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ASHRAE 365 APP

ASHRAE has a new app to use at the conference. Download ASHRAE 365 for conference notifications, venue floor plans, Atlanta-area information and the option to connect with other attendees. You can also customize your schedule, participate in live audience polls and complete speaker evaluations. ASHRAE 365 will be available year-round to provide you with the latest information and resources from ASHRAE.

ASHRAE 365 is made possible through support from the following sponsors:



Download ASHRAE 365 now on the App Store or Google Play. For additional information, go to ashrae.org/365



KEISHA LANCE BOTTOMS
MAYOR



CITY OF ATLANTA

55 TRINITY AVE. S.W.
ATLANTA, GEORGIA 30303-0300

TEL (404) 330-6100

January 12, 2019

Greetings:

As the 60th Mayor of Atlanta, it is my pleasure to welcome attendees of the *2019 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) Winter Conference*.

We are proud to host the *2019 ASHRAE Winter Conference* in our beautiful city, where ASHRAE is headquartered. This four-day event will provide a platform for ASHRAE committees to connect and discuss innovative solutions and topics relevant to the HVAC&R industry. The conference will feature an AHR Expo and twenty professional development seminars for those seeking advanced training.

As you convene for the conference, the City of Atlanta recognizes ASHRAE's commitment, and we thank you for enhancing our communities through sustainable technology.

While visiting our city, I encourage all attendees to explore the world-class attractions Atlanta has to offer such as the Dr. Martin L. King Jr. Center, the Georgia Aquarium, the Atlanta BeltLine, the World of Coca-Cola, CNN Center, Centennial Olympic Park, Woodruff Arts Center, Atlanta Botanical Garden, Children's Museum of Atlanta, National Center for Civil and Human Rights, College Football Hall of Fame and many more. I hope you enjoy our Southern hospitality, sample our great restaurants and experience the rich and diverse heritage of our historic city.

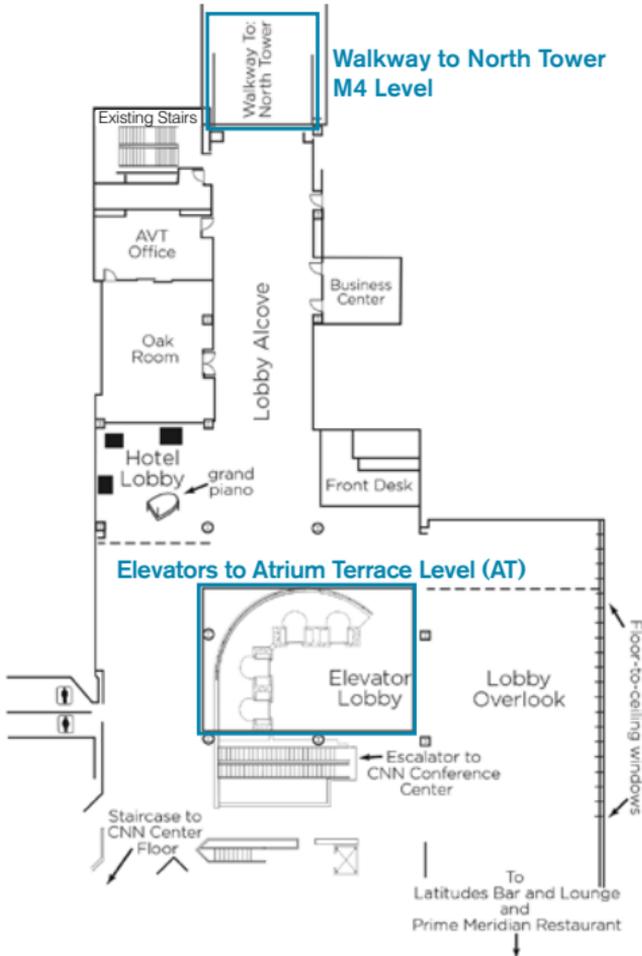
On behalf of the people of Atlanta, I offer my best wishes for a successful and productive conference.

Sincerely,

Keisha Lance Bottoms

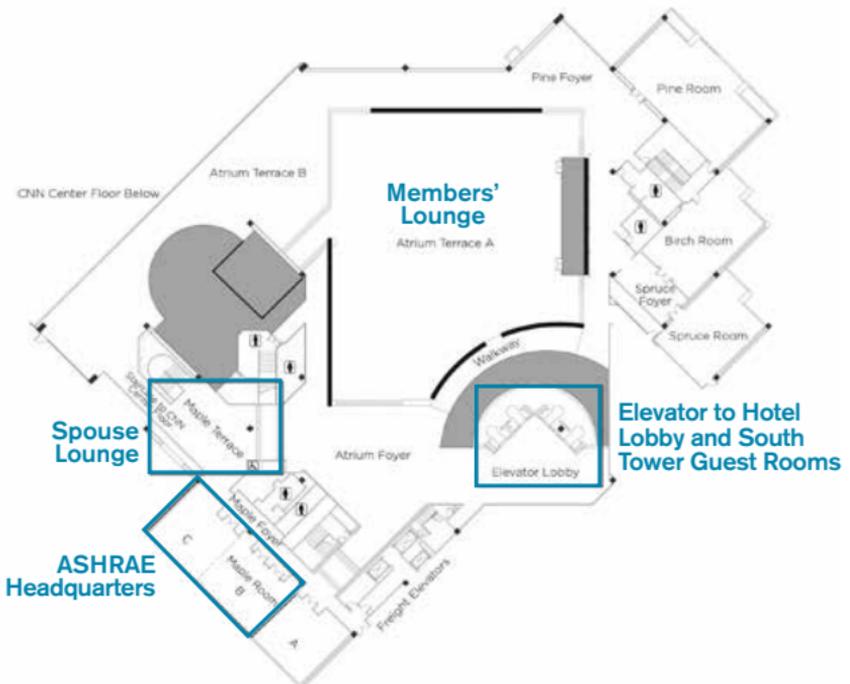
OMNI – SOUTH TOWER LOBBY

The South Tower Lobby includes the Oak meeting room which is located near the walkway to the North Tower, across from the Business Center. The Lobby also houses the Omni's restaurant and lounge. Use the South Tower elevators marked below to access the meeting rooms on the Atrium Terrace Level (AT) as well as all South Tower guest rooms. The escalator and stairs in the South Tower lobby will also take you down to the CNN Center food court for quick grab-and-go meal options.



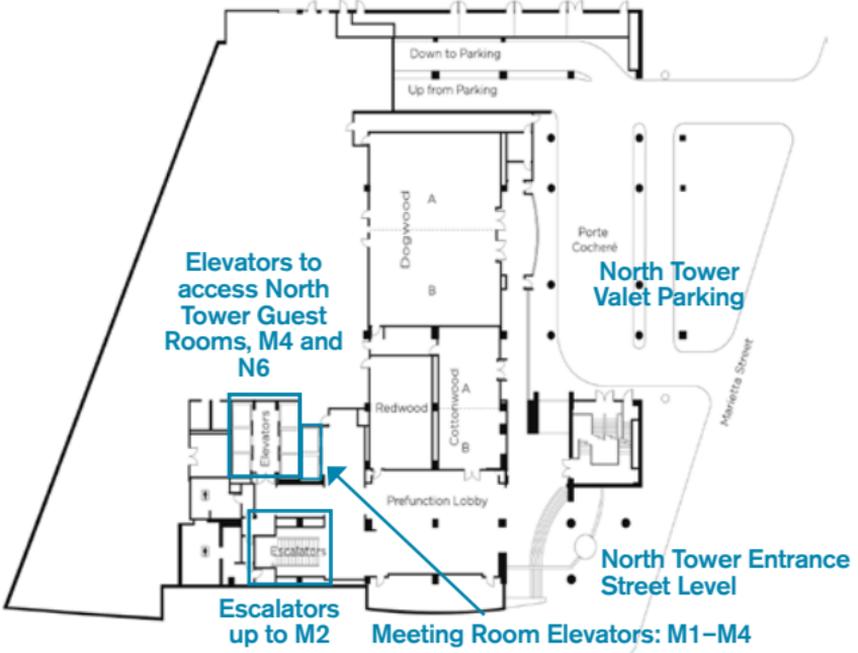
OMNI – ATRIUM TERRACE (AT)

Access the Atrium Terrace (AT) level meeting rooms by using the South Tower elevator bank located in the South Tower lobby.



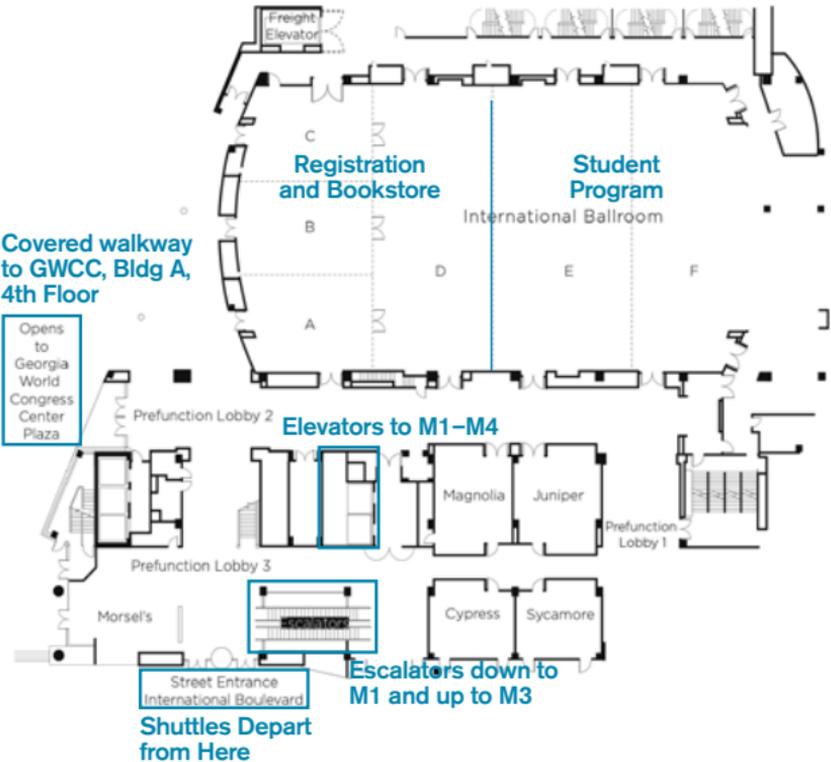
OMNI – M1, NORTH TOWER

From the street level on the North Tower side of the Omni (closest to College Football Hall of Fame), take the first set of elevators to access the meeting room floors: M2, M3 and M4. The second set of elevators access the North Tower guest rooms and N6 (Azalea, Forsythia and Lilac meeting rooms). The escalator will take you up to M2.



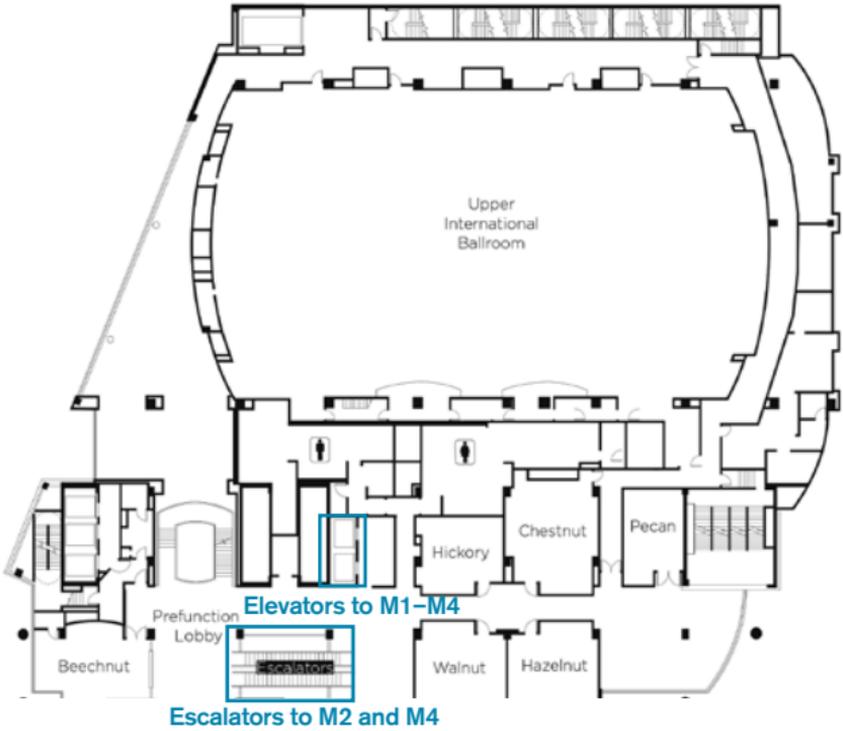
OMNI – M2, NORTH TOWER

To access the M2 meeting rooms, use the Meeting Room elevators or the escalator marked below. The covered walkway that connects the Omni to Building A of the Georgia World Congress Center (GWCC), is on this level near ASHRAE Registration and Bookstore (International A-D).



OMNI – M3, NORTH TOWER

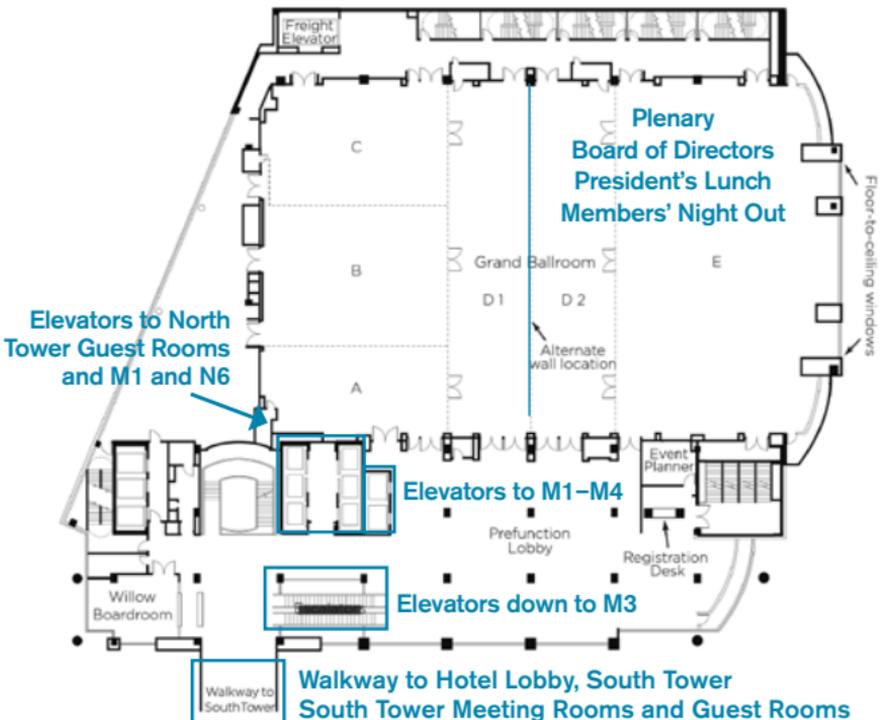
To access the M3 meeting rooms, use the Meeting Room elevators or the escalator marked below.



OMNI – M4, NORTH TOWER

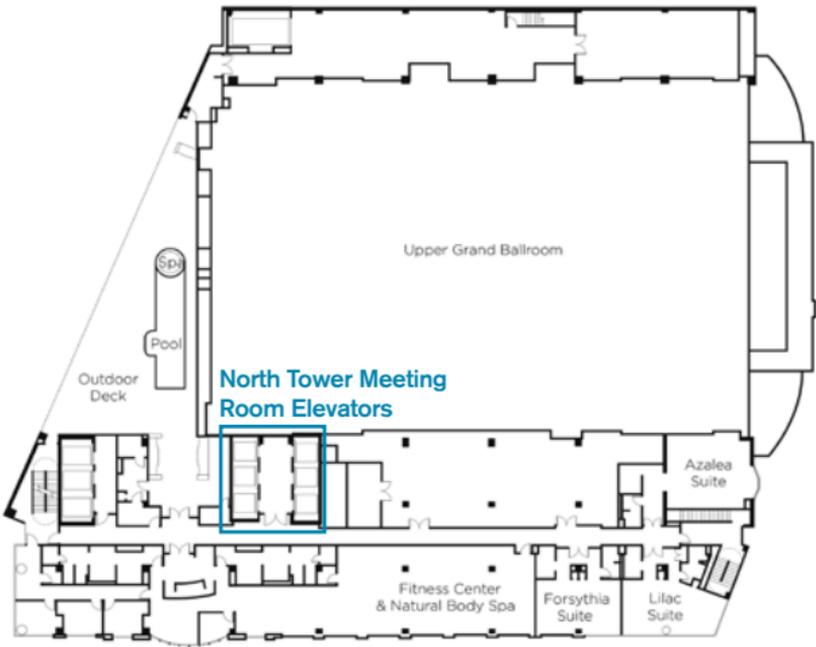
To access the M4 meeting rooms, use either set of elevators in the North Tower or the escalator marked below. Elevators marked below will also take guests to North Tower guest rooms and N6 with Omni guest key card access.

M4 is the level that connects the North Tower to the South Tower. Use the walkway on M4 to access the South Tower Lobby and elevators.



OMNI – N6, NORTH TOWER

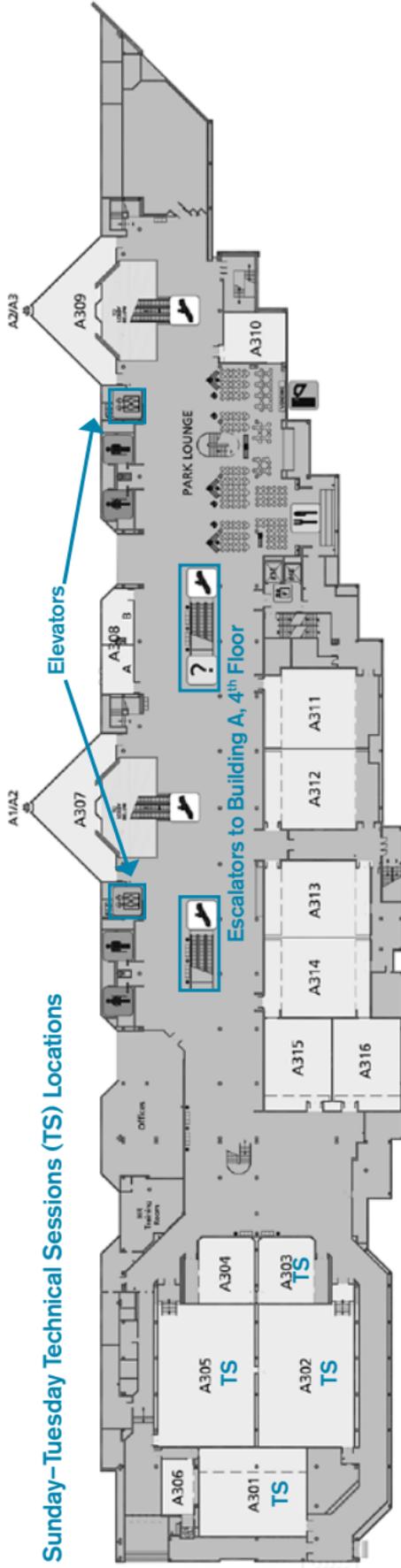
N6 can be accessed by using the guest room elevators in the North Tower on M1, M4 and any other guest room level. If you are staying at the Omni, your key card will give you access to N6. If you are not staying at the Omni, an elevator attendant is stationed to help attendees to get meetings on N6 during scheduled meeting times only.



notes

GWCC – BUILDING A, LEVEL 3

Use the escalators marked on the floor plan to access the 3rd floor from the 4th floor of Building A. Technical Sessions scheduled Sunday – Tuesday will take place in Building A as well as committee meetings. The 3rd floor of Building A does not connect to Building B, you must access Building B from the 4th floor of Building A.



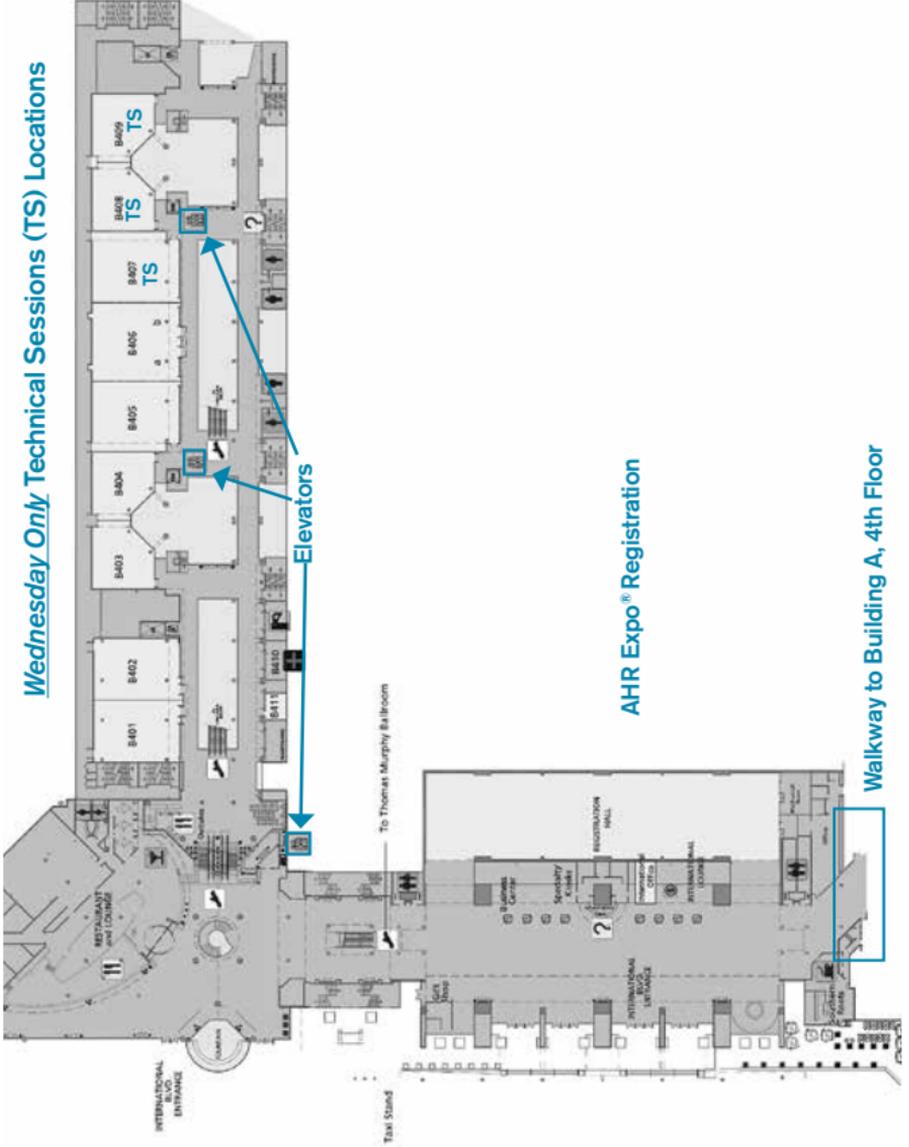
Sunday-Tuesday Technical Sessions (TS) Locations

Elevators

Escalators to Building A, 4th Floor

GWCC – BUILDING B, LEVEL 4

Use the walk way between Building A and Building B on the 4th floor to access Building B. Attendees entering the GWCC from Andrew Young International Blvd. can access Building B through the main lobby and registration area. On **Wednesday only**, some Technical Session rooms will move to Building B, 4th floor (marked below).



