the dairy industry, contributors with considerable experience in the field emphasize the technologies involved and the effect on the quality and properties of the finished products. It is primarily intended for those who work in the dairy or food industry and for students of dairy and food technology who wish to broaden their knowledge of milk product manufacture.

CONTENTS:

Liquid Milk and Cream/ Milk Chemistry and Nutritive Value/ Cheese/ Cultured Milk Products: Yogurt, Quarg and Fromage Frais/ Butter, Margarine and Reduced Fat Spreads/ Concentrated Milkfat Products/ Milk Concentrates/ Milk Powders/ Ice Cream and Aerated Desserts/ Milk Based Desserts/ Laboratory Control in Milk Product Manufacture/ Hygiene in Milk Product Manufacture/ References/ Index.

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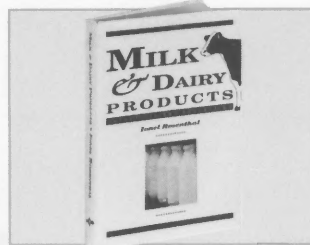
Editor and Compiler: Y.H. Hui, American Food and Nutrition Center, California

For the first time, a leading scientist in food science and technology has created a vast, single-volume compendium that provides scientists and technologists with easy access to a wide array of useful scientific, technical and legal information normally scattered through numerous costly documents and presents it in a clear, easy-to-understand way.

CONTENTS:

Part A: Chemical and Biological Data: Functional and economic food chemicals; biotechnology; Foodborne diseases and associated terminology/ Part B: Product Categories Data: Fruits and vegetables; Meat and poultry products; Bakery products; Fish list; alcoholic beverages/ Part C: Safety Laws, and Regulations: Safety and sanitation; Food laws and regulations.

September, 1991
1-56081-009-2 Cloth 976pp
\$125.00



An Essential Introduction to the Fundamentals of Milk and Milk Products

.....
MILK AND DAIRY PRODUCTS Properties and Processing

lonel Rosenthal, Agricultural Research Organization, Israel

This handy A—Z reference to the dairy industry is an essential introduction to the fundamentals of milk and milk products. From the chemistry of milk to the products produced from milk, the author has produced an easy-to-use overview of the industry divided into five well-organized chapters which will educate the novice, serve as a handy reference for the veteran in the dairy industry and satisfy the interest of anyone involved in food and nutrition.

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September, 1991
0-89573-938-0 Cloth 220pp
\$89.50



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Sanitary Design



A Mind Set (Part XII)

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CIP Systems

Volumes have been written on the design and operation of CIP (clean in place) systems. There are CIP systems designed especially for dairy plants. There are CIP systems for beverage processors and other food processors using closed systems. The design for a CIP system is fairly simple, yet also complicated. It consists of a variation of rinsing, cleaning, rinsing, and sanitizing. The system can consist of one to four tanks with controls ranging from simple to complicated. Heat exchangers can be on-line if hot water is used for cleaning or sanitizing the tanks and lines.

The CIP system must satisfy the cleaning requirements of the process equipment in use. It must be designed to the volume of the lines and tanks in the system or systems to be cleaned. The design also depends on the product and its residue. Dairy systems, for example, have residues consisting mostly of organics such as milk sugar, protein, and milk fat. Other systems leave residues of carbohydrates and combinations of organics and inorganics (milkstone, beerstone) unique to that particular process.

The basis of all CIP systems depends on time, temperature and concentration. These three elements are interdependent and if one element increases, one or both of the others can decrease.

System Types

Single use systems are sometimes confused with a "pot and pump" system. The pot is simply a reservoir for the water used to feed a pump and is usually manually operated. A pot may be a balance tank or a surge tank near the equipment that can hold the water and/or the cleaning solution necessary to clean a pasteurizer or similar equipment.

The single use system is often used for individual "circuits" within a process that require different element values (time, temperature, concentration). These single use systems normally incorporate a controller to maintain accurate times and temperatures for cleaning. Most single use systems consist of one or two tanks, are smaller units and are located adjacent to the equipment requiring cleaning and sanitizing. Single use systems are often used for heavily soiled equipment since reuse

of the solutions is not feasible. The main disadvantages of a single use system are the amount of chemical required and the effect on effluent discharge. Another disadvantage is the excessive water needed for pass through flushing. The main advantages are the lower capital cost and the variations attainable in time, temperature and concentration of the cleaning and rinse cycles. The single tank system is usually not recommended due to the higher costs of operation.

Reuse Systems

Reuse CIP systems, by definition, recover and reuse the rinses, cleaning compounds and solutions. They provide for the recovery of post rinse water for use as a pre-rinse in the next cleaning cycle. The basic pieces of equipment, depending on the use and the process/product design criteria are: pre-rinse tank, alkaline tank, post rinse tank, acid rinse tank (if needed), solution heating system, and CIP supply and return pumps. An important part of the design package is the remote controlled valves and the necessary piping to supply and return the CIP solutions.

Reuse systems normally have automatic sequencing through a program control unit for a predetermined cleaning operation. High capacity, frequent use systems are being designed and successfully controlled from a central control panel with very little manual input. Multi-tank systems allow great flexibility in alkaline cleaner concentrations and rinse water reuse. Some systems provide dual cleaning tanks for solutions of differing concentrations, or a reuse tank for reclaimed cleaner that can be used as a prewash in high residue systems. Differing concentrations can be directed to isolated areas. High concentration cleaner can be directed toward heat exchangers, homogenizers and other areas of high residue. The lower concentrations can be directed to tanks, pipelines and other storage facilities with less residue.

CIP tank capacity is often overstated. In a recirculation situation, the size of the tank is dictated by circuit volumes, and the number of circuits to be cleaned at the same time. When more than one circuit is to be cleaned, it requires the addition of extra CIP supply and return pumps.

Norman Marriott in his book; *Principles of Food Sanitation*, describes multi-use CIP systems which combine the features of single and reuse systems. These multi-use systems are designed for cleaning the pipelines, tanks and other storage equipment that can be effectively cleaned by CIP principles. These systems function by automatically controlling cleaning sequences involving circulation of water, alkaline cleaners, acid cleaners and acidified rinses through the circuits for varying time periods and concentrations.

Minimum Design Features

Some minimal design features for any CIP system are as follows:

- Alkaline and acid wash tanks shall be large enough to hold the volume of the largest circuit without overflowing.
- Tank bottoms shall be pitched to provide fast and complete drainage.
- Pet-cock valves shall be provided for sampling cleaning solution. The valves shall be at a 90 degree angle for safety.
- The distance from the tank bottom to the floor shall allow adequate access to discharge valves and fittings.
- Inlet ports shall be provided with raised flange collars to exclude entry of extraneous matter.
- Sanitary valves, pipe fittings and gaskets shall meet 3-A Accepted Practices for Permanently Installed Sanitary Product-Pipeline and Cleaning Systems - Number 605-04.
- CIP lines shall be pitched 1/16 to 1/8 inch per foot, minimum, to allow drainage. They shall be pitched toward the CIP tanks. In certain instances they can be pitched toward a convenient outlet or drain.
- Permanent and rigid pipe supports of sanitary design are required.
- Whenever possible, pipe joints should be butt welded and ground smooth. However, if frequent dismantling is required for hand cleaning or inspection a John Perry type clamp fitting is recommended. Even sanitary fittings should be kept to a minimum to avoid potential sanitation problems.
- CIP controls shall be designed to pulse any valves during CIP cleaning for 4 to 5 seconds each minute in order to adequately clean the stem O-ring.
- Sanitary valves shall not be welded to sanitary pipelines.
- Utility drop pipes for water and steam should be fabricated from non-rusting alloy(s) from the control valve to the CIP tank.
- Chemical supply tubing for chemical makeup in the CIP tanks must be fabricated from a non corrosive metal with leak proof welds and connections. Line pressures must be minimal for safety reasons.
- Pump cavitation can be reduced by installing a vertical stainless steel standpipe in the inlet side of the CIP supply pump and return pump to serve as an air eliminator. The height of the standpipe should be as high as the lowest working level of the CIP tanks.
- Design minimum distances between check valves and piping junctions to avoid dead ends.
- Design by-passes around positive displacement pumps.
- Physical disconnects are recommended between product

and CIP zones for piping and vessels to avoid product contamination during CIP cleaning.

- The CIP pumps shall deliver a minimum velocity of 5 feet per second for sanitary piping. Generally CIP pumps are sized at 110 G.P.M. to accommodate 3 inch dairy lines.
- The CIP pumps shall deliver between 2 to 2 1/2 gallons per linear foot for tanks and silos.
- CIP pumps shall deliver a flow rate of one and one half times the process flow rate for heat exchangers and coolers.
- The CIP return pump velocity should be greater than the supply to prevent vessel flooding.
- CIP flow to spray devices that are rated in G.P.M. must be checked, and the devices must have proper orificing.
- CIP rinse of vessels must include bursts and delays with a final air blowdown to and from the vessels.
- CIP solution temperatures are to be sensed and recorded in the return line. Timing of the CIP sequence will not start until the temperature requirement is met at the return sensing point.
- Suitable alarms (low level, high or low temperature) must be provided to sound the alarm and activate system shutdown if design conditions are not met.
- Air blow systems are to be installed to remove solutions from lines after each cleaning step and recover the solutions in the proper tanks.

Spray Devices

Spray devices must be selected for the specific vessel to be cleaned. Location of spray balls depends on such things as shadowing caused by agitators and baffles. Spray devices can be permanent as well as removable depending upon application. The balls can be static or dynamic, the former being stationary while the latter rotates. Pressure can vary from 5 psig to 60 psig. The goal is to obtain good impingement of the fluid and a cascading effect down the vessel sidewalls. For good impingement and cascading effect, a pressure of 30 psig is recommended for a maximum practical pressure.

This article has covered the basics of CIP systems. Every facility has a special product and a resulting special need in its CIP design. Criteria such as type of product, residues, circuit lengths, water supply, effluent concerns, costs of equipment and chemical costs all enter into the design. There are many more parameters and design criteria that enter into designing, installing and operating an effective CIP system then were detailed here. It is not a job for an amateur and should be undertaken by a professional engineer who understands CIP needs and requirements and can apply them to the specific needs of the processing equipment to be cleaned.

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Control of Surface Microorganisms and Biofilms

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PURPOSE OF CLEANING

All food production and distribution facilities must be kept clean and sanitized. These facilities include bakeries, supermarkets, convenience stores, delicatessens, restaurants, institutional foodservice facilities as well as food preparation areas in homes. The reasons for cleaning and sanitizing are obvious. When areas are dirty and littered, pests (insects and rodents) invade the area and find a source of food for existence and reproduction. Microorganisms also find these conditions suitable for incubation and multiplication.

Biofilms

Before surfaces (cutting boards, slicers, kettles) can be sanitized, they must be cleaned (i.e. dirt and soil removed). This is critical, because bacteria can form **biofilms** on the surface of stainless steel or other food contact surfaces. Biofilms are defined as microcolonies of bacteria closely associated with an inert surface attached by a matrix of complex polysaccharide-like material in which other debris including nutrients, microbes and viruses may be trapped. When a microbe lands on a surface, it attaches itself to the surface with the aid of filaments or tendrils (spider-like appendages) that reach out to grab hold of the cracks and crevices of even a stainless steel surface. Almost immediately, the organism begins to produce a polysaccharide-like material. Within 20 minutes, the bacterium can become quite firmly attached to the surface by its numerous appendages and polysaccharide cement. In time, the biofilm builds layers of the polysaccharide material populated with pathogens, including *Salmonella*, *Listeria*, *Staphylococcus aureus*, and any other microbes that may be in the vicinity. (Costerton et al., 1978) (Mafu et al., 1990)

Removal of Biofilms

Adequate amounts of detergent and hot water must be applied, and mechanical action with a scrub brush or pressure sprayer must be used to loosen the surface biofilm, which can be 25 to 30 microorganisms "deep". After the surface is rinsed, a sanitizing agent can be applied. Sanitizing agents will be ineffective if the biofilms are not first removed from surfaces. **Sanitizers will not penetrate biofilms.** They only kill the surface layer for microorganisms.

