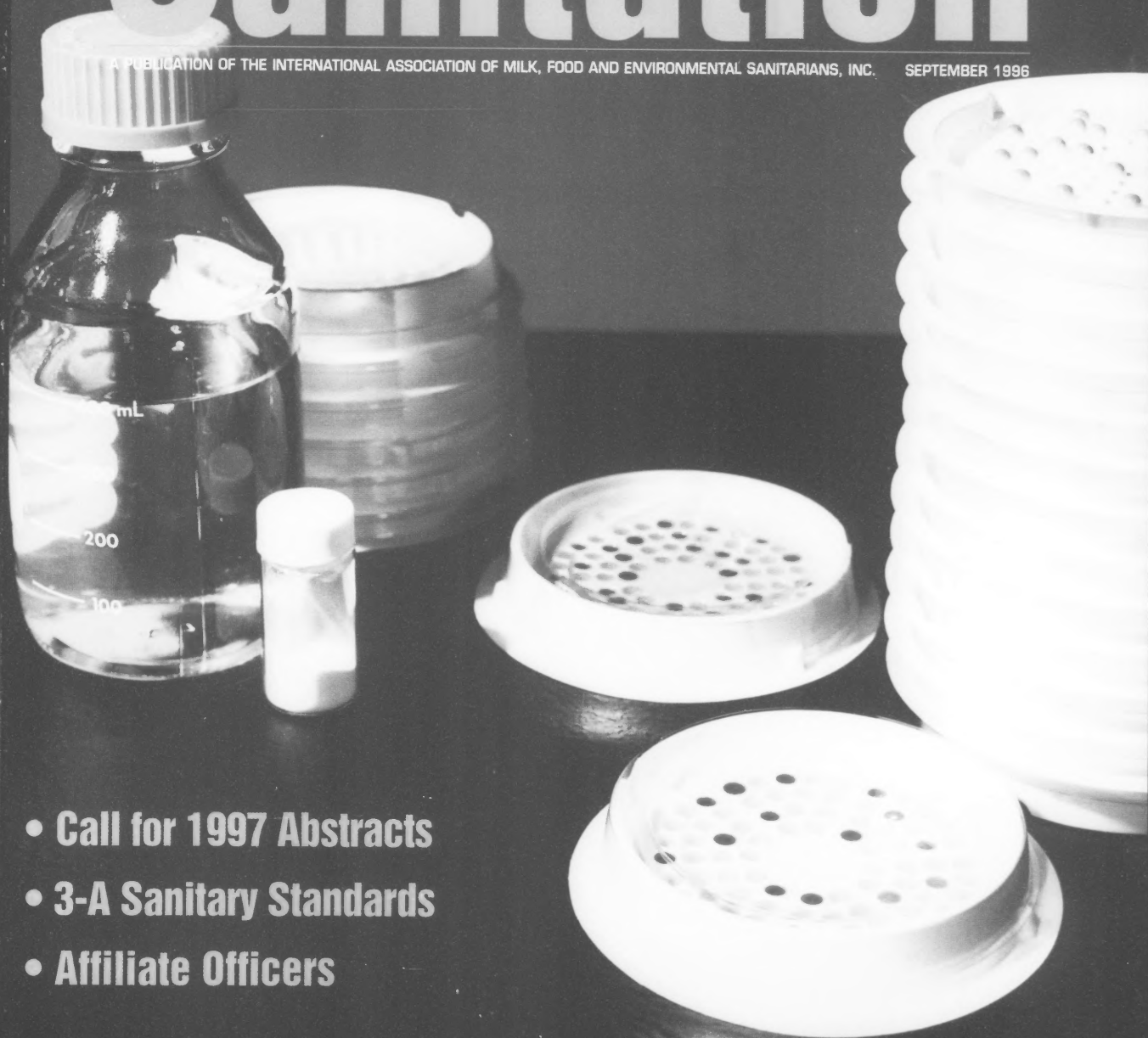


DAIRY, FOOD AND ENVIRONMENTAL

Sanitation

A PUBLICATION OF THE INTERNATIONAL ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL SANITARIANS, INC. SEPTEMBER 1996



- Call for 1997 Abstracts
- 3-A Sanitary Standards
- Affiliate Officers

DISCOVER HIGHER SANITATION STANDARDS WITH HY-LiTE ATP MONITORING.

HY-LiTE™

Call for Your FREE
HY-LiTE Demonstration Video

NO REAGENT MIXING

UNIQUELY UNITIZED REAGENT STORAGE
AND DISPENSING TECHNOLOGY.

CONVENIENT & PORTABLE

CHOICE OF PORTABLE WORKSTATION OR
LIGHTWEIGHT SHOULDER BAG.

EXCELLENT PRECISION

MORE REPEATABLE AND 7 TIMES MORE
SENSITIVE THAN THE LEADING ATP SYSTEM.

VERSATILE SAMPLING OF LIQUIDS & SURFACES

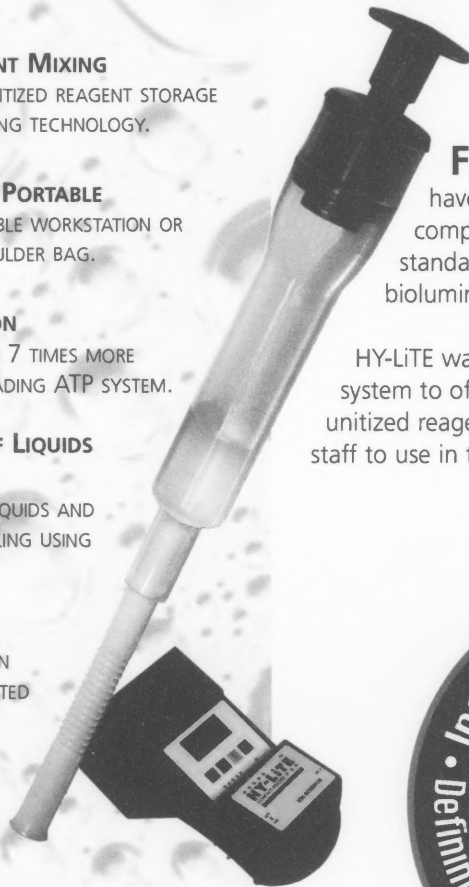
DIRECT SAMPLING OF CIP LIQUIDS AND
CONVENIENT SURFACE SAMPLING USING
ONE PEN TECHNOLOGY.

RUGGED TEST PROCEDURE

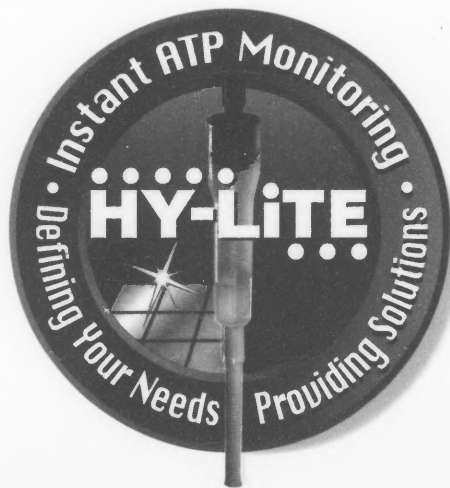
STEP-WISE REAGENT INTRODUCTION
ALLOWS THE TEST TO BE INTERRUPTED
WITHOUT SACRIFICING INTEGRITY
OF RESULTS.

For 5 years, HY-LiTE systems
have guided over 500 food
companies to higher sanitation
standards, with state-of-the-art ATP
bioluminescence technology.

HY-LiTE was the first ATP monitoring
system to offer a simple and dependable
unitized reagent device, for non-technical
staff to use in the plant.



480 DEMOCRAT ROAD
GIBBSTOWN, NEW JERSEY 08027
1-800-222-0342 FAX: 609-423-4389



Please circle No. 134 on your Reader Service Card

Read any good books lately?

If you have recently read or heard about an interesting and informative book relative to food science, safety, or sanitation, and would like to recommend it for our **Book Review Column**, please contact:

Managing Editor
Dairy, Food and Environmental Sanitation
6200 Aurora Avenue
Suite 200W
Des Moines, Iowa 50322-2863
Telephone: (515) 276-3344 or (800) 369-6337.



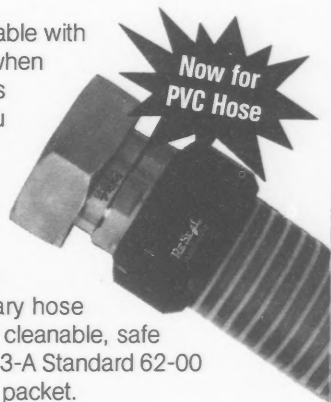
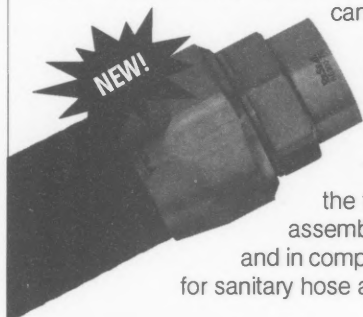
Totally Sanitary Totally Reusable



The New **RESEAL™** Sanitary Hose System

A totally sanitary environment for your food or beverage product, now available with the cost-savings of reusable ends! That's right. With the ReSeal™ system, when your hose assembly gets kinked, run over or simply wears out, the couplers can be reattached to a new length of hose. You still have to buy the hose . . . but you don't have to buy new couplers. That's usually a savings of 50% to 90% over the price of a complete new assembly!

The innovative ReSeal™ system provides all the features you've come to expect in a sanitary hose assembly: sanitary full-flow compression seal, CIP cleanable, safe and in compliance with regulatory standards — including 3-A Standard 62-00 for sanitary hose assemblies. Call today for a free information packet.



**NELSON
JAMESON**
INC.

Nelson-Jameson, Inc.
2400 E. 5th St., P.O. Box 647
Marshfield, WI 54449

Phone 800/826-8302

FAX 800/472-0840

Reader Service No. 173

ABOUT THE COVER...

Photo courtesy of IDEXX Laboratories. SimPlate™, the new 24-hour, easy-reading test for quantifying bacteria. Pictured is the Coliform/*E. coli* test (red wells indicate the presence of coliforms).

DAIRY, FOOD AND ENVIRONMENTAL

Sanitation

A PUBLICATION OF THE INTERNATIONAL ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL SANITARIANS, INC.

ARTICLES

- Redox Potential in Deli Foods: Botulism Risk?** 546
O. Peter Snyder, Jr.
- Implementation of a HACCP Program in a Commercial Fresh-Market Tomato Packinghouse: A Model for the Industry** 549
James W. Rushing, Frederick J. Angulo, and Larry R. Beuchat
- HACCP and HAZOP for a Pulsed Electric Field Processing Operation** 554
Humberto Vega-Mercado, Lloyd O. Luedecke, Gary M. Hyde, Gustavo V. Barbosa-Cánovas, and Barry G. Swanson
- Book Review: Poultry Products Technology** 561
George J. Moutney and Carmen R. Parkhurst

ASSOCIATION NEWS

- Sustaining Members 539
- Off the Top From the President 542
- Perspectives From the Executive Director 544
- New IAMFES Members 568
- IAMFES Affiliate Officers 570

DEPARTMENTS

- Updates 573
- News 575
- Industry Products 579
- Business Exchange 583
- Coming Events 605
- Advertising Index 606

EXTRAS

- Call for 1997 Abstracts 562
- Developing Scientist Awards Competitions 564
- IAMFES Commercialism Policy 566
- 3-A Sanitary Standards: No. 17-08, 02-09, and Amendment 20-17 584
- IAMFES Booklet Form 607
- IAMFES Membership Application 608

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

The Power to See **Bacteria** As You've Never Seen Them Before. And We Put It on Your Lab Bench.



The RiboPrinter™ System is one of a kind.

The RiboPrinter™ Microbial Characterization System *automatically* produces a genetic fingerprint of a bacterium in less than eight hours. This "molecular typing lab in a box" from Qualicon™ gives you reliable, reproducible information about your microbial environment. So you can explore epidemiology, monitor manufacturing processes and target decontamination activities with unprecedented ease.

Qualicon™ is changing the way microbiology is done.

Qualicon™, a subsidiary of the DuPont Company, is creating new ways to meet your microbial quality and safety needs. We're putting the power of advanced genetics-based technology in your hands.

Let us help you streamline your operations by providing better quality information faster and more conveniently than ever before. To learn more or to send samples to the Qualicon™ Molecular Typing Lab,

Call us at
1-800-863-6842.



Reader Service No. 229

Qualicon, L.L.C., Route 141 and Henry Clay Road, P.O. Box 80357, Wilmington, DE 19880-0357, Tel. 800-863-6842, Fax 302-695-9027

SEPTEMBER 1996 - Dairy, Food and Environmental Sanitation **535**

Why settle for
just a



when you
could have
the whole



Receiving monthly issues of *Dairy, Food and Environmental Sanitation* is just one of the many benefits of being a member of the International Association of Milk, Food and Environmental Sanitarians.

To find out what you've been missing and how you can join IAMFES, please contact:
Julie Cattanach, Membership Coordinator,
IAMFES, 6200 Aurora Avenue, Suite 200W,
Des Moines, Iowa 50322-2863;
telephone (515) 276-3344 or (800) 369-6337;
fax (515) 276-8655.

DAIRY, FOOD AND ENVIRONMENTAL

Sanitation

A PUBLICATION OF THE INTERNATIONAL ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL SANITARIANS, INC.

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. Each volume comprises 12 numbers. Printed by Heuss Printing, Inc., 911 N. Second Street, Ames, IA 50010, USA. Periodical 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 50322-2863, USA.

IAMFES, Inc., Mailing Address: 6200 Aurora Avenue, Suite 200W, Des Moines, IA 50322-2863, USA.

Manuscripts: Correspondence regarding manuscripts and other reading materials should be addressed to Carol F. Mouchka, Managing Editor, IAMFES, Inc.

News Releases, Updates and Cover Photos: Correspondence for press releases should be sent to Donna Bahun, Publication Specialist, IAMFES, Inc.

"Instructions to Contributors" can be obtained from Michelle Sproul, Publication Assistant, IAMFES, Inc.

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

Reprint Permission: Questions regarding permission to reprint any portion of **Dairy, Food and Environmental Sanitation** should be addressed to: Managing Editor, IAMFES, Inc.

Business Matters: Correspondence regarding business matters should be addressed to David W. Tharp, Director of Finance and Administration, IAMFES, Inc.

Membership Dues: Membership in the Association is available to individuals only. Dues are \$75.00 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 \$120.00. Student membership is \$37.50 per year, with verification of student status, and includes **Dairy, Food and Environmental Sanitation** or **Journal of Food Protection**. Student membership with both journals is \$60.00. No cancellations accepted.

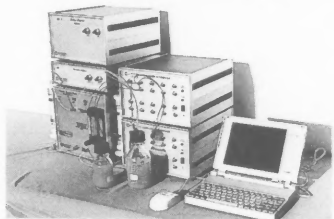
Sustaining Membership: A sustaining membership in IAMFES is available to companies at a rate of \$485.00 per year. For more information, contact IAMFES, Inc.

Subscription Rates: \$140.00 per year. Single copies \$21.00 each. No cancellations accepted. For more information, contact IAMFES, Inc.

Postage: Outside U.S. add \$22.50 per journal for surface delivery; add \$95.00 per journal for air mail delivery. U.S. FUNDS ONLY - ON U.S. BANK. Single copies add \$9.00 per issue.

Claims: Notice of failure to receive copies must be reported within 30 days domestic, 90 days outside U.S. All correspondence regarding changes of address and dues must be sent to IAMFES, Inc.

Universal
**O₂/CO₂ & CH₄ / H₂S / CO
Respirometer**



For measuring gas exchanges (respiration) of bacteria cultures, bioremediation, photosynthesis, respiration of fruits, insects, animals, rancidity, photo-degradation of polymers, etc. Measures gas exchanges in the head space of 1 to 80 liquid or solid samples in chambers of various sizes.

Sensitivity 0.2 μ l (of gas) /h.

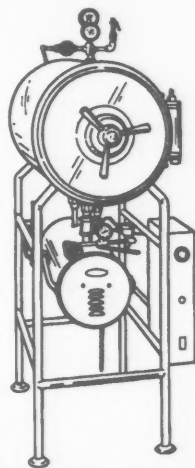
Applicable for aerobic and anaerobic processes. Computerized, real time graphics. 24h operation.

Columbus Instruments

Columbus, OH 43204-2121, USA
ph.(614)276-0861 fax:(614)276-0529
E-mail:75144.2413@compuserve.com

Reader Service No. 123

**Getting Ready to Buy
a New AUTOCLAVE?**



**Call today
toll free
1-800-487-8983**

Authorized Consolidated
Sterilizer Dealer
Since 1967

**LUXERIN LABORATORIES
FOND DU LAC, WI 54935**

Reader Service No. 223

Publish It.

The Editors are seeking articles of general interest and applied research with an emphasis on food safety for publication in *Dairy, Food and Environmental Sanitation*.

Submit your articles to:

Managing Editor
Dairy, Food and Environmental Sanitation
c/o IAMFES, Inc.
6200 Aurora Ave., Suite 200W
Des Moines, Iowa 50322-2863

Please submit three copies of manuscripts along with a fourth copy on 3 1/2" computer disk.



Let your voice be heard!



Do you have an opinion regarding the format and design of *Dairy, Food and Environmental Sanitation*? Why not let us know?

Submit comments to: Managing Editor, *Dairy, Food and Environmental Sanitation*, 6200 Aurora Avenue, Suite 200W, Des Moines, Iowa, 50322-2863; telephone (515) 276-3344 or (800) 369-6337; fax (515) 276-8655.

SCIENTIFIC EDITOR

William LaGrange, Ph.D.
Iowa State University
Department of Food Science
and Human Nutrition
Food Sciences Building
Ames, IA 50011-0001
(515) 294-3156; fax (515) 294-8181
e-mail: foodsci@exnet.isu.edu

IAMFES STAFF

Executive Director

David M. Merrifield

Director of Finance & Administration

David W. Tharp

Accounting Assistant

Bryan Ladd

Managing Editor

Carol F. Mouchka

Publication Specialist

Donna A. Bahun

Publication Assistant

Michelle L. Sproul

Publication Proofreader

Pam Wanninger

Director of Member Services

& Marketing

Rick McAtee

Advertising/Exhibit Account

Executive

Darci Davenport

Advertising/Exhibit Account

Executive

Carolyn L. Rubicam

Membership/Meeting Coordinator

Julie A. Cattanch

Lending Library Coordinator

Tanya Smith

Order Fulfillment/Receptionist

Karla Jordan

COVER PHOTOS

Send your photographs to be considered for publication on the cover of *Dairy, Food and Environmental Sanitation* to:

Donna Bahun, Publication Specialist
IAMFES

6200 Aurora Ave., Suite 200W
Des Moines, IA 50322-2863

Photos will be returned if requested.

DAIRY, FOOD AND ENVIRONMENTAL

Sanitation

IAMFES EXECUTIVE BOARD

President, Michael H. Bradsky, Ontario Ministry of Health, P.O. Box 9000, Terminal A, Toronto, Ontario, Canada M5W 1R5; phone (416) 235-5717; e-mail: brodskm@gov.on.ca

President-Elect, Gale Prince, The Krager Co., 1014 Vine Street, Cincinnati, OH 45202-1100; phone (513) 762-4209; e-mail: gp94343@aol.com

Vice President, Robert E. Brackett, University of Georgia, Center for Food Safety and Quality Enhancement, GA Experiment Station, Griffin, GA 30223-1797; phone (770) 412-4735; e-mail: rbracke@cfsqe.griffin.peachnet.edu

Secretary, Jack Guzewish, New York State Department of Health, Bureau of Community Sanitation and Food Protection, 2 University Place, Room 404, Albany, NY 12203-3399; phone (518) 458-6714; e-mail: jjg01@health.state.ny.us

Past President, F. Ann Draughan, University of Tennessee, Food Science and Technology Department, P.O. Box 1071, Knoxville, TN 37901-1071; phone (423) 974-7425; e-mail: draughan@utk.edu

Affiliate Council Chair, Jahn C. Bruhn, University of California-Davis, Department of Food Science and Technology, 101 Cruess Hall, Davis, CA 95616-8598; phone (916) 752-2192; e-mail: jcb Bruhn@ucdavis.edu

EXECUTIVE DIRECTOR

David M. Merrifield, 6200 Aurora Ave., Suite 200W, Des Moines, IA 50322-2863; phone (515) 276-3344; e-mail: iamfesed@dwx.com

EDITORIAL BOARD

SIDNEY BARNARD	University Park, PA
HAROLD BENGSCHE	Springfield, MO
FLOYD W. BODYFELT	Corvallis, OR
JOHN C. BRUHN	Davis, CA
J.H. BURKETT	Sioux City, IA
WARREN S. CLARK, JR.	Chicago, IL
WILLIAM W. COLEMAN, II ..	St. Paul, MN
OLIVER D. COOK	Rockville, MD
NELSON COX	Athens, GA
RUTH G. FUQUA	Mt. Juliet, TN
THOMAS M. GILMORE	Rackville, MD
DAVID GOMBAS	Arlington Heights, IL
CHARLOTTE W. HINZ	Leray, NY
RICHARD F. JOLLEY	Branford, FL
JAMES W. LITTLEFIELD	Austin, TX
PAUL F. MARTIN	Chicago, IL
JOHN R. MOLENDI	Salisbury, MD
DEBBY L. NEWSLOW	Plymouth, FL
DARYL S. PAULSON	Bazeman, MT
DAVID H. PEPPER	Sioux City, IA
MICHAEL PULLEN	White Bear Lake, MN
J. REEDER	Reston, VA
ROBERT L. SANDERS	Pensacola, FL
P.C. VASAVADA	River Falls, WI

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

Sustaining Members

3M Microbiology Products, 3M Center, Bldg. 275, St. Paul, MN 55144-1000; (612) 733-9558

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

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

Alfa-Laval Agri, Inc., 11100 North Congress Avenue, Kansas City, MO 64153; (816) 891-1528

Applied Research Institute, 29 Platts Hill Road, Newtown, CT 06470; (800) 410-1988

APV Crepaco, 9525 W. Bryn Mawr Ave., Rosemont, IL 60018; (708) 678-4300

ASI Food Safety Consultants, Inc., 7625 Page Blvd., St. Louis, MO 63133; (314) 725-2555

Becton Dickinson Microbiology Systems, Inc., P.O. Box 243, Cockeysville, MD 21030; (410) 584-7188

Bentley Instruments, Inc., 4004 Peavey Road, Chaska, MN 55318; (612) 448-7600

BioControl Systems, Inc., 19805 N. Creek Parkway, Bothell, WA 98011; (206) 487-2055

Biolog, Inc., 3938 Trustway, Hayward, CA 94545; (510) 785-2585

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

Bioscience International, Inc., 11607 Magruder Lane, Rockville, MD 20852-4365; (301) 230-0072

Celsis, Inc., 1801 Maple Ave., BIRL Bldg., Evanston, IL 60201; (847) 467-6600

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

Copesan Services, Inc., 3490 N. 127th St., Brookfield, WI 53005; (800) 267-3726

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

Dairy Quality Control Institute, 5205 Quincy Street, Mounds View, MN 55112-1400; (612) 785-0484

DARDEN RESTAURANTS, P.O. Box 593330, Orlando, FL 32859-3330; (407) 245-5330

Darigold, Inc., 635 Elliott Ave., P.O. Box 79007, W. Seattle, WA 98119; (206) 286-6772

Dean Foods, P.O. Box 7005, Rockford, IL 61101-7005; (815) 962-0647

Decagon Devices, 950 N.E. Nelson Court, P.O. Box 835, Pullman, WA 99163; (509) 332-2756

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

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

Dynal, Inc., 5 Delaware Drive, Lake Success, NY 11042; (516) 326-3270

Ecolab, Inc., Food & Beverage Division, 370 Wabasha St. N., St. Paul, MN 55102; (612) 293-2233

Educational Foundation of the National Restaurant Assn., 250 S. Wacker Drive, Suite 1400, Chicago, IL 60606-3834; (800) 765-2122

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., P.O. Box 3985, Springfield, MO 65808; (417) 881-6114

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

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

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

Gardex Chemicals, Ltd., 7 Meridian Rd., Etobicoke, ON M9W 4Z6; (800) 563-4273

GENE-TRAK Systems, 94 South Street, Hopkinton, MA 01748; (508) 435-7400

Gist-brocades Dairy Ingredients Group, N93 W14560 Whittaker Way, Menomonee Falls, WI 53051; (800) 423-7906

Glo Germ Company, 1120 S. Highway 191, Moab, UT 84532; (800) 842-6622

Great Western Chemical Co., 1717 E. Fargo, Nampa, ID 83687; (208) 466-8437

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

Sustaining Members

IDEXX Laboratories, Inc., 1 Idexx Drive, Westbrook, ME 04092; (207) 856-0300

International BioProducts, Inc., 14780 N.E. 95th Street, Redmond, WA 98052; (206) 883-1349

International Dairy Foods Association, 1250 H Street, N.W., Washington, D.C. 20005; (202) 737-4332

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

Malthus Diagnostics, Inc., 35888 Center Ridge Road, North Ridgeville, OH 44039; (216) 327-2585

Maryland & Virginia Milk Producers Assn., Inc., 1985 Isaac Newton Square South, 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; (310) 928-0553

Mid America Dairymen, Inc., 3253 E. Chestnut Expressway, Springfield, MO 65802-2584

NSF International, 3475 Plymouth Road, Ann Arbor, MI 48105; (313) 769-5523; (313) 769-0109

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

National Mastitis Council, 2820 Walton Commons West, Suite 131, Madison, WI 53704; (608) 224-0622

The National Food Laboratory, 6363 Clark Ave., Dublin, CA 94568; (510) 551-4231

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

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

New Horizons Diagnostics, 9110 Red Branch Road, Columbia, MD 21045; (410) 992-9357

Northland Laboratories, 502 Huron St., Manitowoc, WI 54221; (414) 682-5132

Norton Performance Plastics Corp., P.O. Box 3660, Akron, OH 44309-3660; (216) 798-9240

Organon Teknika, 100 Akzo Avenue, Durham, NC 27712; (919) 620-2000

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

Perstorp Analytical, Inc., 12101 Tech Road, Silver Spring, MD 20904; (301) 680-7248

Pharmacia & Upjohn Animal Health, 7000 Portage Road, Kalamazoo, MI 49001; (616) 385-6726

PRISM, 8300 Executive Center Drive, Miami, FL 33166-4680; (305) 592-6312

Puritan/Churchill Chemical Co., 916 Ashby St., N.W., Atlanta, GA 30318; (404) 875-7331

Qualicon, A DuPont Subsidiary, P.O. Box 80357, Wilmington, DE 19880; (302) 695-2262

R-Tech, P.O. Box 116, Minneapolis, MN 55440-0116; (800) 328-9687

REMEL, L.P., 12076 Santa Fe Dr., Lenexa, KS 66215; (800) 255-6730

Rio Linda Chemical Company, 1902 Channel Dr., West Sacramento, CA 95691-3441; (916) 443-4939

Ross Laboratories, 625 Cleveland Avenue, Columbus, OH 43215; (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 Road, Homewood, IL 60430; (708) 957-7878

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

Tekmar Co., P.O. Box 429576, Cincinnati, OH 45242-9576; (513) 247-7000

Unipath Co., Oxoid Division, 800 Proctor Ave., Ogdensburg, NY 13669-2205; (800) 567-8378

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

Wal-Mart Stores, Inc., 702 S.W. 8th St., Bentonville, AR 72712; (501) 273-4903

Warren Analytical Laboratory, 650 'O' St., P.O. Box G, Greeley, CO 80632; (800) 945-6669

Weber Scientific, 2732 Kuser Road, Hamilton, NJ 08691-9430; (609) 584-7677

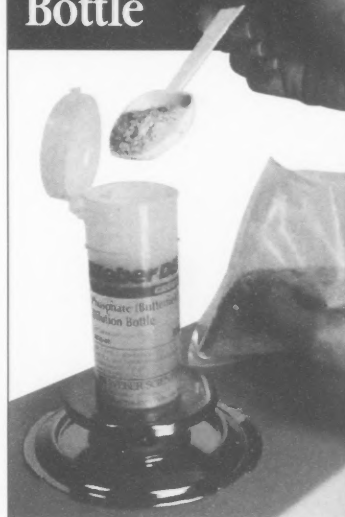
Zep Manufacturing Co., 1310 Seaboard Industrial Blvd., Atlanta, GA 30318; (404) 352-1680

**IAMFES
LENDING
LIBRARY
ANNOUNCES
NEW VIDEOS
NOW
AVAILABLE**

- **GMP: Sources and Control of Contamination During Processing** – 20 Min.
– Penn State
- **GMP: Personal Hygiene and Practices in Food Manufacturing** – 14 Min.
– Penn State – *Available in Spanish and Vietnamese*
- **Food Safety: You May Make the Difference** – 28 Min.
– Seattle-King County Dept. of Public Health

To order any video,
contact Tanya Smith,
Lending Library Coordinator
(800) 369-6337; (515) 276-3344
FAX (515) 276-8655

**The Weber DB™
Wide-Mouth
Dilution
Bottle**



Our pre-filled dilution bottle has a gigantic 45 mm opening. You will find it is dramatically easier to measure most samples into this larger mouth. The bottle also features an attached cap with a unique living hinge. It stays put and out of the way during use, and is never set down or held, **greatly reducing the chance of contamination.** This design also promotes the use of two hands for superior ease and control when adding a sample to the diluent.

- Formulations for Foods and Dairy Products (Butterfield's Buffer), or Water/Wastewater (Phosphate Buffer)
- Single Service— Pre-Filled to Either 99 or 90 ml
- Leakproof
- Guaranteed Sterile
- Accurately Buffered to 7.2 ± 0.2
- **Most economical bottle available by far ... only 54¢ per use**



WEBER SCIENTIFIC

2732 Kuser Road, Hamilton, NJ 08691
609-584-7677 • Fax: 609-584-8388

To order or for more information:

800-328-8378

Reader Service No. 190

OFF THE TOP

FROM THE PRESIDENT



By MICHAEL H. BRODSKY,
IAMFES President

“Ask not what my organization can do for me, ask what I can do for my organization”

Why IAMFES?...

Analysis of membership data indicates that, on average, members remain in IAMFES for only 3-5 years. Why? With all of the professional societies vying for your membership, why did you join IAMFES? What would you tell your colleagues to convince them that they should also join IAMFES? How can

you derive the most benefit out of your membership and how can IAMFES derive the most benefit from you?

In 1973, as a newly appointed environmental research microbiologist in the Central Public Health Laboratory in Ontario, I was looking for a professional affiliation that had a strong association with the microbiological safety of food, water and environmental sanitation. My initial contact was with a local organization called the Ontario Association of Milk, Food and Environmental Sanitarians (OAMFES), which later became the Ontario Food Protection Association (OFPA). I joined this organization in 1975 and subsequently began to receive the *Journal of Milk and Food Technology* from some organization called the International Association of Milk, Food and Environmental Sanitarians, or IAMFES, out of Ames, Iowa. I initially only attended the OAMFES annual meetings. Then, out of curiosity, I began to attend the monthly meetings of the Board of Directors. It was through the BOD that I really began to meet and get involved with other members in planning and organizing meetings. I was subsequently nominated and elected to the Board of Directors of the OFPA in 1982. It was at this point that I started to take a greater interest in IAMFES, which I now realized was the parent organization of the local affiliate.

My involvement in the OFPA and subsequently my activities in IAMFES, stemmed from a desire: to travel; to share research data; and to meet international colleagues and discuss microbiological con-

cerns of mutual interest. I guess my initial interest was somewhat self-serving; but, the more active I became, the more enjoyment I received from my membership in the OFPA/IAMFES. At first, I presented research papers only at the OFPA's annual meetings; but, in 1985, I made my first presentation at the IAMFES Annual Meeting in Tampa, Florida. I became aware that government support for my attendance at, and travel to international meetings was dependent upon my playing an active role in terms of presenting data, organizing symposia or presenting workshops. In addition, I had to show the benefit of my role in IAMFES to my employer, the Ministry of Health in Ontario. Perhaps the greatest benefit that I derived from my involvement with the OFPA/IAMFES were the many professional contacts I made and the many special friendships that evolved.

As you reflect on your membership, either with your local affiliate, or with the International Association, ask yourself if you are getting the most benefits from your membership. If you are not getting out of your membership all that you expected, look at how much you are putting in. By increasing your input, I guarantee that the output to you will increase dramatically. With due respect for the originator of this thought and using literary licence, “Ask not what my organization can do for me, ask what I can do for my organization.” The rewards will be well worth the effort. I can personally vouch for it.

We don't care *how* you get it here...



but we do care *if* we get it!

Affiliates are an important part of IAMFES, and that's why we need you, our Affiliate Associations and Affiliate Members, to let us know what is going on in your organizations. Keep us abreast of meetings, activities, seminars and other events by sending us min-

utes, announcements or just a quick update. In return, we'll publish it in our next issue of *Dairy, Food and Environmental Sanitation*. All we ask is that you please send information regarding upcoming events at least two months in advance.