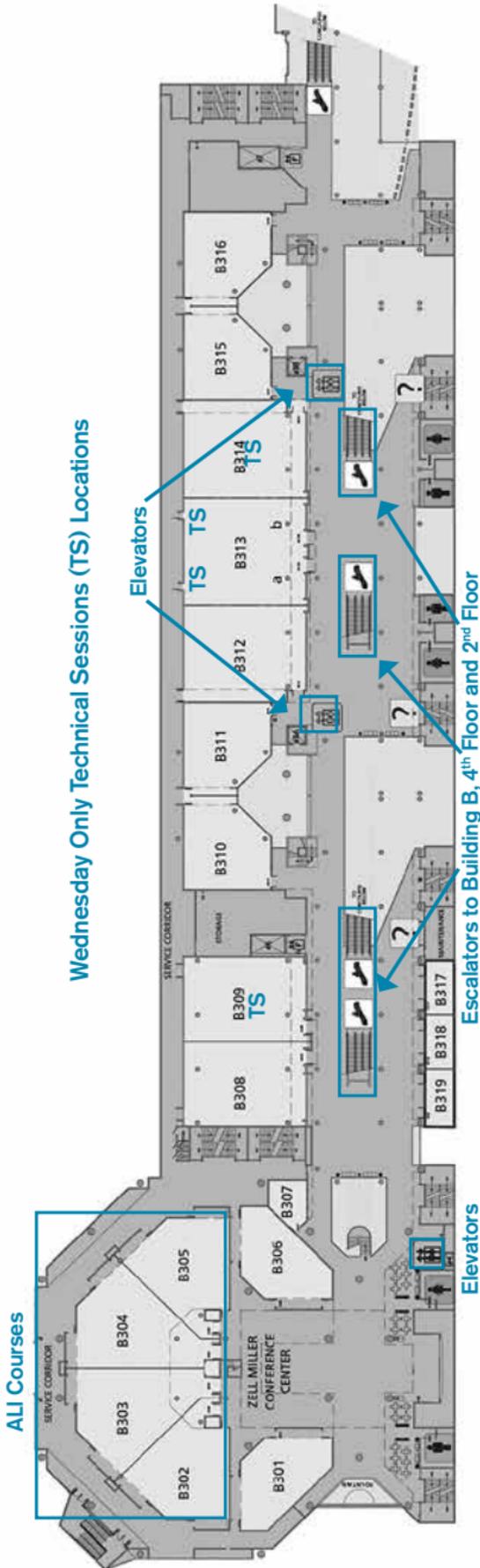
Wednesday Only Technical Sessions (TS) Locations

AHR Expo® Registration

Walkway to Building A, 4th Floor

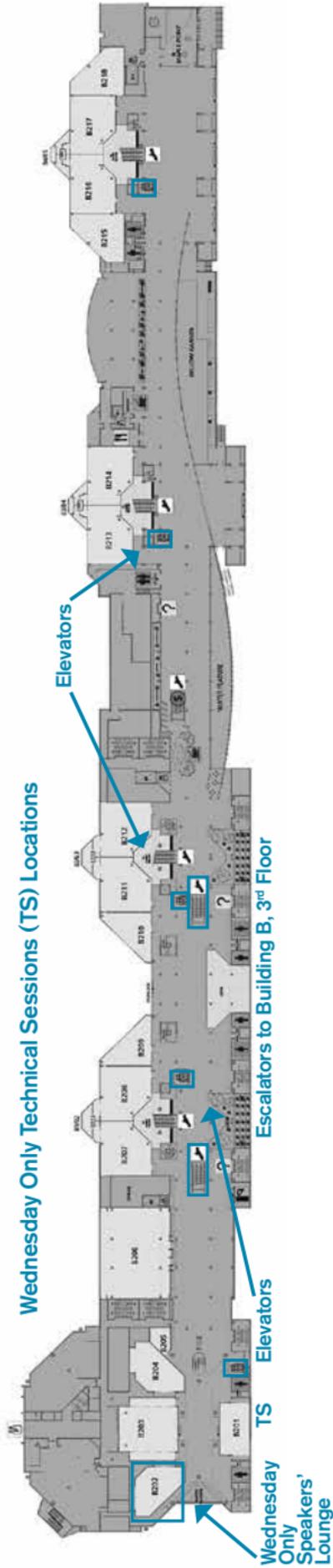
GWCC – BUILDING B, LEVEL 3

Use the escalators marked below to get from the 4th floor to the 3rd floor. On **Wednesday only**, some Technical Session rooms will move to Building B, 3rd floor (marked below).



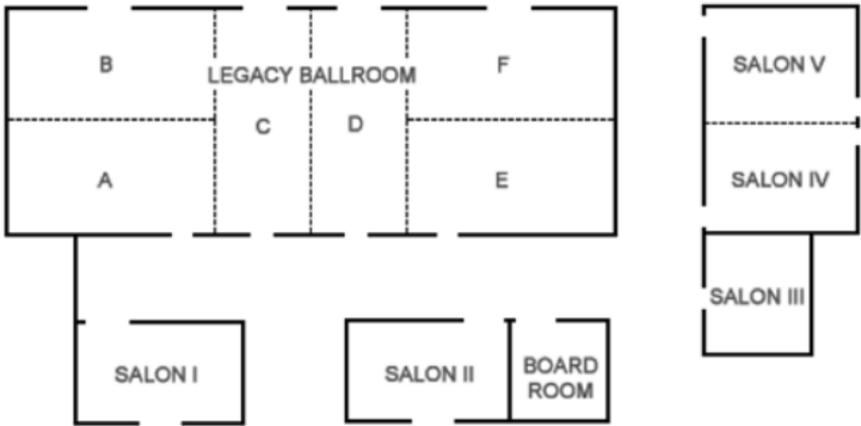
GWCC – BUILDING B, LEVEL 2

Use the escalators marked below to get from the 3rd floor to the 2nd floor. On **Wednesday only**, one Technical Session room and the Speakers' Lounge will move to Building B, 2nd floor (marked below).



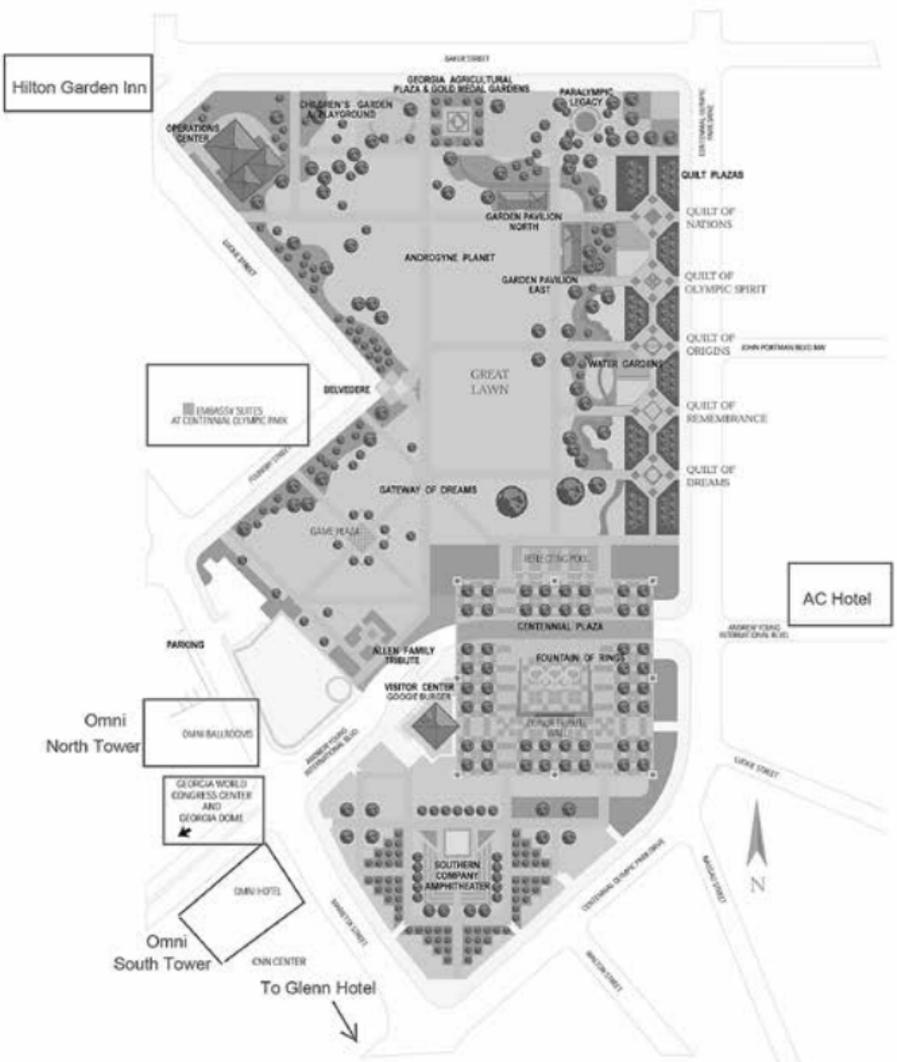
EMBASSY SUITES (ES) – LOBBY

SSPC 90.1 will meet at the Embassy Suites located at 267 Marietta St. NW, across the street from the North Tower side of the Omni. All meeting rooms at the Embassy Suites are located on the Lobby level.



CENTENNIAL OLYMPIC PARK

The ASHRAE overflow hotels are mapped out below around the Centennial Olympic Park.



CONFERENCE SPONSORS

ASHRAE thanks the following sponsors for their support of the 2019 ASHRAE Winter Conference:



TRANE®

Sponsor of the Women in ASHRAE Breakfast



Sponsor of the Keynote Speaker



Munters

Your Perfect Climate

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COILS™**

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Bell & Gossett

a xylem brand

Sponsor of the YEA Hospitality Reception

CHAPTER AND SOCIETY OFFICIALS

A special thanks to all the members in the Atlanta Chapter who helped make the 2019 ASHRAE Winter Conference a success!

ATLANTA CHAPTER OFFICERS

Irvin G. Sierra, *President*
Parker Brunelle, *Vice President*
Matthew R. Mumpower, *Secretary*
Pedro Pacheco, *Treasurer*

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Vice Chair, Meghan McNulty
Entertainment and Tours, Pam Immekus, Peggy Fritz,
Caroline Calloway
Sessions, Ben Coe, Matt Rowe
Hospitality, Charles Miltiades
Information and Publicity, Sarah Young

ASHRAE OFFICERS

Sheila J. Hayter, P.E., Fellow ASHRAE, *President*
Darryl K. Boyce, P.Eng., *President-Elect*
Charles E. Gulledge III, P.E., *Treasurer*
Julia A. Keen, Ph.D., P.E., *Vice President*
Michael CA Schwedler, *Vice President*
Dennis Knight, P.E., Fellow ASHRAE, *Vice President*
Farooq Mehboob, P.E., Fellow ASHRAE, *Vice President*
Jeff H. Littleton, *Executive Vice President*

CONFERENCES AND EXPOSITIONS COMMITTEE

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Michael M. Collarin, Vice Chair	M. Maggie Moninks
Corey B. Metzger, 2019 Winter Conference Chair	Carrie Anne Monplaisir
Devin A. Abellon	Leticia De Oliveira Neves
Vikrant C. Aute	Kimberly Pierson
Robert L. Cox	Sonya M. Pouncy
Gary C. Debes	Ashish Rakheja
Melanie Derby	Christine Reinders-Caron
Joseph T. Firrantello	Lee Riback
Ashu Gupta	Raul Simonetti
Richard D. Hermans	Marianna Vallejo
Stephen A. Idem	Daniel R. Rogers, BOD
Rupesh S. Iyengar	Ex-Officio
Nivedita Jadhav	Darryl K. Boyce, Coordinating Officer
Bing Liu	

GENERAL INFORMATION

BADGE SCANNING

Badges must be worn for admission to the technical program. Room monitors will scan badges at the door. The scanning process will provide you with a summary of all sessions attended at the conclusion of the conference and will be emailed to you. Please keep track of the sessions that you attend at the conference. If you do not desire to have a summary of the sessions you do not need to be scanned.

SESSION EVALUATIONS

Starting with the 2019 Winter Conference in Atlanta all speaker and session evaluations, including forums, will be made available via the ASHRAE 365 app. Evaluations are a very important aspect of the conference and provide for the valuable feedback needed to ensure the best speakers and programs are selected. Please complete session evaluations for every Technical Session you attend. Response cards are distributed to audience members that comment during Technical Paper sessions. Please complete the question/comment card and return it to a monitor or submit online at www.ashrae.org/QOnline. Questions are given to the author for reply and published with the Technical Paper in *ASHRAE Transactions*.

VENUE ADDRESS, TELEPHONE

Omni Atlanta Hotel at CNN Center

100 CNN Center NW, Atlanta, GA 30303
(404) 659-0000

Georgia World Congress Center

Building A and Building B
285 Andrew Young International Blvd NW, Atlanta, GA 30313

Embassy Suites Atlanta Centennial Olympic Park Hotel

267 Marietta Street, Atlanta, Georgia, 30313
(404) 223-2300

ON-LINE REGISTRATION

Need to register or buy a ticket for social events, tours, or Learning Institute courses? You can register online throughout the conference. You can also register during registration hours in International A-D on M2 level in the North Tower of the Omni. Come to registration to pick up your tickets or badge.

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 the Omni nor at GWCC.

INTERNET ACCESS

Wireless internet will be available in all meeting rooms at the Omni as well as the ASHRAE meeting rooms at the Georgia World Congress Center, Buildings A and B. Due to the number of users, please limit usage to functions that do not use excessive bandwidth such as Facebook, YouTube, streaming videos, etc. The username and password for WiFi at the Omni and the GWCC is the same for ASHRAE meetings:

Username: **ASHRAE2019**

Password: **atlanta19**

Username and passwords are case sensitive.

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.

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 Winter 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; however, Members' Night Out will be cocktail attire with a 1940s twist! Dazzle everyone with your 1940s era attire and accessories for the Gatsby Gang Jazz Band!

LOST AND FOUND

Items found during the conference should be turned into staff in the ASHRAE headquarters room, Maple BC, Atrium Terrace Level, South Tower of the Omni or at ASHRAE registration located in the International A-D, M2 Level, North Tower of the Omni. All items turned into ASHRAE lost and found will be given to Omni hotel security once the Conference ends.

TECHNICAL PROGRAM PDHs

All of the sessions presented in the technical program have been approved for professional development hours (PDHs),

including State of Florida PDHs. In addition, some sessions will be approved for State of New York PDHs and AIA Learning Units. Those programs are indicated with a  symbol. Sessions that are approved for LEED AP credits are indicated with a  symbol. Certain sessions may be acceptable for ASHRAE certification renewal. Send questions to certification@ashrae.org. Sign in sheets will be available in all session rooms for attendees to report their attendance for Florida PDHs and/or AIA learning units. Sessions are approved for 1 or 1.5 PDHs depending on the length of the session.

CONFERENCE PAPERS

During the Annual and Winter Conferences, papers presented in the technical and conference paper sessions can be purchased in the ASHRAE Bookstore onsite, as individual hard copies or a collection of downloadable PDFs. After the conference, all papers can be purchased in the ASHRAE Bookstore online (ashrae.org/bookstore). Final technical papers are published with discussion in ASHRAE Transactions. Papers are not available for seminars, forums, panels, workshops or debates. All papers published between the years 1980–1997 may be searched online in the Abstract Archive Center. Access to the Abstract Archives is a member benefit. For ordering information, contact ASHRAE Customer Service at 1-800-527-4723 or cservice@ashrae.org.

VIRTUAL CONFERENCE

Don't miss the state-of-the-art concepts and latest design techniques presented in the Society's technical program available through the virtual conference. The Atlanta Virtual Conference allows you to view presentations and to interact with an online audience through a discussion board. All registered conference attendees will receive an email notification when sessions are available for viewing. The email will include a link to the Atlanta Virtual Conference. If you do not have your password, go to www.ashrae.org/atlantavirtual 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, conference paper sessions, seminars, technical paper sessions and workshops.
- Ability to post comments and rate presentations.
- Print presentation slides in notes format.
- Ability to post questions or answers for selected sessions through Monday, January 28.
- Presentations available online for 18 months.

A full slate of technical programs will be posted beginning Monday, January 14, of the sessions that were presented the previous day, with additional content posted through Thursday, January 17.

Access to the Atlanta Virtual Conference is free with your conference registration. To register only for the Virtual Conference, go to ASHRAE Registration in International A-D, M2 Level, North Tower of the Omni, or register online.

\$249 ASHRAE member; \$445 non-member

AHR Expo®

See new products from 2,100+ Exhibitors

Georgia World Congress Center (GWCC)

285 Andrew Young Intl Blvd NW, Atlanta, GA 30313

If you have registered for the ASHRAE Winter Conference, your conference badge is your admission into the exposition.

If you are attending the exposition only and you did not register in advance, the fee for admission is \$30.00 and can be paid at GWCC. **Registration for the AHR Expo® will be open starting on Sunday, January 13 from 11:00 a.m. – 4:00 p.m.**

Show Hours:

Monday, January 22 10:00 a.m.–6:00 p.m.

(Registration opens at 8:00 a.m.)

Tuesday, January 23 10:00 a.m.–6:00 p.m.

(Registration opens at 9:00 a.m.)

Wednesday, January 24 10:00 a.m.–4:00 p.m.

(Registration opens at 9:00 a.m.)

You must be 18 years or older to be admitted to the show floor. Students ages 16 and 17 will be admitted on Show days but only if accompanied by an adult.

The Omni Hotel Atlanta at CNN Center is connected to GWCC and can be accessed from the M2 level of the North Tower. All other ASHRAE overflow hotels are all within walking distance to GWCC (see map on page 12).

- Embassy Suites by Hilton Atlanta at Centennial Olympic Park (0.3 mile walk to GWCC)
- Hilton Garden Inn Atlanta Downtown (0.4 mile walk to GWCC)
- Glenn Hotel (0.4 mile walk to GWCC)
- AC Hotel by Marriott Atlanta Downtown (0.4 mile walk to GWCC)

If you are staying at one of the AHR Expo Official Show hotels, free shuttle bus services will operate between official show hotels (or points nearby) on Show days (Monday – Wednesday). Be sure to check the schedule posted in your hotel lobby to confirm the times and exact pick-up location.

ARH Expo Shuttle Bus Hours of Operation:

Monday, January 14 7:00 a.m. – 7:00 p.m.

Tuesday, January 15 8:00 a.m. – 7:00 p.m.

Wednesday, January 16 8:00 a.m. – 6:00 p.m.

For more information on the AHR Expo, visit www.ahrexpo.com.

SAFETY TIPS

Street Safety. The streets of any city at any time can be unsafe. When you leave your hotel to go out during the day or the 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 are 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. 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.

EMERGENCY SITUATIONS

In case of an emergency, follow these instructions:

At the Omni

In case of an emergency at the Omni, please dial 911 first. All 911 calls made from a house phone will also notify the Omni's security department. The Omni security department is operational 24 hours a day and can be reached at (404) 818-4380.

The Omni has the ability to alert all guests via public address system in the event of an emergency or evacuation. Listen to the announcements made over the PA system for instructions on how to proceed.

At the GWCC

For all emergencies, it is requested that you contact the GWCC Police/Security Communications Center. The number (4911) can be dialed directly from a red courtesy phone located conveniently throughout the facility. If using a cellphone, dial 404-223-4911.

Emergencies are most effectively handled through in-house channels. Please provide the following information when calling:

- Type of emergency
- Number of people involved
- Location of emergency within the facility

The GWCC has the ability to alert all guests via public address system in the event of an emergency/evacuation.

The closest hospital is **Grady Memorial Hospital**, 80 Jesse Hill Jr Drive SE, approximately 1.3 miles away. The phone number is (404) 616-1000.

The closest precinct of the **Atlanta Police Department** is located at the CNN Center (Zone 5) at 190 Marietta St NW. The phone number is (404) 658-7830. Dial 911 for an emergency.

Fire Emergency

In case of a fire, dial 4911 from any red house phone at the GWCC or dial 911 from a house phone at the Omni. It is important not to panic. If a fire emergency does in fact happen, take all cues from security and venue staff. The Omni and GWCC will make any announcements about evacuation over the PA system that can be heard through the venue. In case of an evacuation, follow the instructions announced over the PA system and use the emergency exits which are clearly marked with illuminated signs that are supported by the emergency power system and continue to function even during periods of power outages.

Plan ahead—when you check into your room, check the location of exits. Walk to the nearest exit; learn the route, obstacles, etc. Keep your room key on the night stand when you are in your room. Examine your room. Check the windows to see if they open and how. Examine the area outside your window.

The closest fire station is **Atlanta Fire Rescue Station 1** at 71 Elliott St SW, 1 mile away. The phone number is (404) 546-7000.

MEALS

Meals are not included in your conference registration, however, we know that sometimes you have limited time to grab a quick meal between meetings and technical sessions. Here are few grab-and-go options, as well as other dining options, at the Omni and CNN Center.

Prime Meridian

Breakfast 6:30 – 11:00 a.m.
Lunch 11:30 a.m. – 2:30 p.m.
Dinner 5:00 – 10:00 p.m.
Full service restaurant located in the hotel lobby in the South Tower

Latitudes Bistro and Lounge

Monday – Saturday 3:00 – 10:00 p.m.
Sunday 3:00 p.m. – Midnight
Bar and Lounge with appetizers, small bites and sandwiches also located in the hotel lobby in the South Tower.

Morsel's

Open daily at 6:00 a.m.
Located on M2 of the North Tower, Morsels has grab-and-go snacks and coffee.

CNN Center Food Court

The CNN Center is connected to the Omni and across the street from GWCC. To access the CNN food court take the escalator in the Omni's hotel lobby in the South Tower down to the CNN Center. The following options are available at the CNN Center:

– Fast Casual –

Arby's · BurgerFi · Chick-fil-A · China Breeze · Dunkin Donuts · Fresh to Order · Great Wraps · Naturals · Moe's Southwest Grill

· Roman Delight Pizza & Pasta · Starbucks · Subway · Taco Bell
· TJ's Sandwiches

– Full-Service Restaurants –

Dantanna's · McCormick & Schmick's

Hours of operation vary and have been posted in the FAQ section of the ASHRAE 365 app.

THINGS TO DO IN ATLANTA

Stop by the Host Committee desk outside ASHRAE Registration and Bookstore area in International A-D, M2 of the North Tower at the Omni.

Check out the "Resources" section of the ASHRAE 365 app to find out for more information about the following local programs:

CityPass Attraction Pass for ASHRAE Attendees

Discounted tickets to local attractions.

Savings in the City

Printed savings card that gets you special offers on local ATL arts and culture, attractions, entertainment, restaurants, retail, etc.

Discover Atlanta App

Easy access to local restaurant, retail, events information as well as downtown maps and transportation.

Free and Fun Things to do in Atlanta

A list of free things to do while you are here in ATL!

FAMILY SERVICES

The Atlanta Convention and Visitors Bureau, recommends the following company for child care services while in Atlanta:

TLC Sitters of Atlanta

770-410-4774

www.tlcsittersofatlanta.com

ASHRAE makes no representation as to the quality or suitability of the child care options available. ASHRAE has done no investigation or inquiry into these options and accordingly assumes no liability for these services. All participants considering these facilities should perform their own investigation into the quality, suitability or desirability of these child care facilities.

MOTHERS' ROOM

ASHRAE is pleased to offer a private room to nursing mothers. The Mothers' rooms is located in the Planner Office on M4, North Tower of the Omni. Please visit the Registration Information desk in International A-D (M2, North Tower) to receive a key to the room. A refrigerator is also available.

COMPANION/GUEST GUIDE

ASHRAE MEMBER LOUNGE

Atrium Terrace, Atrium Terrace Level, South Tower, Omni

The ASHRAE Member Lounge is open daily for all individuals who are registered for the conference. Light refreshments are available in the morning each day and beverages are available all afternoon in both rooms.

