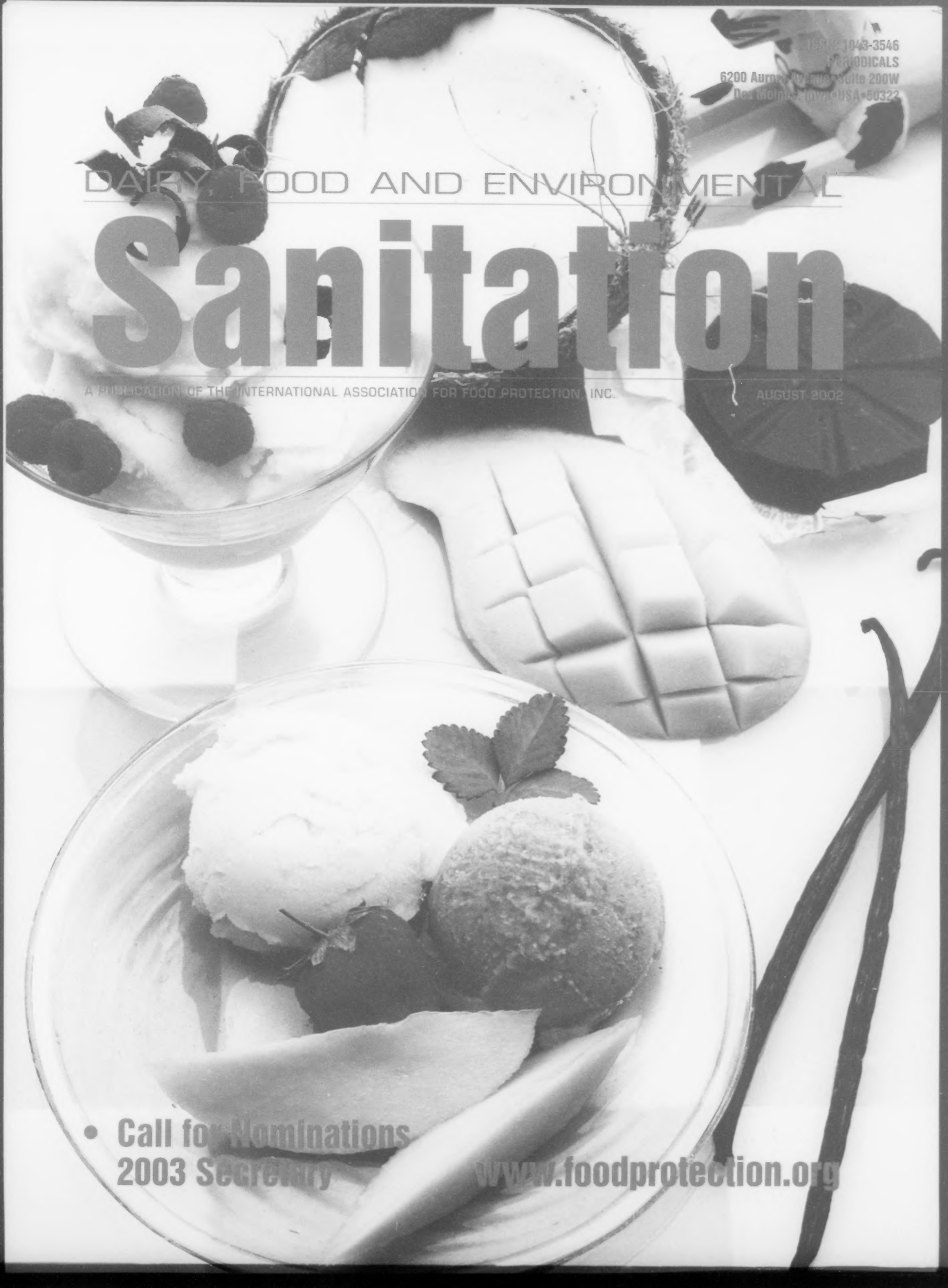
ISSN 1043-3546
PERIODICALS
6200 Aurora Ave., Suite 200W
Des Moines, Iowa USA 50322

DAIRY, FOOD AND ENVIRONMENTAL

Sanitation

A PUBLICATION OF THE INTERNATIONAL ASSOCIATION FOR FOOD PROTECTION, INC.

AUGUST 2002



- Call for Nominations
2003 Secretary

www.foodprotection.org

New Rapid-Check™ pathogen screening for E. coli 0157 Results you can depend on...time after time.

Your pathogen testing program has to meet tough, real world criteria. Strategic Diagnostics Inc. develops food safety products that provide real world value. Our knowledge, products and people can help raise confidence in the safety of your food products.

SDI's new Rapid-Check™ for E. coli 0157 is quick, economical, and easy-to-use. Our proprietary one-step media means you can perform enrichment in as little as 8 hours. You don't need to boil your sample or refrigerate our cassette, so there's no waiting for materials to come to room temperature. You'll get results in half the time of other tests. And you don't have to make judgement calls on difficult to read cassettes. Rapid-Check™ produces crystal clear results every time.

Let SDI and Rapid-Check™ bring simplicity, accuracy and economy to your testing programs. For a free sample, just call 1-800-544-8881 or email your request to sales@sdix.com

While you're here, make sure to visit us at booths 408 & 409.

Rapid

Part of SDI's family of food safety products.

SDI

Strategic Diagnostics Inc.

Reader Service No. 166

DQCI Services, Inc.
Bacteriological & Chemical Testing

Standards and Calibration Sets
Raw Milk Component Standards
Raw Lowfat Component Standards
Pasteurized/Homogenized Lowfat Standards
High Fat Cream Standards
Light Cream Standards
Electronic Somatic Cell Standards
Skim Condensed Standards
Urea Standards
Goat Standards
A & B Control Samples
Standards Made to Customer's Specs

Chemical and Bacteriological Testing
Milk and Milk Products
Producer Quality Testing
Producer Component Testing
Mastitis Culture-Cow or
Bulk Tank Testing
Third Party Verification/
Validation

High Performance Liquid Chromatography
Carbohydrates and/or
Antibiotics in Milk

DQCI Services, Inc., Mounds View Business Park, 5205 Quincy St., Mounds View, MN 55112
(763) 785-0484 phone, (763) 785-0584 fax

Reader Service No. 129

ABOUT THE COVER...

Photo courtesy of Photo Disc, Food Essentials, Volume 20.

Use of this photo does not imply endorsement of any product by the International Association for Food Protection.

DAIRY, FOOD AND ENVIRONMENTAL

Sanitation

International Association for Food Protection

Articles

Association News

Editor's Note:

In the June 2002 issue of *DFES* on page 523, the Web site address for Hot Links for Educators was listed incorrectly. The correct address is http://www.cdc.gov/foodsafety/edu.htm. We apologize for this error.

Departments

Extras

The 20-minute Listeria Test from Oxoid. Because time is money.

The Oxoid Listeria Rapid Test is a fast and reliable method for the detection of Listeria species in food samples.

1. After just two 21-hour enrichment steps, place 135ul of the sample into this Clearview™ Test Unit window.

2. Only 20 minutes later, a blue line in this window clearly indicates the presence of Listeria species.

3. Another blue line appears here as a control, confirming that the test has worked correctly.

4. If no blue line appears, the sample is negative.

5. There is no need to wait up to 5 **more** days as with some other tests. You're ready to ship product and fill orders right now.

6. Are you ready to call for details
Contact: Oxoid Inc.
800 Proctor Ave.,
Ogdensburg, NY 13669,
Phone: (800) 567-TEST.
Fax: (613) 226-3728. Or Oxoid Inc
1926 Merivale Road, Nepean,
Ontario, K2G 1E8 Canada.
Phone: (800) 267-6391
Fax: (613) 226-3728

INCORPORATING
CLEARVIEW
LISTERIA

OXOID
Listeria
RAPID TEST

Reader Service No. 126

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

DAIRY, FOOD AND ENVIRONMENTAL

Sanitation

A PUBLICATION OF THE INTERNATIONAL ASSOCIATION FOR FOOD PROTECTION

Dairy, Food and Environmental Sanitation (ISSN-1043-3546) is published monthly beginning with the January number by the International Association for Food Protection, 6200 Aurora Avenue, Suite 200W, Des Moines, Iowa 50322-2864, USA. Each volume comprises 12 numbers. Printed by Heuss Printing, Inc., 911 N. Second Street, Ames, Iowa 50010, USA. Periodical Postage paid at Des Moines, Iowa 50318 and additional entry offices.

Manuscripts: Correspondence regarding manuscripts should be addressed to Donna A. Bahun, Production Editor, International Association for Food Protection.

News Releases, Updates, Coming Events and Cover Photos: Correspondence for these materials should be sent to Donna A. Bahun, Production Editor, International Association for Food Protection.

"Instructions for Authors" may be obtained from our Web site at www.foodprotection.org or from Donna A. Bahun, Production Editor, International Association for Food Protection.

Orders for Reprints: All orders should be sent to ***Dairy, Food and Environmental Sanitation***, International Association for Food Protection. Note: Single copies of reprints are not available from this address; address single copy reprint requests to principal author.

Reprint Permission: Questions regarding permission to reprint any portion of ***Dairy, Food and Environmental Sanitation*** should be addressed to: Donna A. Bahun, Production Editor, International Association for Food Protection.

Business Matters: Correspondence regarding business matters should be addressed to Lisa K. Hovey, Managing Editor, International Association for Food Protection.

Membership Dues: Membership in the Association is available to individuals. Dues include a 12-month subscription to ***Dairy, Food and Environmental Sanitation*** at a rate of $95.00 US, $105.00 Canada/Mexico, and $120.00 International. Dues including ***Dairy, Food and Environmental Sanitation*** and the ***Journal of Food Protection*** are $165.00 US, $190.00 Canada/Mexico, and $235.00 International. Student memberships are available with verification of student status. Student rates are $47.50 US, $57.50 Canada/Mexico, and $72.50 International for ***Dairy, Food and Environmental Sanitation***; $47.50 US, $62.50 Canada/Mexico, and $92.50 International for ***Journal of Food Protection***; and $82.50 US, $107.50 Canada/Mexico, and $152.50 International for ***Dairy, Food and Environmental Sanitation*** and ***Journal of Food Protection***. All membership dues include shipping and handling. No cancellations accepted. Correspondence regarding changes of address and dues must be sent to Julie A. Cattanach, Membership Services, International Association for Food Protection.

Sustaining Membership: Three levels of sustaining membership are available to organizations. For more information, contact Julie A. Cattanach, Membership Services, International Association for Food Protection.

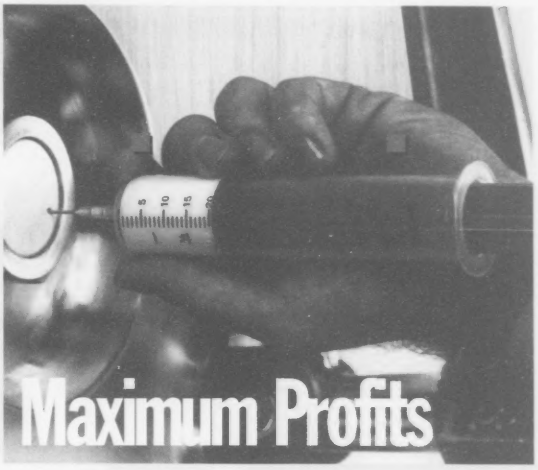
Subscription Rates: *Dairy, Food and Environmental Sanitation* is available by subscription for $210.00 US, $220.00 Canada/Mexico, and $235.00 International. Single issues are available for $26.00 US and $35.00 all other countries. All rates include shipping and handling. No cancellations accepted. For more information contact Julie A. Cattanach, Membership Services, International Association for Food Protection.

Claims: Notice of failure to receive copies must be reported within 30 days domestic, 90 days outside US.

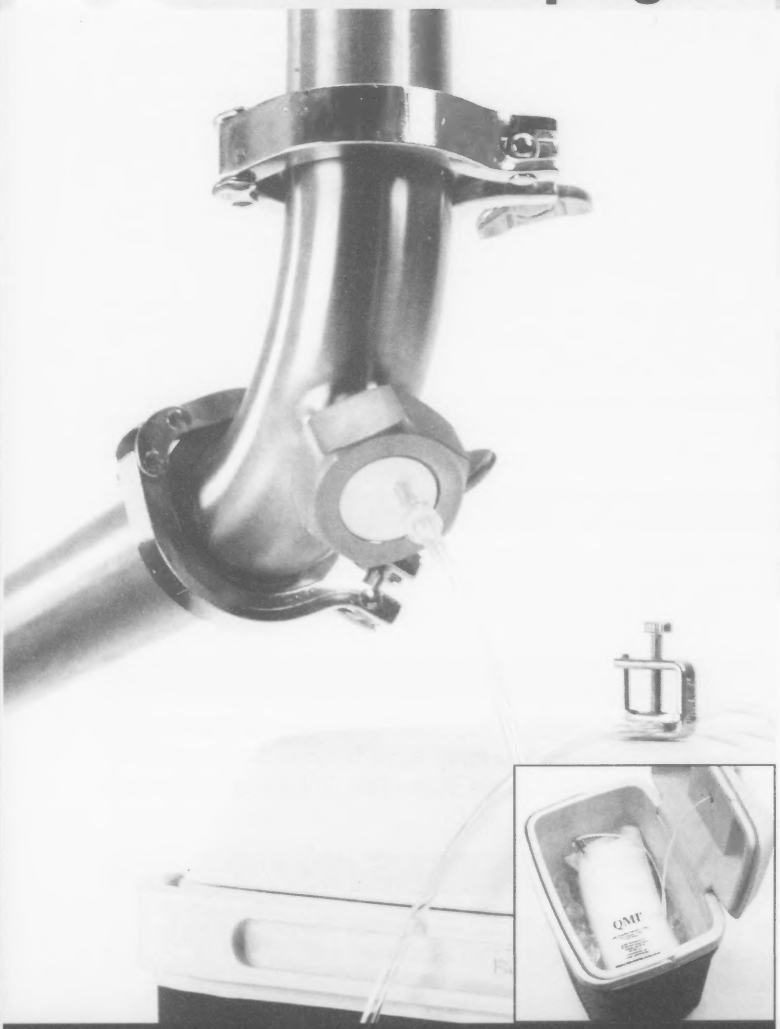
Postmaster: Send address changes to ***Dairy, Food and Environmental Sanitation,*** 6200 Aurora Avenue, Suite 200W, Des Moines, Iowa 50322-2864, USA.

Dairy, Food and Environmental Sanitation is printed on paper that meets the requirements of ANSI/NISO 239.48-1992.

Today's Dairy Farmers Require Accurate Milk Sampling For Maximum Profits



Staphylococcus aureus



You work hard to run a clean and healthy dairy operation. Get maximum profits for all that effort by using the QMI Line and Tank Sampling System. The benefits are:

- Precise composite sampling to aid in mastitis control
- Contamination-free sampling resulting in accurate bacterial counts
- Reliable sampling to measure milk fat and protein

As you know, your testing is only as good as your sampling.

Escherichia coli

For more information, contact:

QMI
426 Hayward Avenue North
Oakdale, MN 55128
Phone: 651.501.2337
Fax: 651.501.5797
E-mail address: qmi2@aol.com

Manufactured under license from Galloway Company, Neenah, WI, USA. QMI products are protected by the following U.S. Patents: 4,914,517; 5,086,813; 5,289,359; other patents pending.

For more information, visit our website at www.qmisystems.com or the University of Minnesota website at http://mastitislab.tripod.com/index.htm

QMI®

Quality Management, Inc.

Future Annual Meetings

IAFP 2003

August 10-13

Hilton New Orleans Riverside
New Orleans, Louisiana

IAFP 2004

August 8-11

JW Marriott Desert
Ridge Resort
Phoenix, Arizona

DAIRY, FOOD AND ENVIRONMENTAL

Sanitation

International Association for Food Protection

"The mission of the Association is to provide food safety professionals worldwide with a forum to exchange information on protecting the food supply."

DFES EDITORIAL BOARD

Sustaining Members

Sustaining Membership provides organizations and corporations the opportunity to ally themselves with the International Association for Food Protection in pursuit of Advancing Food Safety Worldwide. This partnership entitles companies to become Members of the leading food safety organization in the world while supporting various educational programs that might not otherwise be possible. Organizations who lead the way in new technology and development join IAFP as Sustaining Members.

Gold

DuPont Qualicon, Wilmington, DE; 302.695.5300

Kraft Foods, Inc., Glenview, IL; 847.646.3678

Silver

bioMérieux, Inc., Hazelwood, MO; 800.638.4835

F & H Food Equipment Co., Springfield, MO; 417.881.6114

MATRIX MicroScience Ltd., Cambridgeshire, United Kingdom; 44.1638.723110

Quality Flow Inc., Northbrook, IL; 847.291.7674

Silliker Inc., Homewood, IL; 708.957.7878

Weber Scientific, Hamilton, NJ; 609.584.7677

Sustaining

3-A Symbol Council, Cedar Rapids, IA; 319.286.9221

3M Microbiology Products, St. Paul, MN; 612.733.9558

ABC Research Corporation, Gainesville, FL; 352.372.0436

AgriLink Foods, Inc., Green Bay, WI; 920.435.5301

Anderson Instrument Co., Fultonville, NY; 518.922.5315

ASI Food Safety Consultants, Inc., St. Louis, MO; 800.477.0778

BD Diagnostic Systems, Sparks, MD; 410.316.4467

Bentley Instruments, Inc., Chaska, MN; 952.448.7600

BioControl Systems, Inc., Bellevue, WA; 425.603.1123

Sustaining Members

Biolog, Inc., Hayward, CA; 510.785.2564

Capitol Vial, Inc., Tucson, AZ; 800.688.9515

Capitol Wholesale Meats, Chicago, IL; 773.890.0600

Cogent Technologies, Ltd., Cincinnati, OH; 513.469.6800

DARDEN Restaurants, Inc., Orlando, FL; 407.245.5330

Dean Foods, Rockford, IL; 815.962.0647

Decagon Devices, Inc., Pullman, WA; 509.332.2756

Deibel Laboratories, Inc., Lincolnwood, IL; 847.329.9900

DonLevy & Associates, Inc., Merrillville, IN; 219.736.0472

DSM Food Specialties, Menomonee Falls, WI; 262.255.7955

DQCI Services, Inc., Mounds View, MN; 763.785.0484

Dynal Biotech, Inc., Lafayette Hill, PA; 866.DYNALTT

EM Science, Gibbstown, NJ; 856.423.6300

Ecolab, Inc., St. Paul, MN; 612.293.2364

Electrol Specialties Co., South Beloit, IL; 815.389.2291

Evergreen Packaging, Division of International Paper, Cedar Rapids, IA; 319.399.3236

FoodHandler, Inc., Westbury, NY; 800.338.4433

Food Processors Institute, Washington, D.C.; 800.355.0983

Food Safety Net Services, Ltd., San Antonio, TX; 210.384.3424

Foss North America, Inc., Eden Prairie, MN; 952.974.9892

Georgia-Pacific Technology Center, Palatka, FL; 386.312.1184

IBA, Inc., Millbury, MA; 508.865.6911

International BioProducts, Inc., Bothell, WA; 425.398.7993

International Dairy Foods Association, Washington, D.C.; 202.737.4332

International Fresh-cut Produce Association, Alexandria, VA; 703.299.6282

Iowa State University Food Microbiology Group, Ames, IA; 515.294.4733

LABPLAS Inc., Ste-Julie, Quebec, Canada; 450.649.7343

Land O'Lakes, Inc., St. Paul, MN; 651.481.2541

Marine BioProducts International, Delta, British Columbia, Canada; 604.523.2400

Medallion Laboratories, Minneapolis, MN; 612.764.4453

Michelson Laboratories, Inc., Commerce, CA; 562.928.0553

Nasco International, Inc., Fort Atkinson, WI; 920.568.5536

The National Food Laboratory, Inc., Dublin, CA; 925.551.4231

National Food Processors Association, Washington, D.C.; 202.639.5985

Nelson-Jameson, Inc., Marshfield, WI; 715.387.1151

Neogen Corporation, Lansing, MI; 517.372.9200

Nestlé USA, Inc., Glendale, CA; 818.549.5799

NSF International, Ann Arbor, MI; 734.769.8010

Oxoid, Inc., Nepean, Ontario, Canada; 800.267.6391

Penn State University, University Park, PA; 814.865.7535

The Procter & Gamble Co., Cincinnati, OH; 513.983.8349

REMEL, Inc., Lenexa, KS; 800.255.6730

Rhodia Inc., Madison, WI; 800.356.9393

Ross Laboratories, Columbus, OH; 614.624.3785

rtech™ laboratories, St. Paul, MN; 800.328.9687

Seiberling Associates, Inc., Dublin, OH; 614.764.2817

Seward Limited, London, United Kingdom; 44.0.181.365.4104

Strategic Diagnostics Inc., Newark, DE; 302.456.6789

United Fresh Fruit & Vegetable Association, Alexandria, VA; 703.836.3410

Warren Analytical Laboratory, Greeley, CO; 800.945.6669

West Agro, Inc., Kansas City, MO; 816.891.1558

WestFarm Foods, Seattle, WA; 206.286.6772

Zep Manufacturing Company, Atlanta, GA; 404.352.1680

THOUGHTS FROM THE PRESIDENT

"TIMING IS EVERYTHING..."

By ANNA M. LAMMERDING
President

"We encourage all our Members to participate actively in IAFP"

As I begin my term as President of IAFP, I consider myself fortunate for being in the right place at the right time! (That doesn't happen often!) I note that the road to the "right place" has been paved by the dedicated individuals who made our Association what it is today. The list includes those who have served on the Executive Board and have taken their turn "at the helm," providing the leadership and guidance that helped us grow into the organization that is reflected by our name today. It also includes the many members who volunteer a piece of their most valuable commodity, time, and turn their efforts to serve on committees, organize symposia and workshops, contribute articles, and more. And at the core of our Association is our IAFP staff. They are "always there" for the Executive Board and make our jobs seem easy! The IAFP staff is "always there" for you, too. You saw that at the Annual Meeting. From the pre-planning stages through to the final "hurrah," every one of our staff members dedicates long hours to make sure events at the meeting run smoothly. Outside of the Annual Meeting are the day-to-day responsibilities, and delivery of services to our Membership. Many of you who are actively involved with your local affiliate know that whenever and whatever you need from IAFP, it is just a phone call or an E-mail message away.

This is the "right time" to continue our growth and to continue to become truly an international association. At the Annual Meeting we recognized two new affiliates: SCAFP, the Southern California Association for Food Protection, and ABRAPA, Associacao Brasileira de Protecao de Alimentos (Brazil Association for Food Protection). Margaret Burton, President of SCAFP, and our Brazilian colleagues, Maria Teresa Destro and Mariza Landgraf, professors of food microbiology at the University of São Paulo, Brazil, were on hand to be presented with their new affiliate charters. We continue to maintain our liaisons with the Food and Agriculture Organization (FAO) and the World Health Organization (WHO). Representatives Sarah Cahill, from FAO, Rome, and Peter Ben Embarek, from WHO, Geneva, presented their agencies' initiatives toward developing global food safety strategies. The International Commission for Microbiological Specifications in Foods (ICMSF) sponsored one of their members, Susanne Dahms, of Berlin, Germany, to talk about the statistical basis of sampling plans – a favorite (or feared?!) topic for many. I also thank Catherine Nnoka, of the International Life Sciences Institute-North America (ILSI-NA), for her active involvement in IAFP, and continuing to help arrange sponsorship of excellent speakers and symposia year after year. The high caliber of our Annual Meeting program was attested to when a trip to attend the meeting was awarded to Sera Roberts of South Caernarfon Creameries in the UK, as recipient of the 2001 Oxoid Technician of the Year Award. We

also acknowledge the support of Seward Limited, UK, in continuing to sponsor the Innovations in Food Microbiology Award and bringing new faces to the Annual Meeting.

This year, we were pleased to introduce the new IAFP International Leadership Award. Professor Tom McMeekin of the University of Tasmania, Australia, is the first recipient of this award. As a teacher, a scientist and a leader, Tom is recognized for his dedication to the ideals and objectives of IAFP and for his promotion of the mission of our Association in regions outside the United States and Canada. The award, which includes travel reimbursement to attend the Annual Meeting, is one way we can recognize specifically our colleagues from abroad. We are grateful to Kraft Foods for sponsoring the IAFP International Leadership Award for this year and in 2003. In future years we will seek sponsorship from different sources.

I would also like to note our Student Professional Development Group (SPDG), which has done an outstanding job in welcoming and involving students from around the world.

We encourage all our Members to participate actively in IAFP, and that includes Members from any part of the globe. With E-mail and the Internet, the world has become a very small place indeed. Being actively involved on a committee or PDG is no longer hindered by delays in "snail mail" or telephone calls at odd hours of the day. To our International Members: the information you bring to our Association, as presenters at Annual Meetings, as members of committees and PDGs, or by contributing articles to our journals, broadens our scope of knowledge. The Annual Meeting in particular is a time not only to learn, but also to network and discuss potential collaborative opportunities in food safety research, management, and training. Food safety is a common thread in our global marketplace. *Salmonella* in San Diego, California, pretty much looks the same and acts the same as *Salmonella* in Korea. In this coming year, IAFP will continue to explore opportunities to support our affiliates, our Members and our colleagues in Europe, Australia, New Zealand, South America, Asia...

The IAFP Foundation Fund is an important vehicle that allows us to distribute surplus copies of our journals, *JFP* and *DFES*, to food safety students and professionals in developing countries. If you came home from San Diego with an unusual item or two from the Silent Auction, perhaps the pearl necklace designed and donated by Connie Tharp (our Executive Director David's "better half"), you helped send a box of journals to Ghana. The Foundation Fund is growing, through contributions from our Affiliates, from your support of the Silent Auction, and as a result of the corporate challenge issued earlier this year by President-Elect Paul Hall (and Kraft Foods). Personal donations by you are equally important to help support the goal of creating a self-sustaining fund of a minimum one million dollars. The fund is designated to support existing programs, and its growth will allow us to consider new initiatives to help expand our services worldwide.