THE CLEANING AGENTS (SOAPS AND DETERGENTS)

Soap

The use of soaps for cleaning purposes has largely been replaced by the use of detergents. This is due to the presence of minerals (calcium and magnesium) in hard water. These minerals in hard water replace the sodium in regular soap to form an insoluble curd. As a result, the ability of soap to emulsify grease and free dirt and films from surfaces is diminished.

Detergents

Detergents are surface active agents. Currently, they are usually biodegradable alkyl sulfates, ethoxylates and their sulfates or alkylbenzenesulfonates. The action of detergents lifts and suspends the oily or greasy portion of soil by reducing interfacial and surface tension. This action is aptly described by Troller (1983).

Properties of Soaps and Detergents

Cleaning agents (soaps and detergents) should possess the following properties when used in food processing and foodservice facilities (Gilbert, 1970):

1. Efficient under conditions of use
2. Safe
3. Must not damage or corrode equipment and surfaces
4. Must not affect the flavor of food
5. Must be easily rinsed.

Giese (1991) describes effective detergents as those which are able to:

1. Wet and penetrate soil
2. Emulsify fat
3. Disperse and suspend soil
4. Counteract water hardness

No single detergent possesses all of these traits. Each processing or retail facility must choose the compound(s) that are best for their cleaning operations. The following, as described by Giese (1991), is a short summary of some of the most commonly used cleaning compounds.

Alkaline Agents

Alkaline detergent compounds are used for the removal of organic soils, such as oils, grease, proteins and

carbohydrates. **Strongly alkaline compounds** (pH greater than 13) such as sodium hydrochloride and sodium hydroxide are used for the removal of burnt-on soils in ovens. These compounds are very corrosive and must be used with caution. **Moderately alkaline compounds** (pH 10-12), have good dissolving powers and are less corrosive than sodium hydroxide. These compounds are formulated in detergents to aid in removal of fats and grease. **Mildly alkaline compounds** (pH 7-10) are used for manual cleaning. Sodium carbonate and sodium sesquicarbonate are combined with detergents as buffering agents and for water softening capabilities.

Alkaline cleaners have little or no capability to control mineral deposits. Complex phosphates (sodium and potassium phosphates) may sometimes be added to alkaline detergent products to function as water conditioners.

Acid Agents

Acid detergent compounds are used for the removal of encrusted soils and deposits formed by using alkaline compounds. These deposits must be removed for proper sanitation. Strong inorganic acid compounds (hydrofluorides and hydrochlorides) are used to remove heavy scale deposits on steam producing equipment or other processing equipment. These compounds are corrosive and must be used carefully. Less corrosive organic acid compounds are prepared with citric or acetic acids. These acid detergent products are used in manual cleaning operations where water softeners are needed.

Detergent Auxiliaries

Detergent auxiliaries are sometimes incorporated into cleaning compounds to improve their performance, provide filler material or bulk, condition water or to protect surfaces. Surfactants are auxiliary compounds used in both alkaline and acid detergent formulations to increase soil penetration, improve rinsing, or to control foaming. Sodium tripolyphosphate and tetra-potassium pyrophosphates are sequestrants which combine with magnesium and calcium salts to prevent scale deposition. Sodium gluconate and ethylene diamine tetraacetic acid are also commonly added to act as chelators. Water and sodium salts are common filler materials.

SANITIZERS

Sanitizers are chemical compounds which are used to reduce the number of microorganisms on and within surfaces. Surfaces must be cleaned to remove grease, films, soil, and debris, and rinsed before sanitizing solutions are applied.

Goldenberg and Relf (1967) described sanitizers or disinfectants suitable for food use as follows:

1. Must be efficient for conditions of use
2. Must be safe for use by those applying it
3. Must not influence the flavor or odor of food process by equipment sanitized by its use
4. Should leave no toxic residue
5. Should be easy to use.

Sanitizer activity or effectiveness is affected by exposure time, pH, temperature, concentration, water hardness, and surface cleanliness (Bakka, 1991).

Sanitizer Testing

Sanitizers are not tested in operating conditions. The Chambers Test is used to determine the efficiency of a sanitizer in a laboratory. The test requires that sanitizers produce a 99.999 percent kill of 75 million to 125 million *Escherichia coli* and *Staphylococcus aureus* on stainless steel discs within 30 seconds after application of the sanitizer at 68°F (20°C). Sanitizer and cleaner use is regulated by the Food and Drug Administration (FDA), the Environmental Protection Agency (EPA), and the U.S. Department of Agriculture (USDA). This laboratory test has little or no correlation with the effectiveness of the sanitizer in a specific food environment. In order to determine the effectiveness of any cleaner or sanitizer in a food operation, the cleaned and sanitized surface must be microbiologically tested after cleaning and sanitizing.

Sanitizer Classifications

Chemical sanitizers can be classified into two classes:

1. **Halogens**, which include chlorine and iodine compounds.
2. **Surfactants**, which include quaternary ammonium compounds and acid ionic compounds.
3. **Water** is also a sanitizer when it is hot or in steam form.

Chlorine Compounds

Chlorine compounds in a variety of forms are commonly used as sanitizers that include:

1. Sodium hypochlorite solutions (bleach).
2. Granular chlorine sanitizers.
3. Chlorine dioxide.

Bleach Effectiveness and pH

Hypochlorite in its concentrated form is ineffective as a sanitizer. It is adjusted to a pH above 10 for storage stability of about 6 months. At this pH, the sanitizer has essentially no microcidal action. When sodium hypochlorite solution is dissolved in normal city water, pH less than 7.5, there is a decrease in pH as hypochlorous acid is formed. Hypochlorous acid is a strong oxidizing agent and kills bacteria by reacting with and disrupting their cell walls. If city water is adjusted to a pH of 8.5 or above, which is common today to prevent leaching of lead from pipes, the hypochlorite has only a 10 to 20 percent effectiveness.

Toxicity

The advantage of using hypochlorite is that it is inexpensive and is effective against a wide range of bacteria, and bacterial and mold spores. Chlorite solutions above 200 ppm are quite toxic if consumed. To avoid this hazard, concentrations should be kept below 200 ppm. Chlorite solutions produce an odor, can irritate skin, and bleach the color of colored surfaces.

Organic matter in hypochlorite solutions seriously degrades the effectiveness of the solution as a sanitizer. Dirty rags cannot be put into these sanitizer solutions because the organic matter in the rags has a severe effect on the strength of the solutions.

Antimicrobial Activity

The antimicrobial activity of chlorine solutions is related to the pH of the surrounding solution. As the pH rises above 6-7, more chlorine is in the less active sodium hypochlorite form. Hence, sanitizer effectiveness diminishes. For maximum effectiveness, chlorite solutions should be carefully prepared daily, or more often if the solution becomes dirty. They should be sprayed on and wiped across a clean surface with a clean paper towel and allowed to air dry.

Some typical dilutions of household bleach (5.25% hypochlorite concentration at time of production) can be used to prepare sanitizing solutions as listed in the following table. Note, a bottle of concentrated solution should not be more than 6 months old.

SANITIZER SOLUTIONS USING LIQUID BLEACH

Sanitizer	Usage Immersion [75°F(24°C) for 1 min.]	Surface	Maximum
	ppm	ppm	ppm
Hypochlorite	50	100	200
Iodine	12.5	25	25
Quaternary Ammonium Compounds (Quats)	100-200	150-200	150-200

Granular Chlorine Compounds

Granular chlorine sanitizers are formulated as organic salts of chlorine with buffering agents to control corrosion and bactericidal activity. These stable, rapidly dissolving chlorine carriers release chlorine to form sodium hypochlorite in solution. Note that once they are in solution, they have all of the problems of liquid bleaches.

Chlorine Dioxide

Chlorine dioxide is used in water and sewage treatment operations and in plant operations where there is slime development. Chlorine dioxide must be generated on-site and has limited use in food processing facilities. Because it is quite effective in the presence of higher levels of organic matter, it is being used more frequently.

Iodine Compounds

Iodine compounds are used for sanitizing plant equipment, utensils, and as skin antiseptics in food production. Iodophors are less irritating to the skin and less corrosive to metals than chlorine, and are not as affected by organic matter. The disadvantages of using iodine compounds are their narrow effective pH range (the solution must have a pH of 4.5 to 5.5) and their ability to vaporize above 122°F (50°C).

Iodophors in combination with phosphoric acid, to acidify the water, are used for clean-in-place systems in dairies and large food production facilities. When used in this combination, the iodophor functions as a sanitizer, and the phosphoric acid removes and prevents a build-up of mineral deposits.

Quaternary Ammonium Compounds

Quaternary ammonium compounds are cationic surfactants used on floors, walls, and aluminum equipment. These products form a residual bacteriostatic film when applied to most hard surfaces. They are effective over a wide, especially alkaline, pH range (6 to 10), are noncorrosive, and are stable over a wide temperature range. They are not as effective as hypochlorite or iodine against many pathogens such as coliforms and gram negative bacteria. Quats are more expensive than hypochlorites and have a tendency to leave an oily film on surfaces.

Acids

Acid-anionic sanitizers are anionic surfactants used as antimicrobials in the final rinse of automated cleaning systems. Phosphoric acid is the most commonly used compound in the formulation of these sanitizers. They are well suited to cleaning stainless steel surfaces and can prevent mineral deposits from accumulating. The maximum antimicrobial effectiveness of these products is at a pH below 3.0. Alkaline waters decrease the effectiveness of these sanitizers.

The activity of acid-anionic sanitizers is rapid against bacteria. It is thought that microorganisms are destroyed when their cell membranes and cell permeability are disrupted by the action of these sanitizers.

Hot Water and Steam as Sanitizers

Hot water and steam above 170°F are effective sanitizers. The objective when using hot water/steam as a sanitizer is to get the surface of an object above 165°F, a highly effective sanitizing temperature. The advantage of using hot water or steam is that there is no chemical residue remaining on the surface to influence the flavor or odor of products. The disadvantages are that there is a higher energy expenditure, caution must be used to prevent employee injuries, and there may be mineral deposits when hard water is used.

Comparison of Sanitizers

A comparison of sanitizers is given in the table, **Advantages and Disadvantages of Various Sanitizers**. Sanitizer effectiveness is described in the table, **Factors of Sanitizer Effectiveness**. (See page 528.)

THE FOUR-STEP SURFACE SANITIZING PROCESS

Cleaning Cutting Boards

Food contact surfaces such as tabletops cannot be effectively cleaned because it is difficult to get enough soap and hot water, and rinse water on their surfaces. Hence, **all food preparation work should be done on cutting boards**. The first step to cleaning a cutting board is to 1) **wipe** the food and organic matter from the surface and **pre-rinse** the board with hot water. Next, it must be 2) immersed in **clean, hot (above 110°F), detergent water** in the first compartment sink, and **scrubbed** vigorously with a stiff scrub brush to loosen the biofilm and to clean out the knife cuts. The water must have an APC per ml of less than 1,000 microorganisms. Otherwise, the rinse and sanitize steps cannot

ADVANTAGES AND DISADVANTAGES OF VARIOUS SANITIZERS*

Advantages	Disadvantages
HYPOCHLORITES	
<ul style="list-style-type: none"> • Effective against a broad spectrum of microorganisms • Effective against spores and bacterial phages • Easy to use • Least expensive 	<ul style="list-style-type: none"> • Corrosive to stainless steel and other metals, if misused • May oxidize lipids • May discolor products • Effectiveness diminished by organic matter • May irritate skin • May affect the flavor and odor of food
IODOPHORES	
<ul style="list-style-type: none"> • Non-corrosive • Easy to use • Non-irritating • Effective against a broad spectrum of microorganisms, both spore and non-spore forming 	<ul style="list-style-type: none"> • May affect the flavor and odor of food • Forms purple colored stains with starch • Moderately expensive • Should not be used at temperatures above 122°F (50°C) • Narrow effective pH range (2.5 to 3.5)
QUATERNARY AMMONIUM COMPOUNDS (QUATS)	
<ul style="list-style-type: none"> • Non-corrosive • Non-irritating • Leaves no flavor or odor • Effective over a wide pH range (6 to 10) • Effective against most microorganisms, especially gram positive slime formers and molds • Effective at high temperatures • Stable in the presence of organic matter 	<ul style="list-style-type: none"> • Not effective against coliforms and gram negative bacteria • Forms films on surface • May enhance the growth of <i>Pseudomonas</i> spp.
ACID ANIONIC SANITIZERS	
<ul style="list-style-type: none"> • Suited for stainless steel • Prevent mineral deposits • Good for automated systems • Low corrosive effect • Not effected by organic material 	<ul style="list-style-type: none"> • Effectiveness decreases when pH rises above 3.0. This can occur if water is alkaline.
HOT WATER AND STEAM	
<ul style="list-style-type: none"> • Non-corrosive • Leaves no residue 	<ul style="list-style-type: none"> • Antimicrobial effect depends on temperature and exposure time • Not effective against some spores • Mineral deposits on equipment, if water is hard • Higher energy costs

*Adapted from: Troller, J. A. 1983. *Sanitation in Food Processing*. Academic Press Inc. New York, N.Y. and Giese, J.H. 1991. *Sanitation: The key to food safety and public health*. Food Technol. 45(12):74-80.

