December • 1994 • Vol • 14 • No. 12 • Pages 723-774

ISSN: 1043-3546

6200 Aurora Avenue • Suite 200W
Des Moines • Iowa • U.S.A. • 50322

DAIRY, FOOD AND ENVIRONMENTAL

SANITATION

DECEMBER 1994

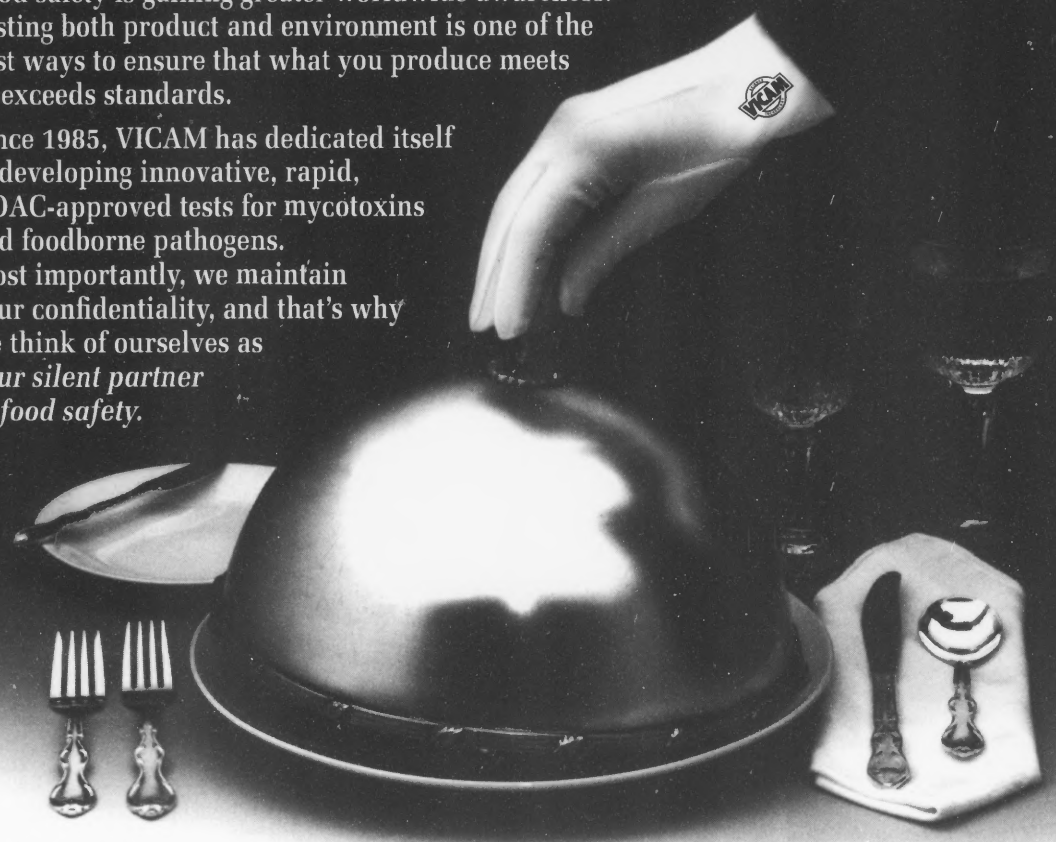
A Publication of the International Association of Milk, Food and Environmental Sanitarians, Inc.

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

Maintain food safety *in confidence.*

Food safety is gaining greater worldwide awareness. Testing both product and environment is one of the best ways to ensure that what you produce meets or exceeds standards.

Since 1985, VICAM has dedicated itself to developing innovative, rapid, AOAC-approved tests for mycotoxins and foodborne pathogens. Most importantly, we maintain your confidentiality, and that's why we think of ourselves as *your silent partner in food safety.*



Serve your customers *with confidence.*

Every one of our tests offers significant improvements over other methods, providing each of these important benefits:

- ***Speed*** – *Results in minutes or hours, not days.*
- ***Sensitivity*** – *Detect levels at or below guidelines.*
- ***Ease-Of-Use*** – *Little training required.*
- ***Accuracy*** – *Quantitative measurements.*
- ***Safe*** – *Test methods minimize hazards.*

For example, ListerTest™ gives accurate, quantitative results within 24 hours for live Listeria. And, AflaTest® is the industry standard for aflatoxin testing, providing quantitative results in ppb within 10 minutes. No other tests are this fast, simple or sensitive.

For more information on how VICAM rapid test kits can help you maintain food safety, ***call us toll-free at (800) 338-4381 or contact:***

Your Silent Partner In Food Safety

SCIENCE VICAM TECHNOLOGY

313 PLEASANT STREET, WATERTOWN, MA 02172
TEL: 617- 926-7045 / FAX: 617- 923-8055 **Please circle No. 198 on your Reader Service Card**

IAMFES Members

INVITE A COLLEAGUE TO JOIN THE ASSOCIATION

You, as a member of IAMFES, can contribute to the success of the Association and the professional advancement of your colleagues by inviting them to become a part of IAMFES. On your behalf, we would be happy to send a colleague a membership kit, including complimentary copies of *Dairy, Food and Environmental Sanitation* and the *Journal of Food Protection* and an invitation to join IAMFES. It's easy, just fill in the following information and return this card to IAMFES. (Please Print)

Name: _____ Company: _____

Address: _____ City: _____

State/Prov.: _____ Zip: _____ Phone: _____

Your Name: _____ Your Phone: _____

IAMFES Members

INVITE A COLLEAGUE TO JOIN THE ASSOCIATION

You, as a member of IAMFES, can contribute to the success of the Association and the professional advancement of your colleagues by inviting them to become a part of IAMFES. On your behalf, we would be happy to send a colleague a membership kit, including complimentary copies of *Dairy, Food and Environmental Sanitation* and the *Journal of Food Protection* and an invitation to join IAMFES. It's easy, just fill in the following information and return this card to IAMFES. (Please Print)

Name: _____ Company: _____

Address: _____ City: _____

State/Prov.: _____ Zip: _____ Phone: _____

Your Name: _____ Your Phone: _____

Place
Stamp
Here

IAMFES

200W Merle Hay Centre
6200 Aurora Ave.
Des Moines, Iowa 50322

DFES
12/94

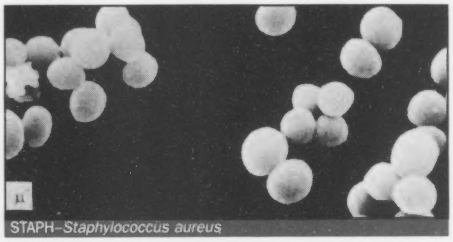
Place
Stamp
Here

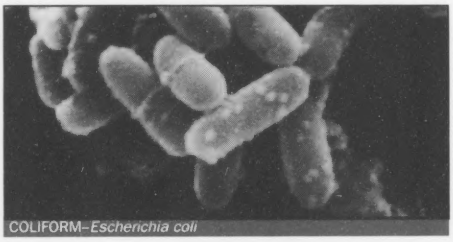
IAMFES

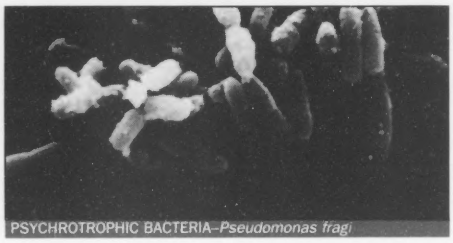
200W Merle Hay Centre
6200 Aurora Ave.
Des Moines, Iowa 50322

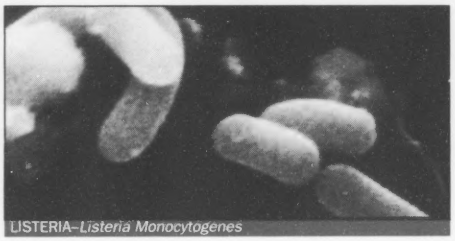
DFES
12/94

QMI helps you identify the source of product contamination


STAPH–*Staphylococcus aureus*


COLIFORM–*Escherichia coli*

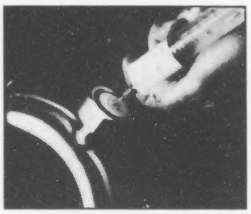

PSYCHROTROPHIC BACTERIA–*Pseudomonas fragi*

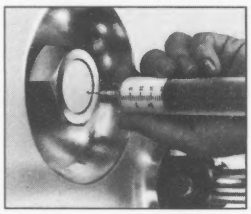

LISTERIA–*Listeria Monocytogenes*

AND helps you avoid it!

With its patented QMI Aseptic Sampling System and Aseptic Transfer System, QMI is a fast, sure and easy solution for the threat of contamination. More importantly, QMI goes a long way to help avoid an even bigger threat—the threat of product recall due to spoiled or unsafe products.

- Using the QMI Aseptic Sampling System, you can effectively document microbiological process control, which is critical to an effective HACCP system.
- Using the QMI Aseptic Transfer System, you can avoid contamination during inoculation.





Don't take chances. Take action against contamination. Get all the facts on our aseptic sampling and transfer systems now.

QMI FOOD AND DAIRY QUALITY MANAGEMENT, INC.

245 E. Sixth Street • St. Paul, MN 55101 • Phone: (612) 228-0474 • FAX (612) 291-9179

QMI Products are protected by the following U.S. Patents (4,941,517; 5,086,813; 5,119,473). Manufactured under License from Galloway Company, Neenah, WI USA. Photographs of bacteria supplied by Dr. Edmund Zottola of the University of Minnesota, St. Paul, MN.

IAMFES Sustaining Members

A & B Process Systems, 528 North Street, Stratford, WI 54484; (715) 687-4332

ABC Research, 3437 S.W. 24th Avenue, Gainesville, FL 32607; (904) 372-0436

ABELL Pest Control, 246 Attwell Drive, Etobicoke, ON M9W 5B4; (416) 675-6060

Accurate Metering Systems, Inc., 1651 Wilkening Court, Schaumburg, IL 60173; (708) 882-0690

Alfa-Laval Agri, Inc., 11100 North Congress Avenue, Kansas City, MO 64153; (816) 891-1565

AMPCO Pumps, Inc., 4000 W. Burnham St, Milwaukee, WI 53215; (414) 643-1852

APV Crepaco, 100 South CP Avenue, Lake Mills, Wisconsin 53551; (708) 678-43009

Atkins Technical, Inc., 3401 S.W. 40 Blvd., Gaines-ville, FL 32608; (904) 378-5555

Babson Bros. Co., 1880 Country Farm Drive, Naperville, IL 60563; (708) 369-8100

Becton Dickinson Microbiology Systems, Inc., PO Box 243, Cockeysville, MD 21030; (301) 584-7188

Bentley Instruments, Inc., 327 Lake Hazeltine Drive, Chaska, MN 55318; (612) 448-7600

Biolog, Inc., 3447 Investment Blvd., Suite 2, Hayward, CA 94545; (415) 785-2585

bioMérieux Vitek, Inc., 595 Anglum Drive, Hazelwood, MO 63042-2395; (800) 638-4835

Borden, Inc., 180 E. Broad Street, Columbus, OH 43215; (614) 225-6139

Capital Vial Corp., PO Box 446, Fultonville, NY 12072; (518) 853-3377

Charm Sciences, Inc., 36 Franklin Street, Malden, MA 02148; (617) 322-1523

Custom Control Products, Inc., 1300 N. Memorial Drive, Racine, WI 53404; (414)637-9225

Dairy and Food Labs, Inc., 3401 Crow Canyon Road, Suite 110, San Ramon, CA 94583-1307; (510) 830-0350

Dairy Quality Control Inst., 5205 Quincy Street, St. Paul, MN 55112-1400; (612) 785-0484

Dairymen, Inc., 10140 Linn Station Road, Louisville, KY 40223; (502) 426-6455

Darigold, Inc., 635 Elliott Avenue, W., Seattle, WA 98119; (206) 284-6771

Dean Foods, 1126 Kilburn Avenue, Rockford, IL 61101; (815) 962-0647

Decagon Devices, PO Box 835, Pullman, WA 99163; (509) 332-2756

Difco Laboratories, Inc., PO Box 331058, Detroit, MI 48232; (313) 462-8478

Diversey Corp., 12025 Tech Center Drive, Livonia, MI 48150-2122; (313) 458-5000

DonLevy & Associates, Inc., 1551 E. 89th Ave., Merrillville, IN 46410; (219) 736-0472

Dynal, Inc., 5 Delaware Drive, Lake Success, NY 11043; (516) 326-3270

Eastern Crown, Inc., PO Box 216, Vernon, NY 13476; (315) 829-3505

Educational Foundation of the National Restaurant Assn., 250 S. Wacker Drive, Suite 1400, Chicago, IL 60606; (800) 765-1222

Electrol Specialties Company, 441 Clark Street, South Beloit, IL 61080; (815) 389-2291

Evergreen Packaging, Division of International Paper, 2400 6th Street, S.W., Cedar Rapids, IA 52406; (319) 399-3236

F & H Food Equipment Co., PO Box 398595, Springfield, MO 65808; (417) 881-6114

Alex C. Fergusson, Inc., Spring Mill Drive, Frazer, PA 19355; (215) 647-3300

Foss Food Technology Corporation, 10355 W. 70th Street, Eden Prairie, MN 55344; (612) 941-8870

FRM Chem, Inc., PO Box 207, Washington, MO 63090; (314) 583-4360

H. B. Fuller Co., 3900 Jackson Street, N.E., Minneapolis, MN 55421; (612) 781-8071

G&H Products Corp., 7600 57th Avenue, Kenosha, WI 53142; (414) 694-1010

Gardex Chemicals, Ltd., 246 Attwell Drive, Etobicoke, ON M9W 5B4; (800) 563-4273

General Mills Restaurants, Inc., PO Box 593330, Orlando, FL 32859; (407) 850-5330

GENE-TRAK Systems, 31 New York Avenue, Framingham, MA 01701; (508)872-3113

Gist-brocades Food Ingredients, Inc., N93 W14560 Whittaker Way, Menomonee Falls, WI 53051; (800) 423-7906

Hess & Clark, Inc./KenAg, 7th & Orange Street, Ashland, OH 44805; (800) 992-3594

IBA, Inc., 27 Providence Road, Millbury, MA 01527; (508) 865-6911

Idetek, Inc., 1245 Reamwood Ave., Sunnyvale, CA 94089; (408) 745-0544

IDEXX Laboratories, Inc., 1 idexx Drive, Westbrook, ME 04092; (800) 321-0207

Integrated BioSolutions, Inc., 4270 U.S. Route One, Monmouth Junction, NJ 08892; (908) 274-1778

International Dairy Foods Association, 888 16th Street, N.W., Washington, DC 20006; (202) 296-4250

Kienzade Division, Ecolab, Inc., Ecolab Center North, St. Paul, MN 55102; (612) 293-2233

Land O'Lakes, Inc., PO Box 116, Minneapolis, MN 55440-0116; (612) 481-2870

Maryland & Virginia Milk Prod. Assn., Inc., 1985 Isaac Newton Square, Reston, VA 22090; (703) 742-6800

Metz Sales, Inc., 522 W. First Street, Williamsburg, PA 16693; (814) 832-2907

Michelson Laboratories, Inc., 6280 Chalet Drive, Commerce, CA 90040; (213) 928-0553

Mid America Dairymen, Inc., 3253 E. Chestnut Expressway, Springfield, MO 65802-2584; (417) 865-7100

Nabisco Foods Group, 75 North Arlington Avenue, East Orange, NJ 07017; (201) 503-2080

Nasco International, 901 Janesville Avenue, Fort Atkinson, WI 53538; (414) 563-2446

National Mastitis Council, 1840 Wilson Boulevard, Suite 400, Arlington, VA 22201; (703) 243-8268

Nelson-Jameson, Inc., 2400 E. Fifth Street, PO Box 647, Marshfield, WI 54449-0647; (715) 387-1151

NESTLE USA, Inc., 800 N. Brand Blvd., Glendale, CA 91203; (818) 549-5799

Northland Food Lab., 2415 Western Avenue, PO Box 160, Manitowoc, WI 54221-0160; (414) 682-7998

Norton Company Transflow Tubing, PO Box 3660, Akron, OH 44309-3660; (216) 798-9240

Organon Teknika, 100 Akzo Avenue, Durham, NC 27704; (919) 620-2000

Pall Ultrafine Corp., 2200 Northern Boulevard, East Hills, NY 11548; (516) 484-5400

Penn State Creamery, 12 Borland Laboratory, University Creamery, University Park, PA 16802; (814) 865-7535

PRISM, 8300 Executive Center Drive, Miami, FL 33166-4680

Ralston Analytical Laboratories, 2RS Checkerboard Square, St. Louis, MO 63164; (314) 982-1680

Rio Linda Chemical Company, 410 N. 10th Street, Sacramento, CA 95814; (916) 443-4939

Ross Laboratories, 625 Cleveland Avenue, Columbus, OH 43216; (614) 227-3333

Seiberling Associates, Inc., 94 North High Street, Suite 350, Dublin, OH 43017-1100; (614) 764-5854

Silliker Laboratories Group, Inc., 900 Maple Drive, Homewood, IL 60430; (708) 957-7878

SmithKline Beecham Animal Health, 812 Springdale Dr., Exton, PA 19341; (215)363 3140

Sparta Brush Co., Inc., PO Box 317, Sparta, WI 54656; (608)269-2151

Tekmar Co., PO Box 371856, Cincinnati, OH 45222-1856; (513)761-0633

3-M Surgical Division, 3M Center, St. Paul, MN 55144-1000; (612)736-9593

Unipath Co., Oxoid Div., PO Box 691, Ogdensburg, NY 13669; (800)567-8378

Viatran Corporation, 300 Industrial Drive, Grand Island, NY 14072; (716)773-1700

VICAM, 313 Pleasant Street, Watertown, MA 02172; (617)926-7045

Walker Stainless Equipment Co., 618 State Street, New Lisbon, WI 53950; (608)562-3151

Weber Scientific, 2732 Kuser Road, Hamilton, NJ 08961-9430; (609) 584-7677

World Dryer, Inc., 5700 McDermott Dr., Berkeley, IL 60163; (708) 449-6950

Vol. 14 No. 12 DECEMBER 1994

Dairy, Food and Environmental Sanitation CONTENTS

Articles:

ABOUT THE COVER . . . *Photo courtesy of Meritech, Englewood, Colorado. Hand in a CleanTech® system clear plastic handwashing cylinder back-lit to show its operation.*

Dairy, Food and Environmental Sanitation (ISSN-1043-3546) is published monthly beginning with the January number by the International Association of Milk, Food and Environmental Sanitarians, Inc. executive offices at 6200 Aurora Avenue,Suite 200W, Des Moines, IA 50322-2838, USA. Each volume comprises 12 numbers. Printed by Heuss Printing, Inc., 911 N. Second Street, Ames, IA 50010, USA. Second Class Postage paid at Des Moines, IA 50318 and additional entry offices.

Postmaster: Send address changes to **Dairy, Food and Environmental Sanitation,** 6200 Aurora Avenue, Suite 200W, Des Moines, IA 50322-2838, USA.

Manuscripts: Correspondence regarding manuscripts and other reading materials should be addressed to Jodie M. Cantwell, IAMFES, 6200 Aurora Ave., Suite 200W, Des Moines, IA 50322-2838; 515-276-3344. "**Instructions to Contributors**" can be obtained from the editor.

Orders for Reprints: All orders should be sent to DAIRY, FOOD AND ENVIRONMENTAL SANITATION, IAMFES, Inc., 6200 Aurora Ave., Suite 200W, Des Moines, IA 50322-2838. Note: Single copies of reprints are not available from this address; address reprint requests to principal author.

Business Matters: Correspondence regarding business matters should be addressed to Steven K. Halstead, IAMFES, 6200 Aurora Ave., Suite 200W, Des Moines IA 50322-2838.

Subscription Rates: $120.00 per year. Single copies $10.00 each. No cancellations accepted.

Sustaining Membership: A sustaining membership in IAMFES is available to companies at a rate of $450 per year, which includes $100 credit toward an ad in the July "annual meeting issue" of **Dairy, Food and Environmental Sanitation.** For more information, contact IAMFES, 6200 Aurora Ave., Suite 200W, Des Moines, IA 50322-2838; 515-276-3344.

Membership Dues: Membership in the Association is available to individuals only. Dues are $60 per year and include a subscription to **Dairy, Food and Environmental Sanitation.** Dues including both **Dairy, Food and Environmental Sanitation** and **Journal of Food Protection** are $90.00. Student membership is $30.00 per year, with verification of student status, and includes **Dairy, Food and Environmental Sanitation** or **Journal of Food Protection.** No cancellations accepted. Student membership with both journals is $45.

Postage: Canada and foreign add $22.50 PER journal subscription. U.S. FUNDS ONLY — ON U.S. BANK. Single copies add $7.00.

Claims: Notice of failure to receive copies must be reported within 30 days domestic, 90 days foreign. All correspondence regarding changes of address and dues must be sent to IAMFES, Inc., 6200 Aurora Ave., Suite 200W, Des Moines, IA 50322-2838; 515-276-3344.

Thoughts From the President . . .

By
C. Dee Clingman
IAMFES President

If You Always Do What You Always Did, You Will Always Get What You Always Got

As the new calendar year is upon us, it becomes time for New Year's Resolutions. We make these innocuous commitments to lose weight, stop smoking, spend more time on our hobbies, etc. I never hear of anyone "resolving" to spend more time at work. I wonder why? Oh well, I guess the thought of a new challenge at the beginning of the year has some special meaning as opposed to a 4th of July resolution. I wonder why? The important thing is that we are trying something different; we are trying to accomplish something we would like to do but somehow failed to do the previous 365 days. I wonder why? But if you always do what you always did, you will always get what you always got. I wonder why?

Professional Associations are not much different than people. I guess it is because they are people in a generic sense. IAMFES has also been trying new things during the past few years. We have moved to professional office space, enhanced our fiscal management by the addition of a CPA, developed a long-range plan to guide the Association's future, expanded our Annual Meeting program by the addition of sponsored symposia, as well as other new ideas which have been tried. Did all those new ideas work out to our expectations? In some cases, no. But we did try new things. We tried things "outside of the box" in some instances. By stretching our imagination and maximizing our potential we can develop and grow to support our members better for the future.

So what is in store for IAMFES' resolutions for the new year? For one thing, the Program Advisory Committee is busy putting together an outstanding educational program for the meeting in Pittsburgh this summer. Efforts are also underway in planning the 1996 meeting in Seattle and the 1997 meeting in Orlando. The 1998 meeting in Singapore should be unique. Well, maybe Singapore is a little too far "out of the box" but conceptually it brings us to a good discussion point. The first word in our Association's name is "International" yet outside of the U.S. and Canada we have no Affiliates. Even in Canada we have only two Affiliates.

