

2005

118th Anniversary MBAA Convention

Where Brewers Come Together

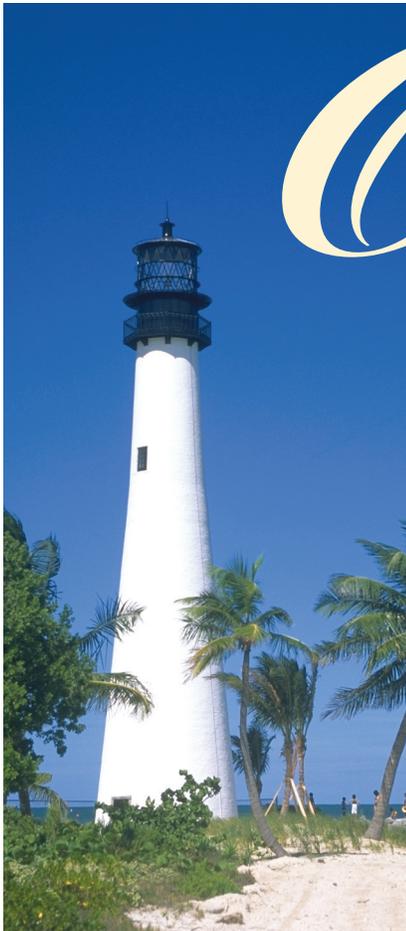


Program Book

October 14-16
InterContinental Hotel
Miami, Florida



Welcome Letter



On behalf of the MBAA Program Committee, welcome to the 118th Anniversary Convention of the Master Brewers Association of the Americas in sunny Miami! This year's convention is sure to have something for everyone.

We have put together an exciting program for 2005 that features two preconvention workshops, an excellent variety of oral and poster presentations, and the new brewery management track. Make sure you attend the Award of Merit Lecture by Finn Knudsen and the keynote presentations by Laine Murphey and Paul Hegarty. These presentations will stimulate discussions on the latest trends in the brewing industry.

Not only is the 2005 meeting packed with education covering the most recent advances in the brewing industry, there is also ample time to network with more than 65 exhibitors, view posters, and catch up with colleagues at the President's Night Reception and After Glow, the after party following the Installation of Officers and Awards Dinner.

Throughout the meeting, in addition to attending all the sessions, take time to relax at the Bierstube, catch up on the latest news in the industry, and explore all that Miami has to offer.

*Paul Kramer
MBAA President*

*Mike Sutton
Technical Committee Chair*

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Governing Committees

Executive Committee

President: Paul L. Kramer. **1st Vice President:** Jaime Jurado.
2nd Vice President: Larry L. Sidor. **Secretary/Treasurer:**
Mark P. Sammartino. **Past President:** Inge Russell. **Technical
Director:** Raymond J. Klimovitz

Board of Governor Representatives

District Caribbean: Allan C. Fields; **District Cincinnati:** Roy A. Johnson; **District Eastern Canada:** Jacques A. Desautels; **District Michigan:** John Muuse, III; **District Mid-Atlantic:** Carl H. Heins; **District Milwaukee:** Tom Eplett, III; **District New England:** Jaime C. Schier; **District New York:** John C. Ehmann; **District Northern California:** Michael C. Martin; **District Northwest:** John F. Harris; **District Ontario:** John Ian Stanners; **District Philadelphia:** Marc A. Worona; **District Pittsburgh:** Seamus Gardiner; **District Rocky Mountain:** Jeff C. Biegert; **District St. Louis:** Susan M. Simmons; **District St. Paul/Minneapolis:** Joseph C. Dirksen; **District Southeast:** James L. Diamantis; **District Southern California:** George O. Christoferson; **District Texas:** Joseph W. Caracausa; **District Venezuela:** Michael Bruns; **District Western Canada:** Bryan L. Harvey; **District Western New York:** Mark P. Sammartino

Location photos courtesy of the Greater Miami Convention & Visitors Bureau.

Thank You to our 2005 Beer Donors!

Anheuser-Busch
•
BridgePort Brewing Co.
•
Gordon Biersch Brewery &
Restaurant
•
Harpoon Brewery
•
Jacob Leinenkugel Brewing Co.
•
Miller Brewing Company
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Otter Creek Brewing Co.
•
Red Stripe Diageo
•
Sierra Nevada Brewing Co.
•
Spoetzl Brewery
•
Trumer Brauerei
•
Widmer Brothers Brewing Co.

As of September 20, 2005



General Meeting Information

Registration Desk

Registration will be located on the Mezzanine Level of the InterContinental Miami, near the elevators.

Onsite Hours:

Thursday, October 13 3:00 – 6:00 p.m.
Friday, October 14 7:00 a.m. – 4:00 p.m.
Saturday, October 15 8:00 a.m. – 4:00 p.m.
Sunday, October 16 8:00 a.m. – 4:00 p.m.

Exhibits

Don't miss the latest products and services offered by industry suppliers! Representatives from over 65 leading industry suppliers will be available to answer questions and share information.

Exhibition Hours

Friday, October 14	2:00 – 5:00 p.m.	Setup
Saturday, October 15	9:30 – 10:30 a.m.	Exhibits & Posters Open
	11:45 a.m. – 1:15 p.m.	Exhibits, Posters, & Lunch
		<i>Lunch served until 12:45 p.m.</i>
Sunday, October 16	12:15 – 2:00 p.m.	Exhibits, Posters, & Lunch
		<i>Lunch served until 1:15 p.m.</i>
	2:00 – 5:00 p.m.	Takedown

Member Services

Need to renew your membership? Not sure what your MBAA login is? Interested in joining MBAA? Staff will be available to answer your membership-related question at the Registration Desk.

Open Meeting Room

MBAA has a small meeting room available for use throughout the meeting. To check availability and room location and to reserve a meeting time, stop by the Registration Desk.

Media

Members of the media seeking news releases or other MBAA information should contact headquarters staff at the Registration Desk.

Photo Release

Photographs will be taken at the MBAA Annual Convention. By registering for this meeting, you agree to allow MBAA to use your photo in any MBAA publications or websites.

Emergency Information

Medical emergencies should be communicated to either an MBAA staff member at the Registration Desk or a hotel employee. Dial **0** for the Hotel Operator or **9-911** from your room. Give your name, location of the incident, and a description of what is happening. The hospital facility located closest to the InterContinental Miami is (MBAA does not endorse this facility):

Mercy Hospital

3663 S. Miami Avenue
Miami, FL 33131 U.S.A.
Tel: +1.305.854.4400

Annual Convention Facility

InterContinental Miami
100 Chopin Plaza
Miami, FL 33131 U.S.A.
Tel: +1.305.577.1000
Fax: +1.305.577.0384

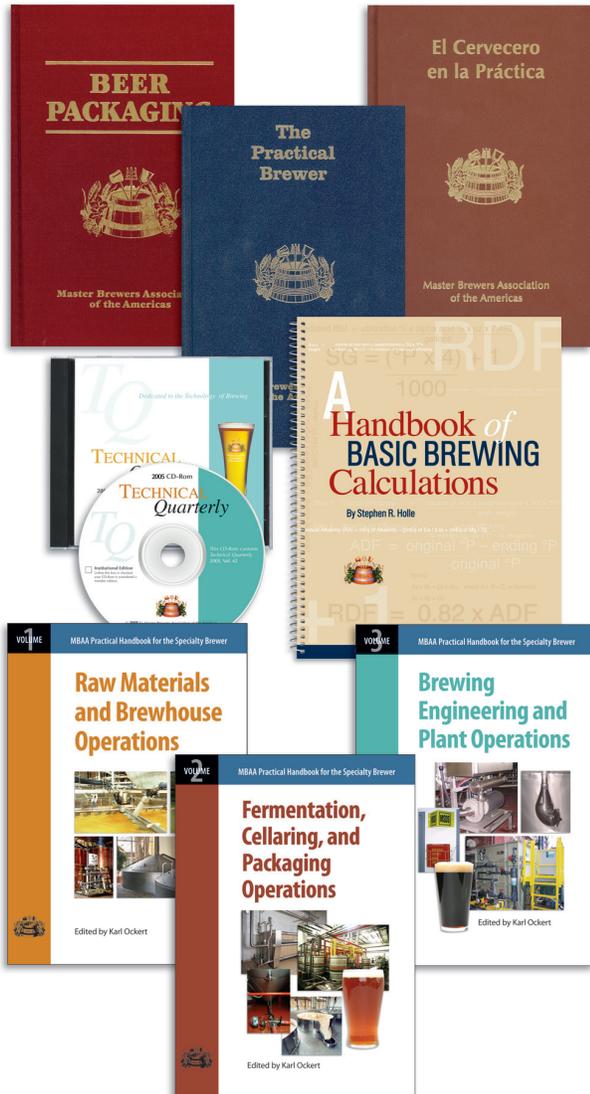
Attention Women Brewers!

Join your colleagues for the annual Women in Brewing Networking Session. This informal networking session will be held Saturday, October 15 from 5:30 – 6:30 p.m. Don't miss this great opportunity to connect with other women working in the brewing industry!

We'll see you there!



SAVE on MBAA Merchandise at the Convention!



Safety Tips

- Do not travel alone – stay in groups and travel in well lit areas.
- Remove name badges when outside the hotel unless you are participating in an MBAA event.
- Do not give your room number out to anyone you do not know and avoid giving out your room number in conversations where strangers may hear you talking.
- Bolt your hotel room door and only open when you know who is on the other side. (Note: Hotel personnel wear uniforms and have an identification badge. If in doubt, call hotel security to verify an employee's identity.)
- Do not leave your door ajar if you are going down the hall for ice. Someone may enter when you are not looking.
- Know where the stairs are located in case of fire (do not use elevators). Also count the number of doors to the nearest exit in case you can not see in a smoke-filled hallway.
- Valuables, airline tickets, and money should be kept in a hotel safety deposit box or in a room safe, if available.

Procedures In Case of Fire

In case of fire:

- Try to leave the hotel/center as quickly as possible. If you can not, stay in your room and call the operator or security to let them know you are in your room.
- Put your hand on the room door to see if it is hot before opening it. If it is, do not open quickly. Open it just a crack to see what is on the other side and be prepared to slam it quickly if necessary.
- If you leave your room, take your room key with you! Shut your room door to keep smoke out. You may have to return if the exit is blocked. Remember the way back to your room as you go to the exit in case you need to return.
- If necessary, drop to your knees to avoid smoke. Tie a wet towel around your nose and mouth to act as a smoke filter. Fold it into a triangle and put the corner in your mouth.
- Do not take the elevator when you smell smoke or if you know that there is a fire in the building.

Procedures In Case of Hurricane

If you are in your guestroom...

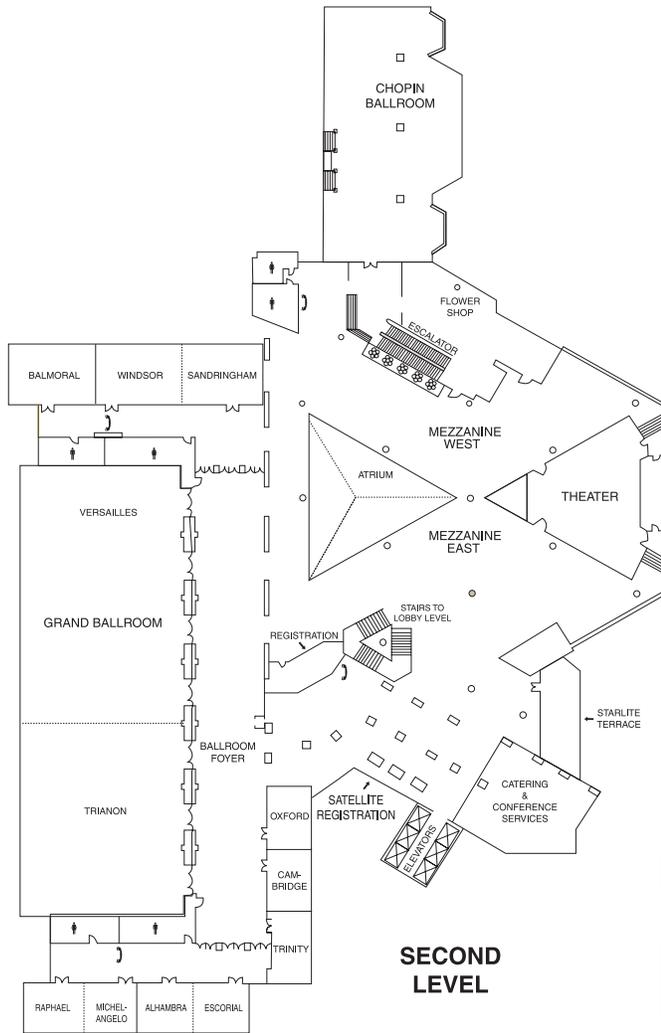
- Stay calm
- Proceed to your guestroom door and follow the Emergency Procedures listed on the back of the door.
- Stand and listen for instructions over the Hotel public address system.

If you are in other areas of the Hotel...

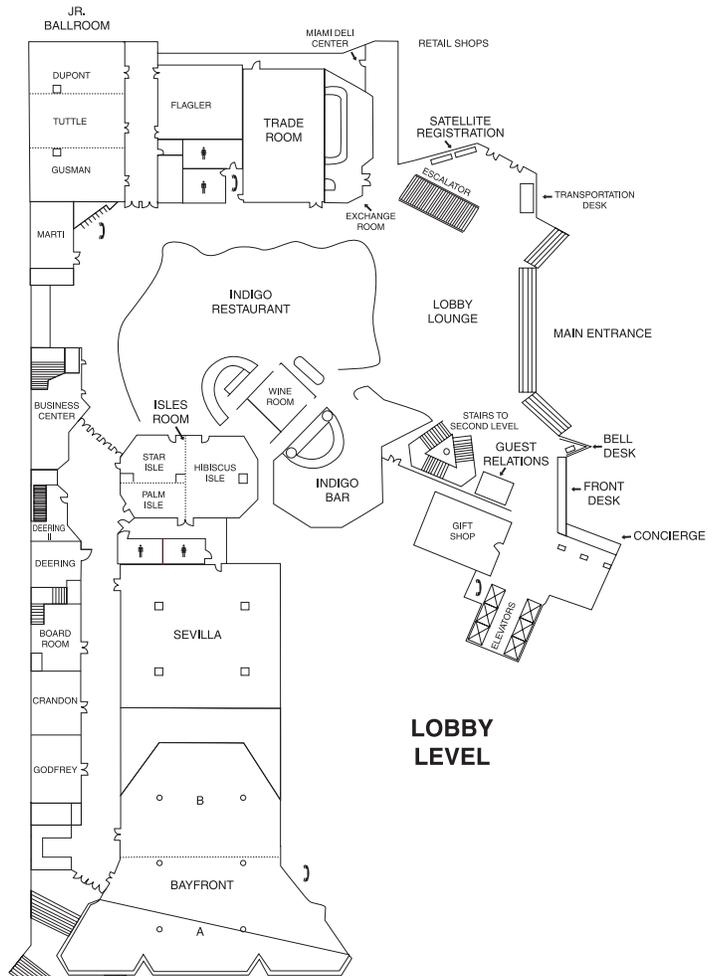
- Stay calm
- Know the location of the nearest fire exit.
- Stand and listen for instructions over the Hotel public address system.

For information on the weather, tune to the local TV or radio station or call the State of Florida Emergency Information Line at 1.800.342.3557.

InterContinental Miami Floor Plans



SECOND LEVEL



LOBBY LEVEL

Schedule at a Glance

Friday, October 14	Saturday, October 15	Sunday, October 16
<p>Technical Committee Meeting 7:00 – 7:45 a.m. • Windsor</p> <p>Beer Stability & Yeast Workshop 8:00 a.m. – 12:00 p.m. • Theater</p> <p>Beer Flavor Sensory Workshop 1:00 – 5:00 p.m. • Sevilla</p> <p>Education Committee Meeting 2:00 – 3:30 p.m. • Windsor</p> <p>Exhibits & Poster Setup 2:00 – 5:00 p.m. • Mezzanine</p> <p>Meeting Orientation 4:30 – 5:00 p.m. • Michelangelo/Raphael</p> <p>District Officers' Orientation 5:00 – 6:00 p.m. • Michelangelo/Raphael</p> <p>TQ Editorial Meeting 5:00 – 6:00 p.m. • Windsor</p> <p>President's Night Reception 7:00 – 10:00 p.m. • Poolside</p>	<p>Presenters' Breakfast 7:00 – 7:45 a.m. • Escorial/Alhameda</p> <p>Past Presidents' Breakfast 7:00 – 8:00 a.m. • Sandringham</p> <p>Opening Keynote 8:00 – 9:30 a.m. • Versailles Ballroom</p> <p>Guest Breakfast 8:00 – 11:00 a.m. • Michelangelo/Raphael</p> <p>Exhibit and Poster Viewing with Authors Present 9:30 – 10:30 a.m. • Mezzanine</p> <p>The Value of Project Management 10:30 – 11:45 a.m. • Trianon Ballroom</p> <p>Technical Session I — General Brewing 10:30 a.m. – 12:00 p.m. • Versailles Ballroom</p> <p>Exhibits, Posters, & Lunch 11:45 a.m. – 1:15 p.m. • Mezzanine</p> <p>Project Management — Project Execution in the Brewery 1:15 – 2:00 p.m. • Trianon Ballroom</p> <p>Technical Session II — Brewhouse 1:15 – 2:45 p.m. • Versailles Ballroom</p> <p>Human Resources: A Brewery Plant Manager's Survival Guide 2:00 – 2:45 p.m. • Trianon Ballroom</p> <p>Benchmarking of Utilities and Other Areas of the Brewery 3:15 – 4:00 p.m. • Trianon Ballroom</p> <p>Technical Session III — Brewing Co-Products 3:15 – 4:45 p.m. • Versailles Ballroom</p> <p>A Journey in Brewing as Captured in Fishbone Diagrams 3:30 – 5:00 p.m. • Theater</p> <p>Utility Cost Management: The Past and Future Opportunities 4:00 – 4:45 p.m. • Trianon Ballroom</p> <p>Award of Merit Lecture 5:00 – 5:30 p.m. • Versailles Ballroom</p> <p>Women in Brewing Networking Social 5:30 – 6:30 p.m. • Sandringham</p>	<p>Presenters' Breakfast 7:00 – 7:45 a.m. • Windsor</p> <p>Guest Breakfast 8:00 – 10:00 a.m. • Michelangelo/Raphael</p> <p>Technical Session IV — Yeast/Fermentation 8:00 – 10:00 a.m. • Versailles Ballroom</p> <p>Technical Session V — Packaging 8:00 – 10:00 a.m. • Trianon Ballroom</p> <p>Technical Session VI — Beer Filtration 10:15 a.m. – 12:15 p.m. • Versailles Ballroom</p> <p>Technical Session VII — Bio/Analytical Methods 10:15 a.m. – 12:15 p.m. • Trianon Ballroom</p> <p>Exhibits, Posters, & Lunch 12:15 – 2:00 p.m. • Mezzanine</p> <p>Poster Authors Present 1:00 – 2:00 p.m. • Mezzanine</p> <p>Technical Session VIII — Beer Stability 2:00 – 4:00 p.m. • Trianon Ballroom</p> <p>Closing Keynote 4:15 – 5:00 p.m. • Trianon Ballroom</p> <p>Installation of Officers and Awards Social 6:00 – 7:00 p.m. • Ballroom Foyer</p> <p>Installation of Officers and Awards Dinner 7:00 – 9:00 p.m. • Versailles Ballroom</p> <p>After Glow, sponsored in part by International Malting Company 9:00 – 11:00 p.m. • Bayfront</p>

Registration Desk — Mezzanine		Bierstube — Exchange/Trade Room	
Thursday	3:00 – 6:00 p.m.	Thursday	4:00 – 10:00 p.m.
Friday	7:00 a.m. – 4:00 p.m.	Friday	11:00 a.m. – 7:00 p.m.
Saturday	8:00 a.m. – 4:00 p.m.	Saturday	10:00 a.m. – 10:00 p.m.
Sunday	8:00 a.m. – 4:00 p.m.	Sunday	10:00 a.m. – 6:00 p.m.

Thank You Members!

Membership matters.

Without your continued support, MBAA would not be the leading brewing association it is today!

MBAA membership offers a terrific opportunity to interact with other industry professionals as well as gain practical solutions, resourceful safeguards, and innovative technologies to strengthen your ability to succeed.

MBAA members receive:

- Subscription to the MBAA *Technical Quarterly*, which includes *The MBAA Communicator*
- Opportunities to network with more than 2,500 members worldwide
- Participate in continuing education courses at a special member rate
- Attend District meetings and technical conferences
- Consult MBAA for technical support
- Save on MBAA books and CD-Roms
- Receive consultant referrals from MBAA
- Keep up-to-date through monthly member e-mail newsletters
- Publish and present your research

Not a member?

Join today!

Already a member?

Tell a colleague.

Visit the membership table during the convention or online at www.mbaa.com for details and an application.



Program Highlights

NEW!

Brewery Management Track

Join leaders in the brewing industry to discuss Human Resource, Utilities Management, and Project Management issues facing brewery managers today. Learn practical day-to-day solutions that you can apply upon return to your office.

Topics include:

- Human Resources: A Brewery Plant Manager's Survival Guide
- Utility Cost Management: The Past and Future Opportunities
- Benchmarking of Utilities and Other Areas of the Brewery
- The Value of Project Management
- Project Management — Project Execution in the Brewery

Guest Program

New in 2005 — Guests do not pay for meeting registration! MBAA will host a complimentary breakfast on Saturday and Sunday for all Guests. Saturday's breakfast will feature a representative from the Miami and the Beaches Convention and Visitor's Bureau to discuss all that Miami has to offer. Guests wishing to attend the President's Reception on Friday and the Awards & Officers Installation Dinner on Sunday, must purchase tickets at the Registration Desk in order to attend.

