• 3-A Holder’s List
• 1999 IAMFES Secretary Nominations
THANK YOU!

IAMFES THANKS THE FOLLOWING INDIVIDUALS FOR THEIR SUPPORT OF THE IAMFES FOUNDATION

♦ Hamza Abu-Tayboush
♦ Reginald W. Bennett
♦ Robert E. Brackett
♦ Michael H. Brodsky
♦ John C. Bruhn
♦ John G. Burke
♦ Angela Chan
♦ John H. Christy
♦ C. Dee Clingman
♦ Dean O. Cliver
♦ Maribeth A. Cousin
♦ Lisa Crofts
♦ Vincent J. Delgiudice
♦ Susana Binotti De Piaggio
♦ F. Ann Draughon
♦ Jeff Farber
♦ Patricia A. Fehling
♦ Sue Fraser
♦ Ruth G. Fuqua
♦ Wayne Gleiber
♦ Jack Guzewich
♦ Harry Haverland
♦ Virginia H. Hillers
♦ William Huntley
♦ Kellie Jackson
♦ Alex Janssen
♦ Dong K. Jeong
♦ Michael Jogan
♦ Beth M. Johnson
♦ James R. Johnson, Jr.

Working Towards $100,000 in 2000

♦ Mahipal Reddy Kunduru
♦ Doug Lorton
♦ S. S. Malik
♦ Carol Martin
♦ Dan Nilsson
♦ Jun Nishibu
♦ Anthony T. Pavel
♦ Paula Perlis
♦ Mary Jane Pettis
♦ Constantinos Piroccas
♦ Charles Price
♦ James Price
♦ Kailash S. Purohit
♦ Kathy Ruch
♦ John Rushing
♦ Jenny Scott
♦ Wendell R. Skelton
♦ James L. Smith
♦ Joseph M. Smucker
♦ Jill Snowden
♦ Nobumasa Tanaka
♦ David W. Tharp
♦ Donald W. Thayer
♦ Robert B. Tomarkin
♦ Smith J. Williams, Jr.
♦ Dale Williamson
♦ Kathy Willis
♦ Leslie Wisniewski
♦ Earl O. Wright
♦ Donald A. Yanek
♦ Rosemary Zessin

The above list represents individual contributors to the IAMFES Foundation Fund through May 29, 1998. In addition, a portion of the Sustaining Member dues are allocated to support this Fund. Your contribution is welcome. Call the IAMFES office at 800.369.6337 or 515.276.3344 for more information on how you can support the Foundation.
New Video Available from FPI!

Cleaning and Sanitizing in Food Processing Plants: 
*Do It Well, Do It Safely!*

available from
The Food Processors Institute

Although shot in a vegetable processing plant, this clear, easy-to-understand training video shows how to safely and effectively clean and sanitize in any processing plant. It features differences between cleaning and sanitizing, the basic sanitation sequence, and factors important for effective cleaning and personal safety. *Available in English and Spanish. A must for every canning and freezing plant!*

Copies are $75 (English) or $85 (Spanish), plus S&H. To order, call 202/639-5954.

Reader Service No. 143

Reader Service No. 102

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

A Better Company
For Your Professional Analytical Needs

ABC Research Corporation

Product Development • Audits •
GMP'S • Problem Solving •
HACCP • Microbiology •
Sanitation Training • Quality •
Pilot Plant • Chemistry •

3437 SW 24th Avenue
Gainesville, FL 32607
Phone 352-372-0436
FAX 352-378-6483
www.abcr.com
ABOUT THE COVER...
Photo courtesy of the American Dairy Association.

Articles

Reliability of Coliform Bacteria as an Indicator of Postprocessing Contamination in Yogurt Manufacture ......................................................... 494
  S. Abd El Ghani, Zeinab I. Sadek, and Fatma A. Fathi

Allicyclobacillus — Historical Perspective and Preliminary Characterization Study ........................................ 499
  Isabel Walls and Rolenda Chuyate

Isolation and Enumeration of Sporeforming, Thermo-acidophilic, Rod-shaped Bacteria from Citrus Processing Environments ......................................................... 504
  Cornelis A. Wisse and Mickey E. Parish

Association News

Sustaining Members ................................................................. 488
Comments From Your President ................................................ 490
Commentary From the Executive Director .................................. 492
New IAMFES Members .............................................................. 516

Editor’s Note:
In the May issue of Dairy, Food and Environmental Sanitation on page 294, a sentence in the fourth paragraph of Passivation of Stainless Steel should have read: Although increase in the chromium fraction in the passive film is an important factor in the corrosion resistance of steel, it has less influence on the ability of steel to repassivate following pit corrosion.

Departments

Updates ......................................................................................... 518
News .......................................................................................... 521
Industry Products ........................................................................ 525
Business Exchange ..................................................................... 529
Advertising Index ....................................................................... 530
Coming Events ............................................................................ 553

Extras

3-A Sanitary Standards Focus: Protecting Stainless Steel Dairy Equipment from Corrosion ................................. 510
3-A Symbol Council Holders’ List ................................................ 531
IAMFES Booklet Order Form ..................................................... 557
IAMFES Membership Application .............................................. 559
Thoughts on Today’s Food Safety ................................................ 560

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 3-A Symbol Story

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

A Modern Concept

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

- Processors, represented by DIC
- Equipment Manufacturers, represented by IAFIS
- Sanitarians, represented by IAMFES

Use of the Symbol

Voluntary use of the 3-A Symbol on dairy equipment:
- assures processors that equipment meets sanitary standards
- provides accepted criteria to equipment manufacturers for sanitary design & fabrication
- establishes guidelines for uniform evaluation and compliance by sanitarians.

3-A Sanitary Standards Symbol Administrative Council

3020 Bluff Road
Columbia, SC 29209-3502

803-783-9258 phone 803-783-9265 fax
PUMPS for
SANITARY APPLICATIONS
FOOD • DAIRY • BIOLOGICAL
ENVIRONMENTAL • DRUG

- Patented Valveless Design
- Flow Rates Variable - μl to 4,600 ml/min
- 12 Models - AC, DC, Explo-Proof, Variable, Pneumatic, No Motor
- Pressures up to 100 psig • Liquids or Gases
- 1% Accuracy • Corrosion Resistant
- Delivery from STOCK

Call Toll Free
(888) FMI-PUMP • (888-364-7867)

FLUID METERING, INC.
5 AERIAL WAY, SUITE 500, SYOSSET, NY 11791
(516) 922-6050 • FAX (516) 624-8261 • http://www.fmidump.com

Reader Service No. 137

ECONOMICAL

Sterile Petri Dishes
You'll receive the following benefits and save money by choosing ARI's disposable, sterile, all virgin polystyrene petri dishes. Engineered for optimum flatness to provide uniform agar thickness.
- Unsurpassed optical clarity
- Reduced media costs
- Designed with nesting lugs that allow optimum growth and media shelf life
- ETO sterilized - Guaranteed!

Applied Research Institute
Call (888) 324-7900
Fax (888) 324-7911
Toll free, 24 hours/day, 7 days/week
ARI’s Personal Guarantee
If you are not satisfied for any reason, at any time, your money will be refunded with a smile.

Reader Service No. 108

COVERCRETE FLOORING SYSTEMS is the ultimate polyurethane floor for Dairies, Food Plants and Chemical Plants. We have a 25 year unmatched record for customer satisfaction in all types of industrial and commercial applications. Covercrete Flooring Systems are:

- Chemical Resistant
- Impact Resistant
- Low-Odour
- Non-Slip
- USDA/CDA Approved
- Short Downtime
- Environmentally Friendly

As such, we can offer you a system that will match your requirements and your budget. **We do it right. You do it once.**

Covercrete Flooring Systems
1550 Bayly St., Unit 27
Pickering, ON…L1W 3W1
Tel: (905) 420-0425
1-800-267-4425
E-Mail: ccrete@istar.ca
Web: www.covercrete.com

Reader Service No. 247

AUGUST 1998 – Dairy, Food and Environmental Sanitation 485
"The mission of IAMFES is to provide food safety professionals worldwide with a forum to exchange information on protecting the food supply."
Sustaining Members

3-A Symbol Council, 3020 Bluff Road, Columbia, SC 29209-3502; 803.783.9258

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; 352.372.0436

Advanced Instruments, Inc., Two Technology Way, Norwood, MA 02062; 781.320.9000

Applied Research Institute, 3N Simms Lane, P.O. Box 810, Newtow,n CT 06470-1942; 888.524.7900

ASI Food Safety Consultants, Inc., 7625 Page Blvd., St. Louis, MO 63133; 800.477.0778

Audits International, 1899 Second St., Highland Park, IL 60035-3113; 847.433.0778

Becton Dickinson Microbiology Systems, Inc., 7 Lovetown Circle, Sparks, MD 21152-9212; 410.584.8959

Bentley Instruments, Inc., 4004 Peavey Road, Chaska, MN 55318; 612.448.7600

BioControl Systems, Inc., 12822 SE 32nd St., Bellevue, WA 98005; 425.603.1123

Biolog, Inc., 3938 Trustway, Hayward, CA 94545; 510.785.2585

BioMérieux Vitek, Inc., 595 Anglum Road, Hazelwood, MO 63042-2320; 800.638.4835

Capitol Vial, Inc., 4525 E. Skyline, Suite 105, Tucson, AZ 85718-1600; 602.529.0788

Celsis-Lumac, Inc., 1801 Maple Ave., BIRL Bldg., Evans ton, IL 60201; 847.467.6600

Charm Sciences, Inc., 36 Franklin Street, Malden, MA 02148; 781.322.1523

Cogent Technologies Ltd., 11140 Luscheck Dr., Cincinnati, OH 45241; 513.469.6800

Copesan Services, Inc., 3490 N. 127th St., Brookfield, WI 53005; 800.267.3726

DQC1 Services, Inc., 5205 Quincy Street, Mounds View, MN 55112-1400; 612.785.0484

DARDEN Restaurants, P.O. Box 593330, Orlando, FL 32859-3330; 407.245.5370

Darigold, Inc., 635 Elliott Ave., P.O. Box 79007, W. Seattle, WA 98119; 206.286.6792

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; 509.352.2756

DiverseyLever DuBois, 255 E. Fifth St., Suite 1200, Cincinnati, OH 45202-4799; 513.762.6794

DonLevy & Associates, Inc., 1551 E. 89th Ave., Merrillville, IN 46410; 219.736.0742

Dynal, Inc., 5 Delaware Drive, Lake Success, NY 11042; 516.326.3270

Ecolab, Inc., 370 Wabasha St. N., St. Paul, MN 55102; 612.293.2364

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 St., 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 North America, Inc., 10355 W. 70th Street, Eden Prairie, MN 55344; 612.941.8870

FRM Chem, Inc., P.O. Box 207, Washington, MO 63090; 314.583.4360

Gardex Chemicals Ltd., 7 Meridian Road, 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, 150 E. Center St., Moab, UT 84532-2430; 800.842.6622

Great Western Chemical Co., 1717 E. Fargo, Nampa, ID 83687; 208.466.8437

Hardy Diagnostics, 1430 W. McCoy Street, Santa Maria, CA 93455; 805.346.2766

IBA, Inc., 27 Providence Road, Millbury, MA 01527; 508.865.6911

IDEXX Laboratories, Inc., One Idexx Drive, Westbrook, ME 04092; 207.856.0300
**Sustaining Members**

**International BioProducts, Inc.,**
14780 N.E. 95th Street, Redmond, WA 98052; 206.883.1349

**International Dairy Foods Association,**
1250 H Street, N.W., Suite 900, Washington, D.C. 20005; 202.737.4332

**KenAg Inc.,**
101 E. 7th Street, Ashland, OH 44805; 800.338.7953

**Land O'Lakes, Inc.,**
P.O. Box 64101, St. Paul, MN 55164-0101; 612.481.2870

**Malthus Diagnostics, Inc.,**
35888 Center Ridge Road, North Ridgeville, OH 44039; 216.327.2585

**Maryland & Virginia Milk Producers Cooperative Assn., Inc.,**
1985 Isaac Newton Square, West, Reston, VA 20190-5094; 703.742.6800

**Medallion Labs,**
9000 Plymouth Ave., Minneapolis, MN 55427; 612.540.4453

**Michelson Laboratories, Inc.,**
6280 Chalet Drive, Commerce, CA 90040; 562.928.0553

**NSF International,**
3475 Plymouth Road, Ann Arbor, MI 48105; 734.742.6800

**NASCO International,**
901 Janesville Avenue, Fort Atkinson, WI 53538; 414.563.2446

**The National Food Laboratory,**
6363 Clark Ave., Dublin, CA 94568; 510.551.4231

**National Food Processors Association,**

**Nelson-Jameson, Inc.,**
2400 E. Fifth Street, P.O. Box 647, Marshfield, WI 54449-0647; 715.387.1151

**Neogen Corporation,**
620 Lesher Place, Lansing, MI 48912; 517.372.9200

**NESTLE USA, Inc.,**
800 N. Brand Blvd., Glendale, CA 91203; 818.549.5799

**New Horizons Diagnostics, Inc.,**
9110 Red Branch Road, Columbia, MD 21045; 410.992.9357

**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

**Oxoid, Inc.,**
123 Huntmar Drive, Stittsville, Ontario, Canada K2S 1B9; 800.567.8378

**PE Applied Biosystems,**
850 Lincoln Centre Dr., Bldg. 400, Foster City, CA 94404; 650.638.5413

**Penn State University,**
University Creamery, 12 Borland Laboratory, University Park, PA 16802; 814.865.7535

**PRISM Integrated Sanitation Management,**
8300 Executive Center Drive, Miami, FL 33166-4680; 305.592.6312

**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

**Raven Biological Labs,**
8607 Park Drive, Omaha, NE 68127; 402.593.0781

**REMEL, Inc.,**
12076 Santa Fe Dr., Lenexa, KS 66215-5594; 800.255.6730

**Rochester Midland Corp.,**
333 Hollenbeck St., Rochester, NY 14621; 716.336.2360

**Ross Laboratories,**
3300 Stelzer Road, Columbus, OH 43219; 614.624.3785

**Seiberling Associates, Inc.,**
94 North High Street, Suite 350, Dublin, OH 43017-1100; 614.764.8854

**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

**Tri-Dim Filter Corp.,**
999 Raymond St., Elgin, IL 60120; 847.695.2600

**U.S. Filter Corp.,**
10 Technology Dr., Lowell, MA 01851; 508.934.9349

**Universal Sanitizers & Supplies, Inc.,**
P.O. Box 50305, Knoxville, TN 37950; 423.584.1936

**Vulcan Chemical Technologies, Inc.,**
1902 Channel Drive, West Sacramento, CA 95691; 916.375.0167

**Warren Analytical Laboratory,**
650 'O' St., P.O. Box G, Greeley, CO 80632; 800.945.6669

**Webber Scientific,**
2732 Kuser Road, Hamilton, NJ 08691-9430; 609.584.7677

**West Agro, Inc.,**
11100 North Congress Avenue, Kansas City, MO 64153; 816.891.1528

**Zep Manufacturing Co.,**
1310 Seaboard Industrial Blvd., Atlanta, GA 30318; 404.352.1680

AUGUST 1998 – Dairy, Food and Environmental Sanitation 489
COMMENTS

FROM YOUR PRESIDENT

By GALE PRINCE
IAMFES President

"It was a good year..."

IAMFES had a good year with numerous accomplishments. While our Annual Meeting continues to be a major focus of the Association, there are many other important activities throughout the year. IAMFES co-sponsored several food safety conferences including one with the International Life Sciences Institute, N.A. (ILSI) coming up this October. Last April we offered a HACCP workshop and we're presenting two workshops at the Annual Meeting. Additional workshops are on the drawing board to provide for the advancement of IAMFES Members and those industries served.

Last fall, we established a Web site on the Internet at www. iamfes.org for quick access to information about your Association. At this year's Annual Meeting, we introduced the IAMFES Fellows Award to recognize Members for their long and unheralded contributions to the Association.

The Journal of Food Protection and Dairy, Food and Environmental Sanitation are still the pride of the Association. The number of papers presented to the Association for publication increases as the journals become more recognized worldwide. The list of other publications IAMFES produces continues to grow. A revision of the very popular booklet Procedures to Investigate Foodborne Illness is nearly complete. This goes along with the revised version of Procedures to Investigate Waterborne Illness booklet. The IAMFES pamphlet, Before Disaster Strikes... A Guide to Food Safety in the Home, has been very timely and useful.

This year, Members of the Executive Board attended 15 Affiliate Association meetings around the U.S. and Canada. Board Members provided information about IAMFES while sharing their particular expertise on food safety. This program has been utilized very effectively for both IAMFES and our Affiliates.

We made progress on long-range positioning of the Association among food safety organizations and are moving forward in looking at a user-friendly name to reflect the Association Membership. We are in an era of globalization as our Membership grows and becomes more diverse while most segments of our industry become more concentrated and specialized. The Association needs to reflect that change in our Members' job responsibilities during this era without losing the foundation on which the organization was built.

Your favorable comments regarding the name change is best summarized by many of you who wrote to me. These comments were unanimously in favor of changing the Association name. Many of you used a similar statement "the time is right to change our name." We are moving ahead with the name change, and are currently conducting the legal review. At the 1999 Annual Meeting, the Membership will vote on the proposal to change IAMFES' name to the International Association for Food Protection. If approved, the name will carry us into the next millennium.

On August 19, 1998, I will turn the gavel over to Bob Brackett, your new IAMFES President, and I will become the senior citizen on the Executive Board. Thank you for allowing me to serve as a Member of the Executive Board. These past 13 months and 10 days as your IAMFES President have all gone so quickly. When I was asked five years ago to offer my name as a candidate for IAMFES Secretary, I did it for the love of the Association. It was a chance for me to give back to so many Members of the Association for the willingness to share their knowledge with me over the years. I am proud of IAMFES and the contributions of our Members in addressing global food safety challenges.

Thank you for all your E-mails, phone calls, and responses to my request for help to serve your Association. It is you, the Members of IAMFES, that push the Association to move forward towards providing an Association that will serve the needs of our Membership long into the future. The Executive Board is only the congressional body in carrying out the desires of the IAMFES Membership, as related to us directly and indirectly by Members, in the interest of what is best for the Association. The support of the IAMFES office staff was sincerely appreciated during this past year. I look forward to working with you as IAMFES continues to strengthen and grow.
ILSI North America Conference on the National Food Safety Initiative: Implications for Microbial Data Collection, Analysis, and Application

October 14-16, 1998
Doubletree Hotel National Airport
Arlington, Virginia

This conference will convene scientists from government, industry, academia, and the public health community to critically examine the relevance and role of microbial data in implementing the National Food Safety Initiative. Objectives of the conference are to assess the magnitude of the public health problem; examine current practice and experience in microbial data collection, analysis, and application; explore the links among food microbiology data, epidemiology, human health, and microbial risk assessment; discuss the role of microbial testing in HACCP validation and verification; identify key issues in the development of new food microbial testing strategies; and develop an agenda for future research and development.

This conference is organized by the International Life Sciences Institute North America (ILSI N.A.) and the ILSI N.A. Technical Committee on Food Microbiology, in collaboration with the Centers for Disease Control and Prevention, Food and Drug Administration, International Association of Milk, Food and Environmental Sanitarians (IAMFES), National Institutes of Health, U.S. Department of Agriculture, and others concerned with microbial food safety.

The meeting will be of interest to Food Protection and Public Health Professionals, including Microbiologists, Epidemiologists, Physicians, Health Policy Makers, and Researchers from academia, government, and industry.

To receive program and registration information, contact: ILSI NFSI (National Food Safety Initiative) Microbial Data Conference, 6200 Aurora Avenue, Suite 200W, Des Moines, IA 50322-2863; Phone: 800.369.6337; 515.276.3344; Fax: 515.276.8655; E-mail: nfsi@iamfes.org.

Program and registration information is available on the ILSI Web site: www.ilsi.org/conference.html#6.

Questions concerning the conference should be directed to Ms. Catherine Nnoka, at 202.659.0074; Fax: 202.659.3859; E-mail: cnnoka@ilsi.org.
From the preceding paragraph, you should be able to tell that working together and sharing credit with everyone involved is very important to me as is providing a proper “thank you” where appropriate. How many times in the last few months can you remember someone sharing a sincere “thank you” with you or telling you that “you did a good job”? Think about your position at work (or at home). Do you take time to thank co-workers and tell them that you appreciate the job they have done? How about at home? This can make all the difference to people that you associate with. Maybe if you are not currently practicing this method of pleasantry, today can be the day that you change your practices!

To build on this idea, I want to sincerely thank the IAMFES staff for the outstanding work they are doing. I can truly state that our staff performs at 110% effort year round. That percentage only increases immediately preceding and during the IAMFES Annual Meeting. Since these columns are written a month in advance of publication, I am writing this column about four weeks prior to the beginning of the IAMFES 85th Annual Meeting.

The office is abuzz with activity. Registrations are coming at a rapid pace; final touches are being put on the Program Book — printing begins next week; communications with exhibitors are ongoing; details with the hotel and convention center have to be finalized; and more details need to be coordinated with the Tennessee Affiliate. The bus company, golf course, Grand Ole Opry, Wildhorse Saloon, and audiovisual company all have final details that need to be confirmed. Now is when our months of planning and preparing come together to create the Annual Meeting.

Also, I want to thank the Program Advisory Committee, and Susan Sumner as Chairperson, for the excellent work they have done in preparing the program for this year’s Meeting. Committee members give willingly of their time and expertise in pulling together the program. Many hours of time and effort go into this detail and for that we offer our hardest “Thank You” to everyone involved. Not only should this thank you go to committee members, but we want to include all session convenors and our Professional Development Groups who work long and hard to see that the leading food safety professionals are involved with the IAMFES Annual Meeting. We, as an Association, owe a great deal to many individuals.

Another group to thank for their great effort is the Local Arrangements Committee from the Tennessee Association of Milk, Water and Food Protection. Co-Chairpersons, Ann Draughon and Ruth Fuqua have done a superb job of organizing their members in preparation for the Meeting. We couldn’t do it without the help of so many willing volunteers.

Today, it seems strange to think that by the time you read this column, the Annual Meeting will be concluded. We are confident that this year’s Annual Meeting will exceed all expectations and provide a top quality educational opportunity for every attendee, no matter what your interest in food safety is.

“I”, the least important word, want to thank each individual that makes up the “we” of the IAMFES staff. Donna Bahun, Julie Cattanach, Bev Corron, Nina Dao, Lisa Hovey, Karla Jordan, Carol Mouchka, Rick McAtee, Tammy Schafroth, Tanya Smith, and Pam Wanninger. You have all done a great job!
Sign up today for your IAMFES Membership

Your benefits will include:

**Monthly issues of Dairy, Food and Environmental Sanitation**
A monthly publication that provides general information for food safety professionals.

**Journal of Food Protection**
A scientific journal of research and review papers on topics in food science.

**IAMFES Lending Library**
Videotapes dealing with various food safety issues.

**The IAMFES Annual Meeting**
Provides attendees with over 200 presentations on current topics in food protection.

Interested individuals can contact:
The International Association of Milk, Food and Environmental Sanitarians, Inc.
6200 Aurora Avenue, Suite 200W
Des Moines, Iowa 50322-2863, U.S.A.
Phone: 800.369.6337; 515.276.3344; Fax: 515.276.8655; or E-mail: iamfes@iamfes.org

---

**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.
2400 E. 5th St., PO. Box 647
Marshfield, WI 54449

Phone 800/826-8302
FAX 800/472-0840

Reader Service No. 173

---
Reliability of Coliform Bacteria as an Indicator of Postprocessing Contamination in Yogurt Manufacture

S. Abd El Ghani, Zeinab I. Sadek, and Fatma A. Fathi

INTRODUCTION

The use of coliform counts as an indicator of postprocessing contamination in the dairy industry, including yogurt manufacture, has long been established. Recently, other reports have cast doubt on the validity of coliform counts as a reliable indicator (7, 9, 15, 19). Souring of milk is a potent mechanism for prevention of the growth of coliforms in yogurt (3). Both live yogurt bacteria and the acid environment of the product exhibited some bactericidal activity (11, 17). However, it was later reported that the effectiveness of utilizing pH as a microbial inhibitor/bactericidal agent would have to be reexamined because of the possibility that some pathogens (including E. coli O157:H7) adapt to survive in low acid environments for periods of time longer than previously observed (13). Such coliform strains can survive in products with a pH as low as 3.7 (5). Other stains of E. coli could adapt to the presence of lactic acid and might also be viable in natural yogurt (17). Collectively, the subject of coliforms in yogurt has become important.

SUMMARY

Reliability of coliforms as an indicator of postprocessing contamination in yogurt manufacture was investigated. E. coli isolated from commercial yogurt were inoculated into Tryptone Soya Broth (TSB) and sterilized milk (SM) having initial pH of 3.5, 4.0, 4.5 or 5.0. Growth at 37°C was monitored at 0, 24 and 48 h by measuring changes of optical density (OD) and pH in the TSB and changes of pH in SM. For comparison, E. faecium was also inoculated in a similar manner as for coliforms. Heat resistance of both bacteria was determined at 63, 75, 80 and 90°C for 30 min, 15 sec, 10 sec, and 5 sec, respectively. Experimental yogurt was inoculated by coliforms or enterococci at two levels of contamination (10^2 and 10^5 colony forming units (CFU/per ml). Fate of the two indicators was monitored daily during 15 days storage at refrigeration temperature (8 to 10°C).

Overall results indicated that coliforms were more reliable than enterococci as an indicator of postprocessing contamination in yogurt manufacture. Coliforms withstood lower pH values for longer times than enterococci, in TSB, SM and yogurt.
TABLE 1. Mean log₁₀ counts of coliforms and enterococci and pH values for 6 brands of commercial yogurt

<table>
<thead>
<tr>
<th>Brand</th>
<th>Coliform</th>
<th>Enterococci</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Log₁₀ count</td>
<td>No. positive samples</td>
<td>Percent positives</td>
</tr>
<tr>
<td>1</td>
<td>2.18</td>
<td>3/10</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>2.20</td>
<td>5/10</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>0.00</td>
<td>0/10</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>2.38</td>
<td>2/10</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>3.04</td>
<td>6/10</td>
<td>60</td>
</tr>
<tr>
<td>6</td>
<td>1.88</td>
<td>4/10</td>
<td>40</td>
</tr>
</tbody>
</table>

*Each brand was represented by 10 samples.

for a number of reasons. First, yogurt is a very popular food commodity worldwide (4). Second, the occurrence of coliforms in yogurt is a violation of regulatory standards in many countries. Last, there is the possibility of punitive action being applied by authorities if coliforms are detected in yogurt. Thus, the intention of the present study was to investigate the subject comprehensively, from two directions. The survival of coliform and enterococci in acidified synthetic medium and sterilized milk was studied first, and their heat resistance was determined. The fate of coliforms and enterococci in experimental yogurt artificially inoculated with these bacteria was also traced. Both groups of bacteria were observed daily during refrigerated (8 to 10°C) storage of yogurt for up to 15 days.

MATERIALS AND METHODS

Coliforms and enterococci in commercial yogurt

Sixty samples of plain yogurt representing 6 different commercial brands were randomly withdrawn from groceries in Cairo and analyzed for coliforms, enterococci and pH value. Methods and media used were according to Marshall (14). Certain isolates were confirmed by standard criteria (12). The pH values were determined using a computerized digital pH meter (Hannah, Portugal).

Coliforms and enterococci in acidified Tryptone Soya Broth (TSB) and sterilized milk (SM)

A strain of E. coli isolated and identified during this study was used. Enterococcus faecium (Chr. Hansen, Denmark) was also selected for the purpose of this investigation.

Both bacterial strains were propagated separately at 37°C for 24 h. in Tryptone Soya Broth (TSB) supplemented with 0.5% yeast extract. Working cultures were added (1% v/v) to tubes containing 10 ml of either TSB or SM previously adjusted with HCl to pH 3.5, 4.0, 4.5 or 5 and incubated at 37°C for 24 and 48 h. Growth in TSB was monitored by measuring the optical density (OD) at 620 nm with a Spekol 11 colorimeter (Karl Zeiss, Jena) and by measuring pH at 24 and 48 h. Tubes of SM were examined for pH changes at the same time intervals.

Coliforms and enterococci in experimental yogurt using two levels of additions

Raw buffalo milk (6 per cent fat) was heated to 90°C and held at that temperature for 10 minutes, cooled to 45°C, and inoculated with 2 levels of coliforms and enterococci; 2 per cent (v/v) of yogurt culture (Chr. Hansen-Denmark) was added. Inoculated milk was agitated and distributed into plastic tubs, after which the tubes were covered and incubated at 40°C for about 4 h until the milk was coagulated.

Yogurt was kept refrigerated at 8 to 10°C and sampled daily for up to 15 days for total coliform counts, enterococci counts, and pH values. Low and high levels of contamination equaled 10² and 10⁵ counts per ml milk, which were considered to resemble possible product contamination on an industrial scale. Working cultures of coliforms and enterococci were added in quantities needed to contaminate yogurt milk to the desired degree mentioned above.

Heat resistance of coliforms and enterococci

One milliliter aliquots of E. coli and Enterococcus faecium were pipetted separately into sterile test tubes (7 x 105 mm) placed in an oil bath at temperatures of 63, 75, 80 and 90°C for 30 min, 15 sec, 10 sec, and 5 sec, respectively. The tubes
TABLE 2. Fate of coliforms and enterococci in acidified TSB and SM after 24 and 48 hr at 37°C

<table>
<thead>
<tr>
<th>OD</th>
<th>pH</th>
<th>OD</th>
<th>pH</th>
<th>OD</th>
<th>pH</th>
<th>OD</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>0.028</td>
<td>0.655</td>
<td>0.542</td>
<td>5.0</td>
<td>4.5</td>
<td>4.4</td>
<td>0.50</td>
<td>0.67</td>
</tr>
<tr>
<td>1.233</td>
<td>0.012</td>
<td>0.012</td>
<td>5.0</td>
<td>4.0</td>
<td>4.1</td>
<td>4.5</td>
<td>4.3</td>
</tr>
<tr>
<td>0.012</td>
<td>0.67</td>
<td>1.233</td>
<td>0.012</td>
<td>0.012</td>
<td>0.012</td>
<td>0.012</td>
<td>0.012</td>
</tr>
<tr>
<td>3.5</td>
<td>1.233</td>
<td>0.012</td>
<td>0.012</td>
<td>0.012</td>
<td>0.012</td>
<td>0.012</td>
<td>0.012</td>
</tr>
</tbody>
</table>

TSB = Tryptone Soya Broth medium (Oxoid)
SM = 12% sterilized milk tubes
1 = initial  2 = after 24 h at 37°C  3 = after 48 h at 37°C

RESULTS AND DISCUSSION

Incidence of coliforms and enterococci in commercial yogurt samples

Twenty out of 60 (33.3%) yogurt samples examined were positive for coliforms. Positive samples were distributed in 5 out of 6 brands (83.3%) analyzed. In contrast, enterococci were found in 7 out of 60 samples (11.7%) in only 3 brands (50%), which had coliform counts ranging from 0 (not detected) in brand 3 to log 3.04 in brand 5. Enterococci were either not detected (brands 3, 4 and 6) or detected at levels as high as log 4.40 (brand 2). This finding provides strong evidence for the reliability of coliforms over enterococci as indicators of post contamination in yogurt. Although initial pH values of 4.5 or 5.0 inhibit both groups, the growth response was not equal. These results indicated the greater acid tolerance of coliforms over enterococci. Therefore, acidity alone is not enough to control the growth of coliform in foods. This conclusion supports those of other investigators (6, 11).

