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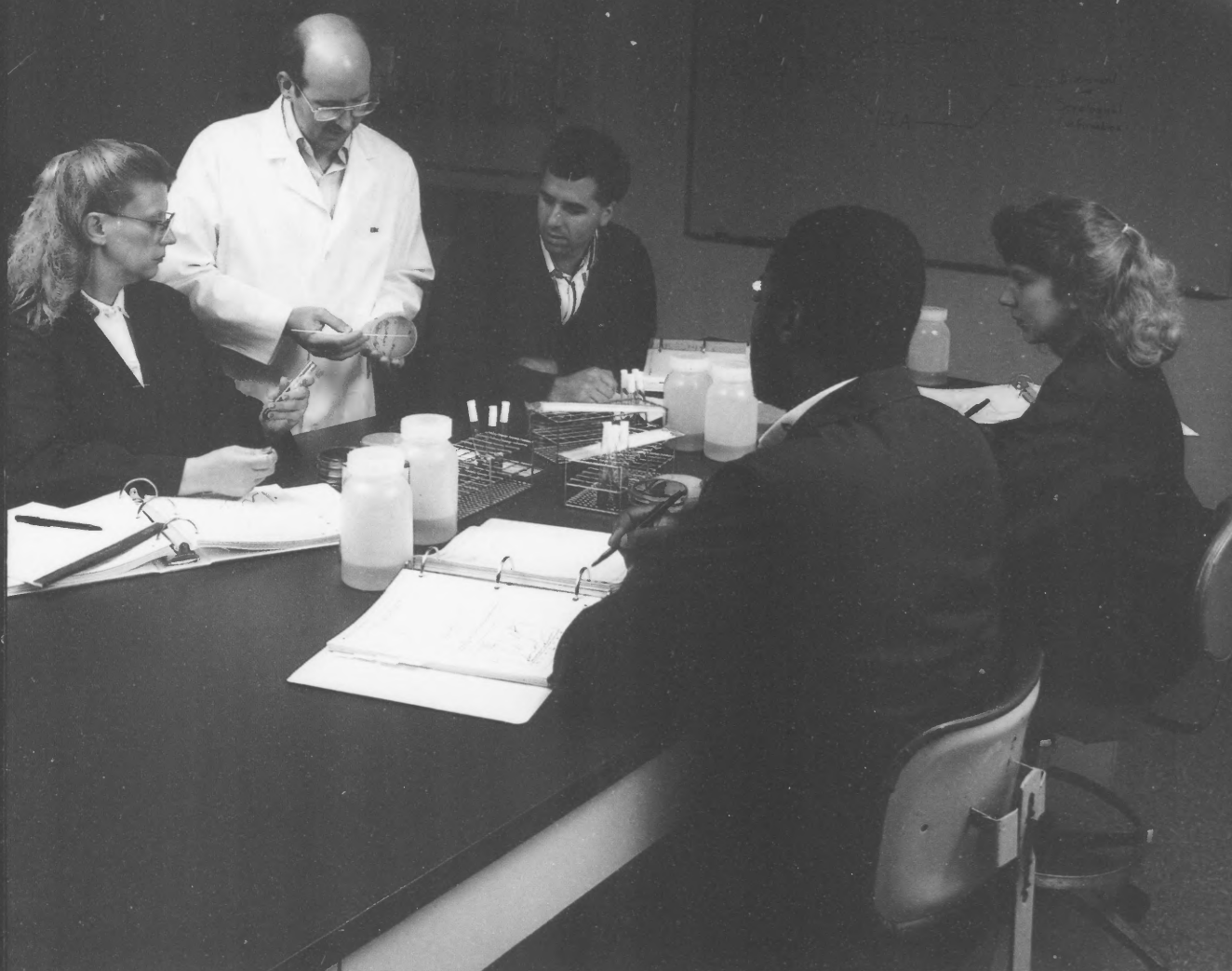
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DAIRY, FOOD AND ENVIRONMENTAL

# SANITATION

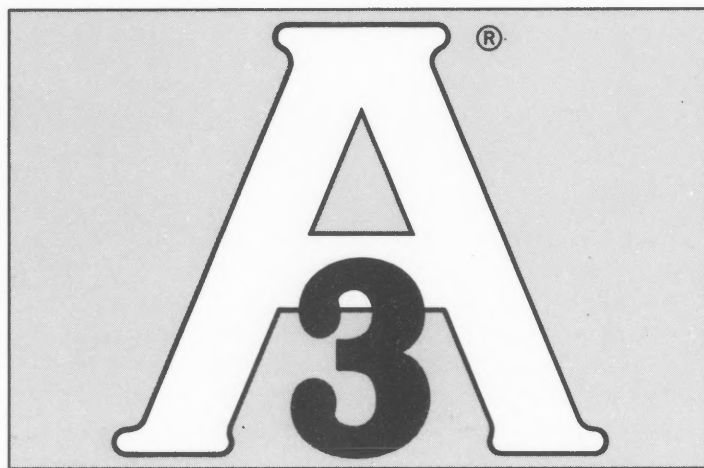
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# Dairy, Food and Environmental Sanitation CONTENTS

## Articles:

- Industry Perspectives on *Listeria monocytogenes* in Foods: Manufacturing and Processing** ..... 140  
Dane Bernard

- Industry Perspectives on *Listeria monocytogenes* in Foods: Retail Distribution** ..... 144  
Catherine E. Adams

- The Status of *Listeria monocytogenes* in the Canadian Food Industry** ..... 146  
A. M. Lammerding and J. M. Farber

- Determination of Non Actionable Positives Associated with Antibiotic Tests** ..... 151  
Stanley E. Charm

- A Field Study Evaluating the Effectiveness of Different Hand Soaps and Sanitizers** ..... 155  
Mary L. Miller

- Foodborne Illness (Part 5): Foodborne Campylobacteriosis** ..... 161  
George H. Reed

- News** ..... 163

- Federal Register** ..... 166

- Food and Environmental Hazards to Health** ..... 167

## Association News:

- Sustaining Members** ..... 134  
**Thoughts From the President** ..... 136  
**On My Mind** ..... 138  
**New IAMFES Members** ..... 171  
**Preview of the 81st Annual Meeting** ..... 175  
**81st Annual Meeting Registration Forms** ..... 180

- HAZCON-Based Total Quality Management** ..... 168

- Industry Products** ..... 172

- "Where To Find It"** ..... 174

- Amendment to Rescind E-3-A Sanitary Standards for Egg and Egg Products Equipment** ..... 182

- Business Exchange** ..... 184  
"Classifieds"

- Coming Events** ..... 185

- Advertising Index** ..... 186

- IAMFES Booklet Form** ..... 187

- IAMFES Membership Application** ..... 188

ABOUT THE COVER... *Photo courtesy of Silliker Laboratories Group, Inc., Homewood, IL. A research scientist and short course instructor, demonstrates to students during Silliker's Laboratory Methods in Food Microbiology course how to select typical Salmonella colonies.*

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# Thoughts from the President . . .



By  
**Harold Bengsch**  
IAMFES President

While watching television the other night, I was performing my manly duty of channel roaming with a remote control. Flashing in front of my eyes was a scene showing a pan of fish being stuck with a food thermometer. Now being a sanitarian of many years, you will be proud to know that I lifted my finger from the remote button and dutifully watched the rest of the program dealing with food hazards for the consumer.

During the next thirty or so minutes, several things imprinted themselves in my mind.

1. The degree to which the network went to in providing a very broad view of consumer food at the retail level, i.e., from tropical banana plantation in South America to fishing fleets in the North Sea and everywhere in between.
2. The skillful manner in which the human aspect of foodborne illness was woven into the story with an interview of a distraught mother whose child had just died from HUS.
3. The amount of air time that was devoted to this tragic human aspect when compared to the interview time devoted to out take of regulatory officials trying to respond to very technical and wide ranging questions.
4. The conveyed impression which was given was that very little is being done about food safety issues; and
5. No distinction interpreting test results regarding differences between presence/absence and actionable levels of contaminant.

Was this program informative? Yes. Was it accurate? To a great extent, yes. Did it do anything to educate the consumer to their personal responsibility in food safety? Very, very little.

As I thought about this last question, two things became very apparent to me. First, the network has, at their disposal fantastic resources upon which they may draw when producing a program. Secondly, their marketing experts certainly know what pulls hardest on the heartstrings of the viewers.

As my finger once again sprang to life in resuming its expert skill of channel roaming, my mind kept coming back to one particular and very short piece in the program. That piece had to do with how just a few degrees higher cooking temperature could have prevented a foodborne outbreak.

During the ensuing week since the program aired, I have often reflected back on what could have been instead of what was and would anyone have watched, "What could have been."

In discussing my thoughts with a reporter friend, the answer to my concern was a qualified, yes. The qualifier was, "If the fluff that tugs at the heartstrings and sells the piece can be effectively integrated with the in-home consumer safety procedures, then you might have something the media is interested in.

It doesn't take a rocket scientist to figure out: "Hey, there may be some real possibilities here." The real question is, "How do we go about developing a process to explore capitalizing on the high-tech media to take our message of personal responsibility for food safety into the homes of the consuming public?"

Well, I am not sure just what the answer to that question is. But there is one thing of which I am sure, this subject will be a matter of discussion at the IAMFES Board Meeting on February 22, 1994.

Until next month . . .

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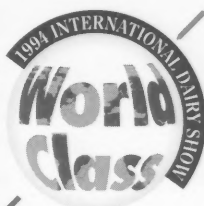
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# On My Mind . . .



By  
Steven K. Halstead, CAE  
IAMFES  
Executive Manager

is lifetime membership...

I have an older son, Robert, who is a hunting enthusiast. For his thirteenth birthday, his grandfather gave him a lifetime membership in the National Rifle Association. Nothing could have made Robert happier.

The NRA's politics aside, lifetime membership in it is kind of a family tradition with my wife's family. Her brothers each received a lifetime membership on their thirteenth birthdays as did Mary's father. I wouldn't be surprised if Mary's grandfather also had a lifetime membership.

For half his life now, Robert has been a member of the NRA. Among other things, each month he receives the NRA magazine. Its the second thing he asks for when he gets home (right after "What's for dinner?"). He will continue to receive the magazine every month for the rest of his life, and neither he nor anyone else will ever have to pay another cent in dues.

About a year ago, the IAMFES Executive Board directed me to look into the possibility of establishing a lifetime membership for IAMFES. My first step was to contact the American Society of Association Executives for information about lifetime memberships. They sent me quite a bit of material from which I was able to determine the pros and cons from the association's perspective. I counted on the Executive Board to provide the pros and cons from a member's perspective.

Both groups shared one concern--the cost. From the association's view, if the price isn't high enough, it faces the prospect of having to provide services without being paid for them. The member, on the other hand, has to figure out some way to cash flow the amount of upfront money which is required for a lifetime membership.

Certain ground rules must be established — for example, a Lifetime Membership is an individual membership and cannot be transferred to another person; the Lifetime Member will receive all benefits of membership, including both journals; the payment must be in a lump sum; there can be no cancellation or refund; the membership ends upon the death of the member or at his/her direction.

To calculate what we needed to fund a lifetime membership, we had to make certain assumptions such as what it would cost us each year to provide the membership; how long the member would be receiving member benefits; what kind of interest we might expect on the investment; and what it would cost us to administer this kind of membership. Once those assumptions were made, the mathematics were the same as an annuity problem--what kind of one time payment do you need to generate \$N a year for M years if the interest rate is X%? A quick call to a financial planner with a handheld calculator yielded the answer.

In our case, the numbers came out to be \$1,500.

That still didn't tell us if there was any kind of a market--ie would anyone be interested in paying that kind of money for a lifetime membership? We did lots of guessing. Its a good deal for young people, but they don't have the money. Older members have the money, but its not such a good deal for them. Would companies which now pay a member's dues, pay for a lifetime membership? We still had lots of questions.

So we put together a survey to measure the market which we distributed at the Atlanta Meeting. Sadly, we received only thirteen responses and most of those questioned the calculations more than the concept.

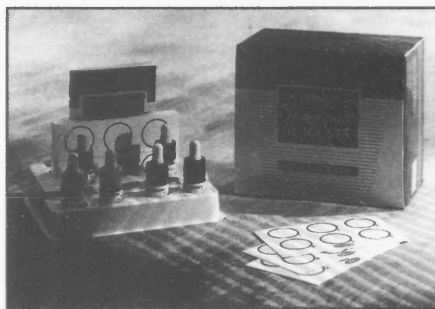
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## Industry Perspectives on *Listeria monocytogenes* in Foods: Manufacturing and Processing

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"*Listeria monocytogenes*: Current Issues and Concerns" sponsored by the International Life Sciences Institute

This article will focus on industry's efforts to meet the challenge of controlling the presence of *Listeria monocytogenes* in ready-to-eat (RTE) food products. A "zero tolerance" for *L. monocytogenes* in all RTE food products is current regulatory policy. While we are not in complete agreement with the current policy, the industry has responded appropriately by developing process control and intervention strategies for minimizing the presence of *L. monocytogenes* in RTE food products. Manufacturers of this category of foods have utilized a Hazard Analysis Critical Control Points (HACCP) approach along with research to develop systems to determine critical control points and control procedures that will minimize the potential for occurrence of *Listeria* in finished products. In addition, most operations find that if they can control *Listeria*, they will also minimize potential for contamination by other pathogens as well.

For the purpose of this paper, we will utilize the categorization suggested by the National Advisory Committee on Microbiological Criteria for Foods (NACMCF) as presented in its *Recommendations For Refrigerated Foods Containing Cooked, Uncured Meat Or Poultry Products That Are Packaged For Extended Refrigerated Shelf Life And That Are Ready-To-Eat Or Prepared With Little Or No Additional Heat Treatment*, which was adopted January 31, 1990. The NACMCF suggested three categories for RTE foods: 1) assembled and cooked, 2) cooked and assembled, and 3) assembled with cooked and (or) raw ingredients. We have modified the third category description slightly by adding the word "or." Many items outside the meat and poultry area which fall in the RTE category may be made completely from raw ingredients - vegetable salads being an example.

The *Listeria* control measures for each category will vary as dictated by the type of ingredients and processing to which the food is subjected. For the assembled and cooked products (Category 1), control measures include application of a listericidal process, adjustment of product formulations to take advantage of barriers to microbial

growth, and the prevention of recontamination of products using proper handling and packaging following processing. For those products which are cooked and then assembled into their final package (Category 2), control measures include application of a listericidal process, utilization of appropriate barriers, and the minimization of potential for recontamination of cooked products with *Listeria*. For Category 3 products, which may contain or be made from raw ingredients, control measures will typically be more difficult. Control measures may include sourcing of *Listeria*-free ingredients, although this may prove to be impossible in certain categories of products, as researchers have shown many raw foods may routinely carry low levels of *L. monocytogenes* (2,3,5). Alternatively, processors may need to maintain a larger inventory of ingredients which would be used only after adequate testing for *Listeria*. Processors may also consider purchasing ingredients such as fresh vegetables which have been pre-washed and treated with a sanitizing rinse. Other control measures will include application of a sanitizing rinse and/or blanch step and, as above, the plant environmental and operational control measures necessary to minimize potential for contamination of product. This paper will focus on the challenge of managing the processing environment to minimize the potential for contamination of product in the plant.

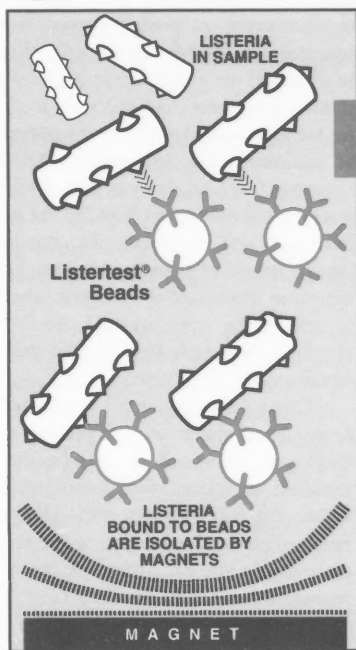
As noted earlier, many companies have utilized a HACCP approach for determining critical control points which are necessary for minimizing the potential for contamination of RTE foods by *Listeria*. Before a food processor can identify critical control points, a processor must identify potential sources of *Listeria* and determine potential *Listeria* harborage sites within food plants. Steps for identifying potential harborages of *Listeria* include reviewing literature, physically inspecting processing equipment, and conducting microbiological surveys within the food plant environment. Past plant surveys (1) have found *Listeria* in the following locations, listed approximately in the order of prevalence:

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- floors
- drains
- cleaning aids such as brushes, sponges, etc.
- product and/or equipment wash areas
- food contact surfaces
- condensate
- walls and ceilings
- compressed air

At this point, we must note the unusual situation of including sanitation as a critical control point within a HACCP plan. Although cleaning and sanitation are very important, these operations are normally expected to be addressed through good manufacturing practice (GMP) programs and will not be of great enough significance in terms of hazard control to be included within HACCP plans. However, when dealing with RTE commodities that do not receive a cook in the final package sufficient to eliminate pathogens, the control steps must address the immediate product contact environment. In the case of this particular product category, it is appropriate to address sanitation utilizing HACCP management techniques. Thus, for *Listeria* control when dealing with Category 2 or 3 RTE products, HACCP plans will generally include a *targeted* sanitation and product handling critical control point (CCP). In introducing the terminology of "targeted," we use an analogy of a "bull's-eye" where the center of the target is the most critical part of an operation and the outer concentric rings of the bulls-eye are of secondary or tertiary importance. In this instance, the center of the bulls-eye for *Listeria* control will focus on potential points of product contamination located between the cook (listericidal) step and the point in the process where the product is protected from potential contamination by its package.

The primary points of potential contamination will include:

- direct product contact surfaces
- personnel who handle product between the listericidal step and final packaging
- items such as clothing or gloves which may come into direct contact with product

The second level of concern to target is the immediate environment in "exposed product areas," including the sanitary quality of:

- floors
- walls
- ceilings
- heating ventilation and air conditioning systems
- drains
- condensate drip pans
- other equipment which may be in the immediate area but are not intended for direct product contact

The third level of concern (outer ring of the bull's-eye) is the potential for cross-contamination. This may be from:

- traffic in the production processing and packaging area (both people and equipment)
- product coolers
- non-product-contact areas of equipment or support structures
- other areas that may have an impact on the environmental conditions in the exposed product areas, such as adjacent passageways, lunchrooms, etc.

We will speak more about how some of these areas may be cleaned and sanitized later.

When considering these primary, secondary, and tertiary target areas, we will attempt to point out some sites which have been found through previous surveillance (4) to be potential harborage for *Listeria*. This list is by no means exclusive but is provided only to note prior experience. Sites found to be potential harborage for *Listeria* include:

- rollers for conveyors, especially the hollow type
- on/off control switches
- rubber seals around doors
- fibrous or porous type conveyor belts
- open bearings within equipment, such as slicers, strippers, etc.
- hollow implements, including box cutters
- certain pieces of ancillary equipment, such as trash cans
- standing water in production areas

If these or other potential sites of *Listeria* harborage are noted within the exposed product environment, they should be eliminated, or control measures must be adopted. If equipment is damaged, pitted, corroded, or cracked, it should be repaired or replaced. Regular maintenance schedules should be adopted and followed to minimize the potential for harborage and to reduce the potential for contamination of equipment due to repair operations. Acceptability of equipment design from a microbiological and sanitation standpoint should be reviewed before any new or replacement pieces are acquired. High-risk situations, such as new and inexperienced/untrained employees working with new and unproven pieces of equipment, should be identified by reviewing the operation (1). Such situations should be eliminated or controlled so that these situations will not compromise the product.

Other *Listeria* control measures include adoption of strong good manufacturing practice programs that include employee training in hygiene and sanitation and food handling practices. A "clean room mentality" should be established within the RTE product area. This clean room mentality must emphasize employee and equipment traffic control programs to prevent equipment out of less controlled environments from entering the RTE "clean room" area. This clean room approach will include the wearing of clean outer garments, gloves, sleeve guards, and head coverings; the use of sanitizing foot baths; the availability and use of sanitizing hand dips; and employee *accountability* for understanding the operational rules associated with this concept. The clean room approach may even include separate changing facilities for only those employees working in the RTE area, and separate equipment and cleaning utensils to be used only for the RTE exposed product area.

In preparing or handling extremely sensitive products, extraordinary measures may be considered. These may include:

- maintaining the RTE clean room area under positive pressure with filtered/treated air
- eliminating overhead fixtures where possible
- requiring employees to wear surgical masks and special non-particle-shedding clothing
- germicidal baths for wheeled traffic, such as fork lifts

- re-design of floor drains to allow for easier or even automated sanitizing

Also, since standing water is a great promoter of *Listeria* growth and a source of potential product contamination, wet process areas should be isolated from other production areas.

Adherence to proper operational procedures by plant personnel during production will also help reduce potential for contamination of product. Such operational control measures may include the use of low-pressure water for rinsing or cleaning. High-pressure water can generate mists of bacteria which may stay airborne and circulate throughout processing plants. Standing water should also be removed as soon as possible from processing areas.

Those who have addressed the *Listeria* problem most effectively have learned that sanitation programs must go well beyond those previously believed to be adequate. While many of the sanitation and process control improvements listed here were made before the current popularity of HACCP, the logical approach utilized in making these improvements parallels those prescribed by HACCP. The following sanitation suggestions have been utilized by some companies to successfully address *Listeria*. It is by no means an inclusive list, nor are we providing any guarantee that utilization of these suggestions will result in a completely controlled environment for every product.

They are presented here as an example of procedures which may be useful in certain instances.

The sanitation program must include regular cleaning and sanitizing of product contact surfaces utilizing an appropriate sanitizer. It is also suggested that product contact water be chlorinated, depending on the type of product being processed and whether the product contact water is designed merely to reduce the bacterial load in the water or to sanitize the food it contacts. Depending on the intended purpose, the chlorine content may vary from 5 to 200 ppm. Other sanitation measures include routine cleaning and sanitizing of non-food-contact areas. One sanitizing agent found to be most useful for environmental use is quaternary ammonium compounds (quats). Quats are effective against *Listeria* and leave a residual germicidal effect on surfaces. Areas to be sanitized with quats along with a suggested sanitizing frequency are:

AREA	FREQUENCY
Drains	daily
Floors	daily
Waste containers & storage	daily
Walls	weekly/monthly
Condensate drip pans	weekly/monthly
HVAC	weekly/monthly
Coolers	weekly/monthly

Cleaning tools should be stored in quat solutions. It may also be useful to eliminate trash containers in favor of disposable plastic bags supported by leaf-holder type sanitizable frames. Some companies have also found it useful to include iodophores in their sanitizing program and to rotate the sanitizers used in certain areas to provide for even greater effectiveness. Use of quats to sanitize entire production areas by fogging either weekly or monthly has also proven effective in some operations.