FACTORS OF SANITIZER EFFECTIVENESS*

Sanitizer	Use Concentration ppm	Exposure Time	Opt. pH	Temp. Range °F	Dilution Effect	Recommended Use
Chlorine	100-200	2-10 min.	4	70-100	Significant	General
Iodophors	25	2-15 min.	<3	70-100	Moderate	Hand/Utensil Dip
Quats	100-200	>25 h.	6-10	70-120	Little	Long exposure
Acid-Anionic	200-400	>30 min.	1.6-2.3	90-150	Very little	CIP or COP**

*Adapted from: Giese, J.H. 1991. *Sanitation: The key to food safety and public health*. Food Technol. 45(12):74-80.

**CIP = Clean in place; COP = Clean out of place

reduce the count to less than 1 microorganism per cm². Then, the cutting board is rinsed with clean, hot water. Finally, it is 3) sanitized with a 100 ppm sanitizing solution and then 4) air dried.

Cleaning Other Food Contact Surfaces

When an item such as a slicing machine or kettle must be cleaned and sanitized, it must first be cleaned and rinsed

to remove as much food residue as possible. Next, a clean detergent solution and scrub brush are used to remove the biofilm. Then, the organic matter is rinsed from the surface with hot (110°F), clean water. Finally, sanitizer solution should be squirted onto the food contact surface from a squirt bottle, and spread with a clean paper towel. The towel is then discarded, and the item is air dried.

Care of the Sanitizing Solutions in Use

Note that a sanitizing solution, whenever possible, should be kept in a squirt bottle, not in a bucket. If people put their hands into a sanitizing solution regularly throughout the day, they destroy the resident microorganisms on their hands, which creates a hand washing problem. In addition, when a dirty towel is placed into a sanitizing solution, the sanitizer content of the solution is immediately degraded, which leads to an unstable amount of sanitizer in the solution, and hence, ineffective sanitizing.

Importance of Drying Surfaces

One critical element to effective cleaning is to get the surface dry within fifteen minutes after it is washed. However, this does not mean using a towel to dry the surface. It must be allowed to air dry. No surface can be washed so completely, so as to eliminate all organic residues which are substantial enough to allow the multiplication of the few surviving microorganisms. Typically, in a 12-hour period, a count of 10 microorganisms per square centimeter of a sanitized surface will increase to 1,000 organisms per square centimeter, if the surface is not dry.

Sanitizer Concentration

The table, *Sanitizer Use Concentrations for Foodservice and Food Production Facilities*, lists sanitizer use concentrations for foodservice and food production facilities.

SANITIZER USE CONCENTRATIONS FOR FOODSERVICE AND FOOD PRODUCTION FACILITIES

Liquid Bleach	Water	Approx. Dilution	Final Concentration
1 Tbsp. (1/2 oz.)	1 gal. (128 oz.)	250:1	200 ppm
1/2 Tbsp. (1/4 oz.)	1 gal. (128 oz.)	500:1	100 ppm
1/4 Tbsp. (1/8 oz.)	1 gal. (128 oz.)	1,000:1	50 ppm
(Approx 1 tsp.)			
1 Tbsp. (1/2 oz.)	4 gal. (500 oz.)	1,000:1	50 ppm

Sanitization Standard

A very effective standard after sanitizing is to have less than 1 microorganism per centimeter squared (1/cm²). In the foodservice environment, sterilization is not necessary. Sterilized equipment is found in hospitals and operating rooms, but not in foodservice. In foodservice, food is pasteurized, and food contact surfaces are sanitized. Note that numerous studies show that visual cleanliness is not a reliable indicator that surfaces are sanitized. One must know that the correct pre-rinse and wash (to remove biofilms), rinse, sanitize, air dry procedure has been used.

Checking a Surface for Microorganisms

The only way to verify if a specific cleaning procedure is effective is to measure the residual microorganisms on the surface. One of the simplest methods is to use Aerobic Count Petrifilm™ plates manufactured by 3M. Each plate is a two-film device, where there is dry media on one of the films, and a gel solution on the mating surface film. This system is extremely portable. A Petrifilm™ is about 0.005 inch thick, 3.5 inches long, and 3.25 inches wide. It functions exactly as an APC petri dish.

In use, one also needs a swab, such as made by Fisher, and a 10-ml tube of letheen broth to wet the swab, neutralize any sanitizer on the surface being tested, and then elute the microorganisms from the swab. Finally a 1-ml sterile pipet is used to transfer the broth containing the eluted surface microorganisms to the film. One ml is placed in the middle of the media side of the film, and the other film containing the gel is put on top. A small plastic spreader disc is pressed gently over the 1 ml spot of liquid to spread the liquid exactly over a 20 cm² area.

The method for swabbing the surface has never been officially specified. However, the original unofficial government publication which is used (DHEW, 1967) states that 5 areas of one food contact surface, each 8 square inches, should be swabbed.

To do this, wet the swab in the broth and squeeze out the excess liquid on the inside of the tube. Rub the swab slowly and firmly in a path 0.5 inch wide by 16 inches long, and then reverse the direction. Finally, swab the original path once more. Elute the microorganisms from the swab by twisting the swab in the broth. Repeat this procedure four more times in areas of the food contact surface that are likely to be contaminated. These swabbings will cover a total of 40 square inches (approximately 250 square centimeters). After the last elution, cap the tube and mix. If there is any residual sanitizer on the surface, it is neutralized by the letheen broth.

It is best to plate the solution immediately. If this is not possible, the tube should be kept on ice and plated in 4 hours to prevent the growth of microorganisms in the solution. To plate, take 1 ml of the solution from the tube with a pipet and place on the Aerobic Count Petrifilm™ plate, and spread with the plastic spreader. The unofficial standard for recovered organisms is 500 on the 40 square inch (250 square cm). The aerobic count plate can be incubated at 90°F to 95°F

(32°C to 35°C) for 48 hours, if one wants to count mesophiles. However, a better incubation temperature is 70°F (21°C) for 72 hours. At this temperature, both the psychrophilic spoilage microorganisms and mesophiles will multiply.

The 3M company also makes plates for coliforms, yeasts and molds, and *E. coli*. Since coliforms and some yeasts and molds are not considered pathogenic, these tests can be done in the quality assurance manager's office in the food facility without any hazard. The plates are no more hazardous than the microorganisms on the raw food in the refrigerator, on the floor, or in the garbage can. Pathogen-specific plates such as for *E. coli* should not be used in the food process area.

Since 1 ml of the 10-ml tube was used to make the count, the plate will have only 10 percent of the count. The maximum count on the Aerobic Count Petrifilm™ should be, therefore, 50 colonies, which is equivalent to 12.5 microorganisms removed per in², or 2 microorganisms removed per cm². Note, the rule of thumb is that only half of the organisms on the surface will be removed by the swab. Note also, that there is no specific swabbing procedure to deal with the question of biofilms. However, this standard has been shown to be highly effective in verifying the safety of a surface, and should be used.

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Food and Environmental Hazards to Health

Dengue Epidemic — Peru, 1990

From March to July 1990, an epidemic of classical dengue caused by dengue types 1 and 4 (DEN-1 and DEN-4) occurred in Iquitos and the surrounding area of the department of Loreto in the Amazon region of Peru. A smaller outbreak was reported in Tarapoto in the neighboring department of San Martín. Although cases were reported in Peru during 1953-1955 and in 1958, the epidemic in 1990 was the first laboratory confirmation of indigenous transmission of dengue in Peru. This report summarizes the preliminary findings of the epidemiologic investigation by the Peruvian Ministry of Health (MOH) and the U. S. Naval Medical Research Institute Detachment (NAMRID), Lima, Peru, which conducted special studies and laboratory confirmation of cases in persons seen at the Peruvian Naval Medical Center, Iquitos, Peru.

The first case in Iquitos occurred in late March 1990. Common manifestations included fever, headache, and musculoskeletal pain. A case was subsequently defined according to major and minor criteria (e.g., fever, headache, and musculoskeletal pain and rash, ocular pain, and adenopathy). Predominant manifestations were fever, headache, and malaise. Hemorrhagic manifestations, such as bleeding gums, were noted in 6.5% of patients with clinical dengue; no cases of shock syndrome were documented.

Acute-phase blood samples were collected at the Naval Medical Center from patients whose illness met the case definition for dengue. A total of 158 blood specimens were inoculated into cultures of C6/36 mosquito cells and Vero (African green monkey kidney) cells; 58 viral isolates were obtained. Based on indirect fluorescent antibody (IFA) tests, 24 of these isolates were identified as DEN-1 and seven as DEN-4. Identification of the remaining 27 viral isolates is pending. Of 43 paired serum samples analyzed by IFA and hemagglutination inhibition (HI) antibody tests, fourfold or greater rises in antibody to DEN-1 occurred in eight and to DEN-4 in 26; in eight persons, similar increases occurred to both DEN-1 and DEN-4 (HI antibody titer >10,240).

Five of 20 pools of mosquitoes (approximately 25 females per pool) collected with human bait or dry ice in or near Iquitos during the first 3 weeks of the outbreak yielded DEN-1 virus. However, only two of the five pools comprised *Aedes aegypti*. The remaining three pools comprised *Culex amazonensis*, *Aedeomyia squamipennis*, and an undetermined *Sabethes* species.

A random survey based on a grid plan of houses in early May 1990 indicated that approximately 25% of the 305,000 residents of Iquitos had a febrile illness during the 60 days before the survey. Based on this finding, an estimated 76,000 persons in Iquitos may have experienced a dengue-like illness at that point in the epidemic.

Control measures during the epidemic were constrained by limitations in the availability of medical workers and equipment for spraying insecticide. However, public an-

nouncements using local radio, television, and newspapers provided information about the prevention of mosquito breeding.

Editorial Note: In the 1990 epidemic in Peru, although mosquito pools containing species other than *Ae. aegypti* yielded dengue virus, it is not possible to determine whether other species were actually involved in dengue transmission. Two possibilities exist: 1) one or two mosquitoes of the three other species had taken blood meals from viremic persons but were not involved directly in dengue transmission, or 2) body parts of infected *Ae. aegypti* mosquitoes were inadvertently mixed with the other three species during processing.

Ae. aegypti, the epidemic vector of dengue, was declared eradicated from Peru in 1958. In October 1984, reinfestations were detected in Iquitos by MOH officials. In 1985, MOH officials reported a house index (i.e., the percentage of houses inspected that had larval *Ae. aegypti*) of 10%; by 1988, the index had increased to 26%. Serum specimens collected from a random sample of 1015 persons in coastal, mountain, and jungle areas of Peru during 1985-1987 were analyzed by the Evandro Changas Institute in Belem, Brazil, for HI antibodies to DEN-1, DEN-2, DEN-3, and DEN-4 antigens. Of the 1015 persons tested, DEN-4 antibody was detected in two (0.2%); in both cases, antibody titers were low, and all samples were negative to the other three dengue serotypes (NAMRID, unpublished data).