As we continue to recruit members in North America, we need to expand our global impact by recruiting members worldwide and assisting with the organization of Affiliates worldwide. To do this, we now have an international recruiting membership application and a colorful IAMFES brochure. These are available through the IAMFES office in Des Moines. If you have contact with other professionals abroad, please pass along your Association's message and mission to them as you travel or cross their paths.

Perhaps, an Annual meeting in Singapore may be a reality some day. I wonder why not!

We'll take the hassle out of HACCP.

The SERVSAFE® Serving Safe Food

Food Safety Management System

SERVSAFE® Serving Safe Food from The Educational Foundation is a complete educational program, designed to address critical food safety issues through the Hazard Analysis Critical Control Point (HACCP) system. Our materials bring you the latest, most up-to-date information — and the easiest, most understandable implementation of the HACCP food safety system available. The SERVSAFE system features products for:

Foodservice Managers and Employees — The *Applied Foodservice Sanitation* course is the most recognized, widely accepted food safety training and certification program available for managers today. It is the first manager certification program to define and discuss the HACCP system. It's great as an introduction for new sanitarians with food program responsibilities. And SERVSAFE also includes a manager training video, instructor materials and employee videos and guides to streamline training.

Sanitarians — The *Managing a Food Safety System* HACCP-based course is designed specifically to meet the needs of sanitarians and industry professionals. It offers opportunitites for collaborative workshops between regulatory and industry professionals to discuss the practical implementation of the principles of HACCP consistent with the 1993 FDA Food Code. Some examples of past workshops include:

- *The Department of Commerce and FDA* use of the *Managing a Food Safety System* course as the HACCP curriculum for the National Seafood Foodservice Pilot Program.
- *The Department of Commerce and the Chicago Health Department* use of SERVSAFE programs to train field personnel.
- *National and state environmental health association* sponsorship of SERVSAFE programs for their members.

The *Managing a Food Safety System* course, as well as other SERVSAFE programs, can be presented as a seminar in your state. For more information on arranging a seminar, call **1-800-765-2122 ext. 772.**

Let us help you take the hassle out of HACCP with the most recognized, up-to-date food safety training available— **SERVSAFE Serving Safe Food.** For more information on our HACCP-based SERVSAFE programs, call **1-800-765-2122 today!**

National Restaurant Association
THE EDUCATIONAL FOUNDATION
Your Source For Professional Training

Please circle Reader Service No. 142.

On My Mind . . .

By
Steven K. Halstead, CAE
IAMFES
Executive Manager

...is FINANCES.

At the November meeting of the IAMFES Executive Board, we received the report of our auditors. In the course of discussing the report, a question was raised as to how much money a federal tax exempt, non-profit organization (such as IAMFES) can have in cash reserves before its tax status is questioned.

The question waived a red flag for me. Was there a perception that we have a lot of money in reserve? As the discussion continued, it became quite clear some members of the Executive Board and perhaps others were of the opinion we had a great deal of money in reserve.

Further investigations showed that the source of this misunderstanding was the simplified financial report we publish in the November issue of *Dairy, Food and Environmental Sanitation*. This form has been used for a number of years and people seem to be comfortable with it, so we have not changed it. As we see now, our efforts to simplify and make the financial status of the association understandable, led to misunderstandings.

On page 752, you will find an excerpt from our 1994 Financial Statements. This shows the Balance Sheet at August 31, 1994 and the fiscal year end Statement of Revenue and Expense. In Accounting 101, you learn that the Balance Sheet is like a financial photograph, which is to say, it looks at the financial picture on a given day. The Statement of Revenue and Expense shows the financial activity for the entire year. Any discussion of the finances of a business (or an association) must reference without both these reports.

The other thing you would have learned in Accounting 101 is that there are two commonly used methods of accounting. There is the cash basis — which most of us use on a daily basis in our homes. We have cash coming in and cash going out. At the end of the year, hopefully more came in than went out.

Then there is the accrual basis which is required by Generally Accepted Accounting Practices (or GAAP). The accrual basis is preferred by businesses because it ties revenue to income (i.e., the business preformed a service or offered a product and is paid for it). Under the accrual basis, revenue is recognized when the service or good is delivered.

As an example, if you pay your dues in January, under the cash basis, we would recognize all the money you sent us in January and would draw against that for the rest of the year. We might have lots of income in January and none for the rest of the year. This can make budgetary control a nightmare especially if your expenses are unpredictable — aren't they always?

Under the accrual basis, we would only recognize 1/12 of your dues in January (that's all we "earned"), 1/12 in February, 1/12 in March, etc. until all was recognized by the end of December. Thus, the revenue is spread out over the year, just as the cost of providing your member services is spread out over the year.

IAMFES presents its financial statements using the accrual basis in conformance with GAAP.

Looking only at the General Fund column of the Balance Sheet, you will see we had a variety of assets totalling $269,811 on August 31, 1994. We also had a variety of liabilities which totalled $311,177. This is $41,366 more than our assets, and is called the "fund balance."

If we had closed IAMFES on August 31, 1994, and then tried to pay our members and subscribers what we owed them for the value of the services we had not provided, we would have been short by $41,366. We "owe" this money to ourselves, no one else. (The $222,827 in unearned revenue is money we received in dues and subscriptions for which we have not yet provided services.)

The Statement of Revenues and Expenses informs us where the money came from and where it went. Again, looking just at the General Fund column, for the year, we generated $860,177 from a variety of sources. We spent $851,232 in a variety of ways. So, for the year,we spent $8,945 less than we took in or we "made" $8,945. (Had we not cut back on travel and laid off two employees, we would have lost between $30,000 and $40,000.)

Taking these two statements in concert, we see that the financial position of the association is strong, but we have no actual cash reserves. We will continue to spend less than we take in until the fund balance is $0. Then, our assets will equal our liabilities.

Our long-range goal is to have the fund balance at least equal the unearned revenue — that would truly be a cash reserve. In the best case scenario, our fund balance would amount to one-half of our operating budget. That is a long way and a lot of work away.

By the way, the IRS does not have a hard and fast rule as to how much non-profits can have in cash reserves.

Please circle Reader Service No. 228

Please circle Reader Service No. 110

Please circle Reader Service No. 134

Please circle Reader Service No. 213

Dairy, Food and Environmental Sanitation, Vol. 14, No. 12, Pages 733-737

Meat and Poultry Rankings: An Expert Elicitation

Donald W. Anderson, Senior Economist and Jackqueline L. Teague, Economist, Research Triangle Institute, P.O. Box 12194, Research Triangle Park, North Carolina 27709-2194; Gary R. Acuff, Associate Professor, Food Microbiology, Animal Science Department, Texas A&M University, College Station, Texas 77843-9354

ABSTRACT

The United States Department of Agriculture's (USDA) Food Safety and Inspection Service (FSIS) needed an assessment of the health risks of various types of meat and poultry processing operations relative to one another. A demonstrated method to evaluate the relative risks of different types of meat processing would help FSIS evaluate the feasibility of using risk-assessment to help allocate inspection resources. In the absence of epidemiological and laboratory data, we gathered expert opinion concerning the relative risks of various meat processes. Twenty-three of 36 experts in government, industry and academia responded by quantitatively assessing the relative risks of 12 processes. We find that simple processing operations such as cutting, slicing, grinding and repackaging are not generally considered lower risk than other processes; that there are significant differences in relative risk rankings depending on whether inherent or controlled risks are being considered, and that microbiologists ranked simple processing operations higher in risk than non-microbiologists. There is statistical evidence of agreement among experts, suggesting that expert elicitation shows promise as a means to generate food safety risk information.

ACKNOWLEDGMENTS

The authors acknowledge the support of the FSIS of the USDA, and the guidance and comments of Judith Segal, Jane Roth, and Clark Danford of the Policy, Evaluation and Planning Staff. We also thank the 23 anonymous experts for their time and energies. This paper was prepared by the authors alone, and any views or opinions expressed herein do no necessarily reflect those of the Agency.

Demands for processing risk information.

Even the simplest forms of meat processing present microbiological and other types of hazards that pose a potential risk to public health. The hazards associated with cutting, slicing, grinding, and repackaging meat may be controlled, though not necessarily eliminated, by implementing Good Manufacturing Practices (GMP) and Hazard Analysis and Critical Control Point (HACCP) systems. While many processors do control simple processing hazards, other processors may fail to control hazards for various reasons. For example, some processors may lack knowledge about hazards and/or available control measures, while others may perceive that the expected costs of controlling the hazards outweigh the expected benefits.

The Food, Agriculture, Conservation and Trade Act Amendments of 1991 amended the Federal Meat Inspection Act and Poultry Products Inspection Act to commission a study of the appropriateness of exempting wholesale meat outlets selling to hotels, restaurants and institutions (HRI) from FSIS inspection, provided the outlets only cut, slice, grind or repackage (CSGR) meat into small quantities. Unrelated to the Amendments, a 1992 General Accounting Office (GAO) report stated that "Federal agencies responsible for food safety and quality inspections could use their resources more efficiently by basing inspection frequencies on risk . . ." (*3*).

As part of a broader review of USDA's meat inspection exemption policies, and a focused examination of the appropriateness of granting inspection exemptions to simple processors (*1*), FSIS required an assessment of the health risks of simple processing relative to other types of meat processing. Further, in the absence of laboratory or epidemiological data, a proven methodology to assess relative risks of different types of meat processing would help FSIS evaluate the feasibility of using risk-assessment to help allocate inspection resources as recommended by GAO (*3*).

Should simple-processing HRI-wholesalers be exempted from the Acts? What is the validity of the GAO's implicit assertion that firms engaged in relatively simple cutting ar 1 packaging operations could be inspected less often?

Data collection methodology.

In order to conduct a risk assessment of simple meat and poultry processes it is necessary to have a working knowledge of microorganisms constituting a significant public health threat, and how these organisms might change in numbers and types during production, distribution and preparation of meat and poultry. Limited epidemiological data regarding various meat processes can be found in technical journals on food microbiology, especially in regard to the transmission of

bacterial pathogens through raw meat and poultry products (*4*). When data is available, it is difficult to make direct comparisons for risk assessment between and among various processes studied in isolation. Unless and until baseline data on the types and level of microbial contamination that can be expected on raw beef products is established, and an active surveillance study is undertaken to establish the role of raw meat and poultry in transmission of human enteric disease (*4*), hazard analyses and risk assessments must be based on experience, judgment and common sense.

In the summer of 1993, we elicited experts' judgments concerning the relative risk of each of 12 processes including cutting, slicing, grinding, and repackaging. Thirty-six experts — 10 in government, 14 in industry, 12 in academia — were selected to participate in this research based on their colleagues' recommendations for their expertise in meat or poultry science, food technology, microbiology or related fields. Government, industry and academic professionals were chosen to include a variety of experience. The list of experts includes food microbiologists, chemists, meat scientists and epidemiologists from both the United States and Canada who were employed with universities, research institutes, private companies, professional associations, government food agencies, and centers for disease control. We asked them to rate the relative level of food safety risk presented by 12 meat and poultry processes by completing a one-page ranking form (Fig. 1) which was accompanied by a set of instructions. We assured the experts that when findings were made public, their individual responses would remain anonymous.

While permitting them to assign ties, we asked experts to rank the 12 alphabetically arranged processes from 1 to 12, with 1 representing the highest risk and 12 representing the lowest risk with respect to inherent and controlled processing risk. For the purposes of this ranking, inherent and controlled processing risks were defined as follows:

- Inherent risk is defined as the number and types of hazards associated with carrying out the particular process (i.e., those hazards associated with processing complexity) without considering the production technology available to control the hazards or considering hazards associated with processing previous to or following the process being ranked.
- Controlled processing risk is defined as the inherent risk controlled by standard production technologies routinely used by industry. "Routinely used" means that not all producers follow these risk management practices, but that those who do not are clearly recognized as deviant.

In Column A of Fig. 1, experts considered the number and type of hazards inherent in each process and ranked the processes from 12 (lowest risk) to 1 (highest risk). In Column B, experts assumed the presence of production technologies routinely used by industry for managing inherent processing and re-ranked processes from lowest to highest risk. In Column C, experts again assumed the presence of standard production technologies and provided a sense of how much higher or lower in risk each process is compared to the others by assigning the lowest risk process 10 points and then allotting points to each of the other processes relative to one another. For example, if an expert considered grinding three times as risky as cutting, she assigned grinding three times as many points as cutting.

Figure 1. *Risk Elicitation Instrument sent to 36 experts in meat or poultry science, food technology, microbiology, or related fields.*

Types of Meat and Poultry Processes	Inherent Risk Column A Ordinal Ranking	Controlled Processing Risk Column B Ordinal Ranking	Column C Relative Ranking
Canning	_____	_____	_____
Cooking	_____	_____	_____
Curing	_____	_____	_____
Cutting	_____	_____	_____
Drying	_____	_____	_____
Fermenting	_____	_____	_____
Grinding Rendering (Edible low-temperature)	_____	_____	_____
Repackaging (Cooked)	_____	_____	_____
Repackaging (Raw)	_____	_____	_____
Slicing	_____	_____	_____
Smoking	_____	_____	_____

Please tell us which term best describes your field of expertise (check one):

Food Microbiology
Food Chemistry
Food Technology
Other (specify)

Risk assessment results.

RTI received a total of 23 completed ranking forms from the 36 requests sent to experts. Of the 23 experts, two incorrectly completed the relative scoring section (Column C) by again ranking the processes from 1 to 12 instead of assigning points starting with 10 points for the lowest risk process and assigning the other processes points relative to one another. Therefore, results are reported from 23 experts for the inherent and controlled rankings (Columns A and B) and from 21 experts for the relative risk rankings (Column C).

Table 1 shows the 12 processes in decreasing order of inherent and controlled risk, measured by the mean of the usable responses. For example, repackaging cooked product had the highest inherent risk with a mean rank of 4.4 (1 being the highest possible), and repackaging raw product had the lowest inherent risk with a mean response of 8.7. When routine controls are assumed to be in place, repackaging cooked product remains the highest risk process, but a number of other processes change ranks rather significantly. For example, canning, which had the second-highest inherent risk, had the lowest controlled risk. Grinding, which had the fifth-highest inherent risk, had the second-highest controlled risk. Experts do not necessarily think that "controlled" grinding is riskier than "uncontrolled" grinding. Rather, the risk of controlled grinding is higher in comparison to other controlled processes than uncontrolled grinding compared to

Table 1. *Risks of 12 meat and poultry processes.*

Inherent risk (N=23)[a,b]				Controlled risk (N=21)[a,c]			
	Median	Mean	Mode		Median	Mean	Mode
Repacking (cooked)	4	4.4	7 (1)	Repackaging (cooked)	3	3.6	8 (1)
Canning	3	5.2	10 (1)	Grinding	3	3.65	5 (1,2,3)
Fermenting	4	5.2	5 (2)	Slicing	5	4.2	6 (5)
Slicing	5	5.5	5 (2,5)	Cutting	4	4.7	7 (4)
Grinding	5	5.5	4 (2,3,5,9)	Fermenting	6	5.8	5 (4)
Rendering	7	6.5	5 (4)	Rendering	6	6.6	6 (6)
Cooking	7	7.0	7 (11)	Repackaging (raw)	7	7.0	5 (11)
Drying	7	7.1	4 (3)	Drying	8	7.2	5 (8)
Cutting	8	7.1	4 (10)	Cooking	9	7.3	7 (11)
Curing	8	7.6	5 (9)	Smoking	8	7.9	5 (8,9)
Smoking	8	8.2	4 (6,10)	Curing	9	8.3	7 (10)
Repackaging (raw)	11	8.7	9 (12)	Canning	12	9.5	12 (12)

[a] Lowest possible mean risk = 12.0; highest possible mean risk = 1.0.
[b] Inherent risk considers the number and types of hazards associated with the particular process without considering the production technology available to control the hazards or considering hazards associated with processing previous to or following the process being ranked.
[c] Controlled risk assumes the presence of routine controls (e.g., good manufacturing practices).

other uncontrolled processes. We surmise that the risk of grinding probably declines when controls are present, but not as much as the risks of other processes with controls.

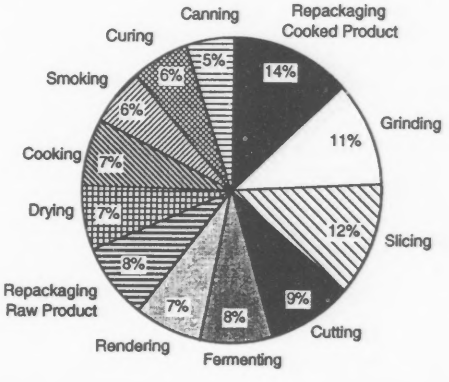
Three simple processes mentioned in the Amendments and by GAO as processes to be considered for exemption or less frequent inspection were ranked among the highest inherent risk processes: repackaging cooked product, slicing and grinding. Four simple processes — repackaging cooked product, grinding, slicing and cutting — were ranked as the highest controlled-risk processes.

In Column C of the elicitation instrument, we asked experts to assign 10 points to the process with the lowest controlled risk and increasingly higher point-scores to processes with successively higher controlled risk. While experts were asked to "anchor" their responses by assigning a "10" to the lowest risk process, they were not confined at the high-risk end. We converted the experts' points into percentages to standardize the rankings while maintaining the proportional nature of their scoring. From these standardized proportional rankings, we report summary rankings in Fig. 2, which shows, on average, how experts allotted their total risk points to each of the 12 processes. Fig. 2 shows that, averaged across experts, canning received only 5% of all controlled risk points, curing and smoking each received 6% of all controlled risk points, and so on.

Overall, experts apparently assigned lowest risk ranking to those processes that generate products requiring less handling and preparation by the final food preparer. We believe many experts would not hesitate to open and consume a commercially canned food product without further preparation because they perceive the process, although inherently risky, to be controlled by preventative real-time process controls through standard production technologies. Other processes like canning, such as smoking and curing, produce end-products that were also perceived by the experts as relatively well protected from bacterial hazards and requiring less preparation by end users for safe consumption. On the other end of the scale, notice that repackaging cooked products, grinding and slicing received fairly high-risk rankings. Hazards associated with these processes were perceived to be either frequently uncontrolled or difficult to control. Cooked products are easily recontaminated during repackaging, and the experts displayed a lack of confidence in the ability or willingness of processors to take the measures necessary to ensure that products are not recontaminated during processing. Slicing usually involves a cooked product (deli meats), and safety depends on slicer sanitation and on the responsible processor preventing raw and cooked products from being sliced on the same equipment.

Sixteen of the 21 experts described themselves as microbiologists. The other five considered themselves to be specialists in the following areas: food technology (three experts), chemistry (one expert), and epidemiology (one expert). To help discern whether the controlled risk rankings assigned by microbiologists systematically differed from those of non-

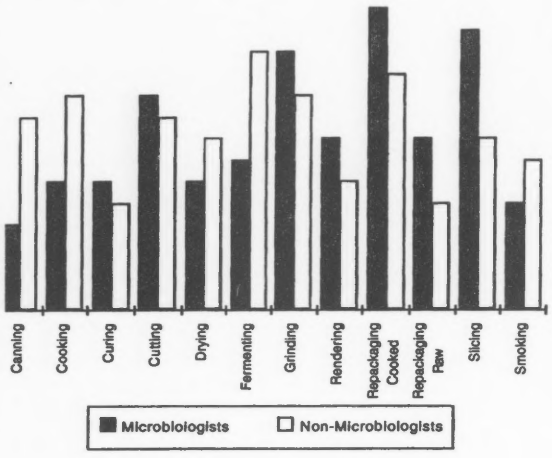
Figure 2. *Average share (percent) of allotted points assigned by 23 experts ranking processes by risk.*



microbiologists, Fig. 3 compares the mean responses of the two types of experts. The processes themselves are ordered alphabetically in Fig. 3. Note how similar the two types of experts' rankings were for some processes (e.g., curing, cutting and grinding) and how much they differed for certain others (e.g., canning, cooking, fermenting and slicing).

We considered several ways to assess whether our 23

Figure 3. *Average Risk Share (percent) by Expert Type, including 16 microbiologists and 5 other experts.*



experts, simply stated, tended to agree with one another on which processes were lower in risk than others. Pearson's product-moment correlation, Spearman's rho, Cohen's Kappa and Kendall's tau-b can all be used to evaluate the amount of agreement between two observers (*5*). Incorporating three or more observers using rank-ordered data is more complicated because what constitutes an "agreement" must be defined at the outset (*2*).

The level of agreement in rank orderings among many judges is appropriately measured using T_c (Tau-c). Tc has the advantage over several other statistics because it can be used to measure the correlation among three or more judges (our 23 experts) and a criterion ranking (here, inherent or controlled risk) (*5*). T_c can be thought of as the average number of net agreements in proportion to the total number of agreements possible.

To calculate T_c, we did pair-wise comparisons between all pairs of processes for all experts. If *all* 23 experts agreed on the relative risks of *all* pairs of 12 processes, there would be a total of 1,518 agreements {[23 • 12 • (12 - 1)]+2}. Naturally, agreement among 23 experts ranking 12 processes by risk was not universal. First, using the majority opinion, the items being ranked were placed in order of mean ranking from 12 (lowest risk) to one (highest risk). Next, the items were compared in pairs to assess the number of experts who ranked one process of lesser or equal risk than another process. For example, canning was ranked of lesser or equal controlled risk than curing by 18 experts while the other five experts ranked canning as higher risk than curing. Since canning was considered to be of lesser or equal risk than curing by the majority opinion of the group (18 of 23 experts), the group majority becomes "canning is lesser or equal risk than curing." The 23 individual rankings were then divided into agreements (18 experts) and disagreements (5 experts) with the group majority. We followed this procedure for all possible process pairs, and the average proportion of net agreements to total possible agreements yielded T_c.

The estimated value of T_c for the controlled risk rankings is 0.441.[1] If the 23 experts had assigned risk rankings to the 12 processes randomly, T_c would equal zero. With perfect agreement, T_c would equal one. There is no index for interpreting the various values of T_c. That is, we can observe the estimated value of 0.44[1], but cannot state that there is "weak agreement," "moderate agreement," or "strong agreement." We can, however, test the significance of T_c. The calculated $\underline{z}$ statistic is 9.56, which is greater than 1.645, the critical $\underline{z}$ for a 0.05 significance level2. We note there is significant evidence to reject the no-agreement (TC=0) hypothesis. The probability of achieving this level of agreement by chance is less than one in one thousand.

For the inherent risk rankings, Tc equals 0.29. The calculated z statistic is 6.391, which is greater than 1.645, the critical $\underline{z}$ for a 0.05 significance level. We conclude that there is significant evidence to reject the no-agreement hypothesis. The probability of achieving this level of agreement by chance is again less that one in one thousand.

Summary, limitations and need for further research.