Also, to assist in control of *Listeria* which may reside in biofilms, sanitizing by using high temperatures can be very beneficial. For certain pieces of equipment which are not easily disassembled, this may be the only effective method available to prevent contamination from within hidden areas such as bearings.

In addition to the above control measures, an environmental monitoring program should be implemented for *Listeria* species to verify (e.g., the verification step in a HACCP plan) the effectiveness of the control programs. This environmental monitoring program should be started when the control measures are in place and audited for compliance with the above *Listeria* control criteria. The routine sampling of environmental surfaces will help identify potential problem areas. Those areas to be sampled may include:

- product contact surfaces
- support structures
- non-contact surfaces, such as adjacent plant environments
- overhead areas or structures
- walls
- drains
- air within processing areas

In summary, to paraphrase Tompkin et al., (4), it must be concluded that existing technology cannot eliminate *Listeria* from processing plants. Therefore, the processing environment must be vigorously managed so that the probability of direct contamination from ingredients and surfaces and cross-contamination from the environment are minimized. This will require a commitment by management to support the costs associated with implementing a *Listeria* control program.

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# Industry Perspectives on *Listeria monocytogenes* in Foods: Retail Distribution

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As presented at the IAMFES 80th Annual Meeting, Atlanta, Georgia, August 2, 1993, in the symposium "Listeria monocytogenes: Current Issues and Concerns" sponsored by the International Life Sciences Institute

## Introduction

Listeriosis remains a paradoxical human disease even after almost a decade of investigation. It is clear that *Listeria* bacteria are consumed daily by healthy and immunocompromised individuals. But the incidence of outbreaks and sporadic disease remains quite low. Listeriosis is a serious disease and should not be considered lightly. And efforts by the food industry to control and minimize this ubiquitous environmental contaminant have proven effective. Through prevention-oriented control programs in food plants, specifically implementation of HACCP programs which target *Listeria*; and through active consumer awareness campaigns, sponsored by USDA, FDA, and the Centers for Disease Control (CDC) the incidence of listeriosis in this country has declined. The CDC report a 40% decline in reported cases of listeriosis between the years 1989 to 1992. That reduction in human disease is remarkable testimony to the effectiveness of HACCP food safety control programs and to our ability to influence consumer behavior of at least certain population groups. I will suggest that further reduction and control programs be targeted to retail establishments, where cross-contamination is occurring at the deli counter and where the opportunity is great to communicate important food safety messages to the most susceptible consumers.

## Data from the CDC

In 1988 the CDC initiated a comprehensive microbiological survey of foods collected from refrigerators of patients with listeriosis. Both patient and food isolates of *Listeria monocytogenes* were subtyped by the highly specific methodology of multilocus enzyme electrophoresis (MEE). The electrophoretic mobility of the number of different enzyme types in food and patient samples were compared. Of the 123 patients investigated in the study, 64% had at least one food in their refrigerators with *Listeria*. Of this number, only 33% of food samples corresponded in terms of the strain which infected the patient.

From these data, CDC concluded that the type of food specimens which grew *Listeria* were ready-to-eat products. Further, foods that contained serotype 4b and where *Listeria*

was found in high concentration were more likely to cause disease. While these conclusions may not provide the answers to our many compelling questions about *Listeria* control, they are useful as indicators to help us select an appropriate course of action.

## Proposed Focus for a Future Strategy for *Listeria* Control

The fact is that CDC's data reveal that we will be minimally effective in further reducing listeriosis incidence if we keep beating the same drum. That drum, which has sounded since 1988, is to put pressure and more pressure on the food industry to control *Listeria*. The tool of choice is HACCP and the industry and regulatory agencies should do everything possible to advance the implementation of HACCP as a flexible food safety control tool. Beyond that, there should be increased attention and education for retail operators, particularly those which maintain deli counters. These sites are known focal points for *Listeria* transmission. We know that ready-to-eat products which are kept open, are exposed to air, and are frequently handled with likely cross-contamination using common utensils and machinery for cutting or slicing are likely candidates for *Listeria* contamination. We also know that these retail sites are frequented by populations interested in convenience, so many of these foods will be minimally reheated, if at all. These populations include the elderly, pregnant women, and those who want convenient meals because they don't feel well enough to cook — for example, those individuals with underlying disease. These are the very same populations we identify as most susceptible for listeriosis.

We have struggled with the concept of consumer education about proper food handling for a long time. This issue has been hotly debated by government agencies, including USDA and FDA, and by advisory bodies including the National Advisory Committee on Microbiological Criteria for Foods. I suggest that the target for these educational efforts move from the general population to the retail environment. The best data that we have — from comprehensive studies conducted by the CDC — indicate that this is a site where cross-contamination occurs and where corrective actions are possible. That action is two-fold.



First, educate food handlers about the ways to minimize the presence of *Listeria* in the retail environment and how to avoid cross-contamination. Secondly, let's work more on educating the consumers most at risk, namely susceptible population groups. It also includes a commitment to educate them at the point of purchase in the retail establishment where these individuals are doing their shopping. This action will require the active collaboration of industry, the retail industry, government agencies and consumer groups.

### Conclusion

We have proven beyond a shadow of a doubt that we will not eliminate *Listeria* from the environment. But that is not our most effective or efficient goal. There are many active research programs of merit which are searching for

definitive answers regarding *Listeria* control or elimination. Waiting for the conclusions from these research studies is not productive. We have come a long way in our efforts to control this microorganism in food manufacturing establishments. Now is the time to implement the lessons learned from research studies which point to controls in the retail environment. I reiterate that this strategy is two-fold and includes management and food handler education as well as providing point-of-purchase programs for consumer education. By implementing the philosophy as well as the principles of HACCP in the retail marketplace we can achieve collaboration of industry, government agencies and the consumer in truly effective *Listeria* control programs at the source where the majority of the problems originate and the opportunities are greater for achieving success in reducing listeriosis.

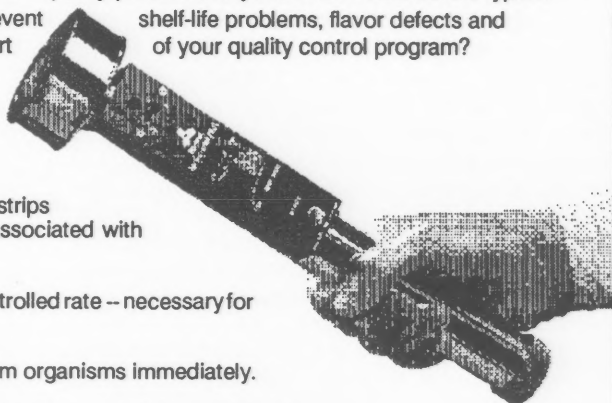
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# The Status of *Listeria monocytogenes* in the Canadian Food Industry

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As presented at the IAMFES 80th Annual Meeting, Atlanta, Georgia, August 2, 1993, in the symposium "*Listeria monocytogenes*: Current Issues and Concerns" sponsored by the International Life Sciences Institute

## ABSTRACT

As our understanding of the epidemiology of *Listeria monocytogenes* improves, it is becoming clearer that if fundamental principles of food safety are diligently applied at all levels of the food chain, the risk of foodborne disease caused by *L. monocytogenes* can be minimized. Canadian regulatory agencies have implemented a control strategy for foodborne listeriosis which takes into account that total elimination of *L. monocytogenes* from all foods may be impractical and impossible to achieve. Rather than focusing on end-product testing, a three-phase approach is used to ensure adherence to good manufacturing practices (GMPs) and compliance with the Canadian Food and Drug Act. This approach stresses overall plant sanitation and management strategies which incorporate hazard analysis and critical control point (HACCP) techniques. An update of the *L. monocytogenes* policy, drafted in July 1993 to incorporate recent epidemiological information and currently undergoing review by the food industry, continues to emphasize adherence to GMPs. The proposed policy directs priorities and compliance action toward high-risk foods, i.e., foods causally involved in outbreaks of listeriosis, and those foods capable of supporting growth of *L. monocytogenes* and which have a shelf-life of greater than 10 days. In addition, Canadian agencies have established programs to ensure high standards among private laboratories that test for *L. monocytogenes*, and provide updated educational materials for industries and consumers. Approximately 45 to 63 cases of sporadic listeriosis are reported each year in Canada, and no foodborne outbreaks have been reported since 1981. By continually reviewing and improving GMPs, and conducting frequent inspections in food plants, Canadian food processors and regulators are striving to minimize the risk of foodborne listeriosis.

## HUMAN LISTERIOSIS IN CANADA

The first documented isolation of *Listeria monocytogenes* from a human patient in Canada was in 1951 (2). In

1981, the first epidemiologically-confirmed foodborne outbreak of listeriosis occurred in Nova Scotia (12). Health and Welfare Canada's (now Health Canada's) Laboratory Centre for Disease Control (LCDC) initiated a laboratory-based surveillance system for human listeriosis in 1987 (13), and, in 1991, listeriosis was listed as a nationally-notifiable disease (6).

Forty-four cases were recorded for 1987, but since the surveillance program was initiated during that year, much of the data collection was done retrospectively (13). In both 1988 (14) and 1989 (15), 63 cases were identified, an incidence rate of 2.4 cases per million population. In 1990 and 1991, 49 cases per year were reported (P.V. Varughese, LCDC, personal communication). However, as with many infectious diseases, reporting of listeriosis is inaccurate, and follow-up investigations inadequate; a more realistic figure is likely 100 to 125 cases per year for all of Canada, an incidence of 3.8 to 4.7 cases per million population (P.V. Varughese, personal communication).

Evidence for foodborne listeriosis in Canada is limited (Table 1). The 1981 outbreak was attributed to contaminated coleslaw and involved an unusual combination of factors (12). The cabbages from which the coleslaw was manufactured were directly contaminated with manure from a sheep flock in which listeriosis had been diagnosed, and the

Table 1. Foodborne human listeriosis in Canada.

Year	No. cases	Vehicle
1981	41	Coleslaw; cabbages fertilized with manure from infected sheep flock; over-wintered cold-storage.
1988	1	Imported soft cheese
	1	Alfalfa tablets
1989	1	? Refrigerator contents positive
	1	? Refrigerator contents positive
1992	1	Goat meat

cabbages were overwintered in cold storage, possibly allowing proliferation of the organism. Forty-one cases were involved in the outbreak, seven adult and 34 perinatal cases, with a 41.5% mortality rate (12). Since this incident, no other outbreaks of listeriosis have been reported in Canada.

Two cases in 1988 were directly linked to foods: imported soft cheese in one case and in the other, alfalfa tablets (3). Both patients were elderly and immunocompromised. In 1989, two separate cases were linked to foodstuffs (15). Testing foods from the patients' refrigerators yielded the same strain as that isolated from the patients. However, in both cases, more than one food item was positive and none of the foods were in sealed packages, preventing identification of a single food source.

Early in 1992, the Public Health Laboratory in Ontario reported a case of listeriosis attributed to the consumption of undercooked or recontaminated goat meat purchased in California and brought privately into Canada (10). The patient was a young woman suffering from lupus erythematosus and receiving steroid treatment, both factors that probably contributed to the occurrence of listeriosis.

#### THE CANADIAN COMPLIANCE POLICY, 1988

In 1988, the then Department of Health and Welfare Canada responded to the worldwide concern over foodborne *L. monocytogenes* with a compliance policy that worked with industry to reduce the risk of foodborne listeriosis by reducing contamination during manufacture of foods (5). Formulation of the policy took into account the then-known facts about the epidemiology of foodborne listeriosis, and consideration of evidence that strongly suggested that although the minimum infectious dose was not known, low numbers of the organism would not necessarily cause listeriosis, even in susceptible individuals. Since three of the four major outbreaks at that time had involved dairy products in which the organism could grow to high numbers prior to consumption, dairy foods supporting growth of the *L. monocytogenes* were targeted as highest priorities in sampling and inspection activities. Of second priority were dairy products not supporting growth of the organism. The coleslaw outbreak was regarded as an episode resulting from a unique combination of factors. Therefore, contamination of any non-dairy ready-to-eat (RTE) food that supported growth of *L. monocytogenes*, including coleslaw with a pH of 5.5 or greater, RTE meats and seafood were ranked as third priorities, with RTE foods not supporting growth in a fourth class.

Recall action taken in cases of contaminated product was in accordance with the relative degree of health hazard identified by the priority categories, with a Class I recall representing the most urgent level of action, implemented in the case of contaminated dairy products supporting growth of *L. monocytogenes*. However, in all cases, a health alert was considered for any RTE food contaminated with *L. monocytogenes* if there was a possibility for increased risk to the public because of factors such as the level or incidence of the organism in the food, the source of contamination e.g. faecal material, or if the food was specifically marketed to a vulnerable segment of the population.

A significant aspect of the compliance policy was that all sectors of the food industry - production, manufacturing, food service and retail - were encouraged to make every effort to market foods free of *L. monocytogenes*. The presence of *L. monocytogenes* in any food as a result of poor sanitation or non-adherence to good manufacturing practices (GMPs) was deemed to be unacceptable, and enforceable under provisions of the Canadian Food and Drug Act. All RTE food manufacturers were expected to reduce/eliminate contamination through plant sanitation programs using hazard analysis, critical control point techniques (HACCP). In this regard, the compliance policy was and still is considered a HACCP-based policy.

The policy was supported by a three-phase approach to ensure adherence to GMPs and compliance with the Food and Drug Act in any facility manufacturing RTE foods (Figure 1). Initial inspections encouraged strict implementation of GMPs and emphasized a review of processes, sanitation program and systems of quality assurance. In particular, the potential for post-process contamination of a RTE product was of concern. If a firm was not adhering to GMPs and was not moving towards control of post-process contamination, the next phase was environmental sampling to clearly demonstrate the problem(s). If environmental tests showed a possibility of finished product contamination, and the firm was still not moving towards control, then end-product testing was considered. In the case of a firm manufacturing RTE food which supported the growth of *L. monocytogenes*, and the firm was not adhering to GMPs, the three phases could have been done simultaneously.

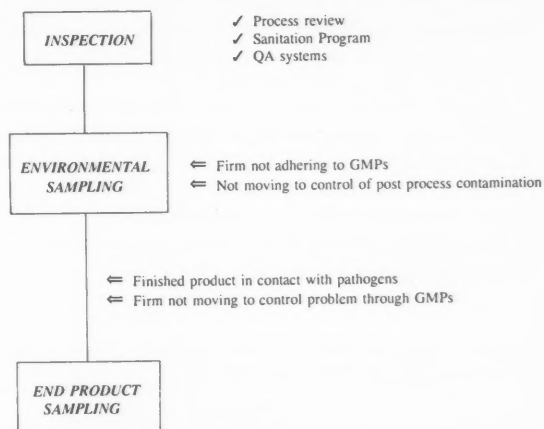


Figure 1. Three-Phase inspection approach to ensure adherence to Good Manufacturing Practices (GMPs) and compliance with Canadian Food and Drugs Act.

In addition, Agriculture and Agri-Food Canada has implemented a routine environmental sampling of RTE premises, i.e., all federally-registered RTE meat processing plants in Canada are environmentally sampled twice a year.

The critical areas for sampling are post-processing contact surfaces, where products are handled or further processed. This includes: all surfaces directly in contact with the products, such as employees hands/gloves, slicers, etc.;

surfaces from which liquids may drop or drain into finished product such as condensate-laden pipes; items that may touch surfaces directly in contact with food, such as cleaning aids, or aprons, and especially surfaces on which (food) debris is likely to accumulate. Ten to 20 samples are usually taken, normally in the latter part of a shift. Areas up to one square meter are aseptically swabbed with sterile sponges dampened with enrichment broth. Swabs are placed into the broth after sampling and then transported within 24 hours to the laboratory. The qualitative culture method is based on the U.S. Department of Agriculture, Food Safety and Inspection Services protocol, with modifications made by the Health Protection Branch of Health Canada (7).

Upon initial inspection and testing, swabs are normally analyzed in a single composted unit. Follow-up testing in an environmentally-positive plant analyzes swabs separately to determine specific sites and extent of contamination. Thus, the environmental sampling program benefits the manufacturer by demonstrating the effectiveness of the sanitation program with respect to *L. monocytogenes*, identifying probable post-processing cross-contamination sites and the extent of *L. monocytogenes* contamination when multiple swabs are analyzed separately, and providing information on faulty equipment design and operation. This approach helps manufacturers ensure that effective procedures are in place to minimize the hazard of *L. monocytogenes* contamination of finished product, and to take steps to correct the situation where lapses occur.

Results of environmental sampling in RTE food processing facilities for the year April 1992 to March 1993 are shown in Table 2. Following an initial environmental-positive finding, increased diligence in sanitation protocols has been effective in decreasing the potential for recontamination of product with *L. monocytogenes*, demonstrated in follow-up environmental samplings.

Domestic product testing is normally carried out only when a facility is environmentally-positive and in violation of GMPs, with no efforts being made by the manufacturer to rectify the sanitation problems. Results of domestic product testing for 1992-93 are listed in Table 3. Of 1,757 dairy products (including cheese, frozen dairy products, etc., but not fluid milk), seven were positive for *L. monocytogenes*;

**Table 2. Results of environmental sampling in Ready-to-Eat food processing establishments, 1992-93<sup>1</sup>.**

Product	No. plants	No. of plants positive <sup>2</sup>		
		I	II	III
Cheese	348	7	3	2
Other dairy	161	1	0	-
Processed eggs	13	2	1	-
Meat	188	32	13	5
Seafood	53	17	6	-

<sup>1</sup>Data from: Health Protection Branch, Health Canada; Food Production and Inspection Branch, Agriculture and Agri-Food Canada; Scientific and Technical Programs Inspection Branch, Fisheries and Oceans Canada; or combined; unpublished.

<sup>2</sup>Number of environmentally-positive establishments upon initial sampling (I) and upon subsequent follow-up samplings (II & III) in positive plants.

**Table 3. Results of domestic product testing for *L. monocytogenes*: Monitoring and follow-up investigations, 1992-93<sup>1</sup>.**

Product	No. Tested	No. Positive (%)
Dairy	1757	7 (0.4%)
Egg	809	3 (0.4%)
Meat	144	15(10.4%)
Seafood	103	4 (3.9%)

<sup>1</sup>For data sources, see Footnote 1, Table 2.

three of 809 egg products (pasteurized liquid, powdered) yielded *L. monocytogenes*. Of 144 RTE-meat samples, 15 were positive, and four of 103 seafood samples (e.g., battered cod fillets, cooked crustaceans) were positive. During the same period food recalls were initiated for the following domestic foods: jellied cooked chicken pieces, lentil pâté, smoked meat and cooked ham (all single lots), and sausages, meat spread and wieners (9).

Since we are unable to observe the GMPs maintained throughout the production of foods from other countries, imported products are tested for the presence of *L. monocytogenes* (Table 4). Recalls of imported foods during 1992-93 included cheeses, coleslaw mix (shredded cabbage and carrots), breaded chicken and biscuit sandwiches, and fully cooked, heat-and-serve chicken pieces (9).

**Table 4. Results of import product testing for *L. monocytogenes*, 1992-93<sup>1</sup>.**

Product	No. Tested	No. Positive (%)
Dairy	598	30 (5.0%)
Egg	86	0 (0.0%)
Meat	385	9 (2.3%)
Seafood	313	21 (6.7%)

<sup>1</sup>For data sources, see Footnote 1, Table 2.

## REVISED CANADIAN COMPLIANCE POLICY, DRAFT, JULY 1993

An update of the *L. monocytogenes* policy has been proposed this year to incorporate recent epidemiological information. This revised policy is still under review and will be undergoing scrutiny by the food industry and other parties. As such, this updated policy may be changed in accordance with recommendations provided by all parties. Priorities and compliance action are directed towards high-risk foods, i.e., foods causally involved in previous outbreaks of listeriosis, and those foods capable of supporting growth of *L. monocytogenes* and which have a > 10 d shelf-life. However, the policy also reflects current knowledge that the risk of contamination by *L. monocytogenes* can be reduced, but the organism cannot always be eradicated from finished product or the environment.

The new policy continues to focus on plant adherence to GMPs and the possibility of post-process contamination, and again is based on a combination of inspection, environmental sampling and product testing. For those establishments which have adequate GMPs in place, regulatory agencies will not normally implement environmental or

product testing. However, where plants are not following adequate GMPs, all three aspects of the program may be implemented either sequentially or together. Inspection priorities for imported RTE food products are set on the basis of the risk categories defined for domestic products.

Products in Category 1 (Table 5) have been causally linked to outbreaks of listeriosis and should receive the highest priority in inspection and compliance activities. Foods which have recently been causally linked to listeriosis outbreaks include pâté (11) and glazed pork tongue (4). If there is a reason for these products to be sampled and they are found to be contaminated with *L. monocytogenes*, it will trigger a Class I recall with consideration of a public alert. Category 2 contains all other RTE foods which are capable of supporting growth of *L. monocytogenes* (See Table 5, footnote 2, for definitions) and have a shelf-life exceeding 10 d. These products require a Class II recall with possible consideration of a public alert and should receive the second highest priority in inspections and compliance activity. However, some formulations of Category 1 or 2 RTE foods appearing in column 2 of Table 5 may not support growth of *L. monocytogenes*, and therefore may not be subject to a Class I or Class II recall. The Health Protection Branch assumes that RTE foods exceeding the conditions of pH and water activity specified in Table 5 do support growth of *L. monocytogenes*, unless the manufacturer/importer is able to present data, to be evaluated by Health Protection Branch, which demonstrates otherwise.

Category 3 contains two types of RTE food products: those supporting growth with a < 10 d shelf-life and those not supporting growth. These products should receive the lowest priority in terms of inspection and compliance action. For Category 3 RTE foods, factors such as the presence or absence of GMPs, the number of *L. monocytogenes* organisms present in the food, and/or a health hazard evaluation should all be considered in the compliance action taken.

Although RTE foods in Category 3 present a low priority for sampling and compliance action, on occasion these products may be tested, e.g., in compliance activity pursued by other countries or in routine monitoring performed by provincial/municipal health departments. Compliance action should be a Class II recall if GMPs are violated and/or *L. monocytogenes* counts are > 100 CFU/g.

Because of the potential for temperature abuse of some foods supporting growth of *L. monocytogenes* with a refrigerated shelf-life < 10 d, and some RTE frozen foods which upon thawing may support growth (Category 3 RTE foods), a finding of *L. monocytogenes* in these products may require a health hazard evaluation to determine the type of compliance action to be taken.

The following definitions have been proposed for interpretation of the policy. Ready-To-Eat (RTE) foods are foods not requiring any further preparation before consumption, except perhaps washing, thawing or moderate reheating. However, only the following kinds of RTE foods are subject to the provisions of the new *L. monocytogenes* Compliance Guide: foods which have been subjected to some form of processing in order to render them RTE (most often cooking), and which have been subjected to another form of process to extend their shelf-life, including but not restricted to the use of heat, chemicals, reduction of pH, reduction of water activity, or special packaging. These foods may be shelf-stable or may require refrigeration or freezing in order to assure their preservation until the time of consumption.

