

Your Guide to the ASHRAE Annual Conference

June 23–27, 2012

Personal Program	2	General Tours	26
Hotel & Convention Center Floor Plans	4	Technical Tours	27
Chapter and Society Officials	11	Committee Chair Recognition	28
General Information	12	Types of Sessions	29
Lost and Found	12	Technical Program Schedule.	30
Spouse/Guest Guide	14	Sunday	30
Past and Future Meetings	14	Monday	36
Welcome Party Information	15	Tuesday	40
Members' Night Out Information.	15	Wednesday.	45
Plenary Speaker	15	General Committee, Subcommittee and Ad Hoc	
Green Practices at Hyatt and Henry B. Gonzalez		Committee Meetings	50
Convention Center	16	Technical Committee Meetings.	54
Sustainability Project	19	ASHRAE Staff	65
How to Find your Meeting Room	20	Speaker Listing	66
Scheduled Events & Meeting Locations.	22	ASHRAE Learning Institute Courses.	69
Awards Presentation	24		

PERSONAL PROGRAM—PLAN YOUR OWN MEETING SCHEDULE!

FRIDAY, JUNE 22	SATURDAY, JUNE 23	SUNDAY, JUNE 24
8:00 am–12:00 noon	8:00 am–12:00 noon	8:00 am–9:30 am
1:00 pm–5:00 pm	8:00 am–3:00 pm	8:30 am–12:00 noon
5:00 pm–10:00 pm	1:00 pm–3:00 pm	9:45 am–10:45 am
	<p>3:15 pm–5:00 pm</p> <p>Plenary Session Grand Hyatt Texas Ballroom D</p>	11:00 am–12:30 pm
		1:30 pm–3:00 pm
	<p>6:30 pm–8:30 pm</p> <p>Welcome Party Buckhorn Saloon</p>	3:00 pm–7:00 pm

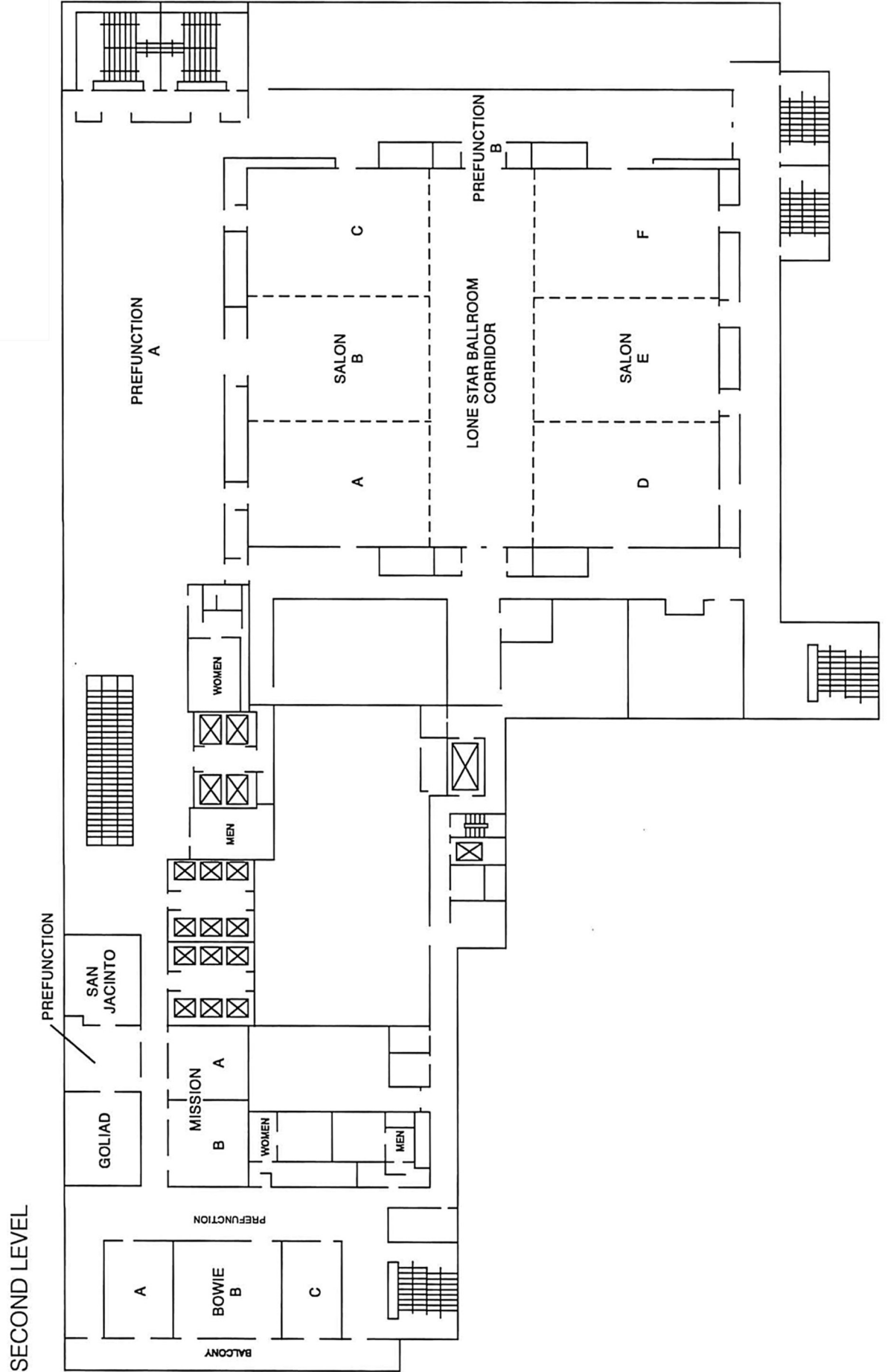
NOTES:

PLAN YOUR OWN MEETING SCHEDULE!—PERSONAL PROGRAM

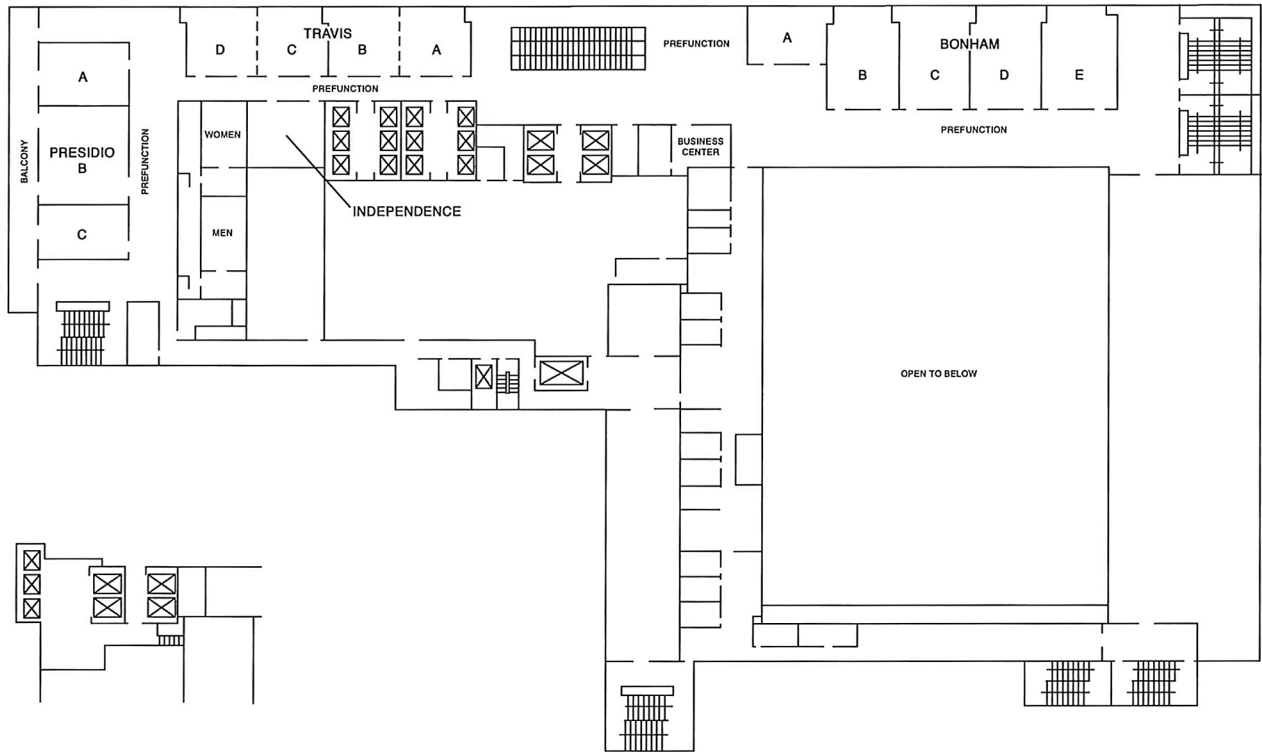
MONDAY, JUNE 25	TUESDAY, JUNE 26	WEDNESDAY, JANUARY 27
8:00 am–9:30 am	8:00 am–9:00 am	8:00 am–9:30 am
9:45 am–10:45 am	9:45 am–10:45 am	9:45 am–10:45 am
11:00 am–12:00 noon	11:00 pm–12:30 pm	11:00 am–12:30 pm
12:15 pm–2:00 pm President’s Luncheon Grand Hyatt Texas Ballroom D	1:00 pm–3:30 pm	1:00 pm–5:00 pm
2:15 pm–4:15 pm	3:30 pm–6:00 pm	
4:15 pm–6:30 pm	7:15 pm–10:30 pm Members’ Night Out Grand Hyatt Texas Ballroom D	

GRAND HYATT

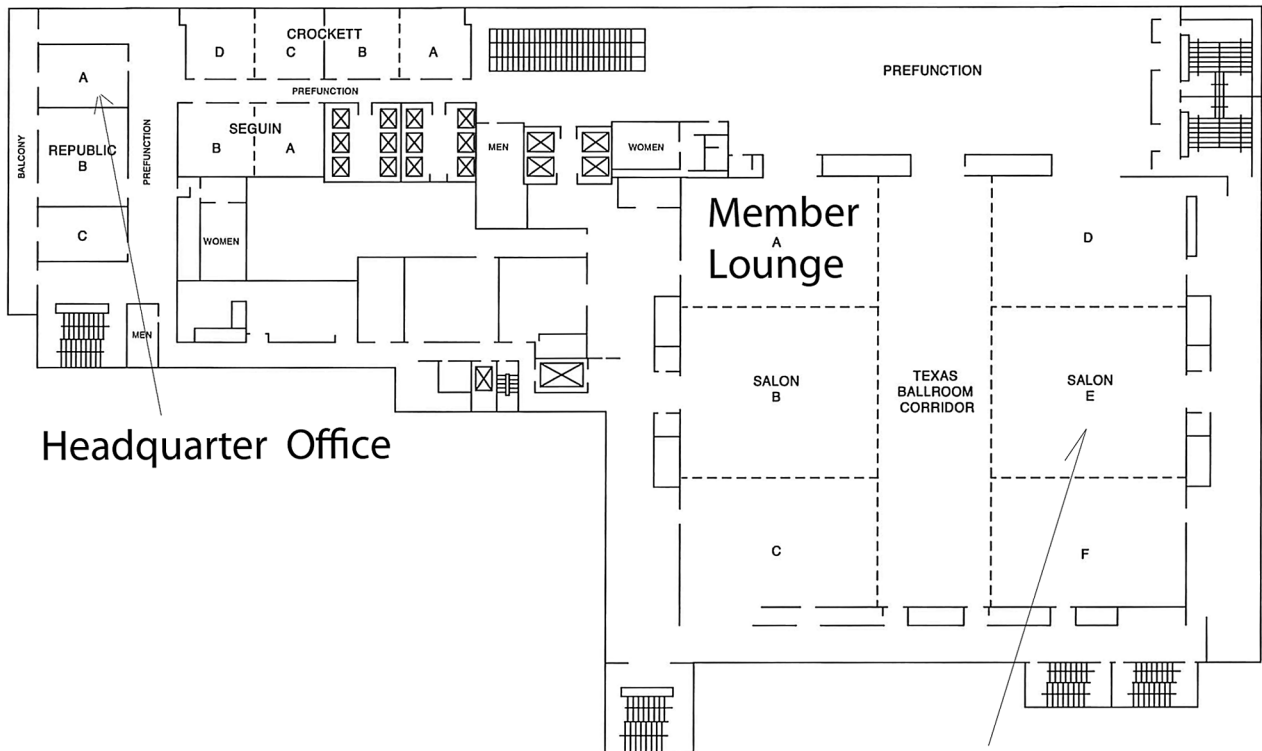
2ND LEVEL



THIRD LEVEL



FOURTH LEVEL



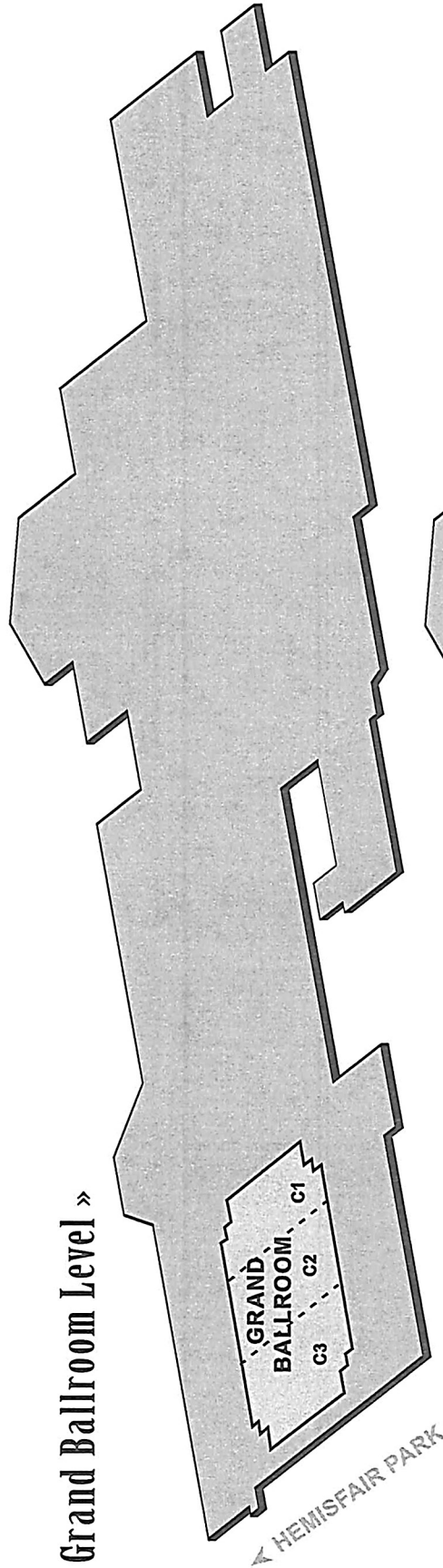
Headquarter Office

Plenary, MNO and
President's Luncheon

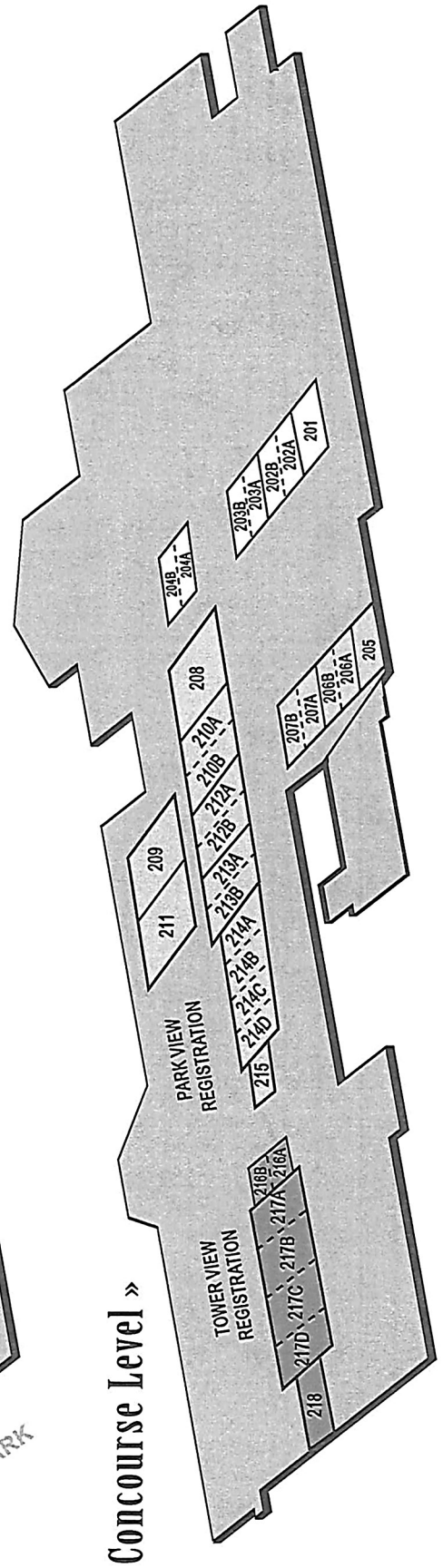
HENRY B. GONZALEZ CONVENTION CENTER

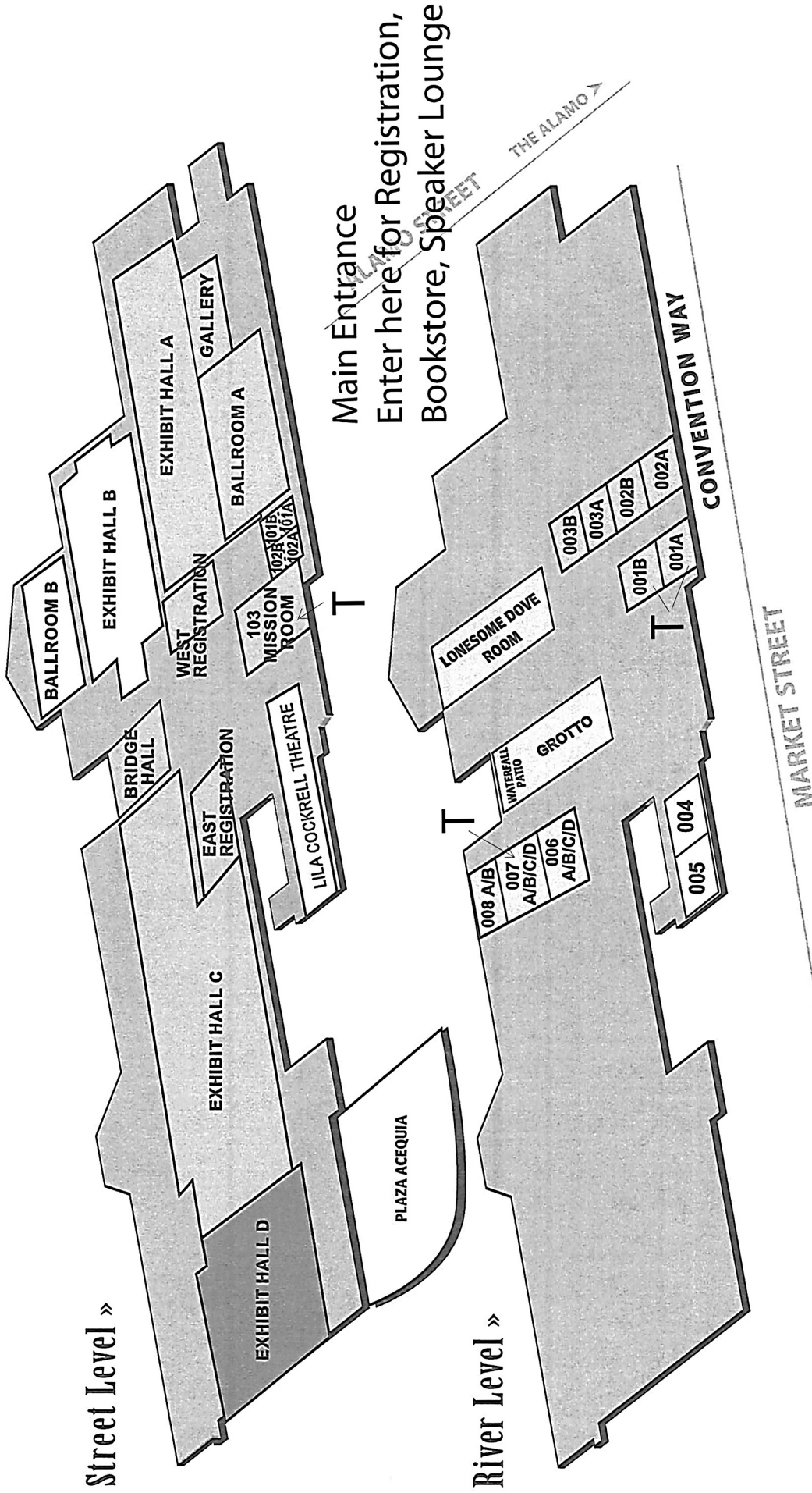
CONVENTION CENTER LEVELS

Grand Ballroom Level »



Concourse Level »



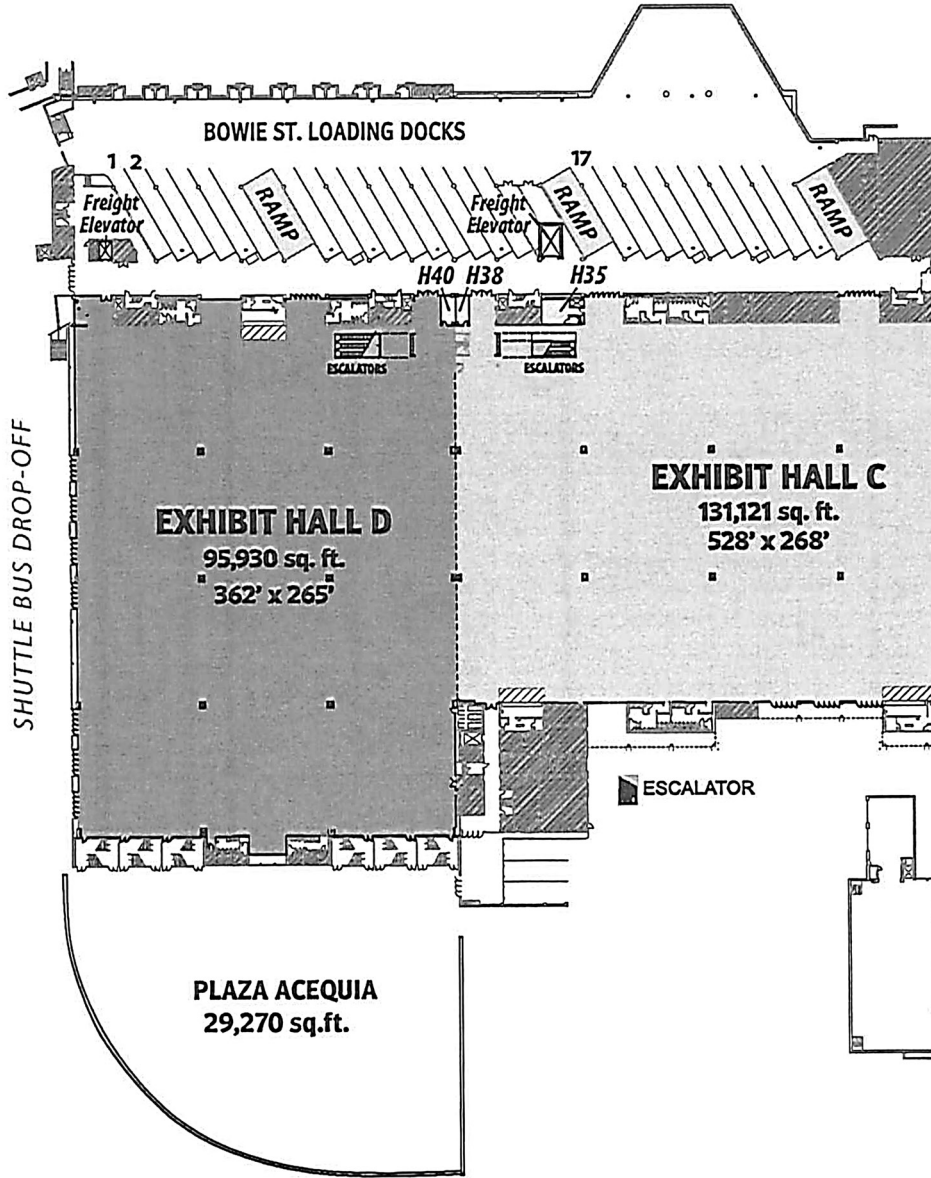


T = Technical Sessions

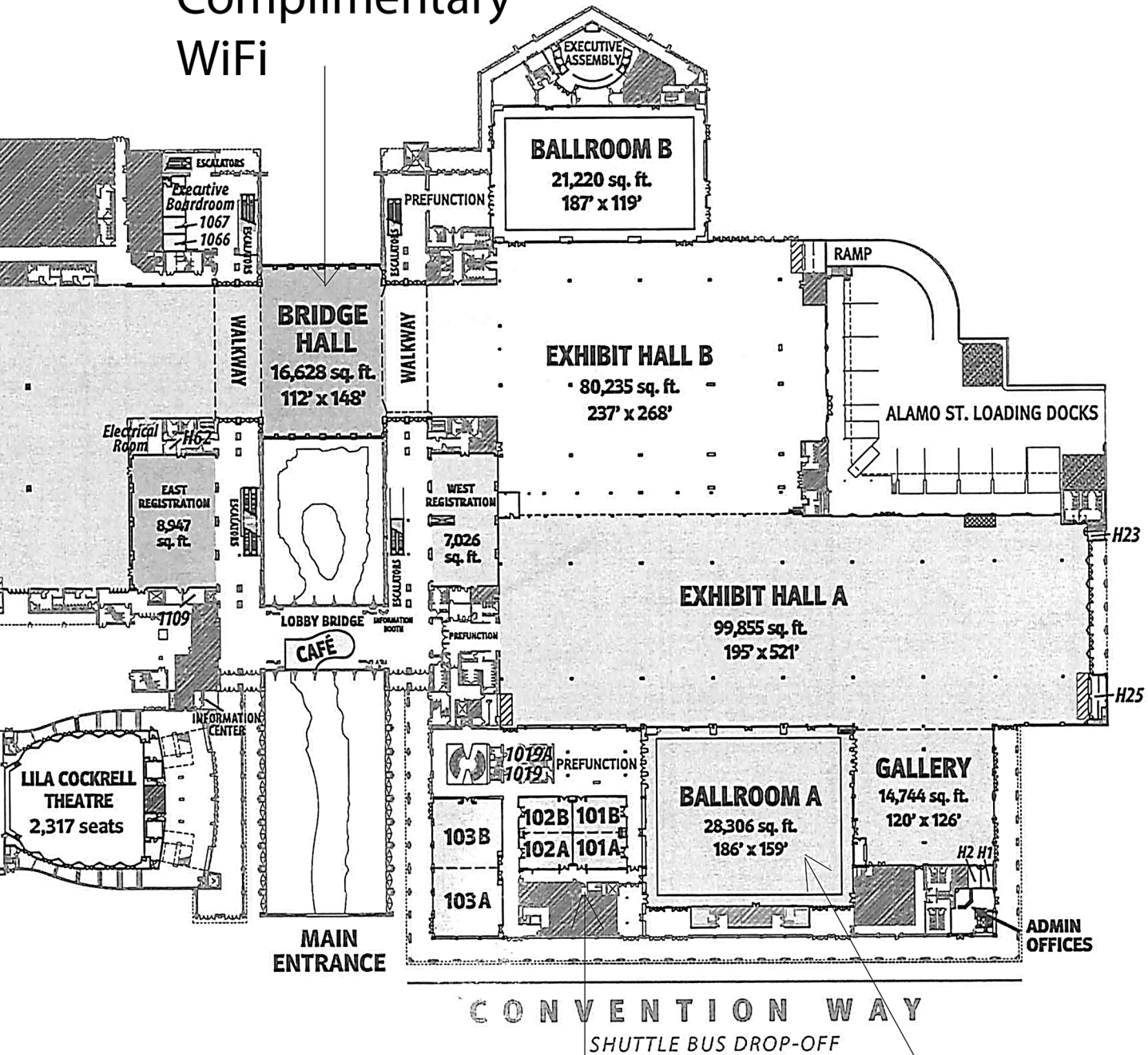
TO
ALAMODOME

BOWIE STREET

SHUTTLE BUS DROP-OFF



Concessions
Complimentary
WiFi



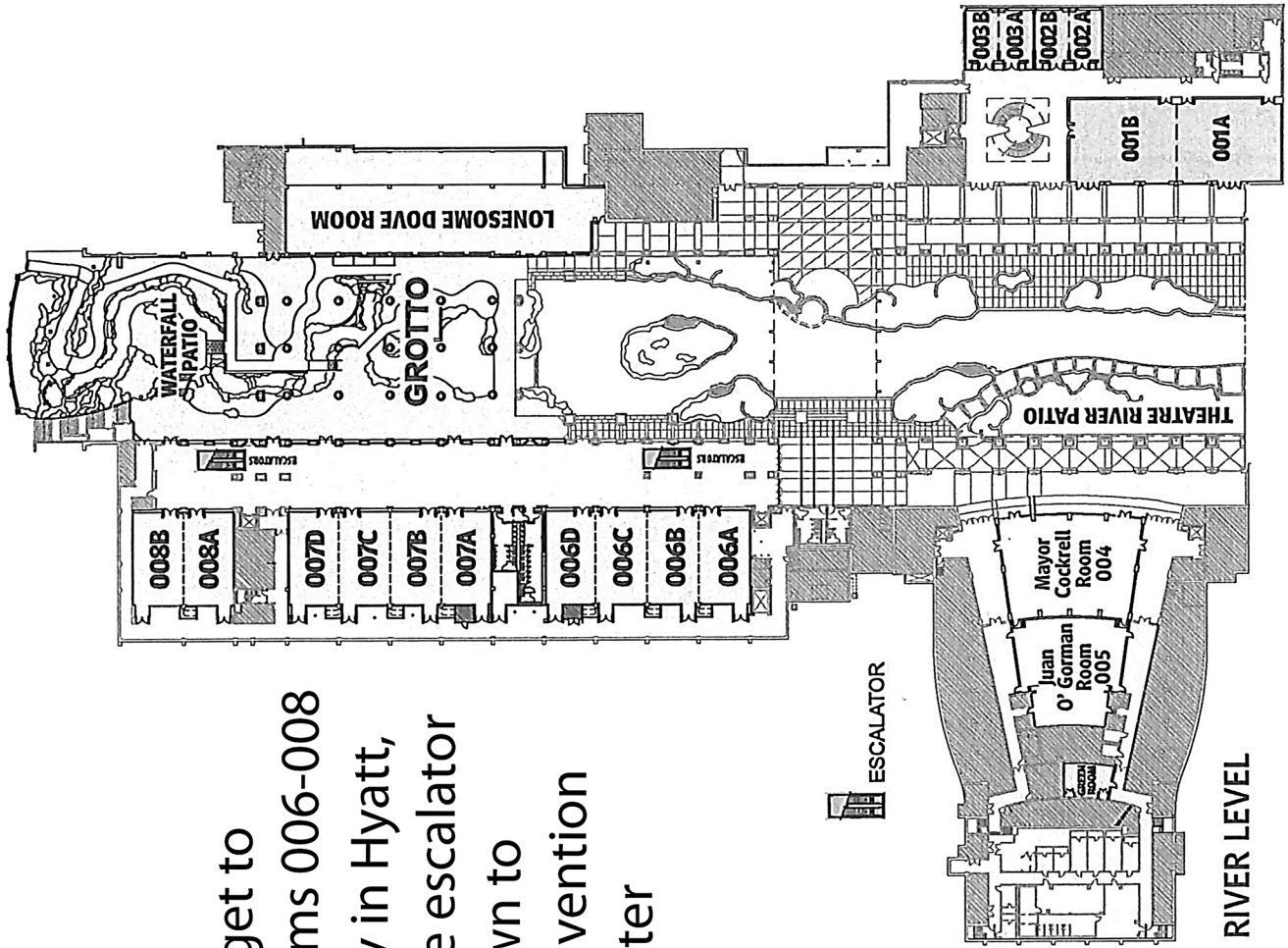
Speaker
Lounge

Registration
Bookstore
Press

HENRY B. GONZALEZ CONVENTION CENTER

RIVER LEVEL

ALAMO STREET



To get to
rooms 006-008
stay in Hyatt,
take escalator
down to
convention
center

RIVER LEVEL

MARKET STREET

BOWIE STREET



CONFERENCE SPONSORS

ASHRAE thanks the following sponsors for their support of the 2012 Annual Conference



CHAPTER AND SOCIETY OFFICIALS

A special thanks to all the members in the Alamo Chapter who helped make the conference a success!

ALAMO CHAPTER OFFICERS

Jennifer King, *President*
Rocky Ormand, *President-Elect*
Rey Gutierrez, *Secretary*
Shannon Novak, *Treasurer*

SAN ANTONIO HOST COMMITTEE

Fred Gleeson, *General Chairman*
Howard Decker, *Honorary Chairman*
Jim Rodriguez, *Entertainment*
Bill Klock and Ken Graham, *Sessions*
Golda Weir, *Hospitality*
Rocky Ormand and Madison Bryer, *Tours*
Joe Brooks, *Sustainability*
Shannon Novak and Daniel Nuckolls, *Information/Publicity*

ASHRAE OFFICERS

Ronald E. Jarnagin, *President*
Thomas E. Watson, P.E., *President-Elect*
William P. Bahnfleth, Ph.D., P.E., *Treasurer*
Constantinos A. Balaras, Ph.D., P.E., *Vice President*
Ross D. Montgomery, P.E., *Vice President*
T. David Underwood, *Vice President*
Timothy G. Wentz, P.E., *Vice President*
Jeff H. Littleton, *Executive Vice President*

CONFERENCES AND EXPOSITIONS COMMITTEE

Dennis J. Wessel, *Chair*
Ben A. Leppard, *Vice Chair*
Pamela L. Androff
Robert G. Baker
Walid Chakroun
Jon J. Cohen
Wade H. Conlan
Kelley P. Cramm
K. William Dean
Charles E. Henck
Mohammad H. Hosni
Yunho Hwang
Julia A. Keen
Dustan L. Macauley III
Sarah E. Maston
Michael J. McDermott
Keith C. Newcomer
Robert B. Risley
Monte G. Troutman
A. Damon Gowan

GENERAL INFORMATION

BADGES MUST BE WORN FOR ADMISSION TO SESSIONS

Your ASHRAE Conference badge is required for admission to the technical program. Room monitors will be checking and scanning badges at the rooms. The scanning process will provide you with a summary of all sessions attended at the conclusion of the conference and will be sent directly to you by email. The room monitors will also distribute evaluation forms for each session. Please complete the form and return it to the monitor when you leave the session. Room monitors will also distribute and collect comment cards on which attendees are encouraged to submit written questions regarding papers presented in the technical paper sessions. Questions are given to the authors for reply and published in *ASHRAE Transactions*.

HOTEL ADDRESS, TELEPHONE

Grand Hyatt San Antonio

600 East Market Street
San Antonio, TX 78205
210-224-1234

La Quinta

303 Blum
San Antonio, TX 78205
210-222-9181

INTERNET ACCESS

Internet access for e-mail is available in the Cyber Café located in the registration area during operating hours. Please be considerate to others and limit your usage to five minutes.

Internet is also available complimentary in your sleeping room in the Grand Hyatt but you are required to request it at the front desk.

MEMBERSHIP BALLOT

Eligible Members will be given the opportunity to cast votes for Society officers online for the ballot during the 2012 ASHRAE Annual Conference in San Antonio during registration hours in the meeting registration area (Henry B. Gonzalez Convention Center, Ballroom A). Polls will be open Friday, June 22 through Sunday, June 24 at 5:00 p.m. New Officers and Directors will be installed at the President's Luncheon on Monday, June 25.

NOTICE

ASHRAE regards the materials presented at these sessions to be the unique work of ASHRAE and exercises control over the dissemination and/or use of such products in the future. Accordingly, videotaping and recording of this program are not allowed without ASHRAE's prior written consent.

CELL PHONES/PAGERS

Please be considerate and turn off your phones and pagers in committee meetings and in technical program sessions.

COMPANY-SPONSORED HOSPITALITY SUITE POLICY

Hospitality suite hours must not conflict with ASHRAE meetings or social functions. Product displays, literature handouts, posting of signs in hotel lobbies or hallways, and commercial advertising or recruiting are not allowed in either the Grand Hyatt, ASHRAE's headquarters hotel, or the La Quinta.

SALE OF MERCHANDISE

Sale of merchandise, or the solicitation to sell merchandise, of any type at the Annual and Winter Conferences will only be permitted by prior approval of the Conferences and Expositions Committee and any surplus will go to the Society.

SIGNS/DISPLAY OF AFFILIATE MEETING INFORMATION

Signs and information concerning affiliate or related organizations must be approved by the Society prior to display. No signs are to be attached to walls, and all signs must be professionally printed.

PHOTO RELEASE

Photographs will be taken at the ASHRAE Annual Conference. By registering for this conference, you agree to allow ASHRAE to use your photo in any ASHRAE-related publications or Web site.

WHAT TO WEAR

Business casual attire is appropriate for meetings and social events. For Members' Night Out, sport coat and sport shirt. The Welcome Party is casual.

WEATHER

Average June temperatures
Average June high: 92F (33C)
Average June low: 73F (22C)

LOST AND FOUND

Items found during the conference should be turned into the staff in the ASHRAE headquarters room, Republic A/B in the Hyatt or ASHRAE registration in Ballroom A in the convention center. If you have misplaced something during the conference please check these two locations as well as security with the hotel and convention center.

TECHNICAL PROGRAM PDHs

All of the sessions presented in the technical program are approved for professional development hours (PDHs). All sessions qualify for State of Florida PDHs. In order to report your attendance at the session, please sign the PDH sign-in sheets that are in each room and include your license number for Florida. In addition, most sessions are approved for State of New York PDHs, AIA Learning Units and GBCI LEED AP credits. See program listing for specific information. Sessions are approved for 1, 1.5 or 2 PDHs depending on the length of the session. Certain sessions may be acceptable for ASHRAE certification renewal. Send questions to certification@ashrae.org.

Badges are required for attendance at any of the technical sessions. **Scanners will be used to capture the information located on your badge.** Upon conclusion of the conference you will be able to get a complete record of all the sessions you attended. Please be patient if the line to get into the room is a little longer – try to get to the sessions you really want to attend early to ensure a seat.

MEETING PAPERS

Abstracts of all sessions are included in this program. During the conference, papers presented at the technical paper and conference paper sessions can be purchased in the ASHRAE Bookstore. After the conference, papers will be posted in the

online ASHRAE Bookstore. Papers are not available for seminars or forums. Technical paper session papers will be published with discussion in ASHRAE Transactions. Conference papers will be published in ASHRAE Transactions without discussion. Prior meeting papers can be purchased in the online Bookstore at www.ASHRAE.org or searched online in Abstract Center. The Abstract Center is a searchable database of abstracts on everything ASHRAE has published since 1980. This service is free to ASHRAE members, but a subscription fee will be charged to nonmembers. For ordering information, contact ASHRAE Customer Service at 1-800-527-4723.

VIRTUAL CONFERENCE *Free for Paid Conference Registrants*

ASHRAE has added a virtual conference option so you won't miss the state-of-the-art concepts and latest design techniques presented in the Society's technical program. The San Antonio Virtual Conference allows you to view presentations and to interact with an online audience through a discussion board. All conference attendees paying the full registration fee will receive an email notification when sessions are available for viewing. The email will include a link to the San Antonio Virtual Conference. If you do not have your password and link go to www.ashrae.org/sanantoniovirtual and click on the link to access the Virtual Conference and put in your email address to request your password.

Virtual Conference registration includes:

- Synced audio and PowerPoint presentations from all technical paper sessions, conference paper sessions and seminars.
- Ability to post comments and rate presentations.
- Print presentation slides in notes format.
- Ability to post questions or answers for selected sessions through Monday, July 9.
- Presentations available online through January 2014.

A full slate of technical programs will be posted beginning Monday, June 25, of the sessions that were presented the previous day, with additional content posted through Thursday, June 28.

Access to the San Antonio Virtual Conference is free with your paid conference registration. To register only for the Virtual Conference, go to ASHRAE Registration, Henry B. Gonzalez Convention Center, 200 E. Market Street, Ballroom A.

\$299 ASHRAE member

\$464 non member or register online.

MEMBERS' NIGHT OUT RESERVED SEATING

Grand Hyatt, Texas Ballroom D-F, Fourth level

Members' Night Out will be in the Grand Hyatt on Tuesday, June 26. If you have purchased a ticket for this event, you will receive an exchange coupon. Take this coupon to the Reserved Seating desk, located in the ASHRAE registration (Henry B. Gonzalez Convention Center, Ballroom A) and exchange it for a reserved seat ticket by 2:00 p.m., Monday, June 25. Each table seats ten. A seating chart is available to help in deciding table preference. Seats are available on a first come, first served basis. When reserving your seat, please advise us of any special dietary requirements at that time to ensure that we are able to accommodate your requests during the evening.