NEW FORMAT!

Installation of Officers and Awards Social/Dinner

Sunday, October 16 • 6:00 – 9:00 p.m.

Join us at the end of an exciting MBAA Annual Convention to celebrate the awardees and officers of MBAA at this sit-down dinner. Following dinner, join us at the After Glow party, for a relaxing night of cocktails and networking.

After Glow is sponsored in part by International Malting Company

Program

Thursday, October 13

3:00 – 6:00 p.m.	Registration	Mezzanine
4:00 – 10:00 p.m.	Bierstube	Exchange/Trade Room
8:00 – 10:00 p.m.	Executive Committee Meeting	Raphael

Friday, October 14

7:00 a.m. – 4:00 p.m.	Registration	Mezzanine
7:00 – 7:45 a.m.	Technical Committee Meeting	Windsor
8:00 a.m. – 12:00 p.m.	Beer Stability & Yeast Workshop	Theater
11:00 a.m. – 7:00 p.m.	Bierstube	Exchange/Trade Room
1:00 – 5:00 p.m.	Beer Flavor Sensory Workshop	Sevilla
2:00 – 3:30 p.m.	Education Committee Meeting	Windsor
2:00 – 5:00 p.m.	Exhibits and Poster Setup	Mezzanine
4:30 – 5:00 p.m.	Meeting Orientation	Michelangelo/Raphael
5:00 – 6:00 p.m.	District Officers' Orientation	Michelangelo/Raphael
5:00 – 6:00 p.m.	TQ Editorial Meeting	Windsor
7:00 – 10:00 p.m.	President's Night Reception	Poolside

Thursday & Friday Highlights

Beer Stability and Yeast Workshop

8:00 a.m. – 12:00 p.m. • Theater

Learn from experts in the field about the effects of yeast on beer stability. Lecture topics will include the effects of pasteurization, shear, and high-gravity fermentation on beer stability, foam, flavor, and physical stability. How yeast management techniques can be used to affect fermentation performance and beer stability, along with questions provided by the attendees will also be discussed.

Beer Flavor Sensory Workshop

1:00 – 5:00 p.m. • Sevilla

Complementing the morning workshop on “Beer Stability and Yeast” is a sensory session on beer flavor. Increase your tasting knowledge in some of the most difficult areas of taste perception, including stability and aging, trouble shooting, and flavor development.

Meeting Orientation

4:30 – 5:00 p.m. • Michelangelo/Raphael

All first-time meeting attendees are welcome to attend and discover how to take advantage of the wealth of activities offered at the annual convention. It is a great opportunity to meet members who can answer your questions and help you make the most of your meeting experience.

District Officers' Orientation

5:00 – 6:00 p.m. • Michelangelo/Raphael

All District Officers are invited to attend this orientation to learn more about the priorities of MBAA, to discuss what challenges your district is facing, and how MBAA Headquarters can assist in your operation.

President's Night Reception

7:00 – 10:00 p.m. • Poolside

Kick start your annual convention experience at the President's Night Reception. Mix and mingle with old and new friends, exhibitors, and poster authors, while enjoying light hors d'oeuvres and beverages. *In case of rain the reception will be held in the Chopin Ballroom.*

Saturday, October 15

7:00 – 7:45 a.m.	Presenters' Breakfast	Escorial/Alhameda
7:00 – 8:00 a.m.	Past Presidents' Breakfast	Sandringham
8:00 a.m. – 4:00 p.m.	Registration	Mezzanine
8:00 – 9:30 a.m.	Opening Keynote <i>A Physician's Perspective on Beer Consumption and Health</i> Laine Murphey, Vanderbilt University	Versailles Ballroom
8:00 – 11:00 a.m.	Guest Breakfast	Michelangelo/Raphael
9:30 – 10:30 a.m.	Exhibit and Poster Viewing with Authors Present	Mezzanine
10:00 a.m. – 10:00 p.m.	Bierstube	Exchange/Trade Room
10:30 – 11:45 a.m.	The Value of Project Management	Trianon Ballroom
10:30 – 12:00 p.m.	Technical Session I — General Brewing <i>Moderator:</i> Mike Sutton, General Manager of Hop Processing Operations, S.S. Steiner, Inc. O-1 Reproduction of gruit beer. K. Teramura O-2 Unraveling federal regulations governing organic products. B. Rush O-3 Portraying beer as a “good for you” drink — Possibilities and pitfalls. C. Wright	Versailles Ballroom
11:45 a.m. – 1:15 p.m.	Exhibits, Posters, & Lunch	Mezzanine
1:15 – 2:00 p.m.	Project Management — Project Execution in the Brewery	Trianon Ballroom
1:15 – 2:45 p.m.	Technical Session II — Brewhouse <i>Moderator:</i> Lars Larson, Master Brewer, Trumer Brauerei O-4 Fouling during wort boiling — Effects on wort quality. J. Voigt O-5 The wort stripping technology to save energy — Targets and new industrial results. B. Bonacchelli O-6 Zero emission from the brewhouse. T. Buehler	Versailles Ballroom
2:00 – 2:45 p.m.	Human Resources: A Brewery Plant Manager's Survival Guide	Trianon Ballroom
2:45 – 3:15 p.m.	Refreshment Break	
3:15 – 4:00 p.m.	Benchmarking of Utilities and Other Areas of the Brewery	Trianon Ballroom
3:15 – 4:45 p.m.	Technical Session III — Brewing Co-Products <i>Moderator:</i> Rick Brundage, Industry Technical Consultant, Food & Beverage Industry O-7 Brewery wastewater — A source of renewable energy. J. Van Voorhis O-8 Treatment of brewers' spent grain: Upgrading by-products. K. Schwencke O-9 Dissolved O ₂ in packaged beer and brewery CO ₂ self-sufficiency. M. Holterman	Versailles Ballroom
3:30 – 5:00 p.m.	A Journey in Brewing as Captured in Fishbone Diagrams	Theater
4:00 – 4:45 p.m.	Utility Cost Management: The Past and Future Opportunities	Trianon Ballroom
5:00 – 5:30 p.m.	Award of Merit Lecture <i>Still Crazy About Brewing After All These Years</i> Finn Knudsen, Beverage Consult International, Inc.	Versailles Ballroom
5:30 – 6:30 p.m.	Women in Brewing Networking Social	Sandringham

Saturday Highlights

Opening Keynote — A Physician's Perspective on Beer Consumption and Health

Laine Murphey, MD, PhD, Vanderbilt University

8:00 – 9:30 a.m. • Versailles Ballroom

The health effects of mild to moderate alcohol consumption have been appreciated for several years. This presentation reflects on the experience and perspective of the physician on how beer consumption, in particular, affects human health. Dr. Murphey has been a home brewer for more than 10 years. Recently, he contributed to the development and brewing of a Ninkasi beer, based upon the ancient Sumerian “Song of Ninkasi,” which went on to win a gold medal at the 2003 Great American Beer Festival in the experimental category.

Dr. Murphey received his undergraduate degree from Oregon State University, during which time he also attended the Université de Poitiers, France, as an exchange student. He matriculated at the Oregon Health Sciences University in 1988 as the Medical Research Foundation of Oregon Scholar in the joint MD/PhD program. He pursued his doctorate in pharmacology with George D. Olsen, MD on the neonatal respiratory pharmacology of active morphine metabolites. He graduated with medical and graduate degrees in 1995, at which time he moved to Vanderbilt University, where he was an intern and resident in internal medicine from 1995 to 1998. Following residency, he was a fellow in clinical pharmacology at Vanderbilt from 1998 to 2000 with Nancy J. Brown, MD studying the human in vivo metabolism of the peptide hormone bradykinin. He joined the faculty of the Vanderbilt University School of Medicine in 2000, where is currently an assistant professor of medicine and pharmacology in the Division of Clinical Pharmacology. Dr. Murphey's research interests in the fields of hypertension and cardiovascular disease include the contribution of kinins to the mechanisms of action of angiotensin converting enzyme inhibitors and angiotensin receptor blockers; the contribution of the renin angiotensin system to oxidative stress and lipid peroxidation in human hypertension; and the development of bradykinin metabolites as novel anti-platelet agents for treatment of cardiovascular disease. He has published more than 30 peer-reviewed manuscripts and reviews, is a member of the editorial board for the International Journal of Clinical Pharmacology and Therapeutics and is a peer reviewer for several journals, including the American Journal of Physiology, Clinical Pharmacology & Therapeutics, and the Journal of Pharmacology and Experimental Therapeutics. He is also a member of several professional societies, including the American College of Physicians and the Council for High Blood Pressure Research of the American Heart Association. Dr. Murphey has been a home brewer for more than 10 years. Recently, he contributed to the development and brewing of a Ninkasi beer, based upon the ancient Sumerian “Song of Ninkasi”, which went on to win a gold medal at the 2003 Great American Beer Festival in the experimental category. He lives in Nashville with his wife and son.

The Value of Project Management

Lou Gedansky, Ph.D., PMI Director, Governance and Executive Programs, Newtown Square, PAP

10:30 – 11:45 a.m. • Trianon Ballroom

Join Lou Gedansky, director, governance and executive programs, from the Project Management Institute (PMI) in a lively discussion about the value of project management and how organizations are leveraging it to achieve results, along with the role that PMI is playing to advance and communicate it. The presentation will touch upon an understanding of project management, its current level of acceptance, the benefits being realized from it, the potential for its additional growth and application, and the challenges for its

future. In covering those topics, information will be shared about the actions being taken by PMI to support the practice of project management, its acceptance by various organizations, and the ever-expanding list of businesses, government agencies, and other organizations utilizing it. Come prepared to share your own thoughts and ask your questions about the current and future value of project management.

Lew Gedansky is director, governance and executive programs, for the Project Management Institute (PMI). He has been on the staff of PMI for more than 8 years. Prior to joining PMI, Lew spent 27 years in the paper industry, mostly in project and program management. During this time, Lew focused primarily on product and process development and commercialization and on technology strategy and integration. With an educational background in chemistry, Lew earned his bachelor's degree from Union College in Schenectady, NY, and both of his graduate degrees from Carnegie-Mellon University in Pittsburgh, PA. Lew has served as the PMI research manager, PMI standards manager, PMI educational foundation manager, and the primary information resource for the PMI Knowledge & Wisdom Center. Also, in a prior role as director, center for operational excellence, Lew provided overall leadership, management, and facilitation for PMI's Global Operations Center's enterprise-wide initiatives involving operational best practices and solutions to major new market and customer-driven needs. In his current role, Lew reports to the CEO of PMI and works with the Board of Directors, staff executives, other personnel, and other volunteers on a variety of programs pertaining to organizational governance and executive operations. Lew is a member of the American Society of Association Executives and the Delaware Valley Society of Association Executives.

Project Management — Project Execution in the Brewery

David Kapral, Assistant Brewmaster Retired, Active Project Consultant

1:15 – 2:00 p.m. • Trianon Ballroom

Developing a project that will affect an operating brewery requires detailed knowledge of current processes and their limitations. It will involve competition for funds and skills to support the effort. Medium to large projects can have a dramatic effect on the plant, the community, and even the organization. This session will discuss successful project preparation, successful project execution, how to select your team, how to manage the money, close out strategies, and how to appreciate the effects of your change.

Since joining Anheuser-Busch in 1968, David Kapral has been closely involved in project management. In the early 1990s, David was responsible for increasing the capacity of the A-B brewhouse. David and his team were able to increase brew size from 690 bbl/brew to 850 bbl/brew, while increasing yield by 4% with minimal capital investment. In 2001, his project management involvement was culminated by his appointment as brewing project manager for a \$65mm project to modernize Anheuser-Busch's Baldwinsville, New York grains unloading, brewhouse, and fermenting operations. In 2003, David retired from his position as assistant brewmaster at A-B. He is currently living with his family in Boise, Idaho, where he works as a technical consultant to the brewing industry. He is actively performing beer schools and has participated in a beer-related radio talk show for A-B's Wholesaler in Boise.

Human Resources: A Brewery Plant Manager's Survival Guide

Tim Saggau, Sr. Human Resource Manager, Anheuser-Busch
2:00 – 2:45 p.m. • *Trianon Ballroom*

Human resources are very much a part of daily management. Today's brewer and/or plant manager often spend more time on "people" issues than on process issues. This presentation will discuss several topics to assist plant management with the "people" focus. Topics covered will be hiring, performance management, employee benefits, labor, and training. The rules have changed. Learn how you can again gain control of human resource issues in front of you.

Tim Saggau has worked within Anheuser-Busch for over 25 years in the human resources department. Prior to his current position in Jacksonville, Tim has worked at the St. Louis, Tampa, Merrimack, and Newark facilities. Tim's experience includes training, FMLA, contract negotiations, human resource generalist, and human resource management. Tim received his degree in Criminology from Florida State University and lives in the Jacksonville area with his wife Deborah and their six children.

Benchmarking of Utilities and Other Areas of the Brewery

Alexander E. Othmer, CEA/CBA/NDE III, Energy and Management Services

3:15 – 4:00 p.m. • *Trianon Ballroom*

Join a recognized energy expert to learn about the latest techniques employed to install and/or retrofit existing lighting, HVAC, and other processing systems with alternative and sustainable energy sources. Systems to be discussed include Daylight Harvesting Systems, Solar Heating and Cooling Systems, Geothermal Systems, Heat Reclaim Systems, as well as conventional conservation measures. All the technologies discussed are off-the-shelf systems that are readily available through a variety of suppliers with proven track records. Bring back practical skills that will produce repeatable results with a simple pay back on investment in 2 to 7 years.

Alexander Othmer created and is the CEO of Energy and Management Services. His 5 decades of "real world" experience as a certified business analyst, U.S. Department of Energy certified energy auditor, environmental auditor, OSHA inspector and nondestructive testing failure analyst create a unique package to service any client's needs. As a recognized expert on the practical use of solar and other modern energy conservation measures, he has been published by leading universities and trade journals worldwide, such as the University of Florida, Florida Energy Extension Service (A Profile of Energy Use in Restaurants, 1992), The Center for the Analysis and Dissemination of Demonstrated Energy Technologies (CADET result 251, August 1996), Environmental Design & Construction magazine (The Art of Daylighting, January/February 1998), and Texas A&M University's 12 Symposium on Improving Building Systems in Hot and Humid Climates (Physical Surveys of over 300 Buildings in Hot and Humid Climates Indicate Material/Design Performance Flaws Exist in Comparison to Expected Results Using Nationally Accepted Standards, May 2000).

A Journey in Brewing as Captured in Fishbone Diagrams

Greg Casey, President, American Society of Brewing Chemists
3:30 – 5:00 p.m. • *Theater*

The upcoming publication *Brewing Chemistry & Technology in the Americas*, will contain over 100 "fishbone" diagrams dealing with a wide variety of product quality and brewery productivity parameters. The fishbone diagrams are structured to reflect the importance of aligning and optimizing gauge and product design consider-

ations with equipment design and operation in enabling the people of the malting and brewing industries to achieve process control. A series of flavor stability fishbone diagrams, structured by gauge, design, and equipment and sequential malting, brewing, packaging and distributing processes, will be presented.

Greg Casey, born and raised in Toronto, Canada, graduated from the University of Guelph in 1979 with a B.Sc. degree in applied microbiology, continuing on to obtain a Ph.D. degree in 1984 in applied microbiology at the University of Saskatchewan (thesis: Ethanol Tolerance of Brewers Yeast in High Gravity Brewing). Following 2 years as a NATO postdoctoral scientist at Carlsberg Laboratories in Copenhagen researching yeast chromosome fingerprinting and diacetyl production by lager yeasts, he returned to the University of Saskatchewan as an assistant professor in the Food Biotechnology Department (1986–1987). Since then Greg has been employed as a senior research scientist with Anheuser-Busch in Saint Louis (1987–1991), senior project leader in charge of the Strain Development Laboratory at Red Star Yeast and Products in Milwaukee (1991–1992), and senior director responsible for the Corporate Laboratories at the Stroh Brewery Company in Detroit (1992–1999). Greg joined Coors Brewing Company in April 1999 and since that time has served in the capacities of director of corporate quality assurance (1999–2003), director of brewing R&D (2002–2003), director of brewing services technical support (2003–2004), and since May 2004, director of brewing services.

Utility Cost Management: The Past and Future Opportunities

Greg Kellerman, Senior Director of Operations, Utilities, Anheuser-Busch Companies, Inc.

4:00 – 4:45 p.m. • *Trianon Ballroom*

Utility costs have a significant impact on your company's bottom line. In the past five years, utility price increases encompass the leading factors in increased production cost pressure. The near and long term future potential, although mixed, looks not to break this trend. This presentation will show how good business focus using benchmarking tactics can produce a focus to reduce costs and high-light emerging technologies that appear to have potential to make inroads to these cost pressures.

Greg Kellerman graduated from the University of Missouri-Rolla, magna cum laude, and since then has been with Anheuser-Busch. Greg spent his first 8 years with Anheuser-Busch in the Central Engineering Department performing equipment and process installations at many of the 12 domestic breweries. In 1989, Greg transferred into the Brewery Operations Division with his initial assignment at the Fort Collins Colorado brewery. After 4 years at Fort Collins, Greg transferred to the Cartersville Georgia Brewery as part of the brewery's initial startup in 1993. During his brewery assignments, Greg served in engineering/maintenance, packaging, and operations management positions. Greg became plant manager of the Cartersville facility in 1998 and remained in that role prior to transferring to the corporate operations staff in 2001. In his current position, Greg is responsible for the utilities, residual, and wastewater operations for all domestic brewery locations.

Award of Merit Lecture — Still Crazy About Brewing After All These Years

Finn Knudsen, Beverage Consult International, Inc.

5:00 – 5:30 p.m. • *Versailles Ballroom*

This presentation reflects on the various experiences with brewing technology and business developments by a chemical engineer who happened to be drawn into the international brewing industry more

than 40 years ago. A passion for brewing and its related technologies was born that day and started a continuous search for improvements in existing and new brewing technologies allowing work on numerous technical and brewery projects around the world from different home bases in Denmark, Canada, Sweden, and the U.S.A.

Some of the challenges and experiences presented deal with changes in the brewing technologies while working in different environments and also include some of the pleasures and dangers of international travel. Suggestions for new opportunities in brewing technologies will also be presented while keeping one goal in mind, namely how best to improve the international beer business and of course the healthy beverage we all love — a good beer! *Finn B. Knudsen has more than 30 years of experience working in the brewing and beverage industry from various management positions at Tuborg Breweries, Rainier Brewing Company, Molson Breweries of Canada, Danbrew Consult Ltd. (Carlsberg), Coors Brewing Company, and Pripps Breweries. Finn also has*

worked with several universities during his career, such as giving lectures to graduate students in waste control at the University of Washington. In 1993, Finn founded and became president of Beverage Consult International, Inc., Colorado, providing management and technical services to the beverage industry worldwide. In 1995, he was also appointed the president for the newly established American Region, New Zealand Hops Ltd., supporting the sales and services of the New Zealand Hop Products primarily in the Americas. He has served as chair for and on the MBAA Technical Committee for many years.

Women in Brewing Networking Social

5:30 – 6:30 p.m. • Sandringham

Over the past 30 years, the number of women in the brewing industry has grown substantially. Women working in the industry are invited to attend for this informal networking session.

Sunday, October 16

7:00 – 7:45 a.m.	Presenters' Breakfast	Windsor
8:00 – 10:00 a.m.	Guest Breakfast	Michelangelo/Raphael
8:00 a.m. – 4:00 p.m.	Registration	Mezzanine
8:00 – 10:00 a.m.	Technical Session IV — Yeast/Fermentation <i>Moderator:</i> Ray Kanzleiter, Corporate Brewing Manager, Miller Brewing Company	Versailles Ballroom
	O-10 Consideration concerning the decrease of hydrogen sulfide content observed in the final stage of fermentation. T. Hayashi	
	O-11 Yeast flocculation: A review of flocculation and how to control it in the brewery. J. Caudill	
	O-12 Coping with cold: Brewing yeast sensing and responses to low temperatures. K. Smart	
	O-13 Oxygen enhanced fermentation. P. Takacs	
8:00 – 10:00 a.m.	Technical Session V – Packaging <i>Moderator:</i> Roy Johnson, Beverage Sales Manager, Tuchenhausen Flow Components, LLC	Trianon Ballroom
	O-14 Approaches to the high-quality, highly effective bottling line restructuring. M. Suzuki	
	O-15 The maintenance system to guarantee the stable operation with one operator per one watch. J. Tanaka	
	O-16 Bottle-conditioned beer from laboratory trials to commercial production. D. Prentice	
	O-17 The life and times of a beer keg: Use cycle, tracking, and ergonomics. L. Larson	
10:00 – 10:15 a.m.	Refreshment Break	Ballroom Foyer
10:00 a.m. – 6:00 p.m.	Bierstube	Exchange/Trade Room
10:15 a.m. – 12:15 p.m.	Technical Session VI — Beer Filtration <i>Moderator:</i> Fred Havel, Development Brewer, Molson	Versailles Ballroom
	O-18 Full-scale results of second generation beer membrane filtration. R. Schuurman	
	O-19 Crossflow membrane filtration of beer with ceramic membranes: Chances and limitations of the technology. J. Zuber	
	O-20 Crossflow filtration in the brewery—New concept for safe and economical beer filtration. A. Modrok	
	O-21 Twin flow system: The new generation of precoat filtration. A. Fratianni	
10:15 a.m. – 12:15 p.m.	Technical Session VII — Bio/Analytical Methods <i>Moderator:</i> Xiang Yin, Technical Manager, Prairie Malt Ltd.	Trianon Ballroom
	O-22 Using genetics to tame the west for malt barley. T. Blake	
	O-23 Development of a DNA microarray method for the identification of beer-spoilage microorganisms. K. Hatanaka	
	O-24 A comparison between the instrumental measurement of head retention/lacing and perceived foam quality. J. Roza	

	O-25 A novel analytical method for determining the quality of retail beverage gases. C. Duffell	
12:15 – 2:00 p.m.	Exhibits, Posters & Lunch	Mezzanine
1:00 – 2:00 p.m.	Poster Authors Present	Mezzanine
2:00 – 4:00 p.m.	Technical Session VII — Beer Stability <i>Moderator:</i> George F. Reisch, Brewmaster, Anheuser-Busch Inc.	Trianon Ballroom
	O-26 The influence of process parameters on beer foam stability. G. Stewart	
	O-27 CSS combined beer stabilization. A. Jany	
	O-28 The study of haze formation in freshly packaged and stored beers. D. Parker	
	O-29 Perceptions of beer haze. C. Bamforth	
2:00 – 5:00 p.m.	Exhibit & Poster Takedown	Mezzanine
4:00 – 4:15 p.m.	Refreshment Break	Ballroom Foyer
4:15 – 5:00 p.m.	Closing Keynote <i>Beer's Place at the Dinner Table: The Image of Beer Today and Tomorrow</i> Paul Hegarty, Coors Brewers Ltd.	Trianon Ballroom
6:00 – 7:00 p.m.	Installation of Officers and Awards Social	Ballroom Foyer
7:00 – 9:00 p.m.	Installation of Officers and Awards Dinner	Versailles Ballroom
9:00 – 11:00 p.m.	After Glow <i>Sponsored in part by International Malting Company</i>	Bayfront

Sunday Highlight

Closing Keynote — *Beer's Place at the Dinner Table:*

The Image of Beer Today and Tomorrow

Paul Hegarty, PhD, Coors Brewers Ltd.