SPOUSE LOUNGE

Maple Terrace, Atrium Terrace Level, South Tower, Omni

The Spouse Lounge is open daily with light refreshments available in the morning and beverages available all day. The lounge is open to all registered companions and guests, and is a great place to meet other guests of conference attendees. The Maple Terrace is accessible via the elevators in the lobby of the South Tower and is on the Atrium Terrace (AT) level.

Member and Spouse Lounge Hours:

Saturday, January 12	7:30 a.m.–3:00 p.m.
Sunday, January 13	7:30 a.m.–4:00 p.m.
Monday, January 14	7:30 a.m.–4:00 p.m.
Tuesday, January 15	7:30 a.m.–4:00 p.m.
Wednesday, January 16	7:30 a.m.–1:00 p.m.

MEET AND GREET

Grand Ballroom C, M4, North Tower, Omni

Monday, January 14

9:30–11 a.m.

The Meet and Greet, open to all registered companions and guests, gives companions an opportunity to meet with old friends and greet new ones.

Join Chef Greg Wright, the Omni's Executive Chef, for a cooking class with an Atlanta twist. Attendees have the opportunity to learn how to make Coca-Cola peanut brittle – an Atlanta favorite and with the main ingredient as Georgia's official state crop! And of course, tasting is the best part. Attendees will get to savor their new recipe and creation.

Light refreshments will be served.

notes

SOCIAL EVENTS

PLENARY SESSION KEYNOTE SPEAKER – GRANT IMAHARA

Grand Ballroom DE, M4, North Tower, Omni
Saturday, January 12 • 3:15 – 5:00 p.m.



Kick off the ASHRAE Winter Conference with the opening Plenary session. ASHRAE award winners are recognized and updates on the Society will be presented.

For almost a decade, Grant Imahara was one of the hosts of Discovery Channel's Mythbusters. Using a blend of science and fun, he put urban legends to the test, sometimes with explosive results.

Sponsored by:



WELCOME PARTY

Fernbank Museum of Natural History
Saturday, January 12 • 6:30 – 8:30 p.m.
Cost: \$60

Enjoy good company with other ASHRAE members and conference attendees under the Tyrannosaurus Rex in the Great Hall. Grab a cocktail and catch up with friends under the stars in the Star Gallery. Take a Walk Through Time in Georgia and explore other permanent exhibits which will be open to all party goers.

Shuttle service is provided starting at 5:40 p.m. Shuttles depart on Andrew Young International Blvd., at the M2 level of the North Tower outside of Morsel's. Shuttles will begin to depart Fernbank at 8:00 p.m.

Menu

Appetizers

- *Coca-Cola Braised Short Ribs On Sweet Potato Chip Jalapeno Creme Fraiche*
- *Rosemary Biscuits Carved Virginia Ham Honeycup Mustard*
- *Sizzling Shrimp and Grits, Smoked Gouda Cheese, Andouille Sausage, Pepper and Onion Hash*
- *Blistered Tomato and Goat Cheese On Goji Crisp, Fried Basil*
- *Chicken and Waffle Bites, Bourbon Maple Drizzle*

Stations

- *Macaroni and Cheese Bar, Three Cheese Mac with numerous topping selections*
- *Peach Pulled Pork, Smoky Peach BBQ Sauce, Bread and Butter Pickles, Asiago Cheese Rolls*
- *Fried Pickles and Okra, Spicy Buffalo Sour Cream*
- *Meatloaf Sliders, Applewood Bacon, Tomato Jam, Frizzled Onions*
- *Crispy Buttermilk Chicken, NC Slaw, Sourdough Roll*
- *Fried Green Tomato Sliders, Pimento Cheese, Micro Greens*
- *House-made Chips, Yukon Gold + Sweet Potato with Blue Cheese Fondue*

Your ticket includes (2) drink tickets.

WOMEN IN ASHRAE BREAKFAST

Grand Ballroom C, M4, North Tower, Omni

Monday, January 14 • 7:00 – 8:30 a.m.

Cost: \$25

Come and listen to ASHRAE 2018-19 Society President, Sheila J. Hayter, P.E., Fellow ASHRAE, at the Women in ASHRAE Breakfast. Everyone is welcome and coffee and breakfast will be served!

Sponsored by:  **TRANE**

PRESIDENT'S LUNCHEON

Grand Ballroom DE, M4, North Tower, Omni

Monday, January 14 • 12:15 – 2:00 p.m.

Cost: \$50

2018-19 ASHRAE President Sheila Hayter provides an update on her presidential theme. Major contributors to the ASHRAE RP Campaign are also recognized.

Doors open at 12:00 p.m.

LIFE MEMBERS' LUNCHEON

Maple A, Atrium Terrace Level, South Tower, Omni

Tuesday, January 15 • 12:00 – 1:30 p.m.

Cost: \$35

Enjoy lunch, share ideas about the future of technology and swap memories of the Society while dining with Life Members. This is for members who have completed 30 years of continuous membership and are at least 65 years of age.

MEMBERS' NIGHT OUT

Grand Ballroom DE, M4, North Tower, Omni

Tuesday, January 15

Cost: \$60

Reception and Cash Bar

6:15 p.m.-7:15 p.m.

Grand Ballroom Foyer

Dinner and Entertainment

7:15 - 10:00 p.m.

Dress in your best 1940s attire and dance the night away to the Gatsby Gang Jazz Band. Start the evening with a cocktail reception followed by dinner and dancing. Music from Duke Ellington, Ella Fitzgerald, Frank Sinatra, Nat King Cole and others will have you dancing the night away. Attire for the evening is cocktail attire (coat and tie and cocktail dresses). Dazzle everyone with your 1940s era attire!

HOW TO GET THE MOST OUT OF THE ASHRAE CONFERENCE

ASHRAE conferences provide opportunities for you to learn about the latest technology in the HVAC&R industry, express your opinion about controversial issues, explore new applications for fundamental ideas, to meet the people behind those ideas and to help shape the Society that serves your profession.

Whether you are attending your first conference or your tenth, chances are that you will have questions about what is available, which events you want to attend, how to hear one speaker without missing another or where to go to give input regarding a standard or research project. The following summary should answer some of your questions and aid you in getting the most out of an ASHRAE conference and meeting.

SHARING TECHNOLOGY:

The ASHRAE Conference Technical Program

The technical program for the ASHRAE Conference includes technical paper sessions, conference paper sessions, seminars, workshops and forums. Check the program book or ASHRAE 365 app to see what you want to attend. You can jump between sessions if you want to hear one specific presentation in each session. Host committee volunteers will be at the door checking and scanning badges.

See page 53 for more information on the five types of sessions that are presented in the Technical Program.

PowerPoint presentations with audio descriptions are posted online in the Virtual Conference for all Technical Paper Sessions, Conference Paper Sessions, Seminars and Workshops. The Virtual Conference is included with full Conference registration.

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 to be awarded. 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.

ADVANCING THE INDUSTRY: SOCIETY MEETINGS

The technical expertise of ASHRAE is concentrated in its technical committees, task groups and technical resource groups, which are responsible for preparing the ASHRAE Handbook volumes, initiating and supervising Society research projects, presenting programs at ASHRAE conferences, reviewing technical papers and evaluating the need for standards.

To be a member of a technical committee (TC), you must be active in the field addressed by the committee. You do not have to be an ASHRAE member to participate in a technical committee, nor do you have to be a member of a technical committee to attend committee meetings.

Standards project committees (SPCs) are appointed specifically by the Standards Committee to develop and revise standards to reflect technical advances in the areas that they cover. To qualify for membership in a committee, you must be knowledgeable in the discipline of the proposed standard.

A schedule of all meetings is included in the conference program and ASHRAE 365 app. Attendance at TC and SPC meetings is open. Please consult your schedule and plan to attend the committee meetings that interest you.

SUPPORT SERVICES

The ASHRAE Bookstore and Membership Desk are set up on site to offer conference participants the latest information about the industry and to answer questions concerning ASHRAE membership.

ASHRAE publications, including conference papers, are available for sale in the ASHRAE Bookstore. Located in the registration area the bookstore features a display of books devoted entirely to the HVAC&R industry. Publications from ASHRAE's publications catalog, as well as a variety of new publications and books from allied organizations are on display. ASHRAE publications may be purchased individually on site, or you may wish to order several books and have them shipped to you at a later date or use the online bookstore at www.ashrae.org/bookstore.

The Membership Desk is located in the registration area. Membership applications are available, as well as brochures about the HVAC&R industry and information on student membership. Registrants paying the non-member registration fee receive their first year of membership free. To obtain membership an application form must be submitted with the meeting registration form or within 60 days following the meeting. A staff member will be present during registration hours to assist you.

Networking: Getting Involved

ASHRAE conferences and meetings provide an international setting for attendees to gather and exchange ideas, to explore possibilities in the industry and to examine its problems. Opportunities to get involved range from presenting a conference paper to participating in a seminar or attending committee meetings. By reviewing your program and planning ahead, you can ensure that the conference will be a success instead of a series of missed opportunities.

AWARDS PRESENTATION

Saturday, January 12, 2019, 3:15–5:00 p.m.

Plenary Session

Grand Ballroom DE, M4, North Tower, Omni

STUDENT DESIGN PROJECT COMPETITION

“Given in recognition of outstanding student research and design projects”

HVAC DESIGN CALCULATIONS

First Place: Jack Buckley, Madeline Sampsel, Austin Seagren, Christopher Wozny

University of Nebraska – Lincoln

HVAC SYSTEM SELECTION

First Place: Kevin J. Clark, Madison Hopfinger, Evan Reese, Whitney Luck, Andres Saldivar

Kansas State University

INTEGRATED SUSTAINABLE BUILDING DESIGN

First Place: Vasileios Filis, Myrto Ananida, Oluwatobi Gbadebo, Alexandre Hugo Matthieu, William McCann, Salvador Ordorica, Ashutosh Kumar Ojha, Marie K. Rottschaefer, Siddharth Swaminathan

The Pennsylvania State University and Technical University of Denmark

THE SETTY FAMILY FOUNDATION APPLIED ENGINEERING CHALLENGE

First Place: Iik Wahyu Anggara, Katon Vembriarto Widayaswara, Yoga Hutomo Putra, Mohammad Ilham Akbar, Fahmi Rizaldi

Bandung Institute of Technology

TECHNOLOGY AWARDS

“Given in recognition of innovative designs that comply with ASHRAE standards for indoor air quality and energy efficiency”

First Place

“Recognizing the first place ASHRAE Technology Award project which demonstrates the most outstanding achievement in the design and operation of energy efficient buildings”

Category I – Commercial Buildings – New

Dwight Schumm and Tim Lentz for Indian Creek Nature Center Amazing Space

Owner Representative, John Myers, Indian Creek Nature Center

Category I – Commercial Buildings – Existing

Hiroki Kawakami, Hiroaki Takai, Kazuki Wada and Kogi Tanaka for TAKENAKA Corporation Higashikanto Branch Office Renovation

Owner Representative, Hiroshi Suzuki, Takenaka Corporation

Category I – Commercial Buildings – EBCx

John Tsingas and **David Eldridge** for 801 Grand,
Des Moines, IA

Owner Representative, Bill Johnson, Principal Financial Group

Category II – Educational Facilities – New

Michael P. Sherren for Wilde Lake Middle School

Owner Representative, Scott Washington, Howard County
Public School System

Category II – Educational Facilities – Existing

Morgan Heater for Westside School

Owner Representative, Ted Kalmus, Westside School

Category II – Other Institutional Buildings – New

David Meyer, Jaimeeganleong Wilson, Eric LePore, and
Alfred Rodgers for Koffman Southern Tier Incubator

Owner Representative, Daniel Mori, Koffman Southern Tier
Incubator

Category V – Public Assembly – New

Sarah Berseth and **Scott Lichty**, Ramsey County Library –
Shoreview

Owner Representative, Carol Morpew, Ramsey County
Property Management

Category V – Public Assembly – Existing

Dominic Desjardins, Maurice Landry and **André-Benoît
Allard** for Montreal Olympic Park's Integrated Performance
Contracting Project

Owner Representative, Maurice Landry, Olympic Park

HONORARY MEMBER

*“Given to recognize notable persons of preeminent professional
distinction”*

William Henry Gates, III

Medina, Washington

E.K. CAMPBELL AWARD OF MERIT

*“Given in recognition of outstanding service and achievement in
teaching”*

William P. Bahnfleth, Ph.D., P.E., Presidential Fellow
Member ASHRAE

University Park, Pennsylvania

**ASHRAE AWARD FOR DISTINGUISHED
PUBLIC SERVICE**

*“Given to recognize members who have performed outstanding
public service in their community and, in doing so, have helped
to improve the public image of the engineer”*

Patricia T. Graef, P.E., Life Member, Fellow ASHRAE
Fort Myers, Florida

JOHN F. JAMES INTERNATIONAL AWARD

“Given to an ASHRAE member who has done the most to enhance the Society’s International activities”

Stephen Gill, C.Eng.,
Nottingham, United Kingdom

ASHRAE FELLOW

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

Fred S. Bauman, P.E., Life Member, Berkeley, California
Alexander S. Butkus, P.E., Life Member, Evanston, Illinois
Charles Eley, P.E., BEMP, San Francisco, California
Kenneth M. Elovitz, P.E., Worcester, Massachusetts
Paul W. Francisco, Champaign, Illinois
Hwataik Han, Ph.D., P.E., Seoul, South Korea
Yunho Hwang, Ph.D., College Park, Maryland
Arthur A. Irwin, Halifax, Nova Scotia, Canada
James Kamm, Ph.D., P.E., Life Member ASHRAE,
Toledo, Ohio
Kathleen Owen, Cary, North Carolina
Gary Phetteplace, Ph.D., P.E., Life Member, Lyme,
New Hampshire
Elbert (Bert) Phillips, P.Eng., Life Member, Winnipeg,
Manitoba, Canada
Michael A. Pouchak, P.E., Golden Valley, Minnesota
Dharam V. Punwani, Naperville, Illinois
M. Ginger Scoggins, P.E., Cary, North Carolina
James R. Tauby, P.E., Hauppauge, New York
Philip C.H. YU, Ph.D., C.Eng., Hong Kong

ASHRAE HALL OF FAME AWARD

“Given to honor deceased members who have made milestone contributions to the growth of ASHRAE-related technology”

George Bedley Hightower, P.E.

notes

ROOMS/HOURS

FINDING YOUR ASSIGNED MEETING ROOM

Please refer to the Omni, GWCC and Embassy Suites floor plans located on pages 3–12.

The Omni's meeting space is located on levels M1–M4 and N6 in the North Tower, and on the Lobby level and Atrium Terrace level (AT) in the South Tower.

ASHRAE Technical sessions and committee meetings are located in Buildings A and B of the Georgia World Congress Center (GWCC). Building A's 4th floor is connected to the Omni on the M2 level of the North Tower. Sessions and meetings in Building A are located on levels 3 and 4. Sessions and meetings in Building B are located on levels 2-4.

SSPC 90.1 is the only committee and subcommittees meeting at the Embassy Suites. All meeting space is on the Lobby level. See page 12 for more information.

CONFERENCE REGISTRATION

International A-D, M2 level, North Tower, Omni

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

Friday, January 11	10:00 a.m.–5:00 p.m.
Saturday, January 12	7:15 a.m.–6:00 p.m.
Sunday, January 13	7:00 a.m.–5:00 p.m.
Monday, January 14	7:00 a.m.–5:00 p.m.
Tuesday, January 15	7:30 a.m.–4:30 p.m.
Wednesday, January 16	7:30 a.m.–11:00 a.m.

ASHRAE BOOKSTORE AND LOGO STORE

International A-D, M2 level, North Tower, Omni

More than 300 books, conference 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 and ASHRAE logo items. The ASHRAE Bookstore will be open during the following hours:

Friday, January 11	10:00 a.m.–5:00 p.m.
Saturday, January 12	7:15 a.m.–6:00 p.m.
Sunday, January 13	7:00 a.m.–5:00 p.m.
Monday, January 14	7:00 a.m.–5:00 p.m.
Tuesday, January 15	7:30 a.m.–4:30 p.m.
Wednesday, January 16	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.

SPEAKERS' LOUNGE

A406/407, 4th Floor, GWCC, Building A

The Speaker's Lounge will be open during the following hours:

Saturday, January 12	1:00 p.m.–3:00 p.m.
Sunday, January 13	7:00 a.m.–5:00 p.m.
Monday, January 14	7:00 a.m.–12:15 p.m. and 1:30–5:00 p.m.
Tuesday, January 15	7:00 a.m.–5:00 p.m.
Wednesday, January 16	7:00 a.m.–1:00 p.m.*

(New Room: B202, 2nd Floor, GWCC, Bldg B)

**For Wednesday, January 16 only, the Speakers' Lounge will be relocated to room B202, 2nd Floor, GWCC, Building B.*

MEMBERSHIP DESK

International A-D, M2 level, North Tower, Omni

The membership information desk is available for paying dues, applying for membership, updating membership information. 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

Maple BC, Atrium Terrace (AT) level, South Tower, Omni

The ASHRAE Headquarter office offers members complimentary copying and access to printers for laptop computers.

Friday, January 11	12:00 p.m.–5:00 p.m.
Saturday, January 12	8:00 a.m.–5:00 p.m.
Sunday, January 13	8:00 a.m.–5:00 p.m.
Monday, January 14	8:00 a.m.–5:00 p.m.
Tuesday, January 15	8:00 a.m.–5:00 p.m.
Wednesday, January 16	8:00 a.m.–1:00 p.m.

ASHRAE MEMBER LOUNGE

Atrium Terrace, Atrium Terrace (AT) level, South Tower, Omni

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

Saturday, January 12	7:30 a.m.–3:00 p.m.
Sunday, January 13	7:30 a.m.–4:00 p.m.
Monday, January 14	7:30 a.m.–4:00 p.m.
Tuesday, January 15	7:30 a.m.–4:00 p.m.
Wednesday, January 16	7:30 a.m.–1:00 p.m.

More information about the ASHRAE Member Lounge can be found on page 22.

ASHRAE SPOUSE LOUNGE

Maple Terrace, Atrium Terrace (AT) level, South Tower, Omni

The lounge will be open to all registered companions/guests during the following hours:

Saturday, January 12	7:30 a.m.–3:00 p.m.
Sunday, January 13	7:30 a.m.–4:00 p.m.
Monday, January 14	7:30 a.m.–4:00 p.m.
Tuesday, January 15	7:30 a.m.–4:00 p.m.
Wednesday, January 16	7:30 a.m.–1:00 p.m.

More information about the ASHRAE Spouse Lounge can be found on page 22.

ATLANTA HOST DESK

Outside International A-D, M2 level, North Tower, Omni

Stop by the Atlanta Host Committee to receive information about local Atlanta recommendations and discounts on dining, retail and entertainment.

KANSAS CITY ANNUAL CONFERENCE INFORMATION,

International A-D, M2 level, North Tower, Omni

Information on the upcoming Annual Conference scheduled for June 22–26, 2019 at the Marriott Downtown Kansas City and the Kansas City Convention Center in Kansas City, MO, will be available in the registration area.

YOUNG ENGINEERS IN ASHRAE (YEA)

YEA Hospitality Reception, Grand Ballroom A, M4 level, North Tower, Omni

Attention young professional members age 35 and younger! You are invited to visit the YEA Hospitality reception on Sunday, January 13, from 4:00 p.m.–6:00 p.m. The reception offers social and networking opportunities and light refreshments will be served.

Sponsored by:  **Bell & Gossett**
a xylem brand

LEADERSHIP U

At each ASHRAE conference, the Leadership U program gives four future ASHRAE leaders the opportunity to shadow an ASHRAE Board member, providing a high level conference experience and unique networking opportunity. This program is operated by the Young Engineers in ASHRAE (YEA) Committee and more information can be found at www.ashrae.org/yea. The Leadership U participants for the 2019 ASHRAE Winter Conference are:

Kevin Muldoon, Louisville Chapter, Region VII

Ahmed Abdel-Salam, Saskatoon Chapter, Region XI

Blair Richardson, Connecticut Chapter, Region I

Randika Amarasuriya, Sri Lankan Chapter, Region-at-Large

STUDENT PROGRAM

A special program for students will take place at the 2019 Winter Conference. Events and activities include a mixer, technical talks, a design competition session, student congress and a tour. Students are also encouraged to attend recommended technical sessions throughout the conference.

All Student Program activities will take place in International EF, M2 level, North Tower of the Omni.

Student Welcome

Saturday, January 12

1:00 – 3:00 p.m.

Hear welcoming remarks from ASHRAE President Sheila Hayter followed by presentations by recipients of last year's



Dr. Christine
Darden

Grant program, an awards ceremony and talk from Dr. Christine Darden. Dr. Darden is an internationally recognized authority in the field of sonic-boom minimization and is one of the researchers featured in the book *Hidden Figures: The American Dream and the Untold Story of the Black Women Mathematicians Who Helped Win the Space Race* (2016),

a history of some of the influential African-American women mathematicians and engineers at NASA in the mid-20th century, by Margot Lee Shetterly.

YEA and STUDENT MIXER

Saturday, January 12

5:00 – 6:30 p.m.

Mix and mingle with Young Engineers in ASHRAE (YEA) and Technical Committee members. Meet new friends, win prizes in our group poker run activity, and enjoy free food and drinks.

STUDENT PROGRAM

Sunday, January 13

8:00 a.m. – 1:30 p.m.

The program will feature a discussion on ASHRAE's Design Competition, technical talks, a group design build challenge, plus roundtable discussions over lunch.

STUDENT TOUR

The Kendeda Building for Innovative Sustainable Design and the Living Building Challenge at Georgia Institute of Technology

Sunday, January 13

1:30 – 3:00 p.m. and 2:30 – 4:00 p.m.

\$25

See page 41 for more details.

LOCATION OF MEETINGS

Please refer to the venue floor plans located in this program on pages 3–12 for more information locations of meeting rooms and how to access the different venues and levels.

MEETING SCHEDULE

A more detailed schedule can be found using the “Schedule” section of the ASHRAE 365 app. Attendees can also create their own schedule using the ASHRAE 365 app.

FRIDAY, JANUARY 11

8:00 a.m.–5:00 p.m. **Committee Meetings**

See listing on pages 98–128

10:00 am–5:00 pm **Registration and ASHRAE Bookstore**
International A-D, M2 level, North Tower, Omni

SATURDAY, JANUARY 12

7:15 a.m.–6:00 p.m. **Registration and ASHRAE Bookstore**
International A-D, M2 level, North Tower, Omni

7:30 a.m.–3:00 p.m. **ASHRAE Member Lounge**
Atrium Terrace, AT level, South Tower, Omni

Spouse Lounge, Maple Terrace,
AT level, South Tower, Omni

See description on page 22

8:00 a.m.–5:00 p.m. **Committee Meetings**

See listing on pages 98–128

9:00 a.m.–12:30 p.m. **Certification Exams**
Pecan, M3 level, North Tower, Omni

More information on page 52

1:00–3:00 p.m. **Speakers’ Lounge**
A406/407, 4th Floor, GWCC, Building A

1:00–3:00 p.m. **Student Welcome**
International EF, M2 level, North Tower, Omni

Special Event

3:15–5:00 p.m. **Meeting of the Members**

Plenary Session, Grand Ballroom DE,
M4 level, North Tower, Omni

Opening and Welcoming Remarks
by ASHRAE President Sheila Hayter

Welcome by Director and Chair,
Region IV, Billy Austin

Secretary’s Report by Executive Vice
President Jeff Littleton

Awards Presentation

See description on page 23

Keynote Address: Grant Imahara

See description on page 23

Plenary Session is open, no badge nor registration is required to attend. Doors open at 3:00 p.m.

5:00–6:30 p.m.

YEA/Student Mixer

International EF, M2 level, North Tower, Omni

Special Event

6:30–8:30 p.m.