Detailed information on the entertainment for Members' Night Out is located in this program.

CONCESSIONS AVAILABLE AT THE HENRY B. GONZALEZ CONVENTION CENTER

El Puente (Lobby Bridge, Street Level)

Complimentary WIFI available

Featuring

Starbucks Coffee (small cup) \$2.50 (large cup) \$3.50

Starbucks Iced Coffee \$3.50

Starbucks Doubleshot \$4.00

Starbucks Frappuccino (Vanilla, Coffee & Mocha) (BOC) \$3.50

Starbucks Tazo Iced Tea \$3.50 Hot Tea (lg) \$3.50 (sm) \$2.50

Lipton Iced Tea \$3.00 Diet Green Tea \$3.50 Green Tea \$3.50

Assorted Bottled Juices \$3.00 | 20 oz. Bottled Soda \$3.50

Bottled Waters \$3.00 | Energy Drink \$3.25

Chilled Milk – Whole, Skim & 2% (per half pint) \$2.00

Assorted Cookies or Brownies \$2.25

Granola Bars \$1.50

Assorted Chips – individual size \$2.25

Whole Fresh Fruit \$1.50 Fruit Cups (per cup) \$3.50

Danish/Muffins/Bagels \$2.25

Assorted Yogurts \$2.00

Assorted Deli Sandwiches w/ PC Condiments \$5.25

Garden Salad with Choice of Dressings \$3.50

Chef Salad \$5.50

SAN ANTONIO SUSTAINABILITY PROJECT

The sustainability footprint program was launched by the Salt Lake City Host Committee at the 2008 Annual Conference.

Those wishing to donate to the San Antonio sustainability project can do so at the Host Committee booth located in the convention center or via online registrations. Take a moment to stop by and thank the committee for their efforts. A complete description of the project is located in this program.

SOME COMMON SENSE SAFETY TIPS

Street Safety. The streets of any city at any time can be unsafe. When you leave your hotel to go out – day or evening – make sure you take off your badge. Wearing a badge is an advertisement that you are a visitor to the city and that you're probably unfamiliar with your location. Walk "smart" when you leave the convention site; know your destination and the best way to reach it. Walk along lighted sidewalks at night and don't walk alone. Trust your instincts – if you're uncomfortable with a situation, get out of it.

Hotel Safety. Some general guest safety tips include:

- Don't answer the door in a hotel room without verifying who it is. If a person claims to be an employee, call the front desk and ask if a staff person is supposed to have access to your room and for what purpose.
- Use the hotel safe-deposit box.
- When you're in your hotel room, use all of the locking devices provided.
- Don't reveal your room number or discuss plans for leaving the hotel within earshot of strangers.

MEDICAL EMERGENCY

Hotel emergencies should be directed to the hotel operator. Hotel security is trained in emergency response and can get to the scene of an emergency quickly. The closest hospital is Nix located at 414 Navarro Street, San Antonio, TX 78205, (210) 579-3211.

SPOUSE/GUEST GUIDE

SATURDAY, JUNE 23

7:30 a.m.-3:00 p.m.

ASHRAE Member Lounge

Grand Hyatt, Texas Ballroom A, Level Four

The ASHRAE Lounge is open daily for all individuals who are registered for the meeting. Refreshments are available from 7:30 to 9:30 a.m. each day and beverages are available all afternoon. Detailed information on the city including brochures and maps can be found at the Host Committee Desk located in the ASHRAE Registration area in the Henry B. Gonzalez Convention Center.

SUNDAY, JUNE 24

7:30 a.m.-4:00 p.m.

ASHRAE Member Lounge

Grand Hyatt, Texas Ballroom A, Level Four

MONDAY, JUNE 25

7:30 a.m.-4:00 p.m.

ASHRAE Lounge

Grand Hyatt, Texas Ballroom A, Level Four

MONDAY, JUNE 25

9:30 a.m.-11:00 a.m.

ASHRAE Lounge

Grand Hyatt, Texas Ballroom A, Level Four

Meet and Greet

Join ASHRAE as we spice up things at the Meet and Greet. The Hyatt chef will demonstrate how to make salsa and guacamole with a twist! Following the demonstration everyone will have the opportunity to sample chips and salsa along with sangria (alcohol free) featuring fresh fruit. Ole!

TUESDAY, JUNE 26

7:30 a.m.-4:00 p.m.

ASHRAE Lounge

Grand Hyatt, Texas Ballroom A, Level Four

WEDNESDAY, JUNE 27

7:30 a.m.-1:00 p.m.

ASHRAE Lounge

Grand Hyatt, Texas Ballroom A, Level Four

FUTURE ASHRAE MEETINGS

Winter	Date	Annual
Dallas January 26-30	2013	Denver June 22-26
New York January 18-22	2014	Seattle June 28-July 2
Chicago January 24-28	2015	Atlanta June 27-July 1

PAST ASHRAE MEETINGS

Los Angeles	1980	Denver
Chicago	1981	Cincinnati
Houston	1982	Toronto
Atlantic City	1983	Washington
Atlanta	1984	Kansas City
Chicago	1985	Honolulu
San Francisco	1986	Portland
New York	1987	Nashville
Dallas	1988	Ottawa
Chicago	1989	Vancouver
Atlanta	1990	St. Louis
New York	1991	Indianapolis
Anaheim	1992	Baltimore
Chicago	1993	Denver
New Orleans	1994	Orlando
Chicago	1995	San Diego
Atlanta	1996	San Antonio
Philadelphia	1997	Boston
San Francisco	1998	Toronto
Chicago	1999	Seattle
Dallas	2000	Minneapolis
Atlanta	2001	Cincinnati
Atlantic City	2002	Honolulu
Chicago	2003	Kansas City
Anaheim	2004	Nashville
Orlando	2005	Denver
Chicago	2006	Quebec City
Dallas	2007	Long Beach
New York	2008	Salt Lake City
Chicago	2009	Louisville
Orlando	2010	Albuquerque
Las Vegas	2011	Montreal
Chicago	2012	San Antonio



PLENARY SPEAKER

Saturday, June 23

Jason Ryan Dorsey, The Gen Y Guy®

*Crossing the Generational Divide:
Leveraging the Power of Generations™
for Your Strategic Advantage*

For the first time in world history, four different generations are working side by side – and a fifth generation is on the way! Each generation brings a different perspective, strengths, and priorities to the workplace. These differences can be a frustrating challenge (you leave a voicemail and they reply with a text!) or a strategic opportunity depending entirely on how you respond.

In *Crossing the Generational Divide*, bestselling author Jason Dorsey entertainingly reveals each generation’s workplace mindset. He then shares surprising statistics, laugh-out-loud stories, and frontline-tested strategies that quickly drive results across generations. You leave motivated with ready-to-use actions that you can apply immediately.

Jason Ryan Dorsey is The Gen Y Guy®. You may have seen him on 60 Minutes, 20/20, The Today Show, The View, or in Fortune Magazine. His talent is teaching ready-to-use actions and creative strategies that quickly increase cross-generational performance. A bestselling author at age 18, Jason’s newest book is *Y-Size® Your Business*. This acclaimed book features more than 50 ways to increase Gen Y performance from day one.

The Chief Strategy Officer for The Center for Generational Kinetics, Jason constantly studies the unique dynamics created within a multigenerational workforce. He shares his insights on his entertaining *What the Gen?! blog*. A proud member of Gen Y, Jason won the Austin Under 40 Entrepreneur of the Year Award at age 25 – one of the youngest winners ever. And, yes, he text messages his mom every day.

WELCOME PARTY

Saturday, June 23 • 6:30-8:30 p.m.
Buckhorn Saloon and Museum

Join your colleagues at the Buckhorn Saloon and Museum, where former U.S. president Teddy Roosevelt recruited Rough Riders, and Pancho Villa is rumored to have planned the Mexican Revolution.

The Buckhorn Saloon and Museum provides a taste of the Old West with wildlife exhibits from all over the world. Stroll through 33,000 square feet of artifacts from Texas history and world record wildlife exhibits with African, Asian, Alaskan and North American themes – over 520 different species in all, including fish from the Seven Seas. Don’t miss the world’s only Wax Museum of Texas History.

The Welcome Party menu includes:

- Texas brisket poor boy sandwich station
- Grilled chicken rattlesnake pasta
- Shrimp Vera Cruz
- Blue Ribbon dessert table featuring homemade Texas pecan cookies.

The Buckhorn Saloon and Museum is a short shuttle ride from the Hyatt. Shuttles will run continuously from 6:30 to 8:30 p.m. Shuttle service is available at the Grand Hyatt Market Street entrance, curbside. The Buckhorn is also a short walk from the Grand Hyatt.

Ticket required

Cost: \$57

MEMBERS NIGHT OUT

Tuesday, June 26

Grand Hyatt, Texas Ballroom D, Fourth Level

Cash Bar Reception, 6:15-7:15 p.m., Texas Ballroom Foyer

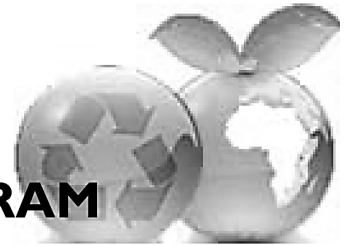
Dinner, 7:15-8:30 p.m. Entertainment, 8:45 p.m.

Finish out the conference with Members Night Out on Tuesday, June 26, with a celebration of a special performance of Fiesta Noche del Rio, which is the longest-running open-air musical revue of its kind in the U.S. It is a professionally produced, fast-paced and colorful show performed in seven acts featuring beautifully costumed dancers and singers with lively music from Mexico, Spain, Argentina and Texas.

An abbreviated version of this nationally known production featuring a professional cast of musicians, singers and dancers will perform following dinner.

Fiesta Noche del Rio is produced by the Alamo Kiwanis Charities, Inc. All net proceeds from the production will benefit youth serving charities in the San Antonio area.

Ticket required. Cost: \$50



HBGCC SUSTAINABILITY PROGRAM

We are committed to enhancing our sustainable practices at the Henry B. Gonzalez Convention Center, with our primary goal being to reduce our carbon impact on the environment while being the best stewards we can be with our resources. Our current green initiatives include:

WASTE REDUCTION

- The HBGCC has been diverting the following items since 2006
 - Cardboard (*a strict cardboard recycling policy is in effect for all decorators/contractors. The recycling compactors are easily accessible and clearly marked. Any vendor found placing cardboard in the trash dumpster is notified of the violation and asked to comply.*)
 - Polyurethane foam (*carpet padding*)
 - Wooden pallets
 - Scrap metal
 - Paper
 - Glass (*such as juice, water or soft drink bottles labeled with a code of 1 or 2*)
 - Plastic (*such as water & soft drink bottles labeled with a recycling code of 1 or 2*)
 - Aluminum
- In 2009 we invested \$118 thousand dollars in new recycling containers and other program enhancements including 2 new single stream recycling compactors.
- From July 2009 to December 2011 the total tonnage diverted from landfills exceeded **242 tons**
- Other Items recycled by our business partners include:
 - Telephones (*Smart City*)
 - Cables and wire (*Smart City*)
 - Toner cartridges (*UPS Store*)

ENERGY CONSERVATION

- Convention Center staff practices stringent energy conservation. Lights, air conditioning, escalators are kept at reduced or off settings when areas of the building are not in use.
- Upgraded the building controls system allowing for better scheduling of building systems
- The department has executed a Performance Contracting initiative. This initiative is utilizing expert recommendations to help the Convention Center maximize its conservation efforts and realize savings that come with system efficiencies. The initial energy audit was completed in early 2010 and the implementation phase completed in October 2011. Items installed to improve our energy efficiencies include:
 - Upgraded lighting fixtures and ballasts
 - Solar thermal window film
 - Improved HVAC components and control systems
 - Solar thermal domestic hot water
- Ultimate goals are to:
 - Reduce electrical consumption of the building by 35%
 - Obtain future LEED certification

WATER CONSERVATION

- Low-flow touch-less automatic faucets and dual flush valves have been installed in all restrooms
- Drought tolerant plants are used around the convention center

GREEN PURCHASING

- Recycled garbage bags (*100% recycled material*)
- Toilet paper and hand towels (*recycled material*)
- Micro fiber mop heads (*these mop heads can be washed and reused*)
- Recycled copy paper is used
- Green cleaning chemicals (*biodegradable, non-toxic, eco-friendly and non-corroding*)

OTHER PRACTICES

- City of San Antonio Bike Sharing Program (*stations are located in front and back of the convention center*)
- Meeting planner(s) can arrange to utilize composting bins. Requires partnership with our caterer (The RK Group) to ensure food waste is properly segmented.
- Other recycling practices and opportunities with our caterer include:
 - Disposables – as often as possible, disposable cups will be replaced with reusable mugs and/or eco-friendly products. Disposable cutlery will be replaced with reusable silverware and/or cornstarch compostables. Napkins will be replaced with cloth napkins and/or 100% recycled paper napkins
 - Coffee Filters – we use commercial coffee brewers that do not use filters. Liquid concentrate coffee is used and aluminum containers are recycled
 - Food Donations – any prepared food not served from convention meals (within established guidelines) will be donated to local food banks for distribution to those less fortunate. Food donations are provided to Daily Bread Ministries and the San Antonio Food Bank, with an average of 1000 meals a month
 - When available, we will use locally grown purveyors or fair trade products, depending on seasonal allowances
 - Member of the Convene Green Alliance

CITY OF SAN ANTONIO

- The City of San Antonio has made a substantial commitment to the greening of our community via the Mission Verde Initiative. This initiative is taking a holistic approach to sustainability by creating the following programs:
 - Build a 21st Century urban energy infrastructure in San Antonio
 - Create a multi-tech venture capital fund in San Antonio
 - Create a Green Jobs program
 - Adopt a green, high performance building code for new residential and commercial construction
 - Build a Green Retrofit Program for existing homes and buildings
 - Create an integrated efficient multi-modal transportation system for San Antonio
 - Municipal Facility Tree Planting
 - Employee Sustainability Education Program

For more information pertaining to the City's **Mission Verde** initiative, please go to <http://www.sanantonio.gov/oep/center.asp#Sustainability>



Hyatt Earth

A healthy environment is essential to sustaining a thriving community. Hyatt Earth is a focused effort to drive environmental stewardship in Hyatt hotels and the communities they serve.

Hyatt focuses on educating and engaging its associates about positive environmental action, and implementing sustainable practices to reduce resource consumption, emissions and waste at its hotels. Through Hyatt Earth, the company provides its associates with the necessary resources to be catalysts for positive change.

Focus Areas

- Create a culture of environmental responsibility
- Conserve natural resources and reduce greenhouse gas emissions
- Reduce waste
- Establish responsible purchasing practices
- Integrate sustainable practices into the design and construction of Hyatt properties

Green Teams

Hyatt's commitment to environmental stewardship is backed by the strength of more than 85,000 Hyatt associates and hundreds of dedicated Green Teams established at properties throughout the world. As Hyatt's local environmental ambassadors, Green Teams work to implement a range of local environmental initiatives that combine to make a global impact. Hyatt provides its Green Teams with resources, including training, environmental guidelines and best practices, and an online forum for Green Team members to share their experiences and spark new ideas.

Hyatt Earth in Action

- **Grand Hyatt Dubai** implemented one of the Middle East's largest solar panel installations to heat the property's water, cutting the hotel's annual diesel fuel consumption by 33 percent.
- Seattle's **Hyatt at Olive 8's** innovative design is estimated to reduce water use at the hotel by approximately 2.4 million gallons per year. The property is Hyatt's first LEED-certified hotel.
- **Hyatt Regency Kyoto** is planting 450 square meters of grass on its rooftop, and expects the project to reduce the hotel's CO₂ emissions by three metric tons per year.
- Associates at **Hyatt's corporate headquarters in Chicago** held a competition to reduce paper consumption, which saved 2.5 million sheets of paper – a 30 percent reduction from the previous year. Reducing paper saved the company US\$22,000, which it then donated to a nonprofit organization that preserves local parks.

Goals and Progress

Hyatt EcoTrack is a web-based tool that monitors and measures Hyatt's environmental impact by gathering monthly data from the company's properties to help it benchmark performance and drive improvement. Hyatt began measuring key environmental metrics in 1994, and is making progress toward the environmental goals it set for its managed, full-service hotels to reach by 2015. These goals include:

- Reducing energy consumption per square meter by 25 percent from 2006 levels
- Reducing water consumption per guest night by 20 percent from 2006 levels
- Reducing greenhouse gas emissions per square meter by 25 percent from 2006 levels
- Reducing waste sent to landfills per guest night by 25 percent from 2010 levels

For more information regarding Hyatt Earth, visit www.HyattThrive.com.

Media Contact Information

Katie Rackoff
Hyatt Hotels & Resorts
+1 312 780 5361
Katie.Rackoff@hyatt.com

Updated July 2011

Eco-Centro Community Outreach Focus of San Antonio Sustainable Footprint Project

San Antonio Colleges' Eco-Centro, a community outreach program funded through a U.S. Department of Housing and Urban Development grant for eligible entities serving Hispanic communities, has been selected as ASHRAE's 2012 Annual Conference sustainable footprint project.

The program seeks to leave behind a lasting sustainable footprint in the cities where the Society's conferences are held. The footprint program was launched in 2008 when ASHRAE held its Annual Conference in Salt Lake City, Utah.

The neighborhoods adjacent to Eco-Centro are a mixed bag of demographic descriptions, from a historical neighborhood's grand homes to those residential units cited for code violations. Scattered throughout this area are individuals and families whose limited access to education and employment render them permanent members of a less educated, lower income subgroup. Eco-Centro literally brings sustainability principles to their backyards and exposes them to practices

that may have positive effects on their homes, their pocket-books and their lifestyles, according to Fred Gleeson, general chair of the ASHRAE Conference. Through the project, EcoCentro will receive a photovoltaic and rainwater collection systems.

"Through ASHRAE's donation toward the purchase of a rainwater collection vessel and photovoltaic, not only will the sustainability intent of the project be enhanced, but the lives and livelihood of the surrounding citizenship will be enhanced for years to come on a sustainable basis," Gleeson said. "Additionally the project itself will be a lasting legacy for ASHRAE and its commitment to improving the sustainable environment in the greater San Antonio area."

Scheduled for completion by June 2012, EcoCentro will be a 3,500-square-foot educational facility located across from the San Antonio College campus on land donated by Alamo Colleges.



ROOMS/HOURS

FINDING YOUR ASSIGNED MEETING ROOM

To assist you in finding your meeting room at the Annual Conference, please refer to the floor plans located in this program. Two sites are being used for meetings.

Codes: H=Hyatt, CC=Convention Center.

MEETING REGISTRATION

Henry B. Gonzalez Convention Center
Ballroom A, Street Level

Registration is required for all meeting participants. Official badges must be worn at all functions and for admission into the technical sessions. ASHRAE meeting registration will be open during the following hours:

Friday, June 22	11:00 a.m. 5:00 p.m.
Saturday, June 23	7:15 a.m. 6:00 p.m.
Sunday, June 24	7:00 a.m. 5:00 p.m.
Monday, June 25	7:30 a.m. 5:00 p.m.
Tuesday, June 26	7:30 a.m. 4:00 p.m.
Wednesday, June 27	7:30 a.m. 10:15 a.m.

ASHRAE BOOKSTORE

Henry B. Gonzalez Convention Center
Ballroom A, Street Level

More than 300 books, meeting papers and other recent publications will be available for purchase in the ASHRAE Bookstore. The bookstore provides HVAC&R technical literature from ASHRAE and other publishers. The ASHRAE Bookstore will be open during the following hours:

Friday, June 22	11:00 a.m. 5:00 p.m.
Saturday, June 23	7:15 p.m. 6:00 p.m.
Sunday, June 24	7:00 a.m. 5:00 p.m.
Monday, June 25	7:30 a.m. 5:00 p.m.
Tuesday, June 26	7:30 a.m. 4:00 p.m.
Wednesday, June 27	7:30 a.m. 1:00 p.m.

ASHRAE's eLearning system, from the ASHRAE Learning Institute, will be demonstrated at the bookstore. Take a hands-on demonstration and learn more about new ways to earn PDHs/CEUs, on demand, online.

SPEAKER'S LOUNGE

Henry B. Gonzalez Convention Center
Room 101A/B, Street Level

The Speakers' Lounge will be open during the following hours:

Saturday, June 23	1:00 p.m. – 3:00 p.m.
Sunday, June 24	7:00 a.m. – 3:30 p.m.
Monday, June 25	7:00 a.m. – 12:15 p.m. and 2:00 – 3:30 p.m.
Tuesday, June 26	7:00 a.m. – 1:00 p.m.
Wednesday, June 27	7:00 a.m. – 1:00 p.m.

PRESS ROOM

Henry B. Gonzalez Convention Center
Ballroom A, Street Level

The Press Room will be open as follows:

Saturday, June 23	9:00 a.m. – 2:30 p.m.
Sunday, June 24	7:30 a.m. – 5:00 p.m.
Monday, June 25	7:30 a.m. – 11 a.m. and 2 p.m. – 4:00 p.m.
Tuesday, June 26	7:30 a.m. – 4:00 p.m.

MEMBERSHIP DESK

Henry B. Gonzalez Convention Center
Ballroom A, Street Level A

The membership information desk is available for paying dues, applying for membership, updating membership information and purchasing ASHRAE logo items. This desk is open during the same hours as registration, so feel free to stop by if you have any questions concerning your ASHRAE membership.

HEADQUARTER OFFICE

Grand Hyatt, Republic B, Level 3

The ASHRAE Headquarter office offers members complimentary copying, services of a typist and access to printers for laptop computers.

Friday, June 22	Noon – 5:00 p.m.
Saturday, June 23	8:00 a.m. – 5:00 p.m.
Sunday, June 24	8:00 a.m. – 5:00 p.m.
Monday, June 25	8:00 a.m. – 5:00 p.m.
Tuesday, June 26	8:00 a.m. – 5:00 p.m.
Wednesday, June 27	8:00 a.m. – 1:00 p.m.

YEA ACTIVITY

Young Engineers in ASHRAE (YEA) Hospitality Suite
Grand Hyatt, Bowie B, Level Two

Attention young professional members age 35 and younger! You are invited to visit the YEA Hospitality Suite on Sunday, June 24, from 4:00 p.m. – 7:00 p.m. The suite offers social and networking opportunities and light refreshments will be served.

ASHRAE LOUNGE

Grand Hyatt, Texas Ballroom A, Level 4

The ASHRAE Lounge offers an opportunity to network with friends or stop for a cup of coffee between technical sessions. Coffee will be offered throughout the day and anyone who is registered for the meeting is welcome in the lounge.

The lounge will be open to all registered attendees during the following hours:

Saturday, June 23	7:30 a.m. – 3:00 p.m.
Sunday, June 24	7:30 a.m. – 4:00 p.m.
Monday, June 25	7:30 a.m. – 4:00 p.m.
Tuesday, June 26	7:30 a.m. – 4:00 p.m.
Wednesday, June 27	7:30 a.m. – 1:00 p.m.

SAN ANTONIO HOST COMMITTEE DESK

Henry B. Gonzalez Convention Center
Ballroom A, Street Level

The Host Committee will have an information desk located near the ASHRAE registration area. General information about the sights of the city will be available and a host committee member will be present to answer questions about San Antonio. The information desk will be open:

Friday	1:00 – 3:00 p.m.
Saturday	8:00 a.m. – 3:00 p.m.
Sunday	8:00 a.m. – 3:00 p.m.
Monday	9:00 a.m. – Noon

CREATIVE DINING

Henry B. Gonzalez Convention Center
Ballroom A, Street Level

San Antonio has a very diverse selection of restaurants, many of them within walking distance from the Grand Hyatt. San Antonio is also a very popular tourist location and restaurants can get very crowded with substantial waiting time, especially those along the Riverwalk. Save yourself some time by stopping by the Creative Dining booth and let them assist you with making dinner reservations. Menus, coupons, promotional pieces from various restaurants and entertainment venues will be displayed and distributed.

DALLAS 2013 WINTER CONFERENCE INFORMATION

Henry B. Gonzalez Convention Center
Ballroom A, Street Level

Information on the upcoming Winter Conference, scheduled for January 26-30 in Dallas, TX, will be available in the registration area.

notes

SCHEDULE

Location of Meetings

To assist you in finding your meeting room at the Annual Conference, please refer to the floor plans located in the front of this program. Meetings are scheduled in the Grand Hyatt (H) and Henry B. Gonzalez Convention Center (CC).

Meeting Schedule

FRIDAY, June 22

8:00 am – 5:00 pm **Committee Meetings**
See listing on pages 50–64

11:00 am – 5:00 pm **Registration, ASHRAE Bookstore**
Henry B. Gonzalez Convention Center,
Ballroom A, Street Level

SATURDAY, JUNE 23

7:30 am – 3:00 pm **ASHRAE Lounge**, Grand Hyatt,
Texas Ballroom A, Fourth Level

7:15 am – 6:00 pm **Registration, ASHRAE Bookstore**
Henry B. Gonzalez Convention Center,
Ballroom A, Street Level

9:00 am – 2:30 pm **Press Room**, Henry B. Gonzalez
Convention Center, Ballroom A,
Street Level

8:00 am – 5:00 pm **Committee Meetings**
See listing on pages 50–64

1:00 pm – 3:00 pm **Speakers' Lounge**, Henry B. Gonzalez
Convention Center, Rooms 101 A/B,
Street Level

Special Event

3:15 pm – 5:00 pm Meeting of the Members,
Plenary Session, Grand Hyatt,
Texas Ballroom D, Fourth Level

Opening and Welcoming Remarks by
ASHRAE President **Ronald E. Jarnagin**

Welcome by Director and Chair,
Region VIII, **John L. Harrod**

Secretary's Report by Executive Vice
President **Jeff H. Littleton**

Awards Presentation
See page 24 for details

Keynote Speaker, **Jason Ryan Dorsey**
See page 15 for details

Special Event

6:30 pm – 8:30 pm **Welcome Party**, Buckhorn Saloon
Shuttle service to Buckhorn will begin at
the Grand Hyatt at 6:15 pm. Shuttles will
load from curbside on E. Market. Shuttle
service will run continuously from 6:15 to
8:45 p.m. Buses will load at Hyatt, drop
off at the Buckhorn Saloon and return to
Hyatt for additional pick up. Shuttles will

take about 15 minutes to drop off at the
Buckhorn and return to the Hyatt.

If you prefer to walk the Buckhorn is
approximately a 2 minute walk.

Note: \$57 ticket per person required.
Tickets may be purchased/picked up at
the ASHRAE Registration Desk;
advance-purchase tickets may be picked
up at the door if after registration hours.

See page 15 for details

SUNDAY, June 24

7:00 am – 3:30 pm **Speakers' Lounge**, Henry B. Gonzalez
Convention Center, Rooms 101 A/B,
Street Level

7:00 am – 5:00 pm **Registration, ASHRAE Bookstore**,
Henry B. Gonzalez Convention Center,
Ballroom A, Street Level

7:30 am – 4:00 pm **ASHRAE Lounge**, Grand Hyatt,
Texas Ballroom A, Fourth Level

7:30 am – 5:00 pm **Press Room**, Henry B. Gonzalez
Convention Center, Ballroom A,
Street Level

8:00 am – 3:00 pm **Technical Sessions**
See Technical Program on pages 30–49

8:00 am – 5:00 pm **Committee Meetings**
See listing on pages 50–64

10:00 am – 3:00 pm **Tour: Missions Tour**
Tour departs from Hyatt curbside on
E. Market Street

4:00 pm – 7:00 pm **Young Engineers in ASHRAE (YEA)**
Networking Event, Grand Hyatt, Bowie B,
Second Level

*Attention members age 35 and younger—
You are invited to participate in the YEA
Networking Event, offering social and
networking opportunities.*

MONDAY, June 25

7:00 am – 12:15 pm **Speakers' Lounge**, Henry B. Gonzalez
Convention Center, Rooms 101 A/B,
Street Level

7:30 am – 5:00 pm **Registration, ASHRAE Bookstore**,
Henry B. Gonzalez Convention Center,
Ballroom A, Street Level

7:30 am – 4:00 pm **ASHRAE Lounge**, Grand Hyatt,
Texas Ballroom A, Fourth Level

7:30 am – 11:00 am **Press Room**, Henry B. Gonzalez
Convention Center, Ballroom A,
Street Level

8:00 am – Noon **Technical Sessions**
See Technical Program on pages 30–49

8:00 am – 5:00 pm **Committee Meetings**
See listing on pages 50–64

10:00 am – 11:00 am **Tour: 60 Minute Trolley Tour**
Tour departs from Hyatt curbside on E. Market Street

Special Event

12:15 pm – 2:00 pm **President's Luncheon**
(doors open at noon), Grand Hyatt, Texas Ballroom D, Fourth Level

President-Elect **Thomas Watson** will present his 2012–2013 presidential theme. Certificates of Appreciation will be presented to retiring Board members and the 2012–2013 Officers and new Board members will be installed. Spouses and guests are cordially invited to attend.

Note: Ticket required and may be purchased at the ASHRAE Registration desk for \$42.

Technical Tours: SAWS Chiller Plant

Tour #1 3:00-4:00pm

Tour #2 4:00-5:00pm
(Repeat of first tour)

Walking tour from the Hyatt across the street to SAWS Chiller Plant. Assemble in the lobby area at the garage exit.
See description on page 27

2:00 pm – 4:00 pm **Press Room**, Henry B. Gonzalez Convention Center, Ballroom A, Street Level

6:00 pm – 7:00 pm **Tour: Special Tour of the Alamo**
Tour departs from Hyatt curbside on E. Market Street, *Walking tour*
See description on page 26

Regional Dinners Sign up in ASHRAE registration area.

TUESDAY, June 26

7:00 am – 1:00 pm **Speakers' Lounge**, Henry B. Gonzalez Convention Center, Rooms 101 A/B, Street Level

7:30 am – 4:00 pm **Registration**, ASHRAE Bookstore, Henry B. Gonzalez Convention Center, Ballroom A, Street Level

7:30 am – 4:00 pm **ASHRAE Lounge**, Grand Hyatt, Texas Ballroom A, Fourth Level

7:30 am – 4:00 pm **Press Room**, Henry B. Gonzalez Convention Center, Ballroom A, Street Level

8:00 am – 12:30 pm **Technical Sessions**
See Technical Program on pages 30–49

8:00 am – 5:00 pm **Committee Meetings**
See listing on pages 50–64

9:30 am – 2:30 pm **Tour: River boat ride, El Mercado, and La Villita**
Tour departs from Hyatt curbside on E. Market Street
See description on page 26

Noon – 1:30 pm **Life Members' Luncheon**, Grand Hyatt, Bowie A, Second Level

Note: Ticket required and may be purchased at the ASHRAE registration desk for \$30.

3:00 – 5:00 pm **Tour: Blue Star Brewery Tour and Taste Testing**
Tour departs from Hyatt curbside on E. Market Street
See description on page 26

3:00 – 5:00 pm **Technical Tour: Blue Wing Solar Farm**
Tour departs from Hyatt curbside on E. Market Street
See description on page 27

Special Event

6:15 – 7:15 pm **Reception**, Grand Hyatt, Texas Ballroom Foyer, Fourth Level

7:15 – 10:30 pm **Members' Night Out**, Texas Ballroom D, Fourth Level

— **Dinner** —

Note: Ticket required and may be purchased at the ASHRAE registration desk for \$50.
See page 15 for details

WEDNESDAY, June 27

7:00 am – 1:00 pm **Speakers' Lounge**, Henry B. Gonzalez Convention Center, Rooms 101 A/B, Street Level

7:30 am – 10:15 am **Registration**, Henry B. Gonzalez Convention Center, Ballroom A, Street Level

7:30 am – 1:00 pm **ASHRAE Bookstore**, Henry B. Gonzalez Convention Center, Ballroom A, Street Level

7:30 am – 1:00 pm **ASHRAE Lounge**, Grand Hyatt, Texas Ballroom A, Fourth Level

8:00 am – 12:30 pm **Technical Sessions**
See Technical Program on pages 30–49

8:00 am – 5:00 pm **Committee Meetings**
See listing on pages 50–64

AWARDS PRESENTATION

Saturday, June 23, 3:15-5:30 p.m.

Plenary Session, Lone Star A

LINCOLN BOUILLON AWARD

“Given in recognition of outstanding work in increasing the membership of the Society.”

David B. Farala, P.E., Mandaluyong City, Philippines
Philippines Chapter

CHAPTER PROGRAM STAR AWARD

“Given in recognition of excellence in chapter program endeavors.”

Marco Ottavino, Toronto Chapter

WILLIAM J. COLLINS, JR., RESEARCH PROMOTION AWARD

“Given in recognition of the most outstanding fundraising campaign supporting ASHRAE research.”

Nicolas Lemire, ASHRAE HPDP, Montreal, QC, Canada
Montreal Chapter

LOU FLAGG HISTORICAL AWARD

“Given in recognition for preparing the most outstanding historical presentation related to HVAC&R.”

Philip C. H. Yu, Ph.D., C.Eng., Hong Kong Quarry Bay,
Hong Kong

STANDARDS ACHIEVEMENT AWARD

“Given in recognition for excellence in volunteer service for developing ASHRAE standards/ guidelines.”

Steven T. Taylor, P.E., Alameda, CA

RALPH G. NEVINS PHYSIOLOGY AND HUMAN ENVIRONMENT AWARD

“Given to a member under 40 years of age in recognition for significant accomplishment in the study of physiology and human response to the environment.”

Lily M. Wang, Ph.D., P.E., Omaha NE
University of Nebraska

HOMER ADDAMS AWARD

“Given in recognition of a graduate student working on an ASHRAE research project to advance engineering education.”

Harrison Skye, Ph.D., Germantown, MD

ENVIRONMENTAL HEALTH AWARD

“Given in recognition of excellence in volunteer service focused on environmental health issues”

Steven J. Emmerich, Gaithersburg, MD

2011 TECHNICAL PAPER AWARD

“Given in recognition of the best paper presented at a Technical Paper Session at a Society Meeting in 2011”

Jacob L. Edmondson, San Antonio, TX, **Dennis L. O’Neal**, Ph.D., P.E., College Station, TX, **John A. Bryant**, Ph.D., P.E., College Station, TX, **Michael A. Davis**, Ph.D., New York, NY for authoring “Performance of Series Fan-Powered Terminal Units with Electronically Commutated Motors”

Jacob L. Edmondson, San Antonio, TX, **Dennis L. O’Neal**, Ph.D., P.E., College Station, TX, **John A. Bryant**, Ph.D., P.E., College Station, TX, and **Michael A. Davis**, Ph.D., New York, NY for authoring “Performance of Parallel Fan-Powered Terminal Units with Electronically Commutated Motors”

Kris Subbarao, Ph.D., College Station, TX, **Yafeng Lei**, Ph.D., Katy, TX, **T. Agami Reddy**, Ph.D., P.E., Tempe, AZ for authoring “The Nearest Neighborhood Method to Improve Uncertainty Estimates in Statistical Building Energy Models”

William M. Healy, Ph.D., Gaithersburg, MD, **Tania Ullah**, Gaithersburg, MD, **John Roller**, Gaithersburg, MD for authoring “Input-Output Approach to Predicting the Energy Efficiency of Residential Water Heaters-Testing of Gas Tankless and Electric Storage Water Heaters”

WILLIS H. CARRIER AWARD

“Given in recognition of the best paper presented at a Society Meeting in 2011 by a member thirty-two years of age or less.”

Jacob L. Edmondson, San Antonio, TX for authoring “Performance of Series Fan-Powered Terminal Units with Electronically Commutated Motors”

POSTER PRESENTATION AWARD

“Given in recognition of the best Poster Presentation at each Winter and Annual meeting in 2011.”

Jasmin Raymond, Ph.D., McMasterville, QC, Canada, **Alexandre Leger**, PE, **Rene Therrien**, Ph.D., Quebec, QC, Canada, **Marc Frenette**, ING., La Pocatiere, QC, Canada, **Eric Magni** for authoring, “Numerical Modeling of Thermally Enhanced Pipe Performances in Vertical Ground Heat Exchangers” (LV-11-024)

Charles Eley, P.E., ASHRAE BEMP, San Francisco, CA, **Kimberly Goodrich**, **John J. Arent**, P.E., San Francisco, CA, **Randall T. Higa**, P.E., Los Angeles, CA and **Devin Rauss**, P.E., Irwindale, CA for authoring, “Rethinking Percent Savings – The Problem with Percent Savings and zEPI: The New Scale for a Zero Net-Energy Future” (ML-11-029)

ASHRAE JOURNAL PAPER AWARD

“Given in recognition of the best paper published in the ASHRAE Journal in 2011.”

John A. Murphy, La Crosse, WI
Wisconsin Chapter

CROSBY FIELD AWARD

“Given in recognition of the best paper published by the Society in 2011 with the winner being chosen from the best Transactions and Poster papers.”

Jacob L. Edmondson, San Antonio, TX, **Dennis L. O’Neal**, Ph.D., P.E., College Station, TX, **John A. Bryant**, Ph.D, P.E., and **Michael A. Davis**, Ph.D., New York, NY for authoring “Performance of Series Fan-Powered Terminal Units with Electronically Commutated Motors”

DISTINGUISHED FIFTY-YEAR MEMBER AWARD

“Given in recognition of fifty years of membership and distinction in the arts and sciences of heating, refrigeration, air conditioning and ventilation.”

Presidential Member **Richard A. Charles**, P.E., Oakland, CA
Mario Costantino, Ph.D., P.E., Segrate, Italy
Philip A. Dugan, Edina, MN
Thomas J. Ferdelman, Dayton, OH
Donald P. Gatley, P.E., Atlanta, GA
Presidential Member **Harley W. Goodman, Jr.** P.E., Little Rock, AR
Harald E. Loewer, Ph.D., Hamburg, Germany
C. Mike Scofield, P.E. , Sebastopol, CA
Lawrence G. Spielvogel, P.E., Bala Cynwyd, PA

DISTINGUISHED SERVICE AWARD

“Given in recognition of faithful and distinguished service on behalf of the Society.”

Ainul Abedin, P.E., Karachi, Pakistan
Jeff Gatlin, P.E., Memphis, TN
Walter T. Grondzik, P.E., Muncie, IN
David A. John, P.E., Tarpon Springs, FL
William K. Klock , Austin, TX
Alison G. Kwok, Ph.D., Eugene, OR
Howard J. McKew, P.E., North Andover, MA
William F. McQuade, P.E., York, PA
Thomas Meyer, Gaithersburg, MD
Daniel H. Nall, P.E., BEMP, HBDP, New York, NY
James L. Newman, OPMP, BEAP, Bloomfield Hills, MI
Karl L. Peterman, P.E, Toronto, Ontario, Canada
Florentino R. Rodriguez, Sr., P.Eng., Buenos Aires, Argentina
Monte G. Troutman, P.E., Owensboro, KY
Paul G. Turnbull, Buffalo Grove, IL
Lily M. Wang, Ph.D., P.E., Omaha, NE

EXCEPTIONAL SERVICE AWARD

“Given in recognition of faithful service with exemplary effort on behalf of the Society.”

Michael R. Bilderbeck, P.E., Memphis, TN
Michael J. Brandemuehl, Ph.D., P.E., Boulder, CO
Charles E. Henck , P.E., Baltimore, MD
David E. Knebel, P.E., Tulsa, OK
Carl N. Lawson, Zephyrhills, FL
Steven T. Taylor, P.E., Alameda, CA
Kay C. Thrasher, Chattanooga, TN-
Joseph K. Ting, P.E., P.Eng., Honolulu, HI

LOUISE AND BILL HOLLADAY DISTINGUISHED FELLOW AWARD

“Given to a Fellow of the Society in recognition of continuing preeminence in engineering or research work.”

Stanley A. Mumma, Ph.D., P.E., Bellefonte, PA

notes

GENERAL TOURS

Tours utilizing buses will depart from the E. Market Street exit of the Grand Hyatt at curbside.

Stand-by tour tickets will be distributed at ASHRAE registration after a tour sells out. Stand-by tickets are provided to ensure that a tour is filled in the event of no-shows or last minute cancellations. If you have a stand-by ticket, please have the exact amount of the ticket cost available to pay at the bus.

Tour tickets may be purchased at the ASHRAE registration desk, Ballroom A, Henry B. Gonzalez Convention Center.

Sunday, June 24

Missions Tour

10:00 a.m. – 3:00 p.m.

This tour will include the Missions San Jose, Missions Concepcion, Mission San Juan, and Mission Espada.

Mission San José

Established in 1720, this is the best example of a restored mission in the United States.

Mission Concepción

Visit Mission Concepcion and experience the strength of the Friars who Christianized the Indians. View the original frescos still visible within the rooms of the mission. This is the oldest stone church in our nation.