Unprocessed products such as dry goods (seeds, cereals, dry pasta, etc.), raw fruits and raw whole vegetables, any raw meat or raw fish or seafood are excluded from the *L. monocytogenes* guide. Processed products which require cooking and which are clearly labelled with adequate cooking instructions, are also excluded.

For purposes of this policy, a food is considered capable of supporting growth of *L. monocytogenes* if, in a naturally-

Table 5. Proposed compliance criteria for *L. monocytogenes* (Lm) in RTE foods, July 1993.

Category	Examples of RTE food types	Class hazard	Analytical test unit
1. Food causally linked to listeriosis <sup>1</sup>	Soft cheese, liver pâté, coleslaw mix with shelf-life > 10 d, jellied pork tongue	Class I Recall and consideration of Public Alert	5 x 10 g
2. All other foods supporting growth of <i>Lm</i> with refrigerated shelf-life of > 10 d <sup>1</sup>	Vacuum-packaged meats, modified atmosphere (MAP) sandwiches, refrigerated sauces	Class II Recall and possible consideration of Public Alert (this will happen when illness is associated with the product).	5 x 5 g
3. Foods supporting growth of <i>Lm</i> with refrigerated shelf-life of < 10 d and all foods not supporting growth <sup>2</sup>	Cooked seafood, packaged salads, ice cream, hard cheese, frozen foods, dry salami, salted fish	Class II Recall only if GMPs are violated and/or <i>Lm</i> counts are >100 CFU/g <sup>3</sup> . A health hazard evaluation may be required.	5 x 5 g

<sup>1</sup>If a manufacturer demonstrates that a particular product does not support growth of *L. monocytogenes*, then that particular product would be treated as a Category 3 food.

<sup>2</sup>Foods not supporting growth of *L. monocytogenes* include the following:

- (a) pH <5.5 and  $a_w$  <0.95
- (b) pH <5.0 even though  $a_w$  >0.95
- (c) pH >5.5 but  $a_w$  <0.92

<sup>3</sup>Enumeration to be done by direct plating onto LPM and Oxford agars.

contaminated lot of the food under consideration, *L. monocytogenes* can be detected by direct plating onto LPM and Oxford agars (7) after the food has been stored at 4°C until the end of its stated shelf-life; or if, in an inoculated batch representative of the food, *L. monocytogenes* increases in number by at least 1 log after it has been stored at 4°C until the end of its stated shelf-life, as determined by the direct plating method. Manufacturers are also encouraged to perform an identical challenge test at mild-abuse temperatures (7-10°C) to determine if there is an extra margin of safety. Challenge testing should be done in accordance with the guidelines of the Institute of Food Technologists (1) using an initial inoculum of 100 cells of *L. monocytogenes* per gram.

### OTHER ACTIVITIES

In support of the focus on plant post-process contamination and general adherence to GMPs, Agriculture and Agri-Food Canada has introduced the Food Safety Enhancement Program (FSEP), an approach to encourage the establishment of mutually agreeable HACCP-based systems in all federally registered agri-food processing establishments and shell egg grading stations. During the past two years, 22 pilot projects and 10 expert committee models have been undertaken to develop generic models for HACCP/FSEP. It is anticipated that HACCP programs will be integrated into all federally inspected meat processing plants over the next 3 years.

Agriculture and Agri-Food Canada has also implemented the Laboratory Accreditation Program to accredit laboratories which have demonstrated high standards of quality in the isolation and identification of *L. monocytogenes*, initially from meats, meat products and environmental samples. This program increases the national testing capacity for *L. monocytogenes* and identifies laboratories which could be contracted for regulatory analyses should the need arise. The process of accreditation follows the guidelines of the International Organization for Standardization (ISO) and involves: proficiency samples (panel of ten samples); on-site inspection by a Department microbiologist; approval of a quality assurance manual; and post-accreditation check sample testing and bi-annual on-site reinspections to ensure continued proficiency. The program began in 1991; as of September 30, 1993, 14 laboratories have been accredited and 10 are in the process of becoming accredited for *L. monocytogenes* testing.

Health Canada has continuously briefed the medical community, public health officials and the food industry on *L. monocytogenes* (8). Health Canada has informed the food industry that food manufacturing plants, food service and retail establishments must minimize food contamination through good hygienic practices and that the Canadian food industry should follow guidelines on sanitation in order to minimize all potential sources of food contamination. The Department will continue to provide information and guidance to all interested parties on the issue of *Listeria* contamination of foods.

In addition to the above, Health Canada is promulgating GMP regulations under the Food and Drugs Act which will

form the basis for future inspection activities. Furthermore, in cooperation with other food agencies, Health Canada is developing common standards which will be the norm for all government activity in the food inspection area.

### SUMMARY

By continually reviewing and improving GMPs, and conducting frequent HACCP-based inspections in RTE food manufacturing plants, Canadian food processors and regulators are striving to minimize the risk of foodborne illness. In addition, as we continually enhance our understanding of the biology of *L. monocytogenes*, the ability to draft a policy which protects the health of all Canadians, while at the same time being fair and equitable to Canadian food manufacturers and importers, will improve.

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# Determination of Non Actionable Positives Associated with Antibiotic Tests

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## INTRODUCTION

The FDA has completed its evaluation of antibiotic test kits for penicillin type or beta-lactam drugs and published its results in a memorandum for state regulatory and the dairy industry, (M-I-93-3), (1). M-I-93-3 notes the minimum detection level (giving 90% positives with 95% confidence) of the various antibiotic tests for 6 target beta-lactam drugs and the FDA "Safe Levels" for these drugs. All such detection levels are equal to or less than "Safe Levels".

Of great interest is the difference between a detection level and the "Safe Level" since this was supposed to be a measure of the false violatives or non actionable positives (NAPs) associated with a test. The greater the difference the more NAPs supposedly associated with a test. This translates into the more tankers rejected that should not be rejected.

Don't confuse NAPs with false positives which are the result of test error, i.e., identifying a negative as a positive. A NAP is a true positive that is due to a drug concentration less than FDA "Safe Level"/tolerance.

It is now recognized that some detection levels noted in M-I-93-3 may not truly be the minimum detection levels, (2), but more important, the differences between detection levels and safe levels may not in fact reflect the NAPs associated with a test (3).

The FDA now plans to publish a revision of M-I-93-3 that includes the dose-response data associated with the various test kits. It is the dose-response data plotted into curves, that allows the mathematical calculation of NAPs associated with an antibiotic test. Each NAP results in a positive for a tanker and all the ramifications associated with that situation.

The major value of this calculation is the comparison of various antibiotic tests to determine which has the least number of NAPs associated.

## ABOUT THE CALCULATION

If the distribution of various drug concentrations among tankers were known, it would then be possible to determine the NAPs expected in a given time with a particular test. This information is not known. However, over varying periods of time every drug concentration will be present in a number of tankers, for example in 100 tankers. The time it takes for this to occur will be less for lower concentrations. It will depend on the frequency of each drug used, how they are

used, and their withdrawal times. Over some period of time there will have been 100 tankers with each concentration appearing at the plant and tested. In essence, this is basing the calculation on a uniform distribution of concentration among tankers for the 6 target beta-lactam drugs ranging from zero to the drug "Safe Level", (Pen G, ceftiofur, cephalirin, cloxacillin, ampicillin, amoxicillin).

The dose-response data used in these calculations are published data for the test kits, (4), but the tests are not named.

## DOSE-RESPONSE CURVES AND CALCULATION OF NAPs AND NAPC

In Table 1 are presented dose-response data for pen G for 3 different tests A, B, C. The data plotted as dose-response curves are shown in Figures 1 and 2, where Figure 1 compares test A with test C and Figure 2 compares test B with test C.

Table 1. Dose-response Data for three Penicillin G tests, A, B, and C.

TEST A		TEST B		TEST C	
Conc. ppb	%pos	Conc. ppb	%pos	Conc. ppb	%pos
0	0	0	0	0	0
1	17	1	0	1	0
2	38	2	0	2	0
3	100	3	100	2.7	0
4	87	4	100	3.5	50
5	100	5	100	4	100
6	100	6	100	4.8	100
				6.0	100

The dose-response curve for the pen G test giving zero NAPs is shown in Figure 3 along with the dose-response for the test giving the maximum NAPs. The area under the dose-response curve represents a concentration. In Figure 3, fraction positive is noted on the "y" axis. A fraction positive of 1 multiplied by 5ppb on "x" axis gives an area that represents 5ppb. This is the concentration associated with the maximum NAPs or the NAP concentration, NAPC.

Reversing the procedure, dividing the area by the "Safe Level", the fraction positive associated with the test for the drug is found. In Figure 3, area 5ppb divided by "Safe Level"

Figure 1.

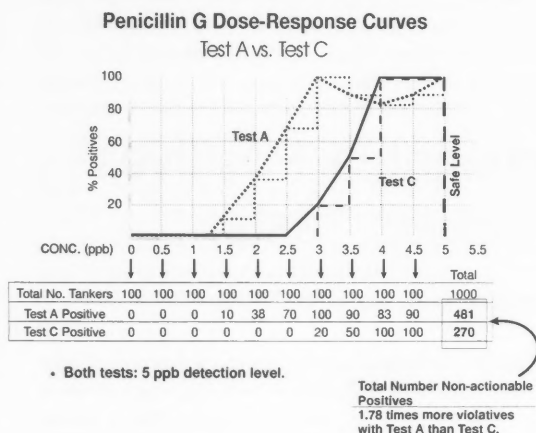


Figure 2.

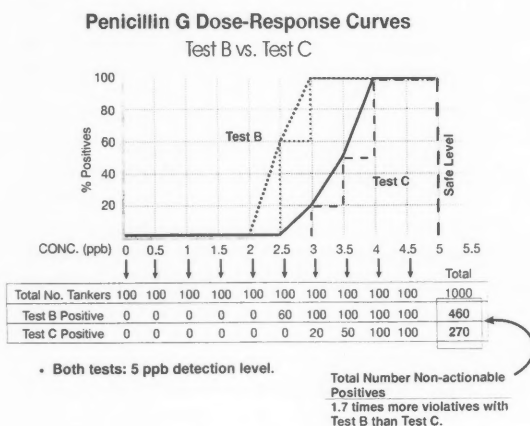
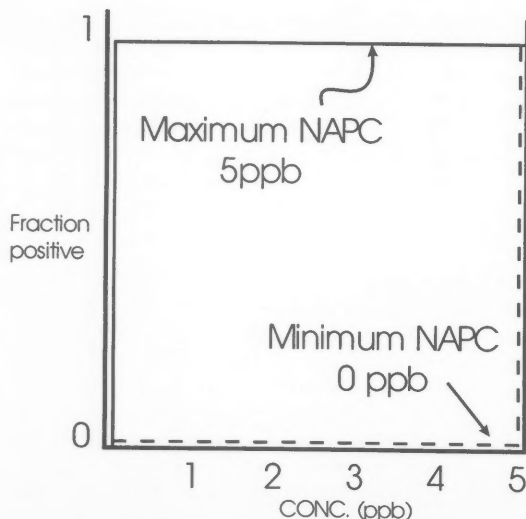


Figure 3. Dose-response curves for Maximum NAPC (non-actionable positive concentration) and Minimum NAPC.

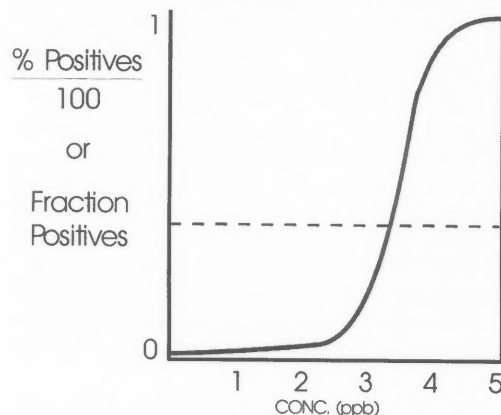


5ppb is  $1 \times 100 = 100\%$ . All tests for pen G will have NAPC between zero and 5ppb.

Although the data presented for dose-response curves are not ideal since there are only 6 replicates associated with each point, it is possible to make useful estimates. Some curves may show "dips" and "peaks" rather than a smooth curve and this is a symptom of erratic results. Since it is known that the shape of the dose-response curve must be sigmoid, (Figure 4), it is possible to statistically improve the plotted data by submitting it to a probit analysis. However, in this calculation take the actual curves realizing that "dips" and "peaks" do not occur with a large number of samples, and should be smoothed out to look like Figure 4.

In Figure 4, it is shown how area under curve divided by "Safe Level" concentration gives the fraction positive of NAPS associated with the test.

Figure 4. **EXAMPLE: Penicillin G**  
Area of rectangle equals area under curve



**COMPARISON OF NAPs ASSOCIATED WITH TESTS A, B, AND C**

Referring to Figure 1, for pen G assume 100 tankers eventually come to the plant containing concentrations between 0 and 5ppb and all are tested by tests A & C. Starting at zero and moving along the concentration, ("x" axis), the number of tankers positive for each concentration using a .5ppb interval is found. For test A this is 481, and test C 270 out of the 1000 tankers tested with each test.

Thus, test A has  $481/1000 \times 100 = 48.1\%$  NAPs  
and test C =  $270/1000 \times 100 = 27\%$ .

A smaller concentration interval, e.g., .2ppb would result in a more accurate determination.

Using the method of calculating NAPs from area under curve, (or from the NAPC), the squares under each curve are counted. For example, there are 15 squares under curve C and 25 squares under curve A. Converting % positive to fraction positive by dividing by 100, each square in Figure 1 is equivalent to  $.2 \times .5 = .1$ ppb. Therefore, the NAPC associated with test A is  $25 \times .1 = 2.5$ ppb and with test C  $15 \times .1 = 1.5$ ppb. Calculating the fraction positive NAPs by



dividing NAPC with "Safe Level"; for test A,  $2.5/5 = .5$  or 50% and for test C,  $1.5/5 = .3$  or 30%.

In comparison test A has  $48.1/27 = 1.78$  or 78% more NAPs than test C if calculated from number of tankers and  $50/30 = 1.66$  or 66% if calculated from NAPC.

If calculated from a probit analysis with a mathematical integration, test A has 92% more NAPs than test C. The probit analysis statistically smoothed out the "dip" in the test A curve giving a greater area than determined with the "dip". This is the most accurate determination.

Referring to Figure 2 and similarly comparing test B with test C, test B has 70% more NAPs than test C counting tankers.

#### DIFFERENCES BETWEEN DETECTION LEVELS AND SAFE LEVELS DO NOT CORRELATE WITH NAPs ASSOCIATED WITH TESTS

In M-I-93-3, these 3 tests have essentially the same detection levels noted for pen. G. This proves detection level-Safe Level difference does not determine expected NAPs.

#### DETERMINING THE TEST WITH LEAST NAPs

To determine the test with the smallest number of NAPs this calculation should be carried out for each of the 6 target beta-lactam drugs.

For a given test, the NAPs for each drug are added and compared with other similar tests. The test with the smallest number will have the least number of non actionable positives associated with it, e.g., see equation (1).

(1) Total non actionable positives associated with test = (NAPs) pen G + (NAPs) clox + (NAPs) ceft + (NAPs) amox + (NAPs) ampi + (NAPs) cep

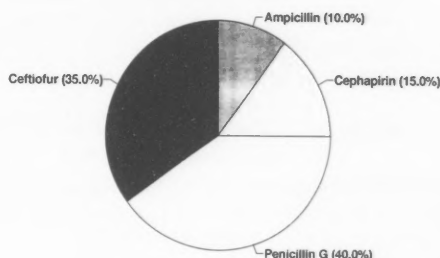
Some tests don't detect all six target drugs. Such tests will have false negatives for these undetected drugs. Thus, be sure to compare tests that detect the same drugs.

#### THE DRUG INCIDENCE FACTOR

The frequency of use of a drug also influences equation (1). For example, if pen G is more commonly used than cloxacillin the (NAPs) pen G could be weighted with an incidence factor so that the total NAPs are influenced more by pen G than by cloxacillin. With the HPLC-Receptorgram our identification lab has identified 20 positive beta-lactams sent to it in 1993 with distribution as shown in Figure 5. Pen G was found 40% and ceftiofur 35% as the two major beta-lactam drugs. If drug incidence is available, the NAPs for each drug in equation (1) could be multiplied by its drug incidence to give a more refined total. However, the data in Figure 5 has not been substantiated as representative. In view of this, the incidence of each drug may be considered equal and equation (1) used as is.

Figure 5.

#### HPLC-Receptorgram for Beta-Lactams 1993 - 20 samples

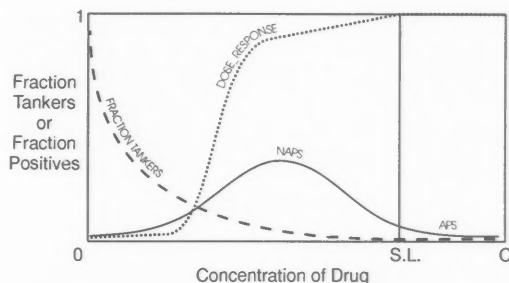


#### A UNIFIED SOLUTION FOR CALCULATING EXPECTED POSITIVES, (Actionable and Non-actionable) FOR VARIOUS DRUGS WITH VARIOUS TESTS

It was noted previously that to determine the actual number of NAPs or APs (actionable positives) expected at a plant, the drug concentration distributed among tankers must be known. In Figure 6, a distribution curve is shown assuming that more tankers have lower concentrations (see fraction tankers vs. concentration).

Figure 6.

#### A Unified Solution for Calculating Expected Positives, (Actionable and Non-actionable) for Various Drugs with Various Tests



By multiplying the test dose-response curve by the fraction tankers-concentration curve the product is the NAPs-APs curve.

The area under this curve is the total number of positives. The Safe Level (S.L.) is a concentration selected by FDA that divides total positives into NAPs and APs.

The mathematical notation indicating what has been described is shown in equations 2 and 3. In equation 4 is shown the effect of not using a tanker-concentration curve. This in effect simply assumes a uniform concentration distribution among tankers. In comparing dose-response

curves and NAPs with different tests, but for the same drug, the constant K representing the uniform distribution cancels out.

Fraction positives = fraction positive for test, (dose-response)  
or  
= fraction positive tankers NAPs or APS. (NAPS are non-actionable positives, APS are actionable positives)

C = any drug concentration  
S.L. = Safe Level concentration

Fraction tankers = fraction of tankers having various concentrations of a drug

Fraction tankers as a function of concentration =  $F^I(C)$

Test fraction positives for drug as a function of concentration =  $F^{II}(C)$

(dose-response)

$$\begin{aligned} \text{Equations for fraction positive tankers associated with the test} &= \int_0^{S.L.} \frac{F^I(C) \cdot F^{II}(C) dc}{S.L.} \quad (2) \text{ Non-actionable} \\ + \\ &= \int_{S.L.}^C \frac{F^I(C) \cdot F^{II}(C) dc}{C-S.L.} \quad (3) \text{ Actionable} \end{aligned}$$

Without knowing  $F^I(C)$ , it is assumed that drugs are uniformly distributed among tankers, (i.e. a straight line in place of curve). This means  $F^I(C) = \text{constant}$  (e.g. K) and

$$\text{fraction NAPs} = K \int_0^{S.L.} \frac{F^{II}(C) dc}{S.L.} \quad (4)$$

### CONCLUSION

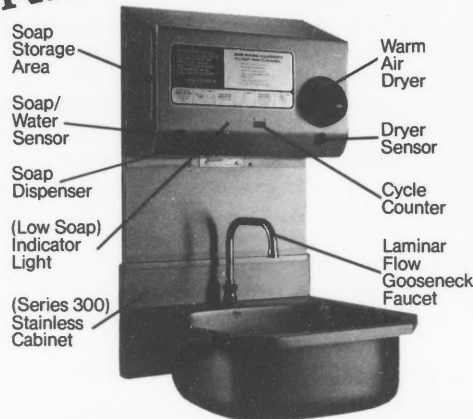
Differences between FDA "Safe Levels" and detection levels do not measure number of NAPs associated with antibiotic tests. The area under the dose-response curve for the test is related to the NAPs. By adding the NAPs associated with each drug, the test giving the smallest number will be the one with the least NAPs.

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# A Field Study Evaluating the Effectiveness of Different Hand Soaps and Sanitizers

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## ABSTRACT

Plain hand soaps, antimicrobial hand soaps, E2 rated hand soaps, and instant hand sanitizers were evaluated in a foodservice setting to determine their effectiveness in reducing bacteria on hands. The results showed that the three types of hand soaps were effective using a twenty second handwash procedure. The E2 rated hand soaps were significantly (90% confidence) more effective in reducing bacterial numbers than the plain or antimicrobial hand soaps. The instant hand sanitizers resulted in a significant increase in bacterial numbers on hands and may, therefore, be counterproductive for use in the foodservice industry.

## INTRODUCTION

The importance of proper handwashing by employees in a foodservice establishment cannot be underestimated. Pathogenic bacteria can be found on the hands after using the restroom, handling raw foods, or touching soiled surfaces. Handwashing is vital to prevent the transfer of these pathogenic bacteria to cooked food items that will be served to the dining guest.

The microflora of the skin is generally grouped into two categories: resident and transient microorganisms. Resident bacteria have been defined as organisms representing particular species that are recovered on more than 75% of 25 sampling days over a seven month period; whereas transient bacteria are those organisms that appear less than 25% of the time during this type of sampling (6). The predominant resident flora of the hands are coagulase negative staphylococci and coryneform bacteria (90%) (4). These organisms are usually buried deep within the pores of the skin where they are protected by fatty secretions of the sebaceous glands and are not easily removed during handwashing (6). The resident group of microflora contains only one commonly accepted foodborne pathogen, *Staphylococcus aureus*. *S. aureus* is believed to be carried on the skin of approximately 35% of normal adults (6). The transient bacterial group represents a major concern for the foodservice industry because these organisms are loosely attached to the skin surface and can easily cross contaminate food products if the

employee does not wash hands adequately. Although transient organisms can be any microorganism that the restaurant worker comes in contact with, the major bacteria comprising this group are the gram-negative organisms, including the enteric organisms such as *Escherichia coli* and *Salmonella* species. Low or moderate levels of *E. coli* and *Salmonella* or other enteric organisms usually result from contact with raw food products of animal origin, while contamination with high numbers usually signifies improper handwashing after using the restroom. Since transient organisms are picked up from the restaurant worker's environment and are only loosely attached to the outer epidermal layer, they can be readily removed during handwashing.

An effective handwashing program should kill a broad spectrum of microorganisms, including both transient and resident microorganisms, and be non-irritating to the skin. Washing the hands with plain hand soap and water removes the transient bacteria, while resident flora are reported to be controlled by the use of antiseptic or sanitizing agents in or after the application of hand soap (10). There are presently several antimicrobial hand soaps and instant hand sanitizers available on the market. Table 1 summarizes the USDA classification of these various products.