Welcome Party

Fernbank Museum of Natural History

Ticket required.

Shuttle service is provided starting at 5:40 p.m. Shuttles depart on Andrew Young International Blvd., at the M2 level of the North Tower outside of Morsel's. Shuttles will begin to depart Fernbank at 8:00 p.m.

See description on page 23

SUNDAY, JANUARY 13

7:00 a.m.–5:00 p.m.

Speakers' Lounge

A406/407, 4th Floor, GWCC, Building A

7:00 a.m.–5:00 p.m.

Registration and ASHRAE Bookstore

International A-D, M2 level, North Tower, Omni

7:30 a.m.–4:00 p.m.

ASHRAE Member Lounge

Atrium Terrace, AT level, South Tower, Omni

Spouse Lounge, Maple Terrace, AT level, South Tower, Omni

8:00 a.m.–4:45 p.m.

Technical Sessions

3rd and 4th Floor, GWCC, Building A

See Technical Program on pages 55–97

8:00 a.m.–5:00 p.m.

Committee Meetings

See listing on pages 98–128

9:00–9:30 a.m.

Networking Coffee Break

3rd and 4th Floor, GWCC, Building A

9:00 a.m.–1:30 p.m.

Student Program

International EF, M2 level, North Tower, Omni

1:00–5:00 p.m.

General Tour: All About Atlanta

See description on page 39

1:30–3:00p.m. &
2:30–4:00 p.m.

Student Tour: The Kendeda Building for Innovative Sustainable Design and the Living Building Challenge at Georgia Institute of Technology

See description on page 41

3:30–5:30 p.m.

Technical Tour: Omni Atlanta at CNN Center North Tower Central Plant Tour.

See description on page 40.

4:00–6:00 p.m. **Young Engineers in ASHRAE (YEA) Hospitality Reception**
Grand Ballroom A, M4 level, North Tower, Omni
Attention members age 35 and younger—you are invited to visit the YEA Hospitality Reception, offering social and networking opportunities. Light refreshments will be available.
See description on page 32

MONDAY, JANUARY 14

7:00–8:30 a.m. **Women in ASHRAE Breakfast**
Grand Ballroom C, M4 level, North Tower, Omni
See description on page 24

7:00 a.m.–12:15 p.m. **Speakers' Lounge**
A406/407, 4th Floor, GWCC, Building A

7:00 a.m.–5:00 p.m. **Registration and ASHRAE Bookstore**
International A-D, M2 level, North Tower, Omni

7:30 a.m.–4:00 p.m. **ASHRAE Member Lounge**
Atrium Terrace, AT level, South Tower, Omni
Spouse Lounge, Maple Terrace, AT level, South Tower, Omni

8:00 a.m.–12:00 p.m. **Technical Sessions**
See Technical Program on pages 55–97

9:30–11:00 a.m. **ASHRAE Meet and Greet**
Grand Ballroom C, M4 level, North Tower, Omni
See description on page 22

8:00 a.m.–5:00 p.m. **Committee Meetings**
See listing on pages 98–128

10:00–11:45 a.m. **Student Congress**
Dogwood A, M1 level, North Tower, Omni

10:00 a.m.–6:00 p.m. **AHR Expo®**
GWCC, Buildings B and C
The M2 level, North Tower of the Omni connects to GWCC Building A via a covered walkway.
See description on page 18

11:00 a.m.–5:00 p.m. **Technical Sessions at AHR Expo®**, B313a and B313b, 3rd floor, GWCC, Building B.
See description on page 75–79.

Special Event

- 12:15.–2:00 p.m. **President's Luncheon**
Grand Ballroom DE, M4 level, North Tower, Omni
Doors open at 12:00 p.m.
Ticket required.
See description on page 24
- 1:30–4:00 p.m. **Speakers' Lounge**
A406/407, 4th Floor, GWCC, Building A
- 2:15–3:45 p.m. **Technical Sessions**
See Technical Program on pages 55–97
- 2:30–5:30 p.m. **General Tour:**
College Football Hall of Fame.
Ticket required.
Technical Tour: Engineered Biosystems Building at Georgia Tech.
Ticket required.
See descriptions on pages 39 & 40
- After 5:00 p.m. **Regional Dinners**
Sign up in ASHRAE registration area.

TUESDAY, JANUARY 15

- 7:00 a.m.–5:00 p.m. **Speakers' Lounge**
A406/407, 4th Floor, GWCC, Building A
- 7:30 a.m.–4:00 p.m. **ASHRAE Member Lounge**
Atrium Terrace, AT level, South Tower, Omni
Spouse Lounge, Maple Terrace, AT level, South Tower, Omni
- 7:30 a.m.–4:00 p.m. **Registration and ASHRAE Bookstore**
International A-D, M2 level, North Tower, Omni
- 8:00 a.m.–4:45 p.m. **Technical Sessions**
See Technical Program on pages 55–97
- 8:00 a.m.–5:00 p.m. **Committee Meetings**
See listing on pages 98–128
- 9:00 a.m.–1:00 p.m. **General Tour:** Atlanta's Heroes.
Ticket required.
See description on page 39
- 10:00 a.m.–6:00 p.m. **AHR Expo[®]**
GWCC, Buildings B and C
See description on page 18
- 12:00–1:30 p.m. **Life Members' Lunch**
Maple A, AT level, South Tower, Omni.
Ticket required.
See description on page 24

- 1:00–2:00 p.m. **Technical Tour:** Georgia World Congress Center Central Plant Tour.
Ticket required.
- 1:30–3:00 p.m. **Technical Tour:** The Kendeda Building for Innovative Sustainable Design and the Living Building Challenge Tour at Georgia Tech.
Ticket required.
- 2:30–5:30 p.m. **General Tour:** Atlanta Movie Tour.
Ticket required.
See descriptions on page 40

Special Event

- 6:15–7:15 p.m. **Reception**
Grand Ballroom Foyer, M4 level, North Tower, Omni
- 7:15–10:30 p.m. **Members' Night Out**
Grand Ballroom DE, M4 level, North Tower, Omni.
Ticket required.
See description on page 24

WEDNESDAY, JANUARY 16

- 7:00 a.m.–1:00 p.m. **Speakers' Lounge** **NEW LOCATION: B202, 2nd floor, GWCC, Building B**
- 7:30–11:00 a.m. **ASHRAE Registration**
International A-D, M2 level, North Tower, Omni
- 7:30 a.m.–1:00 p.m. **ASHRAE Bookstore**
International A-D, M2 level, North Tower, Omni
- 7:30 a.m.–1:00 p.m. **ASHRAE Member Lounge**
Atrium Terrace, AT level, South Tower, Omni Spouse Lounge, Maple Terrace, AT level, South Tower, Omni
- 8:00 a.m.–12:30 p.m. **Certification Exams**
C213, 2nd Floor, GWCC, Building C.
More information on page 52
- 8:00 a.m.–12:30 p.m. **Technical Sessions** **NEW LOCATIONS:**
2nd–4th floors, GWCC, Building B
New Technical Session rooms on Wednesday only are: B201, B309, B313a, B313b, B315, B407, B408, B409.
See Technical Program on pages 55–97
- 8:00 a.m.–5:00 p.m. **Committee Meetings**
See listing on pages 98–128
- 10:00 a.m.–4:00 p.m. **AHR Expo®**
GWCC Buildings B and C
See description on page 18

TOURS

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 last minute cancellations. If you have a stand-by ticket, please be prepared to pay by credit card or exact cash at the bus. Tour tickets may be purchased at the ASHRAE registration desk located in International A-D, M2 level, North Tower, Omni.

Longer descriptions of tours can be found in the ASHRAE 365 app and at www.ashrae.org/atlanta.

All tours depart from the Street Entrance (Andrew Young International Blvd) on the M2 level, North Tower of the Omni outside of Morsel's. Please arrive at least 10 minutes before the tour is scheduled to depart.

GENERAL TOURS

All About Atlanta

Sunday, January 13 | 1:00 – 5:00 p.m.

\$45

Guests will see downtown's soaring skyscrapers, Midtown's "Fabulous" Fox Theater, the High Museum of Art and where Margaret Mitchell wrote *Gone with the Wind*. Stops also include Buckhead – an area of exquisite homes often called the Beverly Hills of the South, the Governor's Mansion, Atlanta History Center and the Swan House. Guests will also see the shopping and entertainment district – Atlantic Station, the Georgia Tech campus, Olympic venues, the Georgia Aquarium, World of Coca-Cola, Centennial Olympic Park and the CNN Center. Guests will also visit Ebenezer Baptist Church where Dr. Martin Luther King, Jr. and his father were pastors.

College Football Hall of Fame

Monday, January 14 | 2:30 – 5:30 p.m.

\$45

The College Football Hall of Fame features historic and contemporary artifacts, interactive multimedia displays, children's activities and a theater featuring an originally produced ultra-high-definition film on the history and excitement of college football. As you enter the Quad, spend your first few minutes trying to find your alma mater or favorite college team's football helmet on the famous Helmet Wall.

Atlanta's Heroes

Tuesday, January 15 | 9:00 a.m. – 1:00 p.m.

\$50

Dr. Martin Luther King, Jr. and President Jimmy Carter have something special in common they both call Atlanta home. The tour begins with a stop at the Martin Luther King, Jr. Center for Nonviolent Change. Guests will have a chance to explore Dr. King's burial site, the Visitor Center and Ebenezer Baptist Church where Dr. King and his father were both pastors.

Next, guests will enjoy a tour of the Carter Presidential Center where President Carter's life and administration, and the office of the presidency itself, are portrayed through films, videos and displays.

Atlanta Movie Tour

Tuesday, January 15 | 2:30 p.m. – 5:30 p.m.

\$80

With over 1,200 movies and television shows filmed here in Atlanta, this tour is packed with tons of locations, clips and behind the scenes tours. Whether you love The Walking Dead, Marvel, Ant Man, Spider-Man, the Avengers, The Hunger Games, Fast and Furious, The Real Housewives of Atlanta, Teen Wolf, or The Vampire Diaries – this tour has something for everyone!

TECHNICAL TOURS

Omni Atlanta at CNN Center North Tower Central Plant Tour

Sunday, January 13 | 3:30 – 5:30 p.m.

\$20

The North Tower of the Omni Atlanta at CNN Center was built in 1994 and houses a large central plant. The tour will be led by the Omni's Engineering Department and will include a tour of the central plant, mechanical room and a boiler room with three boiler pumps/VFDs and expansion tanks, two chillers with pumps/VFDs, and domestic pump rooms with controls.

Engineered Biosystems Building at Georgia Tech

Monday, January 14 | 2:30 – 5:30 p.m.

\$30

The Engineered Biosystems Building (EBB) on Georgia Tech's campus is a biological research building to support growth in the areas of bio-science and biotechnology, and provides an interdisciplinary environment, with shared laboratory facilities for merging engineering and science disciplines. It achieved a green certification of LEED Platinum, and features many sustainable features as they pertain to building design, energy and emissions, material management, and water use. Additionally, this tour will highlight the Georgia Tech eco-commons, an innovative storm water management system.

The Kendeda Building for Innovative Sustainable Design and the Living Building Challenge Tour at Georgia Tech

Tuesday, January 15 | 1:30 – 3:00 p.m.

\$30

Once completed, The Kendeda Building for Innovative Sustainable Design is expected to become the most environmentally advanced educational and research facility of its kind in the Southeast. It is anticipated that the project will achieve Living

Building Challenge 3.1 certification in 2020. To be certified under the Living Building Challenge, projects must meet a series of ambitious performance requirements over a minimum of 12 months of continuous occupancy and operations.

For more information on the Living Building Challenge and safety restrictions for the tour please check the ASHRAE 365 app or www.ashrae.org/atlanta in the “Tours” section.

Georgia World Congress Center Central Plant Tour

Tuesday, January 15 | 1:00 p.m. – 2:00 p.m.

\$20

The Georgia World Congress Center (GWCC), the third-largest convention center in the United States, is the venue for the 2019 AHR Expo and ASHRAE Winter Conference Technical Program and committee meetings. GWCC maintains 4 million square feet of building space and over 220 acres and hosts more than a million visitors each year. The technical tour will be led by the GWCC lead engineer and will give participants a quick look at GWCC’s newly renovated chiller/boiler plant.

STUDENT TOUR

The Kendeda Building for Innovative Sustainable Design and the Living Building Challenge Tour at Georgia Tech
Sunday, January 13 | 1:30 – 3:00 p.m. AND 2:30 – 4:00 p.m.
\$25

Once completed, The Kendeda Building for Innovative Sustainable Design is expected to become the most environmentally advanced educational and research facility of its kind in the Southeast. It is anticipated that the project will achieve Living Building Challenge 3.1 certification in 2020. To be certified under the Living Building Challenge, projects must meet a series of ambitious performance requirements over a minimum of 12 months of continuous occupancy and operations.

For more information on the Living Building Challenge and safety restrictions for the tour please check the ASHRAE 365 app or www.ashrae.org/atlanta in the “Tours” section.

FUTURE ASHRAE CONFERENCES

Winter	Date	Annual
Atlanta, GA January 12–16	2019	Kansas City, MO June 22–26
Orlando, FL February 1–5	2020	Austin, TX June 27–July 1
Chicago, IL January 23–27	2021	Phoenix, AZ June 26–30

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
Dallas	2013	Denver
New York	2014	Seattle
Chicago	2015	Atlanta
Orlando	2016	St. Louis
Las Vegas	2017	Long Beach
Chicago	2018	Houston

NEW! BUILDING EQ PORTAL DEMONSTRATION

Sunday, January 13

3:00 – 4:00 p.m.

A404, 4th Floor, GWCC, Building A

Come learn about ASHRAE's newly revamped Building EQ program and watch a live demonstration of the new Building EQ Portal. The program helps building owners make informed decisions to improve their energy performance by connecting them with energy audit solutions and actionable recommendations. The Portal improves the process with online data entry and validation, standardized reports, and quick processing time. The demonstration will outline basic usage, available reports and the latest updates to the system.



UPCOMING TOPICAL CONFERENCES

2019 ASHRAE Building Performance Analysis Conference

September 25-27 • Denver, CO

www.ashrae.org/BuildPerform2019

Seventh International Conference on Energy Research and Development, co-organized by Kuwait University and ASHRAE

November 19-21 • Kuwait

www.ashrae.org/Kuwait

2019 Buildings XIV International Conference

December 9-12 • Clearwater Beach, FL

www.ashrae.org/BuildingsXIV

WHAT IS A TECHNICAL COMMITTEE?

The technical expertise of ASHRAE is concentrated in its Technical Committees (TCs), Task Groups (TGs), Technical Resource Groups (TRGs) and Multidisciplinary Task Groups (MTGs). These groups are responsible in various degrees for:

- Preparing the text of ASHRAE Handbook chapters
- Originating, coordinating and supervising Society-sponsored research projects
- Presenting programs at ASHRAE conferences
- Reviewing papers for conferences
- Developing ASHRAE publications
- Evaluating the need for standards, and
- Advising the Society on all aspects of the technology it embraces

ASHRAE TCs and these other groups are comprised of volunteers who have a recognized proficiency in a specific field of interest. There are some active 100 TCs addressing all aspects of the HVAC&R and buildings industries.

Applying for Membership on a Technical Committee

ASHRAE welcomes new members to its technical committees. You can join a technical committee by accessing our website at www.ashrae.org/joinatc. You will immediately be assigned as a Provisional Corresponding Member for a two-year term, and be able to participate in committee activities. At the end of the term, you may be considered for a position that has voting membership.

Please note:

If you do not have an ASHRAE ID, please go to www.ashrae.org and click on the Log In tab at the top of the page. Next, click on "Need a Login?" to request an ID and PIN. You may also use that link if you already have an ASHRAE ID as a non-member.

Attending Technical Committee Meetings

TC meetings take place at the Society's Winter and Annual Conferences, and they are open. Attend any meetings in which you have a technical interest. TC chairs welcome new attendees—a TC can never have too many willing and able volunteers.

See the listing of Technical Committee meetings in the Final Program, online or in the app.

HOW AND WHY TO JOIN AN ASHRAE PROJECT COMMITTEE

What Is a Project Committee?

ASHRAE Project Committees (PCs) develop ASHRAE standards and guidelines. ASHRAE PCs consist of people who have a recognized expertise in a specific field of interest. Standards produced by ASHRAE are used as authoritative documents throughout our industry.

Applying for Membership on a Project Committee

ASHRAE welcomes new members to its project committees. With the exception of PC Chairs and Vice Chairs, it is not necessary to be a member of ASHRAE to participate on any of ASHRAE's Standards Project Committee (SPC), Guideline Project Committee (GPC), or Standing Standard/Guideline Project Committees (SSPC, SGPC).

To be considered for project committee membership, you must:

- Submit a PC Application for Membership to ASHRAE staff at Standards.Section@ashrae.org
- Submit a Bias/Conflict of Interest Statement to ASHRAE staff
- Update or complete an ASHRAE Bio online

After you correctly submit all necessary paperwork:

- ASHRAE staff processes the application and provides the membership package to the PC chair
- The PC Chair reviews the membership package and accepts or declines each applicant
- ASHRAE's Standards Project Liaison Subcommittee approves new members

More details on applying for PC membership are available at www.ashrae.org/standards.

Attending Project Committee Meetings

A PC member is expected to attend meetings and pay attention to correspondence. The PC Chair may recommend removal of a PC member for lack of participation such as failing to attend at least half of the scheduled PC meetings in a year.

ASHRAE Project Committees meet at each Society Winter and Annual Conference. Attendance at these meetings is open to everyone. You are encouraged to attend any of these meetings in which you have a technical interest. PC Chairs welcome visitors to PC meetings – a PC can never have too many willing and able volunteers.

See the listing of Standards and Guidelines Committees meetings in the Final Program, online or in the app.

FULL-DAY PROFESSIONAL DEVELOPMENT SEMINARS

Registration fees: \$510 (ASHRAE Member \$415)

SATURDAY, JANUARY 12, 2019

Commercial Building Energy Audits (code 60)

8:00 a.m.–3:00 p.m., GWCC, Building B, 3rd Floor | B302

This seminar provides guidance on how to perform commercial building energy audits. Best practices and other information relevant for building owners, managers, and government entities are covered. The seminar includes a summary of materials essential for performing ASHRAE Level 1, 2, and 3 audits, time-saving tips for every auditor, how to hire an auditor, what to ask for in a comprehensive audit report, and how to build a successful energy efficiency retrofit team.

Instructor: Jim Kelsey, P.E., Member ASHRAE, BEAP, LEED® AP

Effective Energy Management in New and Existing Buildings (code 61)

8:00 a.m.–3:00 p.m., GWCC, Building B, 3rd Floor | B303

Buildings use 40% of U.S. energy, of which one-third can be cost effectively saved by using energy management—an orderly process in which managers use resources at their disposal to accomplish clear, energy-saving objectives. Sustained energy management is the quickest, cheapest, cleanest way to expand our world's energy supplies and reduce greenhouse gas emissions. This seminar weaves together energy management principles of the ASHRAE Handbook—HVAC Applications, ENERGY STAR guidelines, and the new ASHRAE/IES Standard 100-2018, Energy Efficiency in Existing Buildings. Practical experiences of successful energy managers are presented. Numerous case studies are discussed.

Instructor: Richard Pearson, P.E., Fellow/Life Member ASHRAE

Operations and Maintenance of High-Performance Buildings (code 62)

8:00 a.m.–3:00 p.m., GWCC, Building B, 3rd Floor | B304

A high-performance building “consistently delivers a highly productive environment without wasting resources” according to ASHRAE Guideline 32, Sustainable High-Performance Operations and Maintenance. Operating and maintaining high-performance buildings often requires different actions than for a typical commercial or institutional building. This course includes an interactive group project to reinforce concepts, such as how to identify and define energy and maintenance management metrics, and how to make the business case for changes to an existing building and its systems.

Instructor: Laurie Gilmer, P.E., Member ASHRAE, LEED® AP

TUESDAY, JANUARY 15, 2019

Choosing the Right Energy Code for your Project: IECC 2018 or ASHRAE 90.1-2016 (code 75)



9:00 a.m.–4:00 p.m., GWCC, Building B, 3rd Floor | B303

This seminar compares the requirements of ASHRAE/IES Standard 90.1-2016 and the IECC. It is based on the instructor's experience with the two documents and will explain how to apply the codes based on the project design. The participants will identify the effort and compromises required to show compliance with codes based on the project design. This seminar will provide the information necessary to make the code determination with full knowledge of the requirements that must be met.

Instructor: McHenry Wallace, P.E., Member ASHRAE, LEED® AP

Commissioning Process in New and Existing Buildings (code 76)

9:00 a.m.–4:00 p.m., GWCC, Building B, 3rd Floor | B302

This introductory seminar focuses on how the building commissioning process can be applied cost-effectively to new construction and to existing facilities, with a strong emphasis on existing facilities applications. The seminar also discusses how the application of the commissioning process in existing facilities differs from new construction. Benefits of commissioning and 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 will be covered.

Instructor: Rick Casault, P.E., Member ASHRAE

HALF-DAY SHORT COURSES

Registration fees: \$184 (ASHRAE Member \$139)

SUNDAY, JANUARY 13, 2019

Advanced Designs for Net Zero Buildings (code 63)



3:30 p.m.–6:30 p.m., GWCC, Building B, 3rd Floor | B302

This advanced course is for professional engineers and architects who want to expand their practice to include the design, construction and operation of zero energy (net zero) buildings. The first principle of zero energy design is to make the building as energy efficient as possible. On-site renewable energy systems will then be added to achieve these efficiency goals. Proper commissioning and operator training are critical to success. These zero energy principles are presented with case studies and examples showing how other design professionals have met the zero energy goal.

Instructors: Peter Simmonds, Ph.D., Fellow ASHRAE, and Charles Eley, P.E., Member ASHRAE, AIA, BEMP, CEM, LEED® AP

Air-to-Air Energy Recovery Applications: Best Practices (code 64)

3:30 p.m.–6:30 p.m., GWCC, Building B, 3rd Floor | B305

Air-to-air energy recovery provides one of the most cost-effective and efficient ways to recycle waste energy and create superior indoor environments. This course will review real-world examples of where and how air-to-air energy recovery technologies are integrated into some of the most common, commercially available systems. Particular configurations that are most commonly used in high performance buildings and how they can best be used to meet stretch goals for IEQ, energy efficiency, and thermal comfort will be examined with respect to established performance metrics, peak performance results, and annual energy savings.

Instructor: Paul Pieper, P.Eng., Member ASHRAE

Latest in High-Performance Dedicated Outdoor Air Systems (DOAS) (code 65)

3:30 p.m.–6:30 p.m., GWCC, Building B, 3rd Floor | B303

The dedicated outdoor air system (DOAS) has become a very popular means to provide ventilation for buildings, particularly for low-energy, max tech, and zero energy buildings. DOAS and the accompanying room-level heating/cooling units provide many benefits, including low energy use, cost-effective humidity control, redundancy, and control simplicity. This course covers the latest in DOAS application, design, and control. This course is best suited for those seeking basic to intermediate discussions on DOAS, including an overall introduction to the concept.

Instructor: Arthur Hallstrom, P.E., Fellow/Life Member ASHRAE, BEMP

Variable Refrigerant Flow Systems: Design and Applications (code 66)

3:30 p.m.–6:30 p.m., GWCC, Building B, 3rd Floor | B304

Variable refrigerant flow (VRF) systems are now being applied in many building types across North America. This course provides non-manufacturer-specific concepts of how to apply VRF systems to buildings. The course supplements the fundamental technology presented in the 2016 ASHRAE Handbook—HVAC Systems and Equipment, offering consulting engineers who already have a basic knowledge of VRF technology comprehensive system design and application guidance using building-specific scenarios. This course is geared towards mechanical engineers, design/build contractors, consulting engineers, HVAC system designers, and facility engineers.