Mission San Francisco de la Espada

Founded in 1690 as San Francisco de los Tejas near present-day Weches, Texas, this was the first mission in Texas. In 1731, the mission transferred to the San Antonio River area and renamed Mission San Francisco de la Espada. A friary was built in 1745, and the church was completed in 1756.

Price: \$37

Monday, June 25

60 Minute Trolley Tour

10:00 – 11:00 a.m.

The trolley tour is a 60 minute narrative tour that includes The Alamo, Riverwalk, Hemisfair Park, Tower of the Americas, Institute of Texan Cultures, The Missions, King William District, Market Square, San Fernando Cathedral, Spanish Governor's Palace, and La Villita.

Price: \$20

Monday, June 25

Special Tour of the Alamo

6:00 – 7:00 p.m.

At 6 p.m. Monday, June 25, join your ASHRAE colleagues for a private tour of the Alamo. More than 2.5 million people a year visit the 4.2 acre complex known worldwide as "The Alamo." Most come to see the old mission where a small band of Texans

held out for 13 days against the Centralist army of General Antonio López de Santa Anna. Although the Alamo fell in the early morning hours of March 6, 1836, the death of the Alamo Defenders has come to symbolize courage and sacrifice for the cause of Liberty. Just a short distance from the River Walk, the Alamo is a "must see" for all who come to San Antonio. Let's face it, if you are in San Antonio and do not visit the place where Texans died for their independence then you didn't visit San Antonio.

The Alamo is a short walk from the Grand Hyatt.

Price: \$22

Tuesday, June 26

River boat ride, El Mercado, and La Villita

9:30 a.m. – 2:30 p.m.

Start the morning off with a cruise down the romantic San Antonio River. Discover a world of sidewalk cafes, lush tropical foliage and charming boutiques.

Visit El Mercado and shop for bargains from over 25 shops selling colorful Mexican imports from South of the Border. You will also find a variety of Mexican food restaurants to enjoy for lunch.

LaVillita is located on the south bank of the San Antonio River, La Villita was San Antonio's first neighborhood.

Late in the 19th century European immigrants from Germany and France moved into the area. These pioneers became San Antonio's business leaders, bankers, educators, and craftsmen. The cultural mix that occurred at this time is best illustrated by the variety of architectural styles reflected in La Villita's buildings. The architecture portrays the evolution of buildings from palisado to Victorian Houses.

Today La Villita is a thriving art community that stands as a monument to San Antonio's past. La Villita is on the National Registry of Historic Districts

Price: \$27 lunch not included

Tuesday, June 26

Blue Star Brewery Tour and Taste Testing

3:00 – 5:00 p.m.

Owned and operated by Joey and Maggie Villarreal of Joey's on N. St. Mary's Street, the Blue Star Brewing Company has been open since June 25, 1996. They offer medal-winning beers. The brew pub is located in the Blue Star Arts Complex at 1414 S. Alamo, on the San Antonio river across the street from the Pioneer flour mill. The stainless steel vats and brewing facility are right at home in what was once an old beer storage warehouse.

Includes 5 samples of beer

Price: \$24

TECHNICAL TOURS

Tours utilizing buses will depart from the E. Market Street exit of the Grand Hyatt at curbside.

Stand-by tour tickets will be distributed at ASHRAE registration after a tour sells out. Stand-by tickets are provided to ensure that a tour is filled in the event of no-shows or last minute cancellations. If you have a stand-by ticket, please have the exact amount of the ticket cost available to pay at the bus.

Tour tickets may be purchased at the ASHRAE registration desk, Ballroom A, Henry B. Gonzalez Convention Center.

Monday, June 25

SAWS Chiller Plant

Tour #1 3:00-4:00pm

Tour #2 4:00-5:00pm (Repeat of 3:00 tour)

Walking tour from the Hyatt across the street to SAWS Chiller Plant

The SAWS Chiller plant supplies chilled water and steam to downtown San Antonio. It was originally built in 1968 and consists of (5) 2000 ton chillers, (2) 1500 ton chillers, (2) 40,000 lb/hr boilers and ice storage tanks.

Price: \$12

Tuesday, June 26

Blue Wing Solar Farm

3:00 p.m. – 5:00 p.m.

Blue Wing is San Antonio's first solar farm and the largest solar array in the state of Texas. Located in southeast San Antonio on 113 acres near the intersection of IH-37 and U.S. 181, the 14-megawatt installation utilizes 214,500 solar photovoltaic modules or panels to produce clean, emission-free energy for CPS Energy customers

The Blue Wing Solar Project is capable of producing more than 26,570 megawatt-hours of electricity per year – enough to power 1,800 households. The renewable energy generated by the farm is equivalent to taking 3,800 cars off the road.

Price: \$17

STANDING COMMITTEE CHAIRS

As this Society year draws to a close, I want to thank you for your service as a standing committee chair. We rely on our volunteer leaders to set ambitious goals and provide strong leadership, and I appreciate all that you and your committee have accomplished this year.

ASHRAE is recognized throughout the industry for high quality, authoritative technical material in our Handbook, standards, guidelines, design guides and educational courses. Your efforts this year have contributed to our effectiveness and advanced our progress. I am impressed by the number of committees that have accelerated their efforts and held conference calls and interim meetings. It has been a productive year.

As you have experienced, ASHRAE provides you an opportunity to collaborate with colleagues from diverse backgrounds. I have found the insights gained from my ASHRAE colleagues to be invaluable, both in technical knowledge and developing leadership skills. I hope you have found your service as committee chair to be both satisfying and personally rewarding.

I appreciate the time and talent that you contributed this year as a standing committee chair. It was a pleasure working with you. Thank you!

Sincerely,



Ronald E. Jarnagin
ASHRAE President

Thomas E. Watson, Chair
Advocacy Committee

Rex E. Noble, Chair
Handbook Committee

Douglas C. Scott, Chair
Refrigeration Committee

Thomas H. Phoenix, Chair
Building Energy Quotient Committee

George E. Menzies, Chair
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William P. Bahnfleth, Chair
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Young Engineers in ASHRAE
Committee

William S. Fleming, Chair
Publications Committee

ASHRAE ANNUAL CONFERENCE TECHNICAL PROGRAM

San Antonio – June 2012

Earn Professional Development Hour (PDH) credits by attending sessions listed in the Technical Program. Each hour attended in a session equals one PDH. For forums and other one-hour sessions, you must be present for the entire 50-minute program to earn a PDH. Sign-in sheets will be available in all session rooms for attendees to complete. New York State PDHs, AIA LUs and LEED AP credits are awarded for select sessions. Also, certain sessions may be acceptable for ASHRAE certification renewal. Send questions to certification@ashrae.org. Your badge will be scanned as you enter the session and a summary of sessions attended will be emailed to you upon conclusion of the conference. Please keep track of the sessions that you attend at the conference.

Technical sessions are in the Henry B. Gonzalez Convention Center. All sessions listed as starting at the same time are concurrent.

ASHRAE'S CONFERENCES AND EXPOSITIONS COMMITTEE WELCOMES YOU TO THE 2012 ANNUAL CONFERENCE

Four types of sessions are presented:

Technical Paper Sessions.

These sessions present papers on current applications or procedures, as well as papers resulting from research on fundamental concepts and basic theory. Papers presented in these sessions have successfully completed a rigorous peer review. You are invited to comment on these papers. Forms for written comment are available at each session, and if received by July 16, 2012, comments will be sent to respective authors for reply and publication in ASHRAE Transactions. PowerPoint presentations with audio descriptions of the presentations are posted online in the Virtual Conference. Preprints of papers and the Annual Conference Preprints CD are available for purchase in the ASHRAE Bookstore.

Conference Paper Sessions.

These sessions present papers on current applications or procedures, as well as papers reporting on research in process. These papers differ from technical papers in that they are shorter in length and undergo a much less stringent peer review. PowerPoint presentations with audio descriptions of the presentations are posted online in the Virtual Conference. Preprints of conference papers and the Annual Conference Preprints CD are available for purchase in the ASHRAE Bookstore. Conference papers will be published in ASHRAE Transactions but without comments.

Seminars.

Seminars feature presentations on subjects of current interest. Papers are not available from the Society; however, seminar PowerPoint presentations with audio descriptions of the presentations are posted online in the Virtual Conference. Access is free for attendees who purchase a conference registration. Additional Virtual Conference registrations can be purchased in the ASHRAE Registration. For a permanent record of the seminar presentations, the Seminar DVD will be available. Orders can be taken in the ASHRAE Bookstore.

Forums.

Forums are “off-the-record” discussions held to promote a free exchange of ideas. Reporting of forums is limited to allow individuals to speak confidentially without concern of criticism. There are no papers attached to these forums.

VIRTUAL CONFERENCE

Free for Paid Conference Registrants

ASHRAE is offering a virtual conference option so you won't miss the state-of-the-art concepts and latest design techniques presented in the Society's technical program. The San Antonio Virtual Conference allows you to view presentations and to interact with an online audience through a discussion board. All conference attendees paying the full registration fee will have access to the Virtual Conference, posted at www.ashrae.org/sanantonio-virtual. Click on the link to access the Virtual Conference and put in your email address to request your password.

- Virtual Conference includes:
- Synced audio and PowerPoint presentations
- Access to all seminar, technical paper and conference paper presentations
- Ability to post questions or answers through July 11
- Presentations available online for 18 months.

A full slate of technical programs will be posted beginning Monday, June 25 of the sessions that were presented the previous day, with additional content posted daily through Wednesday, June 27.

On-site registration is available for those who would like to purchase the Virtual Conference. **To sign up, go to ASHRAE Registration, Henry B. Gonzalez Convention Center, Ballroom A, Street Level, \$299 ASHRAE member; \$464 non member.** If you register on site, you will be able to log on the www.ashrae.org/sanantoniovirtual to request your password within 24 hours of your registration.



Annual Conference Preprints CD (All Papers on CD)

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\$98 (includes five FREE hard copies of preprint papers)

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Conference Seminar DVD

67 Seminars (PowerPoint files synced with speakers' audio)

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Conference Preprints (Individual Papers, In Print)

Technical Paper and Conference Paper Session papers as presented at this Conference

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ASHRAE Transactions (Print Volume)

Technical Paper Session papers with discussion questions and answers for papers in bound, library-quality form. Includes Conference Papers without discussion.

\$119 (ships August 2012)



Approved for New York State Professional Development Hours (PDHs) and American Institute of Architect Learning Units (LUs)



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All prices are special conference-only member prices.

Sunday, June 24

8:00 AM-9:30 AM

Technical Paper Session 1 (Intermediate)

Case Studies of Efficiency Improvements in Chilled Water, Domestic Hot Water and Formula Standardization for Estimating Savings Uncertainties

Track: HVAC&R Fundamentals and Applications



Room: 007B

Chair: M. Ginger Scoggins, P.E., Member, Engineered Designs Inc., Raleigh, NC

This session groups a set of technical papers that all relate to expanding our knowledge of energy savings potential by using case studies which focus on more efficient chiller plants, domestic hot water loops in multi-family dwelling units, and the use of Bayesian formula for estimating savings uncertainties in retrofit projects.

1. Simulations of Chilled Water Cooling Coil Delta-T Characteristics (SA-12-001)

Zhiqin Zhang, Ph.D.¹, Hui Li, Ph.D., P.E.² and Jingjing Liu¹, (1)Nexant, Inc., San Francisco, CA, (2)Texas A & M University, College Station, TX

2. Energy Savings Potential of Variable Condenser Water Flow Systems (SA-12-004)

Zhiqin Zhang, Ph.D. and Jingjing Liu, Nexant, Inc., San Francisco, CA

3. Method for Estimating Energy Savings Potential of Chilled Water Plant Retro-Commissioning (SA-12-005)

Zhiqin Zhang, Ph.D.¹ and W. Dan Turner, Ph.D., P.E.², (1)Nexant, Inc., San Francisco, CA, (2)Energy Systems Laboratory, College Station, TX

4. Using Energy Flow Analysis to Assess Energy Savings from Recirculation Controls in Multi-Family Central Domestic Hot Water Systems (SA-12-002)

Yanda Zhang, Ph.D., Member, Charlotte Bonneville, Stephen Wilson, Michael Maroney, P.E., Jeff Staller and Julianna Yun Wei, Hescong Mahone Group, Inc., Gold River, CA

5. Bayesian Analysis of Savings from Retrofit Projects (SA-12-003)

John A. Shonder, Member and Piljae Im, Oak Ridge National Laboratory, Oak Ridge, TN

Conference Paper Session 1 (Intermediate)

Low Energy Design and Integrated Energy System

Track: Integrated Energy Systems



Room: 007A

Sponsor: 07.01 Integrated Building Design, 07.04 Exergy Analysis for Sustainable Buildings

Chair: Tom Meyer, Member, National Environmental Balancing Bureau, Gaithersburg, MD

This conference paper session explores low energy design with integrated energy systems including applications in existing buildings and retrofits of a federal office building.

1. Achieving Deep Energy Savings in Existing Buildings Through Integrated Design (SA-12-C001)

Dave Moser, P.E., Member¹ and Guopeng Liu, P.E.², (1)PECI, Portland, OR, (2)Pacific Northwest National Laboratory, Richland, WA

2. Right Steps for Retrofits: Byron G. Rogers Federal Office Building Case Study (SA-12-C002)

Kendra Tupper, P.E., Member¹, Nicole Hammer, P.E.¹, Richard Osbaugh, P.E., Member² and Michelle Swanson, P.E., Member², (1)Rocky Mountain Institute, Boulder, CO, (2)RMH Group, Lakewood, CO

Seminar 1 (Intermediate)

Breaking Boundaries in Building Controls Integration

Track: Integrated Building Controls



Room: 001A

Sponsor: 07.06 Building Energy Performance

Chair: Kimberly A. Barker, Member, Siemens Building Technologies, Inc., Buffalo Grove, IL

Advanced, integrated BAS connects building systems in ways that pay off for building owners. They optimize building systems (HVAC, lighting,

elevators, irrigation, etc.) based on occupancy (e.g., access control, occupancy sensors) and weather conditions. Building occupants interact with the building using dashboards to extend occupancy conditions in their office to seeing the buildings carbon-footprint. They allow remote monitoring and control from outside the building, empowering those who manage portfolios to even coordinating consumption in a sustainable city.

1. Enterprise Portfolio Management

James P. McClendon, P.E., Member, Walmart Stores Inc., Bentonville, AR

2. Integrated Automation in a Net Zero Energy Laboratory

Joseph Kilcoyne, Member, SC Engineers, Inc., San Diego, CA

3. Sustainable Cities Need Smart Integration

Pornsak Songkakul, Member, Siemens Building Technologies, Buffalo Grove, IL

Seminar 2 (Advanced)

Cleanroom Mechanical System Design and Operation Impact on Energy Usage

Track: HVAC&R Fundamentals and Applications



Room: 007D

Sponsor: 09.11 Clean Spaces

Chair: Vincent A. Sakraida, P.E., Member, Engineered Air, Denver, CO

Cleanrooms typically have very high air change rates and energy usage per square foot, making cleanroom air very expensive air. This seminar evaluates design and operational topics that can have a substantial affect on a cleanroom's energy usage. The first topic evaluates the potential energy savings and technical challenges of implementing a cleanroom variable air flow control system. The second topic evaluates the different mechanical system types that can be implemented for a specific cleanliness classification and their respective energy usage. The third topic presents research results on airlock impact on cleanroom performance.

1. Evaluate Potential Energy Savings and Technical Challenges Implementing a Cleanroom Variable Air Flow Control System

Vincent A. Sakraida, P.E., Member, Engineered Air, Denver, CO

2. Evaluate the Different Mechanical System Types That Can Be Implemented for a Specific Cleanliness Classification and Their Respective Energy Usage

Kevin Breslin, Merrick and Co., Aurora, CO

3. Functionality and Performance of Airlocks, Anterooms and Vestibules, Important Findings From Recent ASHRAE Research (RP-1431)

Wei Sun, P.E., Member, Engsysco Inc., Ann Arbor, MI

Seminar 3 (Basic)

Climate Change Basics

Track: HVAC&R Fundamentals and Applications



Room: 001B

Sponsor: 02.05 Global Climate Change

Chair: Van D. Baxter, P.E., Fellow ASHRAE, Oak Ridge National Laboratory, Oak Ridge, TN

This session discusses the basics of the science of climate change and stratospheric ozone depletion, the International and U.S. regulatory directions, and the potential impact of these issues on the HVAC&R industry. The first speaker discusses the basics of ozone depletion and climate change science and how it drives the Kyoto and Montreal Protocol regulations. Speaker two addresses the current status of the international regulations (Kyoto and Montreal Protocols) as well as potential US domestic legislation and/or regulatory action. The final speaker discusses what the potential future regulatory actions/directions might mean for the HVAC&R industry.

1. Basics of Climate Change and Ozone Depletion Science

Donald Brundage, P.E., Member, Southern Company Services, Atlanta, GA

2. Montreal and Kyoto Protocol Status and Decisions

Steven H. Bernhardt, Ph.D., Member, Honeywell International, Morristown, NJ

3. Potential Impact of An HFC Phase-Down On the HVAC&R Industry

Rajan Rajendran, Ph.D., Associate Member, Emerson Climate Technologies, Inc., Sidney, OH

Seminar 4 (Advanced)

Power Trends of Information Technology Equipment and the Usage of ASHRAE's Thermal Guidelines in Data Center Design and Operation

Track: HVAC&R Fundamentals and Applications



Room: 103A

Sponsor: 09.09 Mission Critical Facilities, Technology Spaces and Electronic Equipment

Chair: Robin A. Steinbrecher, Member, Intel Corp., Dupont, WA

Datacom (data processing and telecommunications) equipment advances quickly resulting in short product cycles and rapid upgrade frequency. Based on the latest information from the leading datacom equipment manufacturers, this seminar summarizes the latest datacom equipment power trends documented in the 3rd edition of the Datacom Power Trends and Cooling Applications, authored by ASHRAE TC 9.9. Optimization of data center cooling may be misinterpreted as simply increasing the inlet temperature to the ITE. However, energy savings and optimization must be viewed as a carefully considered and methodical process including all aspects of data center optimization. This seminar presents that process and its application to all types of data centers.

1. Datacom Component Power Trends

Robin A. Steinbrecher, Member, Intel Corp., Dupont, WA

2. Datacom Equipment Power Trends

Roger R. Schmidt, Ph.D., P.E., Member, IBM Corporation, Poughkeepsie, NY

3. A Methodology for Determining the Optimum Data Center Temperature for Energy Efficiency

Michael K. Patterson, Ph.D., P.E., Member, Intel Corp., Dupont, WA

Seminar 5 (Basic)

Thermal Comfort in Commercial Kitchens

Track: Indoor Environmental Applications



Room: 007C

Sponsor: 05.10 Kitchen Ventilation

Chair: Greg DuChane, Member, Trane, Columbus, OH

The commercial kitchen is a unique space where many different HVAC applications take place within a single environment (exhaust, supply, transfer, air conditioning, etc.). Obviously, the main activity in the commercial kitchen is the cooking process that is generating heat and effluents which must be captured and exhausted in order to control and guarantee thermal comfort and good air quality for the employees. However commercial kitchens also have spaces for food preparation and dishwashing that experience different thermal environments. The existing knowledge of evaluation of thermal comfort may be inadequate and unsuitable for practical application in environments like commercial kitchens. The purpose of the ASHRAE (RP 1469) sponsored study "Thermal Comfort in Commercial Kitchens" is to determine the occupant thermal comfort range for workers in commercial kitchens' environments and to subsequently provide baseline data for the design community to evaluate new technologies for sustainable kitchen heating, ventilation, and air conditioning (HVAC) designs.

1. Thermal Comfort In Commercial Kitchens

John Stoops, Member, KEMA, Inc., San Francisco, CA

2. Thermal Comfort In Kitchens: Procedure, Instrumentation and Surveys for Documentation of the Thermal Environment In Kitchens

Angela Simone, Ph.D., Member, Denmark Technical University (KEMA, Inc.), San Francisco, CA

3. Thermal Comfort In Kitchens: Evaluation of Thermal Comfort In Kitchens Based On Physical Measurements and Subjective Results

Bjarne W. Olesen, SCANVAC, Lyngby, Denmark

Seminar 6 (Intermediate)

ASHRAE Guideline 20 and Better HVAC Software:

A BIM Perspective

Track: *Building Modeling Applications*

Room: 103B

Sponsor: 01.05 Computer Applications, 07.01 Integrated Building Design

Chair: Stephen Roth, P.E., Member, Carmel Software Corporation,

San Rafael, CA

ASHRAE GPC-20 (Guideline 20) is titled "Documenting HVAC&R Work Processes and Data Exchange Requirements." Its purpose is to define procedures for documenting work processes (Use Cases) and data exchange requirements for specific HVAC&R activities. For example, this guideline can be used by software designers to develop better software for HVAC engineers, energy modelers, and architects. This seminar provides an overview of the Guideline and how it can help HVAC practitioners improve their daily work-flow efficiency. It also describes a real-world example of how a use case is being used to improve HVAC load calculation work-flows.

1. Overview of Guideline 20: Documenting Work Processes and Data Exchange Requirements

Robert J. Hitchcock, Member, Hitchcock Consulting, Kelsey, CA

2. A Real-World Use Case: Building Load Calculations

Charles S. Barnaby, Member, Wrightsoft Corporation, Lexington, MA

3. Create a Sample Guideline 20 Use Case

Benjamin Welle, P.E., Member, Center for Integrated Facility Engineering (CIFE), Stanford University, Stanford, CA

9:45 AM-10:45 AM

Technical Plenary (Intermediate)

Interoperability of Smart Building Systems and Smart Grid

Track: *Integrated Energy Systems*

Room: 001A

Sponsor: *Conferences and Expositions Committee*

Chair: Dunstan Macauley, P.E., Member, TAI Engineers,

Owings Mills, MD

As the industry moves toward smart buildings systems, the interoperability of smart buildings and the power grid becomes paramount. On the forefront of this activity of smart grids is Lawrence E. Jones, Ph.D., Director, Regulatory Affairs, Policy & Industrial Relations at Alstom Grid Inc. Dr. Jones has over 20 years of experience in the energy industry with expertise in, power systems engineering, communications and control technologies in power grid and electricity market operations, smart grid technologies including renewable energy integration. Dr. Jones will speak on the interoperability of smart building systems and smart grid.

1. Interoperability of Smart Building Systems and Smart Grid

Lawrence Jones, Ph.D., Alstom Grid Inc., Washington, DC

11:00 AM-12:30 PM

Technical Paper Session 2 (Intermediate)

Advanced Technologies in Building Envelope Construction

Track: *HVAC&R Fundamentals and Applications*

Room: 007D

Chair: Andrew Price, P.E., Member, Stanley Consultants, Muscatine, IA

1. ASHRAE Standard 90.1 Metal Building U-Factors-Part 5: Mathematical Modeling of Wall Assemblies (SA-12-006)

Chris Kasprzak, Associate Member¹, David Musick¹, Mark Henry², Doug Fast, P.E.³ and Manoj K. Choudhary⁴, (1)Owens Corning, Toledo, OH, (2) Butler Manufacturing, Grandview, MO, (3)Johns Manville, Littleton, CO, (4)Owens Corning Center of Science and Technology, Granville, OH

2. Review and Economic Feasibility Study of the Currently Practiced New Housing Construction in Ontario (SA-12-007)

Alan Fung¹ and Aya Dembo, Student Member², (1)Ryerson University, Toronto, ON, Canada, (2)Ryerson University MIE, Toronto, ON, Canada

Conference Paper Session 2 (Basic)

Improving System Efficiency: How Measured Performance and Analysis Can Yield a Low Energy Solution

Track: *HVAC&R Fundamentals and Applications*

Room: 007B

Chair: Carl F. Huber, WaterFurnace International, Inc., Roanoke, IN

This conference session will cover a range of high efficiency options for residential applications that have the potential to lower energy consumption and/or the installed cost. Ground source heat pumps for space conditioning and water heating sharing a common foundation loop, the impact of a heat pump water heater within the conditioned space, a hybrid ground source heat pump that uses the ground as a thermal storage medium and humidification via a transport membrane in a gas furnace will be presented. The field sites, equipment, data collection methods and analysis techniques for these experimental applications will be examined.

1. Measured Performance and Analysis of Ground Source Heat Pumps for Space Conditioning and for Water Heating in a Low-Energy Test House Operated Under Simulated Occupancy Conditions (SA-12-C003)

Moonis R. Ally, Ph.D., Member, Jeffrey D. Munk, Van D. Baxter, P.E., Fellow ASHRAE and Anthony C. Gehl, Oak Ridge National Laboratory, Oak Ridge, TN

2. Measured Impact on Space Conditioning Energy Use in a Residence Due to Operating a Heat Pump Water Heater Inside the Conditioned Space (SA-12-C004)

Jeffrey D. Munk, Moonis R. Ally, Ph.D., Member and Van D. Baxter, P.E., Fellow ASHRAE, Oak Ridge National Laboratory, Oak Ridge, TN

3. Thermal Storage Properties of a Hybrid Ground Source Heat Pump (SA-12-C005)

Amanda Pertzborn, Student Member¹, G.F. Nellis² and Sanford A. Klein, Ph.D.³, (1)University of Wisconsin - Madison, Solar Energy Laboratory, Madison, WI, (2)University of Wisconsin - Madison, Madison, WI, (3) University of Wisconsin, Madison, WI

4. Field Trials of a Waterless Home Heating and Humidification Technology (SA-12-C006)

Dexin Wang, Ph.D., Shawn Scott, Ainan Bao, Ph.D and William Liss, Gas Technology Institute, Des Plaines, IL

Conference Paper Session 3 (Intermediate)

Performance and Operational Measurement

Track: *Indoor Environmental Applications*

Room: 007A

Chair: Gregory Dobbs, Ph.D., Member, Pennsylvania State University, Philadelphia, PA

It is increasingly important to be able to measure the performance of buildings. The data accumulated will allow us to better manage and predict energy use as well as evaluate the effectiveness of new design, construction and operational strategies. This session reports several new performance measurement techniques.

1. Environmental Noise Case Studies: Air-Cooled Refrigeration Chiller Installations near Residential Structures (SA-12-C007)

Jack B. Evans, P.E., Member, Chad N. Himmel, P.E., Member and Joshua D. Leasure, P.E., JEAcoustics / Engineered Vibration Acoustic & Noise Solutions, Austin, TX

2. Field-Test of the New ASHRAE/CIBSE/USGBC Performance Measurement Protocols for Commercial Buildings: Part I Intermediate and Advanced Level Indoor Environmental Quality Protocols (SA-12-C008)

Hyojin Kim, Student Member and Jeff S. Haberl, Fellow ASHRAE, Texas A&M University, College Station, TX

3. An Experimental and Simulation Study of Lighting Performance in Offices with Automated Roller Shades (SA-12-C009)

Hui Shen, Student Member and Athanasios Tzempelikos, Purdue University, West Lafayette, IN

Seminar 7 (Intermediate)

Effective Calibration of Building Energy Modeling Using Measured Data

Track: *Building Modeling Applications*

Room: 103B

Sponsor: **04.07 Energy Calculations**

Chair: *Keith R. Cockerham, P.E., Member, DLB Associates, Eatontown, NJ*



Building energy modeling consistency has and will continue to be an area of concern for the BEM community. As BEM is relied on more and more as part of the United States' and ASHRAE's commitment to reduce energy consumption, more accurate and better calibrated output from the models is critical to this energy saving effort. Continuing with the recent successful session from the 2012 Winter Conference on the same topic, this session shows best-practice methods to identify plausible causes of discrepancies between measured and modeled performance based on utility-level data, identifying causes of discrepancies, and understanding the challenges encountered. A number of case studies from various building types are presented. Some of these studies also compare post ECM utility data with the original simulation data.

1. Lessons Learned with Calibrating An Energy Simulation Model of a High Performance Hi-Rise Office Building

Tom Webster, P.E., Member, Center for the Built Environment (CBE), University of California, Berkeley, CA

2. BESTEST-EX: A Method for Testing Model Calibration Procedures

Ron Judkoff, Ph.D., Member, National Renewable Energy Laboratory, Golden, CO

3. Case Study of Calibrating Multiple Energy Simulation Studies for Hospital and Datacenter Clients As Part of a Utility Incentive Program

Nick Gmitter, Associate Member, DLB Associates, Eatontown, NJ

Seminar 8 (Intermediate)

Exploring Indoor Environmental Applications with Displacement Ventilation and Radiant Cooling and Heating Systems

Track: *Indoor Environmental Applications*

Room: 103A

Sponsor: **05.03 Room Air Distribution, 06.01 Hydronic and Steam Equipment and Systems, 06.05 Radiant Heating and Cooling**

Chair: *Mike McDermott, Member, Grumman Butkus Associates, Evanston, IL*



Radiant chilled ceilings (CC) with thermal displacement ventilation (TDV) represent a promising integrated system design that combines the energy efficiency of both sub-systems with the opportunity for improved ventilation performance resulting from the thermally stratified environment of DV systems. Presenters cover recent indoor environmental developments in TDV systems combined with radiant cooling and heating hydronic systems. We present appropriate applications for schools, offices, laboratories and large volume spaces. We explain how ASHRAE Standards 55-2010 and 62.1-2010 impact system design of these integrated air and hydronic systems. This presentation introduces a new design method based on laboratory experiments.

1. Predicted Thermal Comfort and Ventilation Performance In Combined Hydronic Floor and Displacement Ventilation Systems

Michel Tardif, P.Eng., Member, CanmetENERGY Natural Resources Canada, Ottawa, ON, Canada

2. Room Air Stratification and Ventilation Performance In Combined Chilled Ceiling and Thermal Displacement Ventilation Systems

Stefano Schiavon, Ph.D., Member, University of California, Berkeley, CA

3. Applied Chilled Sails and Thermal Displacement Ventilation

Jerry Sipes, Ph.D., P.E., Member, Price Industries Inc., Suwanee, GA

4. DV in Healthcare

Bob Gulick, P.E., Member, Mazzetti Nash Lipsey Burch, Portland, OR

Seminar 9 (Intermediate)

Practical Applications for DDC Dashboards and Green Kiosks

Track: *Integrated Building Controls*

Room: 001A

Sponsor: **01.04 Control Theory and Application, 07.03 Operation and Maintenance Management, 07.01 Integrated Building Design**

Chair: *Frank Shadpour, P.E., Fellow ASHRAE, SC Engineers, Inc., San Diego, CA*



What is the most useful information to motivate occupants to reduce building energy use? As owners, facility operators, and occupants become more interested in the health and energy performance of their buildings, access to real-time data has become a priority in many high performance buildings. The displays, which were once locked away in mechanical rooms, are now proudly exhibited in lobbies. This seminar demonstrates practical applications to integrate DDC and lighting controls, web services, and metered energy data into effective and eye-catching facility dashboards. Enable and empower building stakeholders to be more energy efficient by becoming better informed and ultimately make better decisions.

1. Intelligent System Integration for Facility Dashboards and Green Kiosks

Ron Burnstein, Echelon Corporation, Encinitas, CA

2. Teaching Through Touch

Nathan Bailey, Automated Logic, Pasadena, TX

3. An Owner's Perspective On Leveraging Dashboard Information to Reduce Energy Use

David Umstot, P.E., San Diego Community College District, San Diego, CA

Seminar 10 (Basic)

Some Acoustical Impacts of Poor Aerodynamic Conditions in HVAC Systems

Track: *HVAC&R Systems & Equipment*

Room: 001B

Sponsor: **02.06 Sound and Vibration Control**

Chair: *Mark E. Schaffer, P.E., Member, Schaffer Acoustics Inc., Pacific Palisades, CA*



The noise ratings for the equipment used in air distribution systems are determined from laboratory testing that is done with optimal airflow aerodynamics at the equipment's inlet and discharge connections. Real-world HVAC systems often do not have these optimal aerodynamic conditions. This seminar shows how less-than-optimal airflow aerodynamics in and near air handling units, terminal boxes and diffusers can cause the systems to produce unexpected, excessive noise.

1. The Effects of Poor Aerodynamics On Diffuser Noise

Zaccary Poots, Member, Nailor Industries, Houston, TX

2. Aerodynamic Effect of Terminal Unit Noise

Patrick Oliver, P.Eng., Member, E.H. Price, Ltd., Winnipeg, MB, Canada

3. The Effect of Poor Aerodynamics On Air Handling Unit Noise

Mark E. Schaffer, P.E., Member, Schaffer Acoustics Inc., Pacific Palisades, CA

Seminar 11 (Intermediate)

Standards Development for 2L Flammable Refrigerants

Track: *Refrigeration Applications*

Room: 007C

Sponsor: **03.01 Refrigerants and Secondary Coolants**

Chair: *William Walter, Member, Carrier Corporation, Syracuse, NY*



Environmental considerations are reducing the number of chemicals that can be used as refrigerants. The HFCs were introduced to replace ozone depleting CFCs and HCFCs, but they are greenhouse gases and are subject to use restrictions in some countries. As a result the industry is evaluating chemicals with very low global warming potential. Some of these chemicals are mildly flammable and have been assigned to a new flammability safety classification, 2L, in ASHRAE Standard 34. This seminar provides information on the changes to standards that specify requirements for the use of 2L flammable refrigerants.

- 1. ASHRAE Standard 15: Proposed Changes to Incorporate 2L Refrigerants**
Phillip Johnson, P.E., Member, McQuay International, Staunton, VA
- 2. EN 378, ISO 5149, IEC 60335-2-40: Proposed Changes to Incorporate 2L Refrigerants**
Els Baert, Daikin Europe N.V., Ostende, Belgium
- 3. UL's Effort to Harmonize Product Safety Requirements for A2L, A2, and A3 Refrigerants**
Brian Rodgers, Underwriters Laboratories, Northbrook, IL

1:30 PM-3:00 PM

Conference Paper Session 4 (Intermediate)

Energy Conservation Strategies for HVAC Systems

Track: HVAC&R Systems & Equipment

Room: 001B

Chair: Andrew Rhodes, Southland Industries, Dulles, VA

1. Impacts of Air Filters on Energy Consumption in Typical HVAC Systems (SA-12-C010)

Nabil Nassif, Ph.D., P.E., Associate Member, North Carolina A&T State University, Greensboro, NC

2. Design and Analysis of an Integrated Heat and Energy Recovery Ventilation System with Economizer Control for Net-Zero Energy Solar Houses (SA-12-C011)

Jiten Mistry¹, Carl Yu Chen, Student Member¹, Sumeet Jhingan², Wey Leong, Ph.D.¹, Alan Fung¹, Seyed Pishavee¹ and Saman Shaban Nejad³, (1)Ryerson University, Toronto, ON, Canada, (2)Morrison Hershfield, Brampton, ON, Canada, (3)Ryerson University, North York, ON, Canada

3. Potential Peak Reduction and Energy Savings of Innovative Building Envelope Technologies Using Phase Change Materials (SA-12-C012)

Paulo Cesar Tabares-Velasco, Ph.D., Associate Member, Craig Christensen and Marcus Bianchi, National Renewable Energy Laboratory, Golden, CO



Seminar 13 (Intermediate)

Designing Commercial Kitchen Ventilation for High Performance, Low Energy Buildings

Track: Integrated Energy Systems

Room: 007C

Sponsor: 05.10 Kitchen Ventilation, ASHRAE Std 90.1

Chair: Francis Kohout, P.E., Member, McDonald's Corp, Oak Brook, IL

A commercial kitchen is an energy intensive manufacturing facility. It is the largest consumer of energy per unit of floor area when compared to other commercial or institutional occupancies. Given this condition, there exists opportunities to design ventilation systems which minimize both energy use and environmental impact, all while still addressing large internal heat gains and high ventilation requirements. To achieve these goals, this seminar provides guidance on general design approaches as well as specific design examples.

1. How Does Standard 189 Impact My Kitchen Ventilation Design?

Francis Kohout, P.E., Member, McDonald's Corp, Oak Brook, IL

2. CKV DCV, Energy Considerations, Codes, and Standard 90.1

Jeff Stein, P.E., Member, Taylor Engineering, Alameda, CA

3. How Hood Selection, Exhaust, and Makeup Air Systems Contribute to a High Performance Building Design

Richard T. Swierczyna, Associate Member, Food Service Technology Center, San Ramon, CA

4. Considerations When Designing High Performance Exhaust Systems

John Clark, P.E., Member, Karges-Faulconbridge, Inc, Minneapolis, MN



Seminar 14 (Intermediate)

Energy Efficient Snow Melt System Design

Track: HVAC&R Systems & Equipment

Room: 007B

Sponsor: 06.05 Radiant Heating and Cooling

Chair: Devin A. Abellon, P.E., Member, Uponor, Phoenix, AZ

Pedestrian and transportation safety, security, and building accessibility may require snow and ice control afforded by snow melting systems. Balancing energy and environmental issues with client expectations has never been more important, requiring greater analysis of system designs and equipment selection. The seminar reviews research leading to the development of the ASHRAE Transient Snow-melting Analysis Software, examples of load calculations based on storm characteristics using the program, conversion of loads into system designs and equipment selections for various applications.

1. Snow Melt Research and Analysis of Design Alternatives Using the ASHRAE Snow Melt Software Tool

Jeffrey Spitzer, Ph.D., P.E., Oklahoma State University, Stillwater, OK

2. Thermal to Hydraulic Calculation Procedure for Snow Melting Systems

Robert Bean PL(Eng.), Member, Healthy Heating, Calgary, AB, Canada

3. Optimizing Circulator Selections for Temperature Extremes In Glycol Mixes

Hans Brink Hansen M.Sc., Member, Grundfos A/S, Bjerringbro, Denmark



Seminar 12 (Advanced)

Data Center Containment, Control and Modeling:

Interactions and Optimization Opportunities

Track: HVAC&R Fundamentals and Applications

Room: 103A

Sponsor: 09.09 Mission Critical Facilities, Technology Spaces and Electronic Equipment

Chair: David Moss, Dell, Inc, Austin, TX

In most data centers both the IT equipment and the data center itself are highly managed to optimize power, cooling and performance. In the past that optimization did not include simultaneous optimization of the overall entity. This seminar explores resulting non-optimal design characteristics and the methods used to operate both the IT equipment and the data center to solve cooling problems and better optimize its capability. The interaction of containment systems on IT equipment is covered along with the opportunity created using thermal sensing and simulation to manage the cooling. Techniques for avoiding data center limitation and stranded capacity are addressed as they relate to both the ITE and the data center cooling infrastructure.

1. Data Center Containment and Control: Data Center and ITE Interactions

David Moss¹ and Robin A. Steinbrecher, Member², (1)Dell, Inc, Austin, TX, (2)Intel Corp., Dupont, WA

2. Optimization of Containment Control Strategies Using Wireless Technology

Michael K. Patterson, Ph.D., P.E., Member¹ and Raju Pandey, Ph.D.², (1) Intel Corp., Dupont, WA, (2)University of California, Davis, Folsom, CA

3. Data Center Operational Management: Evaluating Data Centers and Avoiding Stranded Capacity

Mark Seymour, Member, Future Facilities, London, United Kingdom



Seminar 15 (Advanced)

Exploiting the Advances in Absorption Fundamentals for Transformative Impact

Track: HVAC&R Systems & Equipment

Room: 007A

Sponsor: 08.03 Absorption and Heat Operated Machines

Chair: Ersin Gercek, P.E., Associate Member, Concord Engineering Group, Voorhees, NJ

In this session, three different research facets towards improving performance and efficiency of absorption cooling technologies are evaluated. First author presents method of utilizing absorption cooling system assisted with a vapor compression system to improve system performance at high ambient temperatures. Second author deals with the application and evaluation of micro-channel heat exchangers in absorbers. Finally, the last authors present alternative fluids for absorbers to improve system resistance to crystallization issues.



1. Water/LiBr Absorption System Assisted Vapor Compression System for High Ambient Temperatures

Yunho Hwang, Ph.D., Member, University of Maryland, College Park, MD

2. Physical Properties of the Lithium Bromide + 1, 2-Propanediol Aqueous Solution

Omar Abdelaziz, Ph.D., Associate Member, Oak Ridge National Laboratory, Oak Ridge, TN

3. High Efficiency Energy Recovery Utilizing Micro-Channel Heat & Mass Exchangers Absorption System

Ebrahim Al-Hajri, Ph.D., Member, Petroleum Institute, Abu Dhabi, United Arab Emirates

Seminar 16 (Intermediate)

Modeling the Performance of VRF Systems

Track: Building Modeling Applications

Room: 103B

Sponsor: 08.07 Variable Refrigerant Flow

Chair: Dominic Kolandayan, Member, Daikin AC (Americas), Inc., Carrollton, TX

Expectations are at an all-time high for energy models to match the mechanical design exactly. However, many energy modeling programs do not explicitly model Variable Refrigerant Flow (VRF) systems. This seminar presents methods that utilize controlled laboratory data in energy simulation software with the goal of improving existing and future VRF energy models. Techniques are presented for modeling VRF systems using eQUEST which is based on the DOE-2.2 modeling engine. Finally, the differences in results among three energy modeling programs based on an example building are explored.