Currently antimicrobial hand soaps and sanitizers are generally tested for their available chlorine germicidal equivalent concentration with respect to *Staphylococcus aureus* and *Salmonella typhi* following the A.O.A.C. standard method (1). The E2 and E3 compounds are approved based on their equivalency to 50 parts per million chlorine against these organisms. This test is performed *in vitro* and results may not directly relate to the applied or actual use of these products in a foodservice establishment. Furthermore, the chlorine equivalency test, as defined in the A.O.A.C. procedure, should be restricted to nonporous surfaces, which would preclude its use as a meaningful test for hand (skin) disinfecting agents. Currently, there are no official methods comparable to the A.O.A.C. use-dilution method for sanitizer efficacy on surfaces applicable to hands (12).

This study investigated and compared the effectiveness of several plain hand soaps, antimicrobial hand soaps, E2 hand soaps, and instant hand sanitizers that are available on the market by observing the change in bacterial numbers that

**Table 1. U.S.D.A. Classification of Hand Soaps and Sanitizers for Use in Meat Processing Plants\***

**E1 Compounds:** Handwashing compounds for use in all departments

The compounds must be dispensed from adequate dispensers located a sufficient distance from processing lines to prevent accidental product contamination.

—After the use of the compounds, the hands must be thoroughly rinsed with potable water.

—Under conditions of use, there can be no odor or fragrance left on the hands.

**E2 Compounds:** Handwashing and Sanitizing Compounds

— The compounds must be dispensed from adequate dispensers located a sufficient distance from processing lines to prevent accidental product contamination.

— The hands need not be washed prior to the use of the compounds.

— After the use of the compounds, the hands must be thoroughly rinsed with potable water.

— The compounds must always be used at dilutions and according to applicable directions provided on the label.

— The compounds have been accepted on the basis of their equivalency to 50 parts per million chlorine.

**E3 Compounds:** Hand Sanitizing Compounds (Hand dips)

— The compounds must be dispensed from adequate dispensers located a sufficient distance from processing lines to prevent accidental product contamination.

— The hands must be washed and thoroughly rinsed prior to sanitizing with the compound.

— The compound may be injected directly into the wash and rinse water.

— The hands need not be rinsed after the use of the compound.

— The compounds have been accepted on the basis of their equivalency to 50 parts per million chlorine.

\* Gel-based hand sanitizers are limited to use by employees leaving the plant unless they meet specific guidelines ensuring that residues remaining on the hands will not be inappropriate for food handling. Only if such guidelines are met can these hand sanitizers be classified as E3.

**E4 Compounds:** Hand Creams, Lotions and Cleaners (including gel-based hand sanitizers not meeting E3 requirements).

— The use of such compounds is limited to toilets and dressing rooms. Employees who handle edible products may use the compounds only when leaving the plant.

\* Hand creams and lotions not having any antibacterial ingredients should not be allowed in foodservice establishments. The use of cosmetic lotions and creams raises the humidity of the skin, resulting in an increase in the microflora. Furthermore, the use of non-antimicrobial hand lotions prior to using an antimicrobial hand soap could prevent the total effectiveness of the hand soap (11).

\*E classifications of hand soaps and sanitizing compounds apply only to U.S.D.A approved meat processing plants. Currently there is no classification system for handwashing products relating to foodservice establishments.

result from the application of each agent to the hands. The three most commonly used methods for assaying the bacterial flora of hands are the contact or impression plate (Rodac plate), the swab method and the glove-juice technique (9). The contact plate technique is the method of choice for identifying and surveying bacteria on the fingertips (4). The fingertip region of the hand is generally considered the most important area of the hand with regard to the transmission of bacteria during food preparation (12). The contact RODAC

plate procedure was therefore chosen to enumerate bacterial flora in this study.

## MATERIALS AND METHODS

**Table 2. Characteristics of the Hand Soaps and Sanitizers Examined in this Study.**

Product	USDA Classification	Active Ingredient	pH	Manufacturer
Clean & Smooth	E1	---	5.9	Ecolab
Hand Magic	E1	---	7.5-8.0	Diversey
Antibacterial Clean & Smooth		Triclosan	5.9	Ecolab
Purell Antibacterial		Chloroxylenol	9.43	Gojo
Bac-Down	E2	Low level iodophor	6.0-6.5	Du Bois (Diversey)
Derma Klenz E-2	E2	Low level iodophor	4.4	Ecolab (Klenzade)
Fresh & Clean	E2	Nonylphenoxy poly ethanol	7.0	Du Bois (Diversey)
Handex HC-3	E2	Para-chloro-meta-sylenol	5.9	Diversey
Handex HC-5	E4	Ethyl alcohol	6.0	Diversey
Purell Instant Hand Sanitizer	E4	Ethyl alcohol	8.3	Gojo
Sanigizer	E4	Ethyl alcohol	7.4	Ecolab

Rodac plates were prepared with Difco D/E Neutralizing Agar, adjusted to a final pH of 7.6 +/- 0.2. D/E Neutralizing Agar contains a compound that neutralizes sanitizers, thereby eliminating carryover of excess sanitizer from the hands onto the growth medium which could result in a delayed bactericidal effect. This medium allowed for an accurate count of bacterial organisms on the hands at the time of sampling.

Twenty people were utilized for the testing of each product. The participants were representative of workers in the food industry and included back of the house production workers, line workers, servers, bussers and dishwashers. A small percentage, approximately 5 percent, of non-food handlers were also included to determine the effects of handwashing products on hands having a low initial bacterial load.

Each participant had his/her hands sampled by touching the Rodac contact plate against the fingertip/forefinger region on the palm side of the hands. Right hands were tested separately from left hands. Each participant was asked their preferred handedness as well as the food products which they had handled prior to being tested.

Different testing procedures were needed for each category of hand cleansing product to account for the different intended uses of each product as well as the prescribed instructions for use of that product. The following protocol was followed:

### I. Study Controls

Several controls were incorporated into this study to ensure that bacterial levels on the hands of participants after washing with the various products were not affected by the material used in the study. Microbiological analyses were performed on the water used for rinsing hands, the paper towels used for drying hands, and on each hand soap and sanitizing agent to ensure that bacteria were not introduced onto the participants' hands from these sources.

### II. Plain Hand Soaps (Hand Magic, Clean & Smooth)

These products are plain hand soaps which contain no antimicrobial or disinfecting agents. It has been suggested that an initial handwashing may draw bacteria up from underlying layers of the skin, resulting in increased bacterial numbers on the surface of the hands. For this reason a two step successive handwashing program has been suggested by some researchers. In this study the effect that these soaps had on bacterial numbers was compared after an initial application of soap and after a second application.

#### Procedure:

1. The fingertip region of each hand was touched to the surface of separate Rodac plates.
2. Three ml of the cleaning agent to be tested was applied to the hands using a sterile pipet. The hands were rubbed together for a period of 20 seconds, followed by a 10 second rinse under warm potable water. Hands were then dried with a paper towel.
3. Hands were tested after the application of the hand soap by touching each fingertip region to the surface of a separate Rodac plate.
4. Steps 2 and 3 were repeated to test the effects of a second, successive handwashing step.

### III. Antimicrobial and E2 Hand Soaps (Antibacterial Clean & Smooth, Purell Antibacterial Lotion Soap, Handex HC-3, Derma Kleenz E-2, Bac-Down, Fresh & Clean)

These are one step products that have an antimicrobial agent or sanitizing agent incorporated into the hand soap.

#### Procedure:

1. The fingertip region of each hand was touched to the surface of separate Rodac plates.
2. Three ml of the cleaning agent to be tested was applied to the hands using a sterile pipet. The hands were rubbed together for a period of 20 seconds, followed by a 10 second rinse with warm potable water. Hands were then dried with a paper towel.
3. Hands were tested after the application of the combined product by touching each fingertip region to the surface of a separate Rodac plate.

### IV. E4 Hand Sanitizer Products (Sanitizer, Handex HC-5, and Purell Instant Hand Sanitizer)

These are sanitizing agents that are applied to thoroughly cleaned and dried hands and require no rinsing.

#### Procedure:

1. The fingertip region of each hand was touched to the surface of separate Rodac plates.

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2. To initially clean the hands, three ml of one of the plain hand soaps was applied to the hands using a sterile pipet. (The corresponding manufacturer of soap to the sanitizer to be tested was used. For example, Ecolab hand soap was used to wash the participants' hands before the application of Ecolab Sanitizer.) Hands were rubbed together for a period of 20 seconds, followed by a 10 second rinse with warm potable water. Hands were then dried with a paper towel.
3. Hands were tested after the application of the soap by touching each fingertip region to the surface of a separate Rodac plate.
4. Two squirts of instant hand sanitizer from the supplied automatic dispenser were applied to the participants' hands. The hands were lightly rubbed together to distribute the sanitizer and to allow for air drying.
5. Hands were tested after the application of the instant hand sanitizer by touching each fingertip region to the surface of a separate Rodac plate.  
All plates were incubated at 35°C for 24 hours. Plates were enumerated and the predominant flora before and after handwashing was compared.

### V. Statistical Analysis of Data

Right hand and left hand data were statistically analyzed using the non-parametric Paired-Sample Sign Test to determine whether or not a significant difference in numbers occurred between the right and left hands or the dominant and non-dominant hands of the participants. The absence of a significant difference between right and left hand and

dominant and non-dominant hand values allowed for the averaging of right and left hand data for each participant. These averages were then used for further analysis.

Further statistical analysis of the raw data was conducted using the SAS/STAT program, version 5, SAS Institute. In brief, the raw data was calculated as the log<sub>10</sub> ratios of the number of microorganisms released from hands after washing to the number released before washing for each pair of numbers (log drop). The mean log drop was calculated for each handwash treatment and was used to calculate the percent reduction. A one-way Analysis of Variance was computed and used to make comparisons of the groups of treatments. A confidence level of 90 percent ( $p < 0.1$ ) was chosen for evaluation of the results.

## RESULTS

**Table 3. Average Percent Reductions of the Various Categories of Handwashing Agents**

Handwashing Agents	Percent Reductions (%)
Plain Hand Soaps	41.7
Antibacterial Hand Soaps	48.2
E2 Hand Soaps	59.1
Instant Hand Sanitizers	-260.8%*

\*The number of microorganisms on the hands actually increased after the use of instant hand sanitizers.

**Table 4. Percent Reductions of Individual Handwashing Agents**

Product	Type of Handwashing Agent	Percent Reduction (%)
Clean & Smooth	Plain Hand Soap	43.9
Hand Magic	Plain Hand Soap	39.5
Antibacterial Clean & Smooth	Antibacterial Hand Soap	52.4
Purell Antibacterial Lotion Soap	Antibacterial Hand Soap	43.8
Bac-Down	E2 Hand Soap	63.2
Derma Klenz E-2	E2 Hand Soap	72.1
Fresh & Clean	E2 Hand Soap	53.4
Handex HC-3	E2 Hand Soap	41.4
Handex HC-5	Instant Hand Sanitizer	-298.5%*
Purell Instant Sanitizer	Instant Hand Sanitizer	-156.7%*
Sanigizer	Instant Hand Sanitizer	-327.3%*

\*The number of microorganisms on the hands actually increased after the use of these instant hand sanitizers.

## DISCUSSION

It should be noted that this study was a field study which utilized different people handling different food products within the foodservice industry. The initial bacterial loads on participants' hands varied with each different handwashing agent tested. With this variable in mind it appears prudent to emphasize the overall effectiveness of each category of handwashing agents over the ratings of each individual product. In the discussion that follows the effectiveness of each category (plain hand soaps, antimicrobial hand soaps, E2 hand soaps and instant hand sanitizers) will be discussed

separately and a comparison among these classes of handwashing agents will be made.

### I. Study Controls

All plain hand soaps, antibacterial hand soaps, E2 hand soaps and instant hand sanitizers, as well as all samples of water used for hand rinsing had bacterial counts  $< 1$  per ml. The paper towels used for hand drying had bacterial counts  $< 1$  per 25 cm<sub>2</sub> area. These controls ensured that bacterial counts on the hands were not influenced by these sources.

### II. Plain Hand Soaps (Clean & Smooth, Hand Magic)

Washing with plain hand soap should result in a significant decrease in the transient flora of the skin. In this study Hand Magic and Clean & Smooth, after an initial application, resulted in a significant reduction in bacterial populations of 39.5% and 43.9%, respectively. No significant difference between the effectiveness of the two plain hand soaps was seen. No significant difference was seen between the first and second wash for Hand Magic, however a significant difference did occur between the first and second wash for Clean & Smooth. Due to the unlikelihood of foodservice employees performing a second, successive handwash, all comparisons to the other soaps and sanitizers examined in this study were made using the single wash data.

The transient organisms most frequently observed on hands before washing included *Bacillus* species, gram-negative enteric rods, *Pseudomonas*, yeasts (which can sometimes be considered normal flora), filamentous bacteria and molds. The predominant organisms after washing were resident gram-positive, catalase positive cocci. For some of the participants bacterial numbers increased after handwashing. However, in all of these instances the initial bacterial levels on the hands of these participants were extremely low. The organisms enumerated before and after handwashing in these cases were resident gram-positive cocci flora. These results are supported in the literature. Elaine Larson from Georgetown University, well known for her work on handwashing and handwashing agents, has found that in general, the number of organisms detectable on the hands decreases as the frequency of handwashing increases (2). However, with very frequent handwashing bacterial counts on the hands can actually increase (3,8). This phenomenon most likely results from the removal of some of the protective skin lipid layer during washing (7). The exact extent to which it is desirable for soaps to remove surface fats from the skin is not known. It must be emphasized, however, that an increase in bacterial numbers was only observed when the initial bacterial load was extremely low. This scenario would be unusual for foodservice employees who are handling various food products.

### III. Antibacterial Hand Soaps (Antibacterial Clean & Smooth, Purell Antibacterial Lotion Soap)

These products should effectively reduce both transient and resident flora, and in this study a significant reduction in bacterial numbers occurred with both antibacterial hand soaps tested. Antibacterial Clean & Smooth and Purell Antibacterial Lotion Soap resulted in a reduction of total

flora of 52.4% and 43.8%, respectively. No significant difference, with respect to reduction of bacterial numbers, was found between these two antibacterial hand soaps.

While the antibacterial hand soaps as a group showed an overall percent reduction of bacteria of 48.2%, as compared to the plain hand soaps which had a 41.7% reduction, this difference was not found to be statistically significant. Transient organisms were readily washed away as in the case of the plain hand soaps, with the majority of remaining organisms being gram-positive, catalase positive cocci (resident organisms).

#### IV. E2 Hand Soaps (Bac-Down, Derma Klenz E-2, Fresh & Clean, and Handex HC-3)

These products should effectively reduce both transient and resident flora, and in this study a significant reduction in bacterial numbers occurred with all E2 hand soaps tested. The percent reductions obtained with each E2 hand product were as follows: Bac-Down 63.2%, Derma Klenz E-2 72.1%, Fresh & Clean 53.4%, and Handex HC-3 41.4%. The only significant difference within the group of E2 hand soaps occurred between Derma Klenz E-2 and Handex HC-3, with Derma Klenz E-2 resulting in a significantly greater reduction in bacterial levels than Handex HC-3. It should be noted that although the Derma Klenz E-2 hand soap resulted in a greater percent reduction in bacterial numbers than the other handwashing agents tested in this study, the twenty participants used to test Derma Klenz E-2 also had the highest average pre-wash bacterial load of all groups tested.

The percent bacterial reductions for the E2 hand soaps as a group was 59.1%, as compared to 48.2% for the antimicrobial hand soaps and 41.7% for the plain hand soaps. The E2 hand soaps as a group resulted in a statistically significant reduction in bacterial numbers than either the plain or antibacterial hand soaps.

#### V. Instant Hand Sanitizers (Handex HC-5, Purell Instant Hand Sanitizer, and Sanigizer)

These products should reduce bacterial levels on contact when applied to the surface of clean hands. In all cases in this study, however, the application of instant hand sanitizers resulted in a significant increase in bacterial numbers on the surface of the hands. The percent increases for the products tested in this study were as follows: Handex HC-5 298.5%, Purell Instant Hand Sanitizer 156.7%, and Sanigizer 327.3%.

These results may seem confusing at a first glance since each of these products offers literature attesting to their efficacy. However, the way in which these tests were performed needs to be closely scrutinized. For example, Sanigizer was evaluated for antibacterial activity by a 15-Second Kill Test and was found to be roughly 99.9% effective in killing a wide range of organisms including *S. aureus*, *Salmonella choleraesuis*, *E. coli*, *Bacillus cereus* and *Listeria monocytogenes*. However, this test is performed *in vitro* and does not take into account the physiological complexity of the human skin. Purell Instant Hand Sanitizer has been shown to be equivalent to 200 ppm chlorine by the A.O.A.C. Available Chlorine Germicidal Concentration Test. As stated previously this chlorine equivalency test is applicable to nonporous surfaces. The human skin is composed

of multiple layers with bacteria attached to the pores of each layer. Alcohol, the common active ingredient in these instant hand sanitizer products, is a powerful drying agent. Therefore, even if the alcohol is effective in killing the organisms on the skin surface, it appears to simultaneously dry the skin and may pull the bacteria residing in the various skin layers to the surface. Since no rinsing occurs after the application of these instant hand sanitizers, there is no mechanical washing away of the bacteria that has been drawn to the skin surface. The end result is an increase in resident bacterial numbers on the surface of the hands. If the person using this agent naturally harbors *S. aureus* as part of their natural skin flora, the use of an instant hand sanitizer may be counter-productive.

The results of the E2 hand products in this study support the necessity of incorporating a soaping agent to aid in mechanical removal of organisms from the surface of the hands. The active ingredients in the E2 hand soaps, like the instant hand sanitizers, probably act to draw up resident flora from beneath the skin surface. In the case of the E2 hand soaps however, the soap base and the mechanical action used in the application and rinsing of the E2 hand soap result in an overall decrease in resident flora.

The medical industry's standard for hand surgical scrubbing further testifies to the necessity of incorporating sanitizing ingredients into a detergent base and to the importance of mechanical removal of skin flora. Removing resident bacteria, as well as transient bacteria, is vital for health care personnel since nonpathogenic bacteria may become opportunistic pathogens when introduced into open wounds or immunocompromised individuals. There are various surgical scrubs available that have different active ingredients such as alcohols, iodophors and chlorhexidine gluconate. These scrubs, however, all contain a detergent base and each is used in a standardized five minute scrub regimen (5). Instant hand sanitizing agents are not normally used in the medical industry.

It was proposed during the course of this study that the use of an E2 hand soap followed by an instant hand sanitizer would be valuable in decreasing total bacterial flora on hands. To test this theory, a smaller scale study was performed in which five participants' hands were tested before washing with Derma Klenz E-2, after washing with Derma Klenz E-2, and after the application of Sanigizer. In each case bacterial numbers decreased after washing with Derma Klenz E-2 but increased after the application of the instant hand sanitizer. Again, the flora which was enumerated after the application of hand sanitizer was representative of gram-positive, catalase positive, resident skin flora.

It is possible that the frequent, continual use of instant hand sanitizers may eventually have an overall effect of sustaining low bacterial populations on the surface of hands. However, such frequent use may impair the normal integrity of the skin causing cracking and chapping, thus providing increased surface area for the harboring of bacteria (4). Further study would be needed to address these questions. It must also be emphasized that casual use of these instant hand sanitizer products can lead to increased residential flora on the surface of hands, possibly including *S. aureus*. Considering the possible negative effects of both frequent

use of these products on skin integrity and sporadic use of these products on increased skin flora, instant hand sanitizers do not seem appropriate for the foodservice setting. Furthermore, most gel-based instant hand sanitizers do not meet the specific U.S.D.A. guidelines for E3 handwashing products. Instead these instant hand sanitizers are generally classified by U.S.D.A. as E4 products because residues, which may remain on the hands after use, make these products inappropriate for food handling. An E4 designation means that employees who handle edible food in meat processing plants may use these instant hand sanitizers only when leaving the plant. While this regulation is enforced only in U.S.D.A. approved meat processing facilities, this restriction seems applicable to all foodhandlers.

### CONCLUSION

This study has served to underscore the importance of proper handwashing in a foodservice establishment. A twenty second handwash using plain hand soaps resulted in a significant decrease in bacteria on the surface of restaurant workers' hands. Furthermore, both plain hand soaps evaluated in this study effectively reduced transient organisms on the surface of hands. Although slight increases in percent reductions occurred with the antimicrobial hand soaps, as compared to the plain hand soaps, these differences were not found to be statistically significant. A significant increase in the reduction of bacterial numbers occurred with the E2 hand soaps as compared to the plain hand soaps and the antibacterial hand soaps. In order to further improve the effective-

ness of handwashing in foodservice establishments, the use of an E2 hand soap should be considered. The instant hand sanitizers evaluated in this study resulted in increased residential flora on the surface of hands and their use in a foodservice establishment appears ineffective.

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Amherst, MA 01003

*Campylobacter jejuni* has emerged through the 80's as a very common and important cause of diarrheal illness in humans. Besides being foodborne, transmission patterns include contact with pets and domestic and wild animals, including birds (wide distribution in animal reservoirs), person to person spread, and contaminated water.

*C. jejuni* is a small, non-sporeforming bacterium, appearing as a curved or spiral rod. The temperature range for growth is reported as 86-113°F (30-45°C), with the optimum being 107.6-109.4°F (42-43°C). It is easily destroyed by heat. The organism is not likely to grow in food items that remain edible because it (a) will not grow below 86°F (30°C), (b) requires low oxygen concentrations, 5-10%, for growth (microaerophilic), (c) grows very slowly even under optimal conditions, doubling in about one hour, and, (d) is not a good competitor with other microbes in a food. It is sensitive to environmental influences, including being very fragile to drying, acid conditions, disinfectants, normal atmospheric oxygen, and heat.

Onset of illness is from 3 to 5 days (range, 1-10) after ingestion of contaminated food. It is an acute enteritis and symptoms commonly include profuse diarrhea (sometimes bloody), abdominal pain (intensity and duration can be somewhat severe), headache, malaise, and fever; it is not uncommon for a person to have eight or more bowel movements in the first 24 hours. These symptoms are similar to those caused by other enteric organisms, especially *Salmonella* and *Shigella*. Usually the illness is self-limited (5-8 days) and antibiotic treatment is seldom required. A temporary carrier state may last for several weeks and does not seem to be of epidemiological importance. Many infections are asymptomatic.

Although *C. jejuni* is not likely to grow or survive well in foods, foods of animal origin may be contaminated initially with large numbers of organisms through fecal contamination. But studies suggest that only around 500 cells may need to be ingested to produce illness; this is a small number when compared to other foodborne pathogens.