Instructors: Paul Doppel, Member ASHRAE, and Jocelyn Léger, P.Eng., Member ASHRAE, CEM, LEED® AP

MONDAY, JANUARY 14, 2018

Humidity Control I: Design Tips and Traps (code 67)

8:30 a.m.–11:30 a.m., GWCC, Building B, 3rd Floor | B302

In commercial buildings, excess humidity and moisture promotes mold, mildew, and uncomfortable conditions for occupants. This course, based on ASHRAE's Humidity Control Design Guide for Commercial and Institutional Buildings and on the ASHRAE Guide for Buildings in Hot & Humid Climates, helps the designer achieve true control of humidity, rather than just its moderation. The course covers how to understand and easily estimate the major humidity loads that must govern the design of the system and decisions about equipment size and configuration.

Instructor: Mark Nunnally, P.E., Member ASHRAE, CxA, LEED® AP

Solar PV and Thermal Systems Analysis and Design (code 68)



8:30 a.m.–11:30 a.m., GWCC, Building B, 3rd Floor | B303

This course is designed to introduce the HVAC community to sustainable design principles and provide the knowledge necessary to evaluate and implement cost-effective solar applications for commercial facilities. The purpose is to provide attendees with the knowledge and skills required for the development, evaluation, procurement and installation of commercial solar projects. The technical focus is on cost-effective photovoltaic and solar water heating applications for commercial facilities. The objective is to enable the participants to economically evaluate, procure, and monitor the design and installation of a wide variety of cost-effective solar energy applications.

Instructors: Khalid Nagidi, P.E., Member ASHRAE, LEED® AP, and Svein Morner, Ph.D., Member ASHRAE

Thermal Energy Storage Systems for Air Conditioning (code 69)



8:30 a.m.–11:30 a.m., GWCC, Building B, 3rd Floor | B304

Building air-conditioning systems are the single greatest contributor to aggregate peak electrical demand. As a technology, thermal energy storage enables shifting a significant proportion of a facility's demand for electricity from daytime to nighttime periods. Furthermore, thermal energy storage enables flexibility in the demand for electricity by building air-conditioning systems—principally operating during time periods where renewable energy is plentiful and idling during time periods where renewable energy is sparse or unavailable. This course discusses how thermal energy storage can enable greater use of renewable energy generation.

Instructor: Doug Reindl, Ph.D., P.E., Fellow ASHRAE

Understanding and Designing Chilled-Beam Systems (code 70)

8:30 a.m.–11:30 a.m., GWCC, Building B, 3rd Floor | B305

Chilled-beam systems save on cooling and transport energy by decoupling most or all of the space sensible loads from the air-distribution system and removing them with water, a much more efficient heat transfer medium. Attendees will review HVAC fundamentals as they relate to chilled-beam system design. They will also understand the system benefit, be able to identify suitable applications, and learn how to design chilled-beam systems to optimize the energy and operational benefits. Efficient design of a chilled-beam system requires some departure from practices and conventions used to design all-air VAV systems.

Instructor: Ken Loudermilk, P.E., Member ASHRAE

ASHRAE Guideline 0: The Commissioning Process (code 71)

2:45 p.m.–5:45 p.m., GWCC, Building B, 3rd Floor | B305

This course is ideal for building owners, facility managers, design engineers, building designers, architects, equipment manufacturers, and others interested in the commissioning process as defined by ASHRAE Guideline 0. The course focuses on commissioning objectives, activities, and deliverables. This is an entry-level course that will provide an understanding of the ASHRAE commissioning process for new construction.

Instructor: Walter Grondzik, P.E., Fellow/Life Member ASHRAE, LEED® AP

Design of Affordable and Efficient Ground-Source Heat Pump Systems (code 72)

2:45 p.m.–5:45 p.m., GWCC, Building B, 3rd Floor | B304

This course describes the best design practices of ground-source heat pump systems to achieve maximum customer benefit. The course examines the economic analysis of ground-source versus more traditional systems and what is necessary to design an effective and efficient ground-source system. The course covers energy analysis, equipment selection, drilling technologies, testing requirements, hydronic system design, and system controls. Participants will learn all that is necessary for the design and installation of a successful ground-source heat pump system.

Instructor: Steve Kavanaugh, Ph.D., Fellow ASHRAE

Designing and Operating High-Performing Healthcare HVAC Systems (code 73)

2:45 p.m.–5:45 p.m., GWCC, Building B, 3rd Floor | B303

This advanced course discusses in detail the interactions of the key elements of high performance in healthcare, infection control, comfort, reliability, safety, maintenance, energy, and sustainability. Numerous energy conservation strategies will be considered in the context of achieving all the goals of a

high-performing hospital. For example, the hardware and controls for setback of temperature and airflow and the relationship to temperature, relative humidity, air exchange, filtration, and pressurization requirements are discussed

Instructor: Dan Koenigshofer, P.E., Member ASHRAE, MSPH, HFDP

Humidity Control II: Real-World Problems and Solutions (code 74)

2:45 p.m.–5:45 p.m., GWCC, Building B, 3rd Floor | B302

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 also covers the effects of different humidity levels on thermal comfort, corrosion, mold growth, and airborne microorganisms—information that helps the owner and designer define the optimal humidity control level for each application.

Instructor: Lew Harriman, Fellow ASHRAE

TUESDAY, JANUARY 15, 2019

Avoiding IAQ Problems (code 77)

9:00 a.m.–12:00 p.m., GWCC, Building B, 3rd Floor | B305

Based on ASHRAE's Indoor Air Quality Guide, this course provides a systematic overview of the key objectives that must be met to achieve good indoor air quality. A review of the most common causes of IAQ problems in buildings, as well as the process management strategies that owners and design teams can use during design, construction and turnover to help avoid IAQ problems are discussed. The course discusses state-of-the-art strategies to prevent IAQ problems related to moisture and mold in building assemblies, outdoor contaminants, moisture and dirt in air handling systems, material emissions, outdoor air monitoring and control, and more.

Instructor: Hoy Bohanon, P.E., Member ASHRAE, BEAP, LEED® AP

How Smart, Efficient, Sustainable Systems Lead to Improved Resilience (code 78)



9:00 a.m.–12:00 p.m., GWCC, Building B, 3rd Floor | B304

In the case of individual buildings, resilience can depend on diverse issues such as building function, interrelated systems and equipment, and occupant demographics. This course provides a descriptive summary of the concept of resilience in the built environment and how sustainability, efficiency and smart technology can help improve resilience. The concept of resilience in the context of the built environment applies to both manmade (e.g., terrorism) and natural (e.g., weather events) events as they influence the infrastructure and systems that our society is built around. Future trends and technologies will also be discussed.

Instructors: Tom Lawrence, Ph.D., P.E., Fellow ASHRAE, LEED® AP, and Dru Crawley, Ph.D., Fellow ASHRAE, AIA, BEMP

High-Performance Building Design: Applications and Future Trends (code 79)

1:00 p.m.–4:00 p.m., GWCC, Building B, 3rd Floor | B304

This course presents applications of new technologies and design concepts to achieve the goal of high-performance buildings, including zero energy or nearly zero energy buildings. The course discusses exactly what a high-performance building is from the perspective of various stakeholders. High performance is more than just energy efficiency, and this course addresses issues and methods for providing high performance in areas beyond energy efficiency, such as indoor environmental quality. The course describes future possibilities for high-performance buildings across the globe and quickly summarizes how ASHRAE standards (existing and those in development) address these topics.

Instructor: Tom Lawrence, Ph.D., P.E., Fellow ASHRAE, LEED® AP

ASHRAE CERTIFICATION EXAMS

Saturday, January 12

9:00 a.m. – 12:30 p.m.

Pecan, M3 level, North Tower, Omni

Wednesday, January 16

8:00 – 11:30 a.m.

C213, 2nd floor, GWCC, Building C

Recognized by over 35 national, state and local government bodies – and with nearly 3,000 certifications earned – ASHRAE certifications increasingly have become the must-have credential for built-environment professionals. ASHRAE certification exams will be administered to candidates in these key, built-environment fields: Commissioning, Energy Auditing, Energy Modeling, Healthcare Facility Design, High-Performance Building Design and Building Operations.

Pre-application required.



ASHRAE 2019 WINTER CONFERENCE TECHNICAL PROGRAM

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. State PDHs, AIA LUs and LEED AP credits are awarded for select sessions.

Types of sessions presented:

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 an online papers collection are available for purchase in the ASHRAE Bookstore.

Debates. Debates highlight hot-button issues. Experts, either on teams or as individuals, present different sides of an issue in debate format. Each participant presents evidence for or against a specific statement or question such as "Is Sustainability Really Sustainable?".

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.

Panels. Panel discussions can feature a broad range of subjects and explore different perspectives on issues in the industry. A panel may feature discussions about integrated project delivery among designers, builders and facility management professionals.

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. A permanent record of the seminar presentations will be available online. Orders can be taken in the ASHRAE Bookstore.

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. Power point presentations with audio descriptions of the presentations are posted online in the Virtual Conference. Preprints of papers and an online papers collection are available for purchase in the ASHRAE bookstore.

Workshops. Workshops enable technical committees and other ASHRAE committees to provide a series of short presentations on a topic requiring specific expertise. These short presentations are provided with an increased emphasis on audience participation and training in a specific set of skills. PowerPoint presentations with audio descriptions are posted online in the Virtual Conference.



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Sunday, January 13

8:00 AM – 9:00 AM

Debate 1 (Basic)

Should Sex Sell HVAC Equipment?

Track: HVAC&R Fundamentals and Applications

Room: GWCC Building A, A410

Sponsor: 7.6 Building Energy Performance

Moderator: Cindy Moreno, Member, T & M Mechanical Sales Co., Mesa, AZ

1. **Pam Duffy, Member, Lennox International, Dallas, TX**
2. **Jessica Mangler, P.E., Member, Affiliated Engineers, Inc., Seattle, WA**
3. **William P Bahnfleth, Ph.D., P.E., Presidential Fellow ASHRAE, Penn State, University Park, PA**
4. **Ronald Jarnagin, Pacific Northwest National Lab, Richmond, WA**
5. **Alyse Falconer, P.E., Member, Point Energy Innovations, San Francisco, CA**
6. **Carrie Anne Monplaisir, Associate Member, Clark Nexsen, Virginia Beach, VA**

8:00 AM – 9:00 AM

Conference Paper Session 1 (Intermediate)

Energy Modeling Simulations



Track: HVAC&R Fundamentals and Applications

Room: GWCC Building A, A408

Chair: Samir Traboulsi, P.Eng., Fellow Life Member, Thermo-trade/Ranec, Beirut, Lebanon

1. HAMT Extension for EnergyPlus Encompasses Moisture Sources Due to Air Leakage (AT-2019-C001)

Florian Antretter, Member¹ and Simon Pallin, Ph.D., Associate Member², (1)Fraunhofer IBP, Holzkirchen, Germany, (2)Oak Ridge National Laboratory, Oak Ridge, TN

2. Accuracy of a Crude Approach to Urban Multi-Scale Building Energy Models Compared to 15-min Electricity Use (AT-2019-C002)

Eric Garrison¹, Joshua New, Member² and Mark Adams, Associate Member³, (1)UTK, Knoxville, TN, (2)Oak Ridge National Laboratory, Knoxville, TN, (3)Oak Ridge National Laboratory, Oak Ridge, TN

3. Challenges of Creating a Verifiable Building Energy Model (AT-2019-C003)

Ali Razban, Ph.D., P.E., Associate Member, Daniel Sebastian, Member and Jayraj Ligade, Student Member, IUPUI, Indianapolis, IN

8:00 AM – 9:00 AM

Conference Paper Session 2 (Intermediate)

Examples of Cost Saving Initiatives



Track: Construction, Operation, and Maintenance of High Performance Systems

Room: GWCC Building A, A303

Chair: Jaya Mukhopadhyay, Ph.D., Member, Montana State University, Bozeman, MT

1. Economic Feasibility of Combined Cooling, Heating and Power Systems (AT-2019-C004)

Hyeunguk Ahn, Student Member, Donghyun Rim, Ph.D. and James Freihaut, Member, Pennsylvania State University, State College, PA

2. Field Demonstration of an Automated Building Commissioning Tool (AT-2019-C005)

Hayden Reeve, Ph.D., Member, Anarta Ghosh, Buyun Jing, Rohan Chabukswar, Yun Li and Zhengang Zhu, United Technologies Research Center, East Hartford, CT

3. Optimization of Condenser Water Loop Control in Hot and Humid Climates (AT-2019-C006)

Lei Wang, Ph.D., P.E., Member, Steven Bowman and Yasuko Sakurai, Utilities & Energy Services, Texas A&M University, College Station, TX

8:00 AM – 9:00 AM

Seminar 1 (Intermediate)



Advances in Hybrid HVAC Efficiency and Performance

Track: Systems and Equipment

Room: GWCC Building A, A305

Sponsor: 5.7 Evaporative Cooling

Chair: Jonathan Woolley, University of California, Berkeley, Berkeley, CA

1. New Hybrid HVAC Modeling Capability in EnergyPlus Building Energy Simulation

Spencer Dutton, Ph.D., Lawrence Berkeley National Laboratory, Berkeley, CA

2. Hybrid Indirect Evaporative/DX Capacity Modeling

Steven Slayzak, Associate Member, Seeley International, Denver, CO

3. RTU Optimization: Fixed Compressor Speed Reduction and Condenser-Air Pre-cooling

Caton Mande, UC Davis Western Cooling Efficiency Center, Davis, CA

4. Growing the Pre-Cooling Market with Pre-Sold Maintenance

Steve Short, Integrated Comfort Inc., West Sacramento, CA

8:00 AM – 9:00 AM

Seminar 2 (Intermediate)



Steps toward Net Zero for the Marine Corps Logistics Base at Albany GA

Track: Renewables and Natural Systems

Room: GWCC Building A, A301

Sponsor: 9.1 Large GWCC Building Air-Conditioning Systems,

6.7 - Solar and other Renewable Energies

Chair: Alonzo Blalock, P.E., Member, Jacobs Engineering, Fort Worth, TX

1. Step One: Addition of 31 MW PhotoVoltaic Facility at MCLB Albany

William Houser, P.E., Georgia Power, Atlanta, GA

2. Step Two: Installation of BTES system at MCLB Albany

Chuck Hammock, P.E., Associate Member, Andrews, Hammock & Powel, Inc., Macon, GA

3. Step Three: Maximizing by Retro-Commissioning

Robert Bucey, P.E., Member, Jacobs, Dallas, TX

8:00 AM – 9:00 AM

Seminar 3 (Intermediate)



Tales from the Crypt

Track: Common System Issues and Misapplications

Room: GWCC Building A, A302

Sponsor: 7.7 Testing and Balancing

1. Tales from the Crypt

Thomas Schlachter, P.E., Member, Engineered Air Balance Co Inc, Richardson, TX

2. Best Laid Plans: Cautionary Tales for Designers and Engineers

Donald Prather, Affiliate, Air Conditioning Contractors of America, Arlington, VA

8:00 AM – 9:00 AM

Seminar 4 (Intermediate)



Thermal Energy Storage in the Cold Chain

Track: HVAC&R Fundamentals and Applications

Room: GWCC Building A, A404

Sponsor: 6.9 Thermal Storage

Chair: Eric House, H I Solutions, Inc., Kennesaw, GA

1. Thermal Energy Storage in the Cold Chain (Part 1)

Collin Coker, Viking Cold Solutions, Houston, TX

2. Thermal Energy Storage in the Cold Chain (Part 2)

John Lerch, Axiom Exergy, Richmond, CA

8:00 AM – 9:00 AM

Workshop 1 (Intermediate)



Construction, Operation and Maintenance of High Performance Systems of Large Central Plants and Distribution Systems

Track: Construction, Operation, and Maintenance of High Performance Systems

Room: GWCC Building A, A405

Sponsor: 7.3 Operation and Maintenance Management

Chair: Sonya Pouncy, Member, Energy Sciences, Detroit, MI

1. Construction, Operation and Maintenance of High Performance Systems of Large Central Plants and Distribution Systems

Terrence Rollins, Member¹, Tim Anderson² and Mitchell Swann, P.E.³, (1)RHC Global Energy Solutions, Corpus Christi, TX, (2)Applied Engineering Services, Inc, Indianapolis, IN, (3)MDC Systems, Paoli, PA

2. Construction, Operation and Maintenance of High Performance Systems of Large Central Plants and Distribution Systems

Sonya Pouncy, Member, Energy Sciences, Detroit, MI

9:00 AM – 12:00 PM

Seminar TC

Defining Health

Track: The Convergence of Comfort, IAQ, and Energy Efficiency Building

Room: Omni, Grand Ballroom C, M4 Level, North Tower

Sponsor: SGPC 10

Chair: *Walter Grondzik, P.E., Fellow ASHRAE, Ball State University, Muncie, IN*

1. Defining Health

Carl Grimes, Member¹ and **Frederick Marks, AIA²**, (1)Hayward Healthy Home, Denver, CO, (2)Visiting Scholar, Salk Institute for Biological Studies, La Jolla, CA

9:45 AM – 10:45 AM

Technical Paper Session 1 (Intermediate)

ASHRAE Research on Ductwork



Track: The Convergence of Comfort, IAQ, and Energy Efficiency Building

Room: GWCC Building A, A303

Chair: Hyojin Kim, Ph.D., Member, Catholic University of America, Washington, DC

1. A Review of Prior ASHRAE Research Efforts to Characterize Noise Propagation in Ducts (AT-2019-001)

David Herrin, Associate Member, University of Kentucky, Lexington, KY

2. The Effect of Length on the Insertion Loss of Fiberglass Lined Sheet Metal Ducts, Part I: Rectangular Duct (RP-1408) (AT-2019-002)

Michael Schwob, Member, Michael Schwob Acoustics, Las Vegas, NV

3. The Effect of Length on the Insertion Loss of Fiberglass Lined Sheet Metal Ducts, Part II: Round Duct (RP-1408) (AT-2019-003)

Michael Schwob, Member, Michael Schwob Acoustics, Las Vegas, NV

9:45 AM – 10:45 AM

Conference Paper Session 3 (Intermediate)

Using Buildings to Improve Hydronic Efficiency

Track: Renewables and Natural Systems



Room: GWCC Building A, A408

Chair: Peng Yin, Ph.D., Associate Member, University of Louisiana at Lafayette, Lafayette, LA

1. Surface Condensation Control for Concrete Core Systems Utilizing Model Predictive Control (AT-2019-C007)

Deok-Oh Woo, BEAP, Affiliate, University of Michigan, Ann Arbor, MI

2. Applying TABS to a Publishing Company Headquarters Using Integrated Design (AT-2019-C008)

Kosuke Sato, Member¹, Eri Kataoka, Member¹, Jun Shionda, BEAP, Student Member², Shin-ichi Tanabe, Ph.D., BEAP, Fellow ASHRAE² and Susumu Horikawa, Member¹, (1)NIKKEN SEKKEI LTD, Tokyo, Japan, (2)Waseda University, Tokyo, Japan

3. Hybrid GEOTABS: System Concept, Individual Modules and Interfaces (AT-2019-C009)

Dolaana Khovalyg, Associate Member¹, Bjarne Olesen, Ph.D., Presidential Member¹, Gerald Parnis², Jiří Cigler, Ph.D.³ and Ongun Kazanci, Ph.D., Associate Member¹, (1)Danish Technical University, Lyngby, Denmark, (2)Boydens Engineering, Zedelgem, Belgium, (3)Energoklastr, Prague, Czech Republic

9:45 AM – 10:45 AM

Seminar 5 (Basic)



ASHRAE Conference Crash Course

Track: HVAC&R Fundamentals and Applications

Room: GWCC Building A, A410

Sponsor: 7.6 Building Energy Performance

Chair: Vanessa Freidberg, P.E., Member, Siemens Building Technologies, Austin, TX

1. The Ins and Outs of ASHRAE

Rachel Romero, P.E., Member, National Renewable Energy Laboratory, Golden, CO

2. Make the Most of Your Conference Experience

Madison Schultz, P.E., Member, Guernsey Engineers/Architects/Consultants, Oklahoma City, OK

9:45 AM – 10:45 AM

Seminar 6 (Intermediate)



Condensing High-Efficiency Boilers and Their Proper Operation and Maintenance

Track: Construction, Operation, and Maintenance of High Performance Systems

Room: GWCC Building A, A405

Sponsor: 6.1 Hydronic and Steam Equipment and Systems

Chair: Rex Scare, P.E., Member, Armstrong International Inc, Three Rivers, MI

1. The Design Factors that go into Providing a High Efficiency Condensing Boiler Heating System and Having the System Perform as Intended Once Installed and Throughout its Life

Thomas Neill, Member, Mestek Inc, Southampton, MA

2. High Efficiency Boiler Operation, Maintenance and Control for Efficient Operation

Ted Duffy, P.E., Member, LAARS Heating Systems Company, Rochester, NH

9:45 AM – 10:45 AM

Seminar 7 (Intermediate)



Critical Mobile Food Refrigeration Systems Using Low-GWP Refrigerants

Track: Refrigeration

Room: GWCC Building A, A302

Sponsor: 10.6 Transport Refrigeration

Chair: William Murphy, Ph.D., P.E., Fellow Member, University of Kentucky, Paducah, KY

1. Design of a Refrigerated Transport Container Using CO2 (R744) as a Refrigerant

Neal Lawrence, Ph.D., Associate Member, Creative Thermal Solutions, Urbana, IL

2. Mission Critical Submarine Food Refrigeration System Using R1234ze as a Refrigerant

Augusto San Cristobal, Bronswerk, Brossard, QC, Canada

Tech Program

9:45 AM – 10:45 AM

Seminar 8 (Intermediate)



Sustainable Building Operation via ASHRAE Standard 189.1 and Lessons Learned

Track: Construction, Operation, and Maintenance of High Performance Systems

Room: GWCC Building A, A305

Sponsor: MTG.EBO - Effective Building Operations

Chair: Sonya Pouncy, Member, Energy Sciences, Detroit, MI

1. Sustainable Building Operation via Standard 189.1

Douglas Zentz, Associate Member, Ferris State University, Big Rapids, MI

2. Lessons Learned for Sustainable High Performance Building Operation

Stephen Hamstra, P.E., Member, Melink Solar & Geo, Detroit, MI

9:45 AM – 10:45 AM

Seminar 9 (Intermediate)



The Doctor is In! Diagnosing Common System Issues and Misapplications in GWCC Building Automation Systems

Track: Common System Issues and Misapplications

Room: GWCC Building A, A404

Sponsor: 1.4 Control Theory and Application

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

1. Assessment Tools and Techniques for Existing GWCC Building Automation Systems

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

2. Simple Misapplications of Control Systems in Hospitals and How to Avoid Them

Daniel Farrow, Palomar Health, San Diego, CA

9:45 AM – 10:45 AM

Seminar 10 (Basic)



What's New in Cybersecurity

Track: Systems and Equipment

Room: GWCC Building A, A301

Sponsor: 1.5 Computer Applications

Chair: Michael Galler, Member, National Institute of Standards and Technology, Gaithersburg, MD

1. GWCC Building Automation Systems + Cybersecurity

Levi Tully, Member, Reliable Controls, Columbus, OH

2. SmartBuilding Technology: In the Hacker's Crosshairs

Fred Gordy, Member, Intelligent Buildings, Atlanta, GA

11:00 AM – 12:30 PM

Conference Paper Session 4 (Intermediate)

Modeling HVAC Systems



Track: HVAC&R Fundamentals and Applications

Room: GWCC Building A, A303

Chair: David Yashar, Ph.D., P.E., Member, National Institute of Standards and Technology, Gaithersburg, MD