Please address to: Managing Editor, *Dairy, Food and Environmental Sanitation*,
6200 Aurora Avenue, Suite 200W, Des Moines, Iowa 50322-2863,
Telephone: (515) 276-3344 or Fax: (515) 276-8655; e-mail: iamfescm@dwx.com

Our Affiliates Count!

PERSPECTIVES...

From the Executive Director



By DAVID M. MERRIFIELD,
IAMFES Executive Director

“How do you become involved”

I'm jealous! One article in *DFES* by our new president, Michael Brodsky, and he gets several responses. And, like any good president, he passes them on to me to follow-up. Secretly, I'm glad he did, because one member suggested we write an article about our committees and how to get involved. What an opening...an opportunity to present a primer on IAMFES involvement! So, in the words of an old TV show, “You Asked For It!”

In addition to the Executive Board and staff, IAMFES is made up of committees, professional development groups, task forces, and support groups. Some are defined in our Constitution and Bylaws, while most were formed

out of a recognized need to develop and promote technical standards and to exchange information. Each has different purposes, functions, requirements and commitments. A complete listing was printed in the “mini-directory” distributed in March, however, many of the leaders and members have since changed. A current listing will be published in this Fall's membership directory.

Committees established in the Bylaws are of two types; standing and special. They are led by a chairperson appointed by the President-Elect with Executive Board approval for a one-year, renewable term. Committee members, unless otherwise defined in the Bylaws, are appointed by the chairperson with Executive Board approval.

IAMFES Standing Committees include: the *DFES* and *JFP* Management Committees; the Nominating Committee; the Teller Committee; and the Past Presidents' Advisory Committee. The journal management committees are tasked with the oversight of the two IAMFES monthly journals. Among its members are the scientific editors and the IAMFES managing editor. The Nominating and Teller Committees have responsibility for the nomination and election process for a new secretary each year. The Past Presidents' Advisory Committee serves in an advisory capacity to the Executive Board.

Special Committees include: Communicable Diseases Affecting Man with primary responsibility for producing the various IAMFES procedure booklets such as *Procedures to Investigate Waterborne Illness*; the Program Advisory Committee, responsible for developing the program for the Annual Meeting; and the Sanitary Procedures Committee, IAMFES' representatives for the 3-A Sanitary Standards Program.

Professional Development Groups (PDGs) are led by a group leader who serves a two-year, renewable term at the direction of the President. The PDGs accomplish projects and other work of a continuous nature, primarily where a need is recognized. Members, invited to serve by the group leader, complete work of a scientific and technical nature. The PDGs include all of the Safety and Quality groups (dairy, meat, poultry and seafood), as well as the Food Safety Network, Food Sanitation, Applied Laboratory Methods, Audio Visual Library and Viral Foodborne Disease. Recently, a new PDG was formed on Microbial Risk Assessment.

Task Forces (TFs) are led by an Executive Board appointed task leader, normally for the duration of the task assigned. The Executive Board also appoints all TF members. Active IAMFES TFs include Awards, Constitution and Bylaws, Developing Scientist Awards, Education, and Finance.

Lastly, there are two IAMFES Support Groups; the Foundation Fund, which sponsors Annual Meeting speakers and the Audio Visual Library, and the Affiliate Council, made up of delegates of all of the IAMFES local affiliates. The chairperson of the Affiliate Council is elected annually by the delegates and serves as a voting member of the Executive Board.

With all these opportunities available, how do you become involved? It's easy...simply pick up the phone and call, or send a fax or an e-mail to me or any member of the Executive Board and we will put you in contact with the chairperson or group leader you're interested in joining (you can contact them directly if you wish). The only requirement to serve is your desire to help!

QMI PRODUCTS ARE ESSENTIAL TOOLS FOR AN EFFECTIVE HACCP SYSTEM

THE PROBLEM



Escherichia Coli



Listeria Monocytogenes

THE SOLUTION



QMI Aseptic Transfer System



QMI Aseptic Sampling System

With its patented products, QMI has extremely effective tools 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.

- With the QMI Aseptic Transfer System, you can eliminate the hazard of contamination during inoculation of yogurt, cheese, culture, buttermilk or other fermented products, necessary for an effective HACCP program.
- With the QMI Aseptic Sampling System, you can identify sources of contamination and effectively document process control, essential for an effective HACCP program.

Don't take chances. Take action against contamination. Get all the facts on our Aseptic Sampling and Transfer Systems now.

QMI ASEPTIC TRANSFER SYSTEMS

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.

Reader Service No. 188

ATTENTION:

Members Only!

Get the latest information on food safety training and **MORE** through the **IAMFES AUDIO VISUAL LIBRARY**. Our extensive selection of industry videos is available on a lending basis **EXCLUSIVELY** for IAMFES members!

The Audio Visual Library is just one of the **MANY** benefits of becoming a member of IAMFES, so don't waste anymore time. Join now!

For **MORE INFORMATION** on the Audio Visual Library, or becoming a member, contact IAMFES at (800) 369-6337, or (515) 276-3344.

Redox Potential in Deli Foods: Botulism Risk?

O. Peter Snyder, Jr.

Hospitality Institute of Technology and Management
830 Transfer Road, Suite 35, St. Paul, MN 55114, USA

SUMMARY

The oxidation-reduction potential (E_h) of packages of four delicatessen food items (lasagna, deluxe chicken salad, dressy chicken, and chicken à la king) was measured. The E_h of these four foods ranged from -198 to -23 mV. This range is more than sufficient to allow the growth of *Clostridium botulinum* in food. Supermarket delicatessens and restaurant operations do not purposely add preservatives to prevent the growth of *C. botulinum* in food. Therefore, it must be assumed that keeping food temperatures below 50°F (10°) has been adequate to prevent the hazards from both proteolytic and nonproteolytic strains of *C. botulinum*, since there has been no record of botulism from deli food in retail food operations.

INTRODUCTION

Today in the retail food industry there is essentially a ban on vacuum packaging of potentially hazardous food, because the U.S. Food and Drug Administration (FDA) insists on multiple barriers in addition to cold temperature (2). The apparent concern of the FDA is that vacuum packaging represents an unusually risky food-packaging method that will imminently lead to a greater occurrence of the outgrowth of the common food contaminant, proteolytic *Clostridium botulinum*, or the uncommon contaminant, nonproteolytic *C. botulinum*, with the resulting production

of toxin and the death of people consuming the food.

In contrast, the U.S. Department of Agriculture (USDA) has no special concern. It simply requires that when processors request a label for a food product, detailed processing procedures (description of product formulation, preparation, cooking and cooling temperatures, type of container, and cooking and handling instructions) be included with adequate consumer labeling information. This is called a partial quality control program (6). Through the partial quality control program, it is determined if processors have taken adequate precautions so that there is an accept-

able risk of consumer illness or death from *C. botulinum*. There is no mandatory set of additional microbiological hurdles in finished products other than temperature.

A principal category of chilled food that has been produced for more than 25 years in USDA approved facilities is that of chilled deli meats, specifically, turkey, beef, chicken, and ham loaves, which are either dry roasted or slowly cooked in water baths to maintain maximum yield. These products come in large-sized packages in the range of 5- to 10-lb loaves. They are vacuum-packed, anaerobic products that have the potential for *C. botulinum* outgrowth and represent the risk about which the FDA Retail Food Protection Branch is apparently concerned.

In many states such as Minnesota, where retail food markets are under the jurisdiction of the state's Department of Agriculture, state inspectors follow the USDA guidelines for vacuum packaging sliced meats. They allow food markets to slice processed meat and poultry products in house, and repackage them in vacuum-packed bags to sell in the stores' delicatessens. There is no further microbiological control other than temperature. This practice has continued for many years with no epidemiological indication of any hazard.

Actually, food does not need to be in a vacuum bag in order to have a sufficiently low oxidation-reduction

TABLE 1. Temperature pH and E_h of typical deli food items

Food item	Temperature °F (°C)	pH	E_h (mV)
Lasagna	136 (57.8)	4.7	-26
Deluxe chicken salad	57 (13.9)	5.5	-23
Dressy chicken	125 (51.7)	5.7	-125
Chicken à la king	134 (56.7)	6.1	-198

Figure 1. Lasagna

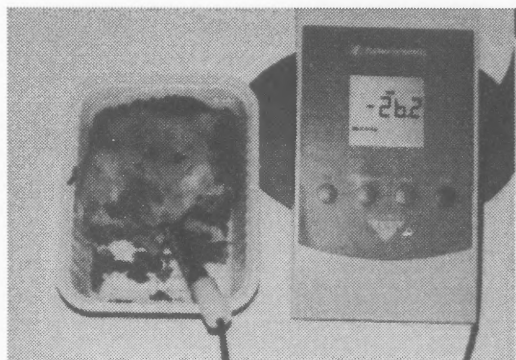


Figure 2. Deluxe chicken salad

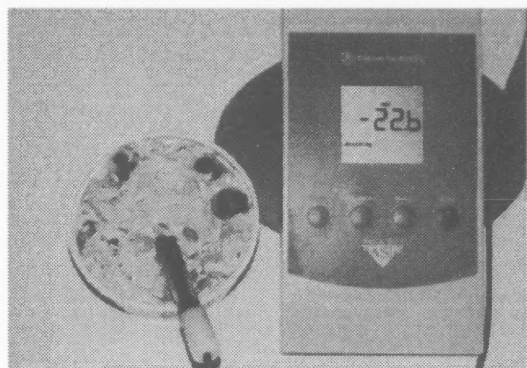
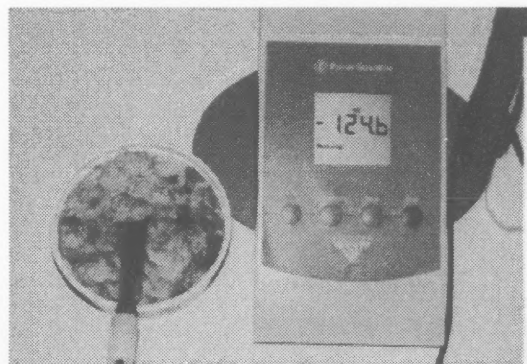


Figure 3. Dressy chicken



potential (E_h) to grow *C. botulinum*. Most food, 2 in. (5.08 cm) deep in a pan, provides an environment that is conducive for the growth of *C. botulinum*. In order to ascertain if this condition does in fact exist, the following experiment was performed on four foods purchased at a local food market delicatessen. The (E_h) of the foods was measured to show the potential of these typical foods to grow *C. botulinum* if they are sufficiently temperature abused.

MATERIALS AND METHODS

Eight-ounce portions of four food items, lasagna, deluxe chicken salad, dressy chicken, and chicken à la king, were purchased from a local food market delicatessen. Each of these food items was placed in a small plastic take-home container, with dimensions of approximately 1.25-in. depth and 5-in. diameter. The packaged food items were transported to the laboratory, where the (E_h) was measured using a platinum redox electrode Model 96-78 (Orion, Cambridge, MA). The electrode was standardized with quinhydrone saturated buffer at pH 4 and pH 7. The pH of the food items was measured with an Accumet Basic pH meter with an Accumet pH electrode Model 13-620-758 (Fisher Scientific, Pittsburgh, PA). Food temperature was measured using a thermocouple meter Model 115 (Barnant Company, Barrington, IL).

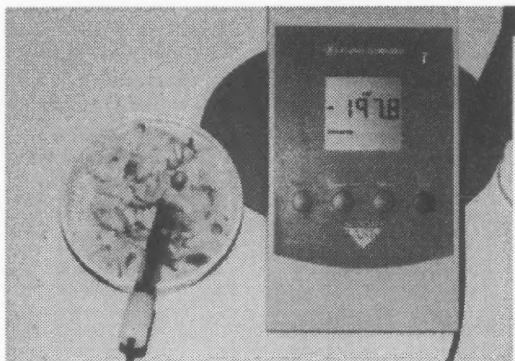
RESULTS

The positioning of the (E_h) electrode in the food items is shown in Figures 1 to 4. The data are presented in Table 1.

DISCUSSION

The upper E_h level that will allow initiation of growth from spores of both proteolytic and nonproteolytic *C. botulinum* strains is on the order of +200 mV (1, 4). Stress factors such as salt concentration and decreased acidity will lower the critical level for spore growth (5). Once growth is initiated, the E_h of the *C. botulinum* culture declines rapidly to -200 mV. It is apparent from the data in this study

Figure 4. Chicken à la king



that the E_n of typical foods sold in delicatessens, which will also be found in restaurant kitchens, is more than sufficiently reduced, and will allow the growth of *C. botulinum*, given the opportunity. The spores of *C. botulinum* are extremely resistant to pasteurization temperatures. It takes 3 min at 250°F to achieve sufficient destruction of 10^{12} *C. botulinum* spores, according to canning standards. Typical retail food cooking temperatures of 180 to 212°F (82.2 to 100°C) are merely activation temperatures for the spores. In these four food items, the pH was sufficient to allow growth and toxin production from proteolytic strains of *C. botulinum*, which begin to produce a toxin at 50°F (10°C) (3), and of non-proteolytic strains of *C. botulinum*, which begin to grow and produce toxin at 38°F (3.3°C) (3).

CONCLUSIONS

It is apparent from this simple study that foods processed in typical retail food operations may have an oxidation-reduction potential low enough to allow the growth of *C. botulinum* and consequently, production of toxin, if temperature is not controlled. No additives are specifically added to typical recipes in the retail food industry to prevent the growth of *C. botulinum*. If the 1995 FDA Food Code (3-502.12 *Reduced Oxygen Packaging, Criteria*) (2) is to be followed, essentially all foods in the retail food industry must be for-

mulated with hurdles in order to meet these criteria, because even food in a pan 2 in. deep will have an E_n low enough to be hazardous.

While the word, "packaging," may be interpreted as a container for sales, it is equally appropriate to consider packaging as a hot-packed pan, or as wrapped with plastic wrap and then refrigerated. These forms of packaging are more than adequate to prevent the transmission of oxygen and promote the development of a sufficiently low E_n in the center of the food product to allow the outgrowth of *C. botulinum*. *Clostridium botulinum* will normally be present in most retail foods because this pathogen is found on most vegetables and spices, which are specified in the recipes formulated in retail food operations.

It is evident that over the many years of commercial food-service operation, there have been no reported outbreaks of *C. botulinum* intoxication when hot foods or cold foods under temperature control are sold. Problems have arisen when cooked food was allowed to remain at room temperature for 24 to 48 h. When vegetables, especially, come out of the ground, they contain low levels of *C. botulinum*. *Clostridium botulinum* will be found in almost all food items prepared in the retail food environment. All people consume this organism throughout their lives. This information clearly indicates that temperature and time management alone, such as keeping food below 50°F (10°C) and eating it soon after pur-

chase is sufficient to prevent the hazardous growth and toxin production of *C. botulinum*.

REVIEW

There will be no new hazard created by placing food in a plastic bag versus current methods of packaging hot and cold food in rigid containers for take-out or use in retail food operations. Vacuum packaging should be allowed in the same way that all packaging is allowed in the retail food industry. However, people who want to vacuum pack food items for retail sale should complete a USDA Partial Quality Control Program, because if food abuse is sufficient, a hazard can be created. People who want to use vacuum packaging only in their food operating systems should write a HACCP internal procedure scheme, and should not be required to add chemicals to provide multiple barriers.

REFERENCES

1. Ando, Y., and H. Iida. 1970. Factors affecting the germination of spores of *Clostridium botulinum* type E. Jpn. J. Microbiol. 14:361-370.
2. FDA. 1995. Food code. U.S. Public Health Service, U.S. Dept. of Commerce. Technology Administration, National Technical Information Service: Pub. no. PB94-113941AS. Springfield, VA.
3. Hauschild, A. H. W. 1989. *Clostridium botulinum*. In M. P. Doyle, (ed.), Food-borne bacterial pathogens. Marcel Dekker, Inc., New York. p. 112-189.
4. Huss, H. H., I. Schaeffer, A. Pedersen, and A. Jepsen. 1979. Toxin production by *Clostridium botulinum* type E in smoked fish in relation to the measured oxidation-reduction potential (E_p), packaging method and the associated microflora. In J. J. Connell (ed.), Advances in fish science and technology. Fishing News Books Ltd., Farnham, Surrey, England. p. 476-479.
5. Smoot, L. A. and M. D. Pierson. 1979. Effect of oxidation-reduction potential on the outgrowth and chemical inhibition of *Clostridium botulinum* 10755 A spores. J. Food Sci. 44: 700-704.
6. USDA. 1987. Perishable, uncured meat and poultry products in hermetically sealed containers. Policy Memo 110. USDA FSIS Standards and Labeling Division. Washington, D.C.

Implementation of a HACCP Program in a Commercial Fresh-Market Tomato Packinghouse: A Model for the Industry

James W. Rushing,^{1*} Frederick J. Angulo,² and Larry R. Beuchat²

¹Clemson University, Coastal Research and Education Center,
2865 Savannah Highway, Charleston, South Carolina 29414

SUMMARY

Epidemiologic studies linked outbreaks of salmonellosis in 1991 and 1993 to raw tomatoes. Subsequent research funded by the tomato industry confirmed that *Salmonella montevideo* can grow on raw tomatoes at temperatures commonly found in food handling systems. In response to this situation, a model hazard analysis critical control points (HACCP) program was designed, implemented, and monitored in a commercial tomato packinghouse in South Carolina in 1994 and 1995. Three control points were identified. The key point was water quality maintenance, i.e., control of chlorine, pH, and temperature in the water bath. Other points were cleaning and inspection of field bins and monitoring of the hand-sorting procedures on the packingline. Testing of tomatoes in 1994 and 1995 for the presence of *Salmonella* spp. verified that the HACCP program was effective in controlling the risk of contamination in the packinghouse. This model HACCP program, especially monitoring of water quality, could be applicable to other fresh fruit and vegetable handling systems.

BACKGROUND

Salmonella contamination is the most frequently reported cause of foodborne outbreaks of gastroenteritis in the United States, with an estimated 2 to 6 million cases each year (8, 17). Foods of animal origin, including poultry and other meats, eggs, and dairy products, are the most commonly implicated sources of salmonellosis (17). In recent years, however, several multistate outbreaks of salmonellosis have been associated with eating fresh fruits and vegetables (7, 10, 12). Two of these outbreaks were thought to have resulted from eating fresh uncooked tomatoes contaminated with *Salmonella* spp.; *S. javiana* in 1991 (19) and *S. montevideo* in 1993 (2). In both of these outbreaks, *Salmonella* was not isolated from tomatoes, but epidemiologic evidence indicated that the cause of both outbreaks may have originated from the same tomato packinghouse in South Carolina (2, 11). Therefore, we

designed and implemented a hazard analysis critical control points (HACCP) program in a commercial tomato packinghouse in South Carolina with the goal of preventing *Salmonella* contamination of tomatoes.

HACCP PROGRAM

Hazard analysis

The possibility that uncooked tomatoes might be a vehicle for salmonellosis was demonstrated in recent laboratory studies which revealed that *Salmonella* spp. could survive on or in tomatoes subjected to handling practices currently used for their movement from packinghouses to retail outlets (20). Chopped, ripe, uncooked tomatoes supported *Salmonella* growth, and small populations that infiltrated into the stem scar of whole tomatoes multiplied inside the fruit when temperatures were favorable for microbial growth (20). This finding was in agreement with those of earlier studies on tomato infiltration by decay-causing bacteria, in which infiltration was significantly increased when the temperature of the water bath was 5°C cooler than the pulp temperature of the tomato (4, 16). Since *Salmonella* spp. can survive and multiply on tomatoes, these results suggest that even a small amount of bacterial inoculum on tomatoes may ultimately lead to human infections if the fruit is not handled properly (3, 20).

Because eating uncooked tomatoes had been associated with human illness, and because of the observation that fresh tomatoes can support *Salmonella* growth, we sought to explore methods of ensuring the absence of *Salmonella* spp. in tomatoes. In South Carolina, tomatoes are grown on plastic mulch, staked and tied to further restrict contact with the soil, fertilized through drip-irrigation tubes under the plastic mulch, and hand-picked (9), practices that seemed unlikely to result in widespread *Salmonella* contamination.

Contamination seemed more likely to occur at the packinghouse, where tomatoes are dumped into a water bath and transported across conveyors for hand sorting and other procedures before being machine packed into cartons.

Process flow description

Before the 1994 harvest, the harvesting, handling, and packing procedures were inspected on farms and in a packinghouse in South Carolina to identify critical control points. Mature green tomatoes are transported from the field to the packinghouse in 40-ft³ (1.32 m³) wooden bins that have a capacity of approximately 1,000 lb (ca. 453.6 kg) of fruit. At the packinghouse, tomatoes are dumped into a water bath, also called a dump tank, which minimizes physical injury to the fruit as it is emptied from the bins. The dump tank contains approximately 4,000 gal (ca. 15,140 liters) of water, which is circulated with pumps in a closed system. Water is added to this system during operation only if there is substantial loss of volume due to spillage or drainage for repairs; normally, the tank is emptied and washed each night and refilled with clean water for the following day's operation. Fruit leaves the dump tank via a roller conveyor. Transit time for fruit in the water is 5 to 10 s.

The packing-line conveyors pass the fruit through a light application of vegetable oil-based wax and automatically separate the fruit into several size categories. The fruit is then hand sorted (by workers without gloves) into quality categories and transported to automated carton-filling machines, which place 25 lb (ca. 11.25 kg) of fruit per box. Boxes are labeled with a code that identifies the grower and the date the fruit was packed. An additional label indicates the type of wax that was applied. The total lapsed time from bin dumping to carton filling is approximately 3 min. Filled boxes are placed on pallets by hand

and the pallets are then moved to storage rooms and held at 12°C with approximately 90% relative humidity. Ripening is initiated by metering ethylene gas into the storeroom to a concentration of approximately 100 ppm. The timing and duration of ethylene treatment varies according to the requirements of the buyer, who may request that the fruit be at a particular stage of development (e.g., mature-green, pink, or full-ripe) upon arrival at the destination. As sales are confirmed and appropriate ethylene treatments completed, pallets are transferred from holding rooms to refrigerated trucks for shipment.

Critical control points

Three critical control points in the tomato handling system were identified: (i) cleaning and inspection of the wooden bins used for transporting fruit from the field to the packinghouse, (ii) water quality maintenance in the packinghouse dump tank, and (iii) hand sorting of individual tomatoes on the packing line. In addition to these specific control points, general sanitation procedures throughout the facility were inspected and potential problems identified.

Implementation and monitoring

The HACCP program was implemented in the 1994 season and monitoring was continued through the 1995 season. In the week preceding the harvest, each wooden bin was sprayed thoroughly with a solution of 10% sodium hypochlorite and pressure cleaned with hot water. Harvest managers then visually inspected the cleanliness of the bins in the field before filling them with freshly harvested fruit.

The dump tank had previously been equipped with a chlorine gas injection system (Decco, Inc., Monrovia, CA). To monitor the operation of the injection system, a free-chlorine monitor and control-

ler (both from Decco, Inc.) were installed before the 1994 harvest. The monitor used electronic oxidation-reduction potential sensors to sense free-chlorine content. Solenoid valves regulated the input of chlorine gas into the dump tank water upon demand. The chlorinated water passed through a bed of calcium carbonate to neutralize the pH before injection into the dump tank. The unit was equipped with a recorder, which provided a continuous record of free chlorine level as a function of oxidation-reduction potential, and an alarm, which alerted packinghouse workers when free-chlorine concentration fell below the desired level. The temperature of the dump-tank water was maintained with a thermostatically controlled gas heater. The thermostat set point was 40°C.

To further ensure that the automated system was functioning properly, total chlorine, pH, and water temperature were checked manually at approximately 2-h intervals. Total chlorine was checked with paper test strips (Diversey Wyandotte, Inc., Wyandotte, MI) and a liquid chemical kit (Hach, Inc., Loveland, CO). An electrode type pH meter was used for pH measurement and an electronic thermometer was used for monitoring water temperature (Cole-Parmer, Inc., Nile, IL). Measurements of water quality parameters, i.e., pH, chlorine content, and temperature, were recorded manually and the handwritten records were made available to University personnel who visited the site.

Recommendations for tomato dump-tank water conditions are usually in the range of 100 to 200 ppm free chlorine, pH between 6.5 and 7.5, and temperature at least 5°C above the pulp temperature of the fruit (6, 13, 14, 15). The mechanisms for chlorine injection, pH control, and water heating were adjustable. When manual testing revealed that any quality parameter

was outside the recommended range, or when the alarm indicated that chlorine concentration was reduced to 10 ppm, adjustments were made in the equipment to compensate for the deficiency in water quality.

Workers who had to touch the fruit on the packing line were issued rubber gloves and instructed to disinfect the gloves at the beginning of the work day and following breaks or visits to the restroom. A continuous supply of rubber gloves was available. Wearing gloves was mandatory; the supervisor monitored glove use and instructed workers who had removed the gloves to put them back on. No records are available for the number of workers who violated this rule. Soap and disinfectant were provided in all restrooms, and instructions for workers to wash their hands before returning to work were posted in prominent locations. The signs were written in English and Spanish. Restrooms were thoroughly cleaned each evening and periodically inspected throughout the day.

General sanitation throughout the packing facility was improved over past practices. All of the packing-line equipment was cleaned with a pressure cleaner and industrial disinfectant at the start of the season as described for the wooden bins. Special attention was given to areas that could retain small amounts of water and potentially support the survival of bacteria. This included all drain pans underneath the machinery and water troughs recessed in the concrete floor. Each evening floors were swept and washed with disinfectant, soap, and water. Special care was taken to remove all fruit, leaves, or other debris from floors and beneath equipment. In the ripening rooms, refrigeration coils, condensate drainage pans, walls, and floors were pressure cleaned with disinfectant as described for bins and packing lines.

Verification

During the 1994 and 1995 seasons, samples of fruit were collected at the packinghouse and analyzed for *Salmonella* spp. to verify the success of the HACCP program. Tomato fruit samples (20 fruits per sample) were collected from the distal end of the packing line approximately every 2 h on 2, June 1994, the first day of packing. These samples were immediately placed in cold storage (1°C) in darkness to await analysis. The packinghouse did not run more fruit for 3 days, but when packing resumed, water samples (100 ml) were collected from the dump tank and additional fruit samples (5 fruits per sample) were collected every 2 h on 6 and 7 June. These samples were transported in an ice chest to the Centers for Disease Control and Prevention (CDC) and to the University of Georgia for analysis.

Water samples were tested at the Centers for Disease Control and Prevention by using standard membrane-filtration techniques (1). No coliforms were detected in water samples. At the University of Georgia, tomatoes were individually placed in plastic bags with 20 ml of sterile aqueous solution of 0.1% peptone. The bag was sealed and the surface of the tomato was gently rubbed by hand for 1 min. The wash fluid from the tomato surface was serially diluted (1:10) in 0.1% peptone, surface plated (0.1 ml) in duplicate on bismuth sulfite agar and brilliant green agar (Difco Laboratories, Detroit, MI) and incubated for 24 h at 37°C. No *Salmonella* spp. were detected on the 45 tomatoes analyzed, but coliforms were detected on the surface of 2 of the 45 fruits; the coliforms were identified as *Leclercia adecarboxylata* and *Enterobacter cloacae*.

Beginning 6, June 1994, and continuing through the 1995 season, tomatoes were also analyzed for *Salmonella* spp. in a private laboratory (ABC Research, Gainesville, FL). In 1994, samples of 5 fruits each were collected

approximately every 2 h on every day of packinghouse operation. In 1995, sampling was done at approximately 4-h intervals. Each evening, samples were transported by car at ambient temperature to the laboratory. A radial slice, approximately 2 cm thick, was removed from the stem end of each tomato. Slices were placed in 225 ml of lactose enrichment broth at 35°C for 24 h, and then 1-ml aliquots were removed and plated as described above. In 1994 and 1995, respectively, 158 and 77 samples were collected and analyzed. All samples were negative for the presence of *Salmonella* spp.

Numerous unannounced visits were made to the packinghouse by Clemson University Extension personnel in 1994 and 1995 to verify that management was implementing the HACCP program appropriately. Random checks of the water bath revealed that the water pH varied from 6.8 to 7.2 and that the water temperature was between 35 and 39°C. The water temperature never reached the set-point temperature of 40°C, which is normal because of the cooling effect of constantly running fruit. The total chlorine content exceeded 250 ppm in all tests and free chlorine varied from 40 to 100 ppm, except once, when the chlorine content of the water had been depleted to about 10 ppm free chlorine and the low-chlorine alarm sounded. In this case, none of the tomatoes packed during this time was sold until test results from the private laboratory were received to confirm that no *Salmonella* spp. were present.

DISCUSSION

A HACCP program has not previously been reported for a tomato-handling system. Tomatoes are an appropriate commodity for the testing of a HACCP program because they are consumed raw in most households, they usually are not refrigerated below 12°C, they may be stored as long as 3 weeks from harvest to consumption, and

they support *Salmonella* growth. In our study, the risk to tomato consumers was previously identified, the CDC and Clemson University personnel visited the fields and packinghouse, hazards were analyzed, critical control points were defined, and the HACCP program was implemented. The advantage of a HACCP program is that it is a comprehensive preventive strategy which appropriately places responsibility for food safety on handlers, manufacturers, or distributors (18). This preventive proactive role of industry is a greater safeguard for the health and safety of consumers than the reactive measures that regulatory agencies are forced to take after problems arise.

Water is the most likely source of widespread low-level microbial contamination in food-handling systems in general. Virtually all fruit and vegetable packing and processing facilities include operations that require water. Chlorination is effective in reducing the proliferation of microbes in water, but its efficacy is dependent on the amount of free chlorine present (5). As the water becomes contaminated with soil and organic debris, free chlorine may decrease dramatically. For this reason, the free-chlorine content needs to be automatically monitored, and all fruit packers should consider installing a monitoring system. As an additional measure, tomato dump-tank water should be heated at least 5°C above the pulp temperature of the fruit to prevent infiltration of contaminated water through the stem scar due to the suction effect created by cooling and contraction of intercellular spaces (16). The importance of water quality maintenance in postharvest operations has long been recognized and university extension services in several states have published information specifically directed to fresh-produce handlers (6, 13, 14, 15).

Implementation and testing of a HACCP program requires cooperation and open communication between all parties involved (18). In this study, risk was identified by

the CDC, funding was provided by the tomato industry for University researchers to further define the risk, the packer fully cooperated in implementation of the HACCP program, the university extension service had unrestricted access to the packing facilities and to the results of private testing, there was oversight and participation by CDC, and there were numerous follow-up visits to the site by university personnel. All these factors allowed us to successfully meet our objective of implementing and testing a HACCP program for fresh-tomato packing operations, and we commend the leaders of the tomato industry for their support. Future effort by university extension personnel will emphasize the need for packinghouse operators to improve record-keeping procedures so that regulatory agencies will have a basis for evaluation of the HACCP program implementation and monitoring.

We propose that this HACCP program for fresh-market tomato packinghouses and the manner in which it was implemented and monitored can serve as a general model for the fresh-produce industry.

REFERENCES

1. American Public Health Association. 1992. Standard methods for the examination of water and wastewater, 18th ed., p. 53-61. American Public Health Association, Washington, D.C.
2. Angulo, F. J., A. Schuchat, L. Helsen, and the Investigative Team. 1994. Multistate outbreak of *Salmonella montevideo* infections associated with consumption of tomatoes, Illinois; p. 20 (abstract). In CDC Epidemic Intelligence Service 43rd Annual Conference, Centers for Disease Control and Prevention, Atlanta, GA (18-22 April 1994). U.S. Department of Health and Human Services. Public Health Service, Washington, D.C.
3. Asplund, K., and E. Nurmi. 1991. The growth of salmonellae in tomatoes. *Int. J. Food Microbiol.* 13:177-182.
4. Bartz, J. A., and R. K. Showalter. 1981. Infiltration of tomatoes by aqueous bacterial suspensions. *Phytopathology* 71:515-518.
5. Beuchat, L. R. 1992. Surface disinfection of raw produce. *Dairy Food Environ. Sanit.* 12:6-9.

