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# FOOD PROTECTION TRENDS

SCIENCE AND NEWS

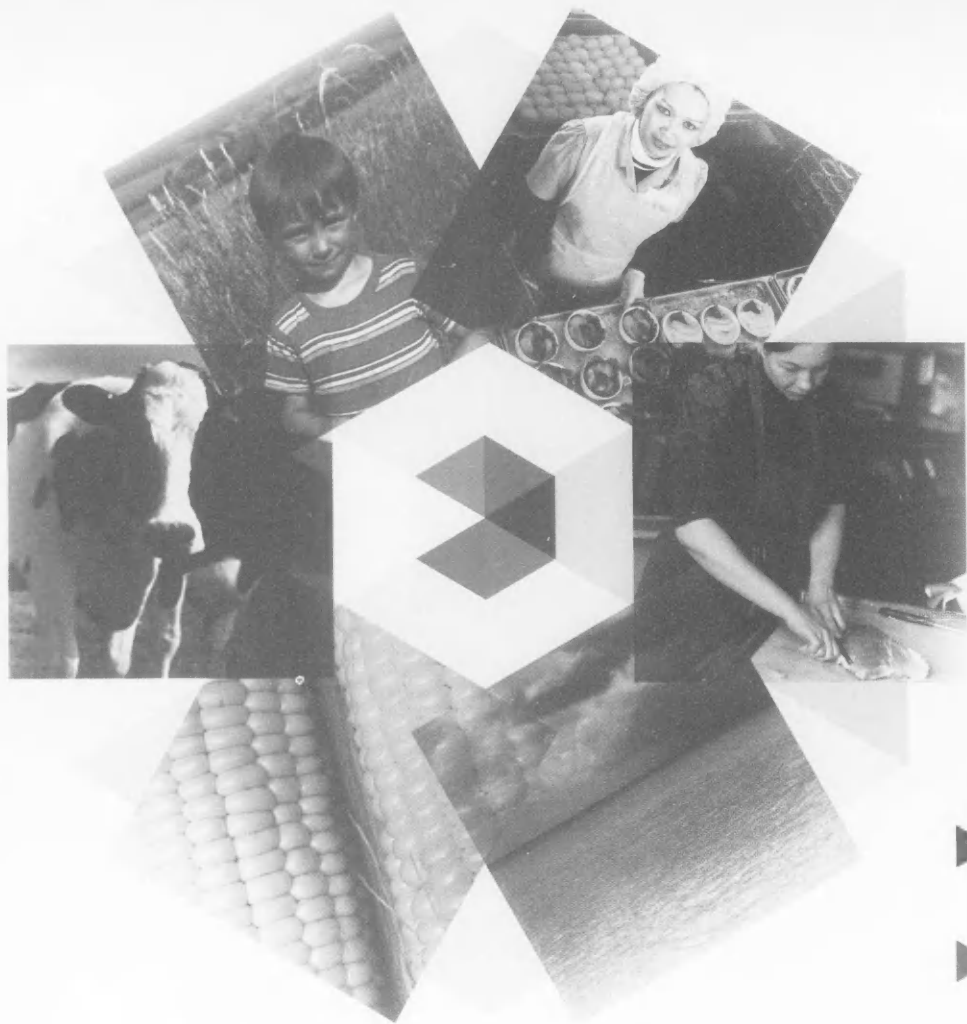
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# FOOD PROTECTION TRENDS

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## A NOTE FROM THE FPT SCIENTIFIC EDITOR...

# BILL LAGRANGE

**D**airy, Food and Environmental Sanitation (*DFES*) is history, as of the December 2002 issue. *Food Protection Trends (FPT)* is the new name as the standard bearer for our International Association for Food Protection (IAFP). We encourage you to keep up with the news of IAFP and our members through *FPT*. Also we encourage you to consider preparing manuscripts, based on your professional experiences and scientific research, for possible publication in *FPT*. All manuscripts are peer reviewed by two authorities who work within the manuscript's subject area.

During 2002, 34 manuscripts were submitted to IAFP for possible publication in *DFES*. The year before, 33 manuscripts were submitted for consideration. In 2002, the 12 issues of Volume 22 included 28 scientific papers along with all the news of IAFP and its members. Of the 32 manuscripts submitted, 30 were accepted for publication or are still out for review. Twelve were published in Volume 22 of *DFES* during 2002 with the other 16 submitted in 2001. The remaining 18 submitted in 2002 will be published in Volume 23 of our new *Food Protection Trends* journal as they are prepared for publication.

One goal of the Journal Management Committee continues to be the review and publication of submitted manuscripts in a timely fashion. There are 53 members of the *FPT* Editorial Board eager to review submitted manuscripts from IAFP Members. So don't hesitate to get your paper into IAFP for possible publication in *FPT*.

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E-mail: [info@foodprotection.org](mailto:info@foodprotection.org)  
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### FPT JOURNAL STAFF

**David W. Tharp, CAE:** Executive Director  
E-mail: [dtharp@foodprotection.org](mailto:dtharp@foodprotection.org)

**Lisa K. Hovey, CAE:** Managing Editor  
E-mail: [lhovey@foodprotection.org](mailto:lhovey@foodprotection.org)

**Donna A. Bahun:** Production Editor  
E-mail: [dbahun@foodprotection.org](mailto:dbahun@foodprotection.org)

**Pam J. Wanninger:** Proofreader  
E-mail: [pwanninger@foodprotection.org](mailto:pwanninger@foodprotection.org)

### INTERNATIONAL ASSOCIATION FOR FOOD PROTECTION STAFF

**David W. Tharp, CAE:** Executive Director  
E-mail: [dtharp@foodprotection.org](mailto:dtharp@foodprotection.org)

**Lisa K. Hovey, CAE:** Assistant Director  
E-mail: [lhovey@foodprotection.org](mailto:lhovey@foodprotection.org)

**Donna A. Bahun:** Design and Layout  
E-mail: [dbahun@foodprotection.org](mailto:dbahun@foodprotection.org)

**Julie A. Cattanaach:** Membership Services  
E-mail: [jcattanaach@foodprotection.org](mailto:jcattanaach@foodprotection.org)

**Bev Corron:** Public Relations  
E-mail: [bcorron@foodprotection.org](mailto:bcorron@foodprotection.org)

**Donna Gronstal:** Senior Accountant  
E-mail: [dgronstal@foodprotection.org](mailto:dgronstal@foodprotection.org)

**Karla K. Jordan:** Order Processing  
E-mail: [kjordan@foodprotection.org](mailto:kjordan@foodprotection.org)

**Didi Sterling Loynachan:** Administrative Assistant  
E-mail: [dloynachan@foodprotection.org](mailto:dloynachan@foodprotection.org)

**Lucia Collison McPhedran:** Association Services  
E-mail: [lmcphebran@foodprotection.org](mailto:lmcphebran@foodprotection.org)

**Beth Miller:** Accounting Assistant  
E-mail: [bmiller@foodprotection.org](mailto:bmiller@foodprotection.org)

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SCIENCE AND NEWS  
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AUGUST 10-13

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New Orleans, Louisiana

## IAFP 2004

AUGUST 8-11

JW Marriott Desert  
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AUGUST 14-17

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### EXECUTIVE DIRECTOR

**David W. Tharp**, CAE, 6200 Aurora Ave., Suite 200W, Des Moines, IA 50322-2864; Phone: 515.276.3344; E-mail: dtharp@foodprotection.org

### SCIENTIFIC EDITOR

**William LaGrange**, Ph.D., Iowa State University, Department of Food Science and Human Nutrition, Food Sciences Building, Ames, IA 50011-0001; Phone: 515.294.3156; Fax: 515.294.8181; E-mail: lagrange@iastate.edu

### SCIENTIFIC NEWS EDITOR

**Doug Powell**, Ph.D., University of Guelph, Guelph, Ontario N1G 2W1 Canada; Phone: 519.821.1799; Fax: 519.824.6631; E-mail: dpowell@

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THOUGHTS FROM THE PRESIDENT  
“TIMING IS EVERYTHING”

In October 2002, I had the opportunity to participate in the International Seminar on Microbiological Food Safety, held at the University of São Paulo, organized by members of our new affiliate, the Brazilian Association for Food Protection (ABRAPA, Associação Brasileira de Proteção de Alimentos). The two-day meeting was held in collaboration with the Brazilian Society for Microbiology and the Iberoamerican network for food quality and safety, RICSA. ABRAPA President Mariza Landgraf, in her opening remarks, noted that the new IAFP affiliate in Brazil “was only a baby, but with lots of opportunity to grow.” The meeting program was timely and comprehensive, featuring speakers that addressed such topics as microbiological sampling plans, food safety objectives, food traceability, the microbiological safety of foods of vegetable origin, and the epidemiology of foodborne diseases in Latin America. I congratulate our new affiliate members for a very successful first meeting and for attracting a very enthusiastic audience. I suspect this “new baby” will mature rapidly to provide leadership contributing to the IAFP mission and activities in promoting and ensuring food safety throughout the Latin American countries.

After Brazil, my travels in South America continued on to a beautiful location in the southern part of Chile, the town of Pucon, situated only 14 kilometers from an active volcano, Volcan Villarrica. The purpose of this part of the journey was a working



By ANNA M. LAMMERDING  
PRESIDENT

**“This is also  
your association  
publication, and  
we would also like  
to hear from you”**

meeting of the International Commission on Microbiological Specifications for Foods (ICMSF) to discuss, debate and write about some of the current issues in the management of food safety for international trade. This was then followed by the VII Latin American Congress of Food Microbiology and Hygiene, held in Santiago, Chile, where I participated as a speaker in an ICMSF symposium on “HACCP and Food Safety Objectives”. This also proved to be an excellent forum to present, discuss and debate some of the current developments in our field. Other speakers at the Congress

included IAFP Past President Robert Gravani (1989), Professor of Food Science at Cornell University. IAFP has Bob to credit for starting the tradition of writing this monthly President’s column. Although sometimes a challenge to keep up with our Production Editor Donna Bahun’s deadlines for copy, it is a great way to communicate with our membership, and, in Bob’s words, “write about whatever you want!” (which prompted me to contemplate writing about some people’s lack of “conference-call etiquette”, which drives me crazy... is there no “Emily Post” to instruct people about this?... but that topic is for another time!!)

However, this is also **your** association publication, and we would also like to hear from you. We look not only for peer-reviewed articles on applied food safety issues but also invite your perspectives for our commentary page and any other contribution that would help to inform the broad audience that reads this publication.

I hope you like the new look and name of this publication. Much deliberation went into deciding upon the name *Food Protection Trends* by the (formerly known as) *Dairy, Food and Environmental Sanitation Management Committee* and the IAFP Executive Board. It is hoped that the new name reflects the intent of having a publication that is timely and informative about current happenings in our field. Your contributions will help to make that happen!

# NFPA Food Safety Award Nominations Wanted!

The International Association for Food Protection welcomes your nominations for the National Food Processors Association (NFPA) Food Safety Award. This award honors an individual (Member or non-member) or a group or organization in recognition of a long history of outstanding contributions to food safety research and education.

**Eligibility:** Individuals or organizations may be from industry (including consulting), academia, or government. International nominations are encouraged. The nominee must have a minimum of 10 years of service in the food safety arena:

**Nomination deadline  
is March 17, 2003.**

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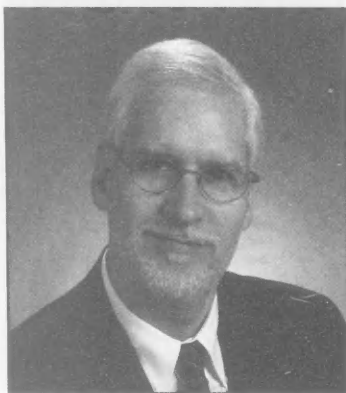
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# “COMMENTARY” FROM THE EXECUTIVE DIRECTOR

Today marks a revolutionary change in our Membership communication journal by changing the name to *Food Protection Trends*. First off, we hope that you recognized the new name when your journal arrived and we hope that you like the fresh cover design and the contemporary look inside the journal. Months of discussion, research and preparation have preceded this title and design change. Thank you to everyone involved with this transformation and to those who offered their opinions during the transition. If you have comments about the new look of *Food Protection Trends*, please forward them to my attention. We would be happy to hear your opinions.

So thus begins the twenty-third volume, now named *Food Protection Trends*. *Dairy, Food and Environmental Sanitation (DFES)* and *Dairy and Food Sanitation (DFS)* preceded *Food Protection Trends*. *DFES* was published for 14 volumes beginning in 1989 and *DFS* was published for 8 years marking its start in 1981. The focus of each journal, no matter the title, has been to share pertinent information with Association Members that allows you to better perform your job duties by becoming more informed about the food safety world around you. Just as importantly, we strive to keep you informed about Association news and activities.

Some of the Association news and activities currently underway are



By **DAVID W. THARP, CAE**  
EXECUTIVE DIRECTOR

**“With the New  
Year beginning,  
let’s all ‘make the  
best of everything’  
as we move  
forward into 2003!”**

the awards nomination process and the election of the 2003 Secretary. Registration for IAFP 2003 – the 90th Annual Meeting also begins this month. The registration form is printed on page 63 of this issue. Additional details will be included in February’s *Food Protection Trends* and are available now on the IAFP Web site.

This year’s deadline for award nominations is March 17. All award nominations must be received at the

IAFP office by March 17 to be considered. Nomination details and award criteria can be found on the IAFP Web site or on page 44. Many times at our Annual Meetings I hear someone say, “I wish I had nominated ‘Bob’ for ‘blank’ Award; he so deserves this award.” Right now is the time to take action and prepare the nomination materials! Take the time to nominate your colleagues; you will feel better about yourself knowing that you have done something good for a friend.

Ballots for the 2003 Secretary election will be mailed to you at the beginning of February; watch your mail for the envelope from IAFP. Completed ballots are due to the IAFP office by March 21 to be included in the Teller’s count. This year’s candidates will be announced on the IAFP Web site by the first of February and will be included in the February issue of *Food Protection Trends*. Be sure to make your voice heard, vote when your ballot arrives!

This month, I want to close with a little saying that I recently read in a small pamphlet printed by *Leadership ... with a human touch*. It reads, “The happiest people don’t necessarily have the best of everything. They just make the best of everything.” This made a lot of sense to me and I can think of quite a few people that this saying fits. I imagine that you can too! With the New Year beginning, let’s all “make the best of everything” as we move forward into 2003! Best wishes for a prosperous New Year.

## New Bioterrorism Web site Now Online

### **CDC has redesigned its bioterrorism Web site**

This Web site offers new and updated information for health professionals and the public.

The redesigned Web site, which focuses on public health preparedness and emergency response, is the official federal site for medical, laboratory, and public health professionals to reference when providing information to the public and for updates on protocols related to health threats such as anthrax.

CDC redesigned the site in response to overwhelming demand from the public and professionals for credible information during the anthrax crisis.

The site offers easy-to-use categories for key audiences, including clinicians.

**[www.bt.cdc.gov](http://www.bt.cdc.gov)**

## NOMINATE A COLLEAGUE TODAY FOR THE ASSOCIATION FELLOWS AWARD

The nominee must be a current International Association for Food Protection Member, and must have been a Member of the Association for 15 or more consecutive years.

The purpose of the Fellows Award is to honor and recognize Association Members who have contributed to the International Association for Food Protection and its Affiliates with quiet distinction over an extended period of time.

**NOMINATION DEADLINE IS MARCH 17, 2003.**

Nomination criteria available  
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6200 Aurora Avenue, Suite 200W  
Des Moines, IA 50322-2864, USA  
Phone: 800.369.6337 • 515.276.3344  
Fax: 515.276.8655  
E-mail: [info@foodprotection.org](mailto:info@foodprotection.org)  
Web site: [www.foodprotection.org](http://www.foodprotection.org)

This is Part I of a three-part series. Part II will run in February and Part III will run in March.

# Providing an Adequate Supply of Microbiologically Safe and Palatable Food and Drinking Water: Contribution of a European Vertically Integrated Approach to Educating Professionals and Consumers — Part I

D. A. A. MOSSEL,<sup>1</sup> G. P. MORRIS,<sup>2,3</sup> C. B. STRUIJK,<sup>1,4</sup> J. M. COWDEN,<sup>2</sup> and L. M. BROWNING<sup>2</sup>

<sup>1</sup>Eijkman Foundation for Postgraduate Education and Research in the Medical Microbiology of Foods and Drinking Water at Utrecht University, P.O. Box 6024, 3503 PA Utrecht, The Netherlands;

<sup>2</sup>Scottish Centre for Infection and Environmental Health, Clifton House, Clifton Place, Glasgow G3 7LN;

<sup>3</sup>University of Strathclyde, Division of Environmental Health, Glasgow, Scotland;

<sup>4</sup>University of Hertfordshire, Faculty of Natural Sciences, Hatfield, Herts., UK

## SUMMARY

Great efforts are being made, almost worldwide, to identify and subsequently rectify potential causes of process control failures that endanger the microbiological safety of foods. This is being done through application of HACCP-based intervention technologies, relying on impressive scientific and technological knowledge. Nonetheless, food-transmitted infections and intoxications with a microbiological etiology remain worryingly common.

This failure in management implies the need for a critical review of the strategies in use for protection of the public, with reference, among many other commodities, to catered meals, especially those sold by smaller and less developed enterprises. Success will hinge on motivating and educating all staff whose actions might adversely affect food safety. A decisive element in these efforts will be to ensure compliance with the Wilson Triad, i.e., longitudinally integrated management of contamination, colonization, and microbial metabolism.

Relevant professionals need improved understanding of the crucial elements of microbiological food and water safety assurance: the interactions between the commodities and their biotic associations, i.e., microbial ecology. Although an abundant number of meetings on this subject have been convened, structured professional education, ending in at least some test of satisfactory digestion of the presentations, has been mostly lacking. These considerations have prompted the creation of a unique distance-learning course: the European MSc in Public Health Science (Food and Drinking Water). The course is a joint initiative of the University of Hertfordshire, the Eijkman Foundation at the University of Utrecht, and the Scottish Centre for Infection and Environmental Health. It is intended that the project will evolve to embrace academic institutions in other European Union countries.

A peer-reviewed article.

\*Author for correspondence: Phone 31.30.2.933.019;

Fax: 31.30.2.948.687



## BOX I.

### Hippocratic oath, elaborated by the World Health Organization

Prompted by the medical atrocities that occurred during World War II, WHO, in 1948, elaborated an innovative version of the classic Hippocratic Oath, to be taken by the physician who has just graduated: 'It is the best right of every individual to be treated with the utmost respect for human life.' This entails the requirement that Preventive Medicine be targeted at *any individual person* at risk, which calls for ending or adjusting the collective, population-based approach. (*Italics by the authors.*)

## INTRODUCTION

Serious foodborne outbreaks, and severe cases of foodborne disease in individuals, occur frequently in affluent as well as in less privileged regions. Some incidents are linked to traditional foods and others to novel ones, particularly convenience items hitherto considered safe. Reporting by the media inevitably heightens consumer fears over diet. These concerns are aggravated by statements from experts and government agencies that often seem ambiguous and unhelpful, while comments from interest groups and the food industry are viewed as biased and unreliable.

Similarly, many outbreaks of enteric infectious diseases associated with drinking water have been reported during the past five decades. As is the case for food-transmitted incidents, their control is within reach by adherence to a consistent intervention strategy: *vide infra*. This crucial component of health protection will be dealt with in a companion paper (47).

Focusing on foodborne infectious diseases and intoxications, representatives of the industry would assert that some of the problems result from excessively-sensitive microbiological methods of analysis. These, they say, per-

haps with justification, draw attention to the presence of organisms that would hitherto have gone undetected and that in reality present no threat. In short, they suggest, concern is being heightened by what is little more than an artefact.

Acceptance of the importance of sensitive laboratory methods and better sampling and surveillance strategies is consistent, however, with the view that other factors exist. These relate closely to the people involved and their practices. It is a fundamental truth that foodborne illnesses, like the diseases transmitted via drinking water, are essentially preventable by the actions of the players. In assurance of food safety, the players include manufacturers, handlers, their managers, and the public (34). Although public health professionals are duty bound to state this at every opportunity, this repetition is not in itself enough. Practical assistance to the food and catering industries demands more. On one level is the need to provide the best possible information and its expert interpretation, particularly in the area of the fate of microorganisms in foods: Microbial Ecology (33). This can be, and has been shown to be, effective. It is clear, however, that an inconsistency exists between scientific knowledge and

technical expertise on the one hand, and the perennial incidence of foodborne illness on the other (40). Scientific and technological knowledge requires appropriate dissemination if it is to be translated into *optimum practices*. Quite clearly, meetings such as the plentiful national and international conferences that have been organized on this issue have not resulted in a sizeable reduction of food-transmitted diseases or in a diminished extent of microbial spoilage of commodities. Consequently, it is, as will be addressed in a later section, vital to review and update *formal* education and training in the area of safe production and distribution of food (24, 30, 49).

This paper sets out to present what is a promising new strategy for assuring Microbiological Food Integrity, *sensu* G. S. Wilson, i.e., quality in addition to safety. This strategy will ensure, through the innovative education of industry personnel and others, protection of the public at large against the scourge of foodborne disease and of starving populations against readily avoidable food losses. The broad range of actors and disciplines involved in optimizing preventive strategies make food integrity an appropriate area for structured advanced study. There can be no better place to address complex and challenging educational issues than in the universities.

## THE HOLISTIC APPROACH TO CONSUMER PROTECTION: ENSURING FOOD INTEGRITY

As early as the 1980s, the Jelliffes (19) emphasized that, to be effective, efforts to protection against adverse effects of foods

## BOX 2.

### Definition of an approved code of practice (ACoP)

*Example: a Codex Alimentarius 'Hygiene Code'*

A document that

- provides sector (branch) guidance to assure that the food prepared and/or distributed in that sector is microbiologically safe for consumption;
- encompasses both basic (prerequisite) hygiene advice and protocols for adherence to the seven principles of HACCP, specifically elaborated and validated for the process applied in the sector;
- takes into account the level of education and cultural background of the operators and staff to whom the code is directed.

must take into account all factors that might render a diet unsafe. These factors include not only those that compromise the wholesomeness of food, but also those associated with nutritional failures: intake deficiencies and hyper-caloric diets. The pursuit of food safety and nutritional balance is not a scientific hobby, or a luxury for the economically privileged regions of the globe. The World Health Organization's Mission implicitly includes the provision of sufficient food of compositional and microbiological integrity (Box 1). The Codex Alimentarius Commission of FAO/WHO re-emphasized this ethical principle in the 1960s (21, 22, 34). Unfortunately, there has been reluctance among many food and catering businesses to embrace these fundamentals. As already mentioned, this resistance has led to a loss of public confidence in the food industry, and it will be rather hard to regain the public's trust (29).

Clearly, a wide range of disciplines is involved in ensuring safe food, and any initiative in this area must therefore reach out to epidemiologists, parasitologists,

toxicologists, animal and human pathologists, and today even "prionologists" (5a) as well as to professionals in the many other disciplines traditionally included in the European designation "bromatology" (16).

The National Food Safety Authorities that are being set up in many countries in Europe and elsewhere must embrace this multidisciplinary approach in relation to those whom they employ and in the networks they form. It might be regarded as essential, for example, to nurture close links to disciplines such as behavioral science (7, 9, 32). Agencies will have to address three needs common to all food safety initiatives: (1) to persuade employees, whether in large food manufacturing and catering concerns or in small or medium sized enterprises, of the need to comply with the law; (2) where legal requirements may not suffice, in order to attain food integrity, to ensure adoption of good manufacturing and distribution practices, meticulously laid down in Approved Codes of Practices (ACoPs), as in Box 2 (34); (3) to provide reassurance (where justified) and warnings (where appro-

priate) to concerned consumer groups through carefully, expertly formulated safety communication (32).

The challenge of adopting the multidisciplinary strategy will be much greater in deprived regions (34, 51). A truly eclectic approach will be necessary to ensure that education and training in food safety meets the needs of the many professional groups involved. Of necessity, a public health perspective must infuse the course content with a prominent role for teaching and training in theoretical and field epidemiology. In deference to this public health ethos, the microbiological content must be focused on achieving and assuring, through efficacious monitoring, a safe food supply. Inevitably this will require an approach extensive enough to include topics such as microbial genomics. Professionals experiencing such an education will master the knowledge and skills to improve public health markedly in their own countries and regions. They will also contribute commercial benefits and improve health through their influence on the quality of exports and encouragement of tourism, development of which is too often deterred, in spite of attractive climatic conditions, by concern about the safety of local food.

## RELATIVE HEALTH IMPACT OF DIVERSE FOOD SAFETY ISSUES

### Chemical intoxicants

There is ample evidence that the once common toxic accidental contaminants of foods, such as arsenic, mercury, lead and cadmium (19), no longer play an important role in foodborne

**TABLE 1. WHO recommendations (2000) with respect to use of antimicrobials in food animals and the protection of human health**

1. Obligatory prescriptions for all antimicrobials used for *disease control* in food animals.
2. Elaboration of guidelines for *veterinarians to reduce overuse and misuse* of antimicrobials for treating infection in food animals.
3. Termination, or rapid phasing-out, of the use of antimicrobials for *growth promotion*, if the same agent is also used for the treatment of humans.
4. Creation of national systems to monitor *antimicrobial usage in food animals*.
5. *Monitoring of resistance*, to identify emerging health problems, and *timely corrective actions* to protect human health.

**TABLE 2. Performance of broilers fed on formulae containing various types of feed additives**

Feed containing	Body weight at slaughter (kg)	Feed conversion rate
Antibiotic + xylanase	2.5	1.76
Lactic acid + xylanase	2.6	1.73
Lactic acid + xylanase + propionic acid	2.6	1.72

Source: Adams, C.A., 2000. *World Poultry* 16, nr. 8, 16-18.

**TABLE 3. Effect of feeding practice on *Salmonella* seroprevalence in a swine herd of about 500 animals**

One half received standard feeding, the other, the "test group", the same, but the water supply acidified with a mixture of formic acid, lactic acid, propionic acid and sorbic acid

	Positives within 240 specimens each	
	Median titre	High titre
Control group	135	94
Test group	30	6

Source: van der Wolf, P.J., Ph.D. Thesis, Faculty of Veterinary Medicine, Utrecht University, 2000.

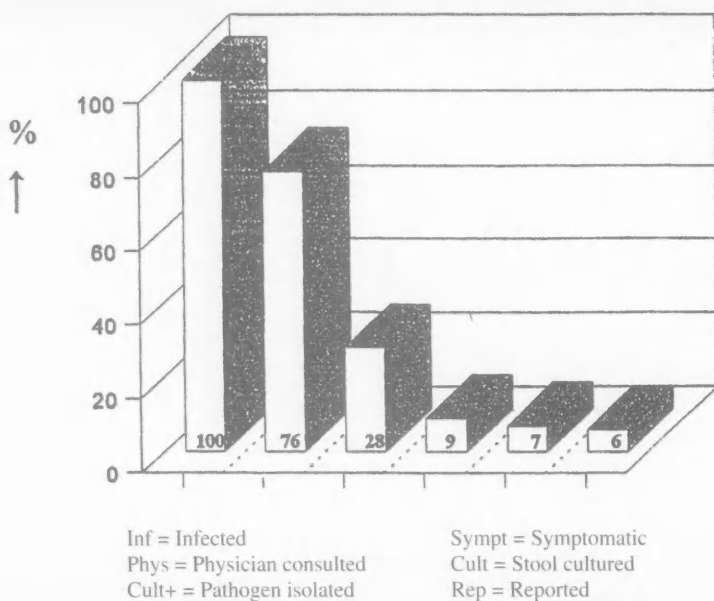
illness. Even chemical contaminants of more recent concern, particularly the group of persistent, toxic and bioaccumulating substances that include biocide residues and polychlorobiphenols, have in general been successfully brought under control through regulation and enforcement. The recently identified putative adverse health impacts of exposure to acrylamide, produced by Maillard type condensation and decomposition reactions, at levels markedly in excess of the 1µg per day NOAEL level in heated, fat-containing foods is being addressed by various expert panels (SCIEH Weekly Report 36, 2002, p. 136). The possibility of fraudulent use of severely toxic biocides always remains. However, an alert, responsible government will enforce adherence to Good Agricultural Practices. A sophisticated, very sensitive analytical armature is available for monitoring staples in trade channels.

Yet chemical additives deliberately used in foods to improve their keeping quality are often most feared by the public (32). Despite this, almost all such additives are hazard 'free', with a few exceptions, which are intensively biotested and closely regulated. It is to be hoped that public anxiety about a causal connection between anaphylaxis and ingestion of antimicrobial food additives has been allayed by the recent demonstration that such effects are exerted only by sulphites in sensitive individuals (5, 27, 41).

### Biological toxins

Mycotoxins (11, 17) at one time constituted a serious threat to human health. The classical example of a mycotoxin source was,

FIGURE 1. Loss of epidemiological data



**BOX 3.**  
**Position of YOPI group within the general population of consumers**

Group 1 – *physiological variation in sensitivity through stages in life*  
The young, old, pregnant.

Group 2 – *weakened immune system*  
Congenital, resulting from antecedent disease, iatrogenic.

of course, moldy cereal, which, under conditions of starvation during war, was incorporated into bread. Consumption of this caused the severe internal disease alimentary toxic aleukia. A similar mycotoxin-induced syndrome, termed yellow rice disease, in the past constituted a severe health hazard in Japan. Biosynthesis of mycotoxins, particularly in agricultural products, results from the metabolic activities of (1) field fungi, those infecting and colonizing seeds and plants at the pre-harvest state, and (2) storage fungi, those colonizing and metaboliz-

ing in staples. The former problem calls for control by Good Agricultural Practices. Mold colonization of foods such as grains can be, and in practice is, controlled by carefully limiting the water content and the water distribution (31). This inhibits germination of spores of the often xerophilic mycotoxinogenic mold species that are always present. However, two problems remain related to the minute traces of particular mycotoxins that occasionally continue to be produced in some foods. Debilitated human immune response and some chronic

liver dysfunction have also been linked to mycotoxin consumption, but, even here, greater attention to controlling  $a_w$  offers real hope of reducing the responsible mycotoxins to safe limits.

Among seafoods, a broad variety of food toxins (18) present a perennial potential health hazard. The histamine group of scombroid intoxicants can readily be brought under control by inhibiting development of the bacteria that produce the toxins in fresh seafood. Management of the neurotoxic and diarrheagenic marine biotoxins is a far more complex problem. Substantial progress is being made, however, with the development of a better understanding of their mode of production and the development of ever more sensitive analytical methods for their detection, facilitating improved control.

A toxin group of microbiological origin that also deserves vigilance consists of endotoxins, produced by many (for instance, Gram-negative) food bacteria (2). They may particularly menace consumers with immature or impaired enteric defense mechanisms.

#### Improper use of antibiotics

A recently identified hazard of chemical nature is the emergence in the environment of vancomycin-resistant enterococci (3, 52). Spread of these organisms to humans, from feeds that have been 'medicated' with subtherapeutic concentrations of antibiotics to promote growth of slaughter animals, makes it virtually impossible to manage severe human internal infections caused by bacteria that have developed resistance to vancomycin. A similar problem originates from the addition

**TABLE 4. Complications observed after bacterial, viral and parasitic infections transmitted by foods**

<i>Aeromonas hydrophila</i> enteritis	Bronchopneumonia, cholecystitis, meningitis
Brucellosis	Aortitis, arthritis, brain abscesses, endocarditis, epididymo-orchitis, hepatitis, meningitis, pericarditis, prostatitis, spondylitis
Campylobacteriosis	Abducens paresis, abortion, acute febrile polyneuritis, arthritis, carditis, cellulitis, cholecystitis, colitis, encephalopathy, endocarditis, erythema nodosum, Guillain-Barré syndrome, haemolytic-uraemic syndrome, hepatitis, irritable colon syndrome, meningitis, pancreatitis, perinatal sepsis, peritonitis, septicaemia, thrombocytopenic purpura, toxic mega-colon, transient atrial fibrillation, uveitis
<i>E. coli</i> (EVEC types) enteritis	Erythema nodosum, haemolytic-uraemic syndrome, neurological manifestations, seronegative arthropathy, thrombocytopenic purpura
Listeriosis	Brain abscesses, liver abscess, peritonitis, pleuritis, septic arthritis
Q fever	Cutaneous syndromes, endocarditis, granulomatous hepatitis, meningo-encephalitis, pancreatitis, predisposition for CVA and ischaemic heart disease, pulmonary pseudotumors
Salmonellosis	Aortitis, appendicitis, arterial aneurism, cholecystitis, colitis, erythema nodosum, endocarditis, encephalopathy, epididymo-orchitis, intracerebral abscesses, irritable bowel syndrome, liver and splenic abscesses, meningitis, myocarditis, myonecrosis, osteomyelitis, pancreatitis, perinephric abscesses, Reiter's disease, rheumatoid syndromes, septic arthritis, septicaemia, thyroiditis
Shigellosis	Convulsions, erythema nodosum, glomerulonephritis, haemolytic-uraemic syndrome, hepatic dysfunction, myocarditis, peripheral neuropathy, pneumonia, reactive arthritis, Reiter's disease, septicaemia, splenic abscesses, synovitis
<i>V. parahaemolyticus</i> enteritis	Colonic ulceration, reactive arthritis, septicaemia
Yersiniosis	Arthritis, cholangitis, dermal vasculitis, endocarditis, erythema nodosum, liver and splenic abscesses, lymphadenitis, pericarditis, pharyngitis, pneumonia, polyneuropathy, pyomyositis, septicaemia, spondylitis, Still's disease
Amoebiasis	Cerebral complications, intraperitoneal rupture, liver abscesses, pericarditis, pleuropneumonia
Ascariasis	Biliary colic, cholangitis, cholecystitis, pancreatitis
Cryptosporidiosis	Pancreatitis, reactive arthritis, toxic megacolon
Dracunculiasis	Permanent neurological disability
Giardiasis	Cholangitis, dystrophy, hepatitis, lymphoidal hyperplasia, reactive arthritis
Taeniasis	Arthritis, epilepsy
Toxoplasmosis	Encephalitis and other central nervous system diseases, Guillain-Barré syndrome, pancarditis, polymyositis
Trichinosis	Cardiac failure, neurological sequelae
Enterovirosis	Pericarditis
Rotavirosis	Myositis

Source: Mossel and Struijk, 2000. (34)

**TABLE 5. Essential differences, with respect to health impact, between chemical and microbiological hazards in foods**

Parameter	Disease triggered by	
	Toxic constituents	Infective or toxinogenic organisms
Distribution in commodity	As a rule entropic (homogeneous)*	Erratic (strongly 'stratified' in nests)
Concentration flux as function of time	Virtually constant in 'recalcitrant'	Permanent and perennial in non-toxicants, which constitute the sporing organisms majority
Patient-to-other-person transmission	Non existent	Always realistic hazard
Sequelae ('complications', i.e., subsequent morbid effects, different from main syndrome)	None	Frequent and serious, particularly, but far from exclusively, in immuno-debilitated consumers (YOPIs); cf Box 3
Protection by previous exposure to same agent	None	Variable, affected by pathogenic agent and attributes of consumers

\*The dioxine contamination catastrophe in Europe (1999) demonstrated that in some instances, particularly adulteration of commodities, severe stratification may mar the reliability of analytical data; cf Stark et al. 2002 Food Control 13:1-11.

of fluoroquinolones (6, 50) to pig and poultry feed (point 3 of Table 1 [1]). The data in Tables 2 and 3 demonstrate that use of these antibiotics in feeds can be successfully replaced by use of other, non-offensive feed additives, and if this approach is adopted consistently, it can eliminate this serious health hazard (10).