Dengue appears to be increasing in the Americas, particularly in South America. Although the outbreak in Peru began as one was concluding in Caracas, Venezuela, the origin of the outbreak in Peru has not been established. Iquitos is a thriving, commercially active city with daily river and air traffic from Brazil, Venezuela, and Colombia. Surveillance and control programs are needed to minimize morbidity and mortality from dengue epidemics.

MMWR 3/8/91

Veterinarian Convicted in Illegal Drug Scheme

In the first case investigated by FDA's National Animal Investigation Team to go to jury trial, a federal jury recently convicted an Iowa veterinarian of four felony counts involving receiving and distributing illegal animal drugs. To date, 40 individuals and corporations have been found guilty as part of the animal investigation team intensive crackdown on illegal sales of animal drugs.

John A. Minneman, D.V.M., of Washington, Iowa, was found guilty of one count of conspiracy and three counts of receiving and distributing the drug chloramphenicol, which is banned in the United States for use in food-producing animals. Although an extremely effective antibiotic, chloramphenicol can cause a fatal blood disorder called aplastic anemia in humans. Even indirect exposure, such as eating meat tainted with residues of the drug, is potentially deadly.

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An anonymous phone call to an investigator in FDA's Des Moines, Iowa, office led to important evidence, including samples of the chloramphenicol used by Minneman to treat cattle at the farms of several clients.

Among the information collected by FDA was evidence that chloramphenicol was purchased from Andrew J. Cotten, D.V.M. Cotten, as part of a plea agreement, pleaded guilty to two felony charges just before his trial, which was scheduled for November 1990. (For more information on the case against Cotten, See "Veterinarian Indicted" in the November 1990 *FDA Consumer*.)

Cotten testified at Minneman's trial that, in an effort to avoid suspicion, Minneman told Cotten to label the chloramphenicol "Spec II" and address the packages to Minneman's daughter rather than the veterinary clinic.

Cotten further testified that Minneman said he needed to hide the chloramphenicol from clinic employees, especially his partner, who had complained about Minneman's illegal use of the drug.

The trial in the U. S. District Court for the Northern District of Iowa began on January 7, 1991. Two days later, the jury found Minneman guilty on all four felony charges. The conspiracy conviction carries a maximum sentence of five years in prison and a fine of up to \$250,000. Each count relating to receipt and distribution of illegal animal drugs carries a maximum sentence of three years in prison and a fine of up to \$250,000.

At press time, the court had not set a date for sentencing. *FDA Consumer*, May 1991

Choosing a Food-Safe Facility

A conscientious nursing home kitchen staff offers the first line of defense against food-borne illnesses. When choosing a nursing home, the best way to check the kitchen is by visiting it and watching how the food handlers prepare meals.

"I'd look at the environment and people — see if the kitchen looks clean and the people look fairly healthy," advises Emma Luten of the Health Care Financing Administration, which certifies nursing homes to receive Medicare and Medicaid funds.

Ask if the nursing home has a registered dietitian on staff. If it does not, ask what kind of training the person in charge has, and look for the following:

- a knowledgeable and effective food service supervisor
- food handlers who wash their hands frequently and *always* after using the bathroom
- pasteurized or powdered eggs instead of pooled fresh eggs (one spoiled egg can ruin the whole batch)
- no poached, runny, or sunny side up eggs
- hot foods that are served hot and cold foods kept cold
- prompt serving of meals to residents
- thoroughly cooked meats
- blender equipment that is routinely disassembled, cleaned and sanitized.

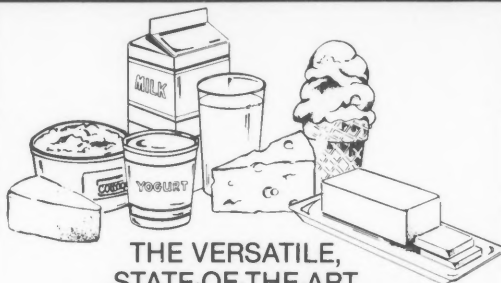
Ideally, the kitchen should use separate blenders for poultry products and puréed diets.

By law, each nursing home must post its most recent survey inspection report. You may also want to read past reports, available at your local public library, Social Security office, state health department, or in the office of your state's long-term care ombudsman, who responds to complaints of abuse by nursing home residents.

You can find the ombudsman either in your state's health department, social services department, or area agency on aging.

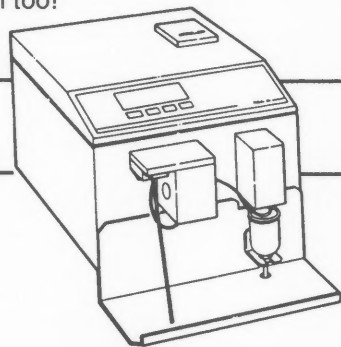
FDA Consumer, December 1991

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THE VERSATILE, STATE-OF-THE-ART DAIRY PRODUCT ANALYZER

DAIRYLAB is a simple to use, sturdy, fully microprocessor controlled infrared analyzer. It will provide your laboratory with modern, analytical technology for compositional analysis of your dairy products — and, of course, fluid milk and cream too!



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Use the Dairylab for production control, raw material quality control, intermediate product quality control, and final product quality control.

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Industry Products

533-2

UniPath Co. Oxoid Toxin Detection Kits

Oxoid Reversed Passive Latex Agglutination (RPLA) kits are used for rapid and simple "on the spot" detection of toxins in food and culture samples. The SET-RPLA kit is used for the detection of Staphylococcal enterotoxin A, B, C, and D while the BCET-RPLA detects *Bacillus cereus* enterotoxin (diarrhoeal type). The Oxoid RPLA kit is simple yet sensitive and easily used by all types of laboratories without the need for special equipment. Results are available in 20-24 hours, giving a major time saving over alternative methods. There is no need for washing steps, accurate timings, or second incubations. The agglutination end point gives a reliable, visual reading. Its that simple!

Unipath Co., Oxoid Div. -
Ogdensburg, NY

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3-A Ishida Weigher

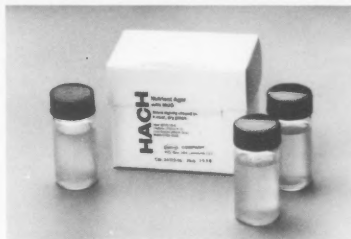
Heat and Control is pleased to announce the availability of an Ishida Computer Combination Weigher that conforms to 3-A Sanitary Standards.

Designed specifically for the diced and shredded cheese industry, the new CCW-Z-214W-S/20-WP-3A combines all the benefits of an Ishida weigher with the assurance of 3-A compliance.

This computer-control 14-head combination weigher promises fast and accurate product weighing. Waterproof construction allows easy washdown, and stepper motor drive units precisely control the speed and opening profiles of each hopper gate.

Heat and Control - San Francisco, CA

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Confirm *E. coli* in four hours with USEPA-approved media

In four hours USEPA-approved Nutrient Agar with MUG easily confirms *E. coli* in drinking water samples. The procedure eliminates media preparation and waste of extra media. Using MUG reagent provides analysts with faster, more specific results than when using conventional nutritive media methods.

Samples that test total coliform positive with the Membrane Filtration methods can be confirmed for *E. coli* in five easy steps.

1. Melt the agar.
2. Pour agar into two 50-mm petri plates (one tube makes two plates).
3. When agar solidifies, transfer coliform positive membrane filter to Nutrient Agar with MUG.
4. Incubate at $3.5 \pm 0.5^\circ\text{C}$ for four hours.
5. Confirm *E. coli* by observing fluorescing colonies under long-wave ultraviolet light.

Recent USEPA requirements for drinking water require confirmation of either fecal coliform or *E. coli*, and Hach's Nutrient Agar with MUG makes confirmation of *E. coli* fast and reliable. MUG reagent helps analysts: identify *E. coli* rapidly and economically; detect non-gas producing (anaerogenic) strains of *E. coli*; and identify *E. coli* in the presence of competitive organisms. When glucuronidase (an enzyme specific to *E. coli*) hydrolyzes MUG it produces a fluorogenic product, which verifies the presence of *E. coli*.

HACH COMPANY - Loveland, CO

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POP-PAK Technology Gives Fruit Juice Long Shelf Life in Convenient, Multi-Size Cartons

FBI Brands Ltd., a major juice and drink producer in Canada, has introduced a new technology that will revolutionize fruit juice processing and packaging. Now this technology will be available in the United States.

The juice packaging process involves a new, innovative shelf stable technology for juices and drinks, using a patented sealing technique, special five-layer co-extruded gable-top carton and unique post-pasteurization process. This cold-fill process allows high acid beverage producers to significantly increase productivity and reduce packaging costs. FBI Brands made this possible by taking the brick pack or "drink box" a step further with POP-PAK, a package that only has a shelf life comparable to aseptics, but is easy to open.

The unique features of POP-PAK employ a hermetic sealing technique and post-pasteurization process that seal in freshness and flavor. "The shelf stable carton must have a good seal to prevent bacteria and air from entering and be able to withstand the post-pasteurization temperatures," says Donald Poole, FBI's vice president of R & D and operations. "But it must also be easy to open," he adds.

The key to the POP PAK technology is a patented hermetic sealing technique that allows easy opening and a post-pasteurization process which eliminates the need for "pre-packaging" product pasteurization. POP PAK features a 5-layer co-extruded carton (developed for FBI by International Paper Co.) with several construction enhancements to ensure product protection and shelf stability.

FBI Brands Ltd. - Montreal, Quebec

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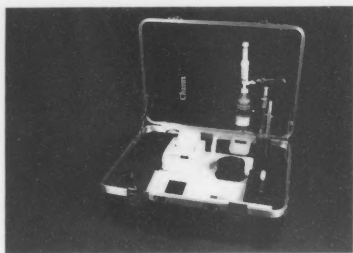
Catalase Reagent: Unique Dropper Format

Difco SpotTest™ Catalase is an innovative ready-to-use tube of reagent for determining the catalase reaction of bacteria. The plastic tube which contains 0.75ml of 3% hydrogen peroxide provides a consistent high quality product without dilutions or the potential of contamination and loss of activity seen with traditional large reagent dispensers.

To use, simply remove the cap and squeeze the tube. The dispensing tip makes the drop-by-drop placement of the catalase reagent easy to control. The reaction is dependent upon the ability of the enzyme, catalase, to decompose hydrogen peroxide, the end product of aerobic carbohydrate metabolism, into water and oxygen. Microorganisms that are positive for the enzyme demonstrate the rapid appearance of gas bubbles. In between uses the product can be resealed and stored at room temperature. This commonly used reagent is supplied in 50 dispensers per box. SpotTest Catalase is one of 20 Difco SpotTest Reagents that are available from leading laboratory supply distributors.

Difco Laboratories - Detroit, MI

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NEW! Portable Charm Luminometer for Rapid Bacteria Counts, Alkaline Phosphatase Testing

The Charm Luminometer is a portable system for use with the Charm ABC (Active Bacteria Count) and Charm Alkaline Phosphatase Test (CAP Test). The Charm Luminometer is: **VERSATILE:** Use the Charm Luminometer with the Charm ABC for 2-minute hygiene monitoring (equipment and surfaces), shelf life prediction in 18-24 hours, and 7-minute total bacteria counts.

The Charm Luminometer may also be used for the CAP Test, which detects raw milk contamination in a full range of dairy products in only 4 minutes.

PORTABLE: The Charm Luminometer goes anywhere potential problems are; it's less than one square foot and comes in a carrying case with all required accessories.

ECONOMICAL: Combining the Luminometer with convenient, cost-effective tableted reagents makes it the best value available.

Charm Sciences, Inc. - Malden, MA

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New Disposable Test Cells for Rapid Microbial Testing

Radiometer America Inc. has just announced the introduction of a new series of disposable cells for use with the Malthus 2000 microbiological analyzer. Cells are available for the detection of total microbial activity and coliforms and provide test results within 24 hours. The single-use disposable cells are supplied pre-filled with medium, and after inoculation they are incubated on the Malthus 2000 analyzer. When the test is completed, the cells are simply autoclaved and thrown away. The simple to use coliform test also includes an indicator to give immediate confirmation for the presence of coliforms.