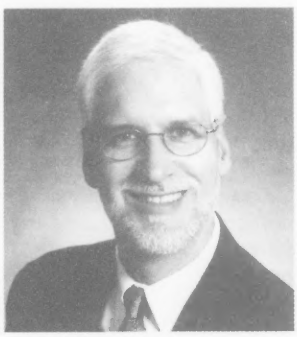
Concern about the deliberate contamination of our food and water supplies, the topic of our keynote address in San Diego, reaches beyond the traditional realm of food microbiologists and public health inspectors. IAFP Members strive to be on the forefront of the science and management of any threat to the food supply, at home and globally. We invite individuals who have not been part of the IAFP Membership in the past to consider joining as IAFP tackles these difficult issues.

IAFP continues to grow in its scope and Membership. We embrace change as our Association moves forward to meet the challenges of a global economy. At the same time, we will continue to maintain and build on the scientific excellence of our Annual Meetings, the quality of our publications, and the support of our Membership worldwide.

From a personal perspective, I think this will be another good year for IAFP!

COMMENTARY

From the Executive Director



By DAVID W. THARP, CAE
Executive Director

"We will build upon the success of IAFP 2002 as we plan for the future and IAFP 2003!"

The completion of IAFP 2002 brings both excitement and relief! Excitement in what has been achieved; relief for those involved in planning and execution of sessions, events and the meeting in general.

Today we give thanks for the success of IAFP 2002 with over 1,400 attendees and the safe travel to and from San Diego for all involved. The energy and interaction among attendees really makes the Annual Meeting come to life! Socializing with colleagues at IAFP 2002 is very easy and is a huge benefit to those who take advantage. While striking up a conversation, you may find yourself talking with leaders in FDA, USDA or state government working on policy development (or leaders from non-US countries), lead researchers at universities around the world, or industry leaders in food safety. Many lifelong contacts and friendships are initiated at IAFP Annual Meetings. These can be a very important resource for you during your career in dealing with food safety issues. This was definitely an exciting meeting as gauged by the interaction between attendees.

An area where both excitement and relief can be recognized is the sessions presented in San Diego. Many session rooms were filled to capacity as interest ran high in the subject matter presented. The IAFP Annual Meeting makes it easy for attendees to reach the presenter after their presentation to ask questions and discuss the information presented. Excitement is contagious as our sessions go to break or conclude for the day while attendees continue the discussions. Relief is recognized by organizers and convenors (and staff) when the sessions end and all has gone well!

The change of Officers for the Executive Board also provides an exciting setting. At the Awards Banquet, Jim Dickson passed the gavel to Anna Lammerding, our new President. Before doing so, Jim reviewed the accomplishments of the past year: Membership remains stable, Online renewal now available, Student PDG activities, increased submissions to both *DFES* and *JFP*, corporate challenge to grow the Foundation Fund, chartering two Affiliate organizations, and a record number of attendees and presentations at IAFP 2002! Indeed, it was an exciting year! As Jim relinquishes the Presidency, we want to recognize him for his year of accomplishments and also recognize Peter Hibbard for his one year of service and Jenny Scott for her five years of service to IAFP on the Executive Board. Jim, Peter and Jenny have helped to shape the organization into what it is today!

Relief has come to all who were involved in planning and organizing the Annual Meeting! The relief comes in the form of joy and happiness, recognizing that their efforts over the past year culminated in the success of IAFP 2002. The Local Arrangements Committee of the Southern California Association for Food Protection (one of the new

Affiliates this year), headed by Margaret Burton and Jennylynd James, helped us in so many ways prior to and during the Annual Meeting. Margaret told me about a week before the beginning of IAFP 2002 that she was now working "full time" for IAFP because of all of her responsibilities! I don't doubt that she had 40 hours of time (actually most likely more!) devoted to IAFP, but I am also confident that she continued to carry out her responsibilities to her employer, Jack in the Box! I am certain that Margaret is relieved that the Meeting is over as are her colleagues at Jack in the Box. Thanks to all of the volunteers from Southern California who donated freely of their time – we couldn't have done it without you!

I also know that our staff is relieved to have IAFP 2002 concluded. Everyone works so very hard in preparation, especially during the four to six weeks prior to the meeting; then during the meeting itself, we are working literally 16-hour days. By the time Wednesday night and the Awards Banquet conclude we are certainly relieved! It is a proud moment when we can look back and say that we have done our best to provide the environment, the setting and the tools to conduct The Leading Food Safety Meeting in the World!

My personal thanks to Lisa Hovey, Donna Bahun, Julie Cattanach, Bev Corron, Shannon Green, Donna Gronstal, Karla Jordan, Didi Loynachan, Lucia McPhedran, Beth Miller and Pam Wanninger for their dedication to the work they perform. Our staff operates in a truly professional manner and I am so very proud of each and every one of them!

As I said, the completion of IAFP 2002 brings both excitement and relief. Relief that it is over and that it was a great success. Excitement in what was accomplished and from the new ideas discussed that will lead to new plans and projects. Excitement is also generated as we have already begun to plan for IAFP 2003 in New Orleans. We received symposium proposals for next year, the Program Committee made their first review of the proposals, and our staff held its first meeting to begin our timeline of preparations for next year!

We will build upon the success of IAFP 2002 as we plan for the future and IAFP 2003! Thanks once again to everyone who helped IAFP 2002 to be a resounding success!

Dairy, Food and Environmental Sanitation, Vol. 22, No. 8, Pages 590-598

A Review of North American Apple Cider-Associated *E. coli* O157:H7 Outbreaks, Media Coverage and a Comparative Analysis of Ontario Apple Cider Producers' Information Sources and Production Practices

A. N. Luedtke and D. A. Powell*
Food Safety Network, Department of Plant Agriculture,
University of Guelph, Guelph, Ontario, Canada, N1G 2W1

SUMMARY

A review of North American apple cider-associated *E. coli* O157:H7 outbreaks revealed that in the United States, government officials, cider producers, interest groups and the public were actively involved in reforming and reducing the risk associated with apple cider. In Canada, media coverage was limited and government agencies may have inadequately managed and communicated relevant updates or new documents to the industry and the public. A survey was conducted with fifteen apple cider producers in Ontario, Canada, to gain a better understanding of production practices and information sources. Small, seasonal operations in Ontario each produce approximately 20,000 liters of cider per year. Improper processing procedures employed by some operators included failure to wash apples or use sanitizers and failure to label products accurately. Most did not pasteurize the product or have additional safety measures. Larger cider producers ran yearlong, some producing in excess of 500,000 liters of cider. Most sold their product to large retail stores and have implemented safety measures such as HACCP plans, cider testing and pasteurization. All Canadian producers surveyed received government information on an irregular basis, and the motivation to ensure safe, high-quality apple cider was influenced by financial stability along with consumer and market demand, rather than by government enforcement.

A peer-reviewed article.

*Author for correspondence: Phone: 519.824.4120 Ext. 2506;
Fax: 519.763.8933; E-mail: dpowell@uoguelph.ca

INTRODUCTION

There are over 22,000 growers of fruits and vegetables in Canada, producing approximately 337 million tons of apples each year. Apples are ranked as the number one fruit crop and are therefore an important agricultural product in Canada. Shipments of fresh apples account for two-thirds of total apple sales while the remainder is processed, either pressed for juices and ciders or peeled for the canning and baking industries. Annual apple juice production is 62 million liters, 10 percent of which is sweet cider (*8*).

Sweet apple cider, an unfermented, unclarified liquid, is distinct from hard cider, which is fermented and carbonated and which has a 5 percent alcohol content (*5*). Apple juice is an unfermented, clarified liquid that is generally pasteurized. Pasteurization requires heating the liquid to at least 160°F for six seconds, which eliminates pathogenic bacteria and which has been demonstrated to increase the shelf life of fresh cider (*24*). It is estimated, however, that 65 percent of retail cider sold in Canada is unpasteurized because the large number of small, family operated, seasonal businesses (*8*).

Traditionally, apple cider has been perceived as a wholesome, nutritious beverage consumed without known consequence and considered safe because of its natural acidic barrier. Many consumers enjoy the distinctive taste, and cider provides an important source of income for apple growers.

Over the past two decades, however, fresh apple cider has become a safety concern because of several outbreaks of foodborne illness. Unpasteurized, unpreserved, refrigerated apple cider and juice have been found to allow the growth and survival of *E. coli* O157:H7 for up to four weeks *(16)*.

In 1982, *E. coli* O157:H7 was first recognized as a human pathogen and was associated with ground beef; subsequently, numerous outbreaks associated with ground beef and other foods have been reported across North America (*18*). However, in retrospect, the index outbreak for *E. coli* O157:H7 occurred in 1980, in Pickering, Ontario. Fourteen school children (aged 18 months to four years) were infected after ingesting unpasteurized apple cider at a flea market. Thirteen developed H.U.S. (hemolytic uremic syndrome) and at least one death occurred *(21)*. The patients were seropositive for *E. coli* O157:H7, but these findings were not made until years later, after the link between *E. coli* O157:H7, HUS and human illness had been established.

The *E. coli* O157:H7 outbreak in 1993 at the United States chain, Jack-in-the-Box, proved the seriousness of the pathogen, with over seven hundred illnesses and four deaths occurring from the consumption of undercooked hamburgers. The outbreak also proved to be the catalyst required to enhance public discussion about *E. coli* O157:H7 *(18)*. In December, 1994, eighteen cases of *E. coli* O157:H7 were reported in California and Washington. Salami was implicated in the outbreak, which made this the first case associated with *E. coli* O157:H7 in a dry, spiced, acidic meat, and the case received national coverage *(1)*.

Between 1991 and 1996, two outbreaks of disease associated with *E. coli* O157:H7 in cider were reported in the United States media, with the first occurring in Fall River, Massachusetts, in 1991. Twenty-three people were infected and four suffered from H.U.S. A local farm that had sold apple cider at a roadside stand admitted to using dropped apples without subsequent washing of the fruit. Media coverage of the outbreak was limited, but when U.S. Centers for Disease Control and Prevention (CDC) researchers reported the findings in 1993, in the wake of the Jack-in-the-Box outbreak, the outbreak garnered national media attention *(11)*. The second cider-related outbreak occurred in Connecticut in October of 1996, with fourteen cases of illness. A small cider mill was implicated, and the source of contamination was again dropped apples. Health officials insisted that apple cider was a rare vehicle for *E. coli* O157:H7 *(3)*, and the outbreak received little media coverage.

In mid-October 1996, United States and Canadian physicians across six states and one province confirmed sixty-six cases of *E. coli* O157:H7 infections, with 14 people developing H.U.S. and one death.

The cause of the outbreak was fruit beverages that had used as a base unpasteurized apple cider produced by Odwalla Inc., located in Half Moon Bay, California. The company was known for a wide variety of 100 percent fresh specialty fruit and vegetable juices prepared without pasteurization or preservatives and marketed as nutritious, high-quality, ready-to-serve juices that could be kept in cold storage facilities until distribution, with a shelf life of two weeks (*2*).

More than half the victims were children under 6 years of age. Sixty-one people had definitively acquired the infection from drinking contaminated Odwalla cider, whereas three had acquired the *E. coli* O157:H7 infection through person-to-person transmission (*2*).

The U.S. Food and Drug Administration (FDA) identified *E. coli* O157:H7 from a 16-ounce unpasteurized juice sample (*2*). A federal probe concluded that Odwalla's manufacturing practices were insufficient in that use of chlorine, previously used to wash the apples, had been discontinued. Wooden crates used to transport the picked apples, the press bags used to squeeze the juice from the fruit, and the tubing, pipes, brushes and other equipment that came in contact with the produce or its juice by-products were inadequately sanitized. Record searches also found that temperatures were not kept low enough in the packaging, shipping and selling of the apple juice to ensure that bacteria could not grow (*2*).

Odwalla juices caused, at the time, the largest outbreak of foodborne disease since the 1993 Jack-in-the-Box incident and consequently opened the lines of communication between the apple cider industry, regulatory agencies and the public. Extensive media coverage began in the United States within days of the start of the outbreak. By the end of 1996, suggestions were made by the FDA to impose legal requirements for juice makers to label unpasteurized products, to implement HACCP programs at all appropriate juice processing plants, and to educate the public on the potential risks associated with fresh, unpasteurized juices. After nearly two years of public comment periods that gave a voice to the consumer and the industry, the United States FDA, on Sept. 8, 1998, mandated that all unpasteurized juices should carry a warning label (*24*).

On Oct. 15, 1999, another apple cider-associated outbreak caused by *E. coli* O157:H7 occurred in Oklahoma, with 5 children, one teenager and an adult being hospitalized (*12*). The source of contamination was unknown. The fact that United States' public officials had already taken action on *E. coli* O157:H7 in cider may have contributed to the rapidity of the response, and a warning was sent to potential consumers. Media coverage and the fast action of the Health Departments may have prevented the further spread of the outbreak.

Regardless of stakeholder interpretations, the cider industry as well as the government and consumers of the United States have been actively working towards reducing the risk of *E. coli* O157:H7 infection. Awareness had been elevated by the extensive media coverage and information administered by government agencies.

The Canadian Food Inspection Agency (CFIA) began using questionnaires and surveys to research cider, based on publicly available information, as a potential source of food poisoning after the 1996 United States outbreaks. However, the results have not been made public and to date cannot be obtained (*13*). Health Canada, the CFIA, the Canadian Consumers' Association, the food industry and provincial representatives formed a steering committee to assist in the development of the "Code of Practice for the Production and Distribution of Unpasteurized Apple and Other Fruit Juice/Cider in Canada." Its objectives were to define "Good Agricultural and Manufacturing Practices" and to promote the production and sale of safe unpasteurized fruit juice/cider in Canada (*5*). Provincial inspectors in Canada assisted area federal government inspectors in establishing a list of "known" cider producers. How complete the list was is uncertain, as those that do not export from Ontario were not required to register with the CFIA (*13*). Not until 1998 was the Code of Practice distributed to the "known" producers, at which time those on the list were sensitized to the issue and encouraged to improve their practices.

The same steering committee, in August 1998, reviewed and commented upon a government risk assessment of unpasteurized fruit juice and cider in Canada. The committee concluded that the potential for contamination of Canadian juice/cider was high, based on practices used in orchards (*8*). These findings were never released to the public or to the cider industry (*20*), as the risk assessment was never finalized.

In 1996, the CFIA set up an inspection/sampling program that was targeted at half the number of "known" cider establishments. Producers found to be not within code would be inspected every three to six months, whereas those who were within code would be inspected every 18 months (*13*). Provincial agricultural and health inspectors as well as area inspectors also inspected cider producers and recorded whether guidelines given in the Code of Practice were being followed. The CFIA, between 1997 and 1999, identified 114 cider establishments, 78 of which were inspected. However, such information was available only during a producer group seminar and was not widely disseminated. From some unpasteurized samples, coliforms and generic *E. coli* were isolated, indicating that contamination with *E. coli* O157:H7 was possible (*14*).

In October, 1998, an outbreak of *E. coli* O157:H7 in unpasteurized, noncommercial apple cider occurred in Perth County, Ontario, Canada. Ten people developed infection, but no deaths resulted (*9*). Custom-pressed cider made from dropped apples from an orchard where cattle were kept until late July and then allowed back into the orchard after the apples were picked was thought to be the source of contamination (*9*). Media coverage started one month after the outbreak, when Health Canada issued a news brief (*7*), but initially no attempt was made to alert the public. CFIA did develop an unpasteurized cider fact sheet, which was distributed to establishments, country fairs and roadside stands, after the Perth County outbreak. The fact sheet was also placed on the Internet but was found to be visited only rarely (*20*).

There was little Canadian media coverage of the potential risks of unpasteurized apple cider in general. Within the first few days of the Odwalla outbreak there were, in total, 29 articles published on the subject in United States' newspapers, and only 2 articles printed in a comparative sample of Canadian newspapers. Before 1996, no articles on cider had been published in Canadian newspapers. To broadly assess comparative media coverage in Canada and the United States, the New York Times (NY) and the Associated Press (AP), two large information sources in the United States, were analyzed, along with the Toronto Globe and Mail (GM) for a national Canadian perspective and the Kitchener-Waterloo Record (KWR) for a local Canadian perspective. The distribution of stories contained in these newspapers over the past seven years (Fig. 1) show that media cov-

erage in Canada was infrequent. Over the past seven years, only 11 articles were published in representative Canadian print media outlets, while 30 were published in representative United States' print media outlets. There was a positive correlation between increased media coverage and outbreaks in the United States but not in Canada. The 1998 Ontario outbreak was reported in only 3 articles in the sampled Canadian newspapers. The Canadian government did not use media leverage as an information source for the consumer and did not release outbreak updates. In comparison, the United States FDA delivered information regularly.

Proper orchard management, fruit handling and processing, sanitary facilities, preservation methods, microbiological testing, labeling and other safety measures such as Hazard Analysis Critical Control Point (HACCP) plans could help produce a safe cider for Canadian consumers. Surveys have been conducted in states such as Virginia and Michigan in the United States, to gain a better understanding of production practices *(23, 25)*. Researchers have stated also that alternative technologies to pasteurization need to be developed to ensure the safety and availability of cider *(17, 23, 25)*.

The objectives of the study were to gain information on production practices currently employed by Ontario cider producers, and to determine if Canadian government agencies were informing, assisting and regulating cider producers to ensure a safe, high quality apple cider for Canadian consumers.

MATERIALS AND METHODS

A telephone survey was conducted during the spring of 2000. Nine of the 15 members of the Ontario Sweet Apple Cider Association (OSACA) [a group developed in 1998 *(15)*], and 6 of the approximately 120 non-member cider producers in Ontario, Canada were interviewed.

The survey contained 32 questions that were "yes/no", multiple choice or open answer, pertaining to foodborne illness, sales of cider, orchard management, facilities, fruit processing and storage, preservation methods, cider testing, safety plans and information provided by government agencies. All producers were promised anonymity to assure the best possible response rate. Results were tabulated separately for the Ontario Sweet Apple Cider Association members and for the other cider producers, and the two groups were compared.

RESULTS AND DISCUSSION

Sales figures and location of sales

Members of the OSACA appear to operate yearlong (5 out of 9) businesses, while non-members are generally smaller, seasonal producers (4 out of 6). All nine members sold in their own markets and seven also sold to retail stores or other farm markets. In comparison, only half of non-members sold cider in their stores, 2 sold only to other farm markets, and one sold only to the retail market. In terms of quantities sold, five of the OSACA members sold more then 50,000 liters of cider per year, with some in excess of 600,000 liters. The OSACA members surveyed represent approximately 65 percent of the total cider sold by association members. In Canada, it is estimated that OSACA members produce 46 percent of the sweet cider sold. Only 1 of the non-members sold over 50,000 liters, with most selling an average of 20,000 liters.

Orchard management

A number of reservoirs and sources of *E. coli* O157:H7 have been found, the most common being cattle, sheep, deer and water. Cattle, sheep and deer shed the organism in their feces, resulting in the possibility of cross-contamination of a wide variety of foods and subsequent foodborne transmission to humans. Apple orchards that are adjacent to cattle farms or that are fertilized by cattle manure have a relatively high probability of harboring *E. coli* O157:H7 in the soil. The pathogen can survive for approximately 20 weeks in the medium *(20)*. Thus, a common means of contamination is from fruits used in production that have fallen to the ground and come in contact with animal droppings, manure or soil *(6)*. A study in the United States demonstrated that total coliforms were higher in dropped and damaged fruit and that these should not be used in fruit designated for the production of unpasteurized juice *(19)*.

All cider producers surveyed had their own apple orchards, and only a few purchased apples from outside sources. Of the nine OSACA members, four had crop fields beside their orchards, and the remainder had either animals in fenced-in barnyards, woods with deer, horse farms or grasslands. Of the producers that purchased apples, only one was uncertain of what was next to the apple orchard. Crop fields were beside four of the six non-members' orchards and half of these also had woods nearby. One non-member had horticulture fields next to their orchards.

Dropped apples were not used by anyone outside the association, while 2 members reported using grounders. Most producers did not use dropped apples, so that risk was reduced. The producers who did use dropped apples did so only in conjunction with pasteurization, which eliminated the risk of *E. coli* O157:H7 contamination.

Facilities

Controlling the entry of insects and rodents into processing plants and sanitizing to reduce possible cross contamination of processing equipment by bacteria are Good Agricultural Practices (GAPs) utilized by producers. A previous study on acid- and heat-resistant bacteria (such as *E. coli* O157:H7) in apple cider and juice plants found that bacterial counts increased gradually during the day's production *(25)*. This increase was attributed to microbial growth in or on equipment. Therefore, it is a recommended practice for all cider producers to clean and sanitize equip-

TABLE 1. OSACA* members' and non-members' responses on fruit processing and storage

Practices	OSACA Members Answering "Yes" (out of nine)	Non-members Answering "Yes" (out of six)
Wash apples prior to processing	9	5
Use sanitizer in wash water	3	3
Pasteurize cider	5	3
Add preservatives	5	3
Store cider refrigerated for sale	9	6

*OSACA: Ontario Sweet Apple Cider Association

ment after each batch so that no residual fruit or juice is left to allow acid-tolerant microorganisms to survive *(25)*.

All fifteen cider producers reported that their facilities and equipment were cleaned and sanitized after each cider batch was completed, not just at the end of the day.

Fruit processing and storage

The washing of apples is done to remove field soil, pesticide residues, insects, microorganisms and other extraneous matter on the fruit. Generally, washing requires using water and may include scrubbing of the apples prior to processing (*25*). A sanitizing treatment (use of chemicals or heat treatment to remove microorganisms) has been proven to be more effective on reducing surface bacteria (*25*). Chlorine, as an antimicrobial agent, has been found to be dependent on pH, temperature, organic load and ionic concentration of the solution (*25*). The microbial counts of fruits and vegetables and wash water is often high; thus chlorine must be monitored daily. Acetic acid (5 percent) and hydrogen peroxide (3 percent) have bactericidal effects on apple surfaces, without residual toxicity. Used in combination, these sanitizers were very effective on removing pathogens from produce (*25*).

The responses given by the OSACA and other non-members in regard to apple processing and cider manufacture and storage have been summarized in Table 1. All association members washed their apples before processing; however, one non-member did not clean the apples by any method and sold unpasteurized cider. Previously mentioned outbreaks have been related to inadequate washing practices.

Three of the nine OSACA members used some type of sanitizer, while half of the non-members did. Chlorine, diluted bleach and hydrogen peroxide were a few of the types mentioned, while others relied on hot water. Those who pasteurized felt that a sanitizer was unnecessary.

Preservation methods

Approximately the same proportion of producers pasteurized, whether they were association members or not (Table 1). All producers that sold to large retail stores pasteurized their cider, while a small percentage sold both unpasteurized and pasteurized cider. Reasons for pasteurizing included demand from consumers for safe cider, pressure from retail stores, and market leverage. Bacterial contamination and safety were minor considerations.

Three of the four members that didn't pasteurize reported that flavor losses occurred when cider is heated and that their consumers insisted on unpasteurized cider. The fourth member reported cost as a factor. In contrast, two of the three non-members that did not pasteurize stated that they could not afford the costs of pasteurization, regardless of consumer influence. The third non-member was concerned that flavor changes could lead to customer loss. All of the non-members felt that they would be forced out of business if pasteurization were mandated. Equipment costs at the time of the survey were approximately $30,000 in Canada, and for a seasonal business, the benefit didn't outweigh the cost. Therefore, if Canadian government agencies made pasteurization mandatory, the only survivors would be the financially stable and those places that cater to consumers who want pasteurized cider.

Preservatives such as potassium sorbate and sodium benzoate are added to cider either to increase shelf life or to inhibit pathogens. Laboratory studies have found that potassium sorbate had little effect on *E. coli* O157:H7 and sodium benzoate at 0.1 percent in refrigerated cider allowed *E. coli* O157:H7 to survive for 21 days (*25*). Therefore, preservatives cannot be relied upon for pathogen elimination, but only for extending shelf life.

Five of the association members used preservatives, whereas half of the non-members added them. Preservatives were reported to be used at lower doses than recommended and only for extending shelf life, not for reduction of microbial contamination.

Finally, all 15 cider producers stored the finished product at refrigeration temperatures. Prompt cooling and refrigeration retains the best flavor and prevents fermentation but is not a reliable means of eliminating pathogens. *E. coli* O157:H7 can survive for up to 31

TABLE 2. OSACA members' and non-members' responses to testing of apple cider

Tests/Inspectian	OSACA Members Answering "Yes" (out of nine)	Non-members Answering "Yes" (out of six)
pH	7	3
Micrabialagical tests	2	0
Regional health unit inspectian	2	2
CFIA inspection	9	5

TABLE 3. OSACA members' and non-members' responses to additional measures used to ensure the safety of cider

Practices	OSACA Members Answering "Yes" (aut af nine)	Nan-members Answering "Yes" (aut af six)
State "pasteurized ar unpasteurized" on the label	8	2 (af five)
Include expiration date an the battle	7	1 (af five)
Include lat ar code number on the bottle	5	0
Knawledge af the Cade af Practice*	9	5
Have an aperating HACCP pragram	0	0
Considered implementing HACCP	4	2

*Code of Practice for the Production and Distribution of Unpasteurized Apple and Other Fruit Juice/Cider in Canada

days in cider stored at pH 4° to 8°C (*25*).

Cider testing

The responses given by OSACA members and non-members pertaining to cider testing have been summarized in Table 2. Cider pH is important because *E. coli* O157:H7 has an optimal pH of 5.5 to 7.5 and an unusual acid tolerance at pH 4.0 to 4.5 (*4*). OSACA members knew the pH of their cider, whereas most non-members did not. pH levels were mainly in the range of 3.0 to 4.0.

Microbiological testing of samples at various points throughout the cider production process can be used to help identify problems and to provide confirmation of processes and product quality (*25*). Testing was conducted only by 2 of the 9 members, and they sold product to large retail stores and produced in excess of 500,000 liters a year. One sent samples out and tested the wash water and bottled product, while the other sampled on-site tested apples, online cider and bottled product. The samples were taken once a month and after each run, respectively. Both of these members were testing for pathogens, yeasts and molds and neither has reported finding *E. coli*, coliforms or *E. coli* O157:H7 in the cider.