1. Data for Publicly Available VRF Systems

Ronald Domitrovic, Ph.D., Associate Member, Electric Power Research Institute, Knoxville, TN

2. Modeling VRF Systems Using eQUEST

Jaeyoon Koh, Ph.D., Member, LG Electronics U.S.A., Inc., Alpharetta, GA

3. Interpreting the Variations In Results When Modeling VRF Systems

Pam Androff, Associate Member, Mitsubishi Electric, Atlanta, GA

Seminar 17 (Intermediate)

Practical Applications with Storage and Treatment with Using Reclaimed and Harvested Waters in Your Water Conservation Efforts

Track: HVAC&R Fundamentals and Applications

Room: 007D

Sponsor: 03.06 Water Treatment

Chair: Scott Mayes, LAKOS, Olathe, KS

Everyone wants to save water, but how to do it. This seminar addresses the practical realities encountered using reclaimed and harvested waters by presenting real life experiences with water conservation efforts, including: 1) logistics of reclaimed/harvested water storage, 2) getting reclaimed water to storage/treatment areas, 3) practical uses for reclaimed/harvested waters, 4) expected treatment requirements for reclaimed/harvested waters, and 5) a comparison of issues with reclaimed vs. harvested waters.

1. Practical Applications with Storage and Treatment with Using Reclaimed and Harvested Waters

Dan Weimar, Member, Chem-Aqua, Tallahassee, FL

2. Using Reclaimed Water for Boiler Water Make Up

Mike Adams, Member, Garrett Calahan, Atlanta, GA

3. Water Treatment of Harvested Waters

Robert Walki, Ph.D., Associate Member, Nalco, Naperville, IL

Seminar 18 (Intermediate)

Strategies for Transformation of Facilities Management to Foster Economically, Environmentally and Socially Sustainable Buildings

Track: Integrated Building Controls

Room: 001A

Sponsor: 07.03 Operation and Maintenance Management, 02.08 Building Environmental Impacts and Sustainability

Chair: Om Taneja, Ph.D., P.E., Member, US, General Services Administration, Manhattan, NY

Buildings have more impact on the natural environment than any other sector of the economy. The future of facilities is going to be governed by how effectively we can transform facilities management towards lowering utilities and operating costs, minimizing waste, and improving work space based on measurements, commissioning and retro-commissioning of buildings. This seminar presents simple operation and maintenance measures guided by trained O&M staff to optimize demand with building automation, load shaving technologies and collaboration with other parts of organizations to integrate HVAC&R systems with other building systems to enhance the effectiveness of integrated operational and maintenance practices.

1. An Approach to Facilities Operational Improvements: Train O&M Staff and Provide Tools to Measure, Track and Adjust Equipment and Systems

Om Taneja, Ph.D., P.E., Member, US, General Services Administration, Manhattan, NY

2. Green Buildings Can Waste Energy Efficiently

Larry Spielvogel, P.E., Fellow Life Member, Consulting Engineer, Bala Cynwyd, PA

3. The Commissioning OPR, BOD and Systems Manual: Make Them Work for You

Ronald Wilkinson, P.E., Member, Consultant, New York, NY

3:15 PM-4:45 PM

Seminar 19 (Intermediate)

When Integrated Controls Are Not Integrated

Track: Integrated Building Controls

Room: 007D

Sponsor: 09.01 Large Building Air-Conditioning Systems

Chair: John Kuempel Jr., P.E., Member, DeBra-Kuempel, Mechanical/Electrical, Cincinnati, OH

Three case studies are shared where integrated controls did not work and lessons learned presented. These examples will help designers improve project delivery by learning from others' mistakes.

1. Case Studies: How We Got This Student Union Building, Unified

Drew Rimmer, P.E., Member, Henderson Engineering, Lenexa, KS

2. Case Studies: City Hall Out of Control- Overview

Howard J. McKew, P.E., Member, BuildingSmartSoftware, Inc., North Andover, MA

3. Case Studies: Commissioning Finds Project without Control

Wade Conlan, P.E., Member, Exp, Maitland, FL



Monday, June 25

8:00 AM-9:30 AM

Technical Paper Session 3 (Intermediate)

Modeling and Simulation for Data Center Cooling, Rack Boundary Conditions, Central Chiller Plant Loop Delta T and Indoor Swimming Pool Evaporation

Track: HVAC&R Systems & Equipment



Room: 007C

Chair: Nick Gangemi, P.E., Member, Facility Gateway Corp., Madison, WI

The use of probabilistic methods of predicting failure in Reliability Engineering has greatly assisted the design of reliable electrical power distribution systems for data centers. We will discuss this same proven technique as applied to the mechanical cooling system in a data center. As cloud computing and computational needs grow, data centers will continue to be a large part of our energy load. Proper design and layout of the data center are critical to efficient energy use within the data center. Rather than just modeling racks as a black box, we will validate them against experimental temperature and velocity data. Chilled water loop Delta "T" is a critical parameter for the simulation and optimization of a central chilled water system. A quadratic regression model will be used to model the loop Delta "T". The modeling procedure will be divided into three steps: variables selection and filtering, best regression screening, and model adequacy check. Accurate calculation of evaporation from swimming pools is needed to ensure proper sizing of HVAC equipment as well as for the estimation of energy consumption. Previously, formulas for evaporation from occupied and unoccupied indoor swimming pools have been published and shown to be in good agreement with test data. However it was applicable only to positive density difference. This paper now extends them to negative density differences and includes the case when air is forced over the surface of the pool to remove off gases.

1. Reliability Modeling for Data Center Cooling Systems (SA-12-008)

Bob Schuergger, P.E.¹, Gardson Githu, P.E.¹, Bob Arno² and Christopher W. Kurkjian, P.E., Member³, (1)HP Critical Facility Services, Los Angeles, CA, (2)HP Critical Facility Services, Frankfort, NY, (3)kW Mission Critical Engineering, Troy, NY

2. The Development of Simplified Rack Boundary Conditions for Numerical Data Center Models (SA-12-009)

John Zhai, Ph.D., Member, Knud A. Hermansen, Student Member and Salah Al-Saadi, Member, University of Colorado, Boulder, CO

3. Simulating Central Chiller Plant Loop Delta-T with Quadratic Regression Models (SA-12-010)

Zhiqin Zhang, Ph.D. and Jingjing Liu, Nexant, Inc., San Francisco, CA

4. Calculation of Evaporation from Indoor Swimming Pools: Further Development of Formulas (SA-12-011)

M. Mohammed Shah, Ph.D., P.E., Fellow ASHRAE, Consultant, New York, NY

Conference Paper Session 5 (Basic)

Thermal Comfort

Track: Indoor Environmental Applications



Room: 007A

Chair: Bjarne W. Olesen, SCANVAC, Lyngby, Denmark

The basic requirement of a properly designed and managed indoor environment is to maintain an acceptable level of thermal comfort. This session explores various approaches and their impact on thermal comfort.

1. A Comparison of Thermal Comfort Between the Archetype Sustainable Homes at the Kortright Centre for Conservation (SA-12-C013)

Agatha E. Pyrka and Alan Fung, Ryerson University, Toronto, ON, Canada

2. Long-Term Evaluation of Internal Thermal Comfort with Different Kinds of Glazing Systems and Window Sizes: From Energetic Considerations to Users' Comfort (SA-12-C014)

Francesca Cappelletti, Ph.D.¹, Andrea Gasparella, Ph.D.², Giovanni Pernigotto, Dr.Ing.³ and Piercarlo Romagnoni, Ph.D., Member¹, (1) University IUAV of Venice, Venezia, Italy, (2)Free University of Bolzano, Bolzano, Italy, (3)University of Padova, Vicenza, Italy

3. Occupant Perceptions of an Indoor Thermal Environment in a Naturally Ventilated Building (SA-12-C015)

Salman Ilyas, Member¹, Ashley Emery, Fellow ASHRAE², Dean Heerwagen, Life Member² and Judith Heerwagen, Ph.D.³, (1)Arup, Los Angeles, CA, (2) University of Washington, Seattle, WA, (3)J.H. Heerwagen & Associates, Inc., Seattle, WA

Seminar 20 (Intermediate)

BAS Integration in the Occupied Space

Track: Integrated Building Controls



Room: 001A

Sponsor: 01.04 Control Theory and Application

Chair: James Coogan, P.E., Member, Siemens, Buffalo Grove, IL

Integrated BAS is not confined to equipment rooms. In today's automated room, lighting, shading HVAC and natural ventilation systems work together to serve the occupant and maximize efficiency. Integration at the occupant's interface makes it simple to use a room with sophisticated capabilities.

1. Room Automation in Today's Office Building

Markus Kissel, Siemens Industry Inc, Gubelstrasse, Switzerland

2. Specifying Integrated Lighting and HVAC Controls

Ronald Poskevich, Blue Ridge Technologies, Atlanta, GA

3. Integrated BAS from the Hospital Bed

Robert Dubiel, Member, Mayo Clinic Health System, Eau Claire, WI

Seminar 21 (Basic)

Can I Determine My Loads with My Energy Modeling Program?

Track: Building Modeling Applications



Room: 103B

Sponsor: 04.01 Load Calculation Data and Procedures, 04.07 Energy Calculations

Chair: Glenn Friedman, P.E., Member, Taylor Engineering, Alameda, CA

Load calculations and energy modeling tools are based on the same fundamental heat transfer theory. At present, the methods are fairly similar, yet there are some key differences in assumptions, especially with regards to the weather data. This seminar looks at the differences between the methods using the ASHRAE Headquarters Building. The results from both the design load calculation approach and the energy calculation approach are compared to actual measured data.

1. Overview of Cooling Load Calculation and Energy Modeling Procedures

Jeffrey Spitzer, Ph.D., P.E., Oklahoma State University, Stillwater, OK

2. Comparison of Results From Cooling Load Calculation and Energy Modeling Programs

Steve Bruning, P.E., Fellow ASHRAE, Newcomb & Boyd, Atlanta, GA

3. Comparison of Calculated and Measured Loads for the ASHRAE HQ Building

Daniel Fisher, Oklahoma State University, Stillwater, OK

Seminar 22 (Intermediate)

Combined Heat and Power as a Policy Tool to Meet State Mandates to Provide Clean, Reliable Cost Effective Power

Track: Integrated Energy Systems



Room: 007B

Sponsor: 01.10 Cogeneration Systems

Chair: James Freihaut, Ph.D., Member, The Pennsylvania State University, State College, PA

Twenty-two states adopted Energy Efficiency Resources Standards (EERS) between 2007 and 2010, passing the tipping point so that now more than half of all states have EERS in place for electricity, natural gas, or both. Utilities have been responding to this new policy environment by adding and developing programs, efficient technologies, market segmentation strategies, program approaches, and program designs. Certain states have recognized the importance of Combined Heat and Power technologies as an important tool in economically achieving energy efficiency, reliability and carbon reduction. This seminar presents three strategic arguments for increasing the use of CHP

focusing on clean power production, reliable energy supply and economics of energy supply.

1. Clean Power

Richard Sweetser, Member, Exergy Partners Corp., Herndon, VA

2. Reliable Power

Bruce Hedman, Ph.D., ICF, Arlington, VA

3. Cost Effective Power

Garroid Foley, Member, Integrated CHP Systems Corp., Princeton Junction, NJ

Seminar 23 (Basic)

New Acoustical Criteria and Methods of Measuring HVAC Sound

Track: HVAC&R Fundamentals and Applications

Room: 007D

Sponsor: 02.06 Sound and Vibration Control

Chair: Karl L. Peterman, P.E., Member, Vibro-Acoustics, Markham, ON, Canada

Noise problems in buildings remains one of the top causes of occupant complaints. Recognizing this, many of the high performance building programs now require a minimum standard of acoustical performance - though the method to determine compliance has not yet been formalized. Recent ASHRAE-sponsored research and influence from international standards have led the technical committee on sound and vibration control to change the acoustical criteria table in the ASHRAE Applications Handbook. This session reviews the new table, sound criteria methods, new guides such as the IgCC and ASHRAE 189, and a sound measurement methodology currently under development.

1. Standardized Methodology for Sound Level Measurement

Karl L. Peterman, P.E., Member, Vibro-Acoustics, Markham, ON, Canada

2. Multi-Cultural Acoustical Criteria and the New ASHRAE Criteria

Jason Swan, Member, Sandy Brown Associates, LLP, London, United Kingdom

3. Uncertainties in Measuring HVAC Noise

Richard Peppin, Member, Scantek, Inc., Columbia, MD

Seminar 24 (Intermediate)

Proper Sizing of Copper Tube and Fittings for High Pressure Refrigerant Applications

Track: Refrigeration Applications

Room: 001B

Sponsor: 10.03 Refrigerant Piping, 03.08 Refrigerant Containment

Chair: John J. Sluga, Member, Hansen Technologies Corporation, Bolingbrook, IL

The purpose of the session is to address inconsistencies in current practices for predicting failure in pressure piping. This is particularly important to engineers using R410a and CO2 in their refrigeration designs. Presentations show hoop strain is a better predictor of failure than wall thickness for pressure piping; compare hoop strain predicted performance to other performance predictors; and lastly describe what changes to ASME and ASTM codes are under development with this knowledge.

1. Development and Evaluation of Copper Tube and Fittings Used In R-410A and CO2 Applications

Chris Mueller, Member, Mueller Industries, Memphis, TN

2. Evaluation of Predicted Failure Using Dimensional Criteria In Current Standards

Charles Stout, P.E., Member, Mueller Industries, Memphis, TN

3. Proposed Changes to Regulations Governing Pressure Piping

Charles Stout, P.E., Member, Mueller Industries, Memphis, TN

Seminar 25 (Intermediate)

Radiant Cooling in High Humidity Environments

Track: HVAC&R Fundamentals and Applications

Room: 103A

Sponsor: 06.05 Radiant Heating and Cooling

Chair: Devin A. Abellon, P.E., Member, Uponor, Phoenix, AZ

The use of radiant cooling systems has been proven as an alternative strategy to provide superior thermal comfort while significantly reducing overall building energy usage. However, its adoption in many regions has been slow due to concerns over surface condensation. This seminar explores the conditions which define an indoor environment conducive to human health and comfort, and show that a radiant cooling system designed to such guidelines would not be at risk for condensation. This seminar also includes case studies showing how radiant cooling systems have been used as part of an energy efficient design solution in high humidity environments.

1. Designing the Indoor Environment for Health and Comfort

Robert Bean PL(Eng.), Member, Healthy Heating, Calgary, AB, Canada

2. Radiant Cooling: The Bangkok Airport

Peter Simmonds, Ph.D., Fellow Member, IBE Consulting Engineers, Sherman Oaks, CA

3. Radiant Cooling: Clemson University

Michael Talbot, P.E., Talbot & Associates Consulting Engineers, Inc., Charlotte, NC

9:45 AM-10:45 AM

Conference Paper Session 6 (Advanced)

Integrated Building Controls

Track: Integrated Building Controls

Room: 001A

Chair: Michael R. Brambley, Ph.D., Fellow ASHRAE, Pacific Northwest National Laboratory, Richland, WA

This conference paper session shares lessons learned in 20 years of experience in HVAC system commissioning services and recommendations for solving common issues found in commissioning. It then examines a method for reducing energy consumption in HVAC systems using model-based optimization that could be integrated into energy management and control systems. This optimization process uses evolutionary algorithms and artificial neural networks to implement the optimization process.

1. What We Have Learned from 20 Years of HVAC System Commissioning (SA-12-C016)

E. Thomas Lillie, P.E., Member, Horizon Engineering Associates, LLP, St. Louis, MO

2. Modeling and Optimization of HVAC Systems Using Artificial Intelligence Approaches (SA-12-C017)

Nabil Nassif, Ph.D., P.E., Associate Member, North Carolina A&T State University, Greensboro, NC

Conference Paper Session 7 (Basic)

Optimal Zoning Strategies to Maximize Building Performance

Track: Building Modeling Applications

Room: 007A

Chair: Megan LaHiff, P.E., Associate Member, Stan Weaver Company, Orlando, FL

1. Beyond the Shoebox : Zoning Approaches for Unusual Building Shapes (SA-12-C018)

Lillian Smith, Autodesk, Waltham, MA

2. A Simulation and Experimental Study of the Impact of Passive and Active Façade Systems on the Energy Performance of Building Perimeter Zones (SA-12-C019)

Ying-Chieh Chan, Student Member and Athanasios Tzempelikos, Purdue University, West Lafayette, IN

Seminar 26 (Intermediate)

Laboratories and Environmental Performance Criteria

Track: HVAC&R Fundamentals and Applications

Room: 103B



Sponsor: 09.10 Laboratory Systems

Chair: Michael Ratcliff, Ph.D., P.E., Member, RWDI, Redlands, CA

Laboratories have special requirements and characteristics compared to regular buildings. The Labs21 Environmental Performance Criteria was an attempt to establish a LEED type program to reduce the environmental impacts for laboratories. Unfortunately the LEED organization has decided to not pursue a LEED for labs program. This seminar discusses the current Labs21 criteria and how such a program may advance in the future.

1. What Gives with the Labs 21 Environmental Performance Criteria?

Philip Wirdzek, International Institute of Sustainable Laboratories, Arlington, VA

2. A Planned Sustainability Improvement Evaluation System for Labs

Gordon Sharp, Ph.D., P.E., Member, Aircuity, Inc., Newton, MA

Seminar 27 (Intermediate)

Thermal Energy Storage: From Concept to Completion

Track: HVAC&R Systems & Equipment

Room: 007C



Sponsor: 06.09 Thermal Storage, 01.10 Cogeneration Systems

Chair: Robert Willis, Member, Ice Energy, Fort Collins, CO

Thermal energy storage (TES) is a proven technology, historically providing benefits to system owners and utilities by shifting electric loads from peak to off-peak periods. In addition, integration of TES into the design of various mechanical systems can reduce cost, improve efficiency and reliability, and enable more effective operating strategies. This session provides an in-depth look at several supply and demand side applications of TES demonstrating these benefits. Design and modeling considerations are covered along with performance results of the installations. Case studies presented feature a range of technologies including chilled water storage, turbine inlet cooling, ice storage, and geoechange systems.

1. Chilled Water Thermal Energy Storage: Case Studies

Guy S. Frankenfield, P.E., Member, Natgun Corporation, Grand Prairie, TX

2. Integration of Energy Storage with GeoExchange Systems

Ed Lohrenz, Member, Geo-Xergy Systems, Inc., Winnipeg, MB, Canada

Seminar 28 (Intermediate)

Advanced Techniques for Editing Building Energy Models

Track: Building Modeling Applications

Room: 103A



Chair: Molly Curtz, P.E., Member, Arup, Seattle, WA

In this practical seminar, attendees will learn to work more efficiently and accurately with large, complex building energy model input files. Techniques presented will include both direct manipulation of text-based input files and approaches for efficient editing within the eQuest GUI (Graphical User Interface), including regular expressions, BDL expressions, and user-defined defaults. We will focus primarily on working with DOE-2.2 (eQuest) input files, but the core techniques are also useful in other modeling software. This seminar will help experienced modelers learn to work faster and smarter, avoiding repetitive and error-prone manual editing.

1. Advanced Techniques for Editing Building Energy Models

Molly Curtz, P.E., Member, Arup, Seattle, WA

Seminar 29 (Intermediate)

Current Design Standards for Upper Air UV Disinfection Installations: Bridging Global Gaps

Track: HVAC&R Fundamentals and Applications

Room: 007D



Sponsor: 02.09 Ultraviolet Air and Surface Treatment

Chair: Sam Guzman, Member, American Ultraviolet Company, Schooleys Mountain, NJ

This seminar discusses the need for a set of standards regarding the proper application of upper air UV disinfection units and how it impacts the transmission

of airborne diseases worldwide. The lack of standards and the variation in the application of UV wall and ceiling mounted fixtures has led to resistance to the use of UV technology as a solution for transmission control. The design and installation of the UV fixtures has a dramatic impact on the effectiveness and safety of their use.

1. The Need for Standards for Upper Air UV Applications

Richard L. Vincent, Member, Mount Sinai School of Medicine, New York, NY

2. System Design for Upper Air Disinfection

Chuck Dunn, Member, Lumalier Corporation, Memphis, TN

Forum 1 (Advanced)

IBD, IPD - We OK? When Performance Is the Goal, What Should Be In the Deal?

Track: Integrated Energy Systems

Room: 007B

Sponsor: 07.01 Integrated Building Design, 01.07 Business, Management & General Legal Education

Chair: E. Mitchell Swann, P.E., Member, MDC Systems, Paoli, PA

IBD and IPD have become common terms in project execution today. In many of these projects, high performance is the goal. But perceptions of performance can be subjective. How do you know when it is good enough? This forum captures the experiences and expectations of ASHRAE members on IBD, IPD and performance-based projects with an aim to help inform the industry about what works and doesn't work so well in the contractual agreements covering their projects. The feedback collected will help to develop a future joint guidance publication from TC 1.7 and 7.1. Forewarned is forearmed!

Forum 2 (Intermediate)

Will Standard 90.1 Help or Hurt the Data Center Industry?

Track: HVAC&R Fundamentals and Applications

Room: 001B

Sponsor: 09.09 Mission Critical Facilities, Technology Spaces and Electronic Equipment

Chair: David Quirk, P.E., Member, Verizon Wireless, Basking Ridge, NJ

ANSI/ASHRAE/IESNA Standard-90.1, Energy Standard for Buildings, has been amended to include data centers within the scope of the 2010 edition, following approval of Addendum aq. Since this change to Standard 90.1 there have been many industry letters, public review comments, articles, and even presentations indicating concerns and disagreement over the changes. This forum reviews some of the current requirements and get industry feedback on whether the current requirements will hurt the data center industry and possibly require steps backwards for innovation in data center design.

11:00 AM-12:00 PM

Conference Paper Session 8 (Intermediate)

Field and Laboratory Results from

HVAC Maintenance Programs

Track: HVAC&R Systems & Equipment



Room: 007A

Sponsor: 06.03 Central Forced Air Heating and Cooling Systems

Chair: Judith Jennings, P.E., Member, Pacific Gas and Electric, San Francisco, CA

HVAC Maintenance Measures have been a central part of utility HVAC energy efficiency efforts in recent years, yet the savings reported using different metrics vary widely and are subject to a wide range of factors. HVAC installation and maintenance faults, weather dependency, refrigerant charge method, system characteristics such as metering device, line length, unit location, individual vs. combined measures, and a host of other variables affect the outcome of maintenance efforts. Utility programs, contractors and researchers have spent considerable effort trying to understand the key elements and to determine the most successful approach to achieving savings. EM&V efforts have been limited and challenging. The three papers in this session provide three perspectives to broaden our understanding this complex problem. Heine-meier provides analysis of the sources of uncertainty in delivering and measuring these programs. Stoops will focus on the challenges and uncertainties faced in conducting evaluations of HVAC tune-up and refrigerant charge correction

programs. Mowris will provide laboratory test results of HVAC diagnostic fault detection and the impacts of installation and maintenance faults on the measured application Energy Efficiency Ratio (EER) and Seasonal Energy Efficiency Ratio (SEER).

1. Uncertainties in Achieving Energy Savings from HVAC Maintenance Measures in the Field (SA-12-C020)

Kristin Heinemeier, Ph.D., P.E., Member¹, Marshall B. Hunt, P.E.², Marc A. Hoesele, P.E.³ and Elizabeth Weitzel, Affiliate³, (1)Western Cooling Efficiency Center, Davis, CA, (2)Pacific Gas & Electric, Davis, CA, (3) Davis Energy Group, Davis, CA

2. Laboratory Measurements of HVAC Installation and Maintenance Faults (SA-12-C021)

Robert Mowris, P.E., Member¹, Robert Eshom² and Ean Jones², (1)Verified Inc., Olympic Valley, CA, (2)Verified Inc., Truckee, CA

Seminar 30 (Intermediate)

Case Studies in Controls

Track: Integrated Building Controls

Room: 001A

Sponsor: 01.04 Control Theory and Application

Chair: David Kahn, P.E., Member, RMH Group, Lakewood, CO

This session examines two differing approaches to energy savings: a case study of a retrofit and a programming strategy, and performance verification for VAV terminals. The case study is an energy retrofit of a Salt Lake office building resulting in 50% energy reduction. Controls were replaced, enhanced monitoring installed and solar PV and domestic water heating employed. Strategies for controlling terminal equipment to minimize energy usage while remaining in compliance of ventilation requirements are presented. Specialized database optimized for the intake, management, analysis and presentation of large volumes of "time series" data from building systems, sensors, and controls is described.

1. Over 50% Energy Reduction with Retrofits Plus Solar: An Office Building Case Study

Gaylen Atkinson, Member, Atkinson Electronics, Salt Lake City, UT

2. Dynamic Reset of VAV System Duct Pressure, Ventilation Airflows and Concurrent Compliance/Performance Verification

Matt Dugan, Member, DLV Automation, Atlanta, GA

Seminar 31 (Intermediate)

Commissioning the Building Envelope

Track: HVAC&R Fundamentals and Applications

Room: 001B

Sponsor: 07.09 Building Commissioning

Chair: Mike Eardley, P.E., Member, Cannon Design, Boston, MA

This seminar focuses on the complexities of building envelope commissioning, specifically examining the differences and interactions between typical mechanical and building envelope commissioning from pre-design through post occupancy. Various commissioning techniques and testing procedures utilized by the presenters are discussed.

1. Leading the Commissioning Process for the Building Envelope

David Cantrill, P.E., Associate Member, Commissioning & Green Build Solutions Inc., Duluth, GA

2. Design and Field Testing Considerations for the Building Envelope

Fiona Aldous, Wiss, Janney, Elstner Associates, Inc., Irving, TX

Seminar 32 (Basic)

Ramification of Aisle Containment and Server Airflow Design in New and Existing Data Centers

Track: HVAC&R Fundamentals and Applications

Room: 103A

Sponsor: 09.09 Mission Critical Facilities, Technology Spaces and Electronic Equipment

Chair: Nick Gangemi, P.E., Member, Facility Gateway Corp., Madison, WI

Cold and hot aisle containment has become a widely accepted method of increasing the efficiency of data center operation. The concept of physically separating cold and hot air paths in the data center makes logical sense, and aisle containment provides a simple method for accomplishing this, that on

the surface appears to remove the chance of any airflow mixing. However, like most data center operation concepts, the true nature of containment is more complex. This presentation explores the theoretical application of aisle containment, and the reality of server airflow leakage that results in bypass air that is at the heart of the potential inefficiencies that may be found. Methods of eliminating this bypass air are presented.

1. Ramification of Aisle Containment and Server Airflow Design In New and Existing Data Centers

Daniel B. Kennedy, Associate Member, Tate Inc, Jessup, MD

Seminar 33 (Intermediate)

Review of the Updated AHRI Standards 260 and 880

Track: HVAC&R Systems & Equipment

Room: 007C

Sponsor: 02.06 Sound and Vibration Control

Chair: Chris Papadimos, Member, Papadimos Group, San Francisco, CA

More than ever the need for valid sound data for ducted equipment and air terminals is required to be subsequently used in accurately predicting sound levels inside the building and developing appropriate sound treatment options that have direct bearing on costs. This session discusses at length the recently updated AHRI Standards 260 and 880 for testing and rating ducted air handling equipment and air terminals, respectively.

1. Update On AHRI Standard 260, Sound Rating of Ducted Equipment

Curt Eichelberger, P.E., Member, Johnson Controls, York, PA

2. Consequences of Recent Updates to AHRI Standard 880 Performance Rating of Air Terminals

Patrick Oliver, P.Eng., Member, E.H. Price, Ltd., Winnipeg, MB, Canada

Seminar 34 (Intermediate)

Update on Evaporative Cooling Technologies: Simple Keeps Getting Better

Track: HVAC&R Fundamentals and Applications

Room: 103B

Sponsor: 05.07 Evaporative Cooling

Chair: Leon Shapiro, J.D., Member, VRTX Technologies, Oak Park, CA

Evaporative cooling technologies have been successfully utilized for years to provide energy efficient cooling. Advances in the design of indirect evaporative cooling equipment allow for hybrid systems that improve efficiencies and indoor air quality. This program provides insights in their use in high performance and sustainable data centers and big box retail buildings.

1. Indirect Evaporative Cooling Offers Advantages for Data Center Recovery from Power Interruption

Nicholas H. DesChamps, Ph.D., P.E., Fellow Life Member, eForay Consulting LLC, Las Vegas, NV

2. Field Results for Retrofit Hybridization of High Performance Evaporative Cooling In Big Box Retail

Steve Slayzak, Associate Member, Coolerado Corporation, Denver, CO

Forum 3 (Basic)

How Could the Service Water Heating Handbook Chapter Better Assist You?

Track: HVAC&R Fundamentals and Applications

Room: 007B

Sponsor: 06.06 Service Water Heating Systems

Chair: Amin Delagah, Associate Member, PG&E Food Service Technology Center, San Ramon, CA; Jim Lutz, Ph.D., Member, Lawrence Berkeley National Laboratory, Berkeley, CA

The water heater is the last major energy using appliance to be examined by energy efficiency professionals. Hot water systems have been evolving in the last five years, with many new water heating products and distribution systems architectures introduced. Research of domestic hot water systems has gained steam and there has been great emphasis to reduce the hot water use of fixtures and equipment. Unfortunately, some of the reference documents that support several key sections of the current Service Water Heating chapter are outdated, dating back to 1969 for commercial and 1985 for residential facilities. This forum is an opportunity for the Society to help build a roadmap for updating Chapter 50 of the HVAC Applications Handbook.



Forum 4 (Intermediate)

Optimum Design Verification: Is It Really Optimum?

Track: Building Modeling Applications

Room: 007D

Sponsor: TGI Optimization

Chair: Stephen J. Treado, Ph.D., P.E., Member, The Pennsylvania State University, University Park, PA

Optimization is frequently misused and misunderstood. Part of the reason is that optimization means different things to different people, ranging from a general assessment to a rigorous mathematical procedure. When applied to the design process, optimization may require certain idealizations and assumptions in the modeling process to facilitate a timely solution or to account for unknown parameters. As a result, there exists lingering questions regarding the accuracy or realism of the optimization results. The purpose of this forum is to provide an opportunity for designers to discuss their use of optimization and their experiences with verifying their results, and identify needs for optimum design verification.

2:15 PM-3:15 PM

Seminar 35 (Intermediate)

Integrating Design, Commissioning and BMS Controls to Deliver Mission Critical Success

Track: Integrated Building Controls

Room: 007D

Sponsor: 07.09 Building Commissioning

Chair: Gerald J. Kettler, P.E., Life Member, AIR Engineering and Testing, Carrollton, TX

Mission critical facilities require a unique holistic approach to design, controls and commissioning to ensure maximum system reliability. Going beyond the traditional approach and establishing a more unified automation project team provides the best opportunity to meet the client owner's project requirements (OPR) while minimizing total cost of ownership (TCO). Integration of these critical project team members throughout all project phases from planning through operations is critical to optimizing a facility that is reliable and easy to own and operate. Best practices at various stages are explored including ways to setup projects for success. Case studies are presented providing lessons learned that have helped develop and improve this non-traditional approach.

1. Mechanical System Commissioning of Mission Critical Facilities

Justin Seter, Member, DLB Associates, Atlanta, GA

2. Controls and Automation for the Commissioning Process

Sean Graham, P.E., Member, DLB Associates, Atlanta, GA



3:30 PM-4:30 PM

Seminar 36 (Intermediate)

Control Specification Fundamentals: How to Get What You Really Want

Track: Integrated Building Controls

Room: 007D

Sponsor: 01.04 Control Theory and Application

Chair: Larry J. Fisher, Member, ECT Services, Louisville, KY

Over the past 30 years controls have advanced from nearly 100% pneumatic controls (which were interoperable), to proprietary DDC controls, to the current day of integrated building systems that use open protocols (BACnet, LON, MODBUS). This has presented a challenge to the engineering community. Specifications today must not only address factory and field mounted control systems; they must provide sequences of operation for traditional HVAC systems, new green technologies, building energy use optimization, and predictive control strategies; they must specify graphical user interfaces, including dashboards and educational kiosks; they must address network communication and response speeds; and they must span the specification sections within the plan and spec documents that include the building systems integrated into the building automation system.



1. Controls Specification 101

Chariti Young, Member, Automated Logic Corp., Kennesaw, GA

2. DDC: How to Get What You Really Want?

Frank Shadpour, P.E., Fellow ASHRAE, SC Engineers, Inc., San Diego, CA

Tuesday, June 26

8:00 AM-9:30 AM

Technical Paper Session 4 (Intermediate)

Improvements in HVAC System Efficiency

Track: HVAC&R Fundamentals and Applications



Room: 007B

Chair: Dharam V. Punwani, Avalon Consulting, Naperville, IL

1. Short-Term Curtailment of HVAC Loads in Buildings (1390-RP) (SA-12-012)

Lixing Gu, Ph.D., P.E., Member and Richard Raustad, Florida Solar Energy Center, Cocoa, FL

2. Development of a Tool to Improve the Energy Efficiency of Existing Commercial and Institutional Buildings (SA-12-013)

Angela Lewis, P.E., Student Member, University of Reading, Alexandria, VA

3. Laboratory Testing of a Fabric Air Dispersion System (SA-12-014)

Stephen A. Idem, Ph.D.¹, D. Kulkarni¹, Ananth Nalla² and Kevin J. Gebke, Member³, (1)Tennessee Tech University, Cookeville, TN, (2)Mechanical Engineering, Tennessee Tech University, Cookeville, TN, (3)DuctSox Corporation, Peosta, IA

4. Ventilation Requirements for Refrigerating Machinery Rooms (1448-RP) (SA-12-015)

Scot Wayne, Ph.D., P.E., Member, Ronald Petersen, Ph.D., Member and Anke Beyer-Lout, CPP Inc., Fort Collins, CO

Seminar 37 (Intermediate)

Commissioning of Under Floor Air Distribution Systems

Track: HVAC&R Systems & Equipment



Room: 103B

Sponsor: TRG7 Underfloor Air Distribution, 05.03 Room Air Distribution

Chair: Michael McQueeny, P.E., Member, AirFixture, Kansas City, KS

Presenters cover the differences in commissioning (Cx), troubleshooting, testing and balancing underfloor air distribution (UFAD) systems as compared to traditional ducted systems. Presentation content includes the idiosyncrasies associated with UFAD that engineers, contractors and operators need to be aware of so that obstacles to a successfully operating system can be avoided. The audience will learn how to obtain the IAQ, energy and cost saving benefits associated with UFAD through the use of proper Cx techniques. Real examples of successes and lessons learned will be used throughout the session including data collected to demonstrate compliance of system operation and performance. The seminar also highlights typical misunderstandings and misconceptions of UFAD operation and the resolutions developed during design, construction, and operation of UFAD systems.

1. Design Phase Commissioning of Under Floor Air Distribution Systems

Dennis Jones, P.E., Member, GROUP14 ENGINEERING, INC., Denver, CO

2. UFAD System Forensics and Troubleshooting Challenges

Jim Megerson, P.E., Member, Aviations & Facilities, M.E. GROUP, Overland Park, KS

3. Proper Testing and Balancing of UFAD Systems

Donald Hill, P.E., Member, Accutec Service, Inc., Lee's Summit, MO

Seminar 38 (Intermediate)

Case Studies In Engineering Ethics, Part 1

Track: HVAC&R Fundamentals and Applications

Room: 007C

Sponsor: 01.07 Business, Management & General Legal Education

Chair: Michael Connor, P.E., Member, Connor Engineering Solutions, Alpharetta, GA

This is an interactive session where participants will breakup into small groups and discuss an ethics case adjudicated by the NSPE. Test your ethics IQ against an actual case decided by a board of your peers and obtain ethics continuing education credits in the process. Three cases are presented along with the final outcome.

1. Don't Burn the Fire Code!

Michael Bilderbeck, P.E., Member, Pickering, Inc., Memphis, TN

2. Trespassing On Intellectual Property

Warren Hahn, P.E., Member, Hahn Engineering, Tampa, FL

3. Rush to Judgment

Michael Connor, P.E., Member, Connor Engineering Solutions, Alpharetta, GA

Seminar 39 (Intermediate)

Indoor Moisture and Health: The Ins and Outs of the Wet and Dry, Part 1

Track: Indoor Environmental Applications

Room: 001A

Sponsor: Environmental Health Committee

Chair: Andrew Persily, Ph.D., Fellow ASHRAE, NIST, Gaithersburg, MD

Among the many indoor air quality issues faced by building designers, engineers and occupants, indoor moisture is one of the most important. While not a contaminant itself, excessive moisture levels increase the likelihood for microbial growth and the resulting health affects of allergy, asthma and other respiratory impacts. In addition, relative humidity is a key factor in determining occupant comfort, and there are significant questions as to the impacts of dry air on both health and comfort. This two part seminar will present the latest research findings on health effects associated with indoor moisture and provide practical perspective on how to better manage indoor moisture through design, operation and maintenance.

1. Indoor Moisture and Viruses: Will Damp Air Give You a Cold or Not?

Yuguo Li, Ph.D., Fellow ASHRAE, Hong Kong University, Hong Kong, China

2. Is There a Connection Between House Dust Mites and the Sensation of Dryness?

Jan Sundell, M.D., Fellow ASHRAE, Tsinghua University, Beijing, China

3. Indoor Moisture In ASHRAE Standards: What's a Designer to Do!

Andrew Persily, Ph.D., Fellow ASHRAE, NIST, Gaithersburg, MD

Seminar 40 (Intermediate)

Market Transformation of DCV Systems for Kitchen Ventilation

Track: Integrated Energy Systems

Room: 007A

Sponsor: 05.10 Kitchen Ventilation

Chair: Derek W. Schrock, Member, Halton Co., Scottsville, KY

Commercial kitchens have the largest energy intensity (usage per square foot) and can exceed any other building segment by an order of magnitude. Of the largest components of the energy use in a kitchen is the HVAC component which consists of the large exhaust hoods along with the energy required to treat the replacement air. By applying demand control ventilation (DCV) systems on the cooking equipment lineup with the exhaust hoods, large energy savings can be obtained. This seminar presents an overview of DCV systems, a case study of energy savings that can be obtained with DCV systems, a description of a field protocol for evaluating the performance of DCV systems, and field challenges that these systems encounter.

1. DCV Technologies for Commercial Kitchens: Past, Present and Future!

Don Fisher, Food Service Technology Center, San Ramon, CA

2. A Field Test Method to Determine the Performance of DCV Systems

Richard T. Swierczynna, Associate Member, Food Service Technology Center, San Ramon, CA

3. M & V for Kitchen Ventilation DCV Controls

Vernon A Smith, P.E., J.D., Associate Member, Smith Energy Engineers, Niwot, CO

4. Field Challenges with DCV Systems

Andrey Livchak, Ph.D.¹ and Derek W. Schrock, Member², (1)Halton Group Americas, Bowling Green, KY, (2)Halton Co., Scottsville, KY

Seminar 41 (Intermediate)

New Research In Ground Source Heat Pumps

Track: HVAC&R Systems & Equipment

Room: 007D

Sponsor: 08.04 Air-to-Refrigerant Heat Transfer Equipment, Publishing & Education Council

Chair: Reinhard Radermacher, Ph.D., Fellow ASHRAE, University of Maryland, College Park, MD

This session features two recently published papers on advances in heat transfer research, in ASHRAE's HVAC&R Research Journal. Ground coupled heat pumps are gaining considerable attention. To shed additional light on the challenges, opportunities and latest research for such systems, HVAC&R Research prepared a topical issue on these systems under the guidance of guest editors Jeff Spitler and Michel Bernier.

1. Multipole Method to Calculate Borehole Resistances In Borehole Heat Exchangers

Johan Claesson, Ph.D., Member¹ and Göran Hellström, Ph.D., Member², (1)Chalmers University of Technology, Gothenburg, Sweden, (2)Lund University, Lund, Sweden

2. New Analytical Solution for Sizing Vertical Borehole Ground Heat Exchangers In Environments with Significant Groundwater Flow: Parameter Estimation from Thermal Response Test Data

Andrew Chiasson, Ph.D., P.E., Member, University of Dayton, Dayton, OH

3. A Semi-Analytical Model for Serpentine Horizontal Ground Heat Exchangers

Mikael Philippe, Ph.D., Member¹, Michel Bernier, Ph.D., Fellow ASHRAE², Dominique Marchio, Ph.D.³ and Simon Lopez, Ph.D., Member¹, (1)Bureau des Recherches Géologiques et Minières, Département Géothermie, Orléans, France, (2)Ecole Polytechnique De Montreal, Monreal, QC, Canada, (3)Mines ParisTech, Centre Energétique et Procédés, Paris, France

Seminar 42 (Intermediate)

Sustainable Chiller Plant Efficiency: GPC 22 In Application

Track: HVAC&R Systems & Equipment

Room: 001B

Sponsor: 08.02 Centrifugal Machines, 09.01 Large Building Air-Conditioning Systems

Chair: Ray Good, P.E., Associate Member, McQuay International, Staunton, VA

Monitoring the performance of chilled-water plants is of growing importance in these times of rising energy costs and increased environmental awareness. This session explores the role that ASHRAE Guideline 22-2008 can play in guiding the designer and end user to obtain better performance data for the purpose of monitoring the efficiency of chilled-water plants. First an overview of Guideline 22 is given with recommendations for its proper interpretation and application. Specific experiences and recommendations are shared from the perspectives of both a consultant and end user who have applied Guidelines 22 in real world situations.