6. Boyette, M. D. 1993. Chlorination and postharvest disease control. *In* Vegi-News 13 (6):2-8. North Carolina State University Cooperative Extension Service, Raleigh, NC.
7. Centers for Disease Control and Prevention. 1991. Multistate outbreak of *Salmonella poona* infections - United States and Canada. *Morbidity and Mortality Weekly Report* 40:549-552.
8. Chalker, R. B., and M. J. Blaser. 1988. A review of human salmonellosis: III. Magnitude of *Salmonella* infection in the United States. *Rev. Infect. Dis.* 10: 111-124.
9. Cook, W. P., C. E. Drye, and R. P. Griffin. 1985. Commercial tomato production in South Carolina. Clemson University Cooperative Extension Circular 625. Clemson University, Clemson, SC.
10. Hedberg, C. W., K. L. MacDonald, and M. T. Osterholm. 1994. Changing epidemiology of foodborne disease: a Minnesota perspective. *Clin. Infect. Dis.* 18:671-682.
11. McFarland, J. W., C. Hedberg, J. Besser-Wiek, W. Schell, M. Osterholm, and the Investigative Team. 1994. A multistate outbreak of *Salmonella montevideo* infections associated with uncooked tomatoes, Wisconsin and Minnesota, p. 21 (abstract). *In* CDC Epidemic Intelligence Service 43rd Annual Conference, Centers for Disease Control and Prevention, Atlanta, GA (18-22 April 1994). U.S. Department of Health and Human Services, Public Health Service, Washington, D.C.
12. O'Mahony, M. J., J. Cowden, B. Smith, D. Lynch, M. Hall, B. Rowe, E. L. Teare, R. E. Tettmar, A. M. Tampling, M. Coles, R. J. Gilbert, E. Kingcott, and C. L. Bartlett. 1990. An outbreak of *Salmonella saint-paul* infection associated with beansprouts. *Epidemiol. Infect.* 104:229-235.
13. Rushing, J. W. 1986. Tomato dump tank management. *In* Harvesting and handling South Carolina vegetables 86-2. Clemson University Cooperative Extension Service, Clemson, SC.
14. Rushing, J. W. 1986. Water chlorination. *In* Harvesting and handling South Carolina vegetables 86-3. Clemson University Cooperative Extension Service, Clemson, SC.
15. Sherman, M., R. K. Showalter, J. A. Bartz, and G. W. Simone. 1991. Tomato packinghouse dump tank sanitation. Vegetable crops fact sheet VC - 31. University of Florida Cooperative Extension Service, Gainesville, FL.
16. Showalter, R. K. 1993. Postharvest water intake and decay of tomatoes. *Hort Technol.* 3:97-98.
17. Tauxe, R. V. 1991. *Salmonella*: a post-modern pathogen. *J. Food Prot.* 54: 563-568.
18. Taylor, M. R. 1994. FDA's plans for food safety and HACCP - Institutionalizing a philosophy of prevention. *Dairy Food Environ. Sanit.* 14(5):256-258.
19. Wood, R. C., C. Hedberg, and K. White. 1991. A multistate outbreak of *Salmonella javiana* infections associated with raw tomatoes, p. 69. (abstract). *In* CDC Epidemic Intelligence Service 40th Annual Conference, Atlanta, GA. U.S. Department of Health and Human Services, Public Health Service, Washington, D.C.
20. Zhuang, R.-Y., L. R. Beuchat, and F. J. Angulo. 1995. Fate of *Salmonella montevideo* on and in raw tomatoes as affected by temperature and treatment with chlorine. *Appl. Environ. Microbiol.* 61:2127-2131.

Author for correspondence: ¹Tel: 803-766-3761; Fax 803-571-4654. Co-authors: ²Foodborne and Diarrheal Diseases Branch, Division of Bacterial and Mycotic Diseases, National Center for Infectious Diseases, Centers for Disease Control and Prevention, Mail Stop A38, 1600 Clifton Road, NE, Atlanta, Georgia 30333; and ³Center for Food Safety and Quality Enhancement, Department of Food Science and Technology, University of Georgia, Griffin, Georgia 30223, USA

IAMFES Announces the Availability of the Procedures to Implement the Hazard Analysis Critical Control Point (HACCP) System

For Order Information,
Contact IAMFES
at (800) 369-6337
or FAX (515) 276-8655



**ABC
RESEARCH**

YOUR FULL SERVICE FOOD AND
ANALYTICAL CONSULTING
LABORATORY

- FOOD CHEMISTRY
- ENVIRONMENTAL CHEMISTRY
- MICROBIOLOGICAL ANALYSES
- PRODUCT DEVELOPMENT-
PILOT PLANT
- CONTRACT RESEARCH
- PROBLEM SOLVING
- HACCP TRAINING-AUDITS
- PLANT SANITATION/GMP SURVEYS

ABC RESEARCH CORPORATION

3437 S.W. 24th Avenue
(352) 372-0436
FAX: (352) 378-6483

Reader Service No. 102

HACCP and HAZOP for a Pulsed Electric Field Processing Operation

Humberto Vega-Mercado,¹ Lloyd O. Lueddecke,² Gary M. Hyde,¹
Gustavo V. Barbosa-Cánovas,^{1*} and Barry G. Swanson²

¹Department of Biological Systems Engineering, ²Food Science and Human Nutrition,
Washington State University, Pullman, Washington 99164-6120, USA

SUMMARY

The hazard analysis critical control point (HACCP) and hazard and operability study (HAZOP) concepts have been considered in the design of a pulsed electric field (PEF) food-processing operation. These concepts are currently used for the improvement of industrial operations as total quality management tools. The HACCP program leads to the processing and production of safe foods in analyzing health hazards associated with processing, distribution, and consumption of food, while the HAZOP analysis is used to identify hazardous working conditions in a specific step of a processing operation.

The design of a PEF facility based upon the HACCP and HAZOP concepts is a preliminary step toward approval by regulatory agencies such as the U.S. Food and Drug Administration (FDA) and the U.S. Department of Agriculture (USDA). The HACCP concept was used to define the following critical control points in a PEF facility: (i) the raw material receiving area, (ii) the treatment chamber, and (iii) the packaging machine. Process parameters and process conditions, such as product temperature, electric field intensity, number of pulses, pulse shape, and cleanliness are fundamental in the inactivation of microorganisms and enzymes. Product characteristics such as conductivity, pH, ionic strength, and composition must be considered in designing the process. In addition, treatment chamber geometry, and electrical components and connections are key engineering aspects at the design and construction phases of both the pulser and treatment chambers to avoid safety hazards concerning both equipment operation and product integrity.

INTRODUCTION

The hazard analysis critical control point (HACCP) and the hazard and operability study (HAZOP) concepts are used as total quality management tools. The HACCP concept was advanced in the 1970s at the Pillsbury Company (Minneapolis, MN) in collaboration with the National Aeronautics and Space Administration (NASA) and the U.S. Army Research Laboratories (9). The HACCP concept leads to the production of safe foods by the analysis of health hazards associated with the production, distribution, and consumption of food. The system places emphasis on the microbiological safety of ingredients and process specifications on the premise that safe products will result from the use of high-quality raw materials and proper operation of the equipment to accomplish process specifications (5, 8). The U.S. National Advisory Committee on the Microbiological Criteria for Foods (NACMCF) and the International Commission on Microbiological Specifications for Foods (ICMSF) view HACCP use as a systematic approach to food safety consisting of the seven principles listed in Table 1 (9).

TABLE 1. HACCP principles (5, 9)

1. Assess the hazards and risks associated with the growing, harvesting, processing, manufacturing, distribution, marketing, preparation, and consumption of the food.
2. Determine the CCP(s)^a required to control the identified hazard.
3. Establish the critical limits that must be met at each identified CCP.
4. Establish procedures to monitor the CCP(s).
5. Establish corrective actions when there is a deviation in a CCP.
6. Establish effective record-keeping systems.
7. Establish procedures for verification that the HACCP system is working properly.

^aCCP: critical control point.

TABLE 2. HAZOP principles (6)

1. Identify the hazardous condition associated with an operation.
2. Establish corrective actions to prevent the hazardous condition(s).
3. Implement corrective actions by modifying the procedures used in the operation.
4. Establish monitoring procedures to verify the effectiveness of the corrective actions.
5. Establish personnel training programs.
6. Establish effective record-keeping systems.
7. Establish procedures for verification of the effectiveness of the corrective actions.
8. Update plant layout scheme with the corrective actions.

The design and construction of processing equipment and facilities is regulated by the Occupational Safety and Health Administration in the U.S. HAZOP analysis is used to identify hazardous conditions in manufacturing and packaging operations that jeopardize the safety of employees (6). Table 2 summarizes the steps considered while developing and implementing a HAZOP analysis.

Both HACCP and HAZOP concepts may be used in the design, construction, and troubleshooting of a pulsed electric field (PEF) processing facility. The

HACCP component will focus on the process design in terms of process-product compatibility, product safety, process capability, and consumer preferences. The HAZOP component will focus on the equipment design, process requirements, personnel protection, and equipment safeguards.

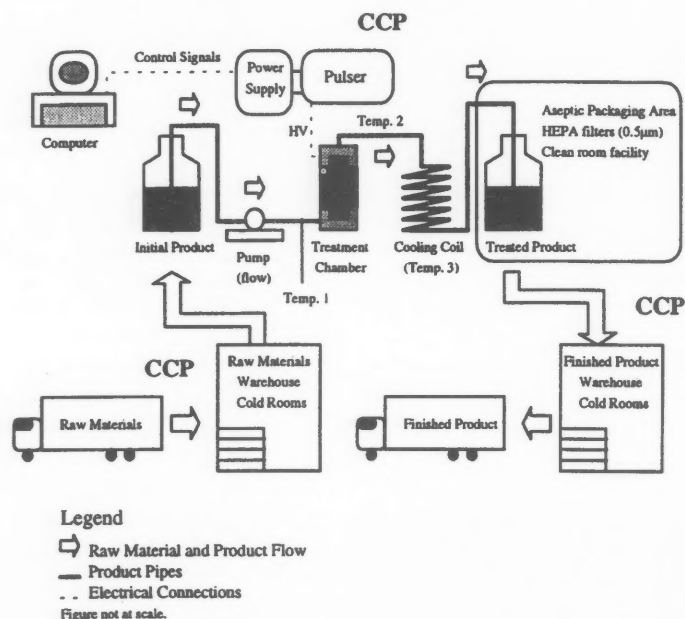
The development of pulsed electric field technology started in the 1920s with the so-called Electropure Process for milk (13). The Electropure Process consisted of passing an electric current through carbon electrodes to heat the milk to 70°C. Beattie and Lewis

(1) demonstrated the lethal effect of electrical discharges on microorganisms, in addition to the thermal effects, when the voltage applied to inactivate the microorganisms was increased to 3,000 to 4,000 volts. The electrohydraulic treatment to inactivate microorganisms suspended in liquid foods was introduced in the 1950s, using capacitor discharges and arcs. The inactivation of microorganisms was attributed to the shock wave generated by the arc and the formation of highly reactive free radicals from chemical species contained in the food by the spark (13). Gilliland and Speck (2) applied the concept of pulsed electric discharges at different energy levels in the inactivation of *Escherichia coli*, *Streptococcus faecalis*, *Bacillus subtilis*, *Streptococcus cremoris*, and *Micrococcus radiodurans* suspended in sterile distilled water and observed the effect of the electric-shock treatment on trypsin and a protease from *Bacillus subtilis*.

Sale and Hamilton (11) demonstrated the nonthermal lethal effect of homogeneous electric fields on bacteria such as *Escherichia coli*, *Staphylococcus aureus*, *Micrococcus lysodeikticus*, *Sarcina lutea*, *Bacillus subtilis*, *Bacillus cereus*, *Bacillus megaterium*, *Clostridium welchii* and yeasts such as *Saccharomyces cerevisiae* and *Candida utilis*. In general, an increase in the electric field intensity and the number of pulses leads to an increase in the inactivation of microorganisms (3, 4, 7, 10, 12, 15, 16). Other factors that affect microbial inactivation are the treatment temperature, pH, ionic strength, and conductivity of the medium containing the microorganisms (10, 14).

The main objective of this paper was to develop the HACCP and HAZOP concepts in a PEF facility as a preliminary step toward the approval of this novel process by regulatory agencies such as the U.S. Food and Drug Administration (FDA) and the U.S. Department of Agriculture (USDA).

Figure 1. Pulsed electric field unit operations layout.



HACCP PRINCIPLES AND PEF TECHNOLOGY

The PEF process is summarized in Figure 1, where key operations are the receiving of raw materials, PEF treatment, aseptic packaging operation, and finished product storage and distribution. The seven principles described in Table 1, when applied to the PEF process, lead to the following analysis.

1. Hazard assessment

Microbial hazards are the main concern throughout the PEF operation. Raw materials contain pathogens and spoilage microbes that may spoil the ingredient or raw material and may be harmful to the consumer. In addition, the storage facilities for raw materials may increase the risk of microbial contamination from soil and water deposits and airborne microorganisms. The cleanliness of processing equipment plays a key role in preventing microbial contamination, because multiple-assembly parts that are not properly sanitized can be a source of microorganisms. Finally, the aseptic packaging operation and storage conditions of the processed product may result in microbial contamination if improper handling of the product occurs.

The chemical hazards to consider are the presence of antibiotic and pesticide residues on raw materials, electrically induced chemical reactions, and excessive detergent-sanitizer residues from processing and packaging equipment.

The physical hazards include foreign matter in raw materials (e.g., stones, rubber, plastic, metals, egg shells), metal particles from the treatment chamber after a spark, and plastic or rubber pieces from seals.

The final risk classification may be defined in terms of the products (e.g., milk, apple juice, eggs, soups, etc.). Six microbiological hazard characteristics, listed in Table 3, as

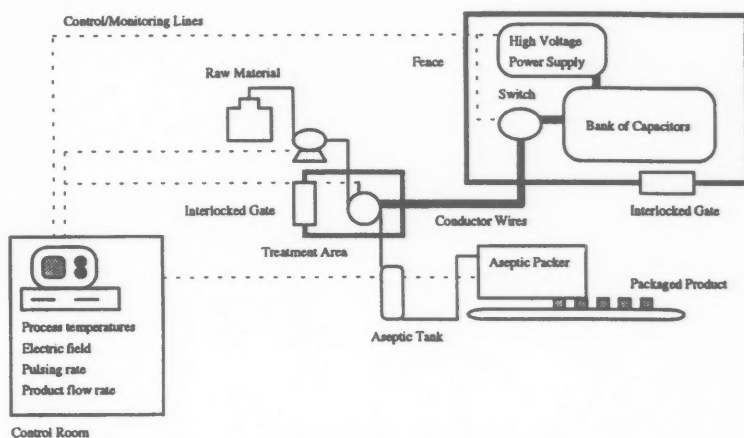
TABLE 3. General microbial hazard characteristics (9)

- Hazard A: A special class that applies to nonsterile products designated and intended for consumption by at-risk populations.
- Hazard B: The product contains sensitive ingredients in terms of microbiological hazards.
- Hazard C: The process does not contain a controlled processing step that effectively destroys harmful microorganisms.
- Hazard D: The product is subject to recontamination after processing before packaging.
- Hazard E: There is a substantial potential for abusive handling in distribution or in consumer handling that could render the product harmful when consumed.
- Hazard F: There is no terminal heat process after packaging or when cooked in the home.

TABLE 4. Risk categories for food products and raw materials (9)

Risk	Definition
0	No hazard.
I	Food products subject to one of the general hazard characteristics.
II	Food products subject to two of the general hazard characteristics.
III	Food products subject to three of the general hazard characteristics.
IV	Food product subject to any four general hazard characteristics.
V	Food products subject to all five general hazard characteristics.
VI	Special category that applies to nonsterile products.

Figure 2. Schematic diagram of a PEF equipment configuration.



well as chemical and physical hazard characteristics are defined by the National Advisory Committee on the Microbiological Criteria for Foods (NACMCF) and will be used to classify the PEF products. In general, the final hazard classification should range between risk categories IV and VI as defined by the NACMCF. Table 4 illustrates the seven risk categories identified by the NACMCF (5, 9).

2. Critical control points (CCPs) — determination, limits, procedures, and corrective actions

The following CCPs should be selected to ensure the safety of PEF products:

- Receiving and storage section
- PEF treatment section
- Aseptic packaging section

The main factors considered and monitored for each CCP are the handling and processing time, temperature of material, and cleanliness of equipment and utensils. The treatment conditions (electric field intensity, pulsing rate, input voltage, input current, and chamber temperature) should be monitored and recorded on a continuous basis. A uniform PEF treatment requires the design and construction of a pulser that produces variable pulsing rates, charging rates, voltage settings, pulse widths, and pulse shapes. Pulser components such as the power source, computerized controls, triggering mechanism, overloads, dummy loads, and treatment chamber should comply with defined specifications and characteristics such as maximum operating temperature, maximum voltage and current outputs, and reliability (i.e., mean time between failures, yields, etc.). The reliability of the pulser may be measured in terms of number of pulses with correct energy level per unit of time as well as total pulses per unit of time. Monitoring devices may include oscilloscopes for voltage and current measures and pulse counters.

TABLE 5. CCP deviations and possible corrective actions in a PEF operation

CCP	Control parameter	Deviation	Action
Raw material			
Receiving & storage	Spoilage/particulate	Detected	Reject
	Storage time	Exceeded	Reject
	Storage temperature	Above specifications	Adjust temperature Reject
PEF processing unit	Electric field intensity	Below specifications	Adjust electric field Reprocess product Laboratory analysis
		Pulsing rate	Below specifications
	Flow rate	Above specifications	Adjust flow
	Arcs or sparks	Detected	Reprocess product Reject
Finished product			
Packaging/storage	Package seal	Leaks	Adjust packaging machine Reprocess/reject
		Storage temperature	Above specifications
	Storage time	Exceeded	Reject
	Spoilage/particulate	Detected	Reject

TABLE 6. Batch record for a PEF operation

Product: _____

Batch ID: _____

A. Raw Materials

Item	Description	ID Number	Amount

By: _____ Time: _____

B. Equipment and Utensils

Treatment chamber: _____

Sterile utensils	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Totally disassembled	<input type="checkbox"/> Yes	<input type="checkbox"/> No
with detergent	<input type="checkbox"/> Yes	<input type="checkbox"/> No
with chlorine-200 ppm	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Rinsed with sterile water	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Autoclaved - 121°C/ 15 min	<input type="checkbox"/> Yes	<input type="checkbox"/> No

By: _____ Time: _____
 By: _____ Time: _____ Cleaned
 By: _____ Time: _____ Sonitized
 By: _____ Time: _____
 By: _____ Time: _____
 By: _____ Time: _____

Pump Head or Peristaltic Hose System, Heat Exchanger, Plastic Fittings, Plastic Tubing

Cleaned with detergent	<input type="checkbox"/> Yes	<input type="checkbox"/> No
with chlorine-200 ppm	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Rinsed with sterile water	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Autoclaved - 121°C/15 min	<input type="checkbox"/> Yes	<input type="checkbox"/> No

By: _____ Time: _____ Sonitized
 By: _____ Time: _____
 By: _____ Time: _____
 By: _____ Time: _____

Aseptic Package

Number of bags: _____

UV light exposed	<input type="checkbox"/> Yes	<input type="checkbox"/> No
with H ₂ O ₂ _____%	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Rinsed with sterile water	<input type="checkbox"/> Yes	<input type="checkbox"/> No

By: _____ Time: _____
 By: _____ Time: _____ Sonitized
 By: _____ Time: _____
 By: _____ Time: _____

Work Bench

UV light exposed	<input type="checkbox"/> Yes	<input type="checkbox"/> No
with chlorine - 200 ppm	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Rinsed with sterile water	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Dry and clean	<input type="checkbox"/> Yes	<input type="checkbox"/> No

By: _____ Time: _____ Sonitized
 By: _____ Time: _____
 By: _____ Time: _____
 By: _____ Time: _____

C. Prepulsing Procedures

Pulser Setup

Safeguards in place	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Compressor "ON"	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Setup voltage: _____ kV		
Setup frequency for pulsing: _____ Hz		
of pulser	<input type="checkbox"/> Manual	<input type="checkbox"/> Auto

By: _____ Time: _____
 By: _____ Time: _____
 By: _____ Time: _____
 By: _____ Time: _____ Operation
 By: _____ Time: _____

Product Circulation

Removal of air bubbles	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Flow rate: _____ l/min		
of steps: _____		

By: _____ Time: _____
 By: _____ Time: _____ Number
 By: _____ Time: _____

D. Process Conditions

Process Parameters:

Step	1	2	3	4	5	6	7	8	9		
Flow rate	___/	___/	___/	___/	___/	___/	___/	___/	___/	___/	L/min
Pulsing rate	___/	___/	___/	___/	___/	___/	___/	___/	___/	___/	Hz
Set voltage	___/	___/	___/	___/	___/	___/	___/	___/	___/	___/	kV
Peak field	___/	___/	___/	___/	___/	___/	___/	___/	___/	___/	kV/cm
Peak current	___/	___/	___/	___/	___/	___/	___/	___/	___/	___/	A
In - treatment chamber:	___/	___/	___/	___/	___/	___/	___/	___/	___/	___/	°C
Out - treatment chamber:	___/	___/	___/	___/	___/	___/	___/	___/	___/	___/	°C
Holding section length:	___/	___/	___/	___/	___/	___/	___/	___/	___/	___/	m
In - cooling coil:	___/	___/	___/	___/	___/	___/	___/	___/	___/	___/	°C
Out - cooling coil:	___/	___/	___/	___/	___/	___/	___/	___/	___/	___/	°C
Length of cooling coil	___/	___/	___/	___/	___/	___/	___/	___/	___/	___/	m
Operator	___/	___/	___/	___/	___/	___/	___/	___/	___/	___/	

Packaging

Aseptic tonk - intermediate	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Aseptic manual packaging	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Laminar flow hood pack	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Automatic packaging	<input type="checkbox"/> Yes	<input type="checkbox"/> No

By: _____ Time: _____
 By: _____ Time: _____
 By: _____ Time: _____
 By: _____ Time: _____

Standard operating procedures (SOPs) should be in place to define aspects such as receiving, storing, and preparation of raw materials to ensure proper handling and reduce the risk of contamination. The pulsing and packaging units must have procedures to specify the assembly and disassembly of the machinery. Cleaning specifications such as frequency and type of detergents and sanitizers should be established to prevent any type of contamination between products. The operational parameters for PEF treatments must be specified for each product based upon microbial, physical, and chemical characteristics (e.g., initial microbial counts, pH, ionic strength, and composition) as well as the maximum time needed to complete the processing of each food (i.e., time from initial discharge of raw materials to the end of the packaging operation). Alternative procedures must define the corrective actions for deviations from process specifications or CCP limits. Quality assurance procedures must be developed for the approval or rejection of PEF treated products based on the CCP limits and corrective actions (Table 5).

3. Record keeping

Record keeping is a key aspect not only in a PEF operation but in any successful manufacturing operation. The status of raw materials, process and packaging sequence, and storage and shipping procedures must be reflected in the batch or lot documents. Proper design of the documents is an important and difficult task because they must provide enough space for critical measurements without confusing the operator. Table 6 is an example of a batch record intended for a PEF operation, combining the setup and CCP monitoring procedures into a single document.

HAZOP PRINCIPLES AND PEF TECHNOLOGY

The main concern of the individuals working in a PEF facility is the voltage intensity, which reaches the kilovolt range. A typical pulser configuration is presented in Figure 2. A high-voltage power supply is selected to charge the capacitors and a discharge switch releases the stored electric energy from the capacitor(s) through the product in the form of an electric field. The power supply, capacitors, and treatment chamber must be confined in a restricted access area with interlocked gates. Opening the gates will turn off the pulser while the power supply is on. Emergency switches must be accessible in case of a process failure. Also, discharging bars must be provided to discharge the elements in the circuit before maintenance or inspection of the unit occurs. To prevent the leakage of high voltage through any fluid (food or refrigerant) in contact with the treatment chamber, all connections to the chamber are isolated and the pipes carrying materials to or from the chamber connected to ground.

Electrical and mechanical devices such as pumps, computers, and packaging machines must be protected using safeguards. Proper warning signs must be in place regarding safety hazards (high voltage, high-intensity electric field) in the processing area. The information related to the operation and maintenance procedures must be contained in standard operating procedures (SOPs). The personnel involved in the PEF operation must be properly trained and instructed in those SOPs.

The selection of appropriate detergents and sanitizers must comply with FDA and USDA/FSIS regulations. Proper protection devices such as face masks or goggles, aprons, boots, and gloves must be used by employees while applying and removing the cleaning

solutions. A complete procedure must be in place to define how, when, what, and where to use the cleaning and sanitizing solutions. Proper record keeping is required to avoid contamination of the products with the detergent or sanitizer solutions.

A complete layout of the facility including details about location of utilities, location of equipment, and emergency exits must be available. Changes in the configuration of the facility must be reflected in the layout.

FINAL REMARKS

The design and construction of a PEF facility for food processing requires both state-of-the-art equipment and common sense. The HACCP principles are key elements to the preparation of a strategy for manufacturing a PEF product, with special attention given to product handling, treatment parameters and equipment cleanliness. Appropriate batch records and procedures must be implemented to ensure the production of a safe product.

Safety to the personnel working in a PEF facility is another key issue in the design and construction of the PEF facility. Proper safeguards must be in place to prevent anyone working with the pulser from an electro-shock as well as to protect the pulser itself.

ACKNOWLEDGMENTS

This work was funded by the AASERT Program (U.S. Department of Defense), the Natick Research Development and Engineering Center (U.S. Army), and the Bonneville Power Administration (U.S. Department of Energy).

REFERENCES

1. Beattie, J. M., and F. C. Lewis. 1925. The electric current (apart from the heat generated). A bacteriological agent in the sterilization of milk and other fluids. *J. Hyg.* 24:123-137.

2. Gilliland, S. E., and M. L. Speck. 1967. Mechanism of the bactericidal action produced by electrohydraulic shock. *Appl. Microbiol.* 15:1038-1044.
3. Hülshager, H., J. Potel, and E. G. Niemann. 1983. Electric field effects on bacteria and yeast cells. *Radiat. Environ. Biophys.* 22:149-162.
4. Jacob, H. E., W. Foster, and H. Berg. 1981. Microbial implication of electric field effects. II. Inactivation of yeast cells and repair of their cell envelope. *Z. Allg. Mikrobiol.* 21:225-233.
5. Jay, J. M. 1991. Microbiological safety of foods, p. 434-452. *In Modern food microbiology*, 4th ed. Van Nostrand Reinhold, New York.
6. Lipton, S., and J. Lynch. 1994. Major process hazards, p. 873-928. *In Handbook of health hazard control in the chemical process industry*. John Wiley & Sons, Inc., New York.
7. Mizuno, A., and Y. Hori. 1988. Destruction of living cells by pulsed high-voltage application. *IEEE Trans. Ind. Applic.* 24:387-394.
8. NFPA. 1993. Implementation of HACCP in a food processing plant. *J. Food Prot.* 56:548-554.
9. Pierson, M. D., and D. A. Corlett. 1992. HACCP: principles and applications. AVI Book, Van Nostrand Reinhold, New York.
10. Pothakamury, U. R., H. Vega-Mercado, Q. Zhang, G. V. Barbosa-Cánovas, and B. G. Swanson. Submitted for publication.
11. Sale, A. J. H. and W. A. Hamilton. 1967. Effect of high electric fields on microorganisms. I. Killing of bacteria and yeast. *Biochim. Biophys. Acta.* 148:781-788.
12. Sato, M., K. Tokita, M. Sadakata, and T. Sakai. 1988. Sterilization of microorganisms by high-voltage pulsed discharge under water. *Kagaku Hogaku Ronbunshu* 4:556-557.
13. Sitzmann, W. 1995. High voltage pulse techniques for food preservation, p. 236-252. *In G. W. Gould (ed.), New methods of food preservation*. Blackie Academic & Professional, Chapman & Hall, New York.
14. Vega-Mercado, H., U. R. Pothakamury, F. J. Chang, G. V. Barbosa-Cánovas, and B. G. Swanson. Submitted for publication.
15. Zhang, Q., A. Monsalve-González, G. V. Barbosa-Cánovas, and B. G. Swanson. 1994. Inactivation of *E. coli* and *S. cerevisiae* by pulsed electric fields under controlled temperature conditions. *Trans. ASAE* 37:581-587.
16. Zhang, Q., B. L. Qin, G. V. Barbosa-Cánovas, and B. G. Swanson. 1995. Inactivation of *E. coli* for food pasteurization by high-intensity-short-duration pulsed electric fields. *J. Food Proc. Pres.* 19:103-118.



DQCI
Services, Inc.

Bacteriological & Chemical Testing

Standards and Calibration Sets

Raw Milk Component Standards
Raw Lowfat Component Standards
Past/Homo Lowfat Standards
High Fat Cream Standards
Light Cream Standards
Electronic Somatic Cell Standards
Whey Standards
Urea Standards

Chemical and Bacteriological Testing

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

High Performance Liquid Chromatography

Carbohydrates
Antibiotics in Milk

Mounds View Business Park
5205 Quincy St.
Mounds View, MN 55112
(612)785-0484 phone
(612)785-0584 Fax

Reader Service No. 129



SEIBERLING ASSOCIATES, INC.

*The Acknowledged Leaders in
State-of-the-Art Sanitary
Process & CIP Engineering
Design Automation & Software
for Projects that feature:*

- Lowest Capital Costs
- Maximum Operating Efficiency
- Top Product Quality & Shelf Life

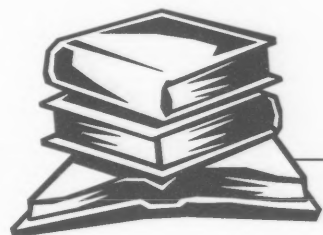
*Supporting IAMFES
for over 17 Years.*

Dublin, OH	Roscoe, IL	Redwood City, CA
(614) 764-2817	(815) 623-7311	(415) 363-0577
Fax (614) 764-5854	Fax (815) 623-2029	Fax (415) 367-8682

Reader Service No. 207

Book reviewed by: Arthur J. Maurer, Ph.D., Professor,
University of Wisconsin-Madison, College of Agricultural and Life Sciences

Book Review



"Poultry Products Technology"

George J. Mountney, Ph.D.
Carmen R. Parkhurst, Ph.D.

The Third Edition of "Poultry Products Technology" is one of the few texts that covers both poultry meat and eggs. The entire spectrum of poultry products is presented, from the live bird through processing, preserving, value-added products, and much more. Likewise, eggs receive complete coverage as well. A real bonus in this book is the chapter on methods of analyses, making the text very useful for us in academics (faculty and students), and also for the egg industry.

This text will be used in many classrooms, especially for those courses that address poultry and egg processing products. Information in this book will also be helpful to consumers via university and industry education and outreach programs. The poultry industry will benefit from chapters that relate to their particular processes and products. For example, the information and formulas on value-added products will help compa-

nies get started on new items or allow processors to expand and improve existing product lines. Internationally, many entrepreneurs will be able to obtain a good overview of the entire poultry products industry as they consider initiating new business ventures in poultry marketing.

Although this Third Edition is a complete text on poultry meat and eggs, there are some topics that could be added in a future revision to make it even more comprehensive. For example, advancements in electrical and CO₂ stunning prior to poultry slaughter is an important area. Likewise, some of the recent research findings could be integrated more fully into a next edition. Nevertheless, the Third Edition of "Poultry Products Technology" provides a wealth of information for poultry processors, food scientists, dietitians, consumers and anyone else who wishes to learn about poultry.

For copies of "Poultry Products Technology":

Mail requests to: Haworth Food Products Press, 10 Alice Street, Binghamton, NY 13904-1580.

CALL FOR ABSTRACTS

IAMFES
84th Annual Meeting — July 6-9, 1997
Orlando, Florida

Instructions for Preparing Abstracts

Procedure

- Type abstract in space provided on the abstract form. Abstracts must be double-spaced in a font size no smaller than 12 point. Left and right margins must be no less than 1/2 inch.
- Type in the title, CAPITALIZE the first letter of the first word and proper nouns.
- List the names of authors and institution(s). Capitalize first letters and initials.
- Give the full name, title, mailing address and the office telephone number of the author who will present the paper.
- If the paper is to be presented by a student entered in the Developing Scientist Awards Competitions, check the box to indicate this and have the form signed by your Major Professor or Department Head. (For more information on the Developing Scientist Awards Competitions, see the following pages.)
- Check the most appropriate box to indicate the general subject area of the paper. Indicate subject if checking "other." Mail two (2) printed copies and one (1) on 3 1/2 inch disk saved as text export or ASCII file of the abstract to be received by December 16, 1996 to:

Carol Mouchka
IAMFES
6200 Aurora Avenue, Suite 200W
Des Moines, IA 50322-2863

Enclose two (2) self-addressed postcards for each abstract that is submitted. One will be returned to acknowledge receipt of the abstract and the other to notify the author of acceptance or rejection.

Content of the Abstract

The abstract should describe briefly: a) the purpose of research/objectives; b) methodology; c) essential results; d) conclusions/significance/implications.

Presentation Format

Papers may be presented orally or by poster format at the discretion of the IAMFES Program Advisory Committee. Oral presentations will be scheduled so a speaker has a maximum of 15 minutes, including a 2-4 minute discussion. Carousel projectors for 35 mm slides will be available. Other equipment may be used at speaker's expense. Prior authorization must be obtained. Overhead projectors are not to be used.

Subject Matter for Papers

Papers should report the results of applied research on: food, dairy and environmental sanitation; foodborne pathogens; food and dairy microbiology; food and dairy engineering; food and dairy chemistry; food additives and residues; food and dairy technology; food service and food administration; quality assurance/control; mastitis; environmental health; waste management and water quality. Papers may also report subject matter of an educational and/or nontechnical nature.