4:15 – 5:00 p.m. • Trianon Ballroom

UK beer sales have declined significantly over the past 25 years as drinkers turn to other drink categories, such as wine. Brewers need to make the image of beer attractive to modern consumers and ensure that beer “surprises and delights” drinkers at the point of purchase. Learn about how Coors Brewers have carried out a 3-year campaign, “Beer Naturally,” to enhance the perception and quality of beer in the UK.

Paul Hegarty is head of external communications for Coors Brewers Ltd., based in Burton on Trent. Coors Brewers is a subsidiary of Molson Coors and is the second largest brewer in the UK with a brand portfolio that includes Carling lager, Grolsch, and Coors Fine Light Beer. Paul is a biochemist with a Ph.D. degree in plant biotechnology from Sheffield University. He joined the company in 1986 working in various technical roles covering quality, research and innovation, and consumer science. He joined the Communication Department in 2001 and is responsible for managing all aspects of Coors external corporate communication including the Coors "Beer Naturally" Campaign.

NEW FORMAT!

Installation of Officers and Awards Social/Dinner

Sunday, October 16 • 6:00 – 9:00 p.m.

Join us at the end of an exciting MBAA Annual Convention to celebrate the awardees and officers of MBAA at this sit-down dinner. Following dinner, join us at the After Glow party, for a relaxing night of cocktails and networking.

After Glow is sponsored in part by International Malting Company

Monday, October 17

8:00 – 12:00 p.m. Board of Governors

Windsor



MBAA invites you to attend the
World Grains Summit: Foods and Beverages...
*bringing together the grains-based
food and beverage community.*

Don't miss this opportunity to discuss with experts evolving products, ingredients, advancing technologies, scientific and technological progress, and the future of the grain-based foods and beverages industries.

Scientific Program includes:

Plenary Sessions covering the issues and challenges facing the industry today.

•
Comprehensive Technical Program featuring a specially designed beverages track, and grain-based foods product tracks.

•
Poster Sessions focusing on relevant topics in an informal setting.

•
Exhibits, networking, and more!

September 17-20, 2006
The Moscone Convention Center
San Francisco, California U.S.A.



<http://meeting.mbaa.com>

Abstracts

Oral Presentations

O-1

Reproduction of gruit beer

Presenter: Koji Teramura, Kirin Brewery Co., Ltd., Yokohama, Japan

Coauthors: Etsuji Tawada, Kirin Brewery Co., Ltd.; Karl Wackerbauer, University of Technology of Berlin; Motoo Ohkochi, Kirin Brewery Co., Ltd.

Until hops became the main additive of beer, a beer using a blend of savory herbs was popular in medieval Europe. It was called “gruit beer”, but no one today knows what it tasted like. We recently reproduced the beer ourselves to discover its flavor. We used oat, wheat, and barley malt in the reproduction process. We had great difficulty acquiring “sweet gale” (*Myrica gale*), an essential herb for gruit beer, because it has become rare in nature and there are restrictions on taking it. However, we finally managed to obtain it from Scotland. Eventually, we selected 36 different types of herbs, such as sweet gale, ground ivy, and anise. As for yeast, we used a top-fermenting yeast. In laboratory tests and a pilot experiment on a 200-L scale, the procedure for saccharification, fermentation, and the final selection of herbs and their quantities were determined. In the actual brewing process, we used wooden casks for the brewing and fermentation, as well as a copper coolship, to reproduce medieval brewing techniques. We also stirred the brew by hand, which was the traditional method in those times. The reproduced gruit beer has an alcohol content of 8% and an original extract of 20°P. It has a bittersweet taste and is rather stout and strong. The “top note” of sweet gale is perceived when the drink is first smelled, and the savory herbs give the brew a distinctive taste. Although the contents of 4-VG and diacetyl are high, they are not noticeable as the taste is masked by the savory herbs. Gruit beer is very different from pilsner, the mainstream beer today, but it seems suitable for modern tastes. We could gain a deeper insight into the influences of microbiological processes on a balanced flavor and a certain flavor stability of the beers. According to today’s knowledge about spontaneously fermented beers, they must have something in common, such as by-products of *Lactobacillus* and *Brettanomyces* strains beside those of regular top-fermenting yeasts. Even in those times the content of air (oxygen) must have had a decisive influence on flavor and flavor stability, certainly without brewers having been aware of it at all.

Koji Teramura joined Kirin Brewery Co., Ltd. in 1978. He worked for the barley breeding section for 15 years and worked for the malting section at the Fukuoka Plant of Kirin Brewery for 6 years. Koji has been engaged in the research laboratory for brewing since 1999.

O-2

Unraveling federal regulations governing organic products

Presenter: Brad Rush, Briess Malt & Ingredients Co., Chilton, WI

Once available only through specialty outlets, organic products are fast becoming part of mainstream America. And while still a small and an untracked portion of the \$10 billion and growing organic foods industry, the organic beer segment offers exciting opportunities for many brewers looking for growth potential and support of wholesome lifestyle choices. Successfully brewing and selling organic beer, however, requires a good knowledge and understanding of the local market as well as availability and cost of organic ingredients. Most important, however, is the need to understand and apply complex federal regulations that govern the marketing of all organic products in the United States. This presentation will unravel USDA National Organic Program regulations that govern the production, handling, labeling and certification of organic ingredients. It will explain the federal definition of “organic”, discuss the different ways to label organic products, and walk through the process of selecting a third-party certifying agency. Participants will leave this presentation with a basic understanding of federal organic regulations; why it is important to make labeling and distribution decisions prior to selecting a certifying agency, selecting suppliers and formulating a beer; and better understand the audit trail that follows ingredients from supplier through the brewery and to the retailer. Resources available will also be discussed.

Brad A. Rush received a Bachelor of Science degree in environmental analysis from Carroll College, Waukesha, Wisconsin, and is a graduate of the quality engineering program at the Milwaukee School of Engineering. Brad has worked as a brewer and in research and operations at Leinenkugel and Miller Brewing Companies. Since 2002, Brad has been manager of quality, safety, health & environmental at Briess Malt & Ingredients Company, Chilton, Wisconsin. He is an active member of the MBAA. He is past president of the MBAA District Milwaukee and was a member of the 2003 MBAA Convention Committee. Brad is a former member of the American Society of Brewing Chemists and officer of the ASBC Milwaukee/Chicago Section.

O-3

Portraying beer as a “good for you” drink—Possibilities and pitfalls

Presenter: Christine Wright, Department of Food Science and Technology, University of California, Davis, CA

Author: Charles Bamforth, Department of Food Science and Technology, University of California, Davis, CA.

The wine lobby has hardly been hesitant in championing the cause of moderate wine consumption as a component of a healthy lifestyle. Brewers have been more reticent about their product, despite ample evidence that beer is likely at least the equal of wine in terms of its impact on the body. Is this reticence advisable or is the stance overly cautious?

Christine Wright graduated from the University of Wyoming in 1994 with a degree in chemistry. She worked as a chemist for 9 years before returning to graduate school at UC Davis. She is currently pursuing a master's degree in food science, with an emphasis on malting and brewing.

O-4

Fouling during wort boiling—Effects on wort quality

Presenter: Jens Voigt, Technical University Munich Weihenstephan, Freising, Germany

Wort heating and boiling is influenced by the degree of fouling, which leads to differences in the quality of the product in a series of batches. Trials in industrial plants were carried out to identify the impact of fouling in modern boiling systems. Wort quality changes were observed over a series of brews without intermediate cleaning. The thermal load on the wort increased due to the heating profile, which was adapted in order to compensate for decreasing heat transfer caused by fouling. Different temperatures and heating regimes were applied. The wort color, aroma compounds, and nitrogen composition were analyzed. The ways to overcome the problem of changing wort quality differences are described.

Jens Voigt received a degree as diploma engineer (M.Sc.) in brewing and beverage technology from TU München–Weihenstephan, Germany, in 1985. Jens started his career with A. Steinecker GmbH, Freising, as a technical engineer in brewhouse and fermentation and filtration equipment. He held positions of sales and product and manager with Steinecker until 1995. From 1988 until 1992, he received his doctorate in brewing technology on beer foam from Weihenstephan (Prof. Dr. Narziss). In 1996, he joined Doemens Brewing School in Munich, Germany, as managing director. In late 1997, he joined Heinrich Huppmann GmbH, Kitzingen, Germany, as key account manager for brewery equipment and was managing director of brewmaxx, supplier of software solutions for the brewing industry. Since early 2004, Jens has been a research associate with Prof. Dr. Karl Sommer at Lehrstuhl für Maschinen- und Apparatekunde (Chair for Mechanical Engineering & Process Technology) at the WZW (Wissenschaftszentrum Weihenstephan) (Center of Life Science, Weihenstephan). He is a member of the IGB and a member of the Editorial Board and referee for papers in the Journal of the Institute of Brewing (JIB).

O-5

The wort stripping technology to save energy—Targets and new industrial results

Presenter: Bruno Bonacchelli, Meura Technologies, Louvain la Neuve, Belgium

Coauthors: Rafael Tigel, Meura Technologies, Louvain la Neuve, Belgium; Frédérique Harmegnies, Meura Technologies, Louvain la Neuve, Belgium; Lionel Michelet, Meura, Péruwelz, Belgium; Benoit Formesyn, Inbev, Louvain, Belgium

In breweries, the boiling step alone can represent up to 30% of the total process energy cost of packaged beer and up to 50% of the needs for energy in only the brewhouse. Recent mashing-in, mashing, and wort filtration technological developments have allowed the production of high-gravity wort while still reaching the laboratory extraction yield. This can be achieved even without collecting weak wort as mashing liquor. Evaporation is therefore not needed anymore. The whole world is nowadays focused on energy savings in order to reach ecological targets, such as the Kyoto protocol. On the other hand, industries more and more have to meet a quality level requirement for their products. We have developed an industrial system combining moderate boiling with an efficient wort stripping of unwanted volatile compounds. Trials have first been carried out at a pilot scale (3 hL/h) in a pilot brewery. Then, a pilot stripper has been used in different industrial brewing environments. After validating the method, a whole industrial plant, for batches of 500 hL, has been commissioned. Industrial results will be presented and compared with results coming from a classical boiling system. Figures such as energy savings, wort characteristics (volatiles content, color, aldehydes, furfural), and beer characteristics (foam stability, aging) will be discussed. Capacity of that kind of a boiling system to achieve the tasks of conventional boiling (except for evaporation) will also be discussed: inactivation of enzymes, sterilization of wort, extraction of hop compounds, isomerization of alpha acids, coagulation of protein, pH decreasing, and formation of reductions.

Bruno Bonacchelli studied chemistry and biotechnology engineering at the University of Liège, Belgium. He then worked for 2 years on a collaboration between Meura s.a. (Belgium) and the CWBI (Centre Wallon de Biologie Industrielle) in research for beer filtration using regenerable filter aid. Bruno has been working for 8 years at Meura Technologies, R&D department of Meura s.a., on different topics such as fine milling under water, continuous brewing, clean steam injection, mash filtration, continuous boiling and stripping, and fermentation monitoring. At the same time, he contributes to the commissioning of industrially scaled-up new technologies designed by Meura.

O-6

Zero emission from the brewhouse

Presenter: Thomas Buehler, Huppmann GmbH, Kitzingen, Germany

Coauthor: Rudolf Michel, Huppmann GmbH, Kitzingen, Germany

Today, odor emissions from the brewhouse are less and less accepted by neighbors and environmental regulations. In densely populated areas, breweries are even forced to achieve zero odor emission. Several proposals have been made on how this goal can be achieved, and some plants have even been built. Incineration, biogas filter, and washing systems of the vapors have been realized. This paper will present a survey of different possibilities put in place, and it will look at their design and efficiency levels. At Grolsch Brewery in the Netherlands, Huppmann built a zero emission brewhouse based on vapor incineration. The vapors from the major evaporation steps, such as the wort kettle, mash kettle, and whirlpool, are connected via a specially designed venting system to the biogas burners of the steam generation plant. This paper will present the design and practical experience of this system.

Thomas Buehler started brewing with an apprenticeship as a brewer and maltster. In 1991, he graduated with a Diplom-Ingenieur in brewing from Technical University of Munich-Weihenstephan. From 1991, Thomas was a scientist at BRI, Nutfield, England. In 1995, he started as manager of training and technology at APV, Dortmund, Germany. Thomas graduated with a Ph.D. degree in chemical engineering from Loughborough University, England in 1997. From 1996 until 2003, he was managing editor for Brauwelt at Fachverlag Hans Carl, Nuremberg, Germany. Currently, Thomas is director of marketing at Huppmann AG, Kitzingen, Germany.

O-7

Brewery wastewater—A source of renewable energy

Presenter: Jeff Van Voorhis, Triad Engineering Incorporated, Milwaukee, WI

Coauthor: Dennis Totzke, Applied Technologies Inc., Brookfield, WI

The brewing process generates a unique, high-strength wastewater as a by-product. The wastewater typically has a high concentration of biochemical oxygen demand (BOD) from the carbohydrates and protein used in brewing beer. Brewery wastewater usually has a warm temperature (greater than 100°F). The high level of soluble BOD and the warm temperature make brewery wastewater an ideal substrate for anaerobic treatment. Anaerobic treatment of brewery wastewater is a proven process. More than 250 full-scale systems are operational worldwide. Anaerobic wastewater treatment systems generate an alternative fuel source known as biogas. Biogas is similar to natural gas but has a lower BTU value, contains more moisture, and often has contaminants such as H₂S. Biogas is a unique substance that must be handled with safety. Specific guidelines and standards should be followed for the safe handling of biogas. In this presentation, types of biogas handling equipment, materials of construction, and application highlights will be discussed. There are many applications for utilizing biogas instead of disposing of it with a flare. One of the most common applications of biogas use is as a fuel in boilers. Since anaerobic digestion systems require a heat source, biogas can be a free fuel. Biogas can also be blended with natural gas for use in production plant boilers. Heating equipment variations will be presented and discussed. Biogas can also be used to generate electricity. With energy costs at an all-time high, alternative fuel sources, especially “green power”, are in demand. Equipment such as internal combustion engines, microturbines, Stirling Cycle engines, fuel cells, and absorption chillers are specifically designed to transform biogas into power. The pros and cons of this equipment will be presented. Biogas handling and utilization equipment can be expensive. The interest in the utilization of biogas is evident by the increasing sources of funding available for private and public projects of this nature. Major sources of funding will be listed for interested parties. With funding assistance and proper equipment selection and engineering, biogas utilization can be a cost-effective means of developing green energy.

Jeff Van Voorhis is a senior project manager with Triad Engineering Incorporated, with responsibility for industrial wastewater business development and project management. Jeff is a member of the MBAA District Milwaukee. His primary area of expertise is with design engineering and project management for industrial wastewater treatment projects in the food processing industry. He also has experience leading renewable energy projects. Jeff has extensive experience working on many phases of beverage industry projects, such as treatability studies, waste minimization studies, process designs, and construction-related services. Jeff is a Wisconsin native who earned a B.S. degree in civil engineering from Purdue University and an MBA degree from Marquette University.

O-8

Treatment of brewers' spent grain: Upgrading by-products

Presenter: Kirsty Schwencke, Heineken, Zoeterwoude, Netherlands

Coauthors: Gerald Zanker, Brau Union Österreich, Graz, Austria; Paul Bruijn, Heineken, Zoeterwoude, Netherlands; Onno Snip, Heineken, Zoeterwoude, Netherlands

Spent grains represent the larger part of the breweries' by-products (ca. 18 kg/hL beer). If possible, spent grains are sold as cattle feed. From an economical and ecological point of view, this can be considered an optimal solution. However, this outlet is not applicable in areas where there is no cattle. For this reason, alternatives are under investigation to ensure a sustainable worldwide outlet for the spent grains. Heineken has developed a straightforward and flexible process that separates spent grains into two different product categories: proteins and fibers. The protein product is rich in proteins and fats and low in fiber, which makes it suitable as nonruminant animal feed (e.g., pigs and poultry). The fiber product is high in fibers and low in proteins and can be used for sustainable thermal energy generation. This presentation addresses the process characteristics, the quality of the protein, and the fiber product, as well as the economical evaluation of the process.

In 2001, Kirsty Schwencke graduated as a food science technologist from the Wageningen University and Research Centre in the Netherlands. Since 2002, she has executed several international projects within Heineken, in brewing and in packaging. Currently, Kirsty is working as project leader on the Brewers' Spent Grains Treatment project in the R&D department of Heineken Technical Services.

O-9

Dissolved O₂ in packaged beer and brewery CO₂ self-sufficiency

Presenter: Menno Holterman, Haffmans BV, Venlo, Netherlands
Coauthors: Ivan Williams, Haffmans BV, Venlo, Netherlands; Dan Gruber, Haffmans North America

Carbon dioxide (CO₂) gas recovery and its use is demanding more attention within breweries worldwide. CO₂ added to the breweries' final product during total beer processing (carbonation, counter pressure, push gas, and final packaging) is in fact the fifth ingredient. Quality requirements are more stringent and thus CO₂ must be purer than ever to avoid the addition of oxygen, which can lead to flavor imbalance and reduced beer shelf life. Breweries are finding that the use of "bought-in" CO₂ can lead to quality issues. The use of "bought-in" CO₂ can leave the brewery dependent on a third party for this key ingredient. Faced with quality and quantity issues related to CO₂ supply, Haffmans BV, on behalf of brewers worldwide, have developed and implemented new technology for retro-fitting existing CO₂ recovery systems, to improve CO₂ quality with the added benefit of recovering more CO₂ as compared with traditional CO₂ recovery systems. In fact, Haffmans technology is giving brewers the opportunity to optimize CO₂ management and to become self-sufficient. As a result of this new technology, the oxygen pick-up in the finished product due to CO₂ can be reduced to lower than 0.001 ppm. In addition, breweries can yield up to 40% more CO₂ and easily become self-sufficient. In many instances, breweries are able to produce such a surplus of high-quality food-grade CO₂ from their own source that they can sell CO₂ in return for secondary revenue. Haffmans intention is to present a paper based on the outcome of recent case studies, which will give brewers worldwide a new outlook on the subject of CO₂ recovery. Brewers will then have the necessary ammunition to effectively study and implement technologies within their breweries to improve the quality of their own packaged product and to achieve CO₂ self-sufficiency.

Menno M. Holterman received his M.Sc. degree in shipbuilding and marine technology at Delft Technical University in the Netherlands in 1995. His professional career began at Heineken and he worked for several Heineken breweries in Europe, Slovakia, and Papua New Guinea. From 1998 until now, he has been managing director of Haffmans B.V. a subsidiary of NORIT The Purification Company. He was responsible for the market introduction of NORIT (kieselguhr-free) beer membrane filtration technology in 2001 and became a member of the Board of Directors of NORIT Process Technology Holding B.V in 2004.

O-10

Consideration concerning the decrease of hydrogen sulfide content observed in the final stage of fermentation

Presenter: Teruhiko Hayashi, Kyushu-Kumamoto Plant, Suntory Ltd., Kashima-Machi, Kamimashiki-Gun, Kumamoto, Japan
Coauthors: Yusuke Umezawa, Kyushu-Kumamoto Plant, Suntory Ltd., Kashima-Machi, Kamimashiki-Gun, Kumamoto, Japan; Kaneo Oka, Kyushu-Kumamoto Plant, Suntory Ltd., Kashima-Machi, Kamimashiki-Gun, Kumamoto, Japan; Yoshihiko Kakimi, Beer & RTD Production Division, Suntory Ltd., Minato-Ku, Tokyo, Japan

Hydrogen sulfide (H₂S) is well-known as an immature off-flavor in beer. When high levels of H₂S remain in green beer, we must extend the maturation time before filtration to decrease H₂S content to below the sensory threshold. In order to produce a high-quality beer within the designed brewing schedule, it is important to control the H₂S behavior in the brewing process. It is also known that H₂S content in fermenting wort changes rapidly during fermentation, resulting in the appearance of several peaks of H₂S production. As a sulfur odor was found in lager beer, the H₂S behavior during fermentation was investigated, and a rapid decrease of H₂S content was observed in the final stage of fermentation, although the carbon dioxide (CO₂) evolution rate became extremely small. It was found that the timing of the rapid decrease of H₂S content was related to the decreasing rate of fermentable carbohydrates. It was suggested that the exhaustion of fermentable carbohydrates triggers the reduction of H₂S in the final stage of fermentation. Further investigation of the maturation process showed that the necessary time for H₂S reduction to below the sensory threshold was related to the number of suspended yeast cells. The report discusses the changes of H₂S content during the brewing process, especially the rapid decrease of H₂S content in the final stage of fermentation from the viewpoint of both the purging-out caused by CO₂ evolution and the uptake by yeast.