1. Overview of Guideline 22

Mick Schwedler, P.E., Member, Trane, La Crosse, WI

2. Use and Specification of Guideline 22: A Consulting Engineer's Perspective

Stephen W. Duda, P.E., Member, Ross & Baruzzini, Inc., St. Louis, MO

3. Experiences Utilizing Guideline 22: A Facility Director's Perspective

John I. Vucci, Member, University of Maryland, College Park, MD



Seminar 43 (Intermediate)

Standard 62.1: Multiple-Zone Systems, Demand Control and Energy

Track: Indoor Environmental Applications

Room: 103A

Sponsor: 04.03 Ventilation Requirements and Infiltration

Chair: John J. Carter, Member, CPP, Inc., Fort Collins, CO

Standard 62.1-2010 has added additional requirements to the design of demand controlled ventilation. This seminar provides an update on the validity of the multiple-zone systems calculations, presents several different schemes for implementing demand control ventilation in these systems, and provides analysis of the potential for reducing energy consumption.

1. Experimental Validation of the Multiple Zones Procedure of ANSI/ASHRAE Standard 62.1

Grenville K. Yuill, Ph.D., Fellow Life Member, Retired – University of Nebraska – Lincoln, Placitas, NM

2. CO₂-Based Demand Controlled Ventilation for Multiple Zone HVAC Systems

Josephine Lau, Ph.D., Associate Member, University of Nebraska – Lincoln, Omaha, NE

3. Standard 62.1: One Dynamic Reset Approach

Dennis Stanke, Member, Trane, La Crosse, WI



9:45 AM-10:45 AM

Conference Paper Session 9 (Basic)

Energy Modeling Basics

Track: Building Modeling Applications

Room: 103A

Chair: Yunho Hwang, Ph.D., Member, University of Maryland, College Park, MD

1. Energy Modeling Basics: A Brave New World for Young Building Modeling Professionals (SA-12-C022)

Jared A. Higgins, P.E., Member, Parkhill, Smith, & Cooper, Inc., Lubbock, TX

2. DOE Commercial Building Asset Rating: An Application of Centralized Modeling Tools (SA-12-C023)

Na Wang, Ph.D.¹, Viraj Srivastava, Ph.D., Member¹, Willy Gorrissen¹ and Cody Taylor², (1)Pacific Northwest National Laboratory, Richland, WA, (2)Department of Energy, Washington, DC

3. Calibration of a Building Energy Model Considering Parametric Uncertainty (SA-12-C024)

Zheng O'Neill, Ph.D., P.E., Member¹, Bryan Eisenhower, Ph.D., Member², Vladimir Fonoberov, Ph.D.³ and Trevor E. Bailey, Ph.D.¹, (1)United Technologies Research Center, East Hartford, CT, (2)UCSB-Center for Energy Efficient Design, Santa Barbara, CA, (3)Aimdyn, Inc., Santa Barbara, CA



Seminar 44 (Intermediate)

Advances in Heat Transfer Research

Track: HVAC&R Systems & Equipment

Room: 007D

Sponsor: 08.04 Air-to-Refrigerant Heat Transfer Equipment, Publishing & Education Council

Chair: Reinhard Radermacher, Ph.D., Fellow ASHRAE, University of Maryland, College Park, MD

This session features three recently published papers on advances in heat transfer research in ASHRAE's HVAC&R Research Journal.

1. Model-Based Robust Temperature Control for VAV Air-Conditioning System

Gongsheng Huang, Ph.D., Member, Hong Kong Polytechnic University, Hong Kong, Hong Kong



2. Experimental Measurement And Numerical Simulation to Determine Characteristics of an Infrared Tube System

Samer Hassan, Ph.D., Member, Schwank Ltd., Ontario, ON, Canada

Seminar 45 (Intermediate)

Case Studies in Engineering Ethics II

Track: HVAC&R Fundamentals and Applications

Room: 007C

Sponsor: 01.07 Business, Management & General Legal Education

Chair: Michael Connor, P.E., Member, Connor Engineering Solutions, Alpharetta, GA

This is an interactive session where participants will breakup into small groups and discuss an ethics case adjudicated by the NSPE. Test your ethics IQ against an actual case decided by a board of your peers and obtain ethics continuing education credits in the process. Three cases are presented along with the final outcome.

1. In Plain Sight

Michael Bilderbeck, P.E., Member, Pickering, Inc., Memphis, TN

2. Thanks for the Help

Warren Hahn, P.E., Member, Hahn Engineering, Tampa, FL

Seminar 46 (Intermediate)

Energy Conservation and Fan Energy Efficiency Grade

Track: HVAC&R Systems & Equipment

Room: 103B

Sponsor: 05.01 Fans, 05.09 Enclosed Vehicular Facilities

Chair: Aresh Raychaudhuri, P.E., Member, US Dept. of Veterans Affairs, Washington, DC

Minimum fan efficiency grade is under consideration in several national standard. This seminar discusses the definition and meaning of fan energy efficiency grade. The impact of the efficiency grade on the fan selection and technologies also is discussed.

1. Fan Efficiency Grade Classification for Fans

Michael Brendel, Ph.D., Member, Lau Industries/Ruskin Company, Dayton, OH

2. Impact of Minimum Fan Efficiency Grade

John Cermak, Ph.D., Member, ACME Engineering & Manufacturing Corp., Tulsa, OK



Seminar 47 (Intermediate)

Indoor Moisture and Health: The Ins and Outs of the Wet and Dry, Part 2

Track: Indoor Environmental Applications

Room: 001A

Sponsor: Environmental Health Committee

Chair: Andrew Persily, Ph.D., Fellow ASHRAE, NIST, Gaithersburg, MD

Among the many indoor air quality issues faced by building designers, engineers and occupants, indoor moisture is one of the most important. While not a contaminant itself, excessive moisture levels increase the likelihood for microbial growth and the resulting health affects of allergy, asthma and other respiratory impacts. In addition, relative humidity is a key factor in determining occupant comfort, and there are significant questions as to the impacts of dry air on both health and comfort. This two part seminar will present the latest research findings on health effects associated with indoor moisture and provide practical perspective on how to better manage indoor moisture through design, operation and maintenance.

1. How Building Operators Avoid Soggy Facilities

Lawrence Schoen, P.E., Fellow ASHRAE, Schoen Engineering Inc., Columbia, MD

2. Humidification Systems As Potential Sources of Indoor Contaminants

Wayne Thomann, Ph.D., Associate Member, Duke University/ Medical Center, Durham, NC

3. ASHRAE's Newly Revised Position Document On Mold: What We Know and Don't Know about Mold In Buildings

Lew Harriman III, Fellow ASHRAE, Mason Grant, Portsmouth, NH



4. Moisture In Residences: From Wet Basements to Leaky Roofs

William B. Rose, Member, University of Illinois, Champaign, IL

Seminar 48 (Intermediate)

Variable Frequency Drive Performance:

What Is It and How Does It Relate to AHRI 1210-2011?

Track: HVAC&R Systems & Equipment

Room: 001B

Sponsor: 01.11 Electric Motors and Motor Control

Chair: Derrick Vigil, Member, Baldor Electric Company, Greenville, SC

Variable frequency drive (VFD) usage is on the rise in HVAC&R systems. Can VFD performance have a significant effect on system performance? How would you know how your VFD performs? This seminar explores how VFD performance can effect system performance and provide an overview of AHRI Standard 1210-2011, Performance Rating of Variable Frequency Drives.

1. VFD Efficiency: Part-Load Variability and Effects On Air-Handling System Energy Consumption

Andrea Krukowski, Brown University/ Lawrence Berkeley National Laboratory, New York, NY

2. AHRI Standard 1210-2011, Performance Rating of Variable Frequency Drives

Rupal Choksi, Associate Member, AHRI, Arlington, VA



11:00 AM-12:30 PM

Technical Paper Session 5 (Advanced)

Innovative Strategies to Improve Equipment Efficiency

Track: HVAC&R Systems & Equipment



Room: 007C

Chair: Jon J. Cohen, H-O-H Water Technology, Inc, Palatine, IL

1. Secondary Control Strategies for Cycling Air Conditioning and Refrigeration Systems (SA-12-016)

Bryan Rasmussen, Ph.D., Member¹ and Swarooph Seshadri², (1)Texas A&M University, College Station, TX, (2)The Mathworks Inc., MA

2. New Correlation Equations for Ammonia Water Vapor-Liquid Equilibrium (VLE) Thermodynamic Properties (SA-12-017)

Syed Said, M. A. El-Shaarawi, Ph.D. and Muhammad Umar Siddiqui, King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia

3. Development of a High Efficiency Home Heating and Humidification Technology (SA-12-018)

Dexin Wang, Ph.D., Ainan Bao, Ph.D. and William Liss, Gas Technology Institute, Des Plaines, IL

4. Selection of Desiccant Equipment at Altitude (RP-1339) (SA-12-019)

Nelson Fumo, Ph.D., Member¹ and Pedro Mago, Ph.D., Member², (1)The University of Texas at Tyler, Tyler, TX, (2)Mississippi State University, Mississippi State, MS

Conference Paper Session 10 (Basic)

Optimizing Energy Modeling Strategies to Improve Energy Usage Forecasting

Track: Building Modeling Applications



Room: 001B

Chair: Michelle Contri, P.E., Member, DLB Associates, Eatontown, NJ

1. Use of Flexible Research Platforms (FRP) for BIM and Energy Modeling Research (SA-12-C025)

Piljae Im and Mahabir Bhandari, Member, Oak Ridge National Laboratory, Oak Ridge, TN

2. Using Measured Utility Data to Verify Energy Models (SA-12-C026)

Jared A. Higgins, P.E., Member, Stephen D. Foster and J. Ryan Bailey, Associate Member, Parkhill, Smith, & Cooper, Inc., Lubbock, TX

3. Investigating the Performance of Two Types of Solar Domestic Water Heating (SDWH) Systems with Drain Water Heat Recovery Through Computer Simulation and Experimental Analysis (SA-12-C027)

Kamyar Tanha, Student Member, Alan Fung and Wey Leong, Ph.D., Ryerson University, Toronto, ON, Canada

4. Decision Making for HVAC&R System Selection for a Typical Office Building in the UK (SA-12-C028)

Mehdi Shahrestani, Student Member, Running Yao, Ph.D., Member and Geoffrey Cook, Ph.D., School of Construction Management and Engineering, University of Reading, Reading, United Kingdom

Seminar 49 (Intermediate)

Net Zero Energy with Large Radiant Surface Heat Exchangers

Track: HVAC&R Systems & Equipment



Room: 103A

Sponsor: 06.05 Radiant Heating and Cooling

Chair: Devin A. Abellon, P.E., Member, Uponor, Phoenix, AZ

Radiant heating and cooling systems, utilizing “low temperature heating and high temperature cooling” allow system components, such as chillers, boilers, heat pumps and renewable sources, to operate within their maximum engineered performance range. This seminar covers design and control strategies for embedded-tube radiant-based HVAC systems for maximum energy efficiency and enhanced thermal human comfort. A case study of an ambitious project in San Francisco, California will illustrate how radiant based systems can be used as part of an energy efficient design solution on a projected LEED Platinum, Net-Zero project.

Forum 5 (Intermediate)

Safety Requirements for Class 2L Refrigerants

Track: Refrigeration Applications

Room: 007A

Sponsor: 03.01 Refrigerants and Secondary Coolants

Chair: Christopher Seeton, Ph.D., Member, Honeywell, Buffalo, NY

In 2010, ASHRAE Standard 34 added an optional subclass 2L to the existing Class 2 flammability classification of refrigerants. Subsequently Standard 34-2010 “addendum h” reclassified several refrigerants from Class 2 to Class 2L, including R-32, R-717, R-143a, & R-1234yf, and “addendum i” designated R-1234ze(E) as Class 2L. This forum discusses the approaches to development of safety requirements for Class 2L refrigerants, to define the safe use and application of HVAC&R equipment using these refrigerants. Standard 15-2010 currently defines safety requirements for Class 1, 2, and 3 refrigerants, pertaining to restrictions on refrigerant use, installation restrictions, design and construction of equipment and systems, and operation & testing. This forum will provide an opportunity for interested parties to discuss the appropriate use of Class 2L refrigerants.

Forum 6 (Intermediate)

Standards As They Relate to Cooling Tower Operations and Design: Too Much, Too Little, Or Just Right?

Track: HVAC&R Systems & Equipment

Room: 007B

Sponsor: 08.06 Cooling Towers and Evaporative Condensers

Chair: Frank Morrison, Member, Baltimore Aircoil Company, Baltimore, MD

ASHRAE Standards (such as Standards 90.1, 189.1, and proposed Standard 191) as well as State and local Standards (such as California’s Title 24) have been used as an effective means to achieve greater energy and water efficiencies. Proposed revisions to some of these Standards seek to push efficiency requirements for many HVAC&R systems and equipment further still. This forum explores whether current Standards and proposed revisions do not do enough to maximize energy/water efficiencies; or do they go so far as to render some equipment non-competitive in the marketplace; or are they, as Goldilocks would say, “just right”?

1. Designing for Net-Zero Energy Usage Using Radiant-Based Heating and Cooling Systems

Peter Simmonds, Ph.D., Fellow Member, IBE Consulting Engineers, Sherman Oaks, CA

2. Simplified Control and Piping Options for Low Temperature Heating with High Temperature Cooling

Robert Bean, Healthy Heating, Calgary, AB, Canada

3. Case Study: Exploratorium Museum San Francisco

Peter H. Rumsey, Member, Rumsey Engineers, Inc, Oakland, CA

Seminar 50 (Advanced)

Design, Performance and Efficiency Impact of Low-GWP Refrigerants on Systems and Components

Track: HVAC&R Systems & Equipment



Room: 007D

Sponsor: 03.01 Refrigerants and Secondary Coolants, TC 8.01 Positive Displacement Compressors, 10.07 Commercial Food and Beverage Cooling Display and Storage

Chair: Georgi S. Kazachki, Ph.D., Fellow ASHRAE, DRS Technologies, Florence, KY

The properties of the Low-GWP refrigerants are in most cases different from the properties of refrigerants to be replaced. These differences have an impact on the design, performance and efficiency of the systems and their components. The purpose of the session is to explain and illustrate the evolution of the design process around the specific properties of the Low-GWP refrigerants that are already in an advanced stage of development.

1. Advances In Low-GWP Refrigerants for Stationary Systems

Brett L. Van Horn, Ph.D., Member, Arkema, King of Prussia, PA

2. Analysis of Low-GWP Refrigerants In Existing Compressor Technologies for Refrigeration Systems

Samuel Yana Motta, P.Eng., Member, Honeywell - Buffalo Research Laboratory, Buffalo, NY

3. Transient Performance Evaluation of Automotive Secondary Loop Systems with Low-GWP Fluids

Yunho Hwang, Ph.D., Member, University of Maryland, College Park, MD

4. Prospective of Low-GWP Refrigerants

J. Steven Brown, Ph.D., Member, The Catholic University of America, Washington, DC

Seminar 51 (Basic)

Existing Building Commissioning Process: Best Practices

Track: HVAC&R Fundamentals and Applications



Room: 103B

Sponsor: 07.09 Building Commissioning

Chair: Mark "Dusty" Wheeler Jr., Member, Honeywell, Washington, DC

This session outlines the activities involved in performing the Existing Building Commissioning Process (EBCxP) by presenting best practices according to ASHRAE Guidelines as well as case studies.

1. Existing Building Commissioning Process (EBCxP): Best Practices

Bill Dean, National Research Council of Canada, Saskatoon, SK, Canada

2. Existing Building Commissioning (EBCx): Case Studies

Holly Townes, P.E., Member, Puget Sound Energy, Bellevue, WA

3. On-Going Commissioning for Existing Buildings: Case Studies

David E. Claridge, Ph.D., P.E., Fellow ASHRAE, Texas A & M University, College Station, TX

Seminar 52 (Basic)

Federal, State and Local Grassroots Engagement: How Helping ASHRAE Helps You

Track: HVAC&R Fundamentals and Applications



Room: 007A

Sponsor: Advocacy Committee

Chair: Mark Wills, ASHRAE, Washington, DC

Federal, state, and local governments propose thousands of ordinances, regulations, and bills each year on building codes and standards; engineering

licensure; sustainable buildings; and many other issues impacting ASHRAE members' work. Consequently, member involvement in the policy process is crucial to achieving the Society's overarching mission and goals. This session addresses the current status of key policy initiatives, and provides members guidance for effectively combining technical expertise with policymaking opportunities to become a more effective advocate for themselves, the Society, chapters, and the profession, thus enabling them to become a more "complete" ASHRAE member.

1. State and Local Energy Codes: Development, Adoption, Implementation and Compliance

Maureen Guttman, Building Codes Assistance Project, Washington, DC

2. Challenges to Engineer Licensure

Richard B. Hayter, Ph.D., P.E., Kansas State University, Manhattan, KS

3. Key ASHRAE Issues and Priorities In Congress and Federal Agencies

Mark R. Ames, ASHRAE, Washington, DC

Seminar 53 (Intermediate)

Green Building Energy Performance Pathways and Evaluation Approaches

Track: Integrated Energy Systems



Room: 001A

Sponsor: 02.08 Building Environmental Impacts and Sustainability, 07.06 Building Energy Performance

Chair: David Ellis, P.E., Member, HDR Architecture Inc., Alexandria, VA

Several government and private sector organizations, including ASHRAE, publish model codes, standards, and guidelines for use in the U.S. as well as other countries. These documents address the design, construction, commissioning, and operation of green buildings and are intended for voluntary as well as mandatory adoption. This seminar will describe different approaches used in model codes and standards to determine and compare the energy and environmental performance of new green buildings as well as existing buildings that are renovated and desire to be considered green. Site energy, energy cost, primary energy, and greenhouse gas emissions calculation options will be discussed. Pathways to implement these methods will also be identified, including mandatory, prescriptive, and performance pathways, as well as an outcome-based pathway. Major distinctions among approaches and pathways will be illustrated, as well as the benefits and challenges of the different options.

1. ASHRAE Standard 189.1 and bEQ Baseline Energy Performance Calculations

Neil P. Leslie, P.E., Member, Gas Technology Institute, Des Plaines, IL

2. 2012 International Green Construction Code Energy Performance Methodology

R. Christopher Mathis, Member, MC² Mathis Consulting Company, Asheville, NC

3. Outcome-Based Energy Compliance Pathway for Green Building Designs

David Conover, Member, Pacific Northwest National Laboratory, Washington, DC

Seminar 54 (Intermediate)

How to Efficiently Serve Low Dewpoint Applications

Track: HVAC&R Fundamentals and Applications



Room: 007B

Sponsor: 08.12 Desiccant Dehumidification Equipment and Components

Chair: Andrew Lowenstein, Ph.D., Member, AIL Research, Inc., Princeton, NJ

The supply of low dewpoint air often is essential to the successful functioning of a building or industrial process. Supplying air at dewpoints below 40 F can be particularly challenging. This seminar will present case studies where desiccant systems successfully served applications that demanded air with dewpoints below 40 F and as low as -55 F. The potential for energy savings will be highlighted.

1. Desiccants for Low Dewpoint In Hospital and Archival Applications

Scott McGinnis, Member, Munters Corporation, Selma, TX

2. Minimize Cooling System Refrigerant Charge Using Liquid Desiccant Dehumidification/Cooling Equipment

Michael Harvey, Kathabar Dehumidification Systems Div. of Niagara Blower Company, Buffalo, NY

3. Keeping Dewpoints Low In Supermarkets - Costs and Savings

Jeffrey Halley, J & J Mechanical, Brea, CA

4. Application of Desiccant Dehumidification to a Foundry

Chris Bogart, BRY Air, Sunbury, OH

5:30 PM–6:30 PM

Forum (Intermediate)

Comparing HVAC Efficiency: Why Ground Source Heat Pump Systems Are Superior

Track: HVAC&R Systems & Equipment

Room: 001B

Sponsor: 06.08 Geothermal Heat Pumps and Energy Recovery Applications

Chair: Keith Swilley, Member, Gulf Power Company, Pensacola, FL

OPEN SESSION: no badge required; no PDHs awarded; presented during the TC's meeting. Make no mistake, when you need space conditioning the most, part load or full load, ground source heat pumps provide the overall best efficiency. Metered and manufacturer data will be shared comparing different types of mechanical equipment to ground source heat pump equipment and their system efficiencies.

Wednesday, June 27

8:00 AM–9:30 AM

Technical Paper Session 6 (Advanced)

Improvements in Building Thermal Performance

Track: HVAC&R Fundamentals and Applications

Room: 007B

Chair: Charles E. Henck, Whitman, Requardt & Associates LLP, Baltimore, MD

1. Thermal Performance and Charge Control Strategy of a Ventilated Concrete Slab (VCS) with Active Cooling Using Outdoor Air (SA-12-020)

Yuxiang Chen, Student Member¹, Andreas Athienitis, Ph.D., P.E., Member² and Khaled Galal, Ph.D., P.E.³, (1)Concordia University, Montreal, ON, Canada, (2)Concordia University, West Montreal, QC, Canada, (3) Concordia University, Montreal, QC, Canada

2. Thermal Performance of Building Envelope Details for Mid- and High-Rise Buildings (1365-RP) (SA-12-021)

Patrick Roppel, P.Eng., Mark Lawton, P.Eng., Member and Neil Norris, Morrison Hershfield, Vancouver, BC, Canada

3. Parametric Investigation of PCM Thermal Properties on Energy Demand and Temperature of Buildings in Toronto (SA-12-022)

M. Ebrahim Poulad, Student Member and Alan Fung, Ryerson University, Toronto, ON, Canada

Technical Paper Session 7 (Advanced)

Modeling Indoor Thermal Performance

Track: Building Modeling Applications

Room: 007C

Chair: Michael Meteyer, P.E., Member, Cogdell Spencer ERDMAN, Madison, WI

1. Field Measurements of Thermal Conditions During Surgical Procedures for the Development of CFD Boundary Conditions (SA-12-023)

John Zhai, Ph.D., Member¹, James S. McNeill, Student Member¹ and Jean Hertzberg, Ph.D.¹, (1)University of Colorado, Boulder, CO

2. Modeling Phase Change Materials with a Building Simulation Code Developed in MATLAB (SA-12-024)

Dahai Zhang, Student Member¹, Alan Fung¹, Fabio Almeida, Ph.D., Student Member¹ and Sridhar Sadasivam, Ph.D.², (1)Ryerson University, Toronto, ON, Canada, (2)Purdue University, West Lafayette, IN

3. Occupancy Simulation in Three Residential Research Houses (SA-12-025)

Philip R. Boudreaux, Anthony C. Gehl and Jeffrey E. Christian, Associate Member, Oak Ridge National Laboratory, Oak Ridge, TN

Conference Paper Session 11 (Intermediate)

Optimizing HVAC System Performance

Track: HVAC&R Systems & Equipment



Room: 007A

Chair: Henry A. Becker, Member, H-O-H Water Technology, Inc, Palatine, IL

1. Laboratory Evaluation of Aftermarket Boiler Control Systems (SA-12-C029)

Patricia F. Rowley¹ and Paul Glanville, P.E., Associate Member¹, (1)Gas Technology Institute, Des Plaines, IL

2. Using Steady State Predictions to Improve the Transient Response of a Water to Air Heat Exchanger (SA-12-C030)

David A. Hodgson, Ph.D., Member¹, Peter M. Young, Ph.D.², Charles W. Anderson, Ph.D.², Douglas C. Hittle, Ph.D.², William S. Duff, Ph.D.² and Daniel B. Olsen, Ph.D.², (1)Union College, Schenectady, NY, (2)Colorado State University, Fort Collins, CO

3. A High-Efficiency, Reduced-Emissions Combustion Control System for Commercial and Industrial Boilers (SA-12-C031)

Guido Poncia, Ph.D.¹, Christoph Haugstetter¹, David Liscinsky¹, Junqiang Fan, Ph.D.¹, Joseph Mantese, Ph.D.¹, Meredith Colket, Ph.D.¹, Heidi Hollick¹, Ricardo Garvey¹, Kenneth Swanson², Mike McCarron², Alan Bukofske², Duffly Parlett² and Mauro Atalla, Ph.D.¹, (1)United Technologies Research Center, East Hartford, CT, (2)Fireye Inc., Derry, NH

4. Hybrid Solar Thermal and Ground Source Heat Pump System (SA-12-C032)

Farzin Rad, P.Eng., Member, Alan S. Fung, Dr.Eng., P.Eng., Member and Wey H. Leong, Dr.Eng., P.Eng., Member, Ryerson University, Toronto, ON, Canada

Seminar 55 (Intermediate)

bEQ In Operation Rating: An Overview

Track: Integrated Energy Systems



Room: 001A

Sponsor: bEQ Committee

Chair: Amy Musser, Ph.D., P.E., Member, Vandemusser Design, PLLC, Asheville, NC

This seminar provides an overview of the bEQ In Operation building rating overview, describing what is involved in the rating and the how the rating is conducted. Also, it addresses the BEAP certification and energy auditing, which will cover the basics of getting certified, explaining why and how an auditor would become a certified BEAP. Ways to use certification to enhance your consulting business and market your company's services will be discussed. Finally, a review of an applied Building Energy Assessment answers questions, such as what is required for building energy assessment and how is it applied in the field and why does assessment go beyond energy and look at other aspects of the building?

1. bEQ In Operation Rating

Thomas H. Phoenix, SPC, Greensboro, NC

2. BEAP Certification and Energy Auditing

John Dunlap, Dunlap and Partners, Richmond, VA

3. Applied Building Energy Assessment

Hoy R. Bohanon, P.E., Member, Working Buildings, Winston-Salem, NC

Wednesday, June 27 45

Seminar 56 (Intermediate)

How Air Filter Selection Affects Energy Consumption

Track: *Indoor Environmental Applications*

Room: 007D



Sponsor: 02.04 Particulate Air Contaminants and Particulate Contaminant Removal Equipment

Chair: Philip Winters, P.E., Member, Filtration Group, Joliet, IL

Approximately half of all energy consumed in commercial and residential buildings is used for the HVAC systems and a significant contributor to that energy consumption is the fan power required to move air throughout the building. Air filters create resistance to that air flow and as a result, contribute to the energy consumption. However, air filters play a critical role in keeping the HVAC system clean and contribute to good IAQ within the occupied spaces. This seminar combines the lessons from recent ASHRAE-funded research with other emerging research to help building owners and operators understand the role that air filter pressure drop plays in building energy consumption.

1. Energy Implications of Residential HVAC Filters

Jeffrey Siegel, Ph.D., Member, University of Texas, Austin, TX

2. Filter Pressure Drop Matters: Results of Field Reductions in Static Pressure on Air Conditioner Performance

John Proctor, P.E., Proctor Engineering, San Rafael, CA

3. Selecting Air Filters with Lowest Life Cycle Cost Using Field Measurements of Air Filter Performance and Fan Energy Measurements

Donald D. Thornburg, Member, Camfil-Farr, Riverdale, NJ

Seminar 57 (Basic)

Methods and Tools to Support the Modeling Process

Track: *Building Modeling Applications*

Room: 103B



Sponsor: 04.07 Energy Calculations

Chair: Amir Roth, United States Department of Energy, Washington, D.C.

Today's burgeoning market for building energy modeling services presents great opportunities and challenges for practitioners. Challenges exist due to the expansive knowledge required to deliver services, the lack of standardized methods and the absence of building energy modeling (BEM) tools that support the modeling process. This session reviews key BEM tasks and identifies those that would benefit from being automated in software tools. The session provides examples of practical user-developed BEM tools that support delivering and streamlining services. It introduces efforts to develop modular, standardized whole-building simulation components, automated workflow procedures and an open source energy modeling platform.

1. Supporting the Modeling Process

Ellen Franconi, Rocky Mountain Institute, Boulder, CO

2. Supporting BEM: The Practitioner Perspective

Kate Turpin, P.E., Member, SERA Architects, Portland, OR

3. Supporting BEM: The "Technicians" Perspective

Jesse Dean, National Renewable Energy Laboratory, Golden, CO

Seminar 58 (Intermediate)

Mold, Moisture, and Damp Buildings: New Understanding and Guidelines for Reducing the Health Effects

Track: *Indoor Environmental Applications*

Room: 103A



Sponsor: 01.12 Moisture Management in Buildings, TC 8.10, TC 8.12, and SSPC 62.1

Chair: Steve Cornick, Member, National Research Council Canada, Ottawa, ON, Canada

For years, damp buildings were thought to generate negative health effects. Until recently, the magnitude of health effects has not been quantified. The mechanisms which lead to negative effects were not understood. Research advances have provided a clearer path towards understanding what levels of dampness are problematic, what the specific links are between asthma and dampness, and what strategies are effective in reducing moisture accumulation. The presentations describe results of research as well as new guidance for

architects, mechanical system designers and owners. The information is also of interest to occupants of buildings which are perceived to be damp.

1. The Revised ASHRAE Position Document On Indoor Mold and Moisture Management

Lew Harriman III, Fellow ASHRAE, Mason Grant, Portsmouth, NH

2. Observations and Recommendations Based On NIOSH Investigations of Damp Buildings and Their Health Effects

Jean Cox-Ganser, Ph.D. and Kay Kreiss, M.D., CDC-NIOSH, Morgantown, WV

3. New U.S. EPA Guidelines for Moisture Management In Buildings

Terry Brennan, Camroden Associate, Westmoreland, NY

Seminar 59 (Intermediate)

The Effect of the Outdoor Environment on Indoor Environment Modeling

Track: *Indoor Environmental Applications*

Room: 001B



Sponsor: 04.10 Indoor Environmental Modeling

Chair: James VanGilder, P.E., Member, APC by Schneider Electric, Billerica, MA

While it is common practice to represent the effects of the outside world simplistically when performing an indoor environment analysis, this approach may not always yield realistic predictions. This seminar considers the coupled nature of the indoor and outdoor environments with examples including indoor CO exposure rates from outside generators. Concepts discussed here are directly applicable to the design of high-performance, energy-efficient buildings which utilize natural ventilation.

1. How to Define Flow Boundary Conditions for Natural Ventilation Through Large Openings by CFD

Qingyan Chen, Ph.D., Purdue University, West Lafayette, IN

2. Wind Driven Natural Ventilation When There Are No Windward Openings

David Banks, Ph.D., Member, CPP Wind Engineering and Air Quality Consultants, Ft. Collins, CO

3. Impact of Indoor Buoyancy On Outdoor Wind Driven Natural Ventilation

Atila Novoselac, Ph.D., Associate, University of Texas at Austin, Austin, TX

4. Modeling the Effects of Outdoor Gasoline Powered Generator Use On Indoor Carbon Monoxide Exposures

Liangzhu (Leon) Wang¹ and Steven Emmerich, Member², (1)Concordia University, Montreal, QC, Canada, (2)National Institute of Standards and Technology, Gaithersburg, MD

9:45 AM-10:45 AM

Technical Paper Session 8 (Advanced)

Study the Degradation of Typical HVAC Materials, Filters and Components Irradiated by UVC Energy

Track: *HVAC&R Systems & Equipment*



Room: 007A

Chair: Richard L. Vincent, Member, Mount Sinai School of Medicine, New York, NY

1. Study the Degradation of Typical HVAC Materials, Filters, and Components Irradiated by UVC Energy. Part I. Literature Search (1509-RP) (SA-12-026)

Robert E. Kauffman, Ph.D., University of Dayton Research Institute, Dayton, OH

2. Study the Degradation of Typical HVAC Materials, Filters, and Components Irradiated by UVC Energy. Part II. Polymers (1509-RP) (SA-12-027)

Robert E. Kauffman, Ph.D. and J. Douglas Wolf, University of Dayton Research Institute, Dayton, OH

Technical Paper Session 9 (Advanced)

Design Applications for High Performing Buildings

Track: *Integrated Energy Systems*

Room: 001A

Chair: Mike McDermott, Member, Grumman Butkus Associates, Evanston, IL



1. Design of Roofs for Increased Solar Potential of BIPV/T Systems and their Applications to Housing Units (SA-12-028)

Caroline Hachem, Ph.D., Student Member, Andreas Athienitis, Ph.D., P.E., Member and Paul Fazio, Ph.D., P.Eng., Member, Concordia University, West Montreal, QC, Canada

2. Achieving Net-Zero Energy Conditions in Retrofit: A Case Study for a Performance Arts Building Using an Hourly Simulation Approach (SA-12-029)

Dr. Cenk Cy Yavuzturk, Ph.D., SBA Member¹, J.E. Fuller² and Dennis J. O'Connor, Student Member³, (1)Mechanical Engineering Dept, University of Hartford, West Hartford, CT, (2)University of Hartford, West Hartford, CT, (3)University of Hartford, Hartford, CT

Technical Paper Session 10 (Intermediate)

Commission and Calibration of HVAC Systems to Improve Efficiency

Track: *HVAC&R Fundamentals and Applications*

Room: 001B

Chair: Charles E. Henck, Whitman, Requardt & Associates LLP, Baltimore, MD



This session will present a case study of energy saving opportunities implemented in an existing building and then commissioning the systems to perform at their optimal levels. A savings for over \$500,000 was realized with the improvements which is a 15% electrical reduction and a 7% gas reduction. The second paper will present a methodology to calibrate the multi-zone model CONTAM to two buildings. An air flow sensitivity analysis identifies influential systems and a tracer gas analysis identifies macro zones which are used to tune the model parameters.

1. HVAC Systems Commissioning in a Manufacturing Plant (SA-12-030)

Yunhua Li, Student Member¹, Bei Zhang, Student Member¹, Mingsheng Liu, Ph.D., P.E., Member², Lixia Wu, Ph.D., Member³, Jinrong Wang, Member⁴ and Tom Lewis, Member⁴, (1)University of Nebraska-Lincoln, Lincoln, NE, (2)DTL Controls, LLC, Omaha, NE, (3)Bes-Tech, Inc., Philadelphia, PA, (4)Omaha Public Power District, Omaha, NE

2. Investigation of CO2 Tracer Gas-Based Calibration of Multi-Zone Airflow Models (SA-12-031)

T. Agami Reddy, Ph.D., P.E., Fellow ASHRAE¹, Steven Synder, Associate Member² and William P. Bahnfleth, Ph.D., P.E., Fellow ASHRAE³, (1)The Design School/ The School of Sustainability, Tempe, AZ, (2)Johnson Controls Inc., Philadelphia, PA, (3)Pennsylvania State University, University Park, PA

Seminar 60 (Intermediate)

Datacom Space Technology Advances; From Containment Fire Protection to Oil Immersion Cooling

Track: *HVAC&R Fundamentals and Applications*

Room: 103A

Sponsor: 09.09 Mission Critical Facilities, Technology Spaces and Electronic Equipment

Chair: Michael K. Patterson, Ph.D., P.E., Member, Intel Corp., Dupont, WA



IT equipment and facilities are in a constant state of technology advancement; from airflow management to alternative cooling, such as oil immersion cooling. This seminar covers specific topics supporting these advances. Airflow containment is now commonly used in the datacom space to improve airflow management, helping drive energy efficiency improvements. One of the main challenges in containment implementation is fire protection design. This is covered in the first presentation. In the second, a side-by-side evaluation of air and oil immersion cooling is presented. Energy and thermal performance is shared from identical racks of IT equipment across a range of workloads.

1. Datacom Aisle Containment Systems and Associated Fire Protection Requirements

David Quirk, P.E., Member, Verizon Wireless, Basking Ridge, NJ

2. Oil Immersion Cooling and Reductions In Data Center Energy Use
Michael K. Patterson, Ph.D., P.E., Member¹ and Christiaan Best², (1)Intel Corp., Dupont, WA, (2)Green Revolution Cooling, Austin, TX

Seminar 61 (Intermediate)

Next Generation of Heat Exchangers and Energy Systems with Sustainability in Mind

Track: *HVAC&R Systems & Equipment*

Room: 103B

Sponsor: 01.03 Heat Transfer and Fluid Flow,

08.05 Liquid-to-Refrigerant Heat Exchangers

Chair: Amir Jokar, Ph.D., P.E., Member, Exponent Inc. Thermal Sciences Practice, Los Angeles, CA



Design, optimization and maintenance of micro/mini-channel compact heat exchangers are critical in energy efficiency of HVAC&R systems. This seminar discusses new technologies for heat exchangers that aim to significantly improve energy efficiencies while preserving economic and environmental sustainability of the systems. These topics are critical to current and future ASHRAE research, as indicated in the ASHRAE 2010-2015 strategic plans. TC 1.3 and TC 8.5 have sponsored and monitored several ASHRAE funded research projects related to the topics presented in this seminar for the last five years. The seminar assists engineers, practitioners, and operators in the design and operation of this type of equipment.

1. Energy Efficiency and Heat Exchanger Compaction with the Next Generation Micro Channel Heat Exchangers

Michael M. Ohadi, Ph.D., Fellow ASHRAE, University of Maryland, College Park, MD

2. Ammonia/Carbon Dioxide Cascade Condensers Using Plate Exchangers

Zahid Ayub, Ph.D., P.E., Fellow ASHRAE, Isotherm, Inc., Arlington, TX

Seminar 62 (Intermediate)

Smart Grid in Texas, What's Happening?

Track: *Integrated Energy Systems*

Room: 007D

Sponsor: 07.05 Smart Building Systems

Chair: Joshua D. Rhodes, Student Member, The University of Texas at Austin, Austin, TX



The current energy grid is antiquated and is losing the ability to meet the demand required of it. To meet rapidly growing demand, the current grid is being modernized not only with the capacity to move more resources, but to do so in a smarter way. This Grid 2.0, or Smart Grid is evolving to not only move more energy and water, but to move information as well. This track discusses the development and build-out of smart grid infrastructure in Texas.

1. Making the "Smart Grid" a "Green Grid"

Colin Meehan, Environmental Defense Fund, Austin, TX

2. The Pecan Street Smart Grid Demonstration Project

Chris Holcomb, Pecan Street, Austin, TX

Forum 7 (Intermediate)

Accurately and Correctly Modeling Air-to-Air Energy Recovery Technologies

Track: *Building Modeling Applications*

Room: 007C

Sponsor: 05.05 Air-to-Air Energy Recovery

Chair: Carol E. Marriott, P.Eng., Member, Carol Marriott Consulting, Maple Grove, MN

To help determine and isolate issues in correctly modeling AAERV systems in the most popular modeling programs used by architects and engineers. How is the technology properly quantified with respect to performance? Are controls sequences properly identified when estimating savings in buildings? Should an algorithm be developed to support these initiatives? Is there/are there metrics that can be used with existing programs? The results of this forum will fuel future Research and Program initiatives by TC 5.5.

Forum 8 (Intermediate)

If Hydronic HVAC Systems Are So Great, Why Doesn't Everyone Have One?

Track: HVAC&R Systems & Equipment

Room: 007B

Sponsor: 06.01 Hydronic and Steam Equipment and Systems, 06.05 Radiant Heating and Cooling

Chair: Paul A. Torcellini, Ph.D., Member, National Renewable Energy Laboratory, Golden, CO

Radiant heating/cooling and hydronic systems have been identified as underutilized technologies and a low-energy HVAC system that can reach a 50% net site energy savings goal. So, if radiant heating and cooling systems are so great, why are they not "front of mind" for new construction and retrofits? Is it the costs? Is it a lack of understanding of designs? Is it lack of knowledge in proper installation and commissioning? Come prepared to discuss the barriers and your methods to overcome them as we strive for low energy buildings to help create research and implementation agendas for this technology.

11:00 AM-12:30 PM

Conference Paper Session 12 (Intermediate)

Low Energy Design and Integrated Energy Systems

Track: Integrated Energy Systems

Room: 001B

Sponsor: 01.10 Cogeneration Systems, 07.01 Integrated Building Design
Chair: Dharam V. Punwani, Avalon Consulting, Naperville, IL

This conference paper session explores low energy design with integrated energy systems including collection of condensate water, combined heat/power systems, tri-generation systems and commissioning and energy management.