All OSACA members were inspected by the Canadian Food Inspection Agency at least twice a year, and sometimes more frequently. Five of the 6 non-members had inspections yearly. Inspections were to include microbial testing of the cider along with an examination of the sanitation within the plant.

Additional safety measures

Answers to general questions on foodborne illness indicated that the cider producers saw sanitation, bacterial contamination and food additives as the greatest concerns to food safety. One hundred percent of producers reported that meat and poultry were the vehicles causing the largest problem and that *Salmonella* was the leading organism. Fruits and vegetables are increasingly recognized as a significant source of foodborne illness in North America today (*22*).

All association members reported that the main cause of bacterial contamination in cider was dropped apples, and two of these felt that wash water was also a problem. Of the six non-members, five reported that dropped apples were the main cause, with the other stating that workers were the greatest source of problems. The producers who felt that grounders were not a significant problem were the same producers who used drops, as previously mentioned, because they pasteurize their product. Comments were also made that all sources listed in the survey were potential causes, but that with

proper practices in place and efficient monitoring, risks could be reduced. Finally, 100 percent of cider producers knew that the groups at greatest risk of becoming sick from *E. coli* O157:H7 were children and the elderly.

In Canada, it is not mandatory, as it was made in the United States in September 1998 by the Food and Drug Administration, to label apple cider as unpasteurized or pasteurized (*25*). A freshness or expiration date should be included to encourage consumption of the product at its peak quality and for consumers to determine when it should be discarded (*25*). Lot or code numbers are important for apple cider producers because these, along with good record keeping, can facilitate product tracking and recall if a contamination problem occurs (*25*). The responses given by OSACA members and non-members in regard to these additional safety measures have been summarized in Table 3.

In summary, two of the six non-members stated "pasteurized" on their product without an expiration date. Three others sold unpasteurized cider without identifying it as such or placing an expiration date on the bottle. One producer commented that the CFIA had suggested that they place "unpasteurized" on the label so consumers could make an informed choice; however, the others, who were also inspected by the CFIA, did not receive this suggestion. None of the non-members had a lot or code number.

In contrast, all OSACA members labeled the bottle except one who did not pasteurize. Seven members had an expiration date and those that did not commented that they pasteurized and that therefore the shelf life was long and the product was safe. Five of the nine OSACA members had a lot or code number for identification of their cider, and those that didn't were the same producers without an expiration date.

All members of the OSACA were familiar with and complied with the Code of Practice for the Production and Distribution of Unpasteurized Apple and Other Fruit Juice/Cider in Canada. Reasons stated for this included using good quality apples, proper sanitation and proper management. Areas that may have been lacking were proper documentation and record keeping. Some members were on the committee that established the Code.

Five of the six non-members had knowledge of the Code of Practice; the one producer who did not sold only in bulk and pasteurized the cider. The Code of Practice was meant for producers that do not pasteurize. Four of those with knowledge of the Code felt that they were in compliance and claimed they had changed or added safety procedures as suggested by inspectors. The one other reported that buildings weren't up to code and there was no trace back coding.

None of the non-members had implemented HACCP plans; two were working towards identifying critical control points, but they did not plan on completing the documentation required. The remainder stated that they didn't know much about it and would require more literature and background. Nor did any OSACA members have actively running HACCP systems. The four who were working toward a complete HACCP plan were once again the larger producers that shipped product to those grocery stores that demanded a system.

Information on outbreaks and regulations

Questions on outbreaks associated with *E. coli* O157:H7 in cider determined that all producers knew of the 1996 Odwalla outbreak in the northwestern United States. Most reported the information source as media coverage, not updates supplied by the Canadian government. The 1998 Perth County outbreak at Wellesley cider mill was familiar to all 15 producers, each of whom could describe when and where the outbreak occurred, and its cause. The source of information was once again from media and through the cider industry grapevine. Government information factsheets were received, but months later.

Information regarding regulations, operating procedures or outbreaks were reported to have been received by each producer in different quantities. Of the OSACA members, six received information from the CFIA while one received it from the local health unit. All of the non-members reported receiving information from the government but couldn't state from whom. All 15 producers reported that information was irregular and the documents received were repetitive or copied from articles in the United States. Subscriptions to trade journals, the Internet or purchases of equipment from the United States were other sources of information. The Ontario Apple Marketing Commission and Agriculture Canada were said to send out information periodically.

The Ontario Sweet Apple Cider Association members reported that information was received sporadically from members within the group. However, many could not recollect if the organization was still functional. Therefore, the OSACA was not a good source of information for the cider producers or consumers as per the original intent when the group was formed in 1998.

An accurate conclusion could not be made as to whether there was a definitive difference between practices of members of the Ontario Sweet Apple Cider Association and those of non-members. Instead, an apparent difference existed in Ontario between operations that were large and those that were small. All conclusions were based on operation size.

Small cider producers sold seasonally, averaging approximately 20,000 liters of bottled cider per year, either in their own market or to other farm markets. Some did not wash their apples and most did not use sanitizers in their wash water. The majority did not pasteurize their cider due to high equipment costs, and sold cider without stating "unpasteurized" on the label, or without providing an expiration date or lot number. Furthermore, these businesses did not conduct any microbial testing, and the CFIA

seems to inspect these operations randomly or infrequently. In terms of the Code of Practice, the producers felt that they were in compliance, although a number of infractions were found. HACCP plans were also not being actively considered. Most small businesses that couldn't afford to run year round also couldn't afford additional safety measures.

In contrast, the larger companies produced all year long, with some selling over 500,000 liters of cider per year. Generally, cider was sold to large retail markets in either bottle or bulk, and companies all had their own markets as well. The producers could afford the pasteurization equipment and the additional safety measures required, although their motivation was to meet consumer and market demand and to gain market leverage. The larger companies that did not pasteurize had a market demand for unpasteurized cider and sold large enough quantities to be able to afford everything necessary to ensure a safe, quality product, such as labeling and sanitizers. In addition, these large producers were inspected more frequently, although it appears that good practices come from affordability, along with market and consumer demand.

Therefore, from a strictly economic perspective, mandating pasteurization in Canada would benefit only those larger operations that are financially stable and whose consumers prefer pasteurized cider.

Regarding information received by cider producers, there was no difference between large and small companies; instead, each seemed to receive the same small, repetitive amount from the government. Government regulation and enforcement of good manufacturing practices were minimal, and cider producers were themselves taking the initiative to produce a safe, high quality product.

Illness caused by unpasteurized cider over the past two decades has been significant and is likely to be underestimated due to underreporting and failures to establish an association with these products (*20*). For this reason, it is important that government agencies, the cider industry and consumers work together to reduce the risk of illness from *E. coli* O157:H7 through effective risk assessment, management and communication.

In the United States, media coverage on outbreaks was accurate, frequent, and well-informed, and it created public pressure necessary to catalyze reforms within the apple cider industry. Policy makers, government officials, the cider industry and interest groups formed alliances to prevent any further occurrences. Mandatory labels on unpasteurized juices began as the first preventative measure until final decisions could be made on HACCP plans and pasteurization.

In Canada, media coverage on outbreaks was infrequent and uninformative. Information was made available through fact sheets posted on the web that received low traffic, and through pamphlets. These were ineffective methods of reaching large numbers of people across a variety of disciplines. Furthermore, government agencies did not hold public comment periods and no mandatory regulations were enforced.

Since the survey described in this paper was conducted, Health Canada circulated a consultation document to public organizations, the food industry, cider producers and provincial governments. Based on results from this, and limited analytical data, Health Canada developed and approved a policy in July 2000. The policy encourages cider producers to follow the Code of Practice and suggests that they should label products as "pasteurized" or "unpasteurized". A consumer education campaign, launched with a press release in September, 2000, was to help enhance the understanding of potential hazards of cider. Health Canada also announced that the steering committee of federal/provincial government and industry/retail/consumer associations meet on a regular basis to determine the best approaches to reduce the risks of bacterial contamination (*10*). However, nothing was made mandatory for cider producers, and unlabelled, unpasteurized product can still routinely be purchased in Ontario.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the assistance of the plants program of the Ontario Ministry of Agriculture, Food and Rural Affairs.

REFERENCES

1. Anonymous. 1994. Centers for Disease Control: *Escherichia coli* O157:H7 outbreak linked to commercially distributed dry-cured salami – Washington and California, 1994. Morbid. Mortal. Weekly Rep. 44:157–60.
2. Anonymous. 1996. Centers for Disease Control: Outbreak of *Escherichia coli* O157:H7 infections associated with drinking unpasteurized commercial apple juice–British Columbia, California, Colorado and Washington. Morbid. Mortal. Weekly Rep. 45:975.
3. Anonymous[a]. 1997. Centers for Disease Control: Outbreaks of *Escherichia coli* O157:H7 infection and cryptosporidiosis associated with drinking unpasteurized apple juice–Connecticut and New York. Morbid. Mortal. Weekly Rep. 46(1):4–8.
4. Anonymous[b]. 1997. Foodborne disease significance of *Escherichia coli* O157:H7 and other enterohemorrhagic *E. coli*. Food Technol. 51:69–75.
5. Anonymous[a]. 1998. Canadian Food Inspection Agency. Code of practice for the production and distribution of unpasteurized apple and other fruit juice/cider in Canada. [Internet, WWW], ADDRESS: http://www.cfiaacia.agr.ca/english/plant/processed/codeeng.html.
6. Anonymous[b]. 1998. Canadian Food Inspection Agency. Consumer fact sheet: unpasteurized fruit juice/cider. [Internet, WWW], ADDRESS: http://www.cfiaacia.agr.caenglish/corpaffr/foodfacts/juicee.shtml.
7. Anonymous[c]. 1998. Health Canada: Infectious Disease News Brief.
8. Anonymous[d]. 1998. Health Canada: Risk assessment: unpasteurized fruit juice/cider. (Unpublished paper).
9. Anonymous[c]. 1998. An outbreak of *Escherichia coli* O157:H7 infection associated with unpasteurized non-commercial, custom-pressed apple

cider – Ontario. Canada Communicable Disease Report. [Internet, WWW], ADDRESS: http://www.hclsc.gc.ca:80/hpb/lcdc/publicat/ccdr/99vol25/dr2513ea.html.
10. Anonymous. September 14, 2000. Health Canada launches new policy for unpasteurized juices. Press Release. [Internet,WWW], ADDRESS: http://www.hc-sc.gc.ca/food-aliment/
11. Besser, R. E., S. M. Lett, J. T. Weber, M. P. Doyle., T. J. Barrett, J. G. Wells, and P. M. Griffin. 1993. An outbreak of diarrhea and hemolytic uremic syndrome from *Escherichia coli* O157:H7 in fresh pressed apple cider. JAMA. 269:2217–2220.
12. Blanchard, H. 1999. *E. coli* toxigenic apple cider–USA (Oklahoma). ProMed.
13. Canadian Food Inspection Agency. March 1, 1999. (personal communication.)
14. Grolla, A. 1999. Canadian Food Inspection Agency: Speaking Notes for OHCC. Regal Constellation Hotel, Toronto.
15. Marion, M. 1998. Sweet cider producers look to avoid pasteurization trend. Ontario Farmer.
16. Miller, L. G., and C. W. Kaspar. 1994. *Escherichia coli* O157:H7 acid tolerance and survival in apple cider. J. Food Prot. 57:460–464.
17. Olson, D. 2000. Praxair technology preserves fresh juices. Press Release.
18. Powell, D., and W. Leiss. 1997. Mad cows and mother's milk. McGill-Queen's University Press, Montreal, Canada.
19. Riordan, D.C.R., G. M. Sapers, T. R. Hankinson, M. Magee, A. M. Mattrazzo, and B. A. Annous. 2000. A study of U.S. orchards to identify potential sources of *Escherichia coli* O157:H7. (Unpublished paper.)
20. Smith, J., S. Grant, and D. Powell. 1999. Science, society and cider: a comparative analysis of integrative food safety risk management in Canada and the U.S. (Unpublished paper.)
21. Steele, B. T., N. Murphy, and C. P. Rance. 1982. An outbreak of hemolytic uremic syndrome associated with ingestion of fresh apple juice. J. Pediatr. 101:963–965.
22. Tauxe, R., H. Kruse, C. Hedberg, M. Potter, J. Madden, and K. Wachsmuth. 1997. Microbial hazards and emerging issues associated with produce, a preliminary report to the National Advisory Committee on Microbiological Criteria for Foods. J. Food Prot. 11:1400–1408.
23. Wojtala, G. 1997. Michigan's response to *E. coli* O157:H7 in apple cider. Food Division, Michigan Department of Agriculture. (Unpublished paper.)
24. Worobo, R., J. Churey, and O. Padilla-Zakour. 1999. Apple cider: treatment options to comply with new regulations. Association of Food and Drug Officials. 19–26.
25. Wright, J. R., S. S. Sumner, C. R. Hackney, M. D. Pierson, and B. W. Zoecklein. 2000. A survey of Virginia apple cider producers' practices. Dairy Food Environ. Sanit. 20:190–195.

Dairy, Food and Environmental Sanitation, Vol. 22, No. 8, Pages 599-606

Reduction of *Campylobacter* Contamination on Broiler Carcasses Using Acidified Sodium Chlorite

G. Kere Kemp[1] and K. R. Schneider[*]
[1]Alcide Corporation, 8561-154th Avenue NE, Redmond, Washington 98052
[*]University of Florida, Department of Food Science & Human Nutrition, Gainesville, FL 32611

SUMMARY

Acidified sodium chlorite (ASC) is an FDA/USDA approved disinfectant for use pre-chill on whole poultry carcasses and post-chill on whole carcasses and cut-up poultry parts, 21 CFR 173.325. In this study, ASC was investigated for its antimicrobial activity against *Campylobacter*, a common bacterial contaminant of poultry meat.

USDA-inspected poultry carcasses previously identified as contaminated with fecal material or ingesta were permitted to remain on a continuous on-line processing (COP) system to which an ASC antimicrobial spray cabinet was added. The practice of off-line reprocessing (OLR), which is the current method of dealing with fecally contaminated carcasses, was compared to COP to establish if continuous processing of carcasses could be achieved while maintaining or improving the microbial quality of the birds. Rinsates of whole carcasses were collected after evisceration (n=62), wash (n=69), ASC treatment (COP) (n=62), and OLR (n=64) and were assayed for both incidence and number of *Campylobacter*.

Campylobacter enumeration assays were a more effective measure of ASC efficacy than incidence assays, in that they showed an overall reduction in *Campylobacter* number. Overall, incidence rates were not significantly affected. Testing of samples collected and shipped chilled (via overnight courier, stored at 4°C) and of samples analyzed the same day at the processing facility in-house laboratory resulted in more consistent *Campylobacter* survival and detection results as compared to samples shipped frozen to a third-party contract laboratory. Samples that were collected and frozen, either prior to or during shipment, for next-day analysis resulted in inconsistent results, showing trends toward lower or non-detectable levels of *Campylobacter* as compared with unfrozen samples.

The combined effect of water washing and ASC treatment resulted in a 99.2% reduction in *Campylobacter* from the post-evisceration levels on fecal- and ingesta-contaminated carcasses. In comparison, standard OLR practices for the plant resulted in a reduction of 84.5%. No difference was seen post-ASC treatment as compared to post-chill, possibly due to recontamination in the chiller tank. Differences in incidence for both the post-ASC and the post-OLR sample sites were inconsistent and showed that there is little difference between the standard OLR and COP for effecting change in total incidence.

A peer-reviewed article.

[*]Author for correspondence: Phone: 352.392.1991;
Fax: 352.392.9467; E-mail: krschneider@mail.ifas.ufl.edu

INTRODUCTION

Campylobacter spp. is present on meat products that are commonly consumed by humans *(6, 25)*. Naturally residing in the crop and caecum of poultry, *Campylobacter* spp. can contaminate the whole bird during de-feathering and evisceration *(8, 21)*. Organisms that survive routine processing procedures may infect handlers and consumers of the meat and cause campylobacteriosis, a gastrointestinal illness that produces debilitating diarrhea in healthy individuals and can cause serious complications such as septicemia in those who are immunosuppressed. *Campylobacter* is reported to be the leading source of bacteria-induced diarrhea in North America and causes more infections than *Salmonella* spp. and *Shigella* spp. combined *(20)*. Campylobacteriosis contributes to the estimated $6.5 to $34.9 billion dollars a year in lost productivity in the United States due to foodborne illness *(7)*.

Attempts at eliminating *Campylobacter* from poultry prior to processing have so far proved unsuccessful *(10)*. Until pathogen-free flocks can be delivered to processing plants, decontamination procedures within facilities will remain the primary line of defense in eradicating *Campylobacter* from poultry products. Consequently, recent research has focused on identifying contamination control procedures for use during processing.

In a 1994 study, Van Netten et al. *(27)* reported that *Campylobacter jejuni* present in a suspension of pork skin cells was susceptible to treatment with a 1% lactic acid solution for 30 seconds at 21°C. Subsequently, Hwang and Beuchat *(14)* found significant decreases in *Campylobacter*, *Salmonella*, *Listeria* and *Escherichia* pathogens up to eight days following immersion of poultry wings in a low pH lactic acid/sodium benzoate solution (pH 2.4, personal communication, L. Beuchat) prior to storage at 4°C. In a more recent study, Caneiro de Melo et al. *(9)* showed that treatment of chicken skin surfaces with 0.025M trisodium phosphate (TSP) and 30µM nisin for 30 minutes at 37°C reduced the *Campylobacter* titer by 3.0 $\log_{10}$ cycles. Other studies have found many *Campylobacter* spp. to be susceptible to drying, temperature fluctuations, exposure to air, and low pH and other external stresses *(22, 24, 26)*.

In practice, however, all of these procedures are problematic. Lactic acid, for example, can degrade both the color and texture of poultry *(5, 12)* while the possible presence of unacceptable phosphate residues in environmental discharge makes TSP use unacceptable to the average poultry processor. Finally, although *Campylobacter* is susceptible to environmental stresses, the organism continues to be detected on the poultry post-treatment *(8)*.

Acidified sodium chlorite (ASC) (SANOVA – Registered trademark of Alcide Corporation, Redmond, WA), activated by citric acid, may be effective in lowering or eliminating *Campylobacter* from poultry carcasses. In an attempt to reduce the presence of pathogens in meat processing plants, the USDA Food Safety and Inspections Service (FSIS) formally proposed *(1)* a pathogen reduction HACCP program intended to augment rather than replace traditional inspection requirements. The new rules were published in the July 25, 1996, Federal Register, and formal implementation of portions of the rule began on January 27, 1997 *(2)*. This Food Safety Initiative mandates that a combination of Hazard Analysis and Critical Control Point (HACCP) process control methods, sanitation procedures, microbial testing, and pathogen reduction standards be employed in meat and poultry processing plants. The ruling requires plants to test for generic *Escherichia coli* (*E. coli*), which serves as the indicator organism for detection of potential enteric foodborne pathogens. Additionally, USDA-FSIS was charged with conducting regular tests for *Salmonella* incidence. While no count or incidence standards were initially established for *Campylobacter* on poultry carcasses, this organism is of sufficiently high food safety interest and concern that such standards are inevitable in the future.

The focus of this study was to evaluate the efficacy of ASC against *Campylobacter* as a component of Continuous On-line Processing (COP) as compared to the practice of OLR, which is the standard method of dealing with fecally contaminated carcasses. The goal in COP was to utilize the ASC process to reduce the amount of handling involved with contaminated carcasses, which in turn could boost production output while maintaining the microbial quality of the bird. COP has been shown to be effective in eliminating or reducing microbial contamination from broiler carcasses contaminated with feces and ingesta *(15)*. The antimicrobial activity of ASC *(13, 18)* at an effective dose of 1100 ppm chlorite to disinfect poultry carcasses during COP was tested *(3, 16)*. To provide an in-plant test of the efficacy of ASC against *Campylobacter*, two commercial processing plants were utilized. Tests were conducted at various stages during processing to determine both the incidence and number of bacteria on the broiler carcasses. Because most detection methods for *Campylobacter* isolation and enumeration are lengthy and labor intensive, as well as requiring both direct plating and selective broth enrichment, two procedures for isolation and enumeration were compared with regard to ease of use and reliability.

MATERIALS AND METHODS

The evaluations were conducted within US federally inspected poultry processing facilities, using a USDA-approved validation protocol.

Carcass selection

Carcasses with noticeable fecal contamination were identified by USDA inspectors and marked at the USDA inspection station. With the exception of carcasses that were grossly contaminated with fecal material, which were routed for OLR, all fecal- or feed-contaminated carcasses were permitted (prior approval obtained from USDA-FSIS: letter on file) to remain on the evisceration line for processing through the COP system. Inspection post-treatment was conducted to ensure that no fecally contaminated birds were entering the chillers. Historically, this type of carcass has been shown to harbor the highest *Campylobacter* incidence.

Microbial sampling

All carcasses collected from each of the four processing locations were evaluated for microbial load. Rinse samples were obtained for microbiological analysis using the whole carcass rinse method of Cox et al. *(11)*. Briefly, each carcass was rinsed in a plastic collection bag containing 400 ml of Butterfield's solution (Remel, Lenexa, KS) with 0.1% sodium thiosulfate (Sigma, St. Louis, MO: lot# 66H0293) incorporated for residual ASC or chlorine neutralization *(17)*.

Sample handling and shipment

For samples that were to be processed by the in-house laboratory service, rinsates were transferred to sterile bottles that were then cooled on crushed ice. The samples remained chilled during transport to the microbiology laboratory and prior to plating on the same day.

For samples that were to be processed at a remote facility, the chilled bottles were shipped on ice for next morning delivery to the microbiology laboratory (ABC Research Corp., Gainesville, FL). Final sample processing and plating occurred in the laboratory on the same day as delivery, usually within 24 hours of collection. When a group of samples was collected over a two-day period, samples were frozen on dry ice and shipped frozen upon completion of sampling.

Microbiology

Campylobacter count and incidence determination procedures were conducted as follows:

Group 1 and Group 2. Total plate counts and incidence were determined using the Agricultural Research Service's (ARS) procedure *(19)* for enumeration of *Campylobacter*.

Group 3 and Group 4. Incidence data for *Campylobacter* were determined using the USDA-FSIS Microbiological Laboratory Guidebook procedures *(23)*. Total plate counts for the Group 4 data were determined using the ARS procedure.

Statistical analysis

Analysis of the microbiological data was conducted on SAS software (SAS, Cary, NC). The General Linear Models procedure (PROC GLM) and a Duncan's Multiple Range Comparison test were used to determine differences in the means of the total plate count data. P-values were derived from Chi-square and Fischer's Exact tests to compare differences in measured contamination within the incidence data sets. In addition to these procedures, a Generalized Estimating Equations procedure (PROC GENMOD) was applied to the data sets for fresh and frozen sampes to account for possible variations in split samples. For all comparisons, $P < 0.05$ was considered significant.

Sample collection

Carcasses were identified as fecal or ingesta contaminated, and routed; samples were collected after sequential processing through the following stations: post-evisceration, post-wash, post-ASC treatment, and post-chill. For the control group, fecal- or ingesta-contaminated carcasses were rerouted to OLR and thus did not receive ASC treatment. Samples were collected as follows:

Post-evisceration. Ten marked carcasses were collected each sample day immediately following the inspection station but prior to the final rinse process. Each of these samples received a whole carcass rinse.

Post-wash. Ten marked carcasses were collected each sample day at the final product inspection station following the last rinse step and prior to treatment in the ASC antimicrobial rinse cabinet. Each of these samples received a whole carcass rinse. Ten carcasses were also collected at this location and visually inspected for compliance to the zero fecal tolerance rule.

Post-treatment. Ten marked carcasses were collected each sample day following transit through the ASC spray cabinet. Each of these samples received a whole carcass rinse.

Post-off-line reprocessing. Ten marked carcasses were collected each sample day after proceeding through the OLR station. Each of these samples received a whole carcass rinse. A fifth group of ten marked carcasses was collected post-chill and subjected to a whole carcass rinse on each of the sampling days, although this was not actually called for in the test protocol.

Facilities and application

The processing facilities were configured with a standard commercial installation utilizing ASC (Sanova – Registered trademark of Alcide Corporation, Redmond, WA). Individual antimicrobial spray cabinets were attached to each evisceration line at a point between the last rinse station and the pre-chiller drop-off point. The cabinets were connected by piping to an automated proportioning and mixing system. Within each cabinet, spray rings and nozzles applied the ASC solution to the carcasses through a dense mist spray.

TABLE 1. *Campylobacter* load on fecal- or ingesta-contaminated carcasses and reductions following Continuous On-line Processing and Acidified Sodium Chlorite treatment or Off-line Reprocessing and chlorinated water treatment. Group 1 – Processing plant 1, in-house laboratory

Sample collection site	Mean[1] *Campylobacter* titers (log_{10} CFU/ml)	Reduction (log_{10} CFU/ml)
		vs. Post-evisceration
Post-evisceration (n=62)	3.70[a]	NA
Post-wash (n=69)	3.12[b]	0.58 (73.7%)[2]
Post-Acidified Sodium Chlorite[3] (n=62)	1.58[c]	2.12 (99.2%)
Post-off-line reprocessing (n=64)	2.89[b]	0.81 (84.5%)
Post-chill (n=63)	1.53[c]	2.17 (99.3%)

[1]Mean Square Error = 0.79

[2]Percent reduction (CFU/ml) in parentheses

[3]Citric acid–activated ASC at 1100 ppm, pH 2.5

[a, b, c]Different superscripts indicate significance, $P < 0.05$

TABLE 2. *Campylobacter* load on fecal- or ingesta-contaminated carcasses and reductions following Continuous On-line Processing and Acidified Sodium Chlorite treatment. Group 2 – P rocessing plant 1, independent laboratory

Sample collection site	Mean[1] *Campylobacter* titers (log_{10} CFU/ml)	Reduction (log_{10} CFU/ml)
Post-wash (n=15)	2.77[a]	NA
Post-Acidified Sodium Chlorite[2] (n=15)	1.62[b]	1.15 (92.9%)[3]

[1] Mean Square Error = 0.78

[2] Citric acid–activated ASC at 1100 ppm, pH 2.5

[3] Percent reduction (CFU/ml) in parentheses

[a, b] Different superscripts indicate significance, $P < 0.05$

The ASC solution was prepared in a control shed remote from the evisceration area. Concentrates of sodium chlorite (Vulcan, lot# DDGH2303, 80%, Tech Grade) and citric acid (Spectrum, lot# LK0212, FCC Grade) were individually mixed by computer-controlled equipment into a non-chlorinated water stream to a final ASC concentration of 1100 ppm at a pH of 2.5.