A number of the experts indicated either by phone or by mail that this exercise was very difficult and frustrating. One microbiologist indicated that the risk rankings would differ depending on whether red meat or poultry was being processed. Another, however, felt that the controlled risk rankings would be unaffected by species since the purpose of controls is to ensure that the microbial load of the product, whatever it is when the meat arrives at the processor, does not worsen during processing. This question of the interrelationship between species and risk could be explored in further

[1] Denoting the difference as A between the sum of the frequencies in the upper left diagonal of the preference matrix and the sum of the frequencies in the lower left diagonal of the preference matrix, we calculate T_c, the correlation with a criterion ranking, as follows:

$T_c = A + I\,k\,N(N - 1)] + 2 = (1{,}094 - 424) + 123(12)(11)] + 2 = 0.441$ where k is the number of observers, here 23, and N is the number of objects, here 12.

[2] Because the sampling distribution of T_c is approximately normal for k >3 and N >5, to test the hypothesis that $T_c = O$ against the alternative hypothesis that Tc>O we use the z statistic as follows:

$z = ITC + (2 + (k\,N(N - 1)]\ [(3\sqrt{k}\,N(N - 1)) + \sqrt{2}(2N + 5)]$.

The z is approximately normally distributed with zero mean and standard deviation of 1. This hypothesis implies that raters without agreement would "randomly" assign rankings. Thus, the agreements and disagreements would be approximately equal and the difference between the number of agreements and the number of disagreements would be zero.

elicitahons. Another expert commented that he/she had to make many assumptions in assigning the risk rankings and that experts' assumptions necessarily influenced their rankings. This expert commented specifically that whether the meat was raw or cooked would influence the rankings for fermenting, cutting, drying, and slicing. By design, the ranking instructions were not detailed and allowed room for interpretation. While it would be informative to repeat the risk elicitation providing extensive instructions about what to assume, the interrater reliability results suggest that experts made like assumptions.

Notwithstanding the difficulty of the elicitation exercise for the experts, a number of conclusions are suggested:

- "Simple" CSGR processes are not necessarily "low risk" relative to other processes.
- The risks of processes relative to one another often differ considerably depending on whether the availability and effectiveness of control measures are considered.
- Hazard control measures, at least as experts assume they are implemented, are more effective in reducing hazards for some processes than for others.
- Experts consider processes that have adequate controls and a good history of control to be of lesser risk, other things equal.
- Experts consider processes that require less end-user handling to be of lesser risk, other things equal.
- Microbiologists ranked the five CSGR processes higher in risk than the non-microbiologists; the controlled risk rankings for the five processes varied from 1 to 5 percentage points.

In addition to exploring the risks of species interactions and raw/cooked interactions, there are a number of other research extensions that could be studied. We hope that our work has demonstrated that expert elicitations can contribute to the intelligent allocation of internal monitoring resources, inspection resources, and perhaps assist in the identification of hazards and critical control points in the development of HACCP plans.

REFERENCES

1. Anderson, Donald W., Jackqueline L. Teague, Sheila A. Martin, Brian Calingaert and Nancy Dean. 1994. Review of USDA meat and poultry inspection exemption policies. Final report prepared for the Food Safety and Inspection Service of the U.S. Department of Agriculture. January 1994. Research Triangle Institute, Research Triangle Park, NC.
2. Bishop, Y. M. M., S. E. Fienberg and P. W. Holland, with the collaboration of R. J. Light and F. Mosteller. 1975. Discrete multivariate analysis: Theory and practice. MIT Press, Cambridge, MA.
3. General Accounting Of fice (GAO). 1992. Food safety and quality: Uniform, risk-based inspection system needed to ensure safe food supply. GAO/RCED-92-152. June 1992. U.S. General Accounting Office, Washington, D.C.
4. National Advisory Committee on Microbiological Criteria for Foods, USDA (NACMCF). 1993. Generic HACCP for raw beef. Food Microbiology. 10:449-488.
5. Siegal, S. and N. J. Castellan, Jr. 1988. Nonparametric statistics for the behavioral sciences. 2nd ed. McGraw-Hill Book Company, New York, NY.

Dairy, Food and Environmental Sanitation, Vol. 14, No. 12, Pages 738-741

The Role of Epidemiology in Risk Assessment: A CDC Perspective

Morris E. Potter, DVM, MS

ABSTRACT

The risk assessment literature reflects a tension between the belief that epidemiologic data derived from real-life clinical experiences should produce the best estimates of risk, and the desire to use data arising from carefully controlled experiments with accurate measurements of optimal specimens taken at appropriate times. The introduction of "soft data" and social science methodology is blamed for the public's refusal to accept the pictures of reality provided by experts, but neither the public nor the experts appear confident that laboratory experiments reflect reality (*10*). Currently available epidemiologic data, information from microbiological surveys of foods, and data from controlled studies together provide the basis for qualitative and crude quantitative risk assessments. By clarifying the data needs, the epidemiologic, clinical, and microbiologic studies also are the first step in protocol and mathematical model development necessary for improved quantitative risk assessment (*7*).

The Centers for Disease Control and Prevention (CDC) has developed a number of tools to study foodborne disease that can contribute importantly to risk assessment. The lack of a regulatory role in managing foodborne hazards provides a useful perspective for conducting risk assessment for foodborne hazards. The strict separation of risk assessment and risk management advocated by the 1983 National Research Council report on risk assessment in the federal government (*14*) may not be necessary or, in the long run, appropriate (*10*). However, what we know about risk is always conditioned by background facts, and the facts structured by regulatory imperatives and economic interests can influence the expert evaluation of risk. In addition, because food safety regulators make a practice of congratulating themselves on the safety of the products under their authority and excusing residual risk as being unavoidable (and, therefore, not subject to risk management), it may be difficult to divorce these values from risk assessments conducted by regulators. The results of such risk assessments are likely to poorly serve the public, the food industry, the risk management agencies, and the credibility of the risk assessment process.

Whether CDC directly assesses risks of infectious foodborne hazards or provides fodder for others, the data derived from CDC's mix of epidemiologic and laboratory studies of human diseases can help fill many of the needs for qualitative and quantitative risk assessment of infectious foodborne hazards. The tools CDC uses to study foodborne disease are outbreak investigations, prospective studies of sporadic foodborne disease, laboratory-based surveillance of foodborne pathogens, and the foodborne disease outbreak surveillance system.

During its investigations of foodborne disease outbreaks, CDC identifies hazards in foods. For example, a large outbreak in Nova Scotia in 1981 provided the first evidence for transmission of *Listeria monocytogenes* by uncooked vegetables (*20*). The epidemiologically implicated coleslaw was shown to be contaminated by the epidemic strain of *L. monocytogenes*, providing microbiological support for the epidemiologic conclusions. Later microbiological studies showed that raw cabbage would support the growth of *L. monocytogenes*, demonstrating how epidemiologic results can help select which foods to study so microbiological results can define critical control points (*3*).

The largest epidemic of foodborne listeriosis in North America occurred in 1985 in Los Angeles (*13*). The epidemiologic investigation implicated soft cheese, and the cheese was shown to be contaminated with the outbreak strain of *L. monocytogenes*. This outbreak unleashed a flood of microbiological and regulatory activity and changes in dairy industry practices, which resulted in a decrease in *L. monocytogenes* in dairy products. It also stimulated microbiological studies of other processed foods and prompted the Food and Drug Administration (FDA) to fund epidemiologic studies of sporadic listeriosis. At that point, finding *L. monocytogenes* in frozen dairy products, which do not share important risk factors with soft cheese, resulted in regulatory action, whereas finding *L. monocytogenes* in processed meat and poultry products, which share risk factors with soft cheese, did not. We need to use what we learn as we learn it to effectively and efficiently protect the public's health, but rapidly transforming new data into reasonable public policy is complicated by residual unknowns.

Outbreak investigations have identified other foodborne hazards. Investigations in 1982 identified *Escherichia coli* O157:H7 in ground beef as a cause of hemorrhagic colitis (*16*). In 1988, an outbreak investigation identified pork chitterlings as a source of *Yersinia enterocolitica* infections (*11*). When implicated foods cannot be cultured or are contaminated at levels that make adequate sampling difficult,

epidemiologic investigations may provide the only available basis for actions to protect the public. They can also help define the range of exposures that result in illness in the community, as they have in a number of cheese-associated outbreaks of salmonellosis. In addition, outbreak investigations can provide information on rates of hospitalization and death, economic costs of illness, and other indicators of severity of disease.

While much can be learned about foodborne disease by investigating outbreaks, additional information is derived from prospective studies of sporadic foodborne diseases. These studies provide data on infection rates in the populations studied, which can help rank foodborne pathogens; the proportion of illness attributable to specific foods, which can help rank food vehicles; and other information useful for characterizing risk. Sporadic case studies on campylobacteriosis and listeriosis have shown the usefulness of this type of epidemiologic and microbiological investigation. The initial FDA-funded case-control studies of sporadic listeriosis that CDC conducted in 1986-87 identified undercooked chicken and non-reheated hot dogs as risk factors for infection (*21*). While these results stimulated considerable industry interest in determining critical control points during food processing, there was a reluctance to accept epidemiologic data that were unsubstantiated microbiologically. To extend these observations and provide microbiological support for the link between contaminated foods and sporadic disease, CDC conducted further studies in 1988-90. These studies implicated soft cheeses and foods purchased from store delicatessen counters, identified the patient's strain of *L. monocytogenes* in foods from the patient's refrigerator for a number of cases and, in general, provided microbiological support for the epidemiologic conclusions of the earlier epidemiologic studies (*15,19*). These efforts resulted in specific dietary recommendations for high-risk consumers, and industry and regulatory measures to prevent contamination of ready-to-eat foods (*9*). The most recent CDC epidemiologic studies of sporadic listeriosis suggest that the combination of risk management strategies has resulted in a 44% reduction in illness and a 48% reduction in deaths associated with listeriosis (Tappero, Schuchat, Deaver, et al., manuscript submitted, 1994). Thus, epidemiology is also valuable for program evaluation.

Laboratory-based surveillance for foodborne microorganisms at CDC provides important information on disease trends and on characteristics of foodborne pathogens. For example, the laboratory-based *Salmonella* surveillance system provided the first indication of the emerging *Salmonella* serotype Enteritidis problem in the early 1980s. Also, periodic examination of a subset of these reference specimens has permitted us to monitor the increasing antimicrobial resistance of *Salmonella* isolates (*12*). In addition, laboratory-based surveillance tracks the spread of epidemics. For example, in 1993 these data helped delineate the course and geographic spread of an interstate outbreak of *Salmonella* serotype Montevideo infections. We traced these infections to consumption of tomatoes, and this investigation has resulted in studies on how to prevent *Salmonella* contamination of tomatoes.

CDC's system of nationwide foodborne disease outbreak surveillance helps identify factors associated with the occurrence of outbreaks (such as retrospectively determining the association between egg-containing dishes and *Salmonella* serotype Enteritidis infections) and measure the effectiveness of regulatory controls. As an example of the latter, in 1979-1981, data from outbreak investigations demonstrated the growing role of precooked roast beef in outbreaks of foodborne salmonellosis. After microbiological investigations documented that cooked roasts were contaminated and that cooking conditions were inadequate to kill *Salmonella*, USDA cooking requirements were changed. CDC's foodborne disease outbreak surveillance data indicate that very few salmonellosis outbreaks have since been traced to precooked roast beef.

However, data from the foodborne disease outbreak surveillance system do not accurately reflect the universe of foodborne disease, and they should not be used as the sole source of information for ranking the public health importance of foodborne pathogens, food commodities and food preparation practices (*6*). In addition, this system lacks sensitivity; it may not detect an outbreak of diarrheal illness involving thousands of cases randomly distributed in a large urban area (*2*). Thus, people who use the data from this source to emphasize the relative safety of one food commodity or another are using CDC data the way a drunk uses a lamp post — more for support than illumination.

To review, epidemiologic data are useful for hazard identification, dose response assessment, severity assessment, and risk characterization, including identifying the products, processes and people at greatest risk of being associated with foodborne disease. However, critical and only slowly reducible uncertainties remain, and there exists a sense that unsubstantiated epidemiologic studies produce a muddled picture of the magnitude of the risk of particular hazards; whereas hard, quantitative analyses of data from controlled studies represent risks as they really are (*10*). While epidemiologic data are often sufficient for the first public health reaction to a foodborne hazard, they must be integrated with information from clinical and food microbiological studies to produce credible risk assessments. This is particularly true for exposure assessment and dose response assessment.

Microbial characteristics and patterns of food handling complicate exposure assessment for infectious foodborne hazards. Although microbiological data collected under a variety of environmental conditions can be modeled to predict the frequency and amount of pathogenic microorganisms going into the kitchen, prediction of exposure cannot automatically lead to an assumption of human health risk because the hazard may be eliminated by events between the point of its identification and consumption of the food. Therefore, it is not clear how the level of contamination during production, slaughter, processing, and other stages from farm to kitchen correlates with the potential for disease transmission.

Furthermore, we have no evidence or even any suspicion that foodborne risks to human health are uniformly distributed. Like statistics on the weather, the average level of contamination by pathogenic microorganisms of one agriculture commodity or another is probably a mathematical fiction derived from the extremes that occur in nature, and the

extremes are most likely to be associated with measurable public health risk. Therefore, nationwide surveys that provide us information on the average number of *Salmonella* on a broiler carcass or the incidence of *E. coli* 0157:H7 contamination of ground beef, whatever their other utility, are unlikely to be useful in calculating exposure estimates. Reconstructing the chain of events of everything that went wrong to produce an outbreak and determining microbial levels in raw food products leading to those events through well-coordinated epidemiologic and laboratory investigations of outbreaks will be the most fertile ground for exposure assessment data and for developing a predictive data base for elevated risk of foodborne disease outbreaks. Such a data base for sporadic disease will undoubtedly be more difficult to construct.

Dose response assessment is complicated for infectious foodborne disease by variability in the characteristics of the foodborne pathogens as modified by characteristics of the food vehicle, its handling, and the consumer. For example, it is known that various populations are at increased risk of disease following foodborne exposure to *Salmonella*. These populations are grossly characterized as the elderly, the very young, and the immune compromised; the dose of *Salmonella* necessary to cause disease in these groups is characterized as low. As the understanding of the pathogenesis of infection with *Salmonella* improves, the definition of these "at risk" populations can be identified by their specific deficiencies and their risk of illness following measured doses of *Salmonella* predicted more precisely.

Exact data on the minimum infectious dose for humans are generally not possible because of the cost, unethical nature of human experimentation, and uncertainty in extrapolating dose response curves to low exposure levels and in comparing the subpopulation of volunteers with other subpopulations that may be more or less susceptible *(4)*. Although very large doses of *Salmonella* were required to cause disease in human volunteer studies that have been done (on the order of millions of organisms), a number of outbreaks have been caused by much lower doses, sometimes only 10 to 100 cells. Mathematical approaches have been developed to predict the likelihood of a *Giardia cyst* in water surviving body defenses to cause infection, and it should be possible to exploit the same logic for foodborne pathogens, although factoring in host susceptibility, vehicle, microorganism, and preparation variables will complicate the model *(17)*. A quantitative risk assessment for the relatively simply analyzed problem of viral contamination of shellfish demonstrates the difficulties these variables present *(18)*. In sum, the quality and quantity of infectious dose data are rarely of the precise form and format required for classical statistical methods, so expert judgment must be used to create a range of estimates for what proportion of the population will become ill at increasing levels of exposure *(1)*. Well-studied outbreaks involving different populations in a variety of settings will help determine the shape of the dose response estimate distribution.

Current epidemiologic data suggest that both illness and death associated with foodborne disease are unacceptably high, that a broad array of potential pathogens contaminate our food supply, and that even though most foodborne diseases could be controlled in the kitchen they are not; therefore, risk reductions at every possible point from farm to table are needed. Epidemiologic data also suggest that our most important foodborne hazards are *Salmonella* and *Campylobacter* (on the basis of numbers of reported cases), and *Listeria* and *E. coli* O157:H7 (on the basis of severity of disease), and that foods of animal origin, while not the sole purveyors of contagion, are more often associated with infectious foodborne disease than are other foods.

These conclusions are tentative because of limited epidemiologic data. Deriving firmer conclusions with reduced margins of uncertainty will require large amounts of human resources, financial resources and time. Inasmuch as disease investigation and reporting begins at the local level, the first step toward improved data for infectious foodborne hazard risk assessment will be the repair of our crumbling public health infrastructure at the local level *(8)*. The next step will be establishing active surveillance sites, like those for listeriosis, for the broad range of foodborne pathogens. Microbiological surveys that improve the accuracy of predictions of the load of pathogens entering the kitchen also will be necessary. To this submodel one can add data on population consumption patterns and information from outbreak investigations, such as attack rates and rates of cooking failures and post-cooking contamination, to extend the estimates of microbial load to the consumer's fork. Future epidemiologic and microbiologic studies should be designed with an eye toward how the data derived from these studies can be best applied to risk assessment models.

REFERENCES

1. Apostolakis, G. 1990. The concept of probability in safety assessments of technological systems. Science 250:1359-1364.
2. Berkelman, R. L., R. T. Bryan, M. T. Osterholm, J. W. LeDuc and J. M. Hughes. 1994. Infectious disease surveillance: A crumbling foundation. Science 264:368-370.
3. Beuchat, L. R., R. E. Brackett, D. Y.-Y. Hao and D. E. Conner. 1986. Growth and thermal inactivation of *Listeria monocytogenes* in cabbage and cabbage juice. Can. J. Microbiol. 32:791-795.
4. Gerba, C. P. and C. N. Haas. 1988. Assessment of risks associated with enteric viruses in contaminated drinking water. Chemical and Biological Characterization of Sludges, Sediments, Dredge Spoils and Drilling Mud, ASTM STP 976. J. J. Lichtenberg, J. A. Winter, C. I. Weber and L. Franklin (eds.). American Society for Testing and Materials, Philadelphia, PA. pp. 489-494. 13
5. Haas, C. N. 1983. Estimation of risk due to low doses of microorganisms: A comparison of alternative methodologies. Am. J. Epidemiol. 118:573-582.
6. Hedberg, C. W., K. L. MacDonald and M. T. Osterholm. 1994. Changing epidemiology of food-borne disease: A Minnesota perspective. Clin. Infect. Dis. 18:671-682.
7. Hueston, W. D. and K. D. Walker. 1993. Macroepidemiological contributions to quantitative risk assessment. Rev. Sci. Tech. Off. Int. Epiz. 12:1197-1201.
8. Institute of Medicine. 1988. The future of public health. National Academy Press, Washington, D.C. p. 225.
9. Jackson, L. A. and J. D. Wenger. 1993. Listeriosis: A foodborne disease. Infect. Med. 10:61-66.
10. Jasanoff, S. 1993. Bridging the two cultures of risk analysis. Risk Analysis 13:123-129.
11. Lee, L. A., A. R. Gerber, D. R. Lonsway, J. D. Smith, G. P. Carter, N. D. Puhr, C. M. Parrish, R. K. Sikes, R. J. Finton and R. V. Tauxe. 1990. *Yersinia enterocolitica* O: 3 infections in infants and children, associated with the household preparation of chitterlings. N. Engl. J. Med. 322:984-987.
12. Lee, L. A., N. D. Puhr, E. K. Maloney, N. H. Bean and R. V. Tauxe. 1994. Increase in antimicrobial-resistant *Salmonella* infections in the United States, 1989-1990. J. Infect. Dis. 170:128-134.

13. Linnan, M. J., L. Mascola, X. D. Lou, V. Goulet, S. May, C. Salminen, D. W. Hird, L. Yonekura, P. Hayes, R. Weaver, A. Audurier, B. D. Plikaytis, S. L. Fannin, A. Kleks and C. V. Broome. 1988. Epidemic listeriosis associated with Mexican-style cheese. N. Engl. J. Med. 319:823-828.
14. National Research Council. 1983. Risk assessment in the federal government: managing the process. National Academy Press, Washington, D.C. p. 191
15. Pinner, R. W., A. Schuchat, B. Swaminathan, P. S. Hayes, K. A. Deaver, R. E. Weaver, B. D. Plikaytis, M. Reeves, C. V. Broome and J. D. Wenger. 1992. Role of foods in sporadic listeriosis II. Microbiologic and epidemiologic investigation. J. Am. Med. Assoc. 267:2046-2050.
16. Riley, L. W., R. S. Remis, S. D. Helgerson, H. B. McGee, J. G. Wells, B. R. Davis, R. J. Hebert, E. S. Olcott, L. M. Johnson, N. T. Hargrett, P. A. Blake and M. L. Cohen. 1983. Hemorrhagic colitis associated with a rare *Escherichia coli* serotype. N. Engl. J. Med. 308:681-685
17. Rose, J. B., C. N. Haas and S. Regli. 1991. Risk assessment and control of waterborne giardiasis. 81:709-713.
18. Rose, J. B. and M. D. Sobsey. 1993. assessment for viral contamination of shellfish and coastal waters. J. Food Protect. 56:1043-1050.
19. Schuchat, A., K. A. Deaver, J. D. Wenger, B. D. Plikaytis, L. Mascola, R. W. Pinner, A. L. Reingold and C. V. Broome. 1992. Role of foods in sporadic listeriosis. I. Case-control study of dietary risk factors. J. Am. Med. Assoc. 267:2041-2045.
20. Schuchat, A., B. Swaminathan and C. V. Broome. 1991. Epidemiology of human listeriosis. Clin. Microbiol. Rev. 4:169-183. 21. B. Schwartz, C. A. Ciesielski, C. V. Broome, S. Gaventa, G. R. Brown, B. D. Gellin, A. W. Hightower and L. Mascola (eds.). 1988. Association of sporadic listeriosis with consumption of uncooked hot dogs and undercooked chicken. Lancet ii:779-782.
21. Schwartz, B., C. A. Ciesielski, C. V. Broome, S. Gaventa, G. R. Brown, B. D. Gellin, A. W. Hightower and L. Mascola. 1988. Association of sporadic listeriosis with consumption of uncooked hot dogs and undercooked chicken. Lancet ii:779-782.

Dairy, Food and Environmental Sanitation, Vol. 14, No. 12, Pages 742-747

Escherichia coli (Including O157:H7): An Environmental Health Perspective

John R. Molenda, Ph.D., M.P.H. , Professor, Biological Sciences Department Coordinator, Environmental Health Program, The Richard A. Henson School of Science and Technology, Salisbury State University, Salisbury, Maryland 21801

ABSTRACT

The recent multistate outbreak of intestinal disease in the western United States caused by the consumption of undercooked hamburgers containing pathogenic *Escherichia coli* has generated considerable interest in the disease potential of this species of bacteria.

Adding to this concern is the fact that *E. coli* is a common place microorganism in that it is one of the most commonly found bacteria in the intestinal tract of man and other warm blooded animals.

This species has long been used by the public health community as an indicator of fecal pollution of water, food. dairy and other products. Now it has assumed a new role — that of a signicant agent of foodborne illness — in and of itself.