Criteria for Acceptance of Abstracts

1. Abstract must accurately describe briefly: a) the problem studied/objectives; b) methodology; c) essential results; d) conclusions/significance/implications. Results should be summarized. **Do not use tables or graphs.**
2. Abstract must report the results of original research pertinent to the subject matter described above in subject matter for papers section.
3. Research must be based on accepted scientific practices.
4. Research should not have been previously presented nor intended for presentation at another scientific meeting; paper should not have appeared in print prior to the Annual Meeting.

Typical Reasons for Rejection of Abstracts

1. Abstract was not prepared according to "Instructions for Preparing Abstracts."
2. Abstract does not contain essential elements described above in #1, "Criteria for Acceptance."
3. Abstract reports inappropriate or unacceptable subject matter, is not based on accepted scientific practices, or the quality of the research or scientific approach is inadequate.
4. Work reported appears to be incomplete.
5. The abstract was poorly written or prepared.
6. Results have been presented/published previously.
7. The abstract was received after the deadline for submission.
8. Abstract contains information that is in violation of the IAMFES Policy on Commercialism.

Additional Abstract Forms

Photocopies of the abstract form may be used.

Membership in IAMFES

Membership in IAMFES is NOT a requirement for presenting a paper at the IAMFES Annual Meeting.

IAMFES Abstract Form

DEADLINE: Must be Received by December 16, 1996

Title of Paper _____

Authors _____

Full Name and Title of Presenter _____

Institution and Address of Presenter _____

Office Phone Number (____) ____ - _____

Fax Number (____) ____ - _____

e-mail _____

Developing Scientist Awards Competitions Yes Oral Poster

Major Professor/Department Head approval (signature and date) _____

Selected presentations, with permission, will be recorded (audio or visual).

I authorize IAMFES to record my presentation.

Signature _____ Date: _____

I do not wish to be recorded.

Signature _____ Date: _____

General Subject Area

- | | |
|--|---|
| <input type="checkbox"/> Quality Assurance/Control | <input type="checkbox"/> Food Service |
| <input type="checkbox"/> Food Microbiology | <input type="checkbox"/> Sanitation |
| <input type="checkbox"/> Dairy Microbiology | <input type="checkbox"/> Food Safety |
| <input type="checkbox"/> Waste Management | <input type="checkbox"/> Processing |
| <input type="checkbox"/> Lab Methods | <input type="checkbox"/> Epidemiology |
| <input type="checkbox"/> Foodborne Pathogens | <input type="checkbox"/> Nontechnical/
Education |
| <input type="checkbox"/> Chemical Residues | |
| <input type="checkbox"/> Environmental Health | <input type="checkbox"/> Other _____ |

Check the format you prefer.

- | | |
|--|--|
| <input type="checkbox"/> Oral | <input type="checkbox"/> Poster |
| <input type="checkbox"/> Video Theater | <input type="checkbox"/> No Preference |

Please TYPE abstract, DOUBLE-SPACED, in the space provided here.

Call for Entrants in the Developing Scientist Awards Competitions (Supported by Sustaining Members)

IAMFES is pleased to announce continuation of its program to encourage and recognize the work of students and recent graduates in the field of food safety research. Qualified individuals may enter either the Developing Scientist Oral Competition or the Developing Scientist Poster Competition.

Purpose:

1. To encourage students and recent graduates to present their original research at the IAMFES Annual Meeting.
2. To foster professionalism in students and recent graduates through contact with peers and professional members of IAMFES.
3. To encourage participation by students and recent graduates in IAMFES and its Annual Meeting.

Developing Scientist Oral Awards Competition:

The Developing Scientist Oral Awards Competition is open only to **graduate students enrolled in M.S. or Ph.D. programs or recent M.S. or Ph.D. graduates** in programs at accredited universities or colleges where research deals with environmental, food or dairy sanitation, protection or safety. **Competition entrants cannot have graduated more than one year prior to the deadline for submitting abstracts.**

Prior to the Annual Meeting, up to ten finalists will be selected for Competition and awards will be presented at the Annual Meeting to the top three presenters (first, second and third places). Presentations are limited to fifteen minutes which should include two to four minutes for discussion.

Awards: First Place, \$500 and an engraved plaque; Second Place, \$300 and a framed certificate; Third Place, \$100 and a framed certificate. Award winners will also receive a complimentary, one-year IAMFES membership including both *Dairy, Food and Environmental Sanitation* and *Journal of Food Protection*.

Developing Scientist Poster Awards Competition:

The Developing Scientist Poster Awards Competition is open to **enrolled undergraduate and graduate students or recent graduates from undergraduate or graduate programs** at accredited universities or

colleges where research deals with environmental, food or dairy sanitation, protection or safety. **Competition entrants cannot have graduated more than one year prior to the deadline for submitting abstracts.**

Prior to the Annual Meeting, up to ten finalists will be selected for Competition and awards will be presented at the Annual Meeting to the top three presenters (first, second and third places). The presentation must be mounted on an eight feet by four feet (8' x 4') display board provided at the Annual Meeting for the duration of the assigned Poster Session. The presenter must be present at his or her poster for the specified time (approximately two hours) during the assigned session.

Awards: First Place, \$500 and an engraved plaque; Second Place, \$300 and a framed certificate; Third Place, \$100 and a framed certificate. Award winners will also receive a complimentary, one-year IAMFES membership including both *Dairy, Food and Environmental Sanitation* and *Journal of Food Protection*.

Instructions to Developing Scientist Awards Oral and Poster Competitions Entrants:

1. Abstracts must be received by the IAMFES office no later than December 16, 1996.
2. In addition to adhering to the general procedures for abstract preparation and submission required of all individuals submitting abstracts, Competition entrants must submit **one additional copy** of their abstract (i.e., a total of three (3) copies must be submitted). **Competition entrants must also mark the appropriate box on the abstract form to indicate their intention to participate in the Developing Scientist Awards Competition and to designate whether it is "oral" or "poster."**
3. Both the Competition entrant and his or her presentation must be recommended and approved for the Competition by his or her major professor or department head, who must sign the abstract.
4. The work must represent original research done by the Competition entrant and must be presented by the Competition entrant.
5. Competition entrants may enter only one paper in either the Oral or the Poster Competition.

Additional Information:

1. Acceptance of papers by IAMFES for presentation at the Annual Meeting is independent of acceptance as a Competition finalist. Competition entrants who are chosen as finalists will be notified of their status by the Competition Chair by May 1, 1997.
2. All Competition entrants (not just Competition finalists) with abstracts accepted by IAMFES will receive a complimentary, one-year IAMFES membership which includes their choice of *Dairy, Food and Environmental Sanitation* or *Journal of Food Protection*.
3. All Competition finalists will receive a complimentary Awards Banquet ticket and are expected to be present at the banquet where the award winners will be announced and recognized.
4. All Competition entrants are required to pay the registration fee (i.e., student member rate, member rate, or nonmember rate). Nonmembers may join IAMFES and receive the member rate.

Judging the Developing Scientist Awards Competitions:

Abstracts and presentations will be evaluated by an independent panel of judges. Selection of up to ten finalists for the Developing Scientist Oral and Poster

Awards Competitions will be based on evaluations of the abstracts and the scientific quality of the work (see judging criteria). All Competition entrants will be advised of the judges' decisions by May 1, 1997.

Only the Competition finalists will be judged at the Annual Meeting and will be eligible for the awards. All other Competition entrants with abstracts accepted by the IAMFES Program Advisory Committee will be expected to present their papers/posters as part of the regular Annual Meeting program, but their presentations will not be judged and they will not be eligible for the awards.

Judging Criteria for the Developing Scientist Awards Competitions:**ABSTRACT:**

Clarity; comprehensiveness; conciseness.

SCIENTIFIC QUALITY:

Adequacy of experimental design; extent to which objectives were met; difficulty and thoroughness of research; validity of conclusions based upon data; technical merit; contribution to science.

ORAL PRESENTATION OR POSTER PRESENTATION:

Organization (clarity of introduction, objectives, methods, results and conclusions); quality of visuals; quality and poise of presentation and in answering questions.

***NOTE: Your abstract must be received by the IAMFES office no later than December 16, 1996. Photocopies of the abstract form may be used.**

IAMFES Policy on Commercialism

1. INTRODUCTION

No printed media, technical sessions, symposia, posters, seminars, short courses, and/or all related type forums and discussions offered under the auspices of IAMFES (hereafter referred to as IAMFES forums) are to be used as platforms for commercial sales or presentations by authors and/or presenters (hereafter referred to as authors) without the expressed permission of the IAMFES staff or Executive Board. IAMFES enforces this policy in order to restrict commercialism in technical manuscripts, graphics, oral presentations, poster presentations, panel discussions, symposia papers, and all other type submissions and presentations (hereafter referred to as submissions and presentations), so that scientific merit is not diluted by proprietary secrecy.

Excessive use of brand names, product names or logos, failure to substantiate performance claims, and failure to objectively discuss alternative methods, processes, and equipment are indicators of sales pitches. Restricting commercialism benefits both the authors and recipients of submissions and presentations.

This policy has been written to serve as the basis for identifying commercialism in submissions and presentations prepared for IAMFES forums.

2. TECHNICAL CONTENT OF SUBMISSIONS AND PRESENTATIONS

2.1 Original Work

The presentation of new technical information is to be encouraged. In addition to the commercialism evaluation, all submissions and presentations will be individually evaluated by the Program Advisory Committee (PAC) chair, technical reviewers selected by the PAC chair, session convenor, and/or IAMFES staff on the basis of originality before inclusion in the program.

2.2 Substantiating Data

Submissions and presentations should present technical conclusions derived from technical data. If products or services are described, all reported capabilities, features or benefits, and performance parameters must be substantiated by data or by an acceptable explanation as to why the data are unavailable (e.g., incomplete, not collected, etc.) and, if it will become available, when. The explanation for unavailable data will be considered by the PAC chair and/or technical reviewers selected by the PAC chair in order to ascertain if the presentation is acceptable without the data. Serious consideration should be given to withholding submissions and presentations until the data are available as only those conclusions that might be reasonably drawn from the data may be presented. Claims of benefit and/or technical conclusions not supported by the presented data are prohibited.

2.3 Trade Names

Excessive use of brand names, product names, trade names, and/or trademarks is forbidden. A general guideline is to use proprietary names once and thereafter to use generic descriptors or neutral designations. Where this would make the submission or presentation significantly more difficult to understand, the PAC chair, technical reviewers selected by the PAC chair, session convenor, and/or IAMFES staff will judge whether the use of trade names, etc., is necessary and acceptable.

2.4 "Industry Practice" Statements

It may be useful to report the extent of application of technologies, products, or services, however, such statements should review the extent of application of all generically similar technologies, products, or services in the field. Specific commercial installations may be cited to the extent that their data are discussed in the submission or presentation.

2.5 Ranking

Although general comparisons of products and services are prohibited, specific generic comparisons that are substantiated by the reported data are allowed.

2.6 Proprietary Information (See also 2.2.)

Some information about products or services may be proprietary to the author's agency or company, or to the user and may not be publishable. However, their scientific principles and validation of performance parameters must be described. Conclusions and/or comparisons may only be made on the basis of reported data.

2.7 Capabilities

Discussion of corporate capabilities or experiences are prohibited unless they pertain to the specific presented data.

3. GRAPHICS

3.1 Purpose

Slides, photographs, videos, illustrations, art work, and any other type visual aids appearing with the printed text in submissions or used in presentations (hereafter referred to as graphics) should be included only to clarify technical points. Graphics which primarily promote a product or service will not be allowed. (See also 4.6.)

3.2 Source

Graphics should relate specifically to the technical presentation. General graphics regularly shown in, or intended for, sales presentations cannot be used.

3.3 Company Identification

Names or logos of agencies or companies supplying the goods or services must not appear on the graphics, except on the first slide of the presentation. Slides showing products may not include predominant nameplates. Graphics with commercial names or logos added as background borders or corners are specifically forbidden.

3.4 Copies

Graphics that are not included in the preprint may be shown during the presentation only if they have been reviewed in advance by the PAC chair, session convener, and/or IAMFES staff, and have been determined to comply with this policy. Copies of these additional graphics must be available from the author on request by individual attendees. It is the responsibility of the session convener to verify that all graphics to be shown have been cleared by PAC chair, session convener, IAMFES staff, or other reviewers designated by the PAC chair.

4. INTERPRETATION AND ENFORCEMENT

4.1 Distribution

This policy will be sent to all authors of submissions and presentations in IAMFES forums.

4.2 Assessment Process

Reviewers of submissions and presentations will accept only those that comply with this policy. Drafts of submissions and presentations will be reviewed for commercialism concurrently by both IAMFES staff and technical reviewers selected by the PAC chair. All reviewer comments shall be sent to and coordinated by either the PAC chair or the designated IAMFES staff. If any submissions are found to violate this policy, authors will be

informed and invited to resubmit their materials in revised form before the designated deadline.

4.3 Author Awareness

In addition to receiving a printed copy of this policy, all authors presenting in an IAMFES forum will be reminded of this policy by the PAC chair, their session convener, or the IAMFES staff, whichever is appropriate.

4.4 Monitoring

Session convenors are responsible for ensuring that presentations comply with this policy. If it is determined by the session convener that a violation or violations have occurred or are occurring, he or she will publicly request that the author immediately discontinue any and all presentations (oral, visual, audio, etc.), and will notify the PAC chair and IAMFES staff of the action taken.

4.5 Enforcement

While both technical reviewers, session convenors, and/or IAMFES staff may check submissions and presentations for commercialism, ultimately it is the responsibility of the PAC chair to enforce this policy through the session convenors and IAMFES staff.

4.6 Penalties

If the author of a submission or presentation violates this policy, the PAC chair will notify the author and the author's agency or company of the violation in writing. If an additional violation or violations occur after a written warning has been issued to an author and his agency or company, IAMFES reserves the right to ban the author and the author's agency or company from making presentations in IAMFES forums for a period of up to two (2) years following the violation or violations.

NewMembers

CANADA

Yuehua Cai
Ottawa, Ontario

Lori Cucheron
MDS Kasper Medical Labs
Calgary, Alberta

Lyne Gosselin
COPRAL Inc., Montréal, Québec

Maureen Howes
Agriculture and Agri-Food Canada
Mississauga, Ontario

Klaus Jericho
Agriculture and Agri-Food Canada
Lethbridge, Alberta

R. Lawrence
Health Canada Medical Services
Vancouver, British Columbia

Lynn McIntyre
University of Guelph
Guelph, Ontario

HONG KONG

Angela Chan
Alliance Technical Services, Ltd.
Hong Kong

UNITED STATES

ALABAMA

Ananta Porobodessai
Tuskegee University, Tuskegee

CALIFORNIA

Chris Paddon
Wildwood Natural Foods
Santa Cruz

Lawrence E. Wyatt
The Cheesecake Factory
Calabasas Hills

COLORADO

Barry Davis
Golden

Jeff Devere
Prowers County, Lamar

CONNECTICUT

Jeffrey Hastings
Franklin Foods, N. Franklin

DISTRICT OF COLUMBIA

Jeffrey Brown
Food & Drug Administration,
Washington

IDAHO

Richard O'Horne
District Seven Health Dept.
Idaho Falls

ILLINOIS

Susan Nied
Sara Lee Bakery
Arlington Heights

Tim Parish
Quaker Oats Co., Danville

KENTUCKY

Jean McGlone
Lewis Co. Health Dept., Vanceburg

Melvin Pleasant
American Institute of Baking
Louisville

LOUISIANA

Barbara E. Davis
U.S. Air Force, Shreveport

MARYLAND

Tom Armstrong
bioMérieux, Arnold

MICHIGAN

Carol Groenwegen
Diversey Corporation, Plymouth

MINNESOTA

Ruth Iyorbo
Sandoz Nutrition, Minneapolis

Bob Lang
Sandoz Nutrition, Minneapolis

Suzanne Malesa
Sandoz Nutrition, Minneapolis

Todd McAloon
Cargill Inc., Minneapolis

Terry McCall
3M Microbiology Products
Burnsville

Nancy Robertson
Schwan's Sales Enterprises, Inc.
Marshall

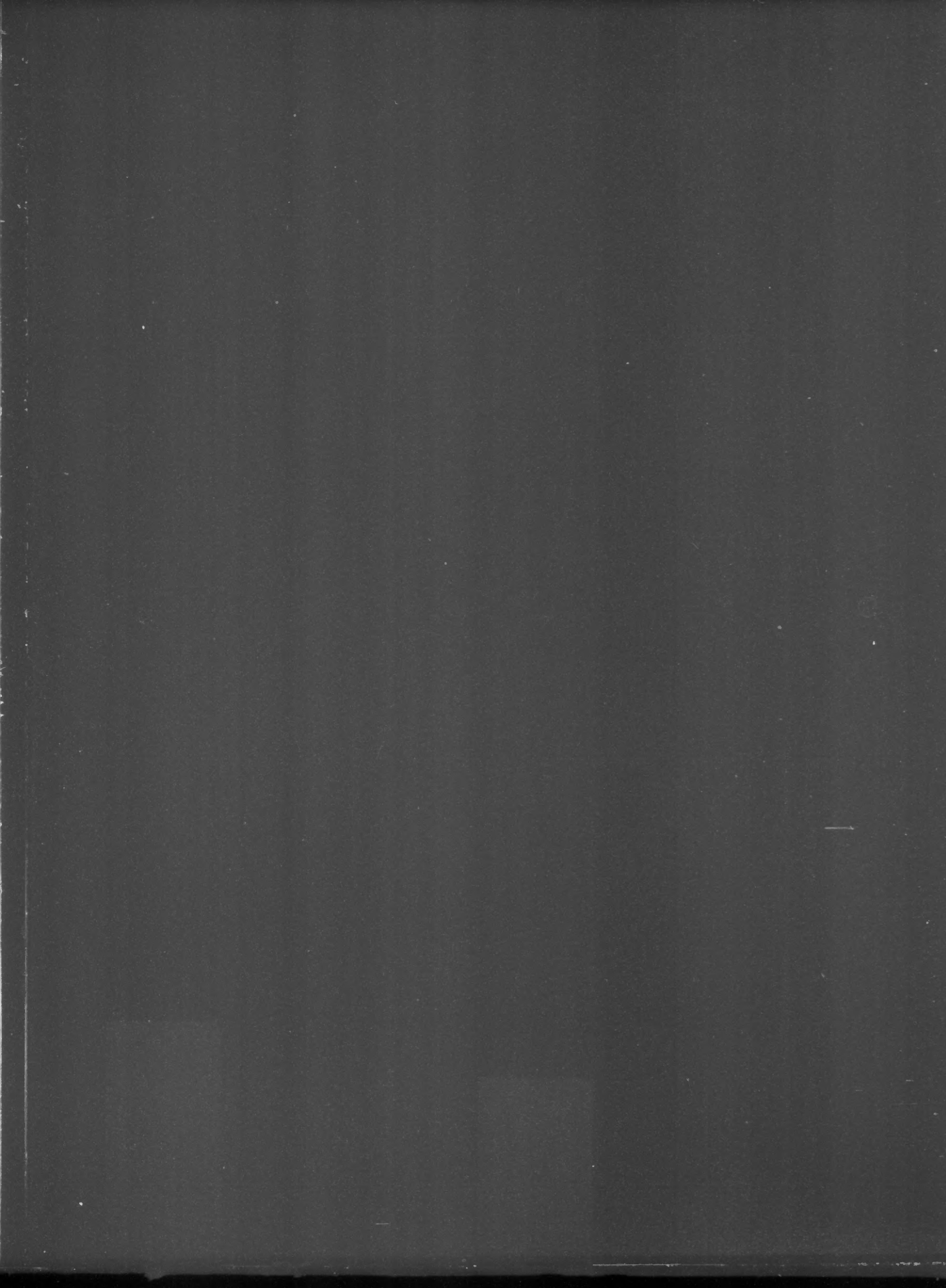
Catherine Strubel
Sandoz Nutrition, Minneapolis

MISSISSIPPI

Charlie Busler
Mississippi State Dept. of Health
Meridian

Tim Carr
Mississippi State Dept. of Health
Magnolia

Edward M. Course, Jr.
Delta Hills Public Health District III
Greenwood



New Members

CANADA

Yuehua Cai
Ottawa, Ontario

Lori Cucheron
MDS Kasper Medical Labs
Calgary, Alberta

Lyne Gosselin
COPRAL Inc., Montréal, Québec

Maureen Howes
Agriculture and Agri-Food Canada
Mississauga, Ontario

Klaus Jericho
Agriculture and Agri-Food Canada
Lethbridge, Alberta

R. Lawrence
Health Canada Medical Services
Vancouver, British Columbia

Lynn McIntyre
University of Guelph
Guelph, Ontario

HONG KONG

Angela Chan
Alliance Technical Services, Ltd.
Hong Kong

UNITED STATES

ALABAMA

Ananta Porobodessai
Tuskegee University, Tuskegee

CALIFORNIA

Chris Paddon
Wildwood Natural Foods
Santa Cruz

Lawrence E. Wyatt
The Cheesecake Factory
Calabasas Hills

COLORADO

Barry Davis
Golden

Jeff Devere
Prowers County, Lamar

CONNECTICUT

Jeffrey Hastings
Franklin Foods, N. Franklin

DISTRICT OF COLUMBIA

Jeffrey Brown
Food & Drug Administration,
Washington

IDAHO

Richard O'Home
District Seven Health Dept.
Idaho Falls

ILLINOIS

Susan Nied
Sara Lee Bakery
Arlington Heights

Tim Parish
Quaker Oats Co., Danville

KENTUCKY

Jean McGlone
Lewis Co. Health Dept., Vanceburg

Melvin Pleasant
American Institute of Baking
Louisville

LOUISIANA

Barbara E. Davis
U.S. Air Force, Shreveport

MARYLAND

Tom Armstrong
bioMérieux, Arnold

MICHIGAN

Carol Groenwegen
Diversey Corporation, Plymouth

MINNESOTA

Ruth Iyorbo
Sandoz Nutrition, Minneapolis

Bob Lang
Sandoz Nutrition, Minneapolis

Suzanne Malesa
Sandoz Nutrition, Minneapolis

Todd McAloon
Cargill Inc., Minneapolis

Terry McCall
3M Microbiology Products
Burnsville

Nancy Robertson
Schwan's Sales Enterprises, Inc.
Marshall

Catherine Strubel
Sandoz Nutrition, Minneapolis

MISSISSIPPI

Charlie Busler
Mississippi State Dept. of Health
Meridian

Tim Carr
Mississippi State Dept. of Health
Magnolia

Edward M. Course, Jr.
Delta Hills Public Health District III
Greenwood

Kirk Embry

Mississippi State Dept. of Health
Batesville

Rick Herrington

Mississippi State Dept. of Health
Hattiesburg

Susan Howell

Mississippi State Dept. of Health
Starkville

Pansy Maddox

Coastal Plains Health District IX
Gulfport

Jesse Shields

Mississippi State Board of Health
Tupelo

NEW JERSEY**Ethel P. Beraquit**

Nabisco Inc., East Hanover

NEW MEXICO**Pauline Gutierrez**

Albuquerque

Martin F. Sancho

New Mexico State University
Las Cruces

OHIO**Virginia A. Meacham**

Cincinnati Health Dept.
Cincinnati

PENNSYLVANIA**Thomas T. Morgan**

Allentown Health Bureau
Allentown

SOUTH CAROLINA**Jean Kintzler**

Flowers Baking Co., Chesnee

TEXAS**Vernon E. Blocker**

Energy Sprouts, San Antonio

Donna Coles

Victoria City-County Health Dept.
Victoria

Albert Espinoza

H.E.B. Grocery Co., San Antonio

UTAH**Yehia El-Samragy**

Utah State University
Logan

WISCONSIN**Rick Alderson**

Belgioioso Cheese Inc., Denmark

Yi-Cheng Su

Corning Hazleton, Inc.
Madison

*Just a
reminder...*

It's time to start planning for the 1997
IAMFES Annual Meeting in Orlando, FL
at the Hyatt Regency Grand Cypress
Hotel.

July 6-9, 1997



Affiliate Officers

ALABAMA ASSN. OF MILK, FOOD & ENVIRONMENTAL SANITARIANS

Pres., Ken Reamer Montgomery
 Pres. Elect, Sandy Dunlap Montgomery
 Vice Pres., Ronnie Sanders Montgomery
 Sec'y. Treas., Tollie Haley Tuscaloosa
 Past Pres., Benji Mikel Auburn
 Delegate, Tom McCaskey Auburn

Mail all correspondence to:
 Tollie Haley
 Tuscaloosa County Health Dept.
 1101 Jackson Avenue
 Tuscaloosa, AL 35401
 (205)554-4540

ALBERTA ASSN. OF MILK, FOOD & ENVIRONMENTAL SANITARIANS

Pres., Mike Mavromaras Edmonton
 Past Pres., Rick Leyland Sherwood Park
 Pres. Elect, Tony Warwaruk Edmonton
 Sec'y., Connie Zagrosch-Miller Edmonton
 Treas., Bonnie Jensen Edmonton
 Delegate, Lawrence Roth Edmonton

Mail all correspondence to:
 Mike Mavromaras
 Regional Dairy Specialist
 Alberta Agriculture
 O.S. Longman Building, 3rd Flr.
 6909-116 St
 Edmonton, Alberta, Canada T6H 4P2
 (403)427-2450

CALIFORNIA ASSN. OF DAIRY & MILK SANITARIANS

Pres., John Jackson LaHabra
 Past Pres., O. Mostafa Sherzad Turlock
 1st Vice Pres., Les Wood Benicia
 2nd Vice Pres., Ed Wensel ... Livermore
 Exec. Sec'y. Treas., John Bruhn .. Davis
 Recording Sec'y., Gary Timmons Ontario
 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 95616-8598
 (916)752-2191

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

Pres., Kay Sigmon Moresville, NC
 Vice Pres., Felix Barron Clemson, SC
 Sec'y., Tom Williamson Raleigh, NC
 Treas., Joe Neely Columbia, SC
 Delegate, Beth Johnson ... Columbia, SC

Mail all correspondence to:
 Kay Sigmon
 NCDEHNR
 919 N. Main St.
 Mooresville, NC 28115
 (704)663-1699

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., Marian Ryan Winter Haven
 Pres. Elect, Faith Holcm Lakeland
 Vice Pres., Buddy Levin Longwood
 Past Pres., Kathleen Ward Jacksonville
 Sec'y., Faith Holcm Lakeland
 Treas., Bill Thornhill Winter Haven
 Delegate, Peter Hibbard Orlando

Mail all correspondence to:
 Bill Thornhill
 3023 Lake Alfred Road
 Winter Haven, FL 33881
 (941)299-6555

GEORGIA ASSN. OF FOOD & ENVIRONMENTAL SANITARIANS

Pres., Yao-wen Huang Athens
 Vice Pres., Ed Giera Atlanta
 Past Pres., Debbie Chapman Atlanta
 Sec'y., Judy Harrison Athens
 Treas., James C. Camp Newnan
 Delegate, David Fry Lilburn

Mail all correspondence to:
 Judy Harrison
 GAFES Secretary
 Cooperative Extension Service
 Hoke-Smith Annex,
 University of Georgia
 Athens, GA 30602
 (706)842-8865

IDAHO ENVIRONMENTAL HEALTH ASSN.

Pres., Edgar Hale Coeur d'Alene
 Pres. Elect, Edward Marugg Pocatello
 Past Pres., Steve Bastian Preston
 Sec'y. Treas., Tom Hepworth Pocatello
 Delegate, Edgar Hale Coeur d'Alena

Mail all correspondence to:
 Tom Hepworth
 Fort Hall SLF,
 1500 N. Fort Hall Mine Rd.
 Pocatello, ID 83204
 (208)236-0607

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., Robert Crombie Joliet
 Past Pres., Marlena Bordson Springfield
 Past Pres., Cheryl Pieper Elmhurst
 Delegate, Charles Price Lombard

Mail all correspondence to:
 Robert Crombie
 Crombie Company
 521 Cowles Avenue
 Joliet, IL 60435
 (815)726-1683

INDIANA ENVIRONMENTAL HEALTH ASSN., INC.

Pres., Sylvia Garrison Bloomington
 Pres. Elect, Cyndi Wagner ... Indianapolis
 Vice Pres., Stephanie Dunlap Indianapolis
 Treas., Don Artmeier Bloomington
 Sec'y., Janice Wilkins Muncie
 Past Pres., Deanna English Danville
 Delegate, Helene Uhlman ... Hammond
 Auditor, E. Patience McGruder Lafayette
 Auditor, Matthew Galbraith Columbus

Mail all correspondence to:
Indiana Environmental Health Assoc.
Attn: Tammi Barrett-Coomer
P.O. Box 457
Indianapolis, IN 46206-0457
(317)383-6168

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

Pres., Loren Johnson Le Mars
Pres. Elect, Herb Belz Slater
Past Pres., Randy Hanson Dubuque
Sec'y. Treas., Janet Burns
..... Manchester
Delegate, Randy Hanson Dubuque

Mail all correspondence to:
Janet Burns
Box 69
Manchester, IA 52057
(319)927-3212

KANSAS ASSN. OF SANITARIANS

Pres., George Blush Topeka
Past Pres., Ron Tubb Overland Park
1st Vice Pres., Dan Hutchison
..... Topeka
2nd Vice Pres., Marvin Simonton
..... Wellington
Sec'y., Galen Hulsing Topeka
Treas., Earnest Barnes Wichita
Delegate, Don Bechtel Manhattan

Mail all correspondence to:
Galen Hulsing
Topeka-Shawnee County Health Agency
1615 S.W. 8th Street
Topeka, KS 66606
(913)295-3650

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

Pres., Keith Brock Lebanon
Pres. Elect, Ed Cecil Owensboro
Vice Pres., Jim Wesley Somerset
Past Pres., Guy Delius Frankfort
Sec'y., Pam Kuist Princeton
Treas., Judy True Frankfort
Delegate, David Klee Elizabethtown

Mail all correspondence to:
Judy True
Local Health Personnel
275 East Main Street
Frankfort, KY 40621
(502)564-3796

**MASSACHUSETTS MILK, FOOD
& ENVIRONMENTAL
INSPECTORS ASSN.**

Pres., David Kochan Northampton
Past Pres., Max Bookless Pittsfield
Vice Pres., Gail Lawrence Springfield
Sec'y. Treas., Fred Kowal Chicopee
Delegate, Barb Kulig
..... West Springfield

Mail all correspondence to:
Fred Kowal
45 Beaumont Avenue
Chicopee, MA 01013
(413)592-5914

**METROPOLITAN ASSN. OF DAIRY,
FOOD AND ENVIRONMENTAL
SPECIALISTS**

Pres., Eileen Wachowski
..... New Rochelle, NY
Past Pres., Donald Hammer
..... Marlton, NJ
1st Vice Pres., Gloria Dougherty
..... Montague, NJ
2nd Vice Pres., Carol A. Schwarz
..... Alpha, NJ
Sec'y. Treas., Dennis Tidwell
..... Hamilton, NJ
Delegate, Fred Weber Hamilton, NJ

Mail all correspondence to:
Fred Weber
2732 Kuser Road
Hamilton, NJ 08691-9430
(609)584-7677

**MICHIGAN ENVIRONMENTAL
HEALTH ASSN.**

Pres., Chuck Lichon Midland
Pres. Elect, Janet Morlick Flint
Past Pres., Dick Fleece Manchester
Treas., Bruce DuHamel Coruna
Sec'y., Tom Olson Holland
Delegate, Chuck Lichon Midland

Mail all correspondence to:
Chuck Lichon
220 N. Ellsworth
Midland, MI 48640
(517)832-6656

**MINNESOTA SANITARIANS
ASSN., INC**

Pres., Ray Cherry Faribault
Pres. Elect, Mary Jean Pettis .. Newulm
Vice Pres., Dan Erickson St. Paul
Sec'y. Treas., Paul Nierman St. Paul
Past Pres., Dennis Decker Litchfield
Delegate, Paul Nierman St. Paul

Mail all correspondence to:
Paul Nierman
Dairy Quality Control Institute
5205 Quincy Street
Mounds View, MN 55112-1400
(612)785-0484

**MISSISSIPPI ENVIRONMENTAL
HEALTH ASSN.**

Pres., Dana Carson Meridian
Pres. Elect, Brenda Clark Gulfport
1st Vice Pres., Robert Course
..... Greenwood
2nd Vice Pres., Charlie Busler
..... Meridian
Sec'y. Treas., Donna Fareyaldenhoven
..... Meridian
Past Pres., Kenneth Bruce Akerman
Delegate, Dana Carson Meridian

Mail all correspondence to:
Dana Carson
Environmental Health Lauderdale
Co. Health
P.O. Box 4419
Meridian, MS 39304
(601)693-2451

**MISSOURI MILK, FOOD &
ENVIRONMENTAL HEALTH ASSN.**

Pres., Diana Pasley Hillsboro
Pres. Elect, David Gailey
..... Jefferson City
Vice Pres., Don Falls Jefferson City
Sec'y., Linda Wilson Springfield
Treas., Patrick Shannon
..... Jefferson City
Past Pres., Janet Murray Moberly
Delegate, Diana Pasley Hillsboro

Mail all correspondence to:
Diana Pasley
Jefferson County Health Department
P.O. Box 0437
Hillsboro, MO 63050
(314)789-3372

**NEBRASKA ASSN. OF MILK
& FOOD SANITARIANS**

Pres., Curt Sales Lincoln
Vice Pres., Michelle Westland
..... Lincoln
Sec'y. Treas., Roger Biltoft Lincoln
Past Pres., Greg Henn Lincoln
Delegate, Susan Sumner Lincoln

Mail all correspondence to:
Michelle Westland
Laboratory, Douglas Co.
Health Dept.
1819 Farnam St.
Omaha, NE 68183
(402)444-7496

NEW YORK STATE ASSN. OF MILK & FOOD SANITARIANS

Pres., Kim Bukowski E. Syracuse
 Pres. Elect, Ronald Gardner Ithaca
 Past Pres., Jerome Hopcus ... Lancaster
 Exec. Sec'y., Janene Gargiulo
 Ithaca
 Delegate, Terry Musson Keyport, NJ

Mail all correspondence to:

Janene Gargiulo
 Cornell University
 172 Stocking Hall
 Ithaca, NY 14853
 (607)255-2892

NORTH DAKOTA ENVIRONMENTAL HEALTH ASSN.