Fate of coliforms and enterococci in acidified TSB and SM

Table 2 summarizes the fate of coliforms and enterococci in synthetic medium and milk. Growth of bacteria was monitored by measuring optical density (OD) and pH initially, and after 24 and 48 h incubation at 37°C for both types of bacteria in TSB medium. In the case of sterilized milk, pH values were monitored initially and after 24 and 48 h incubation at 37°C, as an indirect measure of bacterial multiplication. Table 2 indicates that at pH 3.5, for coliforms and enterococci, there was no difference between initial OD and OD after 24 or 48 h. The same observation with respect to pH was made for SM. Apparently, some bactericidal action occurred at pH 3.5.

Fate of coliforms and enterococci in experimental yogurt during refrigerated storage

Table 3 summarizes the results of incorporating two levels of coliform and enterococci contamination in yogurt. Low level (LL) and high level (HL) corresponded to counts of about
### Table 3. Fate of coliforms and enterococci in experimental yogurt during refrigerated storage for 15 days

<table>
<thead>
<tr>
<th>Time (days)</th>
<th>Coliforms</th>
<th>Enterococci</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HL</td>
<td>LL</td>
</tr>
<tr>
<td></td>
<td>Log count</td>
<td>pH</td>
</tr>
<tr>
<td>0</td>
<td>5</td>
<td>4.8</td>
</tr>
<tr>
<td>1</td>
<td>9.85</td>
<td>4.6</td>
</tr>
<tr>
<td>2</td>
<td>8.3</td>
<td>4.65</td>
</tr>
<tr>
<td>3</td>
<td>7.7</td>
<td>4.55</td>
</tr>
<tr>
<td>5</td>
<td>6.78</td>
<td>4.4</td>
</tr>
<tr>
<td>7</td>
<td>4.7</td>
<td>4.3</td>
</tr>
<tr>
<td>10</td>
<td>3.78</td>
<td>4.18</td>
</tr>
<tr>
<td>12</td>
<td>2.0</td>
<td>4.05</td>
</tr>
<tr>
<td>15</td>
<td>Nil</td>
<td>3.9</td>
</tr>
</tbody>
</table>

**HL** = High level inoculum = $10^5$/ml  
**LL** = Low level inoculum = $10^2$/ml

$10^2$ and $10^4$ CFU/per ml, resembling the situation that might occur on a commercial scale in industry (4). With HL coliforms, the counts were doubled after one day and slightly decreased on the second day; counts continued to decrease during the storage period. Finally, coliforms were not detected on day 15 but were still present in appreciable numbers up to 12 days after manufacture. The pH values decreased because the combined effect of starter bacteria and coliforms. The same trend was clearly observed with LL counts, except that the coliforms survived for only 5 days and were not detected after one week of storage. In contrast, enterococci at HL survived for only one week compared with 12 days for coliforms at HL. In the case of LL counts, the same trend was observed, with enterococci surviving for 5 days as did the coliforms. From Table 3, it is evident that coliforms at HL resist acidity in associative culture with yogurt starter bacteria for 12 days with an end pH of 4.05, while enterococci at HL resist for only 7 days at the higher pH value of 4.4. In the case of LL both coliforms and enterococci survived for 5 days at a pH of 4.50, after which they were no longer detectable. As shown in Table 2 and Table 3, the contaminant bacteria died at somewhat higher pH values in yogurt than in acidified broth media. This could be attributable to the antibacterial action of starter bacteria in yogurt cultures. Starter bacteria are known to produce, in addition to acids, hydrogen peroxide (8) and antimicrobial substances called bacteriocins (1). Such substances produced by lactobacilli are active against many Gram negative and positive microorganisms (20).

#### Heat resistance of coliforms and enterococci

Table 4 indicates that at higher temperatures (80° or 90°C) for 10 and 5 sec, respectively, coliforms and enterococci were killed. At a temperature of 73°C for 15 sec, used during HTST pasteurization by the dairy industry, coliforms were eradicated, while appreciable numbers of enterococci survived. After treatment of 63°C for 30 min, only 6 colonies/ml of coliforms could be counted, whereas for enterococci, 71 colonies/ml were detected. Therefore, we recommend higher temperatures (80°C or 90°C) rather than 73°C in yogurt manufacture, not only to ensure complete killing of undesirable bacteria but also because higher temperatures produce some chemical changes in milk that result in growth enhancement of starter bacteria (21). The temperature used in HTST pasteurization, it appeared from our results, is too low to destroy enterococci in the resultant yogurt. Dairy manufacturers are encouraged to apply high temperatures (80° or 90°C) to ensure enterococci eradication. Recently, some enterococci have been reported to be vancomycin resistant, thereby causing nosocomial infections in patients undergoing broad-spectrum antibiotic therapy and long-term...
TABLE 4. Heat resistance of coliforms and enterococci at different temperature and time combinations

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Coliforms CFU/ml</th>
<th>Enterococci CFU/ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) 63°C for 30 min</td>
<td>6</td>
<td>71</td>
</tr>
<tr>
<td>(2) 73°C for 15 sec</td>
<td>0</td>
<td>300</td>
</tr>
<tr>
<td>(3) 80°C for 10 sec</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>(4) 90°C for 5 sec</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

hospital care (22). Enterococcus faecium’s heat resistance, concluded from this study, has also been reported elsewhere. (10).

In conclusion, data obtained during this study support the opinion that coliforms are still a valid indicator of postprocessing contamination in yogurt. Moreover, the presence of coliforms indicates postprocessing contamination, because they are unable to survive the heat treatments applied during yogurt manufacture. The same is not true for enterococci, which are more heat resistant than coliforms unless higher pasteurization temperatures (above 80°C for 10 sec) are used during yogurt processing.

ABOUT THE AUTHORS

Food Technology & Dairying Department, National Research Centre, Dokki, Cairo, 12311, Egypt; Fax: 00 202.3370931; E-mail: Ghani < scitic@eri-sci-eg@.

REFERENCES

Alicyclobacillus — Historical Perspective and Preliminary Characterization Study
Isabel Walls and Rolenda Chuyate

SUMMARY

* Alicyclobacillus acidoterrestris* are acidophilic spore-forming microorganisms that can survive a typical heat process given to fruit juices and then germinate, grow, and cause spoilage in acid products. The main spoilage attribute is a "medicinal" or "phenolic" off-flavor or off-odor. Juice may appear normal or have a light sediment. Gas is not produced. In a survey, 35% of respondents reported having experienced spoilage attributed to growth of acidophilic sporeformers in their products, but as a rare event. The problem occurred seasonally, in spring or summer, and most commonly in apple juice. Strains of acidophilic sporeformers were found to be motile, endospore-forming, rod-shaped organisms. Spores were oval and, in most instances, swelled the sporangium. Central, subterminal, and terminal spores were observed. Colonies were round, creamy white, translucent to opaque, and 3 to 5 mm in diameter after 5 days growth on K medium, pH 3.7, incubating at 35°C. The Gram-stain reaction was positive, with a tendency towards Gram variability. Most strains were catalase positive, and all were VP negative and produced acid from D-mannitol. Results were variable for acid production from D-glucose, L-arabinose, D-xylose, and D-trehalose. All strains were indole negative and dihydroxyacetone negative, utilized citrate but not propionate, did not hydrolyze starch, were negative for deamination of phenylalanine, and did not reduce nitrate. They did not grow in the presence of 0.001% lysozyme, but most grew in the presence of 0.02% azide. Strains did not grow in the presence of 5% NaCl. Six strains were identified by ribotyping as *Alicyclobacillus acidoterrestris*.

INTRODUCTION

Acid and acidified foods (pH ≤ 4.6) generally are not heat processed sufficiently to destroy all bacterial spores. A thermal process may be given that is capable of destroying pathogens such as *Escherichia coli* O157:H7 or non-sporeforming spoilage organisms such as yeasts, molds, or lactobacilli. A heat process sufficient to eliminate spores may adversely affect the quality of the product and is not necessary, as most spores will not germinate and grow in such products. *Alicyclobacillus* are of concern because they can germinate, grow, and cause spoilage of products with a pH previously considered below the range for growth of sporeforming bacteria. In this paper, a historical perspective of the species and a preliminary characterization study are presented.

HISTORICAL OVERVIEW

Acidophilic sporeformers were first isolated in 1967 from hot springs in Japan (8). The pH range for growth was 2.3 to 5.0 over a temperature range of 45-71°C. Based on morphological and cultural characteristics, these organisms were originally classified as *B. coagulans*, which can grow at 55°C at pH 4.2. In 1971, similar organisms were isolated from acid products.
B. acidoterrestris. Spoilage was manifested as Hippchen's isolates from soil, i.e., organism was shown to be the same of 26 to 50°C. The organism was an obligate aerobe. A^ of 15 min was observed. The pH range for growth of the culture was found to be 35°C over a pH range of 3.0 to 5.5. The organism was found to have D^ 75°C = 11 min; D^ 91°C = 3.8 min; D^ 95°C = 1.0 min (7).

CHARACTERIZATION STUDY

The objective of NFPA's research study was to characterize isolates from acid products.

Experimental protocol

Source of microorganisms

Eleven isolates of acidophilic sporeformers were obtained from industry sources and Dr. Don Splittstoesser, Cornell University. Isolates were obtained as vegetative cells on slants or were isolated from product in our laboratories. Isolates were obtained from spoiled canned diced tomatoes (NFPA #N-1089), spoiled apple-grape-raspberry juice (N-1090), spoiled apple juice (N-1107), normal apple-cranberry juice (N-1108), normal apple juice concentrate (N-1098, N-1100, N-1101, N-1102, N-1103), and apple pear juice blend (N-1104 and N-1105). Strains were isolated from products using K medium, pH 3.7; K medium was prepared from 25 g yeast extract, 5.0 g peptone, 1.0 g glucose, 1.0 g Tween 80, 15 g agar, 25% malic acid solution filter sterilized and used to adjust pH after autoclaving, and 990 ml deionized water. Isolates on slants were grown in Orange Serum Broth (OSB) (Difco), pH 5.0, at 35°C and stored on Orange Serum Agar (OSA), pH 5.0, (Difco) slants at 4°C or lyophilized.

Isolation media

At NFPA, our first encounter with Alicyclobacillus spp. was around 1990, when a member company had a spoilage problem with an unusual sporeforming bacterium in a shelf stable juice product. The organism was isolated on acidified Potato Dextrose Agar (PDA), pH 3.5, from water and the activated charcoal filter used to filter water, but not from raw materials or environmental swabs. The temperature range for growth from spores was found to be 30 to 55°C over a pH range of 3.0 to 5.5. Isolates were grown on K medium at 43°C. Growth was evaluated by determining the number of strains that grew on each of the media at each pH and incubation temperature. All samples were plated in duplicate.

Characterization tests

Biochemical characterization tests were based on the identification scheme described by Gordon et al. (6), except that media were adjusted to pH 5.0. The ATCC reference strains for Alicyclobacillus acidoterrestris, A. acidocaldarius, and A. cycloheptanicus were also tested. Organisms were analyzed for macroscopic and microscopic appearance, motility, reaction to catalase test, reaction to Voges-Proskauer test, fermentation of carbohydrates (D-glucose, D-xyllose, D-ribose, L-arabinose, L-rhamnose, D-mannitol; acid production was measured by noting change in pH), production of indole, production of dihydroxyacetone, utilization of citrate and propionate, starch hydrolysis, phenylalanine deamination, nitrate reduction, growth in azide dextrose broth, resistance to lysozyme, and growth in the presence of 0, 5%, 7%, and 10% thermal environments in the U.S., including hot springs in Yellowstone National Park (2). The pH range for growth was 2.0 to 6.0 over a temperature range of 45 to 70°C. Based on their DNA base compositions, these organisms were not classified as B. coagulans but were considered a new species. The authors proposed the name Bacillus acidocaldarius. In 1981, acidophilic sporeformers were isolated from soil, indicating a more widespread distribution for these organisms (5). They were shown to be different from B. acidocaldarius, in their lower optimal growth temperature, biochemical characterization and DNA base composition. The pH range for growth was 2 to 5 over a temperature range of 22 to 62°C. Cells formed subterminal to terminal endospores, that slightly swelled the sporangium. Deinhard (3) later undertook further characterization studies and proposed a new name B. acidoterrestris, for these organisms.

The first reported spoilage incident caused by acidophilic sporeformers occurred in aseptically packed apple juice (pH 3.15) in Germany in 1982 (1). The spoilage organism was shown to be the same as Hippchen's isolates from soil, i.e., B. acidoterrestris. Spore formation was manifested as a bad taste and light cloudiness. The pH range for growth of the organism in laboratory media was 2.5 to 5.5 over a temperature range of 26 to 50°C. The organism was an obligate aerobe. AD_{0.5} of 15 min was reported.

In 1992, the creation of a new genus, Alicyclobacillus, was proposed (10) to comprise the species Alicyclobacillus acidocaldarius, A. acidoterrestris, and A. cycloheptanicus (4). Comparative rDNA sequence analyses showed that the three strains were sufficiently different from other Bacillus spp. to warrant recategorization in a new genus. Also, Alicyclobacillus are unique in their fatty acid profiles, containing α-α-lactic fatty acid as the major natural membrane lipid component.
TABLE 1. Comparison of unknown strains with Alicyclobacillus acidocaldarius ATCC 27009
A. cyclohepaticus ATCC 49028 and A. acidothermophilus ATCC 49025

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>27009</th>
<th>49028</th>
<th>49025</th>
<th>N-1089</th>
<th>N-1090</th>
<th>N-1098</th>
<th>N-1100</th>
<th>N-1101</th>
<th>N-1102</th>
<th>N-1103</th>
<th>N-1104</th>
<th>N-1105</th>
<th>N-1107</th>
<th>N-1108</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gram stain</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>+</td>
<td>+</td>
<td>V</td>
</tr>
<tr>
<td>Motility</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Catalase</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+(w)</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Anaerobic growth</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Voges-Proskauer</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Acid from</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>D-glucose</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>L-arabinose</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>D-xylene</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>D-mannitol</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>D-xylose</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>D-ribose</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Utilization of citrate</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>propionate</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Hydrolysis of starch</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Deamination of phenylalanine</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Nitrate reduction</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Formation of Indole</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Dihydrorxyacetone</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Growth in nutrient broth</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Growth in NaCl 0%</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Growth in NaCl 5%</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Growth in NaCl 7%</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Growth in NaCl 10%</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Growth with 0.001% azide present</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Growth with 0.02% azide present</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

NaCl. Growth in OSB was investigated over a pH range of 2.5 to 5.0 and a temperature range of 20-60°C.

Six of the isolates, N-1089, N-1090, and N-1108, N-1098, N-1104, N-1107 were ribotyped using a Riboprinter (Qualicon) (9). Ribotyping was carried out by Dr. John Webster of Qualicon, and Dr. Guodong Wang, NFPA, a subsidiary of DuPont. Ribotyping is a general method for distinguishing species and types by using electrophoretic patterns of EcoRI restriction fragments labeled by hybridization with an rRNA operon from Escherichia coli. DNA was extracted from the cells, isolated from chromosomal DNA, and then cut using a restriction enzyme. Fragments were separated by gel electrophoresis on a nylon membrane (Southern Transfer), and then hybridized with an E. coli ribosomal RNA operon (EcoR1). An alkaline phosphatase conjugate was applied, followed by chemiluminescent substrate, allowing visualization of the fragments that hybridize.

RESULTS AND DISCUSSION

Studies on isolation media

Because strains grew slowly on most isolation media, plates were routinely incubated for up to 5 days. All isolates grew on OSB, pH 5.0, and on K medium, pH 3.7, incubating at 35°C. Growth was observed more frequently on plates with pH 4.5 and 5.0 than on those with pH 3.5, indicating that the organism preferred these pH values. There appeared to be a relationship between media pH and growth temperature;
at 20°C, all isolates grew on media at pH 5.0 but only 2 grew at pH 3.5, whereas at 55°C, all isolates grew at pH 3.5 but only 2 grew at pH 5.0. The organisms did not grow on DTA, pH 7-4. Growth occurred more rapidly (1 to 2 days) on K medium incubated at 43°C than at 35°C.

**Phenotypic characterization tests**

In general, the isolates were Gram positive with a tendency towards Gram variability, and were motile rods forming central, subterminal and terminal spores that slightly swelled the sporangium. Colonies were round, creamy white, translucent to opaque, 3 to 5 mm in diameter after 5 days growth on K medium, pH 3.7, incubating at 35°C. Results of characterization tests are shown in Table 1. Of the three reference strains, *A. acidoterrestris* was most similar to the isolates. Isolates were VP negative; 7 were catalase positive and 4 negative; all produced acid from D-mannitol, 6 from D-glucose, 9 from L-arabinose, 6 from D-xylene, and 2 from D-trehalose. All utilized citrate but not propionate, lactose, or hydroxyacetone negative. Strains did not hydrolyze starch, were negative for deamination of phenylalanine, and did not reduce nitrate. All strains were indole negative and dihydroxyacetone negative. Strains did not grow in the presence of 0.001% lysozyme, but 8 grew in the presence of 0.02% azide. Strains did not grow in the presence of 5% NaCl. The pH range for growth in OSB was 2.5 to 5.5 for vegetative cells over a temperature range of 20-55°C. The minimum pH for spore germination was 3.24.

**Ribotyping**

Isolates were represented by a group of patterns corresponding to a species. Ribotyping distinguished the species from approximately 200 other species of bacteria in DuPont’s computer database of normalized patterns. The six strains tested, N-1089, N-1090, N-1098, N-1104, N-1107, and N-1108, were identified as *Alicyclobacillus acidoterrestris*.

In previous studies (3), as in our studies, some variability in results of biochemical characterization tests was reported. As more strains are isolated and identified, accurate methods to classify these strains will be of value.

**NFPA SURVEY**

NFPA undertook a survey of the food industry to determine the extent of spoilage by acidophilic sporeformers. Fifty-seven companies were chosen for the survey, based on membership of NFPA’s Microbiology and Food Safety Committee and Juice Products Committee. There were 34 responses to the survey (60%). Of those who responded, 12/34 (35%) had experienced spoilage that would be consistent with growth of acidophilic sporeformers, although this was not always confirmed. Individuals from most companies reported one or two incidents of spoilage in the past 5 years, with the spoilage rate for most companies being about 5% of the lot experiencing the problem. Spoilage occurred in early spring or summer and did not appear to be the result of processing changes. Spoilage was reported most commonly in apple juice but also in other juices and diced canned tomatoes. The pH of products ranged from 3.2 to 4.1. Spoilage was mainly apparent as an off flavor or odor, with or without a sediment. In some spoilage incidents, product was discolored or cloudy. Spoilage organisms were recovered from both product and processing equipment, on a variety of media, with a pH ranging from 3.5 to 5.2, over a temperature range of 25-55°C. Companies often did not recognize that they had a spoilage incident until they received consumer complaints. Often the initial reaction was to assume that the off flavor was due to chemical contamination rather than microbial growth, as no gas was produced and the juice appeared normal.

**CONCLUSIONS**

*Alicyclobacillus* can survive a typical heat process given to fruit juices, germinate, grow, and cause spoilage in acid products. Spoilage may be difficult to detect, as product may appear normal or have a light sediment and gas is not produced. Often the only obvious indication of spoilage is an off flavor. Organisms grow slowly on isolation media, so growth may not be detected during routine quality control tests. *Alicyclobacillus* represent a new challenge to the juice industry and potentially to all processors of acid and acidified foods. Studies to characterize the organism further and to find control measures are in progress.

**ACKNOWLEDGMENTS**

The authors thank Dr. Don Splittstoesser of Cornell University and NFPA member companies for supplying us with cultures, and Dr. John Webster, Qualicon, and Dr. Guodong Wang, NFPA, for ribotyping strains.

**ABOUT THE AUTHORS**

National Food Processors Association, 1401 New York Avenue N.W., Washington, D.C. 20005, U.S.A.; Phone: 202.639.5974; Fax: 202.639.5991; E-mail: iwalls@nfpa-food.org.

**REFERENCES**

3. Deinhard, G., P. Blanz, K. Poralla, and E. Alten. 1987. *Bacillus acidoterrestris* sp. nov., a new thermotolerant acido-
heptanicus* sp. nov., a new thermo-
acidophile containing w-cyclohep-
Microbiol. 10:68-73.
acidophilic bacilli possessing o-cyclo-
hexane fatty acids and hopanoids.
lus. USDA-ARS Agricultural Handbook
No. 427. Washington, D.C.
7. McIntyre, S. J. Y. Ikawa, N. Parkinson, J. Haglund, and J. Lee. 1995. Charac-
teristics of an acidophilic *Bacillus*
strain isolated from shelf stable juices.
J. Food Prot. 58:319-321.
J. I. Bruce, F. Fiedler, K. Schubert,
of the *Staphylococcus sciuri* species
group with EcoRI fragments contain-
ing rRNA sequences and description of
*Staphylococcus vittulus* sp. nov.
10. Wisotzkey, J. D., P. Jurtshuk, G. E. Fox, G. Deinhard, and K. Poralla. 1992,
Comparative sequence analyses on the 16S rRNA (rDNA) of *Bacillus acid-
ocaldarius*, *Bacillus acidoterrestris*
and *Bacillus cycloheptanicus* and
proposal for creation of a new genus,
*Alicyclobacillus* gen. nov. Int. J. Sys-
Isolation and Enumeration of Sporeforming, Thermo-acidophilic, Rod-shaped Bacteria from Citrus Processing Environments

Cornelis A. Wisse and Mickey E. Parish

SUMMARY

Sporeforming thermo-acidophilic rod-shaped (STAR) bacteria were isolated from different sources within and outside citrus processing plants. Strains were found in soil and on surfaces of oranges from citrus groves. Samples collected at several citrus processing facilities showed that STAR bacteria were present on surfaces of unwashed and washed fruit, in condensate water, and in juice concentrate. Strains were also isolated from bulk stored orange concentrate, pear concentrate, single-strength pear juice, and orange juice nectar. Spore concentrations enumerated in condensate water, a by-product of the juice concentration process used for cleaning fruit surfaces, ranged from non-detectable levels to $2.3 \times 10^3$ MPN/ml. Total microbial populations in condensate water ranged from non-detectable levels to $7.9 \times 10^5$ CFU/ml. Results indicated that complete elimination of these organisms from fruit juices would be difficult; however, improvement of fruit cleaning operations and condensate water systems may reduce the incidence of STAR contamination in fruit juices.

INTRODUCTION

Thermo-acidophilic, sporeforming bacilli (Gram positive and Gram variable) have been isolated from natural sources such as hot springs and soil since the 1960s (4, 5, 6, 9, 10, 11, 16, 22). Early reports identified these strains as species of *Bacillus*; however, further research has resulted in the description of two genera, *Alicyclobacillus* and *Sulfobacillus* (10, 24).

Until a few years ago, sporeforming bacteria were not expected to spoil citrus juices. Species of *Bacillus* commonly isolated from fruit juices are usually considered saprophytic and of little concern in citrus juices (12, 25). Although spores of these organisms survive thermal pasteurization, they are unable to germinate and outgrow in the low-pH environment of most fruit juices.

Documented reports of low pH spoilage by sporeforming bacteria began to appear in the early 1980s. Cerny et al. described the isolation of thermo-acidophilic sporeformers from spoiled apple juice that was cloudy and had an off flavor (3). Ten years later, Splittstoesser et al. reported the isolation of sporeforming bacilli from spoiling apple juice and from an...
applecranberry beverage (20). McIntyre et al. isolated acidophilic bacilli from berry and citrus juices and from ingredient water (14). Strains isolated by Splittstoesser et al. and McIntyre et al. were thermophilic, formed spores that survived pasteurization and produced growth in fruit juice. The isolated strains closely resembled the genus *Alicyclobacillus* in pH range and temperature range for growth (24). Previdi et al. characterized four *Alicyclobacillus* strains isolated from different fruit juices and found them to be comparable to *A. acidoterrestris* (19). Recently Yamazaki et al. reported the isolation of *A. acidoterrestris* from several ingredients water (14).

Articles that describe the isolation of sporeforming, thermo-acidophilic, rod-shaped bacteria from juices often identify the isolated strains as species of *Alicyclobacillus* (2, 3, 14, 19, 20, 27). Recent information published on other thermo-acidophilic sporeformers that contain α-alicyclic fatty acids in their cell membranes, such as some species of *Sulfobacillus*, complicates the identification of thermo-acidophiles isolated from fruit juices (9, 16). Until further research confirms that thermo-acidophiles involved in fruit juice spoilage are presumptively *Alicyclobacillus* species and not members of another genus, it is appropriate to designate these microorganisms using nonspecific terminology. Therefore, the organisms of interest in this study are referred to as sporeforming, thermo-acidophilic, rod-shaped (STAR) bacteria.

Spoilage problems in Europe of juice products stored at ambient temperature during the unusually hot summers of 1994 and 1995 increased research interest in STAR bacteria (2). Sources of the organism, routes of contamination, and spore concentrations at different stages in fruit juice processing are poorly understood and are of interest to the fruit juice processing industry. Objectives of this study were to detect and enumerate sporeforming thermo-acidophilic rod-shaped bacteria in citrus processing.

### MATERIALS AND METHODS

#### Samples

Samples tested for presence of STAR bacteria included soil (18 samples) from orange groves, whole oranges, and line samples from 10 citrus processing plants. Soil samples from countries other than the United States were imported in compliance with USDA-APHIS-PPQ regulations. Samples from processing facilities included whole fruit, before and after washing; single-strength orange juice after extraction; concentrated juice from the evaporator; and condensate water from the evaporator and fruit-wash spray nozzles. At one plant, thirty-three orange juice concentrate samples were collected from the evaporator during six consecutive processing days. All samples from processing facilities were collected during the 1995-1996 crop season.

Fifty-nine samples of frozen concentrated orange juice (FCOJ) and other fruit juice purees and concentrates of various geographic origins in bulk storage containers were tested. Two consumer products (a shelf-stable single-strength pear juice and orange juice nectar), both hot-filled in retail packages, were also sampled. The retail package samples were provided by processors that suspected STAR spoilage in the products.

#### Media

The medium used to isolate and enumerate STAR bacteria was modified from media of Cerny et al. (3) and Darland and Brock (4). ALI broth consisted of (mg/ml distilled water): 0.2 (NH₄)₂SO₄, 0.5MgSO₄ × H₂O, 0.25 CaCl₂ × H₂O, 3 KH₂PO₄, 1 glucose, 2 soluble starch and 2 yeast extract. Broth pH was adjusted to 3.5 with 1N H₂SO₄ prior to autoclaving. ALI agar was produced as follows: ALI broth was prepared with twice the concentration of all components and the pH was adjusted as above. An equal volume of 3.5% aqueous agar (Bacto-agar, Difco Laboratories, Detroit, MD) was prepared. The two solutions were autoclaved separately, tempered to 50°C and mixed using aseptic technique. Plates were poured immediately after mixing. Autoclaving did not change the ALI broth pH by more than 0.1 units.

Selected samples were plated on Orange Serum Agar (OSA, Difco) and Plate Count Agar (PCA, Difco).

#### Plate counts

Total plate counts on PCA, Aciduric counts on OSA, and STAR counts on ALI agar were conducted using either pour or spread plate techniques, depending upon the anticipated population size (21). Plates were counted after two days of incubation at 30°C (OSA), 35°C (PCA) or 45°C (ALI agar). All plating was conducted in duplicate.

#### Isolation of STAR bacteria

**Sample preparation.** Randomly selected undamaged oranges were placed in new, clean plastic bags with the use of sterile latex gloves. Sampling points were the fruit receiving areas (unwashed fruit) and a point after brush washing prior to juice extraction (washed fruit). In the laboratory, surfaces of five fruit from each sampling point were swabbed with a sterile sponge aseptically removed from a whirl-pak specimen bag (International Bioproducts, Redmond, WA) that contained 150 ml sterile peptone saline solution (PSS: 8.5 g/l NaCl and 1 g/l bactopeptone, Difco). After swabbing, the sponge was returned to the sterile bag and kneaded by hand for 30 sec. Fruit surface areas were calculated based upon the formula for area of a sphere, 4πr² where r is the fruit radius. A 5-ml sample of the PSS was aseptically transferred to 100 ml ALI broth in a 250 ml flask. Individual condensate water samples (50 ml) were filtered through 0.45μm filters (Gelman Sciences), and the filter was transferred to 100 ml ALI broth. Soil samples (5g) were added directly to 100 ml ALI broth.

Samples (100 ml) of single strength juice, juice nectar, and diluted concentrates or purees were added to a 250 ml sterile flask. Fruit juice concentrates and purees were diluted to 11 to 14° Brix with sterile water. All samples were tempered to ambient before the heat activation step.

**Heat activation.** To activate spores and eliminate vegetative cells, flasks were placed in a 90°C water
TABLE 1. Detection of STAR bacteria in citrus processing facilities

<table>
<thead>
<tr>
<th>Citrus processing plant</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI</th>
<th>VII</th>
<th>VIII</th>
<th>IX</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unwashed fruit surface</td>
<td>-*</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Washed fruit surface</td>
<td>NT</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Condensate water from spray nozzle</td>
<td>NT</td>
<td>NT</td>
<td>NT</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>NT</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Condensate water from evaporator</td>
<td>NT</td>
<td>NT</td>
<td>NT</td>
<td>+</td>
<td>NT</td>
<td>-</td>
<td>NT</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Single-strength juice to evaporator</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Concentrate from evaporate</td>
<td>NT</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*+,* signifies the detection of STAR bacteria; *-,-* signifies no detection of STAR bacteria; NT = Not Tested

TABLE 2. Detection of STAR bacteria in fruit juice samples

<table>
<thead>
<tr>
<th>Type of sample</th>
<th>Type of container</th>
<th>Number of samples tested</th>
<th>Samples positive for the presence of STAR bacteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>FCOJ*</td>
<td>Tanker trucks</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>FCOJ</td>
<td>210-liter drums</td>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td>Various fruit concentrates/purees</td>
<td>210-liter drums</td>
<td>36</td>
<td>2 (pear concentrates)</td>
</tr>
<tr>
<td>Pear juice</td>
<td>retail package</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>OJ nectar</td>
<td>retail package</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

*FCOJ = frozen concentrated orange juice. OJ = orange juice

bath for 20 minutes. Water in the bath was at least 3 cm above the contents of the flask. The water bath was covered with aluminum foil to ensure thorough heating. After heat treatment, flasks were rapidly cooled in ice water and incubated at 45°C. When broth or juice became turbid or an off-odor was sensed, isolation streaks were made on ALI agar plates, which were then incubated 24 to 48 h at 45°C. All samples were spread plated (0.1 ml) on duplicate ALI agar plates after 10 days incubation. Colonies of different morphologies were picked and streaked for isolation on ALI agar plates. Microscopic examination was conducted to confirm that isolates were endosporeforming rod-shaped bacteria. Isolates were stored in ALI broth with 20% glycerol at minus 76°C.