Therefore, Environmental Health personnel will now have to become better acquainted with its disease producing potential. They will also have to learn more about its ecology, as well as bacteriological and serological characteristics so that they can make informed judgements and decisions when confronted with problems caused by this microbial agent. Some of these essentials are the subject of this article.

Bacteriological Characteristics of E. coli.

Escherichia coli is classified as a facultative anaerobiic bacterium which means that it can survive in the presence or absence of oxygen. It is a rod-shaped bacterium and stains negative with the gram's staining procedure. It is non-fastidious in its nutritional requirements and is easily grown on commonplace laboratory culture media.

Taxonomically it is placed in the family Enteropacteriaceas which is made up of several genera of bacteria which are usually associated with the intestinal tract. According to the latest edition of *Bergey's Manual of Systematic Bacteriology (28)* there are 20 other genera of bacteria in this family. With respect to intestinal disease other prominent genera in this family include *Salmonella*, *Shigella* and *Yersinia*.

Escherichia coli is often referred to as being a "coliform bacteria" which are classically described as follows: "The coliform bacteria are a group characterized as gram-negative, non-spore forming facultative rod-shaped bacteria that ferment lactose with the production of acid and gas within 48 h at 350°C" *(29)*.

Because *E. coli* is a common member of the normal intestinal flora of man and animals and is easily grown, it is an ideal organism to use as an indicator of fecal pollution.

Serological characteristics of E. coli.

Strains of *E. coli* can be subdiviied by several methods such bacteriophage typing and antibiotic sensitivity patterns, however, the most widely used method is serologic typing. According to Bergey's *(28)*, "Subdivision of *E. coli* can be carried out in several ways, but serology is one of the most useful ways to subdivide the species on a global basis. This method is based on the many antigenic differences found in structures on the bacterial surface.

Bacterial surfaces contain chemical molecules that are called "antigens." Antigens are proteins or carbohyorates which when injected into an animal, result in the production of antibodies against the antigen. Blood serum of an animal that contains antibodies to a particular antigen is called "antiserum." When antiserum comes in contact with the antigen that it was produced against an immunological reaction takes place.

Antiserum therefore can be used to identify the antigen it was produced against, whose presence will be evidenced by the fact that an immunological reaction takes place when the two are interacted. However, if the antiserum is added to a substance that does not have the antigen, no reaction can take place.

Antiserum against an antigen then can be reacted with an *E. coli* strain and if an immunological reaction does occur, that strain has the antigen against which the antiserum was produced. Antiserum against the various *E. coli* surface antigens can be used to determine which surface antigens a particular strain of *E. coli* possesses. In this way an *E. coli* strain can be "serologically typed."

Four major types of surface antigens which are used in the serologic classification of *E. coli* are tthe "O", "H", "K" and "F" antigens.

The "O" antigens, also known as "Somatic Antigens", extend from the cell wall and are polysaccharide in nature.

Presently 171 different "O" antigens are recognized *(28)*. Each of these is designated by the letter "O" followed by a number, such as O157.

The "O" antigens form the basis for serological classification of *E. coli* and each "O" antigen constitutes a distinct "O" group (also called serogroup).

The "H" antigens, also called flagellar antigens are found on the flagellar surface and are protein in nature. There are 56 known "H" antigens which are designated by the letter "H" followed by a number such as H7. Each "H" antigen constitutes a distinct H type.

The *E. coli* strain that was the cause of the hamburger associated outbreak in the western United States had the O157 polysaccharide antigen on its cell wall and the H7 protein antigen on its flagella hence is designated as *E. coli* O157:H7.

Two other antigen categories often useful in the classification of *E. Coli* are the "K" and "F" antigens. "K" antigens are polysaccharide in nature and are located in the capsule of the bacteria. There are about 80 different "K" antigens. Strains of *E. coli* having the K1 antigen are often found to cause meningitis in the newborn *(28)*.

"F" antigens are protein in nature and are found in the fimbriae (pili) of *E. Coli*. Fimbriae are small hair-like projections, differing from flagella, on the cell wall of *E. coli*. Certain "F" antigens are believed to be responsible for the attachment of certain pathogenic strains of *E. coli* to the epithelial cells of the host's small intestine.

Therefore, the serologic classification of *E. coli* can be put to use in determining what serogroup and serotype of *E. coli* is the cause of a particular infection. If thhe identical serologic pattern is found in a series of other cases which can be epidemiologically linked, it can then be useful in establishing the vehicle of infection and tracing the source of the agent.

In addition, certain "O" and "H" serologic profiles of *E. coli* seem to be associated with very specific kinds of infections. Examples of this will be presented in the material that follows.

Escherichia coli *and human illness.*

Most strains of *E. coli* found in the intestinal tract are nonpathogenic organisms which do not interfere with the normal processes of the tract. However, certain strains can cause infection when given the right circumstances.

Human *E. coli* infections can be divided into two broad categories, those being intestinal infections, also refered to as diarrheagenic, and extra-intestinal infections. The latter include: urinary tract infections, neonatal meningitis, wound infections, peritonitis and septicemia.

Diarrheagenic *E. coli* can be further subdivided into five types, based on the kind of infection that the causative strain produces in the host as well as the O:H profile of the causative strain. The five types of diarrheagenic *E. coli* are: Enteropathogenic *E. coli* (EPEC), Enterotoxigenic *E. coli* (ETEC), Enteroinvasive *E. coli* (EIEC), Enteroadherent *E. coli* (EAEC), and Enterohemorrhagic *E. coli* (EHEC).

Enteropathogenic E. coli *(EPEC)*

Although *E. coli* was originally described in 1885 by Escherich *(28)* it was not until the works of John S. Bray in the 1940's in the United Kingdom that it became generally accepted as a cause of diarrhea in humans *(2)*.

In its early history it had been associated with outbreaks of summer diarrhea in infants and nosocomial outbreaks. In 1955 the term "enteropathogenic" was applied by Netter to describe those strains of *E. coli* that caused infantile diarrhea *(27)*. Diarrheal illness caused by these agents are usually found in infants less than one year of age *(3)*. Since the 1960s, it has declined as a significant cause of infantile diarrhea in most developed countries. However, it still remains a significant cause of infantile diarrhea, often having high mortality rates, in developing countries *(3)*. Occasional waterborne outbreaks have been reported in developed countries which have involved all age groups *(19)*.

There are several "O" serogroups that are generally found in association with EPEC infections, however, the following nine are the most common: O55, O86, O111, O119, O125, O126, O127, O128ab and O142 *(3)*.

The reservior of this agent is man himself, and the mode of transmission involves human feces which contains the organism. The mode of transmission in hospital nurseries is described as follows *(3)*: "By contaminated infant formula and weaning foods. In infant nurseries, transmission by fomites and by contaminated hands can occur if handwashing techniques are compromised."

Inadaquately treated sewage containing infected feces possibly could contaminate drinking water. The latter then could serve as a vehicle of infection if not properly treated prior to consumption.

Preventive measures include meticulous attention to maintaining high standards of cleanliness in nurseries *(3)*. Particular attention should be placed on proper handwashing techniques and the proper handling, treatment, and disposal of feces and fecally contaminated materials, not only in outbreak situations, but at all times.

Enterotoxigenic E. coli *(ETEC)*.

ETEC is an important cause of dehydrating diarrheal disease of children residing in developing countries, especially in their first three years of life *(3)*. It can also be contracted by individuals from industrialized countries when they visit less developed countries having lower hygienic standards *(3)*.

The latter infection is known as "Travelers' Diarrhea" for which there are many synonyms. Feldman *(21)* states the following in this regard:

TD probably has more synonyms than any syndrome in clinic; medicine, including turista, Montezuma's revenge, Aztec two-step, GI trots, gyppy tummy, Spanish flux, Casablanca crud, Aden gut, Basra belly, Turkey trot, Hong Kong dog, Poona poohs, Malta dog, Rangoon runs, Tokyo trots, Trotsky's Bombay runs, Ho Chi Minhs, and emporiatric enteritis.

The symptoms of ETEC enteritis resemble those of Cholera. The diarrhea produced is described as being profuse, watery, without blood, along with abdominal cramps, vomiting, prostration and dehydration. Fever, if present, is of a low grade *(3)*.

Enterotoxigenic strains of *E. coli* produce enterotoxin which is defined as an exotoxin produced by bacteria which

has a detrimental effect on the intestinal tract. There are two types of enterotoxins produced by ETEC strains. One is heat labile and called LT, the other is heat stable and called ST.

The production of enterotoxin is one of the ways that ETEC can be differentiated from EPEC strains which do not produce enterotoxin.

In addition to producing an enterotoxin, it is felt that certain adhesive factors associated with the fimbriae (small hair-like projections extending from the cell wall) enable ETEC strains to attach to the mucosal cells of the intestinal tract. The organisms thereby become anchored to the intestinal tissue and can colonize the area which thereby becomes infected *(18)*.

The "O" serogroups most frequently found in association with ETEC infections include: O6, O8.015, O2O, O25, O27, O63, O78, O8O, O114, O115, O128ac, O148, O153, O159 and O167 *(3)*.

It should be noted that there is usually no overlapping between the serogroups of *E. coli* that are classified as EPEC and ETEC or any other category of *E. coli* infections to be subsequently discussed.

The reservior of ETEC strains pathogenic to humans is man himself. The mode of transmission is usually food or water that becomes contaminated with fecal matter from a clinical case or an apparent or inapparent carrier. Direct contact transmission via fecally contaminated hands is not believed to play a role in transmission *(3)*.

Outbreaks of ETEC infections have been reported in hospital nurseries, and also as a result of food and water contamination. A large waterborne outbreak occurred during June and July, 1975, among 200 staff and 2,000 visitors to Crator Lake National Park in Oregon. The outbreak was characterized by diarrhea, cramps, nausea and vomiting which lasted about eight days. The park's shallow spring water supply was found to be contaminated with ETEC O6:K15:H16. The park's chlorination system was found to be inadequate in that drinking water in some parts of the park contained chlorine whereas other parts did not. This was the first outbreak of disease caused by ETEC in which the organism and its mode of transmission was clearly defined *(31)*.

During September, 1983, three outbreaks of intestinal illness attributed to ETEC occurred in Washington D.C. following office parties. There was a strong statistical association between eating imported Brie cheese and illness. The cheese was produced in France during July, 1983, and was imported and distributed in Washington, D.C. and 13 states. Similar clinical illness was associated with eating the same brand of semi-soft cheese in four states. The serotype of the etiologic was O27:H20 which produced an enterotoxin *(9,10)*.

In 1990, Black *(5)* in a review of studies on the etiologic agents and epidemiology of Travelers' Diarrhea reported between 1969-1987 noted a similar median attack rate of 53-54% among groups of travelers to Latin America, Asia and Africa. It was also noted that the etiologic agent most frequently isolated was ETEC followed by *Shigella*.

Kozicki *(23)* in 1985 reported on a follow-up study done on 688 air charter passengers who had traveled to Kenya, West Africa or Sri Lanka, Maldives. It was noted that within the first three days of their visit, 98% of the travelers ate foods or drank beverages, avoidance of which had been traditionally recommended. This points out the need for more effective pre-trip education of travelers to areas noted for Travelers' Diarrhea.

Doyle and Padhye in 1989 *(19)* reviewed several other outbreaks of ETEC gastroenteritis which occurred following social functions, in hospital cafeterias and nurseries, in restaurants and aboard cruise ships.

Preventive measures include the institution of controls which prevent fecal to oral spread of infection *(3)*. Travelers to areas having endemic problems with ETEC infection should be advised to avoid high risk foods. Prior to departure such travelers should discuss prophylactic medication with their own physicians and seek advice on what to do in the event that they display svmptoms of infection while traveling.

Enteroinvasive E. coli *(EIEC).*

EIEC strains produce an inflammatory disease of the intestinal tract wnich closely resembles bacterial dysentary which is caused by *Shigella dysenteriae*. The colon is the predominant site of bacterial localization where the microorganisms invade the mucosal epithelial cells and grow inside the cells and produce lesions. Symptoms include diarrheal stools which contain blood and mucus *(3)*.

Not only do the clinical svmptoms of disease caused by EIEC and *Shigella* resemble one another, but some of the characteristics of both bacteria are also similar. For example *Shigella* are non-motils because they lack flagella. The same is true of most EIEC strains. In contrast, the majority of other types of *E. coli* strains possess flagella and are therefore motile.

The first major foodborne occurrences of EIEC infection in the U.S. occurred during November and December, 1971.

There were 96 separate outbreaks involving at least 227 persons in eight states and the District of Columbia *(7,8)*. The causative agent was *E. coli* O:124 which was isolated from stools of some of the ill as well as from samples of imported French Brie and Camembert cheese which were implicated as the vehicle of infection. The implicated cheese was produced in a factory in France and was distributed to consignees in the District of Columbia and 13 states.

Investigation revealed that a malfunctioning water filter system was used during the processing of the implicated cheese to filter river water which was used for cleaning the plant *(19)*.

Onset of symptoms was usually 24 h after eating the cheese and included vomiting, diarrhea, fever, headache and myalgia (muscle pain). Some patients reported bloody stools *(8)*.

The "O" groups usually involved in EIEC infections include: O28ac, O29, O112, O124, O136, O143, O144, O152, O164 and O167 *(3)*. O124 is the group most frequently encountered *(19)*.

Doyle and Padhye *(19)* reviewed outbreaks caused by EIEC which occurred in the U.S., Hungary, Britain, Australia and Czecnoslovakia, which occurred in schools, including schools for the retarded, in hospital cafeterias and nurseries, homes for the elderly and abroad cruise ships.

The reservoir of the agent is not animals or foods derived from animal sources but is man himself *(3)*. Therefore, control

efforts must be placed on the proper management of fecal matter derived from infected individuals, including active cases and carriers and effective sewage control. Infected fecal matter from these sources must be prevented from contaminating food and drinking material.

Enteroadherent E. coli *(EAEC).*

The most recent category of *E. coli* to be recognized in association with diarrheal disease is EAEC. The term "Enteroadherent" was proposed by Mathewson et al *(25)* in 1983 to describe strains of *E. coli* that were neither EPEC nor ETEC which were isolated from students who traveled to Mexico and contracted Travelers' Diarrhea.

The pnenomenon c- an "Adhesive Factor" among pathogenic strains of *E. coli* was originally described by Cravioto in 1979 *(14)* in a study done con strains of *E. coli* that caused infantile diarrhea. They found that some of these strains that caused diarrhea had the ability to adhere to HEp-2 tissue culture cells in a charcteristic manner.

HEp-2 tissue culture cells are usually used to grow viruses, in the laboratory, but in this case they were found useful in the identification of EAEC. HEp-2 is a line of epithelial-like cells that was originally isolated from weanling rats and have been continually growing, mainly for virus cultivation *(22).*

This adhesive factor of EAEC was found to be different from the fimbriae associated "F" antigens in ETEC infections which enable the ETEC strains to attach to epithelial cells of the intestinal tract of man *(14).*

In 1987 Mathewson et al reported a study of diarrhea among Mexican children which sugested that EAEC is a significant cause of pediatric diarrheal illness in Mexico. They further stated, "EAEC is a definition based on a virulence characteristic rather than on *E. coli* serotype" *(26).*

Therefore, the serologic classification of EAEC strains may not be restricted to certain "O" groups as in other types of *E. coli* intestinal infections. An in depth epidemiological understanding of and control measures for EAEC infections awaits serologic and virulence factor clarification.

Enterohemorrnagic E. coli *(EHE2).*

In the latter part of 1992 and early 1993, an outbreak of foodborne illness occurred in four western states which was found to be associated with the consumption of undercooked hamburgers served in restaurants of a national food chain. Between November 15, 1992, and February 28, 1993, there were over 500 laboratory confirmed cases which included four deaths. The causative agent was EHEC O157:H7 *(12,13).*

The restaurant chain instituted an interstate recall which resulted in the recovery of approximately 272,672 patties which represented 20% of the implicated patties. In addition a meat trace-back by the Communicable Diseaase Center, U.S. Public Health Service, Atlanta, GA, identified five slaughter plants in the U.S. and one in Canada as probable sources of the carcasses used in the contaminated lots of meat. The animals slaughtered in the U.S. facilities were traced to farms and auctions in six western states. No one slaughter plant could be implicated as the sole source *(13).*

The usual symptoms of illness included diarrhea, which was often bloody, and abdominal cramps, with little or no fever. Illness usually lasted 6 to 8 days *(13).*

Symptoms are usually more pronounced in the young and the elderly. Both of these age groups are more prone to developing complications. A serious complication of infection with EHEC is the Hemolytic Uremic Syndrome (HUS) which develops in 2-7% of those ill with EHEC intestinal infection *(13).*

HUS is characterized by renal failure, microangiopathic hemolytic anemia (anemia where the red blood cells are smaller than normal and have shortened survival) and severe thrombocytopenia purpura (reduction in the number of blood platelets) *(15).* Patients suffering from this syndrome often require kidney dialysis or need blood transfusions. In addition it could lead to central nervous system complications *(16).* HUS has a death rate of between 3-5% *(13).*

The first two outbreaks of EHEC O157:H7 colitis in the U.S. that was intensely studied occurred in Oregon and Michigan in 1982. Forty-seven people were affected who ate beef patties which were apparently undercooked and served in restaurants belcnging to a fast food chain. The organism was isolated from stools of some of the ill and from a beef patty made from suspect meat in Michigan *(30).*

Spika et al. *(33)* reported on an outbreak of HUS and diarrheal illness associated with EHEC O157:H7 that occurred in a day care center in 1984. They concluded, "*E. coli* O157:H7 can cause Hemolytic Uremic Syndrome and both non-bloody and bloody diarrhea, and can spread within families and through modes other than foodborne transmission." The latter type of spread was speculated to be person to person and through fomite.

A nursing home outbreak of EHEC O157:H7 infection that occurred in Nebraska in September, 1984, was reported by Ryan et al. *(32)* which involved 34 out of 101 residents. There were four deaths. Hamburger was implicated as the vehicle of infection. Regarding the type of illness involved the authors reported, "The spectrum of illness associated with the infection was broad and involved the following: asymptomatic infection, non-bloody diarrhea, hemorrhagic colitis, hemolytic uremic syndrome and death.

Another outbreak in a nursing home which occurred in southwestern Ontario in September, 1985, was reported by Carter et al. *(6).* This outbreak was characterized by an unusually high rate of morbidity and mortality. There were no deaths among the staff, however 17 of 19 deaths in affected residents was attributed directly to their infection. The investigators concluded that the initial source of the infection was probably food related, which was subsequently followed by person to person spread.

In 1986, Martin et al. *(24)* reported finding *E. coli* O157:H7 in the fecal matter of dairy cattle on two dairy farms. Two infants developed HUS after consuming raw milk produced on these farms.

In 1990, an outbreak of intestinal illness caused by *E. coli* O157:H7 occurred among 70 of 2000 attendees at an agricultural threshing show in North Dakota. Food histories implicated roast beef served at a buffet-style dinner as the probable vehicle of infection *(11).*

Fresh pressed apple cider was reported as the probable vehicle of infection in an outbreak of *E. coli* O157:H7 infection which occurred in southern Massachusetts during the fall

of 1991. The cider was reported to have been produced from unwashed apples which had been picked mostly from the ground. It was non-pasteurized and had no preservatives added. The agent was not isolated from any of the cider examined, however, there was a statistically significant association between drinking one particular brand of cider and illness. It was speculated that the apples could have been contaminated with fecal matter when they fell to the ground, or else they could have been contaminated in the process since the mill press operator also raised cattle *(4)*.

Serotypes O26:H11 3nd O111:H8 have also been implicated as the cause of *E. coli* enterohemorrhagic intestinal disease *(3)*.

Epidemiologically, since the agent is present in the intestinal tract of normal animals, it could very easily contaminate the surface of meat during the slaughtering process. It could tnen easily be distributed through meat products such as hamburger during the grinding process. Inadequte refrigeration, followed by insuffcient heat in the preparation process could result in the live agent being consumed by man. Though cattle are believed to be the major reservior of EHEC, market surveys on fresh meat revealed that EHEC were present in about 1-3% of beef, pork, chicken and lamb samples tested *(17)*.

Control measures include the following recommendations and regulations announced by the Food and Drug Administration and the Food Safety Inspection Service. In an article published in the July-August 1993 issue of FDA Consumer Magazine entitled "Recommended Temperatures for Cooking Ground Beef," *(20)* the following recommendations were made:

FDA has raised the cooking temperature it recommends for cooking ground beef products. The recommendation, published in the agency's model food codes, now reads 'ground beef products should be cooked to heat all parts of the food to at least 155° F. 'This is an increase from the previously recommended 140° F. At the newly recommended temperature, the ground beef product will not be pink at the center and juices will be clear.

In another article, entitled "Final Fatty Rule Published," published in the July-August 1993 issue of *News-O-Gram* the following was stated:

FSIS has published a final rule governing cooking, cooling, handling, and storage of uncured meat patties. The regulation will take effect September 1 and will affect 'hamburgers, Salisbury steaks, breaded and battered chopped veal steaks, beef and pork sausage patties'... The rule added, 'The production process for ground meat assures that any present pathogens will be distributed throughout the product, including the interior, while bacteria tend to remain on the surface of steaks, roasts and chops ... Because a rare steak is thoroughly cooked at the surface, one can assume that any pathogenic bacteria are killed. The fact a rare patty is thoroughly cooked at the surface does not provide such assurance '... The regulation gave the following minimal holding times for minimum internal temperatures at the center of fully-cooked-patties: 41 s at 151°F; 32 s at 152°F; 2b s at 153°F; 20 s at 154°F; l0 s at 155°F; 13 s at 156°F; and 10 s at 157°F and above. 'Fully cooked patties shall be cooled to an internal temperature of 40°F or below within 2 h after heat processing,' the rules said. *(1)*.

In addition, the FSIS is in the process of establishing a safe handling label ruling for raw meat and poultry products *(1)*.

SUMMARY

The recent outbreaks of foodborne illness in the western U.S. caused by pathogenic *E. coli* pointed out the necessity for environmental health professionals to reacquaint themselves with the various types of human infections that this species of bacteria is capable of causing in man.

Initially, in this article, some of the basic bacteriological and serological characteristics of *E. coli* are presented. This is followed by a discussion of the five different kinds of pathogenic *E. coli* involved in human gastrointestinal infections, those being: Enteropathogenic, Enterotoxigenic, Enteroinvasive, Enteroadherent and Enterohemorrhagic. The epidemiology of each is considered along with control measures.

Human gastrointestinal disease caused by each of these different kinds of pathogenic *E. coli* involve environmental aspects in their spread. These implications are considered.

Therefore, effective control measures for each of these will necessitate informed and updated environmental health professionals. Materials on pathogenic *E. coli*, including updated governmental recommendations and regulations, should be an imperative part of continuing education programs for all environmental health professionals involved in food control programs.