Pres., Allen McKay Devils Lake
 1st Vice Pres., Kevin Misk Rugby
 2nd Vice Pres., Mike Walton Bismarck
 Past Pres., Dan Mattern Bismarck
 Sec'y. Treas., Deb Larson Bismarck
 Delegate, Bob Dykeshoom Bismarck
 Member-at-Large, Jim Schothorst
 Grand Forks

Mail all correspondence to:

Debra Larson
 State Dept. of Health
 600 E Blvd. Ave.
 Bismarck, ND 58505-0200
 (701)328-1292

OHIO ASSN. OF MILK, FOOD & ENVIRONMENTAL SANITARIANS

Pres., Roger Tedrick Columbus
 Pres. Elect, Barry Pokorny .. Cincinnati
 1st Vice Pres., Gloria Swick Columbus
 2nd Vice Pres., James Baker
 Lancaster
 Sec'y. Treas., Don Barrett ... Columbus
 Past Pres., Greg DeLong Dayton
 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 ASSOCIATION

Pres., Sue Fraser Ontario
 Vice Pres., Debbie Labelle ... Kitchener
 Sec'y., Joan Wakeman Hamilton
 Treas., Helen Hingston Ontario
 Past Pres., Anna Lammerding .. Guelph
 Delegate, Sue Fraser Ontario

Mail all correspondence to:

Sue Fraser
 Janes Family Foods Limited
 2160 Highway 7
 Concord, Ontario L4K 1W6
 (905)669-1648

PENNSYLVANIA ASSN. OF MILK, FOOD & ENVIRONMENTAL SANITARIANS

Pres., Eugene Frey Lancaster
 Pres. Elect, Jacqueline Hornack
 Hazleton
 Vice Pres., Craig Weaver Stoystown
 Sec'y., Michael John Waynesboro
 Treas., Robert Mock
 New Berlinville
 Past Pres., Clifford Kendall Altoona
 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., Rich McEntaffer Pierre
 Pres. Elect, Rex Van Den Berg Pierre
 Past Pres., Bill Chalcraft Pierre
 Sec'y. Treas., Scott Hipple Pierre
 Delegate, Darwin Kurtenbach ... Pierre

Mail all correspondence to:

Scott Hipple
 SD State Department of Health
 445 E. Capitol
 Pierre, SD 57501-3185
 (605)773-3364

TENNESSEE ASSN. OF MILK, WATER & FOOD PROTECTION

Pres., Genevieve Christen Knoxville
 Pres. Elect, Gail Smith Chattanooga
 Vice Pres., Dewain Patterson
 Brentwood
 Sec'y. Treas., Dennis Lampley . Bon Aqua
 Bd. Mem. at Lge, Suzie Sykes ... Memphis
 Past Pres., Ernest Yates Cross Plains
 Delegate, Ruth Fuqua Mt. Juliet

Mail all correspondence to:

Dennis Lampley
 7346 Sack Lampley Road
 Bon Aqua, TN 37025
 (615)360-0157

TEXAS ASSN. OF MILK, FOOD & ENVIRONMENTAL SANITARIANS

Pres., Jaime Cantu Corpus Christi
 Past Pres., Don Ritch Dallas
 Sec'y. Treas., Ron Richter
 College Station
 Archivist, Joe Goddard Lubbock
 Delegate, Janie Parks Austin

Mail all correspondence to:

TAMFES
 Ron Richter
 Dept. of Animal Science, Texas A & M
 College Station, TX 77843-2471
 (409)845-4409

VIRGINIA ASSN. OF SANITARIANS & DAIRY FIELDMEN

Pres., Bennett Minor Mechanicsville
 1st Vice Pres., Michael Hodges
 Martinsville
 Sec'y. Treas., David Dansey
 Richmond
 Past Pres., Randy Osborn
 Independence
 Delegate, David Dansey Richmond

Mail all correspondence to:

David Dansey
 Box 1163
 Richmond, VA 23209-1163
 (804)786-1452

WASHINGTON MILK & FOOD SANITARIANS ASSN.

Pres., Stephanie Olmsted Seattle
 Pres. Elect, Jim Watkins Lake Tapps
 Past Pres., Don Butler 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., Bill Wendorff Madison
 Pres. Elect, Phil Hermesen Shawano
 Past Pres., Fritz Buss Marshfield
 1st Vice Pres., Amy J. Bender
 Richland Center
 Sec'y., Randall Dags Sun Prairie
 Treas., Neil Vassau Madison
 Delegate, Joseph Disch Madison

Mail all correspondence to:

Neil M. Vassau
 P.O. Box 7883
 Madison, WI 53707
 (608)267-3504

WYOMING ENVIRONMENTAL HEALTH ASSN.

Pres., Stephanie Whitman Laramie
 Pres. Elect, Laurie Leis Casper
 Sec'y., Shirley Ezzell Lander
 Treas., Jennifer Rucinski Laramie
 Past Pres., Terry Carlile Evanston
 Delegate, Laurie Leis Casper

Mail all correspondence to:

Laurie Leis
 473 Trigood Drive
 Casper, WY 82609
 (307)266-1203

Pete Herb Promoted at Fristam Pumps

Pete Herb has been promoted to Director of Engineering and Research & Development at Fristam Pumps, Inc., Middleton, WI. Pete has been with Fristam for nearly 8 years. He is responsible for the design, development and improvement of Fristam's product lines, as well as providing technical support for the company and its customers. He holds a BS in Mechanical Engineering from the University of Wisconsin-Madison and a Masters of Business Administration (Marketing) from the University of Wisconsin-Whitewater. Fristam congratulates Pete on his new position.

Sandra T. Larson Joins NAMA as Western Manager and Counsel

Sandra T. Larson of Sunland, CA has joined the staff of the National Automatic Merchandising Association (NAMA), as western manager and counsel. Her office will be in the association's western office in Encino, CA.

She replaces Joan Bentler who left NAMA to attend graduate school full-time.

A native of Glendale, CA, Larson attended school in Burbank, CA, graduated from the University of California at Los Angeles and received a law degree from Southwestern University School of Law in Los Angeles. Before joining NAMA, Larson was deputy trial counsel for the State Bar of California in Los Angeles. Previously she was an attorney with the law firm of Clark, White, Hutton, Holmes & Simpson

in Glendale and did fund-raising activities for the Boy's Club of Pasadena, CA and United Way of Los Angeles County.

NAMA is the national trade association of the merchandise vending and contract foodservice management business. Its headquarters are in Chicago, with field offices in Reston, VA and Marietta, GA in addition to the office in Encino.

Tri-Clover Names Regional Manager for Food and Dairy Division

Tri-Clover Inc. has announced the appointment of Owen Skelly as district manager for its Food & Dairy Division.

Skelly will be based in Chicago, IL, and will serve customers and distributors throughout Illinois and Indiana as part of the company's Tri-Clover Team 2000 organization. Skelly joins Tri-Clover from APV Fluid Handling where he served as a regional sales manager based in Corpus Christi, TX.

Tri-Clover is a manufacturer of sanitary stainless steel valves, pumps and fittings, as well as automated flow control and Clean-In-Place systems. Founded in 1919, Tri-Clover Inc., is an Alfa Laval company.

AFFI Promotes Bishop to Vice President of Industry and Government Affairs

McNair Bishop has been promoted to the position of vice president of industry and government affairs at the American Frozen Food Institute (AFFI). In that

role, Bishop will have primary staff responsibility for AFFI's Meat and Poultry Committee, Distribution and Logistics Council, Transportation Committee, and the Superfund Task Force, among other issues. Bishop joined AFFI in January 1995 as director of government affairs.

From 1989 to 1994, Bishop was a lobbyist for the Association of National Advertisers, Inc. (ANA), a trade organization that represents national and regional advertisers. Among her achievements at ANA, Bishop was instrumental in assisting the membership in implementing the Nutrition Labeling and Education Act, and evaluating the impact of the labeling law on advertising. Bishop also organized a coalition that orchestrated a three-year campaign to maintain limits on the authority of the Federal Trade Commission to restrict "unfair" advertising.

Bishop received her bachelor's degree from Davidson College in Davidson, NC.

Theodore Wiseman Receives Salt Institute's 1996 Tony J. Cunha Award

Theodore Wiseman, a graduate student at Ohio State University in Columbus, Ohio has received the Salt Institute's 1996 Tony J. Cunha Award.

Eight years ago, the Salt Institute initiated this \$1,500 research support award to commemorate Dr. Tony J. Cunha's contributions in promoting the understanding of the role of salt in animal nutrition and to recognize

the need for research in this important area. The 1996 Award was presented to the graduate student whose proposed research showed the greatest promise of furthering our understanding of the role of salt in animal diets or the benefits of salt as a carrier for trace minerals. Mr. Wiseman hypothesizes that because both Na and Cl are essential for the digestion of protein and the maintenance of homeostasis in the intestinal tract of the pig, an inadequate level of either element will contribute toward poor postweaning performance. Therefore, he hopes to determine the dietary level of NaCl (salt) needed for the 14 day old

weaning pig. The results will help define the mechanism of action of both nutrients for the initial weeks postweaning.

The 1997 Tony J. Cunha Award will be announced in July, 1997. Persons interested in being considered for this prestigious recognition should contact the Salt Institute at 700 North Fairfax, #600, Alexandria, VA 22314, or call (703) 549-4648, or e-mail the Salt Institute at bert@saltinstitute.org. As a non-profit association representing North American and international salt producers, the Salt Institute was founded in 1914, dedicated to promoting better understanding of all aspects of salt production and use.

Tom Holdorf Appointed General Manager at Fristam Pumps

Tom Holdorf has been named Senior Vice President and General Manager of Fristam Pumps, Inc., Middleton, WI. Tom has been with Fristam for 10 years. He holds a BS in Industrial Technology from the University of Wisconsin-Stout. We congratulate Tom on his appointment.

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

FOOD THERMOMETER SAVINGS



LIMITED TIME OFFER
From \$8.32...
Shirt Pocket Digitals Are
Now Less Than Bi-Metals

Buy 5 digital thermometers of \$9.95 each for a total of \$49.95 and receive one FREE thermometer. - 58° to 302°F in 0.1°. Needle 4³/₄" x 1¹/₈" AQA1264F



Other Thermometer Bargains

Refrigerator Colored Dot Thermometers
Hang or stick inside. \$1 each in quantity of 10. AQA1159F



Thermocouple Fast Response

\$99 per -100°/1,000°F thermometer and probe: Select with hypodermic needle probe (shawn), AQA1277F; or with 1¹/₈" dia. needle probe on 30" cable, AQA1278F; or with surface temperature probe on 30" cable, AQA1279F.



Neck Cord or Shirt Pocket Thermometer

\$15 each if you buy five for a total of \$75. - 40° to 300°F (°C). AQA1271



To Order or For Our Catalog Call
1-800-845-8818 or Fax 1-352-335-6736

ALL QA PRODUCTS, INC. - Gainesville, Florida USA



Applied Research Institute

Serving the Dairy Industry for over 40 years

Do YOU Have a
Copy of Our New
Catalog for ALL your Dairy,
Food, and Environmental
Testing needs?

Now Including:

Milk Smear Slides & Stains
Gerber Fat Test Glassware
Babcock Fat Test Glassware
Gerber & Babcock Chemicals
Thermometers
Dairy & Water Test Kits

Call toll free now!
1-888-DAIRY-00

UGA Breaks Ground on \$7.5 Million Expansion to Center for Food Safety & Quality Enhancement

The University of Georgia College of Agricultural and Environmental Sciences broke ground June 5 for a \$7.5 million expansion to the College's Center for Food Safety and Quality Enhancement (CFSQE).

Located on the campus of the Georgia Experiment Station in Griffin, GA, the Center's principal focus is microbial safety of foods and enhancement of food quality through a research team approach. These teams consist of biochemists, engineers, microbiologists, sensory specialists and food scientists. The CFSQE is home to one of the leading food microbiology teams in the country as well as one of the leading sensory programs in academia.

"Food safety and quality research is at the forefront of the food industry's needs and the addition will enable us to conduct the necessary research," said Dr. Michael Doyle, Director of the Center. "The extramural support we are receiving from the food industry for research is stressing our existing facility and without this addition, we would never be able to meet the growing needs of this industry."

Georgia's Lieutenant Governor Pierre Howard, also present at the ground breaking, saluted the work conducted by the food scientists at the CFSQE. "The scientists here at the Center are fighting to prevent outbreaks of foodborne illnesses such as the deadly *E. coli* which caused the Jack-in-the-Box tragedy," said Howard. "These scientists are fighting to prevent that kind of tragedy from happening to another family again."

Also present at the ground breaking were several food industry representatives including Paul Hall, Director of Microbiology and Food Safety for Kraft Foods, Inc. of



NEWS

Glenview, IL. Hall described the Center as an investment for the entire food industry, not only in the United States, but worldwide.

James L. Ayres, Director of Research and Development/Quality Assurance for GoldKist Inc. of Atlanta, GA, said the Center serves as a source of "impartial advice and research information" for his corporation.

The 28,000 square feet of expansion to the Center is expected to take 18 months to complete with a tentative completion date set for December 1997.

Ecolab Completes Monarch Acquisition

Ecolab Inc., the global leader in cleaning and sanitizing products and services for the hospitality, institutional and industrial markets, stated it has completed the previously announced purchase of the Monarch division of H.B. Fuller Company, of St. Paul, MN. Monarch is a provider of cleaning and sanitizing products and services to the food processing and farm markets in the U.S., Canada and Australia.

Details of the transaction were not disclosed.

Ecolab news releases and other investor information are available

on the Internet at <http://www.shareholder.com/ecolab/>; and by telephone at 1-800-FACT-ECL.

Dairy Industry Innovator Celebrates 100th Anniversary

In these days of rapidly advancing technology and sophisticated business practices, it's rare to be able to trace the beginnings of a family-run business back to the days of horse and wagon. However, Axelrod, a company founded in the eighteenth century in Brooklyn, NY, can do just that. This year it is celebrating its 100th year in business.

Wolf Axelrod founded the now successful dairy company in 1896, establishing a retail store and wholesale distribution center on Madison Street on the lower east side of New York City. In the company's early days, sour cream, sweet cream, pot cheese (cottage cheese), and farmers cheese were its specialties. The dairy products were manufactured in small cheese factories located in upstate New York, and along the Canadian side of the St. Lawrence River. The business thrived, and in 1920, 24 years after he founded the company, Wolf Axelrod retired.

Abraham Axelrod, the youngest of Mr. Axelrod's five sons, assumed control of the company, concentrating on the distribution of "soft" cultured cheeses, such as cottage cheese and sour cream. Brooklyn continued as the business' headquarters and in 1930 an Axelrod branch was established in Freeport, NY.

Two years later the business was sold to a subsidiary of the National Dairy Products Corporation, now known as Kraft, Inc. Abraham Axelrod spent the next six years with National Dairy Products as general manager of distribution and sales facilities in New York, New Jersey, Philadelphia, and Boston.

In 1938 Abraham re-established his own dairy products company and named it Axelrod Dairy, keeping the long family tradition intact. He bought products for resale from creameries in New York, Pennsylvania, and Vermont. Along the way, he established strict quality standards for his suppliers, forging a solid reputation for quality and reliability.

In 1949, Axelrod introduced its first packaged product for the consumer — a pint container of yogurt. It was an immediate success, and soon after, cottage cheese and sour cream followed in its packaging footsteps.

On November 27, 1961, Axelrod was sold to Crowley Foods, Inc. Abraham retired that year. His son, Herbert, succeeded Abraham as president and chief operating officer. During Herbert's tenure, the company expanded geographically, opening branches in Paterson, NJ; East Windsor, CT; and Baltimore, MD. Axelrod's headquarters is in Paterson, NJ.

Herbert Axelrod retired in 1988. Today Steve Harper is the chief operating officer. The company enjoys substantial market share in its major areas of distribution (New York City and New Jersey). The company also distributes its products in Baltimore and parts of New England and southern Florida. In most marketing areas, Axelrod-labeled products appear on the dairy shelves of every major retail store. Axelrod is proud to celebrate its 100th year in business.

Peter Barton Hutt Gives Frazier Memorial Lecture

Peter Barton Hutt, formerly with the Food and Drug Administration and now a partner in the law firm of Covington and Burling in Washington, D.C., gave the fifth annual Frazier Memorial Lecture. The lecture was

given on May 29, 1996 in conjunction with the annual meeting of the Food Research Institute at the University of Wisconsin.

Hutt spoke on "Reform of FDA Food Regulations." In his remarks, he opined that priorities within the FDA do not reflect the real concerns in food safety. According to Hutt, most FDA commissioners since the 1970s have identified foodborne pathogens as the greatest food safety problem but then failed to properly direct resources. Hutt went on to say we should declare war on food pathogens and demand that the needed resources be devoted to this effort.

The Frazier Memorial Lecture commemorates the life and career of the late Dr. William C. Frazier, a pioneering professor of food and dairy microbiology at the University of Wisconsin-Madison. Earlier Frazier Memorial lecturers include Drs. Douglas Archer, Richard Gilbert, Mitchel Cohen, and Robert Buchanan. The lectureship is administered jointly by the Departments of Food Science, Bacteriology, and Food Microbiology and Toxicology.

NSF International Prepared to Help Meat and Poultry Companies Comply with New Federal Rules

NSF International, a not-for-profit organization based in Michigan, announced that they are ready to assist the meat and poultry industry by offering a food safety and quality registration program, known as the HACCP-9000SM Program, to processing plants throughout the country.

On Saturday, July 6th, President Clinton announced the biggest changes in ninety years, in the rules governing meat and poultry safety,

adding science to the tools federal inspectors will use to guard Americans against deadly bacteria. Clinton said the system will be revamped with a scientifically-based food system combined with mandatory microbiological tests to uncover the presence of *E. coli* and *Salmonella* bacteria.

NSF International currently offers the HACCP-9000SM Program as a food safety and quality management system that will greatly assist the meat and poultry industry in following these new rules. NSF's program integrates the food safety principles of HACCP (Hazard Analysis and Critical Control Points), with sanitation requirements as embodied by USDA regulations, with the quality management system of the internationally recognized ISO 9000 standards.

NSF has a network of qualified food safety experts that conduct on-site reviews of a company's food safety (HACCP) plan to ensure that the plan has been satisfactory validated. NSF conducts a full food safety and sanitation audit to verify that the food safety system (HACCP Plan) has been effectively implemented. NSF food safety experts and auditors are supported by NSF laboratories that can conduct microbiological and chemical testing to verify the safety of the food processes.

An NSF registration mark is used to communicate conformance to all stakeholders, government officials, suppliers, and customers. This service also includes a monitoring process with periodic surveillance audits to verify continued conformance.

For more information contact Hoz Vischer, HACCP-9000SM Program, NSF International. (Phone (313) 669-0098 or Fax (313) 669-0196).

Food Safety Experts Say Temperature Monitoring is Number One Defense for Food Safety and Quality

As President Clinton announced tough new food safety regulations, the meat and poultry industries are turning to new technologies to make food more safe and address a critical issue: temperature monitoring. According to Dr. Steve Otwell, Professor of Food Science at the University of Florida, "Temperature monitoring is the number one defense against quality and safety problems; temperature monitoring needs to be involved in every facet of food production, including handling and packaging."

Already major meat/poultry processors, fast food chains and supermarkets are adopting new technologies to monitor plant, storage and in-transit temperatures. Said Dr. Otwell: "There are a lot of related food safety issues, but temperature is by far the most important. Temperature controls that can influence food safety involve cooling, cooking, heating, reheating and storage. Temperature abuse enhances cross-contamination, chemical and microbiological contaminant problems. The FDA and the USDA have highlighted the issue by making it mandatory that companies monitor critical control points in processing and handling."

FDA Panel Backs Monsanto on BST Question, but Wants Further Information

An advisory committee to the Food and Drug Administration met last week and concluded that the Monsanto Co. drug BST was not causing additional health problems for dairy cows, but wants further informa-

tion. The committee also recommended a change in label directions on use of the drug, and that more information should be given farmers on dietary management for cows using BST. The FDA will decide later whether to adopt the recommendations. The recommended label change would warn farmers of increased risk of udder swelling if BST use is not initiated at the recommended ninth week of lactation. About 15 percent of U.S. Dairy cows are treated with BST, which is sold under the brand name Posilac. Monsanto researchers and FDA staff said date indicated no change in the tiny amount of milk rejected for human use because of antibiotic residues. A Michigan State University study, presented to the panel, indicated no difference in mastitis rates between cows using BST and those that did not. Committee members expressed pleasure at the information, but said they wanted to see the results of a study of disease rates in 28 herds using BST on a commercial basis. The panel delayed until November a discussion of whether to require Monsanto to carry out a comparison of milk discard rates between BST and non-BST herds. Monsanto agreed two years ago to conduct the study but indicated that some processors were balking at providing the information.

FDA Publishes Compounding Guide

In the July 3, 1996, *Federal Register*, FDA announced the availability of a new Compliance Policy Guide (CPG) entitled, "Compounding of Drugs for Use in Animals." The text of the CPG is included in the *Federal Register* announcement.

The CPG defines compounding as "any manipulation to produce a dosage form drug other than that manipulation that is provided for in the directions for use on the labeling of the approved drug product, for example, the reconsti-

tion of a sterile powder with sterile water for injection."

The Federal Food, Drug, and Cosmetic Act (the Act) does not distinguish compounding from manufacturing or other processing of drugs for use in animals. Under the Act, compounding is limited to the preparation of drug products which do not meet the definition of new animal drugs. This restriction severely limits the compounding of animal drugs. In the absence of an approved new animal drug application (NADA), the compounding of a new animal drug from any article, including an approved or unapproved finished human or animal drug, or a bulk drug, is a violation of the Act. FDA's Center for Veterinary Medicine recognizes the medical need for compounded animal drugs extending beyond the statutory limitations. This CPG outlines criteria and boundaries for regulatory discretion in respect to the compounding of animal drugs.

When the Animal Medicinal Drug Use Clarification Act of 1994 (AMDUCA) goes into effect, it will allow the "extra-label" use of approved animal and human drugs. Under AMDUCA "extra-label" use, which includes compounding, will be subject to conditions specified by regulation. AMDUCA becomes effective after the promulgation of the regulations.

The new Compounding CPG states that FDA recognizes that circumstances exist when it may be necessary for a veterinarian to compound, or direct a pharmacist to compound, an article that will result in an unapproved new animal drug. There is occasionally a need to utilize drugs labeled for human use, and much less commonly, bulk drug substances, for compounding into an appropriate dosage form. The Agency will exercise regulatory discretion and ordinarily will not take regulatory action against if the criteria described in the CPG are met, within the confines of a legitimate practice. The following general criteria apply:

- A legitimate medical need is identified (the health of animals is threatened and suffering or death would result from failure to treat the affected animals),

- There is a need for an appropriate dosage regimen for the species, age, size, or medical condition of the patient, and

- There is no marketed approved animal drug which, when used as labeled or in an extra-label manner in conformity with criteria listed in CPG 615.100 ("Extralabel Use of New Animal Drugs in Food-Producing Animals"), or human-labeled drug when used in conformity with criteria listed in CPG 608.100 ("Human Labeled Drugs Distributed and Used in Animal Medicine"), may treat the condition diagnosed in the available dosage form, or there is some other rare extenuating circumstance. For example, the approved drug cannot be obtained in time to treat the animal(s) in a timely manner, or there is a medical need for different excipients.

The CPG lists additional specific criteria that should be met and precautions that should be observed if the above conditions are met. Among those criteria are that dispensing should be done by a licensed veterinarian or by receipt of a prescription from a licensed veterinarian by a pharmacist. Dispensing should be within the confines of a valid veterinarian-client-patient relationship. In addition, veterinarians need to take measures to ensure that when used in food-producing animals no illegal residues occur, sufficient time is assigned for drug withdrawal, and

steps are taken to assure that the assigned time frames are observed. In addition, procedures should be instituted to assure that appropriate patient records for the treated animals are maintained. All drugs dispensed to the animal owner by the veterinarian or a pharmacist must bear adequate labeling information. The CPG lists a number of other criteria for the exercise of enforcement discretion.

Copies of the Compliance Policy Guide are available from CVM's Communications and Education Branch at the following address: FDA/Center for Veterinary Medicine Communications and Education Branch, HFV-12, 7500 Standish Place, Rockville, MD 20855.

Lipton Foodservice Joins Food Safety Sponsors

The Educational Foundation of the National Restaurant Association announces that Lipton Foodservice has become a program sponsor of the Industry Council on Food Safety, as well as the SERVSAFE® Serving Safe Food training program.

Lipton's sponsorship will help support a national food safety awareness campaign by the Industry Council on Food Safety, a coalition of foodservice operators, manufacturers, suppliers and associations who are concerned and proactive about food safety. In addition to encouraging industry-wide food safety training, this campaign informs the public of the

foodservice industry's training commitment and educates consumers about the importance of following food safety procedures.

Lipton is the world's largest tea buying organization, with 100 years of indepth knowledge concerning all aspects of tea and some of the most experienced tea tasters and blenders in North America. As the industry leader, Lipton takes the responsibility seriously when it comes to protecting the integrity of tea and meeting the high quality customers demand.

To participate in the Industry Council, which was formed by The Educational Foundation in 1993, a foodservice operation must verify that at least one manager or professional is trained and certified in the SERVSAFE program. Developed by The Educational Foundation, SERVSAFE has been the industry's leading food safety and sanitation training program for more than 20 years.

As part of the food safety campaign, supported by Lipton, The Educational Foundation has designated September 1996 as the second annual National Food Safety Education Month. The objectives of National Food Safety Education Month are to make food safety training accessible to as many people as possible, and to build public awareness and understanding of the foodservice industry's commitment to serving safe food. All segments of the foodservice industry take part in the National Food Safety Education Month in a variety of ways, including providing or promoting food safety training or participating in the Industry Council on Food Safety.



G & H Products Corporation

Advanced Control System Reduces Cabling by 95%

The LKM LINK universal remote control system from G&H Products Corp. can control up to 120 valves or pumps within a single loop with only one air line and one cable, reducing cabling and air lines up to 95%.

The LKM LINK system can automate existing components as an economical, universal remote control for processing components in flow systems. As a comprehensive component link, it provides valves and pump motors with data communication facilities and local interface units for remote control.

The system is comprised of an operator's panel, local interface units, and power supply cables. The operator's panel communicates with local interface units, providing communications interface with the host control system. Local interface units receive communication and perform control and monitoring operations, and the cable installation provides data communication and power supply to the electrical units.

The LKM LINK system has low maintenance requirements. The same system is used for all valves, and local control units can be replaced, adjusted, or added independently without taking the system off-line. High operational security is achieved with sensors at each control point, alarms and password protection, a manual mode for system override, and reliable, high speed field bus communication. In addition, the system also offers a high degree of protection against vibration, noise, and harsh processing environments.

G&H Products Corp., Kenosha, WI

Reader Service No. 375

6MM Flexible Borescope Provides High Resolution for Inspecting Wide Range of Industrial Equipment

A new high-resolution small-diameter (6mm) flexible borescope which reaches, magnifies, illuminates and inspects otherwise inaccessible locations of industrial equipment is available from Lenox Instrument Co., Inc. in Trevoise.

The flexible fiberoptic scope provides a resolution of .001" — comparable to that of rigid models. Priced thousands of dollars lower than competitive products, it can be snaked through narrow curved sections and obstructions of diesel engines, heat exchangers and many

other types of equipment, viewing locations from closeup.

The scope's 6mm flexible probe is available in a variety of lengths, including 40", 60", 80", and 120". It provides direct and right angle viewing through a movable two-way (left or right) articulated tip which the user can easily move in different directions, and lock in place as required.

Two bundles of glass fiber carry light to the inspection area, and convey bright self-illuminated images back to the eyepiece with exceptional coherence for maximum resolution.

A flexible stainless steel jacket protecting the bundles easily slides in and out of the part being inspected and can be maneuvered around sharp corners or elbows without sacrificing brightness or image quality.

The flexible scope incorporates quality features which Lenox developed to meet exacting durability requirements of borescopes which inspect jet engines on military aircraft. These features include being waterproof and submersible.

The scope can be easily fitted with a battery-operated Camcorder to record findings on color videotape, displaying these results on a 3" Liquid Crystal Display (LCD) screen.

Lenox Instrument Co., Inc., Trevoise, PA

Reader Service No. 376

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

Food Analysis Made Faster & Easier

Advanced ion selective electrode design expands capabilities. Orion's new *ionplus™* Combination Ion Selective Electrodes help you meet your quality control testing requirements. Quickly and accurately measure levels of chloride, nitrate, nitrite, fluoride, iodide, and calcium in a variety of foods and beverages.

These rugged epoxy bodied electrodes feature the exclusive Sure-Flow® reference system, guaranteed never to clog. Cleaning is trouble free with this flushable reference junction.

Eliminate testing problems caused by varying sample temperature and background matrix with the specialized Optimum Results™ electrode filling solutions. In addition, the methods avoid hazardous chemicals, such as silver nitrate, and are so fast and simple you can test product right at the production line.

Orion Research, Inc., Boston, MA

Reader Service No. 377

New Image Analysis Software for Power Macintosh™

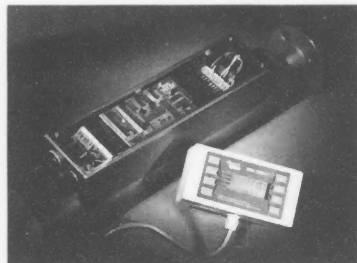
The newest addition to the Zeiss Image™ series of image analysis software packages is specifically designed for use with Power Macintosh computers.

The software covers the full range of counting, measurement, image, image enhancement and image archiving applications. Users can employ gray scale or color acquisition, processing and analysis. Zeiss Image For Power Mac-

intosh works seamlessly with other Macintosh-based applications such as Microsoft Excel and Word. It is suitable for both biological and industrial research applications.

Carl Zeiss, Inc., Thornwood, NY

Reader Service No. 378



Solartron, Inc.

Advanced Liquid Density Transducer with Built-In Signal Conversion Simplifies Process Plant Design

Solartron, Inc. has significantly simplified the integration of liquid density transducers into DCS and SCADA systems with the introduction of its range of intrinsically-safe advanced densitometers. Built-in processing in the densitometer head eliminates the need for separate flow computers or signal converters, allowing stand-alone operation, and offering significant savings to process engineers. Industry-standard Modbus and analog outputs facilitate direct connection into control systems. This highly cost-effective range includes densitometers suitable for fiscal metering and processes involving aggressive fluids or demanding hygiene standards.

Solartron's densitometers use the 'vibrating element' principle, a technique thoroughly proven in thousands of installations worldwide. By monitoring the resonant

frequency of a known vibrating mass immersed in a liquid, the liquid's line density can be calculated continuously. The technique allows the company's advanced densitometers to offer an accuracy of 0.0001g/cc.

Measured and calculated values are output from the densitometer via two standard 4-20mA analog links; a separate pulse output monitors resonant frequency and provides an alarm status line. The microcontroller contains all necessary calibration data for the densitometer, significantly reducing the on-line programming task for the process engineer. An optional mezzanine board on the microcontroller adds digital HART communications, simplifying programming and data acquisition by a control system. This modular approach allows support for fieldbus protocols to be added as standards evolve.

A simple hand-held or wall-mounted terminal is available for in-situ monitoring. This intrinsically safe unit communicates with up to 24 densitometers using Modbus protocol over the meter's standard RS485 digital link – enabling it to be located remotely – and provides a convenient means of displaying calculated values or analyzing a system set-up using the densitometer's built-in diagnostic facilities.

Solartron, Inc., Houston, TX

Reader Service No. 379

X-Ray Inspection Matches Production Line Feeds and Speeds

Fine Tuned Inspection – Unobtrusive, compact and portable X-ray based inspection systems represent a major breakthrough for many industries. "X-ray systems can be fine tuned to

inspect for a total range of non-conformity and contamination. They can detect foreign bodies in either single or bulk products, in almost any production flow process."