*C. jejuni* has been associated with food outbreaks in which undercooked chicken, raw hamburger, raw clams, and raw milk have been implicated as vehicles. Fecal matter

from apparently healthy meat animals seems to be the major source of the bacteria contaminating foods. Studies have shown that as many as 30-100% of poultry, 40-60% of cattle, and 60-80% of swine carry the pathogen in their intestinal tracts. The cross-contamination of "innocent" foods, such as salads and cake, by dirty food-contact surfaces, including cutting boards, and hands may be the most frequent route of transmission. Food outbreaks are probably seldom reported.

Since a wide range of animals harbor *C. jejuni*, transmission of infection may be direct, animal to human contact (also person to person contact), or indirect (fecal-oral), following consumption of contaminated foods (milk) or water. A vegetable salad, contaminated by hands of an infected worker, was implicated in an outbreak in Connecticut in the 1980's.

Preventive measures would include:

- Thoroughly cooking all food items derived from animal sources, particularly poultry;
- Using a metal-stem thermometer to check temperatures;
- Handling foods in a sanitary manner by avoiding cross-contamination of cooked or ready-to-eat foods with raw foods and the food-contact surfaces, equipment, and utensils used for their preparation;
- Minimizing direct handling of poultry and other raw animal products;
- Washing hands and fingertips effectively after touching raw foods;
- Using only pasteurized dairy products.

The Massachusetts Department of Public Health has specified restrictions on food workers for campylobacteriosis under isolation and quarantine procedures (105 CMR 300.000).

A FINAL PRECAUTION: Since transmission is by the fecal-oral route, proper (and frequent) handwashing and hygienic practices are imperative and need to be stressed by management.

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*Part six of the Foodborne Illness Series will be published in the April 1994 issue of Dairy, Food and Environmental Sanitation.*

## 1993 FDA Food Code

The Food and Drug Administration has published the 1993 edition of the *Food Code*, a reference that guides retail outlets such as restaurants and grocery stores and institutions such as nursing homes on how to prepare food to prevent foodborne illness.

Provisions of the new *Food Code* are compatible with the Hazard Analysis Critical Control Point (HACCP) concept and terminology. HACCP is a system for ensuring food safety that involves identifying and monitoring the critical points in food preparation where the risks of foodborne hazards (microbial, chemical and physical) are greatest. FDA is working to make HACCP the basis for its food safety regulations.

Local, state and federal regulators use the FDA *Food Code* as a model to help develop or update their own food safety rules and to be consistent with national food regulatory policy. Also, many of the over 1 million retail food establishments apply *Food Code* provisions to their own operations. Although the *Food Code* is neither federal law nor federal regulation and does not preempt state or local laws, authority to provide such guidance is granted by federal law.

The new code updates and combines into a single document three former editions that separately covered food service establishments (such as restaurants), food vendors, and food stores. Previous editions of the code were 1982 for food stores, 1978 for food vendors, and 1976 for food service.

Prevention of foodborne illness, the primary focus of the new *Food Code*, is emphasized in several modifications and new provisions. These include:

- detailed charts that give specific guidance for time, temperature and humidity for cooking meat and other raw foods derived from animals. For example, ground meat must be cooked to an internal temperature of 155 degrees Fahrenheit (68 degrees Celsius) for 15 seconds to be safe. Cold holding temperatures are 41 F (5 C) or lower.
  - recommendations to retail managers on how to ensure food service workers' health and hygiene practices (including restricting infected employees), how to clean and sanitize food utensils, and how to maintain equipment and facilities. In order to comply with the *Food Code*, retail management will have to be able to demonstrate knowledge of foodborne illness prevention as it relates to their own food operations.
- Also new to the 1993 *Food Code* are provisions for:
- setting time limits for holding cooked foods safely outside of controlled temperatures
  - allowing the temperature of frozen foods to be raised, short of thawing, before cooking, which is sometimes desirable for improving the texture of cooked foods
  - using food additives safely

- marking the date of preparation on all potentially hazardous refrigerated ready-to-eat foods that are prepared and held for more than 24 hours in a food establishment
- preparing wild game, exotic animal species, and wild mushrooms
- ensuring honest presentation of foods to consumers
- advising consumers that certain foods should be ordered and eaten fully cooked in order to ensure their safety.

The new *Food Code* also has expanded provisions for the safety of molluscan shellfish, such as oysters, clams and mussels.

Seven reference sections have been added to the new *Food Code* to help regulators apply the code's provisions uniformly and effectively to their jurisdictions. The sections are:

- compliance and enforcement - shows model provisions on legal due process
- references - cites relevant scientific studies, laws, and regulations by model code section.
- public health reasons - explains in lay terms the purposes of each code provision
- establishment inspections - guides in planning, conducting and reporting inspections under the new code
- HACCP - explains in detail the principles, terminology and applications of the concept
- food processing criteria - gives factors to be considered when preparing, evaluating and approving HACCP plans pertaining to certain food processing operations at the retail level.
- sample forms.

Work on the new *Food Code* began at the request of the Conference for Food Protection after consultation with several professional and trade associations. (The conference is a group of representatives from regulatory agencies at all levels of government, the food industry, academia, and consumer organizations that works to improve food safety at the retail level.)

FDA, other government agencies, and food industry representatives identified and prioritized needed changes and additions to the existing codes and eliminated redundancies and inconsistencies. The proposed *Food Code* was published in the May 9, 1988, *Federal Register*, and FDA received comments from over 150 agencies and organizations. The draft was modified based on the comments, and the *Food Code* was published in final form in January 1994. It will be updated every two years.

Copies of the 1993 *Food Code* are available on computer disk (PB 94-501-285/AS; \$17.50) or paper copy (PB 94-113-941/AS; \$23) from: National Technical Information Service, Springfield, VA 22161, 1-800-553-NTIS or (703)487-4650.

The 1993 *Food Code* and related documents are also available from FDA in downloadable form through the FDA Prime Connection, an online technical information database.

Applications to use this database, accessible without cost (via computer modem and a toll-free call), are available from: FDA Prime Connection (HFS-625), 200 C Street, SW, Washington, DC 20204-0001, FAX (202)205-5560.

The 1993 *Food Code* also is available for public examination, between 9 a.m. and 4 p.m., Monday through Friday, at: Dockets Management Branch (HFA-305), Food and Drug Administration, Room 1-23, 12420 Parklawn Drive, Rockville, MD 20857.

For more information contact: Retail Food Protection Branch, Center for Food Safety and Applied Nutrition (HFS-627), Food and Drug Administration, 200 C St., SW, Washington, DC 20204, Telephone (202)205-8140, FAX (202)205-5560.

## ***Courses Offered to Improve Skills of Maintenance Engineers***

Three basic courses to improve the total job skills of maintenance engineers in food plants are again being offered by the American Institute of Baking in Manhattan, Kansas. These courses, each covering a critical phase of plant operation, will be offered consecutively in May.

The courses and dates are Electrical Troubleshooting, May 2-6; Fundamentals of Programmable Controllers, May 9-13; and Refrigeration Technology, May 16-20.

Electrical Troubleshooting consists of the basics necessary for intelligent troubleshooting, problem analysis, and efficient and economical solutions in problem solving. Laboratory exercises are designed for hands-on application of basic theory and to demonstrate its practical application.

Fundamentals of Programmable Controllers focuses on basic principles of programmable controllers, how they operate, and what they can do. Laboratory exercises provide hands-on experience to reinforce the basic information and demonstrate its practical application. Participants will also learn how to write programs and troubleshoot PC circuits.

Refrigeration Technology will stress the basics necessary for intelligent troubleshooting and problem solving. Instruction will also cover current EPA refrigerant reclamation regulations and clean-up after a burn-out. Laboratory exercises will concentrate on practical application of refrigeration technology.

"Each of these courses will give students the knowledge and background to continue developing as skilled maintenance engineers," commented Scott Casey, AIB's Director of Maintenance Engineering. "Class size will be limited so each student can receive personal attention throughout the class period. Special attention is given to problems each has experienced in his own work environment."

These courses are part of a special training program of the Institute leading to a Certified Maintenance Engineering recognition that is gaining acceptance throughout the industry. Certification not only provides

valuable basic technical knowledge but equips students with the ability to assume greater responsibility, Casey added.

To achieve certification from AIB, students must also complete the Maintenance Management seminar and the 27-lesson Maintenance Engineering correspondence course.

Tuition fees are \$795 per participant for each course from companies who are members of the Institute and \$845 for non-members. For further information write to the Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, Kansas 66502 or call (913)537-4750 or (800)633-5137.

## ***Irradiated Foods Here to Stay***

Despite some misgivings in the public and scientific arena, food irradiation is here to stay, and we most likely will see an increase in the number of irradiated foods available, says a Penn State food scientist.

"Many critics of food irradiation feel that government and industry have not presented strong enough evidence that it is safe," says Manfred Kroger, professor of food science in Penn State's College of Agricultural Sciences. "They also are concerned that irradiated foods can easily become recontaminated."

"Evidence gathered by the U.S. Department of Agriculture and the U.S. Food and Drug Administration shows that foods treated with ionizing radiation do not become radioactive. Also, irradiation does not alter the chemicals in food to make them unacceptable. There always is a chance of recontamination by foodborne pathogens, but this is minimized if food preparers are trained in safe food-handling procedures."

Irradiated foods have been exposed to an extremely low level of radioactive material. For example, irradiated poultry receives a 1.5 to a 3.0 kilogray dose of ionizing gamma rays. This treatment destroys bacteria and other microorganisms, such as *Salmonella*, *E. coli*, *Listeria* and *Campylobacter*. These and other foodborne pathogens are responsible for an estimated 80 million illnesses and 9,000 deaths in the United States each year.

Because irradiation also deters spoilage, it could contribute to alleviating the world's food distribution problem, Kroger says. In November, the World Health Organization released a statement saying that food contamination probably is the most widespread world health problem. The organization called for greater use of irradiation to destroy the organisms that spread a variety of diseases through food, and noted that irradiation could prevent some of the massive food losses due to pests, bacteria and fungi.

Food irradiation is used in more than 30 countries. Japan, for example, irradiates thousands of tons of potatoes each year to prevent sprouting. In the United States, foods have been approved for sale after irradiation since the early 1980s.

"Only one U.S. company currently is irradiating foods — mainly fruits, as well as other foods upon

request," says Kroger. "When retailed, these foods carry a special label showing a logo with a plant inside a circle and the statement "Treated by irradiation."

In 1992, the USDA's Food Safety and Inspection Service approved irradiation of uncooked poultry to control *Salmonella* and other bacteria. Currently, four independently owned food retailers in the U.S. are selling irradiated poultry. Irradiated beef is not yet available.

"Concerns about the process are reminiscent of those expressed during the early years of milk pasteurization," says Kroger. "People were afraid that this process would cause more health problems than it prevented. But pasteurization has posed no danger to human health. On the contrary, it put an end to tuberculosis bacteria in milk, which killed millions of people worldwide."

"Irradiation is no guarantee against spoilage and foodborne illnesses," he says. "But it is an additional preventive measure, and it has the potential to save lives."

For more information contact Manfred Kroger at (814)863-2958.

## ***New Book Investigates Animal Drugs and Human Health***

The presence of drug and chemical residues in food products from animal sources is both a public health problem and a consumer concern.

Now published, a new book, *Animal Drugs and Human Health*, presents the first comprehensive analytical review of drug residues in meat and poultry products, and their public health implications.

Developed by twelve leading authorities, this new book examines and analyzes the problem of animal drugs in a scientific, non-partisan manner.

Chapters discuss pharmacology, drug usage, detection, risk assessment and control, and public health problems. Detailed scientific information is included on residues from antibiotics, hormones, pesticides, and herbicides.

Over 250 pages, the book provides an extensive and unique review of available information for those involved in food science and safety, public and environmental health, agriculture, toxicology, veterinary medicine, and regulation.

Editors of the book are: Lester M. Crawford, Jr., D.V.M., Ph.D., Executive VP, Scientific Affairs, National Food Processors Association, and Don A. Franco, D.V.M., M.P.H., Director of Scientific Affairs, Animal Protein Producers Industry.

Chapter titles include: The Public Health Perspective; Pharmacological Principles of the Disposition of Drugs and Other Xenobiotics; Principles and Implementation of Residue Programs in Meat and Poultry Inspection; Methods of Detection; Antibiotics, Residues and the Public Health; Causes, Detection, and Correction of Sulfonamide Residues in Swine; Hormones; Miscellaneous Growth Promotants; Parasiticides; Pesticide Residues in Foods of Animal Origin; Herbicides; and Decontamination of Livestock.

A detailed brochure describing this new book is available from the publisher.

Available from Technomic Publishing Company, Inc., 851 New Holland Avenue, Box 3535, Lancaster, PA 17604, U.S.A. Telephone: (717)291-5609, FAX (717)295-4538.

## ***Suggestions Sought for Revision of the IAMFES Manual "Procedures to Investigate Water-borne Illness"***

The Communicable Diseases Affecting Man Professional Development Group is in the process of revising the manual, "Procedures to Investigate Water-borne Illness." If you or other members of IAMFES or its affiliate organizations have suggestions for revision, please contact:

Dr. Frank L. Bryan  
Food Safety Consultation and Training  
8233 Pleasant Hill Road  
Lithonia, GA 30058

Consider material on (1) epidemiology of water-borne diseases and their surveillance; (2) diseases transmitted by ingestion of, contact by, or aerosoled by water; (3) investigational procedure; (4) investigative forms; (5) sample/specimen collection; or (6) anything else appropriate to the subject. Contributions can be in the following format:

- 1) Photocopied pages of the existing manual with line and/or marginal comments.
- 2) Reprints or manuals that may be used as references by the Committee.
- 3) Text that can be considered for inclusion into the manual. (If this is extensive, it would be helpful to have the material on computer disk.)

Thank you for your interest in the activities of the Association and for your cooperation.

# Federal Register

## Department of Health and Human Services

### Food and Drug Administration

#### 21 CFR Parts 123 and 1240

#### Proposal to Establish Procedures for the Safe Processing and Importing of Fish and Fishery Products

**Agency:** Food and Drug Administration, HHS.

**Action:** Proposed rule.

**Summary:** The Food and Drug Administration (FDA) is proposing to adopt regulations to ensure the safe processing and importing of fish and fishery products (hereinafter referred to as seafood). These procedures include the monitoring of selected processes in accordance with Hazard Analysis Critical Control Point (HACCP) principles. HACCP is a preventive system of hazard control that can be used by food processors and importers. FDA is proposing these regulations because a system of preventive control is the most effective and efficient way to ensure that these products are safe.

**Dates:** Written comments by March 29, 1994. The agency is proposing that any final rule that may be issued based upon this proposal become effective 1 year following its publication.

**Addresses:** Written comments, data, or information to the Dockets Management Branch (HFA-305), Food and Drug Administration, rm. 1-23, 12420 Parklawn Drive., Rockville, MD 20857.

**For Further Information Contact:** Philip Spiller, Center for Food Safety and Applied Nutrition (HFS-401), Food and Drug Administration, 200 C St. SW, Washington, DC 20204, 202-254-3885.

For further information concerning the guidance entitled "Fish and Fishery Products Hazards and Controls Guide," contact: Donald W. Kraemer (address above).

For further information concerning the economic impact analysis contained in this proposal, contact: Richard A. Williams, Jr., Center for Food Safety and Applied Nutrition (HFS-726), Food and Drug Administration, 200 C St., SW, Washington, DC 20204, 202-205-5271.

#### Supplementary Information:

##### I. Overview

The purpose of these proposed regulations is to establish mandatory preventive controls to ensure the safety of sea-

food products sold commercially in the United States and exported abroad. These preventive controls will be based on a system known as HACCP. HACCP is a system by which food processors and importers can evaluate the kinds of hazards that could affect their products, institute controls necessary to keep these hazards from occurring, monitor the performance of these controls, and maintain records of this monitoring as a matter of routine practice.

FDA is proposing to require that domestic and foreign processors and importers adopt HACCP controls to prevent the occurrence of hazards that could affect the safety of these seafood products for consumers. If these regulations are adopted, FDA will review the adequacy of HACCP controls as part of its program of mandatory inspections and import examinations. Such a review will occur in addition to traditional inspection activities. FDA is also encouraging, but not proposing to require, that processors and importers adopt the same types of controls for nonsafety hazards relating to economic adulteration and quality.

FDA is proposing to make HACCP mandatory for the seafood industry for the following reasons:

1. Adoption of HACCP controls by the seafood industry, coupled with inspections by FDA based on the HACCP system, will produce a more effective and more efficient system for ensuring the safety of seafood products than currently exists. The current inspection system places too great a burden on Government inspectors to uncover problems and to take regulatory action to address those problems. HACCP places primary responsibility upon the industry to demonstrate that hazards are understood and are being prevented.
2. A nationally mandated HACCP system will provide a basis for enhanced consumer confidence in the safety of seafood products. Consumers should not be afraid to eat foods, such as seafood, that are recommended as useful lower fat and lower saturated fat substitutes for higher fat meats.
3. The know-how for applying HACCP to seafood is in an advanced state of development. A considerable amount of work on applying HACCP to seafood has already been done by some States, academia, and the Federal Government as well as through cooperative activities between the Federal Government and industry and through independent industry efforts.
4. Seafood industry representatives have urged the Federal Government to institute a mandatory, HACCP-type inspection system for their products.
5. A nationally mandated HACCP-type system of controls appears to be a prerequisite for continued access to world markets.

*Federal Register/Vol. 59, No. 19/Friday, January 28, 1994/Proposed Rules*

For this complete listing, please contact the IAMFES Office at 1-800-369-6337, US; 1-800-284-6336, Canada or 515-276-3344.

# Food and Environmental Hazards to Health

## ***Salmonella* Serotype Tennessee in Powdered Milk Products and Infant Formula—Canada and United States, 1993**

Since May 1993, three cases of infection with *Salmonella* serotype Tennessee in infants in Canada and the United States have been linked to consumption of contaminated powdered infant formula. This report summarizes preliminary data on isolation of this organism from powdered milk products and alerts laboratories to the possibility that, because this strain may ferment lactose, it may not be identified as *Salmonella*.

Following the isolation of *Salmonella* serotype Tennessee from the stools of two infants in Canada who had consumed Soyalac Powder® D infant formula in May, the Food and Drug Administration (FDA) isolated *Salmonella* Tennessee from production equipment at the Minnesota plant where the product had been dried, and from cans of the powdered infant formula. In June 1993, one case of infection with *Salmonella* Tennessee occurred in Illinois in an infant who consumed Soyalac Powder®. From November 4, 1992, through June 29, 1993, 48 cases of infection with *Salmonella* Tennessee have been reported to CDC; when annualized, this number is not substantially different from the mean of 120 cases reported annually from 1981 through 1991.

On June 28, 1993, FDA ordered a recall of all Soyalac Powder® infant formula produced on or after November 4, 1992. FDA has identified additional products that are spray-dried at this plant; these products include Sumacal® medical food supplement, Propac® protein supplement, canned Medibase® medical meal replacement, Kresto Denia® powdered milk, Enercal® diet beverage, Enercal Plus®, and Promil® weaning formula. No cases of illness have been linked to these products. FDA is working with plant officials to determine whether any other products were dried or packaged at this plant during this time. No spray-dried products have been distributed from this plant since June 7, 1993. FDA has requested recall of all products spray-dried at this plant since November 4, 1992. More detailed product information is available from the Division of Emergency and Epidemiological Operations, FDA, telephone (301) 443-1240.

**Editorial Note:** Outbreaks of salmonellosis caused by powdered milk products have been reported in the United States and elsewhere. The isolates of *Salmonella* Tennessee that were identified from the three infants described in this report are atypical of salmonellae because most colonies ferment lactose and, therefore, may not be detected by clinical laboratories that use media or methods that identify salmonellae based on absence of lactose fermentation.

To isolate this organism, plating media that include an indicator of hydrogen sulfide (H<sub>2</sub>S) production, such as bismuth sulfite (BS) agar, Hektoen enteric (HE) agar, or xylose-lysine-deoxycholate (XLD) agar, should be used. BS does not contain lactose, so typical H<sub>2</sub>S-producing (black) colonies can be selected from this medium. Both HE and XLD contain an indicator of H<sub>2</sub>S production, as well as lactose; selection of colonies from these media should be based on H<sub>2</sub>S production rather than absence of lactose fermentation. At CDC, H<sub>2</sub>S production by this strain was detected more easily on HE than on XLD. Use of either BS or HE is recommended for recovery of this strain. XLD agar should be used only if other media are not available.

To screen colonies selected from isolation plates, lysine-iron agar (LIA) is recommended because the reaction produced by lactose-fermenting salmonellae in this medium is typical and because H<sub>2</sub>S produced by lactose-fermenting organisms can be detected. Triple sugar iron agar (TSI) or other media that depend on lactose fermentation to identify suspect salmonellae should not be used. H<sub>2</sub>S production may not be detected on TSI because of acidic conditions caused by fermentation of lactose. Automated test systems should be used with caution, since lactose-fermenting salmonellae tested at CDC in several such systems were sometimes identified incorrectly. This particular strain was correctly identified as *Salmonella* by the Analytab Products' API 20E® system.

CDC requests that health-care providers and public health departments continue routine reporting to the *Salmonella* surveillance system; that all *Salmonella* sero-group C<sub>1</sub> (of which *Salmonella* Tennessee is a member) isolates be serotyped; that persons infected with *Salmonella* Tennessee be questioned specifically about consumption of powdered milk products or infant formula; and that, until August 15, 1993, new cases of infection with *Salmonella* Tennessee, whether lactose fermenting or nonlactose fermenting, be reported promptly to the state health department.

Morbidity and Mortality Weekly Report 7/9/93

# HAZCON-Based Total Quality Management

## Retail Food Operation Food Hazard Control Checklist

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 St. Paul, MN 55114

The following is the second installment of the Retail Food Operation Food Hazard Control Checklist mentioned in the October 1993 column. This checklist will be continued over the next several months to cover its entirety.