REFERENCES

1. American Association of Food Hygiene Veterinarians. 1993. Final Meat Patty Rule Published. News-O-Gram. 17 (4):6-7.
2. Anonymous. 1993. Bray's discovery of *E. coli* as a cause of gastroenteritis. Archives of Disease in Childhood. 48:923-926.
3. Benenson, A. S. (ed). 1990. Control of Communicable Diseases in Man. 15th ed. pp. 129-138. The American Public Health Association, Washington, D.C.
4. 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. J. of the Am. Med. Assoc. 269:2217-2220.
5. Black, R. E. 1990. Epidemiology of Traveler's Diarrhea and Relative Importance of Various Pathogens. Reviews of Infectious Diseases. 12(Suppl. 1):S73-579.
6. Carter, A. O., A. A. Borczyk, J. A. K. Carlson, B. Harvey, J. C. Hockin, M. A. Karmali, C. Krishnan, D. A. Korn and H. Kior. 1987. A Severe Outbreak of *Escherichia coli* O157:H7 — associate with hemorrhagic colitis in a Nursing Home. N. Eng. J. of Med. 317:1496-1500.
7. Centers for Disease Control. 1971. Gastroenteritis Attributed to Imported French Cheese — United States. Morb. and Mortal. Weekly Rep. 20:427-428.
8. Centers for Disease Control. 1971. Follow-Up on Gastroenteritis Attributed to Imported French Cheese — United States. Morb. and Mortal. Weekly Rep. 20:445.
9. Centers for Disease Control. 1983. Gastrointestinal Illness Associated with Imported Brie Cheese — District of Columbia. Morb. and Mortal. Weekly Rep. 20:533.
10. Centers for Disease Control. 1984. Update: Gastrointestina Illness Associated with Imported Semi-soft Cheese. Morb. and Mortal. Weekly Rep. 33:16,22.
11. Centers for Disease Control. 1991. Foodborne Outbreak of Gastroenteri-

tis Caused by *Escherichia coli* O157:H7 — North Dakota, 1990. Morb. and Mortal. Weekly Rep. 40:265-267
12. Centers for Disease Control. 1993. Preliminary Report: Foodborne Outbreak of Escherichia coli O157:H7 Infections from Hamburgers — Western United States, 1993. Morb. and Mortal. Weekly Rep. 42.85-86.
13. Centers for Disease Control. 1993. Update: Multistate Outbreak O157:H7 Infections from Hamburgers — Western United States, 1992-1993. Morb. and Mortal.Weekly Rep. 42:258-263.
14. Cravioto, A., R. J. Gross, S. M. Scotland and B. Rowe. 1979. An Adhesive Factor Found in Strains of *Escherichia coli* Belonging to the Traditional Infantile Enteropathogenic Serotypes. Current Microbiology. 3:95-99.
15. Dorland's Illustrated Medical Dictionary. 1974. 25th ed. pp. 85, 1290. W. B. Saunders Company, Philadelphia, PA.
16. Doyle, M. F. 1985. Foodborne Pathogens of Recent Concern. Annual Review of Nutrition. 5:25-41.
17. Doyle, M. P. 1990. *Escherichia coli,* pp. 209-215. *In* D. O. Cliver (ed.). Foodborne Diseases. Academic Press, San Diego, CA.
18. Doyle, M. P. 1990. Pathogenic *Escherichia coli, Yersinia enterocolitica* and *Vibrio parahaemolvticus.* The Lancet 336:1111-1115
19. Doyle, M. P. and V. V. Padhye. 1989. *Escherichia coli.* PP. 236-281. *In* M. P. Doyle (ed.). Foodborne Bacterial Pathogens. Marcel Dekker, Inc., New York, NY.
20. Food and Drug Administration. 1993. Recommended Temperatures for Cooking Ground Beef. FDA Consumer. 27(6):2-3.
21. Feldman, M. 1984. Southwestern Internal Medicine Conference: Traveler's Diarrhea. American J. of Med. Sci. 288:136-148.
22. Hay, R , M. Marvin, T. R. Chen, P. McClintock and Y. Reid (ed.). 1988. ATCC Catalogue of Cell Lines and Hybridomas. 6th ed. pp. 16-17. The American Type Culture Collection, Washington, D.C.
23. Kozicki, M., R. Steffen and M. Schor. 1985. 'Boil it, Cook it, Peel it or Forget it': Does this Rule Prevent Traveller's Diarrhoea? Intl. J. of Epid. 14:169-172.
24. Martin, M. L., L. D. Shipman, M. E. Potter, I. K. Wachsmuth, J. G. Wells, K. Hedberg, R. V. Tauxe, J. P. Davis, J. Arnoldi and J. Tiller. 1986. Isolation of *Escherichia coli* O157:H7 from Dairy Cattle Associated with Two Cases of Haemolytic Uraemic Syndrome. Lancet 2:1043.
25. Mathewson, J. J., H. L. DuPont, D. R. Mrgan, S. A. Thornton and C. D. Ericsson. 1983. Enteroadherent *Escherichia coli* Associated with Traveller's Diarrhoea (Letter) Lancet 1:1048.
26. Mathewson, J. J., R. A. Oberhelman, H. L. DuPont, F. Javier de la Cabada and E. V. Garibay. 1987. Enteroadherent *Escherichia coli* as a Cause of Diarrhea Among Children in Mexico. J. of Clin. Microbiol. 25:1917-1919.
27. Netter, E., O Westohal, O. Ludertiz, R. M. Gino and E. A. Gorzynski. 1955. Demonstration of Antibodies Against Enteropathogenic *Escherichia coli* in Sera of Children of Various Ages. Pediatrics 16:801-808.
28. Orskov, F. 1982. Genus *Escherichia.* pp. 420-423. *In* N. R. King and Holt J. G. (eds.). Bergey's Manual of Systematic Bacteriology. Vol. 1. The Williams and Wilkins Co., Baltimore, MD.
29. Pelczar, Jr., M. J., E. C. S. Chan M.D. and N. R. Krieg. 1993. Microbiology concepts and applications. p. 823. McGraw Hill, New York, N.Y.
30. Riley, L. W., R. S. Remis, S. D. Helgerson, H. B. McGee, J. D. Wells, B. R. Davis, R. J. Herbert, E. S. Olcott, L. M. Johnson, N. T. Hargrett, P A. Blake and M. L. Cohen. 1983. Hemorrhagic Colitis Associated with a Rare *Escherichia coli* Serotype. N. Engl. J. of Med. 308:681-685.
31. Rosenberg, M. L., J. P. Koplan, I. K. Wachsmuth. J. G. Wells, E. J. Gangarosa, R. L. Guerrant and D. A Sack 1977. Spidemic Diarrhea at Crater Lake from Enterotoxigenic *Escherichia coli* — A Large Waterborne Outbreak. Annals of Internal Medicine 86:714-718.
32. Ryan, C. A., R. V. Tauxe, G. W. Hosek, J. G. Wells, P. A. Stoesz, H. W. McFadoen, Jr., P. W. Smith, G. F. Wright and P. A. Blake. 1986. *Escherichia coli* O157:H7 Diarrhea in a Nursing Home: Clinical, Epidemiological and Pathologic Findings. J. of Infect. Dis. 154:31-638.
33. Soika,J. S., J. F. Parsons, D. Nordenberg, J. G. Wells, R. A. Gunn and P. A. Blake. 1986. Hemolytic Uremic Syndrome and Diarrhea Associated with *Escherichia coli* O157:H7 in a Day Care Center. J. of Ped. 109:287-291.

Please circle Reader Service No. 225

Please circle Reader Service No. 122

Please circle Reader Service No. 196

Hickok Receives Salt Institute's 1994 Tony J. Cunha Award

David Hickok

David Hickok, a graduate student of the University of Nebraska/Institute of Agriculture and Natural Resources in Lincoln has received the Salt Institute's 1994 Tony J. Cunha Award of $1,500 to assist with proposed research.

Six years ago, the Salt Institute initiated this award to commemorate Dr. Tony J. Cunha's contributions in promoting the understanding of the role salt plays in animal nutrition and to recognize the need for continuing research in this important area. Salt Institute Technical Director Bruce Bertram noted, "The 1994 Award was presented to the graduate student whose proposed research project showed the greatest promise of furthering our understanding of the role salt plays in animal diets or the benefits of salt as a carrier for trace minerals." Hickok's proposed research project will determine factors that influence trace element composition of saliva in cows.

Bertram pointed out, "This particular submission by David Hickok gained strong support from the panel of experts reviewing the applications." Previous research areas awarded included "Salt and Trace Mineral Supplementation of Stocker Cattle Grazing Fescue"; "Interrelationships of Dietary Sodium, Potassium and Chlorine and Cation-Anion Difference in Lactation Rations"; "The Effects of Varying Levels of Feed Grade and Purified Sea Salt on the Performance of Broiler Chicks"; "The Utilization of Salt as a Carrier for DL-Methionine in Self-fed Salt Mineral Mixtures"; "Salt Deficiency in Early Age Broilers"; and "Sodium Chloride Supplementation During Heat Distress in Poultry."

The 1995 Tony J. Cunha Award will be announced in April, 1995. For more information, contact the Salt Institute at 700 North Fairfax, No. 600, Alexandria, VA 22314, or call (703) 549-4648.

Wartheson Spends Sabbatical Leave from University of Minnesota with American Association of Cereal Chemists

Dr. Joseph J. Warthesen, professor in the Department of Food Science and Nutrition at the University of Minnesota, will divide his sabbatical year between the American Association of Cereal Chemists (AACC) and the University of Minnesota.

Warthesen will work on AACC programs including the electronic publishing and retrieval of AACC information; a cereals correspondence course; an in-house cereal chemistry course for staff; a new handbook series to be published by Eagan Press; feature articles for *Cereal Foods World*; and short courses.

"We are delighted to have Dr. Warthesen as our first sabbatical appointment at AACC headquarters," said Steven C. Nelson, AACC Executive Vice President. "It is a great opportunity for us to have someone working with us as we develop several new member services. It adds an element in ensuring user relevance to these products."

A member of AACC since 1971, Warthesen has held various positions within the association such as national president, chairman of the board, chairman of Eagan Press and acting editor-in-chief of *Cereal Chemistry*. He is co-course director for the Introduction to Food Chemistry, an educational short course that has offered multiple times in varied locations.

Warthesen joined the University of Minnesota in 1974 after completing his graduate work at Oregon State University. He teaches food chemistry emphasizing the chemical reactions occurring in foods and food analysis. Warthesen's research interests include vitamin retention in foods, application of high performance liquid chromatography to food analysis, non-enzymatic browning and proteins. He has published over 65 research articles and papers.

Buss Awarded Laboratorian of the Year

Fritz Buss, Technical Director and Senior Product Manager at Nelson-Jameson, Inc., was named recipient of the Joseph Mitayas Laboratorian of the Year for 1994.

The award was presented by the Wisconsin Laboratory Association at a meeting in Waukesha, WI on September 8. The award is given for significant contributions to laboratory science and is the highest award given by the Association.

Presenting the award was George Nelson, professor, chairman and microbiologist at the University of Wisconsin-Stout in Menomonie. In his remarks, Nelson noted that Buss has been a valuable resource to laboratory professionals and has promoted education for laboratory personnel.

The Wisconsin Laboratory Association was founded in 1976 by a group of laboratorians committed to promoting professionals and in furthering education in disciplines, such as water, wastewater, dairy, food, public health, hazardous wastes, cosmetics and paper. Mitayas, now deceased, was a leader in these efforts.

Carbondale Teenager Suggests Vinegar to Combat *Salmonella*

The Chicago Tribune reported that 17-year-old Rachana Gupta of Carbondale, IL., has conducted 4 years of experiments and determined that soaking chicken in a solution of four teaspoons of vinegar per cup of water before cooking kills most, if not all, of the *Salmonella*. She said the chicken should be

rinsed with water before cooking to get rid of the vinegar taste. She observed that while cooking chicken thoroughly kills most of the *Salmonella*, there is a problem with *Salmonella* getting on preparation surfaces and contaminating other foods. This method, she said, eliminates that problem. Reprinted from *Food Chemical News*, **October 3, 1994**.

Stonyfield Farm Yogurt Appoints Director of Research and Development and Quality Assurance

Kasireddy (Kasi) C. Reddy has been appointed Director of Research and Development and Quality Assurance for Stonyfield Farm, Inc., the nation's fastest growing yogurt maker.

Reddy comes to his new post with more than 10 years of experience in dairy science. His previous positions have included Director of Research and Development and Quality Assurance for Richland Valley Products, Inc., a frozen dairy and nondairy novelty product company. Reddy administered the product development and quality assurance, and successfully managed the industrialization of over 300 frozen dairy and nondairy novelty products.

He also worked as Formulation/Research Manager for the Dannon Company where he developed Aspartame sweetened nonfat blended yogurt (Dannon Light) and administered reformulation, product and process development for various cultured and frozen yogurt products. In addition, Reddy served as Vice President of Research and Development, Quality Control and Manufacturing (Plant Operations) at Zack's Frozen Yogurt.

Cooking with Low-fat Spreads May Be Recipe for Disaster

A double layer cake, lovingly prepared for a birthday celebration, is about to emerge from the oven. Unfortunately, the finished result is as flat as a DeSoto spare tire. What went wrong?

The answer could be fat — or more specifically, the lack of it. According to Arun Kilara, professor of food science in Penn State's College of Agricultural Sciences, America's love affair with no-fat or low-fat margarine may be at the heart of many failed recipes.

"Twenty years ago, if you substituted margarine for butter in recipes, you wouldn't have seen much difference," Kilara says.

When recipes fail today, Kilara explains, the blame often can be laid at the door of low-fat margarine. "To make these margarines more attractive to consumers, fat is reduced and water is added," Kilara says. "These spreads taste fine on muffins or toast, but if you put some in a pan to fry an egg, the water evaporates quickly and there is very little fat left to fry anything." "The person who buys the low-fat margarine may not realize you have to use more than the recipe calls for to get enough fat content to make the recipe work," he says.

Kilara points out that butter is about 80% milk fat and 16% water. Margarine is made from vegetable oils that are chemically transformed into solids, creating a different kind of fat, which contains trans-fatty acids. The ratio of fat to water in regular margarine is about the same as in butter.

After margarine became popular during World War II (due to butter rationing and lower prices), consumers asked for soft-spread margarines. These spreads are typically about 60% fat, 40% water. In the '80s and '90s, consumers demanded "lite" products. Kilara says lite margarines have about 30% fat and 70% water. No-fat margarines, usually made from starches and other additives, have about 5% fat.

"Fat is what gives a pastry or a pie crust its structure and other foods their crispiness," Kilara explains. "If you replace fat with low-fat products it is very difficult to get the recipe to come out right. In food science we say, 'Fat is what makes the world beautiful.'" Kilara says cooks can use lite margarines, but they must use enough fat to make the recipe work. For example, a pound cake requires a pound of butter, a pound of sugar, and a pound of flour. To make the recipe work with lite margarines, a cook would have to use 2 1/2 lbs. of a lite margarine or 16 lbs. of a no-fat spread.

Margarine also has lost some of its luster as a healthier alternative to butter. One recent study linked the trans-fatty acids in margarine and processed foods to heart disease and some types of cancer. Another study found that trans-fatty acids increase low-density lipoprotein ("bad" cholesterol) and decreased high-density lipoproteins ("good" cholesterol).

Butter, of course, has been linked to cholesterol and contains saturated fats that are thought to promote heart disease. Kilara says butter is about 50% saturated fats. "The pendulum is swinging the other way," Kilara says of the increasing use of butter. "Certainly the flavor of butter can't be beat. Mother Nature is much better at these things than chemists."

"It has been used for millennia, so the safety record for butter cannot be disputed," he adds. Kilara recommends using butter for recipes, simply because it provides better flavor. "Don't be afraid to experiment and use a little less to reduce calories without sacrificing taste and texture," he says.

Federal recommendations say that fat should account for no more than 30% of total calories in an adult diet. "We should get away from the concept of good food/bad food. It's the overall diet that matters," Kilara says.

Federal Register

[Docket No. 94D-0265]

The Seafood List—FDA Guide to Acceptable Market Names for Seafood Sold in Interstate Commerce; Availability

Agency: Food and Drug Administration, HHS.

Action: Notice of availability.

Summary: The Food and Drug Administration (FDA) is announcing the availability of The Seafood List. The Seafood List is a revision of the "FDA Guide to Acceptable Market Names for Food Fish Sold in Interstate Commerce" (The Fish List), which was developed jointly with the National Marine Fisheries Service (NMFS). It compiles existing names that are recommended or required for use in labeling seafood products in interstate commerce.

Dates: Written comments by December 13, 1994.

Addresses: The Seafood List is available for purchase from the Superintendent of Documents, U.S. Government Printing Office (GPO), Washington, DC 20402, 202-783-3238, at cost of $6.00 per copy. Orders should reference GPO Stock No. 017-012-00-366-4. Submit written comments on The Seafood List to the Dockets Management Branch (HFA-305), Food and Drug Administration, rm. 1-23, 12420 Parklawn Drive, Rockville, MD 20857. Comments should be identified with the docket number found in brackets in the heading of this document. The Seafood List and received comments are available for public examination in the Dockets Management Branch between 9 a.m. and 4 p.m., Monday through Friday.

For Further Information Contact: Spring C. Randolph, Center for Food Safety and Applied Nutrition (HFS-416), Food and Drug Administration, 200 C Street, S.W., Washington, DC 20204, 202-418-3160.

Supplementary Information: In recent years there has been an increase in seafood consumption in the United States, along with increased importation of unfamiliar seafood and use of different names for the same seafood in different regions of the country. These changes have led FDA and NMFS to recognize the need for a single source of recommended or required market names for seafood sold in interstate commerce in the United States.

In 1988, the Fish List was published by FDA to provide a source of names that would facilitate order in the marketplace and reduce confusion among consumers. Although this list has had significant success in achieving its goals, its usefulness has been limited by the fact that it did not address invertebrate seafood species (mollusks and crustaceans). To alleviate this problem and to update The Fish List, FDA included vertebrate and invertebrate species of seafood in its current revision. In addition, to reflect its broader coverage, FDA has renamed it The Seafood List.

The Seafood List represents an extensive, although not complete, listing of seafood commonly sold in the United States. This list included market names, scientific names, common names, and vernacular names for seafood sold in the United States. The agency advises that the listed common name or market name should be used to market seafood sold in interstate commerce. Vernacular names are included on this list for information purposes only and to encourage references to the acceptable common or market name. While a vernacular name may be used within the region, where the name is commonly used, the agency discourages the use of such names. FDA notes that the use of the name outside the region where the name is commonly used may mislead consumers and cause the agency to take regulatory action.

FDA used the following criteria in determining which species to include on the list:

1) The species is currently sold in interstate commerce in the United States or has a strong potential for sale;
2) The species is not listed as endangered; and
3) The species is not prohibited by law or policy from sale in interstate commerce.

FDA used the following sources in determining the scientific nomenclature, common names, market names and vernacular names that it included in the list:

1) Common or usual names prescribed by Federal regulation.
2) In the absence of a required common or usual name, the American Fisheries Society's (AFS) "List of Common and Scientific Names of Mollusks and Crustaceans from the United States and Canada" was the primary reference that FDA consulted.
3) For species not listed in the AFS reference, FDA used the following references, in the order of priority:
   a) Food and Agriculture Organization species catalogues identification worksheets; and
   b) source country reference for species originating outside the United States.

FDA based its determination on the appropriate market name on the common usage in the U.S marketplace. When more than one name is used for a species, FDA based its determination on the above references and on consultation with NMFS. Use of the common and market names supplied in this list will promote consistency in labeling among various areas of the United States and will enhance the ability of the consumer to make informed choices among seafood products. In addition, The Seafood List will provide the industry with uniform nomenclature and assurance that the use of the listed common market names for seafood products will be in compliance with food labeling requirements. This list will also serve as a resource document for FDA and NMFS to provide consistent advice to inquiries. The agency recommends that a manufacturer or distributor who contemplates use of a name other than the listed common or market name first consult with FDA. Such a discussion may prevent expenditure of money and effort for labeling that may mislead consumers and cause the agency to take regulatory action.

Interested persons may, on or before December 13, 1994, submit written comments regarding The Seafood List to the Dockets Management Branch (address above). Two copies of any comments are to be submitted, except that individuals may submit one copy. Comments are to be identified with the docket number found in brackets in the heading of this document. Comments will be used to determine whether amendments to or revisions of The Seafood List are warranted.

Dated September 6, 1994.

William K. Hubbard,
Interim Deputy Commissioner for Policy.
[FR Doc. 94-22647 Filed 9-13-94; 8:45 a.m.]

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

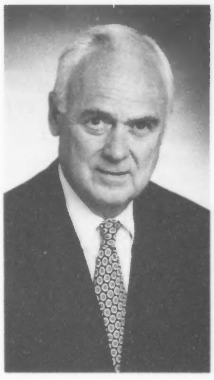
BALANCE SHEET
AS OF AUGUST 31, 1994

	General Fund	Feagan Award Endowment Fund	Restricted Fund	Foundation Fund	Total
ASSETS					
Cash and cash equivalents	$ 109,897	$ 5,367	$ 4,592	$ 9,592	$ 129,448
Investments				49,727	49,727
Certificates of deposit	46,929				46,929
Accounts receivable	39,267			1,260	40,527
Note receivable		16,369			16,369
Interfund receivables (payables)	2,256			(2,256)	
Inventories	5,928				5,928
Other assets	18,303				18,303
Equipment, net of accumulated depreciation	47,231				47,231
TOTAL	$ 269,811	$ 21,736	$ 4,592	$ 58,323	$ 354,462
LIABILITIES AND FUND BALANCES					
Liabilities:					
Accounts payable	$ 68,774				$ 68,774
Accrued and other liabilities	19,576				19,576
Unearned revenue	222,827				222,827
Total liabilities	311,177				311,177
Fund balance	(41,366)	$ 21,736	$ 4,592	$ 58,323	43,285
TOTAL	$ 269,811	$ 21,736	$ 4,592	$ 58,323	$ 354,462

STATEMENT OF REVENUES AND EXPENSES
FOR THE YEAR ENDED AUGUST 31,1994

	Budget	General Fund	Feagan Award Endowment Fund	Restricted Fund	Foundation Fund	Total
REVENUES						
Advertising	$ 137,500	$ 142,566				$ 142,566
Membership	250,000	220,942				220,942
Communication	330,000	327,109				327,109
Administrative	17,000	14,245				14,245
Annual meeting	128,000	146,360				146,360
Workshops	19,500	8,955				8,955
Feagan Award Endowment Fund			$ 10,859			10,859
Restricted Fund				$ 1,192		1,192
Foundation Fund	7,500				$ 12,516	12,516
Total revenues	889,500	860,177	10,859	1,192	12,516	884,744
EXPENSES						
Salaries and benefits	354,483	325,354				325,354
Building operations	36,500	38,355				38,355
Office operations	98,050	88,459				88,459
Professional services	18,000	29,307				29,307
Publications	230,000	229,013				229,013
Travel	27,500	9,893				9,893
Executive board	11,000	8,137				8,137
General committee	7,500	2,579				2,579
Miscellaneous	4,500	6,670				6,670
Annual meeting	80,000	105,314				105,314
Workshops	10,000	8,151				8,151
Feagan Award Endowment Fund						
Restricted Fund				80		80
Foundation Fund	7,500				9,884	9,884
Total expenses	885,033	851,232		80	9,884	861,196
Excess of revenues over expenses	$ 4,467	$ 8,945	$ 10,859	$ 1,112	$ 2,632	$ 23,548

Updates . . .