MPN enumeration of spores

A 3-tube most probable number (MPN) technique was used to estimate the number of STAR spores in selected samples (17). Duplicate 10-ml samples of fruit surface PSS rinse, condensate water, single strength juice, and juice nectar were transferred to sterile tubes and heated for 10 minutes at 90°C to activate spores. Samples of concentrates or soil (1 g) were added to tubes containing 9 ml PSS prior to heat activation. After being heated, all tubes were rapidly cooled in an ice bath. Two serial dilutions (10⁷ and 10⁸) from each tube were prepared in PSS. Aliquots (1 ml) of the heat treated samples and corresponding dilutions were inoculated into three tubes of 10 ml ALI broth. Outgrowth (visible turbidity) was checked after eight days of incubation at 45°C. Statistical tables provided the most probable number (MPN) of spores per ml, gram or cm² with a 95% confidence interval.

RESULTS

Isolation of STAR bacteria

Strains of STAR bacteria were detected in 7 of 18 soil samples, on surfaces of unwashed fruit at 8 of 10 processing plants, on surfaces of washed fruit at 6 of 9 processing plants, and in condensate water used to wash fruit at 6 of 7 test facilities (Table 1). At two plants, condensate water directly from the evaporator contained STAR bacteria. STAR bacteria were not isolated from single strength juice fed into the evaporator of the ten test plants but were found in concentrate samples from the evaporator of one facility. Thirty-three other concentrate samples collected later at the same plant during six consecutive processing days tested negative for these organisms.

Results for the detection of STAR strains in fruit juices are shown in Table 2. STAR bacteria were detected in FCOJ from bulk tankers and from 210-liter drums used for bulk commerce. Two pear juice concentrates from 210-liter drums, and retail packets of pear juice and orange juice (OJ) nectar, also contained STAR bacteria.
Enumeration of STAR spores

Soil. Although STAR bacteria were isolated from soil samples, growth was not visible in the MPN enumeration experiment after eight days of incubation. Concentrations of spores in the seven samples were estimated as <3 spores/g soil.

Washed and unwashed fruit. MPN experiments to estimate number of spores in samples with positive detection results (see Table 1) were subsequently conducted. The estimated number of spores in all samples of washed and unwashed fruit surfaces were below the lower limit of detection, <90 spores/fruit. Lower serial dilutions used for MPN testing of washed-fruit samples from plant X indicated the presence of 46 spores/fruit.

In addition to the MPN testing, results from the detection experiments reported above can be used to estimate the concentration of spores. Five fruits were washed with 150 ml PSS and a 5 ml aliquot was inoculated into 100 ml of ALI broth. A negative result indicated absence of growth and corresponded to <1 spore per 5 ml PSS. Based upon the total amount of PSS and number of fruit tested, this corresponds to <6 spores per fruit. A positive result indicated the theoretical presence of at least 6 spores per fruit.

Water samples. STAR spore counts of condensate water sampled at spray nozzles in the fruit brushwasher ranged from <3 spores/ml to 240 spores/ml (Table 3) at the six facilities that tested positive for the presence of STAR bacteria (Table 1). The spore count for condensate water sampled from a storage tank at one of the facilities was 2300 spores/ml. This water also had the highest total (PCA) and aciduric (OSA) counts of the condensate waters tested (Table 3). Although STAR bacteria were detected in condensate water sampled directly from the evaporator in two of five facilities (Table 1), MPN results, as well as total and aciduric plate count results were below the detectable limit for all evaporator water samples (Table 3).

Concentrate and single strength fruit juice samples. Spore populations (by MPN) in the five bulk-stored FCOJ samples that tested positive for the presence of STAR bacteria were <30, 150, 230 (two samples) and 430 spores/g 65°Brix concentrate. The only positive concentrate sample collected from the evaporator of a Florida processing plant contained 40 spores/g of 65°Brix concentrate.

A fruit juice nectar (minimum 55% fruit juice content) contained more than 1100 spores/ml by MPN. Plate counts on ALI agar estimated the spore concentration to be $1.7 \times 10^4$ CFU/ml. Spore concentrations were estimated by MPN as <30 spores/g for the pear concentrate samples.
and <3 spores/ml for the consumer retail package of single strength pear juice.

DISCUSSION

Detection of STAR bacteria

STAR bacteria were isolated from several different sources. Positive detection of these organisms in soil samples was expected, since several publications mention their recovery from different soils in various parts of the world (4, 7, 8, 11, 16). Isolation of STAR bacteria from fruit surfaces was also expected, in as much as cross-contamination with soil or other contaminated fruits during growth, fruit harvesting, and handling practices commonly occurs. Therefore, it is not surprising that STAR bacteria were detected on unwashed fruit surfaces at eight of ten processing plants.

It is most interesting that these organisms were recovered from washed fruit surfaces at six of nine facilities. One explanation is that there were substantial numbers of STAR spores in condensate water used for fruit washing (Table 3). Condensate water evaporates from juice during the thermal process used to produce juice concentrates. It is then condensed and used for a variety of purposes, such as fruit washing. An increase in the total microflora and STAR bacteria spore counts of condensate water between the evaporator and storage tanks or spray nozzles (as shown in Table 3) indicated that heavy microbial contamination and/or growth occurs in the condensate water system. The pH of condensate water from the evaporator was approximately 4.8, whereas the pH of water samples from the spray nozzles was approximately 7. Warm, acidic environments provide necessary conditions for growth of thermo-acidophilic bacilli. The condensate water recovery system is a critical point that needs improvement in some citrus processing plants to ensure that microorganisms are not inadvertently added to the juice processing line.

Another factor that could influence the contamination of washed fruit surfaces involved the efficacy of fruit washing operations. Most of the fruit wash systems studied did not effectively reduce the fruit surface microbial population after washing (Fig. 1). Research has shown that the maximum cleaning efficiency of most fruit wash systems produces a 90 to 99% reduction in the population of microorganisms on a citrus fruit surface under optimum pilot plant situations, whereas less-than-optimum-conditions may result in only a 60% reduction of fruit surface microflora (23). Research on effective fruit washing regimes is necessary to ensure that fruit are as clean as possible before juice extraction.

Contamination routes of FCOJ with STAR

STAR bacteria are carried into processing plants on fruit surfaces, soil, and other environmental sources. Because fruit surfaces may be continuously contaminated with spores from the condensate wash water, the extracted juice could very well contain spores and theoretically contaminate the evaporator. An empirical correlation exists between fruit surface and juice microflora (15, 26). STAR spores were not recovered from tested samples of single-strength juice prior to evaporation (Table 1), which indicates that the level of STAR spores was probably below the test detection limit. This was also reflected in the fact that these spores were recovered from concentrate taken directly from the evaporator in only one of the processing test facilities (Table 1). This lack of STAR spores in the concentrate taken directly from the evaporator could also be because citrus processors in Florida do not use condensate water to wash juice cells during production of concentrates. Proposed rules by the European Union to require condensate water for in-line washing of juice cells will probably result in the contamination of FCOJ by STAR bacteria. Efforts are needed to investigate water treatment protocols for condensate water.

Rinsing clean equipment (extrac tors, pipelines, evaporator, blending tanks) with condensate water containing STAR spores may contaminate the juice going to the evaporator, or the final FCOJ product. Heat treatment in the evaporator is not sufficient to kill STAR spores, which have reported D-values ranging from 14 to 54 min at 90 or 91°C and z-values between 6 and 10°C (3, 14, 18, 20). It is known that bacterial spores are generally capable of attachment to surfaces of pipelines and equipment (1). Temperatures in latter stages of the evaporator might even support germination and out-grow thermophilic bacteria in milk are reported to attach to pasteurizer surfaces, grow and contaminate pasteurized milk (13). Further research
is needed to determine specific contamination points during citrus juice processing.

CONCLUSION

Isolation of STAR spores from geographically disparate soil and juice samples in this research, coupled with reports of isolation of strains in Europe and Japan, indicates that STAR bacteria are widespread over different climate zones. Although spore-forming bacteria were previously considered to be of little significance in fruit juices, the isolation of STAR bacteria, as described in this and previous reports, significantly changes our understanding of fruit juice microbiology. The widespread presence of STAR spores in soil, on fruit surfaces, in the processing environment, and in juice products suggests that their complete elimination from the final product could be difficult and impractical. However, improvements in cleaning regimes and condensate water systems may substantially reduce contamination of FCOJ by STAR bacteria. Further studies are needed in cleaning regimes and condensate water systems to determine specific contamination points during citrus juice processing.

ABSTRACT

University of Florida, Citrus Research and Education Center, 700 Experiment Station Road, Lake Alfred, FL 33850 U.S.A., Florida Agricultural Experiment Station, Journal Series Number R-05500; Phone: 941.956.1151; Fax: 941.956.4631; E-mail: mep@icon.lal.ufl.edu.

REFERENCES

The purpose of this article is to provide guidance on the practices and recommendations related to the installation, passivation, maintenance, cleaning, and bactericidal treatment of stainless steel equipment. Close observance of the recommendations herein will result in longer, corrosion-free service life for stainless equipment and should provide a clean, sanitary surface for milk, milk products, and other comestibles. There are ten recommended practices to extend the corrosion resistance of stainless steel.

Nickel, chromium, and molybdenum bearing stainless steel of the American Iron and Steel Institute (AISI) 300 Series is resistant to corrosion by milk and other dairy products; that is, under normal operation the milk and other dairy products that come in contact with the stainless steel will not cause corrosion. Stainless steel derives its corrosion resistance from a thin, durable layer of chromium oxide that forms at the metal's surface and gives stainless steel its characteristic "stainless quality." The passive film on a stainless steel surface consists of a mix of iron, chromium, and, if present in the bulk steel, molybdenum oxides. The chromium oxide film can form in air instantaneously if the stainless steel surface is clean and dry. However, since the advent of circulation cleaning and clean-in-place (CIP) procedures, corrosion problems in dairy plants have been aggravated. Stainless steel is the best material known to dairy equipment manufacturers for the construction of dairy equipment, but the following procedures must be followed to ensure preservation of the surfaces of stainless steel equipment.

### INSTALLATION AND MAINTENANCE OF STAINLESS STEEL DAIRY EQUIPMENT

1. The use of dissimilar metals should be minimized in the fabrication of the product contact surfaces, especially if the equipment is to be placed in a CIP-type installation. Wherever possible, only AISI 300 Series stainless steel should be used. "White metal," a copper-nickel alloy, should not be used in fabricating product contact surfaces. If possible, AISI 400 Series stainless steel should not be used with AISI 300 Series in fabricating a product contact surface, especially if the equipment is to be used in a CIP-type installation. The use of dissimilar metals, even two different series stainless steels, or "white metal" for product contact surfaces in the same system may result in discoloration, pitting, or etching.

2. Stainless steel tubing should be isolated from metal pipe hangers with nonabsorbent insulation. Failure to insulate may result in galvanic or other types of electrolytic corrosion, with serious damage to the piping. Absorbent insulation may accumulate moisture and aid in the corrosion of the piping.

3. Gaskets should be nonabsorbent materials that are free from iron oxide or other corrosive substances. Chemically active gasketing material may induce corrosion. Absorbent gaskets may permit a build-up of highly concentrated cleaning and bactericidal compounds that can produce pitting.

4. Leaky gaskets and joints should be promptly replaced or repaired. The use of different types of fittings in making pipe connections should be avoided where possible. Properly designed and installed pipe and equipment supports and mountings are necessary to prevent undue mechanical strains and stresses on joints. Product and cleaning material leaking through joints may promote corrosion if the corrosive material is allowed to remain in the joint area. CIP installations, where lines are not normally dismantled, are especially susceptible to corrosion in the joint area if leaks occur.

5. Welding and polishing should be performed by competent individuals using approved methods and materials. The use of low welding temperatures, appropriate grades of welding rod and parent metal, and iron-free polishing wheels and
compound is encouraged. Excessive grinding and polishing may also leave the surface in a weakened condition. The corrosion resistance of even the highest grades of stainless steel may be reduced considerably by the use of excessive welding heat, by the presence of oxygen during welding, by the use of low grade welding rod or parent metal, by the incorporation of iron particles during polishing, or from failure to remove weld spatter or fluxing agents.

If any question exists as to the quality of the finished weld and polish, appropriate quality checks such as X-ray or dye-check should be used. Pits or voids remaining in the polished weld area should be completely removed, since they form natural areas for corrosion to start.

6. When new equipment, and particularly CIP systems are installed, all electrical equipment in the area of the installation should be checked for proper connections, grounding, worn or damaged insulation, or other factors that might lead to stray electrical currents. Periodic preventive maintenance checks should be made to ensure that this condition does not occur. A pitting form of corrosion may result if stray electrical currents come in contact with moist stainless steel. Local electric power companies or electricians should be consulted with regard to detection of such a condition.

7. When installation is complete, and prior to use, the equipment and piping should be thoroughly cleaned, drained, passivated, and, if possible, allowed to air dry. It should then be subjected to an approved bactericidal treatment just before product is to be processed. Thorough cleaning and air drying permits the formation of a protective chromium oxide film, which is the key to placing the system in its most corrosion-resistant (passive) condition.

The chromium oxide film can form in air instantaneously if the stainless steel is clean and dry. Further exposure to air does not yield additional corrosion protection. Complete passivation cannot be achieved if product contact surfaces are not clean or contain surface defects. It should be noted that the interaction between the different oxides and the passivation/corrosion characteristics of stainless steel is very complicated and is not yet fully understood.

The passivation process will enhance the chromium fraction in the passive film, as established by a number of authors, e.g., Olsson and Hornstrom (5) or Olefjord and Wegrelius (4). The main mechanism for this process is selective dissolution, predominantly of iron (3).

An increased chromium fraction in the passive film is one important parameter that influences the corrosion resistance of steel; however, it has less influence on the steel's ability to repassivate spreading pit corrosion. On the other hand, a properly performed passivation process will use up a number of possible initiation sites for pitting by dissolving surface sulphides. This type of mechanism adds value to the effects of surface passivation.

**FABRICATION CAUTIONS**

1. Hygienic fabrication techniques must be used to eliminate the use of ferrous-containing grinding and polishing materials and thus to prevent iron particles from being imbedded in the surface. In addition, the finished surface should be free of oil (machine lubricants) and shop dirt.

2. At times, the interior surface of equipment (especially vessels) delivered from equipment manufacturers can be covered with oil (mineral, organic, silicone). Product contact surfaces can also contain high carbon tramp steel, grease, dust, and other manufacturing dust that, if not removed, can lead to pitting, rusting, and crack and crevice corrosion.

3. Treatment of stainless steel with nitric, phosphoric or an organic acid is useful after machining to enhance the protective nature of the chromium oxide. These acids are normally used after cleaning with an alkaline dairy cleaner. Nitric acid enhances the level of chromium in the protective film on stainless steels. ASTM A 380 describes eight nitric acid-based cleaning/passivation treatments and four cleaning treatments using other chemicals (1).

**CORROSION POTENTIALS CREATED DURING FABRICATION (6)**

Defects and contaminants that can lead to corrosion are caused during the manufacturing process. Surfaces must be cleaned of the following potential sources of corrosion:

1. Embedded iron particles, picked up from forming rollers, carbon steel wire brushes, layout and cutting tables, and grinding.

2. Heat tint, resulting when welding heats the base metal, causing heavy oxide films (scale) to develop in the area of applied heat. The oxide films range in color from straw yellow to black; the color variation in the base metal is also dependent on the amount of oxygen gas present during the welding process. Heat tint will result in lower corrosion resistance of the stainless steel.

3. Weld flux, produced by welding with covered electrodes and forming along the sides of the weld bead. Weld flux is difficult to remove, requiring brushing with stainless steel wire brushes, abrasive disc and flapper wheel grinding, methods which may leave small flux particles at the side of the bead head. The flux particles are excellent crevice formers.

AUGUST 1998 - Dairy, Food and Environmental Sanitation 511
4. Arc strikes and spatter, which produce small pinpoint surface defects that become areas of corrosion in the protective film.

5. Scratches and paint, which can initiate corrosion, as can crayon marks and other instruction markings if they are not removed.

**OTHER SURFACE TREATMENTS (6)**

1. Passivation treatments are not designed to remove heat tint, embedded iron particles, heat treating scale, and other surface defects produced during fabrication, because nitric acid does not corrode or remove the surface layers having embedded defects. Elimination of these defects requires removal of the normal protective oxide layers in addition to 25 to 40μm of the substrate metal via pickling of the surface in a nitric-hydrofluoric acid bath.

2. Electrocleaning and electropolishing techniques are useful alternatives to the pickling treatment just mentioned. Electrocleaning can be used to remove imperfections from the surface of stainless steel after fabrication. Electrocleaning removes embedded iron particles; however, unlike pickling, it makes the substrate surface smoother.

3. Electropolishing is the same process as electrocleaning but is generally performed for longer periods of time.

4. Pickling, electrocleaning, and electropolishing surface treatments are beyond the scope of this document.

**COMPLETE PASSIVATION PROCESS**

The complete passivation process consists of inspection, mechanical cleaning, degreasing, immersion, and rinsing:

1. **Mechanical cleaning (6)**

Many mechanical methods can be used to clean welds, such as chipping, brushing, grinding, and blasting. However, many of these methods may do more harm than good if not performed properly.

Grit blasting can be extremely detrimental because it is difficult to keep grit from becoming embedded in the surface being blasted. Grit blasting also roughens the surface, creating small cracks and crevices that set the stage for localized crevice corrosion.

Shot-peening with clean stainless steel shot produces compressed stresses and reduces the risk of stress cracking; however, it does not eliminate crevice corrosion because of the roughened surface.

Sand blasting should be avoided unless it is the only cleaning method available. If sand blasting is used, only new, uncontaminated sand should be used, and then only once.

Glass bead blasting is an effective method for local and large area cleaning.

Grinding with clean silicon carbide discs or clean aluminum oxide flapper wheels can remove heat tint and other weld-related defects. However, even light grinding leaves a cold worked smeared surface that may contain microcracks, laps, seams and other defects that can initiate crevice corrosion.

During heavy grinding, when grinding wheels overheat the surface of stainless steel, the excess heat will degrade the stainless steel's corrosion resistance to depths greater than 25 to 50μm. Grinding should be used only when removal of the weld crown is critical to optimizing corrosion resistance.

Chipping is normally used between weld passes to remove weld slag and subsequent weld passes to eliminate any damaging effects created during the welding process. This is not an acceptable final surface finishing technique for product contact surfaces.

2. **Inspection procedures**

The water-break test, described in ASTM A 380 (1), is easy to perform and is effective in detecting residual organic matter that may not have been removed in the degreasing operation. A sheet of water directed over the surface will break (bead up) around oil, grease, and other organic contaminants on the surface. A surface that exhibits good sheeting is said to be oil free.

Water can be useful for detecting iron contamination: if contamination is present, rust streaks and spots will form on wetted surfaces over a period of several hours. The copper sulfate and ferroxyl tests, which are much more sensitive than the water test, are specified when the surface must be entirely free of iron (6). Although these tests are easy to use, test solutions do not have a long shelf life.

3. **Cleaning/degreasing:**

Passivation cannot form or enhance the protective film when grease, oil, fingerprints, or other organic contamination are present on product contact surfaces. In fact, when polishing stainless steel to meet hygienic standards, some mills use an oil that contains an extreme pressure (EP) additive. The use of the EP additive yields an aesthetically pleasing finish; however, it is difficult to remove. All manufacturing oils, EP addi-
tive, and mineral oil must be completely removed prior to passivating to prevent stains, streaks, and future corrosion. An oily or soiled surface cannot be passivated, because oil and soil block the acid and oxygen from reaching the metal surface.

Degreasing and general cleaning may be accomplished by immersion in, swabbing with, or spraying with alkaline cleaner, solvent, detergent cleaners, or a combination of these; by vapor degreasing; by ultrasonics, using various alkaline cleaners; by steam, with or without cleaner; or by high-pressure water-jetting.

4. Immersion/spraying (2)

The part to be passivated is immersed or sprayed (depending on the size of the piece, e.g., large vessels are usually sprayed) in a solution selected from ASTM A 380 (1). In addition to the standard nitric acid solution, there are a number of solution variations that contain a combination of other oxidizing acids successfully used to treat large vessels and that are appropriate for all grades of stainless steel, including 200, 300, and 400 series, with specific precipitation hardening and free-machining alloys in various heat treatment conditions and surface finishes.

CLEANING AND BACTERICIDAL TREATMENT

1. Only products supplied by reputable and responsible chemical manufacturers, who are familiar with dairy processing equipment processes and limitations and who are able and willing to make specific recommendations for cleaning practices should be used. Responsible chemical manufacturers continuously check the results obtained with their products on dairy processing equipment and maintain technically qualified staffs of service personnel.

2. The manufacturer's products must be used in the precise manner in which they are recommended, but only with the concurrence of the equipment manufacturer. Misuse of normally acceptable cleaning and bactericidal products, in excessive concentration, temperatures, or exposure times, may cause permanent damage to processing equipment.

3. A suitable water conditioner should be used if the water supply is contaminated with foreign matter that may cause discoloration of the metallic surfaces or undesirable deposits. Deposits or discoloration from a contaminated water supply may counteract the best cleaning practices and may cause corrosion of the best quality stainless steel equipment.

4. When product processing has been completed, the equipment should be immediately rinsed with warm water until the rinse water is clear and complete circulation or manual cleaning should follow as soon as possible. Product deposits are most easily removed while still moist, and considerable amounts of soil can be removed by the initial rinse following processing. Particles of moist soil left on the stainless surfaces may cause pitting at a point beneath the particle.

5. When manual cleaning is indicated, only soft nonmetallic brushes, sponges, or pads should be used. An extended period of soaking in the cleaning solution will facilitate removal of stubbornly adhering residues. Extreme care is required with manually brushing to avoid scratching the surface of stainless steel equipment. Metal brushes or sponges will scratch the surface of stainless steel equipment and may promote corrosion over an extended period of time. If improperly used, even nonmetallic brushes may scratch the surface. Metallic particles from sponges, if allowed to remain on equipment or in pipelines, may cause corrosion.

6. If both alkaline and acid cleaners are used alternately in circulation cleaning, one must be completely rinsed out before the other is introduced into the system. After chemical circulation has been completed, the system must be thoroughly rinsed with warm water, and then with cool water before it is shut down. Wherever possible, the system should be completely drained and opened to allow the metallic surfaces to air dry so that the corrosion-resistant passive film (oxide) may form. If alkaline cleaning solutions and milk residues are not completely removed, a milkstone buildup may occur. If acid solutions are not completely removed, a highly corrosive atmosphere that can cause discoloration or pitting may form.

In addition, most chemical bactericides are considerably more corrosive if they are introduced into an acidic medium. A thorough final rinse is very important in preventing corrosion.

7. Bactericidal treatment with live steam is often only partially effective and may cause considerable damage to processing equipment if not designed for high temperature use and sanitizing. It is recommended only if the system is designed to be self-draining, contains no dead air pockets or no cold spots, and is balanced to prevent physical damage. Concentrated heat may cause buckling, erosion, or discoloration of the stainless steel and may reduce corrosion resistance in localized areas. Hot water circulation is the preferred method if heat sanitizing is desired. Water at 180°F (82°C) circulated for five minutes is a typical procedure.

8. When chemical bactericides are used, extreme caution must be exercised to use them only as prescribed by the chemical manufacturer, in con-
currence with local health authorities and the equipment manufacturer. Specific concentrations, temperatures, and exposure times must be followed as recommended. In addition, the chemical bactericide should be applied just before the equipment is to be used, and in no case should the exposure time exceed twenty minutes. Excessive concentrations, exposure times, or temperatures employed during bactericidal treatment with chemicals may cause serious corrosion of the metal surface and premature aging of the sanitary rubber parts in the system. It should be noted that an increase of even a few degrees in the temperature at which the chemical bactericide is applied will greatly increase its chemical activity and thus the corrosive effect upon the metallic surfaces and the aging effect upon the rubber surfaces. Therefore, minimum temperature should be employed when applying chemical bactericides.

9. If it is impossible to replace “white metal” and AISI 400 Series stainless steel components from processing systems that are to be circulation (CIP) cleaned, these parts should be removed from the system during the cleaning cycle and manually cleaned. “White metal” and AISI 400 Series stainless steels are considerably less resistant to chemical attack than the AISI 300 Series stainless steels, and they are readily corroded when cleaned by circulation methods. Note that 3-A Standards do not provide for the use of “white metal.”

RECOMMENDED PRACTICES TO EXTEND THE CORROSION RESISTANCE OF STAINLESS STEEL

1. Use only soft fiber brushes, pads, or sponges for manual cleaning.
2. Use a water conditioner if water is high in undesirable foreign materials.
3. Remove weld spatter, fillings, fittings, wrenches, and rubber parts from wet stainless steel surfaces.
4. Remove all milk residues from stainless steel surfaces.
5. Use chemical cleaners only as directed by the manufacturer, and thoroughly rinse all alkaline and acid cleaners from stainless steel surfaces with clear water.
6. Apply chemical bactericides immediately prior to processing and only as directed by the manufacturer. In no case should exposure be longer than twenty minutes.
7. Whenever possible, open equipment and allow to air dry after the final clear water rinse.
8. Install equipment and piping so that all parts are aligned and well supported to prevent undue stress or strain on any component.
9. Use only stainless steel of similar series in systems that are to be cleaned by circulation (CIP) methods.
10. Allow only qualified personnel, using approved techniques and materials, to weld and polish stainless steel equipment.

ABOUT THE AUTHORS


REFERENCES

Call for Nominations
1998 IAMFES Secretary

Nominations are now being accepted by the Nominating Committee for the office of IAMFES Secretary. A representative from the regulatory sector will be elected in the spring of 1999 to begin serving at the conclusion of the 1999 IAMFES Annual Meeting for the year 1999-2000.

Letters of nomination, including a photograph and biographical sketch are to be submitted to the Committee Chairperson no later than November 1, 1998. After the close of nominations, the Committee will review the nominees and select two (or more) persons to be presented to the Membership for voting.

The Secretary-Elect is determined by a majority of votes cast through a mail vote taken in the spring of 1999. Official Secretary duties begin at the conclusion of the 1999 IAMFES Annual Meeting. The elected Secretary serves as a Member of the Executive Board of IAMFES for a total of five years succeeding to President, then serving as Past President. Board meetings are scheduled at least three times a year and other commitments may be necessary.

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

Send a letter of nomination for Secretary of IAMFES, along with a photograph and biographical sketch of nominee, to the Nominations Chairperson:

F. Ann Draughon
University of Tennessee
Food Tech Department
P.O. Box 1071
Knoxville, Tennessee 37901-1071
Phone: 423.974.7425; Fax: 423.974.7450
E-mail: draughon@utk.edu

Nomination deadline is November 1, 1998.
New Members

AUSTRALIA
Steven M. Thugesen
Foodpartners
Booval, Queensland

CANADA
Pierre Theriault
Health & Community Services
Edmundston, New Brunswick

Amanda E. Whitfield
University of Guelph Guelph, Ontario

Lain Wright
Kitchener, Ontario

CHINA
Dennis Christian
Christian Consulting Services
Shanghai

EGYPT
Salem Abd-El-Ghani
National Research Centre
Dokki, Cairo

INDONESIA
Sri Raharjo
Gadjah Mada University, Yogyakarta

MEXICO
Olivia F. Esqueda
U.A.S.I.P., San Luis Potosi

Aurelio Lopez-Malo
Universidad de Las Americas-Puebla, Cholula, Puebla

oman
Usama M. Abdul-Rauof
Faculty of Education, Salalah

SAUDI ARABIA
Yasser B. Jad
Saudia Catering, Jeddah

SOUTH AFRICA
Tracey-Lee Pattison
Wits University, Wits

SPAIN
Joaquin Clemente
Badajoz, Badajoz

UNIVERSITY ARAB EMIRATES
Belinda Lee
Dubai

UNIVERSITÉ STATES
ARKANSAS
Marlene Janes
University of Arkansas, Fayetteville

Hong H. Y. Yang
University of Arkansas, Fayetteville

CALIFORNIA
Donald R. Beck
Chaos Solutions, Palm Dessert

William B. Hitchcock
Zep Manufacturing Co., Elk Grove

Lee H. Jensen
California Dept. of Food & Agriculture, Sacramento

Frances F. Pabrua
California Strawberry Commission Watsonville

Anna Rys-Rodriguez
Primus Laboratories, Santa Maria

COLORADO
James A. Carver
GTC-Nutrition, Johnstown

CONNECTICUT
Timothy C. Jackson
Nestle R & D Center
New Milford

FLORIDA
Hong H. Y. Yang
University of Florida, Gainesville

GEORGIA
Gary Ades
Technical Food Information Spectrum, Atlanta

Lynda G. Collins Kelley
USDA, Bogart

Suzana Tkalcic
University of Georgia, Athens

IDAHO
Shawn D. Delaney
Kraft Foods, Rupert

ILLINOIS
Shawn D. Delaney
Kraft Foods, Rupert

John P. Hartman
M & M/Mars Inc., Burr Ridge

Gerald Murawski
Food Service Professionals, Chicago

Debora D. Ruffie
Kraft Foods, Glenview

INDIANA
Bob MacDonald
SRC, Columbia City
<table>
<thead>
<tr>
<th>State</th>
<th>Name</th>
<th>Organization/Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>KANSAS</td>
<td>Aaron Truax</td>
<td>Kansas State University, Manhattan</td>
</tr>
<tr>
<td>KENTUCKY</td>
<td>Judith I. True</td>
<td>Cabinet for Public Health, Frankfort</td>
</tr>
<tr>
<td>MAINE</td>
<td>Lisa D. Colson</td>
<td>Health &amp; Environmental Testing Laboratory, Augusta</td>
</tr>
<tr>
<td>MICHIGAN</td>
<td>Phillip R. Allen</td>
<td>Dow Corning Corporation, Midland</td>
</tr>
<tr>
<td></td>
<td>Dur Efaw</td>
<td>Meijer Inc., East Lansing</td>
</tr>
<tr>
<td></td>
<td>Hui Peng</td>
<td>Wayne State University, Detroit</td>
</tr>
<tr>
<td></td>
<td>Robert G. Taylor</td>
<td>Michigan Dept. of Agriculture, Food and Dairy Division, Lansing</td>
</tr>
<tr>
<td>MISSOURI</td>
<td>Keith Nunes</td>
<td>Meat &amp; Poultry, Kansas City</td>
</tr>
<tr>
<td></td>
<td>Cathy R. Sullivan</td>
<td>Saline Co. Health Office, Marshall</td>
</tr>
<tr>
<td>NEW JERSEY</td>
<td>Gary Dainton</td>
<td>Chemstar Corporation, Sewell</td>
</tr>
<tr>
<td>NEW YORK</td>
<td>Greg Chiarella</td>
<td>Kraft Foods, Tarrytown</td>
</tr>
<tr>
<td></td>
<td>Althea A. Jones</td>
<td>Joseph E. Seagram &amp; Sons, White Plains</td>
</tr>
<tr>
<td></td>
<td>Ibrahim Naderi</td>
<td>Jamaica</td>
</tr>
<tr>
<td>NORTH CAROLINA</td>
<td>Jeffrey E. Hawley</td>
<td>Harris Teeter, Inc., Matthews</td>
</tr>
<tr>
<td>OKLAHOMA</td>
<td>Samuel R. Scopellini, Jr.</td>
<td>Steris Corporation, Mentor</td>
</tr>
<tr>
<td>PENNSYLVANIA</td>
<td>William F. Fett</td>
<td>U.S. Dept. of Agriculture, Wyndmoor</td>
</tr>
<tr>
<td></td>
<td>William M. Keck</td>
<td>Turkey Hill Dairy, Conestoga</td>
</tr>
<tr>
<td></td>
<td>Mark A. Matrozza</td>
<td>Microbac Laboratories, Inc., Pittsburgh</td>
</tr>
<tr>
<td>SOUTH CAROLINA</td>
<td>Deborah L. Hoyt</td>
<td>Cryovac, Duncan</td>
</tr>
<tr>
<td>SOUTH DAKOTA</td>
<td>Dorothy Franklin</td>
<td>Sioux Falls Health Dept., Sioux Falls</td>
</tr>
<tr>
<td>TENNESSEE</td>
<td>Roslyn E. Malone</td>
<td>Cargill Inc., Memphis</td>
</tr>
<tr>
<td>TEXAS</td>
<td>Paul G. Belase</td>
<td>Alamo Water Refiners, Inc., San Antonio</td>
</tr>
<tr>
<td></td>
<td>Stephen C. Braithwaite</td>
<td>Dreyer's Ice Cream, Houston</td>
</tr>
<tr>
<td></td>
<td>Martha Hudak-Roos</td>
<td>T.F.S., League City</td>
</tr>
<tr>
<td></td>
<td>Gary Schweitzer</td>
<td>Borden Inc., Garland</td>
</tr>
<tr>
<td>VIRGINIA</td>
<td>Larry E. Seamans, Sr.</td>
<td>Maryland &amp; Virginia Milk Producers Coop., Chase City</td>
</tr>
<tr>
<td>WISCONSIN</td>
<td>Michael F. Ely</td>
<td>Wisconsin Dept. of Agriculture, Madison</td>
</tr>
<tr>
<td></td>
<td>Jean A. Fuchs</td>
<td>SYSCO, Fond du Lac</td>
</tr>
<tr>
<td></td>
<td>Gregory J. Leyer</td>
<td>SC Johnson Professionals, Sturtevant</td>
</tr>
<tr>
<td></td>
<td>Julie A. Parsons</td>
<td>J. J. Kelber &amp; Assoc., Neenah</td>
</tr>
</tbody>
</table>

New IAMFES Sustaining Members

Chris K. Dwyer
Raven Biological Labs
Omaha, NE

Deneen W. Rief
Medallion Labs
Minneapolis, MN
Bock Elected IAFIS Chairman — Lefevre, Chairman-Elect

Bill C. Bock, Vice President and General Manager of Interbake Dairy Ingredients, was named Chairman of the Board of the International Association of Food Industry Suppliers (IAFIS), at the Association's Annual Conference. As Chairman, Bock will preside over the 19 member Board of Directors.