### RETAIL FOOD OPERATION FOOD HAZARD CONTROL CHECKLIST

[40°F - 150°F (4.4°C - 65.6°C)]<sup>1</sup>

FOOD SAFETY CONTROL REQUIREMENTS	PERFORMANCE EVALUATION	NEEDED TO ASSURE SAFETY
<p><b>Storage of dishware (Reg)</b></p> <ul style="list-style-type: none"> <li>Clean glasses, cups, and other utensils are stored covered or in an inverted position, and at least 6 inches above the floor in a clean, dry location to protect them from contamination by splash, dust, and drippings.</li> <li>Clean equipment, dishware, and utensils are never stored under exposed sewer lines, waste lines, or water lines, except fire protection sprinkler heads.</li> <li>Clean equipment, dishware, and utensils are never stored in toilet rooms, vestibules, locker or dressing rooms, janitorial areas, soiled, or unapproved areas.</li> <li>Knives, forks, and spoons must be loaded into holders to protect these items from contamination. • Dishware, cookware etc., all utensils, are stored on approved non-absorbent surfaces.</li> <li>Single service items are stored in a closed carton or plastic bag. [In-use boxes of single service utensils and tableware may be open, if box is placed on its side with one end opened.]</li> <li>Single service items are not stored under or adjacent to cleaning agents or toxic materials.</li> </ul>		
<p><b>Cleaning equipment storage (Reg)</b></p> <ul style="list-style-type: none"> <li>All maintenance and cleaning equipment or supplies are stored _____, away from food, clean equipment, or linen.</li> <li>Pressurized tanks and cylinders are safely secured.</li> <li>Mops are hung to dry between uses in _____. Wet mops are not to be stored in buckets.</li> <li>Cleaning and maintenance equipment is clean and maintained.</li> </ul>		
<p><b>Chemicals separation (Haz)</b></p> <ul style="list-style-type: none"> <li>All non-food chemicals (detergents, cleansers, bleach, sanitizers) are kept separated from foods and are stored in _____, away from the food storage areas.</li> <li>Hazardous concentrations of any chemicals or poisons are never stored in the food production area.</li> </ul>		
<p><b>First aid material (Reg)</b></p> <ul style="list-style-type: none"> <li>First aid materials are stored so that materials cannot contaminate food.</li> <li>First aid supplies are checked weekly by FSPMs and are replenished.</li> </ul>		
<b>FOOD PRODUCTION AND SERVICE</b>		
<p><b>General production policy</b></p> <ul style="list-style-type: none"> <li>Recipes for all menu or production items are written to include times and temperatures for all food handling steps, beginning ordering, receiving and storage, preparation, staging for service, transport, service, and handling of leftovers.</li> </ul>		
<p><b>Home prepared food (Haz)</b> No home prepared or home canned foods are allowed to be served or stored in the facility.</p>		

**Abbreviations:** (Haz) = Hazard; (Reg) = Regulatory; (Qual) = Quality; (OSHA) = Occupational Safety and Health Agency

<sup>1</sup>Temperatures, unless otherwise stated, are food temperatures. They are measured both 1/16-inch below the surface as well as at the center of food in order to determine the degree of control and stability of hot and cold systems.



FOOD SAFETY CONTROL REQUIREMENTS	PERFORMANCE EVALUATION	NEEDED TO ASSURE SAFETY
<b>Milk (Reg)</b>		
<ul style="list-style-type: none"> <li>All milk and dairy products served and used in the preparation of products meets government specifications.</li> <li>All fluid milk is served in an unopened container that does not exceed 1 pint, or is dispensed from an approved refrigerated bulk dispenser.</li> </ul>		
<b>Receiving</b>		
<b>Inspection of incoming products (Haz)</b>		
<ul style="list-style-type: none"> <li>Delivery vehicles are inspected and any product is rejected if the cargo area is not at required temperatures of 0°F, 40°F, or 70°F, or storage conditions were not appropriate for the food.</li> <li>All refrigerated and frozen items are stored at appropriate temperatures within 10 minutes of receipt before the product temperature increases &gt; 5 ° F.</li> <li>All incoming food products are inspected for frozen or chill temperature damage, date codes, suspicious odors and drips, and pest infestation.</li> </ul>		
<b>Standard products (Haz)</b>		
<ul style="list-style-type: none"> <li>Managers/supervisors are notified of any standard food item to determine if the product should be kept, discarded, salvaged, or returned to the supplier on the delivery vehicle.</li> <li>Discarded items are recorded on the waste control report.</li> <li>Receiving personnel are alert for damage to cases or boxes that might indicate contamination from an outside source or insect and rodent infestation.</li> <li>Receiving personnel spot-check canned foods for pinholes bulging, and rusting containers. Any cans of food with swells, flippers, leakers, corrosion, or dents on seams and rims are returned to the supplier(s).</li> </ul>		
<b>Proper storage conditions (Reg)</b>		
<ul style="list-style-type: none"> <li>Freezer temperatures are maintained at &lt; 0°F (-18°C), with as little fluctuation in temperature as possible. <ul style="list-style-type: none"> <li>- During defrost, the freezer air temperature does not increase more than 10°F.</li> </ul> </li> <li>Refrigeration units stay below 40°F during defrost.</li> <li>Sufficient air flow around the inventory in refrigerated and freezer storage is assured by keeping items away from the walls and off the floor.</li> <li>All storage areas are kept clean and organized.</li> <li>All food products are stored at least 6 inches above the floor on approved shelving or racks.</li> <li>Food is not stored in restrooms, locker and dressing rooms, or vestibules.</li> <li>Food is not stored under unprotected overhead sewer waste or water lines (except fire protection sprinkler heads).</li> <li>All stored foods are properly covered except during periods of preparation and service.</li> </ul>		
<b>Stock rotation (Qual)</b>		
<ul style="list-style-type: none"> <li>The following stock rotation chart is used as a quality guide for length of storage time. All items are given a use-by-date.</li> </ul>		
<b>Stock Rotation Chart</b>		
<b>Food</b>	<b>Temperature</b>	<b>Length of Storage</b>
<b>Refrigerated Products</b>		
<i>Meat, fish, poultry</i>		
Raw meat, fish poultry	<40°F (4.4°C)	< 3 days
Deli cooked meats, frankfurters, lunch meats	<40°F (4.4°C)	< 5 days
<i>Cooked items</i>		
Leftover cooked meat, fish, and poultry	<40°F (4.4°C)	< 2 days
Gravies, broths	<40°F (4.4°C)	< 2 days
Cooked dishes with eggs, meat, milk, fish, poultry and cream filled pastries	<40°F (4.4°C)	< 1 day
<i>Eggs</i>		
Shell eggs, raw and reconstituted eggs	40°C (4.4°C)	1 week
<i>Dairy Products</i>		
Fluid milk	<40°F (4.4°C)	5 days after code date
Reconstituted milk	<40°F (4.4°C)	5 days
Butter	<40°F (4.4°C)	2 weeks
Hard cheese (cheddar, romano, etc.)	<40°F (4.4°C)	2 weeks (cont.)

FOOD SAFETY CONTROL REQUIREMENTS			PERFORMANCE EVALUATION	NEEDED TO ASSURE SAFETY
Soft cheese (cottage cheese, cream cheese)	<40°F (4.4°C)	3 to 7 days		
<i>Fruit, fresh</i>				
Apples	40°F (4.4°C)	2 weeks		
Berries, cherries	40°F (4.4°C)	5 days		
Bananas, avocados, pineapple, grapes, pears, peaches	40°F (4.4°C)	5 days		
Oranges, lemons, grapefruit	40°F (4.4°C)	2 weeks		
Plums, cranberries	40°F (4.4°C)	1 week		
<i>Vegetables, fresh</i>				
All fresh vegetables except potatoes, squashes and root vegetables	40°F (4.4°C)	2 to 5 days		
Dry storage	50°F to 70° C			
Non perishable food items	(60% rel. hum.)	1 year		
Frozen Food	0°F (-18°C)	2 months		
<ul style="list-style-type: none"> <li>The oldest food will be used first.</li> <li>New inventory (cans, boxes, or cases) are placed behind the older inventory.</li> <li>For highest quality, all food is used before its use-by-date expires.</li> </ul>				
<b>Labeling (Reg)</b>				
<ul style="list-style-type: none"> <li>The labels of all stored food products are placed to the front.</li> <li>All bulk food and food ingredient containers are labeled with the common name of the product.</li> <li>Containers are labeled, rather than just the lids.</li> <li>All packaged food and ice is labeled with product name, name and address of the manufacturer, net weight, and ingredients in descending order of predominance.</li> </ul>				
<b>Use-By-Date (Reg)</b>				
<ul style="list-style-type: none"> <li>Unused portions of opened food are stored in a tightly closed, approved, food-grade bulk container with a label on the container.</li> <li>Perishable foods are labeled with the date they were put in container and a use-by-date.</li> <li>Food is used from the container until the container is empty. The container is then cleaned and refilled.</li> </ul>				
<b>Adding fresh product to old (Haz)</b>				
<ul style="list-style-type: none"> <li>Fresh product is never added to old.</li> </ul>				
<b>Food Storage and Preparation Temperatures and Times (Haz)</b>				
<ul style="list-style-type: none"> <li>Perishable food is held for the following times at the temperatures listed for safety control. This tabulation is a listing of suggested times and temperatures for holding foods in order to control the growth of <i>Listeria monocytogenes</i> to 5 generations (assuming no lag time).</li> <li>At the end of these times, if the food has not been consumed, it is discarded.</li> </ul>				
<b>Safe Holding Times at Specified Temperatures</b>				
<b>Temperature °F (°C)</b>	<b>Holding Time</b>			
	for 5 generations of <i>Listeria monocytogenes</i>			
<32 (0)	until spoiled			
32 (0)	12 days			
35 (1.7)	9 days			
40 (4.4)	5 days			
45 (7.2)	2.5 days			
50 (10)	2 days			
55 (12.8)	30 hours			
60 (15.6)	20 hours			
65 (18.3)	15 hours			
70 (21.1)	10 hours			
75 (23.9)	6.5 hours			
80 (26.7)	5 hours			
85 (29.4)	3.75 hours			
90 to 130 (32.2 to 54.4)	2.5 hours			
> 130 (54.4)	until spoiled			

This Retail Food Operation Food Hazard Control Checklist will continue in subsequent issues of Dairy, Food and Environmental Sanitation. The April installment will cover: Food Production and Service.

# New IAMFES Members

## *California*

**Farouk Keroles**  
California Institution for Men  
Chino

**Terri Mullen**  
Registered Dairy Inspector  
Covina

**John F. Sheehan**  
Hanford

## *Colorado*

**R. Jack Moncada**  
R. Jack Moncada and Assoc.  
Aurora

## *Georgia*

**Samuel D. Center**  
USDA-ARS  
Athens

## *Idaho*

**Ronald J. Tolley**  
Ore-Ida Foods  
Boise

## *Illinois*

**David Gombas**  
National Center for Food Safety and  
Technology  
Summit-Argo

## *Iowa*

**Ruby M. Lee**  
NOBL Lab, Inc.  
Sioux Center

## *Maryland*

**William Bevins**  
Giant Food Dairy  
Landover

## *Massachusetts*

**Noelle M. Sneider**  
bioMérieux Vitek  
Natick

## *Minnesota*

**Austen Cargill**  
Cargill, Inc.  
Minneapolis

**Kathy Horner**  
Associated Milk Producers, Inc.  
New Ulm

**Janet Meeks**  
Vicom  
Princeton

**Jon G. Porter**  
Ecolab, Inc.  
St. Paul

## *New Jersey*

**Kevin Breen**  
Morris Township Health Dept.  
Convent Station

**Martin Tricarice**  
Integrated BioSolutions  
Monmouth Junction

## *New York*

**Frank A. Guido**  
West Chester Co. Health Dept.  
Thornwood

**Joe O'Rourke**  
Borden Foods Research Center  
Syracuse

## *North Carolina*

**Kathy Mitchell**  
Tecan, U.S.  
RTP

**Gary Riggs**  
Ford's Produce Co.  
Raleigh

## *Ohio*

**David Boulay**  
Pillsbury  
Wellston

## *Oregon*

**Roger D. Krug**  
Oregon Dept. of Agriculture  
McMinnville

## *Tennessee*

**Francis Ferke**  
Krystal Company  
Chattanooga

## *Virginia*

**Judith M. Cassani**  
Virginia Beach

## *Wisconsin*

**Denny Staude**  
Chemidyne  
Plymouth

## *Canada*

**Brian Dalshaug**  
Barons-Eureka Health Unit  
Coaldale, Alberta

**Suk Hing Yiu**  
Ontario Ministry of Agriculture & Food  
Toronto, Ontario

## *Ecuador*

**Ing. Germán López**  
Tropifrutas  
Guayaquil

## *Poland*

**C. Correll Durling**  
Bona Sp.

## *Puerto Rico*

**Miriam Meléndex Rivera**  
Indulac  
Juana Diaz

**Candido Torres**  
U.S. Food & Drug Administration  
San Juan

## *England*

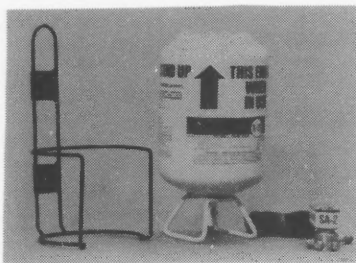
**Bob Mitchell**  
Ministry of Ag Fisheries & Food  
Westminster, London

## *Switzerland*

**Jean-Martin Ducommun**  
Laboratoire cantonal  
Neuchatel

# Industry Products - Special Focus

## Pest Elimination Products and Equipment for Dairy and Food Processing



### Control Insects Effectively and Eliminate Human Error with Hub States' Automatic Industrial Aerosol System

The A-System, Automatic Industrial Aerosol System, from Hub States Corporation, Indianapolis, IN, automatically dispenses insecticides, eliminating human error and providing optimum pest control. Timed to discharge when the plant is shutdown such as during lunch or weekends, the non-flammable A-System protects employees and reduces the manufacturers' obligation under worker right-to-know laws. For added safety, if the system fails, it automatically locks in the off position. Cost-effective, initial capital outlay for the A-system can normally be recouped within a year due to the reduction in labor expenses and errors.

Each A-System is custom designed for individual plants and consists of solenoids, brackets and a timer. Mounted from the ceiling, the brackets hold 10 lb., 16 1/2 lb. or 30 lb. insecticide cylinders which treat 50,000 cubic feet of space per station. The timer controls the flow rate of the insecticide and the time of application and can be placed in any central location. One timer controls up to 4 circuits and one circuit can operate up to 15 solenoids.

Approved for use in USDA, federally-inspected food plants, the A-System utilizes pyrethrin or DDVP insecticides. The A-system leaves no oily residue and is authorized "FI" under the USDA. The system is available in standard or explosive-proof configurations and is available with recyclable 10 lb. and 30 lb. DDVP cylinders or disposable 16 1/2 lb. pyrethrin cylinders.

The A-System comes with a two year warranty on parts and labor and is sold through registered, authorized A-System dealers who are trained to install and service the system.

Hub States Corp. - Indianapolis, IN

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### "Prism Gold Medal Program Goes National"

Prism Guaranteed Pest Elimination, based in Miami, Florida, is expanding the market for its Integrated Pest Management (I.P.M.) System. Originating in the Northeast, the program is now available nationally.

Engineered to specifically serve the food processing and retailing industries, Gold Medal protection adheres fully to a "Quality Process Management" Model.

As Dr. Zia Siddiqi, Corporate Technical Director observes, "Several major influences are emerging in the food industry, one is an increased focus on food product safety, legal compliance and protection of property and the environment. Another is the need for food processors to meet International Quality Standards set by global trading alliances. We have proven over the past fifteen years that our I.P.M. system fills the bill in both these respects.

PRISM is a subsidiary of S. C. Johnson Wax Company, and offers services, business-to-business throughout the United States and Canada, through its affiliate PCO services, Inc.

Prism Guaranteed Pest Elimination -  
Miami, FL

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### Copesan Services Offer Pest Control and Sanitation Newsletter

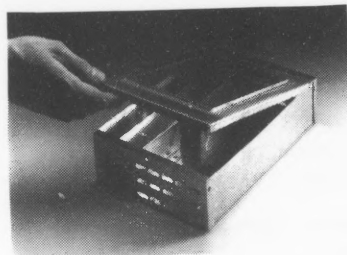
Copesan Services, Inc. offers a free subscription to its quarterly "Pest Control and Sanitation Newsletter". Written by pest control industry consultant, C. Douglas Mampe, M.S., Ph.D., the newsletter provides timely information on preventative pest control, alternative pest control techniques, pending government regulations, and related pest control and sanitation issues.

The quarterly newsletter is available to all who deal with pest control, sanitation, inspections, loss prevention, operations, and building maintenance.

Founded in 1958, Copesan is the largest privately owned, full-service pest control company that specializes in food processing, food distribution, and related packaging industries. Copesan provides documented, quality-assured pest control to commercial accounts with regional and/or national facilities anywhere, any time, in the United States, Canada and Mexico.

Copesan Services, Inc. -  
Brookfield, WI

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### Woodstream's New Victor Tin Cat (R) Helps Control Mice in Poultry Houses

The Victor Tin Cat (R) repeating mouse trap from Woodstream offers superior service and convenience with its see-through "window" lid. Now, you can save time by inspecting traps in poultry houses without having to open them.

This multiple-catch, low-profile trap holds over 30 mice. No baits or poisons are required, and there's no need to reset it. Like its solid top predecessor, the self-monitoring trap works without a winding mechanism, using a double treadle-door system to capture inquisitive rodents.

Model M308 Tin Cat offers the durability of heavy-gauge, galvanized steel. It's built low to the ground for easy placement in poultry houses. And its hinged lid makes disposal and cleaning quick and easy.

The Tin Cat is available in bulk for the poultry and pest control industries as well as high-use consumers such as farmers.

Woodstream, an EKCO Group Company, is the world's leading manufacturer of non-poisonous and low-toxic pest control products.

Woodstream - Lititz, PA

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### Gardex Chemicals Inc. Offers Complete Line of Pest Control Supplies

Gardex Chemicals Inc. is in the business of importing, manufacturing and distributing pest control supplies and equipment. Gardex responds to the industry's demand for greater access to technology and innovative products worldwide.

Gardex not only offers a complete line of insecticides, baits, glue boards, monitors, application equipment and light traps, but is able to offer ancillary services such as application training and consultation on pest management.

Gardex Chemicals, Inc. -  
Etobicoke, Ontario, Canada

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## ***EPA Approves Insecticide to Control and Kill Deer Ticks, Carriers of Lyme Disease, on Livestock, Horses and Dogs***

The Environmental Protection Agency (EPA) has announced its approval of Permethrin II™ insecticide to control and kill deer ticks, carriers of Lyme disease, on livestock horses, dogs and their premise areas.

Boehringer Ingelheim Animal Health, Inc. recently gained the EPA's approval to add "controls and kills deer ticks (carriers of Lyme disease)" to the label of its Permethrin II line of products, which includes Permethrin II Dairy, Cattle and Barn Spray, Permethrin II Horse and Stable Spray and Permethrin Pet, Yard and Kennel Spray. The insecticide already is widely used in agriculture and contains the active ingredient permethrin, a synthetic pyrethroid insecticide.

Permethrin II insecticides have a high toxicity for insects but a low toxicity for people and other mammals, which allows for their use on the animal as well as a premise spray.

Lyme disease is believed to afflict thousands of horses, dogs and livestock animals in the United States every year. According to the National Centers for Disease Control, 30,000 cases of human Lyme disease have been reported nationally since 1982, but the actual number of human Lyme disease victims could be much higher because not all states require that physicians report incidences of the disease to the CDC.

The disease is common in regions that provide an ideal climate — high humidity and dense vegetation — and areas that are inhabited by the specific hosts of the ticks, which include white-tailed deer in the Northeast, Midwest and Southeast, and western fence lizards in the West. In recent years, however, reports have shown that the disease has been found in 46 states, including the Eastern seaboard states and Texas.

The insecticide is for use on horses, beef and dairy cattle, swine, sheep, poultry, horses, dogs and their premises. In addition to controlling deer ticks, the insecticide also effectively controls other insect pests, such as flies, lice, fleas and mites.

## **Permethrin II™ Provides Economical Solutions**

"The EPA's stamp of approval on a broad-spectrum synthetic pyrethroid insecticide for the control of deer ticks is a very positive sign for agribusiness," said Dr. Philip Widell, D.V.M., senior staff veterinarian for Boehringer Ingelheim. "Not only do insect pests cost the livestock producer time and reduce profits, but they also can create a public health nuisance.

"Permethrin II is a hard-hitting insecticide providing high residual capabilities and a broad-spectrum of applications against a wide range of insect pests, which makes it very economical to use. In addition, it has a high toxicity for insects but a low toxicity for people and other mammals, which allows for its use on the animal as well as a premise spray."

According to Widell, pests are most effectively controlled by use of a premise insecticide because they do move from animal to animal rather than resting in one place for long periods of time.

The peak season for Lyme disease is May through mid-fall, with the highest incidence occurring in July, and according to the American Veterinary Medical Association, there is a resurgence of the ticks in mid-September. In areas with an ideal climate, though, Lyme disease can be a year-round threat. Spraying should begin in early spring, when the ticks are in the second year of development and can parasitize medium to large mammals, such as livestock, poultry, swine, horses, pets and humans, Widell said.

Headquartered in St. Joseph, MO, Boehringer Ingelheim Animal Health, Inc. is a major manufacturer and marketer of animal health products for companion animals and commercial livestock. Permethrin II is distributed under the Bio-Centric brand name through veterinarians and under the Anchor brand name to the over-the-counter marketplace.

**Boehringer Ingelheim Animal Health, Inc. - St. Joseph, MO**

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## ***Guaranteed Pest Elimination from Ecolab***

The newest sanitation service from Ecolab - Guaranteed Pest Elimination!

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**Ecolab, Inc. - St. Paul, MN**

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## ***KETCH-ALL, KAGE-ALL and STICK-ALL by Kness Mfg. Co.***

Kness Mfg. Co. has been solving pest control problems since 1924. The KETCH-ALL multiple catch mousetrap works twenty-four hours a day, 365 days a year - catching fifteen to twenty mice in one setting. No bait is needed. No chemicals are used. Nothing is poisonous, so they are safe to use. The KETCH-ALL provides permanent protection against invading mice.

Other Kness traps include the reusable, easy-to-bait, easy-to-set, easy-to-release, single catch SNAP-E mousetrap and the BIG SNAP-E rat trap. "Nothing Katches and Keeps Kritters Better than KAGE-ALL," Kness' live animal trap. The NEW MULTIPLE CATCH RAT & CHIPMUNK TRAP is a welcome addition to live animal trapping. The STICK-ALL DEPOT combines the advantages of a poison-free glueboards and a durable housing that lengthens the glueboards life.

**Kness Mfg. Co., Inc. - Albia, IA**

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## WHERE TO FIND IT . . .



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## Monday Night Social Event

### "A Little Bit Texan"

August 1 — 6:00 - 10:00 p.m.

Cost: Adults \$35 (\$40 on-site)

Children \$20 (\$25 on-site)

*Git your boots, jeans, western shirts  
and cowboy hats (no six-shooters, please)  
and head on out for a "little bit of Texas  
— The Rio Cibolo Ranch."*

*We'll board our Grey Line buses at  
6:00 p.m. and head for the wild, wild east.  
A short ride later, we'll cross the Rio  
Cibolo River and pull into the ranch. A  
Texas style Barbeque dinner - beef brisket  
and chicken quarters, cole slaw, beans,  
relish tray, bread and butter and fruit  
cobbler — will await us.*

*Work up an appetite by learning or  
dancing the Texas National past-time —  
line dancing. A band and dance instruc-  
tor will be there to show you how its done  
— the real way. Or there's the Rol-A-  
Roper, horse shoes, volleyball, basketball,  
cow-chip toss or wagon rides. Or just  
chat with your friends under a beautiful  
Texas sky — (it isn't really any bigger, it  
just seems like it!)*

*We'll mosey on back to the Hyatt  
Regency between 9:30-10:00 p.m.*

*See page 180 for the  
registration form and SIGN UP NOW!!*

# Preview of the 81st IAMFES Annual Meeting

The following is a preview of the papers that will be presented at the 81st IAMFES Annual Meeting, July 31 - August 3, 1994, San Antonio, Texas. Some of the titles are subject to change. A more complete program will be printed in the April Issue of Dairy, Food and Environmental Sanitation.