In food processing, the systems detect bone, cartilage or shell fragments in meat, poultry and seafood; or detect glass and metal fillings in canned foods, glass or plastic containers. Also, the systems detect metal slivers, rubber and other foreign bodies in tobacco products. X-rays inspect beverages packaged in metal glass or plastic containers; and pre-packaged candy, cereal, frozen foods, dairy products, for both contamination and correct quantity.

Digital X-ray Technology – Digital X-ray screening uses a narrow focus fan beam, which scans objects in defined "slices." An array of photodiodes senses the varying intensities of the beam within the narrow slice. Information gathered is stored in digital form before an image is displayed on a monitor. The travel speed of the object being inspected precisely matches the clock span speed of the diodes so that the data presents a clear picture.

NIS real-time systems view objects while they are in motion, then present a three-dimensional image to an operator. The systems focuses the X-ray beam on a fluorescent screen, while at the same time, a CCD camera views the image on a monitor. An image intensifier makes the video image clearer and brighter. The picture is presented in a clear concise manner that distinguishes small objects present in a diffused background. Computer enhancement further clarifies the pictures.

X-Ray In Action – NIS's FBD X-ray system operates as follows. A flat conveyor belt carries products through a low energy, X-ray beam and detector. Every image captured by the camera(s) contain informa-

tion in the form of light intensity levels; or levels of gray, varying in value from 0 (black) to 255 (white). Typically, the image being examined has a very low contrast; a foreign object will show up as darker gray against a lighter gray background.

NIS's FBD X-ray system's computer continuously monitors the data of changing densities and once a variation is found, the package or product is tracked until it reaches a reject device, where it is automatically removed. The FBD system can interface with either a conveyor or a pipeline inspection point. It can run automatically without an operator.

Nationwide Inspection Systems, Inc., Largo, FL

Reader Service No. 380



Ryan Instruments, Inc.

Introducing the NEW Handheld Printer for Use with RL100 and PRO Temperature Monitors

Ryan Instruments has announced the introduction of its new handheld printer for the RL100 and PRO temperature monitors. This printer allows those users who do not have immediate access to a PC to download data from either the RL100 or PRO temperature recorders. Users will be able to retrieve data in the form of graphs, header information and summary reports. The data still is

stored in the recorder and if at a later date the user wants to download the data to their PC they may. Ryan has made this printer easy to use. It comes complete, ready for use, with cable, connector and paper. All one has to do is plug in and press the print button - quick, easy and convenient.

Take the printer to remote locations, or use when a PC is not available. The printer adds another new dimension to using the Ryan RL100 and Ryan PRO recorders. When more printer supplies are needed, such as printer ribbon and paper, they are easily purchased at most office supply stores. This easy-to-use printer runs on either battery or 120 VAC power. The battery can be recharged overnight.

Ryan Instruments, Redmond, WA

Reader Service No. 381

3M Introduces Convenient Redigel Pectin Gel Testing Products

3M has introduced convenient 3M Redigel tests—sample ready testing products—for the food and beverage industry.

Because the media is already prepared, Redigel testing methods are quick and easy. There is no need for sterilization, beakers, test tubes and other media preparation apparatus. The broad product line provides testing for acidophilic microbes, yeast and molds, aerobic bacteria, coliforms and other bacteria.

Redigel tests, used for monitoring a facility's environment or testing for food quality, are an alternative to conventional pour plate testing methods. Now they are backed by technical support and service from 3M Microbiology.

3M Redigel Products, St. Paul, MN

Reader Service No. 382

REQUIRE HACCP SAFE CUTTING BOARDS WITH NSF LOGO EMBOSS!

**Cutting Boards Certified
To Meet FDA Requirements!**

**New Technology Makes
NSF-Certified Boards
Easy To Spot!**

Most plastic cutting boards are not safe for direct food contact! While any cutting board supplier can *claim* their boards meet FDA requirements, very few plastic cutting boards sold for use in commercial foodservice actually do meet those federal requirements or your state health code.

The problem has always been health inspectors have had no way of evaluating safe cutting boards from non-durable, absorbent, non-sanitizable, unsafe boards. Until now! Now, the technology exists to help you distinguish boards which meet FDA requirements and are NSF-certified to prove it. And when you consider that almost every food which passes through a commercial kitchen touches a cutting board, the ability to tell safe from unsafe boards is critical.

All **Kolor-Cut** Cutting Boards from KatchAll are NSF-certified for direct food contact -- and it clearly shows that fact right on the board! There can be no mistakes or uncertainty when you require foodservice operators to use cutting boards with the NSF logo embossed into the material from which the board is made.

You Know The Danger!




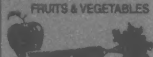


Virtually *all non-NSF-Certified* plastic cutting boards are:

- Made of *inferior, absorbent materials* that do not meet FDA requirements
- *Not safe or approved for use in commercial foodservice*
- *Bacteria & chemical* absorbing, which leads to cross-contamination
- *Not sanitizable or machine dishwasherable*, both essentials for *food-safe use!*

You hold the power to protect consumers. Require cutting boards that are clearly marked as safe for commercial use. **Kolor-Cut** is clearly and permanently NSF marked. **Kolor-Cut** is the simple, logical, easy-to-understand, easily identifiable system that protects against cutting board cross-contamination.

**SAMPLES
available from
KatchAll!**

CUTTING BOARD SELECTOR CHART AND SAFETY GUIDE

 MEAT	 FISH
 POULTRY	 FRUITS & VEGETABLES
 COOKED FOODS	 DAIRY

STEPS TO SANITARY FOOD PREP:

1. Wash and sanitize hands before handling food
2. Wash and sanitize cutting boards before each use
3. Wash and sanitize cutting utensils before each use
4. Place cut foods in washed and sanitized containers and store properly

Kolor-Cut Features

- Meets Board of Health (FDA) requirements for food contact
- NSF emboss for "no-mistake" safety
- Protects against cross-contamination
- Solid color for easy identification from any distance
- Dishwasher, pot sink & sanitizer safe
- Non-porous, non-absorbent
- No special care requirements

KOLOR-CUT WITH NSF LOGO ID -- Another Quality Product in the KatchAll HACCP System!



KatchAll Industries International, Inc.
5800 Creek Road
Cincinnati, Ohio 45242

FOR MORE INFORMATION OR SAMPLES,
CALL KATCHALL TOLL-FREE

800-533-6900

COMPLETE LABORATORY SERVICES

Ingman Labs, Inc.
2945 - 34th Avenue South
Minneapolis, MN 55405
612-724-0121

Reader Service No. 153

ADVERTISEMENT

YOUR PRODUCT OR SERVICE HERE!

For rates or information, contact:

Rick McAtee, Advertising Manager

1-800-369-6337

or 515-276-3344

Volunteers Needed to Set Industry Standards

The Steering Committee of the 3-A Sanitary Standards Program has approved requests to organize two new Task Committees to develop new 3-A Sanitary Standards. In addition a preexisting Task Committee will be reactivated to develop new standards and two holdover projects are moving ahead.

A Task Committee is being formed to develop new 3-A Sanitary Standards for hygienic mechanical seals. A second Task Committee is required for the development of standards for spray balls, other mechanical cleaning devices and product spray devices. Both groups will meet toward the end of the 1996 calendar year.

The Ingredient Feeders Task Committee will be reactivated to develop new 3-A standards for liquid (screw-type) ingredient feeders. The 3-A Steering Committee recommended that a proposal be presented to the User Group during the May 1997 Annual 3-A Committees Meeting. This group is also expected to meet late in 1996.

Two holdover projects on 3-A accepted practices 603-06 for HTST (High Temperature, Short Time) to provide pressure differential in cooling sections and new standards for clarifiers/separators will be scheduled in early 1997.

Parties interested in any of the above activities are asked to contact 3-A Secretary Dr. Thomas Gilmore, at DFISA, phone 703-761-2600, fax 703-761-4334, or write to: 1451 Dolley Madison Blvd., McLean, VA 22101.

The 3-A Sanitary Standards Committees were founded by the Milk Industry Foundation (MIF), the International Association of Milk, Food and Environmental Sanitarians (IAMFES) and the Dairy & Food Industries Supply Association in the 1920s. The objective of the group is to formulate standards and accepted practices for the equipment and systems used to process milk and milk products and other perishable foods. These standards are developed through the cooperative efforts of local, state and federal sanitarians, equipment manufacturers and equipment users, so that they are acceptable to those involved in the sanitary aspects of the dairy and related food industries.

3-A Sanitary Standards Actions

May 1996

Twenty-one documents were passed during the Annual Meeting of the 3-A Sanitary Standards Committees held this past May. These documents include four new standards, five revisions to standards or practices, and twelve amendments to standards or practices. Two 3-A Sanitary Standards were rescinded and combined to form a new standard, and two E-3-A Sanitary Standards were rescinded.

The new standards are:

1. 3-A Sanitary Standards for Centrifugal and Positive Rotary Pumps for Pumping, Cleaning, and Sanitizing Solutions, Number 47-00, effective November 24, 1996.
2. 3-A Sanitary Standards for Ball Valves for Milk and Milk Products, Number 68-00, effective November 23, 1996.
3. 3-A Sanitary Standards for Shear Mixers and Agitators, Number 73-00, effective November 24, 1996.
4. 3-A Sanitary Standards for Belt-Type Ingredient Feeders, Number 75-00, effective November 24, 1996.

The revised standards and practices are:

1. 3-A Sanitary Standards for Centrifugal and Positive Rotary Pumps for Milk and Milk Products, Number 02-09, effective November 24, 1996.
2. 3-A Sanitary Standards for Homogenizer and Reciprocating Pumps, Number 04-50, effective November 24, 1996.
3. 3-A Sanitary Standards for Formers, Fillers, and Sealers of Containers for Fluid Milk and Fluid Milk Products, Number 17-08, effective November 23, 1996.
4. 3-A Sanitary Standards for Thermoplastic Plug-Type Valves for Milk and Milk Products, Number 52-02, effective November 23, 1996.
5. 3-A Accepted Practices for Design, Fabrication, and Installation of Milking and Milk Handling Equipment, Number 606-04.

The twelve amendments are:

1. Amendments to 3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Number 20-18, effective August 23, 1996.
2. Amendment 1 to 3-A Sanitary Standards for Silo-Type Storage Tanks for Milk and Milk Products, Number 22-06, effective November 23, 1996.

3. Amendment 1 to 3-A Sanitary Standards for Equipment Packaging Dry Milk and Dry Milk Products, Number 27-02.
4. Amendment 1 to 3-A Sanitary Standards for Mechanical Conveyors for Dry Milk and Dry Milk Products, Number 41-00.
5. Amendment 1 to 3-A Sanitary Standards for Air or Hydraulically Driven Diaphragm Pumps for Milk and Milk Products, Number 44-01, effective November 24, 1996.
6. Amendment 3 to 3-A Sanitary Standards for Diaphragm-Type Valves for Milk and Milk Products, Number 54-00, effective November 23, 1996.
7. Amendment 1 to 3-A Sanitary Standards for Boot Seal-Type Valves for Milk and Milk Products, Number 55-00, effective November 23, 1996.
8. Amendment 1 to 3-A Sanitary Standards for Tank Outlet Valves for Milk and Milk Products, Number 57-00, effective November 23, 1996.
- 9/10. Amendments 1 and 2 to 3-A Sanitary Standards for Hose Assemblies for Milk and Milk Products, Number 62-00, effective November 23, 1996.
11. Amendment 1 to 3-A Sanitary Standards for Sanitary Fittings for Milk and Milk Products, Number 63-00, effective November 23, 1996.
12. Amendment 1 to 3-A Accepted Practices for Method of Producing Steam of Culinary Quality, Number 609-01, effective November 23, 1996.

The 3-A Sanitary Standards for Instrument Sensors and Sensor Fittings and Connections Used on Milk and Milk Products Equipment, Number 09-09 and 3-A Sanitary Standards for Pressure & Level Sensing Devices, Number 37-01 were rescinded, effective November 24, 1996. These two documents were combined to form a new standard, 3-A Sanitary Standards for Sensor and Sensor Fittings and Connections Used on Milk and Milk Products Equipment, Number 74-00, effective November 24, 1996.

The two documents that were rescinded were E-3-A Sanitary Standards for Liquid Egg Products Cooling and Holding Tanks, Number E-1300 and E-3-A Sanitary Standards for Fillers and Sealers of Single-Service Containers for Liquid Egg Products, Number E-1700, effective May 20, 1996.

For more information on the 3-A Sanitary Standards Program, contact Dr. Thomas Gilmore, 3-A Secretary, 1451 Dolley Madison Boulevard, McLean, VA 22101, Phone (703-761-2600), Fax (703-761-4334).

3-A Sanitary Standards for Formers, Fillers, and Sealers of Containers for Fluid Milk and Fluid Milk Products, Number 17-08

Formulated by
International Association of Milk, Food and Environmental Sanitarians
United States Public Health Service
The Dairy Industry Committee

It is the purpose of the IAMFES, USPHS, and DIC in connection with the development of the 3-A Sanitary Standards program to allow and encourage full freedom for inventive genius or new development. Specifications for formers, fillers, and sealers of containers for fluid milk and fluid milk products heretofore and hereafter developed which so differ in design, material, fabrication, or otherwise as not to conform with the following standards, but which, in the fabricator's opinion, are equivalent or better, may be submitted for the joint consideration of the IAMFES, USPHS, and DIC at any time. **NOTE:** Use current revisions or editions of all referenced documents cited herein.

A SCOPE

- A1 These standards cover the sanitary aspects of unitized equipment for forming, filling, and sealing containers for fluid milk and fluid milk products. The equipment shall perform one or more of the following functions: 1) forming the container, 2) applying and sealing a supplementary fitment or device, 3) filling the container and 4) sealing, including capping if part of the unitized equipment, the container. The equipment shall start at the points where the product, utilities (air, water, steam, cleaning chemicals, etc.), container, container blank, or container material first enters the unitized equipment. The equipment shall end where the formed, filled, and/or sealed container exits the equipment.
- A2 These standards do not pertain to the container, to free-standing container forming equipment or to other equipment such as labelers, printers, daters, cappers, applicators of supplementary fitments or devices or wrappers not furnished as part of the unitized equipment, nor shall it apply to fillers of viscous products, such as frozen desserts, cottage cheese, cultured yogurt, sour cream, whipped butter, cream cheese, and other similar viscous dairy products.
- A3 In order to conform with these 3-A Sanitary Standards, formers, fillers, and sealers of containers shall comply with the following design, material, and fabrication criteria.

B DEFINITIONS

- B1 *Product:* Shall mean fluid milk or fluid milk products, such as whole milk, low-fat milk, skim milk, half and half, creams, cultured buttermilk, frozen dessert mixes, and similar fluid milk products.
- B2 *Container:* Shall mean a package or material being formed into the package, or a packaging construction including one or more of a package body, cap, closure, cover, supplementary device (such as a dispensing fitment), or other structure capable of holding the product.
- B3 *Mechanical Forming Equipment:* Shall mean the equipment for performing all or part of the following integral functions without manual contact with any product contact surface of the container: feeding, opening, seaming, forming, or sealing, and all parts which are essential to those functions that are furnished as a unit by the manufacturer.
- B4 *Mechanical Filling Equipment:* Shall mean the equipment for filling the container with the product without manual contact with any product contact surface of the container.
- B5 *Mechanical Opening Equipment:* Shall mean the equipment for opening a container without manual contact with any product contact surface of the container.
- B6 *Mechanical Sealing Equipment:* Shall mean the equipment for closing and/or sealing the filled container without manual contact with any product contact surface of the container.

B7 Surfaces

- B7.1 *Product Contact Surfaces*: Shall mean all surfaces which are exposed to the product during normal equipment operation, surfaces from which liquids may drain, drop, diffuse, or be drawn into the product or into the container, and surfaces that touch product contact surfaces of the container.
- B7.2 *Solution Contact Surfaces*: Shall mean the interior surfaces of the equipment or system which are used exclusively for supply and recirculation of cleaning and/or sanitizing solutions, except those used to supply concentrated cleaning and/or sanitizing materials to the point of use.
- B7.3 *Nonproduct Contact Surfaces*: Shall mean all other exposed surfaces except Sterilant Contact Surfaces and Splash Contact Surfaces.
- B7.3.1 *Splash Contact Surfaces*: Shall mean other nonproduct contact surfaces that during normal use are subject to accumulation of soil and which require routine cleaning.
- B7.4 *Sterilant Contact Surfaces*: Shall mean the interior surfaces of the equipment or system which are used exclusively for the supply and recirculation of sterilizing solutions.

B8 Cleaning

- B8.1 *Mechanical Cleaning or Mechanically Cleaned*: Shall mean soil removal by impingement, circulation, flowing chemical detergent solutions, and water rinses onto and over the surfaces to be cleaned, by mechanical means in equipment specifically designed for this purpose.
- B8.2 *Manual (COP) Cleaning*: Shall mean soil removal when the equipment is partially or totally disassembled. Soil removal is effected with chemical solutions and water rinses with the assistance of one or a combination of brushes, nonmetallic scouring pads and scrapers, high or low pressure hoses, and tank(s) which may be fitted with recirculating pump(s), and with all cleaning aids manipulated by hand.

B9 *Sanitizing or Sanitization*: Shall mean a process applied to a cleaned surface which is capable of reducing the numbers of the most resistant human pathogens by at least 5 log cycles (99.999%) to 7 log cycles (99.99999%) by applying accumulated hot water or steam or by applying an EPA registered sanitizer according to label directions. Sanitizing may be effected by mechanical or manual methods.

B10 *Sterilization*: Shall mean a process effected by heat, chemicals, or other mechanical means that destroys all vegetative bacteria and inactivates relevant bacterial spores.

B11 Surface Modification'

- B11.1 *Surface Treatments*: Shall mean a process whereby chemical compositions or mechanical properties of the existing surface are altered. There is no appreciable, typically less than 1 μm , build-up of new material or removal of existing material.
 - B11.1.1 Surface treatments may include:
 - 1) Mechanical (shot peening², glass beading, polishing)
 - 2) Thermal (surface hardening by laser, electron beam)
 - 3) Diffusion (carburizing, nitriding)
 - 4) Chemical (etching, oxidation)
 - 5) Ion Implantation
 - 6) Electropolishing
 - B11.2 *Coatings*: Shall mean the results of a process where a different material is deposited to create a new surface. There is appreciable, typically more than 1 μm , build-up of new material.
 - B11.2.1 Coating processes may include:
 - 1) Chemical (conversion coatings)
 - 2) Electrodeposition³
 - 3) Spraying (pneumatic, flame, plasma, arc spray)
 - 4) Physical Vapor Deposition
 - 5) Chemical Vapor Deposition
 - 6) Centrifugal Casting

B12 *Arithmetical Mean (R_a)*: Shall be the arithmetical mean of the absolute values of the profile departure within a sampling length.⁴

B13 *Supplementary Fitment or Device*: Shall mean any component or assembly which is attached to the container. Examples include but are not limited to pour spouts, closures, handles, and tamper evident seals.

B14 *Readily or Easily Removable*: Shall mean quickly separated from the equipment with the use of simple hand tools if necessary.

B15 *Easily or Readily Accessible*: Shall mean a location which can be safely reached by an employee from the floor, platform, or other permanent work area.

B16 *Simple Hand Tools*: Shall mean implements normally used by operating and cleaning personnel such as a screwdriver, wrench, or hammer.

C MATERIALS

C1 Metals

C1.1 All product contact surfaces shall be of stainless steel of the American Iron and Steel Institute (AISI) 300 Series⁵ or corresponding Alloy Cast Institute (ACI)⁶ types (See Appendix, Section E.), or metal which under

conditions of intended use is at least as corrosion resistant as stainless steel of the foregoing types and is nontoxic and nonabsorbent, except that:

- C1.1.1 Those surfaces of container forming, closing, and sealing devices which are product contact surfaces may be made of a nontoxic, nonabsorbent metal which can be adequately manually cleaned and that is corrosion resistant under conditions of intended use; or may be made of metal made corrosion resistant and wear resistant by a covering of an electrodeposited coating of chromium and/or nickel, electroless nickel,⁷ or an equally corrosion and wear-resistant nontoxic metal. (See Appendix, Section F.)

C2 Nonmetals

- C2.1 Where materials having certain inherent functional purposes are required for specific applications, such as rotary seals, carbon and/or ceramic materials may be used. Carbon and/or ceramic materials shall be inert, nonporous, nontoxic, nonabsorbent, insoluble, and resistant to scratching, scoring, and distortion when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization.

- C2.2 Rubber or rubber-like materials may be used for filling nozzles, plungers, gaskets, diaphragms, sealing rings, O-rings, rollers, belts, or conveyors, drip shields, protective caps for sanitary connections, container forming and closing parts, filling valve parts, seals, flexible tubing, hoses, and parts having the same functional purpose.

- C2.2.1 Rubber and rubber-like materials, when used for specific applications, shall comply with the applicable provisions of the 3-A Sanitary Standards for Multiple-Use Rubber and Rubber-Like Materials Used as Product Contact Surfaces in Dairy Equipment, Number 18.

- C2.3 Plastic materials may be used for filling nozzles, plungers, gaskets, diaphragms, sealing rings, O-rings, rollers, belts, or conveyors, drip shields, protective caps for sanitary connections, container forming and closing parts, filling valve parts, seals, flexible tubing, hoses, and parts having the same functional purpose.

- C2.3.1 Plastic materials, when used for specified applications, shall comply with the applicable provisions of the 3-A Sanitary Standards for Multiple-Use Plastic Materials Used on Product Contact Surfaces for Dairy Equipment, Number 20.

- C2.4 Plastic may be used in sight and/or light openings and as direct reading gauge tubes, and when used shall be of a clear, heat resistant type.

- C2.5 Rubber and rubber-like materials and plastic materials having product contact surfaces shall be of such composition as to retain their surface and conformational characteristics when exposed to conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization.

- C2.6 The final bond and residual adhesive, if used, of bonded rubber and rubber-like materials and bonded plastic shall be nontoxic.⁸

- C2.7 Single service gaskets of a sanitary type may be used on parts which must be disassembled for daily cleaning.

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

C4 Nonproduct Contact Surfaces

- C4.1 All nonproduct contact surfaces shall be of corrosion-resistant material or material that is rendered corrosion resistant. If coated, the coating used shall adhere. All nonproduct contact surfaces shall be relatively nonabsorbent, durable, and cleanable. Parts removable for cleaning having both product contact and nonproduct contact surfaces shall not be painted.

D FABRICATION

D1 General Fabrication Requirements

D1.1 Surface Texture

- D1.1.1 All product contact and solution contact surfaces shall have a finish at least as smooth as an R_a of 32 μm . (0.80 μm) (No. 4 Finish) and be free of imperfections such as pits, folds, and crevices in the final fabricated form (See Appendix, Section G), except that:

- D1.1.1.1 Rollers used to apply sterilizing chemicals by contact to the product contact surfaces of the package material may have a surface finish at least as smooth as an R_a finish of 125 μm . (3.18 μm).

- D1.2 Permanent Joints**
- D1.2.1 All permanent joints in metallic product contact surfaces shall be continuously welded. Welded areas on product contact surfaces shall be at least as smooth as an R_a of 32 μin . (0.80 μm) (No. 4 finish) and be free of imperfections such as pits, folds, and crevices.
- D1.3 Bonded Materials**
- D1.3.1 Bonded rubber and rubber-like materials and bonded plastic materials having product contact surfaces shall be bonded in a manner that the bond is continuous and mechanically sound, so that when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization the rubber and rubber-like material or the plastic material does not separate from the base material to which it is bonded. Excess bonding adhesive shall be removed.
- D1.4 Hoses and Flexible Tubing**
- D1.4.1 Hoses and flexible tubing, with attached sanitary fittings used for flexible connections shall meet the requirements of 3-A Sanitary Standards for Hose Assemblies for Milk and Milk Products, Number 62.
- D1.5 Coatings**
- D1.5.1 The thickness of electrodeposited coatings on product contact surfaces shall not be less than 0.0002 in. (0.005 mm), except that when these surfaces are other than stainless steel, the thickness of electrodeposited coatings shall not be less than 0.002 in. (0.05 mm).
- D1.5.2 Coatings of electroless nickel alloy, as specified in C1.1.1, shall conform to the applicable provisions of MIL-C-26074E NOT 2, as amended.
- D1.5.3 The minimum thickness of coating of electroless nickel alloy, as specified in C1.1.1, shall be 0.002 in. (0.05 mm).
- D1.6 Cleaning and Inspectibility**
- D1.6.1 Equipment that is to be mechanically cleaned shall be designed so that the product contact surfaces of the equipment and all nonremovable components of the equipment can be mechanically cleaned and are easily accessible and readily removable for inspection employing simple hand tools.
- D1.6.2 Product contact surfaces not designed to be mechanically cleaned shall be easily accessible for cleaning and inspection either when in an installed position or when removed. Demountable parts shall be readily removable.
- D1.7 Draining**
- D1.7.1 All product contact surfaces shall be self-draining or self-purging except for normal clingage.
- D1.7.2 If filler bowl product contact surfaces are not self-draining, the filler bowl shall have sufficient pitch to suitable drain points so the filler bowl can be drained.
- D1.8 Filler Bowls**
- D1.8.1 All filler bowls shall be effectively enclosed or covered and covers shall be self-draining.
- D1.8.1.1 Filler bowls or tanks not designed for mechanical cleaning or sterilization with pressurized steam shall be equipped with covers which (1) shall be sufficiently rigid to prevent buckling, (2) if provided with handles, the handles shall be adequate, durable, conveniently located and of sanitary design, welded in place or formed into the cover materials, and, (3) unless gasketed and clamped, shall have downward flanges not less than 3/8 in. (10 mm) along all edges. The edges of all cover openings shall extend upward at least 3/8 in. (10 mm) or be fitted with a permanently attached sanitary pipeline connection conforming to D1.17 or D1.18.
- D1.8.1.2 Openings in the bowl cover, except those fitted with a permanently installed sanitary instrument connection, shall be provided with covers having a downward flange of not less than 1/4 in. (6 mm) so designed as to prevent liquid from entering the filler tank.
- D1.8.1.3 Systems in which the filler bowls are subjected to vacuum shall be designed to prevent the movement of gasketing materials or the ingress of contamination while under expected levels of negative pressure.
- D1.8.1.4 The bottom of the filler tank(s) shall have a minimum pitch of 1/8 in. per ft. (10 mm per m) toward the outlet(s).
- D1.8.2 The filling equipment shall be so designed that adjustments necessary during the operation may be made without raising or removing the filler bowl cover(s).
- D1.9 Gaskets**
- D1.9.1 Gaskets having a product contact surface shall be removable or bonded.
- D1.9.2 Grooves in gaskets shall be no deeper than their width, unless the gasket is readily removable and reversible for cleaning.
- D1.9.3 Gasket retaining grooves in product contact surfaces for removable gaskets shall not exceed 1/4 in. (6 mm) in depth or be less than 1/4 in. (6 mm) wide except those for standard O-rings smaller than 1/4 in. (6 mm) and those provided for in Section D1.17.

- D1.10 Radii**
- D1.10.1 All internal angles of less than 135° on product contact surfaces shall have radii of not less than 1/4 in. (6 mm), except that:
- D1.10.1.1 Radii of 1/32 in. (1 mm) may be used when they are required for essential functional reasons, such as those in filler nozzles.
- D1.10.1.2 The radii in grooves in gaskets or gasket retaining grooves shall not be less than 3/32 in. (2 mm), except for those for standard 1/4 in. (6 mm) and smaller O-rings and those provided for in Sections D1.17 and D1.18.
- D1.10.1.3 Radii in standard O-ring grooves for standard 1/4 in. (6 mm) O-rings shall not be less than 3/32 in. (2 mm) and for standard 1/8 in. (3 mm) O-rings shall be not less than 1/32 in. (1 mm).
- D1.10.1.4 The minimum radii for fillets of welds in product contact surfaces shall be not less than 1/4 in. (6 mm) except that the minimum radii for such welds may be 1/8 in. (3 mm) when the thickness of one or both parts joined is less than 3/16 in. (5 mm).
- D1.11 Shields and Guards**
- D1.11.1 Shields or guards shall be provided as necessary and shall be so designed to be self-draining and located to prevent liquid or other contaminants from draining or dropping into the container or product, or onto the product contact surfaces, except that:
- D1.11.1.1 Shields and guards may not be required in equipment designed to provide a controlled environment such as an enclosure pressurized with sterile air or inert gas, or an environment controlled by flowing air rendered sterile by incineration, filtration, irradiation, or other means to adequately prevent contamination.
- D1.11.2 Shields shall be easily cleaned.
- D1.11.3 When packaging material rolls are used, the packaging material product contact surface shall be protected from contamination when installed on the machine.
- D1.11.4 Each fill valve or valve block shall have a deflector shield installed at the lowest practical location in such a manner that it will collect the maximum amount of condensate draining from the exterior of the valve or valve block and discharge it to waste away from the open container, except that:
- D1.11.4.1 Deflector shields may not be required in a system designed to prevent the formation of condensate in critical areas. The formation of condensate may be prevented by:
1. Maintaining a valve block temperature higher than the dew point of its operating environment. Methods include but are not limited to: preventing heat transfer from the product to the exterior of the valve block, warming the valve block, or chilling the ambient air.
 2. Dehumidifying the ambient air.
 3. Maintaining a flow of unsaturated air, across the valve block, of sufficient volume and velocity to prevent the formation of condensate.
- D1.11.4.2 Deflector shields may be required if the exterior of the fill valve is subject to chemical sprays.
- D1.11.5 When an enclosure is provided around the filling system, shields which are outside of such an enclosure shall not drain into the filling enclosure.
- D1.11.6 Shields which are made up of several independent parts shall overlap in such a manner as to prevent condensate from draining between the individual parts.
- D1.11.7 Any guard(s) required by a safety standard shall permit accessibility for cleaning and inspection.
- D1.12 Threads**
- D1.12.1 There shall be no exposed threads on product contact surfaces except as provided in D1.16.
- D1.13 Threads on Splash Contact Surfaces**
- D1.13.1 There shall be no exposed threads on splash contact surfaces, except that:
- D1.13.1.1 Exposed threads are permitted on removable clamps or other components which can be easily removed for cleaning.
- D1.13.1.2 Exposed threads are permitted when required for essential functional reasons. Such exposed threads shall be easily accessible for cleaning.
- D1.14 Metal Tubing**
- D1.14.1 All metal tubing shall comply with the applicable provisions of the 3-A Sanitary Standards for Polished Metal Tubing, Number 33-.
- D1.15 Flow Meters**
- D1.15.1 Product flow meters, if used, shall conform with the applicable provisions of 3-A Sanitary Standards for Flow Meters for Milk and Liquid Milk Products, Number 28-.
- D1.16 Product Pumps**
- D1.16.1 Product pumps, if used, shall conform with the applicable provisions of 3-A Sanitary Standards for Centrifugal and Positive Rotary Pumps for Milk and Milk Products, Number 02-, 3-A Sanitary Standards for Homogenizers and Pumps of the Plunger Type, Number 04-, or 3-A Sanitary Standards for Air Driven Diaphragm Pumps for Milk and Milk Products, Number 44-.