Dean Foods Announces Election of New Director

Dean Foods Company announced the election of John S. Llewellyn, Jr., as a Director of Dean Foods Company. Llewellyn is President and Chief Executive Officer of Ocean Spray Cranberries, Inc., Lakeville-Middleboro, MA.

Llewellyn received a Master of Business Administration degree from Harvard Business School in 1961 and his Bachelor of Arts degree from Holy Cross College in 1956, and he served in the United States Marine Corps, achieving the rank of Captain. He resides in Hingham, MA with his wife, Mary Martha, and family.

Dean Foods is a diversified food processor and distributor, producing a full line of dairy and other food products, including fluid milk, cottage cheese, ice cream and frozen novelties, frozen yogurt and specialty foods such as canned and frozen vegetables, dips, pickles, relishes, powdered coffee creamers, peanut butter, syrups and aseptic products. Products are sold to supermarkets, specialty food stores, foodservice facilities, and other food processors and internationally.

biomérieux Vitek Appoints New President

Philippe Archinard has been named president of bioMérieux Vitek, Inc. Most recently, Archinard served as assistant to the company's chairman.

Since joining bioMérieux in 1985, Archinard has served in a number of management positions in R&D and Marketing in France as well as in the U.S. His last position prior to his recent return to the U.S. was that of director of the European Immunoassay Business.

Archinard holds an undergraduate degree in chemical engineering from Ecole Normale Superieure de Chimie de Montpellier. He earned his graduate degree in biochemistry from the Uniiversite des Sciences and his Ph.D. in biochemistry from Claude Bernard University. He has also completed Harvard Business School's Program for Management Development.

A leading producer of manual, semi-automated and fully automated biomedical diagnostic systems, bioMérieux Vitek serves clinical and industrial laboratories around the world.

HFM Hits 1,000 Members

The National Society for Healthcare Foodservice Management (HFM) has reached the 1,000 member milestone. HFM now has members in 50 states, the District of Columbia and Canada. The 6-year-old Society, founded to provide education, training, networking and support for self-operated healthcare foodservice managers, has had a phenomenal growth from 280 members in January of 1991. The announcement was made at HFM's largest National Training Conference ever just concluded at the Breakers in Palm Beach, FL. Jay Seyss of Columbia/HCA received the Society's first Architect's Award for sponsoring 38 new operator members during 1994.

Joe Bourgeois Joins Sparta Brush Company

Jack Larson, President of Sparta Brush Company has announced that Joe Bourgeois has joined Sparta as Director of Sales for the Western Region.

Bourgeois' responsibilities will include: managing and training sales representatives, food service chains and buying group accounts, covering regional and national trade shows, and new business development.

Previously, Bourgeois was employed as Director of Sales-Western Region for Continental/SiLite International. He started in the food industry as an Account Manager for Libbey Glass, Inc. in 1984.

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

ASDA Announces New Officers

The ADSA Board of Directors were announced June 11, 1994 at the Opening Session of the 89th Annual Meeting of the American Dairy Science Association, hosted by University of Minneapolis. The new officers begin their terms immediately.

Ronald L. Richter, Department of Animal Science, TX A&M University, College Station, was named Vice President.

New directors are, from the Dairy Foods Division, Genevieve Christen, University of Tennessee, and, from the Production Division, Roger P. Natzke, University of Florida. Roger W. Hemken, University of Kentucky, will become the new ADSA President, and Bill Sandine, Oregon State University, will become Past President. Bob Marshall, University of Missouri, will remain as Treasurer. Remaining directors are Carl Polan, Virginia Tech; Harold Swaisgood, North Carolina

State University; Leonard Bull, North Carolina State University; and Mary Ellen Sanders, independent consultant, Littleton, CO. Doug Emmons, Agriculture Canada, Ottawa, Ontario, will become Editor of the *Journal of Dairy Science* at year end; returning Associate Editors are Les Hansen, University of Minnesota, and Mike Murphy, University of Illinois.

Retiring from the board after this year's meeting are: Jimmy H. Clark, University of Illinois, Past President; David Smith, University of Minnesota, Director; Jerry Young, Eli Lilly, Director; and John Fuquay, Mississippi State University, Editor, *Journal of Dairy Science*.

David S. Ring Promoted to Sales V.P. at World Dryer

World Dryer Corporation President, Randy M. Cordova, has announced the appointment of David S. Ring to Vice President of Sales and Service. Ring will be responsible for the company's continued sales growth in all areas. David has been National Sales Manager ('90-'92) and Director of U.S. Sales ('92-'94) with World, and was previously employed by Hobart Corporation ('81-'90). He holds a degree in Marketing from Bowling Green State University and lives with his wife and daughter in Naperville, IL.

World Dryer, the global leader in electric warm air hand dryers and hand sanitation equipment, distributes products in over 77 countries and sells in the U.S. through 43 multi-line rep organizations. Cordova states, "With the expansion of our automatic hand wash station line, touchless products for public washrooms, and Electric-Aire brand, World needs the direction and commitment David offers in this new position to move us through the 90s."

For further information, contact World Dryer Corporation, 5700 McDermott Drive, Berkeley, IL 60163, (708) 449-6950.

Fristam Pumps Announces Promotions

Gary Bymers has been promoted to International Sales Manager of Fristam Pumps, Inc. In his new assisgnment, Gary will be responsible for developing international markets including: Venezuela, Columbia, Central America and Mexico. He will also be responsible for better communication between Fristam Pumps, its sister companies worldwide, and parent company, Fristam Puumpen of Germany.

Bymers received an undergraduate Engineering degree from the University of Wisconsin-Madison. He has been with Fristam Pumps for 5 years.

John Delmage has been named Vice President of Sales for Fristam Pumps, Middleton, WI. Delmage will oversee the entire sales department functions.Along with 10 years of industry experience, John holds a Bachelor of Arts degree from Albany State University in Albany, NY.

Tom Holdorf has been named Senior Vice President of Operations for Fristam Pumps, Middleton, WI. Holdorf is responsible for managing Manufacturing, Purchasing, Industrial Engineering, and Production and Inventory Control. Holdorf has been with Fristam for 9 years.

Christopher Richards has joined the company as Quality Assurance Manager. Richards will be responsible for continuous improvement of the quality functions at Fristam Pumps.

With a background in manufacturing management, Richards brings to Fristam over 24 years experience in the field of Quality Assurance in casting, machining and electrochemical industries.

Richards holds a degree in Physics from the University of Iowa. He has maintained certification as a Certified Quality Engineer with the American Society for Quality Control since 1977. We welcome Richards to Fristam Pumps.

David Skora has been appointed Vice President-Finance. Skora is responsible for managing accounting and computer systems within the company.

Skora has been with Fristam Pumps for 8 years. Skora has a BBA degree from the Uniiversity of Wisconsin-Eau Claire. He achieved certification as a Certified Management Accountant (CMA) in May of 1991.

Wolfgang Stamp, Chairman of the Board of Fristam Pumps, Inc., recently appointed Bill Wanezek President of Fristam Pumps, Middleton, WI. Wanezek has been with Fristam Pumps for nearly 11 years and has been Vice President of the company for the past 7 years. He has a Bachelor of Science degree in Chemistry from the University of Wisconsin-Platteville.

Fristam Pumps, Inc., is a leading manufacturer of sanitary centrifugal and positive displacement pumps sold to the food, dairy, beverage and pharmaceutical/biotech industries.

New Officers to the Association of Water Technologies

The Association of Water Technologies (AWT) proudly announces the appointment of its 1994 – 1995 officers: Jack Altschuler, Maram Corporation (President); John Baum, Craft Products Company, Inc. (Past President); Brent Chettle, W.E.S.T., Inc. (President-elect); Joe Hannigan, Klenzoid, Inc. (Secretary); and Larry Webb, HVC, Inc. (Treasurer).

Elections were held at Water Technologies '94, AWT's annuaconvention, in Orlando, FL on October 12, 1994. Mr. Altschuler was honored at the annual awards banquet where he received the presidential gavelfrom Past President John Baum, signifying his 1-year term.

AWT is an international, non-profit, trade association which represents over 400 regional water treatment companies and suppliers specializing in commercial and industrial cooling and boiler treatments. The Association provides its members, and the water treatment industry, with a variety of products and services designed to improve the performance of the industry, including a quarterly, full color magazine, annual conventions and expositions, spring conferences and exhibitions, and the Certified Water Technologist (CWT) program.

Affiliate Officers

ALABAMA ASSN. OF DAIRY & MILK SANITARIANS

Pres., Gregory B. Utley ..... Tuscaloosa
Pres. Elect, Benjy Mikel ..... Aubum
Vice Pres., Ken Reamer ..... Montgomery
Sec'y. Treas., Tollie Haley ..... Tuscaloosa
Past Pres. Chris Medleyy ..... Montgomery
Delegate, Tom McCaskey ..... Aubum
Mail all correspondence to:
Tollie Haley
Tuscaloosa County Health Dept.
1101 Jackson Avenue
Tuscaloosa, AL 35401
(205))345-4131

ALBERTA ASSN. OF MILK, FOOD & ENVIRONMENTAL SANITARIANS

Pres., Ken Yu ..... Edmonton
Past Pres., Harry Jackson ..... Edmonton
Pres. Elect, Rick Leyland ..... Edmonton
Sec'y., Connie Zagrosh-Miller ..... Edmonton
Treas. Mike Mavromaras ..... Edmonton
Delegate, James Steele ..... Edmonton
Mail all correspondence to:
AAMFES
Attn: Harry Jackson
P.O. Box 8273
Station F
Edmonton, Alberta, Canada T6H 5H3

CALIFORNIA ASSN. OF DAIRY & MILK SANITARIANS

Pres. Tony Freeman ..... Ontario
Past Pres., Richard Bolman ..... Cerritos
Exec. Sec'y. Treas., Interim John Bruhn . Davis
Delegate, John Bruhn ..... Davis
Mail all correspondence to:
Dr. John Bruhn
Department of Food Science & Technology
101B Cruess Hall
University of California - Davis
Davis, CA 95616
(916)752-2191

CAROLINA'S ASSN. OF MILK, FOOD & ENVIRONMENTAL SANITARIANS

Pres. Bernard Kane ..... Greenville, SC
Vice Pres., Kay Sigmon ..... Mooresville, NC
Secretary, Keith Glover ..... Raleigh, SC
Treasurer, Felix Barron ..... Clemson, NC
Delegate, Beth Johnson ..... Columbia, SC
Mail all correspondence to:
Elizabeth M. Johnson
SC DHEC Bureau of Laboratories
PO Box 2202
Columbia, SC 29202
(803)935-6201

CONNECTICUT ASSN. OF DAIRY & FOOD SANITARIANS, INC.

Pres., Colleen Mears ..... Windsor Locks
Vice Pres., David Herrington ..... Middlefield
Sec'y., Donald Shields ..... Hartford
Treas., Kevin Gallagher ..... Hartford
Delegate, Satyakam Sen ..... Bristol
Mail all correspondence to:
Kevin Gallagher
Dept. Consumer Protection (Food Div.)
State Office Bldg., Rm #167
165 Capitol Avenue
Hartford, CT 06106
(203)566-4716

FLORIDA ASSN. OF MILK, FOOD & ENVIRONMENTAL SANITARIANS, INC.

Pres., Kathleen Ward ..... Jacksonville
Pres. Elect, John Chrisman ..... Orlando
Vice Pres., Dean Elliott ..... Tallahassee
Past Pres., Jack Dodd ..... Tallahassee
Sec'y, Marian Ryan ..... Winter Haven
Treas., Bill Thornhill ..... Winter Haven
Delegate, Peter Hibbard ..... Orlando
Mail all correspondence to:
Bill Thornhill
3023 Lake Alfred Road
Winter Haven, FL 33881
(813)299-6555

GEORGIA ASSN. OF FOOD & ENVIRONMENTAL SANITARIANS

Pres., Larry Beuchat ..... Griffin
Vice Pres., Jim Ayres ..... Atlanta
Past Pres., Al Fain ..... Stone Mountain
Secretary, Mark Harrison ..... Athens
Treas., James C. Camp ..... Douglasville
Delegate, David Fry ..... Lilburn
Mail all correspondence to:
Mark Harrison
GAFES Secretary
Dept. of Food Science & Tech.
Athens, GA 30602
(404)542-1088

IDAHO ENVIRONMENTAL HEALTH ASSN.

Pres., Steve Bastian ..... Preston
Pres. Elect, Ed Hall ..... Coeur D'Alene
Sec'y. Treas., Tom Hepworth ..... Pocatello
Mail all correspondence to:
Tom Hepworth
465 Memorial Drive
Pocatello, ID 83201
(208)233-9080

ASSOCIATED ILLINOIS MILK, FOOD & ENVIRONMENTAL SANITARIANS

Pres., Doug Cart ..... Rockford
Pres. Elect, Alan Lundin ..... Cherry Valley
1st Vice Pres., Wayne Knudson ..... Cary
2nd Vice Pres., Karen Engebretson .... Rockford
Sec'y. Treas., Bob Crombie ..... Joliet
Past Pres., Marlena Bordson ..... Springfield
Past Pres., Cheryl Pieper ..... Elmhurst
Mail all correspondence to:
Bob Crombie
Crombie Company
521 Cowles Avenue
Joliet, IL 60435
(815)726-1683

INDIANA ENVIRONMENTAL HEALTH ASSN., INC.

Pres., Deanna English ..... Danville
Pres. Elect, Sylvia Garrison ..... Bloomington
Vice Pres., Cyndi Wagner ..... Indianapolis
Treas., Don Artmeier ..... Bloomington
Sec'y., Kris Conyers ..... Kokomo
Past. Pres., Vince Griffin ..... Plainfield
Delegate, Helene Uhlman ..... Hobart
Auditor, Jerry Thomas ..... Indianapolis
Auditor, Molly Anderson ..... Indianapolis
Mail all correspondence to:
Indiana Environmental Health Assoc.
Attn: Tammi Barrett
Indiana State Board of Health
1330 W. Michigan Street
ndianapolis, IN 46206
(317)633-0168

IOWA ASSN. OF MILK, FOOD & ENVIRONMENTAL SANITARIANS, INC.

Pres. Vicky Streicher ..... Edgewood
Pres. Elect, Randy Hanson ..... Dubuque
1st Vice Pres., Glen Amdahl ..... Charles City
2nd Vice Pres., Loren Johnson ..... Le Mars
Past President, Scott Core ..... Urbandale
Sec'y. Treas., Dale R. Cooper ..... Manchester
Delegate, Randy Hanson ..... Dubuque
Mail all correspondence to:
Dale Cooper
Box 69
Manchester, IA 52057
(319)927-3212

KANSAS ASSN. OF SANITARIANS

Pres., George Blush ..... Topeka
Past Pres., Ann Scheve ..... Emporia
1st Vice Pres., Dan Hutchison ..... Topeka
2nd Vice Pres., Marvin Simonton ..... Wellington
Sec'y. Treas., Galen Hulsing ..... Topeka
Treas., Ernest Barnes ..... Wichita
Delegate, Don Bechtel ..... Manhattan
Mail all correspondence to:
Galen Hulsing
Topeka-Shawnee County Health Agency
1615 W. 8th Street
Topeka, KS 66606
(913)233-8961 ext. 298

KENTUCKY ASSN. OF MILK, FOOD & ENVIRONMENTAL SANITARIANS, INC.

Pres., Anita Travis ..... Frankfort
Pres. Elect, George Heady ..... Frankfort
Vice Pres., Guy Delius ..... Frankfort
Past Pres., Rick Molohon ..... Elizabethtown
Sec'y., Cary Nesselrode ..... Frankfort
Treas., Judy True ..... Frankfort
Delegate, David Klee ..... Elizabethtown
Mail all correspondence to:
Judy True
KAMFES, Inc.
P.O. Box 1464
Frankfort, KY 40602
(502)564-7181

MASSACHUSETTS MILK, FOOD & ENVIRONMENTAL INSPECTORS ASSN.

Pres., Max Bookless ..... Pittsfield
Past Pres., Barb Kulig ..... West Springfield
Vice Pres., David Kochan ..... Northampton
Sec'y. Treas., Fred Kowal ..... Chicopee
Delegate, Barb Kulig ..... West Springfield
Contact:
Fred Kowal
45 Beaumont Avenue
Chicopee, MA 01013
(413)592-5914

MICHIGAN ENVIRONMENTAL HEALTH ASSN.

Pres., Robert Taylor ..... Lansing
Pres. Elect, Dick Fleece ..... Manchester
Treas., David Wilson ..... Ann Arbor
Past Pres., Terry Anderson ..... Lansing
Secretary, Durwood Zank ..... Charlotte
Delegate, Bob Taylor ..... Lansing
Mail all correspondence to:
Durwood Zank
Barry-Easton DHD
PO Box 30161
Lansing, MI 48909
(517)543-2430

MINNESOTA SANITARIANS ASSN., INC

Pres., Sonya Gabriel-Lenarz ..... St. Paul
Pres. Elect, Dennis Decker ..... Litchfield
Vice Pres., Ray Cherry ..... Faribault
Sec'y. Treas., Paul Nierman ..... St. Paul
Past Pres., Greg Pittman ..... Montgomery
Delegate, Paul Nierman ..... St. Paul
Mail all correspondence to:
Paul Nierman
Dairy Quality Control Institute
5205 Quincy Street
St. Paul, MN 55112-1499
(612)785-0484

MISSISSIPPI ENVIRONMENTAL HEALTH ASSN

Pres., Robert J. Prescott ..... McComb
Pres. Elect, Kenneth Bruce ..... Akerman
1st Vice Pres., Dana Carson ..... Meridian
Sec'y/Treas., Tim Carr ..... Magnolia
Past Pres., Robert Rogers ..... Forrest
Delegate, Robert Presscott ..... McComb
Mail all correspondence to:
Robert J. Prescott
P. O. Box 788
McComb, MS 39648
(601)684-9411

MISSOURI MILK, FOOD & ENVIRONMENTAL HEALTH ASSN.

Pres., Terry Long ..... Jefferson City
Pres. Elect, Janet Murray ..... Moberly
Vice Pres., Diana Pasley ..... Hillsboro
Sec'y, Linda Wilson ..... Springfield
Treas., David Stull ..... Jefferson City
Past Pres., Calvin Badding ..... Jefferson City
Delegate, Terry Long ..... Jefferson City
Mail all correspondence to:
Janet Murray
Environmental Sanitarian III
Randolph County Health Department
P. O. Box 488
Moberly, MO 65270
(816)263-6643

NEBRASKA ASSN. OF MILK & FOOD SANITARIANS

Pres., Greg Henn ..... Lincoln
Sec'y. Treas., Kirk Sales ..... Lincoln
Past Pres., Al Ackerman ..... Lincoln
Delegate, Susan Sumner ..... Lincoln
Mail all correspondence to:
Kirk Sales
Meadowgold Dairy
726 "L" Street
Lincoln, NE 68508

NEW YORK STATE ASSN. OF MILK & FOOD SANITARIANS

Pres., Kim Bukowski ..... E. Syracuse
Pres. Elect, Ronald Gardner ..... Ithaca
Past Pres., Jerome Hopcus ..... Lancaster
Exec. Secretary, Janene Gargiulo ..... Ithaca
Delegate, Terry Musson ..... Keyport, NJ
Mail all correspondence to:
Janene Gargiulo
Cornell University
11 Stocking Hall
Ithaca, NY 14853
(607)255-2892

NORTH DAKOTA ENVIRONMENTAL HEALTH ASSN.

Pres., Dan Mattern ..... Bismarck
1st Vice Pres., Allan McKay ..... Devils Lake
Past Pres., Peri Dura ..... Bismarck
Sec'y. Treas., Deb Larson ..... Bismarck
Delegate, Gary Hoffman ..... Bismarck
Mail all correspondence to:
Debra Larson
PO Box 937
Bismarck, ND 58502
(701)221-6147

OHIO ASSN. OF MILK, FOOD & ENVIRONMENTAL SANITARIANS

Pres., Roger Tedrick ..... Columbus
1st Vice Pres., Greg DeLong ..... Dayton
2nd Vice Pres., Barry Pokomy ..... Cincinnati
Sec'y. Treas., Don Barrett ..... Columbus
Past Pres., Gloria Swick ..... Columbus
Delegate, Gloria Swick ..... Columbus
Mail all correspondence to:
Donald L. Barrett
Health Dept.
181 S. Washington Blvd.
Columbus, OH 43215
(614)645-6195

ONTARIO FOOD PROTECTION ASSN.

Pres., Sue Fraser ..... Ontario
Vice Pres., Linda Harrison ..... Guelph
Sec'y., Joan Wakeman ..... Hamilton
Treas., Debbie Lebelle ..... Kitchener
Past Pres., Anna Lammerding ..... Guelph
Delegate, Sue Fraser ..... Ontario
Mail all correspondence to:
Sue Fraser
James Family Foods Limited
2160 Highway 7
Concord, Ontario L4K 1W6
(905)669-1648
Officers Effective January 1995

PENNSYLVANIA ASSN. OF DAIRY SANITARIANS & DAIRY LAB. ANALYSTS

Pres., Tom Angstadt ..... Erie
Pres. Elect, Clifford Kendall ..... Altoona
Vice Pres., Eugene Frey ..... Lancaster
Secretary, Mike John ..... Waynesboro
Treasurer, Robert Mock ..... Gilbertsville
Past Pres., Donald Yanek ..... Orwigsburg
Delegate, Mike John ..... Waynesboro
Mail all correspondence to:
Mike John
Atlantic Dairies
5419 Manheim Road
Waynesboro, PA 17268
(717)762-7789

SOUTH DAKOTA ENVIRONMENTAL HEALTH ASSN.