Teruhiko Hayashi studied agricultural chemistry at Kobe University. His career in brewing began at the Suntory Musasino Brewery as a technical staff member of the quality control section in 2002. He worked there for 1.5 years. In 2003, he worked for the startup of the beer production at the Suntory Kyushu-Kumamoto Brewery. Since then, Teruhiko has been as an assistant brewmaster in that brewery.

O-11

Yeast flocculation: A review of flocculation and how to control it in the brewery

Presenter: Jess Caudill, Wyeast Laboratories, Hood River, OR

Flocculation is a very important trait expressed by most strains of *Saccharomyces cerevisiae* used in the brewing process. Flocculation is defined as a reversible, asexual, calcium-dependent process by which yeast cells adhere to form flocs (Stratford 1989). The subsequent flotation and/or sedimentation of these flocs plays a vital role in the fermentation and yeast management processes in the brewery. The current understanding of flocculation is described by the lectin hypothesis. This hypothesis describes the cell-to-cell interactions between zymolectins and mannose residues of yeast cell walls. A review of this hypothesis, along with factors that affect flocculation, will be given. Understanding this process and the factors affecting it can lead to increased process control in the brewery and can give the brewer more control over maintaining the flavor profile of their beer.

Jess Caudill has been involved with MBAA since 1998. Jess has a B.Sc. degree in microbiology from University of Idaho, Moscow, Idaho, and worked as a research assistant for the Bioremediation Lab at the University of Idaho. He has been involved in the brewing industry for 10 years as the brewmaster for Treaty Grounds Brewpub (Moscow, Idaho) and Elliot Glacier Public House (Parkdale, Oregon) and as a production brewer for Full Sail Brewing Co. (Hood River, Oregon). Jess is currently a microbiologist and brewer for Wyeast Laboratories in Odell, Oregon.

O-12

Coping with cold: Brewing yeast sensing and responses to low temperatures

Presenter: Katherine Smart, Oxford Brookes University, Oxford, UK

Coauthor: Jessica Leclaire, Oxford Brookes University, Oxford, UK

Cold shock is normally associated with organisms that inhabit aquatic, arctic, or antarctic environments. Recent studies using haploid laboratory yeast strains of the genus *Saccharomyces cerevisiae* have demonstrated that cold shock commences at temperatures below 20°C. Since brewing fermentations and yeast handling temperatures typically fall within the range of 2–20°C, it is clear that production strains of lager or ale brewing yeast are permanently exposed to cold temperatures that may at times be extreme. In this study, we have assessed the cold shock tolerance of brewing and laboratory yeast strains at temperatures associated with various stages of the brewing process. In order to determine the extent to which brewing yeasts sense and respond to cold shock, we have examined the expression of several genes associated with cold sensing and the environmental stress response. Strategies for and the effects of low-temperature storage of brewing yeast slurries will be discussed.

Katherine Smart completed a B.Sc. degree (Hons.) in biological sciences at Nottingham University and was awarded the Rainbow Research Scholarship to complete a Ph.D. degree in brewing yeast physiology at Bass Brewers, Burton-on-Trent. She then moved to Cambridge University to take up an appointment as Research Fellow in the Department of Plant Sciences, where she worked on bioactive surfaces, biofouling, and bacterial contamination of beverages. In 1992, Katherine became a lecturer and then senior lecturer in microbiology and fermentation at Oxford Brookes University. In 2000, she was appointed Scottish Courage Reader in Brewing Science and was subsequently appointed Fellow of the Institute and Guild of Brewing. In 2004, she became a professor at Oxford Brookes University. Katherine has received the following awards: the Institute of Brewing and Distilling Cambridge Prize, the prestigious Royal Society Industrial Fellowship, an Enterprise Fellowship, and the Save British Science Award at the Houses of Parliament in the UK. In 2005, Katherine became the SABMiller Professor In Brewing Science. Katherine is a member of the several societies and has served on society committees and journal editorial boards.

O-13**Oxygen-enhanced fermentation**

Presenter: Peter Takacs, Spoetzl Brewery, Shiner, TX

Coauthor: James Hackbarth, The Gambrinus Co., San Antonio, TX

Repeatable fermentations are the hallmark of the modern brewery. Parameters brewers often consider important include time to achieve end attenuation and %RDF realized, VDK reduction time, and yeast biomass formed during fermentation. The evaluation of oxygen-enriched wort on fermentation performance requires all other independent variables to be accounted. To eliminate sources of dependence, worts were selected from a single product and narrow range of OG. Yeast could be tracked back to the same parent propagation. %RDF was normalized for differences in wort fermentability. Three levels of oxygen in wort were studied: 8, 14, and 20 mg/L. Using OLS regression analysis to determine if O₂ is a significant predictor of maximum %RDF after the effects of other variables have been accounted for, 65.5% of the variance was accounted with one variable, yielding 95% confidence limits that were ±7 h in modeling the time to reach 95% RDF. The real value of oxygen enhanced fermentation may be realized with stressed yeast or other factors, but under conditions of this study using one specific yeast, results were not decisively in favor of any change from the control fermentation oxygenation.

Peter Takacs received his B.S. degree in microbiology from the California State University at Los Angeles. He has worked in the quality control departments as a microbiologist, chemist, and manager at Pabst Brewing Company in Los Angeles, California; Blitz-Weinhard Brewing Company in Portland Oregon; Pittsburgh Brewing Company in Pittsburgh, Pennsylvania; the Stroh Brewing Company, in Tampa, Florida. Peter is the quality assurance manager at the Spoetzl Brewery, Inc. in Shiner, Texas.

O-14**Approaches to the high-quality, highly effective bottling line restructuring**

Presenter: Masayuki Suzuki, Suita Brewery, Asahi Breweries, Ltd., Osaka, Japan

Coauthor: Yutaka Henmi, Suita Brewery, Asahi Breweries, Ltd., Osaka, Japan

Asahi Breweries, Ltd. restructured the bottle line by introducing the full bottle inspection machine jointly developed by Asahi with Matsushita Electric Works, Ltd. (as in the presentation of 2004 WBC) in order to enhance the quality assurance system and to raise the production efficiency. This paper introduces the approaches that Asahi Suita Brewery took for the restructure. 1. Approach on Quality. The inspection staff used to perform the final visual inspection of the filled bottle product. The advantage of this inspection method with human power is that the defective products running from upstream can be thoroughly rejected by a versatile man. However, the inspection accuracy depended on the staffs' abilities, which differed greatly. Technically, it is difficult to develop a bottle inspection machine that has an ability equivalent to a human being. Therefore, we created a mechanism of the line as a whole that can prevent the defective products from generating upstream and that can reject the defective products in the lower ends. Let us raise the three actual approaches. First, in the bottle washer, we minimized the number of not-completely-washed bottles going out to the postprocesses. Second, at the empty bottle inspector, we expanded the inspection area and raised the detection accuracy. Third, the full bottle inspector made it possible to detect the defective products that were generated after the empty bottle inspector. 2. Approach on Production Efficiency. We are promoting "fresh management" (to offer fresher products to the customer) as the company's management policy. We need the system of a bottling line that can timely produce the required amount of the required kind of product. Therefore, we made the changeover time the shortest, improved the line operating efficiency of the small lot product (in order for the short time production) and extended the continuous production time of the large lot product. These changes made it possible to supply the demand with two lines, half the lines that we used to need. As a result, the capacity utilization in Asahi's peak period rose to 82.0% from 75.7%. We were able to greatly reduce the equipment management costs (the maintenance cost, its depreciation cost, and others) and the utility cost. In addition, in order to expand the area of the operation, we established the PHS notice system to individual operators about the line trouble, as well as trained the operators to improve their skills. 3. Summary. With all the approaches taken above, we were able to restructure the bottling lines so that they could produce in a timely manner with minimum operators while securing consistent quality with minimum running costs. The cost merit due to such a reduction of labor and equipment maintenance costs was 150 million yen/year (1.43 million dollars/year).

Masayuki Suzuki received a B.E. degree in mechanical engineer from Keio University, Japan. He began his employment with Asahi Breweries, Ltd. in April 1997 as an engineer in the brewery. He has worked for about 7 years as an engineer (brewing, packaging, and so on). Since September 2003, Masayuki has been working in the engineering section of Asahi's Suita Brewery.

O-15

The maintenance system to guarantee the stable operation with one operator per one watch

Presenter: Junichi Tanaka, Ibaraki Brewery, Asahi Breweries, Ltd., Moriya, Ibaraki, Japan

Coauthors: Ryuta Namba, Ibaraki Brewery, Asahi Breweries, Ltd., Moriya, Ibaraki, Japan; Akitoshi Yoshizawa, Ibaraki Brewery, Asahi Breweries, Ltd., Moriya, Ibaraki, Japan

The can lines of Asahi Ibaraki Brewery have been operating with one operator per one watch since September 2003. Under this circumstance, we worked to establish a maintenance system that can prevent the lines from ceasing due to troubled equipment. Asahi's previous maintenance system was a combination of three methods: time-based maintenance (TBM), condition-based maintenance (CBM), and break-down maintenance (BM). However, there are some problems in these methods. The first one has an excess and shortage of maintenance items in the plan. Also, it does not clearly define the priority within the items. The second one cannot totally make the equipment be premeditatedly maintained, and there is a case to become a BM situation unexpectedly. Therefore, as a solution to these problems, "reliability engineering" is brought to the new maintenance system. Fault tree analysis (FTA) is utilized to make this maintenance system. FTA made it clear that "the improvement" is the core of maintenance. It is important to reduce the defective factors of the equipment. By doing so, the actual reliability of a case packer has risen from 98.4 to 99.5%. However, the defective factors that cannot be eliminated equipment-wise require human checks and education. The following is the mechanism of this new maintenance system. First of all, the FT diagram of each piece of equipment is made. The event of "equipment ceases" on the top branches out to basic events. Each basic event should be covered with checklists, such as "daily checklist", "checklist on ceasing", "preliminary goods list", and others. But troubles occur in any case. The root cause analysis and the relapse prevention plan for the occurring trouble are examined in the toolbox meeting the following day, and measures to fix troubled equipment are taken. Then, all the measures are written in a "maintenance history", which becomes a database. If an equipment is improved, the FT diagram of the related area is revised, as well as the frequency of both a human check in the list and equipment parts exchange. Thus, while utilizing the maintenance system, it is polished. In addition, this new maintenance system focuses on education of the operators. Most of the operators are so-called "switch men", and they generally cannot fix the equipment's trouble. Asahi's vision is to educate the operators to have the skills of equipment maintenance. Operators receive independent education as the maintenance team. These educational activities raised the level of maintenance and stabilized the operation.

Junichi Tanaka received a B.E. degree in electric and electronic engineering from Ritsumeikan University in Kyoto, Japan. He began his employment with Asahi Breweries, Ltd. in April 1996 as an engineer in the brewery. He has worked for Asahi for about 8 years as an engineer on brewing, packaging, etc. Since January 2005, Junichi has been working on the production technical subject in the Production Technology Center of Asahi Breweries, Ltd.

O-16

Bottle-conditioned beer from laboratory trials to commercial production

Presenter: Derek Prentice, Young & Co. Brewery plc, London, UK
Coauthor: Josh Taylor, Young & Co. Brewery plc, London, UK

The process of bottle conditioning has been used by a number of brewers to produce a very distinctive product. While there are many benefits from the process, such as a clean, fresh palate that can last the duration of the shelf life, there are also difficulties, from achieving an effective yeast dosing system to maintaining sterility. At Young & Co.'s Brewery, we went through a number of different production developments in producing our bottle-conditioned beer, Special London Ale, before we arrived at the current method. SLA is now one of the largest selling bottle conditioned beers in the UK.

Derek Prentice has been in the brewing industry for more than 35 years and has held positions in brewing and packaging. Derek is a diploma master brewer and has recently been elected as a Fellow of the Institute of Brewing and Distilling. Derek has been with Young's Brewery for 16 years and has been in his current position as brewing manager for the last 6 years. During this period, Derek has been involved in new product development, including bringing to the market new beers and reintroducing bottle conditioning techniques.

O-17

The life and times of a beer keg: Use cycle, tracking, and ergonomics

Presenter: Lars Larson, Trumer Brauerei, Berkeley, CA

Coauthor: Jaime Jurado, The Gambrinus Co., San Antonio, TX

Launching a new keg package across a number of markets in the USA can invite an unexpected and unwelcome consequence: the kegs may take much longer to be returned than planned, creating a bottleneck where the only apparent resolution is to purchase more kegs and a greater cleaning challenge when the empty kegs are returned. Case studies are presented of two breweries: a startup, which launched a base of ½-bbl and ¼ kegs and which integrated a novel tracking identification system, and an established regional brewery, which refurbished its ½ keg float and launched a new ¼-bbl keg float. Both breweries have attempted to monitor where their kegs are to maximize the reuse frequency and minimize additional keg purchases. Because of the increased contact this created between the breweries and the wholesalers, an initiative was undertaken to communicate “keg safety and ergonomics” at the same time, built from the perspective of the brewery engineer using experience from inside the brewery walls as well as classical statistics which reinforces the experience and know-how from the field delivery personnel.

Lars Larson began his brewing career at the Hillsdale Brewpub in Portland, Oregon. After a year at Hillsdale, he obtained an internship at the Berliner Kindl Brauerei in Berlin, Germany, before enrolling in the brewing science program at the Technical University of Berlin and earning his Diplom-Braumeister degree. Shortly after graduation, Lars joined Cerveceria Isenbeck near Buenos Aires, Argentina, a subsidiary of the Warsteiner Brewery of Germany. Here, his experience ranged from packaging and quality assurance to brewing and product development. In 1998, he returned to the United States to become a brewing supervisor with the Stroh Brewing Company in Longview, Texas. In 1999, Stroh sold its breweries and Lars returned to Portland and joined Profamo, Inc., with technical and sales responsibility for brewing instrumentation for the western United States as well as Central and South America. In 2001, he joined the BridgePort Brewing Company in Portland and soon became assistant brewmaster. In 2003, Lars became master brewer at the Trumer Brauerei, Berkeley.

O-18

Full-scale results of second generation beer membrane filtration

Presenter: Rik Schuurman, NORIT Process Technology, Enschede, Netherlands

Coauthors: Lute Broens, NORIT Process Technology, Enschede, Netherlands; Mark Mol, NORIT Process Technology, Enschede, Netherlands; Dick Meijer, NORIT Process Technology, Enschede, Netherlands; André Mepschen, NORIT Process Technology, Enschede, Netherlands

During the writing of this summary, more than 7 million hL of different beer types are filtered on four full-scale plants with the innovative beer membrane filtration technology. After the introduction of the second generation BMF-200 skid, the balance between capital expenses and operational expenses is reviewed. From this it could be concluded that, with some extra membrane surface, process performance and operational costs are improved significantly. All the benefits of membrane filtration, which has been presented in previous papers, can be combined with stabilization without any complex pre- or post-treatment. Since much of the current equipment can be skipped, the future filter room will be more organized and the process more flexible.

Rik Schuurman has been a senior process engineer at NORIT since 1999, with more than 18 years experience in the brewing industry, including his time as a head brewer at Grolsche Brewery, the Netherlands. He is a brewmaster that has specialized in design, engineering, commissioning, and startup of all kind of brewery systems. In the last 3 years, his particular emphasis has been on beer membrane filtration as an alternative to kieselguhr filtration.

O-19**Crossflow membrane filtration of beer with ceramic membranes: Chances and limitations of the technology**

Presenter: Juerg Zuber, Filtrox AG, St. Gallen, Switzerland
 Coauthor: Uli Gans, Filtrox AG, St. Gallen, Switzerland

The application of membrane technology for beer filtration is an old dream, and R&D work started more than 20 years ago. In the meantime, there are a lot of experimental data and also substantial industrial experience available with membrane systems. Filtrox was involved in the development of these systems right from the beginning and, meanwhile, has more than 40 systems with ceramic membranes running in breweries all over the world, the oldest ones for more than 10 years. Based on this experience and, of course, on the experience with more than 600 DE candle filters, we are today in an excellent position to compare the different technologies. Despite all the R&D work and the promises of many suppliers, membrane filtration today is not yet competitive with DE filtration for mainstream beer. Even if all the technical problems (including stabilization) are solved, it remains a substantial cost issue because of investment (membrane) and running (energy and cleaning) costs. We meet a completely different situation for beer recovery from surplus yeast. There, membrane systems with ceramic membranes have proven their practical suitability and economic benefits in many places only through the value of the recovered beer.

Juerg Zuber completed his studies at the Federal Institute of Technology in Zurich, Switzerland, with a masters degree in process engineering in 1977. He then joined Buhler AG, where he worked for more than 20 years in a variety of R&D and management positions for the food industry. In 2000, Juerg joined Filtrox AG and is currently CTO and responsible for the North American market.

O-20**Crossflow filtration in the brewery—New concept for safe and economical beer filtration**

Presenter: Alexander Modrok, Alfa Laval Corporate AB, Noerten-Hardenberg, Germany
 Coauthor: Dirk Weber, Sartorius Food & Beverage GmbH, Goettingen, Germany

Crossflow technology can replace diatomaceous earth (DE) filters and fine filters in the brewery in any step. The subsequent additional use of sterilizing-grade membrane filter cartridges in the filling plant eliminates the need of a thermal microbiological stabilization. The combination of crossflow technology and membrane filter cartridges creates a new filtration concept for breweries. Breweries who use this new concept receive a completely cold filtered beer. Compared with conventional DE filtration, crossflow filtration of beer offers numerous advantages. The key aspect is that the use of kieselguhr (DE) is no longer necessary. The fact that DE is a limited resource will have a negative impact on its quality and price in the future. Moreover, the disposal of DE generates additional costs. The health risks for the user associated with DE that contains cristobalite should not be underestimated as well. Fully automated crossflow systems are less labor intensive to operate than are DE filters. In conjunction with lower water consumption and lower product loss, process costs can be reduced. The use of crossflow technology does not have any negative influence on the quality of beer, whereas yeast and beer-spoiling organisms are reliably removed. In addition, crossflow filtration has a positive effect on the service life of downstream sterilizing-grade filter cartridges. Due to this fact, filtration costs can be reduced even more. Further advantages of crossflow technology can be found in its excellent (up or down) scalability. Sartocon filter cassettes are the heart of every Sartoflow filtration system. They feature optimized hydrodynamic properties, where consistent crossflow rates across the membrane and short flow distances inside the modules are guaranteed. The equally optimized pressure ratios during filtration and cleaning allow high flow rates and efficient cleaning. The crossflow systems contain a new PESU membrane specially developed for beer filtration. The use of narrow channel modules with optimal hydrodynamic properties and an optimized process results in high flux rates of 80–120 L/m²/h and a very low energy consumption in comparison to hollow fiber or spiral wound membranes. In consideration of these facts, crossflow filtration of beer offers a true alternative to conventional DE filtration with comparable cost.

Alexander Modrok started his brewing education in 1974 at the Goettinger Brauhaus AG, followed by various breweries, such as Beck & Co. Bremen and Brewery Kropf (Martini) in Kassel. He joined Sartorius AG Goettingen in 1982 after his brewmaster education in Ulm as a technical support for the food & beverage industry. From 1985 until 1994, he was market manager Europe and he moved to Japan as a market unit director Asia & Pacific. After his return to Germany in 1998, he was head of the market unit brewery. In September 2004, Alexander joined Alfa Laval Brewery Systems in Brussels as the manager of the filtration group, with responsibility for the Sartorius product range.

O-21

Twin flow system: The new generation of precoat filtration

Presenter: Andrew Fratianni, Kronos, Inc., Steinecker Technology, Franklin, WI

Co-Authors: Matthias Pohl, Anton Steinecker Maschinenfabrik GmbH; Joerg Thomas, Anton Steinecker Maschinenfabrik GmbH

The twin flow system (TFS) technology is based on a novel filter vessel construction. Fastening of the bar filter elements and transfer of the filtrate are realized by means of “register” piping. It eliminates the perforated plate, separating the vessel into unfiltrate and filtrate areas, as normally used in the traditional design of candle filters. Hence, in the TFS filter, the entire vessel is the unfiltrate area. Above the register piping is a second outlet at the top of the dome, providing for “twin flow”. This additional flow gives filtration with the TFS another opportunity to influence the whole process technology of the filter. Further, the filter candle itself has been enhanced, offering additional possibilities for increased operational efficiency. The optimal flow around the filter elements, via the bypass, results in savings of kieselguhr during precoating and a wide range of adaptability of the process to beers of varying filterability. With this new concept, the most important results are a lower differential pressure increase when compared with classical candle filter design, a reduced volume of beer/water mixture resulting in less pre- and post-runs, reduced rinse water consumption, low oxygen pickup, and guaranteed biological results. Additionally, the new technology allows replacement of the coarse, flux-calcined kieselguhr by a medium one for the first precoat. It is also possible to completely replace kieselguhr on a perlite basis or with any other filter aid. More than 50 filters sold worldwide, used for either filtration or stabilization, confirm the results with regard to increased performance, kieselguhr savings, rinse water savings, and pre/post-run reductions, as well as increased operational safety and filtrate protection.

Andrew Fratianni started to brew beer at home when he was 14 years old. After completing a master’s degree in German literature from New York University, Andrew moved to Portland, Oregon, and began working in the microbrewing industry. Soon thereafter, he entered the masterbrewers program at the University of California, Davis, where he passed the Institute of Brewing AME exams. Most recently, he was the brewmaster for Pabst Brewing Company in China and has recently started working for the Steinecker Division of Kronos, Inc., based in Franklin, Wisconsin. Andrew is a member of MBAA and the Institute of Brewing and Distilling, London, UK.