**Occurrence and management of the major health problem: food-transmitted diseases of microbial etiology**

**Accurate versus reported morbidity**

Although management of the chemical risks already discussed is within reach and has been achieved, the same is, unfortunately, not true for foodborne enteric infections and intoxications. Reported morbidity of these syndromes in privileged countries is

on the order of one-tenth of a million per million persons at risk annually (34).

This incidence level is, however, a substantial underestimation (12, 28, 43). Many outbreaks are never identified. This applies particularly to those in which viruses are the aetiological agent (24a). The most common Norwalk-like caliciviruses, otherwise known as small round structured viruses, cannot be cultured, and electron microscopic detection, used in stool examination, lacks the sensitivity required for detecting in contaminated foods the low virus levels that cause human enteritis. Though rotaviruses, astroviruses and hepatitis A virus can be grown in cell cultures, the techniques are time-consuming and as yet unreliable (20, 45). Individual sporadic cases only rarely reach Health Statistics at all.

The principal reason for this lack of factual information, as presented in Fig. 1, is, however,

that all too often *medical assistance is not sought*, and when it is, in many instances the food or meal item that triggered the disease is no longer available for analysis. Diagnosis based on patient stool examination is sometimes obscured as a result of the phenomenon termed co-infection, in which more than one pathogen is associated with the syndrome (25, 26, 42).

**The often neglected dimension of food poisoning: systemic complications as late effects**

The disease burden of food-transmitted infections is certainly not limited to the classical acute symptoms (44) of nausea, vomiting, abdominal cramps, diarrhea, and frequently, though not invariably, relatively high fever. Systemic sequelae frequently occur (14, 34), particularly in individuals with immunodeficiency due to immaturity, senescence, chemo-

therapy, gastric hypoacidity (13, 48), pregnancy, or antecedent diseases. Together, individuals with these conditions constitute the so-called YOPI segment of the population (34, 37, 43); cf. Box 3. As illustrated by the data in Table 4, a number of the complications of food "poisoning" are severe, often leading to more permanent suffering and occasionally to death.

#### **Businesses that are at markedly increased risk**

Only fairly recently have the more enhanced risks prevailing in small and very small food manufacture and catering operations, and larger enterprises in less developed regions, been identified. Proprietors and staff have been trained only marginally, if at all, equipment may need repair, and refrigerated storage capacity is often insufficient and sometimes malfunctioning (4, 15, 38, 53). It would be unrealistic to assume that such businesses will be able to adopt *without substantial assistance* any sort of safe practices, even the legally required minimal package (36).

Even in this instance it should be explained to the actors that, as with chemical hazards, microbiological scourges are *in essence* fully preventable, because the etiology of every single syndrome is known in full detail (34). The paradox of nonetheless observing so many outbreaks (40) obviously results from human failure (9, 49): a conspicuous lack of compliance with readily available, previously addressed ACoPs. Serious attention to the management of these issues is therefore long overdue (23). The evidence consequently reinforces the priority that must be accorded to *implementing* strategies that reduce the incidence and

severity of all foodborne disease. Contrary to the too-long held belief, and for the reasons presented in Table 5, this can be attained only by pursuing markedly improved *intervention*. This proactive strategy must replace the retrospective approach that was effective in controlling chemical safety of food but that is totally ineffective when it comes to management of microbiological hazards. The impact of this new direction in food safety practice for education is evident (46).

Experience in underprivileged areas (39, 51) shows that, even here, with systematic, patient and stepwise education programs, marked improvements are within reach. However, where resources and/or motivation are limited, a dangerous situation may persist, unless strict regulations with respect to licensing and inspection are issued and above all enforced. This hinges, once again, on education and training, as well as on techniques aimed at persuading owners and staff of small businesses to be vigilant in control of the major critical practices related to food safety.

#### **REFERENCES**

1. Anon. 2000. Use of antimicrobials in food animals: new WHO recommendations. *Weekly Epidemiol. Rec.* 75: 33:268-269.
2. Baumgarten, G., P. Knuefermann, and N. Nozaki et al. 2001. In vivo expression of proinflammatory mediators in the adult heart after endotoxin administration: the role of toll-like receptor-4. *J. Infect. Dis.* 183:1617-1624.
3. Borgen, K., G. S. Simonsen, and A. Sundsfjord et al. 2000. Continuing high prevalence of *vanA*-type vancomycin-resistant enterococci on Norwegian poultry farms three years after avoparcin was banned. *J. Appl. Microbiol.* 89:478-485.

4. Brashears, M. M., D. E. Burson, and E. S. Dormedy et al. 2001. HACCP implementation and validation in small and very small meat and poultry processing plants in Nebraska. *Dairy Food Environ. Sanit.* 21:20-28.
5. Dean, T. (ed.) 2000. *Food intolerance and the food industry*. Woodhead Publishing, Cambridge.
- 5a. Dormont, D. 2002. Prions, BSE, and food. *Intl. J. Food Micro.* 78:181-189.
6. Engberg, J., F. M. Aarestrup, and D. E. Taylor et al. 2001. Quinolone and macrolide resistance in *Campylobacter jejuni* and *C. coli*: resistance mechanisms and trends in human isolates. *Emerg. Infect. Dis.* 7:24-34.
7. Fielding, J. E., A. Aguirre, and E. Palaiologos. 2001. Effectiveness of altered incentives in a food safety inspection program. *Preventive Medicine* 32:239-244.
8. Gambarotto, K., M.-C. Ploy, and F. Dupron et al. 2001. Occurrence of vancomycin-resistant enterococci in pork and poultry products from a cattle-rearing area of France. *J. Clin. Microbiol.* 39:2354-2355.
9. Gilling, S. J., E. A. Taylor, K. Kane, and J. Z. Taylor. 2001. Successful hazard analysis critical control point implementation in the United Kingdom: understanding the barriers through the use of a behavioral adherence model. *J. Food Prot.* 64:710-715.
10. Gorbach, S. L. 2001. Antimicrobial use in animal food: time to stop. *New Engl. J. Med.* 345:1202-1203.
11. Gutema, T., C. Munimbazi, and L. B. Bullerman. 2000. Occurrence of fumonisins and moniliformin in corn and corn-based food products of U.S. origin. *J. Food Prot.* 63:1732-1737.
12. Handysides, S. 1999. Underascertainment of infectious intestinal disease. *Commun. Dis. Publ. Health.* 2:78-79.
13. Havelaar, A. H., J. Garssen, and K. Takumi et al. 2001. A rat model for dose-response relationships of *Salmonella* Enteritidis infections. *J. Appl. Microbiol.* 91:442-452.
14. Hohmann, E. L. 2001. Nontypical salmonellosis. *Clin. Infect. Dis.* 32:263-269.

15. Holt, G., and S. Henson. 2000. Quality assurance management in small meat manufacturers. *Food Control* 11:319-326.
16. Hooker, N. 2000. Interdisciplinary food safety research. CRC Press UK, London.
17. Hui, Y. H., R. A. Smith, and D. G. Spoerke (eds). 2000. Foodborne disease handbook. Vol. 3: Plant Toxicants. Marcel Dekker, New York.
18. Hui, Y. H., D. Kitts, and P. S. Stanfield (eds). 2000. Foodborne disease handbook. Vol. 4: Seafood and Environmental Toxins. Marcel Dekker, New York.
19. Jelliffe, E. F. P., and D. B. Jelliffe. 1982. Adverse effects of foods. Plenum Press, New York.
20. Jericho, K. W. F., J. Ho, and G. C. Kozub. 2000. Aerobiology of a high-line speed cattle abattoir. *J. Food Prot.* 63:1523-1528.
21. Jukes, D. 1998. The Codex Alimentarius Commission—current status. *Food Sci. Technol. Today* 12:207-212.
22. Jukes, D. 2000. The role of science in international food standards. *Food Control* 11:181-194.
23. Kayser, A., and D. A. A. Mossel. 1984. Intervention sensu Wilson: The only valid approach to microbiological safety of food. *Intl. J. Food Microbiol.* 1:1-4.
24. Klein, R. 2000. The politics of risk: the case of BSE. If we want less paternalism we must first educate ourselves. *Brit. Med. J.* 321:1091-1092.
- 24a. Koopmans, M., C. H. von Bonsdorff, J. Vinje et al. 2002. Foodborne viruses. *FEMS Microbiol. Revs.* 26:187-205.
25. Lorber, B. 1991. Listeriosis following shigellosis. *Revs. Infect. Dis.* 13:865-866.
26. Maurer, A. M., and D. A. Sturchler. 2000. A waterborne outbreak of small round structured virus, *Campylobacter* and *Shigella* co-infections in La Neuveville, Switzerland, 1998. *Epidemiol. Infect.* 125:325-332.
27. Metcalfe, D. D., H. A. Sampson, and R. A. Simon. 1997. Food Allergy. Adverse Reactions to Foods and Food Additives. Blackwell, Oxford.
28. Michel, P., J. B. Wilson, and S. W. Martin et al. 2000. Estimation of the under-reporting rate for the surveillance of *Escherichia coli* O157:H7 cases in Ontario, Canada. *Epidemiol. Infect.* 125:35-45.
29. Mitchell, P. 1997. Struggle worldwide to regain consumers' faith in food. *Lancet* 350:1234.
30. Mortlock, M. P., A. C. Peters, and C. J. Griffith. 2000. A national survey of food hygiene training and qualification levels in the UK food industry. *Intl. J. Environ. Health Res.* 10:111-123.
31. Mossel, D. A. A. 1988. Mould spoilage of cereals during transportation at sea from Latin America to Europe. Mechanisms, impact and management. *Intl. J. Food Microbiol.* 7: 205-209.
32. Mossel, D. A. A., and D. M. Drake. 1990. Processing food for safety: avenues to consumer information and reassurance. *Food Technol.* 44(12): 63-67
33. Mossel, D. A. A., and C. B. Struijk. 1992. The contribution of microbial ecology to management and monitoring of the safety, quality and acceptability (SQA) of foods, p. 15-225. In R. G. Board, D. Jones, R. G. Kroll, and G. L. Pettipher (eds), *Ecosystems: Microbes: Food*. Blackwell, Oxford.
34. Mossel, D. A. A., and C. B. Struijk. 2000. A global perspective on management through education of microbiological food safety issues, p. 162-184. In *Proc. Global Summit People, Food and Agriculture*. University of Minnesota, Minneapolis.
35. Mossel, D. A. A., and P. van Netten. 1991. Microbiological reference values for foods: A European perspective. *J. Assoc. Office Anal. Chem.* 74:420-432.
36. Mossel, D. A. A., C. B. Struijk, G. P. Morris, and J. F. Ehiri. 1997. Shaping the new generation of microbiological food safety professionals. Attitudes, education and training. *Intl. J. Environ. Health Res.* 7:233-250.
37. Mossel, D. A. A., G. P. Morris, G. H. Weenk, and C. B. Struijk. 1998. Identification, assessment and management of food-related microbiological hazards: historical, fundamental and psycho-social essentials. *Intl. J. Food Microbiol.* 40:211-243.
38. Mossel, D. A. A., J. T. Jansen, and C. B. Struijk. 1999. Microbiological safety assurance applied to smaller catering operations world-wide. *Food Control* 10:195-211.
39. Mosupe, F. M., and A. von Holy. 2000. Microbiological hazard identification and exposure assessment of street vending in Johannesburg, South Africa. *Intl. J. Food Microbiol.* 61:137-145.
40. Motarjemi, Y., and F. Käferstein. 1999. Food safety, Hazard Analysis and Critical Control Point and the increase in foodborne diseases: a paradox? *Food Control* 10:325-333.
41. Ortolani, C., C. Bruijnzeel-Koomen, and L. Bengtsson et al. 1999. Controversial aspects of adverse reactions to food. *Allergy* 54:27-45.
42. Pazzaglia, G., R. B. Sack, and E. Salazar et al. 1991. High frequency of coinfecting entero-pathogens in *Aeromonas*-associated diarrhea of hospitalized Peruvian infants. *J. Clin. Microbiol.* 29:1151-1156.
43. Proctor, M. E., M. Hamacher, M. L. Tortorello, J. R. Archer, and J. P. Davis. 2001. Multistate outbreak of *Salmonella* serovar muenchen infections associated with alfalfa sprouts grown from seeds pretreated with calcium hypochlorite. *J. Clin. Microbiol.* 39:3461-3465.
44. Shimian, Z., J. A. Salomon, C. D. Mathers, and C. J. L. Murray. 2001. Applying DALYs to the burden of infectious diseases. *Bull. WHO* 79:267-269.
45. Slomka, M., and H. Appleton. 1998. Feline calicivirus as a model system for heat inactivation studies on small round structured viruses in shellfish. *Epidemiol. Infect.* 121:401-407.
46. Struijk, C. B. 2001. Minutes of the 4th Meeting of the ICFMH Working Party on Academic Education in Food Microbiology, Vethoven, The Netherlands, September 1999. *Intl. J. Food Microbiol.* 66:137-148.
47. Struijk, C. B., and D. A. A. Mossel. 2003. Assurance of the microbiological safety of drinking water. Its application to the food, catering and beverage industries. *Intl. J. Food Microbiol.* (submitted).
48. Takumi, K., R. de Jonge, and A. Havelaar. 2000. Modelling inactivation of *Esche-*



*richia coli* by low pH: application to passage through the stomach of young and elderly people. *J. Appl. Microbiol.* 89: 935-943.

49. Tebbutt, G. M. 1992. An assessment of food hygiene training and knowledge among staff in premises selling high risk foods. *Int. J. Environ. Health Res.* 2:131-137.
50. Threlfall, E. J., L. R. Ward, J. A. Frost, and G. A. Willshaw. 2000. The emergence and spread of antibiotic resistance in foodborne bacteria. *Int. J. Food Microbiol.* 62:1-5.
51. Todd, E. C. D. 2001. Foodborne and waterborne disease in developing countries — Africa and the Middle East. *Dairy Food Environ. Sanit.* 21:110-122.
52. van den Boogaard, A. E., E. E. Stobberingh, J. G. Morris, J. G., A. McIntosh, and J. A. Johnson. 1999. Contamination of animal feed by multiresistant enterococci. *Lancet* 354:163-164.
53. West, A., and E. Hancock. 1994. Good Catering Practice in small businesses. *Int. Food Hygiene* 5:12-13.



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# Comparison of Intervention Technologies for Reducing *Escherichia coli* O157:H7 on Beef Cuts and Trimmings

J. R. RANSOM, K. E. BELK,\* J. N. SOFOS, J. D. STOPFORTH, J. A. SCANGA, and G. C. SMITH  
Center for Red Meat Safety, Department of Animal Sciences,  
Colorado State University, Fort Collins, CO 80523-1171

## SUMMARY

This study evaluated the decontamination efficacy of water (W; 25° or 55°C), 2% acetic acid (AA), 0.001% acidified chlorine (AC), 2% lactic acid (LA; 55°C), 0.02% acidified sodium chlorite (ASC), 0.5% cetylpyridinium chloride (CPC), 1% lactoferricin B (LB), and 0.02% peroxyacetic acid (PAA) on *Escherichia coli* O157:H7 when applied to fresh beef carcass tissue (BCT) surfaces (40 cm<sup>2</sup>) and lean tissue pieces (LTP; 300 g). Samples were inoculated with a five-strain composite of *E. coli* O157:H7 and then immersed in the treatment solutions for 30 s. Viable cell counts were enumerated by plating on sorbitol MacConkey (SMAC) agar. Overall, CPC was most effective ( $P < 0.05$ ) and reduced bacterial populations by 4.8 log CFU/cm<sup>2</sup> and 2.1 log CFU/g on BCT and LTP, respectively. Of the treatments commonly used by industry, LA was the most effective ( $P < 0.05$ ), as it reduced pathogen populations by 3.3 log CFU/cm<sup>2</sup> and 1.3 log CFU/g on BCT and LTP, respectively. Additionally, ASC, AA, PAA, LB, AC and W reduced pathogen populations when plated on SMAC by 1.9, 1.6, 1.4, 0.7, 0.4 and 1.2 log CFU/cm<sup>2</sup>, when applied to BCT, while corresponding reductions following the above treatment applications to LTP were 1.8, 1.1, 1.0, 0.4, 0.5 and 0.3 log CFU/g, respectively. Results from this study indicated that LA and ASC were the most effective pathogen decontamination solutions currently approved for commercial use. Information regarding the antibacterial efficacy of decontamination solutions should prove beneficial to industry personnel as a means of improving microbiological quality as well as potentially improving the quality of non-intact beef tissue.

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\*Author for correspondence: Phone: 970.491.5826;

Fax: 970.491.0278; E-mail: kbelk@ceres.agsci.colostate.edu

## INTRODUCTION

Food safety concerns increased dramatically following the outbreak of illnesses caused by *Escherichia coli* O157:H7 in undercooked ground beef in 1993 (4). Awareness of the consequences of this meatborne pathogen has increased among those in the general public, making *E. coli* O157:H7 a household name in the 21st century. According to the Centers for Disease Control and Prevention (CDC), approximately 76 million cases of foodborne illness occur in the United States annually, with 14 million of those cases attributed to known pathogens (27). As a part of the Pathogen Reduction: Hazard Analysis Critical Control Point (HACCP) Systems Final Rule (18) by Food Safety Inspection Service, United States Department of Agriculture (FSIS-USDA) regulation, FSIS recommended that all beef, pork and lamb slaughter establishments apply at least one antimicrobial treatment to carcasses before chilling. Any antimicrobial compounds previously approved by the Food and Drug Administration (FDA) and FSIS could be used for carcass decontamination (18). Numerous carcass decontamination strategies have been researched to determine which are most effective against bacterial pathogens such as *E. coli* O157:H7 (38).

Van Donkersgoed et al. (41) reported that less than 10% of slaughter cattle carried *E. coli* O157:H7 in their feces or on their hide when entering the abattoir. Ransom et al. (34) found that 36.7% of lots of cattle contained positive hide samples and 13.3% had positive fecal samples. Elder et al. (16) showed that 43% of beef carcasses were positive for *E. coli* O157:H7 prior to evisceration but that, because of carcass decon-

tamination strategies in place, only 18% and 2%, respectively, of carcasses sampled post-evisceration and post-processing were positive for *E. coli* O157:H7.

Carcass decontamination technologies previously studied include: (a) sanitizing solutions such as organic acids, hydrogen peroxide, trisodium phosphate, ozone, activated ozone and the like (5, 7, 8, 10, 15, 17, 31, 33), (b) spray-washing with water (9, 12, 22) (c) thermal (hot water) pasteurization (3, 32), (d) steam pasteurization (29, 30), (e) hot-water or steam vacuuming (26), and (f) conventional knife-trimming, with or without subsequent washing, to determine their efficacy in decontamination of carcasses, cuts and/or trimmings (1, 2, 19, 20, 21, 23, 35, 37, 39, 40). In general, washing and sanitizing agents have been effective in reducing bacterial counts by 1-3 logs and in decreasing occurrence of pathogens on beef carcasses and cuts (37).

There are new additives/chemicals that may, singly or sequentially, be more effective against *E. coli* O157:H7 than are the microbiological interventions that have been previously proven effective or that might be useful as components of multiple hurdle decontamination systems for implementation by the beef packing/processing industry. Presently used by industry for decontamination of beef carcasses/cuts are thermal (hot-water) pasteurization, steam/hot-water vacuuming, steam pasteurization, and organic acid solution rinsing (2). Lactoferricin B, (recommended for preventing attachment and growth of pathogens on carcass surfaces) [5, 28], as well as peroxyacetic acid, acidified chlorine, acidified sodium chlorite, and cetylpyridinium chloride, are microbiological intervention tech-

nologies that have recently received attention for their antimicrobial properties (6, 7, 10, 13, 17, 24, 25).

The objective of this study was to compare the effectiveness of decontamination technologies presently in use with proposed chemicals not presently used as possible intervention strategies to determine their effectiveness in reducing *E. coli* O157:H7 counts on beef carcass adipose tissue and beef trimmings.

## MATERIALS AND METHODS

### Intervention treatment preparation

Chemical treatment solutions used in both phases of this experiment included: (1) 2% acetic acid (AA), vol/vol, prepared from glacial acetic acid, Mallinckrodt Baker Inc, Paris, KY; (2) 0.001% acidified chlorine (AC), vol/vol, prepared from 10% AC, Advanced Food Systems, Kamloops, B.C.; (3) 0.02% acidified sodium chlorite (ASC) vol/vol, prepared from a 7% sodium chlorite concentration, Birko Corporation, Denver, CO, and acidified with 2% lactic acid, Birko Corporation, Denver, CO; (4) 0.5% cetylpyridinium chloride (CPC), vol/vol, prepared from 40% CPC concentration, Cecure; Safe Foods Corporation, Little Rock, AR; (5) 2.0% lactic acid (LA), vol/vol, prepared from a 85% concentration, Birko Corporation, Denver, CO; (6) 1% lactoferricin B (LB), wt/vol, prepared from a 98% concentration, American Peptide Company, Sunnyvale, CA; (7) 0.02% peroxyacetic acid (PAA), vol/vol, prepared from a 5% peracetic acid solution, Birko Corporation, Denver, CO. All chemical solution treatments were prepared by thoroughly

mixing concentrated solutions with tap water to create the desired concentration levels.

### Inoculum preparation

A composite culture of *E. coli* O157:H7 strains ATCC 43895, ATCC 43894, ATCC 43890, ATCC 43889 and EO139 was prepared for use in this study, as they were meat isolates that have been known to cause foodborne illness. These strains were available as frozen (-70°C) cultures in trypticase soy broth (BBL Becton Dickson Co., Sparks, MD) with 0.6% yeast extract (TSBYE) plus 20% glycerol (Mallinckrodt Baker Inc., Paris, KY). The cultures were activated by transferring 0.05 ml of stock culture in 10 ml of TSBYE and incubating (at 37°C) overnight. The strains were subcultured once (37°C, 24 h) by inoculating 100 µl of the activated culture in 10 ml TSBYE. The 10 ml overnight cultures were then mixed to form a 50 ml composite inoculum, which was serially diluted in 0.1% buffered peptone water (BPW; Difco Laboratories-Becton Dickinson Co, Sparks, MD) to obtain the required inoculum to recover either 3 to 4 log<sub>10</sub> CFU/cm<sup>2</sup> (low inoculation level) or 5 to 6 log<sub>10</sub> CFU/cm<sup>2</sup> (high inoculation level) of *E. coli* O157:H7. Each side of each piece of beef carcass adipose tissue (BCT) was inoculated with 500 µl of the culture composite and held at 4°C for 15 min to allow attachment.

### Beef carcass adipose tissue

Fresh (<6 h postmortem) BCT was obtained from a local abattoir and transported to the Center for Red Meat Safety at Colorado State University. The outer surface of the BCT was removed and the remaining tissue

was portioned to obtain 100 pieces approximately 5 cm × 2.5 cm × 1 cm (total surface area of 40 cm<sup>2</sup>) in size. This phase of the study was replicated twice with five samples per treatment per inoculation level in each replicate.

The uninoculated pieces were used as the negative control treatment, and the inoculated BCT were assigned to one of ten control or treatment groups: (1) uninoculated/untreated (negative control); (2) inoculated/untreated (positive control); (3) inoculated/AA (at 25°C); (4) inoculated/AC; (5) inoculated/ASC; (6) inoculated/CPC; (7) inoculated/LA (at 55°C); (8) inoculated/LB; (9) inoculated/PA; (10) inoculated/water (W; at 25°C). The inoculated BCT pieces (with exception of those in the two control groups) were dipped into 500 ml of either ambient temperature or heated (55°C) solutions for 30 s. Control and treated BCT samples were placed into plastic bags Whirlpak® (Nasco, Fort Atkinson, WI) with 0.1% BPW and then pummeled in a stomacher (IUL Instruments, Barcelona, Spain) for 2 min. Aliquots of 0.1 ml were plated on tryptic soy agar containing 0.6% added yeast extract (TSAYE, Difco) for the enumeration of all aerobic bacteria, including *E. coli* O157:H7, and on sorbitol MacConkey agar (SMAC, Difco) for enumeration of sorbitol-negative colonies, which included *E. coli* O157:H7. The TSAYE and SMAC plates were incubated at 37°C for 48 hours and then manually counted. The pH of each solution was measured (Accumet pH meter 50, Fisher Scientific, Houston, TX; glass probe, Denver Instruments, Fisher Scientific) before and after each sample dip in order to monitor the buffering capacity of the BCT in each solution.

Samples that yielded no growth on SMAC plates were also tested by enrichment. One ml of the original sample blend was transferred into 40 ml of both EC broth (Difco) and Brilliant Green Bile broth (Difco) and incubated at 37°C for 24 h, and then streaked on SMAC plates containing cefixime and tellurite supplement (0.5 mg/l; Dynal Inc., Lake Success, NY) (SMACct) for detection of *E. coli* O157:H7. In addition, 1 ml of enrichment broth from each sample was mixed with 20 µl of anti-O157 immunomagnetic beads (Dynal Inc.) on a rocker for 30 min at 25°C. The bead suspensions were washed 3 times in 1 ml of phosphate buffered saline (PBS; Difco) containing 0.05% Tween 20 (Fisher Scientific). After the final wash, the beads were resuspended in 100 µl of PBS/0.05% Tween 20 and 50 µl of the bead suspensions were directly spread-plated on SMACct and incubated overnight at 37°C, at which time sorbitol-negative colonies were manually counted.

### Boneless beef tissue

Fresh boneless beef short plates (BSP) were obtained from a local abattoir approximately 36 hours after harvest and transported to the Center for Red Meat Safety at Colorado State University. BSP was portioned to obtain 132 pieces that were approximately 5 cm × 2.5 cm × 1 cm (total surface area of 40 cm<sup>2</sup>). Pieces of BSP were inoculated to yield the low or high inoculation level of the *E. coli* O157:H7 composite culture as was described for the first phase. For each level of inoculation, 300g of uninoculated lean tissue pieces (LTP) plus 100 g of inoculated BSP were placed in oversized Whirlpak® (Nasco) bags

**TABLE 1.** Least-squares means (standard error) indicating survival and reduction of bacterial counts (log CFU/cm<sup>3</sup>) on beef carcass tissue inoculated with *Escherichia coli* O157:H7, by plating on sorbitol MacConkey agar (SMAC)

Treatment Group	High Inoculation		Low Inoculation	
	Survival (log CFU/cm <sup>2</sup> )	Reduction (log CFU/cm <sup>2</sup> )	Survival (log CFU/cm <sup>2</sup> )	Reduction (log CFU/cm <sup>2</sup> )
Uninoculated/Untreated*	1.6 (0.16)	—	1.5 (0.09)	—
Inoculated/Untreated**	5.8 (0.05) <sup>a</sup>	—	4.1 (0.07) <sup>a</sup>	—
Inoculated/Water at 25°C	4.6 (0.16) <sup>d</sup>	1.2	3.5 (0.14) <sup>b</sup>	0.6
Inoculated/Acidified chlorine, 0.001% (AC)	5.4 (0.04) <sup>b</sup>	0.4	3.4 (0.05) <sup>b</sup>	0.8
Inoculated/Acetic acid, 2% (AA)	4.2 (0.12) <sup>d</sup>	1.6	2.0 (0.09) <sup>d</sup>	2.1
Inoculated/Lactic acid, 2% at 55°C (LA)	2.5 (0.16) <sup>e</sup>	3.3	1.1 (0.14) <sup>e</sup>	3.1
Inoculated/Lactoferricin B, 1% (LB)	5.1 (0.10) <sup>c</sup>	0.7	3.6 (0.06) <sup>b</sup>	0.6
Inoculated/Peroxyacetic acid, 0.02% (PAA)	4.4 (0.06) <sup>d</sup>	1.4	2.7 (0.11) <sup>c</sup>	1.4
Inoculated/Acidified sodium chlorite, 0.02% (ASC)	3.9 (0.16) <sup>d</sup>	1.9	2.1 (0.22) <sup>d</sup>	2.0
Inoculated/Cetylpyridinium chloride, 0.5% (CPC)	1.0 (0.23) <sup>f</sup>	4.8	0.5 (0.15) <sup>f</sup>	3.6

\* Negative control

\*\* Positive control

<sup>a,b,c,d,e,f</sup> Means within each column for survival bearing common superscript letter are not different

( $P \geq 0.05$ ). Means in columns for reduction were not tested for statistical difference

n=10 samples per treatment and inoculation level

and shaken/rotated for one minute each to assure adequate mixing/cross contamination of inoculated and uninoculated pieces. To allow for attachment of the bacteria, the bags were stored at 4°C for 30 min. Uninoculated and inoculated pieces were assigned to each of 11 control or treatment groups: (1) uninoculated/untreated (negative

control); (2) inoculated/untreated (positive control); (3) inoculated/A A (at 25°C); (4) inoculated/AC; (5) inoculated/ASC; (6) inoculated/CPC; (7) inoculated/LA (at 55°C); (8) inoculated/LB; (9) inoculated/PAA; (10) inoculated/W (at 25°C); (11) inoculated/W (at 55°C). For each control or treatment group, individual bags containing BSP and LTP were

shaken/rotated (to assure adequate mixing of treatment with inoculated meat) for 30 s. Each bag of meat (400 g) was divided into three subsamples in order to be effectively homogenized in a sterile Waring Blender jar (Waring Product Division, New Hartford, CT). Aliquots of 1.0 ml were then removed from the subsamples for bacterial enumeration.

tion, to determine the antimicrobial effectiveness of each antimicrobial intervention. This phase of the study was replicated twice with two samples per treatment and inoculation level in each replicate.

### Statistical analysis

Five samples were evaluated per treatment subclass in the first phase of this experiment. In the second phase, two samples were subsampled three times and then evaluated per treatment subclass. Both phases of this experiment were replicated twice. Microbiological counts were converted to  $\log_{10}$  CFU/cm<sup>2</sup> for the first phase and  $\log_{10}$  CFU/g for the second phase before being analyzed. In the first phase of the experiment, the objective was to determine the effectiveness of treatment solutions on BCT. Analysis of fixed effects indicated that counts were dependent on type of media used (F-value = 77.79,  $P < 0.0001$ ) and level of inoculum (F-value = 853.69,  $P < 0.001$ ) determined using the general linear model procedure of SAS<sup>®</sup> Version 8.2 (36). The objective of the second phase was to determine the effectiveness of treatment solutions on LTP, and similarly, analysis of fixed effects indicated that counts were dependent on type of media (F-value = 38.90,  $P < 0.0001$ ) and level of inoculum (F-value = 839.38,  $P < 0.0001$ ). Thus in both phases these effects were dropped from the model and counts for each media are presented in different tables and separated by level of inoculum within tables. For each media and within level of inoculum, treatment least-squares means were segregated using a protected pairwise t-test of SAS<sup>®</sup> Version 8.2 (36) with signifi-

cant differences considered at an alpha level = 0.05.

## RESULTS AND DISCUSSION

### Beef carcass adipose tissue

The pH of each treatment solution was measured before and after treatment applications to ensure that the buffering capacity of the meat was not affecting the pH of the treatment solutions. No deviations greater than 0.5 were observed from the original pH to the post-treatment pH. The most effective chemical intervention used in this study was cetylpyridinium chloride (CPC), which is a quaternary ammonium compound that has been demonstrated to reduce bacterial counts on beef carcasses by up to 6.0 logs when sprayed at concentrations of 0.5% to 1.0% (13). In the present study, the application of CPC to BCT inoculated with high levels of *E. coli* O157:H7 resulted in a reduction ( $P < 0.05$ ) of 4.8 log CFU/cm<sup>2</sup> as observed on both SMAC and TSAYE plates (Tables 1 and 2). The *E. coli* O157:H7 counts on the low-dose inoculated BCT were reduced by 3.6 log CFU/cm<sup>2</sup> on SMAC plates, to almost undetectable levels of 0.5 log CFU/cm<sup>2</sup> (Table 1). The reduction in bacterial counts was very extensive, as indicated by the need to enrich 85% of the CPC treated samples. However, all samples that were tested by enrichment were found to be positive for *E. coli* O157:H7. Levels of bacterial reduction achieved by application of CPC were comparable on both SMAC (Table 1) and TSAYE (Table 2) agar plates. It should be noted, however, that CPC is not currently permitted for direct application to fresh red meat products in the United States (43).

Lactic acid, one of the most widely studied of the organic acids currently used in the beef industry, has been applied both heated and at room temperature (8, 9, 11, 12, 14, 31, 33). The effects of the use of LA differ among studies but generally suggest the achievement of a 1.0 to 2.0 log CFU/cm<sup>2</sup> reduction. In this study, LA (2%; at 55°C) was the second most effective decontamination agent studied, as it reduced significantly ( $P < 0.05$ ) the presence of *E. coli* O157:H7 and total bacterial populations on BCT (Tables 1 and 2). Lactic acid reduced *E. coli* O157:H7 counts on SMAC on products inoculated with high inoculum, from the initial 5.8 log CFU/cm<sup>2</sup> to 2.5 log CFU/cm<sup>2</sup> (Table 1). Bacterial counts on BCT administered the low-dose inoculation were significantly ( $P < 0.05$ ) reduced, by 2.6 log CFU/cm<sup>2</sup>, on TSAYE plates (Table 2).

In the present study, AA achieved lower reductions in bacterial populations than did LA on both SMAC and TSAYE agar plates at both inoculation levels (Tables 1 and 2). More specifically, when 2% AA was applied at room temperature, a 1.6 log CFU/cm<sup>2</sup> reduction ( $P < 0.05$ ) in bacterial counts was observed on the high-dose inoculated BCT (Table 1). Acetic acid was slightly more effective in reducing the pathogen load on the low-dose inoculated BCT, as shown by a 2.1 log CFU/cm<sup>2</sup> decrease in bacterial populations (Table 1). The use of either LA or AA would be feasible and effective for pathogen reduction of sufficient magnitude to aid in increasing the safety of beef.