Pres., Pam Bonrude ..... Pierre
Pres. Elect, ...
Past President, John Robertson ..... Pierre
Sec'y Treas., Rex Vandenberg ..... Pierre
Past Pres., Diane Worall ..... Huron
Delegate, Darwin Kurtenbach ..... Pierre
Mail all correspondence to:
Rex Vandenberg
SD State Department of Health
523 E. Capitol
Pierre, SD 57501
(605)773-3364

TENNESSEE ASSN. OF MILK, WATER & FOOD PROTECTION

Pres., Ernest Yates ..... Cross Plains
Pres. Elect, Genevieve Christen ..... Knoxville
Vice Pres., Gail Smith ..... Chattanooga
Sec'y. Treas., Dennis Lampley ..... Bon Aqua
Bd. Mem. at Lge, Dewain Patterson . Brentowood
Past Pres., Wayne Crabtree ..... Athens
Archivist, Ruth Fuqua ..... Mt. Juliet
Mail all correspondence to:
Dennis Lampley
Rt. #1, Box 468-B
Bon Aqua, TN 37025
(615)360-0157

TEXAS ASSN. OF MILK, FOOD & ENVIRONMENTAL SANITARIANS

Pres., Kent Roach ..... San Antonio
Pres. Elect, Don Ritch ..... Dallas
Sec'y, Janie Park ..... Austin
Treas., Dr. Ron Richter ..... College Station
Archivist, Joe Goddard ..... Lubbock
Delegate, Kirmon Smith ..... Austin
Mail all correspondence to:
TAMFES
Ron Richter
P. O.Box 10092
College Station, TX 77842
(408) 845-4409

VIRGINIA ASSN. OF SANITARIANS & DAIRY FIELDMEN

Pres., Alan G. Grove ..... Blacksburg
Sec'y. Treas., Donna Izac ..... Chesterfield
Past Pres., C. Tom Owen ..... South Boston
Delegate, Donna Izac ..... Chesterfield
Mail all correspondence to:
Donna Izac
9431 Dry Creek Drive
Chesterfield, VA 23832
(804)739-3071

WASHINGTON MILK SANITARIANS ASSN.

Pres., Alan Barr ..... Seattle
Pres. Elect, Stephanie Olmsted ..... Seattle
Sec'y. Treas., Lloyd Luedecke ..... Pullman
Delegate, Lloyd Luedecke ..... Pullman
Mail all correspondence to:
Lloyd Luedecke
NW 312 True Street
Pullman, WA 99163
(509)335-4016

WISCONSIN ASSN. OF MILK & FOOD SANITARIANS

Pres., Fritz Buss ..... Marshfield
Past Pres., Erin Nutter ..... Eau Claire
Pres. Elect, Bill Wendorff ..... Madison
1st Vice Pres., Phil Hermsem ..... Shawano
Sec'y., Randall Daggs ..... Madison
Treas., Neil Vassau ..... Madison
Membership Chairman, Neil Vassau ..... Madison
Delegate, Joseph Disch ..... DeForest
Mail all correspondence to:
Neil M. Vassau
P.O. Box 7883
Madison, WI 53707
(608)267-3504

WYOMING ENVIRONMENTAL HEALTH ASSN.

Pres., Terry Carlile ..... Laramie
Pres. Elect, Stephanie Whitman ..... Laramie
Secretary, Laurie Leis ..... Casper
Treasurer, Lorie Hebart-Hillegas ..... Cheyenne
Past Pres., Dean Finkenbinder ..... Casper
Delegate, Laurie Leis ..... Casper
Mail all correspondence to:
Laurie Leis
427 So. McKinley
Casper, WY 82601
(307)266-1203

New IAMFES Members

ARGENTINA

Alicia Silvia San Martin
Kasdorf S.A., Buenos Aires

CALIFORNIA

Stanley Chia
ZB Industries, Inc., San Pedro

CANADA

Martin Merrette
MDM, Pointe-Claire, Quebec

Doug Powell
Univerity of Guelph, Guelph, Ontario

ENGLAND

Craig Davidson
Faculty of Cultural & Ed. Studies, Leeds

GERMANY

David A. Baker
McDonald's Quality Assurance Europe, Frankfurt

HAWAII

Angela Tagalicod
Department of Health, Honolulu

MAINE

Linda Stahlnecker
Maine Department of Agriculture, Augusta

MARYLAND

Jennifer Crumbaugh
Deer Park Spring Water, Cumberland

MASSACHUSSETTS

Geri Reilly
au bon pain, Boston

MICHIGAN

Fred Benzie
Marquette County Healh Dept., Negaunee

NEW YORK

Joseph Ferrara
(Retired) NYS Dept. of Food Inspection, Albany

TEXAS

Ron Upshaw
Association of Milk, Arlington

VERMONT

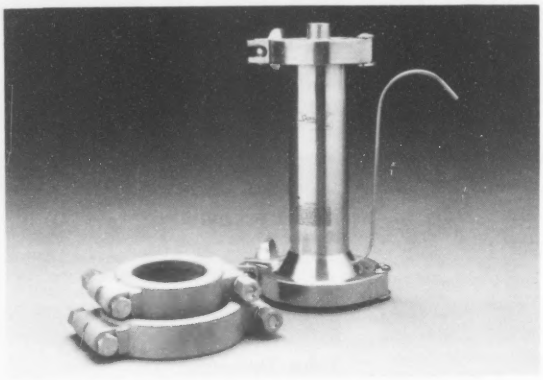
John Jaworski
Agri Lab, Waterbury

WISCONSIN

Linda Kelly
WI State Lab Hygiene, Madison

Carol Martin
Martin Management, Watertown

Industry Products



Osmonics Introduces New Stainless Steel Test Cell

Osmonics, Inc., Minnetonka, MA, has developed a new test cell designed for in-house testing of crossflow membranes. The new SEPA®ST has stainless steel construction, low hold-up volume and high pressure capabilities which make it ideal for application such as chemical processing, biomedical and membrane studies.

The corrosion-resistant 316L stainless steel construction of the SEPA®ST allows chemical compatibility with a broad spectrum of liquids, from aqueous to non-aqueous solutions. The standard unit is engineered to withstand pressures up to 450 psig (31 bar) enabling high pressure applications such as ultrafiltration and microfiltration. Optional high pressure couplings allow operation up to 1,000 psig (69 bar) for testing solutions with high levels of dissolved solids or high osmotic pressures.

The test cell is engineered for ease and efficiency. Its unique design achieves a hold-up volume as low as 1 ml, preventing the waste of valuable solutions. Easy removal of the unit's top and bottom allows for quick membrane change-out and easy solution loading (up to 300 ml). All components can be sterilized to a maximum temperature of 121°C (250°F). Further, the SEPA®ST can accommodate any 47 to 50 mm diameter membrane disk.

The SEPA®ST operates on standard sources of compressed air or inert gases (nitrogen, argon, etc.), permitting versatility in testing options. Compressed gases also provide a source of consistent pressure as well as a safe source for processing volatile solutions.

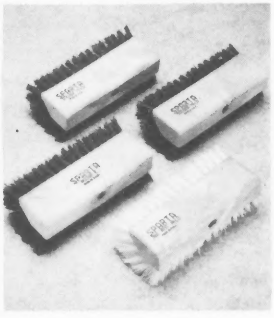
Ramsey Introduces the Mini Model 11-100 Digital C-Level Weight Indicator

Ramsey Technology, Inc., introduces the Mini Model 11-100 Digital C-Level Weight Indicator for use in the food, mining, chemical, power, cement, paper and plastic industries. This technologically advanced, user-friendly and accurate Continuous Level Indicator System that was designed to be a weight indicator can also be used as a level indicator. Incorporating a 16-digit alphanumeric digital display for ease of set-up and calibration, the compact weight indicator is fully compatible with GZ-1 or any other loadcell.

This model is a low-cost, highly flexible device that functions not only as a digital weight indicator but also as a sample batching control with up to four programmable setpoints, and as a weight transmitter to display net, gross or tare weight.

Ramsey Technology, Inc., is a major manufacturer of industrial weighing, monitoring and control equipment and specializes in process instrumentation and automatic control. Ramsey markets its products worldwide to such industries including food processing, packaging, mining, minerals processing, construction equipment and power generation.

Sparta Introduces "Spectrum" "Hi-Lo" Floor Scrubs



Sparta Brush Company has introduced the "Spectrum" line of "Hi-Lo floor scrub Brushes with color coded bristles to help eliminate cross-contamination.

The unique 38X features heavy duty, crimped polypropylene bristles, color coded to help eliminate cross-contamination. Use red for raw meat, green for produce, blue for seafood and white for cooked products or set up your own system.

The original split-brush shape with two position bristle trim is designed to give maximum cleaning action in both open areas and under equipment, counters, etc. Bristles are firmly set in a 10" structural foam block for long life.

New Pathoscreen Medium Detects Waterborne Pathogens

Detect fecal contamination within 24 to 48 h with new PathoScreen™ Medium. PathoScreen is a reliable, inexpensive medium that is well suited for monitoring drinking water systems in developing tropical countries, in remote field locations, and disaster or emergency situations.

You can easily detect hydrogen-sulfide producing bacteria in drinking water, surface water and recreational water. PathoScreen detects *Salmonella*, *Proteus*, *Klebsiella*, *Citrobacter*, *Clostridium*, *Edwardsiella* and other hydrogen-sulfide producing organisms proven to be associated with fecal contamination and the presence of coliforms.

In most tropical climates indigenous *Escherichia coli* produces positive reactions when traditional coliform tests are used. These positive reactions may not indicate fecal contamination. However, indigenous *E. coli* do not interfere with the PathoScreen test, which makes it an excellent alternative to coliform testing.

PathoScreen Medium is ready-to-use and packaged in single-dose pillows for either Presence/Absence or Most Probable Number testing. Just pour a PathoScreen Medium pillow into the sample, incubate and read the results. Positive results are easily identified by the formation of a black solution. You do not need an incubator, just keep samples at a constant temperature.

Digital Pressure Gage Replaces Dial Indicators

New Sensotec Model DG is a solid state microprocessor based digital pressure gage capable of 0.2% accuracy in ranges from 5 to 10,000 psi. A variety of pressure port adapters, including a clean-in-place sanitary flange, are available to accommodate diverse applications.

This EMI/RFI protected eliminates the inaccuracies found in dial gages with a bright, clear four-digit LCD display and your choice of engineering units. Its durable design provides 20% over pressure protection and has no moving parts to bend or break. Front panel push buttons control the ON/OFF, 100% zero adjustment and the peak/valley feature. These buttons may be set, and then disabled to prevent tampering.

High level 0-5 VDC or 4-20 mA outputs are available, as is dual limits with indicator lights and relays. The battery powered unit achieves superior battery life thanks to the ON/OFF switch and the AUTO/OFF feature. The DG is also available loop powered, vehicle powered, or AC powered. Optional NEMA-4 rating for water resistance is also available. Available now from $490.00 (U.S.).

Trace Total Sulfur Analyzer

The Model 7000TS Trace Sulfur Analyzer from ANTEK Instruments, Inc., preforms safe, rapid and accurate analyses of liquid and gas samples for trace levels of chemically bound sulfur. Building on ANTEK's patented, proven combustion technology, the 7000TS adds a reduction step to take advantage of the sensitivity, selectivity, and stability of chemiluminescent detection. Antek's patented method of oxidative/reductive pyrolysis, followed by chemiluminescent detection is entirely instrumental. No chemicals or consumables are needed, and there are no catalysts or environmentally hazardous reagents to dispose of. Typical analysis time is three to four minutes and sensitivity is from 10 ppb.

MPM-510e Multifunctional Environmental Meter

Solomat Neotronics introduces as exceptionally user friendly, hand-held instrument with a broad range of features for measuring relative humidity, air velocity and volumetric airflow, carbon dioxide, carbon monoxide, dewpoint, rpm, temperature and differential/absolute/gage pressure. This rugged, portable meter is ideal for all types of field work; wherever high precision, dependable measurements are needed. An advanced user interface makes this instruments very easy to use. Simply connect your chosen probe, select the parameter and measurement units via the keypad and read your instrument. Features include extremely wide measurement ranges for all parameters (with excellent resolution and accuracy), 150 h battery life, display of minimum/maximum/average measurements, easy prompts, (e.g., "duct size" for volumetric flow calculation), switchable unit symbols and push-button data storage (including site code). The instrument also comes with a standard output (a small portable printer is optional). The MPM-510e is ideal for general HVAC measurements (in buildings, laboratories, cleanrooms, etc.), for indoor air quality investigations and for process monitoring and research applications.

Dairy, Food and Environmental Sanitation
Index to Volume 14

AUTHOR INDEX

SUBJECT INDEX

INDEX OF ADVERTISERS

"BUSINESS EXCHANGE" CLASSIFIED ADVERTISING INDEX

Business Exchange "Classifieds"

Services / Products

Business Exchange "Classifieds"

Employment Opportunities

SANITARIAN/ MICROBIOLOGIST

With a B.S. Degree and 20 years experience in Quality Assurance and Inspection seeks position as a **Quality Assurance/Field Specialist**

Qualifications Include:

- Registered Sanitarian NYS
- USDA, FDA, GMP Regulations
- Vendor and Sanitation Audits
- Some HACCP Enforcement & Implementation
- Laboratory Equipment Experience
- Electron Microscopy Experience
- Pathogen Isolation Identification

Prefer Northeast Area (But Would be Willing to Relocate)

Please contact Howard Malberg 914-794-8264

CIRCLE READER SERVICE NO. 305

Regional Manager

NSF International is seeking an individual with excellent supervisory skills to manage an office and its staff and to coordinate the certification, inspectional, and educational services provided to customers. The successful candidate will possess and undergraduate degree, good communication skills, and the willingness and ability to relocate and to travel extensively. The preferred candidate will possess a BS Degree in environmental health or related work experience, and be registered as a Sanitarian or Environmental Health Specialist.

Service Representative

NSF International is seeking applicants for their regional offices. Successful applicants must possess a BS degree in environmental science, chemistry, biological sciences, engineering, or related field. Three to five years of regulatory or industrial experience is preferred. Extensive travel required, and good verbal and writing skills are a must. Representatives conduct inspections at plants manufacturing food service equipment, plastic pipe, swimming pool and spa equipment, drinking water treatment units, drinking water additives, and other items of health or environmental significance.

Submit resume, salary requirements, and references to: Personnel Manager, NSF, P.O. Box 130140, Ann Arbor, MI 48113-1040. EOE.

CIRCLE READER SERVICE NO. 308

Coming Events

1995

JANUARY

•**3-5, Milling for Cereal Chemists,** sponsored by the American Association of Cereal Chemists, will be held in Kansas State University, Manhattan, KS. For more information, contact Marie McHenry, AACC Short Course Coordinator, 3340 Pilot Knob Road, St. Paul, MN 55121. Phone (612) 454-7250; FAX (612) 454-0766.

•**9-Feb. 10, Dairy Technology Module II — Technology of Cheese and Concentrated Milk Products,** the principles and practices relating to the manufacture of cheese. Includes selection and evaluation of raw materials plus lactic cultures, processing, packaging, storage and distribution. Aspects of quality control, product testing, judging and grading associated with cheese production. Cost: $873.00 For more information, contact Mr. A. W. Hydamaka, at (204) 474-9621; FAX (204) 261-1488.

•**10-12, Introduction to Food Chemistry,** sponsored by the American Association of Cereal Chemists will be held in Los Angeles, CA. For more information, contact Marie McHenry, AACC Short Course Coordinator, 3340 Pilot Knob Road, St. Paul, MN 55121; phone (612) 454-7250; FAX (612) 454-0766.

•**12-13, Dairy Research Foundation Hosts Hands-On No-Brine Mozzarella Cheese Workshop and Symposium,** Elk Grove Village, IL; For more information, contact the Dairy Research Foundation at (708) 228-0715.

•**16-17, Wheat Gluten: Chemistry and Technology,** sponsored by the American Association of Cereal Chemists, will be held in Kansas City, MO. For more information, contact Marie McHenry, AACC Short Course Coordinator, 3340 Pilot Knob Road, St. Paul, MN 55121; phone (612) 454-7250; FAX (612) 454-0766.

•**18, Dough Modifiers,** sponsored by the American Association of Cereal Chemists, will be held in Kansas City, MO. For more information, contact Marie McHenry, AACC Short Course Coordinator, 3340 Pilot Knob Road, St. Paul, MN 55121; phone (612) 454-7250; FAX (612) 454-0766.

•**18-21, U.S. Dairy Forum,** sponsored by the International Dairy Foods Association, will be held at La Quinta Resort and Club in Palm Springs, CA. For more information, call (202) 737-IDFA.

•**19, Food Surfactants,** sponsored by the American Association of Cereal Chemists, will be held in Kansas City, MO. For more information, contact Marie McHenry, AACC Short Course Coordinator, 3340 Pilot Knob Road, St. Paul, MN 55121; phone (612) 454-7250; FAX (612) 454-0766.

•**23-25, The 1995 Conference on Sustainable Agriculture,** sponsored by The Council for Agricultural and Sciene Technology (CAST), is the premier event of 1995 that will bring together scientists, producers, interest groups, industry and federal policy makers to address the critical social, economic and political issues facing sustainable development in and around agriculture. For more information, contact Richard E. Stuckey at (515) 292-2125.

FEBRUARY

•**6-9, Freezing Technology Short Course,** on the UC-Davis Campus. This intensive course teaches the fundamentals of freezing specific commodities and includes hands-on demonstrations. To enroll or request more information, call toll-free in California (800) 752-0881. Outside of California, call (916) 757-8777.

•**8-10, Eighth Australian Food Microbiology Conference** to be held in Melbourne. Utilizing a mixture of local and international speakers, drawn from the key areas of the industry, Academia and Research, the aim of this conference is to provide a wide range of topics of interest to the Food Microbiology Industry. In addition, a poster session will be conducted. For more information, contact Kim King, Conference Secretariat, Food Micro '95, GPO Box 128, Sydney NSW 2001, Australia; phone (612) 262-2277; FAX (612) 262-2323.

•**8-10, 10th Annual Freezing Technology for the Frozen Food Industry,** The fee is $555 which includes three lunches and one dinner. Enroll in section 943E300. To enroll or request more information, contact Sharon Munowitch, University Extension, University of California, Davis, CA 95616 or call (916) 757-8899.

•**12-15, International Symposium on Computer Mapping in Epidemiology and Environmental Health,** Tampa, FL; hosted by the World Computer Graphics Foundation — The University of South Florida. For more information, call (813) 974-2386.

•**13-14, 4th Annual Cheese Symposium to Introduce Product Research Results,** to be held in Burlingame, CA. The conference focuses on the latest developments in cheese science and technology, and introduces the results of dairy products related research. To enroll or request more information, call toll-free in California (800) 752-0881. Outside of California, call (916) 757-8777.

•**22-25, Pharmaceutical Technology, Current Good Manufacturing Practice (cGMP) for Quality Control Laboratory Personnel,** to be held in San Francisco Bay Area, CA. This course provides knowledge about, and an understanding of regulations for drugs and finished pharmaceuticals as they relate to quality control, FDA inspections of quality control laboratories, QC responsibility for clinical trial material and the impact on the industry of "U.S. vs. Barr Laboratories, Inc." To enroll or request more information, call toll-free in California (800) 752-0881. Outside of California, call (916) 757-8777.

•**22-Mar. 2, Pharmaceutical Technology, Project Management in Pharmaceutical Development,** East Brunswick, NJ. This course focuses on making project management effective across the spectrum of applications so that product development scheduling and resource utilization are enchanced. To enroll or request more information, call toll-free in California (800) 752-0881. Outside of California, call (916) 757-8777.

•**22-26, Food Technology: Flavors: Their Creation, Definitions and Use ,** a short course to provide an understanding of the nature of flavorings, color and colorings. For more information contact Registrar, The Center for Professional Advancement, P. O. Box 1052, East Brunswick, NJ 08816; phone (908) 613-4500; FAX (908) 238-9113.

•**27-Mar. 1, Pharmaceutical Technology, Current Good Manufacturing Practice (cGMP) for the Pharmaceutical and Allied Industries;** East Brunswick, NJ. Topics covered will include not only the legal requirements for cGMP in the Federal Food, Drug, and Cosmetic Act but primarily the practical "how to" of purchasing, manufacturing, packaging, labeling and QA/QC, as well as training production personnel in cGMP. To enroll or request more information, call toll-free in California (800) 752-0881. Outside of California, call (916) 757-8777.

•**25-Mar. 1, AFFI's Western Frozen Food Convention,** Monterey, Cal.; featuring Guy Vander Jagt — For more information, contact AFFI's Convention Office at (415) 697-6835.

•**27-Mar. 2, Food Technology, Sensory Evaluation,** East Brunswick, NJ. For more information contact Registrar, The Center for Professional Advancement, P. O. Box 1052, East Brunswick, NJ 08816; phone (908) 613-4500; FAX (908) 238-9113.

27-Mar. 2, Better Process Control School, a course to be offered by UC-Davis campus. The fee is $475.00 and includes four lunches and the text. For more information or to enroll, call toll-free in California (800) 752-0881. Outside California, call (916) 757-8777.

MARCH

•**2-3, Food Technology, Regulatory Compliance for the Food Industry,** East Brunswick, NJ. For more information contact: Registry, The Center for Professional Advancement, P. O. Box 1052, East Brunswick, NJ 08816; phone (908) 613-4500; FAX (908) 238-9113.

•**2-3, Pharmaceutical Technology, Writing Standard Operating Procedures to Meet cGMP Requirements,** East Brunswick, NJ. Acquire a better understanding of what the FDA is looking for, methods used for compiling information, assignment of responsibility for departmental procedures, instruction on technical writing, new plant start-up, and plant revision, or companies experiencing rapid growth or expansion. To enroll or request more information, call toll-free in California (800) 752-0881. Outside of California, call (916) 757-8777.

•**2-4, Introduction to Statistical Methods for Sensory Evaluation of Foods,** a course to be offered at the UC-Davis campus. The fee is $575.00 and includes one dinner, two lunches and the course text or manual. For more information or to enroll, call toll-free in California (800) 752-0881. Outside California, call (916) 757-8777.

•**3, The Baking Industry Sanitation Standards Commmittee 1995 Annual Membership Meeting,** at the Chicago Marriott Hotel. For more information contact the BISSC headquarters, 401 N. Michigan Ave., Chicago, IL 60611; phone (312) 644-6610.

•**6-7, Pharmaceutical Technology, Preparing Clinical Protocols and Managing Clinical Investigations,** East Brunswick, NJ. The purpose of this course is to give participants guidance and workshop expeerience, along with an understanding of government regulations pertaining to clinical protocols. To enroll or request more information, call toll-free in California (800) 752-0881. Outside of California, call (916) 757-8777.

•**6-8, Principles of Cereal Science,** a short course sponsored by American Association of Cereal Chemists will be held in Los Angeles, CA. For more information, contact Marie McHenery, AACC

Short Course Coordinator, 3340 Pilot Knob Road, St. Paul, MN 55121; phone (612) 454-7250; FAX (612) 454-0766.

•**6-8, Sensory Evaluation: Overview and Update,** an additional course offered at the UC-Davis campus. The fee is $55.00, or $1,000 to attend both this and the "Introduction to Statistical Methods for Sensory Evaluation of Foods." For more information or to enroll, call toll-free in California (800) 752-0881. Outside California, call (916) 757-8777.