O-22

Using genetics to tame the west for malt barley

Presenter: Tom Blake, Montana State University, Bozeman, MT

The American West is a wide array of environments that vary dramatically in productivity from year to year and site to site. No other crop is better suited to this variable and often harsh region than barley. Barley’s immediate ancestor, *Hordeum spontaneum*, thrives in many of the world’s driest, harshest environments. Barley’s durability and ability to cope with inconsistent environments makes it the crop of choice for our rainfed crop production areas. The malting and brewing industries demand consistently high-quality barley. Crop production consistency has been attained primarily through the use of irrigated and high-rainfall production areas. Fusarium head blight has rendered one of our most productive malt barley growing regions less reliable. While some irrigated areas in Montana and the West remain underutilized, urban, industrial, and environmental competition for water makes expansion of irrigated malt barley production unlikely. The largest available resources for expanding domestic malt barley production are the vast rainfed croplands in Montana, Idaho, Washington, and Oregon. In these environments, unavailability of sufficient water is the most common reason for malt barley crops failing to meet malting specifications. While effective, durable resistance to head blight has not yet been found, the genes required to produce high quality malting barley on limited water are becoming better understood each year. Two-rowed barley has a nearly unique ability to compensate for limited water availability through reduction in yield components. Many feed barley varieties have been released through the North Dakota Agricultural Experiment Station and through the Montana Agricultural Experiment Station that capitalize on this unique barley characteristic. These varieties produce high starch content, high test weight barley varieties under severe moisture stress. Our first malt barley line that carries the ‘high test weight’ genes in a high-quality malt barley background (‘Hockett’) is now in plant-scale evaluation. We mapped and characterized a single gene on barley chromosome 6 that derives from the six-rowed variety ‘Karl’ and that reduces grain protein content by approximately 1.5%. Through the use of the molecular marker toolkit developed over the past decade, backcrossing these genes into high-quality malt barley varieties has proven straightforward. These genes conferring test weight and kernel plumpness retention under severe drought and reducing grain protein percentage are now being deployed in malt barley varieties adapted to production in the arid Northwest.

Tom Blake has been the barley breeder for the Montana Agricultural Experiment Station and professor of plant breeding at Montana State University since 1984. He received his B.S. degree in genetics from the University of California, Davis in 1976, his M.Sc. degree in agronomy from South Dakota State University in 1979, and his Ph.D. degree in genetics from Washington State University in 1983.

O-23

Development of a DNA microarray method for the identification of beer-spoilage microorganisms

Presenter: Kazushige Hatanaka, Suntory, Ibaraki-Shi, Japan
Coauthors: Yukiko Kodama, Suntory, Takatuki-Shi, Japan; Koichi Tanaka, Suntory, Simamoto-Cho, Mishima-Gun, Japan; Hiroko Kawasaki, Osaka University, Minoo-Shi, Japan

In the brewery that manufactures nonpasteurized draft beer, the microbial control is of major importance and the existence of an effective and reliable microbial test has always been required. For this purpose, we have developed a DNA microarray method specifically to carry out rapid and handy detection and identification of lactic acid bacteria and yeast that can cause microbial beer spoilage. We designed specific oligomers from variable regions of the 16s and ITS rDNA from a variety of microorganisms, including beer-spoilage *Lactobacillus*, and we fixed each specific oligomer on the array. From a microbial sample, we amplified those regions by PCR using biotinylated universal primers. Amplified DNA was hybridized to the oligomers on the DNA microarray. By using this microarray, the signals could be specifically obtained for all the microorganisms that we selected. No special equipment was needed for the signal detection and we could judge easily by visual check. Within 7 h, we could identify these microorganisms at the genus or even species level from a single colony. In the case of *L. brevis*, which we used as a model, we could detect signals from 90 ng of genomic DNA. Using this system, we can easily and rapidly detect the beer-spoilage and the non-beer-spoilage microorganisms, and a wide range of applications as the efficient microbial control are expected in the brewery.

Kazushige Hatanaka finished a bachelor's degree in food engineering chemistry at Nagoya University. He worked 3 years for Kyoto brewery as a staff member of microbial test.

O-24

A comparison between the instrumental measurement of head retention/lacing and perceived foam quality

Presenter: Jeremy Roza, Department of Food Science and Technology, University of California, Davis, CA
Coauthors: Charles Bamforth, Department of Food Science and Technology, University of California, Davis, CA; Candace Wallin, Department of Food Science and Technology, University of California, Davis, CA; Frank Verkoelen, Haffmans B.V., Venlo, Holland

Diverse methods have been proposed for the evaluation of foam stability (head retention) and rather fewer for the quantitative assessment of foam lacing (cling). Even more unusual are instances where there has been a concerted attempt to correlate instrumental data that assesses foam performance with the actual perceived behavior of foam after dispense. In this paper, we describe the relationship between the foam stability and lacing (cling) generated instrumentally with a diversity of beers and how those beers compare for foam performance when dispensed. Furthermore, we have demonstrated the relationship between instrumental and perceived foam performance for beers in which foams have been enhanced by a range of treatments, including the use of propylene glycol alginate, reduced iso-alpha-acids, and divalent metal cations.

Jeremy Roza is an M.S. student at the University of California, Davis. He has a B.S. degree in biology with emphasis in biochemistry/cell biology from the University of California, San Diego. He was formerly a technical support representative for a San Diego chemical and biologics distributor.

O-25

A novel analytical method for determining the quality of retail beverage gases

Presenter: Chris Duffell, domnick hunter ltd., Newcastle, UK
Coauthors: Robert Scrafton, domnick hunter ltd., Team Valley, UK;
Shane O'Leary, Harwell Scientifics, Didcot, Oxford, UK

In the current commercial environment of continuous improvement and quality assurance, the issue of beverage gas quality has attracted much attention. This paper introduces a novel analytical method for determining the quality of gases used for beverage retail dispense, such as carbon dioxide (CO₂) and nitrogen (N₂). The International Society of Beverage Technologists (ISBT) has written guidelines that include specifications for maximum contaminant levels for beverage quality CO₂. The concentration of each group of contaminants may be motivated by either their effect on taste or smell of the beverage, by beverage quality control, or by regulatory measures to protect consumer's health. In-line purifiers have been designed to safeguard against possible CO₂ contamination and maintain the qualities of the beer as the brewer intended. Data obtained by challenging purifiers with out-of-specification CO₂ is presented. This includes results from a test program using contaminated CO₂. Two multistage filters were analyzed. One filter had been exposed to a gas flow containing acetaldehyde, benzene, and cyclohexane. The other filter was a blank sample. After separation of the filter components, volatile organic compounds (VOCs) present on the sorbents were removed by thermal desorption under a stream of helium gas. This was performed by packing the individual sorbents into a stainless steel tube and placing the steel tube in a glass tube, centered in the hot zone of a tube heater (570°F). A flow of clean dry helium gas of 150–200 mL/min was passed through the glass tube, and the exit was connected to two mixed-bed ATD tubes in series. The tubes were analyzed by ATD-GC-MS using a PerkinElmer TurboMatrix ATD linked to an Agilent 6890/5973N GC-MS operating in scan mode. Before the samples were run, a calibration was generated for a range of organic compounds. Compounds were tentatively identified by a computer-based spectral library match and semiquantified using the response of a similar compound found in the standard suite. This allowed for a total amount of contamination to be quantified for the filter and also provided information about the affinity of the different sorbents for the various types of VOCs identified. By using the mass of contamination found on the sorbent material and the volume of gas processed by the filters, it was possible to quantify the concentrations of VOCs present in the test gas stream. Therefore, it has been shown that an analytical procedure has been designed and developed that can effectively quantify the levels of contamination retained on a filter used in a beverage gas stream.

Dr. Chris Duffell completed his master's degree in astrophysics from Cardiff University in 1997. He then began employment at the National Engineering Laboratory in Scotland as a project engineer researching fluid dynamics for the oil and gas industry. Chris achieved Chartered Physicist status through the Institute of Physics in 2000. He then joined Strathclyde University to continue his research into flowmeter development. His Ph.D. project was entitled "Application of optimization techniques to the design of ultrasonic transit-time flowmeters". Upon completion of his Ph.D. degree, Chris began employment with domnick hunter ltd. in Newcastle as senior development engineer in the filtration division. His work now involves product verification and development. The Science Council awarded Chris Chartered Scientist status in July 2004.

O-26

The influence of process parameters on beer foam stability

Presenter: Graham Stewart, The International Centre for Brewing and Distilling, Heriot-Watt University, Edinburgh, Scotland
Coauthors: Michaela Miedl, The International Centre for Brewing and Distilling, Heriot-Watt University, Edinburgh, Scotland;
Paul Chlup, The International Centre for Brewing and Distilling, Heriot-Watt University, Edinburgh, Scotland; Alexander Mader, The International Centre for Brewing and Distilling, Heriot-Watt University, Edinburgh, Scotland

The quality of beer foam is of utmost importance for the brewing industry. Beer head volume and stability are the first quality characteristics observed by the consumer and, therefore, strongly contribute to the appreciation of the product. Brewers' yeast excretes Proteinase A (PrA) into the beer during fermentation and/or PrA leaks from damaged yeast cells. PrA diminishes the hydrophobicity of foam-positive proteins, thus reducing beer foam stability. This effect appears reinforced over prolonged periods of storage and especially in high-gravity worts. Beer production process parameters and type of technical equipment significantly influence the amount of PrA activity in beer and subsequent beer foam stability. We investigated the effect of pasteurization on the activity of PrA and subsequent beer foam stability for a 6.0 million hL brewing company in two of their sites producing similar beer. One brewery employed a tunnel pasteurizer, whereas the other brewery was membrane filtered. We monitored foam stability, PrA activity, and the hydrophobicity of beer proteins in bottled beer from both plants over a 3-month period. We found negligible PrA activity in the pasteurized beer, whereas in the unpasteurized beer, PrA levels were high. Hydrophobic polypeptide levels declined rapidly in the unpasteurized beer due to proteolytic activity. As a consequence, foam stability was deteriorating significantly in the unpasteurized beer, whereas the pasteurized beer exhibited good head retention even after 3 months of storage at room temperature. On the grounds of our findings, a tunnel pasteurizer was installed and head retention improved significantly. Another important process parameter influencing PrA concentration in beer is centrifuges, which have been used in brewing for more than 100 years. Although this clarification step prolongs the operation life of downstream filters, mechanical and thermal stress significantly influences yeast cell integrity. Additionally, yeast cells are highly sensitive to fluid mechanical exposure. Shear stress increases the number of dead cells in pitching yeast, and leakage of cell contents from damaged yeast cells impact on product quality. We identified and quantified the effects of a commercial disk-stack centrifuge (5 hL/h) on yeast cells, which will assist breweries in improving their clarification process employing centrifuges. Future work will include two-dimensional electrophoresis and MALDI-TOF mass spectrometry for improved characterization of foam-positive proteins. Confocal microscopy in conjunction with green fluorescent protein (GFP) labeling of the PrA gene will be used to further clarify the mechanism of PrA excretion from the yeast cell.

Graham Stewart is the director and professor of the International Centre for Brewing and Distilling, Heriot-Watt University, Edinburgh, Scotland. He received his B.Sc. Hons. degree in microbiology and his B.Sc. Hons. degree in biochemistry from the University of Wales at Cardiff and his Ph.D. and D.Sc. degrees from Bath University in the UK. He was a lecturer in biochemistry in the School of Pharmacy at Portsmouth College of Technology (now Portsmouth University) from 1967 until 1969. From 1969 to 1994, he held a number of technical positions with Labatt's in Canada and from 1986 to 1994 was its technical director. He was the Institute of Brewing's president (now the Institute of Brewing and Distilling) in 1999 and 2000. Graham is also a member of

MBAA and ASBC. He has more than 200 publications (books, patents, review papers, articles, and peer-reviewed papers) to his name.

O-27

CSS combined beer stabilization

Presenter: Axel Jany, Handtmann Armaturenfabrik, Biberach, Germany

In recent years, Handtmann has presented the CSS combined stabilization system via MBAA posters and MBAA trade stands. As of now, the two large-scale production CSS units in operation are located in Russia and are performing their task of a combined protein and polyphenol beer stabilization very well. However, in the Western World, the Russian breweries are usually not a reputable reference, despite their modernization in recent years. In a few weeks time, a CSS 600/7000 with a flow speed of 600 hL and a batch size of 7,000 hL will be installed in an Australian brewery, and the CSS should be operational in May 2005. This would give us the opportunity to present unpublished and brand new running data, lab results, and economical aspects from a well-known global brewery.

Axel P. Jany started his brewery career in 1987 (after spending a year in the US) in Germany, where he served an apprenticeship as a brewer and maltster within the Holsten Brewery Group. After his apprenticeship as a brewer and studies at VLB/Technical University Berlin, he received his brewmaster degree in 1994. He joined the Handtmann Company, Biberach, Germany, as a filtration technician and presently holds the position as international sales manager. Axel has been a member of MBAA since 1995.

O-28

The study of haze formation in freshly packaged and stored beers

Presenter: Deborah Parker, Brewing Research International, Surrey, UK

Turbidity in beer is generally unacceptable and, apart from certain recognized beer styles, is regarded as detrimental to beer quality. The mechanism of haze formation has been studied for many years, yet in the literature, there is still uncertainty about which protein fractions participate in haze formation. In particular, methods of haze measurement are focused on the smaller-sized chill haze and permanent haze; the formation of larger-sized haze particles has received little attention and little is known of the composition of such larger-sized hazes formed in beer postpackaging. There have been studies suggesting PGA as a source of haze, thought to be the result of de-esterification following pasteurization. It has also been shown that inappropriate storage enhances the formation of PGA-induced haze. This paper describes work conducted to examine the formation of nonmicrobiological haze during beer storage. Total haze, protein levels, and hydrophobic polypeptides were measured following packaging and pasteurization and during storage. A method for measuring the amount of larger-sized haze particles was included. Beer was treated with foam and haze stabilizers and beers of differing gravities were compared. Beers were stored at three different temperatures and assessed over a 6-month period. The findings show that the amount of total haze present and levels of hydrophobic polypeptide measured in foam, beer, or haze vary depending on treatment, storage temperature, and storage time. The observations indicate that a dynamic equilibrium exists in beer between total protein and hydrophobic polypeptide present in various beer fractions. A mechanism is proposed for the formation of heat-induced and storage haze in beer postpackaging.

Deborah joined BRi in 1988 with an honours degree in biochemistry and was involved in core research within the malt and wort department and product quality investigating barley quality, foam stability, and haze production. Deborah became a trained panelist on various specialized tasting panels, including malt, sulfur, bitterness, and mouthfeel. Deborah passed the Institute of Brewing Associate Members Examination in 1991 and has recently been awarded a doctorate in brewing science. Deborah is a frequent lecturer at industry training courses and technical meetings and is an accredited trainer (City and Guilds 7307). Deborah joined the sensory team at BRi in 1999 as an experienced taster and now designs and delivers sensory training courses and workshops. Deborah is also a member of the European Brewing Convention (EBC) Sensory Sub Group. A professional beer taster for 13 years, Debbie has applied her tasting skills as a judge at competitions such as "The Beauty of Hops" and the Great British Beer Festival.

O-29

Perceptions of beer haze

Presenter: Charles Bamforth, Department of Food Science and Technology, University of California, Davis, CA
Coauthors: Dylan Clark, Department of Food Science and Technology, University of California, Davis, CA; Michael O'Mahony, Department of Food Science and Technology, University of California, Davis, CA

Sensory studies have been used to establish detection limits for haze in beer. Using three different statistical criteria, the lowest level at which a hazy beer can be distinguished from a bright beer is between 2.70 and 3.01 NTU. Beers with haze levels below 2.70 NTU are indistinguishable from bright beers. It is generally accepted that the brighter the beer, the higher the perceived quality. However, our studies indicated that, while beers with substantially elevated haze levels were perceived as being of a lesser quality, beers with haze levels just above the detection limits were consistently ranked as having a better visual appearance than was a clear beer.

Dr. Charlie Bamforth became the first Anheuser-Busch Endowed Professor of Malting and Brewing Sciences at the University of California, Davis in February 1999. He has 27 years of experience in the brewing industry, previously holding senior positions with Brewing Research International and Bass. Charlie was formerly visiting professor of brewing at Heriot-Watt University. A Fellow of the Institute of Brewing and Distilling and a Fellow of the Institute of Biology, he is editor-in-chief of the Journal of the American Society of Brewing Chemists and a member of the Editorial Board of MBAA's Technical Quarterly and of the Journal of the Institute of Brewing, Biotechnology Letters, and the Journal of the Science of Food and Agriculture. He is the chair of the International Section of the Institute of Brewing and Distilling. His books Standards of Brewing and the second edition of Beer: Tap into the Art and Science of Brewing were published in 2003. In 2004, Beer: Health and Nutrition was released. Soon his latest volume Food, Fermentation and Micro-organisms will be published.

Abstracts

Poster Presentations

P-1

Color development modeling of wort and wort concentrates

Presenter: Robert Hansen, Briess Malt and Ingredients, Chilton, WI

Though there is much discussion in brewing literature of wort color development as an important variable in the brewing process, there is little quantitative data on the rate of this development throughout the process and in worts of different colors and concentrations. Initial wort color is mainly a function of the raw ingredients used to manufacture the wort. However, color also develops in wort after the initial extraction in the mash. The rate of this color development in the lauter tun, kettle, whirlpool, and beyond is mainly dependant on the temperature in these vessels, the wort concentration, and resulting water activity of the wort. This “in process” color development is shown to be mostly independent of the original wort color. It is thus a negligible influence on wort color for dark beers but very important to consider for light worts, as “in process” color development can account for a significant amount of the finished wort and beer color. In order to properly control the finished color of wort and the resulting beer, it is important to understand and be able to predict the influence of this “in process” color development. Modern and nontraditional wort production technologies oftentimes involve vacuum or pressure boiling with reduced boiling times. These can lead to different amounts of “in process” color development that must be compensated for. Rates of color development were measured in different color worts at various temperatures and at various concentrations, including liquid and dry concentrated worts (malt extracts). These color development rates are used to build models of color development that can be used to estimate the color increase in worts for a given process. These models are valuable tools for estimating differences in wort and beer color due to process changes or problems. Additionally, these models allow for determination of color development in malt extract and provide important guidelines for proper storage and handling to control the concentrated wort color.

Bob Hansen began brewing at Water Street Brewery in Milwaukee. He has brewed in all grain- and malt extract-based brewhouses in sizes ranging from 3 to 500 barrels. He graduated with a double major in biochemistry/applied math & physics from the University of Wisconsin, Milwaukee. A graduate of several Siebel short courses, he ran his own brewing consulting business, Pubdreams Consulting for several years. For the last 4 years, Bob has worked at Briess Malt and Ingredients, initially as the brewing supervisor and currently as the manager of technical services.

P-2

The effect of long-term serial repitching on the genetic and phenotypic stability of yeast

Presenter: Andy Diacetic, BridgePort Brewing Co., Portland, OR
Coauthor: Chris Powell, Lallemand, Inc., Montreal, Quebec, Canada

When a brewery fermentation is complete, it is common practice to harvest the yeast from the fermentation vessel, store the yeast in a clean and sanitized tank, and then repitch the yeast into subsequent brews. While the physical characteristics of the working yeast culture and actual fermentation performance may appear consistent, genetic mutations can occur over time. The genetic profiles of two different samples of an ale yeast and a lager yeast were analyzed and compared using RAPD polymerase chain reaction (PCR) and restriction fragment length polymorphism (RFLP). Fresh samples of both the ale and lager yeast were compared with a sample of the same respective strains that had been repitched over the course of 2 years in a production brewery environment. In addition to the genetic analysis, physical characteristics of all samples were compared from giant colonies grown on WLN agar. It was shown that, while there was some variation in the phenotypic characteristics in the giant colonies of the ale yeast strain, there proved to be no genetic variation between the fresh culture and the same culture after 101 serial repitchings. The lager yeast analysis is ongoing.

Andy Diacetic received a B.S. degree in fermentation science from Oregon State University in 2001. He began working at BridgePort Brewing Company immediately after graduation as an intern in the quality assurance lab. Andy was hired as a full-time employee later that fall and began working as a brewer. He spent 2 years working as a production brewer until he was moved back into the lab in the winter of 2003. His current title is brewery microbiologist at BridgePort Brewing Co. Andy has been a member of MBAA since 2002.

P-3

Continuous process headspace analysis of liquid products

Presenter: Michael Markelov, ACS Labs, Cleveland, OH

Coauthor: Olga Bershevits, ACS Labs, Cleveland, OH

Headspace analysis is a common and very informative laboratory technique for monitoring of brewing processes and quality control of alcoholic and nonalcoholic beverages. Unfortunately, this powerful analytical approach is limited to laboratory applications and its results suffer from imperfection of sampling techniques and loss of volatiles during sample transfer into headspace vials. These problems are especially profound when one deals with highly carbonated gas saturated liquids, like beer. This poster will present a headspace apparatus for continuous analysis of liquid streams. The sensitivity and repeatability of this flow-thru analyzer compares favorably with corresponding laboratory headspace autosamplers. The instrument can provide compositional information on brewing or any other process every 10–15 min, depending upon the length of chromatographic run. Several examples of determination of acetaldehyde, alcohols, and other important volatiles in beer and wine will be presented.

Dr. Michael Markelov is the director of ACS Labs. This company is a contract R&D and analytical method development laboratory. This laboratory specializes in headspace analytical methods. It is equipped with a number of headspace GC/MS systems, electronic noses, electrophoresis equipment, HPLC and ion chromatography, etc. It is heavily involved in identification of odors; development of methods for analysis of residual monomers and solvents in polymers, pharmaceuticals, and anesthetics; and development of environmentally friendly refrigerants. Michael also is an instructor of the short course "Theory and Practice of Headspace Analysis".