Castillo et al. (10) demonstrated that acidified sodium chlorite (ASC), used in a washing system, reduced the presence of

**TABLE 2. Least-squares means (standard error) indicating survival and reduction of bacterial counts (log CFU/cm<sup>2</sup>) on beef carcass tissue inoculated with *Escherichia coli* O157:H7, by plating on tryptic soy agar with 0.6% yeast extract (TSAYE)**

Treatment Group	High Inoculation		Low Inoculation	
	Survival (log CFU/cm <sup>2</sup> )	Reduction (log CFU/cm <sup>2</sup> )	Survival (log CFU/cm <sup>2</sup> )	Reduction (log CFU/cm <sup>2</sup> )
Uninoculated/Untreated*	1.5 (0.14)	—	1.5 (0.14)	—
Inoculated/Untreated**	6.4 (0.04) <sup>a</sup>	—	4.3 (0.05) <sup>a</sup>	—
Inoculated/Water at 25°C	4.8 (0.16) <sup>c</sup>	1.6	3.9 (0.09) <sup>b</sup>	0.4
Inoculated/Acidified chlorine, 0.001% (AC)	5.7 (0.03) <sup>b</sup>	0.7	3.7 (0.15) <sup>b</sup>	0.6
Inoculated/Acetic acid, 2% (AA)	4.9 (0.10) <sup>c</sup>	1.4	2.5 (0.18) <sup>d</sup>	1.8
Inoculated/Lactic acid, 2% at 55°C (LA)	3.7 (0.10) <sup>e</sup>	2.7	1.7 (0.11) <sup>e</sup>	2.6
Inoculated/Lactoferricin B, 1% (LB)	5.7 (0.06) <sup>b</sup>	0.7	4.4 (0.12) <sup>a</sup>	-0.1
Inoculated/Peroxyacetic acid, 0.02% (PAA)	4.8 (0.10) <sup>c</sup>	1.5	3.2 (0.07) <sup>c</sup>	1.1
Inoculated/Acidified sodium chlorite, 0.02% (ASC)	4.3 (0.16) <sup>d</sup>	2.1	3.0 (0.19) <sup>c</sup>	1.3
Inoculated/Cetylpyridinium chloride, 0.5% (CPC)	1.5 (0.28) <sup>f</sup>	4.8	0.8 (0.24) <sup>f</sup>	3.5

\* Negative control

\*\* Positive control

<sup>a,b,c,d,e,f</sup> Means within each column for survival bearing common superscript letter are not different

( $P \geq 0.05$ ). Means in columns for reduction were not tested for statistical difference

n=10 samples per treatment and inoculation level

*E. coli* O157:H7 by 3.8 to 4.5 log<sub>10</sub> CFU/cm<sup>2</sup> while use of water alone, without subsequent application of ASC, resulted in a 2.3 log CFU/cm<sup>2</sup> reduction. It could be speculated that the force at which the ASC was applied (1,320 Kpa) in the Castillo et al. (10) study aided in the reduction of pathogens on the surface of beef carcass tissue. In the present study, ASC reduced ( $P < 0.05$ ) the pathogen counts (SMAC) on high-inoculum BCT by 1.9 log CFU/cm<sup>2</sup> and on low-inoculum BCT by 2.0 log CFU/cm<sup>2</sup>. In ad-

dition, total counts recovered on the TSAYE plates (Table 2) showed ASC reduced the counts by 2.1 and 1.3 log CFU/cm<sup>2</sup> on high-inoculum and low-inoculum BCT, respectively.

In previous research, Farrell et al. (17) evaluated peroxyacetic acid as a sanitizer for meat contact surfaces. Peroxyacetic acid was effective in reducing the bacterial load, but total elimination of *E. coli* O157:H7 was not achieved. Use of PAA significantly ( $P < 0.05$ ) reduced (1.4 log CFU/cm<sup>2</sup>) pathogen counts on

both high and low inoculated BCT, while a slightly higher reduction of the total bacterial populations (TSAYE) was observed on the high-inoculated product (Tables 1 and 2). In this experiment, PAA was just as effective at the high-inoculated level as AA ( $P > 0.05$ ).

An inexpensive and simple contamination reduction strategy may be washing with water, which has been studied by many researchers (39). The effectiveness of water as a decontamination technology is determined by the temperature, pressure and time

**TABLE 3.** Least-squares means (standard error) indicating survival and reduction of bacterial counts (log CFU/g) on homogenized boneless beef short plates and lean tissue pieces inoculated with *Escherichia coli* O157:H7, by plating on sorbitol MacConkey agar (SMAC)

Treatment Group	High Inoculation		Low Inoculation	
	Survival (log CFU/g)	Reduction (log CFU/g)	Survival (log CFU/g)	Reduction (log CFU/g)
Uninoculated/Untreated*	2.3 (0.12)	—	2.3 (0.12)	—
Inoculated/Untreated**	5.8 (0.04) <sup>a</sup>	—	4.2 (0.29) <sup>a</sup>	—
Inoculated/Water at 25°C	5.4 (0.18) <sup>a</sup>	0.3	4.1 (0.12) <sup>a</sup>	0.2
Inoculated/Acidified chlorine, 0.001% (AC)	5.3 (0.10) <sup>a</sup>	0.5	4.0 (0.32) <sup>a</sup>	0.3
Inoculated/Acetic acid, 2% (AA)	4.7 (0.10) <sup>b</sup>	1.1	2.9 (0.09) <sup>bc</sup>	1.4
Inoculated/Lactic acid, 2% at 55°C (LA)	4.5 (0.19) <sup>b</sup>	1.3	2.5 (0.23) <sup>c</sup>	1.7
Inoculated/Lactoferricin B, 1% (LB)	5.4 (0.06) <sup>a</sup>	0.4	4.1 (0.10) <sup>a</sup>	0.1
Inoculated/Peroxyacetic acid, 0.02% (PAA)	4.8 (0.06) <sup>ab</sup>	1.0	3.1 (0.05) <sup>b</sup>	1.2
Inoculated/Acidified sodium chlorite, 0.02% (ASC)	4.0 (0.19) <sup>c</sup>	1.8	2.8 (0.24) <sup>bc</sup>	1.5
Inoculated/Cetylpyridinium chloride, 0.5% (CPC)	3.7 (0.18) <sup>c</sup>	2.1	2.3 (0.12) <sup>c</sup>	1.9
Inoculated/Water at 55°C	4.7 (0.09) <sup>b</sup>	1.1	3.4 (0.12) <sup>b</sup>	0.8

\* Negative control

\*\* Positive control

<sup>a,b,c</sup> Means within each column for survival bearing common superscript letter are not different ( $P \geq 0.05$ ). Means in columns for reduction were not tested for statistical difference

n=4 samples per treatment and inoculation level with 3 subsamples per sample

at which it is applied; therefore, increasing the temperature, pressure and time should enhance the effectiveness of contamination reduction (22). In the present study, water was applied at room temperature (25°C); its use reduced ( $P < 0.05$ ) the presence of the pathogen (SMAC) by 1.2 and 0.6 log CFU/cm<sup>2</sup> on high-inoculum and low-inoculum BCT, respectively, and similar results were observed on TSAYE plates (Tables 1 and 2). Because of its current availability, water will likely continue to be the most widely used intervention in beef slaughtering facilities.

There is no evidence to date of the effectiveness of acidified chlorine (AC), which is a new intervention proposed for use in Canada to enhance the microbiological status of meat. When used as recommended by Advanced Food Systems, Kamloops, B. C., at 10 ppm (0.001%), its effectiveness in reducing total bacteria (TSAYE) and pathogen (SMAC) populations was slight (Tables 1 and 2). Acidified chlorine reduced pathogen counts (SMAC) by 0.7 and 0.6 CFU/cm<sup>2</sup> for high and low levels of inoculation, respectively (Table 1). Although there

is no scientific evidence, increasing the concentration of the solution may enhance the effectiveness of this intervention.

Lactoferricin B, a peptide in lactoferrin, has been shown to have antimicrobial activity (5). In previous research (42), it was demonstrated that use of 50 and 100 µg/ml of LB reduced *E. coli* O157:H7 by 0.7 and 2.0 log CFU/ml, respectively. In contrast, it has been suggested (5) that the effective dose of lactoferricin B for a 3.0 log CFU/cm<sup>2</sup> reduction in *E. coli* IID:861 was 10 µg/ml. As applied in the present study, LB (10 µg/ml; 1.0%) reduced the to-



**TABLE 4.** Least-squares means (standard error) indicating survival and reduction of bacterial counts (log CFU/g) on homogenized boneless beef short plates and lean tissue pieces inoculated with *Escherichia coli* O157:H7, by plating on tryptic soy agar with 0.6% yeast extract (TSAYE)

Treatment Group	High Inoculation		Low Inoculation	
	Survival (log CFU/g)	Reduction (log CFU/g)	Survival (log CFU/g)	Reduction (log CFU/g)
Uninoculated/Untreated*	2.8 (0.05)	—	2.8 (0.05)	—
Inoculated/Untreated**	5.9 (0.06) <sup>a</sup>	—	4.3 (0.26) <sup>a</sup>	—
Inoculated/Water at 25°C	5.8 (0.09) <sup>a</sup>	0.1	4.3 (0.07) <sup>a</sup>	0.0
Inoculated/Acidified chlorine, 0.001% (AC)	5.7 (0.01) <sup>a</sup>	0.2	4.0 (0.29) <sup>a</sup>	0.3
Inoculated/Acetic acid, 2% (AA)	5.3 (0.18) <sup>b</sup>	0.6	3.2 (0.29) <sup>b</sup>	1.1
Inoculated/Lactic acid, 2% at 55°C (LA)	4.7 (0.06) <sup>c</sup>	1.1	2.8 (0.13) <sup>c</sup>	1.5
Inoculated/Lactoferricin B, 1% (LB)	5.4 (0.04) <sup>ab</sup>	0.5	4.5 (0.20) <sup>a</sup>	-0.3
Inoculated/Peroxyacetic acid, 0.02% (PAA)	4.9 (0.04) <sup>c</sup>	1.0	3.3 (0.11) <sup>b</sup>	1.0
Inoculated/Acidified sodium chlorite, 0.02% (ASC)	4.9 (0.07) <sup>c</sup>	1.0	3.2 (0.05) <sup>b</sup>	1.1
Inoculated/Cetylpyridinium chloride, 0.5% (CPC)	3.9 (0.17) <sup>d</sup>	2.0	2.6 (0.12) <sup>c</sup>	1.7
Inoculated/Water at 55°C	5.3 (0.18) <sup>b</sup>	0.6	3.7 (0.05) <sup>ab</sup>	0.6

\* Negative control

\*\* Positive control

<sup>a,b,c,d</sup> Means within each column for survival bearing common superscript letter are not different

( $P \geq 0.05$ ). Means in columns for reduction were not tested for statistical difference

n=4 samples per treatment and inoculation level with 3 subsamples per sample

tal bacterial populations (TSAYE) on high-inoculum product by 0.7 log CFU/cm<sup>2</sup> and did not reduce ( $P \geq 0.05$ ) the level of bacteria on the low-inoculum product (Table 2). Reductions of 0.7 and 0.6 log CFU/cm<sup>2</sup> in pathogen counts on SMAC (Table 1) at high and low inoculation levels, respectively, were observed when LB was used. Naidu (28) suggests that lactoferricin B is effective in preventing pathogens from attaching on the surface of carcasses; further studies should be conducted to test this suggestion.

#### Boneless beef trimmings

Pieces of BSP and LTP were used to simulate the decontamination of beef trimmings. Trends in reducing *E. coli* O157:H7 counts due to intervention chemicals used on BSP and LTP were generally similar to the counts recovered from BCT, except that fewer chemical interventions significantly ( $P < 0.05$ ) reduced the level of total bacterial and pathogen contamination (Tables 3 and 4). Cetylpyridinium chloride was the most effective at reducing the microbiological load on BSP and LTP at both inoculation levels.

It was observed that, with use of SMAC plates, CPC reduced ( $P < 0.05$ ) pathogen populations, from an initial count of 5.8 log CFU/g to a final count of 3.7 log CFU/g and from an initial count of 4.2 log CFU/g to a final count of 2.3 log CFU/g at high and low inoculation levels, respectively (Table 3). On TSAYE plates, CPC reduced bacterial populations by comparable levels (Table 4).

When bacterial populations were enumerated with TSAYE agar plates, it was found that

heated (55°C) LA (2%) resulted in a 1.1 log CFU/g reduction of total bacterial populations on BSP and LTP at the high inoculation level and a 1.5 log CFU/g reduction of bacteria at the low inoculation level (Table 4). An even greater reduction in *E. coli* O157:H7 counts on BSP and LTP was observed after treatment with LA (2% at 55°C) when counts were enumerated on SMAC agar plates (Table 3). Although the reduction in total bacterial counts (TSAYE) from the original inoculation level was significant ( $P < 0.05$ ), the use of AA was only modestly effective in the decontamination of BSP and LTP, as evidenced by reductions of only 0.6 log CFU/g and 1.1 log CFU/g at the high-dose and low-dose inoculation levels, respectively (Table 4). However, AA was slightly more effective in reducing *E. coli* O157:H7 numbers, as shown by a reduction of 1.1 log CFU/g and 1.4 log CFU/g for the high and low inoculation levels, respectively (Table 3).

Acidified sodium chlorite was also effective at reducing ( $P < 0.05$ ) total bacterial populations (TSAYE) and pathogen populations (SMAC) on BSP and LTP (Tables 3 and 4). The ASC solution treatment was effective in reducing *E. coli* O157:H7 on BSP and LTP based on enumeration from SMAC plates, showing 1.8 and 1.5 log CFU/g reductions at high and low inoculation levels, respectively (Table 3). However, ASC was less effective in reducing total aerobes (TSAYE) on BSP and LTP, as shown by a 1.0 and 1.1 log CFU/g reduction for high and low inoculation levels, respectively (Table 4).

Peroxyacetic acid was shown to reduce bacterial populations on BSP and LTP by 1.0 and 1.2 log

CFU/g as determined on SMAC plates (Table 3), and by 1.0 and 1.0 log CFU/g as determined on TSAYE plates (Table 4) at high and low inoculation levels, respectively. When water was applied to BSP and LTP at 55°C, a 1.1 and 0.8 log CFU/g reduction in bacterial counts was observed on SMAC (Table 3) plates at high and low inoculation levels, respectively. On TSAYE plates the reduction in pathogen populations associated with the use of water (55°C) as a decontamination agent was less than 1.0 log CFU/g at either inoculation level (Table 4). The use of acidified chlorine, lactoferricin B or water (at 25°C) did not reduce ( $P \geq 0.05$ ) bacterial populations at either level of *E. coli* O157:H7 inoculation on either SMAC or TSAYE plates when used as a chemical sanitizer on BSP or LTP (Tables 3 and 4).

The results of this study indicated that LA, which is commonly used in microbiological intervention strategies, was the most effective antimicrobial agent currently approved for use in reducing total bacterial populations on beef carcass tissue and beef trimmings. Similar reductions were observed on total bacterial and pathogen populations on BSP and LTP treated with federally approved AA, ASC, and PAA compounds. The most effective microbiological intervention used in both phases of this study was CPC, which, however, is currently not approved as a chemical intervention on beef carcasses or on food contact surfaces (43).

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## REFERENCES

1. Anderson, M. E., R. T. Marshall, W. C. Stringer, and H. D. Naumann. 1977. Combined and individual effects of washing and sanitizing on bacterial counts of meat—A model system. *J. Food Prot.* 40:668–670.
2. Bacon, R. T., K. E. Belk, J. N. Sofos, R. P. Clayton, J. O. Regan, and G. C. Smith. 2000. Microbial populations on animal hides and beef carcasses at different stages of slaughter in plants employing multiple-sequential interventions for decontamination. *J. Food Prot.* 63:1080–1086.
3. Barkata, M. L., G. R. Acuff, L. Lucia, and D. S. Hale. 1993. Hot water decontamination of beef carcasses for reduction of initial bacteria numbers. *Meat Sci.* 35:397–401.
4. Bell, B. P., M. Goldoft, P. M. Griffin, M. A. Dans, D. C. Gordon, P. J. Tarr, C. A. Bartleson, J. H. Lewis, T. J. Barret, J. W. Wells, R. Baron and J. Kobayashi. 1994. A multistate outbreak of *Escherichia coli* O157:H7 — associated bloody diarrhea and hemolytic uremic syndrome from hamburgers, the Washington experience. *J. Am. Med. Assoc.* 272: 1349–1353.
5. Bellamy, W., M. Takase, H. Wakabayashi, K. Kawase, and M. Tomita. 1992. Antibacterial spectrum of lactoferricin B, a potent bactericidal peptide derived from the N-terminal region of bovine lactoferrin. *J. Appl. Bact.* 73:472–479.
6. Breen, P. J., C. M. Compadre, E. K. Fifer, H. Salari, C. Serbus, and D. L. Lattin. 1995. Quaternary ammonium compounds inhibit and reduce the attachment of viable *Salmonella* Typhimurium to poultry tissues. *J. Food Sci.* 60:1191–1196.
7. Breen, P. J., H. Salari, and C. M. Compadre. 1997. Elimination of *Salmonella* contamination from poultry tissues by cetylpyridinium chloride solutions. *J. Food Prot.* 60:1019–1021.
8. Brackett, R. E., Y. Y. Hao, and M. P. Doyle. 1994. Ineffectiveness of hot acid sprays to decontaminate *Escherichia coli* O157:H7 on beef. *J. Food Prot.* 57:198–203.
9. Castillo, A., L. M. Lucia, K. J. Goodson, J. W. Savell, and G. R. Acuff. 1998. Comparison of water wash, trimming, and combined hot water and lactic acid treatments for reducing bacteria of fecal ori-

- gin on beef carcasses. *J. Food Prot.* 61:823-828.
10. Castillo, A., L.M. Lucia, G.K. Kemp, and G.R. Acuff. 1999. Reduction of *Escherichia coli* O157:H7 and *Salmonella* Typhimurium on beef carcass surfaces using acidified sodium chlorite. *J. Food Prot.* 62:580-584.
  11. Conner, D. E. J. S. Kotrola, W. B. Mikel, and K. C. Tamblyn. 1997. Effects of acetic and lactic acid treatments applied to beef trim on populations of *Escherichia coli* O157:H7 and *Listeria monocytogenes* in ground beef. *J. Food Prot.* 60:1560-1563.
  12. Cutter, N. C., W. J. Dorsa and G. R. Siragusa. 1997. Parameters affecting the efficacy of spray washes against *Escherichia coli* O157:H7 and fecal contamination on beef. *J. Food Prot.* 60:614-618.
  13. Cutter, C. N., W. J. Dorsa, A. Handie, S. Rodriguez-Morales, X. Zhou, P. J. Breen, and C. M. Compadre. 2000. Antimicrobial activity of cetylpyridinium chloride washes against pathogenic bacteria on beef surfaces. *J. Food Prot.* 63:593-600.
  14. Dorsa, W. J., C. N. Cutter, and G. R. Siragusa. 1997. Effects of acetic acid, lactic acid and trisodium phosphate on the microflora of refrigerated beef carcass surface tissue inoculated with *Escherichia coli* O157:H7, *Listeria innocua* and *Clostridium sporogenes*. *J. Food Prot.* 60:619-624.
  15. Dorsa, W. J., C. N. Cutter, and G. R. Siragusa. 1998. Long-term effect of alkaline, organic acid, or hot water washes on the microbial profile of refrigerated beef contaminated with bacterial pathogens after washing. *J. Food Prot.* 61:300-306.
  16. Elder, R. O., J. E. Keen, G. R. Siragusa, G. A. Barkocy-Gallagher, M. Koohmaraie, and W. M. Laegreid. 2000. Correlation of enterohemorrhagic *Escherichia coli* O157 prevalence in feces, hides, and carcasses of beef cattle during processing. *PNAS* 97:2999-3003.
  17. Farrell, B. L., A. B. Ronner, and A. C. L. Wong. 1998. Attachment of *Escherichia coli* O157:H7 in ground beef to meat grinders and survival after sanitation with chlorine and peroxyacetic acid. *J. Food Prot.* 61:817-822.
  18. FSIS-USDA (Food Safety Inspection Service - U. S. Department of Agriculture). 1996. Pathogen reduction: hazard analysis and critical control point (HACCP) systems; final rule. *Fed. Regist.* 61:38805-38989.
  19. Gill, C., J. Bryant, and C. McGinnis. 2000. Microbial effects of the carcass washing operations at three beef packing plants. *Fleischwirtschaft Int.* (3/2000) pp. 46-48.
  20. Gorman, B. M., J. B. Morgan, J. N. Sofos, and G. C. Smith. 1995a. Microbiological and visual effects of trimming and/or spray-washing for removal of fecal material from beef. *J. Food Prot.* 58:984-992.
  21. Gorman, B. M., J. N. Sofos, J. B. Morgan, G. R. Schmidt, and G. C. Smith. 1995b. Evaluation of hand-trimming, various sanitizing agents and hot water spray-washing as decontamination interventions for beef brisket adipose tissue. *J. Food Prot.* 58:899-907.
  22. Graves Delmore, L. R., J. N. Sofos, J. O. Reagan, and G. C. Smith. 1997. Hot-water rinsing and trimming/washing of beef carcasses to reduce physical and microbiological contamination. *J. Food Sci.* 62:373-376.
  23. Hardin, M. D., G. R. Acuff, L. M. Lucia, J. S. Oman, and J. W. Savell. 1995. Comparison of methods for decontamination from beef carcass surfaces. *J. Food Prot.* 58:368-374.
  24. Kenner, B. A., R. A. Quisno, M. J. Foter, and I. W. Gibby. 1946. Cetylpyridinium chloride II. An in vivo method of evaluation. *J. Bact.* 52:449-451.
  25. Kim, J. W., and M. F. Slavik. 1996. Cetylpyridinium chloride (CPC) treatment on poultry skin to reduce attached *Salmonella*. *J. Food Prot.* 59:332-326.
  26. Kochevar, S. L., J. N. Sofos, R. R. Bolin, J. O. Reagan, and G. C. Smith. 1997. Steam vacuuming as a pre-evisceration intervention to decontaminate beef carcasses. *J. Food Prot.* 60:107-113.
  27. Mead, P. S., L. Slutsker, and V. Deitz. 1999. Food related illness and death in the United States. *Emerg. Infect. Dis.* 5:607-625.
  28. Naidu, A. S. 2000. Microbial blocking agents: A new approach to food safety. *Food Technology* 54:112.
  29. Nutsch, A. L., R. K. Phebus, M. J. Riemann, D. E. Schafer, J. E. Boyer, R. C. Wilson, J. D. Leising, and C. L. Kastner. 1997. Evaluation of a steam pasteurization process in a commercial beef processing facility. *J. Food Prot.* 60:485-492.
  30. Phebus, R. K., A. L. Nutsch, D. E. Schaefer, R. C. Wilson, M. J. Riemann, J. D. Leising, C. L. Kastner, J. R. Wolf, and R. K. Prasai. 1997. Comparison of steam pasteurization and other methods for reduction of pathogens on surfaces of freshly slaughtered beef. *J. Food Prot.* 60:476-484.
  31. Podolak, R. K., J. F. Zayas, C. L. Kastner, and D. Y. C. Fung. 1996. Inhibition of *Listeria monocytogenes* and *Escherichia coli* O157:H7 on beef by application of organic acids. *J. Food Prot.* 59:370-373.
  32. Powell, V. H. and B. P. Cain. 1987. A hot water decontamination system for beef sides. *CSIRO Food Res. Quart.* 47:79-84.
  33. Prasai, R. K., C. L. Kastner, P. B. Kenney, D. H. Kropf, D. Y. C. Fung, L. E. Mease, L. R. Vogt, and D. E. Johnson. 1997. Microbiological quality of beef subprimals as affected by lactic acid sprays applied at various points during vacuum storage. *J. Food Prot.* 60:795-798.
  34. Ransom, J. R., R. T. Bacon, K. E. Belk, J. N. Sofos, J. A. Scanga, and G. C. Smith. 2002. Comparison of sampling methods for sampling rectal/colonic feces, hides and carcasses for microbial testing. *J. Food Prot.* 65:621-626.
  35. Reagan, J. O., G. R. Acuff, D. R. Buege, M. J. Buyck, J. S. Dickson, C. L. Kastner, J. L. Marsden, J. B. Morgan, R. Nickelson II, G. C. Smith, and J. N. Sofos. 1996. Trimming and washing of beef carcasses as a method of improving the microbiological quality of meat. *J. Food Prot.* 59:751-756.
  36. SAS. 2001. SAS® system under Microsoft Windows, Version 8.2. Statistical Analysis Systems Institute Inc., Cary, NC.
  37. Smith, G. C., J. N. Sofos, K. E. Belk, J. A. Scanga, and J. D. Tatum. 2000. Pathogen contamination of cattle and beef; challenges and opportunities in process control. Proceedings of the XXI World Buiatrics Congress (Punta del Este, Uruguay). pp. 2921-2939.

38. Smulders, F. J. M., and G. G. Greer. 1998. Integrating microbial decontamination with organic acids in HACCP programs for muscle foods: prospects and controversies. *Int. J. Food Microbiol.* 44:149-169.
39. Sofos, J. N., and G. C. Smith. 1998. Nonacid meat decontamination technologies: Model studies and commercial applications. *Int. J. Food Microbiol.* 44:171-188.
40. Sofos, J. N., L. R. Beuchat, P. M. Davidson, and E. A. Johnson. 1998. Naturally occurring antimicrobials in food. Task Force Report No. 132. Council for Agricultural Science and Technology, Ames, IA.
41. Van Donkersgoed, J., T. Graham, and V. Gannon. 1999. The prevalence of verotoxins, *Escherichia coli* O157:H7, and *Salmonella* in the feces and rumen of cattle at processing. *Canadian Vet. J.* 40:332-338.
42. Venkitanarayanan, K. S., T. Zhao, and M. P. Doyle. 1999. Antibacterial effect of lactoferricin B on *Escherichia coli* O157:H7 in ground beef. *J. Food Prot.* 62:747-750.
43. Waldroup, A. 2002. Personal Communication. Safe Foods Corp. Little Rock, AR.



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# Hygienic Status of Meals in Airline Catering

SABINE THIELKE,<sup>1</sup> ANNETTE SCHEUREN<sup>2</sup> and REINHARD FRIES<sup>1</sup>

<sup>1</sup>Institute of Anatomy, Physiology and Hygiene of Domestic Animals,  
University of Bonn, Germany 53115 Bonn, Katzenburgweg 7-9

<sup>2</sup>Institute of Meat Hygiene and Technology, Free University of Berlin  
Bruemmer Str. 10, 14195 Berlin

## SUMMARY

Three different types of foods (cold meals) of an airline caterer were microbiologically examined with a stage-by-stage approach. From the onset of manipulation of the foods, increased microbiological contamination was observed. The sliced Frankfurter-type sausage was already highly contaminated in the first stage (original); the tureen and whole bulk egg experienced an increasing Aerobic Plate Count (APC) during the course of production. The same was true for positive samples of lactobacilli, *Enterobacteriaceae* and staphylococci. Using the AEA guidelines for aircraft-ready food, the microbiological status was beyond the limits (APC and *Staphylococcus*), particularly for the whole bulk egg and the frankfurter-type sausage. Nineteen percent of the whole sampling lot had more than  $10^6$  CFU/g. With regard to staphylococci, 13% of our samples contained more than  $10^2$  CFU/g. As a preventive measure, and particularly with respect to special types of food, the meal production steps of airline catering firms should be examined more closely.

## INTRODUCTION

With regard to hygiene of food for human consumption, not only the general microbiological status of the commodity but also the characteristics of particular consumer groups must be considered. Because of the special situation, this applies also to food for use in aircraft. In this area, only few data have been published.

Hatakka (2) examined hot meals for airlines by taking samples on board before meals were heated and served. In 9.2% of 1,004 samples, an aerobic plate count (APC) of more than  $10^6$  CFU/g was detected. In 989 samples examined for *Staphylococcus aureus*, 6 contained *Staphylococcus aureus* at levels over  $10^2$  CFU/g. The same author (3) examined cold airline meals, samples of which had been taken just before being served on board. An APC of more than  $10^6$  CFU/g was detected in 41% of 253 appetizers, 34% of 151 salads and 10% of 212 desserts. Of 350 samples examined for *Staphylococcus aureus*, 7% had more than  $10^2$  CFU/g.

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\*Author for correspondence: Phone: 49.30.838.52791  
Fax: 49.30.838.52792; E-mail: Fries@zedat.fu-berlin.de

**TABLE 1. Microbiological criteria for aircraft-ready foods (1) - extracts**

Food Category	Total Count <sup>1</sup>	Staphylococcus	Samples Taken
1.(a) Bulk items that have not been manipulated <sup>2</sup> after heat treatment <sup>3</sup> (e.g., hot meats, gravies). Mayonnaise	100,000/g (5 log units/g)	100/g 2 log units/g	—Egg (Stage 1)
1.(b) Bulk items that have been portioned after heat treatment	500,000/g (5.7 log units/g)	100/g (2 log units/g)	
2. Items that have been manipulated after heat treatment (e.g., sandwiches, starters, snacks, plates, desserts — <u>all</u> cold) (Stage 3) <sup>4</sup>	1,000,000/g 6 log units/g	100/g (2 log units/g)	— Sausage, Tureen (Stage 1) — Sausage, Tureen, Egg (Stage 2) — Sausage, Tureen, Egg (Stage 3) — Sausage, Tureen, Egg (Stage 4) <sup>4</sup>
3. Undercooked items (e.g., vegetables, deep-frozen blanched vegetables, steaks that will receive no more heat treatment before leaving the flight kitchen)	*	100/g (2 log units/g)	
4. Cold-smoked or cold-cured fish, meat or poultry <sup>5</sup>	*	100/g (2 log units/g)	
5. Water and wet ice	*	*	
6. Raw vegetables or raw fruits (or items containing them) sampled when ready for use in aircraft meal <sup>6</sup>	*	*	
7. Acid foods (e.g., yogurt, fruit juices and fruit segments)	*	*	
8. Cheeses	*	100/g (2 log units/g)	

<sup>1</sup> Standards for "Total Counts" specified

<sup>2</sup> "Manipulation" – includes slicing, cutting, mincing, piping, mixing, whipping, peeling, shelling, etc. It does not include cooking, chilling, or portioning

<sup>3</sup> "Heat Treatment" – means pasteurization, i.e., when a core temperature of at least 72°C/162°F is reached

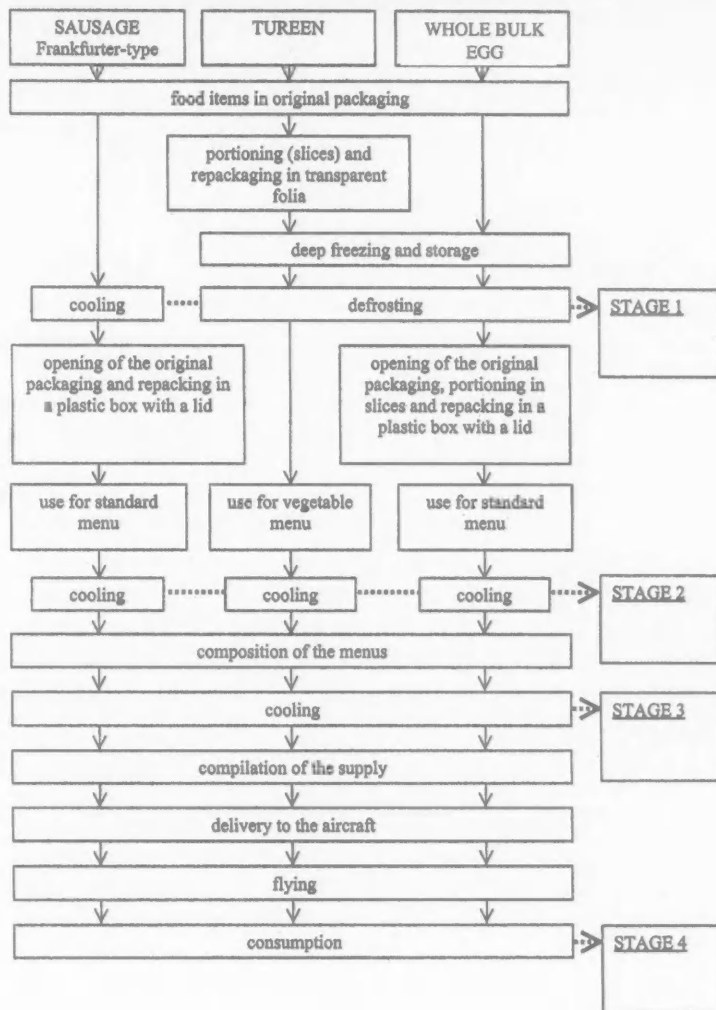
<sup>4</sup> Total counts on products in Categories 1 and 2 may be significantly increased by the addition of raw vegetables, raw fruit, or garnishes, e.g., dill, cheese, etc. and as such may need to be considered under Category 6 Guidelines

<sup>5</sup> "Cold Smoking" and "Cold Curing" – implies that the product has not been pasteurized

<sup>6</sup> Examined after wash and/or disinfection, if such a procedure is carried out

\* Test is not considered necessary as a routine

FIGURE 1. Flow diagram of preparation and stages of sampling



Lambiri et al. (4) examined the microbiology of foods produced by an airline caterer prior to and following the introduction of a HACCP system. The implementation of the system improved the bacteriological status of the foods markedly: Of 145 hot food items, only 9% had an APC of more than  $10^5$  CFU/g, and only 2% had a *Staphylococcus aureus* level more than  $10^2$  CFU/g. Of 38 cold food items examined, 8% had an APC of more

than  $10^6$  CFU/g; in 3% of 64 samples, a *Staphylococcus aureus* level of more than  $10^2$  CFU/g was recovered. Of 29 desserts, only one sample had a total APC of more than  $10^6$  CFU/g and a *Staphylococcus aureus* number more than  $10^2$  CFU/g.

WHO (5) reported that 240 of 1,013 airline meals (24%) had an APC of more than  $10^6$  CFU/g; only 2 samples had more than  $10^{2.3}$  CFU/g *Staphylococcus aureus*. Sampling had been done as near

as possible to the time that foods were loaded into the airplane.

The Association of European Airlines AEA (1) classified foods microbiologically on the basis of various criteria: APC, *Staphylococcus*, coliforms, *Escherichia coli*, *Salmonella*, *Bacillus cereus*, *Campylobacter*, *Clostridium perfringens*, yeasts and molds (Table 1). When results are within the range of limits for these, the food is regarded as safe. If, however, the APC is beyond the limit and *Enterobacteriaceae* and coliforms are detected, an investigation of food production methods is advised. Finally, the food is regarded as unsafe in cases of detection of pathogens including *Salmonella*, *Staphylococcus aureus*, *Bacillus cereus*, *Campylobacter*, *Clostridium perfringens* and *Escherichia coli* in numbers beyond the limits given in the guidelines. However, in this case, no further consequences are specified.

In the research reported in this paper, the microbiological status of three food categories of cold airline meals, at different stages, was determined during processing and during flight.

## MATERIAL AND METHODS

Three different food ingredients (whole bulk egg, vegetarian tureen and sliced Frankfurter-type sausage) of two different menus (cold meals) of a commercial airline caterer in Germany were examined at different stages (Fig. 1): First, the original food items (stage 1); second, food items after opening but before use in preparation of the menus (stage 2); third, the foods after production of the meals, but before meals were loaded into the aircraft (stage

**TABLE 2. Means – standard deviations [log CFU/g] of the microbes in different foods (n=12) (< DL = under detection limit)**

Food	Stage	Aerobic plate count	<i>Lactobacillus</i> spp.	<i>Enterobacteriaceae</i>	<i>Staphylococcus</i> spp.	<i>Streptococcus</i> spp.
Tureen	1	2.56 – 1.39	< DL	< DL	< DL	< DL
	2	2.95 – 1.02	1.73 – 0.40	< DL	< DL	< DL
	3	4.50 – 0.77	2.70 – 0.93	2.52 – 0.80	1.79 – 0.17	1.73 – 0.09
	4	4.27 – 0.52	2.33 – 0.75	2.76 – 0.83	1.84 – 0.31	< DL
Sausage	1	4.97 – 1.53	4.36 – 1.36	< DL	1.78 – 0.27	< DL
	2	5.30 – 1.43	4.58 – 1.46	1.73 – 0.09	< DL	1.73 – 0.09
	3	5.97 – 0.92	5.16 – 0.95	2.50 – 0.88	1.97 – 0.45	2.04 – 0.53
	4	5.93 – 0.90	5.05 – 0.93	2.30 – 0.63	1.87 – 0.35	1.91 – 0.49
Whole bulk egg	1	< DL	< DL	< DL	< DL	< DL
	2	3.54 – 1.05	2.55 – 1.01	1.97 – 0.48	2.01 – 0.51	< DL
	3	5.83 – 1.91	3.95 – 1.10	3.40 – 1.07	2.05 – 0.39	1.78 – 0.21
	4	5.90 – 1.92	4.19 – 0.85	3.51 – 1.03	1.92 – 0.44	1.74 – 0.14

3); and fourth, the meals after the flight was finished (stage 4).