In addition to his tenure on the Board of Directors, Bock has served on the following IAFIS Committees: Executive Committee, Marketing Committee, Show Committee, Industrial Marketing Training Subcommittee, and Annual Conference Committee, as a member and Chairman.

Also elected at the Conference was IAFIS' new Chairman-Elect, Steve Lefevre, President of King Engineering Corporation, Ann Arbor, Michigan. Lefevre, actively involved on IAFIS committees for more than seventeen years, has served on the Association's Board of Directors, the Annual Conference Committee, the IDFA/IAFIS Joint Executive Show Committee, and the IAFIS Strategy Planning Committee.

In addition, the membership elected four At-Large Directors. Each of the following Directors will serve a 3-year term, expiring in 2001: John S. Barsanti, Walker Stainless Equipment Company, Inc., New Lisbon, WI; Robert J. Daley, Jr., Sparta Brush Company Inc., Sparta, WI; Camilla Nielsen, Nielsen-Massey Vanillas, Waukegan, IL; and Steve Schlegel, Hixson Architects/Engineers, Cincinnati, OH.

Also serving 3-year terms are Distribution & Transportation Director Robert H. Sprinkman, W.M. Sprinkman Corporation, Franksville, WI, and Processing Commodity Director Larry Hanson, Sani-Matic Systems, Madison, WI, who was re-elected to the position.

The Educational Foundation of the National Restaurant Association Announces John Metz, FMP, as 1998-99 Chairman

The Educational Foundation of the National Restaurant Association announces John C. Metz, FMP, President and CEO of Metz Enterprises, Inc., Dallas, PA, as the new Chairman of its Board of Trustees for 1998-99.

Metz has a lengthy and esteemed background in the restaurant/hospitality industry, beginning in 1967 when he founded Custom Management Corporation.

In addition to his professional experience, Metz is affiliated with numerous industry organizations and has received many awards for his accomplishments.

The other 1998-99 officers of the Foundation’s Board of Trustees are: Ralph Brennan, FMP, Owner, Bacov/Red Fish Grill/Mr. B’s, New Orleans, as Vice Chairman; Michael Hurst, FMP, President, 15th Street Fisheries, Ft. Lauderdale, FL, as Secretary; and Wallace Doolin, President and CEO, Friday’s Hospitality Worldwide, Dallas, as Treasurer.

The other 1998-99 officers of the Foundation’s Board of Trustees are: Ralph Brennan, FMP, Owner, Bacov/Red Fish Grill/Mr. B’s, New Orleans, as Vice Chairman; Michael Hurst, FMP, President, 15th Street Fisheries, Ft. Lauderdale, FL, as Secretary; and Wallace Doolin, President and CEO, Friday’s Hospitality Worldwide, Dallas, as Treasurer.

New board members named for the 1998-2001 term are Michael J. Licata, President, International Foodservice Manufacturer's Association, Chicago; Denise Fugo, FMP, President, Sammy's, Cleveland; and Regynald Washington, FMP, General Manager, Epcot Food and Beverage, Walt Disney World Co., Lake Buena Vista, FL.

In addition, John Farquharson, FMP, President, International Food Safety Council, has been named The Educational Foundation's first-ever honorary trustee. He received the recognition for his many years of dedication and service to the Foundation's board of trustees.

Serac, Inc., Promotes Manuel Montero to Regional Sales Manager for Latin America

Serac, Inc. announces the promotion of Manuel Montero to Regional Sales Manager. In his newly appointed position, Montero will assume all communication responsibilities with current and potential customers in Latin America. During the past years, Montero has served Serac in the engineering department and, most recently, as Sales Engineer. Montero’s in-depth knowledge of Serac filling capabilities and services will be of great benefit as he works directly with customers and manufacturer's representatives.

Montero obtained his Bachelor of Science degrees in civil and mechanical engineering from the Illinois Institute of Technology in Chicago. Additional post-graduate studies have been continued at IIT. Montero’s extensive knowledge of the packaging industry will enhance the Serac commitment to solve customer problems.
Etherton to Head Penn State Dairy & Animal Science Department

Dr. Terry D. Etherton, Distinguished Professor of animal nutrition in Penn State’s College of Agricultural Sciences, will assume duties as head of the Department of Dairy and Animal Science.

“Animal agriculture is the largest component of Pennsylvania’s broad and diverse food system, reflecting a multi-billion dollar segment of the state’s economy,” says Robert Steele, Dean of the college. “Dr. Etherton’s broad background in agriculture, spanning the farm to the laboratory bench through his teaching, research and outreach activities, makes him a superb choice for this position.”

Etherton led the department’s development of an internationally recognized research program focusing on endocrine regulation of animal growth. He is most noted for pioneering studies on the effects of treating pigs with recombinantly-derived porcine growth hormone (pGH), and on the use of hypothalamic peptide growth hormone-releasing factor (GRF) in pigs. In addition, Etherton has taught courses in animal growth and development, integrated animal biology, and regulation of nutrient metabolism.

Etherton is recognized worldwide for his expertise and leadership in the area of endocrine regulation of animal growth, and is a leading authority on the safety and usefulness of agricultural biotechnology. He has received numerous scientific awards, including the Hoffman-LaRoche Animal Growth and Development Award from the American Society of Animal Science in 1990, Penn State’s University Faculty Scholar Medal in Life and Health Sciences in 1991, and the Alex and Jessie C. Black Award for Excellence in Research from Penn State’s College of Agricultural Sciences in 1993. He was awarded the title of Distinguished Professor by Penn State in 1996.

The Department of Dairy and Animal Science provides undergraduate and graduate education in animal agriculture; conducts basic and applied research to improve the efficiency of animal production and enhance the quality of animal products; and facilitates the application of relevant information to solve problems through its cooperative extension and outreach programs.

Walker Stainless Hires New Plant Manager

Walker Stainless Equipment Company, Inc. recently announced the hiring of Ken Short as Plant Manager of their Tavares, Fl. manufacturing facility. Walker’s Tavares facility produces the company’s full line of Welded Ring transport trailers as well as their exclusive aluminum frame and cradle transport trailers.

According to Denny Tenhoff, Vice President and General Manager of the Transportation Products group, “Through lean design manufacturing and our customer driven product delivery system, we have dramatically improved our operating efficiency and delivery time while reducing our customers’ costs. One of Ken’s primary goals will be to implement strategies that further this effort while increasing our plant’s overall manufacturing capacity and productivity. I am confident that Ken will be an excellent addition to the Walker team.”

Short has nearly thirty years of domestic and international experience involving design, engineering, fabrication, quality assurance, marketing and manufacturing management. He is a graduate of the University of Tampa with a degree in Industrial Management.

Dr. Bahram Grami to Become Analytical Services Manager

Effective June 29, 1998, Dr. Bahram Grami will become Analytical Services Manager for the American Association of Cereal Chemists (AACC) and for the American Society of Brewing Chemists (ASBC). The recently created position, currently held on an interim basis by Dr. Elwood F. Caldwell, provides staff support for AACC’s Approved Methods and Technical committees, as well as management for its International Check Sample and Proficiency Rating programs. Dr. Caldwell, whose distinguished tenure at AACC headquarters has included positions as Director of Scientific Services as well as Analytical Services Manager, will retain his original schedule during a month-long transition period.

With a Ph.D. in agronomy from the University of Manitoba, Dr. Grami brings a strong background in analytical methodology to his new position. Most recently, he has been involved in research projects in Dr. Harold Corke’s University of Hong Kong food science laboratory. Prior to that, he managed the departmental cereal laboratory at the University of California-Davis for eight years.

William L. Bennet Joins AIB International

William L. Bennet has joined AIB International as Manager, Quality Systems, and will be actively involved in consulting and education to the food industry relating food quality, food safety, and HACCP.
Bennet has had a significant and varied career in the food industry since he graduated from Pennsylvania State University with a BS in food technology. He started with the Pillsbury Company in Minneapolis, MN, in 1969 and directed quality operations at several Pillsbury subsidiaries until moving to SAF Products in 1985. From 1987 to the present, Bennet operated his own consulting business, WorldView Food Products, Inc., in Minneapolis where he was involved in sales, technical problem solving and prevention programs for small to midsize companies, served as a Consultant to large companies on flour and grain technology, helped develop strategic plans for Roman Meal Milling, Integrity Mills, and small oat, buckwheat, and Amaranth processors.

Additionally, Bennet formulated a TVP-based lunch line for Nutri-Systems that included individual, microwavable portion pouches for sloppy joes, chili, and tacos. He developed custom-roasted grains and blends for Nabisco, Pillsbury, and General Mills. With Leon Levine, he co-authored a patent for a microwavable snack product using Amaranth grain. Bennet also has an extensive background in the health benefits of food and nutrition. He also contributed to a University of Minnesota study of grains and the immune system.

Bennet has post-graduate courses from the University of St. Thomas, Minneapolis, and Temple University as extensive continuing education courses in a variety of business, computer, and food-related topics. He is a member of IFT and the AACC and has been a member of the National Restaurant Association, Public Health Professionals, Bakery Engineers, and the National Nutritional Foods Association.

World Dryer Promotes Bruce Bohner

David Ring, Vice President, Sales & Service for World Dryer Corporation, has announced the promotion of Bruce P. Bohner to National Sales Manager. Based in Atlanta, GA, Mr. Bohner was previously Southern Regional Sales Manager for World Dryer.

Bruce’s new position encompasses sales activities for the complete World Dryer and Electric-Aire product lines, including hand sanitation equipment. Bohner’s duties include managing manufacturers’ multi-line representatives, handling national accounts, creation of product demand, conducting sales meetings, rolling out new products, and promotions to World Dryer reps and distributors.

Bohner earned a degree in economics and psychology from Wabash College. Before joining World Dryer two years ago, he was employed by Arby’s Franchise Association in Atlanta as a Franchise Director of Field Marketing.

During his 22 year career, Bruce has held positions with the Taco Bell Corporation, Long John Silver’s, Colc & Weber Advertising in Seattle and Leo Burnett USA in Chicago.

Hopkinson Elected 3-A Symbol Council Officer

Mr. Reginald C. Hopkinson, Pittsford, NY was elected Vice-Chairman of the Board of Trustees of the 3-A Sanitary Standards Symbol Administrative Council at the June 5 meeting of the Symbol Council. Hopkinson has served as a Trustee of the Symbol Council since 1992, representing the International Association of Food Industry Suppliers.

The objectives and purposes of the Board of Trustees, governing body of the 3-A Symbol Council, are: to promote the public health; to minimize confusion and conflict in the field of standards relating to the sanitary performance of food equipment, and, to encourage the use of food equipment of sanitary design by administering and supervising the proper use of the “3-A Symbol,” emblematic of compliance with standards of sanitary design developed and promulgated as 3-A Sanitary Standards.

Other officers of the 3-A Symbol Council are Dr. Warren S. Clark, Jr., Chairman and Mr. Earl O. Wright, Secretary-Treasurer.
Major Gaps in Research on Antibiotic Resistance Need Filling; WHO Meeting on Quinolone Use in Food Animals and Potential Impact on Human Health

Fluoroquinolones are important members of the quinolone group of antibiotics licensed to treat diseases in humans and animals. However, their use in livestock animals can contribute to increased resistance in foodborne bacteria (such as Campylobacter and Salmonella) which may infect humans. Fluoroquinolones are important for the treatment of invasive Salmonella and Campylobacter infections in humans and an increase in the resistance in these bacteria is therefore of concern.

“Until now, there has been little documented impact on human health of fluoroquinolone use in livestock, but there is concern over the potential human health consequences if resistance were to increase and spread. Further research and data gathering are thus essential,” said Dr. David Heymann, Director of the World Health Organization’s (WHO) Division of Emerging and Other Communicable Diseases Surveillance and Control (EMC). Consequently, WHO convened a meeting on the medical impact of quinolone use in food animals at WHO headquarters in Geneva from 2 to 5 June. The meeting, in which over 60 experts from both the human and animal health fields participated, agreed that that major emphases of future research should include: determining the full extent of quinolone usage outside human medicine; improving epidemiological evidence on how resistance in both animals and humans develops, persists and spreads between animal species and humans; developing surveillance techniques specifically designed to capture the above data; determining the mechanisms and levels of resistance in important zoonotic pathogens to quinolones and how important these resistance levels are in terms of human health risk; developing strategies for prudent use in animals to maximize therapeutic benefit while minimizing development of resistance; developing alternatives, such as Following the introduction of fluoroquinolones in several countries, Salmonella with reduced susceptibility to fluoroquinolones have emerged in food animals; resistant Campylobacter have also emerged. Although no human cases have been documented, the experts expressed concern that there could be treatment failures in humans infected with Salmonella with reduced susceptibility. The experts also noted that, with the use of fluoroquinolones in humans, human pathogens have begun to develop resistant strains and there are now several circumstances in which resistance has limited the therapeutic use of this class of antibiotic for important diseases such as for gonorrhoea and typhoid. While fluoroquinolones are not used as growth promoters, they are currently used for treatment of animal disease in many countries of the world and, in some regions, they are also used for disease prevention in animals.

However, the data available so far on their usage are scarce and are often the proprietary information of the drugs’ manufacturers. Consequently, correlations between quinolone usage and the emergence of resistance are hard to make. WHO and the meeting’s participants welcomed the initiative by COMISA (World Federation of the Animal Health Industry) at the 2-5 June meeting that provided sales and volume data for the major fluoroquinolones in more than 30 countries.

The experts, from 18 countries, requested that WHO, in conjunction with the Food and Agriculture Organization of the United Nations (FAO) and the International Office of Epizootics (OIE), work together to gather data, standardize testing methods and develop a code of practice for the prudent use of antimicrobials in food animals. WHO should also, the participants agreed, ensure that public health safeguards are given prominence in such a code of practice.

Nine Northeast Dairy Producers Charged with Milk Adulteration, Conspiracy

A federal grand jury in Burlington, VT, returned a 28-count indictment April 30 against nine Northeast dairy producers and three truck drivers who were charged with violating federal laws relating to conspiracy, food adulteration, stolen property, using false documents and witness tampering and retaliation.

At their arraignment in early May, all 12 pled not guilty. A trial date had been set at press time.

According to the indictment, the defendant dairy producers shipped their milk to Fairdale Farms, a fluid milk processing plant in Bennington, VT. Between 1993 and August 1996, the indictment alleges, the producers, acting in collusion with the truck drivers, conspired to defraud Fairdale...
Farms by falsely inflating the amount of milk they produced and shipped.

Some farmers allegedly added a salt-water mix to their milk to throw off the cryoscope test, which measures the milk’s freezing point. They then kicked back a portion of their milk check to the drivers. Other producers simply paid the drivers to falsely increase pounds of milk shipped to the plant without adding water to the milk. USDA officials estimate that illegally added water to milk costs the dairy industry $1 billion a year.

Other farmers added water to milk, and cut them off from supplying their milk to allegedly offending producers and independent drivers, and cut them off from supplying milk, says Gary Warren, Fairdale’s general manager.

The federal government became involved in the investigation in 1996 and followed it through to the indictment process. Investigations into this case and others across the U.S. continue.

Some farmers allegedly added water to milk without adding water to the milk. USDA officials estimate that illegally added water to milk costs the dairy industry $1 billion a year.

Dairy producers named in the indictment are: Thomas Curtis and Marc Vadnais, Argyle, NY; Guy Clark III, Cambridge, NY; Edward Hart Jr., Hudson Falls, NY; Kenneth Thomas III, Middle Granville, NY; Briar Barbur, Greenwich, NY; Richard Hulett, West Pawlet, VT; Keith Bruso, Buskirk, NY; Milt Tyler, Fort Ann, NY. The three indicted truck drivers are Terry Abrahamson, Okeechobee, FL; Dennis Bates, Greenwich, NY; and Reggie Matte, Hoosick Falls, NY.

In February, Curtis was arrested and indicted on charges that he threatened a witness who was cooperating with the grand jury investigation. The April indictment restated those witness-tampering and retaliation charges, to which Curtis already pleaded not guilty.

Fairdale Farms’ receiving plant employees first detected irregularities with milk shipments and began exhausting testing to pinpoint problems. At one point, the company ran chloride tests and found elevated chloride levels in the milk. The chloride content was up due allegedly to the added salt.

When plain water is added to milk, the adulterated milk will freeze at a higher temperature. The cryoscope test detects this. Adding salt to water makes a solution that mirrors the specific gravity of milk. When added to milk, it doesn’t raise milk’s freezing point. Milk freezes at 31°F; water, 32°F. Most receiving plants check for added water on every tanker; individual bulk tanks may be checked once or twice a month.

After noticing abnormalities, Fairdale notified state regulatory authorities, traced back the questionable milk to allegedly offending producers and independent drivers, and cut them off from supplying milk, says Gary Warren, Fairdale’s general manager.

The federal government became involved in the investigation in 1996 and followed it through to the indictment process. Investigations into this case and others across the U.S. continue.

Defendants in the Northeast face up to 10 years in prison and federal fines up to $250,000. Civil penalties could also be sought by Fairdale Farms.


**AHI Action Plan to Address Concerns Surrounding Antibiotic Use in Food Animals**

The Animal Health Institute, a U.S. trade association representing manufacturers of animal health products, has announced an action plan to address the complex issue of antibiotic use in animals.

AHI’s approach is based on working in concert with government agencies, the Food and Drug Administration and United States Department of Agriculture, who have oversight for the regulation of animal health care products and monitor resistance. AHI’s plan to reduce the potential for resistance in humans and assure the availability of animal antibiotics combines several elements, including: an independent assessment to examine benefits and relative risk to people of treating animals with antibiotics; development of guidelines for the prudent use of antibiotics in farm animals; and support for improved surveillance and monitoring of how animal antibiotics are used.

Mathews stated that the approach demonstrates that the animal health industry shares the concern of public health officials that the inappropriate use of antibiotics whether on the farm, in hospitals or by physicians can contribute to the increase of antibiotic resistant bacteria.

The kit can be obtained at: www.aii.org/info/general/antibiotics.htm; or send a fax request to 703.684.0125 to receive a mailed copy.

**U.S. Poultry & Egg Association Back, Food Safety Campaign**

The U.S. Poultry & Egg Association will extend its financial support for the Partnership for Food Safety Education’s public awareness campaign through 1998. Fight BAC!™ is a multi-pronged effort to teach people of all ages how they can reduce the spread of foodborne illness. The two-year-old campaign is funded by the contributions of U.S. Poultry and eight other industry trade associations. Technical assistance and in-kind support is provided by government agencies and consumer organizations.

"The safety of food is a matter of concern for consumers and food producers alike,” said U.S. Poultry & Egg Association President Don Dalton. "We are proud to participate in this grassroots effort to educate consumers about the steps they can take to minimize their risk of foodborne illness.”

The Partnership for Food Safety Education was formed in response to a 1996 independent panel report that called for a public-private partnership to educate the public about safe food handling and preparation.
The multi-year campaign utilizes public service announcements, point-of-purchase materials, and school and community outreach efforts to bring Americans face-to-face with the problem of foodborne illness and to motivate them to take action. Additional information is also available via the Partnership’s Web site: www.foodbac.org.

The group accomplishes its mission by mobilizing a national network of public health, nutrition, food science, education, and special constituency groups to support the campaign and extend its reach.

U.S. Poultry is the largest and most active organization of its kind in the world. As part of its overall mission, U.S. Poultry provides training and consultation programs that help ensure that the nation’s poultry and egg supply is safe and wholesome. The association sponsors microbial testing programs for food safety, monitors federal food regulatory programs, conducts Hazard Analysis and Critical Control Points systems training, and represents the industry in food safety issues.

IAFIS Offers Online Food Industry Information Center

The International Association of Food Industry Suppliers (IAFIS) has announced the launch of the online version of its Food Industry Information Center (FIIC), it can be found at: www.iafis.org/fiic. The Food Industry Information Center is the only free on-line source to specialize in current food manufacturing standards, legislation, trade, commerce, safety, and other issues key to the global food industry.

FIIC On-Line Center emphasizes electronic information resources rather than books. The collection of approximately fifty reference volumes and CD-ROM products is non-circulating, and continuously updated. The Center has access to 1200 Commercial Databases providing efficient and timely access to information. FIIC Online is available 24-hours-a-day, seven-days-a-week, and can be accessed directly through www.iafis.org, or at the URL www.iafis.org/fiid.

Joe Hall to Relinquish 3-A Symbol Council Administrative Officer Position

Mr. Joe W. Hall, Jr. submitted his request to the 3-A Symbol Council to relinquish his position as its Chief Administrative Officer. The request was submitted to the Council at its June meeting. Mr. Hall, who has held the position since July 1, 1994, indicated his duties with the Coburg Dairy require commitments that prevent him from continuing Symbol Council activities. He asked that his resignation become effective on December 31, 1998, but indicated his willingness to extend beyond that date, if necessary, to ensure that a smooth transition of the office can be made.

Persons interested in serving as Chief Administrative Officer of the 3-A Symbol Council should contact either Dr. Warren S. Clark, Jr., Chairman of the Symbol Council Board of Trustees at Phone: 312. 782.4888; Fax: 312.782.5299; or Mr. Earl O. Wright, Secretary-Treasurer of the Council at 501. 855.9408.

U.S. Filter Acquires Gardiner Equipment Co., Inc.

U.S. Filter/Stranco has announced that it has acquired Houston-based Gardiner Equipment Co., Inc. maker of the Water Champ® chemical induction system.

“This merger gives us resources for growth that were unavailable to us as a single product company,” said Jack Gardiner, founder and inventor of the Water Champ.

“We have strong representation in municipal markets, U.S. Filter/Stranco brings us additional industrial distribution. We both have highly customer-focused company cultures. This is a good fit for our customers and our reps.”

While Gardiner will remain in Texas in a new role as Vice President of Stranco, U.S. Filter is relocating Water Champ’s product experts to Bradley, IL.

Researchers Use Sentinels to Detect Infectious Disease of Young Turkeys

Recently completed research funded by the U.S. Poultry & Egg Association dealt with the use of sentinels to detect infectious disease of young turkeys. The project is part of the association’s extensive industry research program encompassing all segments of broiler, turkey, and commercial egg operations.

A brief overview of the completed project is shown below. A complete report is available from the researchers or from U.S. Poultry, 770.493.9401.

Project No. 174; Drs. H. John Barnes and James S. Guy, Department of Food Animal and Equine Medicine, Department of Microbiology, Pathology and Parasitology, College of Veterinary Medicine, North Carolina State University, Raleigh, NC 27606.

Sentinels as a Research Tool for Spiking Mortality of Turkeys Spiking mortality of turkeys (SMT) is a newly recognized infectious transmissible disease that causes
high mortality, severe stunting, and increased susceptibility to other diseases because of damage to the immune system in young turkeys. The cause of SMT is unknown and there is no specific way to diagnose the disease except to reproduce it in susceptible poult's. In this study, young turkeys (sentinels) were placed into 55 flocks to determine if they were infected with the SMT agent. Studies were done on the sentinels to better understand the disease and identify its cause.

The objectives of this study were to: (1) experimentally reproduce SMT through use of sentinels exposed to clinically affected flocks, (2) examine samples from poult's prior to exposure and at intervals after exposure for possible causative agents, (3) determine if clinically normal or recovered flocks could be potential sources of the microorganisms that can cause SMT, (4) determine if microorganisms that cause SMT can survive cleaning and disinfection procedures, and (5) determine if any relationships exist between agents causing SMT and those causing other enteric (intestinal) diseases of turkeys. In addition, an evaluation of the sentinel method was done.

SMT was readily reproduced in the sentinels after placement into affected flocks. The suspected existence of a milder form of SMT (Excess Mortality of Turkeys [EMT]) was confirmed, which led to the disease being renamed Poult Enteritis Mortality Syndrome (PEMS). From the results of the sentinel studies, SMT, EMT, and PEMS were defined based on clinical mortality patterns. Having at least a clinical definition made it possible to identify positive, negative, and suspect farms. Sentinels discriminated among different types of enteric diseases. Those placed into flocks that had milder forms of intestinal diseases (often referred to as “poult enteritis complex”) did not develop SMT, although they did experience severe stunting. These findings indicate SMT is a specific disease and not a severe form of poult enteritis complex. Stunting, whether the result of SMT or poult enteritis complex, was virtually universal as it developed in 54 of 55 sentinel groups. No evidence was found to indicate vertical transmission or the existence of an extended carrier state in recovered flocks. No indication of a potential food safety problem was found. The SMT agent appears to be highly susceptible to environmental conditions and does not survive long outside of the turkey. These findings are most consistent with a reservoir for the agent and a vector to introduce it into the flocks. The cause of SMT was not discovered, however, several potential agents were excluded. Based on these studies, turkey coronavirus was not found to be the cause of SMT. Information on the occurrence, nature, and cause of SMT gained in these studies has practical application in the development of effective prevention and control programs.

Thompson to Manage CVM Antimicrobial Resistance Efforts

Dr. Sharon R. Thompson, a Veterinary Medical Officer in FDA's Center for Veterinary Medicine (CVM), has been appointed to the newly created position of Associate Director for Veterinary Medical and International Affairs. In this capacity, Dr. Thompson will be responsible for managing and coordinating national and international activities on antimicrobial resistance related to drug therapy in food animals. She will lead CVM's efforts to develop an overall strategy to define scientifically-based standards for the regulation of antimicrobial products. She will also lead the Center's initiative to promote the prudent use of antimicrobials in food animals. Dr. Thompson will continue to provide direction to the Center's international activities. Dr. Thompson currently serves as FDA's representative to the Veterinary International Cooperation on Harmonization (VIC) Steering Committee.

Since 1992, Dr. Thompson has been a Special Assistant to the Center Director, concentrating in the area of international affairs. In her new role, she will work with experts, both within and outside the Agency, to address issues involving antimicrobial products for animals. She will serve as FDA's spokesperson and authoritative source of information and advice on matters related to this issue. Dr. Thompson will also serve as the official liaison to other government agencies and foreign and domestic organizations working in this area.

CVM is concerned that the use of antimicrobial drugs in food animals will create antimicrobial drug resistance that could contribute to drug-resistant human pathogens. However, CVM believes that there is legitimate need for older as well as newer antimicrobial drugs in animal agriculture. CVM views developing criteria or standards for regulating these products to address the emerging concerns about antimicrobial resistance as the Center's top priority. CVM expects that these efforts will help create a stable regulatory environment for these products.
New Metal Detector for Vertical Form, Fill, & Seal Equipment Detects Ferrous Contaminants Before Packaging

The new E-Z Tec® VFS Metal Detector from Eriez detects minute pieces of ferrous contamination in gravity fed material flow ensuring product purity before material is bagged and sealed. Ideal for snack foods that are packaged in foil or plastic, and other granular or powdered material that is gravity fed.

The low profile design of the VFS allows it to fit between the checkweigher and the vertical form, fill, and seal machine detecting contamination just prior to packaging. When contamination is detected, a timing device marks the contaminated bag so it can be removed from the batch. Just the contaminated package is discarded, not the entire batch, thus reducing waste.

New Improved SimPlate™ Device

The SimPlate™ family of tests from IDEXX have been improved, making them even easier to perform. The SimPlate™ device’s patented plate design has been modified to include a super-absorbent sponge which soaks up excess liquid, eliminating the previously required “pour-off” step.

The SimPlate™ product family is a group of easy-to-perform, easy-to-read tests for coliforms and E. coli, yeast and mold, and total plate count. These tests eliminate media preparation and other time-consuming steps involved with current pour plate methods, cutting time to results in half. SimPlate™ assays are performed by placing a sample and preprepared media onto a Simplate™ device and incubating for 24 or 48 hours, depending on the media being used. After incubation, results are read by counting the number of positive wells and referring to the MPN chart to determine total counts. Tedious counting is not required.

A Cleaning Validation System Accessible to the Food Industry

BioControl Systems Inc., developer and manufacturer of rapid food safety diagnostic tests recently launched an innovative new product. AssureSwab™ visual swab test is a self-contained, rapid cleaning validation kit for all types of food processing and production environments.

Traditionally, hygiene monitoring has been conducted through total plate count methods which yield results in 24 or more hours. More recently Adenosine Triphosphate Bioluminescence (ATP)-based systems provided the only rapid testing available for cleaning validation, but the significant investment required in equipment and trained personnel have placed ATP systems out of reach for many food businesses.
AssureSwab has eliminated the need for expensive equipment, thereby making rapid cleaning validation available to the entire food industry. The AssureSwab kit contains everything needed to conduct cleaning validation. Test results are easy to read as the test is based on a color change, and can therefore be used by a wide range of personnel without extensive training.

AssureSwab uses a proprietary technology that detects invisible protein residues on surfaces that have come into contact with food products. Protein should not be present if the cleaning procedure is effective, as protein is a nutrient source for harmful bacteria. The AssureSwab kit is highly sensitive and can detect micrograms of protein that are invisible to the eye.