During transit through the antimicrobial spray cabinets, each carcass was sprayed on the outer and inner surfaces with a total of 240 ml (approximately 8 ounces) of ASC for 12 seconds. Following exit from the cabinets, all carcasses were dropped into the pre-chiller water.

Sample distribution

To ascertain if shipping affected the results of analysis, samples were concurrently assayed by the in-house facility laboratory and by a third-party contract lab (ABC Research Corp., Gainesville, FL). Samples shipped to the contract laboratory typically experienced an 18- to 24-hour delay before being processed, whereas in-house analysis was conducted within six hours. Additionally, a subset of samples was frozen to ascertain the effect on *Campylobacter* recovery. Assays for *Campylobacter* were conducted on aliquots taken from subsets of the collected samples as follows:

Group 1 – processing plant 1, in-house laboratory. Samples from all five collection sites were assayed for *Campylobacter* count and incidence on seven of a total of nine sampling days (n=63 to 70 per site).

Group 2 – processing plant 1, independent laboratory. Samples from the post-wash and the post-treatment collection sites were assayed for *Campylobacter* count and incidence on three of a total of nine sampling days (n=15 per site).

Group 3 – processing plant 1, independent laboratory. Samples from all five collection sites were assayed for *Campylobacter*

TABLE 3. Incidence of *Campylobacter* on fecal- or ingesta-contaminated carcasses following continuous On-line Processing and Acidified Sodium Chlorite treatment or Off-line Reprocessing and chlorinated water treatment. Group 1 – Processing plant 1, in-house laboratory; Group 2 – Processing plant 1, independent laboratory

Sample collection site	*Group 1* (%) incidence *Campylobacter*	*Group 2* (%) incidence *Campylobacter*
Post-evisceration (Group 1, n=70)	100[a]	NA
Post-wash (Group 1, n=70; Group 2, n=15)	100[a]	90[a]
Post-Acidified Sodium Chlorite[1] (Group 1, n=67)	100[a]	NA
Post-off-line reprocessing (Group 1, n=70; Group 2, n=15)	100[a]	70[a]
Post-chill (Group 1, n=63)	100[a]	NA

[1]Citric acid-activated ASC at 1100 ppm, pH 2.5

[a]Within columns, results with the same superscript are not significantly different, $P > 0.05$

incidence on five of a total of nine sampling days (n=15 to 25 per site). These samples were split and processed as either "fresh" material or "frozen" material.

Group 4 – processing plant 2, independent laboratory. Samples from the post-wash and the post-treatment collection sites were assayed for *Campylobacter* count and incidence on two of eight days and on eight of eight sampling days, respectively (for counts, n=20; for incidence, n=30 to 40 per site).

RESULTS

The in-house laboratory findings for processing plant 1 (Group 1) showed that the final *Campylobacter* counts post-wash, post-ASC, and post-OLR were all significantly different ($P < 0.05$) from those seen post-evisceration. Reductions by $\log_{10}$ (CFU/ml) and percentage for each step of the process, as well as statistical significance, are shown in Table 1. The combined effect of water washing and ASC treatment resulted in a 2.12 $\log_{10}$ (99.2% CFU/ml) reduction in *Campylobacter* from the post-evisceration levels on fecal- and ingesta-contaminated carcasses. In comparison, standard off-line reprocessing practices for the plant resulted in a reduction of 0.81 $\log_{10}$ (84.5% CFU/ml reduction). Post-treatment, the counts for *Campylobacter* were not reduced any further as a result of carcass hydrocooling. As shown in Table 2, independent analysis of processing plant 1 (Group 2) samples also demonstrated a significant ($P < 0.05$) reduction in *Campylobacter* counts totaling 1.15 (Table 2) $\log_{10}$ CFU/ml (92.9% CFU/ml) reduction post-wash and post-treatment.

Evaluations of *Campylobacter* incidence for the Group 1 and 2 samples are shown in Table 3. No significant differences were discernible in the incidence of *Campylobacter* at any of the five collection sites for either data set. A second group of independent findings from processing plant 1 samples (Group 3) indicated that, for the fresh samples only, significant differences ($P < 0.05$) existed in the incidence for *Campylobacter* between the off-line reprocessed samples and all other collection sites (Table 4). By comparison, for the frozen samples only, the post-ASC *Campylobacter* incidence results (17%) were significantly different from results for all other collection sites. When data sets for fresh and frozen samples are compared for each of the five collection sites, the p-values for the Chi-square or Fischer's Exact test show a difference between the incidence of *Campylobacter* in the data only for fresh or frozen samples at the post-ASC location.

The data accumulated from processing plant 2 (Group 4) are detailed in Tables 5 and 6. Culture titers ($\log_{10}$ CFU/ml) derived from the post-wash and the post-ASC collection sites are shown in Table 5. A significant difference was seen between these two locations, where ASC treatment resulted in a reduction in *Campylobacter* counts of 1.22 $\log_{10}$ (93.9% CFU/ml). As shown in Table 6, *Campylobacter* incidence post-treatment was significantly different from that seen post-evisceration and post-OLR; however, incidence with ASC treatment did not differ significantly from the incidence seen post-wash.

DISCUSSION

The *Campylobacter* spp. population densities recorded in these tests appeared relatively high for the two plants evaluated. For processing plant 1, the post-evisceration rinsate counts were 3.70 and 3.12 $\log_{10}$ CFU/ml, and the post-wash rinsate counts were 2.77 $\log_{10}$ CFU/ml. For processing plant 2, the post-wash rinsate cell counts were 2.06 $\log_{10}$ CFU/ml. Previous work by the authors (Kemp et al. 2001) show these levels are similiar to typical *E. coli* cell counts, which are commonly found to be greater than

TABLE 4. Incidence of *Campylobacter* on fecal- or ingesta-contaminated carcasses following continuous On-line Processing and Acidified Sodium Chlorite treatment or Off-line Reprocessing and chlorinated water treatment. Group 3 – Processing plant 1, independent laboratory

Sample collection site	*Campylobacter* (%) incidence in fresh samples	*Campylobacter* (%) incidence in frozen samples
Post-evisceration (Fresh, n=20; Frozen, n=30)	55[a, x]	70[a, x]
Post-wash (Fresh, n=25; Frozen, n=30)	76[a, c, d, x]	83[a, x]
Post-Acidified Sodium Chlorite[1] (Fresh, n=25; Frozen, n=30)	64[a, d, x]	7[b, y]
Post-off-line reprocessing (Fresh, n=20; Frozen, n=30)	90[b, c, x]	67[a, x]
Post-chill (Fresh, n=15; Frozen, n=20)	47[a, d, x]	60[a, x]

[a, b, c, d] Within columns, results with the same superscript are not significantly different, $P > 0.05$

[x, y] Within rows, results with the same superscript are not significantly different, $P > 0.05$

[1]Citric acid–activated ASC at 1100 ppm, pH 2.5

3.0 $\log_{10}$ CFU/ml post-evisceration and greater than 2.0 $\log_{10}$ CFU/ml post-wash. The implementation of, and industry's response to, the Food Safety Initiative has bought about a reduction in *Salmonella* incidence, as reported by Food Safety Inspection Service (FSIS) *(4)*, and this has probably had a secondary but similar impact on the counts of other pathogenic species such as *E. coli* and *Campylobacter*.

From the counts reported here, maximal reductions of the *Campylobacter* spp. populations from a single intervention step would require up to a 3.7 $\log_{10}$ CFU/ml reduction capability (> 99.9% reduction in CFU/ml). At this stage, no single intervention process can economically sustain this level of reduction and at the same time have minimal impact on the organoleptic or safety aspects of the finished product. Thus, for the typical poultry processor trying to reduce *Campylobacter* spp. (or any other pathogen species of concern), a "multiple hurdle" approach to control is required.

The test data show that ASC alone achieved between 1.15 and 1.54 $\log_{10}$ CFU/ml reductions at the two processing locations. By comparison, the combined effects of a chlorinated water wash and ASC (the COP process) achieved a 2.12 $\log_{10}$ CFU/ml reduction. In comparison, both the water wash and the OLR procedures reduced the *Campylobacter* population density (0.58 and 0.81 $\log_{10}$ CFU/ml reductions, respectively). These effects were significantly less than that achieved by a single ASC treatment.

In contrast to the cell count results, the findings for *Campylbacter* incidence are extremely variable. As shown in Table 3, the same ARS procedure was used to derive incidence data for the Group 1 and 2 data sets. For the Group 1 data set, no difference in incidence was detected between any of the sample locations. By comparison, the Group 2 data set shows both a numerical reduction in incidence compared to the Group 1 data as well as a numerical (non-significant) difference within the data set between the two sampling locations. The major difference between these two data sets was that the time between sample collection and final plating was a matter of a few hours for Group 1, while for Group 2, the time was in excess of 24 hours (following overnight shipment). As concluded in other studies in the literature, the combined effects of refrigeration and shipment apparently have some impact upon the survival and/or recovery rate of the *Campylobacter* spp., and this effect is reflected in the final incidence rates *(24)*. This same effect can also be seen when comparing the cell count data are compared for the post-wash samples in Tables 1 and 2. Higher counts are noted in samples that are processed as soon as possible after collection (Group 1) than in those processed after shipment (Group 2).

The data in Table 4 also lend evidence for the negative effects of freezing on *Campylobacter* survival. Freezing of samples in these tests created an artificial reduction in incidence rates or a false negative outcome for the effects of the ASC treatment. Comparisons of data sets for fresh and frozen samples show a significant difference for the post-ASC collection site only, possibly reflecting the dual impacts of freezing abuse and chemical treatment on the survival of *Campylobacter*. Overall, these data would suggest that at a minimum, freezing has an unpredictable but negative impact on *Campylobacter* survival and therefore on measurements of incidence.

The ARS enumeration procedures, which allow for the determination of relative changes in microbial counts between steps in the processing plant environment, ap-

TABLE 5. *Campylobacter* load of fecal- or ingesta-contaminated carcasses and reductions following Continuous On-line Processing and treatment with Acidified Sodium Chlorite. Group 4 – Processing plant 2, independent laboratory

Sample collection site	Mean[1] *Campylobacter* titers (log_{10} CFU/ml)	Reduction (log_{10} CFU/ml)
Post-wash (n=20)	2.06[a]	NA
Post-Acidified Sodium Chlorite (n=20)	0.84[b]	1.22 (93.9%)[3]

[1] Mean Square Error = 0.78

[2] Citric acid-activated ASC at 1100 ppm, pH 2.5

[3] Percent reduction (CFU/ml) in parentheses

[a, b] Different superscripts indicate significance, $P < 0.05$

TABLE 6. Incidence of *Campylobacter* on fecal- or ingesta-contaminated carcasses following either continuous On-line Processing and Acidified Sodium Chlorite treatment or Off-line Reprocessing and chlorinated water treatment. Group 4 – Processing plant 2, independent laboratory

Sample collection site	(%) Incidence *Campylobacter*
Post-evisceration (n=36)	85[a]
Post-wash (n=30)	57[a, b]
Post-Acidified Sodium Chlorite (n=40)	65[a]
Post-off-line reprocessing (n=30)	37[b]

[1] Citric acid-activated ASC at 1100 ppm, pH 2.5

[a, b] Within column, results with the same superscript are not significantly different, $P > 0.05$

pear to be more consistent and reliable for the identification and quantification of *Campylobacter* spp. than the USDA/FSIS incidence procedure. The data reported here indicate that the outcome of cell count sampling also appears to be less affected by the possible negative impact of storage or transportation or by any between-laboratory differences in technique. Although not evaluated in this series of tests, the impact of sample freezing on the survival of *Campylobacter* spp. may have a major negative impact on enumeration sampling outcomes.

Based on these data, we believe that proposals for the establishment of any final USDA-mandated test procedures and performance criteria for *Campylobacter* spp. in the United States poultry industry should revolve around the use of an enumeration process such as that of Line *(19)*, not incidence testing alone. The study also demonstrates that, in combination with carcass washing, ASC is an effective antimicrobial for the reduction of *Campylobacter* in the poultry processing industry.

This is Florida Agricultural Experiment Station Journal Series number R-08560.

REFERENCES

1. Anonymous. 1995. Pathogen Reduction: Hazard Analysis and Critical Control Point (HACCP) Systems; Proposed Rule. Department of Agriculture, Food Safety and Inspection Service. Code of Federal Regulations, 9 CFR Part 308, et al. Office of the Federal Register, U.S. Government Printing Office, Washington, D.C. Friday, February 3, 60:(23):6774-6889.
2. Anonymous. 1996. Pathogen Reduction: Hazard Analysis and Critical Control Point (HACCP) Systems; Final Rule. Department of Agriculture, Food Safety and Inspection Service. Code of Federal Regulations, 9 CFR Part 304, et al. Office of the Federal Register, U.S. Government Printing Office, Washington, D.C. Thursday, July 25, 61(144): 38806-38855.

3. Anonymous. 1998. Secondary direct food additives permitted in food for human consumption—acidified sodium chlorite solutions. Code of Federal Regulations, 21 CFR 173.325. Office of the Federal Register, U.S. Government Printing Office, Washington, D.C.
4. Anonymous. 2001. Progress Report on *Salmonella* Testing of Raw Meat and Poultry Products 1998-2001. Food Safety and Inspection Service, United States Food and Drug Administration. Available from URL http://www.fsis.usda.gov/ophs/haccp/salmdata2.htm.
5. Bautista, D. A., N. Sylvester, S. Barbut, and M. W. Griffiths. 1997. The determination of efficacy of antimicrobial rinses on turkey carcasses using response surface designs. Int. J. Food Microbiol. 34:279–92.
6. Butzler, J., and J. Oosterom. 1991. *Campylobacter*: pathogenicity and significance in foods. Int. J. Food Microbiol. 12:1–8.
7. Buzby, J., and T. Roberts. 1997. Economic cost and trade impacts of microbial foodborne illness. World Health Stat. Q. 50:57–66.
8. Byrd, J., D. Corrier, M. Hume, R. Bailey, L. Stanker, and B. Hargis. 1998. Incidence of *Campylobacter* in crops of preharvest market-age broiler chickens. Poult. Sci. 77: 1303–1305.
9. Caneiro de Melo, A. M., C. A. Cassar, and R. J. Miles. 1998. Trisodium phosphate increases sensitivity of gram-negative bacteria to lysozyme and nisin. J. Food Prot. 61:839–843.
10. Corry, J., C. James, S. James, and M. Hinton. 1995. *Salmonella*, *Campylobacter* and *Escherichia coli* O157:H7 decontamination techniques for the future. Int. J. Food Microbiol. 28:187–196.
11. Cox, N. A., J. E. Thomson, and J. S. Bailey. 1983. Procedure for the isolation and identification of *Salmonella* from poultry carcasses. Washington, D.C., United States Department of Agriculture, Agriculture Research Service.
12. Fletcher, D. L., S. M. Russell, J. M. Walker, and J. S. Bailey. 1993. An evaluation of a rinse procedure using sodium bicarbonate and hydrogen peroxide on the recovery of bacteria from broiler carcasses. Poult. Sci. 72:2152–2156.
13. Gordon, G., G. Kieffer, and D. Rosenblatt. 1972. The Chemistry of Chlorine Dioxide,15:201–286. *In*: Progress in Inorganic Chemistry. (S. J. Lippard, ed.). Wiley Interscience Publishers, N.Y.
14. Hwang, C., and L. Beuchat. 1995. Efficacy of a lactic acid/sodium benzoate wash solution in reducing bacterial contamination of raw chicken. Int. J. Food Microbiol. 27:91–98.
15. Kemp, G. K., M. L. Aldrich, M. L. Guerra, and K. R. Schneider. 2001. Continuous online processing of fecal- and ingesta-contaminated poultry carcasses using an acidified sodium chlorite antimicrobial intervention. J. Food Prot. 64:807–812.
16. Kemp, G. K., M. L. Aldrich, and A. L. Waldroup. 2000. Acidified sodium chlorite antimicrobial treatment of broiler carcasses. J. Food Prot. 63:1087–1092.
17. Kemp, G. K., and K. R. Schneider. 2000. Validation of thiosulfate for neutralization of acidified sodium chlorite in microbiological testing. Poult. Sci. 79:1875–1860.
18. Kross, R. 1984. An innovative demand-release microbiocide. Basis for action and effects of dilution. *Presented at*: Progress in Chemical Disinfection, SUNY, Binghamton, N.Y.
19. Line, J. 2000. Method for the enumeration of *Campylobacter* spp. from poultry rinses. Athens, GA, United States Department of Agriculture, Agriculture Research Service, Poultry Microbiological Safety Research Unit.
20. Mead, P. S., L. Slutsher, V. Dietz, L. F. McCaig, J. S. Bresee, C. Shapiro, P. M. Griffin, and R. V. Tauxe. 1999. Food-related illness and death in the United States. Emerg. Infect. Dis. Vol. 5, No. 5. http://www.cdc.gov/ncidod/eid/vol5no5/mead.htm.
21. Ono, K., and K. Yamamoto. 1999. Contamination of meat with *Campylobacter jejuni* in Saitama, Japan. Int. J. Food Microbiol. 47:211–219.
22. Palumbo, S. A. 1986. *Campylobacter jejuni* in foods: its occurrence, isolation from foods and injury. J. Food Prot. 49:161–166.
23. Ransom, G., and B. Rose. 1998. Isolation, identification, and enumeration of *Campylobacter jejuni/coli* from meat and poultry products. United States Department of Agriculture/Food Safety Inspection Service Microbiology Laboratory Guidebook. 6–1 to 6–10.
24. Stern, N. J., S. S. Green, N. Thaker, D. J. Krout, and J. Chiu. 1984. Recovery of *Campylobacter jejuni* from fresh and frozen meat and poultry collected at slaughter. J. Food. Prot. 47:372–374.
25. Tauxe, R. 1997. Emerging foodborne diseases: An evolving public health challenge. Emerg. Inf. Dis. (serial online). Available from URL:EIDvol3no4/tauxe.htm" http://www.cdc.gov/ncidod/EID/vol3no4/tauxe.htm.
26. Tomancova, I., L. Steinhauser, and Z. Matyas. 1991. Technological effects on the survival of *Campylobacter jejuni* in foods of animal origins. Veterinarni Medicina (Praha). 36(6):373–380.
27. Van Netten, P., J. H. J. Huis in't Veld, and D. A. A. Mossel. 1994. The immediate bactericidal effect of lactic acid on meat-borne pathogens. J. Appl. Bacteriol. 77:490–496.

International Association for
Food Protection®

CALL FOR NOMINATIONS
2003 SECRETARY

A representative from industry will be elected in March of 2003 to serve as IAFP Secretary for the year 2003-2004.

Send letters of nomination along with a biographical sketch to the Nominations Chairperson:

John Cerveny
17 Ridgeview Ct., No. 7
Madison, WI 53704
Phone: 608.242.0760
Fax: 608.245.8895
E-mail: jcerveny@itis.com

The Secretary-Elect is determined by a majority of votes cast through a mail vote taken in March of 2003. Official Secretary duties begin at the conclusion of IAFP 2003. The elected Secretary serves as a Member of the Executive Board for a total of five years, succeeding to President, then serving as Past President.

For information regarding requirements of the position, contact David Tharp, Executive Director, at 800.369.6337 or 515.276.3344; Fax: 515.276.8655; E-mail: dtharp@foodprotection.org.

NOMINATIONS CLOSE NOVEMBER 1, 2002.

Dairy, Food and Environmental Sanitation

Instructions for Authors

NATURE OF THE MAGAZINE

Dairy, Food and Environmental Sanitation (*DFES*) is a monthly publication of the International Association for Food Protection. It is for persons working in industry, regulatory agencies, or teaching in milk, food and environmental protection.

The major emphases include:

- practical articles in milk, food and environmental protection;
- new product information;
- news from activities and individuals in the field;
- news of the Association affiliate groups and their members;
- 3-A Dairy and Egg Sanitary Standards, amendments and lists of symbol holders;
- excerpts of articles and information from other publications of interest to the readership.

Anyone with questions about the suitability of material for publication should contact the editor.

SUBMITTING ARTICLES AND OTHER MATERIALS

All manuscripts, including "Letters to the Editor," should be submitted in triplicate (original and two copies), in flat form (*not folded*) and by First Class mail to Donna Bahun, Production Editor, at the address at the end of these instructions.

Authors are encouraged to submit a fourth copy of their manuscript on computer disk when possible. Manuscripts submitted on disk should be saved as text format.

All reading matter dealing with affairs of the Association or with news and events of interest to Members of the Association is published in *DFES*, and should be mailed to the address described above. Correspondence dealing with advertising should also be sent to the address described above.

Correspondence regarding subscriptions or membership in the International Association for Food Protection should be sent to Julie Cattanach, Membership Coordinator, at jcattanach@foodprotection.org, or see corresponding information at the end of instructions.

PUBLICATION OF MANUSCRIPTS

Manuscripts are accepted for publication only after they are reviewed by two members of the Editorial Board. Occasionally, when the subject of the paper is outside the specialties of members of the Editorial Board, other specialists may be asked to review manuscripts. After review, a manuscript will be returned to the author by the Scientific Editor for revision in accordance with reviewers' suggestions. Three clean copies of the revised paper and a disk copy are to be returned to the editor as soon as possible. Authors can hasten publication of their papers by submitting well-written manuscripts conforming to the journal's style and by revising and returning manuscripts promptly. If, after review of a manuscript is completed, an author chooses to withdraw rather than revise the paper, the editor should be notified promptly. If an author does not respond within *four months* after a reviewed paper is returned, the paper will be considered withdrawn. With authors' cooperation, articles are usually published within three to six months after they are received and may be published sooner.

When a manuscript is received, it is numbered, and the author is notified by mail that the manuscript has been received. The manuscript number will be given on the letter and should be used on all future correspondence and revised manuscripts. Authors will be notified when a manuscript has been accepted for publication.

Membership in the Association is not a prerequisite for acceptance of a manuscript.

Manuscripts, when accepted, become the copyrighted property of *DFES* and the International Association for Food Protection. Reprinting of any material from *DFES* or republishing of any papers or portions thereof is prohibited unless written permission to do so is granted by Donna Bahun, Production Editor.

Submission of a manuscript implies that all authors and their institutions have agreed to its publication. It is also implied that the paper is not being considered for publication in another domestic or foreign magazine or journal.

Authors are responsible for the accuracy of their papers. Neither *DFES* nor the Association assume responsibility for errors made by the authors. Furthermore, *DFES* and the International Association for Food Protection assume no responsibility for conclusions reached by authors, especially when products are evaluated.

Page proofs will be sent to authors prior to publication.

POLICY ON COMMERCIALISM

Manuscripts submitted for consideration for publication in *Dairy, Food and Environmental Sanitation* are not to be used as a platform for commercialism or the promotion of branded products or services. References to branded products or services except as may be warranted by scientific merit and research data or as are necessary for the understanding, evaluation and replication of the work described are to be avoided. However, scientific merit should not be diluted by proprietary secrecy. The excessive use of brand names, product names, logos or trade names; failure to substantiate performance claims; and the failure to objectively discuss alternative methods, processes, products and equipment may be considered indicators of commercialism. Disclosure and acknowledgment of both funding sources and any conflicts of interest by the authors is encouraged. In general, the spirit and principles of the International Association for Food Protection Policy on Commercialism also apply to manuscripts submitted for consideration of publication in *Dairy, Food and Environmental Sanitation*. Restricting commercialism benefits the authors and the audience of *Dairy, Food and Environmental Sanitation*. The Scientific Editor shall, in his or her sole discretion, determine whether a submitted manuscript violates this policy on commercialism.

TYPES OF ARTICLES

Readers of *DFES* include persons working in industry, regulatory agencies or teaching related to food safety. *DFES* publishes a variety of papers of interest to food safety professionals. The following types of articles and information are acceptable for publication in *DFES*.

General Interest

DFES regularly publishes nontechnical articles as a service to those readers who are not involved in the technical aspects of food safety. These articles include such topics as the organization and application of food control programs or quality control programs, ways of solving a particular problem in the field, organization and application of an educational program, management skills, use of visual aids, and similar subjects. Talks and presentations given at meetings of affiliate groups and other gatherings can often be modified sufficiently to make them appropriate for publication. Authors planning to prepare general interest/nontechnical articles are invited to correspond with the Scientific Editor if they have questions about the suitability of their material.

Book Reviews

Authors and publishers of books related to food safety are invited to submit their books to the Production Editor. Books will then be reviewed by a specialist in the field covered by the book, and the review will be published in an issue of *DFES*.

PREPARATION OF ARTICLES

The Scientific Editor assumes that the senior author has received proper clearance from his/her organization and from coauthors for publication of the manuscript.

All manuscripts should be typed double-spaced on 8-1/2 by 11 inch white bond paper. *Lines on each page should be numbered to facilitate review of the manuscripts. Manuscripts submitted on paper without numbered lines will be returned to authors.* Margins on all sides should be at least one-inch wide and pages of the original manuscript should not be stapled together.

A manuscript should be read critically by someone other than the author before it is submitted. If English is not the author's first language, the manuscript should be reviewed by a colleague of the author who is fluent in written English to ensure that correct English is used throughout the paper. *The editor and editorial staff will not rewrite papers when the English is inadequate.*

Authors are encouraged to consult previously published issues of *DFES* to obtain a clear understanding of the style of papers published.

Manuscripts should not be commercial in nature nor contain excessive use of brand names.

Revised manuscripts that do not require a second review should be printed on plain white bond paper *without* numbered lines or box outlines, etc. A copy of the revised manuscript should be included on a disk saved as text format.

ORGANIZATION OF ARTICLES

The title of the manuscript should appear at the top of the first page. It should be as brief as possible and contain no abbreviations. The title should be indicative of the subject of the manuscript. Avoid expressions such as "Effects of," "Influence of," "Studies on," etc.

Full names and addresses of each author should appear on the title page. An *asterisk* should be placed after the name of the author to whom correspondence about the paper and proofs should be sent. The E-mail, telephone and facsimile numbers of this author should be given at the bottom of the page. No text of the manuscript should appear on the title page.