At each stage, twelve samples were taken, i.e., 48 samples of each food item (altogether, 144 samples) were available. All samples were stored on ice and, after arrival at the laboratory, deep frozen at -20°C. The microbiological examination comprised the APC, as well as the examination for lactobacilli, *Enterobacteriaceae*, staphylococci and streptococci. Media for isolation and enumeration and the identification steps were as follows: APC (plate count agar [Casein-peptone Dextrose Yeast agar], Merck, Darmstadt, Germany, incubation 30°C for 72 h); *Lactobacillus* spp. (selective MRS agar acc. to de Man, Rogosa, Sharp, Merck, Darmstadt, Germany, incubation 37°C for 72-96 h; Gram-positive, regular rods, catalase neg., H<sub>2</sub>S neg., growth at pH 4.5 pos.); *En-*

*terobacteriaceae* (selective VRBD agar acc. to Mossel, Merck, Darmstadt, Germany, incubation 37°C for 24 h; Gram-negative rods, oxidase neg., oxidative/fermentative carbohydrate degradation (O/F-test, basal media based on glucose) +/+, nitrate pos.); *Staphylococcus* spp. (selective Baird Parker agar, Merck, Darmstadt, Germany, incubation 37°C for 48 h; Gram-positive cocci in clusters, catalase pos., oxidase neg., motility neg., lysozyme (reagent: 400 g/ml, 1 droplet on solid agar) resistant, lysostaphine (reagent: 200 g/ml, 1 droplet on solid agar) sensitive); *Streptococcus* spp. (selective Kanamycin Esculin Azide agar, Merck, Darmstadt, Germany, incubation 37°C for 48 h; Gram-positive cocci in chains of different length or pairs, catalase neg., gas from glucose neg., motility neg.).

Samples with a microbiological status below the detection limit were calculated to have half the detection limit. Results were converted to logarithms. All data were then used for calculation of the arithmetic mean and the standard deviation.

## RESULTS

**Tureen:** The APC increased during the course of production (about 2 log<sub>10</sub> units), however, bacteria were not present by the other four microbiological criteria in the first stage. Mainly, it was not until the third and fourth stage that bacteria could be detected according to the other criteria.

**Sausage, frankfurter-type:** Even in the first stage, high APCs and high numbers of lactobacilli were recovered although *Enterobacteriaceae* and streptococci were



**TABLE 3. Percentage (number) of samples with microbiological findings (n=12)**

Food	Stage	Aerobic plate count	Lactobacillus spp.	Enterobacteriaceae	Staphylococcus spp.	Streptococcus spp.
Tureen	1	83 (10)	0 (0)	0 (0)	0 (0)	0 (0)
	2	100 (12)	25 (3)	0 (0)	0 (0)	0 (0)
	3	100 (12)	67 (8)	58 (7)	42 (5)	8 (1)
	4	100 (12)	83 (10)	75 (9)	42 (5)	0 (0)
Sausage	1	100 (12)	75 (9)	0 (0)	8 (1)	0 (0)
	2	100 (12)	83 (10)	8 (1)	0 (0)	17 (2)
	3	100 (12)	100 (12)	75 (9)	33 (4)	42 (5)
	4	100 (12)	100 (12)	92 (11)	42 (5)	17 (2)
Whole bulk egg	1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	2	100 (12)	50 (6)	33 (4)	42 (5)	0 (0)
	3	100 (12)	83 (10)	92 (11)	67 (8)	42 (5)
	4	100 (12)	83 (10)	92 (11)	50 (6)	8 (1)

**TABLE 4. Number of samples exceeding the limits of the AEA Standards**

Food	Stage	Aerobic plate count		Staphylococcus spp.	
		Number of samples	log CFU/g	Number of samples	log CFU/g
Tureen	1	0 of 12		0 of 12	
	2	0 of 12		0 of 12	
	3	0 of 12		1 of 12	2.18
	4	0 of 12		1 of 12	2.74
Sausage	1	4 of 12	6.08 / 6.90 / 6.35 6.41	1 of 12	2.65
	2	5 of 12	7.10 / 6.96 / 6.89 6.61 / 6.05	0 of 12	
	3	5 of 12	6.97 / 7.30 / 6.98 6.97 / 6.06	3 of 12	2.70 / 2.90 / 2.48
	4	5 of 12	7.11 / 7.40 / 6.20 7.14 / 6.52	2 of 12	2.78 / 2.40
Whole bulk egg	1	0 of 12		0 of 12	
	2	0 of 12		3 of 12	2.81 / 3.02 / 2.70
	3	5 of 12	6.20 / 7.30 / 9.00 9.00 / 6.91	4 of 12	2.54 / 2.60 / 2.78 2.18
	4	4 of 12	7.57 / 7.49 / 9.00 9.00	3 of 12	2.54 / 2.18 / 3.04

not. However, at the end, *Enterobacteriaceae* were present in 11 of 12 samples. Similar observations could be made with regard to staphylococci and streptococci: During the production course, the number of samples with microbiological findings increased.

Whole bulk egg: The microbiological status of the original was below the detection limit. However, during the course of production, APC, lactobacilli and *Enterobacteriaceae* increased considerably. The highest number of *Enterobacteriaceae* was recorded in one sample in stage 4 (over  $10^5$  CFU/g). Regarding staphylococci and streptococci, the number of positive samples increased during the course of production (Tables 2, 3).

## DISCUSSION

Especially with the Frankfurter-type sausage and the whole bulk egg, a large number of samples exceeded the AEA limits with regard to APC and *Staphylococcus*. Of 48 sausage samples, 19 (40%) had numbers over  $10^6$  CFU/g; staphylococci, in 13% of samples, exceeded  $10^2$  CFU/g. With the whole bulk egg, these figures amounted to 19% for APC and 21% with regard to staphylococci. In the tureen, only two out of 48 samples (4%) resulted in

more than  $10^2$  CFU/g staphylococci (Table 4).

Using the AEA limit of  $6 \log_{10}$  units/g, several surveys have reported that airline foods had a microbiological status that exceeded the limits in different ways:

APC > $10^6$ CFU/g	
hot meals (2)	9.2%
cold meals (3)	41.0% / 34.0% / 10.0%
cold food items (4)	8.0% / 1 of 29
different items (5)	24%
cold meals (data presented here)	19%

With regard to staphylococci, it is necessary to distinguish between the species *Staphylococcus aureus* and the genus *Staphylococcus*. Hatakka (2, 3) as well as Lambiri et al. (4) and WHO (5) tested for *Staphylococcus aureus* specifically.

<i>Staphylococcus aureus</i> > $10^2$ CFU/g	
hot meals (2)	0.6%
cold meals (3)	7%
hot food items (4)	2%
cold food items (4)	3% / 1 of 29

Data from WHO (5) for *S. aureus* showed that 0.2% of samples contained more than  $10^{2.3}$  CFU/g. In our results, 13% of samples had more than  $10^2$  CFU/g. However, it must be noted that we examined for members of the

genus *Staphylococcus*, i.e., the number of *Staphylococcus aureus* might have been lower.

In particular, microbiological results from foods to be consumed during a flight cannot simply be compared with data on foods from retail sources, and only the limits of the AEA remain for discussion. Considering also similar results from other surveys of airline foods, our data reflect clearly that the microbiological status of airline foods is not generally within the given limits of the AEA. So, as a preventive measure, hygiene in airline catering should be surveyed more intensively than might be the case at present.

## REFERENCES

1. Association of European Airlines 1997. Routine microbiological standards for aircraft-ready food. In Hygiene Guidelines. 9-13. Brussels, Belgium.
2. Hatakka, M. 1998a. Microbiological quality of hot meals served by airlines. J. Food Prot. 61:1052-1056.
3. Hatakka, M. 1998b. Microbiological quality of cold meals served by airlines. J. Food Safety 18:185-195.
4. Lambiri, M., A. Mavridou, and J. A. Papadakis. 1995. The application of hazard analysis critical control point (HACCP) in a flight catering establishment improved the bacteriological quality of meals. J. Roy. Soc. Health. Feb. 26-30.
5. World Health Organization. 1989. Food safety — microbiological quality of airline meals. Wkly Epidem. Rec. 42:324-327.

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References consisting of papers that are "accepted for publication" or "in press" are acceptable, but the author may be asked to provide copies of such papers if needed to evaluate the manuscript in question.

Figures and tables should appear on separate pages and not within the text of the manuscript. Placement of tables and figures should be indicated in the text.

#### **Electronic mail**

E-mail messages should include the name of the person who sent the message, the date, the subject, the sender's E-mail address, and availability (if appropriate).

If the subject is not available, the message should be listed as a Personal Communication.

#### **Web pages**

Include author, date, title, availability information, and accession date, if needed.

## **ILLUSTRATIONS, PHOTOGRAPHS, FIGURES**

Submission of photographs, graphics or drawings to illustrate the article will help the article. The nature of *FPT* allows liberal use of such illustrations, and interesting photographs and drawings often increase the number of persons who read the article.

*Photographs.* Photographs which are submitted should have sharp images, with good contrast. Photographs can be printed in color, but the additional cost of doing so must be incurred by the author. Authors wishing to publish color photographs should contact Donna Bahun, Production Editor for cost estimates.

The editor encourages the submission of four-color photographs to be used on the cover of *FPT*. Photographs should depict a scene relative to food safety. Please submit your photograph in the form of an EPS file, a negative or slide. Cover photographs will be returned only upon request.

*Line drawings.* All line drawings (graphs, charts, diagrams, etc.) should be submitted as black and white glossy or matte finish photographs. Use a lettering set or other suitable

device for all labeling. If graphs are computer generated, printed copies of the graphs must be produced by a good quality laser printer, with sufficiently dark printing or appropriate size letters and numerals. Graphs produced by dot matrix printers *are not* acceptable. Figures are commonly reduced to a 1-column width (85 mm). Lettering should be of sufficient size to allow for reduction. If symbols are used, they must be identified on the Figure and not in the legend. Data that are presented in Figures should not be repeated in Tables. A well-prepared Figure should be understandable without reference to the text of the paper.

*Labeling of figures.* All Figures should be labeled lightly on back, using a soft pencil or a typed adhesive label. Labeling should include:

- figure number,
- last name of author(s),
- title of manuscript,
- the manuscript number (on revised copies),
- identification of the top of the figure.

## **COMMON ABBREVIATIONS**

Frequently used acceptable abbreviations may be used (i.e., using *wt* for the word *weight*, or *s* for the word *second*). For further details on abbreviations see the current edition of the *CBE Style Manual* or *ASM Manual of Style*. Note that a period is used with some but not all abbreviations.

Authors may also contact the Production Editor if they are not sure about acceptable abbreviations.

## **REPRINTS**

Reprints of an article may be ordered by the author. An order form for reprints will be sent to the corresponding author. Reprints may be ordered with or without covers, in multiples of 25. Reprint costs vary according to the number of printed pages in the article.

## **CORRESPONDING ADDRESS**

International Association for Food Protection  
Donna Bahun  
*Food Protection Trends*  
6200 Aurora Avenue, Suite 200W  
Des Moines, IA 50322-2864, USA  
Phone: 800.369.6337; 515.276.3344  
Fax: 515.276.8655  
E-mail: dbahun@foodprotection.org

[www.foodprotection.org](http://www.foodprotection.org)

# Award Nominations

The International Association for Food Protection welcomes your nominations for our Association Awards. We encourage both Members and non-members to nominate deserving professionals. Nomination criteria is available on the association's Web site at [www.foodprotection.org](http://www.foodprotection.org) or contact the office at 800.369.6337 or 515.276.3344.

**Nominations deadline is March 17, 2003.** You may make multiple nominations. All nominations must be received at the IAFP office by March 17, 2003.

- ◆ Persons nominated for individual awards must be current IAFP Members. Black Pearl Award nominees must be a company employing current IAFP Members. NFPA Food Safety Award nominees do not have to be IAFP Members.
- ◆ Previous award winners are not eligible for the same award.
- ◆ Executive Board Members and Awards Committee Members are not eligible for nomination.
- ◆ Presentation of awards will be during the Awards Banquet at IAFP 2003 – the Association's 90th Annual Meeting in New Orleans, Louisiana on August 13, 2003.

**Peter Hibbard, Awards Committee Chairperson**



International Association for  
**Food Protection**®

6200 Aurora Avenue, Suite 200W  
Des Moines, IA 50322-2864, USA  
Phone: 800.369.6337 • 515.276.3344  
Fax: 515.276.8655  
E-mail: [info@foodprotection.org](mailto:info@foodprotection.org)  
Web site: [www.foodprotection.org](http://www.foodprotection.org)

## *Nominations will be accepted for the following Awards:*

### **Black Pearl Award** — Award Showcasing the Black Pearl

Presented in recognition of a company's outstanding achievement in corporate excellence in food safety and quality.

*Sponsored by Wilbur Feagan and F&H Food Equipment Company.*

### **Fellow Award** — Distinguished Plaque

Presented to Member(s) who have contributed to IAFP and its Affiliates with quiet distinction over an extended period of time.

### **Honorary Life Membership Award** — Plaque and Lifetime Membership in IAFP

Presented to Member(s) for their devotion to the high ideals and objectives of IAFP and for their service to the Association.

### **Harry Haverland Citation Award** — Plaque and \$1,000 Honorarium

Presented to an individual for years of devotion to the ideals and objectives of IAFP.

*Sponsored by Silliker, Inc.*

### **Harold Barnum Industry Award** — Plaque and \$1,000 Honorarium

Presented to an individual for outstanding service to the public, IAFP and the food industry.

*Sponsored by NASCO International.*

### **Educator Award** — Plaque and \$1,000 Honorarium

Presented to an individual for outstanding service to the public, IAFP and the arena of education in food safety and food protection.

*Sponsored by Nelson-Jameson, Inc.*

### **Sanitarian Award** — Plaque and \$1,000 Honorarium

Presented to an individual for outstanding service to the public, IAFP and the profession of the Sanitarian.

*Sponsored by Ecolab, Inc., Food and Beverage Division.*

### **Maurice Weber Laboratorian Award** — Plaque and \$1,000 Honorarium

Presented to an individual for outstanding contributions in the laboratory, recognizing a commitment to the development of innovative and practical analytical approaches in support of food safety.

*Sponsored by Weber Scientific.*

### **International Leadership Award** — Plaque, \$1,000 Honorarium and Reimbursement to Attend IAFP 2003.

Presented to an individual for dedication to the high ideals and objectives of IAFP and for promotion of the mission of the Association in countries outside of the United States and Canada.

*Sponsored by Kraft Foods, North America.*

### **NFPA Food Safety Award** — Plaque and \$3,000 Honorarium

Presented to an individual, group, or organization in recognition of a long history of outstanding contribution to food safety research and education.

*Sponsored by National Food Processors Association.*

**Criteria available at [www.foodprotection.org](http://www.foodprotection.org)**

# Past Awardees

## BLACK PEARL AWARD

*Sponsored by Wilbur Feagan and F & H Food Equipment Company, Springfield, Missouri*

- 1994-HEB, Co., San Antonio, Texas
- 1995-Albertson's Inc., Boise, Idaho
- 1996-Silliker Laboratories Group, Inc., Homewood, Illinois
- 1997-Papetti's of Iowa Food Products, Inc., Lenox, Iowa
- 1998-Kraft Foods, Inc., Northfield, Illinois
- 1999-Caravelle Foods, Brampton, Ontario, Canada
- 2000-Zep Manufacturing Company, Atlanta, Georgia
- 2001-Walt Disney World Company, Lake Buena Vista, Florida
- 2002-Darden Restaurants, Orlando, Florida

## FELLOWS AWARD

- 1998-Larry Beuchat, Lloyd Bullerman, Frank L. Bryan  
Michael P. Doyle, Harry Haverland, Elmer M. Marth,  
and Edmund A. Zottola
- 1999-A. Richard Brazis, Michael H. Brodsky, James M. Jay,  
Robert T. Marshall, Lawrence A. Roth, and Earl O. Wright
- 2000-John C. Bruhn, Cameron R. Hackney, Bruce E. Langlois,  
and Lloyd O. Luedecke
- 2001-Ann Draughon and Ewen C. D. Todd
- 2002-David Fry

## HONORARY LIFE MEMBERSHIP AWARD

- 1957-J. H. Shrader
- 1958-H. Clifford Goslee
- 1959-William H. Price
- 1960-None Given
- 1961-Sarah Vance Dugan
- 1962-None Given
- 1963-C. K. Johns and Harold Macy
- 1964-C. B. and A. L. Shogren
- 1965-Fred Basselt and Ivan Parkin
- 1966-M. R. Fisher
- 1967-C. A. Abele and L. A. Black
- 1968-M. P. Baker and W. C. Frazier
- 1969-John Faulkner
- 1970-Harold J. Barnum
- 1971-William V. Hickey
- 1972-C. W. Dromgold and E. Wallenfeldt
- 1973-Fred E. Uetz
- 1974-H. L. Thomasson and K. G. Weckel
- 1975-A. E. Parker
- 1976-A. Bender Luce
- 1977-Harold Heiskell
- 1978-Karl K. Jones
- 1979-Joseph C. Olson, Jr.
- 1980-Alvin E. Tesdal and Laurence G. Harmon
- 1981-Robert M. Parker
- 1982-None Given
- 1983-Orlowe Osten
- 1984-Paul Elliker
- 1985-Patrick J. Dolan, Franklin W. Barber,  
and Clarence K. Luchterhand
- 1986-John G. Collier
- 1987-Elmer Marth and James Jezeski

- 1988-Kenneth Whaley and Paul J. Pace
- 1989-Earl Wright and Vernon Cupps
- 1990-Joseph E. Edmondson
- 1991-Leon Townsend and Dick B. Whitehead
- 1992-A. Richard Brazis and Harry Haverland
- 1993-None Given
- 1994-Ken Kirby
- 1995-Lloyd B. Bullerman and Robert T. Marshall
- 1996-Richard C. Swanson
- 1997-Frank L. Bryan
- 1998-H. V. Atherton and David D. Fry
- 1999-Sidney E. Barnard, Michael H. Brodsky, Charles W. Felix,  
and James L. Smith
- 2000-William L. Arledge and Robert L. Sanders
- 2001-John G. Cerveny, Robert Tiffin, and Edmund A. Zottola
- 2002-Warren S. Clark, Jr.

## HARRY HAVERLAND CITATION AWARD

*Sponsored by Silliker, Inc.  
Homewood, Illinois*

- 1951-J. H. Shrader and William B. Palmer
- 1952-C. A. Abele
- 1953-Clarence Weber
- 1954-C. K. Johns
- 1955-R. G. Ross
- 1956-K. G. Weckel
- 1957-Fred C. Baselt
- 1958-Milton R. Fisher
- 1959-John D. Faulkner
- 1960-Luther A. Black
- 1961-Harold S. Adams
- 1962-Franklin W. Barber
- 1963-Merle P. Baker
- 1964-W. K. Moseley
- 1965-H. L. Thomasson
- 1966-J. C. Olson, Jr.
- 1967-William V. Hickey
- 1968-A. Kelley Saunders
- 1969-Karl K. Jones
- 1970-Ivan E. Parkin
- 1971-L. Wayne Brown
- 1972-Ben Luce
- 1973-Samuel O. Noles
- 1974-John C. Schilling
- 1975-A. Richard Brazis
- 1976-James Meany
- 1977-None Given
- 1978-Raymond A. Belknap
- 1979-Harold E. Thompson, Jr.
- 1980-Don Raffel
- 1981-Henry V. Atherton
- 1982-None Given
- 1983-William B. Hasting
- 1984-Elmer H. Marth
- 1985-Ralston B. Read, Jr.
- 1986-Cecil E. White
- 1987-None Given
- 1988-Carl Vanderzant
- 1989-Clem Honer
- 1990-None Given



1991-Frank Bryan  
1992-Ewen C. D. Todd  
1993-Robert C. Tiffin  
1994-Sidney E. Barnard  
1995-Charles W. Felix  
1996-Joseph J. Disch  
1997-Earl O. Wright  
1998-Anna M. Lammerding  
1999-John C. Bruhn  
2000-Ann Draughon  
2001-Robert B. Gravani  
2002-John G. Cerveny

#### EDUCATOR-INDUSTRY AWARD

1973-Walter A. Krienke  
1974-Richard P. March  
1975-K. G. Weckel  
1976-Burdet H. Heinemann  
1977-Elmer H. Marth  
1978-James B. Smathers  
1979-Joseph Edmondson  
1980-James R. Welch  
1981-Francis F. Busta

In 1982, this award was split into the Educator Award and the Harold Barnum Industry Award.

#### HAROLD BARNUM INDUSTRY AWARD

*Sponsored by Nasco International,  
Fort Atkinson, Wisconsin*

1982-Howard Ferreira  
1983-C. Dee Clingman  
1984-Omer Majerus  
1985-William L. Arledge  
1986-Hugh C. Munns  
1987-J. H. Silliker  
1988-Kenneth Kirby  
1989-Lowell Allen  
1990-Roy Ginn  
1991-Thomas C. Everson  
1992-Ronald Case  
1993-David D. Fry  
1994-R. Bruce Tompkin  
1995-Damien A. Gabis  
1996-Dane T. Bernard  
1997-John G. Cerveny  
1998-None Given  
1999-Russell S. Flowers  
2000-Kenneth Anderson  
2001-William H. Sperber  
2002-None Given

#### EDUCATOR AWARD

*Sponsored by Nelson-Jameson, Inc.  
Marshfield, Wisconsin*

1982-Floyd Bodyfelt  
1983-John Bruhn  
1984-R. Burt Maxcy  
1985-Lloyd B. Bullerman  
1986-Robert T. Marshall  
1987-David K. Bandler  
1988-Edmund A. Zottola  
1989-Vernal Packard  
1990-Michael Stiles  
1991-William E. Sandine  
1992-William S. LaGrange

1993-Irving J. Pflug  
1994-Kenneth R. Swartzel  
1995-Robert B. Gravani  
1996-Cameron R. Hackney  
1997-Purnendu C. Vasavada  
1998-Ronald H. Schmidt  
1999-Eric A. Johnson  
2000-Susan S. Sumner  
2001-Larry R. Beuchat  
2002-Douglas L. Marshall

#### SANITARIAN AWARD

*Sponsored by Ecolab Inc., Food and Beverage Division,  
St. Paul, Minnesota*

1952-Paul Corash  
1953-E. F. Meyers  
1954-Kelley G. Vester  
1955-B. G. Tennent  
1956-John H. Fritz  
1957-Harold J. Barnum  
1958-Karl A. Mohr  
1959-William Kempa  
1960-James C. Barringer  
1961-Martin C. Donovan  
1962-Larry Gordon  
1963-R. L. Cooper  
1964-None Given  
1965-Harold R. Irvin  
1966-Paris B. Boles  
1967-Roger L. Stephens  
1968-Roy T. Olson  
1969-W. R. McLean  
1970-None Given  
1971-Shelby Johnson  
1972-Ambrose P. Bell  
1973-None Given  
1974-Clarence K. Luchterhand  
1975-Samuel C. Rich  
1976-M. W. Jefferson  
1977-Harold Bengsch  
1978-Orlowe Osten  
1979-Bailus Walker, Jr.  
1980-John A. Baghott  
1981-Paul Pace  
1982-Edwin L. Ruppert  
1983-None Given  
1984-Harold Wainess  
1985-Harry Haverland  
1986-Jay Boosinger  
1987-Erwin P. Gadd  
1988-Kirmon Smith  
1989-Robert Gales  
1990-Leon Townsend  
1991-James I. Kennedy  
1992-Dick B. Whitehead  
1993-Lawrence Roth  
1994-Charles Price  
1995-Everett E. Johnson  
1996-Leon H. Jensen  
1997-Randall A. Daggs  
1998-Terry B. Musson  
1999-Gloria I. Swick  
2000-Norris A. Robertson, Jr.  
2001-O. D. "Pete" Cook  
2002-Dan Erickson

## MAURICE WEBER LABORATORIAN AWARD

*Sponsored by Weber Scientific,  
Hamilton, New Jersey*

2001-Elizabeth M. Johnson

2002-Mansel W. Griffiths

## INTERNATIONAL LEADERSHIP AWARD

*Sponsored by Kraft Foods North America  
Glenview, Illinois*

2002-Thomas A. McMeekin

## DEVELOPING SCIENTISTS AWARDS

*Sponsored by the Foundation Fund,  
Des Moines, Iowa*

1986-	1st	Christine Bruhn
	2nd	Elliott T. Ryser
	3rd	Eileen M. Rosenow
	4th	Lisa M. Flores
	5th	Kamal M. Kamaly
1987-	1st	R. K. Lindenthal
	2nd	Elliott T. Ryser
	3rd	Kathleen M. Knutson
	4th	A. A. Airoidi
	5th	Michelle M. Schaack
1988-	1st	A. A. Airoidi
	2nd	Stephen Ingham
	3rd	Douglas Marshall
	4th	B. J. Overdahl
	5th	P. K. Cassidy
1989-	1st	Nancy Nannen
	2nd	Diane West
	3rd	David Baker
	4th	Karl Eckner
	5th	Hassan Gourama
1990-	1st	Bob Roberts
	2nd	Anna Lammerding
	3rd	Hassan Gourama
	4th	Anna Lambert
	5th	Mona Wahby
1991-	1st	Andrea O. Baloga
	2nd	Elaine D. Berry
	3rd	J. Eric Line
	4th	Donna Williamson
	5th	Keith R. Schneider
1992-	1st	Gary J. Leyer
	2nd	Janice M. Baker
	3rd	Kyle Sashara
	4th	Lynn McIntyre
	5th	Kwang Yup Kim
1993-	1st	Randall K. Phebus
	2nd	J. Eric Line
	3rd	David H. Toop
	4th	Lee-Ann Jaykus
	5th	Tom Yezzi
1994-	Oral	1st J. David Monk
		2nd Charles Powell
		3rd Nandini Natraja
	Poster	1st Ratih Dewanti
		2nd Jitu R. Patel
		3rd Chen-Jang Liu

1995-Oral	1st	Maria Nazarowec-White
	2nd	Peter Bodnaruk
	3rd	Tina S. Schwach
	Poster	1st James D. Schuman
		2nd Willie Taylor
		3rd Wei Tan
1996-Oral	1st	Abbey Nutsch
	2nd	M. Rocelle S. Clavero
	3rd	Robert Williams
	Poster	1st Rod Worobo
		2nd John Czajka
		3rd Sherri Kochevar
1997-Oral	1st	Doris D'Souza
	2nd	Paris Leggitt
	3rd	Kunho Seo
	Poster	1st Lisa Lucore
		2nd Soraya Rosenfield
		3rd Jeffrey Semanchek
1998-Oral	1st	Peter J. Taormina
	2nd	Brian Shofran
	3rd	Amanda E. Whitfield
	Poster	1st Aysegul Eyigor
		2nd Ronald D. Smiley
		3rd Jianming Ye
1999-Oral	1st	Susan Abraham
	2nd	Peter J. Taormina
	3rd	Robert L. Sudler, Jr.
	Poster	1st Ziad W. Jaradat
		2nd Kazue Takeuchi
		3rd Yongsoo Jung
2000-Oral	1st	Peter Taormina
	2nd	Nathanon Trachoo
	3rd	Madonna Cate
	Poster	1st William Weissinger
		2nd Marlene Janes
		3rd Robert Williams
2001-Oral	1st	Marsha Harris
	2nd	Shin-Hee Kim
	3rd	Robert Williams
	Poster	1st Jarret Stopforth
		2nd Yong Soo Jung
		3rd Revis Chmielewski
2002-Oral	1st	Tam Mai
	2nd	Maha Hajmeer
	3rd	Leslie Thompson
	Poster	1st Kimberly Lamar
		2nd Kidon Sung
		3rd Julie Jean

## NFPA FOOD SAFETY AWARD

*Sponsored by The National Food Processors  
Association, Washington, District of Columbia*

1998	Food Research Institute at the University of Wisconsin-Madison, Madison, Wisconsin
1999	Michael P. Doyle
2000	Elmer H. Marth
2001	R. Bruce Tompkin
2002	Nelson Cox

## SAMUEL J. CRUMBINE AWARD

*Sponsored by the Conference for Food Protection in cooperation with American Academy of Sanitarians; Association of Food and Drug Officials; Foodservice & Packaging Institute, Inc.; International Association for Food Protection; International Food Safety Council; National Association of County and City Health Officials; National Environmental Health Association; NSF International; and Underwriters Laboratories, Inc.*

- 1955 Cowlitz-Wahkiakum County Department of Public Health, Washington  
New York City Department of Public Health, New York City, New York
- 1956 Tulsa City-County Department of Public Health, Tulsa, Oklahoma  
Macon-Bibb-Jones County Department of Public Health, Georgia
- 1957 San Jose Department of Public Health, San Jose, California  
San Diego County Department of Public Health, San Diego, California
- 1958 Spokane County Department of Public Health, Spokane, Washington  
Los Angeles County Department of Public Health, Los Angeles, California
- 1959 San Diego County Department of Public Health, San Diego, California  
Salt Lake City Department of Public Health, Salt Lake City, Utah
- 1960 Marion County Department of Public Health, Salem, Illinois  
San Bernardino County Department of Public Health, San Bernardino, California
- 1961 Albuquerque Environmental Health Department, Albuquerque, New Mexico  
Philadelphia County Department of Public Health, Philadelphia, Pennsylvania
- 1962 Rocky Mount Department of Public Health, Rocky Mount, North Carolina  
Seattle-King County Department of Public Health, Seattle, Washington
- 1963 Hamilton County Department of Public Health, Cincinnati, Ohio  
Lake County County Department of Public Health, Waukegan, Illinois
- 1964 Orange County Department of Public Health, Santa Ana, California
- 1965 Spokane County Department of Public Health, Spokane, Washington  
Albuquerque Environmental Health Department, Albuquerque, New Mexico
- 1966 Imperial County Department of Public Health, El Centro, California  
Jefferson County Department of Public Health, Birmingham, Alabama
- 1967 Salt Lake City Department of Public Health, Salt Lake City, Utah
- 1974 Lexington-Fayette County Department of Public Health, Lexington, Kentucky
- 1975 None given
- 1976 Region VI Department of Public Health, Roswell, New Mexico
- 1977 Los Angeles County Department of Public Health, Los Angeles, California
- 1978 Arlington County Department of Public Health, Arlington, Virginia
- 1979 Suffolk County Department of Public Health, Riverhead, Virginia
- 1980 Allegheny County Department of Public Health, Pittsburgh, Pennsylvania
- 1981 Nassau County Department of Public Health, Mineola, New York
- 1982 Winnebago County Department of Public Health, Rockford, Illinois
- 1983 Pima County Department of Public Health, Tucson, Arizona
- 1984 Southeastern District Department of Public Health, Idaho
- 1985 Montgomery County Department of Public Health, Dayton, Ohio
- 1986 Tri-County Department of Public Health, Colorado
- 1987 Snohomish Health District, Everett, Washington
- 1988 San Bernardino County Department of Public Health, San Bernardino, California
- 1989 Albuquerque Environmental Health Department, Albuquerque, New Mexico
- 1990 San Joaquin County Environmental Health Division, Stockton, California
- 1991 Tacoma-Pierce County Health Department, Tacoma, Washington
- 1992 Boulder County Health Department, Boulder, Colorado
- 1993 Allegheny County Pennsylvania Health Department, Pittsburgh, Pennsylvania
- 1994 Du Page County Health Department, Wheaton, Illinois
- 1995 None given
- 1996 Snohomish Health District, Everett, Washington
- 1997 Madison Department of Public Health, Madison, Wisconsin
- 1998 Clark County Health District, Las Vegas, Nevada
- 1999 Lake County Health Department, Waukegan, Illinois
- 2000 Olmsted County Public Health Services, Rochester, Minnesota
- 2001 Maricopa County Environmental Health, Phoenix, Arizona
- 2002 None given

## C. B. SHOGREN MEMORIAL AWARD

- 1972-Iowa Affiliate  
1973-Kentucky Affiliate  
1974-Washington Affiliate  
1975-Illinois Affiliate  
1976-Wisconsin Affiliate  
1977-Minnesota Affiliate  
1978-None Given  
1979-New York Affiliate  
1980-Pennsylvania Affiliate  
1981-Missouri Affiliate  
1982-South Dakota Affiliate  
1983-Washington Affiliate  
1984-None Given  
1985-Pennsylvania Affiliate  
1986-None Given  
1987-New York Affiliate  
1988-Wisconsin Affiliate  
1989-Georgia Affiliate  
1990-Texas Affiliate  
1991-Georgia Affiliate  
1992-Georgia Affiliate  
1993-New York Affiliate  
1994-Illinois Affiliate  
1995-Wisconsin Affiliate  
1996-Wisconsin Affiliate  
1997-Florida Affiliate  
1998-Ontario Affiliate  
1999-Wisconsin Affiliate  
2000-Michigan Affiliate  
2001-Florida Affiliate  
2002-Florida Affiliate



# NEW MEMBERS

## CANADA

**Sylvain Desaulniers**  
Universite Laval  
Quebec, Quebec

**Stevie Joy**  
Kraft Canada  
Etobicoke, Ontario

**Ray B. McDonald**  
Grantham Foods Ltd.  
Burnaby, British Columbia

## CZECH REPUBLIC

**Pavel Krcmar**  
Veterinary Research Institute  
Brno

**Eva Rencova**  
Veterinary Research Institute  
Brno

## ISRAEL

**Aliza Levy**  
Strauss Fresh Food Group  
Misgav

**Shlomo Sela**  
Inst. of Tech & Storage of Fresh  
Produce, Beth-Dagan

## SLOVENIA

**Franz Spindler**  
Scala D.O.O.  
Maribor

## UNITED STATES

### ARKANSAS

**Conny Byler**  
USDA-FSIS-FO  
Springdale

### CALIFORNIA

**Mario G. Bolanos**  
Athens Baking Co.  
Oakhurst

**Howard O. Popoola**  
Nestle Ice Cream Co.  
Bakersfield

**George Roughan**  
TAP Series  
Thousand Oaks

**Michael F. Smith**  
Air Liquide America LP  
Danville

### COLORADO

**J. Philip Coombs**  
Matrix Microscience Inc.  
Golden

### CONNECTICUT

**Richard Abate**  
Stop & Shop  
Cheshire

**David J. Pantalone**  
Castle Beverages Inc.  
Ansonia

**Karen Rotella**  
State of Connecticut  
Middlebury

### DISTRICT OF COLUMBIA

**Carl M. Schroeder**  
US Dept. of Agriculture  
Washington

### FLORIDA

**Ray Mobley**  
Florida A&M University  
Tallahassee

**Leila M. Richards**  
Florida's Natural Growers  
Lake Wales

### GEORGIA

**Pat Faison**  
The Kellen Co.  
Atlanta

### ILLINOIS

**Sandra Atwood**  
IL Dept. of Public Health  
Marion

**Susan DiGrino**  
McDonough Co. Health Dept.  
Macomb

### INDIANA

**Layne Montgomery**  
Serim Research  
Elkhart

### IOWA

**Maria G. Romero**  
Iowa State University  
Ames

### KANSAS

**Alicsa L. Bickford**  
Kansas State University  
Manhattan

**Colleen M. Trater**  
Kansas State University  
Manhattan

### LOUISIANA

**Theresa E. Chatelain**  
Louisiana State University  
Baton Rouge

**Julie T. Nguyen**  
Louisiana State University  
Baton Rouge

### MARYLAND

**Declan A. Conroy**  
Pike & Fisher Inc.  
Silver Springs



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# NEW MEMBERS

## MICHIGAN

**Venu Gangur**  
Michigan State University  
East Lansing

## MINNESOTA

**Guillermo Etienne**  
Industrial Consultant  
Eagan

**Steven R. Pretzel**  
General Mills  
St. Paul

## MISSOURI

**Patricia Rule**  
bioMérieux, Inc.  
Hazelwood

## NEW YORK

**Sanders A. Grant**  
Worcester Creameries Corp.  
Roxbury

**JoAnn M. Paciello**  
Gold Medal Packing Inc.  
Oriskany

## NORTH CAROLINA

**James D. Oliver**  
University of North Carolina  
Charlotte

**Jon W. Owen**  
USDA-FSIS, Luverne

## PENNSYLVANIA

**Saumya Bhaduri**  
USDA-ARS-ERRC  
Wyndmoor

## Brett Brumbaugh

Dairy Farmers of America  
Brockway

## WASHINGTON

**John S. Meschke**  
University of Washington-SPHCM  
Seattle

## WISCONSIN

**Judy Perry**  
AgriLink Foods  
Green Bay

## WYOMING

**Roy Kroeger**  
Cheyenne/Laramie Co. Env. Health  
Cheyenne

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# NEW SUSTAINING MEMBER

**Wendy Lauer**  
Bio-Rad Laboratories  
Hercules, California

# UPDATES

## **ILSI North America Technical Committee on Food Microbiology Appoints New Chair and Vice Chair**

ILSI North America announced the appointment of Dr. Les Smoot, from Nestlé USA, Inc. as the new chair of the ILSI North America Technical Committee on Food Microbiology. Dr. Laurie Post from Masterfoods USA has been appointed as the vice chair of the committee.