1. Zero Refrigeration in the USA (SA-12-C033)

Robert Tozer, Ph.D., Member, Operational Intelligence Ltd, Kingston upon Thames, United Kingdom

2. The Challenge of Low Energy Design in Low Energy Cost States (SA-12-C034)

Stephen W. Duda, P.E., Member, Ross & Baruzzini, Inc., St. Louis, MO

3. Targeting a Net-Zero Energy Student Center: Part 1 – Thermal and Electrical Load Minimization (SA-12-C035)

Trevor Caldwell, Kelton Friedrich, Brad Gregus, Ryan Verschuere, Jordan Anderson, Aaron Murenbeeld, Kaveh Arfaei, Mahsa Boroum and James S. Cotton, Ph.D., P.E., Member, McMaster University, Hamilton, ON, Canada

4. Targeting a Net-Zero Energy Student Center: Part 2 – Systems to Meet Building Loads (SA-12-C036)

Kelton Friedrich, Trevor Caldwell, Brad Gregus, Ryan Verschuere, Jordan Anderson, Aaron Murenbeeld, Kaveh Arfaei, Mahsa Boroum and James S. Cotton, Ph.D., P.E., Member, McMaster University, Hamilton, ON, Canada

Conference Paper Session 13 (Intermediate)

Contamination and Environment Control Applications

Track: Indoor Environmental Applications

Room: 007A

Chair: Jeff J. Traylor, P.E., Member, EMCOR Facilities Services, Durham, NC

Increasingly, we are looking to advanced technologies and automated control systems and strategies to provide an acceptable indoor environment in a cost effective manner. This session features several papers that explore our indoor environment and how we can maintain improved control over its quality and acceptability for occupants.

1. Contaminant Removal Effectiveness of Displacement Ventilation Systems During Heating Season; Summary Results from Three Field Studies (SA-12-C037)

Boualem Ouazia, Ph.D., Member¹, Iain Macdonald, Ph.D.² and Michel Tardif, P.Eng., Member³, (1)The Institute for Research in Construction (IRC) / National Research Council Canada (NRC), Ottawa, ON, Canada, (2)National Research Council Canada, Montreal, QC, Canada, (3)CanmetENERGY Natural Resources Canada, Ottawa, ON, Canada

2. A Robust CO₂-Based Demand-Controlled Ventilation Control Strategy for Multi-Zone HVAC Systems (SA-12-C038)

Nabil Nassif, Ph.D., P.E., Associate Member, North Carolina A&T State University, Greensboro, NC

3. Model-Predictive Controls for Efficient Mixed-Mode Cooling of Buildings (SA-12-C039)

Jianjun Hu, Student Member and Panagiota Karava, Ph.D., Associate Member, Purdue University, West Lafayette, IN

4. Contaminants in Hotel Room Exhaust Air (SA-12-C040)

W. Brad M. Stanley and Bryan K. Ligman, AAF International, Doraville, GA

Conference Paper Session 14 (Basic)

Energy Efficiency Strategies

Track: HVAC&R Fundamentals and Applications



Room: 007B

Chair: Michael Deru, Ph.D., Member, National Renewable Energy Laboratory, Golden, CO

1. Evaluation of Thermal Comfort in Low Load Homes Supplied by High Sidewall Air Jets (SA-12-C041)

El Hassan Ridouane, Ph.D., Member, National Renewable Energy Laboratory, Golden, CO

2. Experimental Study on Ceiling Radiant Cooling Panel System with Personal Floor Diffuser (SA-12-C042)

Sei Ito¹, Minoru Kawashima, Ph.D., Member¹, Yoshito Arai¹, Michiya Suzuki, Ph.D.¹, Koji Murakami¹ and Tatsuo Nobe, Ph.D., Member², (1) Shimizu Corporation, Tokyo, Japan, (2)Kogakuin University, Tokyo, Japan

3. Determining the Cost-Effectiveness of Various Energy Sub-Metering Strategies (SA-12-C043)

Christine Maurer, P.E., Member¹, Peter Rojas, Ph.D., P.E., Life Member² and Matt Davey¹, (1)Advanced Energy, Raleigh, NC, (2)M and V Services, Pleasant Garden, NC

Seminar 63 (Intermediate)

Designing Heat Recovery Heat Pumps to Meet Today's Requirements for High Performance Buildings

Track: Integrated Energy Systems



Room: 103B

Sponsor: 06.08 Geothermal Heat Pumps and Energy Recovery Applications

Chair: Cary Smith, Associate Member, Energy Center of Wisconsin, Madison, WI

Heat pumps and chillers are increasingly an effective option for producing useful heating in addition to their normal cooling production. Dedicated heat recovery, geothermal applications, and heat recovery chiller systems are some different configurations that include this technology. But there are many ways to configure and control a heat recovery chiller or heat pump; this seminar discusses some of the more effective approaches.

1. From Hockey Rink to Ground Loop

Ed Lorenz, Member, Geo-Xergy Systems, Inc., Winnipeg, MB, Canada

2. Using Multiple Chillers In a Cascading Operation with a Geothermal Loop

Mike Filler, Member, Trane Company, Pueblo, CO

3. Using Heat Recovery Heat Pumps to Recover Heat from a Chiller to Heat Service Water

Frank Pucciano, Member, Sabot 6, Atlanta, GA

Seminar 64 (Intermediate)

How Smoke Control Systems Contribute to Sustainability Goals

Track: HVAC&R Fundamentals and Applications



Room: 007C

Sponsor: 05.06 Control of Fire and Smoke

Chair: Paul Turnbull, Member, Siemens Building Technologies, Inc., Buffalo Grove, IL

Smoke control systems require coordinated integration between the building's fire alarm system and its mechanical equipment controls to provide the

intended life safety functions. Some building owners view smoke control systems as an unavoidable cost. This seminar explains how smoke control systems can support a building owner's sustainability goals. Presentations describe how different choices can lead to more sustainable smoke control system designs, and how operation of a smoke control system minimizes the environmental impact during a fire emergency. Case studies are presented showing how smoke control systems helped achieve LEED innovation credits and LEED energy usage credits.

1. How Smoke Control Contributes to Sustainability

William A. Webb, P.E., Fellow ASHRAE, WEBB FIRE Protection Consulting, LLC, Brooksville, FL

2. An Overview of Sustainability and Smoke Control

John H. Klote, Ph.D., P.E., Fellow ASHRAE, Fire and Smoke Consulting, Leesburg, VA

3. Case Studies: Using Fire Engineering to Achieve Sustainable Designs

Jeffrey Tubbs, P.E., Member, Arup, Cambridge, MA

Seminar 65 (Intermediate)

Impacts of Environmental Change on Building Design and Their HVAC Systems

Track: HVAC&R Fundamentals and Applications



Room: 103A

Sponsor: 04.02 Climatic Information, 02.05 Global Climate Change

Chair: Steve Cornick, Member, National Research Council Canada, Ottawa, ON, Canada

The environment is changing. The consensus is that the climate is getting warmer. How are engineers and architects going to design buildings to cope with a changing environment? Global Climate and Regional Climate models can make predictions of future climate while Canyon Air Temperature models are capable of predicting temperatures in a street canyon for extended periods. This seminar will show how a changing environment can be accounted for in the design of buildings either by making provisions in advance through design or mitigating the impact after the fact.

1. Can I Predict the Future? Generating Future Climatic Data

Drury Crawley, Ph.D., Member, Bentley Systems, Inc, Washington, DC

2. Climate Change and Its Effect On Design Load Calculations

Charles S. Barnaby, Member, Wrightsoft Corporation, Lexington, MA

3. Climate Change Adaptation – Will There Be Any Consequences for the Built Environment?

Kelly Kalvelage, Iowa State University, Ames, IA

4. Accounting for Urban Microclimate In Computer Simulation of Building Energy Performance

Evyatar Erell, Ph.D., Member, Ben Gurion University of the Negev, Beer-Sheva, Israel

Seminar 66 (Intermediate)

Refrigerated Warehouse Efficiency Regulations for CA and Beyond

Track: Refrigeration Applications



Room: 007D

Sponsor: 10.05 Refrigerated Distribution and Storage Facilities

Chair: Daniel J. Dettmers, Member, Industrial Refrigeration Consortium-U.W. Madison, Madison, WI

Large commercial and industrial refrigeration systems found in supermarkets and refrigerated warehouses are coming under the umbrella of energy efficiency regulation. The process started and continues to evolve in California through their Title 24 Energy Efficiency Standard. Similar measures are being explored and adapted at the national level. Even ASHRAE's Standard 90.1 is exploring what steps can be taken in these areas. This seminar is designed to update the audience on the current advances in energy efficiency regulation for the supermarket and refrigerated warehouse industries so they can make informed commentary to the ASHRAE 90.1 committee.

1. 2013 California Title 24 Building Energy Efficiency Standards for Supermarkets

Brian Dobbs, Associate Member, VaCom Technologies, San Luis Obispo, CA

2. 2013 California Title 24 Building Energy Efficiency Standards for Refrigerated Warehouses

Brian Dobbs, Associate Member, VaCom Technologies, San Luis Obispo, CA

3. ASHRAE Standard 90.1 and Commercial Refrigeration

James P. McClendon, P.E., Member, Walmart Stores Inc., Bentonville, AR

Seminar 67 (Intermediate)

U.S. General Services Administration's New Performance-based Facilities Standards

Track: Integrated Energy Systems



Room: 001A

Sponsor: MTG.BPM Building Performance Metrics

Chair: Martin Weiland, P.E., Member, General Services Administration, Washington, DC

GSA's PBS-P100, "Facilities Standards for the Public Buildings Service", has prescribed better-than-code buildings for decades. Recently, in response to the need to allow designers more flexibility to meet escalating goals, with robust means to verify the results, it was transformed into a performance-based standard. The new standard incorporates four performance tiers, from better-than-code to true high performance. A new process, incorporating a breadth of professionals in technical committees, keeps its development and revision continuous, with quarterly published updates. Issues encountered in the development of the standard, and its implementation in a large organization, will be covered.

1. GSA's New Performance-Based Facilities Standard

Martin Weiland, P.E., Member, General Services Administration, Washington, DC

2. Performance-Based HVAC and Lighting Requirements

Bose Thomas, P.E., Member, US General Services Administration, Washington, DC

notes

SOCIETY COMMITTEE MEETINGS

(Subcommittees are indented)

Most standing committees are scheduled in the Grand Hyatt. Exceptions are noted by CC-number which indicates the location is the Henry B. Gonzalez Convention Center. The convention center is attached to the Hyatt. Numbers in parenthesis is the floor location of the meeting room within the hotel.

ALPHABETICAL LISTING

Advocacy,

Sun., 6/24, 6:30 a.m.–8:30 a.m., Republic C (4)

Codes & Standards,

Sat., 6/23, 1:00 p.m.–2:15 p.m., Bowie B (2)

ASHRAE Foundation,

Mon., 6/25, 8:00 a.m.–10:30 a.m., Crockett A/B (4)

ASHRAE Foundation Excom,

Sat., 6/23, 1:30 p.m.–3:00 p.m., Bowie C (3)

Associate Society Alliance,

Mon., 6/25, 4:15 p.m.–6:00 p.m., Bonham B (3)

bEQ

Sun., 6/24, 8:30 a.m.–11:30 a.m., Lone Star E (2)

Board of Directors,

Sun., 6/24, 1:00 p.m.–5:00 p.m., Texas D/E (4)

Wed., 6/27, 2:00 p.m.–6:00 p.m., Texas B (4)

Certification,

Sat., 6/23, 8:00 a.m.–Noon, Presidio C (3)

Chapter Technology Transfer,

Fri., 6/22, 8:00 a.m.–Noon, Lone Star F (2)

Sat., 6/23, 8:00 a.m.–Noon, Lone Star F (2)

Member Services,

Fri., 1:30 p.m.–5:00 p.m., Bonham D (3)

Operations,

Fri., 1:30 p.m.–5:00 p.m., Travis C (3)

Executive,

Fri., 5:00 p.m.–6:00 p.m., Bonham D (3)

New Member Orientation,

Sat., 12:30 p.m.–2:30 p.m., Lone Star F (2)

CLIMA,

Sat., 6/23, 12:30 p.m.–1:30 p.m., Republic C (4)

College of Fellows Board/Advisory,

Sun., 6/24, 8:00 a.m.–10:00 a.m., Bowie A (2)

College of Fellows

Sun., 6/24, 10:00 a.m.–Noon, Bowie A (2)

Conferences and Expositions Committee,

Sat., 6/23, 8:00 a.m.–Noon, CC-007 A (River Level)

Subcommittees:

Executive,

Fri., 6/22, 1:00 p.m.–3:00 p.m., Bonham B (3)

Training,

Sat., 6/23, 1:00 p.m.–3:00 p.m., CC-101 A/B (Street Level)

Annual and Winter Meeting,

Fri., 6/22, 3:00 p.m.–6:00 p.m., Bonham B (3)

Specialty Conferences,

Tue., 6/26, 1:30 p.m.–3:00 p.m., San Jacinto (2)

CEC/TAC Executive,

Sat., 6/23, 7:00 a.m.–8:00 a.m., Lone Star C (2)

DRC/RVC Orientation,

Fri., 6/22, 3:00 p.m.–6:00 p.m., Crockett A/B (4)

Electronic Communications,

Sat., 6/23, 11:00 a.m.–3:00 p.m., San Jacinto (2)

Environmental Health,

Mon., 6/25, 2:15 p.m.–6:15 p.m., Bowie B (2)

Excom,

Mon., 6/25, 7:00–8:00 a.m., Bowie B (2)

Education/Research,

Mon., 6/25, 8:00 a.m.–10:00 a.m., Bowie B (2)

Handbook/Program,

Mon., 6/25, 10:00 a.m.–Noon, Bowie B (2)

Executive Committee,

Sat., 6/23, 8:30 a.m.–1:00 p.m., Bowie C (2)

Wed., 6/27, 7:30 a.m.–9:00 a.m., Presidio C (3)

Thur., 6/28, 7:30 a.m.–11:00 a.m., Republic C (4)

Finance,

Fri., 6/22, 8:00 a.m.–1:00 p.m., Presidio B (3)

Investment Subcommittee

Thurs., 6/21, 5:00 p.m.–7:00 p.m., Crockett A (4)

Planning Subcommittee

Thurs., 6/21, 5:00 p.m.–7:00 p.m., Crockett B (4)

Handbook,

Sun., 6/24, 10:30 a.m.–1:00 p.m., Lone Star B (2)

Handbook Strategic Planning/Executive

Sat., 6/23, Noon–3:00 p.m., Mission A (2)

Electronic Media,

Sun., 6/24, 8:00 a.m.–9:00 a.m., Independence (3)

Liaison Training,

Sun., 6/24, 8:00 a.m.–9:00 a.m., Lone Star B (2)

Functional,

Sun., 6/24, 8:00 a.m.–9:00 a.m., Mission A (2)

Publicity,

Sun., 6/24, 8:00 a.m.–9:00 a.m., Bonham A (3)

Practical Applications,

Sun., 6/24, 8:00 a.m.–9:00 a.m., Presidio A (3)

Program,

Sun., 6/24, 8:00 a.m.–9:00 a.m., Presidio C (3)

2013 Fundamentals TCs/Volume Subcommittee

Sun., 9:00 a.m.–10:00 a.m., Presidio A (3)

2014 Refrigeration TCs/Volume Subcommittee

Sun., 9:00 a.m.–10:00 a.m., Republic C (4)

2015 HVAC Applications TCs/Volume Subcommittee

Sun., 9:00 a.m.–10:00 a.m., Presidio C (3)

Handbook Volume Subcommittees

Sun., 10:00 a.m.–10:30 a.m., Lone Star B (4)

Historical,

Sun., 6/24, 8:30 a.m.–Noon, Bonham C (3)

Honors & Awards,

Sun., 6/24, 1:30 p.m.–5:00 p.m., Bonham C (3)

Mon., 6/25, 2:15 p.m.–5:30 p.m., Bonham A (3)

Honors & Awards Orientation,

Sun., 6/24, 12:30 p.m.–1:30 p.m., Bonham C (3)

IAQ 2013 Steering Committee

Mon., 6/25, 6:30–8:30 p.m., Bowie B (2)

Life Members Executive Board Meeting,

Tue., 6/26, 9:00–11:00 a.m., Bowie C (2)

Members Council,

Mon., 6/25, 8:00 a.m.–Noon, Lone Star E (2)

Tue., 6/26, 8:00 a.m.–Noon, Lone Star E (2)

Members Council Orientation

Tuesday, 6/26, 2:00 p.m.–4:00 p.m., Lone Star E (2)

Membership Promotion,

Sat., 6/23, 8:00 a.m.–3:00 p.m., Seguin (4)

Subcommittees:

Fri., 6/22, 9:00 a.m.–2:00 p.m., Lone Star D (2)

Nominating,

Sun., 6/24, 8:00–Noon, Texas B (4)

PEAC,

Tue., 6/26, Noon–2:00 p.m., Bowie B (2)

Planning,

Fri., 6/22, 1:00 p.m.–6:00 p.m., Lone Star F (2)

Professional Development,

Mon., 6/25, 8:00 a.m.–Noon, Bonham E (3)

Publications,

Sun., 6/24, 8:00 a.m.–Noon, Bonham D (3)

Planning,

Sat., 6/23, 10:00 a.m.–Noon, Mission A (2)

Publishing and Education Council,

Tue., 6/26, 8:00 a.m.– Noon, Lone Star F (2)

Publishing Council Orientation,

Tue., 6/26, 2:00 p.m.–4:00 p.m., Lone Star F (2)

eLearning,

Sat., 6/23, 1:30 p.m.–3:00 p.m., Republic C (4)

Research Journal Policy Group,

Mon., 6/25, 11:00 a.m.–Noon, Bonham B (3)

Fiscal Planning,

Mon., 6/25, 2:00 p.m.–3:30 p.m., Crockett A/B (4)

Functional Planning,

Mon., 3:30 p.m.–5:00 p.m., Crockett A/B (4)

Refrigeration,

Sun., 6/24, 8:00 a.m.– Noon, Travis A/B (3)

Region-at-Large Planning,

Mon., 6/25, 2:15 p.m.–4:15 p.m., Bonham B (3)

Research Administration,

Sat., 6/23, 8:00 a.m.–3:00 p.m., Lone Star B (2)

Wed., 6/27, 7:00 a.m.– 11:00 a.m., Crockett C/D (4)

Research Subcommittee Chair Workshop,

Mon., 6/25, 6:30 a.m.– 8:00 a.m., Texas D (4)

Research Promotion,

Sat., 6/23, 8:00 a.m.–2:30 p.m., CC-102 A (Street Level)

Research Promotion Executive,

Fri., 6/22, 2:00 p.m.– 6:00 p.m., Republic C (4)

Scholarship Trustees,

Tue., 6/26, 8:00 a.m.–10:00 a.m., Bonham D (3)

Society Rules Committee,

Tue., 6/26, 4:00 p.m.–5:30 p.m., Travis C (3)

Standards,

Sat., 6/23, 8:00 a.m.–Noon, Texas B (4)

Wed., 6/27, 7:30 a.m.–9:30 a.m., Texas B (4)

Executive,

Fri., 6/22, 8:00 a.m. –11:00 a.m., Presidio A (3)

Code Interaction,

Sun., 6/24, 7:00 –10:00 p.m., Bonham B (3)

PPIS,

Fri., 6/22, 2:00 p.m. –5:00 p.m., Presidio A (3)

Tue., 6/26, 11:00 a.m.–1:00 p.m., Presidio A (3)

SRS,

Tue., 6/26, 5:30 p.m.–6:00 p.m., Mission A (2)

TCLS,

Fri., 6/22, 11:00 a.m.–Noon, Presidio A (3)

Tue., 6/26, 5:00 p.m.–5:30 p.m., Mission A (2)

ILS/ISAS

Fri., 6/22, 1:00 p.m.–4:00 p.m., Travis D (3)

SPLS,

Fri., 6/22, 2:00 p.m.–6:00 p.m., Lone Star D (2)

Tue., 6/26, 1:30 p.m.–3:30 p.m. Presidio A (3)

PC's Chair's Training Breakfast,

Sun., 6/24, 7:00 a.m.–9:00 a.m., Lone Star A (2)

Student Activities,

Sat., 6/23, 8:00 a.m.–3:00 p.m., Crockett A/B (4)

Executive,

Fri., 6/22, 10:00 a.m.– Noon, Travis A/B (3)

K–12,

Fri., 6/22, Noon.–2:00 p.m., Travis A/B (3)

ABET/Post High,

Fri., 6/22, 2:00 p.m.–4:00 p.m., Travis A/B (3)

Design Competition,

Fri., 6/22, 4:00 p.m.–6:00 p.m., Presidio C (3)

Grants,

Fri., 6/22, 4:00 p.m.–6:00 p.m., Travis A/B (3)

New Member Training,

Sat., 6/23, 7:00 a.m.– 8:00 a.m., Crockett A/B (4)

CRC Training,

Sun., 6/24, 8:30 a.m.–12:30 p.m., Bonham B (3)

TC Section Meetings/Breakfast

Sun., 6:30 a.m.– 8:00 a.m.

Section 1, (29), Lone Star F (2)
Section 2, (21), Seguin (4)

Section 3, (15), Mission B (2)
Section 4, (17), Presidio A (3)
Section 5, (29), Lone Star E (2)
Section 6, (25), Bonham E (3)
Section 7, (23), Crockett A/B (4)
Section 8, (23), Presidio B (3)
Section 9, (25), Bonham B (3)
Section 10, (25), Bonham C (3)

Technical Activities,

Sat., 6/23, 8:00 a.m.–3:00 p.m., Lone Star C (2)

Wed., 6/27, 7:00 a.m.–10:00 a.m., Sequin (4)

AC/CEC Executive,

Sat., 6/23, 7:00 a.m.–8:00 a.m. , Lone Star C (2)

TC/TG/TRG Chair Training,

Sun., 6/24, 9:45 a.m.–10:45 a.m., CC-007A (River Level)

TC Program Subcommittee Training

Tues., 6/26, 11:15 a.m. – Noon, CC-102B (Street Level)

Technology Council,

Tue., 6/26, 8:00 a.m.– Noon, Lone Star D (2)

Wed., 6/27, 9:00 a.m.–11:00 a.m., Presidio B (3)

Technology Council Orientation,

Tue., 6/26, 2:00 p.m.–4:00 p.m., Lone Star D (2)

Document Review,

Mon., 6/25, 8:00 a.m.–9:00 a.m., Travis D (3)

Site Source Ad Hoc,

Fri., 6/22, 3:00 p.m.–6:00 p.m., Bonham C (3)

Special Projects

Mon., 6/25, 7:30 a.m.–9:30 a.m., Travis C (3) Planning,

Mon., 9:00 a.m.–11:00 a.m., Travis D (3)

Operations,

Mon., 6/25, 10:30.–Noon, Travis C (3)

AEDG Steering,

Mon., 6/25, 2:15 p.m.–5:00 p.m., Presidio A (3)

YEA,

Sun., 6/24, 7:00 a.m. – Noon, Crockett C/D (4)

THURSDAY, JUNE 21

Finance Investment Subcommittee

Thurs., 5:00 p.m.–7:00 p.m., Crockett A (4)

Finance Planning Subcommittee

Thurs., 5:00 p.m.–7:00 p.m., Crockett B (4)

FRIDAY, JUNE 22

Standards Executive,

Fri., 8:00 a.m. –11:00 a.m., Presidio A (3)

Chapter Technology Transfer,

Fri., 6/22, 8:00 a.m.–Noon, Lone Star F (2)

Finance,

Fri., 8:00 a.m.–1:00 p.m., Presidio B (3)

Membership Promotion Subcommittees:

Fri., 9:00 a.m.– 2:00 p.m., Lone Star D (2)

Student Activities Executive,

Fri., 10:00 a.m.– Noon, Travis A/B (3)

Standards TCLS,

Fri., 11:00 a.m.–Noon, Presidio A (3)

Student Activities K–12,

Fri., Noon.–2:00 p.m., Travis A/B (3)

Conferences and Expositions Committee Executive,

Fri., 6/22, 1:00 p.m.–3:00 p.m., Bonham B (3)

Standards ILS/ISAS

Fri., 1:00 p.m.–4:00 p.m., Travis D (3)

Planning,

Fri., 1:00 p.m. –6:00 p.m., Lone Star F (2)

Chapter Technology Transfer Member Services,

Fri., 1:30 p.m.–5:00 p.m., Bonham D (3)

Chapter Technology Transfer Operations,
Fri., 1:30 p.m.–5:00 p.m., Travis C (3)

Student Activities ABET/Post High,
Fri., 2:00 p.m.–4:00 p.m., Travis A/B (3)

Standards PPIS,
Fri., 2:00 p.m.–5:00 p.m., Presidio A (3)

Research Promotion Executive,
Fri., 6/22,2:00 p.m.–6:00 p.m., Republic C (4)

Standards SPLS,
Fri., 6/22,2:00 p.m.–6:00 p.m., Lone Star D (2)

DRC/RVC Orientation,

Fri., 3:00 p.m.–6:00 p.m., Crockett A/B (4)

Conferences and Expositions Committee

Annual and Winter Meeting,

Fri., 3:00 p.m.–6:00 p.m., Bonham B (3)

Technology Council Site Source Ad Hoc,
Fri., 3:00 p.m.–6:00 p.m., Bonham C (3)

Student Activities Design Competition,
Fri., 4:00 p.m.–6:00 p.m., Presidio C (3)

Student Activities Grants,
Fri., 4:00 p.m.–6:00 p.m., Travis A/B (3)

Chapter Technology Transfer Executive,
Fri., 5:00 p.m.–6:00 p.m., Bonham D (3)

SATURDAY, JUNE 23

Student Activities New Member Training,
Sat., 7:00 a.m.–8:00 a.m., Crockett A/B (4)

TAC/CEC Executive,

Sat., 7:00 a.m.–8:00 a.m., Lone Star C (2)

Certification,

Sat., 8:00 a.m.–Noon, Presidio C (3)

Chapter Technology Transfer,

Sat., 8:00 a.m.–Noon, Lone Star F (2)

Conferences and Expositions Committee,

Sat., 8:00 a.m.–Noon, CC-007 A (River Level)

Standards,

Sat., 8:00 a.m.–Noon, Texas B (4)

Research Promotion,

Sat., 8:00 a.m.–2:30 p.m., CC-102 A (Street Level)

Research Administration,

Sat., 8:00 a.m.–3:00 p.m., Lone Star B (2)

Student Activities,

Sat., 8:00 a.m.–3:00 p.m., Crockett A/B (4)

Membership Promotion,

Sat., 8:00 a.m.–3:00 p.m., Seguin (4)

Technical Activities,

Sat., 8:00 a.m.–3:00 p.m., Lone Star C (2)

Executive Committee,

Sat., 8:30 a.m.–1:00 p.m., Bowie C (2)

Publication Planning,
Sat., 10:00 a.m.–Noon, Mission A (2)

Electronic Communications,

Sat., 11:00 a.m.–3:00 p.m., San Jacinto (2)

Handbook Strategic Planning/Executive

Sat., Noon–3:00 p.m., Mission A (2)

CLIMA,

Sat., 12:30 p.m.–1:30 p.m., Republic C (4)

Chapter Technology Transfer New Member Orientation,
Sat., 12:30 p.m.–2:30 p.m., Lone Star F (2)

Advocacy Codes & Standards,

Sat., 1:00 p.m.–2:15 p.m., Bowie B (2)

Conferences and Expositions Committee Training,

Sat., 1:00 p.m.–3:00 p.m., CC-101 A/B (Street Level)

ASHRAE Foundation Excom,
Sat., 1:30 p.m.–3:00 p.m., Bowie C (3)

Publishing and Education Council eLearning,
Sat., 1:30 p.m.–3:00 p.m., Republic C (4)

SUNDAY, JUNE 24

TC Section Meetings/Breakfast

Sun., 6:30 a.m.–8:00 a.m.

Section 1, (29),	Lone Star F (2)
Section 2, (21),	Seguin (4)
Section 3, (15),	Mission B (2)
Section 4, (17),	Presidio A (3)
Section 5, (29),	Lone Star E (2)
Section 6, (25),	Bonham E (3)
Section 7, (23),	Crockett A/B (4)
Section 8, (23),	Presidio B (3)
Section 9, (25),	Bonham B (3)
Section 10, (25),	Bonham C (3)

Advocacy,

Sun., 6:30 a.m.–8:30 a.m., Republic C (4)

PC's Chair's Training Breakfast,

Sun., 7:00 a.m.–9:00 a.m., Lone Star A (2)

YEA,

Sun., 7:00 a.m. – Noon, Crockett C/D (4)

Handbook Electronic Media,

Sun., 8:00 a.m.–9:00 a.m., Independence (3)

Handbook Liaison Training,

Sun., 8:00 a.m.–9:00 a.m., Lone Star B (2)

Handbook Functional,

Sun., 8:00 a.m.–9:00 a.m., Mission A (2)

Handbook Publicity,

Sun., 8:00 a.m.–9:00 a.m., Bonham A (3)

Handbook Practical Applications,

Sun., 8:00 a.m.–9:00 a.m., Presidio A (3)

Handbook Program,

Sun., 8:00 a.m.–9:00 a.m., Presidio C (3)

College of Fellows Board/Advisory,

Sun., 8:00 a.m.–10:00 a.m., Bowie A (2)

Nominating,

Sun., 8:00–Noon, Texas B (4)

Publications,

Sun., 8:00 a.m.–Noon, Bonham D (3)

Refrigeration,

Sun., 8:00 a.m.–Noon, Travis A/B (3)

bEQ

Sun., 8:30 a.m.–11:30 a.m., Lone Star E (2)

Historical,

Sun., 8:30 a.m.–Noon, Bonham C (3)

Student Activities CRC Training,

Sun., 8:30 a.m.–12:30 p.m., Bonham B (3)

Handbook 2013 Fundamentals TCs/Volume Subcommittee

Sun., 9:00 a.m.–10:00 a.m., Presidio A (3)

Handbook 2014 Refrigeration TCs/Volume Subcommittee

Sun., 9:00 a.m.–10:00 a.m., Republic C (4)

Handbook 2015 HVAC Applications TCs/Volume Subcommittee

Sun., 9:00 a.m.–10:00 a.m., Presidio C (3)

TC/TG/TRG Chair Training,

Sun., 9:45 a.m.–10:45 a.m., CC-007A (River Level)

Handbook Volume Subcommittees

Sun., 10:00 a.m.–10:30 a.m., Lone Star B (4)

College of Fellows

Sun., 10:00 a.m.–Noon, Bowie A (2)

Handbook,

Sun., 10:30 a.m.–1:00 p.m., Lone Star B (2)

Honors & Awards Orientation,

Sun., 12:30 p.m.–1:30 p.m., Bonham C (3)

Board of Directors,

Sun., 1:00 p.m.–5:00 p.m., Texas D/E (4)

Honors & Awards,

Sun., 1:30 p.m.–5:00 p.m., Bonham C (3)

Standards Code Interaction,

Sun., 7:00 –10:00 p.m., Bonham B (3)

MONDAY, JUNE 25

Research Subcommittee Chair Workshop,
Mon., 6:30 a.m.– 8:00 a.m., Texas D (4)

Environmental Health Excom,

Mon., 7:00 –8:00 a.m., Bowie B (2)

Technology Council Special Projects

Mon., 7:30 a.m.–9:30 a.m., Travis C (3)

Technology Council Document Review,

Mon., 8:00 a.m.–9:00 a.m., Travis D (3)

Environmental Health Education/Research,

Mon., 8:00 a.m.–10:00 a.m., Bowie B (2)

ASHRAE Foundation,

Mon., 8:00 a.m.–10:30 a.m., Crocket A/B (4)

Members Council,

Mon., 8:00 a.m.– Noon, Lone Star E (2)

Professional Development,

Mon., 8:00 a.m.– Noon, Bonham E (3)

Technology Council Planning,

Mon., 9:00 a.m.–11:00 a.m., Travis D (3)

Environmental Health Handbook/Program,

Mon., 10:00 a.m.–Noon, Bowie B (2)

Technology Council Operations,

Mon., 10:30.–Noon, Travis C (3)

Publishing and Education Council Research Journal Policy Group,

Mon., 11:00 a.m.–Noon, Bonham B (3)

Publishing and Education Council Fiscal Planning,

Mon., 2:00 p.m.–3:30 p.m., Crocket A/B (4)

Region-at-Large Planning,

Mon., 2:15 p.m.–4:15 p.m., Bonham B (3)

Technology Council AEDG Steering,

Mon., 2:15 p.m.–5:00 p.m., Presidio A (3)

Honors & Awards,

Mon., 2:15 p.m.–5:30 p.m., Bonham A (3)

Environmental Health,

Mon., 2:15 p.m.–6:15 p.m., Bowie B (2)

Publishing and Education Council Functional Planning,

Mon., 3:30 p.m.–5:00 p.m., Crocket A/B (4)

Associate Society Alliance,

Mon., 4:15 p.m.–6:00 p.m., Bonham B (3)

IAQ 2013 Steering Committee

Mon., 6:30–8:30 p.m., Bowie B (2)

TUESDAY, JUNE 26

Scholarship Trustees,

Tue., 8:00 a.m.–10:00 a.m., Bonham D (3)

Technology Council,

Tue., 8:00 a.m.– Noon, Lone Star D (2)

Members Council,

Tue., 8:00 a.m.– Noon, Lone Star E (2)

Publishing and Education Council,

Tue., 8:00 a.m.– Noon, Lone Star F (2)

Life Members Executive Board Meeting,

Tue., 9:00 –11:00 a.m., Bowie C (2)

Standards PPIS,

Tue., 11:00 a.m.–1:00 p.m., Presidio A (3)

TC Program Subcommittee Training

Tues., 11:15 a.m. – Noon, CC-102B (Street Level)

PEAC,

Tue., Noon.–2:00 p.m., Bowie B (2)

Conferences and Expositions Committee

Specialty Conferences,

Tue., 1:30 p.m.–3:00 p.m., San Jacinto (2)

Standards SPLS,

Tue., 1:30 p.m.–3:30 p.m. Presidio A (3)

Committee/Council Orientation,

Tue., 2:00 p.m.–4:00 p.m.

Members, Lone Star E (2)

Publishing and Education, Lone Star F (2)

Technology, Lone Star D (2)

Society Rules Committee, Tue., 4:00 p.m.–5:30 p.m., Travis C (3)

Standards TCLS,

Tue., 5:00 p.m.–5:30 p.m., Mission A (2)

Standards SRS,

Tue., 5:30 p.m.–6:00 p.m., Mission A (2)

WEDNESDAY, JUNE 27

Technical Activities,

Wed., 7:00 a.m.–10:00 a.m., Sequin (4)

Research Administration,

Wed., 7:00 a.m.– 11:00 a.m., Crockett C/D (4)

Executive Committee,

Wed., 7:30 a.m.–9:00 a.m., Presidio C (3)

Standards,

Wed., 7:30 a.m.–9:30 a.m., Texas B (4)

Technology Council,

Wed., 9:00 a.m.–11:00 a.m., Presidio B (3)

Board of Directors,

Wed., 2:00 p.m.–6:00 p.m., Texas B (4)

THURSDAY, JUNE 28

Executive Committee,

Thur., 7:30 a.m.–11:00 a.m., Republic C (4)

notes

TC/TG/MTG/TRG/SPC MEETINGS

The ASHRAE Technical Committees, Task Groups and Technical Resource Groups listed below usually meet at each Society Winter and Annual Conference. Attendance at these meetings is open to all society members, to all registered guests at scheduled Society Conferences, and to those invited by the chairman at the request of a member. You are encouraged to attend any of these meetings in which you have a technical interest.

Finding the Assigned Meeting Rooms

Codes for meeting locations: (H) Hyatt, Room Name, (number) Level in hotel (CC) Convention Center, Room number, (S) Street Level, (R) River Level

For easy access to meetings in 006, 007, 008 from the Hyatt: Follow signs to convention center down escalator near Hyatt restaurant and enter the convention center, rooms are straight down the hallway.

For access to Ballroom A, 101, 102, 103 enter from convention center main entrance at street level For rooms 001, 002, 003 you can enter from main entrance or go down to river level from Hyatt The number in parentheses following the room name is the floor location of the meeting room.

NOTE: If the meetings listed below are not printed in color they have not been confirmed.

Format of Listings

Committee Number and Title

Day Time Location

Session(s) the committee is sponsoring

TCs

TC/TG Chair's Breakfast

Sunday 6:30-8:00 a.m.

Section 1, (29),	(H) Lone Star F (2)
Section 2, (21),	(H) Seguin (4)
Section 3, (15),	(H) Mission B (2)
Section 4, (17),	(H) Presidio A (3)
Section 5, (29),	(H) Lone Star E (2)
Section 6, (25),	(H) Bonham E (3)
Section 7, (23),	(H) Crockett A/B (4)
Section 8, (23),	(H) Presidio B (3)
Section 9, (25),	(H) Bonham B (3)
Section 10, (25),	(H) Bonham C (3)

TECHNICAL COMMITTEES (TC)

TC/TG Chair's Training Workshop

Sunday 9:45-10:45a (CC) 007A (R)

Research Subcommittee Breakfast

Monday 6:30-8:00a (H) Texas D (4)

TC Program Subcommittee Training

Tuesday 11:15-Noon (CC) 102B (S)

TC 1.1 Thermodynamics & Psychrometrics (10/15)

Monday 2:15-4:15p (CC) 007A (R)

TC 1.2 Instruments & Measurements (15)

Tuesday 1:00-3:30p (CC) 003A (R)

TC 1.2 Standards/Handbook (8/3)

Monday 4:15-6:30p (H) Travis D (3)

TC 1.3 Heat Transfer & Fluid Flow (25/15)

Tuesday 1:00-3:30p (CC) 001A (R)

Sponsoring: Seminar 61: Next Generation of Heat Exchangers and Energy Systems with Sustainability in Mind

TC 1.3 Handbook

Sunday 1:00-3:00p (H) Bowie C (2)

TC 8.5/1.3 Research (20/30)

Sunday 3:00-5:00p (CC) 103A (S)

TC 1.4 Control Theory & Application (40) (Screen)

Tuesday 1:00-3:30p (CC) 006B (R)

Sponsoring: Seminar 9: Practical Applications for DDC Dashboards and Green Kiosks, Seminar 20: BAS Integration in the Occupied Space, Seminar 30: Case Studies in Controls, and Seminar 36: Control Specification Fundamentals: How to Get What You Really Want

TC 1.4 RP 1597 PMS (8) (Screen)

Sunday 10:30-11:30 (H) Crockett A/B (4)

TC 1.4 Control Components and Applications /Green Buildings (20/5)(Screen)

Sunday 3:00-4:45p (H) Presidio B (3)

TC 1.4 Program (20/5) (screen)

Sunday 4:45-5:30p (H) Presidio B

TC 1.4 Reference Applications (20/10)(Screen)

Sunday 5:30-6:30p (H) Presidio B

TC 1.4 Research (25/5)(Screen)

Monday 2:15-4:15p (H) Bonham E (3)

TC 1.4 Handbook (20/5)

Monday 4:15-6:15p (H) Bonham E

TC 1.4 RP-1633 {8}

Tuesday 9:00-10:30a (H) Travis C (3)

TC 1.4 RP-1455 PMS (8)

Tuesday 9:00-10:30a (H) Presidio A (3)

TC 1.4 Executive (8)

Tuesday 7:00-8:00a (H) Travis C (3)

TC 1.5 Computer Applications (20/5)

Monday 6:30-9:00p (CC) 006B (R)

Sponsoring: Seminar 6: ASHRAE Guideline 20 and Better HVAC Software: A BIM Perspective

TC 1.5 PMS 1468 (5/5)

Sunday 10:15a-Noon (H) Mission A (2)

TC 1.5 Emerging Applications (6/10)

Sunday 5:00-6:00p (H) Bonham D (3)

TC 1.5 Research (15)

Sunday 6:00-7:00p (H) Bonham D (3)

TC 1.5 Program (15)

Sunday 7:00-8:00p (H) Bonham D (3)

TC 1.5 Handbook (15)

Monday 6:00-6:30p (CC) 006B (R)

TC 1.6 Terminology (10/8) (Screen/E)

Monday 4:15-6:30p (H) Republic C (4)

TC 1.7 Business, Management & General Legal Education (20/5)

Monday 10:15a-Noon (CC) 003B (R)

Sponsoring: Seminar 38: Case Studies In Engineering Ethics and Seminar 45: Case Studies in Engineering Ethics II

TC 1.8 Mechanical Systems Insulation (20) (Screen)

Monday 4:15-6:30p (CC) 001B (R)

TC 1.8 Research (10)
Sunday 8:00-9:30a (CC) 003B (R)

TC 1.8 Handbook (10)
Sunday 9:30-10:30 (CC) 003B (R)

TC 1.8 Program
Sunday 10:30-11:00a (CC) 003B (R)

TC 1.9 Electrical Systems (8/4)
Tuesday 3:30-6:00p (H) Travis D (3)

TC 1.10 Cogeneration Systems (20/10)
Tuesday 3:00-5:00p (CC) 003B (R)
Sponsoring: Seminar 22: Combined Heat and Power as a Policy Tool to Meet State Mandates to Provide Clean, Reliable Cost Effective Power and Conference Paper Session 12: Low Energy Design and Integrated Energy Systems

TC 1.10 PMS 1592-CHP Design Guide Update (15)
Tuesday 12:00-1:00p (CC) 003B (R)

TC 1.10 Program/Research/Handbook (15/10)
Tuesday 1:00-3:00p (CC) 003B (R)

TC 1.10 CTIC (10/5)
Monday 4:15-6:30p (CC) 003B (R)

TC 1.11 Electric Motors and Motor Control (13/7)
Tuesday 1:00-3:30p (H) Bonham C (3)
Sponsoring: Seminar 48: Variable Frequency Drive Performance: What Is It and How Does It Relate to AHRI 1210-2011?