P-4

Dehumidification in brewing

Presenter: Mike Harvey, Niagara Blower Co., Buffalo, NY

Coauthor: Phil Nowicki, Niagara Blower Co., Buffalo, NY

Environmental conditions throughout a brewery are important for the longevity of the equipment as well as for proper brewing of the beer. In areas such as fermenting and aging cellars where beer is kept cold, a condition arises in which the beer tanks have condensation on the outer surfaces. This can be especially detrimental to the sanitation and longevity of carbon steel tanks. In order to keep condensation from forming on the tanks and ancillary equipment, the surrounding air needs to be dry enough so that its dew point is lower than the surface temperature of the equipment. Perhaps one of the more interesting developments in the brewing industry involves the use of desiccant-cooling technology. This method of conditioning air comes from the realization that, through the combined use of mechanical refrigeration and a liquid desiccant, the required air conditions that are so closely related to the quality of the finished product can be maintained with minimum energy costs. The low air dew points required to maintain dry surfaces and to facilitate recovery from washdown can be maintained without the need for low refrigerant suction temperatures and their associated high horsepower requirements. Also, the energy associated with the latent (moisture removal) portion of the heat load can be transferred from high-cost electric compressor energy to a lower-cost source, such as natural gas or plant steam. In addition to the above, a desiccant-cooling system that utilizes a liquid chemical absorbent solution will provide very steady leaving air conditions. This is due to the thermal mass associated with the desiccant charge and the removal of any defrost cycles associated with colder temperatures. This gives a refrigeration system the ability to provide a constant dry environment at the required temperature. This is even more useful in today's era, where many breweries brew semicontinuously. With most desiccant-cooling systems, there is no need for a defrost cycle. This not only allows for continuous operation and consistent conditions but also makes for much cleaner air. With a liquid desiccant system the desiccant is continuously cleaning and removing more than 90% of the microorganisms from the air stream. A typical refrigeration system that requires a hot gas defrost cycle will return the majority of the moisture and bacteria that were trapped on the coil back into the air stream and ultimately into the cellar. Sanitizing the air eliminates the chance of product contamination caused by destructive airborne microorganisms. These features have made this type of system ideal for many breweries for years past and for many years to come.

Mike Harvey is currently a member of MBAA. He has been working in the brewing world for 4 years now, specifically in the area of cellar cooling and dehumidification. He has a bachelor's of science degree in engineering from the University at Buffalo, as well as having attended various industry workshops and courses. Mike is currently employed as an engineer for Niagara Blower Company, in their liquid dehumidification group specializing in breweries.

P-5

Development of a new corner-cut wrap-around cardboard box with a 24-can capacity, incorporating a universal design concept

Presenter: Takahiko Okada, Kirin Brewery Co., Ltd., Yokohama, Japan

Coauthor: Kazuhiro Hiraishi, Kirin Brewery Co., Ltd., Nagoya, Japan

Recently, the market has seen an increase in consumers who prefer purchasing beer and happo-shu (low-malt beer) in 24-can bulk cardboard boxes. Having noticed this trend, we began considering ways to devise value-added cardboard boxes that not only serve functionally as a packing container in the distribution chain but also serve as a means to enhance the value of the product inside. First, we focused on an octagonal regular slotted carton (RSC) boxes used for some applications in wine shipping, etc. We expected that the introduction of an octagonal box would bring a new, novel feeling to the shape of cardboard boxes used for beer and happo-shu—boxes that have not changed significantly in the past 40 years. However, compared with RSC boxes, converting a wrap-around cardboard box to an octagonal shape required continual forming at high speeds, raising issues of stabilizing box-forming conditions. Accordingly, we added functions to existing casers to ensure the stable folding and gluing of flaps on the octagonal shape. Further, we made efforts to create a carton shape that ensures consistent flap fold-over angles. As a result, we succeeded in designing and implementing a “corner-cut carton” box having four of the eight octagonal corners folded flat. We believe our corner-cut carton will lead to an increase in perceived product value by offering the following benefits.

- 1) The lack of corners makes the box easier to carry, increasing customer convenience.
- 2) Most beverage cartons holding beer are square, so the difference in box shape improves the visibility of the product.
- 3) Printing on the octagonal sections of the box makes for easy reading and improves communication with the customer.
- 4) An increased withstand load of the cardboard box in the vertical direction prevents tilting and deformation of the boxes when stacking them. At Kirin Brewery, beer, happo-shu, and chuhi have all been packed in corner-cut cartons since 2004. With its novel shape and functionality, the corner-cut carton is gaining recognition as a universal design product.

Takahiko Okada is an engineer in the research laboratories for the Packaging, Technology Development Dept. at Kirin Brewery Co., Ltd. He graduated from Chiba University in 1991 with a major in mechanical engineering and joined Kirin Brewery Co., Ltd. in the same year. He has been engaged in the development of new package and production technology.

P-6

Energy recovery improves bottom line for breweries

Presenter: Vera Groot Kormelinck, Paques BV, Balk, Netherlands

Today, wastewater treatment and energy recovery are hot issues in Europe. To recover energy from wastewater, an anaerobic treatment system can be installed to produce this energy in the form of biogas. The amount of biogas produced with an anaerobic system could replace a significant amount of natural gas and, therefore, reduce the production costs. Biogas can also be converted into electricity or the more popular green energy. Biogas production is not the only driver, but there is also the lower discharge costs to the municipality or the permission to directly discharge wastewater into a canal or sewer. This poster will describe how a wastewater treatment plant and energy recovery can be combined. First, the technology of anaerobic digestion will be described, followed by a case study of a small German brewery. The decision-making process, with regard to the investment, to install a wastewater treatment plant is discussed, data are presented, and information will be given about the amount of biogas produced. Last but not least, the investment and the operational costs will be discussed.

Vera Groot Kormelinck graduated in food technology from the Friesland College of Food Technology in 1989. After graduation, she started her professional career at the laboratories of Vriehoek bv. Her employment with Paques BV began in 1989, where she was leading the biological startup of a large demonstration project at Heineken in Den Bosch. In 1996, having served several years as startup engineer at various industrial effluent treatment projects, she joined the process engineering department of Paques. In 1998, she started her function as proposals manager, in preparation of a more commercially oriented career. In 2000, she became area sales manager for Germany with a focus on the beer and beverage industry. In the beginning of 2004, Vera accepted the responsibility as branch manager beer and beverage market for Paques.

P-7**Flow measurement...It's all about taste**

Presenter: Wade Mattar, Foxboro Company, Invensys Process Systems, Foxboro, MA

Flow measurements are found throughout the modern-day breweries to measure the quantity of a variety of fluids that are transported through pipes to various parts of the process. The fluids that are metered range from the ingredients coming in to the finished product leaving. In some cases, the flowmeters can offer additional information about the makeup or quality of the fluids they meter. Of course, the financial folks value the efficiency improvements that accurate flow measurement offers, but the bottom line in the brewing industry is the quality of the beer. In describing the various flow measurements used in the industry, this poster will show the link between the quality of the flow measurements and the quality of the end product, in this case, beer. The poster will describe the evolution of flow measurement and, in particular, how it relates to the beer industry. The latest developments will be discussed along with what developments are in the not-too-distant future. Sure, in this economy, everyone is scrambling to get the most efficiency and profit from their operations, but at the end of the day...in this industry, it's all about taste.

Wade Mattar has been working in the area of flow measurement with Foxboro Company/Invensys for more than 30 years. His degrees are in both fluid and aeronautical engineering, but most of his career has been in the area of flow measurement R&D. He holds several patents; has authored or coauthored a variety of papers and handbook chapters; and chairs or sits on a number of national, international, and industry-related flow standardization committees.

P-8 Withdrawn**P-9****LEFF® (low-emission flip-flop)**

Presenter: Kristina Boee, Tuchenhagen Brewery Systems GmbH, Buechen, Germany
Coauthor: Fedja Voss, Tuchenhagen GmbH

Reducing the environmental load by less waste water and chemical discharge on one hand and lowering the operating costs on the other hand are important factors in various industries when it comes to a decision in new investments. Environmental relief and cost reduction usually do not fit together, but the LEFF® function module Tuchenhagen has developed for its VARIVENT® valve series proves that this is feasible. Perfect cleaning of the valve seats—crucial for microbiology—is usually carried out time-dependent and at full opening stroke that causes high detergent losses. The LEFF® function module converts the signal for valve disk lifting into a pulse signal that leads to quick stroke-dependent opening and closing of the valve. A minimized amount of cleaning solution accumulates so that the wastewater load is considerably reduced. In practical comparison, it was found that, on a double-seat valve DN 100 alone, around 50 m³ of cleaning solution is saved p.a. on the basis of a valve that is lifted twice a day for 30 s. Apart from detergent saving, the LEFF® technology improves the efficiency of valve seat cleaning and reduces pressure buildup in the valve's isolation chamber. LEFF® is the safer way for an environmentally sound and effective cleaning!

Kristina Boee is head of engineering. She holds a B.Sc. degree in process engineering and a Dipl.-Ing. from the Technical University Hamburg-Harburg, Germany. Kristina has 11 years of experience in the beverage and brewing industry. Her personal project contributions include project engineer for process units (wort aeration and yeast pitching); product manager for process units (carbonation, mix-processing, deaeration, wort aeration, and yeast pitching) presentations, sales material, support, and technical developments; project manager for beverage plants (complete integration, new developments, design, engineering, installation, and startup); and technical support for Tuchenhagen North America and process units. Kristina studied until 1995. She then worked for Tuchenhagen Brewery Systems GmbH, Germany, as product manager (1996–1998), project manager (1998–1999), head of engineering international (2000–2002), head of engineering with power of procuracy (2003–01/2005), and technical director (02/2005–present).

P-10**Methods for long-sustained and continuous filtration of draft beer without a centrifugal machine**

Presenter: Hiroyuki Yamada, Nishinomiya Brewery, Asahi Breweries, Ltd., Hyogo, Japan

Coauthor: Hideaki Matsuo, Asahi Breweries, Ltd., Nishinomiya, Japan

We embarked on establishing methods of the long-sustained and stable filtration of draft beer, using the existing candle filter system without centrifuge, in view of workability improvement, cost reduction, order-driven production with flexible output, etc. This presentation shows some of the methods that were proven to be quite effective, such as optimizing precoating, kieselguhr mixtures, and dosages and establishing an evaluation procedure for young beer. As to the optimization of precoating, we discovered that kieselguhr can be uniformly coated on the elements by modifying the method and timing of kieselguhr slurry insertion. In the kieselguhr mixture optimization, modification of kieselguhr mixtures minimized the increase of differential pressure. As to the optimization of dosage, optimization of the flow volume avoided building the cake up and increasing differential pressure. In the evaluation test of young beer, relativity was discovered between the number of yeasts in young beer and the increase of differential pressure. Accordingly, the effective filtration pattern was created by precounting of the number of yeasts in young beer prior to filtration. We would like to present the methods mentioned above that enable the long-sustained beer filtration, while maintaining the filtering function to trap microorganisms and the quality of foam retention, as well as the result of forcing test, etc.

Hiroyuki Yamada began his employment with Asahi Breweries, Ltd. in March 1988 as a brewing engineer. He worked for the brewing section in Asahi's several breweries in Japan and also in the Shenzhen-Qingdao brewery in China. Since January 2004, Hiroyuki has been a chief supervisor of the brewing section in Nishinomiya Brewery.

P-11**New technology, introduction of the amperometric sulfur detector**

Presenter: Mark Taylor, Arnel Inc., Parlin, NJ

Coauthors: Clarence Wentzel, Arnel Inc., Parlin, NJ; Avinash Dalmia, PerkinElmer Life and Analytical Sciences, Shelton, CT

This presentation describes the productization of a new and novel gas chromatographic detector. The amperometric sulfur detector (ASD) has been developed by PerkinElmer Life and Analytical Sciences of Shelton, Connecticut. This presentation examines utilization of the detector as it is incorporated into a family of sulfur analyzers produced by Arnel Inc., a PerkinElmer partner. The introduction of the ASD dramatically improves sulfur analyses by gas chromatography. The analyzers are dedicated to low-molecular-weight gas analysis where the sulfur content is expected to be in the range of 0.01 to 10.0 ppm. This presentation discusses the practical advantages of the use of the ASD. The product development path and virtues of each model is discussed. Theory, sampling considerations, chromatographic application, detector operational parameters, optimization, stability and precision are presented. This presentation describes the integration of the newly introduced ASD system for the PerkinElmer Clarus 500 GC family of turnkey analyzers produced with Arnel Inc. The ASD technology represents a significant advancement in sulfur-specific detection. An electrochemical sensor with polymeric barrier protection is the basis for the specificity exhibited by the detector. Simplicity of design, equimolar response, low noise, reduction of high failure components, and longevity are salient features of the ASD. The presentation bridges the new technology with a family of "purity analyzers" for the specialty and bulk gas industry, as well as polymeric grade olefins and beverage grade carbon dioxide. Each analyzer is described in terms of its analytical capabilities and impact on current quality requirements. Specifications by compound class are shown, as well as automation, operation, stability, and precision at low ppb levels of impurity analysis.

Mark Taylor received a B.S. degree in biology from Mount Saint Mary's College in Emmitsburg, Maryland. He began employment with Synaptic Pharmaceutical in 1994 as a biologist in the molecular biology laboratory. He joined National Starch and Chemicals in 1995 as a chemist in the process development laboratory, where he utilized extensive instrumental techniques. He joined Arnel Inc. in 1996 as a chemist in the quality assurance group. He holds the position of quality assurance manager, responsible for final test and specification attainment for all products shipped to Arnel's partner, PerkinElmer LAS.

P-12

Semi-pilot-scale study of energy conversion of brewing waste into bio-hydrogen and methane by the Hy-Met system

Presenter: Ryo Atsumi, Frontier Laboratories of Value Creation, Sapporo Breweries Ltd., Yaizu, Shizuoka, Japan

Coauthors: Yasuhiro Oki, Frontier Laboratories of Value Creation, Sapporo Breweries Ltd., Yaizu, Shizuoka, Japan; Yutaka Mitani, Frontier Laboratories of Value Creation, Sapporo Breweries Ltd., Yaizu, Shizuoka, Japan; Masachika Takashio, Frontier Laboratories of Value Creation, Sapporo Breweries Ltd., Yaizu, Shizuoka, Japan

The hydrogen and methane two-stage fermentation (Hy-Met) system can produce hydrogen and methane directly from food processing waste containing solid substances. The hydrogen gas produced from this process is expected to be supplied to a fuel cell, as fuel gas. The produced methane can be used as a boiler combustion gas in the usual manner. Last year, we showed that the Hy-Met system is applicable to the treatment of brewing effluent (WBC 2004). That is, the hydrogen and the methane were produced from the pressed filtrate of spent malt, which was exhausted from the lauter tan. The Hy-Met system converted the brewing effluent into biogas more efficiently than did the single methane fermentation (UASB system). To improve the hydrogen and methane yield from brewing effluent, we began semi-pilot-scale (30-L-vol bioreactor) examinations this year. We conducted fermentation examinations to obtain the optimal condition of the biogas production. The amount of hydrogen gas produced was maximized at the dilution rate of 0.5/day. The gas produced was composed of hydrogen (55%) and of carbon dioxide (45%). No sulfur compounds were detected. More than 2.2 L of hydrogen gas was produced from 1 L of the brewing effluent. Methane fermentation was attempted using the hydrogen fermentation effluent (dilution rate: 0.5/day). More than 3.5 L of methane was produced from 1 L of the supplied effluent. The total heat combustion value of the gas produced from the Hy-Met system was 10% superior to the methane single fermentation system. We supplied the model fuel cell with the hydrogen produced to demonstrate the power generation. Since the produced biohydrogen did not contain sulfur compounds, the fuel cell worked sufficiently. We obtained satisfactory results using the semi-pilot-scale reactor, and now we are attempting to scale up the Hy-Met system (900-L vol). We intend to further improve the biohydrogen and the biomethane yield from brewing effluent in the years ahead.

Mr. Ryo Atsumi graduated from the Shibaura Institute of Technology, Japan, with a bachelor's degree in 1995 and a master's degree in 1997. Then, he joined Sapporo Breweries Ltd. in 1997. He began working in the engineering department at Osaka Brewery. Ryo is currently in the Frontier Laboratories of Value Creation and engaged in environmental technology as a research engineer.

P-13

Smooth brewing operations

Presenter: Sten Aastrup, Novozymes, Bagsvaerd, Denmark

Coauthor: Noel M. Bautista, Novozymes, Kuala Lumpur, Malaysia

Operational predictability, optimum use of raw materials, cost-effective production, and consistently high beer quality are key issues in modern beer production. In many breweries, programs are carried out in order to achieve these goals by finding the optimum combination of raw materials, process, processing aids, etc. This poster describes how the use of exogenous enzymes can play an active role as an integral part of the solutions with the rationale that the malt enzymes and the exogenous enzymes having different characteristics work synergistically to do a much better job. The two enzyme sources simply extend the brewers "frame of action", thereby achieving more smooth brewing operations. The malt beta-glucanases are very heat labile and the malt enzymes for breaking down other cell wall components, such as xylans and arabinoxylans, are almost lacking. By supplementing the malt enzymes with, for example, heat-stable beta-glucanases, xylanases, arabinoxylanases, and alpha-amylases, more effective extraction and better filtration during mashing are achieved. Extract yield can be increased by 1–3% and the filterability by 8–12% using well-modified malt and standard mashing conditions. Furthermore, the combined action of the enzymes ensures that the natural fluctuations in raw material quality do not significantly influence the processability, resulting in high operational predictability. Data from trial brews and production brews will be presented showing the benefits in relation to different mashing profiles and different raw materials. Special focus will be put on the use of exogenous enzymes in combination with well-modified malt. A series of industrial-scale trials with a cytolytic enzyme blend have documented reduced wort filtration time of 15–20 min, more clear wort, 1-day-shorter fermentation time, 30–50% less kieselguhr consumption in beer filtration, and 0.5% less beer lost. The increased benefits of using exogenous enzymes at mashing-in at temperatures above 60°C. will also be shown. In this case, the savings in total mashing, lautering time, and beer filtration are substantial, and on top of this, the better flavor stability brought about by using a higher mashing-in temperature can be achieved. Finally, the benefits and savings of this application segment will be quantified using an economical model.

Sten Aastrup has held the position as global technical service manager for brewing at Novozymes since the start of 2004. In this job, Sten takes care of breweries worldwide on implementation of enzyme solutions, directly to key customers and indirectly through regional Novozymes representatives, lectures, publications, etc. He started his career as a scientist at Carlsberg Research Center, working with barley and malt quality, as well as development of new analytical methods for the malting and brewing industry. In 1990, Sten became head of the Carlsberg malt house and, from 1994 to 2003, Sten worked as a malting and brewing consultant for Alfred Jørgensen Laboratory. Sten has regularly attended international brewing conferences with posters and lectures and is the author of more than 50 papers. Sten's work has been acknowledged several times, and in 1992, he received the "Laurent Bishop Silver Medal" from the Institute of Brewing for "Outstanding Brewing Research".

P-14**Development of novel barley with improved beer foam and flavor stability—The impact of lipoxygenase-1-less barley in brewing industry**

Presenter: Kiyoshi Takoi, Sapporo Breweries Ltd., Yaizu, Shizuoka, Japan

Coauthors: Naohiko Hirota, Sapporo Breweries Ltd., Ota, Gunma, Japan; Hisao Kuroda, Sapporo Breweries Ltd., Yaizu, Shizuoka, Japan; Takafumi Kaneko, Sapporo Breweries Ltd., Ota, Gunma, Japan; Hirofumi Kaneda, Sapporo Breweries Ltd., Yaizu, Shizuoka, Japan; Ikuya Yoshida, Sapporo Breweries Ltd., Yaizu, Shizuoka, Japan; Masachika Takashio, Sapporo Breweries Ltd., Yaizu, Shizuoka, Japan; Kazutoshi Ito, Sapporo Breweries Ltd., Ota, Gunma, Japan; Kazuyoshi Takeda, Okayama University, Kurashiki, Okayama, Japan

We have shown that the flavor and foam of beer can be improved by using a barley line lacking lipoxygenase-1 (LOX-1) as malt. However, we did not know the direct screening method of LOX-1-less trait for breeding and other applications of the LOX-1-less barley (LOX-less barley) in brewing. Here, we report the molecular basis of LOX-1 deficiency in the barley line, and the brewing performance of the LOX-less barley as adjunct. A genomic sequence of the LOX-1 gene isolated from the LOX-less barley line (SBOU2) was determined. The sequence at the splicing donor site of the fifth intron of the clone was mutated from the consensus sequence (GT) to AT. The replacement of the base forms a new stop codon. RT-PCR analysis showed that the amplified fragment of the LOX-1 cDNA from SBOU2 was longer than that of the nonmutant barley. The cDNA clone contains the whole fifth intron sequence. Therefore, based on these results, we conclude that the molecular basis of the LOX-1 deficiency in SBOU2 line is attributed to a single nucleotide mutation at the splicing donor site of the fifth intron, which causes splicing disorder and forms a functional stop codon. To evaluate the brewing performance of a LOX-less barley line as adjunct, samples were prepared from two F5 populations derived from the same cross: LOX-plus and LOX-minus. Trial brewing was carried out with these samples as adjunct. The THOD content in the LOX-minus beer (happo-shu) was reduced to 33% of that in the LOX-plus beer. Moreover, the NIBEM value, an index of beer foam stability, was prolonged for 17 s. After storage at 37°C for 1 week, the *trans*-2-nonenal level of the LOX-minus beer was lower than that of the LOX-plus beer by 44%. In the sensory evaluation, well-trained panel members recognized a significant superiority of the LOX-minus beer in terms of “flavor” and “total aging” (significant at the 5% probability level). The results of the trial brewing suggest that the LOX-less barley can be effectively used not only as malt but also as adjunct to improve flavor and foam stability of beer. These satisfactory results in the trial brewing indicate that the LOX-less barley will become one of the powerful tools to improve the flavor and foam stabilities of beer. We are incorporating the LOX-less trait into several advanced barley varieties worldwide.