These tests save time and money by eliminating the need for lengthy media preparation and offer consistent test results by assuring reproducibility between batches of media.

The new cells add to the growing range of products from Radiometer America, including the widely accepted *Salmonella* disposable cells.

Radiometer America Inc. - Westlake, OH

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New Automated Microbiology System is Introduced

The VIDAS™ (Vitek ImmunoDiagnostic Assay System), a multiparametric immunoanalysis system from bioMérieux Vitek, Inc., is a major advancement in automated microbiology testing. VIDAS has been designed for direct antigen detection and serological testing of infectious disease agents. For the food industry, rapid pathogen screening of *Salmonella*, *Listeria* and Staphylococcal enterotoxin can be easily accomplished.

The VIDAS utilizes a testing format known as ELFA (Enzyme-Linked Fluorescent Immunoassay), a version of the well-known ELISA technology. The end result of the testing protocol is a fluorescent product, and the VIDAS reader utilizes a special optical scanner that measures the degree of fluorescence. The VIDAS uses bioMérieux Vitek's patented SPR (Solid Phase Receptacle), a pipette-like device coated with antibody antigen or other treatments on its interior surface, allowing the capture of the target analyte. The VIDAS system also uses specially designed VIDAS reagent strips which contain all pre-dispensed reagents required for on-line processing of an assay. From the moment the SPRs and the reagent strips are placed in the instrument, the VIDAS is fully automated.

The modular architecture of the VIDAS provides random access testing capability for the laboratory. Different assays can be processed simultaneously or initiated at various times as designated by the operator. Virtually any combination of assays can be processed in a single batch. The flexibility of the VIDAS allows each customer to "mix and match" quantities and types of assays as dictated by the laboratory workflow.

The VIDAS can be operated in combination with the VITEK® System or Bactometer® with the Vitek Nerve Center computer, or as a stand-alone system. Testing capacity is 30 tests with results automatically printed in as little as 45 minutes. Additional VIDAS readers may be added to expand the total VIDAS capacity to 120 tests.

For laboratories with smaller testing volumes, miniVIDAS™ has been designed as a totally integrated, automated, stand-alone system. One section of miniVIDAS functions as a compartment for the printer, computer, display screen and keypad. Two other sections of miniVIDAS are used to process product samples, and they can be run independently or together for a total of 12 tests at a time.

The miniVIDAS also contains optional ports with monodirectional interface to a laboratory information system and/or printer. Results are automatically printed in as little as 45 minutes. The miniVIDAS is capable of running all the same assays as VIDAS.

The speed and accuracy of the VIDAS technology eliminates the need for costly sendouts or labor intensive procedures. The ease of use of the VIDAS or miniVIDAS, coupled with maximum throughput capabilities, allows for an expanded test menu in a busy laboratory. Any laboratory, large or small, can now provide rapid and comprehensive pathogen screening results. bioMérieux Vitek, Inc. - Hazelwood, MO

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Klenzade Announces RO/UF Sanitation Program

An RO/UF sanitation program — Ultrasil — is now available to food and dairy processors from Klenzade, A Service of Ecolab Inc. A combination of products and services, the program provides the industry's most complete RO/UF sanitation program.

The Klenzade Ultrasil products represent years of membrane sanitation research in Europe and the U.S. The Ultrasil products are designed to meet each membrane manufacturer's specifications and deliver superior results to help protect the system's membrane investment.

A full-time RO/UF specialist provides customers with specific technical materials, on-site training, the most current technology and insights into a cost effective sanitation program. In addition to a dedicated specialist and the Ultrasil product line, Klenzade services include research and development consultation, technical training and follow-up sales representative support.

Klenzade, A Service of Ecolab Inc. - St. Paul, MN

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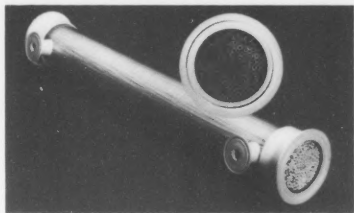
Sparta's Sanitary Mallet Handles Tough Kitchen Jobs

Sparta Brush Company has introduced a new food production mallet with a sanitary polypropylene head and a strong fiberglass handle. Both are FDA & USDA approved materials.

This sanitary mallet is 14" long with a 1" handle diameter. It is made to remove and replace the toughest lids on storage pails and containers. Ideal as a food mallet. When opening tight valves, bounce back is almost eliminated.

Sparta Brush Company is a leading manufacturer of high quality specialized brushes for the food service and food processing industry. Sparta Brush Company - Sparta, WI

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**Compact, Open-Channel
Filtration Cartridges
Designed to Meet Difficult
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An innovative series of compact, open-channel filtration cartridges from A/G Technology is designed for use with heavily particulated or high viscosity process solutions. TurboTube™ filtration cartridges are intended to optimize the energy required to achieve turbulent flow while providing high, stable process flux rates.

TurboTube filtration cartridges offer the exceptional quality, integrity and consistency of A/G Technology's hollow fiber membranes in a nominal 3 mm internal diameter tubule configuration. The open channel membrane configuration allows independent control of feed velocity and pressure gradient. Their non-plugging design allows processing to high solids concentration as well as easy cleaning.

TurboTube membranes are currently available in 0.1µ pore size as well as 30,000 nominal molecular weight cut off (NMWC). These self-supporting, bubble point testable microporous (MF) and macrovoid-free, absolute bacteria retentive ultrafiltration (UF) membranes are provided in a range of cartridge sizes to meet laboratory, pilot-scale and process-scale requirements. Additional ultrafiltration molecular weight cut offs and steam-in-place module versions are under development. TurboTube modules are USP XXI Class 6 for plastics validated.

**A/G Technology Corporation -
Needham, MA**

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**NISAPLIN Product
Description**

Nisin, a naturally occurring polypeptide bacteriocin classified as GRAS by the FDA for processed cheese, extends shelf life, even under adverse storage conditions, and helps protect against deadly botulin poisoning. Nisin is marketed commercially under the brand name Nisaplin™ which is available only from Integrated Ingredients.

Nisin occurs naturally as a fermentation product of *Streptococcus lactis* Lancefield Group N in milk. Nisin works as a bacteriocin against most gram-positive bacteria, including certain strains of *Staphylococcus*, *Streptococcus*, *Lacto-*

bacillus, *Micrococcus*, and practically all spore-forming species of *Clostridium* and *Bacillus*.

Bacteria, particularly *Clostridium* and *Bacillus*, can pose major threats in processed cheese. Processing temperatures (typically, 95-100°C for 6-10 minutes) are too low to kill *Clostridium* and *Bacillus* spores, which may occur in raw cheese, milk powder, or whey powder and also in flavoring agents such as onion and ham. The high moisture and pH levels of processed cheese and the anaerobic packaging environment create excellent conditions for bacterial growth, particularly at warm temperatures or during prolonged storage. Outbreaks of *Clostridium*, particularly *Cl. butyricum*, *Cl. tyrobutyricum*, and *Cl. sporogenes*, spoil the cheese, swelling the package with gas, causing a putrid odor, and digesting the protein. *Cl. botulinum*, though much less common, can make the cheese toxic.

Nisin, long used in high moisture (up to 60 percent) processed cheeses in Europe, is highly effective at stopping *Clostridium* and extending shelf life. As North American processors adopt European formulations in order to reduce salt and phosphate emulsifiers, nisin offers a proven way to protect processed cheese against spoilage.

Outside the United States, nisin is approved in over 44 countries, for canned goods, milk products, baby food, hard cheese, and mayonnaise as well as processed cheese.

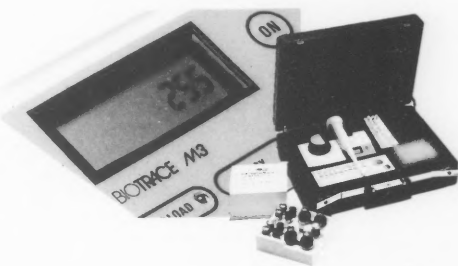
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The BIOTRACE HYGIENE MONITORING System



Weighing 1 kilogram, the **BIOTRACE Hygiene Monitor** uses fourth-generation ATP technology to detect minute traces of product residue or microbial contamination on food-contact surfaces or in water samples. The reagents provide a stable light signal, which allows convenient analysis of individual or batched samples without any critical "timed" steps.

Call BIOTRACE Inc. at 1-800-824-6872 for more information about the Hygiene Monitoring System.

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Synopsis of Papers for the 79th Annual Meeting

The following are abstracts of papers to be presented at the 79th Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians, Inc., to be held in Toronto, Ontario, July 26-29, 1992.

EFFECTIVE METHOD FOR DRY INOCULATION OF SALMONELLA CULTURES, Cynthia M. Hoffmans*, and Daniel Y. C. Fung, Kansas State University, 202 Call Hall, Manhattan, KS 66506

An effective way of inoculating bacteria into dry foods/ingredients and achieving a uniform mixture was developed. Chalk tubes were weighed and soaked in a *Salmonella typhimurium* broth and allowed to dry back to their original weight in a 37°C incubator for approximately 72 hours. The dried chalk was stomached into a powder form, and a viable cell count of this incubated chalk, using a selective media for *S. typhimurium*, showed that the organisms survived the drying while entrapped in the chalk with no loss of viability. The "charged" chalk was used in an experiment as a dry inoculant where it was mixed in with a low-moisture poultry feed. In comparison to a liquid inoculant, the "charged" chalk was a superior way of inoculating into the dry particles because it created a more homogeneous mixture with the feed without altering any properties of the feed itself.

EVALUATION OF ENRICHMENT AND PLATING MEDIA FOR ISOLATION OF VIRULENT YERSINIA ENTEROCOLITICA FROM GROUND MEAT, Linda S. L. Yu*, Research Associate, and Daniel Y. C. Fung, 210 Call Hall, Department of Animal Sciences and Industry, Kansas State University, Manhattan, Kansas 66506-1600

Yersinia enterocolitica is becoming increasingly recognized as an emerging human enteropathogen. Over the years, several procedures are available to detect and isolate this pathogen. The efficacy of newly developed *Y. enterocolitica* isolation media by Schiemann (1979, 1982), Fukushima (1987), Wauters et al. (1988), and Riley and Toma (1989) was tested with naturally contaminated pork and artificially inoculated beef samples. *Y. enterocolitica* (serotypes 0:3 or 0:8) (10^6 - 10^2 CFU/g) were inoculated into ground meat and recovered in three enrichment broths at 22°C for 2 days followed by surface plating onto three selective agar media with 24 h of incubation at 32°C or 36°C to determine the most effective combinations. Greatest recoveries of *Y. enterocolitica* were obtained using sorbitol bile broth (SBB) and yeast extract-rose bengal-bile oxalate sorbose (YER-BOS) broth, followed by isolation on virulent *Y. enterocolitica* (VYE) agar or Congo red-magnesium oxalate (CRMOX) agar. However, irgasan-tetracycline-potassium chlorate (ITC) broth and cefsulodin-irgasan-novobiocin (CIN) agar were less satisfactory than other combinations to give quantitative recovery of test strains. While three plating media resulted in similar counts of *Y. enterocolitica* from the same enrichment broth, a significant variation in the recovery of this organism was noted with different broths.

COMPARISON OF 25G AND 375G COMPOSITE SAMPLES FOR DETECTION OF LISTERIA, D. J. Evanson, D. E. McIver, E. Richter, K. Jost Keating, B. McMorrow, and S. J. Decker*, Director, Silliker Laboratories of New Jersey, 400 S. Avenue, Garwood, NJ 07027

A two part study was conducted 1) to determine the detectable level of *Listeria* in 25g samples of meat and poultry products using the USDA procedure and 2) to investigate the efficacy of compositing in the recovery of *Listeria* in meat and poultry foods.

Part 1 consisted of inoculation of hot dogs with five strains of *Listeria* at levels of 0.1 cells/25g to 275 cells/25g. Ten samples at

each of 4 levels for each strain were analyzed (200 samples). It was determined that the minimum detection level was strain specific and ranged from 0.1/25g to 0.6/25g.