Dr. Smoot and Dr. Post will serve a two-year term that began in November 2002.

## **Chr. Hansen Appoints New Account Manager and Technical Director for Sweeteners**

Paul J. Montgomery joins Chr. Hansen, Inc., as key account/broker manager for the company's sweetener business unit. Mr. Montgomery is a graduate of the business school at Seton Hall University in New Jersey, and has over 25 years of experience within the sweetener industry. His experience includes being a member and having a seat on the NY Coffee, Cocoa, and Sugar Exchange, and being a partner in one of the top sweetener brokerage companies. Most recently, Mr. Montgomery was with Imperial/Savannah Foods, where he was the director of operations for the Wholesome Foods Sweetener Division. Mr. Montgomery will manage sweetener sales for Chr. Hansen on the East Coast via direct and broker participation.

Kevin Ramsey has been promoted to the position of director of technical services for Chr. Hansen's Sweetener business unit. He has been with the Sweetener group for over 10 years.

## **AWT Elects New Board of Directors**

The Association of Water Technologies elected a new Board of Directors during its 2002 Water Technologies Convention in September 2002.

William E. Pearson, II of Southeastern Laboratories, Inc. took office as president of AWT for the coming year.

Charles Hamrick, Jr. was elected as a member of the Board of Directors of AWT. He will serve a three-year term.

The other members of the 2003 Board of Directors are as follows: Bruce T. Ketrick, president-elect; William Martin, treasurer; Steve McCarthy, secretary; Anthony J. McNamara, immediate past president; Allan J. Bly, Jay Farmerie; Fred Potthoff and Robert Zuhl, ex-officio supplier representatives.

## **Silliker Names Fleener as Illinois Laboratory Director**

Randall L. Fleener was named laboratory director of Silliker, Inc.'s Chicago Heights, IL, testing facility. He is responsible for scientific operations, quality systems, and staff to provide accurate, timely services to processors, distributors, and retailers in the greater Midwest.

Fleener joined the Chicago Heights facility in 1987 and served in several supervisory positions during his Silliker career, including chemistry operations manager, prior to his recent appointment.

A graduate of Manchester College with a bachelor's degree in biology chemistry, Fleener is currently pursuing a master's in food science from the University of Illinois at Champaign. He possesses an extensive background in analytical chemistry, laboratory automation, and QA/QC programs.

## **Treleven Chairs International Pest Management Company**

Local business leader and president of Sprague Pest Solutions, Alfred H. Treleven III has been elected as chairman of the board for Copesan Services.

Treleven's responsibilities will include leadership, strategic guidance, and the support of Copesan's core values. He will also ensure the efforts of the organization continue to focus on delivering a superior level of service to the company's clients.

## **Manning Named Director of Consulting**

Strasburger and Siegel, Inc. promoted Toni Manning to director of consulting. She will be responsible for the operation of the Consulting Department and the management of the marketing activities of the company. Ms. Manning joined Strasburger & Siegel, an independent food analytical laboratory, in 2000, as a senior consultant. She has over 25 years of experience in the food industry in both technical and manufacturing environments. Ms. Manning is both a certified food safety professional and an instructor for the National Restaurant Association's ServSafe food safety training program.

## 2003 Crumline Award Criteria Released

The Foodservice & Packaging Institute, Inc. (FPI) has released the criteria for the 2003 Samuel J. Crumline Award for Excellence in Food Protection at the Local Level, which annually recognizes excellence in food protection services at these agencies in the US and Canada.

Entries for the Crumline Award competition are limited to US and Canadian local government public health agencies (county, district, city, town, or township) that provide food protection services to their communities under authority of a statute or ordinance. Past winners may apply five years after receiving the award.

The winner of the Award is selected by an independent panel of food protection practitioners composed of representatives from leading public health and environmental health associations, past Crumline Award winners, a consumer advocate, and a food industry representative. The jury makes its award selection each spring in a judging process administered by FPI. The application deadline for the award is March 14, 2003.

Named for one of America's most renowned health officers and health educators — Samuel J. Crumline, M.D. (1862-1954) — the Award has elevated the importance of food protection programs within local public health agencies and has inspired excellence in the planning and delivery of those services. The Crumline Award was first offered

in 1955 and has been presented virtually every year since then.

The Crumline Award is supported by the Conference for Food Protection in cooperation with the American Academy of Sanitarians, American Public Health Association, Association of Food & Drug Officials, Foodservice & Packaging Institute, Inc., International Association for Food Protection, International Food Safety Council, National Association of County and City Health Officials, National Environmental Health Association, NSF International, and Underwriters Laboratories, Inc.

For more information about the Crumline Award, including the 2003 award criteria, go to FPI's Web site at [www.fpi.org](http://www.fpi.org) (in the "Award Programs" section); or contact Lynn Rosseth at FPI (703) 538-2800, or by E-mail at [lrosseth@fpi.org](mailto:lrosseth@fpi.org).

## One in Three Caterers Don't Wash Hands after Using Lavatory, (UK) Survey Shows

The Food Standards Agency has published the largest ever nationwide survey of the food hygiene knowledge of catering industry workers. The survey of 1,000 workers and managers in small independent catering businesses revealed that more than a third of staff (39%) are neglecting to wash their hands after visiting the lavatory while at work. The research also demonstrated that half of all those interviewed (53%) did not appear to wash their hands before preparing food.

Just over half (55%) of the businesses in the survey had been

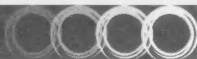
in operation for under two years and two thirds (70%) employed up to four full time employees. Less than two thirds (59%) of the catering workers questioned had a certificate in basic food hygiene and only 3% of catering managers interviewed said retaining skilled, trained staff was important to their business. Only 32% believed good food hygiene practices were important to their business compared with 64% who saw good food as the key to keeping their customers. In the second phase of its five-year Food Hygiene Campaign, the Food Standards Agency is focusing attention on small-to medium-sized independent catering businesses.

In a drive to push up food hygiene standards in restaurants, cafes, take aways, roadside snack bars, pubs, B&Bs and hotel kitchens, more than 300,000 catering businesses around the UK will receive food safety information and a free practical training video.

Encouragingly, the survey discovered that good food hygiene came top of the list of priorities for catering managers, with just under half (42%) listing it as a key factor in the success of their business. There was a general understanding among all workers that they should wash their hands (64%).

Good food hygiene practices and clean surroundings were also named as important by staff, but only 5% of catering workers and managers made the link between washing hands and personal hygiene, recognizing it as something specific to take care of in the workplace.

Sir John Krebs, chair of the Food Standards Agency said, "This survey shows clearly that there are catering businesses that have high standards of hygiene and food.



Unfortunately, it also shows there are too many that don't know you cannot serve good, safe food, unless you also have high standards of food hygiene. Consumers expect value for money when eating out. They don't deserve to be on the receiving end of someone who cannot be bothered to wash their hands after they visit the lavatory, or before they prepare food. Many food poisoning incidents can be prevented through people simply washing their hands properly and at the right time."

"We welcome support from the catering sector for this campaign. Businesses within the catering industry can work together to raise standards across the board to those of the very best in the business. Regular food hygiene training in businesses is key, as is valuing skilled trained staff who understand these issues and the positive effect good food hygiene can have on their business. The practical support offered by the Agency provides catering businesses with a simple way to clean up their act and earn consumer confidence," Krebs said.

Information specifically for catering businesses is available on the dedicated campaign microsite at [www.food.gov.uk/cleanup](http://www.food.gov.uk/cleanup).

## USDA Approves Irradiation of Imported Fruits and Vegetables

The US Department of Agriculture (USDA) has finished writing rules that open the door to the irradiation of fruits and vegetables imported into the United States.

Under the rules, published Oct. 23 in the Federal Register, irradiation can be used to keep various fruit fly species and the mango seed weevil out of imported produce, the USDA's Animal and Plant Health Inspection Service (APHIS) an-

nounced. Other methods are currently used to control those pests in imported produce. "This is not food safety irradiation, it's for plant pests," said APHIS spokesman Ed Curlett.

Irradiation can now be used in place of other permitted treatments, include cold, heat, and methyl bromide, according to the USDA. "This isn't opening a new market as far as different fruits and vegetables, it's just a different treatment for fruits and vegetables that are already allowed," Curlett said.

The Food and Drug Administration in 1986 permitted irradiation of US-grown fruits and vegetables to kill insects and improve shelf life, but the process has been little used. For the past 2 years, however, irradiated papayas and other fruits from Hawaii have been sold on the US mainland. San Diego-based SureBeam Corp. uses electron-beam equipment to irradiate fruit at a facility near Hilo, Hawaii according to Mark Stephenson, the company's vice president for public relations. "An increasing number of retail chains on the West Coast are offering our products, and they're actually clearing off the shelves pretty rapidly," he said.

In a news release, Larry A. Oberkfell, SureBeam chairman and president, welcomed the USDA announcement: "This new USDA rule will allow us to expand our patented SureBeam technology into the major agricultural markets around the world, while providing American agriculture the most optimum bio-security solution available."

How long it will take for irradiated produce from foreign countries to reach US store shelves is unclear. Curlett said the new regulations provide that produce can be irradiated either in US ports or in the country of origin, but in either case the treatment will be used only under USDA monitoring.

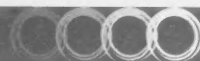
Stephenson said SureBeam is building an irradiation facility in Brazil, but it won't be completed until sometime next year.

The company is also considering building plants in several other countries. Stephenson said he is not aware of any irradiation facilities outside the United States that currently treat produce. Publication of the USDA rule on irradiation of imported produce caps a process that dates back at least 6 years. In May 1996 the agency published a notice that it would begin studying what radiation doses are necessary to kill pests in specific produce items. In May 2000, the USDA published proposed standards for "phytosanitary" irradiation of imported produce and invited comments. More than 2,200 comments were subsequently received according to the Oct. 23 Federal Register notice.

Many of those commenting said irradiation would make produce unsafe or reduce its nutritional value, according to the notice. In response, APHIS said those issues are the FDA's responsibility and beyond the scope of the regulations, but noted that food irradiation has been endorsed by numerous authorities, including the World Health Organization.

Many people commented that other treatments, such as methyl bromide, cold, pressure, and laser ultraviolet light pulses, should be used instead of irradiation. In its notice, APHIS replied that importers are free to use other authorized treatments, and added, "The reason that irradiation may be attractive to certain importers, particularly those importing tropical fruits from fruit fly-infested regions, is that irradiation allows fruits of higher quality to be imported. Treatments like heat, cold, and fumigation often cause unacceptable damage to produce and often must be used





before produce is ripe," the notice added.

Much of the Federal Register notice deals with where irradiation facilities for imported produce can be located within the United States. The USDA decided that these facilities can generally be located only in northern states, where the climate would prevent the targeted fruit flies from establishing themselves. The exceptions to this rule are three southern ports that already have cold-treatment facilities to control imported pests: Wilmington, NC; Gulfport, MS; and the Atlanta airport. The notice also lists approved radiation doses for 11 fruit fly species and the mango seed weevil.

## Hand Hygiene Guidelines Fact Sheet

Improved adherence to hand hygiene (i.e. hand washing or use of alcohol-based hand rubs) has been shown to terminate outbreaks in health care facilities, to reduce transmission of antimicrobial resistant organisms (e.g. methicillin resistant *Staphylococcus aureus*) and reduce overall infection rates.

CDC is releasing guidelines to improve adherence to hand hygiene in health care settings. In addition to traditional handwashing with soap and water, CDC is recommending the use of alcohol-based handrubs by health care personnel for patient care because they address some of the obstacles that health care professionals face when taking care of patients.

Handwashing with soap and water remains a sensible strategy for hand hygiene in non-health care settings and is recommended by CDC and other experts. When health care personnel's hands are visibly soiled, they should wash with soap and water.

The use of gloves does not eliminate the need for hand hygiene.

Likewise, the use of gloves does not eliminate the need for gloves. Gloves reduce hand contamination by 70 percent to 80 percent, prevent cross-contamination and protect patients and health care personnel from infection. Handrubs should be used before and after each patient just as gloves should be changed before and after each patient.

When using an alcohol-based handrub, apply product to palm of one hand and rub hands together, covering all surfaces of hands and fingers, until hands are dry. Note that the volume needed to reduce the number of bacteria on hands varies by product.

Alcohol-based handrubs significantly reduce the number of microorganisms on skin, are fast acting and cause less skin irritation. Health care personnel should avoid wearing artificial nails and keep natural nails less than one quarter of an inch long if they care for patients at high risk of acquiring infections (e.g., patients in intensive care units or in transplant units).

When evaluating hand hygiene products for potential use in health care facilities, administrators or product selection committees should consider the relative efficacy of antiseptic agents against various pathogens and the acceptability of hand hygiene products by personnel. Characteristics of a product that can affect acceptance and therefore usage include its smell, consistency, color and the effect of dryness on hands.

As part of these recommendations, CDC is asking health care facilities to develop and implement a system for measuring improvements in adherence to these hand hygiene recommendations. Some of the suggested performance indicators include: periodic monitoring of hand hygiene adherence and providing feedback to personnel regarding their performance, monitoring the volume of alcohol-based handrub

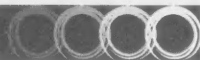
used/1000 patient days, monitoring adherence to policies dealing with wearing artificial nails and focused assessment of the adequacy of health care personnel hand hygiene when outbreaks of infection occur.

Allergic contact dermatitis due to alcohol hand rubs is very uncommon. However, with increasing use of such products by health care personnel, it is likely that true allergic reactions to such products will occasionally be encountered. Alcohol-based hand rubs take less time to use than traditional hand washing. In an eight-hour shift, an estimated one hour of an ICU nurse's time will be saved by using an alcohol-based handrub. These guidelines should not be construed to legalize product claims that are not allowed by an FDA product approval by FDA's Over-the-Counter Drug Review. The recommendations are not intended to apply to consumer use of the products discussed.

## Making Manureborne Pathogens Stay Put

By filtering out pathogens in manure, grass buffer strips may be a useful tool to prevent these organisms from washing into surface water from farmland runoff, Agricultural Research Service scientists report. Microbiologist Daniel R. Shelton and his colleagues at the ARS Animal Waste Pathogen Laboratory in Beltsville, MD, are conducting a study in collaboration with University of Maryland scientist Adel Shirmohammadi to determine how effectively grass buffer strips filter out pathogens.

Shelton's group constructed oddly slanted hills to simulate different topographies bordering farm areas. The scientists planted grass strips on two 20-foot-long, slanted slopes of a wedge-shaped,



above ground mound. One slope had a clay loam soil, while another was covered with sandy loam.

Various indigenous grasses were planted on each soil type to test the filtering effect. Bare slopes devoid of vegetation were used as controls. The researchers applied fresh dairy-barn manure along the top of the slopes, then used overhead sprinklers to simulate rainfall. Collection tubes were placed at various points on the slopes to funnel samples of runoff water to be analyzed for bacteria content.

Runoff from the bare clay loam slope contained virtually all of the pathogens present in the manure. Sandy loam soil fared better: 75 percent of the pathogens remained in the sandy loam slopes. Sand enables water and microbes to move into the soil more quickly, rather than run off the surface.

By contrast, vegetated slopes held on to practically all of the pathogens, leaving none in the runoff water from the sandy loam soil, and only 0.6 percent in the runoff water from the clay loam soil. Pathogens that remain in the soil either become food for other soil organisms, or they settle into an area between soil layers that doesn't support life.

A more detailed story appears in the October 2002 issue of *Agricultural Research Magazine*, available on the World Wide Web at: <http://www.ars.usda.gov/is/AR/archive/oct02/manure1002.htm>.

### Consultations to Begin on Proposed Amendments to Food Irradiation Regulations

Health Canada announced that public consultations will begin on proposed regulatory changes which would expand the list of irradiated foods

allowed to be sold in Canada. The proposed amendments would be made to the existing provisions in the Table to Division 26 in the Canadian Food and Drug Regulations. Currently wheat, flour, whole wheat flour, potatoes, onions, whole and ground spices and dehydrated seasoning preparations are the only foods permitted to be irradiated and sold in Canada. The proposed additions to the table are: fresh and frozen ground beef, fresh and frozen poultry, prepackaged fresh, frozen, prepared and dried shrimp and prawns, and mangoes. The proposed amendments would allow these new foods to be irradiated and sold, but would not make it a mandatory process. Food irradiation is just one method of preserving food by using a type of radiation energy. The regulations require that irradiated foods, whether produced here or imported, be labelled as irradiated and bear the internationally-used "radura" symbol when offered for sale.

After objective and factual review of industry submissions by Health Canada scientists as well as safety review, the department is recommending proposed amendments to the Food and Drug Regulations to extend uses of food irradiation to ground beef, poultry, shrimp and prawns, and mangoes. These reviews, as well as other scientific sources, have concluded that:

- the consumption of these irradiated foods would not result in any risk to the health of the consumer;
- the irradiation of these foods would not result in destruction or loss of nutrients where that food is a significant source of those nutrients in the diet; and the proposed uses of food irradiation could be beneficial through improved safety and quality of these food products resulting from

enhanced control of pathogens, such as *E. coli* and *Salmonella*, reduction in insect infestation and extension of durable life.

Prepublication of the proposals in *The Canada Gazette*, Part I, on November 23, 2002, is providing Canadians with the opportunity to present their views on this subject over the next 90 days. Public information sessions/consultations are slated to take place in centers across the country. Locations and times will be posted. Comments may be submitted in writing via the Health Canada Food Program Web site at: [http://www.hc-sc.gc.ca/food-aliment/e\\_index.html](http://www.hc-sc.gc.ca/food-aliment/e_index.html).

### Food Safety Institute Created at Iowa State University

The new Institute for Food Safety and Security at Iowa State University is dedicated to protecting Iowa's, and the nation's, investment in agriculture.

"The formation of this institute will enhance Iowa State's leadership role in the critical area of food safety and security. Excellence in education and research associated with food production and delivery is one of our top priorities," said Gregory Geoffroy, president of Iowa State.

The Board of Regents, State of Iowa, approved the institute on Nov. 14. Faculty and researchers from the colleges of agriculture, family and consumer sciences, liberal arts and sciences, and veterinary medicine will be affiliated with the institute. "The institute will serve the needs of farmers, producers, food preparers and consumers to control serious foodborne infectious diseases, to prevent contamination of food and water by toxins and to protect plants and animals from the



threat of cataclysmic disease," said Catherine Woteki, dean of the college of agriculture and interim director of the institute. Woteki formerly served as the US Department of Agriculture under secretary for food safety.

Woteki said the institute's first task will be to find a nationally recognized scientist as director.

The institute will oversee seven units to respond to food problems and issues:

- Foodborne Infectious Disease Unit
- Food and Water — Harvest Unit
- Food and Water — Post-Harvest Unit
- Foodservice and Retail Unit
- Society, Communication and Public Policy Unit
- Foodborne Disease Models and Risk Analysis Unit

- International Food Security Unit

The institute's units will develop strategic research and training programs that address problems of human health risks and issues that arise from globalization, intensification of production agriculture, food processing, global warming/environmental changes and the threat of agro-terrorism. The director of the institute will manage it through a council composed of representatives from each unit.

Jim Dickson, director of Iowa State's component of a three-university Food Safety Consortium and chair of the microbiology department, expected the new institute would serve a coordinating function on campus and off. "The institute will help bring together the resources in food safety which are

available, including those at the federal research laboratories and at Iowa State University. It will bring a unifying structure to food safety and security research at our university," he said.

Another benefit would be providing a network for those involved with food safety, according to Don Reynolds, associate dean of the college of veterinary medicine. "This type of institute will allow us to respond quickly to emerging needs related to food safety and security. It will help to strengthen our communications with the private sector," he said. University administrators point to collaborations with USDA animal health agencies in Ames as a strength for the new institute. They say another positive is the \$40 million in support that has been secured by those who will be part of the institute.

**www.fpi-food.org**

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The education provider for National Food Processors Association

# INDUSTRY PRODUCTS



Thermo Orion Corporation

## Thermo Orion Model 925 Flash Titrator™

**T**hermo Orion introduces the new Flash Titrator, an advanced acid base titrator enabling titrations in less than 30 seconds.

Thermo Orion Model 925 Flash Titrator utilizes a new nanotechnology for very rapid Acid/Base titrations with no external titrator. This revolutionary system employs a 12 mm probe which features independent pH FET, planar conductivity and temperature sensors, plus a platinum electrode surrounded by the pH sensor that electrochemically generates the acid or base titrant from the sample itself. The generated acid or base titrant moves by diffusion over the pH FET's sensing area and the pH infection vs. the time profile is obtained. This diffusion time is proportional to the concentration of the acid or base in solution and is reported in the concentration unit selected by the user. Results correlate to traditional titration methods.

The Model 925 titrator features microprocessor design, which automates calibration and measurement

procedures for a wide variety of applications. Twelve acid and base titration templates are coded into the meter, and 30 actual sample methods that have been developed at Thermo Orion are also included to make set up of new methods simple. These methods may be edited and saved to a new method number to reduce keystrokes and get you titrating samples in a flash! Titration data can be sent to your PC for documentation.

The Flash Titrator also features direct pH and conductivity measurement for aqueous samples. The Model 925 Flash probe is an active, electronic device where the potential developed at the sensing surface is dependent on solution pH or conductivity. This surface potential induces a measuring transistor to determine the pH or other parameters of other solution. Temperature is simultaneously monitored at the precise point of measurement, minimizing temperature error.

Thermo Orion offers an automated Flash Titrator system that incorporates the Thermo Orion AS3050 Autosampler for efficient, unattended operation. Comparisons between traditional acid base titrations and the Flash titrations show very good correlation of the concentrations with great Relative Standard Deviations (RSDs) between the Flash runs.

Thermo Orion Corporation,  
Waltham, MA

READER SERVICE NO. 226

## Protein Solutions Introduces Unique Plate Reader

**P**rotein Solutions, Inc. has introduced the DynaPro® Plate Reader, the first ever dynamic light scattering plate reader to assist in high throughput biomolecular characterization efforts. With this new technology, it is now possible to conduct light scattering analysis on hundreds of samples per day. An extension of the company's DynaPro line of dynamic light scattering (DLS) instruments, the new DynaPro Plate Reader allows high-capacity, automated analysis of molecular size, distribution, and other physical properties of proteins and molecules in solution.

The DynaPro Plate Reader is the only non-perturbing, dynamic light scattering plate reader that allows researchers to conduct automated light scattering experiments using either 96- or 384 well plate formats. Proprietary software allows intuitive analysis and scoring of samples utilizing a customizable color scheme that indicates whether or not samples fall within user-defined parameter limits.

DynaPro instruments are high-sensitivity instruments utilizing patented dynamic light scattering technology for characterizing proteins, peptides, liposomes, antibodies, and other macromolecules and nanoparticles in solution. Various experimental methods such as online HPLC, small volume batch (2 microliters minimum sample volume), and auto-titration are

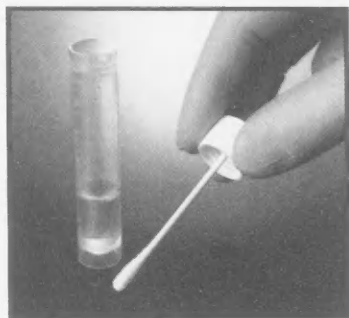
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## INDUSTRY PRODUCTS

achievable using modular optics which cover size ranges from 1nm – 2um in hydrodynamic radius.

Protein Solutions, Inc.,  
Piscataway, NJ

READER SERVICE NO. 227



Hardy Diagnostics, Inc.

### Hardy Diagnostics is Announcing the EnviroTrans™

The EnviroTrans™ is a ready-to-use 15 x 75mm polypropylene tube pre-filled with 5 mls of either Neutralizing Buffer, Lethen Broth, 0.85% Saline, DE Neutralizing Broth, or Neutralizing Saline. A dacron swab is affixed to a screw cap for easy handling. The entire unit is terminally sterilized. The EnviroTrans™ is designed to assist in the detection or enumeration of microorganisms from environmental surfaces or equipment as part of the HACCP Program. When sampling a surface, the cap is removed and the moistened swab is rubbed across the sampling area. The cap is replaced on to the tube and the swab is transported to the laboratory for analysis. Laboratory protocol would determine which solution is to be used.

Neutralizing Buffer is used for the detection of microorganisms found on surfaces disinfected with chlorine or quaternary ammonia compounds; Lethen Broth contains casein peptone and beef extract which promotes growth. Lecithin and Tween® are effective in neutralizing phenols, hexachlorophene, formalin, and ethanol. 0.85% Saline is a sterile, osmotically neutral transport solution. DE Neutralizing Broth used to neutralize antiseptics and disinfectants as well detect organisms remaining after treatment. Neutralizing Saline neutralizes the broadest spectrum of antiseptics and disinfectant chemicals while facilitating survival of the organism in the sample during transport. Recommended for enumeration.

Hardy Diagnostics, Inc., Santa  
Maria, CA

READER SERVICE NO. 228

### BD Rodac™ Racks Now Available for Safe Plate Handling

BD Diagnostic Systems announces that BD Rodac™ Racks are now available. Designed to meet customer specifications, BD Rodac™ Racks are specially engineered to hold plates tightly in place for convenient carrying in the laboratory and clean room. In addition, Rodac™ Racks provide enhanced safety because they assure that lid covers for Rodac™ plates are also held securely in place. BD Rodac™ Racks are made of welded steel rods, epoxy-coated for maximum protection and can be vapor hydrogen peroxide (VHP) disinfected for isolators. The Racks show further durability in that they can be steam autoclaved at 121 degrees Celsius. Rodac™ Racks are available in blue, orange and green

to differentiate samples. Rodac™ plates are the original dish for surface monitoring, containing BBL™ Sterile Pack Prepared Plated Media.

BD Diagnostic Systems, Sparks,  
MD

READER SERVICE NO. 229

### Viking's New Power Load Monitor Offers Pump System Protection

Viking Pump has introduced the Power Load Monitor, which can protect any motor-driven pump and pump system from either overload or underload conditions created by over-pressure, cavitation, empty tank or other problems. Suitable for both new installations and for upgrading existing units, the new Power Load Monitor helps prevent downtime and reduce maintenance costs caused by pump and system problems. It provides high levels of accuracy and reliability, as well as simple installation.

By monitoring both voltage and power, Viking's Power Load Monitor measures the normal working load, then calculates and sets an automatic shutdown point for detected power changes. The load limit margin is adjustable to prevent unintentional stoppage.

To calculate the load, the Monitor utilizes the pump's electrical motor as a sensor, measuring pump input power and calculating power loss using an advanced algorithm. This unique measurement method is more reliable than conventional monitoring methods. The Power Load Monitor can handle single- or three-phase motors up to 50 full load amps, at voltages up to 690 VAC, 50 or 60 Hz.

Viking Pump, Cedar Falls, IA

READER SERVICE NO. 230



Thermo Haake

### Thermo Haake New MiniLab Micro Rheology Compounder Provides Dual Solution for Small Sample R & D Applications

**T**hermo Material Characterization introduces its newest Thermo Haake MiniLab Micro Rheology Compounder, which combines compounding and rheological measurement of micro amounts of material into one compact system. Designed for material science research and development applications, the MiniLab is ideal for new polymer development as well as testing of expensive additives like pharmaceutical drugs.

Based on proven conical twin-screw technology and a new rheological measurement method, the MiniLab combines the advantages of both a mixer and an extruder in a batch process. Designed for small amounts of materials, the MiniLab effectively handles as little as 8 g of material. Testing and handling capabilities include: continuous viscosity measurements in the backflow channel at up to 350°C; automatic bypass operation for circulation and extrusion; inert gas flush of the feeding area and barrel; and pne-

umatic feeding. Digital and graphic data can be manually controlled from the system's large-scale backlit LCD display or from a computer using Windows software.

Available with conical co- and counter-rotating screws, the MiniLab's 400W motor provides a maximum torque of 5 Nm/screw, a speed range of up to 360 rpm, and a maximum pressure up to 200 bar.

Thermo Haake, Madison, WI

READER SERVICE NO. 231

### Ecolab Helps Customers "Kick the Bucket"

**E**colab announces the development of a unique solution for everyday facility cleaning challenges. Whether it's improving operational efficiency or product quality, or controlling sanitation costs, the development of the FaciliTraxx Caravan System provides dairy, food and beverage processors with solutions for all of their spot cleaning, sanitizing or disinfecting needs.

"We are excited to provide our customers with a product and equipment package that provides one solution for their everyday surface or drain cleaning needs at a low-cost for their company," said Jonathan Kingsbury, market manager, Food & Beverage Division. "Being able to help control overuse of product and minimize direct chemical handling will aid in overall efficiency and safety for our customers and their employees."

The new FaciliTraxx Caravan System is designed to replace the traditional method of mixing up buckets of cleaning solutions by using the flow of water to mix the product as it is dispensed.

The FaciliTraxx Caravan comes in two package options: Surface Cleaning and Drain Cleaning.

The Surface Cleaning equipment package allows processors to clean and disinfect or sanitize any surface in their facility. The cart comes with an applicator tool featuring three spray patterns and one foam nozzle. The package also includes a surface cleaning brush that allows detergent to flow through the brush, creating thick foam — for scrubbing walls, floors or other surfaces.

The Drain Solutions equipment package provides one solution for a complete drain management program. This package includes everything from the surface cleaning package plus two uniquely designed drain devices that protect against splash-back while cleaning floor and trench drains. The Caravan's patented drain hats cover the drain while you clean and disinfect to help prevent potential cross-contamination. Both attachments come with quick connect devices for fast, efficient change-over during the cleaning process.

Both systems are designed to improve operational efficiency by:

**Fast switchover** — Save time by being able to switch from cleaning to rinsing to disinfecting or sanitizing.

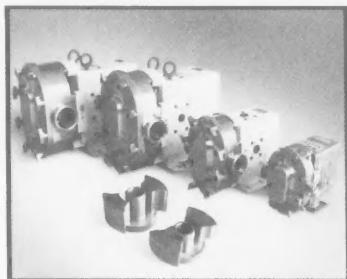
**Automated mixing** — Minimize manual handling of chemicals and improve employee safety. Chemical concentration is controlled to assure consistent, repeatable results.

**Easy to understand** — Language-free operations allows for quick, easy training.

**Handy storage** — Space for other drain-related solutions helps streamline drain management.

Ecolab, Inc., St. Paul, MN

READER SERVICE NO. 232



Wright Pump

### Wright Pump® Offers New Line of Positive Displacement Circumferential Piston Pumps

Wright Pump® introduces a complete line of positive displacement circumferential piston pumps for applications in the food, beverage, dairy, personal care, pharmaceutical, and biotech industries. The new series currently has capacities to 150 gpm and pressure capability up to 200 psi (14 bar), with more sizes expected soon. The pumps are dimensionally interchangeable with Waukesha® Universal I Series pumps and can be used as replacement pumps without any changes in piping, baseplates or other auxiliary equipment.

While the Wright pump is completely interchangeable with Waukesha Universal I Series, pumps, its design includes additional standard features not found in the Universal I Series. For example, all pump models come with a stainless steel gear case that allows four-way mounting. Other standard features include helical timing gears for higher torque carrying capacity and

quieter operation; 17-4 PH stainless steel shafting; and polyester epoxy blend powder coating. To ensure the highest quality, Wright Pump operates its own foundry, pouring its own non-galling "808" stainless alloy, a material critical to the close-clearance operations required of circumferential piston pumps.

Wright Pump, Waukesha, WI

READER SERVICE NO. 233

### DuPont Performance Lubricants Introduces New H-I Food Grade Krytox® Lubricants

DuPont Performance Lubricants introduces Krytox® FG, a new line of perfluorinated oils and greases that were recently approved by NSF for H-I food processing applications. Similar to existing DuPont™ Krytox® products that are H-2 approved, the new line represents the highest level of performance in lubrication technology. Now, for the first time, Krytox® is available with an H-I rating for incidental food contact, which means food processors will be able to experience the superior lubrication performance as other industries have for over 40 years. Krytox® offers significant cost savings versus current H-I lubricants, based on operating temperatures up to 399°C (762°F) in continuous use.

Krytox® FG oils and greases are durable in the most aggressive environments where temperatures reach extremes that exceed the capabilities of conventional lubricants. Krytox® FG can perform at

operating temperatures up to 399°C (762°F) for continuous use, exceeding requirements in the food industry, and providing a safe margin of protection for food processors. Krytox® FG oils and greases are recommended for use in all types of equipment and machinery used to prepare, process, produce, and package food and pharmaceuticals where incidental contact with the lubricant is a possibility. They are insoluble in water and will resist any water washout. They resist rust and corrosion and perform well under extreme pressures. Applications include conveyor chains and bearings, high-temperature fans and ovens, gearboxes, vacuum pumps, and valves.

Krytox® lubricants are based on aerospace fluoropolymer technology, capable of operating over the broadest range of temperatures (-70°F to 762°F, with spikes up to over 800°F).

They have been used for over 40 years in aerospace, automotive, semiconductor, and chemical processing industries and are regarded as the highest performing lubricants available. They are non-flammable, chemically inert, and compatible with all metals, elastomers, and plastics. They do not carbonize — enabling ease in equipment maintenance and facility cleanup. The oils are clear, non-staining, and non-migrating. The greases are clean, pure white and non-migrating.

DuPont, Wilmington, DE

READER SERVICE NO. 234



**IMPORTANT!** Please read this information before completing your registration form.

### MEETING INFORMATION

Register to attend the world's leading food safety conference.

Registration includes:

- ◆ Technical Sessions
- ◆ Symposia
- ◆ Poster Presentations
- ◆ Ivan Parkin Lecture
- ◆ Exhibit Hall Admittance
- ◆ Cheese and Wine Reception
- ◆ Exhibit Hall Reception
- ◆ Program and Abstract Book

### 4 EASY WAYS TO REGISTER

Complete the Attendee Registration Form and submit it to the International Association for Food Protection by:



**Online:** [www.foodprotection.org](http://www.foodprotection.org)



**Fax:** 515.276.8655



**Mail:** 6200 Aurora Avenue, Suite 200W,  
Des Moines, IA 50322-2864, USA



**Phone:** 800.369.6337; 515.276.3344

The early registration deadline is July 9, 2003. After this date, late registration fees are in effect.