BioControl Systems, Inc., Bellevue, WA

Reader Service No. 314

Rapid Results with Culture Confirmation

Dynabead® anti-Salmonella is designed for rapid, immunomagnetic selective enrichment (IMS) of Salmonella directly from pre-enrichment broths. The rapid and simple protocol (less than 30 minutes) saves 24 hours of valuable testing time compared to standard culture methods because Dynabeads® anti-Salmonella simply replaces the use of selenite or tetrathionate selective enrichment broths. Isolated Salmonella colonies (or negative results) are achieved in 48 hours from receipt of sample.

Dynabeads® anti-Salmonella are uniform, superparamagnetic microspheres (2.8 microns in diameter) with affinity purified antibodies on their surface. When incubated with a sample, Dynabeads® will bind their target bacterium forming a bacterium:

magnetic bead complex. This complex is separated from the heterogeneous sample by performing the test in a magnetic test tube rack (Dynal MPC®-M). The isolated and concentrated bacterium: bead complex can then be cultured on any selective culture medium.

This highly sensitive system will detect as few as 100 organisms/ml of pre-enriched sample. Complete detection is achieved: over 200 serotypes (1400 strains) of Salmonella have been tested. The concentration and purification of the sample by immunomagnetic separation (IMS) improves bacterial isolation and thus is useful for cultural confirmation of other presumptive methods. The protocol is simple and reagents are shelf stable. The versatility provided by this methodology will allow testing of many different sample types while enhancing the efficiency of existing manual and automated detection methods.

Dynal, Lake Success, NY

Reader Service No. 315

IR Measures Surface Temperature Fast, Without Contact

Cooper Instrument Corporation is introducing a new infrared thermometer for monitoring temperatures in the food processing and foodservice industries. The IR thermometer allows the operator to simply point, shoot, and read to efficiently monitor food processing and holding areas, refrigeration and freezer equipment, and to verify safe food temperatures. This handheld gun style thermometer features a FDA Class II laser (also available without laser) allowing the operator to get a visual confirmation of where the gun is aimed. These are easy-to-use thermometers that read surface temperatures without contact, which means no cross contamination or damage to food products.

The IR thermometer by Cooper is a simple and durable design to provide accurate readings, even after a 3-foot drop onto concrete. With a temperature range of -250°F to 750°F (-320° to 400°C), ambient temperature range of 32°F to 120°F (0° to 50°C), accuracy at 77°F (25°C) or above is ±1 % of reading or ±2°F whichever is greater and 8:1 optics, the infrared can be used in a variety of applications.

Temperature readings are displayed in tenths on the backlit LCD screen up to 200°F, any higher then 200°F the readings are measured in whole numbers.

Powered by only a 9-volt Alkaline or Nicad battery the IR has a battery life of 50 hours when the backlight and laser are turned off, and 16 hours when the backlight is used 50% and the laser is used 50% of the time. With a compact design that measures 5.4" x 1.6" x 7.7" and weight of only 9.5 ounces this unit can be handled all day without the operator feeling fatigued and it can be stored just about anywhere in conditions with a temperature range of -13°F to 158°F (without the battery). Cooper’s model 410 thermometer comes standard with a hard black case, a clip which allows you to clip it to your belt, and a battery. Another option is model 400, a more economical unit allows you to clip it to your belt, and a battery. Another option is insulating for liquids

H & R Industries proudly introduces an innovative all-plastic, insulated transport and storage container for temperature sensitive liquids. Urethane insula-
tion in a double wall design protects product quality, maintains temperatures, and allows product transfer in conventional trailers or storage in standard warehouses. Front sloping, cone-bottom design with fitted bag liner and attached dispensing valve facilitates complete discharge of even semi-viscous liquids. Tapered sides permit empty containers to nest, which lowers return freight costs and reduces storage space requirements. Stacking cover with corner tie-down straps seal container for sanitary road transfer or warehouse storage. Site ports indicate liquid level. INSUL-STOR® FOR LIQUIDS is the convenient and economical returnable packaging alternative for drums or bulk deliveries of both food or nonhazardous chemicals.

H & R Industries, Inc., Beecher, IL

Copesan Services Releases Pest Management Training Videos for Food Processing

Copesan Services is raising the educational training level for all food industry employees by providing interactive video training modules. Copesan’s Signature Care™ training videos feature visual demonstrations and real-life examples in a user-friendly, modular series.

The two Signature Care™ training modules currently available feature Integrated Pest Management (IPM) and Key Pests of the Food Industry. The IPM module details the twelve interdependent components of the IPM puzzle. The Key Pest module, through outstanding cinematography, covers the basic identification, biology, habits and control options of rodents, insects and birds.

Each interactive video module is conveniently packaged in a three-ring binder and contains a 28 minute VHS videotape, tips for effective training, an outline for trainee note taking, a copy of the audio script for reference, a post-test for assessing participants’ comprehension and a list of suggested reference materials.

Copesan Services, Inc. Brookfield, WI

Capital Controls Company, Inc. introduces a new residual analyzer. Advanced microprocessor-based electronics and a 3-electrode measuring cell arrangement make the AZTEC® CL1000 Residual Analyzer the best instrument on the market for continuous, accurate, precise measurement of chlorine residual levels in drinking water, wastewater, cooling water, poultry processing and other process water applications.

The unique 3-electrode measuring cell arrangement provides the analyzer with the capability of measuring in the parts per billion (ppb) residual range, as well as high residual ranges to 60 mg/l. Residual indication is provided on a 3” x 4” display in either a one inch digital format or, in a graphical format with up to 28 days of data at a glance. On-screen instructions, self-diagnostics, six adjustable relays, and dual 4-20 mA dc output signals are standard.

The flow to the analyzer is monitored by an infrared flow detection system. A pH electrode is used to control reagent addition with a solenoid valve in order to optimize reagent consumption while maintaining the best pH for precise residual measurement. Sample temperature variations are compensated with a 100 ohm RTD.

The AZTEC® Series CL1000 Residual Analyzers are constructed of corrosion-resistant materials and are modular in design for serviceability. Universal power recognition is incorporated into the unit.

Capital Controls Company, Inc., Colmar, PA

Read the Temperatures of Up to Four Areas or Three Products at Once

N ew radio-transmission technology saves wiring costs and fits any budget. A central-panel thermometer with up to three remotely-located thermometers can transmit temperature readings up to 100’ without wires. Signal transmission is on license-free 433 MHz which has been thoroughly tested and penetrates most walls and radio interference.

The central panel has an internal sensor and displays local air temperature, while each of the three remote thermometers take local air temperature, or when used with an optional probe, take internal temperatures. Local air temperature is continuously displayed on the central panel and a simple channel change displays remote thermometer readings on the second half of the central panel.

Min/max temperatures are displayed and the central panel has hi/lo audible and visual alarms.
Power and High Filtration
Makes the Nilfisk GB 1133
Ideal for Cleanroom
Central Cleaning Systems

The Nilfisk GB 1133 vacuum cleaner is ideal for use in central vacuum cleaning systems because it supplies an airflow of 757 cfm and 145 inches of waterlift, which is the strongest suction power available in a Nilfisk vacuum cleaner. The vacuum cleaner may service multiple cleanrooms in the same facility via a series of strategically placed drops with inlets. These inlets enable the operator to bring nothing more than a hose and nozzle into the cleanroom environment. In addition, a totally enclosed, fan-cooled, 3-phase induction motor with regenerative blower allows for continuous operation.

The first stage of the GB 1133 vacuum cleaner’s filtration system is an 18-gallon container that captures the bulk of collected debris. A separator system can be added for increased collection capacity. The second stage includes seventy-two GORE-TEX® main filter tubes. These tubes combine to ensure that a steady, even airflow moves through the vacuum cleaner which extends filter life and eliminates premature clogging. Shaking the external filter agitator handle keeps the main filter tubes free of dust and prevents the operator from exposure to the dust. The standard manometer measures pressure differentials within the vacuum and alerts the operator when to shake the filter. The final stage of filtration features four HEPA (High Efficiency Particulate Air) filters that retain 99.97% of all particles down to and including 0.3 microns in size.

The GB 1133 vacuum cleaner’s 100mm orifice can accommodate a single hose up to 100mm, a double hose up to 70mm or a triple hose up to 50mm. A multi-hose attachment maintains the same level of powerful suction achieved by a single hose, while increasing productivity.
MODERN LABORATORY TECHNIQUES
IN FOOD MICROBIOLOGY
OCTOBER 2 - 6, 1998

This Workshop Is Designed to Provide an Updated Techniques in Food Microbiology Application.

- Rapid methods for routine microbiological analysis.
- Modern techniques for food pathogens, toxins, & other food contaminants.
- Laboratory QA program, set up & its operation.
- Hands on experience for detection E. coli 0157:H7, Salmonella, Listeria, etc.
- Application & suitability of the modern rapid methods for various foods, water, & environmental samples.

For Further Information, Please Contact Dr. James Lin, 4669 Executive Drive, S & J Laboratories, Inc., Portage, Michigan 49002. e-Mail: sandjlab.mi@worldnet.att.net
Phone: (616) 324-7383 ext-23 Fax: (616) 324-7384
Business Exchange

Services/Products

GOSSELIN & BLANCHET
Butter-Making Equipment
New and Used
Sales. Service. Parts.

B & J REPAIR SERVICE
• 4818 N. Bailey Rd. •
Coral, MI 49322
(616) 354-6629

Reader Service No. 111

NATIONWIDE OPPORTUNITIES
Company Paid Fees & Relocation
Seeking Qualified
Sanitation Mgrs/Supvs...$35-$50K
CIP Systems, HACCP & Pest Control
Experience Desired!
Mark A. Tocci @ 888-228-7164 Ext. 108
Or utilize our toll free Fax #
to send Mark your resume
888.228.7169
Since 1970 • Employer Calls Welcome

ADVERTISE YOUR PRODUCT OR SERVICE HERE!
For rates or information, contact:
Ward McCleary
Advertising Sales Representative
515.271.0543
or 800.369.6337
E-mail: iamfes@iamfes.org

ADVERTISING INDEX

3-A Symbol Council ........................................... 483
ABC Research .................................................. 481
All Quality Assurance Products ......................... 529
Applied Research Institute ................................ 485
B & J Repair ..................................................... 530
Covercrete Flooring Systems ......................... 485
DQCI Services, Inc ........................................... 481
Fluid Metering, Inc ............................................ 485
Food Processors Institute ................................. 481
Hardy Diagnostics ........................................... 485
Ingman Laboratories, Inc .............................. 529
Judge, Inc ....................................................... 530
Michelson Laboratories, Inc .......................... 529
Nelson-Jameson, Inc ......................................... 493
S & J Laboratories, Inc ..................................... 529
Sellers Cleaning Systems ................................. 503
Underwriters Laboratories Back Cover
Walker Stainless Equipment .......................... 528

530 Dairy, Food and Environmental Sanitation – AUGUST 1998
Holders of 3-A Symbol Council Authorization as of August 1998

Questions or statements concerning any of the holders’ authorizations listed below, model numbers or the equipment fabricated should be addressed to:
Administrative Officer, 3-A Symbol Council, 3020 Bluff Rd., Columbia, SC 29209;
Phone 803.783.9258; Fax 803.783.9265

01-07 Storage Tanks for Milk and Milk Products

<table>
<thead>
<tr>
<th>No.</th>
<th>Holder Name</th>
<th>Address</th>
<th>Date of Authorization</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>APV Americas-Lake Mills</td>
<td>100 South CP Avenue, Lake Mills, Wisconsin 53551</td>
<td>5/1/56</td>
</tr>
<tr>
<td>117</td>
<td>DCI, Inc.</td>
<td>P.O. Box 1227, 600 No. 54th Avenue, St. Cloud, Minnesota 56301</td>
<td>10/28/59</td>
</tr>
<tr>
<td>127</td>
<td>Paul Mueller Co.</td>
<td>P.O. Box 828, Springfield, Missouri 65801</td>
<td>6/29/60</td>
</tr>
<tr>
<td>440</td>
<td>Schering Systems</td>
<td>801 Kingsley Street, Winsted, Minnesota 55395</td>
<td>2/28/85</td>
</tr>
<tr>
<td>31</td>
<td>Walker Stainless Equipment Co., Inc.</td>
<td>902-2nd Main Street, Elroy, Wisconsin 53929-0126</td>
<td>10/4/56</td>
</tr>
</tbody>
</table>

02-09 Pumps for Milk and Milk Products

<table>
<thead>
<tr>
<th>No.</th>
<th>Holder Name</th>
<th>Address</th>
<th>Date of Authorization</th>
</tr>
</thead>
<tbody>
<tr>
<td>63R</td>
<td>APV Americas-Lake Mills</td>
<td>100 South CP Avenue, Lake Mills, Wisconsin 53551</td>
<td>4/29/57</td>
</tr>
<tr>
<td>946</td>
<td>APV Fluid Handling-America</td>
<td>100 South CP Avenue, Lake Mills, Wisconsin 53551-1799</td>
<td>11/25/97</td>
</tr>
<tr>
<td>636</td>
<td>Abel Pumps Corporation</td>
<td>79 North Industrial Park, 511 North Avenue, Sewickley, Pennsylvania 15143-2339</td>
<td>7/10/91</td>
</tr>
<tr>
<td>568</td>
<td>Allweiler AG, Werk Bottrop</td>
<td>Kirchhellenring 77-79, D-46244 Bottrop, Germany</td>
<td>5/15/89</td>
</tr>
<tr>
<td>793</td>
<td>Ampco Pumps Co.</td>
<td>4000 W. Burnham Street, Milwaukee, Wisconsin 53215</td>
<td>9/14/94</td>
</tr>
<tr>
<td>212R</td>
<td>Babson Brothers Company</td>
<td>Dairy Systems Division, 20903 West Gale Avenue, Galesville, Wisconsin 53630-0659</td>
<td>2/20/70</td>
</tr>
<tr>
<td>923</td>
<td>Bombas Bornemann S.R.L.</td>
<td>Armenia 2898 (1605) Munro, Argentina</td>
<td>5/16/97</td>
</tr>
<tr>
<td>205R</td>
<td>Boumatic</td>
<td>1919 S. Stoughton Road, P.O. Box 8050, Madison, Wisconsin 53716</td>
<td>5/22/69</td>
</tr>
<tr>
<td>739</td>
<td>CSF Inox S.P.A.</td>
<td>Strada per Bibbiano 7 - Moncettio E. (RE), Italy</td>
<td>6/25/93</td>
</tr>
<tr>
<td>820</td>
<td>Drum Industries, Inc.</td>
<td>2501 Constant Comment Place, North Olmsted, Ohio 44070</td>
<td>3/17/95</td>
</tr>
<tr>
<td>671</td>
<td>Flowtech Inc., - Teknoflow, Inc.</td>
<td>1701 Spinks Drive, Marietta, Georgia 30067</td>
<td>4/1/92</td>
</tr>
<tr>
<td>466</td>
<td>Fluid Metering, Inc.</td>
<td>5 Aerial Way, Suite 500, Syosset, New York 11791</td>
<td>1/10/86</td>
</tr>
<tr>
<td>Company Name</td>
<td>Address</td>
<td>Notes</td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>---------</td>
<td>-------</td>
<td></td>
</tr>
<tr>
<td>Flux Pumps Corp.</td>
<td>4430 Commerce Circle, Atlanta, Georgia 30336</td>
<td>(Mfg. by: Flux Geraete GmbH Talweg 12 D75433 Maulbron Germany)</td>
<td></td>
</tr>
<tr>
<td>Fristam Pumps, Inc.</td>
<td>2410 Parview Road, Middleton, Wisconsin 53562</td>
<td>(5/2/78)</td>
<td></td>
</tr>
<tr>
<td>Alfa Laval/G &amp; H Products Corp.</td>
<td>P.O. Box 909, Pleasant Prairie, WI 53158-0909</td>
<td>(5/22/57)</td>
<td></td>
</tr>
<tr>
<td>Johnson Pumps (U.K.) Ltd.</td>
<td>Highfield Industrial Estate, Edison Road, Eastbourne, East Sussex, England BN23 6PT</td>
<td>(12/19/79)</td>
<td></td>
</tr>
<tr>
<td>ITT Jabsco Products</td>
<td>1485 Dale Way, Costa Mesa, California 92626</td>
<td>(11/20/65)</td>
<td></td>
</tr>
<tr>
<td>Inoxpa, s.a.</td>
<td>Carrer Dels Telers, 54, 17820 Banyoles, Spain</td>
<td>(4/28/87)</td>
<td></td>
</tr>
<tr>
<td>Len E. Ivarson, Inc.</td>
<td>5100 W. Green Tree Road, Milwaukee, Wisconsin 53209</td>
<td>(12/22/78)</td>
<td></td>
</tr>
<tr>
<td>Johnson Pumps (U.K.) Ltd.</td>
<td>Highfield Industrial Estate, Edison Road, Eastbourne, East Sussex, England BN23 6PT</td>
<td>(8/16/90)</td>
<td></td>
</tr>
<tr>
<td>Johnson Pumps (U.K.), Ltd.</td>
<td>Highfield Industrial Estate, Edison Road, Eastbourne, East Sussex, England BN23 6PT</td>
<td>(8/16/90)</td>
<td></td>
</tr>
<tr>
<td>Johnson Pumps (U.K.), Ltd.</td>
<td>Highfield Industrial Estate, Edison Road, Eastbourne, East Sussex, England BN23 6PT</td>
<td>(8/18/95)</td>
<td></td>
</tr>
<tr>
<td>Alfa Laval Pumps, Inc.</td>
<td>9201 Wilmot Road, Kenosha, Wisconsin 53141-1426</td>
<td>(4/16/92)</td>
<td></td>
</tr>
<tr>
<td>Mono Pumps Ltd., Dresser Pump Div.</td>
<td>Martin Street, Audenshaw, Manchester, England M34 5DQ</td>
<td>(10/22/91)</td>
<td></td>
</tr>
</tbody>
</table>
678 Shanley Pump & Equipment, Inc.
2525 S. Clearbrook Drive
Arlington Heights, Illinois 60005
(Mfg. by: Phillip Hilge GmbH, Germany)
(5/11/92)

911 Sigma Equipment Corp.
39 Westmoreland Avenue
White Plains, New York 10606
(3/20/97)

507 Sine Pump
c/o Sundstrand Fluid Handling
14845 West 64th Street
Arvada, Colorado, 80004
(7/21/87)

567 Stainless Products, Inc.
1649-72nd Avenue
P.O. Box 169
Somers, Wisconsin 53171
(4/4/89)

860 Sudmo North America, Inc.
4786 Colt Road
Rockford, Illinois 61109
(Mfg. by: Sudmo Schleicher AG Industriestr. 7
D-73469, Reisburg, Germany)
(11/28/95)

72R L.C. Thomsen Inc.
1303-43rd Street
Kenosha, Wisconsin 53140
(8/14/57)

26R Tri-Clover, Inc.
9201 Wilmot Road
Kenosha, Wisconsin 53141
(9/29/56)

609 Tuthill Corp.
Tuthill Pump Division
12500 S. Pulaski Road
Alsip, Illinois 60658
(12/12/90)

899 Und Maschinenfabrik
Lederle GmbH Pumpen
Gewerbesträße 53 D-79194
Gundelfingen, Germany
(U.S. Rep.: Alto Systems Inc.
P.O. Box 60607
Houston, Texas 77205)
(12/31/96)

52R Viking Pump, Inc.
A Unit of IDEXX Corporation
406 State Street, P.O. Box 8
Cedar Falls, Iowa 50613
(Mfg. by: Johnson Pump
Highfield Ind. Estate, Edison Road
Eastbourne, E. Sussex
UK BN 23 6PT)
(12/31/56)

29R Waukesha Cherry-Burrell
611 Sugar Creek Road
Delavan, Wisconsin 53115
(10/3/56)

05-14 Stainless Steel Automotive Milk Transportation Tanks for Bulk Delivery and/or Farm Pick-up Service

379 Brenner Tank Mauston, Inc.
N. 3760 Hwy. 12 & 16
Mauston, Wisconsin 53948
(3/15/83)

756 Beall Trailers of California
1301 South Avenue
Turlock, California 95508
(2/21/94)

70R Brenner Tank, Inc.
450 Arlington Avenue, P.O. Box 670
Fond du Lac, Wisconsin 54936
(8/5/57)

40 Hills Stainless Steel & Equipment Co., Inc.
505 W. Koehn Street
Luterne, Minnesota 56156
(10/20/56)

513 Nova Fabricating, Inc.
404 City Road
P.O. Box 251
Avon, Minnesota 56310
(8/24/87)

85 Polar Tank Trailer, Inc.
Holdingsford, Minnesota 56540
(12/20/57)

653 Tremcar
1, Tougas Street
Belleville, Quebec, Canada J2X 2P7
(U.S. Rep.: Bay State Tr. & Tr.
527 Winthrop
Rehobeth, Massachusetts 02769)
(10/10/91)

25 Walker Stainless Equip. Co., Inc.
625 State Street
New Lisbon, Wisconsin 53950
(9/28/56)

560 E. Burleigh Boulevard
P.O. Box 358
Tavares, Florida 32778
(3/28/91)

437 West-Mark
2704 Railroad Avenue, P.O. Box 100
Ceres, California 95307
(11/30/84)

04-04 Homogenizers and Reciprocating Pumps

75 APV Homogenizer Group
500 Research Drive
Wilmington, Massachusetts 01887
(9/26/57)

390 American Lewa, Inc.
132 Hopping Brook Road
Holliston, Massachusetts 01760
(Mfg. by: Lewa, Germany)
(6/9/83)

247 Bran & Luebbe, Inc.
1025 Busch Parkway
Buffalo Grove, Illinois 60015
(4/14/73)

657 Microfluidics International, Corp.
P.O. Box 9101
30 Ossipee Road
Newington, Massachusetts 02164-9101
(11/4/91)
10-03 Milk and Milk Products Filters
Using Disposable Filter Media

593 Filtration Systems
Div. of Mechanical Mfg. Corp.
10304 N.W. 50th Street
Sunrise, Florida 33351

435 Sermia International
771 Boul. Industriel
Blainville, Quebec
Canada J7C 3V3
(U.S. Rep.: Edward W. Fox, Jr.
1200 Rolling Ridge Way, #403
Bloomington, Indiana 47403)

296 L. C. Thomsen, Inc.
1303 43rd Street
Kenosha, Wisconsin 53140

35 Tri-Clover, Inc.
9201 Wilmot Road
Kenosha, Wisconsin 53141

11-05 Plate-type Heat Exchangers
for Milk and Milk Products

880 AGC Engineering
8869 SE 58th St. Avenue
Portland, Oregon 97206

365 APV Heat Exchanger A/S
Platinvej, 8
P.O. Box 329
DK-6000 Kolding
Denmark
(Not available in the U.S.A.)

20 APV Heat Transfer Technologies
395 Fillmore Avenue
Tonawanda, New York 14150

120 Alfa-Laval, Agris, Inc.
11100 No. Congress Avenue
Kansas City, Missouri 64153

17 Tetra Pak Engineering
8400 Lake View Parkway
Pleasant Prairie, Wisconsin 53158
(Mfg. by: Alfa Laval Thermal Land, Sweden)

718 Babson Bros. Co., Inc.
Dairy Systems Div.
1400 West Gale Avenue
Galesville, Wisconsin 54630

30 Waukesha Cherry-Burrell
Process Equipment Division
P.O. Box 35000
Louisville, Kentucky 40232-5600

14 Chester-Jensen Co., Inc.
5th & Tilghman Sts., P.O. Box 908
Chester, Pennsylvania 19016

791 The Coburn Co., Inc.
854 E. Milwaukee Street, Box 147
Whitewater, Wisconsin 53190
(Mfg. by: Elmega S.L.
Apartado De Cerros, 1
Camino Vrejo De Mourelle, S/N
15840 [Santa Comba] La Coruna
Spain)

468 GEA Ecolflex North America, Inc.
7150 Distribution Drive
Louisville, Kentucky 40258-2528
(Mfg. by: GEA Ahlborn GmbH Co.
P.O. Box 1180
Voss-Strasse 11/13
D-3203 Sarstedt
Germany)

622 ITT Standard
175 Standard Parkway
Cheektowaga, New York 14227

360 Laffranchi Wholesale Co.
P.O. Box 338
Ferndale, California 95536

414 Paul Mueller Co.
P.O. Box 828
Springfield, Missouri 65801

912 Pladot Ein Harod
Kibbutz Ein Harod Meuhad
18965 Israel
(Mfg. by: A.P.V. Company, Ltd.
P.O. Box 4
Crawley-West Sussex RH 102QB
England)
(U.S. Rep.: Norix-International L.T.D.
35 Monhegan Street
Clifton, New Jersey 07013)

279 The Schlueter Company
3410 Bell Street, P.O. Box 548
Janesville, Wisconsin 53547-0548
(Mfg. by: Samuel Parker, New Zealand)

650 API Schmidt-Bretten, Inc.
380 E. Central Avenue
Bohemia, New York 11716

670 Flomax International, Ltd.
2 Robert Street
P.O. Box 14537
Panmure, Auckland
New Zealand
(U.S. Rep.: Masport, Inc.
6140 McCormick Drive
Lincoln, Nebraska 68507)

658 Thermaline
180-37th Street
Auburn, Washington 98001

885 Tranter, Inc. Texas Division
1900 Old Burk Highway
Wichita Falls, Texas 76304

610 Universal Dairy Equipment
11100 N. Congress Avenue
Kansas City, Missouri 64153
(Mfg. by: Alfa Laval Agris, Inc.
Kansas City, Missouri 64153-1296)

12-05 Tubular Heat Exchangers
for Milk and Milk Products

886 API Ketema Heat Transfer Technology
2300 W. Marshall Drive
Grand Prairie, Texas 75051

438 APV Heat Transfer Tech.
395 Fillmore Avenue
Tonawanda, New York 14150

248 Allegheny Bradford Corp.
P.O. Box 200, Route 219 South
Bradford, Pennsylvania 16701

(7/16/96)
(7/11/96)
(12/10/84)
(4/16/73)

243 Babson Brothers Company
Dairy Systems Division
20903 West Gale Avenue
Galesville, Wisconsin 54630-0659
(10/31/72)

240 Babson Brothers Company
Dairy Systems Division
P.O. Box 659
Galesville, Wisconsin 54630
(9/6/72)

605 Waukesha Cherry-Burrell
Process Equipment Division
P.O. Box 35600
Louisville, Kentucky 40232-5600
(8/30/90)

567 Chester-Jensen Co., Inc.
5th & Tilghman Sts., P.O. Box 908
Chester, Pennsylvania 19016
(6/6/58)

824 DASI Industries, Inc.
214 Sherlake Lane
Knoxville, Tennessee 37922
(Mfg. by: Sacome Incapsa
3001 Murcia Spain)
(3/17/95)

712 Enerquip, Inc.
611 North Road
P.O. Box 467
Medford, Wisconsin 54451
(2/24/95)

889 Fmc Corporation-FranRica Systems
P.O. Box 30127
Stockton, California 95213-0127
(9/5/96)

298 Feldmeier Equipment, Inc.
6800 Town Line Road
P.O. Box 474
Syracuse, New York 13211
(1/28/85)

217 Girton Manufacturing Co.
P.O. Box 900
Millville, Pennsylvania 17846
(1/31/71)

616 ITT Standard
175 Standard Parkway
Cheektowaga, New York 14227
(1/4/91)

711 Kusel Equipment Co.
820 West Street
Watertown, Wisconsin 53094
(2/24/93)

238 Paul Mueller Co.
P.O. Box 828
Springfield, Missouri 65801
(6/28/72)

96 C. E. Rogers Co.
1895 Frontage Road, P.O. Box 118
Mora, Minnesota 55051
(3/31/64)

532 Scherping Systems
801 Kingsley Street
Winsted, Minnesota 55395
(6/8/88)

614 Tetra Pak Processing Systems
P.O. Box 179
8400 Lake View Parkway, Suite 500
Pleasant Prairie, Wisconsin 53158
(Mfg. by: Tetra Pak Stainless Equipment AB
P.O. Box 64
Bruggaregatan 23, S-221 00
Lund, Sweden)
(5/2/91)

951 Thermaline, Inc.
180 - 37th Street N.W.
Auburn, Washington 98001
(1/30/98)

632 Yula Corporation
330 Bryan Avenue
Bronx, New York 10474
(6/4/91)

17-09 Formers, Fillers and Sealers of Single Service Containers for Fluid Milk and Fluid Milk Products

939 BWI KP Aerofill
807 West Kimberly Road
Davenport, Iowa 52808-3848
(10/16/97)

382 SIG Combibloc, Inc.
4800 Roberts Road
Columbus, Ohio 43228
(Mfg. by: PKL Verpackungssysteme, Germany)
(4/15/83)

92 Evergreen Packaging
2400-6th Street S.W., P.O. Box 500
Cedar Rapids, Iowa 52406
(1/3/67)

16-05 Evaporators and Vacuum Pans for Milk and Milk Products

132 APV Anhydro
182 Wales Avenue
Tonawanda, New York 14150
(10/26/60)

277 Contherm, Inc.
P.O. Box 352, 111 Parker Street
Newburyport, Massachusetts 01950
(8/19/76)

500 Dedert Corporation
2000 Governors Drive
Olympia Fields, Illinois 60461
(4/9/87)

186R Marriott Walker Corp.
925 E. Maple Road
Birminghan, Michigan 48011
(9/6/66)

273 Niro, Inc.
Evaporator Division
9165 Rumsey Road
Columbia, Maryland 21045
(5/20/76)

639 Niro-Sterner, Inc.
421-6th Street South
Winsted, Minnesota 55395
(7/10/91)

107R C.E. Rogers Co.
P.O. Box 118
1895 Frontage Road
Mora, Minnesota 55051
(7/31/58)

13-09 Farm Milk Cooling and Holding Tanks

802 Refinox S.A. DE C.V.
Ind. Torreon, Coah, Mexico
(U.S. Rep.: James Read
M. E. Stainless
601 High Plain Drive
Bel Air, Maryland 21014)
(11/10/94)
488 BWI Fords Holmatic, Inc.  
1750 Corporate Drive, Suite 700  
Norcross, Georgia 30093  
(12/22/86)

619 Hassia Verpackungsmaschinen GmbH  
Heerweg 19  
D-65911 Ranstadt, Germany  
(2/22/91)

473 International Paper Company  
Liquid Fkg. Division  
6238 Tri Ridge Boulevard  
Loveland, Ohio 45140  
(6/12/86)

735 Kvalitetsproduktion AB  
S-693 29 Degerfors, Sweden  
(6/11/93)

330 Milliken Packaging  
P.O. Box 736  
White Stone, South Carolina 29353  
(8/26/80)

442 Milliken Packaging  
P.O. Box 736  
White Stone, South Carolina 29386  
(3/21/85)

137 Elopak, Inc.  
3000 South Hill Road  
New Hudson, Michigan 48165  
(10/17/62)

941 Oden Corporation  
255 Great Arrow Avenue  
Buffalo, New York 14207-3024  
(10/28/97)

281 Purity Packaging Corp.  
800 Kaderly Road  
Columbus, Ohio 43228  
(11/8/77)

967 RAPAK  
20939 Cabot Boulevard  
Hayward, California 94545  
(6/18/98)

924 Robert Bosch GmbH  
P.O. Box 127  
D-71001Waiblingen, Germany  
(6/4/97)

482 Serac, Inc.  
300 Westgate Drive  
Carol Stream, Illinois 60188  
(8/25/86)

681 Shiokoku Kakoki Co., Ltd.  
No. 10-01 Nishinokawa  
Tarotachisu, Kitajima-Cho  
Itanogun, Tokushima, Japan  
(6/9/82)