•**8-10, Pharmaceutical Technology, Practical Considerations in Preparing Investigational New Drug and New Drug Applications (IND/NDA'S),** East Brunswick, NJ. This continually updated course meets the need for advanced information on preparing IND applications and NDAs in compliance with the most recent regulations. To enroll or request more information, call toll-free in California (800) 752-0881. Outside of California, call (916) 757-8777.

•**13-15, Pharmaceutical Technology, Drug Product Stability and Shelf-Life,** East Brunswick, NJ. The objective of this course is to explore fundamentals of current principles and practice concerning the stability of pharmaceutical and costmetic products. To enroll or request more information, call toll-free in California (800) 752-0881. Outside of California, call (916) 757-8777.

•**13-15, Food Technology, Confectionery and Chocolate Production,** East Brunswick, NJ. For more information contact: Registry, The Center for Professional Advancement, P. O. Box 1052, East Brunswick, NJ 08816; phone (908) 613-4500; FAX (908) 238-9113.

•**13-15, Food Technology, Microwave and RF Technology,** East Brunswick, NJ. For more information contact: Registry, The Center for Professional Advancement, P. O. Box 1052, East Brunswick, NJ 08816; phone (908) 613-4500; FAX (908) 238-9113.

•**15-17, Pharmaceutical Technology, Stabilization of Protein Drugs, Biologics and Devices,** East Brunswick, NJ. The objective of this course is to present current data relevant to the successful development of stable protein drugs, biologics, and devices. To enroll or request more information, call toll-free in California (800) 752-0881. Outside of California, call (916) 757-8777.

•**20-22, Food Technology, Food Irradiation Technology,** Fort Lauderdale, The Center for Professional Advancement, P. O. Box 1052, East Brunswick, NJ 08816; phone (908) 613-4500; FAX (908) 238-9113.

•**21-23, AFFI's Spring Convocation of Committees,** For more information, contact AFFI's Convention Office at (703) 821-0770.

•**23-24, Pharmaceutical Technology, The FDA Investigator Cometh,** East Brunswick, NJ. Recommended actions to be taken before, and after an investigation are outlined in this course. To enroll or request more information, call toll-free in California (800) 752-0881. Outside of California, call (916) 757-8777.

•**25-26, Getting Started in the Specialty Food Business,** a course to be offered at the UC-Davis campus. The fee is $345.00 and includes two lunches, social and the course text. For more information or to enroll, call toll-free in California (800) 752-0881. Outside California, call (916) 757-8777.

•**27-29, Pharmaceutical Technology, Contracting the Manufacture and Packing of Pharmaceuticals;** East Brunswick, NJ. To enroll or request more information, call toll-free in California (800) 752-0881. Outside of California, call (916) 757-8777.

•**27-29, Food Technology, Food Hydrocolloids,** East Brunswick, NJ. For more information contact: Registry, The Center for Professional Advancement, P. O. Box 1052, East Brunswick, NJ 08816; phone (908) 613-4500; FAX (908) 238-9113.

•**27-29, Maintaining Quality and Safety of Fresh Cut Produce,** a course focuses on the physiological, biochemical and microbiological factors that influence quality and safety of fresh-cut (lightly processed) fruits and vegetables. For time and free information call (800) 752-0881. Outside California, call (916) 757-8777.

APRIL

•**3-5, Food Technology, Good Manufacturing Practice (GMP) for the Food Industry ,** This is an introductory course in the laws and regulations enforced by the U.S. Food and Drug Administration as they relate to the processing of foods. For more information, contact Registrar, The Center for Professional Advancement, P. O. Box 1052, East Brunswick, NJ 08816; Phone (908) 613-4500; FAX (908) 238-9113.

•**3-5, Pharmaceutical Technology, Current Good Manufacturing Practice (cGMP) for the Pharmaceutical and Allied Industries;** San Francisco Bay Area, CA. Topics covered will include not only the legal requirements for cGMP in the Federal Food, Drug, and Cosmetic Act but primarily the practical "how to" of purchasing, manufacturing, packaging, labeling and QA/QC, as well as training production personnel in cGMP. To enroll or request more information, call toll-free in California (800) 752-0881. Outside of California, call (916) 757-8777.

•**3-5, Pflug's Microbiology and Engineering of Sterilization Processes;** this intensive lecture problem course is for degreed scientists and technical managers involved in the research, development and manufacture of sterilized food, pharmaceutical products and medical devices. For more information, contact Dr. William Schafer, course coordinator, Department of Food Science and Nutrition, 1334 Eckles Ave., St. Paul, MN 55108; Phone (612) 624-4793.

•**6-7, Pharmaceutical Technology, Writing Standard Operating Procedures to Meet cGMP Requirements,** East Brunswick, NJ. Acquire a better understanding of what the FDA is looking for, methods used for compiling information, assignment of responsibility for departmental procedures, instruction on technical writing, new plant start-up, and plant revision, or companies experiencing rapid growth or expansion. To enroll or request more information, call toll-free in California (800) 752-0881. Outside of California, call (916) 757-8777.

•**6-7, Pharmaceutical Technology, The FDA Investigator Cometh,** East Brunswick, NJ. Recommended actions to be taken before, and after an investigation are outlined in this course. To enroll or request more information, call toll-free in California (800) 752-0881. Outside of California, call (916) 757-8777.

•**10-12, Food Technology, Food Extrusion Technology,** This course is designed to provide a thorough background in extrusion principles and practice. For more information, contact Registrar, The Center for Professional Advancement, P. O. Box 1052, East Brunswick, NJ 08816; Phone (908) 613-4500; FAX (908) 238-9113.

•**23-25, AFFI's Mid-Year Board of Directors Meeting,** For more information, contact AFFI's Convention Office at (703) 821-0770.

Advertising Index

To assure that your meeting time is published, send announcements at least 90 days in advance to: IAMFES, 6200 Aurora Avenue, Suite 200W, Des Moines, IA 50322-2838.

IAMFES Offers the Northeast Dairy Practices Council (NDPC) *"Guidelines for the Dairy Industry"*

At the urging of our **Dairy Quality and Safety Professional Development Group,** IAMFES has entered into an agreement with the Northeast Dairy Practices Council (NDPC) to distribute their *"Guidelines for the Dairy Industry."* NDPC is a non-profit organization of education, industry and regulatory personnel concerned with milk quality and sanitation throughout 15 northeastern/ mid-Atlantic states. Interestingly, its membership and subscriber rosters list individuals and organizations throughout the United States, Canada and Japan.

For the past 25 years, NDPC'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 fluid milk and manufactured dairy products.

The NDPC Guidelines are written by professionals who comprise five permanent Task Forces. Prior to distribution, every Guideline is submitted for approval to the key milk control sanitarian in each of the 15 states which are now active participants in the NDPC process. Should any official have an exception to a section of a proposed guideline, that exception is noted in the final document.

Although the Guidelines are developed east of the Mississippi River, clearly they have a high degree of applicability wherever cows are milked and milk is transported, processed and distributed.

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

The entire set consists of 48 guidelines including:

1 Dairy Cow Free Stall Housing
2 Effective Installation, Cleaning and Sanitizing of Milking Systems
3 Selected Personnel in Milk Sanitation
7 Sampling Fluid Milk
8 NE Ext. Publ., Conferences, Short Courses, Correspondence Courses and Visual Aids in Dairying
9 Fundamentals of Cleaning and Sanitizing Farm Milk Handling Equipment
10 Fluid Milk Shelf-Life
11 Sediment Testing and Producing Clean Milk
13 Environmental Air Control & Quality for Dairy Food Plants
14 Clean Room Technology
16 Handling Dairy Products From Processing to Consumption
17 Causes of Added Water in Milk
18 Abnormal Milk--Fieldman's Approach
21 Raw Milk Quality Tests
22 Control of Antibacterial Drugs and Growth Inhibitors in Milk and Milk Products
23 Preventing Rancid Flavors in Milk
24 Troubleshooting High Bacteria Counts of Raw Milk
25 Cleaning and Sanitizing Bulk Pickup and Transport Tankers
28 Troubleshooting Residual Films on Dairy Farm Milk Handling Equipment
29 Cleaning and Sanitizing in Fluid Milk Processing Plants
30 Potable Water on Dairy Farms
31 Composition and Nutritive Value of Dairy Products
32 Fat Test Variations in Raw Milk
33 Brucellosis and 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 Installation
42 Stray Voltage on Dairy Farms
43 Farm Tank Calibrating and Checking
44 Troubleshooting Dairy Barn Ventilation Systems
45 Gravity Flow Gutters for Manure Removal in Milking Barns
46 Dairy Odor Control
47 Naturally Ventilated Dairy Cattle Housing
48 Cooling Milk on the Farm
49 Postmilking Teat Dips
50 Farm Bulk Milk Collection Procedures
51 Controlling the Accuracy of Electronic Testing Instruments for Milk Components
52 Emergency Action Plan for Outbreak of Milkborne Illness in the Northeast
53 Vitamin Fortification of Fluid Milk Products
54 Selection and Construction of Herringbone Milking Parlors
56 Dairy Product Safety (Relating to Pathogenic Bacteria)
57 Dairy Plant Sanitation
58 Sizing Dairy Farm Water Heater Systems

If purchased individually, the entire set would cost $174. We are offering the set, packaged in three loose leaf binders for $125 plus $9 shipping and handling (outside the U.S., $21 for shipping and handling).
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 IAMFES.

Please enclose $125 plus $9 shipping and handling for each set of Guidelines. Shipments outside the U.S. are $125 plus $21 shipping and handling.

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 of Milk, Food and Environmental Sanitarians, Inc.

IAMFES Booklets

Quantity		Total $
_____	Procedures to Investigate Waterborne Illness $6.00/member; $9.00/non-member	_____
_____	Procedures to Investigate Foodborne Illness - 4th Edition $6.00/member; $9.00/non-member	_____
_____	Procedures to Investigate Arthropod-borne and Rodent-borne Illness $6.00/member; $9.00/non-member	_____
_____	Procedures to Implement the Hazard Analysis Critical Control Point System $6.00/member; $9.00/non-member	_____
_____	Pocket Guide To Dairy Sanitation $.50/member; $.75/non-member (minimum order of 10) ($2.50 shipping for each order of 10)	_____

Multiple copies available at reduced prices.
Phone our order desk for pricing information on quantities of 11 or more.

Shipping/Handling
U.S. $2.00 for first item. $1.00 for each additional item
Outside U.S. $4.00 for first item. $1.00 for each additional item _____

Booklet Total _____

3-A Sanitary Standards

Quantity		Total $
_____	Complete set 3-A Dairy Standards $48 member; $72 non-member	_____
_____	Complete set 3-A Dairy & Egg Standards $70 member; $105 non-member	_____
_____	3-A Egg Standards $40 member; $60 non-member	_____
_____	Five-year Update Service on 3-A Sanitary Standards 3-A Dairy & Egg Standards $62 member; $93 non-member	_____

Shipping/Handling
U.S. $6.25 each item
Outside U.S. $10.25 each item _____

3-A Sanitary Standards Total _____

PRINT OR TYPE . . . ALL AREAS MUST BE COMPLETED IN ORDER TO BE PROCESSED

Name _____ (FIRST MI LAST) Company Name _____

Job Title _____ Office Phone # _____

Address _____ FAX # _____

City _____ State/Province _____ Country _____ Postal Code _____

MAIL ENTIRE FORM TO:

IAMFES
6200 AURORA AVENUE, STE 200W
DES MOINES, IA 50322-2838

OR USE YOUR CHARGE CARD
515-276-3344
800-369-6337
FAX 515-276-8655

U.S. FUNDS on U.S. BANK

PAYMENT MUST BE ENCLOSED IN ORDER TO PROCESS

____ CHECK OR MONEY ORDER
____ MASTERCARD
____ VISA
____ AMERICAN EXPRESS

CARD # _____

EXPIRATION DATE _____

YOUR SIGNATURE _____

To receive information on membership with IAMFES Circle 360 on this card

IAMFES

DFES
12/94

International Association of Milk, Food and Environmental Sanitarians Inc

Reader requests for information are sent to the appropriate company. Follow-up on reader requests are the responsibility of the company advertising.

The Advertisements included herein are not necessarily endorsed by the International Association of Milk, Food and Environmental Sanitarians, Inc.

Name _____ Title _____

Company _____

Address _____

City _____ State/Prov. _____

Country _____ Zip _____

Phone Number _____

Please send information on items circled below: Deadline 60 days from issue date

101	114	127	140	153	166	179	192	205	218	231	244	257	270	283	296	309	322	335	348
102	115	128	141	154	167	180	193	206	219	232	245	258	271	284	297	310	323	336	349
103	116	129	142	155	168	181	194	207	220	233	246	259	272	285	298	311	324	337	350
104	117	130	143	156	169	182	195	208	221	234	247	260	273	286	299	312	325	338	351
105	118	131	144	157	170	183	196	209	222	235	248	261	274	287	300	313	326	339	352
106	119	132	145	158	171	184	197	210	223	236	249	262	275	288	301	314	327	340	353
107	120	133	146	159	172	185	198	211	224	237	250	263	276	289	302	315	328	341	354
108	121	134	147	160	173	186	199	212	225	238	251	264	277	290	303	316	329	342	355
109	122	135	148	161	174	187	200	213	226	239	252	265	278	291	304	317	330	343	356
110	123	136	149	162	175	188	201	214	227	240	253	266	279	292	305	318	331	344	357
111	124	137	150	163	176	189	202	215	228	241	254	267	280	293	306	319	332	345	358
112	125	138	151	164	177	190	203	216	229	242	255	268	281	294	307	320	333	346	359
113	126	139	152	165	178	191	204	217	230	243	256	269	282	295	308	321	334	347	360

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

IAMFES

DFES
12/94

International Association of Milk, Food and Environmental Sanitarians Inc

Reader requests for information are sent to the appropriate company. Follow-up on reader requests are the responsibility of the company advertising.

The Advertisements included herein are not necessarily endorsed by the International Association of Milk, Food and Environmental Sanitarians, Inc.

Name _____ Title _____

Company _____

Address _____

City _____ State/Prov. _____

Country _____ Zip _____

Phone Number _____

Please send information on items circled below: Deadline 60 days from issue date

101	114	127	140	153	166	179	192	205	218	231	244	257	270	283	296	309	322	335	348
102	115	128	141	154	167	180	193	206	219	232	245	258	271	284	297	310	323	336	349
103	116	129	142	155	168	181	194	207	220	233	246	259	272	285	298	311	324	337	350
104	117	130	143	156	169	182	195	208	221	234	247	260	273	286	299	312	325	338	351
105	118	131	144	157	170	183	196	209	222	235	248	261	274	287	300	313	326	339	352
106	119	132	145	158	171	184	197	210	223	236	249	262	275	288	301	314	327	340	353
107	120	133	146	159	172	185	198	211	224	237	250	263	276	289	302	315	328	341	354
108	121	134	147	160	173	186	199	212	225	238	251	264	277	290	303	316	329	342	355
109	122	135	148	161	174	187	200	213	226	239	252	265	278	291	304	317	330	343	356
110	123	136	149	162	175	188	201	214	227	240	253	266	279	292	305	318	331	344	357
111	124	137	150	163	176	189	202	215	228	241	254	267	280	293	306	319	332	345	358
112	125	138	151	164	177	190	203	216	229	242	255	268	281	294	307	320	333	346	359
113	126	139	152	165	178	191	204	217	230	243	256	269	282	295	308	321	334	347	360

Place
Stamp
Here

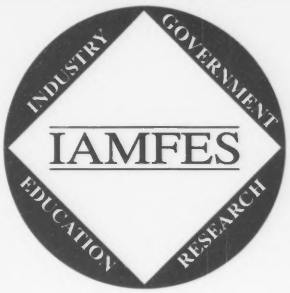
IAMFES

200W Merle Hay Centre
6200 Aurora Ave.
Des Moines, Iowa 50322

Place
Stamp
Here

IAMFES

200W Merle Hay Centre
6200 Aurora Ave.
Des Moines, Iowa 50322



This is Your Personal Invitation to Join

The International Association of Milk, Food and Environmental Sanitarians, founded in 1911, is a non-profit educational association of food protection professionals. The IAMFES is dedicated to the education and service of its members, specifically, as a well as industry personnel in general. Through membership in the Association, IAMFES members are able to keep informed of the latest scientific, technical and practical developments in food protection. IAMFES provides its members with an information network and forum for professional improvement through its two scientific journals, educational annual meeting and interaction with other food safety professionals.

Who are IAMFES Members?

The Association is comprised of a diverse membership of over 3,500 from 38 nations. IAMFES members belong to all facets of the food protection arena. The main groups of Association members fall into three categories: Industry Personnel, Government Officials and Academia.

Why are They IAMFES Members?

The diversity of its membership indicates that IAMFES has something to offer everyone involved in food protection and public health. INFORMATION is that offering.

Your Benefits as an IAMFES Member

Dairy, Food and Environmental Sanitation — Published monthly, this is the official journal of IAMFES. Its purpose is the disseminating of current information of interest to the general IAMFES membership. Each issue contains three to five informational applied research or general interest articles, industry news and events, association news, columns on food safety and environmental hazards to health, a food and dairy industry related products section, and a calendar of upcoming meetings, seminars and workshops. All regular IAMFES members receive this publication as part of their membership.

Journal of Food Protection — A refereed monthly publication of scientific research and authoritative review articles. Each issue contains 12 to 15 technical research manuscripts and one to five articles reporting a wide variety of microbiological research pertaining to food safety and quality. The *Journal of Food Protection* is internationally recognized as one of the leading publications in the food and dairy microbiology fields. This journal is available to all individuals with the Member *Plus* option.

The IAMFES Annual Meeting — Held in a different city each year, the IAMFES Annual Meeting is a unique educational event. Three days of technical sessions, scientific symposia and commercial exhibits provide members and other industry personnel with over 100 presentations on the most current topics in food protection. It offers the opportunity to discuss new technologies and innovations with leading authorities in various fields concerned with food safety. IAMFES members receive a substantially reduced registration fee.

To Find Out More...

To learn more about IAMFES and the **many** other benefits and opportunities available to you as a member, please call (515) 276-3344.

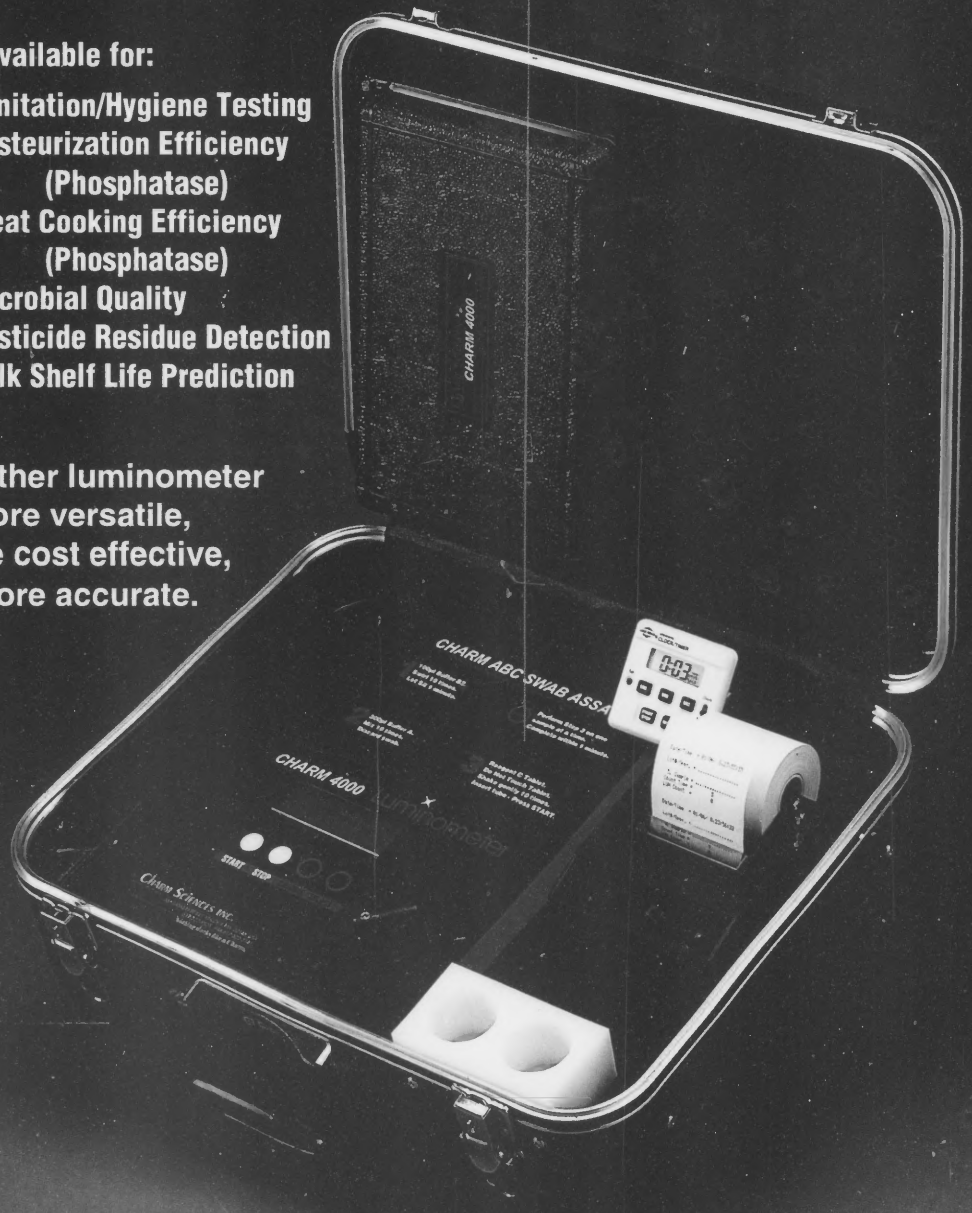
Supercharge your HACCP program...

The Charm 4000

Kits available for:

- **Sanitation/Hygiene Testing**
- **Pasteurization Efficiency (Phosphatase)**
- **Meat Cooking Efficiency (Phosphatase)**
- **Microbial Quality**
- **Pesticide Residue Detection**
- **Milk Shelf Life Prediction**

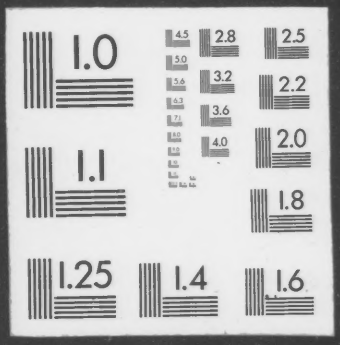
No other luminometer is more versatile, more cost effective, or more accurate.



CHARM SCIENCES INC.
36 FRANKLIN STREET MALDEN MA 02148 USA
800 343-2170 FAX 617 322-3141

Nothing works like a Charm.

Please circle No. 186 on your Reader Service Card


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
6.3
7
8
9
10
11
12
14