1. Computational Fluid Dynamics (CFD) Modeling of Indoor Chemical Reactions under Varied HVAC Operating and Lighting Conditions (AT-2019-C010)

Youngbo Won, Student Member and Donghyun Rim, Ph.D., Associate Member, Penn State University, University Park, PA,

2. Model-based and Data-driven Anomaly Detection for Heating and Cooling Demands in Office Buildings (AT-2019-C011)

Araz Ashouri, Ph.D., Associate Member¹, Guy Newsham, Ph.D.¹, H. Burak Gunay, Student Member², Weiming Shen, Ph.D.¹ and Yitian (Vera) Hu¹, (1)National Research Council Canada, Ottawa, ON, Canada, (2)Carleton University, Ottawa, ON, Canada

3. Optimizing Building Performance using Stochastic Occupant Models (AT-2019-C012)

Mohamed Ouf, Ph.D., Member, H. Burak Gunay, Student Member and William O'Brien, Ph.D., Member, Carleton University, Ottawa, ON, Canada

4. Toward Machine Learning-based Prognostics for Heating Ventilation and Air-Conditioning Systems (AT-2019-C013)

Chunsheng Yang¹, H. Burak Gunay, Student Member², Weiming Shen¹ and Zixiao Shi, Student Member¹, (1)National Research Council Canada, Ottawa, ON, Canada, (2)Carleton University, Ottawa, ON, Canada

11:00 AM – 12:30 PM

Seminar 11 (Intermediate)



Building HVAC System Control Strategies to Interact with the Modern Electric Grid

Track: Renewables and Natural Systems

Room: GWCC Building A, A301

Sponsor: 7.5 Smart Building Systems

Chair: Carlos Haiad, P.E., Member, JCH Energy Management Solutions, Inc., Phillips Ranch, CA

1. The Value of HVAC Control In Transforming Electric Grids

Carlos Haiad, P.E., Member, JCH Energy Management Solutions, Inc., Phillips Ranch, CA

2. The Feasibility, Economics and Challenges of Using HVAC Systems for Power Grid Regulation Services

Jie Cai, Ph.D., University of Oklahoma, Norman, OK

3. Demonstration of Integrated Air- and Water-side HVAC Strategies for Demand Response on a University Campus

Thomas Lawrence, Ph.D., Fellow ASHRAE, University of Georgia, Athens, GA

4. Impacts of On-Site Battery Storage on HVAC and Other Facility Loads Control Strategies for Peak Load Management and Demand Response Programs

Glenn Remington, Member, Consumers Energy, Jackson, MI

11:00 AM – 12:30 PM

Seminar 12 (Intermediate)



Life After R-404A

Track: Refrigeration

Room: GWCC Building A, A305

Sponsor: 10.7 Commercial Food and Beverage Refrigeration Equipment

Chair: Jon Murray, Structural Concepts Corp., Muskegon, MI

1. Using A3s (Hydrocarbons) in Self-contained Equipment

Daryl Erbs, Ph.D., Member, Welbilt, Newport Richey, FL

2. Regulatory/Policy Side of Refrigerant Transitions

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

3. Laboratory Measurements of R407H for Commercial Refrigeration Applications

Ivan Rydkin, Associate Member, Daikin America, Inc., Orangeburg, NY

4. No Pain no Gain: Transition from R-502 to R-22 to R-404A to ???

Dave Demma, Member, United Refrigeration Inc., Philadelphia, PA

11:00 AM – 12:30 PM

Seminar 13 (Intermediate)



Load-based Testing: Adapting Test Methods for Building's Changing Needs and/or the Equipment's Emerging Features

Track: Systems and Equipment

Room: GWCC Building A, A405

Sponsor: 8.11 Unitary and Room Air Conditioners and Heat Pumps

Chair: Zhiwei 'Joy' Huang, Ph.D., Member, Johnson Controls, Norman, OK

1. RP-1608: Load-Based Testing as a Means for Understanding Part-load Performance of Rooftop Units

Pedro Perez, AAON, Inc., Tulsa, OK

2. A Load-Based Testing Approach for HVAC Equipment using Emulation of Building Response

James Braun, Ph.D., Fellow ASHRAE, Purdue University, West Lafayette, IN

3. Seasonal Performance Rating of Heat Pumps and Air Conditioners using Load-Based Testing

James Braun, Ph.D., Fellow ASHRAE, Purdue University, West Lafayette, IN

4. Test Procedure Changes in DOE Appendix M1 and Compliance with the Residential Air Conditioners and Heat Pumps Standards in 2023

Wongyu Choi, AHRI, Cleveland, OH

11:00 AM – 12:30 PM

Seminar 14 (Intermediate)



Multiscale Building Energy Modeling, Part 10

Track: HVAC&R Fundamentals and Applications

Room: GWCC Building A, A408

Sponsor: 4.7 Energy Calculations

Chair: Ron Judkoff, Member, National Renewable Energy Laboratory, Golden, CO

1. Evaluating the Impact of the Urban Context on Building Energy Modeling

Xuan Luo, Carnegie Mellon University, Pittsburgh, PA

2. Modeling Zero Net Energy Communities

Daniel Macumber, Member, National Renewable Energy Laboratory, Golden, CO

3. AutoBEM Capabilities for Creating a Digital Twin of a Utility

Joshua New, Member, Oak Ridge National Laboratory, Knoxville, TN

11:00 AM – 12:30 PM

Seminar 15 (Intermediate)



Occupant-centric Control Technologies: Assessing Comfort, Energy Use and Cost Tradeoffs

Track: The Convergence of Comfort, IAQ, and Energy Efficiency Building

Room: GWCC Building A, A404

Sponsor: MTG.OBB Occupant Behavior in Buildings

Chair: Marina Sofos, U.S. Department of Energy, Washington, DC

1. Developing Prospective National Technology Goals for Occupant-centric Measures

Jared Langevin, Ph.D., Lawrence Berkeley National Laboratory, Berkeley, CA

2. LightLearn: Reinforcement Learning for Occupant Centered Control and Controller Performance Metrics

Jose Vazquez-Canteli, The University of Texas at Austin, Austin, TX

3. Personalized Comfort Modeling for Occupant-centric Environmental Control

Joyce Kim, Student Member, University of California, Berkeley, Berkeley, CA

4. FORK: A Platform for Building Controls Using Accurate Real-Time Occupancy and Thermal Comfort Preference Estimations

Mario Berges, Ph.D., Carnegie Mellon University, Pittsburgh, PA

11:00 AM – 12:30 PM

Seminar 16 (Intermediate)



The Best of Engineer's Notebook 3rd Edition

Track: Common System Issues and Misapplications

Room: GWCC Building A, A410

Sponsor: 9.1 Large GWCC Building Air-Conditioning Systems

Chair: Kelley Cramm, P.E., Member, Henderson Engineers, Lenexa, KS

1. Data Centers, Cooling Towers and Thermal Storage

Daniel H Nall, WSP Flack + Kurtz, New York, NY

2. Designing Pipe Insulation Systems

Kent W. Peterson, P.E., BEAP, Presidential Fellow ASHRAE, P2S Engineering, Inc., Long Beach, CA

3. Making VAV Great Again

Steve Taylor, P.E., Fellow ASHRAE, Taylor Engineering, Alameda, CA

4. N+1 HVAC for IT Closets and Server Rooms

Stephen W. Duda, P.E., BEAP, HBDP and HFDP, Fellow ASHRAE, Ross & Baruzzini, Inc., St. Louis, MO

11:00 AM – 12:30 PM

Workshop 2 (Advanced)



Turning to Old Buildings: Optimizing and Upgrading Our Existing Building Stock

Track: Construction, Operation, and Maintenance of High Performance Systems

Room: GWCC Building A, A302

Sponsor: 7.9 Building Commissioning, YEA Committee

Chair: Cindy Moreno, Member, T & M Mechanical Sales Co., Mesa, AZ

1. Exploring the Financials: Motivating Building Owners to Upgrade Energy Systems

Alyse Falconer, P.E., Member, Point Energy Innovations, San Francisco, CA

2. Barriers to Successful Building Owner Energy Savings Initiatives

Richard Danks, P.E., Member, Cleveland, OH

3. Leveraging Utility Rebates in Offices and Multi-Family Residential Buildings

James Falconer, Member, Affiliated Engineers, San Francisco, CA

4. All the Design Elements We Cannot See: A Case Study of Barrington School District 220

Shona O'Dea, Member, DLR Group

Sunday, January 13, 1:30 PM – 3:00 PM

Conference Paper Session 5 (Intermediate)

Analysis of HVAC Systems for Specific Applications

Track: HVAC&R Fundamentals and Applications



Room: GWCC Building A, A408

Chair: Ratnesh Tiwari, Ph.D., Member, University of Maryland, College Park, MD

1. Power Consumption Simulator of Data Center by using Computational Fluid Dynamics and Machine Learning (AT-2019-C014)

Hayato Kuwahara, BEAP, Kazuhiro Matsuda, M.D., BEAP, Member, Morito Matsuoka, Member and Ying-Feng Hsu, BEAP, Osaka University, Osaka, Japan

2. The Effect of Forced Air Warming Devices on Surgical Site Infection (AT-2019-C015)

Abdel Darwich, P.E., HFDP, Member, Fatih Turan and Suhasini Pyarasani, Guttman & Blaevot, Sacramento, CA

3. Analysis of Displacement Ventilation for Hospital Patient Rooms (AT-2019-C016)

Kishor Khankari, Ph.D., Fellow ASHRAE, AnSight LLC, Ann Arbor, MI

4. A New Fast Fluid Dynamics Model for Data-Center Floor Plenums (AT-2019-C017)

Wei Tian, Ph.D., Student Member¹, Christopher Healey, Ph.D.¹, James W. VanGilder, P.E., Member¹, Michael Condor¹, Wangda Zuo, Ph.D., Member² and Xu Han, Student Member², (1)Schneider Electric, Andover, MA, (2)University of Colorado Boulder, Boulder, CO

1:30 PM – 3:00 PM

Conference Paper Session 6 (Intermediate)**Maximizing Thermal Comfort and International Design***Track: The Convergence of Comfort, IAQ, and Energy Efficiency Building*

Room: GWCC Building A, A303



Chair: Marija Todorovic, P.Eng., Fellow ASHRAE, University of Belgrade, Belgrade, Serbia

1. The Assumption of Equidistance in the Seven-Point Thermal Sensation Scale and a Comparison between Categorical and Continuous Metrics (AT-2019-C018)*Sama Aghniaey, Ph.D., Student Member and Thomas Lawrence, Ph.D., Fellow ASHRAE, University of Georgia, Athens, GA***2. Predicting Thermal Comfort in Mixed-mode Office Building in the UK (AT-2019-C019)***Xiaoyan Luo, Student Member, Dulhas Maliyekkal-Kanhirothkandi, Associate Member, Faisal Durrani, Ph.D. and Mahroo Eftekhari, Ph.D., Member, Loughborough University, Loughborough, United Kingdom***3. Maximize Thermal Comfort in Open-plan Offices by Occupant-oriented Control Based on Individual Thermal Profile (AT-2019-C020)***Wanni Zhang and Chenlu Zhang, Carnegie Mellon University, Pittsburgh, PA***4. Quantifying the Importance of Measured Metabolic Rates and Clothing Levels for Effectively Using a Predicted Mean Vote Model: A Global Sensitivity Analysis (AT-2019-C021)***Jermy Thomas, Student Member, Amanda Smith, Associate Member and Tiffany Swenson, University of Utah, Salt Lake City, UT*

1:30 PM – 3:00 PM

Seminar 17 (Intermediate)**Building Integrated Renewable Fueled Natural Refrigeration Systems***Track: Renewables and Natural Systems*

Room: GWCC Building A, A405

Sponsor: 8.3 Absorption and Heat Operated Machines

Chair: William Ryan, Ph.D., P.E., Member, University of Illinois at Chicago, Chicago, IL

1. Biomass Power Production in Austria*Douglas Davis, Member, Capstone, Wexford, PA***2. Waste Heat Driven Cooling and Heating Technologies***Rajesh Dixit, Associate Member, Johnson Controls, Inc., York, PA***3. Efficient Dehumidification using a Compact Membrane-based Ionic Liquid Absorption Cycle***Saeed Moghaddam, Ph.D., University of Florida, Nanoengineered Energy Systems (NES) Laboratories, Gainesville, FL*

1:30 PM – 3:00 PM

Seminar 18 (Intermediate)**“Hot Topics for Hotlanta”: Emerging Applications and Markets for UVC***Track: Systems and Equipment*

Room: GWCC Building A, A301

Sponsor: 2.9 Ultraviolet Air and Surface Treatment

Chair: Sam Guzman, Member, American Ultraviolet Company, Hackettstown, NJ

1. Legionella: Need Additional Tools to Control It?

Scott Sherwood, Eco Care Corporation, New York, NY

2. Cannabis: Can UV Make my Grass Grow?

Benoit Despatis, P.Eng., Member, Sanuvox Corporation, St-Laurent, QC, Canada

3. Healthcare: Can UVC Reduce Drug Resistant Hospital Acquired Infections?

William Bahnfleth, Ph.D., P.E., Presidential Fellow ASHRAE, Pennsylvania State University, University Park, PA

1:30 PM – 3:00 PM

Seminar 19 (Advanced)



Not Too Little, Not Too Much, Just Right: ASHRAE Standard 62.1 Demand Controlled Ventilation and RP-1747

Track: The Convergence of Comfort, IAQ, and Energy Efficiency Building

Room: GWCC Building A, A305

Sponsor: 4.3 Ventilation Requirements and Infiltration

Chair: Steve Taylor, P.E., Fellow ASHRAE, Taylor Engineering, Alameda, CA

1. A Practical Demand Controlled Ventilation Strategy for Multiple Zone VAV Systems and Standard 62.1 (RP-1747)

Hwakong Cheng, P.E., Member, Taylor Engineering LLC, Alameda, CA

2. Field Testing of the RP-1747 Demand Controlled Ventilation Logic

Xiaohui Zhou, Ph.D., Member, Seventhwave, Madison, WI

3. Energy Savings from Demand Controlled Ventilation and the Impact of Sensor Error: Simulation Results from RP-1747

Zheng O'Neill, Ph.D., P.E., Member, The University of Alabama, Tuscaloosa, AL

1:30 PM – 3:00 PM

Seminar 20 (Intermediate)



Practical Aspects of Incorporating Occupant Considerations into Building Design and Operations

Track: Construction, Operation, and Maintenance of High Performance Systems

Room: GWCC Building A, A302

Sponsor: MTG.OBB Occupant Behavior in Buildings

Chair: Julia Day, Ph.D., Associate Member, Washington State University, Pullamn, WA

1. Quantifying the Impact of Occupant Behavior on Savings of Energy Conservation Measures

Kaiyu Sun, Member, Lawrence Berkeley National Laboratory, Berkeley, CA

2. Occupant Centered Controls

Jose Vazquez-Canteli, The University of Texas at Austin, Austin, TX

3. Occupant Behavior in Building Design Codes and Standards

Mohamed Ouf, Ph.D., Member, Carleton University, Ottawa, ON, Canada

4. A Case Study: Assessing Occupants' Understanding of Building Controls in High Performance Buildings

Julia Day, Ph.D., Associate Member, Washington State University, Pullamn, WA

1:30 PM – 3:00 PM

Seminar 21 (Intermediate)



Uncertainties in Compressor Performance and Field Performance of Liquid-Chilling Systems

Track: Systems and Equipment

Room: GWCC Building A, A404

Sponsor: 8.2 Centrifugal Machines

Chair: Justin Prosser, P.E., AHRI, Arlington, VA

1. Uncertainties in Compressor Performance

Justin Prosser, P.E., AHRI, Arlington, VA

2. An Introduction to Field Testing of Liquid Chillers and ASHRAE Standard 184

Ian Spanswick, O2RC Solutions LLC, York, PA

1:30 PM – 3:00 PM

Workshop 3 (Basic)



Room Loads to Equipment Sizing Missing Link: How Can ASHRAE Help Young Engineers?

Track: HVAC&R Fundamentals and Applications

Room: GWCC Building A, A410

Sponsor: 4.1 Load Calculation Data and Procedures

Chair: Larry Sun, Member, Independent Consultant, Huntington Beach, CA

1. What We Learned from the Houston Workshop

Rachel Spittler, Cyntergy, Tulsa, OK

2. The Atlanta Workshop: An Interactive Survey

James Pegues, Member, Carrier UTC, Syracuse, NY

3:15 PM – 4:45 PM

Seminar 22 (Intermediate)



Building Energy Storage: The Future of the Smart Grid

Track: Renewables and Natural Systems

Room: GWCC Building A, A410

Sponsor: 6.9 Thermal Storage

Chair: Chris Mincey, P.E., Associate Member, Crom LLC, Gainesville, FL

1. Unique GWCC Building Applications of Ice and Chilled Water Thermal Energy Storage

Guy S. Frankenfield, P.E., Member, DN Tanks, Grand Prairie, TX

2. Batteries are Magic Boxes: Can They Actually Deliver All They Slated To?

Ram Narayanamurthy, P.E., Associate Member, Electric Power Research Institute, Palo Alto, CA

3. Building Energy Storage: A Vital Component in a Low Carbon Future

Mark MacCracken, P.E., Member, CALMAC Corp, Fair Lawn, NJ

Monday, January 14

8:00 AM – 9:30 AM

Technical Paper Session 2 (Intermediate)

Studies in Energy Efficiency



Track: Renewables and Natural Systems

Room: GWCC Building A, A408

Chair: Hyojin Kim, Ph.D., Member, Catholic University of America, Washington, DC

1. A Comparison of the Annual Energy Use of Fixed and Variable Airflow Parallel Fan-Powered Terminal Units in a Small Office Building (AT-2019-004)

Dennis O'Neal, Ph.D., P.E., Fellow ASHRAE, Baylor University, Waco, TX

2. Effects of System Materials towards the Breakdown of Lubricants and Low GWP Refrigerants (RP-1774) (AT-2019-005)

Ngoc Dung (Rosine) Rohatgi, Ph.D., Member, Spauschus Associates Inc., Sylva, NC

3. Performance Evaluation of a 3-Fluid Membrane Liquid Desiccant Air-Conditioning System (WITHDRAWN)

Devin Storle, Saskatoon, SK, Canada

4. Seasonal Solar Energy Storage Technologies in Buildings (AT-2019-006)

Uros Stritih, Univerza v Ljubljani Fakulteta za Strojnistvo, Ljubljana, Slovenia

8:00 AM - 9:30 AM

Conference Paper Session 7 (Intermediate)

Air Distribution Strategies



Track: Systems and Equipment

Room: GWCC Building A, A405

Chair: Samir Traboulsi, P.Eng., Fellow Life Member, Thermo-trade/Ranec, Beirut, Lebanon

1. Photocatalytic Activity and Durability of Commercial TiO₂ Photocatalysts for Indoor Air Purification (AT-2019-C022)

Alireza Haghghatmamaghani, Student Member, Chang-Seo Lee, Ph.D., Associate Member and Fariborz Haghghat, Ph.D., Fellow ASHRAE, Concordia University, Montreal, QC, Canada

2. Capabilities and Limitations of Commercially Available Wireless Indoor Environment Sensors (AT-2019-C023)

Angelos Mylonas, Bjarne Olesen, Ph.D., Presidential Member, Ongun Kazanci, Ph.D., Associate Member and Rune Andersen, International Centre for Indoor Environment and Energy, Technical University of Denmark, Kgs. Lyngby, Denmark

3. Temporal Variations in Estimated Ventilation and Relative Performance Based on Continuous CO₂ Monitoring in Offices (AT-2019-C024)

Samy Clinchard¹, Tomas Novotny, P.Eng., Member¹, Rick Aller¹, Salvatore della Veccia¹ and Ulla Haverinen-Shaughnessy², (1)720 Degrees Ltd, Helsinki, Finland, (2)720 Degrees Ltd, New York, NY

4. Comparing Configurations for Supply and Return Vents in Mixed Air Distribution Systems to Reduce Micro-particle Indoor Concentrations (AT-2019-C025)

Walid M. Chakroun, Ph.D., Fellow ASHRAE¹, Kamel Ghali, Ph.D.², Nesreen Ghaddar, Ph.D., Member² and Soroor Alotaibi, Member¹, (1) Kuwait University, Kuwait City, Kuwait, (2) American University of Beirut, Beirut, Lebanon

8:00 AM – 9:30 AM

Conference Paper Session 8 (Intermediate)**Quality Office Conditions through HVAC and R***Track: The Convergence of Comfort, IAQ, and Energy Efficiency Building**Room: GWCC Building A, A404**Chair: Jaya Mukhopadhyay, Ph.D., Member, Montana State University, Bozeman, MT***1. Restoring Trust: How GWCC Building Automation, Operators and Tenants Restored Indoor Environmental Conditions Following Failed Improvement Measures (AT-2019-C026)***Orvil Dillenbeck, P.Eng., Member, Canadian Nuclear Laboratories, Chalk River, ON, Canada***2. The Convergence of ASHRAE Standards 90.1, 62.1 and 55: Energy Efficiency Measures and an Example of an Office Building (AT-2019-C027)***Chonghui Liu, P.E., Member, IPD Engineering, Syracuse, NY***3. Indoor Air Quality and Energy Efficiency (AT-2019-C028)***Nirmal Ram D, Cerebration Consultants, Bengaluru, India***4. Performance Evaluation of Active Chilled Beam in Real Office Conditions in a High-Performance Building in Heating (AT-2019-C029)***Rohit Upadhyay, Student Member and Dr. Rodrigo Mora, P.Eng., Member, British Columbia Institute of Technology, Burnaby, BC, Canada*

8:00 AM – 9:30 AM

Seminar 23 (Advanced)**Advances in Low-GWP Refrigeration System Architectures***Track: Refrigeration**Room: GWCC Building A, A410****Sponsor: 10.7 Commercial Food and Beverage Refrigeration Equipment, Refrigeration Committee****Chair: Georgi Kazachki, Ph.D., Fellow ASHRAE, Dayton Phoenix Group, Inc., Dayton, OH***1. Micro-Distributed Systems***Timothy Anderson, Hussmann, Bridgeton, MO***2. Application of CO2 Transcritical Advanced Technologies in Hot Climates***Shitong Zha, Ph.D., Member, Heatcraft, Stone Mountain, GA***3. Combining HFO's with Various System Architectures to Reduce Energy Use and Emissions in Commercial Refrigeration***Gustavo Pottker, Member, Honeywell - Buffalo Research Laboratory, Buffalo, NY*

8:00 AM - 9:30 AM

Seminar 24 (Intermediate)**ASHRAE Thermal Guidelines Driving Data Center Performance & Innovation***Track: Construction, Operation, and Maintenance of High Performance Systems**Room: GWCC Building A, A305****Sponsor: 9.9 Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment****Chair: Joseph Gangemi, Life Member, Northern Air Systems, Rochester, NY*

1. The Real Opportunity of the Thermal Guidelines and their Impact on IT Equipment Design

Dustin Demetriou, Ph.D., Member, IBM, Poughkeepsie, NY

2. Data Center Site Selection, Business Decisions and Thermal Guidelines that Facilitate the Bold Decision to Enter the Wholesale Market and Adopt a Free Cooling Strategy

Paul Finch, CEng, Member, Kao Data, London, United Kingdom

3. Validating the Design Concept for a Data Center Without Mechanical Cooling in the Southern UK

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

8:00 AM – 9:30 AM

Seminar 25 (Basic)