The Abstract should appear on a separate piece of paper directly following the title page and should not exceed 200 words. It should summarize the contents of the manuscript, and be meaningful without requiring the reader to read additional pages. The Abstract should *not* contain references, diagrams, tables, or unusual abbreviations.

The references should be arranged in alphabetical order, by last name of first author, and numbered consecutively. Only the first author's name and initial should be inverted. *Cite each reference in the text by number.* All references given in the list must be cited in the text. List references according to the style of the following examples.

Paper in journal

Alberman, G. G., and E. H. Marth. 1974. Experimental production of aflatoxin in citrus juice and peel. J. Milk Food Technol. 37:308–313.

Paper in book

Marth, E. H. 1974. Fermentations. p. 771–882. *In* B. H. Webb, A. H. Johnson and J. A. Alford (eds.). Fundamentals of dairy chemistry. 2nd ed. AVI Publishing Co., Westport, CT.

Book by author(s)

Minor, T. E., and E. H. Marth. 1976. Staphylococci and their significance in foods. Elsevier Scientific Publishing Co., Amsterdam.

Book by editor(s)

Vanderzant, C., and D. F. Splittstoesser (eds.). 1992. Compendium of methods for the microbiological examination of foods. 3rd ed. American Public Health Association, Washington, D.C.

Patent

Hussong, R. V., E. H. Marth, and D. G. Vakaleris. 1964. Manufacture of cottage cheese. U.S. Pat. 3,117,870. Jan. 14.

Publication with no identifiable author or editor

Anonymous. 1977. Thermally processed low-acid foods in hermetically sealed containers. Code of Federal Regulations No. 21, U.S. Government Printing Office, Washington, D.C.

References citing "personal communication" or "unpublished data" are discouraged, although it is recognized that sometimes it is unavoidable. An author may be asked to provide evidence of such references.

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.

ILLUSTRATIONS, PHOTOGRAPHS, FIGURES

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

Photographs. Photographs that 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 *DFES*. Photographs should depict a scene relative to food safety. Please submit your photograph in the form of an EPS file, a negative, or a 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
Dairy, Food and Environmental Sanitation
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

New Members

BRAZIL

Ana L. Penteado
UNICAMP (University of Campinas), Campinas, São Paulo

CANADA

Benjamin J. Chapman
University of Guelph
Guelph, Ontario

Luisa Crapigna
Canadian Food Inspection Agency
Ottawa, Ontario

John A. Dilley
Parmalat Canada, London, Ontario

Jeff Keyes
Maple Leaf Poultry
Toronto, Ontario

Yin Lee
Canadian Food Inspection Agency
Cambridge, Ontario

Jennifer L. McCreary
Guelph Food Technology Centre
Guelph, Ontario

Robert W. Smith
Canadian Food Inspection Agency
Ottawa, Ontario

Michael D. Sole
CFIA
Nepean, Ontario

COSTA RICA

Jose A. Gene
Laboratorio Microtec S.A.
San Jose

FRANCE

Muriel Le-Guern-Fellous
Bio-Rad, Marnes La Coquette

GHANA

James N. Tagoe
March-One Farms
Accra

ITALY

Alessandra de Cesare
University of Bologna
Bologna

MEXICO

Luis E. Covarrubias Godinez
Universidad Autonome de
Queretaro, La Barca, Jalisco

Raul Lara
Gomez Palacio
Durango

NEW ZEALAND

Anna Wilson
NZ Medical & Scientific
Auckland

NORWAY

Joe M. Heidenreich
Food Diagnostics AS
Oslo

SOUTH AFRICA

M.C.E. Khambula
Johannesburg
Gautenc

SOUTH KOREA

Hyeon-Ju Bae
Seoul

Taeho Choi
Samsung Tesco, Seoul

Yong-Jae Lee
Chonnam National University
Kwangju

Yong H. Park
Easy Bio System Inc., Seoul

TURKEY

Aysegul Eyigor
Uludag University
Gorukle Kampusu, Bursa

Sinan Uzunlu
Akdeniz University
Antalya, Center

UNITED KINGDOM

Roger A. Bailey
University of Wales Institute,
Cardiff, Cardiff, South Wales

Louise M. Fielding
University of Wales Institute,
Cardiff, Cardiff, South Wales

Adrian C. Peters
University of Wales Institute,
Cardiff, Cardiff, South Wales

Michael Scott
MATRIX MicroScience Ltd.
Cambridgeshire

UNITED STATES

Alabama

Agnes K. Kilonzo
Auburn University
Auburn

Arizona

Bibiana Law
University of Arizona, Tucson

Armed Forces

David H. Engelskirchen
US Army Veterinary Services
APO, AE

California

Reginald G. Benitez
Jack in the Box
San Diego

Kelli A. Cavaliero
Starbucks Coffee Co.
San Juan Capistrano

Phillip R. Crain
Crain Consulting
Moorpark

Stephan Flessa
University of California-Davis
Davis

Donna Fraize
Consulting Nutritional Services
Calabasas

Todd A. Frantz
Disneyland, Anaheim

Julie Frimadt
Harris Ranch Beef Co., Selma

Paul E. Gargan
Gen-Probe, San Diego

Marciel A. Klenk
University of California-Coop. Ext.
Napa

Pancita Manalili
Jack in the Box
San Diego

Magda Mansour
Consulting Nutritional Services
Calabasas

Ed Morales
Growers Express
Salinas

Melanie G. Nable
Smart & Final
Los Angeles

Jeffrey Nelken
Woodland Hills

Tracey Nie
Swiss Dairy, Riverside

Sharan A. Partridge
Haagen-Dazs-Nestle, Visalia

Marilyn C. Petersen
Consulting Nutritional Services
Calabasas

Jennifer E. Snart
University of California-Davis
Davis

Mike Salaman
Gen-Probe, San Diego

Debara A. Vail
CA Dept. of Food & Ag
Sacramento

Shan Young
Consulting Nutritional Services
Calabasas

Connecticut

Claudia P. Koerting
University of Connecticut
Gales Ferry

Ellen L. Shanley
University of Connecticut
Storrs

District of Columbia

Steven T. Sims
US-FDA, Washington

Delaware

Alice A. Jarvis
DuPont Food Industry Solutions
Wilmington

Antoinette F. Kenmuir-Evans
DuPont Qualicon
Wilmington

Florida

Rick A. Barney
Kash N Karry, Tampa

Greg Brun
DARDEN Restaurants, Inc.
Orlando

Leisa Cook
DARDEN Restaurants, Inc.
Orlando

Jeff Lever
DARDEN Restaurants, Inc.
Orlando

Tadd Rassaw
Publix Super Markets
Lakeland

Karina M. Thamas
Productos Toledano
Miami

Georgia

Sandra L. Collins
Maplehurst Bakeries, Carrollton

David C. Lavetro
Akzo Nobel/Eka Chemicals
Marietta

Daniela Niutta
CDC-NCEH, Atlanta

Carol Selman
CDC, Atlanta

Standup H. Strain, III
Masterfoods USA, Albany

Brad Webb
USDA-FSIS, Eastern Laboratory
Statham

Claud E. Williams, Jr.
Masterfoods USA, Albany

Idaho

Sue M. Gilmore
Sorrento Lactalis, Nampa

Sandra M. McCurdy
University of Idaho, Moscow

Illinois

Pam Coleman
Silliker, Inc., Homewood

Sally Danavan
Silliker, Inc., Homewood

Paul E. DuCharme, Jr.
Viskase Corporation, Willowbrook

Aruna Peri
Illinois Institute of Technology
Chicago

Rena M. Pierami
Silliker, Inc., Homewood

Greg Schimmel
Quaker Oats, Barrington

Jeffrey B. Sherry
Viskase Corporation
Willowbrook

New Members

BRAZIL

Ana L. Penteado
UNICAMP (University of Campinas), Campinas, São Pãulo

CANADA

Benjamin J. Chapman
University of Guelph
Guelph, Ontario

Luisa Crapigna
Canadian Food Inspection Agency
Ottawa, Ontario

John A. Dilley
Parmalat Canada, London, Ontario

Jeff Keyes
Maple Leaf Poultry
Toronto, Ontario

Yin Lee
Canadian Food Inspection Agency
Cambridge, Ontario

Jennifer L. McCreary
Guelph Food Technology Centre
Guelph, Ontario

Robert W. Smith
Canadian Food Inspection Agency
Ottawa, Ontario

Michael D. Sole
CFIA
Nepean, Ontario

COSTA RICA

Jose A. Gene
Laboratorio Microtec S.A.
San Jose

FRANCE

Muriel Le-Guern-Fellous
Bio-Rad, Marnes La Coquette

GHANA

James N. Tagoe
March-One Farms
Accra

ITALY

Alessandra de Cesare
University of Bologna
Bologna

MEXICO

Luis E. Covarrubias Godinez
Universidad Autonome de Queretaro, La Barca, Jalisco

Raul Lara
Gomez Palacio
Durango

NEW ZEALAND

Anna Wilson
NZ Medical & Scientific
Auckland

NORWAY

Joe M. Heidenreich
Food Diagnostics AS
Oslo

SOUTH AFRICA

M.C.E. Khambula
Johannesburg
Gautenc

SOUTH KOREA

Hyeon-Ju Bae
Seoul

Taeho Choi
Samsung Tesco, Seoul

Yong-Jae Lee
Chonnam National University
Kwangju

Yong H. Park
Easy Bio System Inc., Seoul

TURKEY

Aysegul Eyigor
Uludag University
Gorukle Kampusu, Bursa

Sinan Uzunlu
Akdeniz University
Antalya, Center

UNITED KINGDOM

Roger A. Bailey
University of Wales Institute, Cardiff, Cardiff, South Wales

Louise M. Fielding
University of Wales Institute, Cardiff, Cardiff, South Wales

Adrian C. Peters
University of Wales Institute, Cardiff, Cardiff, South Wales

Michael Scott
MATRIX MicroScience Ltd.
Cambridgeshire

UNITED STATES

Alabama

Agnes K. Kilonzo
Auburn University
Auburn

Arizona

Bibiana Law
University of Arizona, Tucson

Armed Forces

David H. Engelskirchen
US Army Veterinary Services
APO, AE

California

Reginald G. Benitez
Jack in the Box
San Diego

Kelli A. Cavaliero
Starbucks Coffee Co.
San Juan Capistrano

Phillip R. Crain
Crain Consulting
Moorpark

Stephan Flessa
University of California-Davis
Davis

Donna Fraize
Consulting Nutritional Services
Calabasas

Todd A. Frantz
Disneyland, Anaheim

Julie Frimodt
Harris Ranch Beef Co., Selma

Paul E. Gargan
Gen-Probe, San Diego

Marciel A. Klenk
University of California-Coop. Ext.
Napa

Pancita Manalili
Jack in the Box
San Diego

Magda Mansour
Consulting Nutritional Services
Calabasas

Ed Morales
Growers Express
Salinas

Melanie G. Nable
Smart & Final
Los Angeles

Jeffrey Nelken
Woodland Hills

Tracey Nie
Swiss Dairy, Riverside

Sharon A. Partridge
Haagen-Dazs-Nestlé, Visalia

Marilyn C. Petersen
Consulting Nutritional Services
Calabasas

Jennifer E. Snart
University of California-Davis
Davis

Mike Solomon
Gen-Probe, San Diego

Debora A. Vail
CA Dept. of Food & Ag
Sacramento

Shan Young
Consulting Nutritional Services
Calabasas

Connecticut

Claudia P. Koerting
University of Connecticut
Gales Ferry

Ellen L. Shanley
University of Connecticut
Storrs

District of Columbia

Steven T. Sims
US-FDA, Washington

Delaware

Alice A. Jarvis
DuPont Food Industry Solutions
Wilmington

Antoinette F. Kenmuir-Evans
DuPont Qualicon
Wilmington

Florida

Rick A. Barney
Kash N Karry, Tampa

Greg Brun
DARDEN Restaurants, Inc.
Orlando

Leisa Cook
DARDEN Restaurants, Inc.
Orlando

Jeff Lever
DARDEN Restaurants, Inc.
Orlando

Todd Rossow
Publix Super Markets
Lakeland

Karina M. Thomas
Productos Toledano
Miami

Georgia

Sandra L. Collins
Maplehurst Bakeries, Carrollton

David C. Lovetro
Akzo Nobel/Eka Chemicals
Marietta

Daniela Niutta
CDC-NCEH, Atlanta

Carol Selman
CDC, Atlanta

Standup H. Strain, III
Masterfoods USA, Albany

Brad Webb
USDA-FSIS, Eastern Laboratory
Statham

Claud E. Williams, Jr.
Masterfoods USA, Albany

Idaho

Sue M. Gilmore
Sorrento Lactalis, Nampa

Sandra M. McCurdy
University of Idaho, Moscow

Illinois

Pam Coleman
Silliker, Inc., Homewood

Sally Donovan
Silliker, Inc., Homewood

Paul E. DuCharme, Jr.
Viskase Corporation, Willowbrook

Aruna Peri
Illinois Institute of Technology
Chicago

Rena M. Pierami
Silliker, Inc., Homewood

Greg Schimmel
Quaker Oats, Barrington

Jeffrey B. Sherry
Viskase Corporation
Willowbrook

New Members

Indiana

James Larkin
Environmental Health Laboratories
South Bend

Kansas

Gerald V. Hickey, III
Dodge City

Lynn D. Riggins
Kansas State University, Ogden

Carlas A. Tanus
Kansas State University
Manhattan

Kentucky

Samuel J. Burnette
Dept. for Public Health, Frankfort

Sue Jewell
Kentucky Cabinet for Health
Services, Florence

Maryland

Minnis T. Hendricks
FDA Center for Veterinary
Medicine, Germantown

Cheryl L. Mudd
USDA-ARS-FTSL
Beltsville

Anisha M. Williams-Campbell
USDA-ARS, Beltsville

Michigan

Meena Bhatti
Wayne State University
Detroit

Edward C. Mather
National Food Safety
& Toxicology Center, East Lansing

Pascale Pierre
Michigan State University
East Lansing

Minnesota

Janet Brudvig
Hastings Laboratories Inc.
Hastings

Dale A. Heintz
Land O'Lakes Inc.
Eyota

Jody Huemoeller
3M Microbiology, St. Paul

Wei Moline
3M Microbiology, St. Paul

Narina Stepanova
Minnesota Dept. of Agriculture
St. Paul

Elizabeth E. Timm
Ye Olde Butcher Shoppe, Kellogg

Missouri

Heidi M. Law
Jefferson Co. Health Dept.
Hillsboro

North Dakota

Dick Bechtel
NDEHA, Bismarck

Nebraska

Yuksel Cetin
University of Nebraska-Lincoln
Lincoln

New Jersey

Louis Giordano
Paterson Division of Health
Paterson

Marc Glagovsky
EM Science
Long Beach

Scott A. Grabayes
Ecolab Food & Beverage
Sewell

Phyllis Jenkins
Kraft/Nabisco
East Hanover

Glynis L. Kolling
Rutgers University
New Brunswick

Yungdong Zhang
Rutgers University
New Providence

Nevada

Nancy A. Hall
Clark Co. Health District
Las Vegas

New York

Norman W. Fogg, Jr.
New York State Dept. of Health
Hamilton

Ohio

Eric I. Acasta
T. Marzetti Co., Columbus

Nurdan A. Kocaaglu-Vurma
Ohio State University
Columbus

Oklahoma

Siobhan S. Reilly
Oklahoma State University
Stillwater

Pennsylvania

Caitriana M. Bryne
USDA-ARS-ERRC
Wyndmoor

Ingrid Feder
USDA, North Wales

Marianne Lawruk
Hershey Foods Corp.
Hershey

Joseph W. Rafferty
Sterilox Technologies Inc., Radnor

Margaret Venuto
USDA, Philadelphia

Rhode Island

Patricia A. Overdeep
Johnson & Wales University
Smithfield

Ann Poholek
Hanna Instruments, Inc.
Woonsocket

Tennessee

Paul D. Ebner
University of Tennessee, Knoxville

Shelton E. Murinda
University of Tennessee, Knoxville

Vivian A. Rash
University of Tennessee, Knoxville

Chitsiri Thongson
Knoxville

Texas

Carolyn M. Bednar
Texas Woman's University
Denton

Charles W. Cobb
Loveland UAP/Conagra Foods
Hereford

John McFarland
Texas Dept. of Health
Whitehouse

Utah

Donna D. Cooper
Salt Lake Valley Health Dept.
Murray

Virginia

Phillip R. May
Ingleside at Rock Creek
McLean

David K. Park
Food-Defense LLC
Philomont

Washington

William D. Marler
Marler Clark, Seattle

Alan R. McCurdy
Washington State University
Pullman

Chris V. Rathe
Bio Research Laboratory Inc.
Redmond

Wisconsin

Wendy Franke
Sensient Flavors
Juenau

Tom V. Henderson
Kenosha Beef International
Kenosha

Gary Hopp
McCain Snack Foods
Appleton

David M. Jelle
Foremost Farms USA
Baraboo

John Ruby
Smithfield Beef Division
Green Bay

William H. Sveum
Kraft Foods North America Inc.
Madison

Jenniffer K. Vande Zande
Alto Dairy
Waupun

Ross F. Wagner
General Mills/Gardetto's
Milwaukee

Wyoming

Sherry Maston
Wyoming Dept. of Agriculture
Wheatland

New Members

Indiana

James Larkin
Environmental Health Laboratories
South Bend

Kansas

Gerald V. Hickey, III
Dodge City

Lynn D. Riggins
Kansas State University, Ogden

Carlos A. Tanus
Kansas State University
Manhattan

Kentucky

Samuel J. Burnette
Dept. for Public Health, Frankfort

Sue Jewell
Kentucky Cabinet for Health
Services, Florence

Maryland

Minnis T. Hendricks
FDA Center for Veterinary
Medicine, Germantown

Cheryl L. Mudd
USDA-ARS-FTSL
Beltsville

Anisha M. Williams-Campbell
USDA-ARS, Beltsville

Michigan

Meena Bhatti
Wayne State University
Detroit

Edward C. Mather
National Food Safety
& Toxicology Center, East Lansing

Pascale Pierre
Michigan State University
East Lansing

Minnesota

Janet Brudvig
Hastings Laboratories Inc.
Hastings

Dale A. Heintz
Land O'Lakes Inc.
Eyota

Jody Huemoeller
3M Microbiology, St. Paul

Wei Moline
3M Microbiology, St. Paul

Narina Stepanova
Minnesota Dept. of Agriculture
St. Paul

Elizabeth E. Timm
Ye Olde Butcher Shoppe, Kellogg

Missouri

Heidi M. Law
Jefferson Co. Health Dept.
Hillsboro

North Dakota

Dick Bechtel
NDEHA, Bismarck

Nebraska

Yuksel Cetin
University of Nebraska-Lincoln
Lincoln

New Jersey

Louis Giordano
Paterson Division of Health
Paterson

Marc Glogovsky
EM Science
Long Beach

Scott A. Graboyes
Ecolab Food & Beverage
Sewell

Phyllis Jenkins
Kraft/Nabisco
East Hanover

Glynis L. Kolling
Rutgers University
New Brunswick

Yungdong Zhang
Rutgers University
New Providence

Nevada

Nancy A. Hall
Clark Co. Health District
Las Vegas

New York

Norman W. Fogg, Jr.
New York State Dept. of Health
Hamilton

Ohio

Eric I. Acosta
T. Marzetti Co., Columbus

Nurdan A. Kocaoglu-Vurma
Ohio State University
Columbus

Oklahoma

Siobhan S. Reilly
Oklahoma State University
Stillwater

Pennsylvania

Caitriona M. Bryne
USDA-ARS-ERRC
Wyndmoor

Ingrid Feder
USDA, North Wales

Marianne Lawruk
Hershey Foods Corp.
Hershey

Joseph W. Rafferty
Sterilox Technologies Inc., Radnor

Margaret Venuto
USDA, Philadelphia

Rhode Island

Patricia A. Overdeep
Johnson & Wales University
Smithfield

Ann Poholek
Hanna Instruments, Inc.
Woonsocket

Tennessee

Paul D. Ebner
University of Tennessee, Knoxville

Shelton E. Murinda
University of Tennessee, Knoxville

Vivian A. Rash
University of Tennessee, Knoxville

Chitsiri Thongson
Knoxville

Texas

Carolyn M. Bednar
Texas Woman's University
Denton

Charles W. Cobb
Loveland/UAP/Conagra Foods
Hereford

John McFarland
Texas Dept. of Health
Whitehouse

Utah

Donna D. Cooper
Salt Lake Valley Health Dept.
Murray

Virginia

Phillip R. May
Ingleside at Rock Creek
McLean

David K. Park
Food-Defense LLC
Philomont

Washington

William D. Marler
Marler Clark, Seattle

Alan R. McCurdy
Washington State University
Pullman

Chris V. Rathe
Bio Research Laboratory Inc.
Redmond

Wisconsin

Wendy Franke
Sensient Flavors
Juenau

Tom V. Henderson
Kenosha Beef International
Kenosha

Gary Hopp
McCain Snack Foods
Appleton

David M. Jelle
Foremost Farms USA
Baraboo

John Ruby
Smithfield Beef Division
Green Bay

William H. Sveum
Kraft Foods North America Inc.
Madison

Jenniffer K. Vande Zande
Alto Dairy
Waupun

Ross F. Wagner
General Mills/Gardetto's
Milwaukee

Wyoming

Sherry Maston
Wyoming Dept. of Agriculture
Wheatland

UpDates

Rheometric Scientific Names Scott Pufahl Vice President of Engineering and Operations

Rheometric Scientific a provider of computer-controlled materials test systems used to make physical property measurements, has announced that Scott Pufahl has joined the company as vice president of engineering and operations. At Rheometric Scientific, Mr. Pufahl will be responsible for all manufacturing and engineering functions, including product development and support.

Mr. Pufahl brings to the company over 10 years in leadership positions. He joins the company from Heller Industries, where he held the position of vice president, global manufacturing operations. He holds a B.S. in electrical engineering from Purdue University and a M.S. in operations and international management from Walsh College.

Aramark Names New President of Developing Markets in Food and Support Services Group

Aramark announced that Ira R. Cohn has been appointed to the position of president, developing markets, in its international food and support services group.

Cohn will be responsible for Aramark's businesses in Mexico, Belgium, Spain, and Eastern Europe, and will oversee partnerships and business development activites in South America.

Most recently, Cohn served as executive vice president for the group's international division. During his 18-year career with Aramark, Cohn has held several leadership positions including senior vice president, international; senior vice president, marketing for Aramark's food and support services business; vice president of planning and operations development; and vice president, sales and marketing for business services.

IFT Appoints Two New Food Science Experts for News Media

The Institute of Food Technologists has appointed two new food science communicators to provide journalists with expert insight on food-related topics.

Roger S. Clemens, Dr.P.H., director of the laboratory for research and services in contemporary therapeutics at the University of Southern California School of Pharmacy in Los Angeles. An adjunct professor in USC's School of Pharmacy and former head and professor at California Polytechnic State University in San Luis Obispo, Clemens is also former scientific advisor in the nutrition division and former manager of nutrition research at Nestlé USA, Inc.

Anu Prakash, Ph.D., associate professor of food science and nutrition at Chapman University in Orange, CA has been added to the IFT Food Science Communicator Committee, a news media resource of more than 70 experts trained in various specializations in food science and technology and accomplished at communicating complex food issues in simple terms.

Anu Prakash earned a bachelor's degree in nutritional biochemistry from Bombay University in India, and a masters and a doctorate degree in food science and technology from Ohio State University.

Alfa Laval Names Mark Larsen to Lead Company's Sanitary Business Segment

Alfa Laval, a supplier of separation, heat transfer and fluid handling services, recently named Mark Larsen vice president and general manager of the company's sanitary business segment. Larsen will lead the sales and marketing of pumps, fittings and sanitary heat exchangers for the segment, which is based in Pleasant Prairie, WI.

Prior to joining Alfa Laval, Larsen spent 10 years as director of sales for Wilden Pump and Engineering Company. He holds a bachelor's degree in Spanish from the University of California at Los Angeles (UCLA), a masters of international management from Thunderbird American Graduate School of International Management, and a Masters in Business Administration from Esade, Escuela Superior De Administracion y Direccion DE Empresas.

Food Safety — A Priority from Paddock to Plate

Australia's food safety record will be boosted by an agreement to transfer standard setting for primary products to the new Food Standards Australia New Zealand (FSANZ), parliamentary secretary to the minister for health and ageing, Trish Worth, announced.

Ms. Worth said that the Council of Australian Governments had agreed that FSANZ would assume responsibility for developing primary production standards for use in all Australian States and Territories. "Food ministers have agreed to an overarching Policy Guideline on Primary Production and Processing Standards to guide FSANZ in this development. It prescribes that the new standards maintain Australia's safe food supply through a consistent approach across the entire food chain without being trade restrictive or by placing an excessive regulatory burden on industry," Ms. Worth said.

"The endorsement of the policy guideline is another step in the successful transfer of primary products standard setting to FSANZ. This ensures that for the first time a single national framework exists for the development of all domestic food standards covering the entire food supply chain."

Ms. Worth said it made good sense to apply the same decision making processes to primary production and processors of primary products along with manufactured foods which, up until now, have been the main focus of FSANZ. "Australia has a proud food safety record but increasingly public confidence is being challenged as they see new food safety issues emerge overseas such as Bovine Spongiform Encephalopathy (BSE - sometimes referred to as 'mad cow' disease)," Ms. Worth said.

"It is important to demonstrate to the Australian community and to our trading partners that safety is a priority from the beginning of the food chain to consumption stage. However, this does not mean farmers will face unrealistic regulations. I will be seeking up-to-date information as the new standard setting system develops – particularly if there are any unintentional consequences that may adversely affect primary producers."

USDA Releases Data on Pilot Meat and Poultry Inspection Program

Data on USDA's Hazard Analysis Critical Control Point (HACCP)-based Inspection Models Project (HIMP) pilot program was presented at a meeting of the National Advisory Committee on Meat and Poultry Inspection (NACMPI).