- D1.17 Fittings and Connections**
- D1.17.1 All sanitary fittings and connections shall conform with the applicable provisions of the 3-A Sanitary Standards for Fittings, including Numbers 59- (Automatic Positive Samplers), 60- (Rupture Discs), 62- (Hose Assemblies), 63- (Sanitary Fittings), and 65- (Sight and/or Light Windows and Sight Indicators) for Milk and Milk Products.
- D1.18 Instrument Connections**
- D1.18.1 All instrument connections having product contact surfaces shall conform to the 3-A Sanitary Standards for Sensor and Sensor Fittings and Connections Used on Milk and Milk Products Equipment, Number 74-.
- D1.19 Sanitary Valves**
- D1.19.1 All sanitary valves shall conform with those applicable provisions of 3-A Sanitary Standards for Valves, including Numbers 51- (Plug-Type Valves), 52- (Thermoplastic Plug-Type Valves), 53- (Compression-Type Valves), 54- (Diaphragm-Type Valves), 55- (Vacuum Breakers and Check Valves), and 64- (Pressure Reducing and Back Pressure Regulating Valves) for Milk and Milk Products.
- D1.20 Springs**
- D1.20.1 Coil springs having product contact surfaces shall have at least 3/32 in. (2 mm) openings between coils including the ends when the spring is in a free position. Coil springs shall be readily accessible for cleaning and inspection.
- D1.21 Sight and Light Openings**
- D1.21.1 Sight and light openings into product contact surfaces, when provided, shall be of such design and construction that the inner surfaces drain inwardly; if the equipment is designed for mechanical cleaning, the inner surface of the glass shall be relatively flush with the inner surface of the product contact surface. The exterior flare shall be pitched so that liquids cannot accumulate. The glass shall be readily removable. The inside diameter or smallest dimension of the opening shall be at least 3 3/4 in. (95.25 mm).
- D1.22 Supports**
- D1.22.1 The equipment shall be mounted on legs or casters that will provide a clearance between the lowest fixed point on the equipment and the floor of at least 4 in. (100 mm) when the base outlines an area in which no point is more than 12 1/2 in. (320 mm) from the nearest edge, or a clearance of at least 6 in. (150 mm) when any point is more than 12 1/2 in. (320 mm) from the nearest edge.
- D1.22.1.1 Legs, if provided, shall be smooth with rounded ends or with a flat, load-bearing foot suitable for sealing to the floor, and have no exposed threads. Legs made of hollow stock shall be sealed.
- D1.22.1.2 Casters, if provided, shall be durable and of a size that will permit easy movement of the equipment.
- D1.23 Guards and Other Safety Devices**
- D1.23.1 Guards required by a safety standard that will not permit accessibility for cleaning and inspection shall be designed so that they can be removed with the use of simple hand tools.
- D1.24 Recirculated Cooling Media**
- D1.24.1 Recirculated cooling media shall be nontoxic and properly protected. Mandrels, piping, and other equipment cooled by recirculated cooling media shall be designed to preclude leakage of cooling media or condensate into product or onto product contact surfaces.
- D1.25 Nonproduct Contact Surfaces**
- D1.25.1 Nonproduct contact surfaces shall have a smooth finish, be free of pockets and crevices, and shall be readily cleanable. Surfaces to be coated shall be effectively prepared for coating.
- D1.26 Information Plates**
- D1.26.1 Where manufacturers provide an information plate, this plate shall be affixed to a surface in such a manner as to be effectively sealed.
- D1.26.2 The information plate shall also provide the following information: "This packaging equipment **(Insert one of the following)** designed for steam sterilization.
- (a) is
(b) is not
- D1.26.3 This packaging equipment is designed with these fittings and design criteria to be part of an aseptic processing system where applicable.
- D2 Special Fabrication Requirements**
- Formers, fillers and sealers shall also comply with the following fabrication criteria when applicable to the specific filler type.
- D2.1 Defoamer Systems**
- D2.1.1 Milk and milk products from continuous defoamers shall not be returned directly to the filler bowl. (See Appendix, Section H.)
- D2.1.2 If a defoamer system is provided, all surfaces from which foam may drain, drop, or be drawn into the product shall be constructed in conformance with D1.6.1 and D1.6.2. All surfaces of blower or vacuum lines subject to contact with foam shall be constructed in

such a manner as to be readily accessible for cleaning and sanitizing.

D2.2 **Supplementary Fitments**

D2.2.1 If supplementary fitments or devices are attached to the container within the unitized equipment, the fitment or device applicator shall be designed, installed and operated such that the attachment of the fitment or device is performed in such a manner that open and unsealed containers are not subject to contamination. If shielding is provided, it shall be properly designed and installed to preclude contamination of open containers.

D2.3 **Automatic Sanitizer Fogging/Spraying Systems for Equipment Surfaces**

D2.3.1 When supplied by the manufacturer, equipment for the intermittent fogging or spraying of sanitizing solutions on equipment surfaces shall be installed in such a manner that it does not interfere with access to product contact surfaces for cleaning and inspection, and shall be accessible and easily cleanable if it is located such that it constitutes a splash contact surface or a product contact surface.

D2.3.2 Automatically timed intermittent systems shall operate only after the filling operation has been stopped and all containers which have entered the product or splash contact area of the machine have been removed. Sufficient time shall be allowed for solutions to drain from the equipment before filling is resumed.

D2.4 **Single Use Fill Nozzle Screen Assemblies**

D2.4.1 Woven wire screen assemblies or assemblies of perforated plates which are installed and removed as unitary assemblies may be used in fill nozzles to minimize the generation of foam in the containers.

D2.4.2 When used, single use fill nozzle screen assemblies shall be readily accessible for removal and replacement.

D2.4.3 Single use fill nozzle screen assemblies shall be constructed such that the edges of the screens are pressed, bonded, or otherwise treated to prevent unraveling or the shedding of material into the product.

D2.4.4 Single use fill nozzle screen assemblies shall be removed and replaced according to Appendix, Section I.

D2.5 **Multiple Use Fill Nozzle Screens**

D2.5.1 Woven wire screens or perforated plates may be used in fill nozzles to minimize the generation of foam in the containers.

D2.5.1.1 Woven wire screens or perforated plates shall be designed so they are readily acces-

sible for cleaning, sanitizing, and inspection. (See Appendix, Section J.)

D2.5.1.2 In woven wire screens, screen wires shall be circular in cross section and shall be no less than 0.010 in. (0.25 mm) in diameter.

D2.5.1.3 Woven wire screens shall have no more than 40 wires per in. (25 mm).

D2.5.1.4 In woven wire screens, the edges of the screens shall be pressed, bonded, or otherwise treated to prevent unraveling.

D2.5.1.5 Holes in perforated plates used in filler nozzles to minimize the generation of foam in the containers may be round, square, or rectangular. If round, the holes shall be a minimum of 1/32 in. (1 mm) in diameter. If square or rectangular, the least dimension shall be no less than 0.020 in. (0.51 mm) with corner radii of no less than 0.0050 in. (0.13 mm).

D2.5.1.6 Spacers between screens and/or perforated plates, if used, shall be accessible for cleaning and inspection.

D2.6 **Culinary Steam**

D2.6.1 Steam used as the sterilizing medium of product contact surfaces, when produced or transported within the unitized equipment, shall meet the criteria for culinary steam as specified in 3-A Accepted Practices for a Method of Producing Steam of Culinary Quality, Number 609.

D2.7 **Coding and Dating Equipment**

D2.7.1 If coding and/or dating is to be performed within the unitized equipment, coding and/or dating devices shall be designed, installed, and operated such that these operations are performed in such a manner that open or unsealed containers are not subject to contamination. If shielding is provided, it shall be properly designed and installed to preclude contamination of open containers.

D2.8 **Aseptic Equipment**

D2.8.1 Filling equipment intended for aseptic operation shall be designed so that adjustments necessary during operation may be made without jeopardizing the sterility of the unit.

D2.8.2 Filling equipment intended to be part of an aseptic processing system shall be equipped with appropriate fittings for required instruments and recording devices.

D2.8.3 Packaging machines used in a processing system to be sterilized by heat and operated at a temperature of 250°F (121°C) or higher shall comply with the following additional criteria:

D2.8.4 The construction shall be such that all product contact surfaces can be (1) steril-

- ized by saturated steam or water under pressure (at least 15.3 psig or 106 kPa) at a temperature of at least 250°F (121°C) and (2) operated at the temperature required for processing.
- D2.8.5 Packaging machines that have a product contact surface(s) to be used in such a processing system, not designed so that the system is automatically shut down if the product pressure in the system becomes less than that of the atmosphere and cannot be restarted until the system is re-sterilized, shall have a steam or other sterilizing medium chamber surrounding the valve stems in the sterile areas, if required, to maintain sterility. The packaging machine shall be constructed so that the steam chamber or other sterilizing medium chamber may be exposed for inspection.
- D2.8.6 Where steam or other sterilizing medium is used, the connection(s) on the packaging machines shall be such that the steam lines or other sterilizing medium lines can be securely fastened to the packaging machines. The packaging machines shall be constructed so that the steam or other sterilizing medium chamber may be exposed for inspection.
- D2.8.7 The seal(s) in a packaging machine designed to be used in a processing system to be sterilized by heat and operated at a temperature of 250°F (121°C) or higher shall be between the product contact surface and the steam or other sterilizing chamber.
- D2.9 **Cappers and Capping Equipment**
- D2.9.1 When supplied as part of the unitized equipment by the manufacturer, all components of the capping equipment that touch product contact surfaces of the cap or closure including but not limited to sorters, hoppers, magazines, chutes, and applicators shall comply with the applicable sections of D1.
- D2.10 **Container Disinfection or Sterilization Systems**
- D2.10.1 Filling equipment which introduces disinfecting or sterilizing chemicals into packages or onto product contact surfaces shall have a means to control the amount of chemical remaining on product contact surfaces.
- D2.10.1.1 Residual chemicals in the package shall not exceed FDA allowable limits for that chemical.
- D2.11 **Air Under Pressure**
- D2.11.1 When supplied by the manufacturer, or transported within the unitized equipment, all air under pressure used in contact with product or product contact surfaces shall be in compliance with 3-A Accepted Practices for Supplying Air Under Pressure in Contact with Milk, Milk Products, and Product Contact Surfaces, Number 604.
- D2.12 **Modified Atmosphere Injection Systems**
- D2.12.1 Modified atmosphere injection systems, when fitted as part of the unitized equipment, shall comply with D2.11 above.
- D2.12.1.1 The gas (e.g. nitrogen, carbon dioxide, etc.)⁹ used in a modified atmosphere injection system shall be of a purity suitable for its intended use. The gas quality shall meet the appropriate FDA Food Quality Specification.
- D2.13 **Self-Contained Mechanical Cleaning Systems**
- D2.13.1 When furnished as a part of the unitized equipment, self-contained mechanical cleaning systems shall meet the Materials and Fabrication criteria described above for product contact surfaces.
- D2.14 **Filling Nozzle Gangs**
- D2.14.1 The area between the filling nozzles shall be defined as a product contact surface, unless shielding per paragraph D1.11 is installed.
- D2.15 **Paper Forming or Scoring Equipment**
- D2.15.1 Radii of less than 1/32 in. (1 mm) may be used in equipment when required for essential functional reasons such as mandrel relief patterns and for paper scoring.
- D2.16 **Hollow Rollers**
- D2.16.1 Hollow rollers shall not be used where they form product contact surfaces or splash contact surfaces, unless the inside of the roller meets the cleanability criteria of this standard or is sealed to prevent ingress of soil or product.

APPENDIX

E STAINLESS STEEL MATERIALS

Stainless steel conforming to the applicable composition ranges established by AISI for wrought products, or by ACI for cast products, should be considered in compliance with the requirements of Section C.1 herein. Where welding is involved, the carbon content of the stainless steel should not exceed 0.08%. The first reference cited in C.1 sets forth the chemical ranges and limits of acceptable stainless steel of the 300 Series. Cast grades of stainless steel corresponding to types 303, 304, and 316 are designated CF-16F, CF-8, and CF-8M, respectively. The chemical composition of these cast grades are covered by ASTM specifications A351/A351M, A743/A743M and A744/A744M.

F ELECTROLESS NICKEL ALLOY

An electroless nickel alloy coating having the following composition is deemed to be in compliance with C1.1 herein:

Nickel - 90% minimum.

Phosphorus - 6% minimum and 10% maximum as a supersaturated solution of nickel phosphide in nickel.

Trace amounts of carbon, oxygen, hydrogen and nitrogen.

No other elements.

G PRODUCT CONTACT SURFACE FINISH

Surface finish equivalent to 150 grit or better as obtained with silicon carbide, properly applied on stainless steel sheets, is considered in compliance with the requirements of Section D1 herein. A maximum R_a of 32 $\mu\text{in.}$ (0.80 μm), when measured according to the recommendations in American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME) B.46.1 -Surfaces Texture, is considered equivalent to a No. 4 finish.¹¹

H HANDLING OF COLLECTED MILK

If the milk or milk product collected in the defoamer system is intended to be used for human

consumption, the following procedures are recommended:

- H1 It should be protected from contamination during collection and in subsequent handling.
- H2 It should be maintained at or below 45°F (7°C).
- H3 It should be re-pasteurized.

I RECOMMENDED REPLACEMENT OF SINGLE USE NOZZLE SCREENS

Single use nozzle screen assemblies should be removed from the filling machine at the end of a production period and should be discarded.

New single use nozzle screen assemblies or packs should be installed in the filling machine immediately prior to sanitizing of the filler prior to production.

J RECOMMENDED CLEANING AND SANITIZING OF MULTIPLE USE NOZZLE SCREENS

The screens should be removed, inspected, cleaned, and autoclaved at 250°F (121°C) for 30 min. After cooling the screens should be reassembled in the filler nozzle immediately prior to sanitizing the filler.

¹Additional information on surface modification is contained in *Advanced Materials and Processes*, Vol. 137 (1), January 1990; p. 59 - "Coating and Coating Practices" by H. Herman and p. 61 - "Surface Modification" by F. A. Schmidt. ASM International, Materials Park, OH 44073 (216-338-5151).

²MIL-S-13165C (1), November 27, 1991. *Military Specification: Shot Peening of Metal Parts*. Available from Standardization, Document Order Desk (Department of Navy), 700 Robbins Avenue, Building 4, Section D, Philadelphia, PA 19111-5094 (215-697-2179).

³QQ-C-320B - *Federal Specification for Chromium Plating (Electrodeposited)*, June 1954 with Amendment 4 on April 10, 1987. QQ-N-290A - *Federal Specification for Nickel Plating (Electrodeposited)*, November 12, 1971. Available from the General Services Administration, Federal Supply Services Bureau, Specification Section, 470 East L'Enfant Plaza, Suite 8100, Washington, D.C. 20407 (202-755-0325).

⁴Additional information on arithmetical mean (R_a) is contained in ANSI B46.1-1978, available from the American National Standards Institute, 1430 Broadway, New York, NY 10018 (212-354-3300).

⁵The data for this series are contained in the *AISI Steel Products Manual, Stainless & Heat Resisting Steels*, November 1990, Table 2-1, pp. 17-20. Available from the Iron and Steel Society, 410 Commonwealth Drive, Warrendale, PA 15086 (412-776-1535).

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

⁷MIL-C-26074E NOT 2, August 22, 1995. *Military Specifications: Coatings, Electroless Nickel, Requirements For*. Available from Standardization, Document Order Desk (Department of Navy), 700 Robbins Avenue, Building 4, Section D, Philadelphia, PA 19111-5094 (215-697-2179).

⁸Adhesives shall comply with 21 CFR Part 175 - "Indirect Food Additives: Adhesives and Components of Coatings." Document for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (202-783-3238).

⁹Nitrogen shall comply with 21 CFR Part 184.1540 and carbon dioxide shall comply with 21 CFR Part 184.1240 - "Direct Food Substances Affirmed as GRAS." Document for sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (202-783-3238).

¹⁰Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 (610-832-9500).

¹¹Available from the American Society of Mechanical Engineers, 345 E. 47th Street, New York, NY 10017-2392 (212-705-7722).

These revised standards are effective November 23, 1996, at which time the 3-A Sanitary Standards for Fillers and Sealers of Single-Service Containers for Milk and Milk Products, Number 17-07 are rescinded and become null and void.

3-A Sanitary Standards for Centrifugal and Positive Rotary Pumps for Milk and Milk Products, Number 02-09

Formulated by
International Association of Milk, Food and Environmental Sanitarians
United States Public Health Service
The Dairy Industry Committee

It is the purpose of the IAMFES, USPHS and DIC in connection with the development of the 3-A Sanitary Standards program to allow and encourage full freedom for inventive genius or new developments. Milk pump specifications heretofore or hereafter developed which so differ in design, material, construction, or otherwise, as not to conform with the following standards, but which in the manufacturer's or fabricator's opinion are equivalent or better may be submitted for the joint consideration of the IAMFES, USPHS and DIC at any time. **NOTE:** Use current revisions or editions of all referenced documents cited herein.

A SCOPE

- A1 These standards cover the sanitary aspects of centrifugal and positive rotary pumps for milk and milk products.
- A2 In order to conform with these 3-A Sanitary Standards, centrifugal and positive rotary pumps shall comply with the following design, materials, and fabrication criteria.

B DEFINITIONS

- B1 *Product:* Shall mean milk and milk products.
- B2 *Surfaces*
- B2.1 *Product Contact Surfaces:* Shall mean all surfaces which are exposed to the product and surfaces from which liquids may drain, drop, or be drawn into the product.
- B2.2 *Nonproduct Contact Surfaces:* Shall mean all other exposed surfaces.
- B3 *Cleaning*
- B3.1 *Mechanical Cleaning or Mechanically Cleaned:* Shall mean soil removal by impingement, circulation or flowing chemical detergent solutions and water rinses onto and over the surfaces to be cleaned by mechanical means in equipment or systems specifically designed for this purpose.
- B3.2 *Manual (COP) Cleaning:* Shall mean soil removal when the equipment is partially or totally disassembled. Soil removal is effected with chemical solutions and water rinses with the assistance of one or a combination of

brushes, nonmetallic scouring pads and scrapers, high or low pressure hoses and tanks(s) which may be fitted with recirculating pump(s) and with all cleaning aids manipulated by hand.

B4 Surface Modification¹

- B4.1 Surface Treatments: Shall mean a process whereby chemical compositions or mechanical properties of the existing surfaces are altered. There is no appreciable, typically less than 1 μm build-up of new material or removal of existing material.
- B4.1.1 Surface treatments include:
1. Mechanical (shot peening,² glass beading, polishing)
 2. Thermal (surface hardening laser, electron beam)
 3. Diffusion (carburizing, nitriding)
 4. Chemical (etching, oxidation)
 5. Ion Implantation
 6. Electropolishing
- B4.2 *Coatings:* Shall mean the results of a process where a different material is deposited to create a new surface. There is appreciable, typically more than 1 μm build-up of new material.
- B4.2.1 Coating processes include:
1. Chemical (conversion coatings)
 2. Electrodeposition³
 3. Spraying (pneumatic, flame, plasma, arc spray)
 4. Physical Vapor Deposition
 5. Chemical Vapor Deposition

- B5 *Simple Hand Tools*: Shall mean implements normally used by operating and cleaning personnel such as a screwdriver, wrench or hammer.
- B6 *Substantially Flush*: Shall mean mating surfaces or other juxtaposed surfaces shall be within 1/32 in. (0.794 mm).
- B7 *Readily or Easily Removable*: Shall mean quickly separated from the equipment with the use of simple hand tools if necessary.
- B8 *Easily or Readily Accessible*: Shall mean a location which can be safely reached by an employee from the floor, platform, or other permanent work area.

C MATERIALS

C1 Metals

- C1.1 Product contact surfaces shall be of stainless steel of the American Iron and Steel Institute (AISI) 300 Series⁴ or corresponding Alloy Cast Institute (ACI)⁵ types (See Appendix, Section E1) or metal which under conditions of intended use is at least as corrosion resistant as stainless steel of the foregoing types, and is nontoxic and nonabsorbent, except that:
- C1.1.1 Rotors, shafts, seals, rotor and impeller retaining devices, and housings may also be made of a metal or an alloy that is as corrosion resistant as AISI 300 Series Stainless Steel and be nontoxic and nonabsorbent under the conditions of intended use. (See Appendix, Section E2.)
- C1.1.2 Product contact surfaces made of the materials provided for in C1.1 and C1.1.1 may have their surfaces modified by surface treatment or coating(s).
- C1.1.3 Solder, when used, shall be silver bearing solder and shall be corrosion resistant, free of cadmium, lead and antimony, nonabsorbent, and shall not impart any toxic substance to the product when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization.

C2 Surface Modification Materials

- C2.1 Surface modification materials that become a part of the parent material on product contact surfaces shall comply with the appropriate provisions of one or more of the following:
- C2.1.1 FDA Regulation 21 CFR 175 Subpart C⁶, Substances for Use as Components of Coatings.
- C2.1.2 FDA Regulation 21 CFR 177 Subpart B⁶, Substances for Use as Basic Components of Single and Repeated Use Food Contact Surfaces.
- C2.1.3 FDA Regulation 21 CFR 177 Subpart C⁶, Substances for Use Only as Components of Articles Intended for Repeated Use.

C3 Nonmetals

- C3.1 Rubber and rubber-like materials may be used for rotors, stators, liners, gaskets, O-rings, seals and parts having the same functional purposes.
- C3.1.1 Rubber and rubber-like materials when used for the above specified application(s) shall conform with 3-A Sanitary Standards for Multiple-Use Rubber and Rubber-Like Materials Used as Product Contact Surfaces in Dairy Equipment, Number 18.
- C3.2 Plastic materials may be used for rotors, stators, liners, gaskets, O-rings, seals and parts having the same functional purposes.
- C3.2.1 Plastic materials when used for the above specified application(s) shall conform with 3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Number 20.
- C3.3 Rubber and rubber-like materials and plastic materials having product contact surfaces shall be of such composition as to retain their surface and conformational characteristics when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization.
- C3.4 The final bond and residual adhesive, if used, on bonded ceramic, on bonded rubber and rubber-like materials, and on bonded plastic materials shall be nontoxic.⁷
- C3.5 Where materials having certain inherent functional purposes are required for specific applications, such as seals, carbon, and/or ceramic materials may be used. Carbon and/or ceramic materials shall be inert, nonporous, nontoxic, nonabsorbent, insoluble, resistant to scratching, scoring, and distortion when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization. These materials must meet the requirements of C2 or be generally recognized as safe (GRAS) by the FDA.

C4 Heat-Resistant Materials

- C4.1 In a processing system to be sterilized by heat and operated at a temperature of 250°F (121°C) or higher, all materials having product contact surface(s) used in the construction of centrifugal and positive rotary pump(s) and nonmetallic component parts shall be such that they can be (1) sterilized by saturated steam or water under pressure (at least 15.3 psig or 106 kPa) at a temperature of at least 250°F (121°C), and (2) operated at the temperature required for processing.

C5 Nonproduct Contact Surfaces

- C5.1 All nonproduct contact surfaces shall be of corrosion-resistant material or material that is rendered corrosion resistant. If coated, the coating used shall adhere. All nonproduct contact surfaces shall be relatively nonabsorbent, durable, and cleanable. Parts removable for cleaning having both product contact and nonproduct contact surfaces shall not be painted.

D FABRICATION

D1 Surface Finish

- D1.1 All product contact surfaces shall have a finish at least as smooth as a No. 4 ground finish on stainless steel sheets and be free of imperfections such as pits, folds and crevices in the final fabricated form. (See Appendix, Section E3.)

D2 Permanent Joints

- D2.1 All permanent joints in metallic product contact surfaces shall be continuously welded. Welded areas on product contact surfaces shall be at least as smooth as a No. 4 ground finish on stainless steel sheets, and be free of imperfections such as pits, folds, and crevices when in the final fabricated form except that:

- D2.1.1 In such cases where welding is impractical, soldering, press-fitting or shrink-fitting may be employed where necessary for essential functional reasons such as bushings, internal bearings, pins and mechanical seal components. (See Appendix, Section E4.)

- D2.1.2 Silver bearing solder may be used around pins for sealing joints and producing fillets for minimum radii.

- D2.1.3 Press-fitting, shrink-fitting or soldering shall produce product contact surfaces which are at least as smooth as a No. 4 ground finish on stainless steel sheets which are free of imperfections such as pits, folds and crevices. (See Appendix, Section E3.)

D3 Coatings

- D3.1 Coatings, if used, shall be free from surface delamination, pitting, flaking, spalling, blistering and distortion when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization.

- D3.2 The minimum thickness of electrodeposited coatings shall not be less than 0.0002 in. (0.005 mm) for all product contact surfaces when used on stainless steel or other corrosion resistant alloy. (See C1.1 and C1.1.1).

- D3.3 Ceramic materials used as coatings shall be at least 0.003 in. (0.08 mm) thick.

- D3.4 Plastic materials, when used as a coating, shall be at least 0.005 in. (0.125 mm) thick.

D4 Cleaning

- D4.1 Centrifugal and positive rotary pumps that are to be mechanically cleaned shall be designed so that the product contact surfaces of the pump and all nonremoved appurtenances thereto can be mechanically cleaned and are easily accessible and readily removable for inspection.

- D4.2 Product contact surfaces not designed to be mechanically cleaned shall be easily accessible for cleaning and inspection when in an assembled position or when removed. Demountable parts shall be readily removable.

D5 Draining

- D5.1 All product contact surfaces shall be drainable when disassembled.

D6 Fittings

- D6.1 All sanitary fittings and connections shall conform with the 3-A Sanitary Standards for Sanitary Fittings for Milk and Milk Products, Number 63.

- D6.2 Rectangular flanges or round flange-type fittings may be used for specific applications such as connectors to hoppers or feeders.

D7 Seals

- D7.1 The shaft seal(s) shall be sanitary in design with all product contact parts demountable and accessible for inspection or cleaning, and shall not be of the packing type.

D8 Gaskets

- D8.1 Gaskets having a product contact surface shall be removable or bonded.

- D8.2 Grooves in gaskets shall be no deeper than their width.

- D8.3 Gasket retaining grooves in product contact surfaces for removable gaskets shall not exceed 1/4 in. (6.35 mm) in depth or be less than 1/4 in. (6.35 mm) wide except those for standard O-rings smaller than 1/4 in. (6.35 mm), and those provided for in Section D6.1.

- D8.4 Gaskets, when used, shall be self positioning and form a substantially flush interior joint.

D9 Radii

- D9.1 All internal angles of less than 135° on product contact surfaces shall have radii of not less than 1/8 in. (3.18 mm) except that:

- D9.1.1 Smaller radii may be used when they are required for essential functional reasons, such as those in seal components and rotors to body clearance areas. In no case shall such radii be less than 1/32 in. (0.794 mm) except that:

- D9.1.1.1 The radius at the intersection of press-fits, shrink-fits and flat sealing surfaces is zero by nature of the design and definition of this type of fabrication.
- D9.1.2 The radii in grooves in gaskets or gasket retaining grooves shall be not less than 1/16 in. (1.59 mm), except for those for standard 1/4 in. (6.35 mm) and smaller O-rings and those provided for in Section D6.1.
- D9.1.3 Radii in standard O-ring grooves shall be as specified in Appendix E6.
- D9.1.4 Radii in nonstandard O-ring grooves shall be those radii closest to a standard O-ring as specified in Appendix E6.
- D10 Springs**
Coil springs having product contact surfaces shall have at least 3/32 in. (2 mm) openings between coils including the ends when it is in a free position.
- D11 Threads**
- D11.1 There shall be no threads on product contact surfaces except for holding the impeller or rotor to the shaft.
- D11.2 Shaft threads must conform to one of the following thread specifications:
- D11.2.1 **Exposed Threads**
1. Pumps with exposed shaft threads shall be designed for manual cleaning.
 2. Threads shall conform to Appendix E5, Figure 1.
 3. Threaded angles shall be not less than 60°.
 4. There shall not be more than 8 threads per in. (25. mm).
 5. The nut shall be of the open type.
 6. The length of the nut shall not exceed three-fourths of the thread's basic diameter.
- D11.2.2 **Enclosed Threads**
1. Pumps with enclosed shaft threads shall be designed for mechanical cleaning.
 2. These are threads that have been sealed from the product by means of an O-ring, gasket or similar type seal.
 3. Thread specifications are designated by the manufacturer.
 4. The rotor or impeller locking nut shall be the enclosed type.
- D12 Bonded Parts**
- D12.1 Pump impellers, rotors, stators or housings may be made of, covered with or bonded with rubber, rubber-like or plastic materials.
- D12.2 Housing liners shall be removable or bonded.
- D12.3 Bonded rubber and rubber-like materials and bonded plastic materials having product contact surfaces shall be bonded in a manner that the bond is continuous and mechanically sound so that when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization the rubber and rubber-like material or the plastic material does not separate from the base material to which it is bonded.
- D12.4 Components within seal assemblies may be bonded with adhesives.
- D13 Sterilization Systems**
- D13.1 Pumps designed to be used in a processing system to be sterilized by heat shall comply with the following:
- D13.1.1 All product contact surfaces shall be in compliance with Section C4.
- D13.1.2 Pumps to be used in a processing system not designed so that the system automatically is shut down if the product pressure in the system becomes less than that of the atmosphere and cannot be started until the system is re-sterilized shall have a steam or other sterilizing medium chamber surrounding (1) the shaft(s), (2) the portion of the inlet and outlet connection adjacent to the product, and (3) the pump cover.
- D13.1.3 Where steam or other sterilizing medium is used, the connection(s) on the pump(s) shall be such that the steam lines or other sterilizing medium lines can be securely fastened to the pump(s). The pump(s) shall be constructed so that the steam or other sterilizing medium chamber may be exposed for inspection.
- D14 Inspectibility**
- D14.1 A pump shall be designed that (See Appendix, Section E7):
- D14.1.1 The open area between the exterior of the driver or gear case housing to the exterior of the product chamber shall be 1/2 in. (12 mm) minimum width and of sufficient area to allow unrestricted viewing of the pump shaft(s) or seal components at the potential leak site. This area shall be self-draining.
- D14.1.2 At least 1/4 in. (6mm) of the shaft(s) exclusive of the seal components shall be visible.
- D14.1.3 Guards required by a safety standard that will not permit accessibility for cleaning and inspection shall be designed so that they can be removed with the use of simple hand tools.
- D15 Nonproduct Contact Surfaces**
- D15.1 Nonproduct contact surfaces shall have a smooth finish, free of pockets and crevices, and be readily cleanable and those surfaces to be coated shall be effectively prepared for coating.

D16 Supports

D16.1 Baseplate Mounted

D16.1.1 A baseplate mounted unit consists of some or all of the following components:

1. Pump
2. Motor
3. Mechanical reduction unit such as a gearbox, gearhead drive, variable speed drive, chain and sprocket system or belt and pulley system.
4. Pedestal
5. Coupling
6. Guard
7. Baseplate
8. Legs

D16.1.2 The baseplate(s) shall be constructed of (a) solid metal plate(s) or (b) tubular metal that has all open ends sealed by welding.

D16.1.3 The metal shall be stainless steel or coated or painted mild steel.

D16.2 Legs

D16.2.1 Legs, when used, shall be adjustable or fixed with rounded ends or have flat load bearing feet suitable for mounting to the floor and have no exposed threads.

D16.2.2 Legs made of hollow stock shall be sealed.

D16.2.3 Legs shall be of sufficient length to provide a minimum clearance between the lowest part of the base, pump, motor or drive and floor no less than 4 in. (100 mm) on pumps with legs designed to be fixed to the floor or pumps having a horizontal base area of more than 1 ft² (0.095 m²).

D16.2.4 Legs shall be of sufficient length to provide a minimum clearance of 2 in. (50 mm) on pumps having a horizontal base area of 1 ft² (0.095 m²) or less and not designed to be fixed to the floor.

D16.2.5 If casters or wheels are used they shall be of sufficient size to provide a clearance between the lowest part of the base and the floor of not less than 4 in. (101.6 mm). Casters or wheels, if provided, shall be easily cleanable, durable, and of a size that will permit easy movement of the centrifugal or positive rotary pump.

E APPENDIX

E1 Stainless Steel Materials

Stainless steel conforming to the applicable composition ranges established by AISI for wrought products or by ACI (Steel Founders Society of America) for cast products should be considered in compliance with the requirements of Section C1.1 herein. Where welding is involved, the carbon content of the stainless steel should not exceed 0.08%. The first reference cited in C1.1 sets forth the chemical ranges and limits of acceptable stainless steels of the 300 series. Cast grades of stainless steel

corresponding to type 303, 304, 316 and 316L are designated CF-16F, CF-8, CF-8M and CF-3M respectively. The chemical compositions of these cast grades are covered by ASTM specifications⁹ A351/A351M, A743/A743M and A744/A744M.

E2.1.1 Metals other than the above may be as corrosion resistant as the 300 Series Stainless Steel. This may be shown when metals are tested in accordance with ASTM G31 - "Laboratory Immersion Corrosion Testing of Metals" and have a corrosion rate of less than 10 mil (250 μm) per year. The test parameters, such as the type of chemical(s) and their concentration(s) and temperature(s) should be representative of product cleaning and sanitizing conditions used in dairy equipment. Alloys containing lead or leachable copper should not be used.

E3 Product Contact Surface Finishes

Surface finish equivalent to 150 grit or better as obtained with silicon carbide, properly applied on stainless steel sheets, is considered in compliance with the requirements of Section D1.1 herein. A maximum R_a of 32 μm. (0.80 μm), when measured according to the recommendations in American National Standards Institute (ANSI) and American Society of Mechanical Engineers (ASME) B46.1 -Surface Texture, is considered to be equivalent to a No. 4 finish.⁹

E4 Press and Shrink Fits

Press-fits or shrink-fits may be used to produce crevice free permanent joints in metallic product contact surfaces when neither welding nor soldering is practical. Joints of these types may only be used to assemble parts having circular cross sections, free of shoulders or relieved areas. For example: they may be used to assemble round pins or round bushings into round holes.

In both types of fits, the outside diameter of the part being inserted is greater than the inside diameter of the hole. In the case of the press-fit the parts are forced together by applying pressure. The pressure required is dependent upon the diameter of the parts, the amount of interference and the distance the inner member is forced in.

In shrink-fits, the diameter of the inner member is reduced by chilling it to a low temperature. Dry ice is commonly used to shrink the inner member. Heat may also be applied to the outer member of the press-fit. Less assembly force is required for this type of fit. The design of these fits depends on a variety of factors. The designer should follow recommended practices to assure that a crevice-free joint is produced. A recognized authoritative reference is *Machinery's Handbook*, published by Industrial Press Inc., 200 Madison Ave., New York, NY 10157.