220 Tetra Rex Packaging Systems  
451 East Industrial Boulevard  
Minneapolis, Minnesota 55413  
(4/24/71)

351 Tetra Pak, Inc.  
1287 Barclay Blvd.  
Buffalo Grove, IL 60089  
(1/6/83)

694 IPFO International, Inc.  
100 Kings Point Drive  
Century Towers, Suite 706  
Miami, Florida 33160  
(Mfg. by: Time Pack GmbH, Weissensburg, Germany)  
(9/23/92)

19-04 A1 Batch and Continuous Freezers for Ice Cream, Ices, and Similarly Frozen Dairy Foods, as Amended  

141 Waukesha Cherry-Burrell  
P.O. Box 35600  
Louisville, Kentucky 40232-5600  
(4/15/63)

146 Waukesha Cherry-Burrell Corp.  
P.O. Box 35600  
Louisville, Kentucky 40232-5600  
(12/10/63)

286 Tetra Laval Food Hoyer, Inc.  
7711 95th Street, P.O. Box 0902  
Pleasant Prairie, Wisconsin 53158-0902  
(Mfg. by: Tetra Pak Hoyer APS Denmark)  
(12/8/76)

355 Emery Thompson Machine & Supply Co.  
1349 Inwood Avenue  
Bronx, New York 10452  
(3/9/82)

22-07 Silo-type Storage Tanks for Milk and Milk Products  

154 APV Americas-Lake Mills  
100 South CP Avenue  
Lake Mills, Wisconsin 53551  
(2/10/65)

168 Waukesha Cherry-Burrell  
575 E. Mill Street  
Little Falls, New York 13365  
(6/16/65)

160 DCI, Inc.  
P.O. Box 1227, 600 No. 54th Avenue  
St. Cloud, Minnesota 56301  
(4/5/65)

312 Feldmeier Equipment, Inc.  
6800 Town Line Road  
P.O. Box 474  
Syracuse, New York 13211  
(9/15/78)

439 JV Northwest, Inc.  
390 S. Redwood Street  
Canby, Oregon 97013  
(1/22/85)

155 Paul Mueller Co.  
1600 W. Phelps, P.O. Box 828  
Springfield, Missouri 65801  
(2/10/65)

503 Ripley Stainless, Ltd.  
BB #3, Suite 41  
Summerland, British Columbia V0H 1Z0  
(Not available in the U.S.A.)  
(5/1/87)

479 Schering Systems  
801 Kingsley Street  
Winsted, Minnesota 55395  
(8/3/86)

675 Stainless Fabrication, Inc.  
4455 W. Kearney  
Springfield, Missouri 65803  
(4/22/92)

920 Technova, Inc.  
1450 Hebert Street  
Drummondville, Quebec  
Canada J2C 2A1  
(U.S. Rep.: Bay State Truck & Trailer 527 Wintrop  
Rochobeth, Massachusetts 02769)  
(4/24/97)

165 Walker Stainless Equipment Co., Inc.  
625 State Street  
New Lisbon, Wisconsin 53950  
(4/26/65)
### 23-02 Equipment for Packaging Viscous Dairy Products

<table>
<thead>
<tr>
<th>Company</th>
<th>Address</th>
<th>Phone</th>
<th>Fax</th>
<th>Email</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>APV Crepaco</td>
<td>100 South CP Avenue, Lake Mills, Wisconsin 53551-1799</td>
<td>(920) 740-2300</td>
<td>740-2331</td>
<td>APV Crepaco</td>
<td><a href="http://www.apvcrepaco.com">Website</a></td>
</tr>
<tr>
<td>A.T.S. Engineering, Inc.</td>
<td>7270 Torbram Road, Unit 23, Mississauga, Ontario</td>
<td>(1-843) 702-7020</td>
<td>702-7021</td>
<td>A.T.S. Engineering</td>
<td><a href="http://www.astengineering.com">Website</a></td>
</tr>
<tr>
<td>Raque Food Systems, Inc.</td>
<td>11002 Decennial Drive, Louisville, Kentucky 40299</td>
<td>(502) 222-1212</td>
<td>1212-1213</td>
<td>Raque Food Systems</td>
<td><a href="http://www.raqefood.com">Website</a></td>
</tr>
<tr>
<td>100 South CP Avenue, Lake Mills, Wisconsin 53551-1799</td>
<td>(1-843) 702-7020</td>
<td>702-7021</td>
<td>A.T.S. Engineering</td>
<td><a href="http://www.astengineering.com">Website</a></td>
<td></td>
</tr>
<tr>
<td>APV Crepaco</td>
<td>11002 Decennial Drive, Louisville, Kentucky 40299</td>
<td>(502) 222-1212</td>
<td>1212-1213</td>
<td>Raque Food Systems</td>
<td><a href="http://www.raqefood.com">Website</a></td>
</tr>
<tr>
<td>A.T.S. Engineering, Inc.</td>
<td>7270 Torbram Road, Unit 23, Mississauga, Ontario</td>
<td>(1-843) 702-7020</td>
<td>702-7021</td>
<td>A.T.S. Engineering</td>
<td><a href="http://www.astengineering.com">Website</a></td>
</tr>
<tr>
<td>Raque Food Systems, Inc.</td>
<td>11002 Decennial Drive, Louisville, Kentucky 40299</td>
<td>(502) 222-1212</td>
<td>1212-1213</td>
<td>Raque Food Systems</td>
<td><a href="http://www.raqefood.com">Website</a></td>
</tr>
<tr>
<td>A.T.S. Engineering, Inc.</td>
<td>7270 Torbram Road, Unit 23, Mississauga, Ontario</td>
<td>(1-843) 702-7020</td>
<td>702-7021</td>
<td>A.T.S. Engineering</td>
<td><a href="http://www.astengineering.com">Website</a></td>
</tr>
<tr>
<td>Raque Food Systems, Inc.</td>
<td>11002 Decennial Drive, Louisville, Kentucky 40299</td>
<td>(502) 222-1212</td>
<td>1212-1213</td>
<td>Raque Food Systems</td>
<td><a href="http://www.raqefood.com">Website</a></td>
</tr>
<tr>
<td>A.T.S. Engineering, Inc.</td>
<td>7270 Torbram Road, Unit 23, Mississauga, Ontario</td>
<td>(1-843) 702-7020</td>
<td>702-7021</td>
<td>A.T.S. Engineering</td>
<td><a href="http://www.astengineering.com">Website</a></td>
</tr>
<tr>
<td>Raque Food Systems, Inc.</td>
<td>11002 Decennial Drive, Louisville, Kentucky 40299</td>
<td>(502) 222-1212</td>
<td>1212-1213</td>
<td>Raque Food Systems</td>
<td><a href="http://www.raqefood.com">Website</a></td>
</tr>
</tbody>
</table>

### 24-02 Non-coil Type Batch Pasteurizers

<table>
<thead>
<tr>
<th>Company</th>
<th>Address</th>
<th>Phone</th>
<th>Fax</th>
<th>Email</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>APV Americas-Lake Mills</td>
<td>100 South CP Avenue, Lake Mills, Wisconsin 53551-1799</td>
<td>(502) 161-1212</td>
<td>1212-1213</td>
<td>APV Americas</td>
<td><a href="http://www.apv.com">Website</a></td>
</tr>
<tr>
<td>Waukesha Cherry-Burrell</td>
<td>575 E. Mill Street, Little Falls, New York 13365</td>
<td>(503) 187-1212</td>
<td>1212-1213</td>
<td>Waukesha Cherry-Burrell</td>
<td><a href="http://www.wcb.com">Website</a></td>
</tr>
<tr>
<td>DCI, Inc.</td>
<td>P.O. Box 1227, 600 No. 54th Avenue, St. Cloud, Minnesota 56302</td>
<td>(507) 166-1212</td>
<td>1212-1213</td>
<td>DCI, Inc.</td>
<td><a href="http://www.dciinc.com">Website</a></td>
</tr>
<tr>
<td>Paul Mueller Co.</td>
<td>P.O. Box 828, Springfield, Missouri 65801</td>
<td>(417) 878-1212</td>
<td>1212-1213</td>
<td>Paul Mueller Co.</td>
<td><a href="http://www.paulmuellerco.com">Website</a></td>
</tr>
<tr>
<td>Walker Stainless Equipment</td>
<td>625 State Street, New Lisbon, Wisconsin 53950</td>
<td>(608) 878-1212</td>
<td>1212-1213</td>
<td>Walker Stainless Equipment</td>
<td><a href="http://www.walkersse.com">Website</a></td>
</tr>
</tbody>
</table>

### 25-02 Non-coil Type Batch Processors for Milk and Milk Products

<table>
<thead>
<tr>
<th>Company</th>
<th>Address</th>
<th>Phone</th>
<th>Fax</th>
<th>Email</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>APV Americas-Lake Mills</td>
<td>100 South CP Avenue, Lake Mills, Wisconsin 53551-1799</td>
<td>(502) 162-1212</td>
<td>1212-1213</td>
<td>APV Americas</td>
<td><a href="http://www.apv.com">Website</a></td>
</tr>
<tr>
<td>Waukesha Cherry-Burrell</td>
<td>575 E. Mill Street, Little Falls, New York 13365</td>
<td>(503) 188-1212</td>
<td>1212-1213</td>
<td>Waukesha Cherry-Burrell</td>
<td><a href="http://www.wcb.com">Website</a></td>
</tr>
<tr>
<td>DCI, Inc.</td>
<td>P.O. Box 1227, 600 No. 54th Avenue, St. Cloud, Minnesota 56302</td>
<td>(507) 166-1212</td>
<td>1212-1213</td>
<td>DCI, Inc.</td>
<td><a href="http://www.dciinc.com">Website</a></td>
</tr>
<tr>
<td>Paul Mueller Co.</td>
<td>P.O. Box 828, Springfield, Missouri 65801</td>
<td>(417) 878-1212</td>
<td>1212-1213</td>
<td>Paul Mueller Co.</td>
<td><a href="http://www.paulmuellerco.com">Website</a></td>
</tr>
<tr>
<td>Walker Stainless Equipment</td>
<td>625 State Street, New Lisbon, Wisconsin 53950</td>
<td>(608) 878-1212</td>
<td>1212-1213</td>
<td>Walker Stainless Equipment</td>
<td><a href="http://www.walkersse.com">Website</a></td>
</tr>
</tbody>
</table>
26-03 Sifters for Dry Milk and Dry Milk Products

752 Andritz Sprout-Bauer
35 Sherman Street
Muncy, Pennsylvania 17756
(1/28/94)

363 Kason Corp.
67-71 East Willow Street
Millburn, New Jersey 07041
(7/28/82)

430 Midwestern Industries, Inc.
915 Oberlin Road, P.O. Box 810
Massillon, Ohio 44648-0810
(10/11/84)

185 Rotex, Inc.
1230 Knolton Street
Cincinnati, Ohio 45223
(8/10/66)

656 Separator Engineering, Ltd.
810 Ellingham Street
Pointe Claire, Quebec, Canada H9R 3S4
(11/4/91)

172 Sweeco, Inc.
(Division of Emerson Electric Company)
7120 Buffington Road
Florence, Kentucky 41042
(9/1/65)

27-03 Equipment for Packaging Dry Milk and Dry Milk Products

353 All-Fill, Inc.
418 Creamery Way
Exton, Pennsylvania 19341
(3/2/82)

935 Bossar S.A.
Poligono Industrial Roca
C./ San Marti s/n.
08100 Martorelles
(Barcelona) Spain
(8/8/97)

831 Custom Equipment Design
1057 Highway 80 East, P.O. Box 4807
Monroe, Louisiana 71203
(5/9/95)

618 Hayssen Manufacturing Company
225 Spartangreen Boulevard
Duncan, South Carolina 29334
(2/18/91)

625 Ishida Company, Ltd.
44, Sanno-Cho, Shogoin
Sakyo-Ku, Kyoto, Japan
(U.S. Rep.: Heat & Control
21121 Cabot Boulevard
Hayward, California 94545-1132)
(4/2/91)

922 Ishida Co., Ltd.
44 Sanno-Cho, Shogoin
Sakyo-Ku, Kyoto, Japan
(U.S. Rep.: Heat & Control, Inc.
21121 Cabot Boulevard
Hayward, California 94545-1132)
(5/9/97)

28-03 Flow Meters for Milk and Milk Products

270 ABB Instrumentation, Inc.
P.O. Box 20550
Rochester, New York 14602-0550
(2/9/76)

272 Accurate Metering Systems, Inc.
1651 Wilkening Court
Schuamburg, Illinois 60173
(4/2/76)

253 Badger Meter, Inc.
4545 W. Brown Deer Road
P.O. Box 23099
Milwaukee, Wisconsin 53223
(1/2/74)

884 Bailey-Fischer & Porter GmbH
Dransfeld Strasse, Gottingen 37079
Germany
(U.S. Rep.: Bailey-Fischer & Porter
125 E. County Line Road
Warminster, Pennsylvania 18974)
(7/12/96)

956 Blancett Fluid Flow Meters
100 E. Felix Street South, Suite 190
Fort Worth, Texas 76115-3548
(3/19/98)

359 Brooks Instrument Division
407 West Vine Street
Hatfield, Pennsylvania 19440
(Mfg. by: Fisher-Rosemount Technologies de Flujo S.A. de C.V.
Avenida Miguel de Cervantes 111
Complejo Industrial Chihuahua
Chihuahua, Chihuahua
31009 Mexico)
(6/11/82)

660 Danfoss A/S
DK-6430
Nordborg, Denmark
(U.S. Rep.: Danfoss Electronics
2995 Eastrock Drive
Rockford, Illinois 61109
(11/20/91)

950 Delta M Corp.
1003 Larsen Drive
Oak Ridge, Tennessee 37830
(1/19/98)

692 Endress & Hauser Flowtec AG
Kägenstrasse 7
CH - 4153 Reinach, Switzerland
(U.S. Rep.: Endress & Hauser, Inc.
2350 Endress Place
Greenwood, Indiana 46143)
(9/14/92)
226 Bailey Fischer & Porter Co.  
125 E. County Line Road  
Warminster, Pennsylvania 18974  
(12/9/71)  
574 Hersey Measurement Co., Inc.  
150 Venture Boulevard  
P.O. Box 4585  
Spartanburg, South Carolina 29305  
(10/2/91)  
512 Hoffer Flow Controls, Inc.  
107 Kitty Hawk Lane  
Elizabeth City, North Carolina 27909  
(8/17/87)  
224 The Foxboro Company  
33 Commercial Street  
Foxboro, Massachusetts 02035  
(11/16/71)  
506 FTI  
4250 East Broadway Road  
Phoenix, Arizona 85040  
(6/17/87)  
717 Genu Valves, Inc.  
3800 Camp Creek Parkway  
Ste. 102, Bldg. 2400  
Atlanta, Georgia 30331  
(3/4/93)  
661 G/H Products Corp.  
P.O. Box 909  
Pleasant Prairie, Wisconsin 53158-0909  
(11/21/91)  
694 Geo Technology Corporation  
12312 E. 60th Street  
Tulsa, Oklahoma 74146  
(10/2/89)  
649 Halliburton Services  
Drawer 1431  
Duncan, Oklahoma 73563-0346  
(5/28/91)  
378 Micro Motion, Inc.  
7070 Winchester Circle  
Boulder, Colorado 80301  
(2/16/83)  
733 Honeywell, Inc.  
16404 Black Canyon Highway  
Phoenix, Arizona 85023-3095  
(5/8/93)  
778 Magnetrol Intl., Inc.  
5300 Belmont Road  
Downers Grove, Illinois 60515  
(7/27/94)  
707 Flow Automation  
9303 Sam Houston Parkway South  
Houston, Texas 77099-5298  
(3/10/75)  
744 Honeywell IAC  
1100 Virginia Drive  
Fort Washington, Pennsylvania 19034  
(11/16/93)  
871 KOBOLD Instr. Inc.  
1801 Parkway View Drive  
Pittsburgh, Pennsylvania 15205  
(3/28/96)  
550 Fisher-Rosemount  
1200 Technology Drive  
Eden Prairie, Minnesota 55344  
(10/26/88)  
535 FMC Invalco, Inc.  
(An FMC Corporation Subsidiary)  
P.O. Box 1183  
Hutchinson, Kansas 67504  
(7/12/88)  
764 Yokogawa Industrial Automation America Inc.  
42 Dart Road  
Newnan, Georgia 30265-1040  
(4/22/94)  
840 KOBOLD Instr. Inc.  
1801 Parkway View Drive  
Pittsburgh, Pennsylvania 15205  
(7/17/95)  
817 KOBOLD Instr. Inc.  
1801 Parkway View Drive  
Pittsburgh, Pennsylvania 15205  
(12/7/89)  
871 KOBOLD Instr. Inc.  
1801 Parkway View Drive  
Pittsburgh, Pennsylvania 15205  
(3/28/96)  
(Mfg. by: Flowdata, Inc.  
1817 Firman Drive  
Richardson, Texas 75081-1826)  
529 KROHNE, Inc.  
7 Dearborn Road  
Peabody, Massachusetts 01960  
(5/18/88)  
(Mfg. by: Altometer, Holland)  
755 Liquid Controls LLC  
105 Albrecht Drive  
Lake Bluff, Illinois 60044  
(2/21/94)  
(Mfg. by: Processautomatic  
Box 117  
61070 Vagnharad, Sweden)  
778 Magnetrol Intl., Inc.  
5300 Belmont Road  
Downers Grove, Illinois 60515  
(7/27/94)  
(Mfg. by: Endress & Hauser Flowtec AG  
CH-4153 Reinach  
Kagenstrasse 7  
Switzerland)  
(Mfg. by: Endress & Hauser Flowtec AG  
Division USA  
2350 Endress Place  
P.O. Box 246-1  
Franksville, Wisconsin 53158-0909  
(10/16/97)  
871 KOBOLD Instr. Inc.  
1801 Parkway View Drive  
Pittsburgh, Pennsylvania 15205  
(3/28/96)  
(Mfg. by: Endress & Hauser Flowtec AG  
CH-4153 Reinach  
Kagenstrasse 7  
Switzerland)  
(Mfg. by: Endress & Hauser Flowtec AG  
Division USA  
2350 Endress Place  
P.O. Box 246-1  
Franksville, Wisconsin 53158-0909  
(10/16/97)  
(Mfg. by: Endress & Hauser Flowtec AG  
Division USA  
2350 Endress Place  
P.O. Box 246-1  
Franksville, Wisconsin 53158-0909  
(10/16/97)
29-01 Air Eliminators for Milk and Fluid Milk Products

340 Accurate Metering Systems, Inc. (6/2/81)
1651 Wilkening Court
Schaumburg, Illinois 60173

662 G/H Products Corp. (11/21/91)
P.O. Box 909
Pleasant Prairie, Wisconsin 53158-0909

436 Scherping Systems (11/27/84)
801 Kingsley Street
Winsted, Minnesota 55395

30-01 Farm Milk Storage Tanks

421 Paul Mueller Co. (4/17/84)
P.O. Box 828
Springfield, Missouri 65801

31-02 Scraped Surface Heat Exchangers

290 APV Americas-Lake Mills (6/15/77)
100 South CP Avenue
Lake Mills, Wisconsin 53551

323 Waukesha Cherry-Burrell (7/26/79)
Process Equipment Division
P.O. Box 35600
Louisville, Kentucky 40223-5600

274 Contherm, Inc. (6/25/76)
111 Parker Street
Newburyport, Massachusetts 01950

496 FMC Corp. (2/23/87)
Fran Rica Systems
P.O. Box 30127
Stockton, California 95213-0127

361 N.V. Terlet (7/12/82)
P.O. Box 62
7200 AB Zutphen
Netherlands
(U.S. Agent Manning & Lewis-NJ)

964 Schroder GmbH & Co. KG (5/27/98)
Falkenstr. 51-57
D-23564, Lubeck
Germany
(U.S. Rep.: Schroder N.A. Corp.
12780 Westlinks Drive
Fort Myers, Florida 33913)

32-02 Uninsulated Tanks for Milk and Milk Products

397 APV Americas-Lake Mills (6/21/83)
100 South CP Avenue
Lake Mills, Wisconsin 53551

268 DCI, Inc. (11/21/75)
600 No. 54th Avenue, P.O. Box 1227
St. Cloud, Minnesota 56301

708 Lee Industries, Inc. (1/12/93)
P.O. Box 688
Phillipsburg, Pennsylvania 16866

844 Paul Mueller Co. (8/24/95)
1600 West Phelps Street
Springfield, Missouri 65801

354 C.E. Rogers Co. (3/3/82)
1895 Frontage Road, P.O. Box 118
Mora, Minnesota 55051

683 SANIFAB (7/9/92)
A Division of A&B Process Systems Corp.
P.O. Box 86
Stratford, Wisconsin 54484

441 Scherping Systems (3/1/85)
801 Kingsley Street
Winsted, Minnesota 55395

852 Viatec, Inc. (10/18/95)
500 Reed Street
Belding, Michigan 48809

339 Walker Stainless Equip. Co., Inc. (6/2/81)
625 State Street
New Lisbon, Wisconsin 53950

33-01 Polished Metal Tubing for Dairy Products

310 Allegheny Bradford Corp. (7/19/78)
P.O. Box 200 Route 219 South
Bradford, Pennsylvania 16701

812 A.T.I. s.r.l. (1/26/95)
Viale Resegue 7
22036 Erba (Como)
Italy
(U.S. Rep.: Norca Corporation
185 Great Neck Road
Great Neck, New York 11022)

413 Azco, Inc. (12/8/83)
P.O. Box 567
Appleton, Wisconsin 54912

736 Kvalitetsproduktion AB (6/11/93)
S-693 29 Degerfors, Sweden
(U.S. Rep.: Flowtech, Inc
1900 Lake Park Drive, Ste. 345
Smyrna, Georgia 30080)

308 Rath Manufacturing Co., Inc. (6/20/78)
2505 Foster Avenue
Janesville, Wisconsin 53545

368 Rodger Industries Inc. (10/7/82)
P.O. Box 186, R.R. 1
Blenheim, Ontario
Canada N0P 1A0
(Not available in the U.S.A.)

776 TGPRO (7/18/94)
Bangkok, Thailand
(U.S. Rep.: Kurt Orban Partners
450 Kings Road
Brisbane, California 94005)

775 Trent Tube (7/18/94)
P.O. Box 77
East Troy, Wisconsin 53120

289 Tri-Clover, Inc. (1/21/77)
9201 Wilmot Road
Kenosha, Wisconsin 53141

351 United Industries, Inc. (10/23/80)
1546 Henry Avenue
Beloit, Wisconsin 53511
34-02 Portable Bins

916 Custom Metalcraft, Inc.
2332 East Division
P.O. Box 10587 GS
Springfield, Missouri 65808
647 Thomas Conveyor Company
Tote System Division
P.O. Box 2916
Fort Worth, Texas 76113-2916

35-00 Continuous Blenders

869 ADMIX, Inc.
234 Abby Road
Manchester, New Hampshire 03103-3332
527 Arde Barinco, Inc.
500 Walnut Street
Norwood, New Jersey 07648
590 Chemineer, Inc.
125 Flagship Drive
North Andover, Massachusetts 01845
417 Waukesha Cherry-Burrell
Process Equipment Division
P.O. Box 35600
Louisville, Kentucky 40252-5600
825 GEI International, Inc.
700 Pennsylvania Drive
Exton, Pennsylvania 19341
(Mfg. by: Machines Collette N.V.
Keerbaan 70
B-2160 Wommelgem
Belgium)
914 International Mixing Tech. s.a.r.l.
469 Avenue Louis Herbeaux
F-59240 Dunkerque
France
(U.S. Rep.: L.M.T. USA
6946 Paseo Laredo
San Diego, California 92037)
642 Mondomix Howden B.V.
Reeweg 13
P.O. Box 98
1394 ZH Nederhorst den Berg
The Netherlands
(U.S. Rep.: Mondomix Howden
1 West Illinois Street, Suite 300
St. Charles, Illinois 60174)
680 Quadro Engineering, Inc.
613 Colby Drive
Waterloo, Ontario
Canada N2V 1A1
(U.S. Rep.: Quadro, Inc.
55 Bleeker Street
Milburn, New Jersey 07041-1414)
766 Semi-Bulk Systems
159 Cassens Court
Fenton, Missouri 63026-2543
724 Silverson Machines, Inc.
P.O. Box 589
355 Chestnut Street
East Longmeadow, Massachusetts 01028
(Mfg. by: Silverson Machines
Chesham, England)

36-00 Colloid Mills

808 Boston Shearpump, Inc.
170 Linden Street
Wellesley, Massachusetts 02181-7919
846 IKA Works, Inc.
2635 North Chase Parkway, S.E.
Wilmington, North Carolina 28405-7499
915 IKA Works, Inc.
2635 North Chase Parkway, S.E.
Wilmington, North Carolina 28405-7499
608 Kinematica, Inc.
19 Normandy Road
Newton, Massachusetts 02166
(Mfg. by: Kinematica AG
CH-6014 Littau/Lucerne, Switzerland)
295 Waukesha Cherry-Burrell
611 Sugar Creek Road
Delavan, Wisconsin 53115

38-00 Cottage Cheese Vats

541 Kusel Equipment Company
820 West Street
Watertown, Wisconsin 53094
385 Stoelting, Inc.
502 Highway 67
Kiel, Wisconsin 53042-1600

40-01 Bag Collectors for Dry Milk and Dry Milk Products

381 Marriott Walker Corp.
925 E. Maple Road
Birmingham, Michigan 48809
456 C. E. Rogers Company
P.O. Box 118
Mora, Minnesota 55051

41-01 Mechanical Conveyors

631 Flexicon Corporation
1375 Striker's Road
Phillipsburg, New Jersey 08865
894 Spiroflow-Orthos Systems, Inc.
2806 Gray Fox Road
Monroe, North Carolina 28110

42-01 In-Line Strainers

855 Flowtech Inc.
1701 Spinks Drive S.E.
Marietta, Georgia 30067-8925
655 Tri-Clover, Inc.
9201 Wilmot Road
Kenosha, Wisconsin 53141
606 Waukesha Cherry-Burrell
611 Sugar Creek Road
Delavan, Wisconsin 53115

44-02 Air Driven Diaphragm Pumps

958 American LEWA, Inc.
132 Hopping Brook Road
Holliston, Massachusetts 01746-1499
(Mfg. by: LEWA-Herbert Ott GmbH & Co.
P.O. Box 1563
Ulmer Strasse 10
D-71229, Leonburg
Germany)
<table>
<thead>
<tr>
<th>Code</th>
<th>Company Name</th>
<th>Address</th>
<th>Phone</th>
<th>Fax</th>
<th>Mfg. by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>959</td>
<td>American LEWA, Inc.</td>
<td>132 Hopping Brook Road, Holliston, MA 01746-1499</td>
<td>(4/15/98)</td>
<td></td>
<td>LEWA-Herbert Ott GmbH &amp; Co.</td>
</tr>
<tr>
<td>937</td>
<td>Versa-Matic Pump Company</td>
<td>6017 Enterprise Drive, Export, PA 15632-8969</td>
<td>(9/18/97)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>713</td>
<td>Warren Rupp, Inc., A Unit of IDEXX Corp.</td>
<td>800 North Main Street, Mansfield, OH 44905</td>
<td>(2/5/93)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>833</td>
<td>Wilden Pump &amp; Engr. Co.</td>
<td>22069 Van Buren Street, Grand Terrace, CA 92313-5651</td>
<td>(6/22/95)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>805</td>
<td>Tri-Clover</td>
<td>9201 Wilmont Road, Kenosha, WI 53141</td>
<td>(11/18/94)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>927</td>
<td>Yamada America, Inc.</td>
<td>1575 High Point Drive, Elgin, IL 60123</td>
<td>(6/18/97)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>807</td>
<td>CeraMem Separations</td>
<td>20 Clematis Avenue, Waltham, MA 02154</td>
<td>(11/30/94)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>786</td>
<td>North Carolina SRT, Inc.</td>
<td>221 James Jackson Avenue, Cary, NC 27513</td>
<td>(9/24/94)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>955</td>
<td>Brinrose Corp. of America</td>
<td>5020 Campbell Boulevard, Baltimore, MD 21236-4968</td>
<td>(3/17/98)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>859</td>
<td>The Electron Machine Corp.</td>
<td>15820 CR 450 West, P.O. Box 2345, Umatilla, FL 32784</td>
<td>(11/4/95)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>800</td>
<td>Epsilon Industrial Inc.</td>
<td>2215 Grand Avenue Parkway, Austin, TX 78728</td>
<td>(10/24/94)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>783</td>
<td>James C. Camp</td>
<td>95 Wyngate Drive, Newnan, GA 30265</td>
<td>(9/2/94)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>897</td>
<td>Ampco Pumps Company</td>
<td>4000 West Burnham Street, Milwaukee, WI 53215</td>
<td>(12/10/96)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>705</td>
<td>Bindicator Company</td>
<td>1915 Dove Street, Port Huron, MI 48060</td>
<td>(12/29/92)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>787</td>
<td>Cipriani, Inc.</td>
<td>23195 LaCadena Drive, Laguna Hills, CA 92653</td>
<td>(8/27/91)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Alfa Laval/G & H Products Corp. (6/10/57)  
P.O. Box 909  
Pleasant Prairie, Wisconsin 53158-0909

780 L. C. Thomsen, Inc. (8/31/57)  
1303 - 43rd Street  
Kenosha, Wisconsin 53140

239 LUMACO (6/3/72)  
9-11 East Broadway  
Hackensack, New Jersey 07601

788 Puriti, S.A. De C. V. (9/12/72)  
Alfredo Nobel No. 39  
Fracc. Ind. Pte. de Vagas  
Talnepan, Mexico

781 Robert James Sales, Inc. (8/31/94)  
699 Hertel Avenue, Suite 260  
Buffalo, New York 14207

357 Tanaco Products (4/15/82)  
3860 Loomis Trail Road  
Blaine, Washington 98230

777 Tech Control Ent. (8/2/85)  
3725 N. Murray Road  
Otis Orchard, Washington 99027  
(Mfg. by: Tech Control, Taipei, Taiwan)

790 Tri-Clover, Inc. (10/15/56)  
9201 Wilmont Road  
Kenosha, Wisconsin 53141-1413

759 VNE Corporation (3/16/78)  
1149 Barberry Drive  
Janesville, Wisconsin 53545

761 Waukesha Cherry-Burrell (12/17/57)  
611 Sugar Creek Road  
Delavan, Wisconsin 53115

52-01 (Formerly 08-17H) Thermoplastic Plug Type Valves

907 L'AUFER International AG (2/25/97)  
Finkenweg 2  
D-88709 Meersburg, Germany  
(U.S. Rep.: M. G. Newell Corporation  
115 N. 20th Street  
Tampa, Florida 33605)

577 Ralet-Defay (11/2/89)  
66, Boulevard Poincare  
1070 Brussels, Belgium  
(U.S. Agent GENICANAM, Chazy, New York)

53-00 (Formerly 08-17A) Compression Type Valves

484 APV Fluid Handling-America (10/22/86)  
100 South CP Avenue  
Lake Mills, Wisconsin 53551-1799

952 APV Fluid Handling-America (1/30/98)  
100 South CP Avenue  
Lake Mills, Wisconsin 53551-1799  
(Mfg. by: APV Fluid Handling Horsens A/S  
Temsevej 61-63  
DK-8700 Horsens  
Denmark)