## MONDAY MORNING — AUGUST 1, 1994

### Quantitative Risk Assessment in Food Microbiology

- Overview - the International Commission on Microbiological Specifications for Foods (ICMSF) Approach
- Risk Assessment Terms and Definitions
- Health Risk Analysis of Food in Canada
- Process Reliability and Risk - A Food Industry Perspective
- Council for Agricultural Science and Technology (CAST) Report on Risk Assessment
- Risk and Regulatory Affairs

### Technical Session — Dairy

- Vitamin Fortification of Milk
- Shelf-life of Commercial Conventionally Packaged Cottage Cheese
- Computer Models for Thermal Inactivation of Native Milk Enzymes

### Technical Session — Risk Assessment

- Application of Sewage Sludge to Food Crops
- Effect of Hydrostatic Pressure, in Combination with Heat and/or Irradiation, on the Survival of *Clostridium sporogenes* in Chicken
- Safety and Food Excellence (S.A.F.E.): A Program for Food Service Workers and Care Givers, who prepare Food for the Chronically Ill
- Environmental Testing for *Listeria*: the Quantitative Edge
- The Practical and Educational Role of Environmental Monitoring of Food Premises
- Food Facility Plan Review
- Regulatory Inspection HACCP vs. Food Operation HACCP Self-Control

### Technical Session — Analytical

- Comparison of Enrichment Protocols for Use with VIDAS to Detect Salmonellae
- Fluorometric Acid Phosphatase Method for Verifying End-Point Temperature in Cooked Poultry
- Improved Medium and Method for Growing *E. coli*
- Comparison of a Micro Identification System to Conventional Biochemical Procedures for the Identification of *Salmonella*, *Escherichia coli* and other Gram Negative Enterobacteriaceae from Food Origin
- A New Rapid Coliform Detection Method. Petrifilm 2000 Coliform Count Plate
- A Murine Monoclonal Antibody Specific to D-serogroup *Salmonella*
- ATP Luminescence as a Means to Rapidly Detect Microbial and Fecal Contamination on Carcass Tissue

- DNA Probe-HGMF Methods to Detect Enterohemorrhagic *E. coli* and *Shigella* in Foods
- Rapid Assessment of *Listeria* Control Using Bioluminescence
- Effect of Monolaurin on *L. monocytogenes* Scott A at 37 and 8°C

### Technical Session — Antimicrobials

- Decontamination of Beef Carcass Tissue with Bacteriocins Using a Model Carcass Washer
- Evaluation of Methods to Deliver Bacteriocins during Wiener Manufacturing for Controlling *Listeria monocytogenes*
- Chemical and Microbiological Qualities of Restructured Vacuum-Packaged Lamb Roasts Containing Sodium or Potassium Lactates
- Growth Inhibition of *Penicillium* species by Lactic Acid Bacteria
- Optimization of Parameters for Production of Nisin and Inhibition of *Lactobacillus plantarum* in a Model Mixed-Culture Fermentation
- Control of *Salmonella*, *Listeria monocytogenes*, *Campylobacter jejuni*, and Psychrotrophs on Chicken Skin with Lactic Acid and Sodium Benzoate
- Influence of Sodium Chloride on Thermal Inactivation and Recovery of Non-proteolytic *Clostridium botulinum* Type B Spores
- A Field Study Evaluating the Effectiveness of Different Hand Soaps and Sanitizers
- Development of Bacteriocin-Based Packaging to Reduce Pathogenic Organisms in Fresh Poultry

## MONDAY AFTERNOON — AUGUST 1, 1994

### Microbiology vs. Epidemiology: Complementary or Incompatible Disciplines Symposium

- Recent Trends in Foodborne Disease Surveillance Worldwide, Based on Epidemiological and Microbiological Findings
- The Recognition of *Listeria monocytogenes* Outbreaks in France: the Combination of Bacterial Analysis and Epidemiological Investigations
- Foodborne Disease Investigation in Texas
- The Role of Armadillos in Spreading Leprosy in the Southeastern United States
- The Significance of Non-cultural Vibrios in the Environment, and Their Potential Role in Causing Disease
- The Role of Bacteria in Changing the Estuarine Environment to Affect People's Health
- The Spread of Disease Agents Through Aquatic Systems

- Microbiology, Chemistry and Epidemiology: the Setting of Food Safety Policy
- Summary of the Issues: the Experience of a Lifetime

#### Technical Session — General Food Microbiology

- Incidence of *Arcobacter* spp. in Ground Pork
- An isolation method for *Arcobacter butzleri* from Poultry
- Improved Enrichment Recovery of *Campylobacter* spp. from Broiler Chicken Carcasses
- Commercial Field Trials Demonstrating Salmonellae Reduction in Broilers Using a Mucosal Competitive Exclusion Treatment
- The Attachment of Viable and Nonviable *Salmonella typhimurium* to Poultry Skin
- Effect of Irradiation on Survival of *Salmonella enteritidis* in Whole Eggs and Liquid Eggs
- Microbiological Evaluation of Reprocessed Broiler Carcasses
- Cider Composition versus Heat Resistance of *Escherichia coli* O157:H7
- Growth of *Shigella flexneri* in Foods: Comparison of Observed and Calculated Growth Kinetics Parameters
- *Staphylococcus intermedius*: Etiologic Association with Foodborne Intoxication from Butter Blend and Margarine
- Irradiation Inactivation of *Listeria monocytogenes* and *Staphylococcus aureus* in Ground Beef as Affected by Fat Content and Temperature
- Trichinosis Outbreak Associated with Smoked Wild Boar Meat, Ontario, Canada
- Enterobacteriaceae from the Chicken Intestine that use Phosphatidylserine for Growth and Inhibit *Salmonella typhimurium*
- Characterization of Pyocyanine Produced by *Pseudomonas Aeruginosa*
- Effects of Ionizing Radiation and Anaerobic Refrigerated Storage on Indigenous Microflora, *Salmonella* and *Clostridium botulinum* types A and B in Mechanically-deboned Chicken
- Efficacy of Cultured Whey of Antagonistic Microorganisms to Inhibit Psychrotrophic Pathogens in Refrigerated, Cooked Beef and Poultry

#### Stainless Steels for Dairy and Food Equipment Symposium

- Utilizing Stainless Steels in the Food and Dairy Industries
- Fabrication and Application of Stainless Steel Equipment for Sanitary Applications
- Orbital Welding of Stainless Steel Tubing for Food and Dairy Applications
- The Effect of Surface Finish on the Behavior of Stainless Steel in Food and Dairy Science
- Hygiene and Other Health and Safety Aspects of Stainless Steel in Food-Handling and Processing Plant

#### Effect of Production and Processing on the Microbial Quality of Meat Symposium

- Overview of Meat Processing Practices in Australia; Innovations in Slaughter Operations

- Verocytotoxigenic *Escherichia coli* — Preharvest and Processing Considerations
- FSIS Microbiological Baseline Survey of Carcasses
- On-farm Intervention Strategies (for *E. coli* O157:H7)
- HACCP in Beef Slaughtering and Processing

#### Poster Session

- Summary of Standard Plate Counts of Plant Obtained Chocolate Milk and Drinks After 14 Days at 7.2°C (45°F)
- Rapid Colorimetric Method for Estimation of Rancidity in Dairy Products
- Survival of *Brucella abortus* in the Mexican White Soft Cheese
- S-Value and Epifluorescence Determination of Bacterial Attachment on the Cleaning Brush of an Automatic Milk-ling System
- Effect of Temperature and Cell Concentration on Radiosensitivity of *Listeria monocytogenes*
- Rapid Detection of Enterotoxigenic *Clostridium perfringens* in Beef Using an Alkaline Phosphatase Microcolony Technique
- Development of Two Simple Methods for the Recovery of *Salmonella* from Food for Detection by PCR
- Comparative Study for Detection of *Listeria monocytogenes* in Foods by a Colorimetric DNA Method and Conventional Culture Methods
- Rapid Assay System for the Detection of Beta-lactam Residues in Milk
- Reduction of Hydroxymethylfurfural of Honey Exposed to Different Sources of Radiation
- Estimation of Coliform Counts using the BacT/Alert Microbial Detection System
- Enrichment Procedures Affecting the Sensitivity of the EHEC-Tek™ ELISA System
- Efficacy of the Microcolony Immunoblot Technique to Detect Heat-Injured *Listeria monocytogenes*
- Use of the BacT/Alert® Microbial Detection System to Monitor Sterility of Aseptically Processed Pudding
- The Development of a PCR Based Assay for the Detection of *Salmonella*
- Identifying and Typing *Listeria* Species with Patterns of Eco R1 Fragments Containing Ribosomal RNA Operon Sequences
- A 43 hour Test for Detecting *Listeria* in Foods Using the Unipath *Listeria* Clearview Immunoassay
- The Rapid Clearview™ *Listeria* Immunoassay for Detection of *Listeria* Species
- Optimization of Commercial Sterility Testing
- Cold Temperature Stress Response of Psychrotrophic *Bacillus cereus*
- Model for the Non-Thermal Inactivation of *Listeria monocytogenes* in a Reduced Oxygen Environment
- The Synergistic Effect of Sodium Acetate or Sodium Propionate Used in Combination with EDTA and Ascorbic Acid on the Inactivation of *Listeria monocytogenes*
- *Aeromonas hydrophila* and Psychrotroph Population of Case- and Pond-Raised Channel Catfish
- The Use of Response Surface Methodology to Model Non-Linear Survival Curves and to Predict the Effects of Temperature, pH and Sodium Chloride on the Heat Resistance of *Listeria monocytogenes* Scott A



- Validation of Predictive Mathematical Models to Demonstrate Applicability to Foods
- The Economics of Federal HACCP Regulations
- An Expert System for HACCP Implementation
- Influence of Temperature on Hemorrhagic *Escherichia coli*: Verotoxin Production and Minimum Temperature of Growth

#### TUESDAY MORNING — AUGUST 2, 1994

##### Applications For Predictive Microbiology Symposium

- Overview — Risk Assessment and Predictive Microbiology
- Modeling Applications
- Food Micromodel Update - UK and European Perspectives
- Model Validation (and Confidence in Models) — an Industry Perspectives
- Cold Storage Temperature Fluctuations and Predicting Microbial Growth
- Predictive Microbiology and HACCP

##### Reduction of Foodborne Pathogens on Poultry Symposium

- Salmonellae Importance and Detection in Poultry Feeds
- Control of Salmonellae During Poultry Production
- The Application of Process Modifications, Chemical Treatments, and Biopeptides to Inhibit Foodborne Pathogens Associated with Poultry Products
- Irradiation as a Means to Control Pathogens on Processed Chicken
- Development of a Comprehensive Total Quality Control Program for use in Fully Integrated Poultry Companies
- Foodborne Industry Perspective on Pathogen Reduction in Poultry

##### Pesticides in the Food Industry Symposium

- The Impact of Sanitation on Pest Control in the Food Establishments
- IPM — Trends in Pesticide Use and Indoor Environmental Quality
- Rodent Control for Food Processing
- Future of Pesticides for Use in Food Handling Establishments

##### Meat Quality Symposium

- Update on Epidemiology of Food Poisoning Outbreaks Caused by Meat Products
- The Challenge of HACCP Implementation in Fast Food Operations
- Safety and Quality of Meat Products at Retail and Deli Operations
- Status of Consumer Education Programs Concerning the Safety of Meat Products
- Microbiological Controls for Safety and Quality of Meats

#### TUESDAY AFTERNOON — AUGUST 2, 1994

##### General Session — The New FDA Model Food Code: How Will We Implement It?

- The New FDA Food Code
- The Restaurant Industry Perspective
- The Food Store Perspective
- The Agricultural Agencies Perspective
- The Health Agencies Perspective

##### Poster Session

- Purification and Characterization of a Bacteriocin Produced by *Carnobacterium piscicola* LK5
- Biofilm formation by *Escherichia coli* O157:H7 on Stainless Steel Surface: Effect of Chemical Agents
- Cooling Rate and Outgrowth of *Clostridium perfringens* Spores in Cooked Ground Beef
- Isolation and Characterization of Enterocin EL1 A Bacteriocin Produced by a Strain of Enterocin faecium
- Effect of Temperature, Salt and pH on Growth Inhibition of *Listeria monocytogenes* by Sodium Polyphosphate
- Evaluation of Different Phosphates to Control Microbial Growth in Meat Products
- Inhibitory Activity of Caffeic Acid Against *Clostridium botulinum* Spores
- Antimicrobial Effect of Sodium Lactate, Trisodium Phosphate, and Sodium Glutamate Monohydrate Pre-Treatments in Combination with Organic Acids on *Escherichia coli* O157:H7
- Microbiological Shelf-Life Stability of Textured Supro™ Granules
- Shelf-life and Microbial Ecology of Precooked Poultry Stored Under Modified Atmosphere at 4°C
- Effect of Water Activity and Humectant Identity on the Growth Kinetics of *Escherichia coli* O157:H7
- Resistance of Acid Adapted Salmonellae to Organic Acid Rinses on Beef
- Survival of *E. coli* O157:H7 in Refrigerated and Frozen Low Fat Ground Beef and Thermal Inactivation by Microwave Energy
- The Fate of *Listeria monocytogenes* and *Clostridium botulinum* in Minimally-Processed Packaged Vegetables
- Use of Time-Temperature Indicator to Monitor the Shelf-Life of Packaged Fresh Catfish
- Recovery of Arcobacter from Broiler Carcasses
- Monoclonal Antibody for Rapid Detection of *Clostridium botulinum* Toxin Type B
- Susceptibility of *Listeria* sp. to Cell Bound Pediocin AcH in BHI Broth, Turkey Frank Slurries, and on Chicken Breast Meat
- The Fate of *Listeria monocytogenes* during the Manufacture of Manchego Cheese with Bacteriocin-producing Lactic Acid Bacteria and Commercial Lactic Starters
- Microbial Changes of Osmotically Dehydrated Green Beans Coupled with Modified Atmosphere Packaging Stored at 10°C
- Mold Content of Stored Popcorn
- Effect of Dry Milling on *Fusarium* Counts and Fumonisin in Corn
- Isolation of the Zearalenone-producing Strains from Ag-

- ricultural Products in Southern Korea
- Inhibition of Phosphate on Mold Growth and Mycotoxin Production (T-2 Toxin, Zearalenone)
- Mechanism of Inhibition of Aflatoxin Biosynthesis by *Lactobacillus Casei Pseudopiantarum*
- Immunolocalization of Aflatoxin B1 in Liver of Chick Embryo Intoxicated with Aflatoxin B1
- The Mycoflora and Mycotoxin-Producing Potential of Fungi from Foods in Burundi
- Application of Immunohistochemical Technique to Visualize Zearalenone Formation of *Fusarium greaminearum*
- Use of TECRA® Unique for the Detection of *Salmonella* in a Range of Food Products within 22 hours
- A Predictive Model with Improved Statistical Analysis of the Interactive Effects of Factors Affecting the Growth of *Staphylococcus aureus* 196E
- Automated Detection of Foodborne Pathogens Using the TECRA® OPUS® System
- Agglutination Behavior of Lactic Starter Cultures

#### WEDNESDAY MORNING — AUGUST 3, 1994

##### A Symposium on Risk Management The Model: *Listeria monocytogenes*

###### Defining the Risk

- Infectious Dose and Susceptible Populations
- Epidemiological Information and National Health Monitoring

###### The Role of Risk Assessment/Risk Management

- Risk Analysis Defined
- Risk Analysis and Foodborne Illness
- Managing Risks From the Industry Perspective

###### Dairy Symposium

Topics to be announced

###### Natural Antimicrobials and Inhibitors for Food Applications

- Bacteriocins for *Listeria* Control
- Antimicrobials for Meat Applications
- Efficacy of Naturally Occurring Food Flavors as Inhibitors of Foodborne Pathogens
- Regulatory Perspectives on the Use of Bacteriocins in Foods
- USDA's Regulatory Perspective on the Use of Bacteriocins in Foods
- Industry Perspective on the Use of Natural Antimicrobials and Inhibitors for Food Applications

###### Quality and Safety Concerns on Aquacultured Products Symposium

- Effects of Cultivation, Harvesting Practices on Microbial Quality of Aquacultured

- Effects of Processing on Microbial Quality of Aquacultured Fishes Product
- Use of HACCP Program on Aquacultured Products from Production to Consumption
- Storage Quality and Safety Improvement as Affected by Advanced Packaging System
- Use of Biochemical Indices and Time-Temp Indicator on Aquacultured Fish Product held Under Modified Atmospheres
- Effects of Current Distribution System and Retail Market Practices on Microbial Safety and Storage Quality of Processed Aquacultured Fish Products

#### WEDNESDAY AFTERNOON — AUGUST 3, 1994

##### A Symposium on Risk Management The Model: *Listeria monocytogenes* (cont.)

###### Control Practices and Their Impact

- Design of Processes to Prevent and Control *Listeria monocytogenes*
- Economic Impact of *Listeria* Control Practices

###### Current Regulatory Approaches

- Short Presentation and Roundtable

###### Dairy Symposium II

Topics to be announced

###### European Food Processing Equipment Hygiene Standards Symposium

- Food Industry Perspective
- Equipment Manufacturers Perspective
- CEN and EHEDG Perspective
- The Government Perspective
- Test Methods and Their Development
- The 3-A Viewpoint on European Standards
- The Challenge

###### Current Food and Health Related Safety Issues Symposium

- The Impact of International Free Trade on Food Safety Standards
- International Food Safety and Quality Standards
- Does International Fair Trade Mean Compromised Food Safety Standards? — Impact on Seafood Safety
- Poultry Safety After NAFTA
- Hantavirus Pulmonary Syndrome (HPS) — An Emerging Public Health Threat
- Use of Foodborne Disease Data for HACCP Risk Assessment: A New Approach in the State of New York

# 81st IAMFES Annual Meeting Spouse/Companion Tours

## BIENVENIDOS

Sunday, July 31 — 9:00 a.m. - It's up to you  
Cost: \$25 (\$30 on-site) Lunch on your own

Welcome to San Antonio . . . one of America's four unique cities . . . where the east meets the west, where the romance and tradition of old Spain meet the sound and energy of a high tech society, where the river dances through the heart of the city and the fiesta never ends. A chartered transit bus will be your magic carpet and Convention Coordinators guide will be your key as you are met at the Hyatt Regency Riverwalk at 9:00 o'clock in the morning for this introductory tour.

First, we'll drive through HemisFair Plaza to the Institute of Texan Cultures. This "hands-on" museum is for the interpretation and assimilation of Texas history and folk culture and tells about the 26 ethnic groups who were the pioneers of this great state.

We'll drive through the King William Historic District, which was one of San Antonio's early residential neighborhoods. Built at the turn of the century by German "merchant princes," the area has been "re-awakened" and is once again a gracious and friendly old-fashioned neighborhood.

On to the new IMAX Theater, featuring "Alamo - The Price of Freedom," located in Rivercenter Mall. The movie is a stunning experience, shown on a six-story screen with a six-track sound system that lets you "feel" the action. "Alamo - The Price of Freedom" is the most historically accurate depiction of the famous battle in existence. The 45-minute movie "puts you in the middle of the battle of the Alamo."

Walk next door to the "Cradle of Texas Liberty," the Alamo, tucked in among downtown hotels, office buildings and crowded streets. The Alamo's roughly pitted, sandstone facade belies its quiet, churchlike limestone interior where even the most casual visitor experiences an awe while viewing the names of the Alamo heroes inscribed in bronze on the walls.

Continue to San Jose, Queen of the Texas Missions, for a tour of the Indian compound in this extensively restored mission. You will see Indian living quarters, Spanish officer's quarters, the convent, the beautiful church with its elaborately carved entrance, and the famous Rosa's Window.

There will be time for lunch on your own, shopping and browsing in El Mercado where the shops are loaded with curios from the Southwest. Items include: Dresses, shirts, pinatas, dolls, jewelry, straw hats, leather goods, and many other "goodies." Our guide will tell us how to ride the trolley back to the hotel for ten cents. Return to the Hyatt at your leisure.

**LBJ RANCH & FREDERICKSBURG**  
Monday, August 1 — 8:45 a.m. - 4:30 p.m.  
Cost: \$25 (\$30 on-site) Lunch on your own

The beautiful Texas Hill Country has never been so well known as when Lyndon B. Johnson was President of the United States. His barbecues under the oak and pecan trees of his ranch were seen by all in those days. So that you can taste a little of "Pedernales country" for yourselves, we have arranged a day in this legendary part of Texas. A chartered motor coach with a Convention Coordinators guide on board will meet you at the Hyatt Regency Riverwalk at 8:45 in the morning for the drive to the LBJ Ranch. There will be a 90 minute educational tour of this National Historic Park including the Junction School, the Johnson birthplace and cemetery, the LBJ ranchlands with its registered Hereford cattle, the Show Barn, and the exterior of the Texas White House where Mrs. Johnson still resides.

On to the historic Fredericksburg for lunch on your own, shopping and browsing on Main Street in this quaint German town, or visiting the Admiral Chester Nimitz Museum of the War of the South Pacific (a Recorded Texas Historic Landmark) with the Japanese Peace Garden.

See the historic "Sunday Houses", where farmers and ranchers stayed on weekends. Return to the hotel at 4:30 in the afternoon.

## MIL COLORES

Tuesday, August 2 — 9:00 a.m. - 3:00 p.m.  
Cost: \$25 (\$30 on-site) Lunch on your own

Capture the spirit and the many colors of San Antonio as you depart the Hyatt Regency Riverwalk at 9:00 in the morning. We'll follow the Mission Trail, pausing at Mission Concepcion, and San Jose, Queen of the Texas Missions. We'll proceed to historic Fort Sam Houston, established in 1876, and now Headquarters for the Fifth Army. We'll see the enormous parade field, the Quadrangle where Chief Geronimo was once held captive, and General's Row where many famous military personalities have resided.

On to the San Antonio Botanical Center, 38-acres representing, in miniature, the diverse Texas landscape - from the wild flowers of the Texas Hill Country to the formal rose gardens of East Texas. A Biblical Garden, Children's Garden, and a Fragrance Garden are also featured. A highlight of the center is the new underground conservatory, with rare and exotic plants and flowers.