E2 OPTIONAL METAL ALLOY

E2.1 The following alloys or metals have been shown to be as corrosion resistant as the 300 Series Stainless Steel:

	UNS N08367	UNS S21900	UNS S20161	UNS N26055	UNS N26455	UNS S17400	UNS S15500	UNS S32900	UNS R20500	UNS R50400
	ASTM A743 Grade	ASTM A743 Grade		ASTM A494 Grade	ASTM A494 Grade	ASTM A747 Grade	ASTM A747 Grade		ASTM A560 Grade	ASTM B67 Grade
	CN-3MN	CF-10 SMaN		CYSSaBIM	CW-2M	CB7Cu-1	CB7Cu-2		50Cr-50Ni	C-2
C	0.03	0.10	0.15	0.05	0.02	0.07	0.07	0.20	0.10	0.10
Ma	2.00	7.00-9.00	4.00-6.00	1.5	1.00	0.70	0.70	1.00	0.30	
Si	1.00	3.50-4.50	3.00-4.00	0.5	0.80	1.00	1.00	0.75	1.00	
P	0.040	0.040	0.040	0.03	0.03	0.035	0.035	0.040	0.02	
S	0.010	0.030	0.040	0.03	0.03	0.03	0.03	0.030	0.02	
Cr	20.0-22.0	16.00-18.00	15.0-18.0	11.0-14.0	15.0-17.5	5.50-17.7	14.0-15.50	23.0-28.0	48.0-52.0	
Ni	23.5-25.5	8.00-9.00	4.00-6.00	Balance	Balance	3.60-4.60	4.50-5.50	2.50-5.00	Balance	
Mo	6.0-7.0			2.0-3.5	15.0-17.5			1.00-2.00		
Cb						0.15-0.35	0.15-0.35			
Cu	0.75					2.50-3.20	2.50-3.20			
N	0.18-0.26	0.08-0.18	0.08-0.20			0.05	0.05		0.30	
Fe	Balance	Balance	Balance	2.00	2.00	Balance	Balance	Balance	1.00	0.30
Sa				3.0-5.0						
Bi				3.0-5.0						
W					1.0					
Ti									0.50	Balance
Al									0.25	
other										H = 0.015 N = 0.03 O = 0.25

* Percentage is maximum unless range is given.

¹Additional information on surface modification is contained in *Advanced Materials and Processes*, Vol. 137 (1), January 1990; "Coatings and Coating Practices" by H. Herman, p. 59; and "Surface Modification" by F. A. Smidt, p. 61. ASM International, Materials Park, OH 44073 (216) 338-5151.

²MIL-S-13165C (1), November 1991. Military Specification: Shot Peening of Metal Parts. Available from Standardization, Document Order Desk (Department of Navy), 700 Robbins Avenue, Building 4, Section D, Philadelphia, PA 19111-5094 (215) 697-2179.

³Federal Specification #QQ-C-320B for Chromium Plating (Electrodeposited), June 1954 with Amendment 4 on April 10, 1987. Federal Specification #QQ-N-290A for Nickel Plating (Electrodeposited), November 12, 1971. Available from the General Services Administration, Federal Supply Services Bureau, Specification Section, 470 East L'Enfant Plaza, Suite 8100, Washington, D.C. 20407 (202) 755-0325.

⁴The data for this series are contained in the *AISI Steel Products Manual, Stainless & Heat Resisting Steels*, November 1990, Table 2-1, pp. 17-20. Available from the Iron and Steel Society, 410 Commonwealth Drive, Warrendale, PA 15086 (412) 776-1535.

⁵Steel Founders Society of America, Cast Metal Federation Building, 455 State Street, Des Plaines, IL 60016 (708) 299-9160.

⁶For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (202) 783-3238.

⁷Adhesives shall comply with 21 CFR Part 175 - "Indirect Food Additives: Adhesives and Components of Coatings." Document for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (202) 783-3238.

⁸Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 (610) 832-9500.

⁹Available from the American Society of Mechanical Engineers, 345 E. 47th Street, New York, NY 10017-2392 (212) 705-7722.

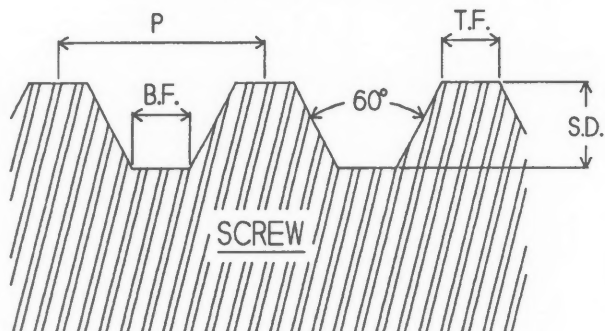
¹⁰The document establishing these standard dimensions is Aerospace Standard (AS) 568, published by SAE, 400 Commonwealth Drive, Warrendale, PA 15086 (412) 776-4970.

¹¹The document establishing these standard dimensions is ISO 3601-1: 1988 (E) published by the International Organization for Standardization (ISO), 1 Rue de Varembe, Case Postale 58, CH 1 1211, Geneva, Switzerland (41-22-734-1240).

E5 Threads

E5.1 American Standard Stub Acme Thread

AMERICAN STUB ACME THREAD



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

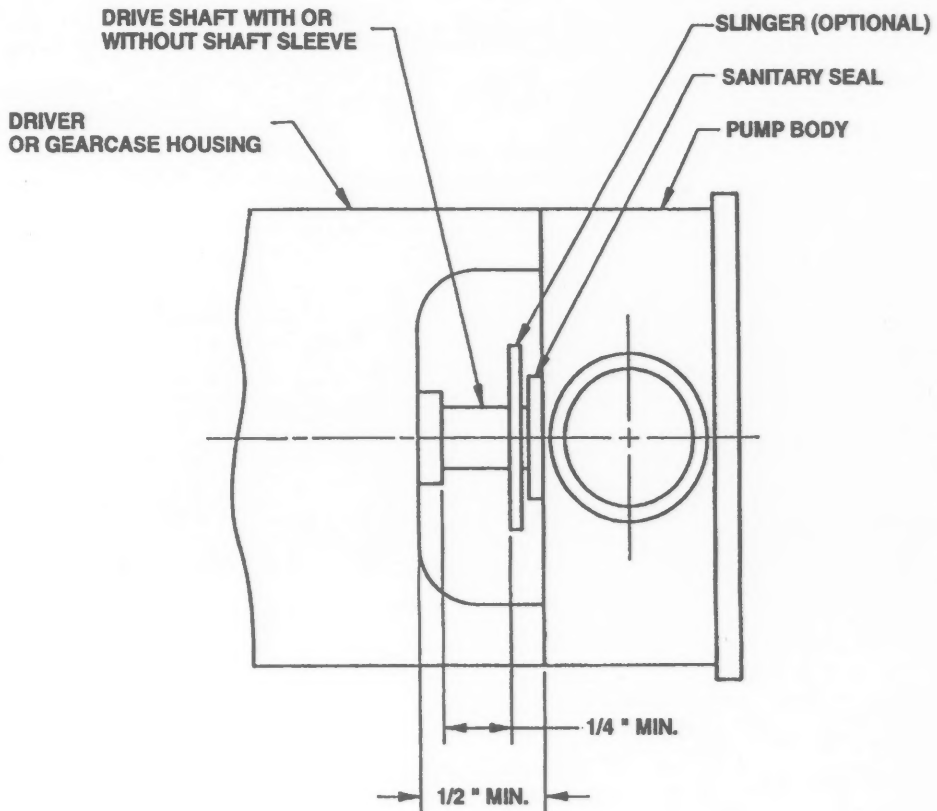
E6 O-Ring Groove Radii

TABLE 1 - Groove Radii Dimensions for Standard O-Rings

O-Ring Cross Section, Nominal (AS 568 ¹⁰)	O-Ring Cross Section, Actual (AS 568)	O-Ring Cross Section, Actual (ISO 3601-1 ¹¹)	Minimum Groove Radius
1/16 in.	0.070 in.	1.80 mm	0.016 in. (0.406 mm)
3/32 in.	0.103 in.	2.65 mm	0.031 in. (0.787 mm)
1/8 in.	0.139 in.	3.55 mm	0.031 in. (0.787 mm)
3/16 in.	0.210 in.	5.30 mm	0.062 in. (1.575 mm)
1/4 in.	0.275 in.	7.00 mm	0.094 in. (2.388 mm)

E7 Diagrams

This diagram is intended to demonstrate general principles only, and is not intended to limit individual ingenuity. The design used should conform with the sanitary requirements set forth in these 3-A Sanitary Standards.



These revised 3-A Sanitary Standards are effective November 24, 1996, at which time the 3-A Sanitary Standards for Centrifugal and Positive Rotary Pumps for Milk and Milk Products, Number 02-08 are rescinded and become null and void.

Amendment 8 to 3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Number 20-17

Formulated By
International Association of Milk, Food and Environmental Sanitarians
United States Public Health Service
The Dairy Industry Committee

It is the purpose of the IAMFES, USPHS, and DIC in connection with the development of the 3-A Sanitary Standards Program to allow and encourage full freedom for inventive genius or new developments. Multiple-use plastic materials used as product contact surfaces for dairy equipment heretofore or hereafter developed which so differ in design, materials, and fabrication or otherwise as not to conform to the following standards but which, in the fabricator's opinion, are equivalent or better, may be submitted for the joint consideration of the IAMFES, USPHS, and DIC at any time. **NOTE:** Use current revisions or editions of all referenced documents cited herein.

The 3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Number 20-17 are hereby amended as indicated for the following sections:

H5 Certification of each formulation for compliance with FDA regulations and/or FD&C Act requirements and compliance with the criteria herein are

to be maintained by the manufacturer and supplier. Test results and a statement of compliance by the testing laboratory shall be kept by the manufacturer and supplier. This information shall be made available to distributors, users, and regulatory agencies upon request. (See Appendix, Section P for the information required on a certification form.)

TABLE 1 - Plastics Included in These Standards

Generic Classes (Code of Federal Regulations Citation ¹)	Maximum % Weight Gain		
	Section E - Cleanability Response	Section F - Product Treatment (Solution I)	Section F - Product Treatment (Solution J)
Acrylics (21 CFR 177.1010)	0.20	0.50	1.50
Acrylonitrile butadiene styrene (21 CFR 177.1020)	0.30	0.45	0.90
Chlorinated polyether (21 CFR 177.2430)	0.05	0.05	0.05
Cross-linked polyester resins (vinyl ester-styrene copolymer) (21 CFR 177.2420)	0.20	0.02	0.20
Epoxy resin as coating (21 CFR 175.300)			
(a) Isopropylidenediphenol Hardener-TETA Triethylenetetramine	0.10	0.15	0.25
(b) Phenol-Formaldehyde Polymer, glycidyl ether (silica filled) Hardener - DETA Adduct	0.15	0.15	2.0
Ethylene-vinyl acetate copolymers (21 CFR 177.1350)	0.25	0.55	0.10
Fluorocarbons (21 CFR 170.39, 177.1380, 177.1550, 177.2510)			
(a) CTFE, PTFE, FEP, PFA, and ETFE types	0.05	0.05	0.05
(b) Vinylidene fluoride types	0.05	0.05	0.15
Nylon (21 CFR 177.1500)			
(a) Nylon Type 66	2.00	3.00	8.00
(b) Nylon Type 610	1.00	2.00	4.00
(c) Nylon Type 6	2.00	3.00	8.00
Plasticized polyvinyl chloride (21 CFR 175.300)			
(a) For contact with high-water, low-fat products ($\leq 8\%$ milk fat)	0.25	0.55	0.90
(b) For contact with high-fat products ($> 8\%$ milk fat)	0.10	0.20	0.55
Polyarylsulfone resin (21 CFR 177.1560)	0.40	0.80	1.50
Polycarbonates (21 CFR 177.1580)	0.10	0.15	0.25
Polyetherimide (21 CFR 177.1595)	0.20	0.25	0.75
Polyethylene (21 CFR 177.1520)			
(a) ASTM Type I	0.20	0.50	0.20
(b) ASTM Type II	0.20	0.20	0.20
(c) ASTM Type III	0.20	0.20	0.20
Polyethylene phthalate polymers (21 CFR 177.1630)	0.10	0.15	0.65
Polymethylpentene (21 CFR 177.1520)	0.10	0.20	0.20
Polyoxymethylene copolymer (21 CFR 177.2470)	0.25	0.60	1.00
Polyphenylene oxide (21 CFR 177.2460)	0.10	0.15	0.25
Polyphenylene sulfide (21 CFR 177.2490)	0.06	0.08	0.08
Polyphenylene sulfide-PTFE (alloy) (21 CFR 177.2490, 177.1380)	0.06	0.08	0.30
Polypropylene - (unmodified and modified for impact resistance) (21 CFR 177.1520)	0.10	0.20	0.20
Polystyrene - Normal (unmodified) Type 3 of ASTM D703-78 (21 CFR 177.1640)	0.10	0.10	0.10
Polystyrene - Modified (impact), Type III, Grade 6, of ASTM D1892-78 (21 CFR 177.1640)	0.10	0.10	0.10
Polysulfone resin (21 CFR 177.1655)	0.05	0.1	0.1
Polysulfone-PTFE (alloy) (21 CFR 177.1655, 177.1380)	0.30	0.45	0.45
Polytetramethylene terephthalate (21 CFR 177.1660)	0.10	0.15	0.65
Polyurethane (21 CFR 177.1680)	1.22	1.59	1.29
Propoxylated bisphenol-A fumarate polyester-styrene copolymer (21 CFR 177.2420)	0.20	0.20	0.20
Reinforced epoxy, molded, natural (no color added), and black (21 CFR 175.300)	0.20	0.25	0.35
Styrene-acrylonitrile (21 CFR 177.1040)	0.20	0.50	0.50
Thermoplastic polyether-ester (21 CFR 177.2600)	0.35	1.1	0.50

K2 Certification of Plastic Materials with Multiple Trade Names or Product Names

K2.1 Plastic materials which already meet 3-A criteria may be certified by suppliers under other trade names and/or product designations. A company manufacturing the final plastic product from a

plastic material already meeting 3-A criteria may certify its trade name and its type or grade meets the 3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Number 20- without re-qualification provided:

¹Citations are by title, part, and section number, thus 21 CFR 177.1010 refers to Title 21, Part 177, Section 1010. CFR references include the basic polymers, optional adjuvants, specifications, and limitations and conditions of use.

APPENDIX P: CERTIFICATION FORM EXAMPLE

PART 1: To be completed by all suppliers. Please type all information except signature.

I certify that _____ (name of plastic, including generic class as listed in Table 1) has been evaluated under the terms of the test regimen contained in 3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Number 20- as amended, and complies with the limitations set forth under Section H of those standards as well as the other criteria in the standards. This plastic complies with Part _____ of Title 21, Code of Federal Regulations. Samples of the material were/were not (choose one) submitted to testing by the company listed below.

Name _____
Company Name _____
Address _____

Signature _____
Date _____

PART 2: To be completed as provided in K2 if the plastic material being certified was not submitted for testing by the company listed above.

The name of the plastic material originally tested, and currently certified is _____ (name of plastic, including generic class as listed in Table 1). I certify that this plastic is the same formulation as that originally tested and is not alloyed or blended with another polymer. Attached is a copy of the Certification Form and a statement of compliance by the testing laboratory used for the initial certification of this material.

Signature _____
Date _____

PART 3: To be completed by all suppliers.

	% WEIGHT CHANGE ALLOWED ²	% WEIGHT CHANGE OBSERVED ³
Section E - Cleanability Response		
Section F - Product Treatment (Solution I)		
Section F - Product Treatment (Solution J)		
Average Weight Loss	0.05%	

PART 4: To be completed by all suppliers.

The surface comparison of the test samples when compared to the original sample and to stainless steel with 150 grit finish when subjected to the cleanability responses and product treatment test regimens showed no change and was at least as smooth as 150 grit stainless steel. {yes/no}.

²See Table 1.

³Averages.

These amendments to 3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Number 20-17 are effective November 23, 1996.

Coming Events

OCTOBER

•2-4, **International Conference on New Developments in Refrigeration for Food Safety and Quality Call for Papers**, Co-sponsored by IAMFES. Lexington, KY. Conference papers are sought from all areas of food refrigeration. The purpose of this conference is to provide an opportunity for food technologists, food processors, and refrigeration engineers from around the world to exchange current information on the role of refrigeration in the food chain. For further information, contact Food Refrigeration Conference, Univ. of Kentucky, 128 Agriculture Engineering Bldg., Lexington, KY 40546-0276; phone (606) 257-3000 ext. 111; fax (606) 257-5671; e-mail wmurphy@bae.uky.edu.

•5-9, **Water Environment Federation's 69th Annual Conference**, at the Dallas Convention Center in Dallas, TX. This year's conference theme focuses on environmental education. For conference information, in the U.S. and Canada call (800) 666-0206; outside the U.S. and Canada call (703) 684-2452; or in the U.S. and Canada fax (800) 444-2WEF; outside the U.S. and Canada (908) 885-6417.

•8-9, **Associated Illinois Milk, Food, & Environmental Sanitarians 1996 Fall Meeting**, at Jumer's Castle Lodge in Peoria, IL. The seminar will focus on Processing Plant Design. Registration in advance is \$50 (members)/\$60 (nonmembers), on site \$60/70. Registration includes a continental breakfast and lunch for both days. For further information, contact Bob Crombie at (815) 726-1683.

•8-12, **1st World Congress on Calcium and Vitamin D in Human Life**, Rome, Italy. Discussion will include the need to protect consumers through improved food quality and measures to enhance the quality and safety of food. Emphasis will be given to public communication and education, including reaching high-risk groups. For further information, con-

tact Congress Secretariat, Maxitraveland s.r.l.-Via Zoe Fontana 220,00131 Rome, Italy; tel. +39.6.4131415; fax +39.6.4191868.

•9-10, **Iowa Association of Milk, Food and Environmental Sanitarians, Inc. Annual Conference**, Waterloo, IA at the Starlight Best Western. For further information, contact Janet Burns at (319) 927-3212.

•10, **Special Symposium: Qualitätssicherung in der Umweltnalytik (Quality Assurance in Environmental Analysis)**. For further information, contact Dr. L. Kiessling, Gesellschaft Deutscher Chemiker, Abteilung Tagungen, Postfach 90 04 40, D-60444 Frankfurt, Germany or phone 069-7917-368; fax 069-7917-475.

•15-16, **Symposium on Microbial Food Spoilage**, Copenhagen, Denmark. Participants are invited to present posters related to microbial food spoilage. An abstract of maximum one page should be sent before September 1 to: Lene Jensen, Danish Institute of Fisheries Research, Dept. of Seafood Research, Technical University of Denmark, Bldg. 221, DK-2800 Lyngby, Denmark; phone +45 4525 2580; fax +45 4588 4774; e-mail: lej@ffl.min.dk. For further information on registration phone +45 88 33 22; fax +45 45 88 47 74; e-mail: fish@ffl.min.dk.

•16-18, **16th-Food Microbiology Symposium and Workshop**, Univ. of Wisconsin, River Falls, WI. The workshop is designed to provide practical demonstrations and discussion of various tests and instruments available for rapid detection, isolation and characterization of foodborne pathogens and toxins as well as prediction of shelf-life and checking hygiene and sanitation in food processing facilities. For further information, contact Dr. Purnendu C. Vasavada, Professor of Food Science, Extension Specialist-Food Safety and Microbiology, University of Wisconsin-River Falls,

Animal and Food Science Dept., River Falls, WI 54022 or phone (715) 425-3150; fax (715) 425 3372; e-mail: purnendu.c.vasavada@uwrf.edu.; http://www.uwrf.edu/food-science/

•16-18, **Food Regulations & Their Impact on Product Development Seminar**, at Hotel International, Basel, Switzerland. This seminar provides comprehensive information about food regulations in the EC/EU, USA, and Latin America, using real-world examples to illustrate the effects of legislation, and how to achieve compliance. For detailed seminar agenda and registration information, please contact: Program Division: TECHNOMIC Publishing Co., Inc., 851 New Holland Ave., Box 3535, Lancaster, PA 17604 or phone (717) 291-5609/(800) 233-9936; fax (717) 295-9637.

•20-23, **The 1996 International Exposition for Food Processors* (IEFP) will Host "El Congreso de las Americas,"** at San Francisco's Moscone Center. IEFP attracts visitors from around the world in every segment of the processing industry, including canning and freezing, dairy, beverages, meat, pharmaceuticals and other industry segments. For more information, contact Janet Palmisano, Communications Coordinator at (703) 684-1080.

•27-29, **International Whey Conference**, sponsored jointly by the American Dairy Products Institute (ADPI), the U.S. National Committee of IDF (USNAC), and the International Dairy Federation (IDF) at the Westin Hotel O'Hare, Rosemont, IL. This international conference will bring together manufacturers of whey and whey products, firms manufacturing equipment used in whey processing, business leaders of the industry, and government and university researchers from throughout the world to discuss current topics of interest relating to the production, research, marketing and utilization of whey and whey products. Anyone interested in presenting papers at the

conference should contact Dr. Warren S. Clark, Jr., Chief Executive Officer, American Dairy Institute, 130 N. Franklin St., Chicago, IL 60606; phone (312) 782-5455; fax (312) 782-5299.

• **28-31, Demands on Animal Hygiene Education and Research Seminar**, sponsored by Universidad Autonoma Metropolitana (UAM). An analysis of American and European requirements. The main subjects of discussion are: concepts on animal hygiene and environment; teaching methodology on animal hygiene; and theoretical and practical aspects. For more information, contact Dr. Jorge Saltijoral, UAM, Departamento de Produccion Agricola y Animal, Calzada del hueso 1100, Col. Villa Quietud, Coyoacan, C.P. 04960 Mexico D.F., or fax (525) 723-5480; e-mail oaxaca@cueyatl.uam.mx.

• **31-Nov. 2, NAMA National Convention and Exhibition**, Cervantes Convention Center, St. Louis, MO. Exhibitors of vending machines, food products and services related to the industry. For additional information, contact Larry Eils at (312) 346-0370.

NOVEMBER

• **7, Tennessee Association of Milk, Water and Food Protection 1996 Fall Meeting**, at the Ellington Agricultural Center Auditorium in Nashville. For further information, contact Dennis Lampley at (613) 360-0157.

• **13-14, The 16th Annual Northwest Food Sanitation Workshop**, at the Columbia River-Red Lion Hotel in Portland, OR. Experts from industry, government and academia will present timely information on food sanitation topics. For further information, contact Reitha McCabe, Food Science and Technology, 100 Wiegand Hall, Oregon State University, Corvallis, OR 97331-6602 or call (541) 737-3463; fax (541) 737-6525.

• **14-15, International Workshop "Women Meet Women in Meat,"** in Utrecht (The Netherlands). The two-day workshop will be jointly organized by ECCEAMST, VVDO and the Dutch Network for Women in the Meat Sector. The central theme of the workshop is the position and experiences of women in the meat sector and quality assurance in the various companies, organizations and countries. For further information, contact VVDO & Network for Women in

the Meat Sector: Mrs. S. A. Burt; phone +31 30 2535350/67 or ECCEAMST: M.J.B.M. Weijtens; phone +31 30 2534402.

• **17-18, Second Conference on Quality Management in Clinical Laboratories**, Antwerp, Belgium. For further information, contact Congress Makers, fax +31-172-443680; e-mail: hoonhout@pi.net.

• **17-21, The American Public Health Association's 124th Annual Meeting & Exposition**, at the New York Coliseum in New York City. For further information call (202) 789-5646.

• **20-22, 2nd Annual Strategic Environmental Research and Development Program (SERDP) Symposium** in Vienna, VA. The Symposium provides a forum for the three federal SERDP partners - Department of Defense, the Department of Energy, and the Environmental Protection Agency - to share the results of SERDP supported research and development projects. For more information, contact Erin Cannelli, Registrar, Labat-Anderson Inc., 8000 Westpark Dr., Suite 400, McLean, VA 22102 or phone (703) 506-1400, ext. 512; fax (703) 506-0946; e-mail: Erin_Cannelli@laib.labat.com.

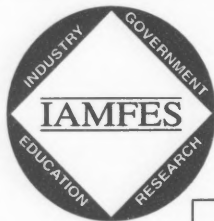
3-A Sanitary Standards

Complete sets of 3-A Dairy & 3-A Egg Standards with Five-Year Update Service Available from IAMFES

See the order form on page 607 for prices and ordering information or call 800-369-6337 or (515) 276-3344.

Advertising Index

ABC Research Corporation	553
All QA Products, Inc.	574
Applied Research Institute	574
Charm Sciences, Inc.	Back Cover
Columbus Instruments	537
DQCI Services, Inc.	560
EM Science	Inside Front Cover
Food and Dairy Quality Management, Inc. (QMI) ..	545
Ingman Labs, Inc.	583
Katch All Industries International, Inc.	582
Luxerin Laboratories	537
Nelson-Jameson, Inc.	533
Qualicon™ - A DuPont Subsidiary	535
Seiberling Associates, Inc.	560
Weber Scientific	541



International Association of Milk, Food and Environmental Sanitarians

MEMBERSHIP

Membership with JFP and DFES \$120.00
(12 issues of the *Journal of Food Protection and Dairy, Food and Environmental Sanitation*)

◀ **BEST VALUE**

Membership with DFES \$75.00
(12 issues of *Dairy, Food and Environmental Sanitation*)

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

SUSTAINING MEMBERSHIP

Membership with BOTH journals \$485.00
(Includes exhibit discount, Annual Meeting issue advertising discount, company monthly listing in both journals and more)

STUDENT MEMBERSHIP*

Membership with JFP and DFES \$60.00

Membership with *Journal of Food Protection* \$37.50

Membership with *Dairy, Food and Environmental Sanitation* \$37.50

*FULL-TIME STUDENT VERIFICATION MUST ACCOMPANY THIS FORM

Shipping Charges: Outside U.S. _____ Surface (\$22.50 per journal) _____ AIRMAIL (\$95.00 per journal)

PLEASE TYPE...ALL AREAS MUST BE COMPLETED FOR ORDER TO BE PROCESSED

Name _____
First Name _____ M.I. _____ Last Name _____

Company Name _____ Job Title _____

Address _____

City _____ State or Province _____

Country _____ Postal/Zip +4 _____

Office Telephone # _____ Fax # _____

e-mail # _____

Membership: _____ New _____ Renewal

Mail Entire Form to:
IAMFES
6200 Aurora Ave, Suite 200W
Des Moines, IA 50322-2863

OR Use Your Charge Card:
(800) 369-6337 (U.S. & Canada)
(515) 276-3344
(515) 276-8655 FAX

U.S. FUNDS on U.S. BANK

Method of Payment

CHECK OR MONEY ORDER ENCLOSED

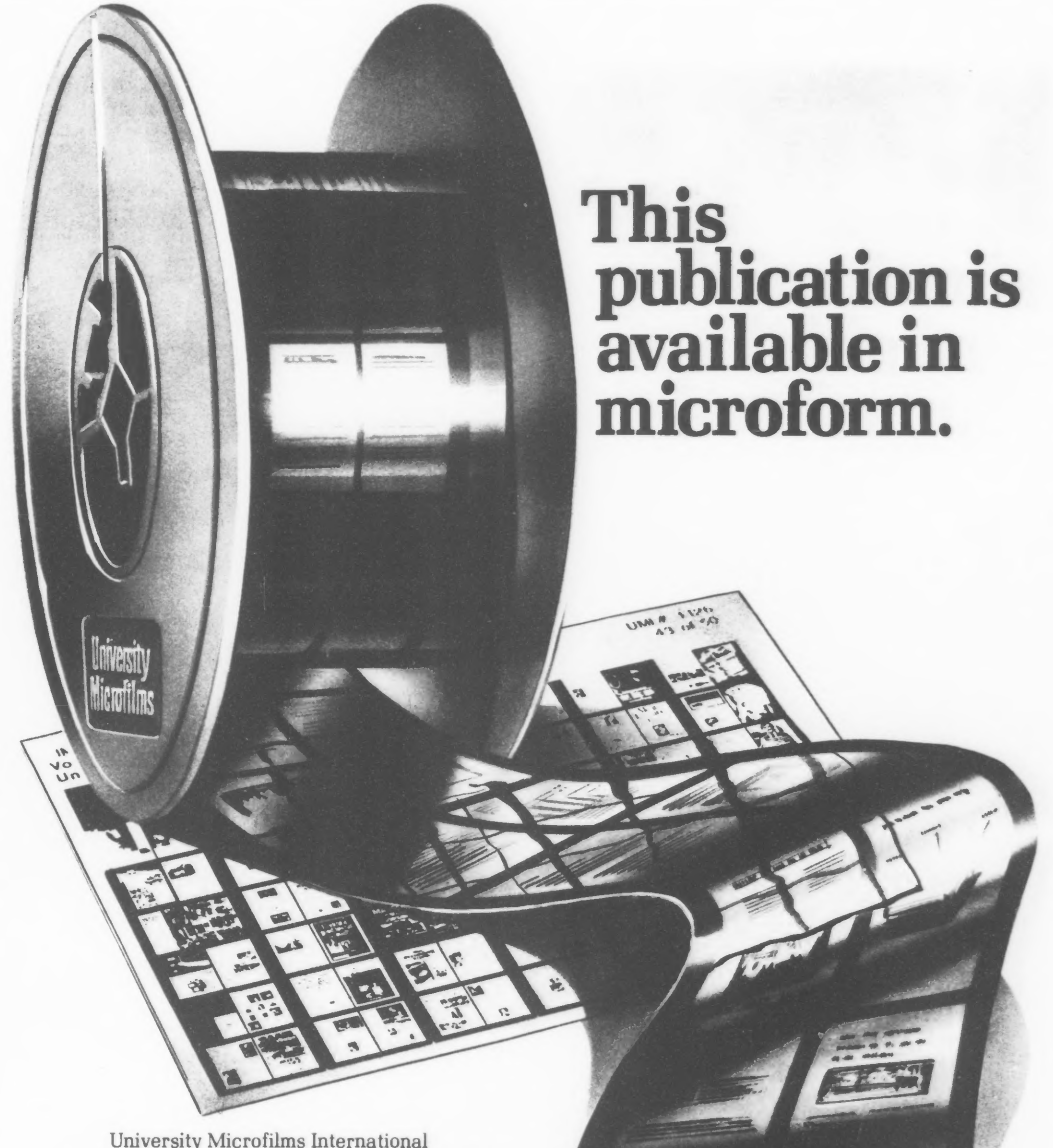
MASTERCARD VISA AMERICAN EXPRESS

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Exp. Date _____

SIGNATURE _____

MEMBERSHIP APPLICATION



**This
publication is
available in
microform.**

University Microfilms International reproduces this publication in microform: microfiche and 16mm or 35mm film. For information about this publication or any of the more than 13,000 titles we offer, complete and mail the coupon to: University Microfilms International, 300 N. Zeeb Road, Ann Arbor, MI 48106. Call us toll-free for an immediate response: 800-521-3044. Or call collect in Michigan, Alaska and Hawaii: 313-761-4700.

**University
Microfilms
International**

Please send information about these titles:

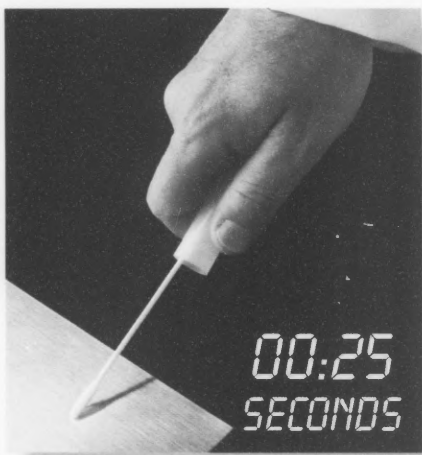
Name _____

Company/Institution _____

Address _____

City _____ State _____ Zip _____

Phone (____) _____



SWAB

PocketSwab™

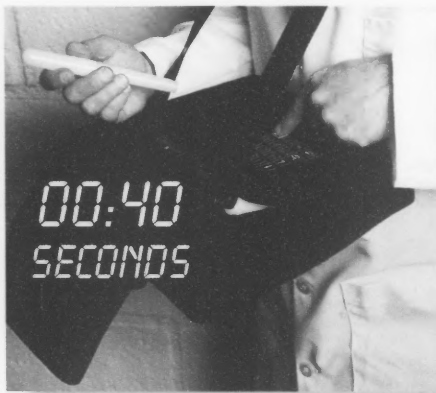
*Pre-op Monitoring of
Sanitation Effectiveness
has never been
Easier or Faster*

- Single Service ATP Hygiene Swab
- *Fastest and Most Sensitive*
- Room Temperature Stable
- No Glass No Tools
- Option to Collect and Hold up to Six Hours
- Reclean and Retest Suspect Areas Faster



TWIST

SECONDS COUNT.



COUNT

Call Now.
800 343-2170

617 322-1523

CHARM SCIENCES INC.

36 FRANKLIN STREET MALDEN MA 02148 USA
617 322-1523 FAX 617 322-3141

Nothing works like a Charm.