Part 2 consisted of inoculation of 6 food products. Fifteen 25g samples from 2 inoculation levels and 15-25g control samples were analyzed. Duplicate analyses were performed in two of three Silliker Labs participating. The results indicate that analysis of 15-25g composited samples was comparable to individual analyses.

DEVELOPMENT OF CULTURE MEDIA FOR THE RAPID DETECTION OF LACTOBACILLUS SPECIES IN HIGH ACID FOODS USING IMPEDANCE MICROBIOLOGY, F. Hoag, P. Rule, W. Ericson, and Carol K. Gravens*, Supervisor, Industrial Biosciences, bioMérieux Vitek, Inc., 595 Anglum Drive, Hazelwood, MO 63042-2395

Impedance culture media have been developed for use in the Bactometer Microbial Monitoring System which allow for the detection of *Lactobacillus* sp. in high acid food products. Both the Capacitance and Conductance components of the impedance equation were monitored. The Capacitance signal provided the greater percent change and earlier detection times than Conductance.

Products successfully tested for low level *Lactobacillus* sp. contamination included condiments, salad dressings, tomato based products, juice beverages, and fruit juices. Six homo fermentative and hetero fermentative strains of *Lactobacillus* sp. of food and beverage origin were tested, including *L. fermentum*, *L. buchneri*, *L. plantarum*, and three strains of *Lactobacillus* sp.

The detection limit of seeded samples was 1 CFU/gm for food products and less than 10 CFU/250 ml for juices and juice beverages. After a preincubation of 24 hours, the majority of Bactometer detections occurred in less than 24 hours, providing a savings of one to two days over the standard plate count method. In seeded samples, growth of six strains of *Bacillus* sp., common non-spoilage flora present in high acid foods and beverages, was inhibited by the impedance media, offering an additional advantage for the selective detection of *Lactobacillus* sp.

EFFECTIVE RECOVERY OF CAMPYLOBACTER IN THE PRESENCE OF MIXED CULTURE, Fahimeh Niroomand*, Ph.D. Candidate, and Daniel Y. C. Fung, Kansas State University, Department of Animal Science, Call Hall, Manhattan, KS 66506

The importance of *Campylobacter jejuni* as a food pathogen is well established. Detection of this organism is time consuming and laborious, and requires anaerobic cultivation system. An enrichment medium was developed to determine growth behavior and recovery of *Campylobacter* in the presence of mixed microflora under normal atmospheric condition. This enrichment consisted of brucella broth (75 ml in Klett flask), hematin solution (0.3ml) FBP supplement (0.3 ml), Skirrow antibiotic (0.3 ml), and Oxyrase enzyme (1.5 ml). Pure culture of *C. jejuni* and *C. coli* at level of 1 cell/ml to 10^3 cells/ml and an inoculum of mixed microflora (*S. aureus*, *Salmonella*, *Pseudomonas* and *E. coli*) at level of 10^6 - 10^7 were inoculated into this medium. Flasks were incubated at 42° C water bath shaker (90 rpm) for 24h. Serial dilutions were made and plated on CVA blood agar plates and on plate count agar medium at 16 and 24 h. CVA plates were incubated in gas pak anaerobic jar at 37° C for 48h, and typical colonies of *Campylobacter* were counted and checked under phase contrast microscope. PCA plates were incubated at 37° C incubator

for 24h and colonies were counted. In our new medium with Oxyrase and culture condition we were able to recover *Campylobacter* from as low as 1 cell/ml, in the presence of high number of competitors (10^6 - 10^7 cells/ml) in 16h of incubation under normal atmospheric condition.

RECOVERY OF *CAMPYLOBACTER* SPP. FROM POULTRY THROUGH ENRICHMENT IN 10 ML OR 100 ML VOLUMES, Norman J. Stern, Research Microbiologist, USDA-ARS-Russell Research Center, Athens, Georgia 30613

Recovery of *Campylobacter* spp. from poultry is greatly enhanced through enrichment culture. Procedures had been developed to assess samples for the presence of the organism using 100 ml volumes. Culture vessels are typically placed in a shaker water bath to maintain a high degree of temperature control and agitation. Consequently, the numbers of samples are limited by the availability of space within the shaker water bath. Equal volumes of carcass rinse were inoculated to enrichment cultures of 100 ml (Hi V) and 10 ml volumes (Lo V). After overnight enrichment, the cultures, and a 1:100 dilution of these cultures were streaked to Campy-Cefex agar. Results indicated that the Hi V yielded *Campylobacter* spp. in 22 of 40 samples, while the Lo V yielded the organism in 16 of 40 samples. Three of the Lo V tests detected the organism in which the Hi V did not, while the Hi V detected 7 positive carcasses when the Lo V did not. Although sensitivity was sacrificed with the Lo V, far more sample numbers can be assayed using test tube culture vessels as compared with the Hi V, and this could be useful when water bath capacity is limited relative to sample numbers.

RAPID METHOD FOR ASSESSING MICROBIOLOGICAL QUALITY OF EGG WASHWATER USING RESAZURIN, F. M. Bartlett, and Jason Tetro*, Centre for Food and Animal Research, Agriculture Canada, Ottawa, Ontario, Canada K1A 0C6

The need exists for a rapid and economical method to monitor the microbiological quality of the recycled washwater used to clean shell eggs at egg processing facilities. In this study a modification of the Resazurin Reduction Test used for milk has been developed and applied to the estimation of bacterial numbers in egg washwater. This test is based on the irreversible reduction of resazurin (blue-purple colour) by bacterial reductases to resorufin (pink colour), with reduction time being proportional to the number of viable bacteria present. The bacterial numbers in 40 egg washwater samples from local egg processing plants were determined by the standard plate count method and the corresponding reduction times measured. Washwater (10mL), adjusted to pH 6.6, was added to 1 mL of the reaction mixture: 0.3% tryptic soy broth, 0.06% yeast extract, ascorbic acid (1mg/mL) and resazurin (8mg/L). A high correlation was found between bacterial numbers and reduction times. Washwater samples with unacceptably high bacterial counts (i.e. $> 10^5$ CFU/mL) could be identified in less than one hour at 37°C using this method.

RAPID FLUOROMETRIC ANALYSIS OF ACID PHOSPHATASE ACTIVITY IN COOKED POULTRY MEAT, Carl E. Davis*, Research Food Technologist, and W. E. Townsend, USDA, ARS, Russell Research Center, P. O. Box 5677, Athens, GA 30613

Poultry muscle acid phosphatase (ACP) activity at five end-point temperatures (EPT) was measured by a quantitative fluorometric assay. Ground turkey breast and dark meat and broiler breast meat (16 g), both, nonfrozen (NFZ) and frozen (FRZ) packed in a glass tube (25x150 mm) were heated to 62.8, 65.6, 68.3, 71.1, and 73.9°C in a water bath, set 1.5°C above target EPT; removed and immediately chilled (0-2°C). A 75 µl aliquot of an aqueous meat extract (1 meat:2 H₂O) was added to 2.0 mL ACP substrate and kinetic increase in fluorescence monitored at 38°C. The experiment was replicated three

times. A curvilinear decrease in mean (N=12) ACP activity occurred within each muscle type. Freezing lowered ACP activity. EPT means (N=12) and standard error for ACP activity (mU/Kg) between 68.3 and 71.1°C differed within broiler breast NFZ and FRZ and turkey breast and dark meat NFZ and FRZ as follows: 11900±338 and 7305±118; 8823±506 and 5149±118; 9727±444 and 7966±475; 8940±794 and 5713±310; 6543±420 and 4296±238; 4479±245 and 2998±118, respectively. This procedure provides a rapid (3 min instrument time), sensitive analytical method for quality assurance process control technicians or regulatory analysts to monitor EPT in cooked poultry.

FLUOROMETRIC ANALYSIS OF ALKALINE PHOSPHATASE INACTIVATION CORRELATED TO *SALMONELLA* AND *LISTERIA* INACTIVATION, Karl F. Eckner, Ph.D., Research Scientist, Silliker Laboratories Group, Inc., 1304 Halsted Street, Chicago Heights, IL 60411

Fresh, raw milk was inoculated with *Listeria monocytogenes* Scott A and *Salmonella senftenberg* 775W at levels of 10,000 to 10,000,000 colony forming units per gram milk. The milk was heat-treated at target temperature of 63° ± 0.5°C, 65° ± 0.5°C, 67° ± 0.5°C, 68° ± 0.5°C, or 71° ± 0.5°C in five trials. The D-values calculated for *Salmonella senftenberg* 775W ranged from 4.6 at 63°C to 0.17 at 71°C. The z-value was 5.0-6.7

The D-values calculated for *L. monocytogenes* Scott A ranged from 8.4 at 63°C to 0.19 at 71°C. The z-value was 4.8-6.1. Concomitantly, alkaline phosphatase inactivation was monitored using a fluorometric assay. The inactivation rate of the test microbes was greater than that of alkaline phosphatase over the temperature range tested and up to 81°-86°C using extrapolation. The fluorometric assay exhibited excellent accuracy, precision, reproducibility, and repeatability under the test conditions. Viable test pathogens were isolated for milk samples with alkaline phosphatase levels corresponding to legal pasteurization requirements of 1.0 µg phenol/mL/15 min (=500 mU/L ALP activity assayed fluorometrically) when inoculated at high (log 5-6) levels.

SHELF LIFE PREDICTION OF PASTEURIZED FLUID MILK USING THE CHARM II SYSTEM, Shefali Trivedi*, Research Associate, Hossein Zarrin, Eliezer Zomer, and Stanley E. Charm, Charm Sciences, Inc., 36 Franklin Street, Malden, MA 02148-4120

A new rapid assay (10 minute) for active bacteria (Charm ABC) was used to predict the shelf life of pasteurized milk using an accelerated incubation of 21 °C. The procedure evaluates and predicts bacterial growth rate under storage conditions ranging from 2°C - 7°C. The assay measures ATP, a common compound of all active bacteria, and uses a stabilized luciferin-luciferase reagent, tableted in a dry formula for individual testing.

Pasteurized fluid milk was obtained from local dairies within 24 hours of processing. Each milk lot was preincubated at various temperatures (4°C - 21°C) in duplicates. The ABC test and a standard plate count were performed on each sample. Samples kept refrigerated at 4°C to 7°C were monitored to determine expiration date. Expiration was determined by odor/visual inspection, standard plate counts (samples with bacterial counts higher than 5-10x10⁵/ml were considered expired), and ATP.

A prediction formula was generated to correlate accelerated bacterial growth rate at elevated temperature and growth at storage temperature. The predictive regression equations were evaluated with regard to shelf life of pasteurized fluid milk

The results indicate that potential shelf life of pasteurized milk can be predicted to within 2 days for storage conditions when temperature is controlled within 1°C. The preincubation temperature and time are critical and are set according to the intended shelf life. Preincubation at 21°C can be set between 16 hours to 36 hours for prediction of shelf life at 6°C - 7°C for 10 to 30 days.

Affiliate News



*FAMFES Officers (L to R):
Wiley Hart, Marian Ryan, Jack Dodd, John Chrisman,
Kathleen Ward and Bill Thornhill.*

FAMFES Holds Annual Educational Conference

The Florida Association of Milk, Food, and Environmental Sanitarians held their annual educational conference on May 11th and 12th at the Marriott Hotel in Orlando, Florida.

Superbly planned by arrangements chairman, John Chrisman, the conference was well attended and featured an exceptional program, and vendor displays.

The conference theme, "Taste of the Future — Food Safety in the 90's", set the stage for presentations on up-and-coming food processing and packaging technologies as well as testing methodologies, legal concerns, and public perception issues.

President, Jack P. Dodd and C. Dee Clingman, IAMFES Secretary, welcomed conference participants and kicked off a Monday morning program that featured Michael P. Doyle, IAMFES President Elect from the Dept. of Food Science, Georgia Experiment Station, at the Univ. of Georgia. Mr. Doyle addressed the ways that "IAMFES is Leading the Way in Food Safety." Dr. George Sadler of the National Center for Food Safety and Technology, Illinois Institute of Technology, spoke on food packaging research. Dr. O. Peter Snyder of the Hospitality Inst. of Technology and Management, Georgia, presented "Hazard Analysis and Critical Control Points — The New Approach in the 90's."