International Association for  
**Food Protection**®

### REFUND/CANCELLATION POLICY

Registration fees, less a \$50 administration fee and any applicable bank charges, will be refunded for written cancellations received by July 25, 2003. No refunds will be made after July 25, 2003; however, the registration may be transferred to a colleague with written notification. Refunds will be processed after August 18, 2003. Event and tour tickets purchased are nonrefundable.

### EXHIBIT HOURS

<b>Sunday, August 10, 2003</b>	8:00 p.m. – 10:00 p.m.
<b>Monday, August 11, 2003</b>	9:30 a.m. – 1:30 p.m. 3:00 p.m. – 6:30 p.m.
<b>Tuesday, August 12, 2003</b>	9:30 a.m. – 1:30 p.m.

### DAYTIME TOURS

(Lunch included in all daytime tours)

<b>Sunday, August 10, 2003</b>	New Orleans Super City Tour	9:00 a.m. – 2:00 p.m.
<b>Monday, August 11, 2003</b>	A Swamp Tour Experience	9:00 a.m. – 1:00 p.m.
<b>Tuesday, August 12, 2003</b>	River Road Plantation Tour	9:00 a.m. – 4:00 p.m.
<b>Wednesday, August 13, 2003</b>	New Orleans School of Cooking	9:30 a.m. – 1:00 p.m.

### EVENING EVENTS

<b>Sunday, August 10, 2003</b>	Opening Session	7:00 p.m. – 8:00 p.m.
	Cheese and Wine Reception	8:00 p.m. – 10:00 p.m.
<b>Monday, August 11, 2003</b>	Exhibit Hall Reception	5:00 p.m. – 6:30 p.m.
	Monday Night Social	
	Mardi Gras World	6:30 p.m. – 10:00 p.m.
<b>Tuesday, August 12, 2003</b>	Creole Queen Dinner and Jazz Tour	7:00 p.m. – 10:00 p.m.
	(Ticket sales will benefit the IAFP Foundation Fund)	
<b>Wednesday, August 13, 2003</b>	Awards Banquet Reception	6:00 p.m. – 7:00 p.m.
	Awards Banquet	7:00 p.m. – 9:30 p.m.

### HOTEL INFORMATION

For reservations, contact the hotel directly and identify yourself as an International Association for Food Protection Annual Meeting attendee to receive a special rate of \$145/\$165 per night, single/double. Make your reservations as soon as possible; this special rate is available only until July 9, 2003.

Hilton New Orleans Riverside  
Two Poydras St.  
New Orleans, Louisiana 70140  
800.HILTONS  
504.561.0500





# International Association for Food Protection®

6200 Aurora Avenue, Suite 200W  
Des Moines, IA 50322-2864, USA  
Phone: 800.369.6337 • 515.276.3344  
Fax: 515.276.8655  
E-mail: info@foodprotection.org  
Web site: www.foodprotection.org



## Attendee Registration Form

Name (Print or type your name as you wish it to appear on name badge)

Member Number: \_\_\_\_\_

Employer

Title

Mailing Address (Please specify:  Home  Work)

City

State/Province

Country

Postal/Zip Code

Telephone

Fax

E-mail



Regarding the ADA, please attach a brief description of special requirements you may have.

Member since: \_\_\_\_\_

IAFP occasionally provides Attendees' addresses (excluding phone and E-mail) to vendors and exhibitors supplying products and services for the food safety industry. If you prefer NOT to be included in these lists, please check the box.

### PAYMENT MUST BE RECEIVED BY JULY 9, 2003 TO AVOID LATE REGISTRATION FEES

#### REGISTRATION FEES:

Registration (Awards Banquet included) \_\_\_\_\_  
Association Student Member (Awards Banquet included) \_\_\_\_\_  
Retired Association Member (Awards Banquet included) \_\_\_\_\_  
One Day Registration: \*  Mon.  Tues.  Wed. \_\_\_\_\_  
Spouse/Companion\* (Name): \_\_\_\_\_  
Children 15 & Over\* (Names): \_\_\_\_\_  
Children 14 & Under\* (Names): \_\_\_\_\_  
\*Awards Banquet not included

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\$ 25 (\$ 25 late)  
FREE

#### NONMEMBERS

\$ 475 (\$525 late)  
Not Available  
Not Available  
\$ 235 (\$260 late)  
\$ 50 (\$ 50 late)  
\$ 25 (\$ 25 late)  
FREE

#### TOTAL

\_\_\_\_\_  
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\_\_\_\_\_

#### EVENTS:

Student Luncheon (Sunday, 8/10) \_\_\_\_\_  
Monday Night Social at Mardi Gras World (Monday, 8/11) \_\_\_\_\_  
Children 14 and under \_\_\_\_\_  
Creole Queen Dinner and Jazz Tour (Tuesday, 8/12) \_\_\_\_\_  
Awards Banquet (Wednesday, 8/13) \_\_\_\_\_

\$ 5 (\$ 10 late)  
\$ 39 (\$ 44 late)  
\$ 34 (\$ 39 late)  
\$ 70 (\$ 75 late)  
\$ 50 (\$ 55 late)

#### # OF TICKETS

\_\_\_\_\_  
\_\_\_\_\_  
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\_\_\_\_\_

#### DAYTIME TOURS:

(Lunch included in all daytime tours)  
New Orleans Super City Tour (Sunday, 8/10) \_\_\_\_\_  
A Swamp Tour Experience (Monday, 8/11) \_\_\_\_\_  
River Road Plantation Tour (Tuesday, 8/12) \_\_\_\_\_  
New Orleans School of Cooking (Wednesday, 8/13) \_\_\_\_\_

\$ 69 (\$ 74 late)  
\$ 68 (\$ 73 late)  
\$ 70 (\$ 75 late)  
\$ 48 (\$ 53 late)

#### PAYMENT OPTIONS:

Check Enclosed



TOTAL AMOUNT ENCLOSED \$ \_\_\_\_\_

US FUNDS on US BANK

Account Number \_\_\_\_\_

Expiration Date \_\_\_\_\_

Name on Card \_\_\_\_\_

**JOIN TODAY AND SAVE!!!**

(Attach a completed Membership application)

Signature \_\_\_\_\_

**EXHIBITORS DO NOT USE THIS FORM**

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The above list represents individual contributors to the Association Foundation Fund during the period November 1, 2001 through October 31, 2002. In addition, a portion of the Sustaining Member dues are allocated to support this Fund. Your contribution is welcome. Call the Association office at 800.369.6337 or 515.276.3344 for more information on how you can support the Foundation.

## 3-A<sup>®</sup> Sanitary Standards for Bag Collectors, Number 40-02

Formulated by  
*International Association of Food Industry Suppliers (IAFIS)*  
*International Association for Food Protection (IAFP)*  
*United States Public Health Services (USPHS)*  
*The Dairy Industry Committee (DIC)*  
*United States Department of Agriculture – Dairy Programs (USDA)*  
*European Hygienic Engineering Design Group (EHEDG)*

It is the purpose of the IAFIS, IAFP, USPHS, DIC, USDA, and EHEDG and in connection with the development of the 3-A Sanitary Standards Program to allow and encourage full freedom for inventive genius or new developments. Bag collector specifications heretofore or hereafter developed which so differ in design, materials, and fabrication or otherwise as not to conform to the following standards but which, in the fabricator's opinion, are equivalent or better, may be submitted for the joint consideration of the IAFIS, IAFP, USPHS, DIC, USDA, and EHEDG at any time. The 3-A Sanitary Standards and 3-A Accepted Practices provide hygienic criteria applicable to equipment and systems used to produce, process, and package milk, milk products, and other perishable foods or comestible products. Standard English is the official language of 3-A Sanitary Standards and 3-A Accepted Practices.

### A SCOPE

A1 These standards cover the sanitary aspects of bag collectors for the dry filter entrapment and collection of particulates of dry food products from air exhausted from spray drying systems, instantizing systems, or other dry product systems beginning at the flanges or junctions of the product/air inlets of the bag collector and terminating at the flanges or junctions of the air exhaust and product outlets.

With respect to pressurized air, the bag collector starts at the air inlet to the pressurized air reservoir, or, in the case of an internal pressurized air receiver, it shall start at the air inlet to the bag collector.

With respect to processing air, if provided, the bag collector starts at the flange or junction of the processing air inlet(s).

If the bag collector is designed for mechanical cleaning, these standards include the cleaning solution pipelines, valves, and associated components integral to the bag collector.

These standards also include materials and fabrication criteria appropriate for bag collectors;

- to be cleaned by a variety of methods and with different degrees of prior disassembly.
- which have optional integral fluid bed components.

These standards do not include product-outlet valves or any valves or isolation devices used upstream from inlet flanges or junctions, or downstream from outlet flanges or junctions.

A2 In order to conform to these 3-A Sanitary Standards, bag collectors shall comply with the following design, material, and fabrication criteria, and the applicable documents referenced herein.<sup>1</sup>

### B DEFINITIONS

B1 *Product:* Shall mean dry milk, dry milk products, and other dry comestibles.

B2 *Solutions:* Shall mean water and/or those homogenous mixtures of cleaning agents and/or sanitizers and water used for flushing, cleaning, rinsing, and sanitizing.

<sup>1</sup>Use current revisions or editions of all referenced documents cited herein.

- B3 *Pressurized Air*: Shall mean air compressed by mechanical means to exceed atmospheric pressure for uses such as pulse or reverse air cleaning of filter bags, operation of inflatable seals, dislodging of product, and purging of shaft seals, instruments, and spray cleaning devices.
- B4 *Processing Air*: Shall mean filtered air which is intended to be used in contact with the product and/or product contact surfaces for fluid beds, air sweeps, drying filter bags, and similar uses.
- B5 *Exhaust Air*: Shall mean air which has passed through the filter bags and is ready for discharge from the bag collector.
- B6 *Easily or Readily Removable*: Shall mean quickly separated from the equipment with the use of simple tools, if necessary.
- B7 *Simple Hand Tools*: Shall mean implements normally used by operating and cleaning personnel such as a screwdriver, wrench, or mallet.
- B8 *Easily or Readily Accessible*: Shall mean a location which can be safely reached by an employee from a floor, platform, or other permanent work area.
- B9 *Inspectable*: Shall mean surfaces which can be made available for close visual observation.
- B10 *Bond*: Shall mean the adhesive or cohesive forces holding materials together. This definition excludes press and shrink fits.
- B11 *Nontoxic Materials*: Shall mean those substances that under the conditions of their use are in compliance with applicable requirements of the Food, Drug, and Cosmetic Act of 1938, as amended.
- B12 **Surfaces**
- B12.1 *Product Contact Surfaces*: Shall mean all surfaces that are exposed to the product or airborne product, terminating at the filter bag(s), and surfaces from which liquids and/or solids may drain, drop, diffuse, or be drawn into the product.
- B12.2 *Pressurized Air Contact Surfaces*: Shall mean surfaces that are exposed to pressurized air downstream of the final pressurized air filter and terminating at the outlet of the air distribution device(s).
- B12.3 *Processing Air Contact Surfaces*: Shall mean surfaces that are exposed to processing air beginning at the inlet flange(s) or junction(s) and terminating at the point(s) of introduction into contact with product or product contact surfaces.
- B12.4 *Exhaust Air Contact Surfaces (Also known as Clean Air Plenum Surfaces)*: Shall mean:
- a) the surfaces of bag cages, plenum chambers, and appurtenances located downstream of the filter bag(s), including the exterior surfaces of pulse air or reverse air distribution devices located in exhaust air plenums, and
  - b) the exterior and interior surfaces of air distribution pipes located in exhaust air plenums downstream from pulse air or reverse air distribution devices.
- NOTE: Flow of pressurized air through those pipes is intermittent. When there is no flow of pressurized air, the interior surfaces become exhaust air contact surfaces.
- B12.5 *Nonproduct Contact Surfaces*: Shall mean all other exposed surfaces.
- B12.6 **Surface Modification<sup>2</sup>**
- B12.6.1 *Surface Treatments*: Shall mean a process whereby chemical composition or mechanical properties of the existing surface are altered. There is no appreciable, typically less than 1.00  $\mu\text{m}$  build-up of new material.
- B12.6.1.1 *Surface Treatments Include*:
- a. Mechanical (polishing)
  - b. Thermal (surface hardening laser, electron beam)
  - c. Electropolishing
- B12.6.2 *Coatings on surfaces other than filter bags*: Shall mean the results of a process where a different material is deposited to create a new surface. There is appreciable, typically more than 1.00  $\mu\text{m}$  build-up of new material. The coating material does not alter the physical properties of the substrate.

<sup>2</sup> Additional information on surface modification is contained in *Advanced Materials and Processes*, Volume 137(1), "Coatings and Coating Practices" by H. Herman, "Surface Modification" by F. A. Smidt. ASM International, Materials Park, OH 44073 (216) 338-5151.

- B12.6.2.1 Coating Processes Include:
- Chemical (conversion coatings)
  - Chemical vapor deposition
  - Overlays and encapsulation
- B13 **Cleaning**
- B13.1 *Mechanical Cleaning or Mechanically Cleaned:* Shall mean soil removal by impingement, circulation, or flowing chemical detergent solutions and water rinses onto and over the surfaces to be cleaned by mechanical means in equipment or systems specifically designed for this purpose.
- B13.2 *Manual (COP) Cleaning:* Shall mean soil removal when the equipment is partially or totally disassembled. Soil removal is effected with chemical solutions and water rinses with the assistance of one or a combination of brushes, nonmetallic scouring pads and scrapers, high or low pressure hoses and tank(s) which may be fitted with re-circulating pump(s), and with all cleaning aids manipulated by hand.
- B13.3 *Dry Cleaning:* Shall mean cleaning with a vacuum cleaner and/or dry brushes and other tools.
- B13.4 *Sanitize, Sanitizing:* Shall mean a process applied to a cleaned surface which is capable of reducing the numbers of the most resistant human pathogens by at least 5 log<sub>10</sub> reductions (99.999%) to 7 log<sub>10</sub> reductions (99.99999%) by applying accumulated hot water, hot air, or steam, or by applying an EPA-registered sanitizer according to label directions. Sanitizing may be effected by mechanical or manual methods.
- B14 **Component Equipment**
- B14.1 *Fire or Explosion Suppression or Deluge Systems:*
- B14.1.1 *Fire Suppression System:* Shall mean equipment which quickly introduces a substance(s) to reduce the level of oxygen required for combustion.
- B14.1.2 *Deluge System:* Shall mean equipment for the quick introduction of water to extinguish fire.
- B14.1.3 *Explosion Suppression System:* Shall mean equipment for the extremely fast introduction of a substance(s) to eliminate or minimize the damaging effect of catastrophic combustion.
- B14.2 *Pressure Relief:* Shall mean equipment which will vent excessive pressures in the system so that structural and mechanical damage is avoided or minimized.
- B14.3 *Fluid Beds:* Shall mean equipment which suspends and moves product particles using processing air forced through a fluid bed screen.
- B14.4 *Fluid Bed Screens:* Shall mean thin metal sheets, which have perforations for the transmission of processing air.
- B14.5 *Product Conveyors:* Shall mean equipment which mechanically conveys product.
- B14.6 *Pulse Air or Reverse Air Distribution Devices (Air Distribution Devices):* Shall mean equipment which distributes pressurized air for pulsing or reverse air cleaning of filter bag(s). Air distribution devices may be valves.
- B14.7 *Pulse Air or Reverse Air Reservoir (Air Reservoir):* Shall mean a receptacle for accumulating or storing pressurized air. The device may be a manifold or a component of an air distribution device.
- B14.8 *Venturis:* Shall mean all devices which direct or amplify the effect of pressurized air for the pulsing or reverse air cleaning of filter bags.
- B14.9 *Filter Bags (Bags):* Shall mean the nonpleated media which serves as the means of entrapment of suspended particles from a stream of air.
- B14.10 *Bag Cages:* Shall mean rigid frames to provide support to the filter bags.
- C **MATERIALS**
- C1 **PRODUCT, PRESSURIZED AIR, PROCESSING AIR, AND EXHAUST AIR CONTACT SURFACES**
- C1.1 **Metals**
- C1.1.1 Product contact surfaces, processing air contact surfaces, pressurized air contact surfaces, and exhaust air contact surfaces shall be of stainless steel of the American Iron and Steel Institute (AISI) Series<sup>3</sup> 300 (except 301 and 302) or

<sup>3</sup> The data for this series are contained in the *AISI Steel Products Manual, Stainless & Heat Resisting Steels*, Table 2-1. Available from the American Iron and Steel Society, 410 Commonwealth Drive, Warrendale, PA 15086 (412) 776-1535.

Corresponding Alloy Cast Institute (ACI) types<sup>4</sup> (See Appendix, Section F), or metal which under conditions of intended use is at least as corrosion resistant as stainless steel of the foregoing types, and is nontoxic and nonabsorbent, except that:

- C1.1.1.1 Aluminum alloys conforming to the Aluminum Association<sup>5</sup> designates A-360, A-380, A-319, A-315G and Danish Standard<sup>6</sup> DS3002 designates Number 4261 or Number 4253, may be used in exhaust air contact surfaces for venturis or for construction of pressurized air distribution devices.
- C1.1.2 Stainless steel surfaces of bag collectors may be modified by surface treatment or coatings to provide a nonstick surface, reduce product retention, and prevent galling on moving surfaces. Product contact surfaces of stainless steel pressure relief panels which have perforations and/or grooves may be modified by surface treatment or coating as defined in Section B12.6 to provide a cleanable, functional surface.
- C1.2 **Nonmetals**
  - C1.2.1 Rubber and rubber-like materials may be used for short flexible connectors, gaskets, inflatable seals, plugs for pressure relief and fire suppression devices and openings and similar functional purposes.
  - C1.2.2 Rubber and rubber-like materials when used for the above-specified applications shall conform to the applicable provisions of the 3-A Sanitary Standards for Multiple-Use Rubber and Rubber-Like Materials Used as Product Contact Surfaces in Dairy Equipment, Number 18-.
  - C1.2.3 Plastic materials may be used for short flexible connectors, gaskets, coatings (as provided for in Section C1.1.2), sight and/or light openings, venturis, pressure relief port membranes, coverings for pressure relief and fire and explosion suppression devices, sliding sealing surfaces for air distribution devices and parts having the same functional purposes.
  - C1.2.4 Plastic materials when used for the above-specified applications, except for coatings, shall conform to the applicable provisions of the 3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Number 20-.

- C1.2.4.1 Coatings shall meet 21 CFR 177 or be on the FDA Premarket Notification List.
- C1.2.5 Bonded rubber and rubber-like materials and bonded plastic materials shall be of such composition as to retain their surface and conformation characteristics when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment.
- C1.2.6 The adhesive, if used, for bonding rubber and rubber-like materials and bonding plastic materials shall be nontoxic.<sup>7</sup>
- C1.2.7 Filter bags may be made of cotton, wool, linen, silk, or synthetic fibers. The filter bags may optionally be covered by an expanded synthetic membrane laminate. When necessary to control static electrical charges, metallic fibers complying with C1.1.1 may be incorporated into the bags. These materials shall be nontoxic, relatively insoluble in water, easily cleanable and shall not impart particulate material or a flavor to the product.
- C1.2.8 All plastic materials referenced in Section C1.2.7 shall be constructed of materials meeting Title 21, Part 170-199 of the Code of Federal Regulations<sup>8</sup>, or be otherwise accepted by the Food and Drug Administration for repeated food contact.
- C1.2.9 Plastic materials which meet Section C1.2.8 may be used for flexible tubing and fittings for such tubing, used to distribute pressurized air for purging shaft seals and for sensing air pressure or flow as described in Section D1.9.1.
- C1.2.10 Rubber and rubber-like materials which meet applicable FDA regulations 21 CFR 177.2600<sup>8</sup> may be used for flexible tubing to distribute pressurized air for purging purposes described in Section D1.9.1. Fittings and connections for such tubing may be made of stainless steel or of plastic specified in Section C1.2.8.

<sup>4</sup> Steel Founders Society of America, Cast Metal Federation Building, 455 State Street, Des Plaines, IL 60016 (708) 299-9160.

<sup>5</sup> The Aluminum Association, 900 19th Street, N.W., Suite 300, Washington, D.C. 20006 (202) 862-5100.

<sup>6</sup> Danish Standard DS3002—Standards may be ordered via [www.en.ds.dk](http://www.en.ds.dk) (Website in English) or Danish Standards Association, Kollegievej 6, 2920 Charlottenlund, Denmark, phone: +45 39 96 61 01, fax: +45 39 96 61 02, e-mail: [dansk.standard@ds.dk](mailto:dansk.standard@ds.dk).

<sup>7</sup> Adhesives shall comply with 21 CFR 175 - Indirect Food Additives: Adhesives and Components of Coatings. Document for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (202) 512-1800.

<sup>8</sup> Document for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (202) 512-1800.

C2	<b>NONPRODUCT CONTACT SURFACES</b>	D1.3	<b>Springs</b>
C2.1	All nonproduct contact surfaces shall be of corrosion-resistant material or material that is rendered corrosion resistant. If coated, the coating used shall adhere. All nonproduct contact surfaces shall be relatively nonabsorbent, durable, and cleanable. Parts removable for cleaning having both product contact surfaces and nonproduct contact surfaces shall not be painted.	D1.3.1	Any coil spring shall have at least 3/32 in. (2.38 mm) openings between coils, including the ends, when the spring is in the free position. Coil springs intended for mechanical cleaning shall be made of round material, and shall not have flattened ends.
D	<b>FABRICATION</b>	D1.4	<b>Bearings</b>
D1	<b>PRODUCT, PRESSURIZED AIR, AND EXHAUST AIR CONTACT SURFACES GENERAL CRITERIA</b>	D1.4.1	Bearings having these surfaces shall be of a nonlubricated type.
D1.1	<b>Coatings</b>	D1.4.2	Lubricated bearings, including the permanently sealed type, shall be located outside these surfaces with at least 1 in. (25.4 mm) clearance open for inspection between the bearing and these surfaces.
D1.1.1	Coatings, if used, shall be free from surface delamination, pitting, flaking, spalling, blistering and distortion when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment.	D1.5	<b>Shafts</b>
D1.1.2	Plastic materials, when used as a coating, shall be at least 0.00100 in. (0.0250 mm) thick.	D1.5.1	Where a shaft passes through these surfaces, the portion of the opening surrounding the shaft shall be protected to prevent the entrance of contaminants and unfiltered air.
D1.2	<b>Threads</b>	D1.6	<b>Gaskets and Seals</b>
D1.2.1	There shall be no exposed threads on these surfaces, except that:	D1.6.1	Gaskets having these surfaces shall be removable or bonded.
D1.2.1.1	Surfaces provided for in D3.1.2 may have exposed threads.	D1.6.2	Foam rubber or hollow tubular gaskets shall not be used, except that:
D1.2.1.2	ACME type threads may be used for connections of pulse air or reverse air piping. In such case(s) the threads shall be ACME type as specified in the 3-A Sanitary Standards for Sanitary Fittings for Milk and Milk Products, Number 63- or the American Standard Stub Acme Thread. (See Appendix, Section O.) The nuts shall be of the open type. Equipment components with exposed threads as described above shall be designed for manual cleaning. The nuts shall be installed on the piping components which are removed for manual cleaning.	D1.6.2.1	Hollow tube material may be used only as inflatable seals using pressurized air. When hollow tube material is used as inflatable seals, a pressure sensing device and alarm shall be provided to detect rupture of, or air leakage from, hollow tube material and
D1.2.1.3	Threads may be enclosed by using cap nuts and appropriately located O-rings or flush-fitting gaskets for essential functional reasons in the following applications:	D1.6.2.2	The manufacturer shall provide means to test the alarm.
D1.2.1.3.1	Special flange connections necessary to attach removable solution piping, pulse air piping, and air distribution devices.	D1.6.3	Grooves in gaskets shall be no deeper than their width, unless the gasket is readily removable and reversible for cleaning.
D1.2.1.3.2	Attachment of inspection ports.	D1.6.4	Gasket retaining grooves in product contact surfaces for removable gaskets shall not exceed 1/4 in. (6.35 mm) in depth or be less than 1/4 in. (6.35 mm) wide except those for standard O-rings smaller than 1/4 in. (6.35 mm), and those provided for in the 3-A Standards referenced in Section D1.8.1 and D1.9.1.

**D1.7 Bonded Materials**

D1.7.1 Bonded rubber and rubber-like materials and bonded plastic materials shall be bonded in a manner that the bond is continuous and mechanically sound so that when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment, the rubber and rubber-like material or the plastic material does not separate from the base material to which it is bonded. The final bond and residual adhesive, if used, shall conform to the criteria in Section C1.2.6.

**D1.8 Fittings and Valves**

D1.8.1 All sanitary fittings shall conform to 3A Sanitary Standards for Sanitary Fittings for Milk & Milk Products, Number 63-, except as provided in section D3.1.2 for pressurized air distribution devices and their connections, except that:

D1.8.1.1 Loose fitting slip-joints and/or retaining clips, which are to be mechanically cleaned, may be used for attachment of components such as pulse air or reverse air piping, venturis, and bag cages. Holes for retaining clips shall be not less than 1/8 in. or 3 mm in diameter.

D1.8.1.2 Slip type connections may be used on pulse air or reverse air piping. If provided with O-ring seals, radii in O-ring grooves shall be as specified in Appendix, Section H. Slip type connections shall be dismantled for manual cleaning.

D1.8.1.3 Crevices are allowed at fittings for flexible tubing for distribution of pressurized air for purging shaft seals. These fittings shall be manually cleaned.

D1.8.2 All sanitary valves shall conform to applicable 3-A Sanitary Standards for valves.

**D1.9 Instrument Connections**

D1.9.1 All instrument connections shall conform to the applicable provisions of the 3-A Sanitary Standards for Sensors and Sensor Fittings and Connections for Milk and Milk Products Equipment, Number 74-, or 3-A Sanitary Standard for Refractometers and Energy Absorbing Optical Sensors for Milk and Milk Products, Number 46- except those connections for instruments used to sense or measure air flow or pressure, which shall be of sanitary design and shall be removed and capped or isolated during cleaning operations.

**D1.10 Tubing for Cleaning Solutions**

D1.10.1 All metal tubing for cleaning solutions shall conform to the 3-A Sanitary Standards for Polished Metal Tubing for Dairy Products, Number 33- and Section G of 3-A Accepted Practices for Permanently Installed Product and Solution Pipelines and Cleaning Systems Used in Milk and Milk Product Processing Plants, Number 605-.

**D1.11 Spray Cleaning Devices**

D1.11.1 All spray cleaning devices intended to remain in place shall conform to the applicable 3-A Sanitary Standards for Spray Cleaning Devices Intended to Remain in Place, Number 78-.

**D1.12 Draining**

D1.12.1 Surfaces intended for regular wet cleaning, except for flat tube sheets, shall be self-draining or self-purging except for normal adherence.

**D1.13 Cleaning and Inspectability**

D1.13.1 Bag collector components that are to be mechanically cleaned, including fluid beds, bag cages, and exhaust air contact surfaces, shall be designed so that the surfaces of the components and all nonremoved appurtenances thereto can be mechanically cleaned and are removable by use of simple hand tools, easily accessible and inspectable, except that:

D1.13.1.1 Bag collectors in excess of 10.0 ft. (3.05m) inside height that are to be mechanically cleaned shall be designed so that the surfaces of the components and all nonremoved appurtenances thereto can be mechanically cleaned and are accessible and inspectable.

D1.13.2 When large or heavy components must be moved to provide access, appropriate mechanical means shall be provided by the fabricator or user.

D1.13.3 If the final filter for pressurized air is located on or at a pulse air or reverse air distribution device located in an exhaust air area, a readily accessible access opening or door shall be provided into the exhaust air chamber, so the final filter is inspectable.

D1.13.4 Surfaces not designed to be mechanically cleaned shall be readily accessible and inspectable when in an assembled position or when removed. Demountable parts shall be readily removable, except that:



- D1.13.4.1 Surfaces of bag collectors in excess of 10.0 ft. (3.05m) inside height not designed to be mechanically cleaned shall be accessible for cleaning and inspection when in an assembled position or when removed. Demountable parts shall be readily removable.
- D1.13.5 When large or heavy components must be moved to provide access, appropriate mechanical means shall be provided by the fabricator or user.
- D1.13.6 On pressurized air contact surfaces, means of access for inspection shall be provided to reservoirs for pressurized air.
- D1.13.7 Parts made of aluminum, as provided for in Section C1.1.1.1 which are located in an area to be mechanically cleaned, shall be removed prior to mechanical cleaning and shall be cleaned manually.
- D1.13.8 Appurtenances having these surfaces, shall be readily removable, or they shall be readily cleanable when assembled or installed, and shall be easily accessible for inspection.
- D1.14 Access, Openings, and Covers**
- D1.14.1 Means of access shall be provided to inspect product contact and exhaust air contact surfaces.
- D1.14.2 The inside dimension of an access port, if provided, shall be not less than 15.0 in. × 20.0 in. or 400 × 500 mm. if elliptical, or 18.0 in. or 450 mm in diameter if round. The upper edge of a top access port shall be not less than 3/8 in. (9.52 mm) higher than the surrounding area and if an exterior flange is incorporated in it, it shall slope and drain away from the opening. The sleeve or collar of an access port opening for an inside swing-type of access port cover shall be installed in a vertical position and pitched so that liquids cannot accumulate. The door shall be constructed in a manner that will prevent the entrance of unfiltered air when closed.
- D1.15 Sight and/or Light Windows**
- D1.15.1 All sight and/or light windows shall conform to the applicable provisions of 3-A Sanitary Standards for Sight and/or Light Windows and Sight Indicators in Contact with Milk and Milk Products, Number 65-.
- D1.16 Bag Cages Located in Exhaust Air**
- D1.16.1 Extruded stainless steel wire, not less than 3/32 inch (2.38 mm) may be used as a construction component of bag cages.
- D1.16.2 Wire-to-wire welds on bag cages may be of the electrical resistance type, relatively free of imperfections.
- D1.16.3 Welds which attach wires to nonwire components shall be continuous type, snag-free, and need not be ground.
- D1.16.4 Minimum radii requirements are not applicable for bag cages.
- D1.17 Other Components**
- D1.17.1 If bag collectors are provided with air driven sonic horns, level sensing devices, check valves, or hose assemblies, these components shall conform to applicable provisions of:
- D1.17.1.1 3-A Sanitary Standards for Air Driven Sonic Horns for Dry Milk and Dry Milk Products, Number 49-.
- D1.17.1.2 3-A Sanitary Standards for Level Sensing Devices for Dry Milk & Dry Milk Products, Number 50-.
- D1.17.1.3 3-A Sanitary Standards for Vacuum Breakers & Check Valves for Milk and Milk Products, Number 58-.
- D1.17.1.4 3-A Sanitary Standards for Hose Assemblies for Milk & Milk Products Equipment, Number 62-.
- D1.17.2 When a mechanical conveyor is provided as an integral component of a bag collector, the conveyor shall conform to the applicable provisions of the 3-A Sanitary Standards for Mechanical Conveyors, Number 41-.
- D2 PRODUCT CONTACT SURFACES**
- D2.1 Surface Texture**
- D2.1.1 Product contact surfaces shall have a finish at least as smooth as a No. 4 ground finish on stainless steel sheets, and be free of imperfections such as pits, folds and crevices in the final fabricated form (See Appendix, Section G), except for:
- D2.1.1.1 Filter bags,
- D2.1.1.2 Perforated fluid bed surfaces provided for in Section D2.5, and

- D2.1.1.3 Fire deluge nozzles and fire suppression nozzles, which shall have surfaces at least as smooth as C-40 (200  $\mu$ m or 5.08  $\mu$ m RMS) on the GAR C-9 Cast Microfinish Comparator, and be relatively free of pits, folds and crevices in the final fabricated form. (See Appendix, Section G4.)
- D2.2 Permanent Joints**
- D2.2.1 All permanent joints in metallic product contact surfaces shall be continuously welded and shall meet the surface texture requirements of Section D2.1.1.
- D2.2.2 Lapped joints may be used in metallic product contact surfaces when necessary for functional reasons provided that the finished joints are welded and finished to meet the surface texture requirements of Section D2.1.1 and the radii requirements of Section D2.3.1 and are cleanable and free draining in the installed position.
- D2.3 Radii**
- D2.3.1 All internal angles of less than 135° on product contact surfaces, shall have radii of not less than 1/4 in. (6.35 mm) when intended for manual cleaning and 1/8 in. (3.18 mm) when designed and equipped for mechanical cleaning, except that:
- D2.3.1.1 Smaller radii may be used when they are required for essential functional reasons, such as those on shaft seals and on sanitary fittings as provided for in Section D1.8 and D1.9. In no case shall such radii be less than 1/32 in. (0.794 mm).
- D2.3.1.2 The radii in grooves in gaskets or gasket retaining grooves shall be not less than 1/8 in. (3.18 mm) except for those for standard 1/4 in. (6.35 mm) and smaller O-rings, and those provided for in Section D1.8 and D1.9.
- D2.3.1.3 Radii in O-ring grooves shall be as specified in Appendix, Section H.
- D2.3.1.4 Minimum radii are not applicable in perforations of fluid bed screens that are slot or oval shaped, crescent shaped, or that are round in shape and less than 1/16 in. (1.59 mm) diameter.
- D2.3.1.5 Minimum radii requirements are not applicable at the junctures of flat sealing surfaces.
- D2.3.1.6 Radii for fillets of welds in product contact surfaces where the thickness of one or both parts joined is 3/16 in. (4.76 mm) or less shall be not less than 1/8 in. (3.18 mm).
- D2.3.1.7 Radii requirements are not applicable for filter bags.
- D2.4 Fluid Beds**
- D2.4.1 All processing air and product contact surfaces of fluid beds, if provided, shall be fabricated to comply with requirements for product contact surfaces.
- D2.5 Fluid Bed Screen Perforations**
- D2.5.1 Round perforations shall be not less than 0.012 in. (0.305 mm) in diameter.
- D2.5.2 Slot or oval-shaped perforations shall be at least 0.00600 in. (0.1524 mm) wide at the widest part of the opening and at least 0.0200 in. (0.508 mm) long.
- D2.5.3 Crescent-shaped perforations shall be at least 0.00400 in. (0.1016 mm) wide at the widest part of the opening and the perforations shall be at least 0.0200 in. (0.508 mm) long. Internal angles of the perforations shall be well defined and free of crevices. One side of the screen may have indentations around the perforations. The other side may have projections around the perforations, together with shallow open grooves between the rows of perforations.
- D2.5.4 All perforations shall be relatively free of burrs.
- D3 PRESSURIZED AIR CONTACT SURFACES**
- D3.1 Where pressurized air from a separate source is used, the air supply up to the final filter shall comply with the applicable criteria in the 3-A Accepted Practices for Supplying Air Under Pressure in Contact with Milk, Milk Products and Product Contact Surfaces, Number 604-, except that:
- D3.1.1 The final filter and disposable media required by 3-A Accepted Practices for Supplying Air Under Pressure in Contact with Milk, Milk Products, and Product Contact Surfaces 604- may be alternatively positioned as close as reasonably possible, in an accessible location, upstream of an air distribution reservoir which supplies pressurized air to individual points of use.
- D3.1.2 Pressurized air reservoirs, piping, and pulse air or reverse air distribution devices are not required to be of sanitary construction, provided they are isolated from moisture and/or vapor during wet cleaning by 1) the installation of plugs at the outlets of distribution pipes, 2) removal of air

distribution pipes and plugging or capping off at the disconnect point, or 3) provisions for flowing air through the pulse pipe(s) during the entire rinsing, cleaning, and air drying cycles.