Ground Source Heat Pumps: You Can't Always Get What You Want

Track: Common System Issues and Misapplications

Room: GWCC Building A, A302

Sponsor: 6.8 Geothermal Heat Pump and Energy Recovery Applications

Chair: Michael Kuk, Member, CERx Solutions, LLC, Oswego, IL

1. Well You Just Might Find (Through Commissioning) That You Didn't Get You Need

Michael Kuk, OPMP, CPMP and BEAP, Member, CERx Solutions, LLC, Oswego, IL

2. But if You Try... You Get What You Need

Stephen Kavanaugh, Member, University of Alabama, Northpoint, AL

3. Burying Mistakes

Lisa Meline, P.E., Member, Meline Engineering Corporation, Sacramento, CA

8:00 AM – 9:30 AM

Seminar 26 (Basic)



Load Calculation Considerations for Radiant Systems

Track: HVAC&R Fundamentals and Applications

Room: GWCC Building A, A301

Sponsor: 4.1 Load Calculation Data and Procedures

Chair: Rachel Spitzer, Associate Member, Cyntergy, Tulsa, OK

1. A Side-by-Side Laboratory Comparison of Peak Space Cooling Loads and Daily Thermal Energy Use for Radiant and All-air Systems

Jonathan Woolley, University of California, Berkeley, Berkeley, CA

2. Difference in Cooling Loads for Radiant and All-Air Systems for Different Load Scenarios

Ardeshir Moftakhari, Student Member, University of Texas, Austin, TX

3. What Happens when Radiant Systems are Designed by Methods Developed for All-air Systems?

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

4. Development and Demonstration of an Interactive Web-based Design Tool for High Thermal Mass Radiant Cooling Systems

Carlos Duarte, University of California, Berkeley, Berkeley, CA

9:45 AM – 10:45 AM

Conference Paper Session 9 (Intermediate)

Ground Source Heat Pumps, from Experimental Applications to Novel Case Studies*Track: Renewables and Natural Systems*

Room: GWCC Building A, A408

Chair: Peng Yin, Ph.D., Associate Member, University of Louisiana at Lafayette, Lafayette, LA

1. Experimental and Simulation Studies on Solar-Ground Source Heat Pump System (AT-2019-C030)

Eikichi Ono, M.D.¹, Masaki Shioya, Ph.D.¹, Taizo Shimo, M.D.¹ and Yoshiro Shiba, Ph.D.², (1)Kajima Technical Research Institute, Tokyo, Japan, (2)Zeneral Heatpump Industry Co.,Ltd., Nagoya, Japan

2. Modeling and Parametric Study of Large Diameter Shallow Bore Helical Ground Heat Exchanger (AT-2019-C031)

Antash Najib, Student Member¹, Angelo Zarrella², Curtis Harrington, P.E.¹, Peter Grant³, Rachael Larson¹ and Vinod Narayanan¹, (1) University of California, Davis, CA, (2)University of Padova, Padova, Italy, (3)Frontier Energy, Davis, CA

3. Strategies and Lessons Learned for Optimal Performance of Gas Heat Pump-Driven Residential Combination Space and Water Heating Systems (AT-2019-C032)

Paul Glanville, P.E., Associate Member¹, Aleksandr Fridlyand, Ph.D., Member¹, Chris Keinath, Ph.D., Member² and Michael Garrabrant, Member³, (1)Gas Technology Institute, Des Plaines, IL, (2)Stone Mountain Technologies, Inc., Johnson City, TN, (3)Stone Mountain Technologies, Inc., Erwin, TN

9:45 AM – 10:45 AM

Conference Paper Session 10 (Intermediate)

Human Factors Design for Residential Buildings*Track: Construction, Operation, and Maintenance of High Performance Systems*

Room: GWCC Building A, A303

Chair: David Yashar, Ph.D., P.E., Member, National Institute of Standards and Technology, Gaithersburg, MD

1. Human Factors of High Performance Multifamily Housing (AT-2019-C033)

Philip Agee, Student Member¹, Andrew McCoy, Ph.D.¹, Brian Kleiner, Ph.D.¹, Dong Zhao, Ph.D.², Frederick Paige, Ph.D.¹ and Georg Reichard, Ph.D., Member¹, (1)Virginia Polytechnic Institute and State University, Blacksburg, VA, (2)Michigan State University, East Lansing, MI

2. Energy Savings Estimates for Occupancy- and Temperature-based Smart Ventilation Control Approaches in Single-family California Homes (AT-2019-C034)

Jordan Clark, Ph.D., Associate Member¹, Brennan Less², Iain Walker, Ph.D., Fellow ASHRAE², Max Sherman, Ph.D., Fellow ASHRAE², Spencer Dutton, Ph.D.² and Xiwang Li, Ph.D.², (1)The Ohio State University, Columbus, OH, (2)Lawrence Berkeley National Laboratory, Berkeley, CA

3. Next-Generation Residential Space Conditioning System for California (AT-2019-C035)

Sara Beaini, Ph.D., Member¹, Ammi Amarnath¹, Curtis Harrington, P.E.², Mark Modera, Ph.D., P.E., Fellow ASHRAE², Morton Blatt, Fellow ASHRAE¹, Robert Davis, P.E., Member³, Ron Domitrovic, Ph.D., Member⁴, Ryohei Hinokuma⁵, Sreenidhi Krishnamoorthy, Ph.D., Student

Monday, January 14

Member² and Walter Hunt, Member⁴, (1)Electric Power Research Institute, Palo Alto, CA, (2)University of California, Davis, CA, (3) PG&E Applied Technology Services (formerly), San Ramon, CA, (4) Electric Power Research Institute, Knoxville, TN, (5)Daikin US Corporation, Irvine, CA

9:45 AM – 10:45 AM

Seminar 27 (Intermediate)



Cannabis Grow Facilities: Challenges for HVAC Design, Equipment Selection and Operation

Track: Systems and Equipment

Room: GWCC Building A, A405

Sponsor: 1.5 Computer Applications

Chair: Stephen Roth, P.E., Member, Carmel Software Corp., San Rafael, CA

1. Specialized HVAC Load Calcs and Equipment Selection for Grow Facilities

Stephen Roth, P.E., Member, Carmel Software Corp., San Rafael, CA

2. Cannabis Grow Facilities: Challenges for HVAC Design and Operation

Bruce Straughan, P.E., Member, Straughan Forensic, LLC, Arvada, CO

9:45 AM – 10:45 AM

Seminar 28 (Intermediate)



Challenges of Using Open Source CFD Tools

Track: HVAC&R Fundamentals and Applications

Room: GWCC Building A, A404

Sponsor: 4.10 Indoor Environmental Modeling

Chair: Mike Koupriyanov, P.E., Associate Member, Price Industries Limited, Winnipeg, MB, Canada

1. Fast Fluid Dynamics for Energy Efficient Building Design and Operation

Wangda Zuo, Ph.D., Member, University of Colorado Boulder, Boulder, CO

2. The Return on Investment: Modeling a Commercial Kitchen with Open CFD Tools

Duncan Phyfe, Associate Member, Alden Research Laboratory, Holden, MA

3. Assessment of the CFD-0 module of CONTAM for Airborne Contaminant Transport Modeling in Hospital and Laboratory Applications

Bruno Perazzo Pedrosa Barbosa, FIOCRUZ, Rio de Janeiro, Brazil

9:45 AM – 10:45 AM

Seminar 29 (Intermediate)



Cutting-Edge Japanese Technologies SHASE Annual Award for ZEB Constructions in 2018

Track: Renewables and Natural Systems

Room: GWCC Building A, A410

Sponsor: MTG.ACR, 9.10 Laboratory Systems, 9.11 Clean Spaces

Chair: Shin-ichi Tanabe, Ph.D., Fellow ASHRAE, Department of Architecture, Waseda University, Tokyo, Japan

1. ZEB City Hall Encompasses Regional History, Climate and Resources in Japan

Tomohisa Takebe, NIHON SEKKEI, INC., Tokyo, Japan

2. ZEB Renovation of Building in Actual Use

Hiroki Kawakami, Member, Takenaka Corporation, Tokyo, Japan

9:45 AM – 10:45 AM

Seminar 30 (Intermediate)



Hydronics Gone Haywire: What the Gen Xers and Baby Boomers Have Done Wrong: The Sequel

Track: Common System Issues and Misapplications

Room: GWCC Building A, A301

Sponsor: 6.1 Hydronic and Steam Equipment and Systems

Chair: Jessica Mangler, P.E., Member, Affiliated Engineers, Inc., Seattle, WA

1. Chilled and Condenser Water System Misapplications and Mitigation

Michael Schwedler, Member, Trane, La Crosse, WI

2. Heating Water System Misapplications and Mitigation

Jason Atkisson, P.E., Member, Affiliated Engineers, Inc., Madison, WI

9:45 AM – 10:45 AM

Seminar 31 (Intermediate)



Thermodynamic Analysis of Non-Vapor-Compression Cooling/Heating Technologies

Track: HVAC&R Fundamentals and Applications

Room: GWCC Building A, A302

Sponsor: 1.1 Thermodynamics and Psychrometrics

Chair: Zhiwei 'Joy' Huang, Ph.D., Member, Johnson Controls, Norman, OK

1. Thermodynamic Analysis of NIK Cooling/Heating Technologies

Kashif Nawaz, Associate Member, Oak Ridge National Laboratory, Oak Ridge, TN

2. Regenerative Elastocaloric Cooling

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

3. Efficiency Benefit of Magnetocaloric Cooling Systems under Part Load Operation

Suxin Qian, Ph.D., Member, Xi'an Jiaotong University, Xi'an, China

9:45 AM – 10:45 AM

Forum 1 (Advanced)

What Do We Know about Contaminant Generation Rates?

Track: The Convergence of Comfort, IAQ, and Energy Efficiency Building

Room: GWCC Building A, A305

Sponsor: 7.6 Building Energy Performance

Moderator: Kishor Khankari, Ph.D., Fellow ASHRAE, AnSight LLC, Ann Arbor, MI

11:00 AM – 12:00 PM

Conference Paper Session 11 (Intermediate)

Equipment Component Design for Enhanced Operation

Track: Systems and Equipment



Room: GWCC Building A, A408

Chair: Bass Abushakra, Ph.D., Member, United States Military Academy, West Point, NY

1. Design of Multi Nozzles for a Portable Air Flow Meter using Numerical Simulation (AT-2019-C036)

Sang Taek Oh, Ph.D., Member¹, Jong Jun Park, Student Member², Sean Hay Kim, Ph.D., Member² and Young Il Kim, Ph.D., P.E., Member², (1) Seoul Industry Engineering Co., Ltd., Seoul, Korea, Republic of (South), (2)Seoul National University of Science and Technology, Seoul, Korea, Republic of (South)

2. Effect of Mixed Super-Hydrophilic and Super-Hydrophobic Surface Coatings on Droplets Freezing and Subsequent Frost Growth during Air Forced Convection Channel Flows (AT-2019-C037)

Ellyn Harges, Student Member, Lorenzo Cremaschi, Ph.D., Member, Amy Strong, Student Member and Burak Adanur, Student Member, Auburn University, Auburn, AL

3. Optimization of Microchannel Shape Using Analytical Models for Condensation (AT-2019-C038)

Khoudor Keniar, Student Member and Srinivas Garimella, Georgia Institute of Technology, Atlanta, GA

11:00 AM – 12:00 PM

Conference Paper Session 12 (Intermediate)

Equipment in Air Distribution



Track: Systems and Equipment

Room: GWCC Building A, A303

Chair: Lorenzo Cremaschi, Ph.D., Member, Auburn University, Auburn, AL

1. Improving Effective Energy-Efficient Commercial Package Dedicated Outside Air Systems Located in Hot-Humid Climate Zones (AT-2019-C039)

Charles Withers Jr.¹ and David Salyer², (1)Florida Solar Energy Center, Cocoa, FL, (2)Addison, Orlando, FL

2. In-Situ Observations of Series and Parallel Fan Powered Terminal Units (AT-2019-C040)

John Bryant, Ph.D., P.E., Member¹ and Basel Kanaan², (1)Texas A&M University, College Station, TX, (2)Grant, Inc., Dallas, TX

3. Development and Calibration of an Online Energy Model for AHU Fan (AT-2019-C041)

Jin Dong, Member¹, Jeffrey Munk, Member¹, Piljae Im, Ph.D., Member¹, Sen Huang, Student Member², Teja Kuruganti¹ and Yan Chen², (1)Oak Ridge National Laboratory, Oak Ridge, TN, (2)Pacific Northwest National Laboratory, Richland, WA

11:00 AM – 12:00 PM

Seminar 32 (Intermediate)**Cutting-Edge Japanese Technologies SHASE Annual Award for New Constructions in 2018***Track: The Convergence of Comfort, IAQ, and Energy Efficiency Building**Room: GWCC Building A, A302***Sponsor: 7.6 Building Energy Performance***Chair: Shinsuke Kato, Ph.D., Fellow ASHRAE, University of Tokyo Institute of Industrial Science, Tokyo, Japan***1. Practice of an Environmental Facility Plan for a New Construction Building***Taro Hongo, Member, NIKKEN SEKKEI LTD., Tokyo, Japan***2. Creation of Urban High-rise Hospitals through Medical and Architectural Collaboration***Koichi Machida, Shimizu Corporation, Tokyo, Japan*

11:00 AM – 12:00 PM

Seminar 33 (Basic)**Low GWP Refrigerants: Components and System Designs***Track: Refrigeration**Room: Building B, B313a***Sponsor: 8.4 Air-to-Refrigerant Heat Transfer Equipment, 8.1 Positive Displacement Compressors***Chair: Pega Hrnjak, Ph.D., Fellow ASHRAE, University of Illinois, ACRC and CTS, Urbana, IL***1. Evaluation of Alternative Lower GWP Refrigerants***Paul de Larminat, Ph.D., P.E., Member, Johnson Controls Industries, York, France***2. Development of a Light-commercial Hot-gas Bypass Load Stand for Accelerated Compressor Development***Craig Bradshaw, Ph.D., Member, Oklahoma State University, Stillwater, OK*

11:00 AM – 12:00 PM

Seminar 34 (Intermediate)**Modeling MegaStructures, Arena, etc.***Track: The Engineer's Role in Architecture**Room: GWCC Building A, A404***Sponsor: 4.10 Indoor Environmental Modeling***Chair: Duncan Phyfe, Associate Member, Alden, Holden, MA***1. Modeling of Road Tunnel with Semi-transparent Photovoltaic (STPV) Installed at Tunnel Approaches***Liangzhu (Leon) Wang, Concordia University, Montreal, QC, Canada***2. Conditioning Strategies for Tall Open Spaces with Large Solar Loads***Mike Koupriyanov, P.E., Associate Member, Price Industries Limited, Winnipeg, MB, Canada*

11:00 AM – 12:00 PM

Seminar 35 (Intermediate)



NetZero: Understanding, Reducing, and Mitigating Uncertainty in the Design Phase

Track: The Convergence of Comfort, IAQ, and Energy Efficiency Building

Room: GWCC Building A, A405

Sponsor: 7.6 Building Energy Performance

Chair: Brenda Morawa, P.E., Member, IES, LTD, Atlanta, GA

1. Design Phase Modeling: Unregulated Uncertainties in the Path to Net Zero

Abigail Hampsmire, P.E., Member, Green Business Certification Inc., Washington, DC

2. NetZero: Best and New Practices to Reduce Uncertainty in the Design Phase Simulations

Brenda Morawa, IES, Atlanta, GA

11:00 AM – 12:00 PM

Seminar 36 (Basic)



Pairing Geothermal and Hydronic Systems in Residential Buildings

Track: Systems and Equipment

Room: Building B, B313b

Sponsor: 6.1 Hydronic and Steam Equipment and Systems

Chair: David Lee, P.Eng., Member, Armstrong Fluid Technology, Toronto, ON, Canada

1. Ground-Source Heat Pump Design for a Moderate Residence in Northern California

Lisa Meline, P.E., Member, Meline Engineering Corporation, Sacramento, CA

2. Energy Efficient Residential Hydronic System Design

Stan Kutin, Member, Xylem Bell & Gossett, Morton Grove, IL

11:00 AM – 12:00 PM

Seminar 37 (Intermediate)



Space Pressurization for Infection Control and Hospital Accreditation

Track: Construction, Operation, and Maintenance of High Performance Systems

Room: GWCC Building A, A305

Sponsor: 1.4 Control Theory and Application

Chair: Chad Moore, P.E., Member, Engineering Resource Group, Jackson, MS

1. Controlling Contaminants with Space Pressurization

James Coogan, P.E., Associate Member, Siemens Building Technologies, Chicago, IL

2. Creating a Program to Identify and Monitor Pressurized Spaces in a Hospital

Dennis Ford, Atrium Health, Charlotte, NC

11:00 AM – 12:00 PM

Seminar 38 (Intermediate)**Tall Space Load Calculations***Track: HVAC&R Fundamentals and Applications**Room: GWCC Building A, A410***Sponsor: 4.1 Load Calculation Data and Procedures***Chair: Jingjuan (Dove) Feng, Ph.D., Associate Member, Taylor Engineering, Alameda, CA***1. Using Physics to Conserve Energy***Peter Simmonds, Ph.D., Fellow ASHRAE, GWCC Building And Systems Analytics LLC, Marina Del Rey, CA***2. Load Estimation for Tall Spaces using Computational Fluid Dynamics***Dan Nall, AIA, Fellow ASHRAE, Syska Hennessy, New York, NY*

11:00 AM – 12:00 PM

Workshop 4 (Basic)**Getting Involved with ASHRAE Standards***Track: HVAC&R Fundamentals and Applications**Room: GWCC Building A, A301***Sponsor: 7.6 Building Energy Performance***Chair: Walter Grondzik, P.E., Fellow Life Member, Ball State University, Muncie, IN***1. Getting Involved with ASHRAE Standards***Walter Grondzik, P.E., Fellow Life Member, Ball State University, Muncie, IN*

2:15 PM – 3:45 PM

Seminar 39 (Basic)**How Revisions to ASHRAE Standard 180 will Help Improve Maintenance Services***Track: Construction, Operation, and Maintenance of High Performance Systems**Room: Building B, B313a***Sponsor: 7.3 Operation and Maintenance Management***Chair: Glenn Friedman, P.E., Fellow ASHRAE, Taylor Engineering, Alameda, CA***1. How ASHRAE Standard 180 Can Transform the HVAC Maintenance Industry***Kristin Heinemeier, University of California, Berkeley, Davis, CA***2. Western HVAC Performance Alliance Inc. (WHPA) Use of ASHRAE Standard 180***Richard Danks, P.E., Member, Cleveland, OH***3. ASHRAE Standard 180 Use and Updates***Tom Paxson, P.E., Life Member, Pax-Sun, Inc., Nacogdoches, TX***4. Operations and Maintenance Programs Using ASHRAE Standard 180: A Factor for Persistence in Building Energy Performance***Cedric Trueman, P.Eng., Life Member, Trueman Engineering Services, Victoria, BC, Canada*

2:15 PM – 3:45 PM

Seminar 40 (Basic)



Update on Global Policies and Programs for Best Use of Refrigerants

Track: Refrigeration

Room: Building B, B313b

Sponsor: 7.3 Operation and Maintenance Management

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

1. An Overview of Refrigerants Related Policies in Article 5 Countries and UN Environment Partnerships to Support Compliance with the Protocol

Ayman Eltalouny, UN Environment, Manama, Bahrain

2. The Application of the EU F-Gas Regulations: An Example for Other Regions?

Didier Coulomb, International Institute of Refrigeration, Paris, France

3. IIR Actions to Reduce Refrigerant Emissions

Didier Coulomb, International Institute of Refrigeration, Paris, France

4. US GHG Regulation and EERE Program Update

Antonio Bouza, U.S. Department of Energy, Columbia, MD

2:15 PM – 4:15 PM

Workshop 5 (Basic)



Best Practices of the Mentor-Mentee Relationship

Track: HVAC&R Fundamentals and Applications

Room: GWCC Building A, A410

Sponsor: , College of Fellows, YEA Committee

Chair: Jacob Kopocis, Member, Control Services, Inc, Omaha, NE

1. Best Practices of the Mentor-Mentee Relationship

Ralph Kison, Member, Kison, Inc., Vancouver, BC

4:00 PM – 5:00 PM

Seminar 41 (Intermediate)



Assessing the Effectiveness of Economizers for De-Centralized Cooling Systems

Track: Systems and Equipment

Room: Building B, B313a

Sponsor: 9.8 Large GWCC Building Air-Conditioning Systems

Chair: William Artis, Member, Essential Energy Consulting LLC, Hicksville, NY

1. Applying Economizers to De-centralized Systems

Jonathan Johrden, P.E., Member, JDJ Engineering, New York, NY

2. Economizer Energy Performance and Cost Benefit Analysis

Sam Mason, P.E., Member, Encompass Energy LLC, Denver, CO

4:00 PM – 5:00 PM

Seminar 42 (Intermediate)



Using Air to Air Energy Recovery to Help Balance Comfort, IAQ and Energy

Track: The Convergence of Comfort, IAQ, and Energy Efficiency Building

Room: Building B, B313b

Sponsor: 5.5 Air-to-Air Energy Recovery

Chair: Ronnie Moffitt, P.E., Member, Ingersoll Rand, Lexington, KY

1. Wraparound Heat Pipe Technology: Using Heat Pipes to Save Energy and Improve IAQ

Mazen Awad, Member, Heat Pipe Technology, Inc, Tampa, FL

2. Upgrading Your Rooftop: Energy Recovery Applications in Commercial Unitary Equipment

Kristin Sullivan, Member, Trane, La Crosse, WI

Tuesday, January 15

8:00 AM – 9:30 AM

Debate 2 (Intermediate)

Filtration Doesn't Matter... or Does it?