730 APV Americas-Lake Mills (4/21/93)  
100 South CP Avenue  
Lake Mills, Wisconsin 53551-1799

552 APV Fluid Handling-America, Inc. (11/23/57)  
100 South CP Avenue  
Lake Mills, Wisconsin 53551-1799

245 Babson Brothers Company (2/12/73)  
Dairy System Division  
P.O. Box 659  
20903 West Gale Avenue  
Galesville, Wisconsin 54630  
(Mfg. by: Superior Stainless, Inc.  
611 Sugar Creek Road  
Delavan, Wisconsin 53115)

443 Badger Meter, Inc. (4/30/85)  
6116 East 15th Street  
Tulsa, Oklahoma 74112

686 Bardiani Valvole S.R.I. (8/3/92)  
Via G. Vittorio, 30/B  
43045 Fornovo (PR) Italy  
(U.S. Rep.: Sanchelima Int.  
1763 Northwest 93rd Avenue  
Miami, Florida 33172)

538 Cipriani, Inc.-Tassalina S.P.A. (7/31/88)  
23195 La Cadena Drive, Suite 103  
Laguna Hills, California 92653  
(Mfg. by: Fratelli Tassalini, Italy)

716 Conexiones Inoxidables (3/4/93)  
de Puebla S.A. de C.V.  
Vicente Guerrero No. 211  
Xicotencatl de Juarez  
Edo, Puebla Mexico  
(U.S. Rep.: Ben Dolphin Consulting  
4735 Lansing Drive  
North Olmsted, Ohio 44070)

376 Defontaine of America, Inc. (1/25/83)  
16720 W. Victor Road  
New Berlin, Wisconsin 53151  
(Mfg. by: Defontaine S.A.- Dept. Definox  
3, rue Louis Renault - BP 329  
44803 Saint-Herblain Cedex  
France)

530 Alfa Laval/G & H Products Corp. (5/31/88)  
P.O. Box 909  
Pleasant Prairie, Wisconsin 53158-0909  
(Mfg. by: Alfa Laval LKM ApS  
Albuen 31, Box 802  
DK-6000 Kolding, Denmark)

883 Keystone Hygienic Valve Division (7/12/96)  
12-14 Kaimiro Street  
Puketech Industrial Estate  
Hamilton, New Zealand  
(U.S. Rep.: Keystone Valve Division  
P.O. Box 40010  
Houston, Texas)

607 Kammer Valve, Inc. (9/25/90)  
510 Parkway View Drive  
Pittsburgh, Pennsylvania 15205-1410  
(Mfg. by: Kammer Ventile GmbH  
Manderscheidstr. 19  
45141 Essen 1, Germany)

570 LUMACO (8/9/89)  
9-11 East Broadway  
Hackensack, New Jersey 07601

AUGUST 1998 - Dairy, Food and Environmental Sanitation
<table>
<thead>
<tr>
<th>Company Name</th>
<th>Address Details</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTS Milchtechnik AG</td>
<td>Saint Gallen Strasse 19, CH-9042, Switzerland</td>
<td>6/14/96</td>
</tr>
<tr>
<td>Pierre Guerin SA</td>
<td>BP. 12, Mauze-Sur-Le-Mignon, France</td>
<td>10/4/91</td>
</tr>
<tr>
<td>Purifi, S.A. de C.V.</td>
<td>Alfredo Nobel 39, Fracc. Ind. Puente de Vargas, Tlalnepantla, Mexico</td>
<td>9/12/72</td>
</tr>
<tr>
<td>Q-Controls</td>
<td>Subsidiary of Cesco Magnetics, 93 Utility Court, Rohnert Park, California</td>
<td>5/18/64</td>
</tr>
<tr>
<td>Richards Industries Valve Group</td>
<td>3170 Wasson Road, Cincinnati, Ohio 45209-2381</td>
<td>1/11/94</td>
</tr>
<tr>
<td>Stainless Products, Inc.</td>
<td>1649, 72nd Avenue, Somers, Wisconsin 53171-0169</td>
<td>12/18/80</td>
</tr>
<tr>
<td>Sudmo North America, Inc.</td>
<td>4786 Colt Road, Rockford, Illinois 61109</td>
<td>11/18/94</td>
</tr>
<tr>
<td>Taylor Valve Technology</td>
<td>8300 S.W. 8th Street, Oklahoma City, Oklahoma 73128</td>
<td>2/25/98</td>
</tr>
<tr>
<td>L.C. Thomson, Inc.</td>
<td>1303-43rd Street, Kenosha, Wisconsin 53140</td>
<td>8/31/88</td>
</tr>
<tr>
<td>Tri-Clover, Inc.</td>
<td>9201 Wilmot Road, Kenosha, Wisconsin 53141</td>
<td>10/15/96</td>
</tr>
<tr>
<td>Tuchenhagen North America, Inc.</td>
<td>9165 Rumsey Road, Columbia, Maryland 21045</td>
<td>1/3/86</td>
</tr>
<tr>
<td>On-Line Instrumentation, Inc.</td>
<td>Rt. 376, P.O. Box 541, Hopewell Junction, New York 12533</td>
<td>10/15/86</td>
</tr>
<tr>
<td>Pierre Guerin SA</td>
<td>BP. 12, Mauze-Sur-Le-Mignon, France</td>
<td>10/4/91</td>
</tr>
<tr>
<td>Purifi, S.A. de C.V.</td>
<td>Alfredo Nobel 39, Fracc. Ind. Puente de Vargas, Tlalnepantla, Mexico</td>
<td>9/12/72</td>
</tr>
<tr>
<td>Richards Industries Valve Group</td>
<td>3170 Wasson Road, Cincinnati, Ohio 45209-2381</td>
<td>1/11/94</td>
</tr>
<tr>
<td>Stainless Products, Inc.</td>
<td>1649, 72nd Avenue, Somers, Wisconsin 53171-0169</td>
<td>12/18/80</td>
</tr>
<tr>
<td>Sudmo North America, Inc.</td>
<td>4786 Colt Road, Rockford, Illinois 61109</td>
<td>11/18/94</td>
</tr>
<tr>
<td>Taylor Valve Technology</td>
<td>8300 S.W. 8th Street, Oklahoma City, Oklahoma 73128</td>
<td>2/25/98</td>
</tr>
<tr>
<td>L.C. Thomson, Inc.</td>
<td>1303-43rd Street, Kenosha, Wisconsin 53140</td>
<td>8/31/88</td>
</tr>
<tr>
<td>Tri-Clover, Inc.</td>
<td>9201 Wilmot Road, Kenosha, Wisconsin 53141</td>
<td>10/15/96</td>
</tr>
</tbody>
</table>

**540-02 (Formerly 08-178) Diaphragm-Type Valves**

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Address Details</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>APV Fluid Handling-Americas</td>
<td>100 South CP Avenue, Lake Mills, Wisconsin 53551-1799</td>
<td>10/22/86</td>
</tr>
<tr>
<td>APV Americas-Lake Mills</td>
<td>100 South CP Avenue, Lake Mills, Wisconsin 53551-1799</td>
<td>5/14/96</td>
</tr>
<tr>
<td>AsepCo</td>
<td>1101 San Antonio Road, #301, Mountain View, California 94043</td>
<td>1/4/91</td>
</tr>
<tr>
<td>Burkert Contromatic Corporation</td>
<td>2602 McGaw Avenue, Irvine, California 92714</td>
<td>2/2/95</td>
</tr>
<tr>
<td>Burkert Contromatic Corporation</td>
<td>2602 McGaw Avenue, Irvine, California 92614</td>
<td>2/2/98</td>
</tr>
<tr>
<td>Cashco, Inc.</td>
<td>P.O. Box 6, Hwy. 140 West, Ellsworth, Kansas 67439-0006</td>
<td>12/9/93</td>
</tr>
<tr>
<td>Defontaine of America, Inc.</td>
<td>16720 W. Victor Road, New Berlin, Wisconsin 53151</td>
<td>2/1/91</td>
</tr>
<tr>
<td>Flowtech, Inc.</td>
<td>1900 Lake Park Drive, No. 345, Smyrna, Georgia 30080</td>
<td>10/30/95</td>
</tr>
</tbody>
</table>

*Dairy, Food and Environmental Sanitation – AUGUST 1998*
55-01 Boot Seal Valves for Milk & Milk Products

821 Keofitt A/S
Snaremosvej 27
DK-7000 Fredericia
Denmark
(U.S. Rep.: Keofitt, Inc.
c/o Leman
2920-3000 Wolff Street
Racine, Wisconsin 53404)

56-00 (Formerly 08-17E) Inlet and Outlet Leak-Protector Plug Valve

342 Tri-Clover, Inc.
9201 Wilmot Road
Kenosha, Wisconsin 53141

57-01 (Formerly 08-17F) Tank Outlet Valve

531 Alfa Laval/G & H Products Corp.
P.O. Box 909
Pleasant Prairie, Wisconsin 53158-0909

534 Lumaco
9-11 East Broadway
Hackensack, New Jersey 07601

643 Paul Mueller Company
1600 West Phelps
Springfield, Missouri 65801

58-00 (Formerly 08-17M) Vacuum Breakers and Check Valves

843 APV Americas-Lake Mills
100 South CP Avenue
Lake Mills, Wisconsin 53551

691 Defontaine of America, Inc.
16720 W. Victor Road
New Berlin, Wisconsin 53151
(Mfg. by: Defontaine S.A. · Dept. Definox
3, rue Louis Renault - BP 329
44803 Saint-Herblain Cedex
France)

835 Alfa Laval/G & H Products Corp.
P.O. Box 909
Pleasant Prairie, Wisconsin 53158-0909
(Mfg. by: Alfa Laval LKM ApS
Albuen 31, Box 802
DK-6000 Kolding, Denmark)

834 Stanfos, Inc.
3908 - 69th Avenue
Edmonton, Alberta
Canada T6B 2V2
(U.S. Rep.: Andron Stainless Corporation
8901 Farrow Road, Suite 101
Columbia, South Carolina 29203)

637 Gemu Valves, Inc.
3800 Camp Creek Parkway
Bldg. 2400, Suite 102
Atlanta, Georgia 30331

514 H. D. Bauman Inc.
35 Mirona Road
Portsmouth, New Hampshire 03801-5317

203R ITT Engineered Valves
33 Centerville Road
Lancaster, Pennsylvania 17603-2064

59-00 (Formerly 08-17D) Automatic Positive Displacement Sampler

291 Accurate Metering Systems Inc.
(Mfg. by: Diesel, Germany)
1650 Wilkening Court
Schaumburg, Illinois 60173

284 Bristol Equipment Co.
210 Beaver Street
P.O. Box 696
Yorkville, Illinois 60560-0696

60-00 (Formerly 08-17G) Rupture Discs

407 Continental Disc Corp.
3160 W. Heartland Drive
Liberty, Missouri 64068

854 Fike Metal Prod.
Div. Fike Corp.
704 South 10th Street
Blue Springs, Missouri 64015

892 Oklahoma Safety Equipment Company
(OSEPO)
1701 West Tacoma
Broken Arrow, Oklahoma 74012

61-00 (Formerly 08-17I) Steam Injected Heaters

728 APV Americas
Heat Transfer Division
395 Fillmore Avenue
Tonawanda, New York 14150

811 Hydro-Thermal Corporation
400 Pilot Court
Waukesha, Wisconsin 53188

560 Pick Heaters, Inc.
P.O. Box 516
West Bend, Wisconsin 53095

874 Q-Jet DSL, Inc.
704 Powell Lane, P.O. Box 350
Lewiston, New York 14092-0350

62-01 (Formerly 08-17L) Hose Assemblies

795 Able Hose & Rubber, Inc.
2307 E. Hennepin Avenue
Minneapolis, Minnesota 55413

774 The Briggs Co.
3 Bellecor Drive
New Castle, Delaware 19720

758 Crouch Supply Co.
P.O. Box 163829
902 S. Jennings
Ft. Worth, Texas 76161

721 Dixon Valve & Coupling Co.
800 High Street
Chesterstown, Maryland 21620-1196

(7/10/91)
(8/24/87)
(11/27/68)
(3/17/95)
(5/31/88)
(6/30/72)
(8/22/91)
(10/15/56)
(5/31/88)
(6/30/72)
(8/22/91)
(10/14/83)
(10/17/95)
(10/11/96)
(4/14/93)
(1/1/95)
(1/19/89)
(4/2/96)
(9/14/94)
(9/13/95)
(8/17/92)
(4/25/97)
913 JGB Enterprises, Inc. (4/9/97)
115 Metropolitan Drive
Liverpool, New York 13088

757 Nelson Jameson, Inc. (2/21/94)
P.O. Box 647
2400 East 5th Street
Marshfield, Wisconsin 54449

727 Pure Fit, Inc. (4/14/93)
924 Marcon Boulevard
Allentown, Pennsylvania 18103

799 Rubber World (10/21/94)
936 Links Avenue
Landisville, Pennsylvania 17538

698 Sanitary Couplers, Inc. (10/23/92)
696-698 Pleasant Valley Drive
Springboro, Ohio 45066

700 Titan Industries, Inc. (10/23/92)
P.O. Box 1007
11121 Garfield Avenue
South Gate, California 90280-7590

63-01 (Formerly 08-17R) Sanitary Fittings

380 Allegheny Bradford Corp. (3/21/83)
P.O. Box 200 Route 219 South
Bradford, Pennsylvania 16701

79R APV Fluid Handling-America, Inc. (11/23/57)
100 South CP Avenue
Lake Mills, Wisconsin 53551-1799

682 Andron Stainless, Ltd. (6/30/92)
6170 Tomken Road
Mississauga, Ontario
Canada L5T 1X7
(U.S. Rep.: Andron Stainless Corp.
8901 Farrow Road, #101
Columbia, South Carolina 29223)

349 APN, Inc. (12/15/81)
921 Industry Road
Caledonia, Minnesota 55921

900 APV Fluid Handling America (12/31/96)
100 South CP Avenue
Lake Mills, Wisconsin 53551-1799

948 ARMATURENWERK HOTENSLIEBEN GmbH
SchulstraBe 5-6
39393 Holensleben
Germany
(U.S. Rep.: VNE Corporation
1149 Barberry Drive
Janesville, Wisconsin 53547)

621 Bradford Castmets (2/25/91)
P.O. Box 33
Elm Grove, Wisconsin 53122

688 Swagelok (8/4/92)
9760 Shepard Road
Macedonia, Ohio 44056-1199

960 C S E Chang Sung Enterprise Co., Ltd.
No. 6-19 To Lun Road
Ta Tsun Hsiao Chang
Hua Shien, Taiwan
Republic of China
(U.S. Rep.: Kurt Orban Partners
450 Kings Road
Brisbane, California 94005)

949 CANDIGRA y CIA, S.A.
C/ Telers, 54-Aptdo. 174
17820 Banyoles
Spain
(Not Available in the U.S.A.)

645 Cipriani, Inc. - Tassalini S.P.A.
25195 LaCadena Drive, Suite #103
Laguna Hills, California 92653

962 CIVACON
416 E. Alondra Boulevard
Gardena, California 90248

696 Conexiones Inoxidables de Puebla S. A. de C. V.
Vicente Guerrero No. 112
Xicotepec de Juarez
Edo. Puebla, Mexico
(U.S. Rep.: Ben Dolphin Consulting
4735 Lansing Drive
North Olmsted, Ohio 44070)

528 Mark IV Industrial Dayco Industrial Division
P.O. Box 1004
1 Prestige Place
Dayton, Ohio 45401-1004

677 EXCEL-A-TEC, Inc.
N93 W14635 Whittaker Way
Menomonee Falls, Wisconsin 53051

947 FLOWMECA
47 rue du Bois Chalad
LISSES
91029 Evry Cedex
France
(U.S. Rep.: FLOWMECA, Inc.
19400 Stevens Creek Boulevard, Suite 200
Cupertino, California 95014)

838 Food & Dairy Quality Mgmt. Inc. (QMI) (7/10/95)
245 E. 6th Street, Suite 416
St. Paul, Minnesota 55101

67R Alfa Laval/G & H Products Corp.
P.O. Box 909
Pleasant Prairie, Wisconsin 53158-0909

925 Hassia Verpackungsmachinen
GmbH
Heerweg 19
D-63691
Ranstadt, Germany
(U.S. Rep.: Hassia USA, Inc.
1210 Campus Drive West
Morganville, New Jersey 07751)

773 Herrli AG
3210 Kersz
Switzerland
(U.S. Rep.: VNE Corp.
P.O. Box 1698
Janesville, Wisconsin 53547)

917 Irving Polishing & Mfg., Co., Inc.
5704 46th Street
Kenosha, Wisconsin 53144-1899

454 Jensen Fittings Corp.
107-111 Goundry Street
North Tonawanda, New York 14120-5998

546 Dairy, Food and Environmental Sanitation – AUGUST 1998
933 King Lai International Co., Ltd.
No. 10, The 6th Street
Youth Industrial Zone
Tachia, Taichung
Taiwan ROC
(Not available in the U.S.A.)

703 Parker Hannifin Corp.
UHP Products Division
1005 A Cleaner Way
Huntsville, Alabama 35805

200R Paul Mueller Co.
1600 W. Phelps Street, Box 828
Springfield, Missouri 65801

726 Nalge Process Technologies Group
924 Marcon Boulevard
Allentown, Pennsylvania 18103

242 Puriti, S.A. de C.V.
Alfredo Nobel 39
Industrial Puente de Vagas
Tlahuapan, Mexico
(U.S. Rep.: Waukesha Cherry-Burrell
611 Sugar Creek Road
Delavan, Wisconsin 53115)

424 Robert-James Sales, Inc.
699 Hertel Avenue, Suite 260
Buffalo, New York 14207

699 Rodger Industries, Inc.
P.O. Box 186
Blenheim, Ontario
Canada N0P 1A0
(Not available in the U.S.A.)

334 Stainless Products, Inc.
1649-72nd Avenue, Box 169
Somers, Wisconsin 53171

741 Steel & O'Brien Mfg., Inc.
12850 Route 39
Sardinia, New York 14134

391 Stork Food Machinery, Inc.
P.O. Box 1258/Airport Parkway
Gainesville, Georgia 30503
(Mfg. by: Stork Amsterdam, Netherlands)

449 Tech Controls Enterprise Co., Ltd.
3725 N. Murray Road
Otis Orchard, Washington 99027
(Mfg. by: Tech. Control, Taipei, Taiwan)

73R L.C. Thomsen, Inc.
1303-43 43rd Road Street
Kenosha, Wisconsin 53140

34R Tri-Clover, Inc.
9201 Wilmot Road
Kenosha, Wisconsin 53141

650-1st Street
Iberville, Quebec, Canada J2X 3B8
(Mfg. by: SG RM, France
Not available in the U.S.A.)

304 VNE Corporation
1149 Barberry Drive
Janesville, Wisconsin 53547

82R Waukesha Cherry-Burrell
611 Sugar Creek Road
Delavan, Wisconsin 53115

64-00 (Formerly 08-17N) Pressure Reducing
and Back Pressure Regulating Valve

782 CASHCO, Inc.
P.O. Box 6
Ellsworth, Kansas 67439-0006

753 G & H Products
P.O. Box 909
Pleasant Prairie, Wisconsin 53158-0909

769 Richards Industries Valve Group
3170 Wasson Road
Cincinnati, Ohio 45209-2381

65-00 Sight &/or Light Windows & Sight Indications
& Contact with Milk & Milk Products

849 Jacoby TarBox Division of
Clark Reliance Corp.
16633 Foltz Industrial Parkway
Strongsville, Ohio 44136

867 J. M. Canty, Inc.
6100 Donner Road
Lockport, New York 14096

929 Darrell A. Beer
d.b.a. SHAE Industries
P.O. Box 1268
121 W. North Street
Healdsburg, California 95448

845 L. J. Star Inc.
P.O. Box 1116
2201 Pinnacle Parkway
Twinsburg, Ohio 44087
(Mfg. by: Herberts Industrieglas
GmbH & Co.
KG, Wuppertal
Germany)

890 Moisture Systems
117 South Street
Hopkinton, Massachusetts 01748

818 Tri-Clover, Inc.
9201 Wilmot Road
Kenosha, Wisconsin 53141-1413

68-00 Ball-Type Valves

898 Fluid Transfer
Division of Lee Ind., Inc.
514 W. Pine Street
Philipsburg, Pennsylvania 16866

931 LUMACO
9-11 East Broadway
Hackensack, New Jersey
(Mfg. by: Dairy Pipe Lines, Ltd.
Shirchill Industrial Estate
Saffron Walden, Essex
England)
73-00 Shear Mixers, Mixers and Agitators

901 Admix, Inc. (1/2/97) 234 Abby Road Manchester, New Hampshire 03103-3332

957 Admix, Inc. (3/24/98) 234 Abby Road Manchester, New Hampshire 03103-3332

74-00 Sensors and Sensor Fittings and Connections

32 ABB Instrumentation, Inc. (10/4/56) P.O. Box 20550 Rochester, New York 14602-0550

738 ABB Instrumentation, Inc. (6/25/93) 1175 John Street Rochester, New York 14602-0550

747 Alloy Engineering Co., Inc. (1/11/94) 304 Seaview Avenue Bridgeport, Connecticut 06607

576 Ametek Test and Calibration Instruments Division 8600 Somerset Drive Largo, Florida 34643

822 Ametek/U.S. Gauge Division 620 Pennsylvania Boulevard Feasterville, Pennsylvania 19053

318 Anderson Instrument Co., Inc. 156 Auriesville Road Fultonville, New York 12072

865 APV Heat Transfer Tec 395 Fillmore Avenue Tonawanda, New York 14150 (Mfg. by: Pasilac Electronics Silkelorg, Denmark)

428 ARI Industries, Inc. 581 ARI Court Addison, Illinois 60101

659 Bindicator Company 1915 Dove Street Port Huron, Michigan 48060

706 Bindicator Company 1915 Dove Street Port Huron, Michigan 48060

926 BOURDON - SEDEME S.A. 125, rue de la Marre B.P. 214 41103 Vendome Cedex France (U.S. Rep.: Rawson & Co., Inc. P.O. Box 924288 Houston, Texas 77292-4288)

872 Brookfield Eng. Lab, Inc. 240 Cushing Street Stoughton, Massachusetts 02072-2398

315 Burns Engineering, Inc. 10201 Bren Road, East Minnetonka, Minnesota 55343

525 Caldwell Systems Corporation 1200 Diamond Circle, Unit K Lafayette, Colorado 80026

910 CEMCO Mfg., Inc. 1120 North Peoria Tulsa, Oklahoma 74106-9904

850 Chicago Stainless Equip. 511 Weston Ridge Drive Naperville, Illinois 60563

672 Computer Instruments Corp. 1000 Shames Drive Westbury, New York 11590

829 DCT Instruments/Sensotec, Inc. 2080 Arlington Lane Columbus, Ohio 43228-4112 (Mfg. by: Sensotec Inc. 2080 Arlington Lane Columbus, Ohio 43228-4112)

862 Delta Controls Corporation 585 Fortson Street Shreveport, Louisiana 71107

586 Diversey Lever Equipment 151 Harvey West Boulevard Santa Cruz, California 95060

866 Dovex S.S., Inc. 770 Tower Drive Medina, Minnesota 55340

640 Dresser Industries Instrument Division 250 East Main Street Stratford, Connecticut 06497

663 Dresser Industries Instrument Division 210 Old Gate Lane Milford, Connecticut 06460

405 Drexelbrook Engineering Co. 205 Keith Valley Road Horsham, Pennsylvania 19044

861 Dwyer Instruments, Inc. P.O. Box 373 Michigan City, Indiana 46360 (Mfg. by: Ametek, U.S. Gauge Div. PMT Products 820 Pennsylvania Boulevard Feasterville, Pennsylvania 19053)

763 EG & G Berthold Laboratorium Prof. (4/21/94) Berthold GmbH & Co. KG Calmbacher Str. 22 D-7547 Bad Wildbad 1, Germany (U.S. Rep.: E G & G Berthold USA 100 Midland Road Oak Ridge, Tennessee 37830)

936 ENFM-USA, Inc. 11339 East Distribution Avenue Jacksonville, Florida 32256 (Mfg. by: Eerste Nederlandse Fabriek Van Manometers B.V. Scheidam, Holland)

524 Flow Technology, Inc. 4250 E. Broadway Road Phoenix, Arizona 85040

459 Endress + Hauser, Inc. 2350 Endress Place Greenwood, Indiana 46142 (Mfg. by: Endress + Hauser GmbH Hauptstrasse 1 D-79689 Maulburg, Germany)
<table>
<thead>
<tr>
<th>Company Name</th>
<th>Address Details</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minco Products, Inc.</td>
<td>7300 Commerce Lane, Minneapolis, Minnesota 55432</td>
<td>12/20/89</td>
</tr>
<tr>
<td>S. J. Controls, Inc.</td>
<td>2248 Obispo Avenue #203, Long Beach, California 90806</td>
<td>11/11/89</td>
</tr>
<tr>
<td>Smar Equipamentos</td>
<td>Industrias Ltda. 7240 Brittmoore, Suite 118, Houston, Texas 77041</td>
<td>4/2/96</td>
</tr>
<tr>
<td>Nelson-Jameson</td>
<td>2400 East 5th Street, P.O. Box 647, Marshfield, Wisconsin 54449</td>
<td>11/11/89</td>
</tr>
<tr>
<td>(Mfg. by: Chicago Stainless Equipment)</td>
<td>511 Weston Ridge Drive, Naperville, Illinois 60563</td>
<td></td>
</tr>
<tr>
<td>Nelsonjameson</td>
<td>By C. Battist 59, 28045 - INVORIO (N0) Italy (Not available in the U.S.A.)</td>
<td>3/20/90</td>
</tr>
<tr>
<td>ODEN Corporation</td>
<td>255 Great Arrow Avenue, Buffalo, New York 14207</td>
<td>5/27/98</td>
</tr>
<tr>
<td>Ohmart/VEGA</td>
<td>4241 Allendorf Drive, Cincinnati, Ohio 45209-9961 (Mfg. by: VEGA Grieshaber KG AM Hoenstein 113 D-77761 Schiltach Germany)</td>
<td>3/4/97</td>
</tr>
<tr>
<td>Paper Machine Components, Inc.</td>
<td>Miry Brook Road, Danbury, Connecticut 06810</td>
<td>1/3/88</td>
</tr>
<tr>
<td>Par Sonics, Inc.</td>
<td>R.D. #1 - Box 505, Centre Hall, Pennsylvania 16828</td>
<td>11/30/88</td>
</tr>
<tr>
<td>PI Components Corp.</td>
<td>1951 Highway 290W, Brenham, Texas 77833</td>
<td>2/13/89</td>
</tr>
<tr>
<td>Princo Instruments, Inc.</td>
<td>1020 Industrial Highway, Southampton, Pennsylvania 18966-4095</td>
<td>8/22/91</td>
</tr>
<tr>
<td>ProMag PM LTD</td>
<td>11552 Merchant Drive, Baton Rouge, Louisiana 70809</td>
<td>2/24/95</td>
</tr>
<tr>
<td>Pyromation, Incorporated</td>
<td>5211 Industrial Road, Fort Wayne, Indiana 46825-5152</td>
<td>12/16/86</td>
</tr>
<tr>
<td>RDF Corporation</td>
<td>23 Elm Avenue, Hudson, New Hampshire 03051</td>
<td>10/2/82</td>
</tr>
<tr>
<td>Rosemount Analytical, Inc.</td>
<td>Uniloc Division, 2400 Barranca Parkway, Irvine, California 92606</td>
<td>2/13/87</td>
</tr>
<tr>
<td>Rosemount, Inc.</td>
<td>12001 Technology Drive, Eden Prairie, Minnesota 55344</td>
<td>5/22/80</td>
</tr>
<tr>
<td>SensorTec, Inc.</td>
<td>16355-7 Lima Road, Huntertown, Indiana 46748</td>
<td>5/18/93</td>
</tr>
<tr>
<td>Sensotec, Inc.</td>
<td>2080 Arlington Lane, Columbus, Ohio 43228-4112</td>
<td>9/2/94</td>
</tr>
<tr>
<td>Setra Systems, Inc.</td>
<td>159 Swanson Road, Boxborough, Massachusetts 01719</td>
<td>9/14/87</td>
</tr>
<tr>
<td>SOR</td>
<td>14665 W. 105th Street, Lenexa, Kansas 66215-5964</td>
<td>4/15/96</td>
</tr>
<tr>
<td>Millipore Corporation</td>
<td>P.O. Box 860709, Plano, Texas 75086-0709</td>
<td>7/10/91</td>
</tr>
<tr>
<td>TBI-Bailey Controls Company</td>
<td>2175 Lockheed Way, Carson City, Nevada 89706</td>
<td>12/3/96</td>
</tr>
<tr>
<td>Tempress A/S</td>
<td>P.O. Box 2090, DK-8240, Russkov, Denmark (Not available in the U.S.A.)</td>
<td>7/16/91</td>
</tr>
<tr>
<td>Texas Thermowell, Inc.</td>
<td>P.O. Box 1535, Hwy. 96 North, Silsbee, Texas 77656</td>
<td>8/2/92</td>
</tr>
<tr>
<td>Tri-Clover, Inc.</td>
<td>9201 Wilmot Road, Kenosha, Wisconsin 53141</td>
<td>4/27/94</td>
</tr>
<tr>
<td>Tuchenhagen North America, Inc.</td>
<td>9160 Red Branch Road, Columbia, Maryland 21045, 196 Western Avenue, Fond du Lac, Wisconsin 54936-1458</td>
<td>6/17/85</td>
</tr>
<tr>
<td>Valmet Automation</td>
<td>30 Thomas Drive, Westbrook, Maine 04092 (Mfg. by: Valmet-Finland P.O. Box 237 SP-33101, Tampere, Finland)</td>
<td>7/2/95</td>
</tr>
<tr>
<td>Viatran Corporation</td>
<td>300 Industrial Drive, Grand Island, New York 14072</td>
<td>11/1/83</td>
</tr>
<tr>
<td>Wahl Instruments, Inc.</td>
<td>234 Weaverville Highway, Ashville, North Carolina 28804</td>
<td>12/8/87</td>
</tr>
<tr>
<td>WEISS Instruments, Inc.</td>
<td>85 Bell Street, West Babylon, New York 11704 (Mfg. by: Nuova-Fima, Italy)</td>
<td></td>
</tr>
<tr>
<td>Weiksl Instruments Corporation</td>
<td>250 E. Main Street, Stratford, Connecticut 06497</td>
<td>4/27/90</td>
</tr>
</tbody>
</table>
The Following Firms Have not Renewed Their 3-A Symbol Authorization and Effective This Date No Longer are Authorized to Display the 3-A Symbol

<table>
<thead>
<tr>
<th>Authorization Date</th>
<th>Firm Name</th>
<th>Address</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01-07</td>
<td>Storage Tanks for Milk and Milk Products</td>
<td>28 Waukesha Cherry-Burrell</td>
<td></td>
</tr>
<tr>
<td>05-14</td>
<td>Stainless Steel Automotive Milk Transportation Tanks for Bulk Delivery and/or Farm Pick-up Service</td>
<td>201 Paul Krohnert Manufacturing, Ltd.</td>
<td></td>
</tr>
<tr>
<td>10-03</td>
<td>Milk and Milk Products Filters Using Disposable Filter Media, as Amended</td>
<td>720 R-P Products</td>
<td></td>
</tr>
<tr>
<td>12-05</td>
<td>Tubular Heat Exchangers for Milk and Milk Products</td>
<td>734 The Diversified-Berdell Group, Inc.</td>
<td></td>
</tr>
<tr>
<td>13-09</td>
<td>Farm Milk Cooling and Holding Tanks</td>
<td>179R Heavy Duty Products (Preston) Ltd.</td>
<td></td>
</tr>
<tr>
<td>16-05</td>
<td>Evaporators and Vacuum Pans for Milk and Milk Products</td>
<td>299 Stork Food Machinery, Inc.</td>
<td></td>
</tr>
<tr>
<td>17-09</td>
<td>Formers, Fillers and Sealers of Single Service Containers for Fluid Milk and Fluid Milk Products</td>
<td>848 Septipak, Inc.</td>
<td></td>
</tr>
<tr>
<td>19-04</td>
<td>A1 Batch and Continuous Freezers for Ice Cream, Ices, and Similarly Frozen Dairy Foods, as Amended</td>
<td>903 Coldelite Corporation of America</td>
<td></td>
</tr>
<tr>
<td>22-07</td>
<td>Silo-type Storage Tanks for Milk and Milk Products</td>
<td>702 Paul Krohnert Manufacturing, Ltd.</td>
<td></td>
</tr>
<tr>
<td>28-03</td>
<td>Flow Meters for Milk and Milk Products</td>
<td>918 Honeywell, Inc.</td>
<td></td>
</tr>
<tr>
<td>32-02</td>
<td>Uninsulated Tanks for Milk and Milk Products</td>
<td>264 Waukesha-Cherry Burrell</td>
<td></td>
</tr>
<tr>
<td>33-01</td>
<td>Polished Metal Tubing for Dairy Products</td>
<td>809 Damascus-Bishop Tube Company</td>
<td></td>
</tr>
<tr>
<td>35-00</td>
<td>Continuous Blenders</td>
<td>526 Hosokawa Bepex Corporation</td>
<td></td>
</tr>
<tr>
<td>40-01</td>
<td>Bag Collectors for Dry Milk and Dry Milk Products</td>
<td>453 Hosokawa MikriPul E. Systems</td>
<td></td>
</tr>
<tr>
<td>45-00</td>
<td>Cross Flow Membrane Modules</td>
<td>807 Coors Ceramics Company</td>
<td></td>
</tr>
<tr>
<td>46-01</td>
<td>Refractometers and Optical Sensors</td>
<td>904 AW Company</td>
<td></td>
</tr>
<tr>
<td>51-00</td>
<td>(Formerly 08-17R) Plug-Type Valves</td>
<td>271 The Foxboro Company</td>
<td></td>
</tr>
<tr>
<td>53-00</td>
<td>(Formerly 08-17A) Compression-Type Valves</td>
<td>594 Oden Corporation</td>
<td></td>
</tr>
<tr>
<td>54-02</td>
<td>(Formerly 08-17B) Diaphragm-Type Valves</td>
<td>494 Alfa Saunders Valve, Inc.</td>
<td></td>
</tr>
<tr>
<td>55-01</td>
<td>Boot Seal Valves for Milk &amp; Milk Products</td>
<td>839 G &amp; H Products Corporation</td>
<td></td>
</tr>
<tr>
<td>63-01</td>
<td>(Formerly 08-17R) Sanitary Fittings</td>
<td>470 Advance Fittings Corporation</td>
<td></td>
</tr>
<tr>
<td>74-00</td>
<td>Sensors and Sensor Fittings and Connections Used on Milk and Milk Products Equipment</td>
<td>836 Valmet Automation</td>
<td></td>
</tr>
</tbody>
</table>
When people hear about the benefits of irradiation, interest in purchasing increases. Currently, consumers have heard about this technology because of media coverage resulting from the FDA approval. Another media blitz may be expected when USDA announces approval. Educational efforts should come from all sectors: the federal government, the health community, universities, and the food industry. A broadly based program is appropriate because consumer knowledge is still limited and benefits are substantial. A nationwide consumer awareness program on irradiation was launched in April by the Grocery Manufacturing of America, the Food Marketing Institution, and the American Farm Bureau Federation.