D3.2 Any air distribution reservoir located after a final filter as specified in Section D3.1.1, shall be stainless steel. Welds shall be continuous but need not be ground.

D3.3 Devices for distribution of pulse air or reverse air may be located outside of the bag collector or may be located in the exhaust air contact area (clean air plenum). If located in the clean air plenum, the exterior surfaces of these devices shall meet applicable requirements for exhaust air contact surfaces.

#### D4 EXHAUST AIR CONTACT SURFACES

##### D4.1 EXHAUST AIR CONTACT SURFACES OF BAG COLLECTORS INTENDED FOR MANUAL DRY CLEANING OR MANUAL WET CLEANING

###### D4.1.1 Surface Texture

D4.1.1.1 Surfaces, except welds, shall be at least as smooth as a finish obtained with 80 grit silicon carbide, except that:

D4.1.1.1.1 Fire deluge nozzles and fire suppression nozzles shall meet the requirements of Section D2.1.1.3.

###### D4.1.2 Permanent Joints

D4.1.2.1 All permanent joints in metallic exhaust air contact surfaces shall be continuously welded and free of imperfections such as pits, folds, cracks, and crevices. The welds need not be ground.

D4.1.2.2 Lapped joints may be used in these surfaces when necessary for functional reasons provided that the finished joints are welded to meet the requirements of Section D4.1.2.1, and are cleanable and free draining in the installed position.

###### D4.1.3 Radii

D4.1.3.1 There are no minimum radii requirements for these surfaces.

##### D4.2 Exhaust Air Contact Surfaces of Bag Collectors Intended for Mechanical Cleaning

Mechanical cleaning may be accomplished with permanently installed spray devices conforming to Section D1.11.1 and/or the use of inserted removable-type spray devices.

Components which are removed for manual cleaning prior to mechanical cleaning of the bag collector shall comply with the criteria in Section D4.1, except for bag cages as provided for in D1.16.

###### D4.2.1 Surface Texture

D4.2.1.1 These exhaust air contact surfaces shall be at least as smooth as a No. 4 finish, except that:

D4.2.1.1.1 Bag cages shall meet the requirements of Section D1.16 and

D4.2.1.1.2 Fire deluge nozzles and fire suppression nozzles shall meet the requirements of Section D2.1.1.3.

###### D4.2.2 Permanent Joints

D4.2.2.1 All permanent joints in metallic exhaust air contact surfaces shall be continuously welded and shall be at least as smooth as a No. 4 finish, except that:

D4.2.2.1.1 Bag cage construction shall meet the requirements of Section D1.16.

D4.2.2.2 Lapped joints may be used in these surfaces when necessary for functional reasons provided that the finished joints are welded and finished to meet the surface texture requirements of Section D4.2.1, and the radii requirements of Section D4.2.3, and are cleanable and free draining in the installed position.

###### D4.2.3 Radii

D4.2.3.1 All internal angles of less than 135° on exhaust air contact surfaces shall have radii of not less than 1/8 in. (3.18 mm), except that:

D4.2.3.1.1 Minimum radii at the junctures of pipe-to-pipe weldments shall be 1/16 in. (1.59 mm).

D4.2.3.1.2 Smaller radii may be used when they are required for essential functional reasons, such as those on shaft seals and on sanitary fittings as provided for in Section D1.8. and D1.9. In no case shall such radii be less than 1/32 in. (0.794 mm).

D4.2.3.1.3 Radii in standard O-ring grooves shall be as specified in Appendix, Section H.

D4.2.3.1.4 Radii in nonstandard O-ring grooves shall be those radii closest to a standard O-ring as specified above.

D4.2.3.1.5 Minimum radii requirements are not applicable at the junctures of flat sealing surfaces.

**D5 NONPRODUCT CONTACT SURFACES**

D5.1 Nonproduct contact surfaces shall have a relatively smooth finish, be relatively free of pockets and crevices, and be cleanable and those surfaces to be coated shall be effectively prepared for coating. Exposed threads shall be minimized. Exposed braided coverings of cable or hose shall not be used. No continuous or piano-type hinges shall be used on the equipment or its control cabinets. Electrical and utility connections shall be as remote as practical from the product areas. Riveted nameplates or appendages shall not be used. Nameplates shall be welded or effectively sealed to the equipment. Socket head cap screws shall not be used. Knurled surfaces shall not be used. External lap joints for sheathing over air gapped or insulated areas shall be overlapped downward. Overlapped joints shall be sealed between the mating surfaces with a suitable sealant. (See Appendix, Section Q.) Supporting structures, braces, catwalks, stairs, handrails, and guards are considered as part of the building structure. Panels or doors shall be provided to allow easy access to the interior of the equipment. They shall be constructed in a manner that will prevent air entrance. Use of hinges, wing nuts, latches, and similar easy-opening fastening devices are recommended to allow easy access without special tools.

The requirement to be free of pockets and crevices does not apply to exposed exterior surfaces of ancillary equipment such as sanitary fittings, service fittings, electric motors, drives, fans, mechanical linkages, drives for air distribution devices and other similar equipment.

**E PROCESSING AIR**

E1 Processing air shall conform to the filtration criteria of the 3-A Accepted Practices for Spray Drying Systems for Milk and Milk Products, Number 607-.

E2 Processing air contact surfaces, except those provided for in D2.5, shall be manufactured to meet the applicable fabrication criteria of the 3-A Accepted Practices for Spray Drying Systems for Milk and Milk Products, Number 607-.

**APPENDIX**

**F Stainless Steel Materials**

F1 Stainless steel conforming to the applicable composition ranges established by AISI<sup>3</sup> for wrought products (Table 1), or by ACI<sup>4</sup> for cast products (Table 2), should be considered in compliance with the requirements of Section C1.1.1 herein. Where welding is involved, the carbon content of the stainless steel should not exceed 0.08%. The first reference cited in C1.1.1 sets forth the chemical ranges and limits of acceptable stainless steel of the 300 Series.

**F2 Table 1**

WROUGHT PRODUCTS TYPICALLY USED			
UNS#	ASTM <sup>3</sup>	AISI/SAE <sup>3</sup>	Common Names
S30300	A-582	303	Free-Machining S.S.; Austenitic
S30400	A-276 A-666	304	Austenitic S.S.
S30403	A-276 A-666	304L	Low Carbon Austenitic S.S.
S31600	A-276 A-666	316	Austenitic S.S. plus Mo*
S31603	A-276 A-666	316L	Low Carbon Austenitic S.S. plus Mo*

\*Molybdenum

**F3 Table 2**

CAST PRODUCTS			
UNS #	ASTM <sup>3</sup>	ACI <sup>4</sup>	Common Names
J92500	A-351 A-743 A-744	CF-3	Cast 304L
J92800	A-351 A-743 A-744	CF-3M	Cast 316L
J92600	A-351 A-743 A-744	CF-8	Cast 304
J92900	A-351 A-743 A-744	CF-8M	Cast 316
J92180	A-747	CB7 Cu — 1	Cast 17-4 PH
J92110	A-747	CB7 Cu — 2	Cast 15-5 PH
N26055	A-494	CY5Sn BiM	Alloy 88
J92701	A-743	CF-16F	Free Machining Austenitic S.S.

<sup>3</sup> Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959. Phone: (610) 832-9500.

F4 **Table 3 — OPTIONAL METAL ALLOYS**

Optional metal alloys having the following compositions are examples considered in compliance with Section C herein. (Percentages are maximum unless range is given.)

	UNS N08367	UNS S21800	UNS S20161	UNS N26055	UNS N26455	UNS S17400	UNS S15500	UNS S32900	UNS R20500	UNS R50400
	ASTM A743 Grade	ASTM A743 Grade		ASTM A494 Grade	ASTM A494 Grade	ASTM A747 Grade	ASTM A747 Grade		ASTM A560 Grade	ASTM B67 Grade
	CN-3MN	CF-10 SMnN		CY5SnBIM	CW-2M	CB7Cu-1	CB7Cu-2		50Cr-50Ni	C-2
C	0.03	0.10	0.15	0.05	0.02	0.07	0.07	0.20	0.10	0.10
Mn	2.00	7.00-9.00	4.00-6.00	1.5	1.00	0.70	0.70	1.00	0.30	
Si	1.00	3.50-4.50	3.00-4.00	0.5	0.80	1.00	1.00	0.75	1.00	
P	0.040	0.040	0.040	0.03	0.03	0.035	0.035	0.040	0.02	
S	0.010	0.030	0.040	0.03	0.03	0.03	0.03	0.030	0.02	
Cr	20.0-22.0	16.00-18.00	15.0-18.0	11.0-14.0	15.0-17.5	15.50-17.5	14.0-15.50	23.0-28.0	48.0-52.0	
Ni	23.5-25.5	8.00-9.00	4.00-6.00	Balance	Balance	3.60-4.60	4.50-5.50	2.50-5.00	Balance	
Mo	6.0-7.0			2.0-3.5	15.0-17.5			1.00-2.00		
Cb						0.15-0.35	0.15-0.35			
Cu	0.75					2.50-3.20	2.50-3.20			
N	0.18-0.26	0.08-0.18	0.08-0.20			0.05	0.05		0.30	
Fe	Balance	Balance	Balance	2.00	2.00	Balance	Balance	Balance	1.00	0.30
Sn				3.0-5.0						
Bi				3.0-5.0						
W					1.0					
Ti									0.50	Balance
Al									0.25	
Other										H = 0.015 N = 0.03 O = 0.25

F5 Metal alloys or metals other than the above may be as corrosion resistant as 300 Series Stainless steel. This may be shown when metal alloys or metals are tested in accordance with ASTM G31 Laboratory Immersion Corrosion Testing of Metals and have a corrosion rate of less than 10 mil per year. The test parameters such as the type of chemical(s), their concentration(s), and temperature(s) should be representative of cleaning and sanitizing conditions used in dairy equipment. Alloys containing lead, leachable copper, or other toxic metals should not be used.

G **Product Contact Surface Finish**

G1 Surface finish equivalent to 150 grit or better as obtained with silicon carbide, properly applied on stainless steel sheets is considered in compliance with the requirements of Section D2.1.1 herein. A maximum  $R_a$  of 32.0  $\mu\text{m}$ . (0.800  $\mu\text{m}$ ), when measured according to the recommendations in American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)<sup>10</sup> B46.1 — *Surface Texture*, is considered to be equivalent to a No. 4 finish.

G2 Sheets (less than 3/16 inch (4.76 mm) thickness) of 2B (cold rolled) stainless steel, inspected and selected to be free of pits, folds, and crevices are generally found to be as smooth or smoother than stainless steel sheets with a No. 4 finish and are acceptable for the fabrication of bag collectors.

G3 Plates (thickness 3/16 inch (4.76 mm) or more) of 2B (cold rolled) stainless steel, inspected and selected to be free of pits, folds, and crevices, and which are measured to have a maximum  $R_a$  of 32  $\mu\text{m}$ . (0.80  $\mu\text{m}$ ) by the method outlined in G1 are acceptable for the fabrication of bag collectors.

<sup>10</sup> Available from the American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017-2392 (212) 705-7722.

- G4 **The GAR C-9 Scale**
- G4.1 The GAR C-9 Cast Microfinish Comparator<sup>11</sup> is used to evaluate surface roughness of metallic castings. The GAR C-9 Scale provides a measure of the degree of smoothness typical for alloy castings made by currently available casting methods. The GAR C-9 Scale consists of nine RMS surface roughness finishes covering a range from 20  $\mu\text{in.}$  (0.51  $\mu\text{m}$ ) to 900  $\mu\text{in.}$  (22.9  $\mu\text{m}$ ). The scales applicable for investment castings are the C-20, C-30, and C-40 having corresponding RMS values of 60  $\mu\text{in.}$  (1.52  $\mu\text{m}$ ), 120  $\mu\text{in.}$  (3.05  $\mu\text{m}$ ), and 200  $\mu\text{in.}$  (5.08  $\mu\text{m}$ ). Areas of transition, such as chamfers, fillets, beads, etc., may conform to the next roughest scale.

H **TABLE 4 - MINIMUM O-RING GROOVE RADII**

**Minimum Groove Radii Dimensions  
for Standard O-Rings**

O-Ring Cross Section, Nominal (AS 568 <sup>12</sup> )	O-Ring Cross Section, Actual (AS 568)	O-Ring Cross Section, Actual (ISO 3601-1 <sup>13</sup> )	Minimum Groove Radius
1/16 in.	0.070 in.	1.80 mm	0.0160 in. (0.406 mm)
3/32 in.	0.103 in.	2.65 mm	0.0310 in. (0.787 mm)
1/8 in.	0.139 in.	3.55 mm	0.0310 in. (0.787 mm)
3/16 in.	0.210 in.	5.30 mm	0.0620 in. (1.575 mm)
1/4 in.	0.275 in.	7.00 mm	0.0940 in. (2.39 mm)

- I **Cleaning Procedures**
- A cleaning regimen which is effective should be employed. A description of this regimen should be available at the plant.
- J **Dry Cleaning**
- J1 Equipment should be regularly inspected for cleanliness. Dry cleaning should be performed in accordance with need. Too frequent opening of equipment to dry clean may lead to contamination of product contact surfaces and should be avoided.

- J2 Cleaning methods employing pressurized air should be avoided.
- J3 While cleaning the bag collector pressurized air should be applied to all air purged seals.
- J4 Hand and vacuum cleaner brushes, scoops, scrapers, and any other tools used in the dry cleaning of product and process air contact surfaces should not be used on any other surfaces. They should be distinctively marked or color coded. Such tools should be made of materials that can be cleaned and sanitized and should not have wooden parts nor be of mild steel or other iron products that will rust. They should be maintained in a sanitary manner and stored in clean, separate, labeled lockers or cabinets.

K **Sanitary Attire and Cleaning Appliances**

- K1 When it is necessary to enter the bag collector for dry cleaning or inspection;
- K1.1 The personnel should be furnished with freshly laundered multiple-use clothing, or new single service outer clothing and suitable footwear;
- K1.2 A suitable place should be provided for the storage of clothing, footwear, and cleaning tools and appliances;
- K1.3 A clean place should be provided adjacent to the point of entry to the bag collector which provides;
- K1.3.1 An area to which the laundered or new single service outer clothing and footwear can be carried;
- K1.3.2 An area in which outer clothing can be removed and stored;
- K1.3.3 An area in which the laundered or new single service outer clothing and footwear can be donned;
- K1.3.4 A special sanitary platform, or a clean floor area covered with single-service plastic or clean paper to maintain the cleanliness of the footwear;

<sup>11</sup> Available from GAR Electroforming Division, Box 340, Danbury, CT 06813-0340 (203) 744-4300.

<sup>12</sup> The document establishing these standard dimensions is Aerospace Standard (AS) 568, published by SAE, 400 Commonwealth Drive, Warrendale, PA 15086 (412-776-4970).

<sup>13</sup> The document establishing these standard dimensions is ISO 3601-1; published by the International Organization for Standardization (ISO), 1 Rue de Varembe, Case Postale 58, CH 1 1211, Geneva, Switzerland (41-22-734-1240).

K1.4 Garments and boots worn for interior cleaning should be worn only while cleaning the bag collector and not while performing other tasks. Boots that have been worn while walking outside the bag collector should be replaced with other suitable boots before reentering.

K2 Cleaning tools and appliances that are used in the bag collector should be kept clean and used for no other purpose than dry cleaning of dry product systems.

L **Manual Wet Cleaning**

L1 Pulse filter bags repeatedly to recover as much powder as possible. Remove bags and distribution devices, venturis, and bag cages. Launder and dry the filter bags, unless new bags are to be installed. Remove all loose dry product. Rinse all parts with clear water and follow with a thorough cleaning of all surfaces using a general purpose cleanser. Rinse thoroughly to remove all cleaning solution or soil. It is recommended that hot water be used for rinsing in order to promote drying.

L2 Allow all removed, manually cleaned components to air dry completely prior to assembly. These cleaned and dry components should be handled in a sanitary manner during drying, storage, and reassembly. After the collector is assembled, all openings should be protected against contamination.

M **Mechanical Cleaning with Inserted or Permanently Installed Spray Cleaning Devices**

M1 Preparation for Cleaning:

- a. Pulse filter bags repeatedly to recover as much powder as possible.
- b. Remove all parts not intended for mechanical cleaning, such as air distribution devices, venturis, aluminum components, bag cages and filter bags. Launder and dry the filter bags, unless new bags are to be installed. Manually clean all the other removed components. Rinse with hot water to promote drying.
- c. Remove any additional parts intended for manual cleaning. (For instance, product outlet valve, or rotor for such valve.)
- d. If some of the components of a dry product system are not to be wet cleaned, they should be completely segregated during the wet cleaning procedure. Examples of such segregation:

- Loosening a flange, inserting a shut-off plate, then tightening the flange to wet clean on one side of the flange.
  - Disconnecting and capping off a sensor tube for an instrument that measures air pressure.
  - Removal of a star valve and replacement with a solution return tank for wet cleaning of the upstream bag collector.
- e. Insert spray cleaning device(s). (When used.)

M2 Typical Cleaning Steps:

- a. Rinse with water to drain using the provided spray cleaning devices.
- b. Recycled water rinse. (Time/temperature dependent on product.)
- c. Recycled cleaning solution, using suitable cleaner material(s) and with time/temperature dependent on product. Recommendations of the cleaning chemical supplier should be followed with regard to time, temperature, and concentration of specific detergents.
- d. Hot water rinse. Remove spray cleaning devices.

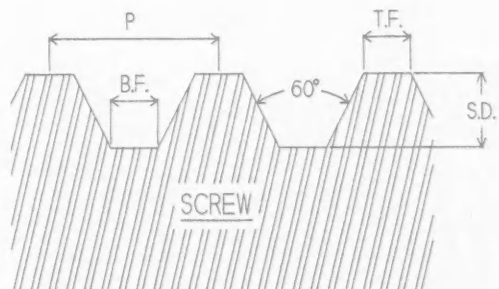
NOTE: An additional rinse/acid-type cleaning/rinse cycle may be advisable at periodic intervals).

M3 Reassembly:

Allow all removed, manually cleaned components to air dry completely prior to assembly. These cleaned and dry components should be handled in a sanitary manner during drying, storage, and reassembly. After the collector is assembled, all openings should be protected against contamination.

N **RESERVED**

O **American Standard Stud ACME Thread**



P = PITCH	P = 1/T.P.I.
S.D. = SINGLE DEPTH	S.D. = 0.433 x P
T.F. = TOP FLAT	T.F. = 0.250 x P
B.F. = BOTTOM FLAT	B.F. = 0.227 x P
T.P.I. = THREADS PER INCH	

P	<b>Filter Bags</b>				<b>and title of responsible official}</b> is responsible for maintaining, publishing, and distributing this EDTCF.
P1	When filter bags are to be wet cleaned by any method and dried for re-use, attention should be given to the kind of filter material, method of sewing or heat-sealing of seams, internal stiffening or retention components, and design of bottom and top areas so that effective cleaning and drying can be achieved.	S3.1.1	Implementation: All divisions, specifically development engineering, standards engineering, sales engineering, and product departments are responsible for implementing this EDTCF.		
Q	<b>Nonproduct Contact Surfaces</b>	S4	<b>Applicability</b>		
Q1	Room temperature vulcanizing silicone rubber may be used for formed-in-place gaskets on joints in nonproduct contact surfaces, such as coverings for insulation. This product should only be used where functionally necessary.	S4.1	The 3-A Sanitary Standards and 3-A Accepted Practices are voluntarily applied as suitable sanitary criteria for dairy and food processing equipment. 3-A Sanitary Standards are referenced in the Grade A Pasteurized Milk Ordinance: "Equipment manufactured in conformity to 3-A Sanitary Standards complies with the sanitary design and construction standards of this Ordinance."		
R	<b>Installation Guidance</b>				
R1	Appropriate regulatory agencies should be contacted for guidance during bag collector construction and/or installation.	S5	<b>References</b>		
S	<b>Engineering Design and Technical Construction File</b>	S5.1	List any additional regulations that apply to the equipment or system covered by this EDTCF.		
	The following is an example of an engineering design and technical construction file (EDTCF) to be maintained by the fabricator as evidence of complying with 3-A Sanitary Standards or 3-A Accepted Practices. (The file may contain more or less information as applicable to the equipment or system.)	S5.2	Date of conformity or 3-A Symbol Authorization and certificate number, if authorized.		
		S6	<b>Design and Technical Construction File</b>		
S1	<b>Purpose</b>	S6.1	The Engineering Design and Technical Construction File may consist of the following:		
S1.1	To establish and document the material, fabrication, and installation (where appropriate) requirements for the engineering design and technical construction files for all products, assemblies, and sub-assemblies supplied by the manufacturer thereof to be in compliance with the sanitary criteria found in 3-A Sanitary Standards or 3-A Accepted Practices. It is recommended that the engineering and construction file or files be submitted with applications for 3-A Symbol use authorization.		a. an overall drawing of the subject equipment;		
			b. full detailed drawings, accompanied by any calculations, notes, test results, etc. required to check the conformity of the equipment with the 3-A Standards or 3-A Practices;		
			c. a list of:		
			1. the essential requirements of the standards or practices;		
			2. other technical specifications, which were used when the equipment was designed;		
			d. a description of methods adopted;		
			e. if essential, any technical report or certificate obtained from a competent testing body or laboratory;		
			f. any technical report giving the results of tests carried out internally by Engineering or others;		
			g. documentation and test reports on any research or tests on components, assemblies and/or the complete product to determine and demonstrate that by its design and construction the product is capable of being installed, put into service, and operated in a sanitary manner (optional);		
			h. a determination of the foreseeable lifetime of the product (optional);		
S2	<b>Scope</b>				
S2.1	This EDTCF applies to equipment specified by:				
S2.1.1	3-A Sanitary Standards for Bag Collectors, Number 40-02.				
S2.1.2	List all applicable 3-A Sanitary Standards and 3-A Accepted Practices.				
S3	<b>Responsibilities</b>				
S3.1	This EDTCF is maintained by: The Engineering Manager (or other company official) {name				



- i. a copy of the instructions for the product (Instruction Manuals/ Instruction Books);
  - j. for serial manufacturing, the internal measures that will be implemented to insure that the equipment will continue to be manufactured in conformity to the provisions of the 3-A Sanitary Standards or 3-A Accepted Practices;
  - k. engineering reports;
  - l. laboratory reports;
  - m. bills of material;
  - n. wiring diagrams, if applicable;
  - o. sales order engineering files;
  - p. hazard evaluation committee reports, if executed;
  - q. change records;
  - r. customer specifications;
  - s. any notified body technical reports and certification tests;
  - t. copy of the 3-A Symbol authorization, if applicable.
- S6.2 The file does not have to include detailed plans or any other specific information regarding the sub-assemblies, tooling, or fixtures used for the manufacture of the product unless a knowledge of them is essential for verification of conformity to the basic sanitary requirements found in 3-A documents.
- S6.3 The documentation referred to in S6.1 above need not permanently exist in a material manner in the EDTCF, but it must be possible to assemble them and make them available within a period of

time commensurate with its importance (one week is considered reasonable time). As a minimum, each product EDTCF must physically contain an index of the applicable documents of S6.1 above.

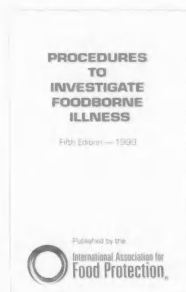
- S6.4 The EDTCF may be in hard copy or software form.
- S7 **Confidentiality**
- S7.1 The EDTCF is the property of the manufacturer and is shown at their discretion, except that all or part of this file will be available to the 3-A Symbol Council or a regulatory agency for cause and upon request.
- S8 **File Location**
- S8.1 The EDTCF shall be maintained at {location}.
- S9 **File Retention**
- S9.1 The EDTCF (including all documentation referred to in S6.1) shall be retained and kept available for 12 years following the date of placing the product in use or from the last unit produced in the case of series manufacture.

These standards are effective November 24, 2002.



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# 3-A<sup>®</sup> Sanitary Standards for Refractometers and Energy Absorbing Optical Sensors for Milk and Milk Products, Number 46-03

Formulated by  
International Association of Food Industry Suppliers (IAFIS)  
International Association for Food Protection (IAFP)  
United States Public Health Service (USPHS)  
The Dairy Industry Committee (DIC)  
United States Department of Agriculture – Dairy Programs (USDA)

It is the purpose of the IAFIS, IAFP, USPHS, DIC, and USDA in connection with the development of the 3-A Sanitary Standards Program to allow and encourage full freedom for inventive genius or new developments. Refractometers and energy absorbing optical sensor specifications heretofore or hereafter developed which so differ in design, materials, and fabrication or otherwise as not to conform to the following standards but which, in the fabricator's opinion, are equivalent or better, may be submitted for the joint consideration of the IAFIS, IAFP, USPHS, DIC, and USDA at any time. The 3-A Sanitary Standards and 3-A Accepted Practices provide hygienic criteria applicable to equipment and systems used to produce, process, and package milk, milk products, and other perishable foods or comestible products. Standard English is the official language of 3-A Sanitary Standards and 3-A Accepted Practices.

## A SCOPE

- A1 These standards cover the sanitary aspects of refractometers and energy absorbing optical sensors used on milk and milk products equipment for sensing concentration, turbidity and/or color.
- A2 In order to conform with these 3-A Sanitary Standards, refractometers and energy absorbing optical sensors shall comply with the following design, material, and fabrication criteria and the applicable documents referenced herein.<sup>1</sup>

## B DEFINITIONS

- B1 *Product*: Shall mean milk and milk products.
- B2 *Refractometer*: A device to measure the refractive index of a product.

B3 *Energy Absorbing Optical Sensor*: A device to measure the energy absorption, such as infrared energy, of a product.

B4 *Optical Element*: An optical device utilized to transmit, reflect, refract, alter the angle of or in some way interface energy with a milk or milk product.

B5 *Flushing Nozzle*: A device utilized to direct flushing media to the optical surface.

## B6 Surfaces

B6.1 *Product Contact Surfaces*: Shall mean all surfaces that are exposed to the product, or surfaces from which liquids may drain, drop, or be drawn into the product.

B6.2 *Nonproduct Contact Surfaces*: Shall mean all other exposed surfaces.

<sup>1</sup> Use current revisions or editions of all referenced documents cited herein.

- B6.3 *Optical Surface*: Shall mean the optically sensitive product contact surface of the optical element.
- B7 **Surface Modifications<sup>2</sup>**
- B7.1 *Coatings*: Shall mean the results of a process where a different material is deposited to create a new surface. There is appreciable, typically more than 1 um, build-up of new material.
- B7.1.1 Coating process include:  
 1. Chemical  
 2. Electrodeposition<sup>3</sup> (including gold)
- B8 *Mechanical Cleaning or Mechanically Cleaned*: Shall denote cleaning by circulation and/or flowing chemical detergent solutions and water rinses onto and over the surfaces to be cleaned by, mechanical means.
- B9 *Optical Surface Flushing*: Shall mean the flushing of the optical surfaces with a flushing media so as to provide an obstruction-free interface.
- B10 *Flushing Media*: Shall mean a safe and product-compatible media such as safe water, culinary steam, or milk or milk product.
- B10.1 *Safe Water*: Shall mean water from a supply properly located, protected, and operated, and shall be of a safe, sanitary quality. The water shall meet the standards prescribed in the National Primary Drinking Water Regulation of the Environmental Protection Agency (EPA) as referenced in The Code of Federal Regulations<sup>4</sup> (CFR), Title 40, Parts 141, 142, and 143. (Information also available from the environmental protection agency [EPA] Drinking Water Hot Line: 800-426-4791.)
- B10.2 *Culinary Steam*: Shall mean steam produced using a system meeting criteria in the 3-A Accepted Practices for a Method of Producing Steam of a Culinary Quality, Number 609-.

## C MATERIALS

### C1 Metals

C1.1 Product contact surfaces shall be of stainless steel of the American Iron and Steel Institute (AISI) 300 Series<sup>5</sup> (except 301 and 302) or corresponding Alloy Cast Institute (ACI) types<sup>6</sup> (See Appendix, Section E), or metal which under conditions of intended use is at least as corrosion resistant as stainless steel of the foregoing types, and is nontoxic and nonabsorbent, except that:

C1.1.1 Gold or Silver bearing solder may be used for connecting optical elements to the element housing and shall be corrosion resistant, free of cadmium, lead and antimony, nonabsorbent, and shall not impart any toxic substance to the product when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization.

### C2 Nonmetals

C2.1 Rubber and rubber-like materials may be used for O-rings, gaskets, and parts having the same functional purposes.

C2.2 Rubber and rubber-like materials, when used for the above-specified application(s), shall conform with the applicable provisions of the 3-A Sanitary Standards for Multiple-Use Rubber and Rubber-Like Materials Used as Product Contact Surfaces in Dairy Equipment, Number 18-.

C2.3 Plastic materials may be used for optical surfaces, optical elements, optical element insulators, optical element holders, gaskets and parts having the same functional purposes.

C2.4 Plastic materials, when used for the above specified application(s), shall conform with the applicable provisions of the 3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Number 20-.

<sup>2</sup> Additional information on surface modification is contained in *Advanced Materials and Processes*, Volume 137 (1); "Coatings and Coating Practices" by H. Herman, "Surface Modification" by F. A. Smid. ASM International, Materials Park, OH 44073 (216) 338-5151.

<sup>3</sup> Federal Specification #QQ-C-320B for Chromium Plating (Electrodeposited), with Amendment 4, Federal Specification #QQ-N-290A for Nickel Plating (Electrodeposited). Available from the General Services Administration, Federal Supply Services Bureau, Specification Section, 470 East L Enfant Plaza, Suite 8100, Washington, DC 20407 (202) 755-0325.

<sup>4</sup> For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (202) 512-1800.

<sup>5</sup> The data for this series are contained in the *AISI Steel Products Manual, Stainless & Heat Resisting Steels*, Table 2-1. Available from the American Iron and Steel Society, 186 Thorn Hill Road, Warrendale, PA 15086 (724) 776-1535.

<sup>6</sup> Steel Founders Society of America, Cast Metal Federation Building, 455 State Street, Des Plaines, IL 60016 (708) 299-9160.

- C2.5 Rubber and rubber-like materials and other materials listed in C2.7, and plastic materials having product contact surfaces shall be of such composition as to retain their surface and conformational characteristics and be thermally stable when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization.
- C2.6 The final bond and residual adhesive, if used, of bonded rubber and rubber-like materials, and or other materials listed in C2.7, and bonded plastic materials shall be nontoxic.<sup>7</sup>
- C2.7 Where materials having certain inherent functional properties are required for optical surfaces, or optical elements materials such as glass, sapphire, quartz, fluorspar and spinel may be used.
- C2.7.1 Materials used for optical surfaces or optical elements shall be inert, nonporous, nontoxic, nonabsorbent, insoluble, resistant to scratching, scoring and distortion when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization.
- C2.7.2 Glass, when used, shall be of a clear, heat resistant type.
- C2.7.3 Optical elements coated with gold and/or nickel may be used.
- C3 Sterilizability**
- C3.1 Materials used as product contact surface(s) in the construction of refractometers and energy absorbing optical sensors used in a processing system to be sterilized by heat and operated at a temperature of 250°F (121°C) or higher shall be such that they can be (1) sterilized by saturated steam or water under pressure (at least 15.3 psig or 106 kPa) at a temperature of at least 250°F (121°C) and (2) operated at the temperature required for processing.
- C4 Nonproduct Contact Surfaces**
- C4.1 Nonproduct contact surfaces shall be of corrosion-resistant material or material that is rendered corrosion resistant. If coated, the coating used shall adhere. All nonproduct contact surfaces shall be relatively nonabsorbent, durable, and cleanable. Parts removable for cleaning having

both product contact and nonproduct contact surfaces shall not be painted.

## D FABRICATION

### D1 Surface Texture

- D1.1 All product contact surfaces shall have a finish at least as smooth as a No. 4 ground finish on stainless steel sheets and be free of imperfections such as pits, folds, and crevices in the final fabricated form. (See Appendix, Section F.)

### D2 Permanent Joints

- D2.1 All permanent joints in metallic product contact surfaces shall be continuously welded, except that:
- D2.1.1 In such cases where welding is impractical, soldering may be employed where necessary for essential functional reasons such as attaching a gold and/or nickel coated optical element to a metallic product surface.

- D2.2 A permanent joint between a metallic product surface and a coated optical element may be formed with gold or silver bearing solder. The metallic and optical joint areas having product contact surfaces shall be at least as smooth as a No. 4 finish on stainless steel sheet free of imperfections such as pits, folds, and crevices.

### D3 Bonded Materials

- D3.1 Bonded rubber and rubber-like materials, other bonded materials listed in C2.7, and bonded plastic materials having product contact surfaces shall be bonded in such a manner that the bond is continuous and mechanically sound so that when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization, the rubber or rubber-like materials, other materials listed in C2.7, or plastic material does not separate from the base material to which it is bonded.

### D4 Cleaning and Inspectability

- D4.1 Product contact surfaces not designed to be mechanically cleaned shall be easily accessible for cleaning and inspection either when in an assembled position or when removed. Removable parts shall be readily demountable.

<sup>7</sup> Adhesives shall comply with 21 CFR 175 - Indirect Food Additives: Adhesives and Components of Coatings. Document for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (202) 512-1800.

D4.2 Optical elements and flushing nozzles that are to be mechanically cleaned shall be designed so that the product contact surfaces of these devices can be mechanically cleaned, and all nonremovable appurtenances thereto can be mechanically cleaned and are accessible for inspection.

D4.3 When used, systems designed to flush the optical surface during processing shall be designed to meet the following criteria:

D4.4 The flushing system nozzle shall be designed to minimize the quantity of flushing media required to adequately flush the optical surface, and shall not adulterate the product with added water when such addition is not permitted.

D4.5 When flushing media is introduced into the product during optical surface flushing, an isolation valve shall be installed as close as practical to the point of flushing media application, and a spring loaded check valve of sanitary design shall be installed between the valve and the point of flushing media application.

D4.6 Steam or water, when used as flushing media, shall comply with Section B10.1 or B10.2 herein.

#### D5 **Draining**

D5.1 Product contact surfaces shall be self-draining except for normal adherence.

#### D6 **Fittings and Valves**

D6.1 All sanitary fittings and connections shall conform with the applicable provisions of 3-A Sanitary Standards for Plug-Type Valves for Milk and Milk Products, Number 51-, 3-A Sanitary Standards for Thermoplastic Plug-Type Valves for Milk and Milk Products, Number 52-, 3-A Sanitary Standards for Compression-Type Valves for Milk and Milk Products, Number 53-, 3-A Sanitary Standards for Diaphragm-Type Valves for Milk and Milk Products, Number 54-, 3-A Sanitary Standards for Boot Seal-Type Valves for Milk and Milk Products, Number 55-, or 3-A Sanitary Standards for Sanitary Fittings for Milk and Milk Products, Number 63-.

#### D7 **Instrument Connections**

D7.1 All instrument connections having product contact surfaces shall conform to the 3-A Sanitary Standards for Sensors and Sensor Fittings and Connections Used on Fluid Milk and Milk Products Equipment, Number 74-.

#### D8 **Sanitary Tubing**

D8.1 All tubing including that for the flushing media lines from a check valve forward to the process shall comply with the applicable provisions for

welded sanitary product pipelines found in the 3-A Accepted Practices for Permanently Installed Sanitary Product Pipelines and Cleaning Systems, Number 605-, and/or with 3-A Sanitary Standards for Polished Metal Tubing for Dairy Products, Number 33-.