USDA's Food Safety Inspection Service contracted with RTI International (RTI), a not-for-profit research organization, to manage and conduct baseline and models redesign data collection, analyze data, and report findings. In addition, FSIS conducted its own analysis and presented its findings at the meeting.

RTI compared baseline data collected between 1998-99 from plants operating under USDA's traditional inspection system to data collected between 2000-01 from plants operating under USDA's pilot program. RTI compiled data from 16 participating plants for each of seven categories. Improvements were noted in five of the seven categories, including the two categories that help measure the safety of the product.

The data show that improvements were made in detecting and controlling quality concerns such as bruises, ingesta, etc. as well as food safety measures such as infectious disease and fecal contamination. There was no improvement in controlling the quality issue pertaining to dressing defects (such as feathers) or the prevalence of *Salmonella*. Regarding *Salmonella*, according to RTI, the prevalence of *Salmonella* was statistically the same for HIMP plants and traditional plants. RTI data also showed that 11 of the 16 HIMP and traditional plants had prevalence rates below 10 percent for *Salmonella*, which is less than half the performance standards required in all plants.

"USDA is committed to the development of innovative programs utilizing proven technology that lead to improvements in public health and safety," said Dr. Elsa Murano, agriculture under secretary for food safety. "Decisions on whether to expand HIMP must be based on sound science and meet our goals for enhancing food safety. For this reason, an independent, third party team will evaluate these data to ensure the statistical validity and reliability of the results. We will also continue to solicit input from all interested parties to strengthen these important programs."

HIMP, a pilot program that began in 1997, was designed to test whether new government slaughter inspection procedures, applied with revised plant HACCP controls and new plant process controls, can improve food safety and increase consumer protection. Only meat and poultry plants

that slaughter exclusively young, healthy, uniform animals—market hogs, fed cattle, or young poultry (including turkeys)—are eligible for the project. These animals comprise nearly 90% of animals slaughtered in inspected establishments. Eligible plants may volunteer to participate in the pilot program.

While implementing the HIMP program, USDA has continued to seek input from interested parties and has been responsive to their concerns as well as those of the General Accounting Office. In January 2002, the US General Accounting Office provided USDA with recommendations on how to improve the pilot program. Since then, USDA has implemented many of GAO's suggestions, including a requirement that participating plants receive formalized training for plant personnel that participate in HIMP and a mandate that participating plants use statistical process control for quality defects.

Nanogen and Centers for Disease Control and Prevention Begin Gene-based *E. coli* Assay Development Collaboration

Nanogen, Inc. announced it has entered into a Development Site Agreement with the Centers for Disease Control and Prevention (CDC) and will shortly begin installation of a NanoChip® Molecular Biology Workstation at the CDC's Foodborne and Diarrheal Diseases Branch in Atlanta, GA. Under this Agreement, Drs. Balasubra Swaminathan and Nancy Strockbine of the CDC will be principal investigators and will seek to develop methods for simultaneously detecting specific strains of diarrheal *Escherichia coli* and other pathogens on the NanoChip® System. In exchange, Nanogen will receive certain licensing and commercialization rights to the assays developed by the CDC. Additionally, the collaboration may eventually lead to the development by Nanogen of certain molecular diagnostic test protocols and other products to be performed on the NanoChip® System. "We look forward to working with the CDC in this very important area of infectious diseases," said Dr. Randy White, chief executive officer of Nanogen. "Our platform, we believe, offers our customers the versatility and accuracy needed to develop new ways of detection of multiple pathogens, such as *E. coli*, anthrax and smallpox. Furthermore, we will continue to enter collaborations such as this, which enable the use of our platform in various markets while complementing our core focus on human diagnostics." Nanogen's Development Site Program was established to actively collaborate with selected customers in strategically important market segments (including clinical research, the research divisions of reference diagnostic laboratories and genomics, pharmaceutical, biotechnology and agrochemical companies) in their development of assays on the Nanogen platform. Under these agreements, collaborating companies and institutions provide expertise and certain rights to intellectual property in exchange for preferential access to Nanogen's technology. After the conclusion of the program, the collaborating institutions may purchase the NanoChip® Molecular Biology Workstation and NanoChip® Cartridges for use in their operations.

New Company to Promote High-pressure Food Preservation

A new company established to promote an innovative high-pressure food preservation technology throughout the Australian food industry was launched in Adelaide by the minister for small business, the Hon. Jane Lomax-Smith. The new company – Australian High Pressure Processors Pty. Ltd. (AHPP) – is working with Food Science Australia researchers to encourage the use of high-pressure processing (HPP) equipment to kill microbes which cause food spoilage.

The intense pressure created by the HPP equipment causes fatal damage to microbes such as yeasts, bacteria and molds. HPP is an innovative alternative to thermal treatment or chemical preservatives which can sometimes adversely affect the flavor, color and composition of food. Food Science Australia acquired the first HPP unit in Australia from US-based Avure Technologies Inc. about two years ago. Over the past 18 months, the 2-liter unit has been used to investigate the viability of HPP on a range of foods including seafood, fruit products and meat.

Managing director of AHPP, Mr. Mark Styan, became aware of HPP during a visit to Food Science Australia. "HPP foods are already commercially available in Europe, Japan and the USA. I thought HPP could have great potential in Australia so we organized several trials to be conducted by the researchers at Food Science Australia," says Mr. Styan.

"The results of the trials were very positive and inspired me to establish AHPP. We have purchased a 215-litre HPP unit and are approaching food companies who may benefit from the tech-

nology. We have already received interest from seafood and meat processors in South Australia."

Food Science Australia and AHPP have signed a memorandum of understanding to work together to support the introduction of HPP to Australian food manufacturers.

Researchers from Food Science Australia will act as technical advisors for AHPP. "The expertise and facilities at Food Science Australia allow us to help the commercialization of HPP here in Australia. In particular, the newly established Innovative Foods Center offers three sizes of HPP equipment – from 2-millilitre kinetic cells to a 35-litre pilot plant. Our role is to provide R&D and advice to ensure the best processing protocol for each food product. The researchers at Food Science Australia provide assistance in all areas of food R&D including microbiology, sensory analysis and chemical analysis," says Dr. Martin Cole from Food Science Australia.

"AHPP provides a great opportunity for Australian food companies to tap into HPP. By trailing the technology companies can lower the risk associated with adopting new processes. In addition, companies have access to the world-class team of researchers at Food Science Australia," said Dr. Cole.

USDA Strengthens Advanced Meat Recovery Policies

The US Department of Agriculture in June announced new measures to ensure that meat products derived from Advanced Meat Recovery (AMR) systems are accurately labeled for consumers. The Food Safety and Inspection Service is issuing a revision to an existing directive that will instruct inspectors at establishments using AMR systems to take routine regulatory samples to verify that spinal cord is not present in AMR product. Under the new sampling program, if spinal cord tissue is identified, then the product would not meet FSIS labeling and inspection requirements for meat. FSIS will also propose changes to strengthen an existing proposed AMR rule to include central nervous system tissue removal specifications.

Additional public comment will be sought on the proposed rule before it is finalized. "These measures will strengthen existing policies and regulations regarding advanced meat recovery systems. At the same time these steps will help ensure that meat products are accurately labeled," said Dr. Elsa A. Murano, USDA under secretary for food safety. "This is another important step in this Administration's efforts to ensure that all regulations are being followed and enforced." AMR is a technology that enables processors to remove remaining muscle tissue from beef carcasses without breaking bones.

Currently, FSIS inspectors are authorized to take regulatory samples of AMR product if they believe that an establishment is not completely removing spinal cord tissue. Spinal cord tissue is not allowed in meat and the new sampling program will require inspectors to test AMR product on a routine basis to verify that spinal cord tissue is not present.

The revised directive specifically requires inspection personnel to notify the establishment at the time they take a sample, allowing the establishment to hold the product being tested. If the tests identify the presence of spinal cord tissue, then inspection personnel will withhold marks of inspection from the establishment's AMR product and tag the AMR system itself, meaning neither the product nor the equipment can be used until satisfactory corrective action has been taken. Inspection personnel will conduct follow-up sampling to verify that the establishment has taken appropriate corrective action. AMR production will not be allowed to resume until FSIS determines that corrective actions have been successful. If the establishment has distributed the sampled product, FSIS will request a voluntary recall.

Call for Shake-up of Food Assurance Schemes in the United Kingdom

Food Assurance Schemes need a radical overhaul, according to a review of 18 schemes published July 9, 2002 by the Food Standards Agency. The Agency is recommending that a new independent organization should govern "Red Tractor" schemes, that core minimum standards need to be put in place across all schemes and that there should be better cooperation between them.

Speaking at the annual conference of the Trading Standards Institute, chair of the FSA Sir John Krebs said, "Assurance schemes such as the Red Tractor are potentially a force for good, driving up production standards and expanding choice, but they need a shake-up. Most people are thoroughly confused about assurance schemes. The number of different schemes and their various logos adds to the confusion. For example, consumers are not sure whether the Red Tractor logo is to do with country of origin, better standards of production, or better quality food. Schemes need to be independent if they are to improve consumer confidence."

To their credit, industry has begun to take steps to improve

the situation, and this is welcome, but further action needs to be taken to redress the balance. "The creation of a new, independent governing body for Red Tractor schemes, along with measures to improve transparency and consistency across the board, are essential to meet the needs of the consumer." The review was commissioned by the Agency last November in the wake of research for its submission to the Policy Commission on the Future of Farming and Food which highlighted consumer concerns about the schemes. Food Assurance Schemes cover between 65% and 85% of food production but the review found that the confusion surrounding them makes it difficult for consumers to make informed choices about the food they are buying.

Consumer Food Safety Behavior: A Case Study in Hamburger Cooking and Ordering

Promoting the benefits to consumers of following food safety recommendations—through food safety education as well as through media coverage of foodborne illness outbreaks—appears to be influencing cooking and eating behavior. For example, more Americans are eating their hamburgers more thoroughly cooked than before, according to several national surveys. Cooking and ordering hamburgers well-done reduces the risk of infection by *E. coli* O157:H7 and other pathogens. For example, the change in behavior reported in the 1996 Hamburger Preparation Quiz (HPQ), a national survey of hamburger cooking and ordering preferences, translates to an estimated 4.6-percent lower risk of *E. coli* O157:H7 infection and an estimated $7.4-million annual reduction in medical costs and productivity losses as well as reductions in other foodborne illnesses associated with rare and medium-rare hamburger. Food safety messages about cooking and ordering hamburgers may encourage consumers to handle other foods more safely as well. While *E. coli* O157:H7 in hamburger is a small part of the burden of foodborne illness—estimated at 5,000 deaths and more than $6.9 billion in medical costs and reduced productivity annually – these findings illustrate the potential benefits from encouraging consumers to follow food safety recommendations as part of an overall strategy to reduce the toll of foodborne illness.

Consumers make their decisions on how to cook and order foods based on several factors, including taste, palatability, and perceived food safety risk. Consumer behavior has changed over time, due in part to increased awareness of the risk of foodborne illness and the importance of thorough cooking in reducing that risk. Of respondents to the 1996 HPQ, 70 percent of those who had switched to more well-done hamburgers in the past 5 years reported they had done so out of fear of foodborne illness. Respondents with higher motivation to avoid foodborne illness were significantly less likely to cook or order hamburgers rare or medium-rare than those with less motivation, holding other factors constant. Taste preferences, however, proved even more important than motivation to avoid foodborne illness. Thus, food safety education not only must convey the risk of lightly cooked hamburgers, but also should include information on how to retain juiciness and flavor in a thoroughly cooked hamburger. Consumers in the South, Northeast, and in large cities were more likely to order hamburgers rare, medium-rare, or medium-pink, even after accounting for risk perceptions, tastes, and other factors. However, consumers in different regions and areas of different sizes reported similar doneness choices when cooking hamburgers for themselves. Only household size was significantly associated with how respondents say they cooked their own hamburgers, after accounting for risk perceptions and tastes. This suggests consumer education to encourage thorough cooking of hamburgers at home should be broadly dispersed rather than focused in certain regions.

White respondents, those with higher income, those with larger families, and those who had experienced foodborne illness had higher motivation to avoid foodborne illness, as did those whose main sources of food safety information were magazines, cookbooks, television, and government sources (such as hotlines). Conveying the consequences of foodborne illness may help motivate consumers to follow food safety recommendations.

Rivera Vineyards is First Coachella Grape Producer Certified

During the first week of June, the Rivera Vineyards of Oasis, CA, became the first table grape grower in the state of California to be certified by the USDA for good handling practices (GHP).

"In a recent Oppenheimer Group customer survey, food safety emerged as the most important trend driving the future of the industry," said John Anderson, Oppenheimer's chairman, president and CEO. The Vancouver, B.C.-based company is the exclusive marketer

for Rivera Vineyards. "The commitment of the Rivera operation to food safety is exemplary, and gives retailers confidence in the disciplines behind each box of grapes that comes off the line."

Rivera Vineyards, which plans to pack 1.3 million boxes this season, was audited by the California Department of Agriculture as part of a voluntary program that assesses industry participants' adherence to the Food and Drug Administration's *Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables*.

This is a pilot assessment program, which will grow to encompass more states in October, according to Gordon Poulsen, program supervisor for Shipping Point Inspection Service for the California Department of Agriculture. Its development was prompted by retailer requests for independent third party food safety audits of grower operations.

"Growers have been using outside auditors to demonstrate the safety of their products; now, producers can request an audit from the USDA's Agriculture Marketing Service which will illustrate to retailers their implementation of food safety practices," Paulson said.

The audit at Rivera Vineyards entailed good handling practices in the areas of storage, transportation, and traceback. Condition and storage of pallets and packs, pest and temperature control, and cleanliness of the storage and transportation facilities were audited satisfactorily. In addition, the Rivera operation demonstrated the appropriate traceback practices, proving that product can be tracked back to a specific pack house and vineyard, and finished product is marked with the date of harvest and packing. Traceback can be the most challenging area to demonstrate compliance, said Robert (Dutch) Bol, grape category manager for The Oppenheimer Group.

"Tracing a pallet is fairly simple, but once a pallet is broken, the boxes lose their identity. At Rivera Vineyards, each box is stamped with a USDA stamp showing the pack date. The crew also marks each box with its name, and we can see from our records which vineyard that crew packed in on a particular date. So the traceback process is quite accurate," Mr. Bol said.

Mr. Bol is among the Oppenheimer sales and QC/operations personnel who relocate to the Coachella Valley for six weeks each spring to work in tandem with vineyard owner Blas Rivera to market his grapes.

Minnesota Ahead of the Curve with New Food Safety Technology

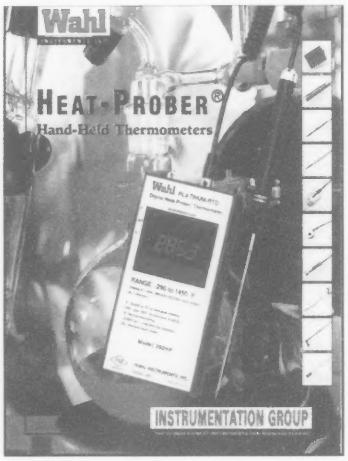
Thanks to the growing number of locally based companies offering irradiated ground beef products, Minnesota's backyard barbecues will be safer than ever this summer. Minnesota made history two years ago when Chandler-based Huisken Meats (now a division of Sara Lee) became the first processor in the nation to use electricity to combat the threat of foodborne pathogens such as *E. coli* O157:H7 in its products. From an initial distribution in 84 stores in the Twin Cities area, the availability of Huisken's irradiated products has grown to include thousands of supermarkets in 35 states.

"Response so far has been outstanding," Huisken sales manager Cliff Albertson said. "Sales of our irradiated products rose 35 percent in 2001 compared with 2000. Our 2002 fiscal year is just ending, and it looks as if our Huisken BeSure irradiated product will show almost a 25 percent increase over last year."

Other companies with Minnesota ties also offer irradiated products. For example, Minnesota-based Schwan's is also successfully marketing irradiated ground beef products nationally. As with Huisken, Schwan's has also reported increasing sales. Likewise, Dairy Queen is now offering irradiated burgers at 13 stores in central Minnesota following a successful test at two stores in Hutchinson and Spicer. Food irradiation is the process of exposing food products to ionizing radiation in order to kill potentially dangerous pathogens that may be present in the product. The process does not compromise quality or flavor. Irradiation complements – not replaces – other food safety procedures at all points in the food system from farm to consumer. That is why consumers should still grill irradiated burgers properly to ensure their safety – for ground beef, that means grilling patties to an internal temperature of at least 160 degrees.

According to Minnesota Department of Agriculture Dairy and Food Division Director Shirley Bohm, irradiation is a promising food safety tool that can help save lives. "We have a very safe food supply, but foodborne diseases still strike an estimated 60,000 Minnesotans every year," Bohm said. "For the very young or the very old, these diseases can be life threatening. The best way to protect your family is to put up as many barriers as possible against the organisms that cause these illnesses. By choosing irradiated products, you take advantage of one of the most effective barriers out there."

Industry Products



Wahl Instruments, Inc.

Wahl Heat-Prober Hand-held Thermometers Catalog from the Instrumentation Group

Wahl Instruments, Inc. introduces a new full color catalog featuring their variety of high performance portable temperature measurement systems.

A Heat-Prober system consists of a meter and a sensing probe. The Heat-Prober meter serves, by means of a microprocessor, to accurately interpret the temperature sensed by the probe, provide digital display output and allow measurement options such as peak reading hold or maximum/minimum memory. The meter also contains the power (battery) to allow complete system portability.

Heat-Prober probes are designed to be interchangeable and RTD probes are individually calibrated to allow such, without changing total system accuracy. This allows users to form a meter/probe system – with any number of specific application probes being used interchangeably with the meter. More probes for additional applications, or replacement probes, may be purchased and added to the system; an additional or replacement meter can be utilized without having to replace the existing probes.

Heat-Prober meters utilize platinum RTD, thermocouple, and thermistor technology. Meters offer range, display, and kit options. All meters have a full set of interchangeable probes carefully designed and built to perform specific measurement tasks. This approach allows Heat-Prober users maximum versatility in specifying, purchasing, utilizing, and maintaining a temperature measuring system suited to their needs.

A Heat-Prober's battery power and rugged compact design make it the perfect choice for service and maintenance technicians who must use their temperature measurement equipment on the move and in a variety of tough environments. Heat-Prober kits with user-selected probes are available for many of the meters.

Because of the Heat-Prober meter's microprocessor, the probe's sensor can be linearized to yield maximum accuracy at all points within the measuring range. Probe design is also a large factor in accuracy. The ability to select a standard or custom probe specific to the task and constructed from superior materials is key in system accuracy.

Wahl Instruments, Inc., Asheville, NC

Reader Service No. 257

Triangle Laboratories New *RapidScreen*™ Contamination Test Safeguards Food and Reduces Business Risk

Triangle Laboratories, Inc., an analytical chemistry laboratory, has announced the introduction of *RapidScreen*™. This new technology reliably screens for dioxins, furans, and PCBs in food and feed. It is faster and less expensive than standard tests used for screening contaminants associated with food. The introduction of *RapidScreen*™ promises to reduce business risk and maximize food safety.

RapidScreen's™ use of high resolution gas chromatography/mass spectrometry and isotopic dilution techniques makes it the first screening technology that can guarantee no false negatives. Applications for *RapidScreen*™

include but are not limited to assessing feed and feed additives, dairy products, food oils, and animal products, including fish.

Food producers who use *RapidScreen* can significantly reduce their business risk. A single instance of undetected contamination could result in major liability and sickness or death in animals and humans. Dioxin contamination in food products is usually present in extremely small amounts, making its detection expensive and time consuming. Yet, it is critical that all "hot spots" of contamination be identified. *RapidScreen* allows food producers to test more samples within the constraints of a given budget. The result is a more comprehensive data set that reduces health and business risks.

RapidScreen tests for dioxins down to the parts per trillion level. That sensitivity is analogous to pinpointing one rotten apple in two billion barrels of apples. Ultra-high sensitivity is necessary when screening for dioxins because even minute amounts are highly toxic. Dioxins are pervasive, accumulating in human and animal organs and fatty tissue. EPA scientists estimate that over 95% of human dioxin exposure comes from dietary intake of animal fat. According to the National Institute of Environmental Health Sciences, dioxin exposure can lead to increased cancer rates, reproductive and developmental problems, increased heart disease, and increased diabetes in humans.

Concerns about dioxin levels in food have directly impacted legislation in the United States and Europe. Enforced by the FDA and USDA, the 1996 Food Safety Act established new rules for safety in food production. In accordance with this legislation, companies must set up their own Hazard Analysis and Critical Control Point (HACCP) plan to monitor their food products. Because dioxin is an identified hazard, food producers will need to provide proof that dioxin levels are within approved limits.

In 1999 a food crisis occurred in Belgium, possibly as a result of inadequate testing procedures. Food oil used as an additive for numerous products was found to contain high levels of dioxins. As a result, a number of food products were banned by the United States and most of Europe, resulting in financial losses and political repercussions in Belgium.

On July 1, 2002, a new EU directive will require these and other food products to be tested for dioxin before importation or sale within the European Community.

While concern about dioxins in food has been growing since the 1980s, dioxin screening technology has only caught up to the concerns in the past several years. *RapidScreen's* design evolved out of standard EPA methods. Using high-resolution gas chromatography/mass spectrometry and isotopic dilution techniques, *RapidScreen* possesses a quality unique among screening methods by guaranteeing no false negative results. The use of this definitive technology makes *RapidScreen* an equally reliable alternative to standard methods.

RapidScreen is analogous to a yes/no, over-the-counter pregnancy test. Just as a pregnancy test indicates pregnant or not pregnant, *RapidScreen* confirms that a food sample does or does not exceed a dangerous, predetermined level of dioxins. If the in-home pregnancy test gives a positive result, more stringent examination can be taken in a follow-up visit with a doctor. Likewise, the same sample that gave a positive result with *RapidScreen* can be tested with a standard method to determine more specific levels of contamination. Scientific reliability in conjunction with a fast turnaround time enables confident and timely decision-making.

Triangle Laboratories, Inc., Durham, NC

Reader Service No. 258

Protector® Stainless Steel Perchloric Acid Hood Uses Washdown System to Self-clean

Labconco Corporation offers the Protector® Stainless Steel Perchloric Acid Laboratory Hood to safely work with perchloric acid. A built-in washdown system facilitates the removal of hazardous perchlorates from the hood interior.

Features include an ergonomic air foil with aerodynamic Clean-Sweep™ airflow openings and a by-pass airflow design. The seamless Type 316 stainless steel liner with integral work surface and drainage trough is welded and polished to provide a smooth, seamless and safe work area. Prewired T8 fluorescent lighting provides a bright work area. A tempered safety glass vertical-rising sash provides clear visibility. Removable exterior front and side panels and front access panels provide access to plumbing and electrical wiring. The glacier white, dry powder epoxy-coated steel exterior is smooth and durable.

Protector® Perchloric Acid Hood is available in 4-, 5-, 6-, and 8-foot widths.

Labconco Corporation, Kansas City, MO

Reader Service No. 259

Rheometric Scientific, Inc.

Rheometric Scientific Introduces Advanced Rheometer System that Establishes New Standard in Materials Testing

Rheometric Scientific has introduced ASTRA, a new universal rotational rheometer system designed and built to set a new standard in rheological testing instrumentation. ASTRA incorporates a host of design and control features never before integrated into a dynamic shear rheometer platform. These features include a new, patented normal force sensor, enhanced software featuring a Visual Method Builder (VMB) engine, and an integral full color LCD touch screen, all of which bring unprecedented simplicity and flexibility in measuring a wide range of materials, including fluids, gels, soft solids, melts and solids during product development, product formulation, and process development.

"We are so pleased to support our continuing legacy of technological leadership with the introduction of ASTRA," said Paul Mangano, President and COO of Rheometric Scientific. "This represents the next generation in rheological testing instrumentation and re-affirms our position as a leader in the development of commercial rheological instrumentation."

A series of innovations to the actuator, air-bearing design and optical encoders, coupled with the integration of multiple, state-of-the-art directly embedded DSP controllers, deliver unparalleled control speed over the functional components of the measurement system, while increasing accuracy, reducing test time and providing superior signal-to-noise ratio. ASTRA's normal force sensor features a patented design that mounts the normal force sensor in the motor shaft, without compliance or frictional effects. This sensor sets a new standard for normal force measurement during transient and steady testing and assures control of the axial displacement of the actuator (gap) between tests and during testing.

The VMB is part of [RSI]Orchestrator, Rheometric Scientific's proprietary software package that runs all of its laboratory instruments. VMB, an extremely easy-to-use and intuitive visual interface for setting up new tests, facilitates programming of custom test methods with an intuitive graphical interface. It integrates smart programming features that guide the user to create test methods faster, with fewer parameter entries.

[RSI]Orchestrator combines a vector driven 3-D spreadsheet, sophisticated analyses routines, and a powerful graphics presentation interface in one easy-to-use software package that provides the materials researcher with all of the tools needed for programming tests, analyzing data, and presenting data in a meaningful way.

A color touch screen is integrated into the ASTRA test station and provides information about the instrument status and test performance. It can be configured to show calibration instructions and system diagnostics information, and it can be used to communicate with the instrument while running customized test programs. Even with the touch screen, ASTRA is extremely compact because it integrates the test head and electronics in a single housing. The increased distance between the base and stress head provides a wide working space and enough room for options and simultaneous measuring techniques.

ASTRA also includes a robust suite of advanced environmental control modules. Among the other optional modules are Optical Analysis (OAM-II) for simultaneous acquisition of both rheometric and optical measurements; Dielectric Thermal Analysis (DETA) for simultaneous or stand-alone execution of both rheological and dielectric relaxation spectroscopy; Magneto-Rheology (MR) for materials analysis under the influence of magnetic fields; and Electro-Rheology (ER) for materials analysis under the influence of precision applied AC/DC voltages. Separate UV-irradiation and high-pressure rheology cells are also available.

Rheometric Scientific, Inc., Piscataway, NJ

Reader Service No. 260

Thermo Cahn Introduces a New Thermogravimetric Analyzer for High Mass, High Volume Samples

Thermo Cahn, a manufacturer of thermal analysis and surface science instruments, has released its newest thermogravimetric analyzer (TGA), the VersaTherm. Featuring a durable

construction of gold-plated corrosion-resistant balance components and a chemically inert polymeric chassis, the VersaTherm allows users to easily analyze high mass, high volume samples in corrosive or high vacuum gas environments.