A luncheon sponsored by General Mills Restaurants, Inc., McArthur, T. G. Lee, and Hart Dairys, featured Dee Buske, IAMFES Affiliate Liaison and Mr. Jon G. Porter, Educational Services Manager of Klenzade (ECOLAB, Inc.).

An awards program was the highlight of the luncheon/business meeting. Ms. Lupe Wilsey Loza was recognized as Sanitarian of the Year. Ms. Loza was honored for her leadership and expertise in the management of the Borden's Dairy Plant in Miami. Her efforts enabled this processing plant to maintain operations and increase profits and efficiency during a time that all other Borden's plants in the state were closed.

The FAMFES President's Award was given to Wiley Hart in recognition of his contributions to the Dept. of Health and Rehabilitative Services as an Environmental Health

Upcoming IAMFES Affiliate Meetings

SEPTEMBER

- 17-18, Minnesota Sanitarians Association, Inc. Annual Meeting will be held at the Earl Brown Center, St. Paul, MN. For more information, please contact Paul Nierman (612)785-0484.
- 22-24, New York State Association of Milk & Food Sanitarians Annual Meeting will be held in Saratoga Springs, NY. For more information contact Janene Gargiulo, Cornell University, 11 Stocking Hall, Ithaca, NY 14853, (607)255-8892.
- 23-24, Wisconsin Association of Milk & Food Sanitarians, Wisconsin Environmental Health Association and Wisconsin Dairy Plant Fieldmen's Association Joint Educational Conference will be held at the Holiday Inn-Downtown, Eau Claire, WI. For more information contact Neil M. Vassau, P.O. Box 7883, Madison, WI 53707; (608)267-3504.
- 29-Oct. 1, Wyoming Environmental Health Association Annual Meeting will be held at the Holiday Inn in Cody, WY. For more information call Terry Carlile at (307)876-2483.

OCTOBER

- 7-9, Kansas Association of Sanitarians Annual Meeting will be held at the Holidome, Great Bend, KS. For more information contact John Davis, Wichita - Sedgewick Co., 1900 E. 9th, Wichita, KS 67214; (316)268-8351.
- 15-16, Iowa Association of Milk, Food and Environmental Sanitarians Annual Meeting will be held at the Ramada Inn, Waterloo, IA. For more information contact Dale Cooper (319)927-3212.
- 21-23, Mississippi Association of Sanitarians will hold their Annual Meeting in Biloxi at the Mississippi Beach Hotel Resort. For further information contact Jerry Hill, P. O. Box 1487, Starkville, MS 39750 or call (601)323-7313.



*FAMFES Past Presidents Honored (L to R):
Lupe Wilsey Loza (1978-79); Dr. Oliver Kaufman (1987-88);
Dr. William Isbell (1982-83); Dr. Ron Schmidt (1988-89, 1989-90);
Dr. Lyman Scribner (1949); Dee Clingman, IAMFES Secretary.*

Coordinator. The President's Award recipient is chosen from written nominations describing a nominee's contributions/performance, during the past year, in the fields of milk, food and/or environmental sanitation.

The FAMFES Service Award was presented to Ken Crothers of the Tampa Independent Dairy Farmers Association. Ken was recognized for his many years of loyal and tireless support for FAMFES.

Tokens of appreciation were also presented to Marian Ryan, FAMFES Secretary and Bill Thornhill, FAMFES Treasurer, for their outstanding service to the organization.

Elections were yet another course of this luncheon. Mr. Jack Dodd will lead the affiliate for a second term. Other officers elected include: Kathleen V. Ward, President Elect,

John Chrisman, Senior Vice President, Edith Garrett, Wiley Hart, Jeff Stephens, and William Thompson, Directors. William Thornhill was reappointed Treasurer and Marian Ryan was reappointed Secretary.

The conference resumed with Mr. Tom Atkinson, Chief of Environmental Epidemiology for the Fla. Dept. of Health and Rehabilitative Services, who spoke on food safety issues relating to Florida's mercury contamination problem.

Mr. C. Bronson Lane, Executive Director of the Dairy & Food Nutrition Council of Florida provided an entertaining and educational program on "Emerging Topics in the Milk Industry." "Environmental Legal Concerns in the 90's" were addressed by Dr. Vance W. Kidder of the law firm of Mang, Rett and Collette. Ms. Gloria VanTrece, Senior Management Analyst with the Fla. Dept. of Agriculture, Consumer Services Division, spoke on "The Consumer Perspective." Mr. Wiley Hart, Environmental Health Coordinator, Fla. Dept. of Health & Rehabilitative Services, presented a course review on Applied Epidemiology.

The evening social, featuring a cash bar and fine food, gave conference participants ample opportunity to network and visit vendor displays.

Tuesday was a half day session that began with a description of the "Aflatoxin Program of Florida", by Dr. Karen Barnes, Division of Chemistry, Fla. Dept. of Agriculture and Consumer Services.

Dr. Roger Inman, Director of Toxicology & Hazard Assessment, with the Fla. Dept. of HRS addressed the mounting concerns of indoor air quality.

President Jack Dodd and IAMFES Secretary, C. Dee Clingman presented tokens of appreciation during a special program that recognized past presidents of FAMFES. Past president's in attendance included Dr. Lyman Scribner (1949), Ms. Lupe Wilsey Loza (1978-79), Dr. William Isbell (1982-83), Dr. Oliver Kaufmann (1987-88), and Dr. Ron Schmidt (1988-90).

The educational conference was wrapped up by a presentation by Dr. John Rychner, Chief, Food Grades & Stds., FDACS, and Dr. Jerry Welbourn, Director of Technical Services for ABC Research, on the Pros and Cons of the Irradiation of Foods.

This was the first annual educational conference for the FAMFES affiliate in two years. Fiscal constraints had forced the cancellation of a conference in 1991. The generosity and support of sponsors including General Mills Restaurants, Inc., Publix, South Bay Growers, Diversey Corp., ECOLAB - Klenzade, Prism, McArthur Dairy, Hart Dairy, Nasco, Inc., T. G. Lee Dairy, Silliker Labs, Winn Dixie, Dairy & Food Nutrition Council of Fla., Idexx, and ABC Research, allowed the Florida affiliate to hold a very successful educational conference.

TAMFES Holds 10th Annual Meeting

The Texas Association of Milk, Food and Environmental Sanitarians met June 2 and 3 at the Howard Johnson South in Austin. Over 300 people registered for the meeting making it the largest in the 10 year history of the group.

A highlight of the meeting was the introduction and recognition of the first ten presidents. Wayne Weatherford

received the TAMFES Outstanding Service Award in recognition for his efforts in developing the TAMFES Pasteurization Short Course. The program began in 1986, and has been offered 28 times to over 1,400 students.

Speakers at this year's meeting included Tom Fuhrmann, DVM, Tempe, Arizona; Larry Maturin, Ph.D., Acting Chief, FDA Center for Food Safety, Summit Argo, Illinois; James R. Fraley, Chief of Quality Standards, Texas Department of Health, Austin, Texas; John Farquhar, V. P., Scientific & Technical Service, Food Marketing Institute, Washington, DC; John Adams, Director, Milk Regulatory & Animal Health Affairs, NMPF, Arlington, Virginia; Bob McCullough, Director for Dairy Manufacturing, H. E. B. Grocery Co., San Antonio, Texas and Auturo Inda, Director, R & D, Tec-Lac Consultants, Saltillo, Coahuila Mexico.

Instead of a banquet, TAMFES members hold a catfish fry/Bar-B-Que complete with a country western dance band. It is catered by the Manchaca Volunteer Fire Department at a facility the Department has built for such events. Anyone who didn't have a good time that night can only blame themselves!

Linda Ybarra, plant manager for Creamland Dairies, Albuquerque, New Mexico was installed as president and Kirmon Smith, Texas State Milk Safety Officers will continue as the TAMFES delegate to the IAMFES Affiliate Council.

The meeting was preceded by a golf seminar on Monday involving some 75 participants. The high point of the program was a hole-in-one shot by Mike Littlefield.

MEHA Annual Educational Conference

The Michigan Environmental Health Association, the affiliate member of IAMFES, held its 48th annual educational conference at the Flint, Michigan Holiday Inn on March 18-20, 1992. Approximately 300 members were in attendance during the conference.

Keynote speaker was Captain Bruce Chelikowsky, Chief Sanitarian for the U. S. Public Health Service. Also speaking were Dr. Nina McClelland, President of the National Sanitation Foundation of Ann Arbor, Michigan and Nelson Fabian of National Environmental Health Association, Denver, Colorado. Steve Halstead of IAMFES also gave a presentation during one of the concurrent sessions later in the program.

A highlight of the conference was a rare appearance made by the Russian General Nickolai Taraknov and Dr. Alexander Popov, both of Moscow who spoke on what really happened with the Chernobyl nuclear reactor explosion. They also showed a video on the disaster which had never been shown outside the Soviet Union.

Elections for new officers and Board positions were also held during the conference and introduced at the Awards banquet on Thursday evening of the conference. New President is Pat Conklin of Fremont; President-Elect is Terry Anderson of Lansing; and the two new Board of Directors are Tom Olson of Holland, and Chuck Lichon of Saginaw. Sanitarian of the Year Award went to Richard Overmyer of the Michigan Department of Public Health.

Federal Register

Department of Agriculture

Animal and Plant Health Inspection Service

Advisory Committee on Foreign Animal and Poultry Diseases; Selection of Members

Agency: Animal and Plant Health Inspection Service, USDA.

Action: Notice.

Summary: We are giving notice that we anticipate renewing the Secretary's Advisory Committee on Foreign Animal and Poultry Diseases (Committee) for a two-year period. The Secretary is soliciting nominations for membership for this Committee.

Dates: Consideration will be given to nominations or comments received on or before July 14, 1992. They should be addressed to the person listed under "For Further Information Contact."

For Further Information Contact: Dr. M. A. Mixson, Chief Staff Veterinarian, Emergency Programs Staff, VS, APHIS, USDA, room 747, Federal Building, 6505 Belcrest Road, Hyattsville, MD 20782, (301)436-8073.

Supplementary Information: The purpose of the Committee is to advise the Secretary regarding program operations and measures to suppress, control, or eradicate an outbreak of foot-and-mouth disease, or other destructive foreign animal or poultry diseases, in the event these diseases should enter the United States. The Committee also advises the Secretary of Agriculture of means to prevent these diseases.

The Committee Chairperson and Vice Chairperson shall be elected by the Committee from among its members.

Terms will expire for the 19 current members of the Committee in July 1992. We are soliciting nominations from interested organizations and individuals to replace members on the Committee. An organization may nominate individuals from within or outside its membership. The Secretary will select members to obtain the broadest possible representation on the Committee, in accordance with the Federal Advisory Committee Act (Pub. L. No. 92-463) and USDA Departmental Regulation 1041-1. Equal opportunity practices, in line with the U. S. Department of Agriculture policies, will be followed in all appointments to the Committee. To ensure that the recommendations of the Committee have taken into account the needs of the diverse groups served by the Department, membership should include, to the extent practicable, individuals with demonstrated ability to represent minorities, women, and persons with disabilities.

Done in Washington, DC, this 11th day of May 1992.

Robert Melland,

Administrator, Animal and Plant Health Inspection Service.
(FR Doc. 92-11448 Filed 5-14-92; 8:45 a.m.)

Federal Register/Vol. 57, No. 95/Friday, May 15, 1992/Notices.

Department of Agriculture

Office of the Secretary

National Advisory Committee on Microbiological Criteria for Foods; Renewal

This notice announces the renewal of the National Advisory Committee on Microbiological Criteria for Foods. The Committee is being renewed in cooperation with the Department of Health and Human Services (HHS), and was recommended by a 1985 report of the National Academy of Sciences (NAS) Committee on Food Protection, Subcommittee on Microbiological Criteria, "An Evaluation of the Role of Microbiological Criteria for Foods."