TC 1.12 Moisture Management in Buildings (15/25) (screen/E)
Saturday 1:00-3:00p (CC) 007D (R)
Sponsoring: Seminar 58: Mold, Moisture, and Damp Buildings: New Understanding and Guidelines for Reducing the Health Effects

TC 1.12 Programs/Handbook/Research (10)
Saturday 8:00a-Noon (CC) 007D (R)

TC 2.1 Physiology & Human Environment (12/18) (Screen)
Tuesday 1:00-3:30p (H) Presidio C (3)

TC 2.1 Research (13/7) (Screen/E)
Sunday 1:00-3:00p (H) Bonham D (3)

TC 2.1 Programs (5/5)
Sunday 3:00-4:00p (H) Bonham D (3)

TC 2.1 Handbook
Sunday 4:00-5:00p (H) Bonham D (3)

TC 2.1 1504-TRP
Tuesday 8:00-9:00a (H) Travis D (3)

TC 2.1 1515 TRP
Tuesday 9:00-10:00a (H) Travis D

TC 2.2 Plant and Animal Environment (10/5)
Monday 4:15-6:30p (CC) 001A (R)

TC 2.3 Gaseous Air Contaminants /Removal Equip. (18/30)
Tuesday 1:00-3:30p (H) Texas B (4)

TC 2.3 RP 1557 (5/15) (Screen)
Sunday 11:00-12:00 (H) Republic C (4)

TC 2.3 Research (20/20) (Screen/Flipchart)
Sunday 5:00-7:00p (CC) 103B (S)

TC 2.3 Handbook (10/10)(Flipchart/screen)
Monday 4:15-6:00p (CC) 003A (R)

TC 2.3 Standards (15/10)
Monday 6:00-8:00p (CC) 008A (R)

TC 2.3 Planning (15) (Flipchart)
Tuesday 6:30-8:00a (H) Crockett C/D (4)

TC 2.3 Program (20/20)(Flipchart/Screen)
Tuesday 12-12:45p (H) Texas B

TC 2.4 Particulate Air Contaminants /Removal Equip. (18/30)
Tuesday 3:30-6:00p (H) Texas B (4)
Sponsoring: Seminar 56: How Air Filter Selection Affects Energy Consumption

TC 2.4 Handbook (10/10)(flipchart)
Saturday 1:00-2:30p (CC) 002A (R)

TC 2.4 PMS 1360-RP (30)(Screen)
Sunday 11:00-Noon (CC) 002B (R)

TC 2.4 Research (20/20) (Flipchart/Screen)
Sunday 3:00-5:00p (CC) 103B (S)

TC 2.4 Planning (20/10)(Screen/flipchart)
Monday 8:00-10:00a (CC) 003A (R)

TC 2.4 Program (20/10) (flipchart)
Monday 10:00-11:00a (CC) 003A

TC 2.4 Standards (20/20) (screen)
Monday 4:15-6:00p (CC) 008A (R)

TC 2.5 Global Climate Change (20/10)
Tuesday 1:30-3:30p (CC) 002A (R)
Sponsoring: Seminar 3: Climate Change Basics

TC 2.6 Sound & Vibration Control (18/30) (Screen)
Monday 2:15-4:15p (H) Lone Star C (2)
Sponsoring: Seminar 10: Some Acoustical Impacts of Poor Aerodynamic Conditions in HVAC Systems, Seminar 23: New Acoustical Criteria and Methods of Measuring HVAC Sound, and Seminar 33: Review of the Updated AHRI Standards 260 and 880

TC 2.6 RP 1408 PMS (Lined Duct) (15/20) (Screen)
Sunday 8:15-9:00a (H) Seguin (4)

TC 2.6 Programs (15/20)
Sunday 9:00-10:00a (H) Seguin (4)

TC 2.6 Publications (15/20)
Sunday 10:00-11:00a (H) Seguin (4)

TC 2.6 BIM (15/20)
Sunday 1:30-2:00p (H) Seguin (4)

TC 2.6 Research (15/20) (Screen)
Sunday 2:00-3:00p (H) Seguin (4)

TC 2.6 Criteria (15/20) (Screen)
Sunday 3:00-5:00p (H) Seguin (4)

TC 2.6 Excom (10)
Monday 9:30-10:30a (H) Bonham D (3)

TC 2.7 Seismic and Wind Resistant Design (24/6)(Screen)
Tuesday 3:30-6:00p (H) Bonham E (3)

TC 2.7 Research, Programs, Publication, Wind, Testing (20/10) (Screen)
Tuesday 1:00-3:30p (H) Bonham E (3)

TC 2.8 Building Environmental Impacts and Sustainability (75)(Screen)
Sunday 5:00-7:00p (H) Lone Star D (2)
Sponsoring: Seminar 53: Green Building Energy Performance Pathways and Evaluation Approaches

TC 2.8 International (15/15) (Screen)
Sunday 12:00-12:45p (H) Lone Star D (2)

TC 2.8 Green Guide (25)
Sunday 12:45-1:45p (H) Lone Star D (2)

TC 2.8 Research
Sunday 1:45-2:45p (H) Lone Star D (2)

TC 2.8 Handbook (25)
Sunday 2:45-3:30p (H) Lone Star D (2)

- TC 2.8 Program (25)**
Sunday 3:30-4:15p (H) Lone Star D (2)
- TC 2.8 Existing Buildings**
Sunday 4:15-4:50p (H) Lone Star D (2)
- TC 2.9 Ultraviolet Air and Surface Treatment (30)(Screen/Flipchart)**
Monday 10:00a-Noon (CC) 006C (R)
Sponsoring: Seminar 29: Current Design Standards for Upper Air UV Disinfection Installations: Bridging Global Gaps
- TC 2.9 Program, Handbook, Standards (30) (Screen/Flipchart)**
Sunday 8:00-1:30p (CC) 006B (R)
- TC 2.9 Research (Flipchart)**
Monday 8:00-10:00a (CC) 006C
- TC 3.1 Refrigerants & Secondary Coolants (20/15)(Screen/E)**
Monday 4:15-6:30p (H) Lone Star F
Sponsoring: Seminar 11: Standards Development for 2L Flammable Refrigerants, Forum 5: Safety Requirements for Class 2L Refrigerants, and Seminar 50: Design, Performance and Efficiency Impact of Low-GWP Refrigerants on Systems and Components
- TC 3.1 Research (10/10) (screen/E)**
Monday 11:00a-Noon (H) Presidio A (3)
- TC 3.1 Program and Handbook (6/4)**
Monday 2:15-3:45p (H) Independence (3)
- TC 3.2 Refrigerant System Chemistry (12/40)(Screen/E)**
Monday 2:15-4:15p (CC) 001A (R)
- TC 3.2 Research (10/8)**
Sunday 4:00-5:00p (CC) 002A (R)
- TC 3.3 Refrigerant Contaminant Control (50)**
Tuesday 3:30-6:00p (CC) 103A (S)
- TC 3.3 Research (10/8)**
Sunday 5:00-5:30p (CC) 002A (R)
- TC 3.4 Lubrication (60)**
Tuesday 1:30-3:30p (CC) 103 A (S)
- TC 3.4 Research (10/8)**
Sunday 5:30-6:00 (CC) 002A (R)
- TC 3.6 Water Treatment (18/10)**
Tuesday 1:00-3:30p (H) Bowie C (2)
Sponsoring: Seminar 17: Practical Applications with Storage and Treatment with Using Reclaimed and Harvested Waters in Your Water Conservation Efforts
- TC 3.6 Handbook/Program/Research (12/4)**
Sunday 3:00-5:00p (CC) 003B (R)
- TC 3.8 Refrigerant Containment (9/5)**
Monday 4:15-6:30p (H) Bowie C (2)
- TC 4.1 Load Calculation Data and Procedures (20/10)**
Monday 2:15-4:15p (H) Travis D (3)
Sponsoring: Seminar 21: Can I Determine My loads with My Energy Modeling Program?
- TC 4.1 Handbook (12/8)**
Sunday 3:00-4:00p (H) San Jacinto (2)
- TC 4.1 Research (12/8)**
Sunday 4:00-5:00p (H) San Jacinto (2)
- TC 4.1 Programs & Standards**
Sunday 5:00-7:00p (H) San Jacinto (2)
- TC 4.2 Climatic Information (20/10) (Screen/Flip)**
Tuesday 1:00-3:30p (H) Bonham D (3)
Sponsoring: Seminar 65: Impacts of Environmental Change on Building Design and Their HVAC Systems

- TC 4.2 1561-PES (20) (Screen/flip)**
Sunday 9:00-10:00a (H) Presidio B (3)
- TC 4.2 1413-RP (20)(Screen/flip)**
Sunday 10:00-11:30a (H) Presidio B (3)
- TC 4.2 1613-TRP PES/H andbook (20) (Screen/Flip)**
Sunday 12-1:30p (H) Presidio B (3)
- TC 4.2 Program (20) (Screen/flip)**
Sunday 1:30-2:30a (H) Presidio B (3)
- SSPC 169 (10/8) (Screen)**
Monday 10a-Noon (CC) 006A (R)
- TC 4.2 Research (20) (Screen/flip)**
Monday 4:15-6:00p (H) Travis C (3)
- TC 4.3 Ventilation Requirements & Infiltration (14/20)**
Monday 4:15-6:30p (H) Seguin (4)
Sponsoring: Seminar 43: Standard 62.1: Multiple-Zone Systems, Demand Control and Energy
- TC 4.3 1596 RP (SP98) PMS (10) (Screen/E)**
Sunday 7:00-9:00p (H) Travis A/B (3)
- TC 4.3 PMS for RP-1478 (6/10)**
Tuesday 8:00-10:00a (H) Independence (3)
- TC 4.4 Bldg. Materials and Bldg. Envelope Performance (30/10)(Screen)**
Monday 2:15-4:15p (CC) 008B (R)
- TC 4.4 Research (30/10) (Screen)**
Sunday 1:00-3:00p (H) Lone Star F (2)
- TC 4.4 Handbook (30/10)**
Sunday 3:00-3:30p (H) Lone Star F (2)
- TC 4.4 Program (20/5)**
Sunday 3:30-5:00p (H) Lone Star F (2)
- TC 4.4 Standards (20/5)**
Sunday 5:00-5:30p (H) Lone Star F (2)
- TC 4.5 Fenestration (10/10)**
Monday 2:15-4:15p (H) Seguin (4)
- TC 4.5 Calculational Methods**
Sunday 1:00-3:00p (H) Mission B (2)
- TC 4.5 Research & Long Range Planning (8/4)**
Sunday 3:00-4:00p (H) Mission B
- TC 4.5 Program (8/4)**
Sunday 4:00-5:00p (H) Mission B
- TC 4.5 Handbook (8/4)**
Sunday 5:00-6:30p (H) Mission B
- TC 4.5 1415-RP PMS**
Monday 9:00-10:00a (CC) 002A (R)
- TC 4.7 Energy Calculations (75) (screen)**
Tuesday 6:00-8:30p (H) Texas C (4)
Sponsoring: Seminar 7: Effective Calibration of Building Energy Modeling Using Measured Data and Seminar 57: Methods and Tools to Support the Modeling Process
- TC 4.7 Simulation and Component Models (20/20) (Screen)**
Monday 6:00-7:30p (H) Texas C (4)
- TC 4.7 Data-Driven Models (25)**
Monday 7:30-9:00p (H) Texas C
- TC 4.7 Applications (40) (Screen)**
Tuesday 3:30-5:00p (H) Texas C
- TC 4.10 Indoor Environmental Modeling (40)**
Monday 2:15-4:15p (H) Lone Star A (2)
Sponsoring: Seminar 59: The Effect of the Outdoor Environment on Indoor Environment Modeling
- TC 4.10 RP 1512 PMS (15) (Screen)**
Sunday 1:00-2:30p (CC) 002B (R)

- TC 4.10 RP 1458 PMS (15) (Screen)**
Sunday 2:30-3:30p (CC) 002B (R)
- TC 4.10 Program (20)**
Sunday 3:30-4:30p (CC) 002B (R)
- TC 4.10 Handbook (20)**
Sunday 4:30-5:00p (CC) 002B (R)
- TC 4.10 Research (30)**
Sunday 5:00-6:00p (CC) 002B (R)
- TC 5.1 Fans (25) (Screen)**
Monday 4:15-6:30p (H) Lone Star C (2)
Sponsoring: Seminar 46: Energy Conservation and Fan Energy Efficiency Grade
- TC 5.1 Research, Handbook, Program (12/5)**
Sunday 3:00-5:00p (H) Presidio A (3)
- TC 5.2 Duct Design (12/20)**
Tuesday 3:30-6:00p (H) Bonham C (3)
- TC 5.2 Duct Leakage (20)**
Sunday 12:30-1:00p (H) Bowie A (2)
- TC 5.2 Duct Fitting Database (20)**
Sunday 1:00-1:30p (H) Bowie A (2)
- TC 5.2 Research (20)**
Sunday 1:30-2:30p (H) Bowie A (2)
- TC 5.2 Handbook (20)**
Sunday 2:30-3:00p (H) Bowie A (2)
- TC 5.2 Standards (20)**
Sunday 3:00-3:30p (H) Bowie A (2)
- TC 5.2 Programs (20)**
Sunday 3:30-4:00p (H) Bowie A (2)
- TC 5.2 1180 Design Guide for Duct Design (20)**
Monday 10:00a-Noon (CC) 002A (R)
- TC 5.3 Room Air Distribution (30/30) (Screen/E)**
Tuesday 1:00-3:30p (CC) 006C (R)
Sponsoring: Seminar 8: Exploring Indoor Environmental Applications with Displacement Ventilation and Radiant Cooling and Heating Systems
- TC 5.3 Handbook (20/20)(screen/E)**
Friday 8:00-5:00p (CC) 007B (R)
- TC 5.3 Handbook (20/20) (screen/E)**
Saturday 8:00-3:00p (CC) 102B (S)
- TC 5.3 Fan Coils (30/20) (Screen/E)**
Sunday 8:30-9:30a (CC) 102A (S)
- TC 5.3 Chilled Beams (30) (Screen/E)**
Sunday 9:30-10:30a (CC) 102A (S)
- TC 5.3 Research Projects (30/20) (Screen/E)**
Sunday 10:30-Noon (CC) 102A (S)
- TC 5.3 Research/ Handbook/Program (30/20) (screen/E)**
Sunday Noon-2:00p (CC) 102A (S)
- TC 5.4 Industrial Process Air Cleaning (11/6)**
Monday 2:15-4:15p (H) Republic C (4)
- TC 5.5 Air-to-Air Energy Recovery (22/4)**
Tuesday 3:30-6:00p (CC) 002A (R)
Sponsoring: Forum 7: Accurately and Correctly Modeling Air-to-Air Energy Recovery Technologies
- TC 5.5 Handbook, Program, Research (12)**
Monday 4:15-6:30p (CC) 007A (R)
- TC 5.6 Control of Fire & Smoke (23/30)(Screen)**
Monday 4:15-6:30p (H) Lone Star E (2)
Sponsoring: Seminar 64: How Smoke Control Systems Contribute to Sustainability Goals
- TC 5.6 Program (12/4) (Screen)**
Sunday 3:00-4:00p (CC) 102A (S)
- TC 5.6 Research**
Sunday 4:00-5:30p (CC) 102A (S)
- TC 5.6 Handbook**
Sunday 5:30-7:00p (CC) 102A (S)
- TC 5.6 Guideline 5 Subcommittee**
Monday 2:15-4:15p (H) Lone Star E (2)
- TC 5.7 Evaporative Cooling (30)**
Monday 4:15-6:30p (H) Lone Star A (2)
Sponsoring: Seminar 34: Update on Evaporative Cooling Technologies: Simple Keeps Getting Better
- TC 5.7 Program, Handbook, Research (9/7)**
Sunday 1:00-3:00p (CC) 006C (R)
- TC 5.8 Industrial Ventilation Systems (20/5)**
Monday 4:15-6:30p (H) Bonham C (3)
- TC 5.8 Ventilation of Hazardous Spaces (5/5)**
Sunday 7:00-9:00p (H) Travis D (3)
- TC 5.9 Enclosed Vehicular Facilities (30/10)**
Tuesday 3:30-6:00p (CC) 102A (S)
- TC 5.9 Program, Handbook, Research (25/10)**
Tuesday 1:00-3:30p (CC) 102A
- TC 5.10 Kitchen Ventilation (30/15) (screen/E)**
Monday 11:00-Noon (CC) 008A (R)
Sponsoring: Seminar 5: Thermal Comfort in Commercial Kitchens, Seminar 13: Designing Commercial Kitchen Ventilation for High Performance, Low Energy Buildings, and Seminar 40: Market Transformation of DCV Systems for Kitchen Ventilation
- TC 5.10 Research**
Sunday 10:15-11:30a (H) Bowie C (2)
- TC 5.10 Handbook**
Monday 8:00-9:00a (CC) 008A (R)
- TC 5.10 Program**
Monday 9:00-10:00a (CC) 008A (R)
- TC 5.10 Codes & Standards**
Monday 10:00-11:00a (CC) 008A (R)
- TC 5.10 PMS 1469 (20)**
Tuesday 10:00-11:00a (CC) 008A (R)
- TC 5.11 Humidifying Equipment (10/3)**
Monday 2:15-4:15p (H) Travis C (3)
- TC 5.11 Handbook/Program (9/5)**
Sunday 10:00-Noon (H) Presidio C
- TC 6.1 Hydronic & Steam Htg. Equip & Sys (35/15)**
Tuesday 1:00-3:30p (CC) 001B (R)
Sponsoring: Forum 8: If Hydronic HVAC Systems Are So Great, Why Doesn't Everyone Have One?
- TC 6.1 Program (10/10)**
Monday 2:15-3:15p (CC) 103B (S)
- TC 6.1 Research (10/10)**
Monday 3:15-4:15p (CC) 103B
- TC 6.1 Handbook**
Sunday 5:00-6:00p (H) Travis D (3)
- TC 6.1 Chilled Water Plant (10/10)**
Sunday 6:00-7:00p (H) Travis D
- TC 6.2 District Energy (20/10) (Screen)**
Sunday 3:00-5:00p (H) Lone Star B (2)
- TC 6.2 Programs, Research, Handbook, Planning, (14)**
Sunday 2:00-3:00p (H) Lone Star B (2)

TC 6.3 Central Forced Air Htg. & Cooling Sys (30)**Tuesday 1:00-4:00p (H) Travis A/B (3)***Sponsoring: Conference Paper Session 8: Field and Laboratory Results from HVAC Maintenance Programs***TC 6.5 Radiant Heating and Cooling (17/10)****Monday 2:15-4:15p (CC) 008A (R)***Sponsoring: Seminar 14: Energy Efficient Snow Melt System Design, Seminar 25: Radiant Cooling in High Humidity Environments, and Seminar 49: Net Zero Energy with Large Radiant Surface Heat Exchangers***TC 6.5 RP 1383 (4/20) (Screen)****Sunday 2:00-3:00p (H) Bonham E (3)****TC 6.5 Research, Spec Pubs, Journal, Program, Handbook (8/20)****Sunday 3:00-5:00p (H) Bonham E (3)****TC 6.6 Service Water Heating Systems (18/15)****Monday 4:15-6:30p (CC) 103A (S)***Sponsoring: Forum 3: How Could the Service Water Heating Handbook Chapter Better Assist You?***TC 6.6 Handbook (15)****Monday 10:00-12N (CC) 002B (R)****TC 6.6 Research/Handbook/Program (18/15)****Monday 2:15-4:15p (CC) 103A****TC 6.7 Solar Energy Utilization (20/10)****Tuesday 1:00-3:30p (CC) 006A (R)****TC 6.7 Research (5/5)****Monday 2:15-3:15p (H) Mission A (2)****TC 6.7 Program (5/5)****Monday 4:15-5:30p (H) Mission A (2)****TC 6.7 Handbook (5/5)****Monday 6:30-8:30p (H) Mission A (2)****TC 6.8 Geothermal Heat Pump and Energy Recovery Applications (16/25)****Tuesday 3:30-6:30p (CC) 001B (R)***Sponsoring: Forum 0: GSHP vs. Traditional Central Plants: The Efficiency Debate and Seminar 63: Designing Heat Recovery Heat Pumps to Meet Today's Requirements for High Performance Buildings***TC 6.8 Research/Handbook/Program (15/15)****Sunday 5:00-7:00p (CC) 102B (S)****TC 6.9 Thermal Storage (20/5)****Monday 4:30-6:00p (CC) 102B (S)***Sponsoring: Seminar 27: Thermal Energy Storage: From Concept to Completion***TC 6.9 Standards (15)****Monday 2:15-2:40p (CC) 102B****TC 6.9 Program (15)****Monday 2:40-3:10p (CC) 102B****TC 6.9 Handbook (15)****Monday 3:10-3:30p (CC) 102B****TC 6.9 LRP /Website (15)****Monday 3:30-3:50p (CC) 102B****TC 6.9 Research (10)****Monday 3:50-4:30p (CC) 102B****TC 6.10 Fuels & Combustion (30)****Tuesday 3:30-6:00p (H) Crockett A/B (4)****TC 6.10 Handbook (4/4)****Monday 2:15-4:15p (H) Travis A/B (3)****TC 7.1 Integrated Building Design (25/10)****Monday 8:15-10:30a (H) Presidio B (3)***Sponsoring: Conference Paper Session 1: Low Energy Design Integrated Energy Systems and Forum 1: IBD, IPD – We OK? When Performance Is the Goal, What Should Be In the Deal?***TC 7.1 Subcommittees (15)****Sunday 5:00-7:00p (CC) 003A (R)****TC 7.2 HVAC Construction and Design Build Technology (15)(Screen)****Sunday 10:00a-Noon (H) Travis D (3)****TC 7.3 Operations & Maintenance Management (25/7)****Tuesday 1:00-3:30p (H) Bonham B (3)***Sponsoring: Seminar 18: Strategies for Transformation of Facilities Management to Foster Economically, Environmentally and Socially Sustainable Buildings***TC 7.3 Standards/Program (7/3)****Monday 2:15-4:15p (H) Mission B (2)****TC 7.3 Research/Handbook (7/3)****Monday 4:15-6:30p (H) Mission B****TC 7.4 Exergy Analysis for Sustainable Buildings (14/8)****Sunday 8:00-10:00a (H) Bowie C (2)****TC 7.5 Smart Building Systems (16/24)(Screen)****Tuesday 3:30-6:00p (CC) 003A (R)***Sponsoring: Seminar 62: Smart Grid in Texas, What's Happening?***TC 7.5 Fault Detection &Diagnosis (40)****Sunday 3:00-3:45 p (CC) 001A (R)****TC 7.5 Wireless Applications (40)****Sunday 3:45-4:30p (CC) 001A (R)****TC 7.5 Smart Grid****Sunday 4:30-5:15p (CC) 001A (R)****TC 7.5 Handbook****Sunday 5:15-6:00p (CC) 001A (R)****TC 7.5 Buildings Operations Dynamics****Monday 4:15-5:30p (CC) 103B (S)****TC 7.5 Research****Monday 5:30-6:30p (CC) 103B****TC 7.6 Building Energy Performance (50)****Tuesday 1:00-3:30p (CC) 102B (S)***Sponsoring: Seminar 1: Breaking Boundaries in Building Controls Integration***TC 7.6 Research (12)****Sunday 1:00-2:00p (H) Mission A (2)****TC 7.6 Commercial Building Energy Audit (15)****Sunday 2:00-3:00p (H) Mission A****TC 7.6 Handbook (8)****Sunday 3:00-4:00p (H) Mission A****TC 7.6 Monitoring & Energy Performance (24)****Monday 2:15-4:15p (CC) 002B (R)****TC 7.6 Energy Management (12)****Monday 4:15-5:15p (CC) 002B****TC 7.6 Standards (12)****Monday 5:15-6:15p (CC) 002B****TC 7.6 Executive (12)****Monday 6:15-6:45p (CC) 002B****TC 7.7 Testing & Balancing (20/30)****Monday 2:15-4:15p (CC) 001B (R)****TC 7.7 Program/Handbook (5/5)****Saturday 1:00-3:00p (H) Goliad (2)****TC 7.8 Owning & Operating Costs (25)****Monday 2:15-4:15p (CC) 003A (R)**

TC 7.8 Program, Handbook, Research (5/5)
Sunday 3:00-5:00p (H) Independence (3)

TC 7.9 Building Commissioning (75) (E)
Sunday 3:00-5:00 (CC) 001B (R)
Sponsoring: Seminar 31: Commissioning the Building Envelope, Seminar 35: Integrating Design, Commissioning and BMS Controls to Deliver Mission Critical Success, and Seminar 51: Existing Building Commissioning Process: Best Practices

TC 7.9 Research (25)(E)
Saturday 9:00-10:30a (H) Presidio A (3)

TC 7.9 Program
Sunday 9:00-10:30 (CC) 002B (R)

TC 8.1 Positive Displacement Compressors (12/14)
Tuesday 3:30-6:00p (H) Bowie C (2)

TC 8.1 Research (6/2)
Monday 2:15-4:15p (H) San Janinto (2)

TC 8.2 Centrifugal Machines (20/8)
Monday 2:15-4:15p (CC) 006A (R)
Sponsoring: Seminar 42: Sustainable Chiller Plant Efficiency: GPC 22 In Application

Research/Program (9/2)
Sunday 5:00-7:00p (CC) 006C (R)

Handbook (5/2)
Sunday 7:00-8:00p (CC) 006C (R)

TC 8.3 Absorption and Heat Operated Machines (30)
Monday 3:30-6:00p (CC) 006B (R)
Sponsoring: Seminar 15: Exploiting the Advances in Absorption Fundamentals for Transformative Impact

TC 8.3 Research/Handbook (8/8)
Monday 2:00-3:30p (CC) 006B (R)

TC 8.4 Air-to-Refrigerant Heat Transfer Equip (20/10)
Tuesday 3:30-6:00p (CC) 102B (S)
Sponsoring: Seminar 41: New Research In Ground Source Heat Pumps and Seminar 44: Advances in Heat Transfer Research

TC 8.4 Research (15/15) (Screen)
Monday 6:30-9:30p (H) Crocket A/B (4)

TC 8.5 Liquid to Refrigerant Heat Transfer (25/10)
Monday 4:15-6:30p (CC) 006C (R)

TC 8.5/1.3 Research (20/15)
Sunday 3:00-5:00p (CC) 103A (S)

TC 8.6 Cooling Towers and Evaporative Condensers (20)
Monday 2:15-4:15p (H) Crocket C/D (4)
Sponsoring: Forum 6: Standards As They Relate to Cooling Tower Operations and Design: Too Much, Too Little, Or Just Right?

TC 8.6 Handbook/Program/Research (10)
Monday 9:00-11:00a (H) Republic C (4)

TC 8.7 Variable Refrigerant Flow (20/30)
Monday 4:15-6:30 (CC) 008B (R)
Sponsoring: Seminar 16: Modeling the Performance of VRF Systems

TC 8.8 Refrigerant System Controls & Accessories (10/10)
Tuesday 1:00-3:30p (CC) 002B (R)

TC 8.8 Program, Research, Handbook (10/5)
Monday 2:15-4:15p (CC) 003B (R)

TC 8.9 Residential Refrigerators and Food Freezers (6/10)
Monday 2:15-4:15p (H) Goliad (2)

TC 8.10 Mechanical Dehumidifiers & Heat Pipes (12/4)
Tuesday 3:30-6:00p (H) Bonham A (3)

TC 8.10 Research/Handbook/Program (8/8)
Tuesday 2:00-3:30p (H) Bonham A

TC 8.11 Unitary and Room Air Conditioners & Heat Pumps (20/30)
Monday 4:15-6:30p (H) Lone Star D (2)

TC 8.11 Handbook/Program/Research (10/10)
Sunday 3:00-5:00p (H) Bowie C (2)

TC 8.12 Desiccant Dehumidification Equipment and Components (30)
Monday 2:15-4:15p (H) Lone Star D (2)
Sponsoring: Seminar 54: How to Efficiently Serve Low Dewpoint Applications

TC 9.1 Large Building Air-Conditioning Systems (23/5)
Tuesday 1:00-3:30p (H) Texas C (4)
Sponsoring: Seminar 19: When Integrated Controls Are Not Integrated

TC 9.1 Research /Program/Handbook/Standards (23/5)
Tuesday 12:00-1:00p (H) Texas C (4)

TC 9.2 Industrial Air Conditioning (25/10)
Tuesday 1:00-3:30p (CC) 103B (S)

TC 9.2 Program, Research, Handbook (12)
Sunday 5:00-7:00p (H) Independence (3)

TC 9.2 Nuclear (15/5)
Monday 2:15-4:15p (H) Bonham D (3)

TC 9.3 Transportation Air Conditioning (25/20)
Monday 3:30-6:00p (CC) 102A (S)

TC 9.3 Handbook (4/4)
Sunday 9:00-10:00a (CC) 006C (R)

TC 9.3 Aviation (20/10) (screen)
Sunday 10a-Noon (CC) 006C (R)

TC 9.3 Automotive (6/4) (screen)
Sunday 5:00-7:00p (CC) 007A(R)

TC 9.3 Research (25/25) (Screen)
Monday 2:15-3:30p (CC) 102A (S)

TC 9.5 Residential and Small Bldg. Applications (20/10)
Tuesday 3:30-6:00p (CC) 006B (R)

TC 9.6 Health Care Facilities (30/30) (Screen)
Sunday 5:00-7:00p (CC) 001B (R)

TC 9.6 SP 91.2 (20) (screen)
Sunday 8:15a-Noon (CC) 002A (R)

TC 9.6 Handbook (15)
Sunday 12:30-1:30p (CC) 003B (R)

TC 9.6 Infectious Diseases (25)
Sunday 12:30-2:00p (CC) 003A (R)

TC 9.6 Energy (20) (Screen)
Sunday 1:30-3:00p (CC) 003B (R)

TC 9.6 Research (20) (Screen)
Sunday 2:00-4:00p (CC) 003A (R)

TC 9.6 Program (10) (screen)
Sunday 4:00-4:45p (CC) 003A (R)

TC 9.7 Educational Facilities (13/10)
Sunday 1:00-3:00p (H) Travis A/B (3)

TC 9.8 Large Building Air-Conditioning Applications (30)
Monday 2:15-4:15p (H) Bonham C (3)

TC 9.8 Museums, Galleries, Archives & Libraries (6/2)
Monday 8:00-9:00a (H) Bonham C (3)

TC 9.8 Research (5/1)**Monday 9:00-10:00a (H) Bonham C (3)****TC 9.8 Handbook (8/2)****Monday 10:00-11:00a (H) Bonham C (3)****TC 9.8 Program (6/5)****Monday 11:00a-Noon (H) Bonham C (3)****TC 9.9 Mission Critical Facilities (25/50)(screen)****Monday 2:15-9:30p (H) Texas B (4)**

Sponsoring: Seminar 4: Power Trends of Information Technology Equipment and the Usage of ASHRAE's Thermal Guidelines in Data Center Design and Operation, Seminar 12: Data Center Containment, Control and Modeling: Interactions and Optimization Opportunities, Forum 2: Will Standard 90.1 Help or Hurt the Data Center Industry?, Seminar 32: Ramification of Aisle Containment and Server Airflow Design in New and Existing Data Centers, and Seminar 60: Datacom Space Technology Advances; From Containment Fire Protection to Oil Immersion Cooling

TC 9.9 Program/ Handbook/ Research (25/10)(screen)**Sunday 5:00-7:00p (H) Lone Star C (2)****TC 9.10 Laboratory Systems (75)(Screen)****Tuesday 3:30-6:00p (H) 001A (R)**

Sponsoring: Seminar 26: Laboratories and Environmental Performance Criteria

TC 9.10 Standards, Research (10/5)**Sunday 3:00-5:00p (H) Travis A/B (3)****TC 9.10 Program (10)****Sunday 5:00-6:00p (H) Travis A/B (3)****TC 9.10 Handbook, Design Guide (8)****Tuesday 1:00-3:30p (CC) 008B (R)****TC 9.11 Clean Spaces (30/45)(Screen/E)****Monday 2:15-4:00p (H) Texas C (4)**

Sponsoring: Seminar 2: Cleanroom Mechanical System Design and Operation Impact on Energy Usage

TC 9.11 RP-1604 PMS (5/10) (Screen)**Sunday 3:00-5:00p (H) Travis C (3)****TC 9.11 Handbook (10/12)(Screen)****Monday 4:00-4:30p (H) Texas C (4)****TC 9.11 Design Guide (10)****Monday 4:30-5:30p (H) Texas C (4)****TC 9.11 Short Course (10)****Monday 5:30-6:00p (H) Texas C (4)****TC 9.12 Tall Buildings (12/5)****Tuesday 3:30-6:00p (H) Crockett C/D (4)****TC 10.1 Custom Engineered Refrig Systems (30)****Monday 2:15-4:15p (CC) 006C (R)****TC 10.1 Research/Handbook, Standards/ Program (15/5)****Sunday 5:00-7:00p (H) Crockett C/D (4)****TC 10.1 Cryogenics Refrigerants Subcommittee (10)****Sunday 3:00-5:00p (H) Crockett C/D (4)****TC 10.2 Automatic Ice Making Plants/Skating Rinks (15)****Monday 4:15-6:30p (H) Goliad (2)****TC 10.3 Refrigerant Piping, Controls and Accessories (30)****Tuesday 1:00-3:30p (H) Crockett A/B (4)**

Sponsoring: Seminar 24: Proper Sizing of Copper Tube and Fittings for High Pressure Refrigerant Applications

TC 10.5 Refrigeration Distrib and Storage Facilities (15/10)**Tuesday 3:30-6:00p (H) Presidio C (3)**

Sponsoring: Seminar 66: Refrigerated Warehouse Efficiency Regulations for CA and Beyond

TC 10.6 Transport Refrigeration (8/10)**Monday 4:15-7:00p (H) Bonham D (3)****TC 10.7 Commercial Food, Beverage Display & Storage (25/25)****Monday 2:15-4:15p (H) Lone Star F (2)****TC 10.7 1467-RP PMS (4/2)****Sunday 7:00-8:00a (H) Travis D (3)****TC 10.7 Program (5/5)****Sunday 5:15-6:00p (H) Lone Star B (2)****TC 10.7 Research (5/10)****Sunday 6:00-6:45p (H) Lone Star B****TC 10.7 Handbook (5/10)****Sunday 6:45-7:30p (H) Lone Star B****TC 10.8 Refrigeration Load Calculations (10/10)****Sunday 3:00-5:00p (CC) 006C (R)****Task Groups (TG), Technical Resource Groups (TRG), and Multidisciplinary Task Groups (MTG)****TG1.Optimization (15) (Screen)****Sunday 1:00-3:00p (H) Crockett C/D (4)****TG2.HVAC Security (20/6)****Tuesday 9:00-12N (CC) 002A (R)****TRG4 Sustainable Building Guidance & Metrics (17/10)****Saturday 1:00-300p (CC) 003B (R)****TRG4.IAQP (12/8)****Sunday 10:30a-12:30p (H) Mission B (2)****TRG7-Under Floor Air Distribution (Screen/E) (40)****Wednesday 8:00-Noon (CC) 102A****TG9.JF Justice Facilities (20/5)****Sunday 8:15-10:15a (H) Crockett A/B (4)****MTG Building Performance Metrics (20/10)(E)****Sunday 1:00-4:00p (CC) 002A (R)****MTG Energy Efficiency Classification of General Ventilation Air-Cleaning Devices (15/5) (Screen)****Tuesday 8:00-Noon (H) Bonham C (3)****MTG Building Information Modeling (15/15)(E)****Saturday 1:00-3:00p (CC) 003A (R)****MTG Energy Targets Multidisciplinary Task Group (20/10)****Saturday 1:00-3:00p (CC) 007B (R)****Standard Project Committees (SPC) and Standing Standard Project Committee (SSPC)****SPC Chair Training Breakfast****Sunday 7:00-9:00a (H) Lone Star A (2)****SSPC 15 Safety Standards for Refrigeration Systems (22/25) (screen)****Sunday 1:00-5:00p (CC) 008B (R)****SSPC 15 Ad Hoc 2L Classification Working Group (11/20)****(Screen)****Sunday 9:00a-11:00a (CC) 008B (R)****SPC 16/58 MOT/Rating Room Air Conditioners and PTAC/ PTHP (5/3)****Tuesday 8:00-Noon (H) Presidio C (3)****SPC 17 MOT/Capacity of TEV's (6/4)****Sunday 5:00-7:00p (CC) 006A (R)**

SPC 20 MOT/Rating Remote Mechanical-Draft Air-Cooled Refrigerant Condensers (5/10) (Screen)

Sunday 12:00-2:00p (H) Presidio A (3)

SPC 22 MOT Water-cooled Refrigerant Condensers (6/10) (Screen)

Sunday 9:00a-Noon (CC) 003A (R)

SPC 23.2 MOT/Rating Positive Displacement Compressors that Operate at Supercritical Temperatures of the Refrigerant (7/4) (Screen)

Monday 10:00a-Noon (H) Mission B (2)

SPC 25 MOT/Forced Convection and Natural Convection Air Coolers for Refrigeration (7/4)

Monday 7:45-9:15p (H) Bowie C (2)

SPC 29 MOT/Automatic Ice Makers (12)

Monday 4:15-6:15p (H) San Jacinto (2)

SPC 30 MOT Liquid Chilling Packages (6/10)(Screen)

Wednesday 8:00-10:00 (H) Bowie C (2)

SSPC 34 Designation & Safety Class. Of Refrig. (25/25) (Screen/E)

Monday 6:30-10:00p (H) Lone Star F (2)

SSPC 34 Designation Nomenclature (10/10) (screen/E)

Saturday 7:00-10:00a (H) Bonham B (3)

SSPC 34 Flammability (15/20)(screen/E)

Saturday 10:00-3:00p (H) Bonham B (3)

SSPC 34 Toxicity (10/20) (screen/E)

Sunday 6:30-10:00p (H) Bonham C (3)

SPC 40 MOT/Rating Heat Operated Unitary Air-Conditioning and Heat-Pump Equipment (5/5)

Monday 10:00-Noon (CC) 006B (R)

SSPC 41 Standard Methods for Measurement (12/8)

Sunday 1:00-4:00p (H) Goliad (2)

41.1 Temperature- Standard Method for Temperature Measurement (10/5)

Monday 8:00-10:00a (H) Bowie C (2)

41.2 Laboratory Airflow-Standard Method for Laboratory Airflow Measurement (10/5)

Monday 10a-Noon (H) Bowie C (2)

41.3 Pressure-Standard Method for Pressure Measurement (10/5)

Sunday 4:00-6:00p (H) Goliad (2)

41.4 Lubricant Content-Standard Method for Measurement of Proportion of Lubricant in Liquid Refrigerant (10/5)

Monday 10:00-Noon (H) Bowie A (2)

41.6 Humidity-Standard Methods for Measurement of Moist Air Properties (10/5)

Sunday 10:00a-Noon (H) Goliad (2)

41.7 Standard Methods for Gas Flow Measurement (10/5)

Tuesday 8:00 – 10:00a (H) Crockett A/B (4)

41.8 Standard Methods for Liquid Flow Measurement (10/5)

Tuesday 10:00-Noon (H) Crockett A/B

41.10 Calorimeter Test Methods for Volatile Refrigerants Mass Flow Measurements Using Flowmeters (10/5)

Monday 2:15-4:15 (H) Bowie C (2)

41.11 Power-Standard Methods for Power Measurement (10/5)

Monday 8:00a-10:00a (H) Bowie A (2)

SPC 51 Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating (15/10) (Screen)

Sunday 12:30-3:00p (H) Lone Star C (2)

SSPC 52.2P MOT/Part Size Eff. Proc. for Testing Air Cleaning Devices (20/30) (Screen)

Saturday 8:00-Noon (CC) 007B (R)

SSPC 55 Thermal Env Cond. for Human Occupancy (19/6) (screen)

Saturday 8:00a-3:00p (CC) 002B (R)

Sunday 9:00a-12p (CC) 006D (R)

SSPC 62.1 Ventilation and Acceptable IAQ in Commercial, Institutional and High-Rise Residential Buildings (30/30) (E/Screen)

Saturday 1:30-3:00p (H) Lone Star A (2)

Sunday 1:00-7:00p (H) Texas C (4)

SSPC 62.1 Education (15/15) (screen)

Friday 1:00-5:00p (CC) 007D (R)

Saturday 8:00a-12:30p (H) Lone Star A (2)

SSPC 62.1 Administration (15/15)(screen)