There will be time for lunch on your own and shopping at Los Patios, an oasis on the banks of Salado Creek. Shop in the boutiques located on the park-like grounds, including: The Flower Forest, Marisol Boutique, Tejas Gifts, Tienda, Big Sky Clothing Company, The Gallery, Vega's Jewelry and Lo Singular. Enjoy lunch at the Gazebo, the Hacienda or the Brazier Restaurants.

The McNay Art Museum is a "treasure house of art," religiously dedicated to discriminating taste. Housed in a magnificent Mediterranean mansion built around a lush courtyard and reflecting pool, you'll view works by Van Gogh, Gauguin, Matisse, Picasso, Renoir - to name a few. The McNay is rated one of the best small museums in the country.

We'll pause on Alpine Drive which affords a beautiful view of the city skyline and the Japanese Sunken Garden below. Arrive back at the Hyatt Regency Riverwalk at 3:00 in the afternoon.

**SHOPPER'S PARADISE**  
Wednesday, August 3 — 9:00 a.m. - 4:00 p.m.  
Cost: \$20 (\$25 on-site) Lunch on your own

"Shop till you drop!" Today you will see some of the most interesting shops in the area as you depart the Hyatt Regency Riverwalk at 9:00 a.m. in a chartered motorcoach to search for bargains galore! First, we'll journey to San Marcos, Texas, to a new and exciting outlet mall, one of the nation's largest. Clothing, accessories, housewares - in such shops as Adolpho, Perry Ellis, Coach, Mikasa, Eddie Bauer, Etienne Aigner, Nike, Sara Coventry, Fitz & Floyd - and much, much more. On to the Tanger Factory Outlet Center where you'll find items for the entire family. Buy directly from 31 upscale designers and manufacturers outlet stores and save 30 to 70% off retail prices.

Then to the quaint German town of New Braunfels, Texas where "Life is Beautiful." The Langston House, a symmetrical Greek Revival style house, was built in 1854 by Franz Moreau. The log and "fachwerk" construction was common in those days. The house was later occupied by the Gross family, the Frieze Family and then the Langston Family.

We'll continue to the nearby town of Gruene, founded in 1872 by Henry D. Gruene from Germany, who built a home and cotton gin and the town grew. It was known for its dance hall and saloon built in the 1880's which is the oldest dance hall in Texas still in existence. Death came to Henry Gruene in 1920 and this also marked the end of the development of the town. In 1925 the boll weevil and the depression struck and it became a ghost town. The untouched town was purchased in 1974 and businesses were once again established in the old buildings. We'll enjoy stepping back in time as we visit the many shops in town including: Texas Homegrown, The Bush Whacker, Nature's Alliance, The Gruene Antique Company, The Back Porch, Buck Pottery and others. Guests can eat on their own at one of the three restaurants located in Gruene. Arrive back at the Hyatt Regency Hotel at 4:00 o'clock in the afternoon.

# 81st IAMFES Annual Meeting Registration Form

Hyatt Regency Riverwalk — San Antonio, Texas — July 31 - August 3, 1994  
(Use photocopies for extra registrations)

FOR OFFICE USE

Date Rec'd. \_\_\_\_\_ First initial \_\_\_\_\_ Last name \_\_\_\_\_  
Registration # \_\_\_\_\_

**\*Sign up to become  
a NEW member  
and take advantage of the  
member discount.**

First Name (will appear on badge) \_\_\_\_\_ (please print) \_\_\_\_\_ Last Name \_\_\_\_\_

Title \_\_\_\_\_ Employer \_\_\_\_\_

Mailing Address (Please specify: Home Work) \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Fax # \_\_\_\_\_ Area Code & Telephone \_\_\_\_\_

## Registration

IAMFES Member (Banquet included) \$150 (\$185 on-site)  
 Non-Member (Banquet included) \$210 (\$245 on-site)  
 IAMFES Student Member \$ 20 (\$ 25 on-site)  
 IAMFES Member One Day (Circle: Mon/Tues/Wed) \$ 80 (\$100 on-site)  
 Non-Member One Day (Circle: Mon/Tues/Wed) \$105 (\$130 on-site)  
 Spouse/Companion (Name): \_\_\_\_\_  
 Children (14 & Under), Name: \_\_\_\_\_  
 FREE

Total Amount \_\_\_\_\_

## Please check where applicable:

- IAMFES Member
- Non-Member
- Local Arrangements
- 30 Yr. Member
- 50 Yr. Member
- Past President
- Executive Board
- Speaker
- Honorary Life Member
- Exhibitor

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## \*New Membership Fees:

- Membership (Dairy, Food & Environmental Sanitation) \$ 50
- Membership Plus (Dairy, Food & Env. Sanitation & Journal of Food Protection) \$ 80
- \*Student Membership  Dairy, Food & Env. San. or  Journal of Food Protection \$ 25
- \*Student Membership Plus (Dairy, Food & Environmental Sanitation & Journal of Food Protection) \$ 40
- \*Full-time student verification required.

\$ 22.50 per journal  
\$ 95.00 per journal

## Other Fees: (Per Person)

- Nachos and Margaritas Reception (Sun., 7/31) \_\_\_\_\_
- Rio Cibolo Ranch Evening (Mon., 8/1) \_\_\_\_\_
- IAMFES Awards Banquet (Wed., 8/3) \_\_\_\_\_

# of tickets \_\_\_\_\_

## Spouse/Companion Events:

- Bienvenidos (Sun., 7/31) \_\_\_\_\_
- LBJ Ranch & Fredericksburg (Mon., 8/1) \_\_\_\_\_
- Mil Colores (Tues., 8/2) \_\_\_\_\_
- Shopper's Paradise (Wed., 8/3) \_\_\_\_\_

\$ 35 (\$ 40 on-site)  
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Please indicate here if you have a disability requiring special accommodations.

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Total Amount Enclosed \$ \_\_\_\_\_  
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## Registration Information

Send payment with registration to IAMFES, 6200 Aurora Avenue, Suite 200W, Des Moines, IA 50322. Make checks payable to IAMFES. Pre-registration must be post-marked by July 1, 1994. The pre-registration deadline will be strictly observed. For additional information contact Julie Heim at 1-800-369-6337 (US).

## Refund/Cancellation Policy

The IAMFES policy on meeting cancellation/refunds is as follows: "Registration fees, minus a \$25 processing fee, will be refunded for written cancellations posted at least two (2) weeks prior to the start of the meeting. No refunds will be made for cancellations made less than two (2) weeks prior to the start of the meeting, however, the registration may be transferred to colleague with written

## Exhibitor Information

An exhibition of products and consultant services will be at the Hyatt Regency Riverwalk. For more information on exhibiting at the conference, please contact Scott Wells at 1-800-369-6337, 1-800-284-6336 (Canada).

Guest Room Commitment  
GOOD UNTIL JUNE 29, 1994  
Make Your Reservation Now

## HOTEL RESERVATIONS IAMFFES

81st Annual Meeting  
July 31-August 3, 1994  
Hyatt Regency Riverwalk  
San Antonio, Texas

Please check accommodation requested:

- Single (1 person)     Triple (3 persons)  
 Double (2 persons)     Quad (4 persons)

Bed type:

- King Bed  
 2 Queen Beds

Special Requests \_\_\_\_\_

Please indicate here if you have a disability requiring special accommodations.  
All room rates are subject to prevailing taxes.  
Reservations must be received by hotel prior to arrival.

NAME \_\_\_\_\_

SHARING WITH (Name) \_\_\_\_\_

COMPANY NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

STATE/PROVINCE \_\_\_\_\_

TELEPHONE \_\_\_\_\_

ARRIVAL DATE \_\_\_\_\_

SPECIAL REQUESTS \_\_\_\_\_

After June 29, 1994 reservations will be accepted on a space availability basis only. Reservations will be held until 6:00 p.m. on the date of arrival, unless guaranteed by one night advance deposit, payable by certified check or a Major Credit Card.

CREDIT CARD # \_\_\_\_\_

EXPIRATION DATE \_\_\_\_\_

CARD HOLDERS SIGNATURE \_\_\_\_\_

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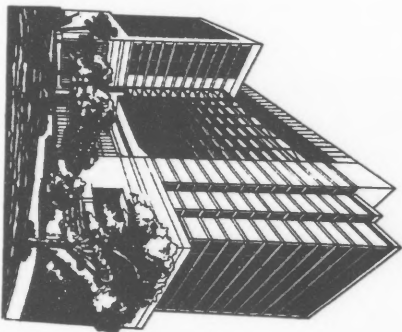
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**AMENDMENT TO RESCIND**  
**E-3-A Sanitary Standards for Egg and Egg Products Equipment**

*Formulated by*  
*International Association of Milk, Food and Environmental Sanitarians*  
*United States Public Health Service*  
*United States Department of Agriculture*  
*Institute of American Poultry Industries*  
*Dairy and Food Industries Supply Association*

**E-3-A Sanitary Standards for Fittings Used on Egg and Egg Products Equipment and  
Used on Sanitary Lines Conducting Egg and Egg Products, Number E-0800**  
*Effective Date February 19, 1972*

**E-3-A Sanitary Standards for Fittings and Connections Used on Liquid and  
Liquid Egg Products, Number E-0903**  
*Effective Date June 23, 1970*

**E-3-A Sanitary Standards for Automotive Transportation Tanks  
for Liquid Egg Products, Number E-0500**  
*Effective Date January 14, 1976*

**E-3-A Sanitary Standards for Continuous Blenders, Number E-3500**  
*Effective Date May 4, 1979*

**E-3-A Sanitary Standards for Pressure and Level Sensing Devices, Number E-3700**  
*Effective Date May 4, 1979*

**E-3-A Sanitary Standards for Scraped Surface Heat Exchangers, Number E-3100**  
*Effective Date May 4, 1979*

**E-3-A Sanitary Standards for Plate-Type Heat Exchangers  
for Fluid Egg Products, Number E-1100**  
*Effective Date June 26, 1975*

**E-3-A Sanitary Standards for Pumps for Liquid Egg Products,  
Number E-0200, as Amended by E-0201**  
*Effective Dates June 23, 1970 and May 22, 1971*

**E-3-A Sanitary Standards for Sifters for Dry Egg Products, Number E-2600**  
*Effective Date June 23, 1970*

**E-3-A Sanitary Standards for Homogenizers and Pumps of the Plunger Type for  
Liquid Egg and Liquid Egg Products, Number E-0401**  
*Effective Date June 28, 1972*

**E-3-A Accepted Practices for Permanently Installed Sanitary  
Product Pipelines and Cleaning Systems, Number E-60500**

*Effective Date May 7, 1971*

**E-3-A Sanitary Standards for Tubular Heat Exchangers  
for Liquid Egg Products, Number E-1200**

*Effective Date January 14, 1976*

**E-3-A Accepted Practices for Supplying Air Under Pressure in Contact with Liquid Eggs and  
Egg Products and Product Contact Surfaces, Number E-60400**

*Effective Date May 7, 1971*

**E-3-A Accepted Practices for Liquid Egg and Liquid Egg Products  
Spray Drying Systems, Number E-60700**

*Effective Date March 6, 1972*

**E-3-A Sanitary Standards for Storage Tanks for Eggs and Egg Products, Number E-0100**

*Effective Date June 28, 1972*

**E-3-A Sanitary Standards for Inlet and Outlet Leak Protector Plug Valves  
for Batch Pasteurizers, Number E-1400**

*Effective Date August 28, 1971*

**E-3-A Sanitary Standards for Multiple-Use Rubber and Rubber-Like Materials Used as  
Product Contact Surfaces in Egg Processing Equipment, Number E-1800**

*Effective Date May 7, 1971*

*These rescinding amendments were effective December 15, 1993.*

# Business Exchange "Classifieds"

## Services / Products



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CIRCLE READER SERVICE NO. 350

## Employment Opportunities

### **Director - Division of Milk & Dairy Products** **TEXAS DEPARTMENT OF HEALTH**

Bachelor's degree from an accredited college or university with a major in natural, physical or biological science, plus eight (8) years of full-time, paid experience in regulatory activities concerning maintenance of standards in milk and dairy products or sanitation, four (4) years of which shall have been in a supervisory or administrative capacity.

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3/94

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101	114	127	140	153	166	179	192	205	218	231	244	257	270	283	296	309	322	335	348
102	115	128	141	154	167	180	193	206	219	232	245	258	271	284	297	310	323	336	349
103	116	129	142	155	168	181	194	207	220	233	246	259	272	285	298	311	324	337	350
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

This second Reader Service Card is provided to allow co-workers to also respond to companies of interest.

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112	125	138	151	164	177	190	203	216	229	242	255	268	281	294	307	320	333	346	359
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# Coming Events

1994

## April

**•4-5, Food Plant Pest Control Update**, sponsored by the American Institute of Baking, will be held at AIB, 1213 Bakers Way, Manhattan, KS 66502. For more information please contact AIB at (913)537-4750, (800)633-5137.

**•6, Nebraska Association of Milk and Food Sanitarians Annual Meeting** will be held at the Lancaster County Extension Office in Lincoln, NE. The subject for the meeting will be "1994 Changes in Food Regulations: Their Impact on the Dairy and Food Industries." For more information, contact Greg Henn at (402)4466-5867.

**•6-8, Annual Educational Conference of the Missouri Milk, Food and Environmental Health Assn.** will be held at the Ramada Inn, Columbia, MO. For more information, contact Janet Murray at (816) 263-6643.

**•11-13, Microbiology and Engineering of Sterilization Processes** will be given at the St. Paul Campus of the University of Minnesota. For further information, contact Dr. William Schafer, course coordinator, Department of Food Science and Nutrition, 1334 Eckles Avenue, St. Paul, MN 55108, (612)624-4793.

**•11-14, Statistical Process Control for the Food Processing Industries**, sponsored by the University Extension, University of California-Davis, will be held on the UC-Davis campus. For more information or to enroll, call toll free in California (800)752-0881, from Davis, Dixon, Woodland or outside California, call (916)757-8777.

**•12-13, Carolina's Association of Milk, Food and Environmental Sanitarians** will meet in Greenville, SC. For more information, contact Beth Johnson at (803)935-6201.

**•15, How to Conduct a Professional Safety Audit**, sponsored by the American Institute of Baking, will be held in St. Louis, MO. For more information please contact AIB at (913)5537-4750, (800)633-5137.

**•18-19, Damage Control of Packaged Foods**, presented by The Food Processors Institute, in cooperation with the National Food Processors Association, The Food Marketing Institute, The Food Processing Machinery and Supplies Association and The Institute of Packaging Professionals, will be held at the Wyndham Garden Hotel, Atlanta, GA. For more information please contact The Food Processors Institute, 1401 New York Avenue, NW, Suite 400, Washington, DC 20005; (202)393-0890.

**•18-21, Purdue Better Process Control School** will be sponsored by the Food Science Department at Purdue University. For more information, contact James V. Chambers, Food Science Department, Smith Hall, Purdue University, West Lafayette, IN 47907, Phone: (317)494-8279.

**•18-22, Wyoming Environmental Health Association and Wyoming Public Health Association Annual Educational Conference** will be held at the Holiday Inn, Sheridan, WY. The theme for this conference will be "Public Health / Planning the Future." For more information, contact Stephanie Whitman at (307) 721-5283.

**•19-20, Food Plant Sanitation**, sponsored by the American Institute of Baking, will be held in Louisville, KY. For more information please contact AIB at (913)537-4750, (800)633-5137.

**•25-27, Principles of Pizza Production**, sponsored by the American Institute of Baking, will be held at AIB, 1213 Bakers Way, Manhattan, KS 66502. For more information please contact AIB at (913)537-4750, (800)633-5137.

**•27-29, Hands-on Pizza Lab**, sponsored by the American Institute of Baking, will be held at AIB, 1213 Bakers Way, Manhattan, KS 66502. For more information please contact AIB at (913)537-4750, (800)633-5137.

## May

**•2-6, Electrical Troubleshooting**, sponsored by the American Institute of Baking, will be held at AIB, 1213 Bakers Way, Manhattan, KS 66502. For more information please contact AIB at (913)537-4750, (800)633-5137.

**•3-4, Food Plant Sanitation**, sponsored by the American Institute of Baking, will be held in Seattle, WA. For more information please contact AIB at (913)537-4750, (800)633-5137.

**•3-5, Extending Food Product Quality and Shelf-Life**, sponsored by the American Institute of Baking, will be held at AIB, 1213 Bakers Way, Manhattan, KS 66502. For more information please contact AIB at (913)537-4750, (800)633-5137.

**•4-5, Wisconsin Association of Milk and Food Sanitarians** will present a two-day workshop on HACCP programs. The workshop will be presented at the Sheraton Inn, Madison, WI. Registration information is available from Neil Vassau, PO Box 7883, Madison, WI 53707.

**•6, How to Write Your Own OSHA Programs**, sponsored by the American Institute of Baking, will be held in Kansas City, MO. For more information please contact AIB at (913)537-4750, (800)633-5137.

**•7-12, Food Structure Annual Meeting** will be held at the Holiday Inn Downtown City Hall, Toronto, Ontario, Canada. For more information, please contact Dr. Om Johari, SMI, Chicago (AMF O'Hare), IL 60666-0507, USA (or call 708-529-6677, FAX: 708-980-6698).

**•9-11, Introduction to Food Industry Quality Management**, sponsored by the University Extension, University of California-Davis, will be held on the UC-Davis campus. For more information or to enroll, call toll free in California (800)752-0881, from Davis, Dixon, Woodland or outside California, call (916)757-8777.

**•9-13, Fundamentals of Programmable Controllers**, sponsored by the American Institute of Baking, will be held at AIB, 1213 Bakers Way, Manhattan, KS 66502. For more information please contact AIB at (913)537-4750, (800)633-5137.

**•16-20, Refrigeration Technology**, sponsored by the American Institute of Baking, will be held at AIB, 1213 Bakers Way, Manhattan, KS 66502. For more information please contact AIB at (913)537-4750, (800)633-5137.

•17-18, **Food Plant Sanitation**, sponsored by the American Institute of Baking, will be in Atlanta, GA. For more information please contact AIB at (913)537-4750, (800)633-5137.

•18-21, **Purdue Better Process Control School** will be sponsored by the Food Science Department at Purdue University. For more information, contact James V. Chambers, Food Science Department, Smith Hall, Purdue University, West Lafayette, IN 47907, Phone: (317)494-8279.

•25-27, **International Conference on Food Physics**, sponsored by the International Society of Food Physicists and the Editorial Board of Journal of Food Physics, will be held at the University of Horticulture and Food Industry, Budapest, Hungary. For further information, contact A. S. Szabo, President of the Organizing Committee, H-1118 Budapest, Somloi Street 14-16, Phone: 361-1850-666/470, Fax: 361-166-6220.

## June

•2, **Tennessee Association of Milk, Water and Food Protection's Annual Meeting** will be held at the Nashville Ramada Airport. For more information please contact Dennis Lampley at (615)360-0157.

## July

•8-15, **Rapid Methods and Automation in Microbiology International Workshop XIV**, to be held at Kansas State University, Manhattan, KS. For more information contact Dr. Daniel Y. C. Fung at (913)532-5654, FAX (913)532-5681. A mini-symposium will occur on July 8th and 9th.

•31-August 3, **81st Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians** will be held at the Hyatt Regency Hotel, San Antonio, TX. For more information, contact: Julie Heim — Registration; Scott Wells — Exhibits; at (800)369-6337 (US), (800)284-6336 (Canada), or (515)276-3344.

## August

•20-25, **41st International Congress of Meat Science and Technology**, hosted by the American Meat Science Association, to be held in San Antonio, TX. For more information contact Ken Johnson, ICoMST Secretariat at (312)467-5520.

•23-24, **Microbiological Concerns in Food Plant Sanitation & Hygiene**, a two day interactive lecture course, sponsored by Silliker Laboratories Group, Inc., will be held in Chicago, IL. For further information, contact Silliker Laboratories, Education Services Department at (800)829-7879.

## September

•19-21, **Indiana Environmental Health Association Fall Annual Educational Conference** will be held in Muncie, IN. For additional information, contact Tami Barrett at (317)633-8400.

## October

•5-8, **1994 International Dairy Show**, sponsored by the International Dairy Foods Association, Milk Industry Foundation, National Cheese Institute and International Ice Cream Association, co-sponsored by the American Butter Institute, will be held at the Minneapolis Convention Center, Minneapolis, MN. For more information, contact International Dairy Show Convention Management at (703)876-0900.

•12-13, **Iowa Association of Milk, Food and Environmental Sanitarians Annual Meeting** will be held at the Best Western Starlite Village (formerly the Ramada Hotel), Waterloo, IA. For more information, call Dale Cooper at (319)927-3212.

•25-26, **HACCP for Meat and Poultry Processors**, a two day interactive workshop designed for those responsible for implementing a HACCP plan in a processing plant, will be held in Dallas, TX. Sponsored by Silliker Laboratories Group, Inc., more information is available by calling Silliker's Education Services Dept. at (800)829-7879.

## November

•2-3, **North Dakota Environmental Health Assn. Annual Educational Conference** will be held at the International Inn, Williston, ND. For more information, contact Deb Larson at (701)221-6147.

To insure that your meeting time is published, send announcements at least 90 days in advance to: IAMFES, 200W Merle Hay Centre, 6200 Aurora Avenue, Des Moines, IA 50322.

## ADVERTISING INDEX

Bentley Instruments, Inc. ....	133
Brevis Corp. ....	160
Cargill Analytical Services .....	160
Charm Sciences, Inc. ....	Back Cover
Gardex Chemicals Ltd. ....	133
International Dairy Show .....	137
Meritech, Inc. ....	157
Nelson-Jameson, Inc. ....	145
Oxoid/Unipath .....	139
Herbert V. Shuster, Inc. ....	154
VICAM .....	141
West Agro .....	133
World Dryer .....	154

## BUSINESS EXCHANGE "CLASSIFIEDS"

DQCI Service Inc. ....	184
Ingman Labs, Inc. ....	184
Midwest Laboratories, Inc. ....	184
Texas Department of Health .....	184
Winston Laboratories, Inc. ....	184

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International Association of Milk, Food and Environmental Sanitarians, Inc.

## IAMFES Booklets

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_____	Procedures to Investigate Foodborne Illness - 4th Edition \$5.00/member; \$7.50/non-member	_____
_____	Procedures to Investigate Arthropod-borne and Rodent-borne Illness \$5.00/member; \$7.50/non-member	_____
_____	Procedures to Implement the Hazard Analysis Critical Control Point System \$5.00/member; \$7.50/non-member	_____
_____	Pocket Guide To Dairy Sanitation \$.50/member; \$.75/non-member (minimum order of 10) (\$2.50 shipping for each order of 10)	_____

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# IAMFES

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## MEMBERSHIP APPLICATION

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- Check here if you are interested in information on joining your state/province chapter of IAMFES**

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Includes exhibit discount, July advertising discount, company monthly listing in both journals and more.

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- Membership with the *Journal of Food Protection* \$25**

\*Full-time student verification must accompany this form.

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#### **Data Collection**

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