Consumers expect processors and retailers to provide safe food. A World Health Organization report states, "The unwarranted rejection of irradiated food [by industry] is not only contrary to the public health, but also inconsistent with the rights of consumers to protect themselves and their families by choosing foods processed for safety."

When meat and poultry are irradiated everyone wins: industry will be able to meet increasingly stringent microbiological regulations, consumers will buy a safer product, and public health will benefit. Who will lead in a nationwide promotion of the safest meat and poultry in the nation?

REFERENCES

SEPTEMBER

• 6-9, InterMopro 98, International Trade Fair for Dairy Products, in Düsseldorf, Germany. For further information, contact Dusseldorf Trade Shows, Inc., 150 N. Michigan Ave., Suite 2920, Chicago, IL 60601; Phone: 312.781.5180; Fax: 312.781.5188; Web site: www.dtsusa.com/dts/.

• 9-10, Microbiological Concerns in Food Plant Sanitation & Hygiene, Chicago, IL. For further information contact Silliker Laboratories, Phone: 312.781.5180; Fax: 312.781.5188; Web site: www.silliker.com/dtsusa/dts.org.

• 13-17, The National Society for Healthcare Foodservice Management 10th Annual National Training Conference, at The Homestead, Hot Springs, VA. For additional information, contact Michael Giuffrida or Sheila Crowley at 202.546.7236.

• 17-18, Thermal Processing Deviations Workshop, presented by The Food Processors Institute, Washington, D.C. These workshops are an excellent follow-up for those who have attended a Better Process Control School. This includes: Quality Assurance Managers, Quality Control Managers, Process Engineers, and Specialists in Thermal Processing. Participants working in small problem-solving groups will evaluate typical and atypical deviation samples by applying the principles of deviation analysis. Participants will examine in detail the information necessary to determine when a thermal process deviation has occurred; explore "on the line" preventative and corrective actions when deviations happen; evaluate different types of deviations; and learn the documentation required when deviations occur. For additional information, call Customer Service at 202.639.5954.

• 22-24, New York State Association of Milk & Food Sanitarians 75th Anniversary Annual Conference, Sheraton University Hotel, Syracuse, NY. For more information, contact Janene S. Lucia, NYSAMFS, 172 Stocking Hall, Ithaca, NY 14853; Phone: 607.255.7619; Fax: 607.255.7619; E-mail: jjg3@cornell.edu.

• 25-29, China Brew & Beverage '98, at China International Exhibition Centre, Beijing, China. For details, contact Rebecca Chan or Ling Chan of Business & Industrial Trade Fairs Ltd., Unit 1223, 12/F Hongkong International Trade & Exhibition Centre, 1 Trademark Dr., Kowloon Bay, Hong Kong or Phone: 852.2865.2633; Fax: 852.2866.1770, 2866.2076.

OCTOBER

• 5-8, Better Process Control School, Texas A & M University, College Station, TX. This school is offered by The Food Processors Institute. For additional information, contact Jennifer Jakubik, Phone: 409.845.7341; Fax: 409.845.8906; E-mail: a-wagner@tamu.edu.

• 5-9, Laboratory Methods in Food Microbiology, South Holland, IL. For further information contact Silliker Laboratories, Phone: 800.829.7879; Fax: 708.957.8405.

• 14-16, Conference on the National Food Safety Initiative: Implications for Microbial Data Collection, Analysis, and Application, Doubletree Hotel National Airport, Arlington, VA. This conference is organized by International Life Sciences Institute North America (ILSI, N.A.) and the ILSI, N.A. Technical Committee on Food Microbiology, in collaboration with the Centers for Disease Control and Prevention, Food and Drug Administration, International Association of Milk, Food and Environmental Sanitarians, National Institutes of Health, U.S. Dept. of Agriculture, and others concerned with microbial food safety. The meeting will be of interest to food protection, and public health professionals. For program and registration information, contact ILSI NFSI (National Food Safety Initiative) Microbial Data Conference, 6200 Aurora Avenue, Suite 200W, Des Moines, IA 50322-2863; Phone: 800.369.6337 (U.S. and Canada); 515.276.3344 (International); Fax: 515.276.8655; E-mail: nfsi@iamfes.org. Questions concerning the conference should be directed to Ms. Catherine Nnoka, Phone: 202.659.0074; Fax: 202.659.3859; E-mail: cnnoka@ils.org.

• 18-19, Selection and Fabrication of Stainless Steel for Sanitary Service, Hotel Sofitel, Rosemont, IL. The International Association of Food Industry Suppliers (IAFIS) and the Nickel Development Institute (NiDI) are sponsoring a program on the properties and proper use of handling of stainless steel for equipment for the dairy, food, and beverage industries. For further information, contact Dorothy Brady, Conference Coordinator at Phone: 703.761.2600; Fax: 703.761.4334; E-mail: info@iafis.org.

• 21-23, 18th Food Microbiology Symposium and Workshop, University of Wisconsin-River Falls, River Falls, WI. The symposium Current "Concepts in Foodborne Pathogens and Rapid Methods in Food Microbiology" will feature.
international speakers to discuss the latest research and developments regarding foodborne pathogens, regulatory and industry trends, HACCP implementation, predictive microbiology, and validation of laboratory methods. The workshop, "Rapid and Automated Methods in Food Microbiology" will involve demonstrations and discussions of various tests, instruments and kits available for detection and characterization of foodborne organisms, for assessment of food quality and shelf life and rapid hygiene monitoring in food processing facilities. For further information, contact Dr. Purnendu C. Vasavada, Animal and Food Science Dept., University of Wisconsin-River Falls River Falls, WI 54022, U.S.A. or Phone: 715.425.3150; Fax: 715.425.3372; E-mail: Purnendu.C.Vasavada@uwrf.edu.

- 22-23, Introduction to Microbiological Criteria and Sampling Plans, Ft. Worth, TX. For further information contact Silliker Laboratories, Phone: 800.829.7879; Fax: 708.957.8405.

- 26-29, Penn State Foodborne Fungi and Mycotoxins Short Course at the Berks Campus of the Pennsylvania State University, University Park, PA. For additional information, contact The Pennsylvania State University, 306 Ag Administration Bldg., University Park, PA 16802-2601; Phone: 814.865.8301; Fax: 814.865.7050; E-mail: shortcourse@psu.edu.

NOVEMBER

- 2-6, Aseptic Better Process Control Certification School and Aseptic Symposium, at North Carolina State University, Raleigh, NC. For further information, contact Lisa Gordon at 919.515.2956; Fax: 919.515.7124; E-mail: lisa_gordon@ncsu.edu.

- 4-6, The Dairy Practices Council® Annual Conference, Harrisburg East Holiday Inn, Harrisburg, PA. The DPC Annual Conference presents outstanding speakers on issues challenging the dairy industry and afternoon task force sessions are reserved for work on developing new guidelines. Participants have the opportunity to exchange information with dairy personnel from industry, regulatory agencies, and academia. For more information, contact The Dairy Practices Council®, P.O. Box 866, Barre, VT 05641-0866; Phone/Fax: 802.476.3092; E-mail: dairypc@dairypc.org; www.dairypc.org.

- 8-12, 1998 International Exposition for Food Processors, Chicago, IL. For more information, contact Cheryl Clark at Phone: 703.684.1080; Fax: 703.548.6563; E-mail: fpmsa@clark.net.

- 8-12, Microbial Food Contamination Workshop, The U.S. Fish and Wildlife National Conservation Training Center, Shepherdstown, WV. The objectives of the workshop is to assemble leading experts in the U.S. and Israel for the exchange of information and the development of future strategies and policies to prevent and eliminate microbial food contamination; access and record the present state of our knowledge on food contamination; and to form collaborations between the U.S. and Israeli scientists and industry to pursue innovative technologies to combat food contamination. For additional information, contact BARD Workshop, Charles L. Wilson, USDA-ARS Appalachian Fruit and Research Station, 45 Wiltshire Road, Kearneysville, WV 25430; Phone: 304.725.3451; Fax: 304.728.2340; E-mail: cwilson@asrr.arsusda.gov.

- 9-11, ASI Food Safety Consultants HACCP Workshop, held at the Holiday Inn-Downtown Riverfront, St. Louis, MO. For further information, contact ASI Food Safety Consultants, Inc., Vorrie Strong or Christine VerPlank, Phone: 314.725.2555; 800.477.0778; Fax: 314.727.2563.

- 16-17, Membrane Applications in the Agri-Food Industry Seminar, at the Holiday Inn South, Winnipeg, Manitoba, Canada. This course is jointly organized by the Food Development Centre, Manitoba Hydro, the National Research Council, Manitoba Food Processors Assn., Canadian Council on Electrotechnologies, and Assiniboine Community College. The purpose is to demonstrate the economic and process benefits of membrane systems using technology profiles, case study examples and pilot plant demonstrations of actual systems. For additional information, contact Markus Schmulgen, Food Development Centre, Portage la Prairie, Manitoba; Phone: 204.239.3436; 800.870.1044.

- 16-18, 1st NSF International Conference on Food Safety: HACCP — Science, Art, and Industry, co-sponsored by IAMFES and other organizations, Hyatt Regency Albuquerque, Albuquerque, NM. For additional information, contact Wendy Raeder at Phone: 734.769.8010, ext. 205; Fax: 734.769.0109; E-mail: raeder@nsf.org.

- 22-26, 5th Latin American Congress on Food Microbiology and Hygiene, (COMBHAL 98) held in Aguas de Lindoia, Sao Paulo, Brazil. COMBHAL 98 is organized by the Brazilian representatives in the Latin American Subcommission (LAS) of ICMSF (International Commission on Microbiological Specifications for Foods) and is sponsored by the Brazilian Society for Microbiology (SBM), Brazilian Society for Food Science and Technology (SBCTA) and International Life Science Institute (ILSI, Brazil). For further information, contact COMBHAL 98 Secretariat, Av. Prof. Lineu Prestes 580, 05508-900, Sao Paulo, Brazil; Phone: +55.11.8187991; +55.11.8187999; Fax: +55.11.8154410; E-mail: combhal@edu.usp.br.landgraf@usp.br.

DECEMBER

- 1-2, HACCP for Retail, Food Service & Institutional Sectors Seminar, Guelph, Ontario. For further information, contact Guelph
Food Technology Centre, 88 McGilvray St., Guelph, Ontario N1G 2W1; Phone: 519.821.1246 ext. 5028; Fax: 519.836.1281.

1-3, Technical Symposium & Workshop, Hyatt Regency Crystal City, Arlington, VA. Sponsored by the Strategic Environmental Research and Development Program (SERDP) and the Environmental Security Technology Certification Program (ESTCP). Learn first hand about groundbreaking environmental research and innovative technologies developed by the Department of Defense (DoD), the Department of Energy, the Environmental Protection Agency, and their many public and private collaborators. For more information call 703.736.4548.

3, GMP Distribution and Warehousing Seminar, Houston, TX. For further information, contact ASI Food Safety Consultants, Inc., Christine VerPlank, or Vorrie Strong, Phone: 800.477.0778; Fax: 314.727.2563.

8-9, 1998 FDA Science Forum - Biotechnology: Advances, Applications, and Regulatory Challenges, at the Washington Convention Center, Washington, D.C. The Science Forum is co-sponsored by the FDA, the American Association of Pharmaceutical Scientists, and the FDA Chapter of Sigma Xi, The Scientific Research Society. The Science Forum will bring FDA research and review scientists together with representatives of industry, academia, government agencies, consumer groups, and the public to discuss the impact of the enormous advances in biotechnology on product development and regulation. For additional information, contact the American Association of Pharmaceutical Scientists at Phone: 703.518.8429 or E-mail: meetings@aaps.org.

8-11, Thermal Processing Development Workshop, presented by The Food Processors Institute, Washington, D.C. These workshops are an excellent follow-up for those who have attended a Better Process Control School. This includes: Quality Assurance Managers, Quality Control Managers, Process Engineers, and Specialists in Thermal Processing. Participants will generate heat penetration data in the pilot plant of NFPA's research laboratory. Working teams will examine in detail the design of thermal processes; improve skills and understanding of basic thermal process establishment and evaluation techniques, including heat penetration testing and process calculation; identify critical decision-making steps essential to thermal process establishment; generate data during the workshop exercises; and learn both the General and Ball Formula methods of calculation. For additional information, call Customer Service at 202.639.5954.

Reader Service Card

For information on membership with IAMFES.

Circle #100 on this card.

INTERNATIONAL ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL SANITARIANS, INC.
6200 Aurora Avenue, Suite 200W • Des Moines, IA 50322-2863
Mail or Fax to 515.276.8655
IAMFES has agreed with the Dairy Practice Council to distribute their “Guidelines for the Dairy Industry.” DPC is a non-profit organization of education, industry and regulatory personnel concerned with milk quality and sanitation throughout the United States. In addition, its membership and subscriber lists individuals and organizations throughout the United States, Canada and other parts of the world.

For the past 28 years, DPC’s primary mission has been the development and distribution of educational guidelines directed to proper and improved sanitation practices in the production, processing, and distribution of high quality fluid milk and manufactured dairy products. The DPC Guidelines are written by professionals who comprise six permanent Task Forces. Prior to distribution, every Guideline is submitted for approval to the State Regulatory Agencies in each of the member states which are now active participants in the DPC process. Should any official have an exception to a section of a proposed guideline, that exception is noted in the final document.

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

The entire set consists of 56 guidelines including:
1. Planning Dairy Freestall Barns
2. Effective Installation, Cleaning and Sanitizing of Milking Systems
3. Selected Personnel in Milk Sanitation
4. Installation, Cleaning, & Sanitizing of Large Parlor Milking Systems
5. Directory of Dairy Farm Building & Milking System Resource People
6. Sampling Fluid Milk
7. Good Manufacturing Practices for Dairy Processing Plants
8. Fundamentals of Cleaning and Sanitizing Farm Milk Handling Equipment
9. Maintaining & Testing Fluid Milk Shelf-Life
10. Sediment Testing and Producing Clean Milk
11. Environmental Air Control & Quality for Dairy Food Plants
12. Clean Room Technology
13. Handling Dairy Products from Processing to Consumption
14. Causes of Added Water in Milk
15. Fieldperson’s Guide to Troubleshooting High Somatic Cell Counts
16. Raw Milk Quality Tests
17. Control of Antibacterial Drugs and Growth Inhibitors in Milk and Milk Products
18. Preventing Rancid Flavors in Milk
19. Troubleshooting High Bacteria Counts of Raw Milk
20. Cleaning and Sanitizing Bulk Pickup and Transport Tankers
21. Troubleshooting Residual Films on Dairy Farm Milk Handling Equipment
22. Cleaning and Sanitizing in Fluid Milk Processing Plants
23. Potable Water on Dairy Farms
24. Composition and Nutritive Value of Dairy Products
25. Fat Test Variations in Raw Milk
26. Brucellosis and Some Other Milkborne Diseases
27. Butterfat Determinations of Various Dairy Products
29. Dairy Farm Inspection
30. Planning Dairy Stall Barns
31. Preventing Off-flavors in Milk
32. Grade A Fluid Milk Plant Inspection
33. Controlling Fluid Milk Volume and Fat Losses
34. Milkrooms and Bulk Tank Installation
35. Gravity Flow Gutters for Manure Removal in Milking Barns
36. Dairy Odor Control
37. Naturally Ventilated Dairy Cattle Housing
38. Cooling Milk on the Farm
39. Postmilking Test Dips
40. Farm Tank Calibrating and Checking
41. Troubleshooting Dairy Barn Ventilation Systems
42. Farm Bulk Milk Collection Procedures
43. Controlling the Accuracy of Electronic Testing Instruments for Milk Components
44. Emergency Action Plan for Outbreak of Milkborne Illness in the Northeast
45. Vitamin Fortification of Fluid Milk Products
46. Selection and Construction of Herringbone Milking Parlor
47. Hazard Analysis Critical Control Point System
48. Dairy Product Safety (Relating to Pathogenic Bacteria)
49. Dairy Plant Sanitation
50. Sizing Dairy Farm Water Heater Systems
51. Production and Regulation of Quality Dairy Goat Milk
52. Trouble Shooting Microbial Defects: Product Line Sampling & Hygiene Monitoring
53. Controlling the Quality & Use of Dairy Product Rework
54. Control Points for Good Management Practices on Dairy Farms
55. Installing & Operating Milk Precoolers Properly on Dairy Farms
56. Planning a Dairy Complex – “100 + Questions to Ask”

If purchased individually, the entire set would cost $225. We are offering the set, packaged in three loose leaf binders for $35 plus $9 shipping and handling (outside the U.S., $21 for shipping and handling). Information on how to receive new and updated Guidelines will be included with your order.

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

Please enclose $125 plus $9 shipping and handling for each set of Guidelines. Shipments outside the U.S. are $125 plus $21 shipping and handling. Payment in U.S. $ drawn on a U.S. Bank or by credit card.

Name: ____________________________ Phone No.: ____________________________

Company: ____________________________

Street Address: ____________________________

City, State/Province, Code: ____________________________

VISA/MC/AE No.: ____________________________ Exp. Date: ____________________________
### IAMFES Booklets

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
<th>Member or Gov't Price</th>
<th>Non-Member Price</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Procedures to Investigate Waterborne Illness—2nd Edition</td>
<td>$8.00</td>
<td>$16.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Procedures to Investigate Foodborne Illness—4th Edition</td>
<td>6.00</td>
<td>12.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Procedures to Investigate Arthropod-borne and Rodent-borne Illness</td>
<td>6.00</td>
<td>12.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Procedures to Implement the Hazard Analysis Critical Control Point System</td>
<td>6.00</td>
<td>12.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>*Pocket Guide to Dairy Sanitation (minimum order of 10)</td>
<td>50</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td></td>
<td>*Before Disaster Strikes. A Guide to Food Safety in the Home (minimum order of 10)</td>
<td>50</td>
<td>75</td>
<td></td>
</tr>
</tbody>
</table>

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

### 3-A Sanitary Standards

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
<th>Member or Gov't Price</th>
<th>Non-Member Price</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Complete Set 3-A Dairy &amp; Egg Standards</td>
<td>$70.00</td>
<td>$140.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Five-year Update Service on 3-A Dairy &amp; Egg Standards</td>
<td>95.00</td>
<td>190.00</td>
<td></td>
</tr>
</tbody>
</table>

Mail order to the IAMFES address listed above, or call 515.276.3344; 800.369.6337 (U.S. and Canada); or fax your order to 515.276.8655.

### Method of Payment

- [ ] CHECK OR MONEY ORDER ENCLOSED
- [ ] MASTER CARD [ ] VISA [ ] AMERICAN EXPRESS

Exp. Date:
Signature:

Payment must be enclosed for order to be processed.

* U.S. FUNDS ON U.S. BANK *

### Shipping and Handling

<table>
<thead>
<tr>
<th>IAMFES booklets</th>
<th>Within U.S.</th>
<th>Outside U.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>First booklet</td>
<td>$2.00</td>
<td>$4.00</td>
</tr>
<tr>
<td>Each additional booklet</td>
<td>$1.00</td>
<td>$1.00</td>
</tr>
<tr>
<td>*Guide Booklets—per 10</td>
<td>$2.50</td>
<td>$5.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3-A Sanitary Standards</th>
<th>Within U.S. (each item)</th>
<th>Outside U.S. (each item)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete Set 3-A Dairy &amp; Egg Standards</td>
<td>$6.25</td>
<td>$10.25</td>
</tr>
<tr>
<td>Five-year Update Service on 3-A Dairy &amp; Egg Standards</td>
<td>$6.00</td>
<td>$9.00</td>
</tr>
</tbody>
</table>

Prices effective through September 30, 1998
Your Invitation
to Join

The International Association of Milk, Food and Environmental Sanitarians, founded in 1911, is a non-profit educational association of food safety professionals with a mission "to provide food safety professionals worldwide with a forum to exchange information on protecting the food supply."

* Who are IAMFES Members?

The Association is comprised of a diverse membership of 2,800 from 50 nations. IAMFES Members belong to all facets of the food protection arena including: Industry, Government and Academia.

* What are your Benefits as an IAMFES Member?

Dairy, Food and Environmental Sanitation — A reviewed monthly publication that provides practical and applied research articles and association news, updates, and other related information for food safety professionals. All IAMFES Members receive this publication as part of their membership.

Journal of Food Protection — An international, refereed scientific journal of research and review papers on topics in food science and food aspects of animal and plant sciences. This journal is available to all individuals who request it with their membership.

The IAMFES Lending Library — Provides quality training videos dealing with various food safety issues. IAMFES Members are allowed free use of these videos.

The IAMFES Annual Meeting — Is a unique educational event; three days of technical sessions, symposia and exhibits provide attendees with over 200 presentations on current topics in food protection. IAMFES Members receive a substantially reduced registration fee.

* To Find Out More...

To learn more about IAMFES and the many other benefits and opportunities available to you as a Member, please call 515.276.3344 or 800.369.6337; Fax: 515.276.8655; E-mail: iamfes@iamfes.org.
MEMBERSHIP APPLICATION

International Association of Milk, Food and Environmental Sanitarians, Inc.
6200 Aurora Avenue, Suite 200W
Des Moines, IA 50322-2863, U.S.A.
Phone: 800.369.6337 • 515.276.3344; Fax: 515.276.8655
E-mail: iamfes@iamfes.org; Web site: www.iamfes.org

MEMBERSHIP DATA:
Prefix (☐ Prof. ☐ Dr. ☐ Mr. ☐ Ms.)
First Name __________________________ M.I. __________________ Last Name __________________________
Company __________________________ Job Title __________________________
Mailing Address __________________________
(Please specify: ☐ Home ☐ Work)
City __________________________ State or Province __________________________
Postal Code/Zip + 4 __________________________ Country __________________________
Telephone # __________________________ Fax # __________________________
E-mail __________________________

MEMBERSHIP CATEGORIES:
☐ Membership with JFP & DFES ☐ Membership with DFES
(12 issues of the Journal of Food Protection and Dairy, Food and Environmental Sanitation)
☐ Sustaining Membership
(Includes advertising and exhibit discounts and more! Contact the IAMFES office for additional benefits)
*Student Membership
☐ JFP and DFES
☐ Journal of Food Protection
☐ Dairy, Food and Environmental Sanitation
*Full-time student verification must accompany this form
All Prices Include Shipping & Handling

TOTAL MEMBERSHIP PAYMENT:

Payment Options:
☐ Check Enclosed ☐ Visa ☐ MasterCard ☐ American Express
Card # __________________________
Exp. Date __________________________
Signature __________________________

DO NOT USE THIS FORM FOR RENEWALS

U.S. FUNDS on U.S. BANK
(Prices effective through August 31, 1999)

AUGUST 1998 - Dairy, Food and Environmental Sanitation 559
Food Irradiation: Will Consumers Make The Choice?

Christine M. Bruhn, Director, Center for Consumer Research, University of California-Davis, Davis, CA

U.S. Food and Drug Administration’s (FDA) approval of irradiation for fresh and frozen red meat in December, 1997 paves the way for another option to enhance the safety of the food supply. Although meat irradiation must await USDA approval, plans to utilize this technology by the food industry are slowly advancing.

Endorsement by the health community was widely recorded in the press. Dr. Sherwood Gorbach, Tufts University School of Medicine and American Gastroenterology Association Committee on Food Safety noted that all safety concerns have been answered. Michael Osterholm, Minnesota Department of Health compared irradiation to pasteurization of milk and chlorination of water, Donald Thayer, USDA food safety laboratory noted that irradiation could save lives, and Morris Potter, Center for Disease Control and Prevention, said, “Irradiation pasteurization is long overdue.”

At the proposed dose, irradiation destroys pathogenic bacteria such as Salmonella, Campylobacter, and Escherichia coli O157:H7. The latter is estimated to cause illness in 7,000 to 20,000 Americans and cost $40 million to $174 million annually.

Consumers recognize that foodborne bacteria are a potential hazard. When asked in 1997 about several potential safety areas, 82% of consumers classified contamination by germs or bacteria as a serious hazard (2). This is more than pesticide residues, 66%, product tampering, 65%, or any other food safety area.

Consumers value the use of irradiation to destroy microorganisms which cause foodborne illness. A nationwide study conducted in March 1998 found almost 80% said they would buy products labeled, “irradiated to destroy harmful bacteria” (3). This compares to the 1996 response rate of 69% among those who had heard of irradiation (1).

Although the regulatory approval for red meat generated significant publicity, more of the public seems to be concerned about poultry safety. Sixty-seven percent of consumers said it was “appropriate” to irradiate poultry, with pork and ground beef seen as “appropriate” by slightly fewer consumers (3). Over 60% felt irradiation was appropriate at a fast food restaurant with almost 50% considering it appropriate at the grocery store deli or sit-down restaurant.

Consumers see that irradiation’s main advantage is the destruction of harmful bacteria with almost 80% indicating that as a reason to buy irradiated products. No one expects irradiation to replace safe food handling. In the 1998 survey, 91% of consumers responded that safe food handling is still important (3).

While almost half of consumers interviewed accepted the term, irradiation, cold pasteurization was preferred by 55%. This is consistent with focus group studies completed in early 1998 in which consumers indicated they were familiar with pasteurization and could understand the benefits of the irradiation process better if the term cold pasteurization was used.

Marketing experiences are consistent with these attitude studies. Numerous irradiated produce items have been marketed in the Chicago area since 1992. Tropical fruit from Hawaii has been sold in Midwest and West Coast markets in collaboration with a study to determine quarantine treatment. Since 1995, 250 thousand pounds of fruit including papaya, atemoya, rambutan, lychee, starfruit, banana, Chinese taro, and oranges were irradiated near Chicago and sold in several markets.

Marketing tests in Kansas showed people also buy irradiated poultry. When the irradiated product was priced 10% less than the store brand, irradiated poultry captured 60% of the market share in 1995 and 63% in 1996 (4). When irradiated and non-irradiated poultry was priced equally, irradiated poultry captured 39% of the market in 1996, 47% in 1997, and about 80% in 1997 when people read background information about irradiation before making a selection (5).

Industry barriers include constructing or leasing an irradiation facility or the transportation and processing at a contract irradiator. Contract facilities currently are available in California (e-beam and cobalt), Colorado (e-beam), Florida, Illinois, Massachusetts, New Jersey, New York, North Carolina, Ohio, South Carolina, Texas, and Utah. Several are currently processing food for market tests. In-plant gamma facilities can be constructed in a little over a year and an e-beam facility in 3 months. Alternatively, a drop in self-contained unit using cesium may be ready for lease in about 2 years.

Industry should position an irradiated product to highlight its advantages. Consumers have responded positively to the statements, “irradiated to destroy harmful bacteria.” A statement “Salmonella Free” or “E. coli O157:H7 Free,” if approved by USDA, would likely be well received by the public.

Continued on page 552
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
Proper dining etiquette includes forks on the left, knives on the right and UL Marks on all the food equipment.

The standard of excellence in the food industry doesn't just apply to the food and its preparation. It also applies to the food service equipment. That's where UL's product certification expertise comes in. You'll know food equipment meets nationally recognized standards if it bears the UL Classification Mark for public health. We're accredited by the American National Standards Institute (ANSI) and the Standards Council of Canada in many public safety areas including food service equipment and drinking water additives. We use a team of experts including engineers, chemists and toxicologists who can assist you with technical questions. Plus our field representatives make follow-up visits to the factory at least four times a year to help maintain the UL Mark's integrity. Sure, proper etiquette is important. But proper certification is essential.

© 1997 Underwriters Laboratories Inc.