Friday 1:00-5:00p (CC) 008A (R)

Saturday 8:00a-12:30p (H) Bowie A (2)

SSPC 62.2 Ventilation and Acceptable IAQ in Low-Rise Residential Buildings (28/13)(Screen/Electric)

Friday 1:00-2:30p (CC) 007A (R)

Saturday 8:30-3:00p (H) Lone Star E (2)

SSPC 62.2 IAQ Subcommittee (12)

Friday 2:30-5:00p (CC) 002A (R)

SSPC 62.2 System Subcommittee (12)

Friday 2:30-5:00p (CC) 002B (R)

SSPC 62.2 Envelope Subcommittee (20)

Friday 2:30-5:00p (CC) 007A (R)

Standard 136 Subcommittee

Friday 9:00-Noon (CC) 007A (R)

SPC 72 MOT/Commercial Refrigerators and Freezers (11/10)

Sunday 1:00-5:00p (H) Presidio C (3)

SPC 79 MOT/for Rating Fan-Coil Conditioners (20/20) (Screen/E)

Saturday 8:00a-Noon (CC) 003A (R)

SPC 84-2008 MOT/Air-to-Air Heat/Energy Exchangers (10/4)

Tuesday 8:00-12:00p (H) Goliad (2)

SSPC 90.1 Energy Eff. Design of New Bldg. (Screen/E) (50/60)

Saturday 8:00a-12p (H) Texas C (4)

Sunday 9:00a-12p (H) Texas C (4)

Monday 8:00a-12p (H) Texas C (4)

Format & Compliance Subcommittee (4/6)(E)

Friday 5:00-10:00p (H) Mission A (2)

Saturday 1:00-5:00p (H) Travis C (3)

Sunday 4:00-7:00p (H) Republic C (4)

Mechanical Subcommittee (25/25)(screen/E)

Friday 9:00a-10p (H) Lone Star E (2)

Saturday 1:00-7:00p (H) Texas C (4)

Sunday 1:00-8:00p (H) Texas B (4)

Lighting Subcommittee (12/10)(screen/E)

Friday 9:00a-10p (H) Bonham E (3)

Saturday 1:00-7:00p (H) Presidio A (3)

Sunday 1:00-8:00p (H) Crockett A/B (4)

ECB Subcommittee (8/10) (E)

Friday 5:00-10:00p (H) Mission B (2)

Saturday 1:00-5:00p (H) Travis D (3)

Sunday 1:00-4:00p (H) Republic C (4)

Envelope Subcommittee (screen/E)(15/30)

Friday 9:00a-10:00p (H) Seguin (4)

Saturday 1:00-7:00p (H) Crockett C/D (4)

Sunday 1:00-7:00p (H) Lone Star E (2)

Daylighting WG (15/10) (Screen/E)

Friday 9:00-Noon (H) Bonham D (3)

Saturday 1:00-7:00p (H) Presidio C (3)

SSPC 90.2 Energy Eff. Design of New Low Rise Res. Bldg. (21/44)(screen/E)

Monday 2:15-6:15p (H) Lone Star B (2)
Tuesday 1:00-5:00p (H) Lone Star C (2)

SSPC 90.2 Lighting (4/4) (Screen/E)

Monday 6:15-9:15p (H) Independence (3)
Tuesday 8:00-Noon (H) Bonham E (3)

SSPC 90.2 Mechanical (6/6) (Screen/E)

Monday 6:15-9:15p (H) Republic C (4)
Tuesday 8:00-Noon (H) Mission A (2)

SSPC 90.2 Envelope (11/15) (Screen/E)

Monday 6:15-9:15 (H) Lone Star B (2)
Tuesday 8:00-Noon (H) Presidio B (3)

SPC 97 Sealed Glass Tube Method to Test the Chemical Stability of Materials for Use Within Refrigerant Systems (6/10)

Tuesday 9:30-11:00a (CC) 00B (R)

SPC 99 Refrigeration Oil Description (6/10)

Tuesday 8:00-9:30a (CC) 003B (R)

SPC 100 Energy Efficiency in Existing Buildings (20/20)(E/Screen)

Tuesday 8:00-12:00p (CC) 006A (R)

SPC 100 Section 5&6 Working Groups (15/5)

Sunday 8:30-10:30a (H) Lone Star F (2)

SPC 100 Section 4&7 Working Groups (15/10)

Monday 2:15-4:15p (H) Presidio B (3)

SPC 100 Lighting (5/5)

Monday 4:15-6:15p (H) Presidio B (3)

SPC 100 Sections 8, 9 & 10 Working Groups (15/10)

Monday 6:15-9:15p (H) Presidio B (3)

SPC 105 Standard Methods of Measuring and Expressing Building Energy Performance (30) (Screen)

Sunday 9:00a-1:00p (CC) 006A (R)

SPC 110 Fume Hood Testing (10)

Saturday 8:00a-Noon (H) Republic C (4)

SPC 118.1 MOT/Commercial Water Heaters (6/6)

Sunday 9:00-11:00a (H) Bonham A (3)

SPC 118.2R MOT/Rating Residential Water Heaters (19/15)

Tuesday 1:00-5:00p (H) Presidio B (3)

SPC 120 MOT/to Determine Flow Resistance of HVAC Ducts and Fittings (10)(screen)

Sunday 10:00-Noon (H) San Jacinto (2)

SPC 124 MOT/Rating Combination Space-Heating and Water Heating Appliances (15/5) (Screen)

Wednesday 8:00-Noon (H) Crockett A/B (4)

SPC 126 MOT/HVAC Air Ducts (10)(screen)

Sunday 8:00-10:00 (H) San Jacinto (2)

SPC 127 MOT/Rating Computer and Data Processing Room Unitary Air-Conditioners (9/6)

Tuesday 1:00-5:00p (H) Goliad (2)

SPC 129 Measuring Air Change Effectiveness (15/10)(Screen)

Sunday 5:00-7:00p (H) Presidio C (3)

SPC 130 MOT/for Rating Ducted Air Terminal Units (10/20) (Screen)

Sunday 2:00-6:00p (CC) 006B (R)

SSPC 134 Graphic Symbols (10/6)

Saturday 1:00-2:00p (H) Bowie A (3)

SSPC 135 BACnet (45/15)

Saturday 8:00-3:00p (H) Lone Star D (2)

Monday 8:00a-Noon (H) Texas B (4)

SSPC 135 (25)

Thursday (6/21) 8:00a-5:00p (H) Presidio B (3)

SSPC 135 Working Group (25)

Friday 8:00a-5:00p (CC) 007C (R)

Friday 8:00a-5:00p (CC) 008B (R)

SSPC 135 BACnet Working Group (25)

Sunday 8:30a-5:00p (CC) 102B (S)

SSPC 135 BACnet (25)

Sunday 8:00a-5:00p (CC) 008A (R)

SPC 139R MOT/for Rating Desiccant Dehumidifiers Utilizing Heat for the Regeneration Process (4/2)

Monday 8:00-10:00a (H) San Jacinto (2)

SSPC 140 Standard MOT for Evaluation of Bldg. Energy Analysis Computer Program (11/10) (screen)

Monday 2:15-6:15p (H) Presidio C (3)

SSPC 145P Test Methods for Assessing Performance of Gas Phase Air Clean. Equip. (11/15)(Screen/ E)

Sunday Noon-3:00p (H) Travis D (3)

SPC 147 Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment (20/6) (Screen)

Saturday 11:00a-3:00p (H) Bonham D (3)

Sunday 6:00-10:00p (H) Seguin (4)

SPC 150 MOT/Performance of Cool Storage Systems (6/2)

Sunday 5:30-7:00p (H) Bowie C (2)

SPC 152R MOT/Determining the Design and Seasonal Efficiencies of Residential Thermal Distribution Systems (8/6)

Sunday 8:00-Noon (H) Travis C (3)

SPC 154 Ventilation for Commercial Cooking Operations (10/10) (Screen)

Monday 2:15-6:15p (CC) 002A (R)

SPC 155P MOT/Rating Commercial Space Heating Boiler Systems (10/9)

Sunday 1:00-5:00p (H) Bonham B (3)

SPC 158.1 MOT/Capacity of Refrigerant Solenoid Valves (6/2)

Sunday 5:00-7:00p (H) Mission A (2)

SSPC 160 Criteria for Moisture Control Design Analysis (12/6) (Screen)

Tuesday 8:00a-Noon (H) Bonham B (3)

SPC 161P Air Quality Within Commercial Aircraft (25/10) (Screen)

Sunday 1:00-5:00p (CC) 006D (R)

Monday 8:00a-Noon (CC) 102B (S)

SPC 164.1 MOT/ for Residential Central-System Humidifiers (12/3)

Monday 8:00-10:00a (H) Bonham A (3)

SPC 164.3 MOT/Commercial and Industrial Humidifiers (10/4) (Screen)

Monday 10:00-Noon (H) Bonham A (3)

SSPC 169 Weather Data for Building Design Standards (10/15) (screen)

Monday 10a-Noon (CC) 006A (R)

SSPC 170 Ventilation of Healthcare Facilities (20/15) (screen)
Tuesday 8:00-1:30p (H) Seguin(4)

SSPC 170 Clinical Subcommittee (15/15)
Monday 4:15-6:15p (CC) 006A (R)

SPC 171 MOT/ of Seismic Restraint Devices for HVAC&R Equipment (7/5)

Tuesday 8:00-Noon (H) Republic C (4)
Wednesday 8:00-Noon (H) Presidio A (3)

SPC 173 MOT/Determine the Performance of Halocarbon Refrigerant Leak Detectors (5/2)

Monday 6:30-9:30p (H) San Jacinto (2)

SPC 175 Metal Pressure Vessel Testing (5/5)

Monday 4:15-6:15p (H) Crocket C/D (4)

SPC 177P MOT/Fractionation Measurement of Refrigerant Blends (7/10)(Screen)

Monday 8:00- 10:00a (H) Bonham B (3)

SPC 179P MOT/Life Testing Positive Displaced Compressors (6/10)

Sunday 1:00-4:00p (H) Bonham A (3)

SPC 181 MOT/Liquid-to-Liquid Heat Exchangers (8/10) (Screen)

Tuesday 9:00a-Noon (CC) 003A (R)

SPC 184 MOT/Field Testing Chillers (9/5) (screen)

Tuesday 8:00-Noon (H) Travis A/B (3)

SPC 185 MOT/UVC Lights for Use in Air Handling Units or Air Ducts to Inactivate Airborne Microorganisms (15/15) (Flipchart/screen)

Saturday 8:00a-3:00p (H) Bonham E (3)

SPC 188 Minimizing the Risk of Legionellosis Associated with Building Water Systems (35/10) (screen)

Tuesday 9:00-Noon (CC) 006C (R)

Tuesday 3:30-6:00p (CC) 006C

SSPC 189.1 ASHRAE/USGBC/IESNA Standard for the Design of High-Performance Green Buildings except Low-Rise Residential Buildings (40/40) (E/screen)

Wednesday 8:00a-2:00p (CC) 008A/B (R)

Working Group 9 (Materials and Resources) (10/10)

Tuesday 8:00-10:00a (H) Lone Star A (2)

Working Group 8 (IEQ) (20/20) (E/Screen)

Tuesday 8:00-11:00a (H) Lone Star B (2)

Working Group 10 (Plans and Operation) (30/20) (E/Screen)

Tuesday 10:00a-Noon (H) Lone Star A (2)

Working Group 7 (Energy Efficiency)(20/20) (E/Screen)

Tuesday 12:00-3:00p (H) Lone Star B

Working Group 6 (Water Use)(30/20)(E/Screen)

Tuesday 2:00-4:00p (H) Lone Star A

Working Group 75 (Energy Performance) (20/20)

Tuesday 3:00-6:00p (H) Lone Star B

Working Group 5 (Site Sustainability)(10/10)(E/Screen)

Tuesday 4:00-6:00p (H) Lone Star A

SPC 189.3 Design, Construction and Operation of Sustainable High Performance Health Care Facilities (14/10)(screen)

Monday 8a-Noon (H) Travis A/B (3)

Monday 2:00-3:00p (H) Travis A/B

SPC 190 MOT/Rating Indoor Pool Dehumidifiers for Moisture Removal Capacity and Moisture Removal Efficiency (6/6)

Tuesday 1:00-2:00p (H) Bonham A (3)

SPC 191 Water Conservation (15/10) (screen)

Sunday 9:00-11:00a (H) Independence (3)

Tuesday 8:00-Noon (CC) 008B

SPC 194 MOT/Direct-Expansion Ground Source Heat Pumps (5/10)

Sunday 1:00-4:00p (CC) 006A (R)

SPC 195P MOT/for Airflow Controls (10/5)

Tuesday 8:00-9:30a (H) Mission B (2)

SPC 196P MOT/ Measuring Refrigerant Leak Rates (12/5)

Sunday 6:00-10:00p (H) Travis C (3)

SPC 197 MOT/Attenuation Characteristics of Vibration Isolators (6/6) (screen)

Monday 4:15-6:30p (H) Independence (3)

SPC 198 MOT/Rating DX Dedicated Outdoor-Air Systems (6/6)

Tuesday Noon-1:00 p (H) Bonham A (3)

SPC 199 MOT/Rating the Performance of Industrial Pulse Cleaned Dust Collectors (9/4)(Screen)

Monday 8:00a-Noon (H) Presidio C (3)

SPC 200 MOT/Chilled Beams (20/20)(screen/E)

Monday 8:00-Noon (H) Lone Star F (2)

SPC 201P: Facility Smart Grid Information Model (35/20) (screen)

Monday 2:15-6:30p (CC) 006D (R)

Tuesday 8:00a-Noon (CC) 102A (S)

SPC 202 The Commissioning Process for Buildings & Systems (15/15)

Monday 8:00-Noon (CC) 102A (S)

SSPC 203 MOT/Determining Heat Gain of Office Equipment Used in Buildings (10/4) (screen)

Saturday 1:00-3:00 (H) Independence (3)

SPC 204P MOT/Rating Micro Combined Heat and Power Devices (11/5)

Monday 6:30-9:30p (H) Travis A/B (3)

SPC 205 Standard Representation of Performance Simulation Data for HVAC&R and Other Facility Equipment (13/20) (Screen)

Tuesday 8:00-10:00a (CC) 102B (S)

SPC 206 MOT/for Rating of Multi-Purpose Residential Heat Pumps for Space Conditioning, Water Heating and Dehumidification (14/6)

Monday 2:15-5:00 p (H) Bowie A (2)

SPC 207P-Laboratory Method of Test of Fault Detection and Diagnostics Applied Commercial Air-Cooled Packaged Systems (20/10) (Screen)

Monday 8:00a-Noon (CC) 008B (R)

SPC 209 Energy Simulation Aided Design (25/25)(Screen)

Tuesday 8:00a-Noon (CC) 006B (R)

SPC 210 MOT/for Rating Commercial Walk-in Refrigerators and Freezers

Monday 8:00-10:00a (H) Presidio A (3)

GUIDELINE PROJECT COMMITTEES (GPC) AND (SGPC)

SGPC 0-General Commissioning Process (12/6)

Saturday 8:00-12:00p (H) Crocket C/D (4)

GPC 1.2 Commissioning Process for Existing HVAC&R Systems (25/5) (Screen)

Friday 8:00a-5:00p (H) Crockett C/D (4)

GPC 1.3 Building Operation and Maintenance Training for the HVAC&R Commissioning Process (8/6)

Tuesday 1:00-5:00p (H) Republic C (4)

GPC 1.4 Systems Manual Preparation for the Commissioning Process (8/6)

Saturday 1:00-3:00p (H) Mission B (2)

GPC 1.5 Commissioning Smoke Control Systems (11/10) (screen/E)

Monday 2:15-4:15 (H) Lone Star E (1)

GPC 6, Refrigerant Information Recommended for Product Development and Standards (6)

Sunday 12:00-1:00p (H) Independence

SGPC-10 Interactions Affecting the Achievement of Acceptable Indoor Environments (12/10) (Screen)

Sunday 9:00-Noon (H) Bonham E (3)

SGPC 13 Guideline for Specifying Direct Digital Control Systems (15) (Screen/E)

Saturday 8:00-Noon (H) Bowie B (2)

GPC 14 Measuring Energy Demand and Water (7/8)(Screen)

Sunday 6:00-10:00p (H) Presidio A (3)

SGPC 20 Documenting HVAC&R Work Processes and Data Exchange Requirements (10)

Monday 10:15a-12:15p (H) Goliad (2)

GPC 23 Guideline for the Design/Application of HVAC Equip. for Rail Passenger Vehicles (12/3) (screen)

Monday 8:00-Noon (H) Seguin (4)

Tuesday 8:00-Noon (H) San Jacinto (2)

GPC 27P Procedures for Measurement of Gases in Indoor Environments (5/5) (flipchart)

Sunday 3:00-5:00p (CC) 007A (R)

GPC 32 Sustainable, High Performance Operations & Maintenance (10/10)

Sunday 1:00-3:00p (H) Travis C (3)

GPC 33P Guideline for Documenting Airflow and Contaminant Transport Modeling Studies (9/6)

Tuesday 11:00-Noon (H) Travis D (3)

OTHER

Thermal Performance of the Exterior Envelopes of While Buildings (30)

Sunday 5:00-11:00p (H) Bonham A (3)

Monday 9:00 a.m.-Noon (H) Crockett C/D (4)

USNC/IIR (20/10)

Tuesday 2:00-4:00p (H) Seguin (4)

USNT/IEA (20/10)

Tuesday 4:00-6:00p (H) Seguin

Cold Climate Heat Pumps/IEA

Saturday Noon-3:00p (H) Bonham A (3)

US TAG to ISO/TC 142 (30/10) (Screen)

Saturday 2:30-3:15p (CC) 007A (R)

US TAG to ISO/TC 205 (20) (Screen)

Tuesday Noon-2:00p (H) Mission B (2)

POLICY FOR SCHEDULING TC/TG/SPC MEETINGS

TC and TG meetings will be automatically scheduled on the same day and time based upon the previous meeting schedule. Any changes to the time slot must be made in writing. All TC/TG subcommittees must be scheduled for each meeting. All SPC meetings must be confirmed prior to scheduling audiovisual equipment and electric for laptops must be ordered for each meeting and only advance orders will be guaranteed. LCD projectors are not available.

NOTE: The parenthesis beside each committee represent the number of people expected to attend the meeting and any audiovisual equipment ordered. We encourage you to order audiovisual equipment in advance, as we are unable to guarantee that equipment will be available on-site. Every effort is made to accommodate room size versus number of committee members. If you have not supplied the Conferences Department with the number of members on your committee or subcommittee, we have no basis for room assignments.

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SPEAKER'S LIST

A

Abdelaziz, Omar, *Seminar 15*
Abellon, Devin A., *Seminar 14, Seminar 25 and Seminar 49*
Adams, Mike, *Seminar 17*
Aldous, Fiona, *Seminar 31*
Al-Hajri, Ebrahim, *Seminar 15*
Ally, Moonis R., *Conference Paper Session 2*
Ames, Mark R., *Seminar 52*
Androff, Pam, *Seminar 16*
Atkinson, Gaylen, *Seminar 30*
Ayub, Zahid, *Seminar 61*

B

Baert, Els, *Seminar 11*
Bailey, Nathan, *Seminar 9*
Banks, David, *Seminar 59*
Barker, Kimberly A., *Seminar 1*
Barnaby, Charles S., *Seminar 6 and Seminar 65*
Baxter, Van D., *Seminar 3*
Bean, Robert, *Seminar 49*
Bean PL(Eng.), Robert, *Seminar 14 and Seminar 25*
Becker, Henry A., *Conference Paper Session 11*
Bernhardt, Steven H., *Seminar 3*
Bildrbeck, Michael, *Seminar 38 and Seminar 45*
Bogart, Chris, *Seminar 54*
Bohanon, Hoy R., *Seminar 55*
Boudreaux, Philip R., *Technical Paper Session 7*
Brambley, Michael R., *Conference Paper Session 6*
Brendel, Michael, *Seminar 46*
Brennan, Terry, *Seminar 58*
Breslin, Kevin, *Seminar 2*
Brown, J. Steven, *Seminar 50*
Brundage, Donald, *Seminar 3*
Bruning, Steve, *Seminar 21*
Burnstein, Ron, *Seminar 9*

C

Cantrill, David, *Seminar 31*
Cappelletti, Francesca, *Conference Paper Session 5*
Carter, John J., *Seminar 43*
Cermak, John, *Seminar 46*
Chan, Ying-Chieh, *Conference Paper Session 7*
Chen, Qingyan, *Seminar 59*
Chen, Yuxiang, *Technical Paper Session 6*
Chiasson, Andrew, *Seminar 41*
Choksi, Rupal, *Seminar 48*
Choudhary, Manoj K., *Technical Paper Session 2*
Claesson, Johan, *Seminar 41*
Claridge, David E., *Seminar 51*
Clark, John, *Seminar 13*
Cockerham, Keith R., *Seminar 7*
Cohen, Jon J., *Technical Paper Session 5*
Conlan, Wade, *Seminar 19*
Connor, Michael, *Seminar 38 and Seminar 45*
Conover, David, *Seminar 53*
Contri, Michelle, *Conference Paper Session 10*
Coogan, James, *Seminar 20*
Cornick, Steven, *Seminar 58 and Seminar 65*
Cotton, James S., *Conference Paper Session 12*

Cox-Ganser, Jean, *Seminar 58*

Crawley, Drury, *Seminar 65*

Curtz, Molly, *Seminar 28*

D

Dean, Bill, *Seminar 51*
Dean, Jesse, *Seminar 57*
Delagah, Amin, *Forum 3*
Deru, Michael, *Conference Paper Session 14*
DesChamps, Nicholas H., *Seminar 34*
Dettmers, Daniel J., *Seminar 66*
Dobbs, Brian, *Seminar 66*
Dobbs, Gregory, *Conference Paper Session 3*
Domitrovic, Ronald, *Seminar 16*
Dubiel, Robert, *Seminar 20*
DuChane, Greg, *Seminar 5*
Duda, Stephen W., *Conference Paper Session 12 and Seminar 42*
Dugan, Matt, *Seminar 30*
Dunlap, John, *Seminar 55*
Dunn, Chuck, *Seminar 29*

E

Eardley, Mike, *Seminar 31*
Eichelberger, Curt, *Seminar 33*
Ellis, David, *Seminar 53*
Erell, Evyatar, *Seminar 65*

F

Filler, Mike, *Seminar 63*
Fisher, Daniel, *Seminar 21*
Fisher, Don, *Seminar 40*
Fisher, Larry J., *Seminar 36*
Foley, Gearoid, *Seminar 22*
Franconi, Ellen, *Seminar 57*
Frankenfield, Guy S., *Seminar 27*
Freihaut, James, *Seminar 22*
Friedman, Glenn, *Seminar 21*
Fumo, Nelson, *Technical Paper Session 5*
Fung, Alan S.,
Conference Paper Session 4 and Technical Paper Session 2

G

Gangemi, Nick, *Seminar 32 and Technical Paper Session 3*
Gercek, Ersin, *Seminar 15*
Gmitter, Nick, *Seminar 7*
Good, Ray, *Seminar 42*
Goodale, Richard, *Seminar 54*
Graham, Sean, *Seminar 35*
Gu, Lixing, *Technical Paper Session 4*
Gulick, Bob, *Seminar 8*
Guttman, Maureen, *Seminar 52*
Guzman, Sam, *Seminar 29*

H

Hachem, Caroline, *Technical Paper Session 9*
Hahn, Warren, *Seminar 38 and Seminar 45*
Halley, Jeffrey, *Seminar 54*
Hansen, Hans Brink, *Seminar 14*
Harriman, Lew, *Seminar 47 and Seminar 58*
Harvey, Michael, *Seminar 54*
Hassan, Samer, *Seminar 44*
Hayter, Richard B., *Seminar 52*
Hedman, Bruce, *Seminar 22*
Heinemeier, Kristin, *Conference Paper Session 8*

- Henck, Charles E.,
Technical Paper Session 6 and Technical Paper Session 10
- Hermansen, Knud A., *Technical Paper Session 3*
- Higgins, Jared A.,
Conference Paper Session 9 and Conference Paper Session 10
- Hill, Donald, *Seminar 37*
- Hitchcock, Robert J., *Seminar 6*
- Hodgson, David A., *Conference Paper Session 11*
- Holcomb, Chris, *Seminar 62*
- Horn, Brett L. Van, *Seminar 50*
- Hu, Jianjun, *Conference Paper Session 13*
- Huang, Gongsheng, *Seminar 44*
- Huber, Carl F., *Conference Paper Session 2*
- Hwang, Yuhno,
Seminar 15, Conference Paper Session 9 and Seminar 50
- I**
- Ilyas, Salman, *Conference Paper Session 5*
- Im, Piljae, *Conference Paper Session 10*
- Ito, Sei, *Conference Paper Session 14*
- J**
- Jennings, Judith, *Conference Paper Session 8*
- Johnson, Phillip, *Seminar 11*
- Jokar, Amir, *Seminar 61*
- Jones, Dennis, *Seminar 37*
- Jones, Lawrence, *Technical Plenary*
- Judkoff, Ron, *Seminar 7*
- K**
- Kahn, David, *Seminar 30*
- Kalvelage, Kelly, *Seminar 65*
- Kauffman, Robert E., *Technical Paper Session 8*
- Kazachki, Georgi, *Seminar 50*
- Kennedy, Daniel B., *Seminar 32*
- Kettler, Gerald, *Seminar 35*
- Kilcoyne, Joseph, *Seminar 1*
- Kim, Hyojin, *Conference Paper Session 3*
- Kissel, Markus, *Seminar 20*
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- Koh, Jaeyoon, *Seminar 16*
- Kohout, Francis, *Seminar 13*
- Kolandayan, Dominic, *Seminar 16*
- Krukowski, Andrea, *Seminar 48*
- Kuempel, John, *Seminar 19*
- Kulkarni, D., *Technical Paper Session 4*
- L**
- LaHiff, Megan, *Conference Paper Session 7*
- Lau, Josephine, *Seminar 43*
- Leasure, Joshua D., *Conference Paper Session 3*
- Leslie, Neil P., *Seminar 53*
- Lewis, Angela, *Technical Paper Session 4*
- Li, Yunhua, *Technical Paper Session 10*
- Lillie, E. Thomas, *Conference Paper Session 6*
- Livchak, Andrey, *Seminar 40*
- Lohrenz, Ed, *Seminar 27 and Seminar 63*
- Lowenstein, Andrew, *Seminar 54*
- Lutz, Jim, *Forum 3*
- M**
- Macauley, Dunstan, *Technical Plenary*
- Marriott, Carol E., *Forum 7*
- Mathis, R. Christopher, *Seminar 53*
- Maurer, Christine, *Conference Paper Session 14*
- Mayes, Scott, *Seminar 17*
- McClendon, James P., *Seminar 1 and Seminar 66*
- McDermott, Mike, *Seminar 8 and Technical Paper Session 9*
- McGinnis, Scott, *Seminar 54*
- McKew, Howard J., *Seminar 19*
- McQueeney, Michael, *Seminar 37*
- Meehan, Colin, *Seminar 62*
- Megerson, James E., *Seminar 37*
- Meteyer, Michael, *Technical Paper Session 7*
- Meyer, Tom, *Conference Paper Session 1*
- Mistry, Jiten, *Conference Paper Session 4*
- Morrison, Frank, *Forum 6*
- Moser, Dave, *Conference Paper Session 1*
- Moss, David, *Seminar 12*
- Motta, Samuel Yana, *Seminar 50*
- Mowris, Robert, *Conference Paper Session 8*
- Mueller, Chris, *Seminar 24*
- Munk, Jeffrey D., *Conference Paper Session 2*
- Musser, Amy, *Seminar 55*
- N**
- Nassif, Nabil,
*Conference Paper Session 4, Conference Paper Session 6
and Conference Paper Session 13*
- Novoselac, Atila, *Seminar 59*
- O**
- Ohadi, Michael M., *Seminar 61*
- Olesen, Bjarne W., *Conference Paper Session 5 and Seminar 5*
- Oliver, Patrick, *Seminar 10 and Seminar 33*
- O'Neill, Zheng, *Conference Paper Session 9*
- Ouazia, Boualem, *Conference Paper Session 13*
- P**
- Papadimos, Chris, *Seminar 33*
- Patterson, Michael K., *Seminar 4, Seminar 12 and Seminar 60*
- Peppin, Richard, *Seminar 23*
- Persily, Andrew, *Seminar 39 and Seminar 47*
- Pertzborn, Amanda, *Conference Paper Session 2*
- Peterman, Karl L., *Seminar 23*
- Petersen, Ronald, *Technical Paper Session 4*
- Philippe, Mikael, *Seminar 41*
- Phoenix, Thomas H., *Seminar 55*
- Poncia, Guido, *Conference Paper Session 11*
- Poots, Zaccary, *Seminar 10*
- Poskevich, Ronald, *Seminar 20*
- Poulad, Ebrahim M., *Technical Paper Session 6*
- Price, Andrew, *Technical Paper Session 2*
- Proctor, John, *Seminar 56*
- Pucciano, Frank, *Seminar 63*
- Punwani, Dharam V.,
Conference Paper Session 12 and Technical Paper Session 4
- Pyrka, Agatha E., *Conference Paper Session 5*
- Q**
- Quirk, David, *Forum 2 and Seminar 60*
- R**
- Rad, Farzin, *Conference Paper Session 11*
- Radermacher, Reinhard, *Seminar 41 and Seminar 44*
- Rajendran, Rajan, *Seminar 3*
- Rasmussen, Bryan, *Technical Paper Session 5*
- Ratcliff, Michael, *Seminar 26*

Raychaudhuri, Aresh, *Seminar 46*
 Reddy, T. Agami, *Technical Paper Session 10*
 Rhodes, Andrew, *Conference Paper Session 4*
 Rhodes, Joshua D., *Seminar 62*
 Ridouane, El Hassan, *Conference Paper Session 14*
 Rimmer, Drew, *Seminar 19*
 Rodgers, Brian, *Seminar 11*
 Roppel, Patrick, *Technical Paper Session 6*
 Rose, William B., *Seminar 47*
 Roth, Amir, *Seminar 57*
 Roth, Stephen, *Seminar 6*
 Rowley, Patricia F., *Conference Paper Session 11*
 Rumsey, Peter H., *Seminar 49*

S

Sakraida, Vincent A., *Seminar 2*
 Schaffer, Mark E., *Seminar 10*
 Schiavon, Stefano, *Seminar 8*
 Schmidt, Roger, *Seminar 4*
 Schoen, Lawrence, *Seminar 47*
 Schrock, Derek W., *Seminar 40*
 Schuerger, Bob, *Technical Paper Session 3*
 Schwedler, Mick, *Seminar 42*
 Scoggins, M. Ginger, *Technical Paper Session 1*
 Seeton, Christopher, *Forum 5*
 Seter, Justin, *Seminar 35*
 Seymour, Mark, *Seminar 12*
 Shadpour, Frank, *Seminar 9 and Seminar 36*
 Shah, M. Mohammed, *Technical Paper Session 3*
 Shahrestani, Mehdi, *Conference Paper Session 10*
 Shapiro, Leon, *Seminar 34*
 Sharp, Gordon, *Seminar 26*
 Shen, Hui, *Conference Paper Session 3*
 Shonder, John A., *Technical Paper Session 1*
 Siddiqui, Muhammad Umar, *Technical Paper Session 5*
 Siegel, Jeffrey, *Seminar 56*
 Simmonds, Peter, *Seminar 25 and Seminar 49*
 Simone, Angela, *Seminar 5*
 Sipes, Jerry, *Seminar 8*
 Slayzak, Steve, *Seminar 34*
 Sluga, John J., *Seminar 24*
 Smith, Cary, *Seminar 63*
 Smith, Lillian, *Conference Paper Session 7*
 Smith, Vernon A., *Seminar 40*
 Songkakul, Pornsak, *Seminar 1*
 Spielvogel, Larry, *Seminar 18*
 Spitler, Jeffrey, *Seminar 14 and Seminar 21*
 Stanke, Dennis, *Seminar 43*
 Stanley, W. Brad, *Conference Paper Session 13*
 Stein, Jeff, *Seminar 13*
 Steinbrecher, Robin A., *Seminar 4*
 Stoops, John, *Seminar 5*
 Stout, Charles, *Seminar 24*
 Sun, Wei, *Seminar 2*
 Sundell, Jan, *Seminar 39*
 Swan, Jason, *Seminar 23*
 Swann, E. Mitchell, *Forum 1*
 Swanson, Michelle, *Conference Paper Session 1*
 Sweetser, Richard, *Seminar 22*
 Swierczyna, Richard T., *Seminar 13 and Seminar 40*

T

Tabares-Velasco, Paulo Cesar, *Conference Paper Session 4*
 Talbot, Michael, *Seminar 25*
 Taneja, Om, *Seminar 18*
 Tang, Julian Wei-Tze, *Seminar 39*
 Tanha, Kamyar, *Conference Paper Session 10*
 Tardif, Michel, *Seminar 8*
 Thomann, Wayne, *Seminar 47*
 Thomas, Bose, *Seminar 67*
 Thornburg, Don, *Seminar 56*
 Torcellini, Paul A., *Forum 8*
 Townes, Holly, *Seminar 51*
 Tozer, Robert, *Conference Paper Session 12*
 Traylor, Jeff J., *Conference Paper Session 13*
 Treado, Stephen J., *Forum 4*
 Tubbs, Jeffrey, *Seminar 64*
 Turnbull, Paul, *Seminar 64*
 Turpin, Kate, *Seminar 57*

U

Umstot, David, *Seminar 9*

V

VanGilder, James, *Seminar 59*
 Vigil, Derrick, *Seminar 48*
 Vincent, Richard L., *Seminar 29 and Technical Paper Session 8*
 Vucci, John I., *Seminar 42*

W

Walki, Robert, *Seminar 17*
 Walter, William, *Seminar 11*
 Wang, Dexin,
Conference Paper Session 2 and Technical Paper Session 5
 Wang, Liangzhu (Leon), *Seminar 59*
 Wang, Na, *Conference Paper Session 9*
 Webb, William A., *Seminar 64*
 Webster, Tom, *Seminar 7*
 Weiland, Martin, *Seminar 67*
 Weimar, Dan, *Seminar 17*
 Welle, Benjamin, *Seminar 6*
 Wheeler, Dusty, *Seminar 51*
 Wilkinson, Ronald, *Seminar 18*
 Willis, Robert, *Seminar 27*
 Wills, Mark, *Seminar 52*
 Winters, Philip, *Seminar 56*
 Wirdzek, Philip, *Seminar 26*

Y

Yavuzturk, Cenk Cy, *Technical Paper Session 9*
 Young, Chariti, *Seminar 36*
 Yuill, Grenville K., *Seminar 43*

Z

Zhai, John, *Technical Paper Session 7*
 Zhang, Dahai, *Technical Paper Session 7*
 Zhang, Yanda, *Technical Paper Session 1*
 Zhang, Zhiqin,
Technical Paper Session 1 and Technical Paper Session 3



ASHRAE 2012 LEARNING INSTITUTE ANNUAL CONFERENCE COURSES – Full-Day Seminars & Half-Day Courses for In-Depth Instruction

All ASHRAE Learning Institute (ALI) seminars and courses will be held at either the Grand Hyatt San Antonio or the Henry B. Gonzalez Convention Center. Each seminar and course will carry Continuing Education Units (CEUs), Professional Development Hours (PDHs), and/or American Institute of Architects Learning Units (AIA LUs) which can be applied toward maintaining your P.E. licensure.

FULL-DAY PROFESSIONAL DEVELOPMENT SEMINARS

Registration fees: \$485 per course
\$395 for ASHRAE members

Completion of the seminar earns 6 PDHs/AIA LUs or .6 CEUs
(check with your state for their continuing education credit requirements)

SATURDAY, JUNE 23, 2012

The Commissioning Process in New and Existing Buildings (code 60)

8:00 am – 3:00 pm, Grand Hyatt San Antonio
Room: Travis A/B

This introductory seminar focuses on how the building commissioning process can be applied cost-effectively to new construction and existing facilities. The seminar describes the fundamentals of the commissioning process through each step of a new construction project from pre-design to occupancy and operations. Also discussed is how the commissioning process in existing facilities differs from new construction. Learn about the benefits of commissioning and understand how the process can improve the built environment, reduce environmental impacts through responsible resource utilization, improve the quality of design and construction, and raise the professional reputation of the entire commissioning team. Commissioning documentation, including an overview of commissioning specifications for new construction, is discussed.

Instructor: Rick Casault, P.E., Member ASHRAE

Healthcare Facilities: Best Practice Design & Applications (code 61)

8:00 am – 3:00 pm, Grand Hyatt San Antonio
Room: Bonham C

Based on the ASHRAE book HVAC Design Manual for Hospitals and Clinics, this course introduces up-to-dated healthcare design consideration and applications. Common medical terminology is introduced and how some terms have very different meaning between the medical and engineering communities. Infection particles and their transport mechanisms are covered, followed by infection control methods. Air distribution design for surgical and patient rooms is a major focus. Various control and energy efficiency techniques for cooling and heating plants are presented along with O&M and other commissioning topics.

Instructors: Robert Cox, P.E., Member ASHRAE; and Daniel Koenigshofer, P.E., Member ASHRAE, HFDP

HALF-DAY SHORT COURSES

Registration fees: \$159 per course
\$119 for ASHRAE members

Completion of the course earns 3 PDHs/AIA LUs or .3 CEUs
(check with your state for their continuing education credit requirements)

SUNDAY, JUNE 24, 2012

Basics of High-Performance Building Design (code 62)

3:30 pm – 6:30 pm, Henry B. Gonzalez Convention Center
Room: 007B

This course focuses on the basic applications of Standards 90.1 and 189.1 to achieve High-Performance Building Design. The intent of this course is to explain the differences in purpose and requirements between 189.1 and 90.1. Course content should be suitable for architects and engineers.

Instructor: Jeff Ross-Bain, P.E., Member ASHRAE, BEMP

Humidity Control: Applications, Control Levels and Mold Avoidance (code 63)

3:30 pm – 6:30 pm, Henry B. Gonzalez Convention Center
Room: 007C

Based on ASHRAE's best-selling Humidity Control Design Guide for Commercial and Institutional Buildings, this course includes

an in-depth discussion of moisture load calculations and how humidity control can be added to HVAC designs for seven different types of commercial buildings. The course covers the effects of different humidity levels on thermal comfort, corrosion, mold growth and airborne microorganism – information that helps the owner and designer define the optimal humidity control level for each application.

Instructor: Lew Harriman, P.E., Fellow ASHRAE

MONDAY, JUNE 25, 2012

Complying with Standard 90.1-2010: HVAC/Mechanical (code 64)

**2:30 pm – 5:30 pm, Henry B. Gonzalez Convention Center
Room: 007B**

This course presents the mechanical requirements from Standard 90.1-2010. Design professionals, code officials and building owners will benefit from this course, which presents the HVAC requirements and methods of compliance. The 2010 standard is a major revision with a goal of saving 30% more energy than the 2007 version. The HVAC/SWH sections of the standard, included in this course, have more than 50 updated requirements including first-time requirements for piping sizing.

Instructor: McHenry Wallace, P.E., AIA, Member ASHRAE, LEED® AP

Understanding Standard 189.1-2011 for High-Performance Green Buildings (code 65)

**2:30 pm – 5:30 pm, Henry B. Gonzalez Convention Center
Room: 007C**

Based on Standard 189.1-2011, this course provides the minimum requirements for the design, construction and plans for operation of high-performance green buildings, including new buildings and their systems, new portions of buildings and their systems

and new systems and equipment in existing buildings. The course presents the goals of establishing mandatory criteria in all topical areas, providing simple compliance options and the complement of green building rating program for Standard 189.1.

Instructor: Tom Lawrence, Ph.D., P.E., Member ASHRAE

TUESDAY, JUNE 26, 2012

Energy Management in New and Existing Buildings (code 66)

**9:00 am – 12:00 pm, Henry B. Gonzalez Convention Center
Room: 006D**

Sustained energy management is the quickest, cheapest, cleanest way to expand our world's energy supplies and reduce greenhouse gas emissions. This course weaves together energy management principles of the ASHRAE Handbook – HVAC Applications, Energy Star guidelines and practical experience of successful energy managers. The course prepares participants to apply energy management principles and the immediate actions they can take to improve the state of energy management in buildings under their care.

Instructor: Dakers Gowans, P.E., Member ASHRAE

Advanced High-Performance Building Design (code 67)

**2:00 pm – 5:00 pm, Henry B. Gonzalez Convention Center
Room: 006D**

This course focuses on advanced concepts involved in applying Standard 90.1 and 189.1 to achieve High-Performance Building Design. More emphasis will be placed on specific case study examples in this portion of the course in order to help the students go beyond the minimum requirements of these standards. Course content should be suitable for architects and engineers.

Instructor: Jeff Ross-Bain, P.E., Member ASHRAE, BEMP