Previously presented at the 30th Congress of the European Brewery Convention on May 14–19, 2005, in Prague, Czech Republic.

Kiyoshi Takoi graduated in 1989 from Tohoku University with an M.S. degree in agricultural chemistry and joined the Brewing Research Laboratories of Sapporo Breweries Ltd. He is currently general manager in the Production & Technology Development Center at Sapporo. He has been engaged in the pilot malting and brewing since 1999.

P-15**Influence of wort boiling and wort clarification conditions on aging-relevant carbonyl compounds in beer**

Presenter: Osamu Ogane, Kirin Brewery Co. Ltd., Research Laboratory for Brewing, Tsurumi-Ku, Yokohama, Japan

Coauthors: Takeo Imai, Kirin Brewery Co. Ltd., Research Laboratory for Brewing, Tsurumi-Ku, Yokohama, Japan; Yutaka Ogawa, Kirin Brewery Co. Ltd., Research Laboratory for Brewing, Tsurumi-Ku, Yokohama, Japan; Motoo Ohkochi, Kirin Brewery Co. Ltd., Research Laboratory for Brewing, Tsurumi-Ku, Yokohama, Japan

Flavor stability is an important quality of beer, and it is still one of the greatest challenges in the brewing industry. Reduction of thermal load during wort boiling is generally considered to improve the beer flavor stability, but the influence of wort boiling and wort clarification on the carbonyl compounds has not been fully elucidated. From our results, it was found that thermal load during wort boiling and wort clarification processes influenced aging-relevant carbonyl compounds and odor-active compounds (dimethyl sulphide, 4-vinylguaiacol, and 3-methyl-2-butene-1-thiol). Based on the total consideration about the beer quality, it could clearly be found the optimum condition.

Previously presented at the 30th Congress of the European Brewery Convention on May 14–19, 2005, in Prague, Czech Republic.

Osamu Ogane joined Kirin Brewery Co. Ltd. in 1991 after obtaining an M.Sc. degree from Tsukuba University. He is assistant manager of the Research Laboratory for Brewing at Kirin Brewery Co. Ltd. He was involved in the research and development field of brewing technology for 9 years. From 2000 to 2003, he served as an assistant brewmaster at Kirin's Hokuriku Brewery. Since 2003, Osamu has studied wort production, raw materials and fermentation.

P-16**Mash filtration: Influence of sparging parameters on wort quality and sparging efficiency**

Presenter: Bruno Bonacchelli, Meura Technologies, Louvain la Neuve, Belgium

Coauthors: F. Harmegnies, Meura Technologies, Louvain la Neuve, Belgium; L. Marlé, Meura Technologies, Louvain la Neuve, Belgium; R. Tigel, Meura Technologies, Louvain la Neuve, Belgium

Sparging is the longest step of the mash filtration process, whatever the filtration technology. It is directly linked to the yield since the target is extract recovery, and it influences wort quality mainly with the risk of excessive elution. This poster presents results of pilot mash filtration trials where the influence of different sparging parameters on wort quality and sparging efficiency were studied. Some results, notably at high sparging flowrates or at higher sparging temperatures, are encouraging in order to allow cycle optimization and to consider future brewing processes.

Previously presented at the 30th Congress of the European Brewery Convention on May 14–19, 2005, in Prague, Czech Republic.

Bruno Bonacchelli has been studying chemistry and biotechnology engineering at the University of Liège, Belgium. He did research for 2 years on a collaboration between Meura sa (Belgium) and the CWBI (Centre Wallon de Biologie Industrielle) on beer filtration using a regenerable filter aid. He then worked for 8 more years for Meura in the Meura Technologies Department on different R&D topics such as fine milling under water, continuous brewing, clean steam injection, mash filtration, continuous boiling and stripping, and fermentation monitoring. In the meantime, he contributes to the commissioning of the industrially scaled new technologies designed by Meura.

P-17**Flavor stability of lager beer: Identification of a new key staling compound**

Presenter: Bruno Bonacchelli, Meura Technologies, Louvain la Neuve, Belgium

Authors: Delphine Callemien, Université Catholique de Louvain, Unité de Brasserie et des Industries Alimentaires, Louvain la Neuve, Belgium; Sébastien Dasnoy, Université Catholique de Louvain, Unité de Brasserie et des Industries Alimentaires, Louvain la Neuve, Belgium; Olivier Heynen, Université Catholique de Louvain, Unité de Brasserie et des Industries Alimentaires, Louvain la Neuve, Belgium; Camille Badot, Université Catholique de Louvain, Unité de Brasserie et des Industries Alimentaires, Louvain la Neuve, Belgium; Sonia Collin, Université Catholique de Louvain, Unité de Brasserie et des Industries Alimentaires, Louvain la Neuve, Belgium

In the last decade, many papers have underlined the key roles on beer staling of *trans*-2-nonenal, dimethyltrisulfide, beta-damascenone, and methional. Recent data have indicated, however, that a phenolic compound could be as important. The aim of this work was to identify this compound. The flavor profiles by AEDA of various beers were determined. Various techniques were used in order to identify the unknown: odor description at the sniffing port, injection on two capillary columns, GC-MS/EI and CI, chemical synthesis, specific extraction techniques, and cold trapping. 4-Vinylsyringol has been identified as one of the most important key flavors in aged lager beers.

Previously presented at the 30th Congress of the European Brewery Convention on May 14–19, 2005, in Prague, Czech Republic.

Bruno Bonacchelli has been studying chemistry and biotechnology engineering at the University of Liège, Belgium. He did research for 2 years on a collaboration between Meura sa (Belgium) and the CWBI (Centre Wallon de Biologie Industrielle) on beer filtration using a regenerable filter aid. He then worked for 8 more years for Meura in the Meura Technologies Department on different R&D topics such as fine milling under water, continuous brewing, clean steam injection, mash filtration, continuous boiling and stripping, and fermentation monitoring. In the meantime, he contributes to the commissioning of the industrially scaled new technologies designed by Meura.

P-18

**Which polyphenols are involved in aged beer astringency?
Assessment by HPLC and time-intensity method**

Presenter: Bruno Bonacchelli, Meura Technologies, Louvain la Neuve, Belgium

Authors: Delphine Callemien, Université Catholique de Louvain, Unité de Brasserie et des Industries Alimentaires, Louvain la Neuve, Belgium; Meriam Bennani, Université Catholique de Louvain, Unité de Brasserie et des Industries Alimentaires, Louvain la Neuve, Belgium; Christine Counet, Université Catholique de Louvain, Unité de Brasserie et des Industries Alimentaires, Louvain la Neuve, Belgium; Sonia Collin, Université Catholique de Louvain, Unité de Brasserie et des Industries Alimentaires, Louvain la Neuve, Belgium

For a long time, we have investigated in our laboratory the evolution of beer stale flavors, such as *trans*-nonenal, dimethyltrisulfide, or beta-damascenone. The current work tries to assess the impact of storage on other active compounds, most probably involved in beer astringency and bitterness. We optimized an extraction procedure for recovering beer proanthocyanidins. The resulting extracts were then concentrated and analyzed by HPLC-UV/ESI. The antioxidant efficiency was measured on various beers. The time-intensity method was used to “quantify” the astringency. As the degree of polymerization increases, bitterness decreases while astringency and reduction power significantly increase.

Previously presented at the 30th Congress of the European Brewery Convention on May 14–19, 2005, in Prague, Czech Republic.

Bruno Bonacchelli has been studying chemistry and biotechnology engineering at the University of Liège, Belgium. He did research for 2 years on a collaboration between Meura sa (Belgium) and the CWBI (Centre Wallon de Biologie Industrielle) on beer filtration using a regenerable filter aid. He then worked for 8 more years for Meura in the Meura Technologies Department on different R&D topics such as fine milling under water, continuous brewing, clean steam injection, mash filtration, continuous boiling and stripping, and fermentation monitoring. In the meantime, he contributes to the commissioning of the industrially scaled new technologies designed by Meura.

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Moderator Biographies

Posters: Gil Sanchez, moderator

Gil Sanchez, Director of Research & Development, Sierra Nevada Brewing Co.

Gil Sanchez is director of research & development at Sierra Nevada Brewing Co. In that capacity, he manages their new 10-bbl pilot brewery and research lab and oversees R&D efforts in product and process improvement and development. Gil received his B.S. degree in chemical engineering at the Massachusetts Institute of Technology and his M.S. degree in chemical engineering at the University of California at Berkeley. Gil started his brewing career at Miller Brewing Company in 1982 in the Brewing Research & Quality Assurance Division, while advancing to senior research engineer. During his 20 years at Miller, Gil has undertaken various project management and technical support responsibilities in brewing process and product development and improvement, including product flavor and flavor stability, bench and pilot scale-up to plant start-up, filtration and stabilization, adsorption, membrane separations, pasteurization, safety and environmental control, corrosion control, by-products, analytical development, and water and carbon dioxide recovery, treatment, and purification. He also developed and coauthored the patent for Sharp's nonalcoholic beverage and authored the chapter on water for The Practical Brewer. He is a member of both MBAA and ASBC. He has authored several papers for the MBAA and has served as national governor for District Milwaukee and as co chair for the 2003 MBAA Convention. He currently is serving on the MBAA Technical Committee.

Session I: General Brewing. Mike Sutton, moderator

Mike Sutton, General Manager of Hop Processing Operations, S.S. Steiner, Inc.

Mike Sutton has worked in the brewing industry for more than 26 years in various major U.S. breweries as brewing manager and brewing director, as well as in the malting and hop industry. Currently, Mike is the general manager for hop processing operations at S.S. Steiner, Inc. in Yakima, Washington, responsible for the hop pelleting, CO₂ extraction, and downstream products in addition to craft brewer sales in the Pacific Northwest. Mike is a 1992 graduate of the diploma course in brewing technology from the Siebel Institute of Technology and holds a Bachelor of Science degree in chemistry from Salisbury University, Maryland. Mike has been a member of MBAA since 1985 and served on the MBAA Technical Committee since 1997. He has been active as a member and/or officer in MBAA Districts Milwaukee, Southeast, St. Louis, Northwest, and Texas during his career.

Session II: Brewhouse. Lars Larson, moderator

Lars Larson, Master Brewer, Trumer Brauerei

Lars Larson studied brewing science at the Technical University of Berlin, earning his Diplom-Braumeister degree. After graduation, Lars joined Cerveceria Isenbeck near Buenos Aires, Argentina, a subsidiary of the Warsteiner Brewery of Germany. After 4 years in Argentina, he returned to the United States to join the Stroh Brewing Company in Longview, Texas. When Stroh sold its breweries, Lars joined Profamo, Inc., with technical and sales responsibility for brewing instrumentation for the western United States as well as Central and South America. In 2001, he joined the BridgePort Brewing Company in Portland, Oregon, which led

in turn to Trumer Brauerei, Berkeley, California, where in 2003, Lars became master brewer.

Session III: Brewing Co-Products. Rick Brundage, moderator Rick Brundage, Industry Technical Consultant, Food & Beverage Industry

Rick Brundage received a B.S. degree in chemical engineering in 1981 from Bucknell University. Rick has spent 15 years as a brewing industry expert for Nalco Company. Three years as product manager for biocides in Nalco's Cooling Water Marketing; and 21 years working in the water treatment area, including 7 years in marketing, 8 years in sales, and 6 in consulting. Rick now spends his time traveling around the world working with Nalco sales engineers in breweries to optimize their current water-related operations. Rick joined MBAA in 1990. He has served in several district positions in Districts Milwaukee and Philadelphia in addition to the MBAA Technical Committee.

Session IV: Yeast/Fermentation. Ray Kanzleiter, moderator

Ray Kanzleiter, Corporate Brewing Manager, Miller Brewing Company

Ray Kanzleiter is a graduate of the University of Illinois at Champaign-Urbana and of the Siebel Diploma Course in Brewing. Ray began his brewing career with Miller Brewing in 1979 at the Eden, North Carolina brewery as a brewing supervisor. He then worked at the Fulton, New York brewery and was a startup team manager in the brewing department at the Trenton, Ohio brewery in 1991. In 1994, he joined the corporate brewing staff in Milwaukee as a senior staff brewer and was heavily involved in the initial international launching of Miller Genuine Draft in Europe. He then has served Miller Brewing as brewing manager at both the Albany, Georgia and Fort Worth, Texas breweries. In 2002, Ray returned to Milwaukee as corporate brewing manager, responsible for all aspects of brewing and brewing processes at Miller.

Session V: Packaging. Roy Johnson, moderator

Roy Johnson, Beverage Sales Manager, Tuchenhagen Flow Components, LLC

Roy Johnson began his brewing career with Miller Brewing Company at the Fulton, NY brewery in 1983 as a QA packaging analyst. He transferred to Miller's Ft. Worth, TX brewery as a QA packaging/product supervisor in 1987. In 1990 Roy was then moved into the Ft. Worth Brewing Department, where he worked in the brewing, fermentation, aging, and package release areas as a brewing supervisor. Roy then was transferred to Miller's Trenton, OH brewery in 1994 where he was a brewing area team manager until 1995. In 1995, Roy accepted a position with The PQ Corporation as a national account manager handling beer stabilization sales to key brewing accounts in North America. Roy then moved to his current position of beverage sales manager for Tuchenhagen Flow Components, LLC in 2003. He is now responsible for all brewing sales for Tuchenhagen in the USA. Roy graduated from The Pennsylvania State University in 1982 with a B.S. degree in food science and a business emphasis. He obtained an M.B.A. from the University of Texas in Arlington in 1994. Roy

is active in MBAA as the current president of District Cincinnati. He is also the current national Membership Chair for MBAA and the BOG rep for District Cincinnati.

Session VI: Beer Filtration. Fred Havel, moderator

Fred Havel, Development Brewer, Molson

Fred Havel is development brewer at Molson's Global Quality and Innovation Department. He received an Hons. B.Sc.Agr. degree from Guelph in 1981 and has been working in the brewing industry throughout the northern hemisphere since 1983. Fred has held positions at Canada Malting, Carling O'Keefe, Molson, SUN Brewing, Carlsberg, and Unibroue and has worked for himself as a consultant. He returned to Molson in 2001 and works out of Montreal, Quebec.

Session VII: Bio/Analytical Methods. Xiang Yin, moderator

Xiang Yin, Technical Manager, Prairie Malt Ltd.

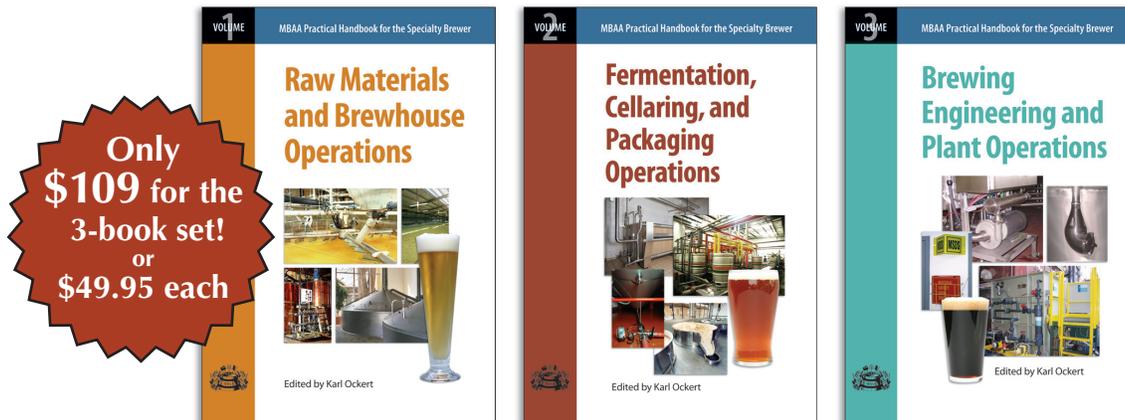
Xiang S. Yin is the Technical Director for Cargill Malt Americas, based out at Prairie Malt Limited, Canada. He obtained his first degree in Engineering in Fermentation Technology, at Wuxi, China, and received his Ph.D. in 1986 from Heriot-Watt University, Edinburgh. He carried out his postdoctoral research at the University of Edinburgh and then at the Grain Research Laboratory in Winnipeg. As the recipient of the 1990 Centenary Research Award of the Institute of Brewing, Xiang worked at the Brewing Research International, England, on beer flavor in the same year. He was an Associate Professor at the Wuxi Institute of Light Industry in China for three years before joining Prairie Malt as Director of Technical Services in 1991. Xiang is the author or coauthor of over 40 scientific and technical papers for international conventions and publications. He recently served as the district executive and representative on the Board of Governors for District Western Canada of MBAA. Xiang is currently the Chairman of the Board of Directors for the Brewing and Malting Barley Research Institute, Canada, and has been serving the ASBC as Secretary since July 2004.

Session VIII: Beer Stability. George Reisch, moderator

George F. Reisch, Brewmaster, Anheuser-Busch Inc.

George F. Reisch is a corporate brewing staff brewmaster in St. Louis. He is a fifth generation brewmaster. His family owned and operated the Reisch Brewing Co. of Springfield, Illinois, from 1849 until it ceased operations in 1966. He attended the University of Wisconsin and worked during the summer months for both the Joseph Schlitz Brewing Co. as a brewery worker and at the Miller Brewing Co. as a research assistant. He graduated in 1979 with a B.S. degree in food chemistry from the University of Wisconsin, Department of Food Science and Technology. He was hired by Anheuser-Busch Inc. and was placed in their corporate management-training program (1979-1980). In 1980, he was promoted to brewing supervisor and transferred to the Los Angeles Anheuser-Busch brewery. At the Los Angeles brewery, he also held the positions of brewing technical coordinator, assistant brewmaster, and staff brewmaster before being moved into corporate brewing. George is an active member of MBAA. He is a past president of MBAA District Southern California and is presently serving on the Technical Committee for the national MBAA office. In addition, he is a member of the Board of Advisors for the North American Brewers Association (NABA). George is a tasting judge at the World Beer Cup and Great American Beer Festival.

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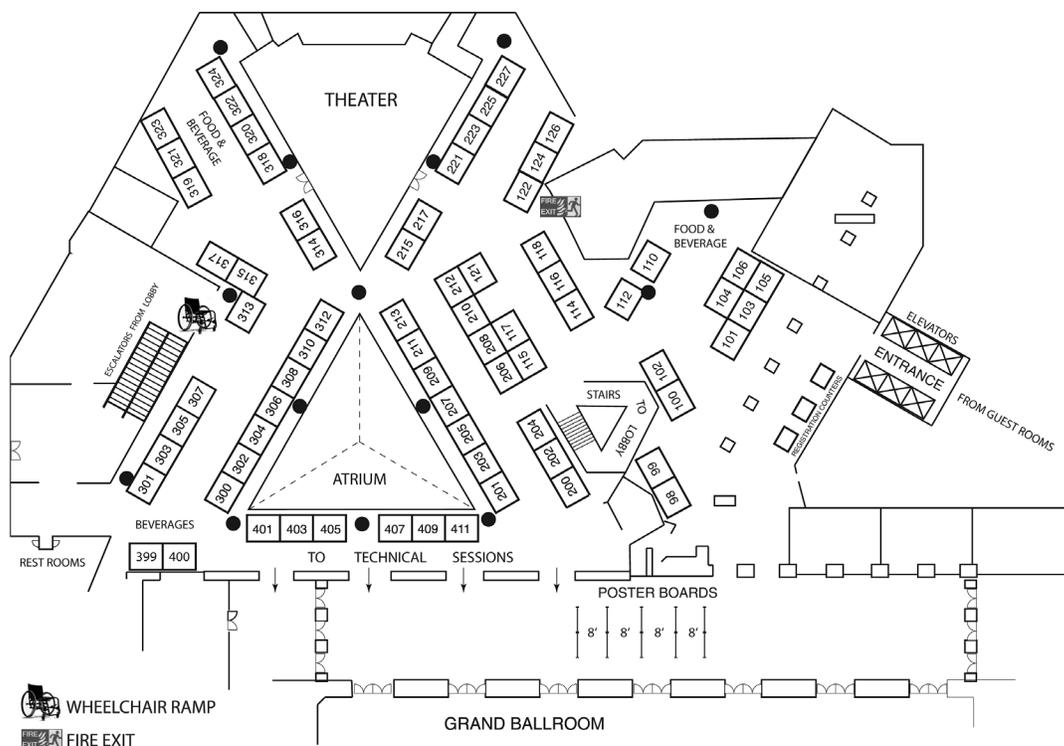
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	2:00 – 5:00 p.m.	Takedown

Exhibit Floor Plan — Mezzanine East/West



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99	PerkinElmer Life & Analytical Sciences	126	Paul Mueller Company	227	Schaefer Kegs	319	Wyeast Laboratories Inc.
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		223	Cambridge Wire Cloth Company				