#### D9 **Gaskets**

D9.1 Gaskets having a product contact surface shall be removable or bonded.

D9.2 Bonded rubber and rubber-like materials and bonded plastic materials having product contact surfaces shall be bonded in a manner that the bond is continuous and mechanically sound so that when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization the rubber and rubber-like material or the plastic material does not separate from the base material to which it is bonded.

D9.3 Grooves in gaskets shall be no deeper than their width, unless the gasket is readily removable and reversible for cleaning.

D9.4 Gasket grooves or gasket retaining grooves in product contact surfaces for removable gaskets shall not exceed 1/4 in. (6 mm) in depth or be less than 1/4 in. (6 mm) wide except those for standard O-rings smaller than 1/4 in. (6 mm).

#### D10 **Radii**

D10.1 All internal angles of less than 135° on product contact surfaces shall have radii of not less than 1/4 in. (6 mm) except that:

D10.1.1 Smaller radii may be used when they are required for essential functional reasons, such as those in the nozzle of the optical surface flushing fitting, the junction of the optical surface flushing fitting with the refractometer or other optical sensor body, and the junction of the refractometer or other optical sensor body with the mounting fitting. In no case shall such radii be less than 1/32 in. (1 mm).

D10.1.2 The radii in gasket grooves, gasket retaining grooves, or grooves in gaskets, except for those for standard 1/4 in. (6 mm) and smaller O-rings, shall be not less than 1/8 in. (3 mm).

D10.1.3 The radii in grooves for standard 1/4 in. (6 mm) O-rings shall not be less than 3/32 in. (2 mm) and for standard 1/8 in. (3 mm) O-rings shall be not less than 1/32 in. (1 mm).

D10.1.4 The minimum radii for fillets of welds in product contact surfaces shall be not less than 1/4 in. (6 mm) except that the minimum radii for such welds may be 1/8 in. (3 mm) when the thickness of one or both parts joined is less than 3/16 in. (5 mm).

**D11 Threads**

D11.1 There shall be no threads on product contact surfaces.

**D12 Sterilization Systems**

D12.1 Refractometers and energy absorbing optical sensors used in a processing system to be sterilized by heat and operated at a temperature of 250°F (121°C) or higher shall comply with the following additional criteria:

D12.2 The construction shall be such that all product contact surfaces can be (1) sterilized by saturated steam or water under pressure (at least 15.3 psig or 106 kPa) at a temperature of at least 250°F (121°C) and (2) operated at the temperature required for processing.

D12.3 Devices that have one or more product contact surfaces to be used in such a processing system, not designed so that the system is automatically shut down if the product pressure in the system becomes less than that of the atmosphere and cannot be restarted until the system is re-sterilized, shall have a steam or other sterilizing medium chamber surrounding the joint at the product contact surface between the fitting and the device.

D12.4 The connection(s) on the steam or other sterilizing medium chamber(s) for the steam or other sterilizing medium lines shall be such that the lines can be securely fastened to the connection(s). The lines shall be connected in a manner that they may be disconnected to allow the sterilizing medium chamber to be inspected and cleaned if necessary.

**D13 Nonproduct Contact Surfaces**

D13.1 Nonproduct contact surfaces shall have a smooth finish, be free of pockets and crevices, and be readily cleanable and those surfaces to be coated shall be effectively prepared for coating.

**APPENDIX**

**E STAINLESS STEEL MATERIALS**

Stainless steel conforming to the applicable composition ranges established by AISI for wrought products, or by ACI for cast products, should be considered in compliance with the requirements of Section C1 herein. Where welding is involved, the carbon content of the stainless steel should not exceed 0.08%. The first reference cited in C1 sets forth the chemical ranges and limits of acceptable stainless steel of the 300 Series. Cast grades of stainless steel corresponding to types 303, 304, and 316 are designated CF-16F, CF-8, and CF-8M, respectively. The chemical compositions of these cast grades are covered by ASTM<sup>8</sup> specifications A351/A351M, A743/A743M and A744/A744M.

**F PRODUCT CONTACT SURFACE FINISH**

Surface finish equivalent to 150 grit or better as obtained with silicon carbide, properly applied on stainless steel sheets, is considered in compliance with the requirements of Section D1 herein.

**G** The flushing media shall not contaminate the product with toxic substances or foreign material through the use of sub-standard steam or steam distribution systems (See Section B9.2) or sub-standard water (See Section B9.1).

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**These amended standards are effective November 24, 2002.**

<sup>8</sup> Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959. Phone: (610) 832-9500.

## 3-A<sup>®</sup> Sanitary Standards for Sanitary Fittings, Number 63-03

Formulated by  
*International Association of Food Industry Suppliers (IAFIS)*  
*International Association for Food Protection (IAFP)*  
*United States Public Health Service (USPHS)*  
*The Dairy Industry Committee (DIC)*  
*United States Department of Agriculture – Dairy Programs (USDA)*

It is the purpose of the IAFIS, IAFP, USPHS, DIC, and USDA in connection with the development of the 3-A Sanitary Standards Program to allow and encourage full freedom for inventive genius or new developments. Sanitary fittings specifications heretofore or hereafter developed which so differ in design, materials, and fabrication or otherwise as not to conform to the following standards but which, in the fabricator's opinion, are equivalent or better, may be submitted for the joint consideration of the IAFIS, IAFP, USPHS, DIC, and USDA at any time. The 3-A Sanitary Standards and 3-A Accepted Practices provide hygienic criteria applicable to equipment and systems used to produce, process, and package milk, milk products, and other perishable foods or comestible products. Standard English is the official language of 3-A Sanitary Standards and 3-A Accepted Practices.

### A SCOPE

- A1 These standards cover the sanitary aspects of fittings and gaskets for fittings used on processing equipment and pipelines which hold or convey milk, milk products, or other comestibles. These standards cover the product contact surfaces of disassemblable joints on sanitary fittings.
- A1.1 Standards for fabricated hose assemblies are found in 3-A Sanitary Standards for Hose Assemblies for Milk and Milk Products, Number 62-<sup>1</sup>
- A2 These standards do not cover:
  - A2.1 Fittings, such as recessed ferrules, which are attached to a pipeline or equipment by means of soldering.
  - A2.2 Recessless or rolled on fittings, except as allowed in Section D2.1.1.
- A3 In order to conform to these 3-A Sanitary Standards for Sanitary Fittings, fittings shall conform to the following design, material, and fabrication criteria, and the applicable documents referenced herein.<sup>2</sup>

### B DEFINITIONS

- B1 *Product*: Shall mean milk, milk products, or other comestibles.
- B2 **Surfaces**
  - B2.1 *Product Contact Surfaces*: Shall mean all surfaces which are exposed to the product and surfaces from which liquid may drain, drop, diffuse, or be drawn into the product.
  - B2.2 *Nonproduct Contact Surfaces*: Shall mean all other exposed surfaces.
- B3 **Cleaning**
  - B3.1 *Mechanical Cleaning or Mechanically Cleaned*: Shall mean soil removal by impingement, circulation, or flowing chemical detergent solutions and water rinses onto and over the surfaces to be cleaned by mechanical means in equipment or systems specifically designed for this purpose.

<sup>1</sup> 3-A Symbol authorization shall not be granted to a fitting used on a fabricated hose assembly.

<sup>2</sup> Use current revisions or editions of all referenced documents cited herein.

- B3.1.1 *Cleaned In Place (CIP)*: Shall mean mechanical cleaning of equipment, the cleanability of which has been sufficiently established such that all product or solution contact surfaces do not have to be readily accessible for inspection (i.e. pipelines that have welded joints).
- B3.2 *Manual (COP) Cleaning*: Shall mean soil removal when the equipment is partially or totally disassembled. Soil removal is effected with chemical solutions and water rinses with the assistance of one or a combination of brushes, nonmetallic scouring pads and scrapers, high or low pressure hoses and tank(s) which may be fitted with recirculating pump(s), and with all cleaning aids manipulated by hand.
- B4 Fitting Types**
- B4.1 *Butt Weld Fittings*: Shall mean fittings which have at least one plain end intended for welding to a pipeline or equipment.
- B4.2 *Mechanically Cleaned Fittings*: Shall mean a fitting which is cleaned while fully assembled. If such a fitting has a demountable joint, the joint is self-centering, employs a gasket, and the resulting gasketed joint forms a substantially flush interior surface. A fitting for attachment to glass or plastic which meets the preceding criteria may also be a mechanically cleaned fitting.
- B4.3 *Manually Cleaned Fittings*: Shall mean a fitting which has a disassemblable joint that is intended for dismantling for manual cleaning. An example of a manually cleaned fitting is the bevel-seat type.
- B5 *Substantially Flush*: Shall mean mating surfaces or other juxtaposed surfaces shall be within 1/32 in. (0.794 mm).
- B6 *Simple Hand Tools*: Shall mean implements normally used by operating and cleaning personnel such as a screwdriver, wrench, or mallet.
- B7 *Coatings*: Shall mean the results of a process where a different material is deposited to create a new surface. There is an appreciable, typically more than 1 µm, build-up of new material.

<sup>3</sup> The data for this series are contained in the *AISI Steel Products Manual, Stainless & Heat Resisting Steels*, Table 2-1. Available from the American Iron and Steel Society, 186 Thorn Hill Road, Warrendale, PA 15086 (724) 776-1535.

<sup>4</sup> Steel Founders Society of America, Cast Metal Federation Building, 455 State Street, Des Plaines, IL 60016 (708) 299-9160.

## C MATERIALS

### C1 Metals

- C1.1 Product contact surfaces shall be of stainless steel of the AISI 300 Series<sup>3</sup> or corresponding ACI types<sup>4</sup> (See Appendix, Section F), or metal which under conditions of intended use is at least as corrosion resistant as stainless steel of the foregoing types, and is nontoxic and nonabsorbent.

### C2 Nonmetal

- C2.1 Rubber and rubber-like materials may be used for coatings for sealing surfaces, gaskets, O-rings, seals, and parts having the same functional purposes.
- C2.1.1 Rubber and rubber-like materials, when used for the above-specified applications, shall conform to the applicable provisions of the 3-A Sanitary Standards for Multiple-Use Rubber and Rubber-Like Materials Used as Product Contact Surfaces in Dairy Equipment, Number 18-.
- C2.2 Plastic materials may be used for coatings for sealing surfaces, fittings, gaskets, O-rings, seals, and parts having the same functional purposes.
- C2.2.1 Plastic materials, when used for the above-specified applications, shall conform to the applicable provisions of the 3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Number 20-.
- C2.3 Rubber and rubber-like materials and plastic materials having product contact surfaces shall be of such composition as to retain their surface and conformational characteristics when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization.
- C2.4 Rubber and rubber-like materials and plastic materials having product contact surfaces that are a bonded coating or a covering shall be of such composition as to retain their surface and conformational characteristics when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization.



C2.5 The final bond and residual adhesive, if used, on bonded rubber and rubber-like materials and bonded plastic materials shall be nontoxic.<sup>5</sup>

C2.6 Glass may be used for fittings specified in the 3-A Accepted Practices for the Design, Fabrication, and Installation of Milking and Milk Handling Equipment, Number 606-, and when used, shall be of a clear heat-resistant type.

### C3 Sterilizability

C3.1 In a processing system to be sterilized by heat and operated at a temperature of 250°F (121°C) or higher, all materials having product contact surface(s) used in the construction of fittings, gaskets, and nonmetallic component parts shall be such that they can be (1) sterilized by saturated steam or water under pressure (at least 15.3 psig or 106 kPa) at a temperature of at least 250°F (121°C) and (2) operated at the temperature required for processing.

### C4 Nonproduct Contact Surfaces

C4.1 All nonproduct contact surfaces shall be of corrosion-resistant material. All nonproduct contact surfaces shall be relatively nonabsorbent, durable, and cleanable.

## D FABRICATION

### D1 Surface Texture

D1.1 All product contact surfaces shall have a finish at least as smooth as a 32  $\mu\text{in. } R_a$  (0.8  $\mu\text{m } R_a$ ) finish on stainless steel sheets and be free of imperfections such as pits, folds, and crevices in the final fabricated form. (See Appendix, Section G.)

### D2 Permanent Joints

D2.1 All permanent joints in metallic product contact surfaces of fittings shall be continuously welded. Welded areas on product contact surfaces shall be at least as smooth as a 32  $\mu\text{in. } R_a$  (0.8  $\mu\text{m } R_a$ ) finish on stainless steel sheets, and be free of imperfections such as pits, folds, and crevices, except that:

D2.1.1 Recessless or rolled-on fittings may be used when modifying or repairing existing on-site farm milk handling systems.

## D3 Cleaning and Inspectability

D3.1 Fittings that are to be CIP or mechanically cleaned shall be so designed. If such fittings have demountable joints, the joints shall be gasketed and so designed as to cause self-centering of gaskets, and to result in substantially flush interior fit of gaskets when correctly assembled. Any demountable product contact parts shall be readily demountable by hand or using simple hand tools.

D3.2 Manually cleaned fittings shall have demountable joints to allow easy access for cleaning and inspection. Use of gaskets in the joints is optional. Any demountable product contact parts shall be readily demountable by hand or using simple hand tools.

## D4 Draining

D4.1 All product contact surfaces shall be self-draining when properly installed.

## D5 Threads

D5.1 There shall be no threads on product contact surfaces.

## D6 Dimensions and Tolerances

D6.1 The inside diameter of the butt weld ends of plain end fittings shall be dimensioned to mate with the part to which it is to be welded and be substantially flush.

D6.2 Mating faces of demountable joints on sanitary fittings shall have internal diameters meeting the dimension and tolerance specifications in Appendix H, Table 1 except:

D6.2.1 Fittings for attachment to glass or plastic components which do not have the standard ID dimensions of metal tubing.

D6.2.2 Fittings for special applications which require other than the standard ID dimensions of tubing.

<sup>5</sup> Adhesives shall comply with 21 CFR 175 - Indirect Food Additives: Adhesives and Components of Coatings. Document for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (202) 512-1800.

D6.3 Fittings excepted by Sections D6.2.1 and D6.2.2 shall be dimensioned to mate with the internal dimension of its counterpart tubing, pipe, glass tubing, plastic component, etc. (Dimension tolerances for these excepted fittings are not provided by these Sanitary Standards.)

**D7 Gaskets and Gasket Retaining Grooves**

D7.1 Gaskets having a product contact surface shall be demountable or bonded.

D7.2 Grooves in gaskets shall be no deeper than their width.

D7.3 Gasket retaining grooves in product contact surfaces for demountable gaskets shall not exceed 1/4 in. (6.35 mm) in depth or be less than 1/4 in. (6.35 mm) wide except those for standard O-rings smaller than 1/4 in. (6.35 mm), and those for self-centering gaskets.

**D8 Bonded Materials**

D8.1 Bonded rubber and rubber-like materials and bonded plastic materials having product contact surfaces shall be bonded in such a manner that the bond is continuous and mechanically sound, so that when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization, the rubber or rubber-like material or the plastic material does not separate from the base material to which it is bonded.

**D9 Coatings**

D9.1 Coatings, if used, shall be free from surface delamination, pitting, flaking, spalling, blistering and distortion when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization.

**D10 Radii**

D10.1 All internal angles of less than 135° on product contact surfaces shall have radii of not less than 1/8 in. (3.18 mm), except that:

D10.1.1 Smaller radii may be used when they are required for essential functional reasons, such as those in gasket retaining grooves. In no case shall such radii be less than 1/64 in. (0.397 mm).

D10.1.2 Radii in standard O-ring grooves shall be as specified in Appendix I.

D10.1.3 Radii in nonstandard O-ring grooves shall be those radii closest to a standard O-ring as specified in Appendix I.

**E STERILIZABLE FITTINGS**

E1 Fittings which have demountable joints and are to be used in a processing system to be sterilized by heat and operated at a temperature of 250°F (121°C) or higher shall conform to the following additional criteria:

E1.1 The construction shall be such that all product contact surfaces can be (1) sterilized by saturated steam or water under pressure (at least 15.3 psig or 106 kPa) at a temperature of at least 250°F (121°C) and (2) operated at the temperature required for processing.

E1.2 Fittings that have a product contact surface(s) to be used in such a processing system, not designed so that the system is automatically shut down if the product pressure in the system becomes less than that of the atmosphere and cannot be restarted until the system is resterilized, shall have a steam or other sterilizing medium chamber surrounding the fittings at the product contact surface if required to maintain sterility. The fittings shall be constructed so that the steam chamber or other sterilizing medium chamber may be exposed for inspection.

E1.3 Where steam or other sterilizing medium is used, the connection(s) on the sterilizable fittings shall be such that the steam lines or other sterilizing medium lines can be securely fastened to the sterilizable fittings. The sterilizable fittings shall be constructed so that the steam or other sterilizing medium chamber may be exposed for inspection.

E1.4 The seal(s) in sterilizable fittings designed to be used in a processing system to be sterilized by heat and operated at a temperature of 250°F (121°C) or higher shall be located between the product contact surface and the steam or other sterilizing chamber.

E2 Nonproduct contact surfaces shall have a smooth finish, free of pockets and crevices, and be readily cleanable.

APPENDIX

F STAINLESS STEEL MATERIALS

Stainless steel conforming to the applicable composition ranges established by AISI for wrought products, or by ACI for cast products, should be considered in compliance with the requirements of Section C1 herein. Where welding is involved, the carbon content of the stainless steel should not exceed 0.08%. The first reference cited in C1 sets forth the chemical ranges and limits of acceptable stainless steel of the 300 Series. Cast grades of stainless steel corresponding to types 303, 304, and 316 are designated CF-16F, CF-8, and CF-8M, respectively. The chemical compositions of these cast grades are covered by ASTM<sup>6</sup> specifications A351/A351M, A743/A743M and A744/A744M.

G PRODUCT CONTACT SURFACE FINISH

Surface finish equivalent to 150 grit or better as obtained with silicon carbide, properly applied on stainless steel sheets, is considered in compliance with the requirements of Section D1 herein. A maximum  $R_a$  of 32  $\mu$ in. (0.80  $\mu$ m), when measured according to the recommendations in American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)<sup>7</sup> B46.1 - *Surface Texture*, is considered to be equivalent to a No. 4 finish.

H DIMENSIONS AND TOLERANCES

Table 1 — Internal Diameter and Tolerance Specification for Mating Faces of Demountable Joints (Unions) of all Sanitary Fittings in D6.2.1 and D6.2.2

Nominal Diameter-in.	ID <sup>a</sup> in.	Tolerance-in.
—	0.152	±0.005
3/8	0.277	±0.005
—	0.370	±0.005
—	0.620	±0.005
1	0.870	±0.005
1 1/2	1.370	±0.005
2	1.870	±0.005
2 1/2	2.370	±0.005
3	2.870	±0.005
4	3.834	±0.005
6	5.782	±0.013
8	7.782	±0.016
10	9.732	±0.016
12	11.732	±0.016

I O-RING GROOVE RADII

O-Ring Cross Section, Nominal (AS 568 <sup>8</sup> )	O-Ring Cross Section, Actual (AS 568)	O-Ring Cross Section, Actual (ISO 3601-1 <sup>9</sup> )	Minimum Groove Radius
1/16 in.	0.070 in.	1.80 mm	0.016 in. (0.406 mm)
3/32 in.	0.103 in.	2.65 mm	0.031 in. (0.787 mm)
1/8 in.	0.139 in.	3.55 mm	0.031 in. (0.787 mm)
3/16 in.	0.210 in.	5.30 mm	0.062 in. (1.575 mm)
1/4 in.	0.275 in.	7.00 mm	0.094 in. (2.388 mm)

<sup>6</sup> Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959. Phone: (610) 832-9500.

<sup>7</sup> Available from the American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017-2392 (212) 705-7722.

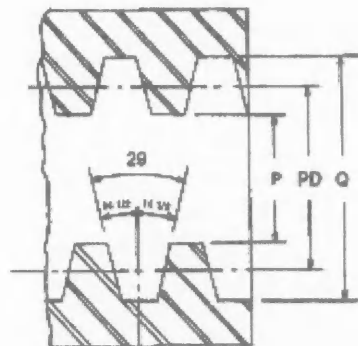
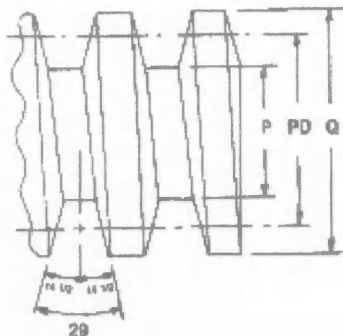
<sup>8</sup> The document establishing these standard dimensions is Aerospace Standard (AS) 568, published by SAE, 186 Thorn Hill Road, Warrendale, PA 15086 (724-776-4970).

<sup>9</sup> The document establishing these standard dimensions is ISO 3601-1: 1988 (E), published by the International Organization for Standardization (ISO), 1 Rue de Varembe, Case Postale 58, CH 1 1211, Geneva, Switzerland (41-22-734-1240).

**J DIAGRAMS**

These diagrams are intended to promote interchangeability of threaded fittings for standard tubing by showing construction dimensions for Dairy ACME Threads. These threads are commonly utilized for threaded external fasteners, such as hex-nuts and spanner nuts, used to connect demountable joints. The 12 pages of drawings of bevel seat fittings formerly shown in this section have been deleted because, although conforming to these standards, they are increasingly supplanted by welded pipeline joints and fittings using self-centering, flush-fitting gaskets, and clamp type unions.

### 3-A 63-03: Dairy ACME Threads



**EXTERNAL THREAD DIMENSIONS**

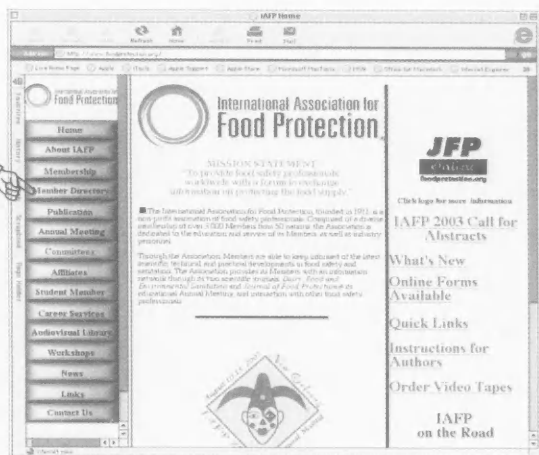
Size	Acme Threads per in.	P	Q	Pitch Dia.	Tolerance P,Q & P.D.
1	8	1.317	1.462	1.3995	+0.00 / -.018
1 1/2	8	1.849	1.994	1.9315	+0.00 / -.019
2	8	2.381	2.526	2.4635	+0.00 / -.020
2 1/2	8	2.913	3.058	2.9955	+0.00 / -.021
3	8	3.445	3.590	3.5275	+0.00 / -.022
4	6	4.509	4.695	4.6120	+0.00 / -.025

**INTERNAL THREAD DIMENSIONS**

Size	Acme Threads per in.	P	Q	Pitch Dia.	Tolerance P,Q & P.D.
1	8	1.352	1.497	1.4145	+0.018 / -.000
1 1/2	8	1.884	2.029	1.9465	+0.019 / -.000
2	8	2.416	2.561	2.4785	+0.020 / -.000
2 1/2	8	2.948	3.093	3.0105	+0.021 / -.000
3	8	3.480	3.625	3.5425	+0.022 / -.000
4	6	4.544	4.730	4.6270	+0.025 / -.000

These standards are effective November 24, 2002.

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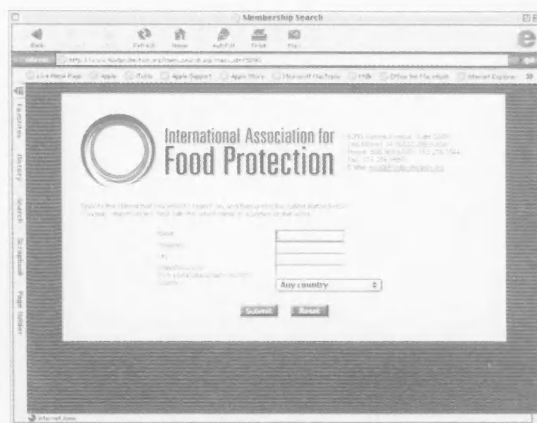
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# COMING EVENTS

## FEBRUARY

- **11, Georgia Association for Food Protection Annual Spring Meeting**, The Salvation Army, Atlanta, GA. For more information, contact Traci Sayer at 770.469.2701.
- **17-19, 29th Annual ABC Research Corporation Technical Seminar**, DoubleTree Hotel, Orlando, FL. For more information, contact Jim Rorie at 352.372.0436, ext. 337; E-mail: info@abcr.com.
- **18-20, California Association of Dairy and Milk Sanitarians Industry Conference**, Radisson Hotel, Stockton, CA. For more information, contact John Bruhn at 209.957.9090.
- **18-19, Microbiological Concerns in Food Plant Sanitation and Hygiene**, Baltimore, MD. For more information, contact Silliker at 800.829.7879 or log onto [www.silliker.com](http://www.silliker.com).
- **19, HACCP: A Management Summary**, Guelph Food Technology Centre, Guelph, Ontario, Canada. For more information, contact Marlene Inglis at 519.821.1246; E-mail: minglis@gftc.ca.
- **20-21, 79th Annual Agricultural Outlook Forum**, Arlington, VA. For more information, call 877.891.2208; E-mail: agforum@oce.usda.gov.
- **21, United 2003, 2003 Annual Produce Business Conference and Exposition**, Long Beach, CA. For more information, call 703.836.3410; Web site: [www.uffva.org](http://www.uffva.org).
- **26, Processing Foods Safely**, Guelph Food Technology Centre, Guelph, Ontario, Canada. For more information, contact Marlene Inglis at 519.821.1246; E-mail: minglis@gftc.ca.

## MARCH

- **3-7, Dairy Technology Workshop**, Randolph Associates, Inc., Birmingham, AL. For additional information, call 205.595.6455; E-mail: us@randolphconsulting.com.
- **4-6, Principles of Food Microbiology**, Huntington Beach, CA. For more information, contact Silliker at 800.829.7879 or log onto [www.silliker.com](http://www.silliker.com).
- **12-14, Michigan Environmental Health Association 59th Educa-**

**tional Conference**, Valley Plaza Hotel, Midland, MI. For more information, contact Bruce DuHamel at 989.831.3637.

- **18-20, Idaho Environmental Health Association Annual Meeting**, Boise, Idaho. For more information, contact Frank Isenberg at 208.334.5947.
- **20, IAFIS 2003 Annual Conference**, Marco Island Marriott Resort and Golf Club, Marco Island, FL. For more information, contact Alexis de la Rosa at 703.761.2600 ext. 207; E-mail: adelarosa@iafis.com.
- **24-25, United Fresh Fruit & Vegetable Assn. Produce Inspection Training Program, Introductory Course**, Fredericksburg, VA. For more information, contact United at 703.836.3410.
- **26-28, United Fresh Fruit & Vegetable Assn. Produce Inspection Training Program, Advanced Course**, Fredericksburg, VA. For more information, contact United at 703.836.3410.
- **27, Ontario Food Protection Association Annual Spring Meeting**, Mississauga Convention Centre, Mississauga, Canada. For more information, contact Glenna Haller at 519.823.8015.

## APRIL

- **2-4, Missouri Milk, Food and Environmental Health Association Annual Educational Conference**, Ramada Inn, Columbia, MO. For more information, contact Linda Haywood at 417.829.2788.
- **3-5, Fresh-Cut Produce Association's 16th Annual Conference and Exhibition**, Tampa, FL. For additional information, contact IFPA at 703.299.6282.
- **22-25, ICCR 2003 - 3rd International Conference on Cryogenics and Refrigeration**, Hangzhou, China. For more information, visit <http://www.cmee.zju.edu.cn/ICCR3.htm>.
- **26-May 1, 29th National Conference on Interstate Milk Shipments**, Doubletree Hotel, Seattle, WA. For more information, contact

Leon Townsend at 502.695.0253; E-mail: ltownsend@ncims.net.

- **30-May 1, Managing Your Food Safety and Quality Systems**, Oak Brook, IL. For more information, contact Silliker at 800.829.7879 or log onto [www.silliker.com](http://www.silliker.com).

## MAY

- **6-8, PACex International**, Toronto International Centre, Toronto, Canada. For more information, contact Maria Tavares at 416.490.7860 ext. 219; E-mail: mtavares@pacexinternational.com.
- **13-14, Pennsylvania Association of Milk, Food and Environmental Sanitarians Spring Meeting**, Nittany Lion College. For more information, contact Eugene Frey at 717.397.0719.
- **21, Associated Illinois Milk, Food and Environmental Sanitarians Annual Spring Meeting**, Bloomington, IL. For more information, contact Larry Terando at 217.278.5900.

## JUNE

- **13-20, International Workshop/Symposium on Rapid Methods and Automation in Microbiology XXIII**, Kansas State University, Manhattan, KS. For more information, contact Daniel Y. C. Fung at 785.532.5654; E-mail: dfung@oznet.ksu.edu.
- **25-27, South Dakota Environmental Health Association Annual Meeting**, Ramkota Convention Center, Pierre. For more information, contact Clark Hepper at 605.773.3364.

## IAFP UPCOMING MEETINGS

**AUGUST 10-13, 2003**  
New Orleans, Louisiana  
**AUGUST 8-11, 2004**  
Phoenix, Arizona  
**AUGUST 14-17, 2005**  
Baltimore, Maryland

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that needed answered included: How should the program be changed? Was there a way of performing the evaluation to provide information to the establishment and gain their cooperation in participating in a HACCP program?

The result is a program that maintains the principles of HACCP, provides a customized plan for participating establishments and incorporates changes made to the City Food Code.

The objective of the 2002 Hazard Analysis Critical Control Point (HACCP) Evaluation Program is to provide assistance to food establishments to develop a HACCP plan.

The goals of the program are to produce the safest food possible, reduce critical violations, and provide the education necessary to accomplish these goals.

Participants in the program will be required to comply with the HACCP plan developed jointly with the Environmental Health Department. Input and cooperation will be critical to the HACCP plan development.

The evaluation includes an assessment of the potential hazards, type of food prepared on site, the preparation process, process based flow charts, time and temperature log sheets, equipment log sheets, when necessary receiving log sheets, and work with the establishment to develop and implement the system.

One to three establishments will be selected annually.

The routine specialist is part of the HACCP team working with the establishment. HACCP development progress on each establishment will be monitored through the routine inspection process in addition to set appointments with the establishment by the HACCP team.

Establishment selection will be divided into two categories: (a) new establishments, and (b) existing establishments.

New establishments will be evaluated during the plan review process and again at opening. New establishments will submit menus for evaluation. Establishments declaring a developed HACCP plan will be asked to submit the plan prior to opening. The HACCP plan will be evaluated by the Department. If the plan does not meet the set requirements by the City of Plano Food Code the plan will be enhanced to comply with Code. This plan will be kept in the establishments file.

Existing establishments will be evaluated annually through the Risk Assessment process and inspection reports. The routine specialist will be asked to evaluate if an establishment could pose a public health hazard and recommend establishments that would benefit from a HACCP evaluation based on, but not limited to the following:

- (a) food handling practices
- (b) time & temperature logs or lack of
- (c) known operating procedures
- (d) routine inspection violations & ratings
- (e) number of valid complaints
- (f) enforcement actions taken
- (g) sanitation
- (h) employee hygiene
- (i) adequate equipment

The recommended establishments will be assessed based on the following criteria:

- (a) menu assessment
- (b) production process
- (c) handling of potentially hazardous foods
- (d) type of food preparation process
- (e) employee training program
- (f) possible contamination of food by customers
- (g) possible contamination of food by employees
- (h) employee hygiene
- (i) basic sanitation program
- (j) written procedures at establishment

The HACCP Team will monitor and enforce implementation of the HACCP plan. The Team and the routine specialist will carry out enforcement during both arranged and unannounced evaluations. All logs, flow charts, written procedures, and employee and supervisory training will be reviewed for compliance with HACCP program. HACCP plan requirements can be found in the City of Plano Code of Ordinances. As needed citations and other enforcement actions will be taken to bring the establishment into compliance.

When changes in management occur, the developed HACCP plan will be required to be passed to the incoming management team. The written plan and required documentation are to remain with the establishment and be available to the HACCP Team and the routine specialist upon request to ensure compliance.

Once the plan is implemented, it can be, and is encouraged to be, re-evaluated and enhanced.

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Sandra Long  
Senior Environmental Health Specialist  
City of Plano  
Plano, Texas 75074

**T**he City of Plano Environmental Health Department believes an educated food worker will help decrease the probability of foodborne illness from the food they prepare and serve. Plano brought the Hazard Analysis Critical Control Point (HACCP) principles to food establishments to help in their effort to minimize foodborne illness. The HACCP program helps food inspectors and food service workers and food establishments build a basic framework for food safety within food service establishments. HACCP principles are designed to reduce the risk of foodborne illness.

A Hazard Analysis Critical Control Point (HACCP) evaluation program was implemented by Plano in 1994. Current records date back to 1996.

A risk assessment tool was utilized by the Environmental Health Department to categorize permitted food service establishments in the city. Establishments were categorized as high, moderate, or low risk, based on individual risk assessments. The Department policy was to schedule and perform 24 HACCP evaluations per year, targeting high-risk establishments. The goal of the program was to reduce hazards contributing to foodborne illness, to reduce or eliminate critical violations and to encourage establishments to incorporate HACCP into their daily operations.

The program adopted was a modified version of a HACCP evaluation. A Plano Environmental Health Specialist with FDA training in HACCP principles and the specialist for the establishment performed the evaluation. Evaluations took two days in the restaurant and one day in the office to complete the evaluation and write the inspection report. The completed evaluation

report included a computer inspection, a flow chart of the menu items tracked, a summary and recommendations for the establishment's use of HACCP principles and methods of application. The establishment was to complete the development of the HACCP plan, create additional flow charts and develop methods of compliance to reduce critical violations and eliminate hazards in the preparation process.

From 1996 to 2001 Plano's Environmental Health Specialists conducted approximately 136 HACCP evaluations.

In 2001 the HACCP program was evaluated for performance. To evaluate the program, two elements were considered: (1) the costs of conducting HACCP evaluations and (2) the achievement of stated goals.

The costs to conduct HACCP evaluations was determined by the number of health specialists (2) required to perform the evaluation, the total number of hours required (40) multiplied by the average hourly rate for the specialists. The cost of performing one HACCP evaluation was approximately \$993.

To determine if the goals of the program were being met, records of 21 random establishments that received HACCP evaluations were reviewed. The records indicated 19 of the 21 establishments exhibited no reduction in the number of critical violations since the evaluation was completed. Two of the establishments showed an increase in the number of critical violations since the HACCP evaluation was completed.

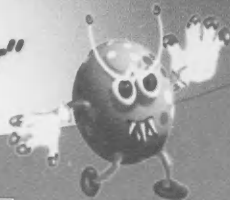
Additionally, site visits were conducted at 15 establishments with prior HACCP evaluations, revealed only one facility was using HACCP principles two years after the evaluation.

Based on records, on-site reviews, and cost associated with conducting evaluations, the HACCP program was determined not to be achieving desired goals of reduction of critical violations, nor was HACCP part of daily operations in establishments. Reasons for this lack of participation included changes in management/personnel, no "buy-in" from management and lack of enforcement. At one establishment, the manager took the HACCP plan when he changed jobs. The HACCP Team was assembled to explore options and make recommendations for revisions to the program. Questions

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