Utilizing Thermo Cahn's unique electromagnetic null-type balance, the VersaTherm can handle samples with a capacity up to100 grams and sensitivity up to 0.1 microgram.

The VersaTherm's patented Synergy interface for FTIR and mass spectrometer acquires highly concentrated samples, which allows for identification of trace level components and provides superior FTIR and MS data.

The VersaTherm includes Thermo Cahn's new Windows 2000™-based Thermal Analyst software suite, a powerful and easy-to-use research tool. The Thermal Analyst software can be combined with the Thermo Nicolet Omnic™ software, providing the user with fully integrated control and data analysis package for TG/FTIR systems.

ThermoCahn, Paramus, NJ

Reader Service No. 261

BD Select APS™ Tryptic Soy Broth (TSB) – A New Non-Animal Origin Medium that Reduces BSE Risks

BD Diagnostic Systems announces the immediate availability of BD Select APS™ Tryptic Soy Broth, a non-animal origin medium derived formulation of the traditional Tryptic Soy Broth (TSB). With the introduction of BD Select APS™ TSB, vaccine manufacturers can now use a non-animal medium to validate the sterility of their fill lines. Sterility of the fill line is critical to assure that the vaccine is free of infectious contamination. BD Select APS™ TSB helps vaccine manufacturers increase assurance that Bovine Spongiform Encephalopathy (BSE) risks are controlled, minimized and eliminated as much as possible. The need to do this comes in response to very strong recommendations made by the FDA and US Department of Agriculture that vaccine manufacturers take steps to reduce any potential risk of BSE introduction into their processes.

BD Select APS™ TSB was developed and tested to meet USP and EP growth promotion criteria, along with the other critical product parameters important to support successful fill line validation. The medium is also available in an irradiated format for aseptic processes, sterile powder fill line validation or viscous liquid fill line validation.

To meet the challenge of reducing and eliminating BSE risks, BD has been working side-by-side with vaccine manufacturers by providing peptones and media of non-animal origin for the production phase of the vaccine manufacturing process. Since 1998 BD has been providing non-animal origin components and media through the Select APS™ (Alternative Protein Source) product line offering. These products are engineered and tested to deliver maximum performance without the risk of potential BSE introduction.

BD Diagnostic Systems, Neenah, WI

Reader Service No. 262

Sensotec High Temperature Subminiature Pressure Transducer

The Sensotec Model A-105 is a subminiature, flush diaphragm pressure transducer that delivers up to 0.1% accuracy (BFSL). This unit is environmentally sealed and now features an operating temperature from -65° to 350°F for use in severe environmental applications found in aerospace and automotive hydraulic pressure measurement. The unit's welded flush diaphragm measures only .355" in diameter and has zero dead volume. The A-105 is fully welded from 17-4PH stainless steel and hermetically sealed to insure reliable performance.

Designed with a one piece, heavy-sidewall body, the A-105 is sensitive, yet sturdy enough to handle pressures of 0-15,000 psig. This rugged design provides overload protection to 100% (safe) and 300% (burst).

Standard output is .1 mV/V up to 100 psi and 2 mV/V for higher ranges. Optional in-line amplification can provide 0-5,0-10 VDC or 4-20 mA output. The A-105 features a 7/16-20 UNF thread, and many ranges are stocked for immediate shipment.

Sensotec, Inc., Columbus, OH

Reader Service No. 263

Sigma-Aldrich Submits Device Master File for Its Stemline™ Medium to the Food & Drug Administration

Sigma-Aldrich, a life science and high technology company, has announced submission of a Device Master File (DMF) to the Food & Drug Administration (FDA) for its novel Stemline™ Hematopoietic Stem Cell (HSC) Expansion Medium (product code S0189). Stemline HSC Expansion Medium is designed to support the expansion of CD34+ progenitor cells from cord blood, bone marrow and mobilized peripheral blood.

Culture results can vary widely from lab to lab for a number of reasons. Stemline medium is designed to perform

consistently in customers' hands to minimize culture inconsistencies while maximizing CD34+ expansion. This is a complete, ready-to-use medium that offers 12 months stability and performance reliability. Sigma-Aldrich's Stemline medium has been developed for flexibility, to give customers the choice in the addition of cytokines. Human serum albumin is the only animal-origin component present in this otherwise defined formulation, to enable consistent performance and to minimize animal component-related safety issues.

In addition, Sigma-Aldrich's Stemline outperforms the competition in head-to-head product comparisons (see our web site www.sigma-aldrich.com/cellculture-HSC) by consistently producing more viable CD34+ cells than any other media on the market today, including the expansion of granulocyte-macrophage colony forming cells (GM-CFC) and high proliferative potential colony forming cells (HPP-CFC). This product is for investigation use only and has not been evaluated for therapeutic use.

Sigma-Aldrich Corporation, St. Louis, MO

Reader Service No. 264

New Video from Keller Focuses on Critical Food Safety Issues

J. J. Keller & Associates, Inc. has just introduced *A Recipe for Food Safety Success,* a video that provides new and veteran employees with an understanding of their role in food safety.

The 25-minute video gives an overview of critical food safety topics, including the United States food supply chain; consumer expectations; USDA, FDA and HACCP requirements; foodborne illness; personal hygiene; cross contamination; sanitation; time and temperature controls; pest control, and foreign material. Viewers learn what the requirements are, why they exist, and the consequences for all involved if they're not adhered to consistently.

A Recipe for Food Safety Success is available for only $159 by calling 1-800-327-6868. A Spanish-language version of the video is also available. Callers should reference Action Code 1509 when ordering.

J. J. Keller & Associates, Inc. Neenah, WI

Reader Service No. 265

IGEN'S *Salmonella* Test is First Rapid Method Approved by National Poultry Improvement Plan

IGEN International, Inc. announced that its PATHIGEN® *Salmonella* test method has been approved by the National Poultry Improvement Plan (NPIP), at its biennial meeting held May 30 – June 1 in San Antonio, TX. The PATHIGEN test method utilizes IGEN's proprietary ORIGEN® technology, and is the first rapid commercial method for identification of *Salmonella* ever approved by NPIP. With this approval, PATHIGEN tests may be used to detect *Salmonella* contamination in live poultry.

NPIP support for approval of the PATHIGEN *Salmonella* test method was based upon results that showed equal or enhanced sensitivity when compared to conventional non-rapid methods. The PATHIGEN method delivers results in approximately 48 hours, offering the economic benefits of reduced testing time, labor and materials. Conventional, non-rapid methods involve incubation in petri dishes, with results taking three to nine days.

"We believe that PATHIGEN's improved sensitivity and its ability to offer labor and time savings will provide a significant competitive advantage in this unique market," said Samuel J. Wohlstadter, IGEN's chairman and chief executive officer. "Our PATHIGEN *Salmonella* test is available using the ORIGEN® Analyzer system and will soon be offered on our new M-SERIES M-1 system."

The NPIP is a Federal-State-Industry cooperative focused on controlling certain poultry diseases. Government participation is through the USDA and various state agriculture and veterinary agencies. Industry members include the breeding portion of the poultry industry. This concentrated group of poultry breeders performs a large number of tests for pathogens on their breeding stock in an effort to produce disease-free flocks. NPIP acceptance of testing methods is the "seal of approval" for poultry and egg producers.

The NPIP is in a position to support technological advances that benefit disease prevention and control for the US poultry and breeding hatcheries but is not authorized to endorse brand name commercial products.

IGEN International, Inc., Gaithersburg, MD

Reader Service No. 266

Dairy, Food and Environmental Sanitation, Vol. 22, No. 8, Page 628

3-A® Sanitary Standards for Flow Meters for Milk and Milk Products Number 28-03

3-A 28-03 published in *DFES* Vol. 15, No. 10, pages 652–655 requires correction in two clauses.

Clause C2.5 should read:

C2.5 Where materials having certain inherent functional purposes are required for specific applications, such as pistons, shafts, meter body liners, bearings, rotary seals, and electrodes, carbon[5], and/or ceramic materials may be used. Carbon and/or ceramic materials 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.

Clause C3.1 should read:

C3.1 The final bond and residual adhesive, if used, on bonded carbon, ceramic materials, plastic materials and/or rubber or rubber-like materials shall be non-toxic.[6]

[5]Carbon which is specifically in compliance with the Food, Drug and Cosmetic Act, as amended, is that which is included in "V Fillers" in the food additive regulations for rubber articles intended for repeated use, 177 2600 of Subpart F, Code of Federal Regulations, Title 21 Food and Drugs.

[6]Adhesives shall comply with 21 CFR Part 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).

We regret these errors of omission.

Dairy, Food and Environmental Sanitation, Vol. 22, No. 8, Pages 629-636

3-A® Sanitary Standards for Tubular Heat Exchangers, Number 12-06

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. Tubular heat exchangers 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 tubular heat exchangers without agitators. The standards do not cover high-pressure (greater than 250 psig or 1724 kPa) product pressure tubular heat exchangers which require special tubing and/or fittings.

A2 In order to conform to these 3-A Sanitary Standards, tubular heat exchangers shall comply with the following design, material, and fabrication criteria.[1]

B **DEFINITIONS**

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

B2 *Tubular Heat Exchangers:* Shall mean heat exchangers having one continuous tube, two or more concentric tubes, or two or more tubes in parallel.

B3 **Surfaces**

B3.1 *Product Contact Surfaces:* Shall mean all surfaces which are exposed to the product, and surfaces from which liquids may drain, drop, or be drawn into the product.

B3.2 *Nonproduct Contact Surfaces:* Shall mean all other exposed surfaces.

B4 **Cleaning**

B4.1 *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.

B4.1.1 *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 (for example, silo-type tanks, welded pipelines and tubular heat exchangers).

[1]Use current revisions or editions of all referenced documents cited herein.

B4.2 *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.

B5 *Bond:* Shall mean the adhesive or cohesive forces holding materials together. This definition excludes press and shrink fits.

B6 *Corrosion Resistant:* Shall mean the surface has the property to maintain its original surface characteristics for its predicted service period when exposed to the conditions encountered in the environment of intended use, including expected contact with product and cleaning, sanitizing, or sterilization compounds or solutions.

B7 *Easily or Readily Accessible:* Shall mean a location, which can be safely reached by personnel from the floor, platform, or other permanent work area.

B8 *Easily or Readily Removable:* Shall mean quickly separated from the equipment with the use of simple hand tools if necessary.

B9 *Nontoxic Materials:* Shall mean those substances, which under the conditions of their use are in compliance with applicable requirements of the Food, Drug, and Cosmetic Act of 1938, as amended.

B10 *Sanitizing or Sanitization:* 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 $\log_{10}$ reductions (99.999%) to 7 $\log_{10}$ 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.

B11 *Simple Hand Tools:* Shall mean implements normally used by operating and cleaning personnel such as a screwdriver, wrench, or mallet.

B12 *Sterilization:* Shall mean a process effected by heat, chemicals, or other mechanical means that destroys all vegetative bacteria and inactivates relevant bacterial spores.

C MATERIALS

C1 Metals

C1.1 Product contact surfaces shall be of stainless steel of the American Iron and Steel Institute (AISI) 300 Series[2], (except 301 and 302) (See Appendix, Section E), or equally corrosion-resistant metal that is nontoxic and nonabsorbent.

C2 Nonmetals

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

C2.1.1 Rubber and rubber-like materials, when used for the above-specified application(s), 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 gaskets, seals, and parts having the same functional purposes.

C2.2.1 Plastic materials, when used for the above-specified application(s), 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 Bonded rubber and rubber-like materials and bonded 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.

[2]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 (724) 776-1535.

[3]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.

C2.4 The adhesive, if used, on bonded rubber and rubber-like materials and bonded plastic materials shall be nontoxic.[3]

C3 **Nonproduct Contact Surfaces**

C3.1 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 and nonproduct contact surfaces shall not be painted.

C4 **Sterilizability**

C4.1 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 tubular heat exchangers 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. Contact and nonproduct contact surfaces shall not be painted.

D **FABRICATION**

D1 **Surface Texture**

D1.1 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 F.)

D2 **Permanent Joints**

D2.1 All permanent joints in metallic product contact surfaces shall be continuously welded.[4] Welds joining two tubes shall be made in conformance with the applicable provisions of the 3-A Accepted Practices for Permanently Installed Product and Solution Pipelines and Cleaning Systems Used in Milk and Milk Product Processing Plants, Number 605-.

D3 **Bonded Materials**

D3.1 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, 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.

D4 **Cleaning and Inspectability**

D4.1 If the tubular heat exchanger is two or more tubes in parallel, the product contact surfaces shall be easily accessible for cleaning and inspection. Demountable parts shall be readily removable.

D4.2 A tubular heat exchanger that is to be mechanically cleaned shall be designed so that the product contact surfaces of the tubular heat exchanger and all nonremoved appurtenances thereto can be mechanically cleaned and are easily accessible, readily removable, and inspectable, except that:

D4.2.1 A tubular heat exchanger that is one continuous tube and that is to be CIP cleaned shall have representative product contact surfaces easily accessible for inspection.

D4.3 Product contact surfaces not designed to be mechanically cleaned shall be easily accessible for cleaning and inspection either when in an installed position or when removed. Demountable parts shall be readily removable.

D4.4 Appurtenances having product contact surfaces shall be readily removable, or they shall be readily cleanable when assembled or installed, and shall be easily accessible for inspection.

D4.5 Tubes shall be supported in a manner that will prevent sagging. In a heat exchanger designed to be mechanically cleaned of the type that incorporates two or more concen-

[4]Criteria for hygienic welds may be found in AWS/ANSI D18.1 – *Specification for Welding of Austenitic Stainless Steel Tube and Pipe Systems in Sanitary (Hygienic) Applications*. Available from the American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126, phone: (305) 443-9353, fax: (305) 443-7559, e-mail: info@amweld.org; and EHEDG Doc. 9 – Welding Stainless Steel to Meet Hygienic Requirements. Available from the European Hygienic Equipment Design Group, Ellen Moens, Avenue Grand Champ 148, 1150 Brussels, Belgium.

tric tubes, means shall be provided to keep the tubes equally spaced. The means provided to keep tubes equally spaced shall not interfere with mechanical cleaning.

D5 **Fittings**

D5.1 All sanitary fittings and connections shall conform to the applicable provisions of the 3-A Sanitary Standards for Sanitary Fittings for Milk and Milk Products, Number 63-.

D6 **Sanitary Tubing**

D6.1 All metal tubing shall conform to the provisions for welded sanitary product pipelines found in Section G of the 3-A Accepted Practices for Permanently Installed Product and Solution Pipelines and Cleaning Systems Used in Milk and Milk Product Processing Plants, Number 605- and to the applicable provisions of 3-A Sanitary Standards for Polished Metal Tubing for Dairy Products, Number 33-.

D6.2 The minimum diameter of circular heat exchange tubing shall be 0.902 in. (22.9 mm) O.D. except that circular cross section heat exchange tubing used in a heat exchanger may be of smaller diameter if the heat exchanger is designed for mechanical cleaning or for clean-in-place.

D7 **Gaskets**

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

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

D7.3 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 Section D5.1.

D8 **Radii**

D8.1 All internal angles of less than 135° on product contact surfaces shall have minimum radii of 1/4 in. (6.35 mm), except that:

D8.1.1 The radii in grooves in gaskets or in 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 D5.1.

D8.1.2 Radii in standard O-ring grooves shall be as specified in Appendix G.

D8.1.3 Radii in nonstandard O-ring grooves shall be those radii closest to a standard O-ring as specified in Appendix G.

D9 **Threads**

D9.1 There shall be no threads on product contact surfaces.

D10 **Supports**

D10.1 If legs are used, they shall be smooth with rounded ends or with a flat, load-bearing foot suitable for sealing to the floor, and have no exposed threads. Legs made of hollow stock shall be sealed. Legs shall provide a minimum clearance between the lowest part of the base and the floor of not less than 6.0 in. (152.4 mm).

D10.2 If mounted on a wall or column, the point of attachment of a tubular heat exchanger to its mounting shall be designed for sealing. The mounting, if supplied by the manufacturer, shall be designed for sealing to the wall or column. The design of a tubular heat exchanger to be mounted on a wall or column shall be such that there will be at least a 4.0 in. (101.6 mm) clearance between the outside of the tubular heat exchanger and the wall or column.

D10.3 When a tubular heat exchanger is suspended from a ceiling, the means of suspension shall be smooth and cleanable.

D11 **Draining**

D11.1 Except for normal adherence, tubular heat exchangers shall be drainable or self-draining and sloped to drain points.

D12 **Nonproduct Contact Surfaces**

D12.1 Nonproduct contact surfaces shall have a relatively smooth finish, relatively free of pockets and crevices, and be readily cleanable and those surfaces to be coated shall be effectively prepared for coating.

D12.2 Riveted nameplates or appendages shall not be used. Socket head cap screws shall not be used. Knurled surfaces shall not be used. Nameplates shall be welded or effectively sealed to the equipment. External lap joints for sheathing over insulated areas shall be overlapped downward. Overlapped joints shall be sealed between the mating surfaces

with a suitable sealant. Supporting structures, braces, catwalks, stairs, handrails and guards are not considered as nonproduct contact surfaces of the equipment but are considered as part of the building structure.

APPENDIX

E STAINLESS STEEL MATERIALS

Stainless steel conforming to the applicable chemical composition ranges established by AISI[2] for wrought products (Table 1) 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%.

TABLE 1:

WROUGHT PRODUCTS TYPICALLY USED			
UNS #	ASTM[5]	AISI/SAE[6]	Properties
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

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. A maximum R_a of 32 µin. (0.80 µm), when measured according to the recommendations in American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)[7] B46.1 - *Surface Texture*, is considered to be equivalent to a No. 4 finish.

G O-RING GROOVE RADII

TABLE 3

Minimum Groove Radii for Standard O-Rings			
1/16 in. O ring Cross Section, Nominal	O-Ring Cross Section, Actual (AS 568[8])	O-Ring Cross Section, Actual (ISO 3601-1[9])	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)

H

When the tubular heat exchanger is mounted on ceiling supports, means should be provided to facilitate inspection and manual cleaning, if necessary.

I ENGINEERING DESIGN AND TECHNICAL CONSTRUCTION FILE

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.)

11 Purpose

11.1 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.

[5]Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959. Phone: (610) 832-9500.

[6]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.

TABLE 2. OPTIONAL METAL ALLOY

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 CN-3MN	ASTM A743 Grade CF-10 SMnN		ASTM A494 Grade CY5SnBiM	ASTM A494 Grade CW-2M	ASTM A747 Grade CB7Cu-1	ASTM A747 Grade CB7Cu-2		ASTM A560 Grade 50Cr-50Ni	ASTM B67 Grade 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	15.50-17.7	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

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.

12 **Scope**

12.1 This EDTCF applies to equipment specified by:

12.1.1 3-A Sanitary Standards for Tubular Heat Exchangers, Number 12-.

13 **Responsibilities**

13.1 This EDTCF is maintained by: The Engineering Manager (or other company official) **{name and title of responsible official}** is responsible for maintaining, publishing, and distributing this EDTCF.

13.2 Implementation: All divisions, specifically development engineering, standards engineering, sales engineering, and product departments are responsible for implementing this EDTCF.

14 **Applicability**

14.1 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 with 3-A Sanitary Standards complies with the sanitary design and construction standards of this Ordinance."

15 **References**

15.1 List any additional regulations that apply to the equipment or system covered by this EDTCF.

15.2 Date of conformity or 3-A Symbol Authorization and certificate number, if authorized.

16 **Design and Technical Construction File**

16.1 The Engineering Design and Technical Construction File may consist of the following:

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);
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 ensure that the equipment will continue to be manufactured in conformity with 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.

16.2 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 with the basic sanitary requirements found in 3-A documents.

16.3 The documentation referred to in 16.1 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 document of 16.1 above.

I6.4 The EDTCF may be in hard copy or software form.

I7 **Confidentiality**

I7.1 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.

I8 **File Location**

I8.1 The EDTCF shall be maintained at the manufacturer's address.

I9 **File Retention**

I9.1 The EDTCF (including all documentation referred to in I6.1) 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.

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

[8]The document establishing these standard dimensions is Aerospace Standard (AS) 568, published by SAE, 400 Commonwealth Drive, Warrendale, PA 15086 (412-776-4970).

[9]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).

These revised standards are effective May 31, 2002.

Coming Events

SEPTEMBER

·4-6, **Mississippi Environmental Health Association Conference,** Grand Hotel Bayview, Biloxi, MS. For additional information, contact Willie Brown at 601.576.7694.

·9-10, **HACCP I: Documenting Your HACCP Prerequisite Program,** Guelph Food Technology Centre, Guelph, Ontario, Canada. For more information, call Marlene Inglis at 519.821.1246; E-mail: gftc@gftc.ca.

·10-11, **Upper Midwest Dairy Industry Association Annual Meeting,** Holiday Inn, St. Cloud, MN. For more information, contact Paul Nierman at 763.785.0484.

·10-12, **Fresh-cut Products: Maintaining Quality and Safety Workshop,** University of California-Davis, Davis, CA. For more information, contact Edith Garrett at 703.299.6282 or E-mail: UC-Davis extension at aginfo@unexmail.ucdavis.edu.

·10-14, **National Society for Healthcare Foodservice Management (HFM) Training Conference,** Boca Raton Resort, FL. For additional information, call HFM at 202.546.7236.

·11-13, **HACCP II: Development of Your HACCP Plan,** Guelph Food Technology Centre, Guelph, Ontario, Canada. For additional information, contact Guelph Food Technology Centre at 519.821.1246; E-mail: gftc@gftc.ca.

·11-13, **HACCP for Juice Processors,** Miami, FL. For more information, contact Food Processors Institute at 202.393.0890; E-mail: www.fpi-food.org.

·17-19, **New York State Association for Food Protection Annual Meeting,** Holiday Inn, Syracuse/Liverpool, NY. For more information, contact Janene Lucia at 607.255.2892.

·18-19, **Wisconsin Association of Milk and Food Sanitarians, Inc. Joint Conference,** Ramada Inn, Eau Claire, WI. For more information, contact Randy Daggs at 608.837.2087.

·18-20, **"Thinking Globally — Working Locally: A Conference for Food Safety Education,"** Radisson Hotel Orlando, Orlando, FL. For more information, call 202.314.3459; E-mail: fsis.outreach@usda.gov.

·18-21, **AWT Convention and Exposition,** Disney's Coronado Springs Resort, Orlando, FL. For further information, contact Carrie Harley at 800.858.6683; E-mail: charley@awt.org.

·19-20, **International Fresh-cut Produce (IFPA) 9th Annual Fall Seminar,** in cooperation with the Food Marketing Institute (FMI), Alexandria, VA. For more information, contact Edith Garrett at 703.299.6282 or E-mail: sburns@fresh-cuts.org.

·23-25, **Indiana Environmental Health Association Fall Educational Conference,** University Inn, West Lafayette. For more information, contact Helene Uhlman at 219.853.6358.

·24, **WAFDO/FDA Food Biosecurity/Recall Workshops,** Seattle Center. Seattle, WA. For more information, contact Mike Govro at 503.986.4720; E-mail: mgovro@oda.state.or.us.

·24-26, **Wyoming Environmental Health Association Annual Educational Conference,** Camplex Center, Gillette. For more information, contact Sherry Maston at 307.322.9671.

·24-27, **Congrilait 2002, 26th IDF World Dairy Congress,** rue de Châteaudun, France. For additional information, call 330.1.49.70.71.71; E-mail: info@congrilait2002.com.

·24-27, **Tecno Fidta 2002,** 6th International Food Technology, Additives and Ingredients Exhibition and Conference, Buenos Aires, Argentina. For further information, contact Julie Bernier at 207.842.5583.

·25-26, **ServSafe® for the Food Industry and Food Service,** Guelph Food Technology Centre, Guelph, Ontario, Canada. For additional information, contact Guelph Food Technology Centre at 519.821.1246; E-mail: gftc@gftc.ca.

·25-27, **Washington Association for Food Protection Annual Meeting,** Campbells' Resort, Chelan, WA. For more information, contact Bill Brewer at 206.363.5411.

·25-29, **The 27th World Veterinary Congress, WORLDVET Tunisia 2002,** Tunis, Tunisia. For further information, contact www.worldvetunisia2002.com.

·30-Oct. 4, **Basic Dairy Technology Workshop,** Birmingham, AL. For further information, contact Kristy Morris at 205.595.6455 ext. 224; E-mail: us@randolphconsulting.com.

OCTOBER

·1-4, **Florida Association for Food Protection Annual Educational Conference,** Melbourne Beach Holiday Inn, Indiatlantic, FL. For more information, contact Zeb Blanton at 850.488.3951.

·8-10, **Kansas Association of Sanitarians Annual Fall Meeting,** Holidome, Manhattan, KS. For more information, contact Tim Wagner at 800.527.2633.

·13-16, **UW-River Falls Food Microbiology Symposium,** University of Wisconsin-River Falls, River Falls, WI. For additional information, contact Doreen Cegielski at 715.425.3704; E-mail: foodmicro@uwrf.edu.

·16, **Good Manufacturing Practices and Food Safety,** Cook College, Rutgers, New Brunswick, NJ. For additional information, contact Keith Wilson at 732.932.9271; E-mail: kwilson@aesop.rutgers.edu.

·21-22, **Thermal Process Development Workshop,** Monarch Hotel, Dublin, CA. For additional information, contact The Food Processors Institute at 202.393.0890; E-mail: www.fpi-food.org.

· **22-24, A Food Industry Approach to Quality System Evaluation,** Atlanta, GA. For additional information, call AIB at 785.537.4750.

· **23-24, Associated Illinois Milk, Food, and Environmental Sanitarians Annual Meeting,** Stony Creek Inn & Conference Center, East Peoria, IL. For more information, contact Larry Terando at 217.278.5900.

· **24-25, Thermal Processing Deviations Workshop,** Monarch Hotel, Dublin, CA. For additional information, contact The Food Processors Institute at 202.393.0890; E-mail: www.fpi-food.org.