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- 122 Albert Handtmann Armaturenfabrik**, Arthur Handtmann Strasse 13 + 23, Biberach 88400, Germany; Phone: +49 7351 3424542, Fax: +49 7351 3424465, www.handtmann.de.
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- 317 APV Invensys**, 100 S. CP Ave., Lake Mills, WI 53551; Phone: +1.920.648.8311, Fax: +1.920.648.1441, www.apv.invensys.com. APV is a world-class supplier of high-quality process engineering solutions and automation to the food, beverage, pharmaceutical and healthcare industries and has been a leading supplier to the brewing industry for over 80 years. APV's range of manufactured products includes heat exchangers, homogenizers, pumps and valves for hygienic applications. Plus, APV also offers a complete range of separation technologies including membrane filtration systems, dryers, evaporators and distillation systems.
- 104 Barry-Wehmiller Company**, 8020 Forsyth Blvd., St. Louis, MO 63105-1707; Phone: +1.314.862.8000, Fax: +1.314.862.2457, www.barry-wehmiller-company.com.
- 403 BASF Corporation**, 100 Campus Dr., Florham Park, NJ 07932; Phone: 1.800.527.9881, Fax: +1.973.245.6843, www.humannutrition.basf-corp.com. BASF doesn't make food, beverages or dietary supplements. But we help our customers make these products better with intelligent system solutions and high-quality products. Our portfolio includes vitamins (A, the B vitamins, C, D, E, K), carotenoids (beta-carotene and lycopene), polyunsaturated fatty acids (Omega-3s), lysine, excipients, emulsifiers, Divergan® beverage clarifying and filtration products and FreshSeal postharvest produce coatings. Technical support and industry-specific formulation expertise back BASF's portfolio of nutritional and functional ingredients. BASF also has a strategic partner for custom premixes in Fortitech.
- 320 Begerow/KLR Machines, Inc.**, 47 W. Steuben St., Bath, NY 14810; Phone: +1.607.776.4193, Fax: +1.607.776.9044. Begerow offers the finest in a full range of filter sheets, disc filters, sheet filters, media and filter cartridges. Several stocking warehouses ensure prompt delivery. In addition, Begerow also offers you, the customer, answers to your filtration questions.
- 211 Bio-Chem Laboratories, Inc.**, 1049 28th St. S.E., Grand Rapids, MI 49508; Phone: +1.616.248.4900, Fax: +1.616.248.4904, www.bio-chem.com.
- 217 Brewers Supply Group**, 800 W. First Ave., Shakopee, MN 55379; Phone: +1.952.224.1381, Fax: +1.952.224.1390, www.brewerssupplygroup.com.
- 401 Briggs of Burton, Inc.**, 5 Marway Cir., Rochester, NY 14624; Phone: +1.585.426.2460, Fax: +1.585.426.0250, www.briggspc.co.uk. Briggs excels in mash conversion, mash separation, wort boiling, yeast management, dry goods, the process block and keg racking. Briggs Symphony External Wort boiling technology is now bringing major benefits in North America. Learn about our experienced engineering support, dedicated service and range of in-house project management and automation services.
- 118 Bruker BioSpin Corporation, EPR Division**, 44 Manning Rd., Billerica, MA 01821; Phone: +1.978.663.7406, Fax: +1.978.670.8851, www.bruker-biospin.com. Bruker BioSpin Corporation manufactures EPR spectrometers for use in flavor-stability applications. Bruker's EMX spectrometer is a high throughput research system for both liquid and solid samples. The e-scan bench top spectrometer provides rapid, automated analysis for optimizing your beer's shelf life.
- 215 Buhler Inc.**, 13105 12th Ave. N., Plymouth, MN 55442; Phone: +1.763.847.0231, Fax: +1.763.847.9915, www.buhlergroup.com.
- 223 Cambridge Wire Cloth Company**, 105 B Goodwill Rd., P.O. Box 399, Cambridge, MO 21613; Phone: 1.877.226.9473, Fax: +1.410.228.2617, www.camwire.com. Premium brews deserve our premium leaf. Cambridge Wire Cloth Continu Weld® 360 filter leaves represent innovation in pressure filtration technology. These leaves feature continuous nonporous welding of filter cloth to solid bar frame for the ultimate in sanitary leak-proof performance. Cambridge can easily repair your 360's to like-new condition.
- 115 Cargill**, 15407 McGinty Rd. W., Wayzata, MN 55391; Phone: +1.937.237.1236 (sweeteners) or +1.920.674.8521 (malt), Fax: +1.937.237.1238 (sweeteners) or +1.920.674.6158 (malt), www.cargill.com. Providing quality ingredients, services and innovative brewing solutions is the focus of Cargill Sweeteners

and Cargill Malt. To learn more about specific brewing adjuncts and malt products, visit us at booth #115. Collaborate, create, and succeed: this is how we work with customers.

- 315 Carmi Flavor & Fragrance Co., Inc.**, 6030 Scott Way, Commerce, CA 90040; Phone: +1.323.888.9240, Fax: +1.323.888.9339, www.carmiflavors.com. Carmi Flavors manufactures a vast selection of high-quality natural, natural/artificial, artificial and organic flavors in liquid or powder form for the entire food and beverage industry. Our flavors are available in warehouses throughout the US and Canada.
- 313 Centec LLC**, P.O. Box 820, Germantown, WI 53022; Phone: +1.262.251.8209, Fax: +1.262.251.8376, www.centec-usa.com. Manufacturer of water deaeration, high-gravity blending, carbonation, flash pasteurizers, nitrogenators, on-line alcohol analyzers, and OG meters.
- 103 ChemTreat, Inc.**, 4461 Cox Rd., Glen Allen, VA 23060; Phone: +1.804.935.2000, Fax: +1.804.965.6974, www.chemtreat.com.
- 321 Deltagen Bioproducts Group**, Marsweg 6, Willemstad, Curacao, Netherlands Antilles; Phone: +5999 7376411, Fax: +5999 7378892, www.deltagengroup.com.
- 304 Design Controls**, 9885 Drysdale Ln., Houston, TX 77447; Phone: +1.713.856.7444, Fax: +1.713.856.8866.
- 405 domnick hunter inc.**, 5900-B Northwoods Pkwy., Charlotte, NC 28269; Phone: 1.800.345.8462, Fax: +1.704.921.1960, www.domnickhunter.com. Manufacturer of a complete range of cartridge filters used for filtration of beer, process water, steam, sterile air and CO₂, PCO₂ range of CO₂ purifiers and MAXIGAS nitrogen gas generators. Filtration applications include trap filtration, final stabilization and process water pre-treatment.
- 318 EaglePicher Filtration & Minerals**, 9785 Gateway Dr., Suite 1000, Reno, NV 89521; Phone: +1.775.824.7646, Fax: +1.775.824.7601, www.eaglepicher.com.
- 407 Ecolab Inc.**, 370 Wabasha St. N., St. Paul, MN 55102; Phone: +1.651.293.2233, Fax: +1.651.293.2260, www.ecolab.com.
- 303 Emerson Process Management**, 12301 Research Blvd., Research Park Plaza, Bldg III, Austin, TX 78759; Phone: +1.512.835.2190, Fax: +1.512.834.7399, www.emersonprocess.com.
- 324 ENERCO CORPORATION**, 317 N. Bridge St., Grand Ledge, MI 48837-1632; Phone: +1.517.627.8444, Fax: +1.517.627.8037, www.enercocorp.com. Full line of cleaners and sanitizers for food and beverage production. Knowledgeable sales representation to assist in service and training. Full line of water treatment chemicals for boilers, cooling towers, hot and cold loops and glycol systems. Equipment for injection or use of all our chemical products.
- 106 Enerfab, Inc.**, 4955 Spring Grove Ave., Cincinnati, OH 45232; Phone: +1.513.641.0500, Fax: +1.513.242.6833, www.enerfab.com.
- 121 Enzyme Development Corporation**, 360 W. 31st St., 21 Penn Plaza, Suite 1102, New York, NY 10001-2727; Phone: +1.212.736.1580, Fax: +1.212.279.0056, www.enzymedevelopment.com.
- 105 Filtrox NA**, 9805 NE 116th St. A-200, Kirkland, WA 98034; Phone: +1.425.820.4850, Fax: +1.425.820.2816, www.filtercorp.com.
- 206 FRINGS America Inc.**, 1413 Sherman Rd. #30, Romeoville, IL 60446; Phone: +1.630.783.1407, Fax: +1.630.783.1410, www.fringsamerica.com.
- 323 GEA Ecoflex North America**, 4810 Poplar Place Dr., Suite 100, Louisville, KY 40218; Phone: +1.502.962.3535, Fax: +1.502.962.5497, www.geaecoflex.com.
- 302 Genencor International**, 200 Meridan Centre Blvd., Suite 300, Rochester, NY 14618; Phone: +1.585.256.5200, Fax: +1.585.256.6952, www.genencor.com. Genencor International, a Danisco Company offers a complete line of high-quality enzymes and processing aids that offer solutions for filtration, chill-haze prevention, adjunct liquefaction and mash optimization; provide technology for low-carbohydrate beer production; improve manufacturing processes and reduce costs by reducing wort viscosity and eliminating barley β-glucans. To find out more, visit us online at www.genencor.com. Cheers!
- 300 GKD-USA, Inc.**, 825 Chesapeake Dr., Cambridge, MD 21613; Phone: 1.800.453.8616, Fax: +1.410.221.0544, www.gkdusa.com. GKD is a worldwide company, weaving high-quality filtration media, providing solutions, as well as, technical assistance to the beer industry. GKD-USA, Inc. manufactures new filter screens and performs the re-screening of other filter screens presently used in the beer industry. The "NEVERLEAK DESIGN" filter leaf, the precision woven KPZ 55 filter media and the "NEW" outlet will be displayed.
- 200/202 Gusmer Enterprises, Inc.**, 1165 Globe Ave., Mountainside, NJ 07092; Phone: +1.908.301.1811, Fax: +1.908.301.1812, www.gusmerenterprises.com. For more than eighty years, Gusmer Enterprises has been dedicated to providing service with knowledge to the brewing industry. Gusmer Enterprises supplies the brewing, malting and distilling industries with a wide variety of products. Instrumentation, malt mills, malting equipment, filtration media, processing aids, and spent grain handling equipment are only a few examples of our extensive product line.
- 209 Hach Company**, P.O. Box 389, Loveland, CO 80539; Phone: +1.970.669.3050 or 1.800.227.4224, Fax: +1.970.669.2932, www.hach.com. Hach Company manufactures and distributes analytical instruments and reagents used to test the quality of water and other aqueous solutions. Our systems are designed to simplify analysis and include complete, easy-to-follow methods, high-quality prepared reagents, accurate instrumentation, life-time technical support. Our goal is to offer quality products and competent, friendly support.

- 201 Haffmans**, 1330 Anvil Dr., Rockford, IL 61115; Phone: +1.815.639.0322, Fax: +1.815.639.1135, www.haffmans.nl. Haffmans, a member of the NORIT Group, is a leading supplier of CO₂ management systems and offers CO₂ recovery plants, CO₂ audits, CO₂ instrumentation, water deaeration, and blending and carbonation units.
- 399 Hanna Instruments**, 584 Park East Dr., Woonsocket, RI 02895; Phone: +1.401.765.7500, Fax: +1.401.762.5064, www.hannainst.com.
- 116 Huppmann Group**, Heinrich-Huppmann-Str. 1, Kitzingen 97318, Germany; Phone: +49 9321 3030, Fax: +49 9321 303603, www.huppmann.com.
- 411 International Specialty Products**, 1361 Alps Rd., Wayne, NJ 07470; Phone: +1.973.872.4403, Fax: +1.973.628.3886, www.ispcorp.com. ISP is recognized worldwide for its Polyclar® line of products (PVPP) used for the stabilization and clarification of beer. The line includes products to remove haze-causing polyphenols (Polyclar 10 and Polyclar Super R) and for the simultaneous balanced removal of haze-causing polyphenols and proteins (Polyclar Plus 730). ISP is also a basic supplier of alginates (PGA) to enhance and stabilize foam in beer. Polyclar Brewbrite is a new addition to our product line; it is a wort clarifier and stabilizer and also gives higher wort yield, reduced fermentation time and longer filter run lengths.
- 207 JohnsonDiversey, Inc.**, 3630 E. Kemper Rd., Cincinnati, OH 45241; Phone: 1.800.233.1000, Fax: +1.513.956.4831, www.johnsondiverse.com. JohnsonDiversey Inc. is a global cleaning and sanitation company with 20,000 associates in more than 60 countries serving the brewing industry. JohnsonDiversey is involved with technology and expertise that meet and exceed your hygiene standards. This results in a better-looking and better-tasting product, while reducing water, energy, other utility usage and environmental impact.
- 98 Kalsec Inc.**, P.O. Box 50511, Kalamazoo, MI 49006; Phone: +1.269.349.9711, Fax: +1.269.382.3060, www.kalsec.com.
- 225 KRONES AG - Steinecker Plant**, Raiffeisenstr. 30, Freising 85356, Germany; Phone: +49 8161 9530, Fax: +49 8161 953150, www.steinecker.com. Krones AG with its Steinecker technologies is one of the world's leading suppliers for brewing plants. The scope of services covers planning, brewing technology, manufacturing and commissioning of plant components as well as turnkey projects. The product range includes brewhouse and filter plants, fermentation and storage cellars, flash pasteurizing and CIP units and also CO₂-recovery systems. Merlin, Pegasus, Twin-Flow-System, Stromboli and ShakesBeer are among the Steinecker innovations for the last four years.
- 400 Loeffler Chemical Corporation**, 5700 Bucknell Dr., Atlanta, GA 30336; Phone: +1.404.629.0999, Fax: +1.404.629.0690, www.loefflerchemical.com.
- 322 MacDonald Steel Ltd.**, 200 Avenue Rd., Cambridge, ON N1R 8H5, Canada; Phone: +1.519.740.9399, Fax: +1.519.740.3686, www.macdonaldsteel.com or www.hdpCanada.com.
- 307 MEURA**, Rond Point J.-B. Meura, 1, Péruwelz 7600, Belgium; Phone: +32 69 886988, Fax: +32 69 886980, www.meura.com. MEURA, founded in Belgium in 1845, are specialists in engineering, design and manufacturing of brewhouses, yeast management plants and turn key projects. The MEURA 2001 mash filter is recognized worldwide as the state-of-the-art mash filtration technology with relation to the wort quality, extract yield, productivity and ability for high-gravity brewing.
- 204 Millipore Corp.**, 900 Middlesex Turnpike, Billerica, MA 01821; Phone: +1.845.621.6560, Fax: +1.845.621.6544, www.millipore.com.
- 205 NORIT Process Technology**, 1330 Anvil Dr., Rockford, IL 61115; Phone: +1.815.639.0322, Fax: +1.815.639.1135, www.noritpt.nl. NORIT Process Technology, a member of the NORIT Group, is a leading supplier of cross flow beer membrane filtration as an alternative to kieselguhr in the brewing industry. NPT also offers technology for the decolorization of beer using a combination of membranes and activated carbon and membranes for the production of process water and treatment of wastewater.
- 312 Novozymes**, 77 Perry Chapel Church Rd., Franklinton, NC 27525; Phone: +1.919.494.3000, Fax: +1.919.494.3450, www.novozymes.com. The key to smooth brewing. Brewing can be unpredictable, but enzymes from Novozymes help smooth the process. Fluctuations in malt quality, long lautering time and diacetyl off-flavors are just some of the challenges that impact the process and costs. Novozymes has been supplying innovative enzyme products to the brewing industry for many years. The Novozymes range of brewing enzymes provides the specific solutions you need to expand your options and refine your brewing operations. Use enzymes to improve capacity and efficiency while retaining the high quality of the beer in every brew. Enzymes are a natural processing aid and are the key to a smooth operation by ensuring consistent processes and results.
- 112 optek-Danulat, Inc.**, N118 W. 18748 Bunsen Dr., Germantown, WI 53022; Phone: 1.800.371.4288, Fax: +1.262.437.3699, www.optek.com.
- 114 Pall Corporation**, 2200 Northern Blvd., East Hills, NY 11548; Phone: +1.516.801.9924, Fax: +1.516.484.3216, www.pall.com. Pall Corporation is the leader in the field of filtration, separation, and purification. The company provides leading-edge products to meet the demanding needs of customers in the machinery and equipment, water processing, food and beverage, fuels and chemical, microelectronics, and power generation industries. Further information can be found on our website at www.pall.com.
- 126 Paul Mueller Company**, 1600 W. Phelps St., Springfield, MO 65801; Phone: +1.417.831.3000, Fax: +1.417.575.9669, www.muel.com.
- 99 PerkinElmer Life & Analytical Sciences**, 710 Bridgeport Ave., Shelton, CT 06484; Phone: 1.800.762.4000, Fax: +1.203.944.4914, <http://las.perkinelmer.com>.

- 221 Perlick Corporation**, 8300 W. Good Hope Rd., Milwaukee, WI 53223; Phone: +1.414.353.7060, Fax: +1.414.353.7069, www.perlick.com. Perlick is a leader in the beverage dispensing bar equipment and brewery fitting industry. Just two of our new products that will be on display are the ASME code-approved pressure safety device and the air-actuated and manually operated sanitary sampling valve.
- 305 Profamo Inc.**, 7506 Albert Tillinghast Dr., Sarasota, FL 34240; Phone: +1.941.379.8155, Fax: +1.941.379.8699, www.profamo.com. Profamo Inc. represents many well-known manufacturers of process and quality control equipment, including; ACM (beer analyzer, density meters, conductivity, refractometer and decarbonizer); Dr. Thiedig (dissolved oxygen and in-line CO₂ meters); Headmaster (oxygen and CO₂ calibrators); Steinfurth (CO₂ and temperature/pressure loggers); Lg-automatic (hazemeter, foam tester, TPO accessories and mash bath); Rotech (keg monitor); OxySense (non-destructive oxygen measurement); Keofitt (sterile sampling); Pfeuffer (friabilimeter, sortimat, tannometer and viscomat).
- 110 Rockwell Automation**, 1201 S. 2nd St., Milwaukee, WI 53204-2496; Phone: +1.414.382.2000, Fax: +1.414.382.4444, <http://rockwellautomation.com>.
- 227 Schaefer Kegs**, 9 Greenwood Trail, Brantford, ON N3R 6G4, Canada; Phone: +1.519.751.1201, Fax: +1.519.753.2305, www.schaeferkegs.com.
- 212 S. S. Steiner, Inc.**, 655 Madison Ave., New York, NY 10021-8078; Phone: +1.212.838.8900, Fax: +1.212.593-4238, www.hopsteiner.com.
- 409 Siebel Institute of Technology/World Brewing Academy**, 1777 N. Clybourn Ave., Suite 2F, Chicago, IL 60614; Phone: +1.312.255.0705, Fax: +1.312.255.1312, www.siebelinstitute.com.
- 316 Siemens Energy & Automation Inc.**, 5300 Triangle Pkwy., Suite 100, Norcross, GA 30092; Phone: +1.770.579.0092, Fax: +1.678.297.8882, www.siemens.com.
- 203 Südmo North America**, 1330 Anvil Dr., Rockford, IL 61115; Phone: +1.815.639.0322, Fax: +1.815.639.1135, www.sudmona.com. Südmo, a member of the NORIT Group, is a leading supplier of high-quality stainless steel mix-proof (double seat) valves and of standard, long stroke, sampling, regulating, tank outlet, aseptic, butterfly, flow diversion, ball, and diaphragm valves. Südmo also supplies fittings, complete manifolds, and control tops that interface directly with simple I/O controls or ASI, DeviceNet, or Profibus.
- 310 Tuchenhausen Flow Components, LLC**, 90 Evergreen Dr., Portland, ME 04103; Phone: +1.207.797.9500, Fax: +1.207.878.7914, www.tuchenhausen-fc.com. Manufacturers of the most complete range of sanitary Mixproof, Single-Seat, Divert, Control, Safety Relief, Sampling, and Butterfly valves. Tuchenhausen's product range includes the famous Varivent range of pocketless instrumentation, tank cleaning devices, our Varitop Modular vessel over- and under-pressure and cleaning units, as well as the newly patented Eco-Matrix tank piping system.
- 301 Tyco Flow Control**, 1195 Airport Rd., Lakewood, NJ 08701; Phone: +1.732.730.1008, Fax: +1.732.730.1038, www.tycoflowcontrol.com.
- 314 USFilter**, 10 Technology Dr., Lowell, MA 01851; Phone: 1.800.525.0658, Fax: +1.518.758.2182, www.usfilter.com. USFilter Corporation, a Siemens Company offers the most complete line of water and wastewater treatment equipment and technologies for the beverage industry. Our water treatment processes include membrane filtration, pretreatment, disinfection and oxygen removal systems. Our wastewater treatment technologies include chemical/physical, biological, evaporation, and recovery and provides the tools you need to meet compliance issues, minimize waste, and reduce BOD levels. USFilter designs, builds, installs, and operates complete water and wastewater systems according to your specifications. Our network of local service branches can provide maintenance, operator training, media replacement, membrane cleaning and emergency response for your water system.
- 213 Westfalia Separator, Inc.**, 100 Fairway Ct., Northvale, NJ 07647; Phone: +1.201.767.3800, Fax: +1.201.767.3416, www.wsus.com.
- 101 Weyermann Specialty Malting Company**, Brennerstrasse 17-19, Bamberg 96052, Germany; Phone: +49 951 93220 33, Fax: +49 951 93220 933, www.weyermannmalt.com.
- 306 Whatman Inc.**, 200 Park Ave., Suite 210, Florham Park, NJ 07932; Phone: +1.973.245.8300, Fax: +1.973.245.8329, www.whatman.com. Products and technical services focusing on microbiological testing in the food and beverage, pharmaceutical and environmental markets.
- 210 The Wittemann Company, LLC**, 1 Industry Dr., Suite A, Palm Coast, FL 32137; Phone: +1.386.445.4200, Fax: +1.386.445.7042, www.wittemann.com. Founded in 1874, Wittemann today is a leading USA-based company, globally recognized as a leader in the design, manufacture, and supply of complete systems and equipment for CO₂ recovery, production, purification, liquefaction, carbonation, vaporization and cylinder filling. We have equipment installed in over 100 countries and offer complete service, including installation supervision, commissioning and spare parts.
- 319 Wyeast Laboratories Inc.**, Box 146, Odell, OR 97044; Phone: +1.541.354.1335, Fax: +1.541.354.3449, www.wyeastlab.com.
- 308 Yakima Chief, Inc.**, 555 W. South Hill Rd., P.O. Box 209, Sunnyside, WA 98944; Phone: +1.509.839.9022 or 1.800.608.4677, Fax: +1.509.839.5570, www.yakimachief.com.
- 100/102 ZIEMANN Ludwigsburg GmbH**, Schwieberdinger Str. 86, Ludwigsburg 71636, Germany; Phone: +49 7141 4080, Fax: +49 7141 408222, www.ziemann.com.