USDA is charged with the enforcement of the Federal Meat and Inspection Act (FMIA), the Poultry Products Inspection Act (PPIA), and the Egg Products Inspection Act (EPIA). Under these Acts, USDA is responsible for the wholesomeness and safety of meat, poultry, egg products and products thereof intended for human consumption. Similarly, the Secretary of HHS is charged with the enforcement of the Federal Food, Drug, and Cosmetic Act. Under this Act, HHS is responsible for ensuring the safety of human foods and animal feeds.

In order to continue to meet the responsibilities under the FMIA, PPIA, EPIA, and the FFDC, the National Committee on Microbiological Criteria for Foods is being renewed. The Committee will be tasked with advising and providing recommendations to the Secretaries on the development of microbiological criteria by which the safety and wholesomeness of food can be assessed, including criteria for microorganisms that indicate whether foods have been processed using good manufacturing practice.

Renewal of this Committee is in the public interest because the development of a sound public policy in this area can best be accomplished by a free and open exchange of information and ideas among Federal, State, and local agencies; the industry; the scientific community; and other interested parties.

Members will be appointed by the Secretary of USDA after consultation with the Secretary of HHS. Because of their interest in the microbiological criteria for foods, advice on membership appointments will be requested from the Department of Commerce's National Marine Fisheries Service, and the Department of Defense's Army Surgeon General's Office. Nominations for membership are based primarily on expertise in food science, microbiology, and other relevant disciplines.

For additional information, please contact Ms. Rhonda S. Nally, Director, Executive Secretariat, USDA, Food Safety and Inspection Service, room 3175, South Agriculture Building, 14th and Independence Avenue, SW, Washington, DC 20250, telephone (202)720-9150.

Comments on this renewal may be sent to the contact person listed above.

Done in Washington, DC, this 21st day of May 1992.

Charles R. Hilty,

Assistant Secretary for Administration.

(FR Doc. 92-12922 Filed 6-2-92; 8:45 a.m.)

Federal Register/Vol. 57, No. 107/Wednesday, June 3, 1992/Notices.

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104	117	130	143	156	169	182	195	208	221	234	247	260	273	286	299	312	325	338	351
105	118	131	144	157	170	183	196	209	222	235	248	261	274	287	300	313	326	339	352
106	119	132	145	158	171	184	197	210	223	236	249	262	275	288	301	314	327	340	353
107	120	133	146	159	172	185	198	211	224	237	250	263	276	289	302	315	328	341	354
108	121	134	147	160	173	186	199	212	225	238	251	264	277	290	303	316	329	342	355
109	122	135	148	161	174	187	200	213	226	239	252	265	278	291	304	317	330	343	356
110	123	136	149	162	175	188	201	214	227	240	253	266	279	292	305	318	331	344	357
111	124	137	150	163	176	189	202	215	228	241	254	267	280	293	306	319	332	345	358
112	125	138	151	164	177	190	203	216	229	242	255	268	281	294	307	320	333	346	359
113	126	139	152	165	178	191	204	217	230	243	256	269	282	295	308	321	334	347	360

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Coming Events

1992

August

•**4-7, Fermentation Microbiology**, sponsored by the American Type Culture Collection, will be held in Rockville, MD. For more information contact ATCC/Workshops, 12301 Parklawn Drive, Rockville, MD 20852; (301)231-5566; FAX (301)770-1805.

•**9-14, The 49th Annual Meeting of the Society for Industrial Microbiology**, Workshop I - "Controlling Biotechnology Risks: A Holistic Approach to Safety and Environmental Protection" (August 9); and Workshop II - "Clean Room Management" (August 9), to be held at the Town & Country Hotel, San Diego, CA. For more information contact the Society for Industrial Microbiology at (703)941-5373 or FAX (703)941-8790.

•**10-14, Biotechnology: Principles and Processes** to be held at the Massachusetts Institute of Technology. For more information contact the Director of Summer Session, MIT, Room E19-356, Cambridge, MA 02139, Phone: (617)253-6721.

•**11-14, Fermentation Microbiology**, sponsored by the American Type Culture Collection, will be held in Rockville, MD. For more information contact ATCC/Workshops, 12301 Parklawn Drive, Rockville, MD 20852; (301)231-5566; FAX (301)770-1805.

•**24-28, Advanced Recombinant DNA Methodology**, sponsored by the American Type Culture Collection, will be held in Rockville, MD. For more information contact ATCC/Workshops, 12301 Parklawn Drive, Rockville, MD 20852; (301)231-5566; FAX (301)770-1805.

•**25-28, International Dairy Federation Seminar** on "Milkfat & Protein Processing" will be held in Munich. For more information contact Verband der Deutschen Milchwirtschaft, c/o Mr. T. Kützemeier, Meckenheimer Allee 137, D-5300 Bonn 1 (Germany), Tel: 228/638270; FAX: 228/638425.

September

•**1-4, Diagnostic Virology**, sponsored by the American Type Culture Collection, will be held in Rockville, MD. For more information contact ATCC/Workshops, 12301 Parklawn Drive, Rockville, MD 20852; (301)231-5566; FAX (301)770-1805.

•**14, Radiation Safety Seminar**, sponsored by the American Type Culture Collection, will be held in Rockville, MD. For more information contact ATCC/Workshops, 12301 Parklawn Drive, Rockville, MD 20852; (301)231-5566; FAX (301)770-1805.

•**14-15, Food Safety for Zero Defects**, sponsored by ASI Food Safety Consultants', will be held in St. Louis, MO. For more information call Christine VerPlank or Nancy Sullivan toll-free at (800)477-0778 or, in MO, (314)725-2555, or write, ASI, P.O. Box 24198, St. Louis, MO 63130.

•**16, Reclamation and Environmental Concerns in the Food Industry**, sponsored by ASI Food Safety Consultants', will be held in St. Louis, MO. For more information call Christine VerPlank or Nancy Sullivan toll-free at (800)477-0778 or, in MO, (314)725-2555, or write, ASI, P.O. Box 24198, St. Louis, MO 63130.

•**17, Employee Health, Hygiene and Practices in the Food Industry**, sponsored by ASI Food Safety Consultants', will be held in St. Louis, MO. For more information call Christine VerPlank or Nancy Sullivan toll-free at (800)477-0778 or, in MO, (314)725-2555, or write, ASI, P.O. Box 24198, St. Louis, MO 63130.

•**17-18, Minnesota Sanitarians Association, Inc. Annual Meeting** will be held at the Earl Brown Center, St. Paul, MN. For more information, please contact Paul Nierman (612)785-0484.

•**21-25, Wisconsin Cheese Technology Short Course** will be held at the University of Wisconsin, Madison, WI. For more information, contact Bill Wendorff, Dept. of Food Science, (608)263-2015.

•**22-24, New York State Association of Milk & Food Sanitarians Annual Meeting** will be held in Saratoga Springs, NY. For more information contact Janene Gargiulo, Cornell University, 11 Stocking Hall, Ithaca, NY 14853, (607)255-8892.

•**23-24, Wisconsin Association of Milk & Food Sanitarians, Wisconsin Environmental Health Association and Wisconsin Dairy Plant Fieldmen's Association Joint Educational Conference** will be held at the Holiday Inn-Downtown, Eau Claire, WI. For more information contact Neil M. Vassau, P. O. Box 7883, Madison, WI 53707; (608)267-3504.

•**23-25, Freezing & Freeze-Drying of Microorganisms**, sponsored by the American Type Culture Collection, will be held in Rockville, MD. For more information contact ATCC/Workshops, 12301 Parklawn Drive, Rockville, MD 20852; (301)231-5566; FAX (301)770-1805.

•**24, Consumer Food Trends**, sponsored by the American Association of Cereal Chemists, will be held at AACC, 3340 Pilot Knob Road, St. Paul, MN. For more information, contact Marie McHenry, AACC Short Course Coordinator, (612)454-7250; FAX (612)454-0766.

•**29-Oct. 1, Wyoming Environmental Health Association Annual Meeting** will be held at the Holiday Inn in Cody, WY. For more information call Terry Carlile at (307)876-2483.

•**30, October 1-2, Statistics and Measurement in Sensory Evaluation** will be held at Tragon Corporation, 365 Convention Way, Redwood City, CA 94063, (415)365-1833; FAX (415)365-3737.

October

•**5-6, The Eleventh Annual Midwest Food Processing Conference "Consumers: Driving Force For Our Future"** sponsored by the Chicago, Iowa, Minnesota and Wisconsin

IFT sections, will be held at the Radisson Hotel in LaCrosse, Wisconsin. For more information, contact Ellen Bragg, MFPC Publicity Chairperson, Cargill, Inc., Salt Division, P.O. Box 5621, Minneapolis, MN 55440; phone: (612)475-6929.

•**7-9, Kansas Association of Sanitarians Annual Meeting** will be held at the Holidome, Great Bend, KS. For more information contact John Davis, Wichita-Sedgewick Co., 1900 E. 9th Wichita, KS 67214; (316)268-8351.

•**12-15, UC Davis/Purdue Aseptic Processing and Packaging Workshop** to be held at the University of California-Davis, Davis, CA. For more information or to enroll, call (800)752-0881. From outside California, call (916)757-8777.

•**14-15, Annual Conference of the North Central Cheese Industries Association** will be held at the Holiday Inn, Brookings, SD. For further information, contact E. A. Zottola, Executive Secretary, NCCIA, P. O. Box 8113, St. Paul, MN 55108.

•**20-22, Basic Pasteurization Course**, sponsored by the Texas Association of Milk, Food and Environmental Sanitarians, will be held at the Le Baron Hotel, 1055 Regal Row, Dallas, TX. For registration information contact Ms. Janie F. Park, TAMFES, P.O. Box 2363, Cedar Park, TX 78613-2363, (512)458-7281.

•**26, GMPs for the Food Industry**, sponsored by ASI Food Safety Consultants', will be held in Chicago, IL. For more information call Christine VerPlank or Nancy Sullivan toll-free at (800)477-0778 or, in MO, (314)725-2555, or write, ASI, P.O. Box 24198, St. Louis, MO 63130.

•**26-29, The Science of Ice Cream Manufacturing** to be held at the University of California-Davis, Davis, CA. For more information or to enroll, call (800)752-0881. From outside California, call (916)757-8777.

November

•**5, Food Industry Sanitation and Food Safety Workshop**, presented by the University of California Cooperative Extension, will be held at the Anaheim Plaza Resort Hotel, 1700 S. Harbor Blvd., Anaheim, CA. For more information contact Heidi Fisher, Food Science and Technology, University of California, Davis, CA 95616; (916)752-1478.

•**8-12, PACK EXPO 92, The World of Packaging Technology**, sponsored by Packaging Machinery Manufacturers Institute (PMMI), will be held at the McCormick Place, Chicago, IL. For more information contact Bonnie E. Kilduff, Exposition Manager, PMMI at (202)347-3838 or FAX (202)628-2471.

•**9-11, Quality Control and Stability Testing** will be held at Tragon Corporation, 365 Convention Way, Redwood City, CA 94063, (415)365-1833; FAX (415)365-3737.

•**10-13, Industrial Refrigeration Workshop** to be held at the University of California-Davis, Davis, CA. For more information or to enroll, call (800)752-0881. From outside California, call (916)757-8777.

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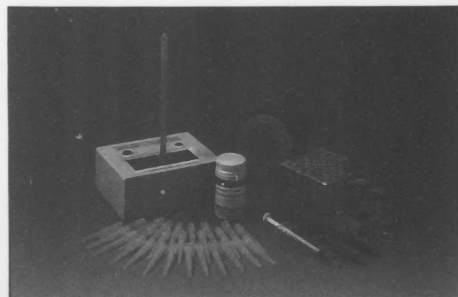
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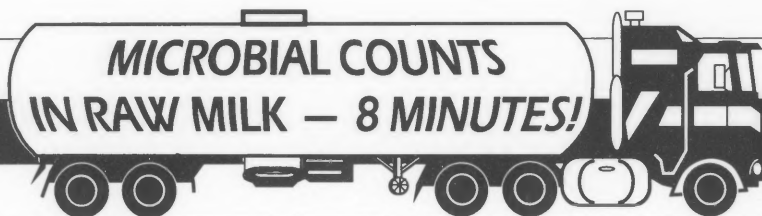
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