· **29, Statistical Process Control in the Food Industry,** Part 1 of 2, Guelph Food Technology Centre, Guelph, Ontario, Canada. For more information, call Marlene Inglis at 519.821.1246; E-mail: gftc@gftc.ca.

· **30-31, Iowa Association for Food Protection Annual Meeting,** Starlite Village Motel, Ames, IA. For more information, contact Phyllis Borer at 712.754.2511; E-mail: borerp@ampi.com.

· **30-31, Statistical Process Control in the Food Industry, Part 2 of 2,** Guelph, Ontario, Canada. For more information, contact Marlene Inglis at 519.821.1246; E-mail: gftc@gftc.ca.

· **31, Brazil Association for Food Protection Annual Meeting,** University of São Pãulo, São Pãulo, Brazil. For more information, contact Maria Teresa Destro at 55.113.818.2399.

· **31, North Dakota Environmental Health Association Annual Meeting,** Holiday Inn Riverside, Minot, ND. For more information, contact Debra Larson at 701.328.6150.

NOVEMBER

· **4-5, GMP Workshop for Packaging Supplier,** Manhattan, KS. For additional information, call AIB at 785.537.4750.

· **4-6, Basic HACCP,** University of California-Davis, Davis, CA. For additional information, contact Jennifer Epstein at 202.637.4818; E-mail: jepstein@nfpa-food.org.

· **7-8, Advanced HACCP,** University of California-Davis, Davis, CA. For additional information, contact Jennifer Epstein at 202.637.4818; E-mail: jepstein@nfpa-food.org.

· **8-9, Mexico Association for Food Protection Annual Fall Meeting,** Mission Carlton Hotel, Guadalajara, Mexico. For more information, contact Lydia Mota De La Garza at 01.5794.0526.

· **18-19, HACCP I: Documentating your HACCP Prerequisite Program,** Guelph, Ontario, Canada. For more information, contact Marlene Inglis at 519.821.1246; E-mail: gftc@gftc.ca.

· **20-21, Alabama Association for Food Protection Annual Meeting,** Holiday Inn-Homewood, Birmingham, AL. For more information, contact G. M. Gallaspy at 334.206.5375.

· **20-22, HACCP II: Development of Your HACCP Plan,** Guelph Food Technology Centre, Guelph, Ontario, Canada. For more information, call Marlene Inglis at 519.821.1246; E-mail: gftc@gftc.ca.

Journal of Food Protection

ISSN: 032-028X
Official Publication

International Association for Food Protection

Reg. U.S. Pat. Off.

Vol. 65 **August 2002** **No. 8**

Research Notes

* Asterisk indicates author for correspondence.

Career Services Section

QUALITY ASSURANCE TECHNOLOGIST

Since 1909, OSI Industries, Inc. has been a leader in the food processing industry. Our global operations supply beef, pork, poultry, fish, pizza and vegetable products, plus a wide assortment of sauces and other foods to customers in the food service and retail markets. Our organization is committed to quality and excellence. You can learn more by visiting our web site: http://www.osigroup.com.

We are currently seeking an experienced Q.A. professional with the following experience: BS degree in food science or related field. Three to five years experience in the meat industry, preferably with Sanitation management experience. HACCP, Food Safety and GMP experience.

The Quality Assurance Technologist has responsibility to develop, implement, and maintain Quality Assurance Programs in the America zone to insure that all OSI system products meet or exceed minimum food safety standards, customer specifications, government regulations, and OSI product standards. This position will be based in Aurora, Illinois but will require 25-50% travel.

OSI offers comprehensive benefits package including health, dental and life insurance, a 401K plan, plus paid vacation and holidays. Please e-mail resumes to recruiter@osi.osigroup.com or fax to 630-851-6674.

Equal Opportunity Employer.

International Association for Food Protection®

CAREER SERVICES SECTION

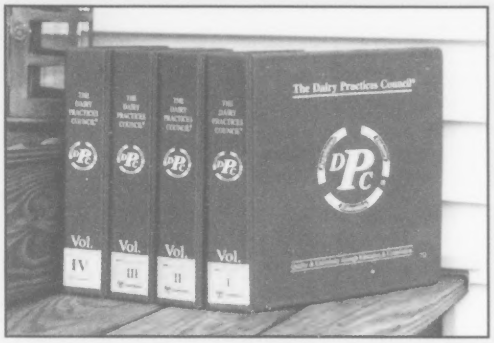
List your open positions in *Dairy, Food and Environmental Sanitation.* Special rates for this section provide a cost-effective means for you to reach the leading professionals in the industry. Call today for rate information.

Ads appearing in *DFES* will be posted on the Association Web site at www.foodprotection.org at no additional cost.

Send your job ads to Donna Bahun at dbahun@foodprotection.org or to the Association office: 6200 Aurora Ave., Suite 200W, Des Moines, IA 50322-2864; Phone: 800.369.6337; 515.276.3344; Fax: 515.276.8655.

IAFP Members

Did you know that you are eligible to place an advertisement if you are unemployed and looking for a new position? As a Member benefit, you may assist your search by running an advertisement touting your qualifications.



IAFP Offers "Guidelines for the Dairy Industry" from The Dairy Practices Council®

This newly expanded Four-volume set consists of 66 guidelines.

1 Planning Dairy Freestall Barns
2 Effective Installation, Cleaning, and Sanitizing of Milking Systems
3 Selected Personnel in Milk Sanitation
4 Installation, Cleaning, & Sanitizing of Large Parlor Milking Systems
5 Directory of Dairy Farm Building & Milking System Resource People
6 Natural Ventilation for Dairy Tie Stall Barns
7 Sampling Fluid Milk
8 Good Manufacturing Practices for Dairy Processing Plants
9 Fundamentals of Cleaning & Sanitizing Farm Milk Handling Equipment
10 Maintaining & Testing Fluid Milk Shelf-Life
11 Sediment Testing & Producing Clean Milk
12 Tunnel Ventilation for Dairy Tie Stall Barns
13 Environmental Air Control and Quality for Dairy Food Plants
14 Clean Room Technology
15 Milking Center Wastewater
16 Handling Dairy Products from Processing to Consumption
17 Prevention of & Testing for Added Water in Milk
18 Fieldperson's Guide to High Somatic Cell Counts
21 Raw Milk Quality Tests
22 Control of Antibacterial Drugs & Growth Inhibitors in Milk and Milk Products
23 Preventing Rancid Flavors in Milk
24 Troubleshooting High Bacteria Counts of Raw Milk
25 Cleaning & Sanitation Responsibilities for Bulk Pickup & Transport Tankers
27 Dairy Manure Management From Barn to Storage
28 Troubleshooting Residual Films on Dairy Farm Milk Handling Equipment
29 Cleaning & Sanitizing in Fluid Milk Processing Plants
30 Potable Water on Dairy Farms
31 Composition & Nutritive Value of Dairy Products
32 Fat Test Variations in Raw Milk
33 Brucellosis & Some Other Milkborne Diseases
34 Butterfat Determinations of Various Dairy Products
35 Dairy Plant Waste Management
36 Dairy Farm Inspection
37 Planning Dairy Stall Barns
38 Preventing Off-Flavors in Milk
39 Grade A Fluid Milk Plant Inspection
40 Controlling Fluid Milk Volume and Fat Losses
41 Milkrooms and Bulk Tank Installations
42 Stray Voltage on Dairy Farms
43 Farm Tank Calibrating and Checking
45 Gravity Flow Gutters for Manure Removal in Milking Barns
46 Dairy Odor Management
48 Cooling Milk on the Farm
49 Pre- & Postmilking Teat Disinfectants
50 Farm Bulk Milk Collection Procedures
51 Controlling the Accuracy of Electronic Testing Instruments for Milk Components
53 Vitamin Fortification of Fluid Milk Products
54 Selection of Elevated Milking Parlors
55 Hazard Analysis Critical Control Point System - HACCP For The Dairy Industry
56 Dairy Product Safety (Pathogenic Bacteria) for Fluid Milk and Frozen Dessert Plants
57 Dairy Plant Sanitation
58 Sizing Dairy Farm Water Heater Systems
59 Production and Regulation of Quality Dairy Goat Milk
60 Trouble Shooting Microbial Defects: Product Line Sampling & Hygiene Monitoring
61 Frozen Dessert Processing
62 Resources For Dairy Equipment Construction Evaluation
63 Controlling The Quality And Use Of Dairy Product Rework
64 Control Points for Good Management Practices on Dairy Farms
65 Installing & Operating Milk Precoolers Properly on Dairy Farms
66 Planning A Dairy Complex - "100+ Questions To Ask"
69 Abnormal Milk - Risk Reduction and HACCP
71 Farmers Guide To Somatic Cell Counts In Sheep
72 Farmers Guide To Somatic Cell Counts In Goats
73 Layout of Dairy Milk Houses for Small Ruminant Operations
80 Food Allergen Awareness In Dairy Plant Operations
83 Bottling Water in Fluid Milk Plants

IAFP has agreed with The Dairy Practices Council to distribute their guidelines. DPC is a non-profit organization of education, industry and regulatory personnel concerned with milk quality and sanitation throughout the United States. In addition, its membership roster lists individuals and organizations throughout the world.

For the past 32 years, DPC's primary mission has been the development and distribution of educational guidelines directed to proper and improved sanitation practices in the production, processing, and distribution of high quality milk and milk products.

The DPC Guidelines are written by professionals who comprise six permanent task forces. Prior to distribution, every guideline is submitted for approval to the state regulatory agencies in each member state. Should any official have an exception to a section of a proposed guideline, that exception is noted in the final document.

The guidelines are renown for their common sense and useful approach to proper and improved sanitation practices. We think they will be a valuable addition to your professional reference library.

If purchased individually, the entire set would cost $306. We are offering the set, packaged in four looseleaf binders for $230.00.

Information on how to receive new and updated guidelines will be included with your order.

To purchase this important source of information, complete the order form below and mail or fax (515-276-8655) to IAFP.

Please enclose $230 plus $12 shipping and handling for each set of guidelines within the U.S. Outside U.S., shipping will depend on existing rates. Payment in U.S. $ drawn on a U.S. bank or by credit card.

Name Phone No.

Company

Street Address

City, State/Province, Code

VISA/MC/AE No. Exp. Date

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

The use of the Audiovisual Library is a benefit for Association Members. Limit your requests to five videos. Material from the Audiovisual Library can be checked out for 2 weeks only so that all Members can benefit from its use.

Member # _____

First Name _____ M.I. _____ Last Name _____

Company _____ Job Title _____

Mailing Address _____

(Please specify: ❒ Home ❒ Work)

City _____ State or Province _____

Postal Code/Zip + 4 _____ Country _____

Telephone # _____ Fax # _____

E-mail _____ Date Needed _____

(Allow 4 weeks minimum from time of request)

For Association Members Only

PLEASE CHECK THE APPROPRIATE BOX

AUDIOVISUAL LIBRARY

DAIRY

- ❒ D1180 10 Points to Dairy Quality
- ❒ D1010 The Bulk Milk Hauler: Protocol & Procedures
- ❒ D1030 Cold Hard Facts
- ❒ D1040 Ether Extraction Method for Determination of Raw Milk
- ❒ D1050 The Farm Bulk Milk Hauler (slides)
- ❒ D1060 Frozen Dairy Products
- ❒ D1070 The Gerber Butterfat Test
- ❒ D1080 High-Temperature, Short-Time Pasteurizer
- ❒ D1090 Managing Milking Quality
- ❒ D1100 Mastitis Prevention and Control
- ❒ D1110 Milk Plant Sanitation: Chemical Solution
- ❒ D1120 Milk Processing Plant Inspection Procedures
- ❒ D1130 Pasteurizer – Design and Regulation
- ❒ D1140 Pasteurizer – Operation
- ❒ D1150 Processing Fluid Milk (slides)

ENVIRONMENTAL

- ❒ E3010 The ABCs of Clean – A Handwashing & Cleanliness Program for Early Childhood Programs
- ❒ E3020 Acceptable Risks?
- ❒ E3030 Air Pollution: Indoor
- ❒ E3040 Asbestos Awareness
- ❒ E3055 Effective Handwashing-Preventing Cross-Contamination in the Food Service Industry
- ❒ E3060 EPA Test Methods for Freshwater Effluent Toxicity Tests (Using Ceriodaphnia)
- ❒ E3070 EPA Test Methods for Freshwater Effluent Toxicity Tests (Using Fathead Minnow Larva)
- ❒ E3075 EPA: This is Super Fund
- ❒ E3080 Fit to Drink
- ❒ E3110 Garbage: The Movie
- ❒ E3120 Global Warming: Hot Times Ahead
- ❒ E3130 Kentucky Public Swimming Pool & Bathing Facilities
- ❒ E3135 Plastic Recycling Today: A Growing Resource
- ❒ E3140 Putting Aside Pesticides
- ❒ E3150 Radon
- ❒ E3160 RCRA – Hazardous Waste
- ❒ E3170 The New Superfund: What It is & How It Works-(1) Changes in the Remedial Process: Clean-up Standards & State Involvement Requirements
- ❒ E3180 The New Superfund: What It is & How It Works-(2) Changes in the Removal Process: Removal & Additional Program Requirements
- ❒ E3190 The New Superfund: What It is & How It Works – (3) Enforcement and Federal Facilities
- ❒ E3210 The New Superfund: What It is & How It Works – (4) Emergency Preparedness & Community Right-to-Know
- ❒ E3220 The New Superfund: What It is & How It Works – (5) Underground Storage Tank Trust Fund & Response Program
- ❒ E3230 The New Superfund: What It is & How It Works – (6) Research & Development/Closing Remarks
- ❒ E3240 Sink a Germ
- ❒ E3245 Wash Your Hands
- ❒ E3250 Waste Not: Reducing Hazardous Waste

FOOD

- ❒ F2260 100 Degrees of Doom...The Time & Temperature Caper
- ❒ F2150 A Guide to Making Safe Smoked Fish
- ❒ F2005 A Lot on the Line
- ❒ F2007 The Amazing World of Microorganisms
- ❒ F2140 Cleaning & Sanitizing in Vegetable Processing Plants: Do It Well. Do It Safely!
- ❒ F2010 Close Encounters of the Bird Kind
- ❒ F2015 Controlling *Listeria*: A Team Approach
- ❒ F2037 Cooking and Cooling of Meat and Poultry Products (2 Videos)
- ❒ F2030 "Egg Games" Foodservice Egg Handling and Safety
- ❒ F2020 Egg Handling & Safety
- ❒ F2036 Emerging Pathogens and Grinding and Cooking Comminuted Beef (2 Videos)
- ❒ F2035 Fabrication and Curing of Meat and Poultry Products (2 Videos)
- ❒ F2039 Food for Thought – The GMP Quiz Show
- ❒ F2040 Food Irradiation
- ❒ F2045 Food Microbiological Control (6 Videos)
- ❒ F2050 Food Safe – Food Smart – HACCP & Its Application to the Food Industry (Part 1&2)
- ❒ F2060 Food Safe – Series I (4 Videos)
- ❒ F2070 Food Safe – Series II (3 Videos)
- ❒ F2080 Food Safe – Series III (4 Videos)
- ❒ F2133 Food Safety First
- ❒ F2090 Food Safety: An Educational Video for Institutional Food Service Workers
- ❒ F2100 Tape 1-Cross Contamination
- ❒ F2101 Tape 2-HACCP
- ❒ F2102 Tape 3-Personal Hygiene
- ❒ F2103 Tape 4-Time and Temperature Controls
- ❒ F2104 Tape 1-Basic Microbiology and Foodborne Illness
- ❒ F2105 Tape 2-Handling Knives, Cuts and Burns
- ❒ F2106 Tape 3-Working Safely to Prevent Injury
- ❒ F2107 Tape 4-Sanitation
- ❒ F2120 Food Safety: For Goodness Sake, Keep Food Safe
- ❒ F2110 Food Safety is No Mystery
- ❒ F2130 Food Safety: You Make the Difference
- ❒ F2125 Food Safety Zone: Basic Microbiology
- ❒ F2126 Food Safety Zone: Cross Contamination
- ❒ F2127 Food Safety Zone: Personal Hygiene
- ❒ F2128 Food Safety Zone: Sanitation
- ❒ F2135 Get with a Safe Food Attitude
- ❒ F2136 GLP Basics: Safety in the Food Micro Lab
- ❒ F2137 GMP Basics: Avoiding Microbial Cross-Contamination
- ❒ F2140 GMP Basics: Employee Hygiene Practices
- ❒ F2143 GMP Basics: Guidelines for Maintenance Personnel
- ❒ F2138 GMP – GSP Employee
- ❒ F2150 GMP: Personal Hygiene and Practices in Food Manufacturing
- ❒ F2147 GMP Basics: Process Control Practices
- ❒ F2160 GMP: Sources & Control of Contamination during Processing
- ❒ F2180 HACCP: Safe Food Handling Techniques
- ❒ F2169 HACCP Training for Employees–USDA Awareness
- ❒ F2172 HACCP Training for Managers
- ❒ F2170 The Heart of HACCP
- ❒ F2171 HACCP: The Way to Food Safety
- ❒ F2175 Inside HACCP: Principles, Practices & Results
- ❒ F2175 Inspecting For Food Safety – Kentucky's Food Code
- ❒ F2190 Is What You Order What You Get? Seafood Integrity
- ❒ F2210 Northern Delight – From Canada to the World
- ❒ F2240 On the Front Line
- ❒ F2250 On the Line
- ❒ F2270 Pest Control in Seafood Processing Plants
- ❒ F2280 Principles of Warehouse Sanitation
- ❒ F2290 Product Safety & Shelf Life
- ❒ F2220 Proper Handling of Peracidic Acid
- ❒ F2230 Purely Coincidental
- ❒ F2310 Safe Food: You Can Make a Difference
- ❒ F2320 Safe Handwashing
- ❒ F2325 Safe Practices for Sausage Production
- ❒ F2460 Safer Processing of Sprouts
- ❒ F2330 Sanitation for Seafood Processing Personnel
- ❒ F2340 Sanitizing for Safety
- ❒ F2350 SERVSAFE® Steps to Food Safety (6 Videos)
- ❒ F2430 Smart Sanitation: Principles & Practices for Effectively Cleaning Your Food Plant
- ❒ F2370 Supermarket Sanitation Program – "Cleaning & Sanitizing"
- ❒ F2380 Supermarket Sanitation Program – "Food Safety"
- ❒ F2390 Take Aim at Sanitation
- ❒ F2410 Wide World of Food-Service Brushes
- ❒ F2420 Your Health in Our Hands – Our Health in Yours

OTHER

- ❒ M1010 Diet, Nutrition & Cancer
- ❒ M1020 Eating Defensively: Food Safety Advice for Persons with AIDS
- ❒ M1030 Ice: The Forgotten Food
- ❒ M1050 Personal Hygiene & Sanitation for Food Processing Employees
- ❒ M1060 Psychiatric Aspects of Product Tampering
- ❒ M1070 Tampering: The Issue Examined

Visit our Web site at www.foodprotection.org for detailed tape descriptions

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

SHIP TO: (Please print or type. All areas must be completed in order to process.)

Member # _____

First Name _____ M.I. _____ Last Name _____

Company _____ Job Title _____

Mailing Address _____

(Please specify: ❒ Home ❒ Work)

City _____ State or Province _____

Postal Code/Zip + 4 _____ Country _____

Telephone # _____ Fax # _____

E-mail _____

BOOKLETS

Quantity	Description	Member or Gov't. Price	Non-Member Price	TOTAL
	Procedures to Investigate Waterborne Illness—2nd Edition	$10.00	$20.00	
	Procedures to Investigate Foodborne Illness—5th Edition	10.00	20.00	

SHIPPING AND HANDLING – $3.00 (US) $5.00 (Outside US)
Each additional booklet $1.50

Multiple copies available at reduced prices.
Phone our office for pricing information on quantities of 25 or more.

Shipping/Handling _____
Booklets Total _____

OTHER PUBLICATIONS

Quantity	Description	Member or Gov't. Price	Non-Member Price	TOTAL
	Pocket Guide to Dairy Sanitation (minimum order of 10)	$ .60	$ 1.20	
	Before Disaster Strikes...A Guide to Food Safety in the Home (minimum order of 10)	.60	1.20	
	*Developing HACCP Plans – A Five-Part Series (as published in *DFES*)	15.00	15.00	
	*Surveillance of Foodborne Disease – A Four-Part Series (as published in *JFP*)	18.75	18.75	
	*Annual Meeting Abstract Book Supplement (year requested _____)	25.00	25.00	
	*IAFP History 1911–2000	25.00	25.00	

SHIPPING AND HANDLING – Guide Booklets – per 10 $2.50 (US) $3.50 (Outside US)
*Includes shipping and handling

Shipping/Handling _____
Other Publications Total _____
TOTAL ORDER AMOUNT _____

Payment Must be Enclosed for Order to be Processed
★ US Funds on US Bank ★

❒ CHECK OR MONEY ORDER ENCLOSED ❒ VISA ❒ MasterCard ❒ Discover

Exp. Date _____

SIGNATURE _____

4 EASY WAYS TO ORDER:

Phone: 515.276.3344; 800.369.6337
Fax: 515.276.8655
Mail: to the Association address listed above.
Web site: www.foodprotection.org

Prices effective through August 31, 2003

MEMBERSHIP APPLICATION

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

MEMBERSHIP DATA:

Prefix (❒ Prof. ❒ Dr. ❒ Mr. ❒ Ms.)

First Name _____ M.I. _____ Last Name _____

Company _____ Job Title _____

Mailing Address _____

(Please specify: ❒ Home ❒ Work)

City _____ State or Province _____

Postal Code/Zip + 4 _____ Country _____

Telephone # _____ Fax # _____

E-mail _____

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

MEMBERSHIP CATEGORIES:

	US	Canada/ Mexico	International
❒ **Membership with *JFP* & *DFES*** ◀ BEST VALUE 12 issues of the *Journal of Food Protection* and *Dairy, Food and Environmental Sanitation*	$165.00	$190.00	$235.00
❒ ***JFP* Online**	$36.00	$36.00	$36.00
❒ **Membership with *DFES*** 12 issues of *Dairy, Food and Environmental Sanitation*	$95.00	$105.00	$120.00
❒ ***JFP* Online**	$36.00	$36.00	$36.00
Student Membership*			
❒ *JFP* and *DFES*	$82.50	$107.50	$152.50
❒ *Journal of Food Protection*	$47.50	$62.50	$92.50
❒ *Dairy, Food and Environmental Sanitation*	$47.50	$57.50	$72.50
❒ ***JFP* Online**	$36.00	$36.00	$36.00

*Student verification must accompany this form

All Prices Include Shipping & Handling

	Gold	Silver	Sustaining
❒ **Sustaining Membership** *JFP* Online included Recognition for your organization and many other benefits. Contact IAFP for details.	$5,000.00	$2,500.00	$750.00

TOTAL MEMBERSHIP PAYMENT:

$ _____

(Prices effective through August 31, 2003)

US FUNDS on US BANK

Payment Options:

❒ Check Enclosed ❒ VISA ❒ MasterCard ❒ Discover

Card | | | | | | | | | | | | | | | | |

Exp. Date _____

Signature _____

DO NOT USE THIS FORM FOR RENEWALS

Invite a Colleague to Join

The International Association for Food Protection, founded in 1911, is a non-profit educational association of over 3,000 food safety professionals with a mission ***"to provide food safety professionals worldwide with a forum to exchange information on protecting the food supply."*** Members belong to all facets of the food protection arena, including Industry, Government and Academia.

Benefits of Membership

- ***Dairy, Food and Environmental Sanitation*** — Published as the general Membership publication, each issue contains refereed articles on applied research, applications of current technology and general interest subjects for food safety professionals. Regular features include industry and association news, an industry-related products section and a calendar of meetings, seminars and workshops.
- ***Journal of Food Protection*** — First published in 1937, the Journal is a refereed monthly publication. Each issue contains scientific research and authoritative review articles reporting on a variety of topics in food science pertaining to food safety and quality.
- ***Journal of Food Protection* Online** — Internet access to abstracts and full text articles. Full text searching, active reference links, multiple delivery options, and table of contents alerting at your fingertips.
- **The Audiovisual Library** — As a free service to Members, the Library offers a wide variety of quality training videos dealing with various food safety issues.
- **The Annual Meeting** — With a reputation as the premier food safety conference, each meeting is attended by over 1,400 of the top industry, academic and government food safety professionals. Educational sessions are dedicated to timely coverage of key issues and cater to multiple experience levels.

Promote YOUR Association to Colleagues

If you know someone who would prosper from being a Member, share with them the benefits of Membership, send them to our Web site, or provide us with their mailing address and we will send them information as well as sample journals. Together we are *Advancing Food Safety Worldwide*!

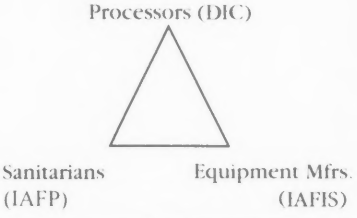
International Association for Food Protection®

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

MARK OF COMPLIANCE

The 3-A Symbol Story

The 3-A Sanitary Standards Symbol Administrative Council, known throughout the industry as the "**3-A Symbol Council**," was organized in 1956. Its purpose is to grant authorization to use the **3-A Symbol** on equipment that meets 3-A Sanitary Standards for design and fabrication.



A Modern Concept

The modern concept of the 3-A program was established in 1944 when the Dairy Industry Committee (DIC) was formed. DIC is one of the three industry segments involved in the preparation of 3-A Sanitary Standards. These industry segments are:

- **Processors,** represented by DIC
- **Equipment Manufacturers**, represented by IAFIS
- **Sanitarians**, represented by IAFP

Use of the Symbol

Voluntary use of the **3-A Symbol** on dairy equipment:

- assures processors that equipment meets sanitary standards
- provides accepted criteria to equipment manufacturers for sanitary design & fabrication
- establishes guidelines for uniform evaluation and compliance by sanitarians.

3-A Sanitary Standards Symbol Administrative Council

1500 Second Avenue S.E., Suite 209

Cedar Rapids, IA 52403

Phone: 319-286-9221
Fax: 319-286-9290

E-mail: aaasansb@ia.net
Web site: http://zeus.ia.net/~aaasansb