Track: The Convergence of Comfort, IAQ, and Energy Efficiency Building

Room: GWCC Building A, A410

Sponsor: 2.4 Particulate Air Contaminants and Particulate Contaminant Removal Equipment

Chair: Marilyn Listvan, Member, Listvan Consulting, Edina, MN

1. Jeffrey Siegel, Ph.D., Fellow ASHRAE, University of Toronto, Toronto, ON, Canada,

2. Matt Middlebrooks, Filtration Group, Dallas, TX,

3. Donald Thornburg Jr., Member, Camfil USA, Riverdale, NJ

4. Dennis Stanke, Member, Retired, West Salem, WI

8:00 AM – 9:30 AM

Conference Paper Session 13 (Intermediate)

Efficiency and Health Benefits of Modern Hydronic Systems

Track: Systems and Equipment



Room: GWCC Building A, A303

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

1. Legionella Regulation, Cooling Tower Positivity and Water Quality in the Quebec Context: A Review of Field Data (AT-2019-C042)

Patrick Racine, Steve Elliott and Stephen Betts, Klenzoid Canada, Mississauga, ON, Canada

2. Method for Centrifugal Chiller Power Estimation and Prediction: Development and Verification (AT-2019-C043)

Marcelo Acosta, P.E., Member and Vladimir Suslov, Armstrong Fluid Technology, Toronto, ON, Canada

3. Industry, Government and Academia Partner to Achieve SCOP>5 Hot-Climate MEPS Air-Cooled Chiller (AT-2019-C044)

Tech Program

Peter Armstrong, Ph.D., P.E., Member and **Muhammad Tauha Ali, Member, Masdar Institute, Khalifa University of Science and Technology, Abu Dhabi, United Arab Emirates**

4. Effect of the Specification of Chilled and Hot Water Coil on Efficiency of Air Conditioning System with Water Thermal Storage (AT-2019-C045)

Tomoya Kawaji, BEAP, Associate Member¹, Hiroshi Ninomiya, Member², Kazuki Nakatsuka, Affiliate³, Nobuo Nakahara, Ph.D., P.E., Affiliate⁴ and Ryuji Yanagihara, Ph.D., Affiliate⁵, (1)Aichi Institute of Technology, Toyota, Japan, (2)Nikken Sekkei, Tokyo, Japan, (3)Sanko Air Conditioning, Osaka, Japan, (4)NESTEC, Osaka, Japan, (5)R.Y. Environment & Energy Design, Osaka, Japan

8:00 AM – 9:30 AM

Seminar 43 (Basic)



Adapting to Thrive: Shaping Resilient Future Urban Performance through Historical Insight

Track: The Engineer's Role in Architecture

Room: GWCC Building A, A301

Sponsor: , CIBSE ASHRAE Liaison Committee

Chair: Tim Dwyer, CEng, Fellow ASHRAE, University College London, London, United Kingdom

1. Adapting to Change

Stephen Lisk, CIBSE President and OneEightLight, Bristol, United Kingdom

2. From Historical Pankhā to Traditional Ceiling Fan: Low-energy Cooling and Ventilation in Indian Homes

Dennis Loveday, Ph.D., Loughborough University, Loughborough, United Kingdom

3. Going Digital: Modeling Historical Infrastructure

Drury Crawley, Ph.D., BEMP, Fellow ASHRAE, Bentley Systems, Inc., Washington, DC

8:00 AM – 9:30 AM

Seminar 44 (Intermediate)



How was that Supposed to Work Again? The Importance of Documented and Understandable Sequences of Operation throughout the Life Cycle of a High Performance Building

Track: Construction, Operation, and Maintenance of High Performance Systems

Room: GWCC Building A, A404

Sponsor: 7.3 Operation and Maintenance Management, 7.9 Building Commissioning

Chair: Mina Agarabi, P.E., Member, Agarabi Engineering PLLC, New York, NY

1. Different Writers, Different Readers, Different Styles

James Coogan, P.E., Associate Member, Siemens Building Technologies, Chicago, IL

2. Case Study: Comparing Effective and Ineffective SOO

Bill Gnerre, Member, Interval Data Systems, Waltham, MA

3. The SOO as a Tool for Construction and Operations

Michael Gallagher, P.E., Member, Western Allied Corporation, Santa Fe Springs, CA

8:00 AM – 9:30 AM

Seminar 45 (Intermediate)**HVAC Optimization***Track: HVAC&R Fundamentals and Applications**Room: GWCC Building A, A408***Sponsor: Publication and Education Council***Chair: Reinhard Radermacher, Ph.D., Fellow ASHRAE, University of Maryland, College Park, MD***1. Development of a Distributed Artificial Fish Swarm Algorithm to Optimize Pumps Working in Parallel Mode***Tianyi Zhao, Ph.D., Dalian University of Technology, Dalian, China***2. Field Test of the ASHRAE/CIBSE/USGBC Performance Measurement Protocols: Parts 1 and 2***Hyojin Kim, Ph.D., Member, Catholic University of America, Washington, DC***3. Multivariable Extremum Seeking Control for a Multi-functional Variable Refrigerant Flow System***Yaoyu Li, Ph.D., Member, University of Texas at Dallas, Dallas, TX*

8:00 AM – 9:30 AM

Seminar 46 (Advanced)**Refrigerant Flammability Fundamentals***Track: Refrigeration**Room: GWCC Building A, A302***Sponsor: 3.1 Refrigerants and Secondary Coolants***Chair: Stephen Kujak, Member, Trane, Ingersoll Rand, La Crosse, WI***1. Flammability Fundamentals***Gregory Linteris, Ph.D., Associate Member, National Institute of Standards and Technology, Gaithersburg, MD***2. Evaluation of Experimental Methods for Burning Velocity of Flammable Refrigerants***Gregory Linteris, Ph.D., Associate Member, National Institute of Standards and Technology, Gaithersburg, MD***3. Flammability and Risk Assessment of Low GWP Refrigerants***Sarah Kim, Ph.D., Associate Member, Arkema, Inc., King of Prussia, PA***4. Hot Surface Ignition Testing of Low GWP 2L Refrigerants***Patrick E. Coughlan, Chemours Fluoroproducts, Wilmington, DE***5. Effects of Temperature and Pressure on Quenching Distances of Low GWP 2L Refrigerants***Kenji Takizawa, National Institute of Advanced Industrial Science and Technology, Tsukuba, Japan*

8:00 AM – 9:30 AM

Seminar 47 (Intermediate)**Securing BACnet Networks: Present and Future***Track: HVAC&R Fundamentals and Applications**Room: GWCC Building A, A305***Sponsor: 7.5 Smart Building Systems***Chair: Carol Lomonaco, Member, Johnson Controls, Milwaukee, WI***1. Understanding the Options for Securing your GWCC Building Automation Infrastructure***Dave Robin, Automated Logic Inc., Atlanta, GA*

Tuesday, January 15

2. BACnet Secure Connect (proposed BACnet Addendum 135-2016bj)
Bernhard Isler, Member, Siemens Switzerland Ltd Building Technologies Division, Zug, Switzerland

3. BACnet Audit Reporting and Logging (published BACnet Addendum 135-2016bi)
Michael Osborne, P.Eng., Member, Reliable Controls Corporation, Victoria, BC, Canada

8:00 AM – 9:30 AM

Seminar 48 (Intermediate)



Understanding the Noise and Vibration Associated with Variable Refrigerant Flow (VRF) Systems

Track: Common System Issues and Misapplications

Room: GWCC Building A, A405

Sponsor: 2.6 Sound and Vibration

Chair: Erik Miller-Klein, P.E., Member, A3 Acoustics, LLP, Seattle, WA

1. VRF Noise Testing Standards

Jerry Lilly, P.E., Member, JGL Acoustics Inc, Issaquah, WA

2. Vibration Isolation & Noise Control for VRF Condensing Units

Erik Miller-Klein, P.E., Member, A3 Acoustics, LLP, Seattle, WA

3. A Field Guide to Noise and Vibration Issues for Installed VRF Systems

Roman Wowk, Associate Member, Papadimos Group, San Francisco, CA

9:45 AM – 10:45 AM

Conference Paper Session 14 (Intermediate)

Dessicant Dehumidification



Track: Systems and Equipment

Room: GWCC Building A, A408

Chair: Christopher R. Laughman, Ph.D., Member, Mitsubishi Electric Research Laboratories, Cambridge, MA

1. Desiccant Dehumidification Process for Energy Efficient Air Conditioning (AT-2019-C046)

Jonathan Maisonneuve, Ph.D., Associate Member and Thomas Cremonte, Student Member, Oakland University, Rochester, MI

2. A Novel Heat and Mass Transfer Model for Membrane-based Ionic Liquid Desiccant Air Dehumidifier (AT-2019-C047)

Ming Qu, Ph.D.¹, Joseph Warner, Student Member², Xiaobing Liu, Ph.D., Member² and Xiaoli Liu, Student Member¹, (1)Purdue University, West Lafayette, IN, (2)Oak Ridge National Laboratory, Oak Ridge, TN

3. Sensitivity Study of Crystallization Fouling in a Liquid-to-Air Membrane Energy Exchanger Using Three Desiccant Solutions (AT-2019-C048)

Adesola Olufade, Associate Member and Carey J. Simonson, Ph.D., P.E., Member, University of Saskatchewan, Saskatoon, SK, Canada

9:45 AM – 10:45 AM

Seminar 49 (Intermediate)



Cutting-Edge Japanese Technologies SHASE Annual Award for Smart Community in 2018

Track: Construction, Operation, and Maintenance of High Performance Systems

Room: GWCC Building A, A302

Sponsor: 7.6 Building Energy Performance

Chair: Yasunori Akashi, Ph.D., Member, The University of Tokyo, Tokyo, Japan

1. A Smart Community with Energy Sharing for the Existing City Area
Akiko Ushiyama, Shimizu Corporation, Tokyo, Japan

2. Smart Energy Management System for 70 University Buildings
Mitsugu Kawamura, Shimizu Corporation, Tokyo, Japan

9:45 AM – 10:45 AM

Seminar 50 (Basic)**Energy Efficiency and the Impact on Human Health**

Track: *The Convergence of Comfort, IAQ, and Energy Efficiency Building*

Room: GWCC Building A, A301

Sponsor: , EHC, MTG.HWBE *Health and Wellness in the Built Environment*

Chair: Lan Chi Nguyen Weekes, P.Eng., Member, College La Cite, Ottawa, ON, Canada

1. Human-Centered Building Standards

Nicholas Clements, Ph.D., Well Living Lab, Rochester, MN

2. Integrated IAQ Strategies via Source Control, Ventilation and Air Purification for Low Energy Buildings

Jensen Zhang, Ph.D., Member, Syracuse University, Syracuse, NY

9:45 AM – 10:45 AM

Seminar 51 (Intermediate)**Ground-Source Heat Pumps Using Carbon Dioxide**

Track: *Refrigeration*

Room: GWCC Building A, A404

Sponsor: , *Publication and Education Council*

Chair: Harrison Skye, Ph.D., Member, National Institute of Standards and Technology, Gaithersburg, MD

1. Developments in Direct Expansion Ground Source Heat Pumps with CO₂

John Scott, Member, CanmetENERGY, Varennes, QC, Canada

2. Measurements and Energy Analysis for a Prototype Carbon Dioxide Ground Source Heat Pump

Harrison Skye, Ph.D., Member, National Institute of Standards and Technology, Gaithersburg, MD

9:45 AM – 10:45 AM

Seminar 52 (Intermediate)**Latest Research Highlights**

Track: *HVAC&R Fundamentals and Applications*

Room: GWCC Building A, A405

Sponsor: *Publication and Education Council*

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

1. Experimental Methodology and Results for Heat Gains from Various Office Equipment and Equipment Power Consumption and Load Factor Profiles for Buildings' Energy Simulation (ASHRAE RP-1742)

Omer Sarfraz, Student Member, Oklahoma State University, Stillwater, OK

- 2. **Field Measurement and Modeling of UVC Cooling Coil Irradiation for HVAC Energy Use Reduction (RP-1738): Part 1 and 2**
Joseph Firrantello, Ph.D., P.E., Member, Envinity, Inc., State College, PA
- 3. **CFD Modeling of Flammable Refrigerant Leaks inside Machine Rooms- Emergency Ventilation Rate for Different Size Chillers**
Paul Papas, Ph.D., United Technologies Research Center, East Hartford, CT

9:45 AM – 10:45 AM

Seminar 53 (Intermediate)



The New Chapter 36 of the HVAC Applications Handbook: Energy and Water Use and Management

Track: HVAC&R Fundamentals and Applications

Room: GWCC Building A, A410

Sponsor: 7.6 Building Energy Performance

Chair: Annie Smith, P.E., Associate Member, Ross & Baruzzini, St. Louis, MO

- 1. **First Impressions: What is New and Updated about Chapter 36?**
John Constantini, Member, Alpha MRC Architects Engineers, Merritt Island, FL
- 2. **Updates on Commercial Building Energy Use and Cost Metrics**
Terry Sharp, P.E., Oak Ridge National Laboratory, Oak Ridge, TN
- 3. **Updates on Energy and Water Benchmarking, Conservation and Audits**
Eric Yang, P.E., HBDDP, CPMP and BEAP, Member, Energy Systems Group, Washington, DC

9:45 AM – 10:45 AM

Workshop 6 (Intermediate)



They Really Did That! Perspectives from State Engineering Board Members

Track: The Engineer's Role in Architecture

Room: GWCC Building A, A305

Sponsor: 1.7 Business, Management & General Legal Education

Chair: Michael Bilderbeck, P.E., Fellow ASHRAE, Pickering Firm, Memphis, TN

- 1. **A Missouri Board Member's Perspective**
Kelley Cramm, P.E., Member, Henderson Engineers, Lenexa, KS
- 2. **A Kansas Board Member's Perspective**
Richard Hayter, Ph.D., P.E., Presidential Fellow Life Member, Kansas State University Retired, Manhattan, KS

11:00 AM – 12:30 PM

Technical Paper Session 3 (Intermediate)

Optimizing Components in HVAC Systems

Track: Construction, Operation, and Maintenance of High Performance Systems

Room: GWCC Building A, A303



Chair: Alamelu Brooks, Member, ICF International, Columbia, MD

- 1. **Energy Performance, Comfort and Lessons Learned from a Net-Zero Energy Library (AT-2019-007)**
Vasken Dermardiros, P.Eng., Student Member, Concordia University, Montreal, QC, Canada

2. Optimizing Stairway Pressurization Systems By Automating CFD Simulation (WITHDRAWN)*Ali Hasan, Amanties, Doha, Qatar***3. Preliminary Investigations of the Impact of VFD Output Voltage on Motor Efficiency (AT-2019-008)***Gang Wang, P.E., Member, University of Miami, Coral Gables, FL***11:00 AM – 12:30 PM****Seminar 54 (Intermediate)****Chemistry of New and Retrofit Systems with Low GWP Refrigerants***Track: Refrigeration**Room: GWCC Building A, A410***Sponsor: 3.2 Refrigerant System Chemistry, MTG.LowGWP Lower Global Warming Potential Alternative Refrigerants***Chair: Edward Hessell, Ph.D., Member, Lanxess Solutions US, Inc., Naugatuck, CT***1. System Chemistry Comparison of HFC and Low GWP Alternatives***Julie Majurin, Member, CPI Fluid Engineering, Midland, MI***2. Evaluation of the Chemical Stability of HFC and HFO Alternatives When Applied as R22 Retrofit in Refrigeration Equipment***Hitomi Arimoto, Associate Member, Daikin Industries, Ltd., Settsu, Japan***3. Chemical Stability of New Low GWP Olefin Based Refrigerants***Stephen Kujak, Member, Trane, Ingersoll Rand, La Crosse, WI***4. What do We Need to Understand about System Chemistry and Low GWP Refrigerants?***Joe Karnaz, DSc, Member, Shrieve Chemical, Houston, TX***11:00 AM – 12:30 PM****Seminar 55 (Basic)****Equipment Selections with Respect to Noise and Vibration***Track: The Engineer's Role in Architecture**Room: GWCC Building A, A301***Sponsor: 2.6 Sound and Vibration***Chair: Erik Miller-Klein, P.E., Member, A3 Acoustics, LLP, Seattle, WA***1. Equipment Selections with Respect to Noise and Vibration: Acoustical Consultant's Perspective***Roman Wowk, Associate Member, Papadimos Group, San Francisco, CA***2. Equipment Selections with Respect to Noise and Vibration: Mechanical Engineer's Perspective***Jeff Boldt, P.E., HBDP, Fellow ASHRAE, KJWW Engineering Consultants, Madison, WI***3. Equipment Selections with Respect to Noise and Vibration: Manufacturer's Perspective***Curt Eichelberger, P.E., Member, Johnson Controls, Inc., York, PA*

11:00 AM – 12:30 PM

Seminar 56 (Intermediate)



Humidity IS Health

Track: The Convergence of Comfort, IAQ, and Energy Efficiency Building

Room: GWCC Building A, A305

Sponsor: 5.11 Humidifying Equipment

Chair: Raul Simonetti, Member, Carel Industries SpA, Brugine, Italy

1. The Effects of Indoor-Air Relative Humidity on Health Outcomes and Cognitive Function in Residents in a Long-term Care Facility

Stephanie Taylor, M.D., Member, Healthcare Acquired Infections Organization, Boston, MA

2. The Impact of Steam Humidification on Influenza Virus in Preschool Classrooms

Alex Generous, Mayo Clinic Graduate School of Biomedical Sciences, Rochester, MN

3. New Options! Fogging Systems in Healthcare Applications

William Truong, Member, Nortec, Ottawa, ON, Canada

4. Estimating the Break-even Point of the Most Common Steam and Adiabatic Systems

Raul Simonetti, Member, Carel Industries SpA, Brugine, Italy

11:00 AM – 12:30 PM

Seminar 57 (Basic)



Multiscale Building Energy Modeling, Part 9

Track: HVAC&R Fundamentals and Applications

Room: GWCC Building A, A408

Sponsor: 4.7 Energy Calculations

Chair: Joshua New, Member, Oak Ridge National Laboratory, Knoxville, TN

1. Modelling London's Building Stock and its Associated Energy Use

Paul Ruysssevelt, Ph.D., University College London, London, United Kingdom

2. Using Regional Building Modeling for Energy Forecasting

David Shipley, P.Eng., Member, ICF Marbek, Ottawa, ON, Canada

3. Wide-area 3D Imaging Using Foliage-penetrating Laser Radars for City-scale Building Evaluation

Eric Statz, Ph.D., MIT Lincoln Laboratory, Boston, MA

4. Building Modeling and District System Optimization at Scale

Peter Ellis, Member, Big Ladder Software, Denver, CO

11:00 AM – 12:30 PM

Seminar 58 (Intermediate)



Not your Father's Onsite Energy Generation System: Lessons Learned from 135 Years Applying Combined Heat and Power Systems (CHP)

Track: Common System Issues and Misapplications

Room: GWCC Building A, A302

Sponsor: 1.10 Cogeneration Systems

Chair: Richard Sweetser, Life Member, Exergy Partners Corp., Herndon, VA

1. Lessons Learned from 98 CHP Systems Operating in New York State Since 2000

Hugh Henderson, CDH Energy Corp., Cazenovia, NY

2. CHP Design and Application Lessons Learned from the Mid-Atlantic Region Since 2000

Gearoid Foley, Member, Integrated CHP Systems Corp, Princeton, NJ

3. CHP Design and Application Lessons Learned from the Southeast Region Since 2000

Bruce Hedman, Dr.Ing., Entropy Research, LLC, Alexandria, VA

11:00 AM – 12:30 PM

Seminar 59 (Intermediate)



Transient Temperature Changes in the Data Center: Should We Be Worried?

Track: Construction, Operation, and Maintenance of High Performance Systems

Room: GWCC Building A, A404

Sponsor: 9.9 Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment

Chair: Joseph Gangemi, Life Member, Northern Air Systems, Rochester, NY

1. Data Center Temperature Rise following the Loss of Primary Power
James W. VanGilder, P.E., Member, Schneider Electric, Andover, MA

2. The Impact of Airside and Waterside Failure on Data Center Lab Cooling Performance

Kourosh Nemati, Ph.D., Future Facilities Incorporated, New York, NY

3. Modeling Transient Behavior in a Data Center: When is it Needed?

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

1:00 PM – 1:30 PM

Seminar TC (Basic)

Want to CONTROL the World?

Track: HVAC&R Fundamentals and Applications

Room: GWCC Building A, A302

Sponsor: 1.4 Control Theory and Application

Chair: Elise Backstrom, Associate Member, M+W Group, Phoenix, AZ

1. Want to Control the World?

Michelle Shadpour, Student Member, SC Engineers, Inc., San Diego, CA

1:30 PM – 3:00 PM

Seminar 60 (Intermediate)



Lighting up Indoor Environmental Quality Interactions in Schools: Impact on Health and Performance

Track: The Convergence of Comfort, IAQ, and Energy Efficiency Building

Room: GWCC Building A, A410

Sponsor: , SGPC 10

Chair: Walter Grondzik, P.E., Fellow ASHRAE, Ball State University, Muncie, IN

1. An Investigation of Indoor Environmental Factors and Their Effects on K-12 Student Achievement

Lily Wang, Ph.D., P.E., University of Nebraska - Lincoln, Lincoln, NE

2. Identifying the Determinants of Indoor Air Quality in Schools in mid-Atlantic Region and Their Impacts on Student Performance

Kirsten Koehler, Ph.D., Johns Hopkins University, Baltimore, MD

3. Did School Indoor Environment Affect Health and Performance among the Students and Teachers in New York State?

Tia Marks, University at Albany, Albany, NY

4. Indoor Air Quality in High Schools in Central Texas

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

3:15 PM – 4:45 PM

Debate 3 (Intermediate)

College of Fellows Debate: Owners Owe a “Standard of Care” to their Projects

Track: Construction, Operation, and Maintenance of High Performance Systems

Room: GWCC Building A, A410

Sponsor: 1.7 Business, Management & General Legal Education, College of Fellows

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

1. Don Beaty, P.E., Fellow ASHRAE, DLB Associates, Eatontown, NJ

2. Stephen Lisk, CIBSE President and OneEightLight, Bristol, United Kingdom

3. Martin Weiland, P.E., Member, US General Services Administration, Washington, DC

4. Robyn Ellis, Associate Member, City of Hamilton – Public Works, Hamilton, ON, Canada,

5. E. Mitchell Swann, P.E., Member, MDCSystems, Paoli, PA

6. Michael Cooper, P.E., Member, Bernhard Mechanical Contractors, Metairie, LA

Wednesday, January 16

8:00 AM – 9:30 AM

Conference Paper Session 15 (Intermediate)

Advances in Heat Recovery

Track: Systems and Equipment

Room: GWCC, Building B, B408

Chair: Zheng O’Neill, University of Alabama, Tuscaloosa, AL

1. A Liquid-Desiccant-Based Heat Recovery System for Gas-fired Boilers in District Heating Networks (AT-2019-C049)

Xiaoyue Zhang, Student Member and Zhen Li, Dr.Eng., Member, Key Laboratory of Thermal Science and Power Engineering of Ministry of Education, Tsinghua University, Beijing, China

2. Integrated Heat Recovery System Design of a Variable Refrigerant Flow (VRF) Heat Recovery System with a Domestic Hot Water System (AT-2019-C050)

Dongsu Kim, Student Member¹, Heejin Cho, Ph.D., Associate Member¹, HyunJin Nam² and Jaeyoon Koh, Ph.D., Member³, (1)Mississippi State



University, Mississippi State, MS, (2)LG Electronics, Seoul, Korea, Republic of (South), (3)LG Electronics U.S.A., Inc., Alpharetta, GA

3. A Case Study of Sensitivity Analysis of the Domestic Hot Water System in Large Hotels (AT-2019-C051)

Zhihong Pang and Zheng O'Neill, Ph.D., P.E., Member, The University of Alabama, Tuscaloosa, AL

4. Demonstrating the Benefit of Multi-Objective Optimization and Clustering for the Design of Waste Heat Recovery Systems (AT-2019-C052)

Gabriel Legorburu, Associate Member and **Amanda Smith**, Associate Member, Utah University, Salt Lake City, UT

8:00 AM – 9:30 AM

Conference Paper Session 16 (Intermediate)

Building Performance with Respect to Energy Efficiency

Track: Construction, Operation, and Maintenance of High Performance Systems

Room: GWCC, Building B, B409



Chair: **Marija Todorovic**, P.Eng., Fellow ASHRAE, University of Belgrade, Belgrade, Serbia

1. Energy, Emissions and Economics (EEE) Impact Derivation and Applications for Energy Performance Calculations and Comparisons (AT-2019-C053)

Neil Leslie, P.E., Member¹ and **David Goldstein**², (1)Gas Technology Institute, Des Plaines, IL, (2)Natural Resources Defense Council, San Francisco, CA

2. System-level Key Performance Indicators (KPIs) for Building Performance Evaluation (AT-2019-C054)

Han Li, Associate Member¹, **Marina Sofos**² and **Tianzhen Hong**, Ph.D., Member¹, (1)Lawrence Berkeley National Laboratory, Berkeley, CA, (2) U.S. Department of Energy, Washington, DC

3. Taking the (Fuel) Blinders off Energy Codes Part 2: Metrics and Mechanics in the Modern Era (AT-2019-C055)

Alexi Miller, P.E., Associate Member and **Jim Edelson**, Associate Member, New Buildings Institute, Portland, OR

4. Targeting Building Energy Efficiency Opportunities: An Open-source Analytical and Benchmarking Tool (AT-2019-C056)

Han Li, Associate Member¹, **Ahmed Bekhit**², **Carolyn Szum**¹, **Clay Nesler**, Member³, **Sara Lisuaskas**² and **Steven Snyder**, P.E., Member⁴, (1)Lawrence Berkeley National Laboratory, Berkeley, CA, (2)ICF International, Toronto, ON, Canada, (3)Johnson Controls, Milwaukee, WI, (4)Johnson Controls, Philadelphia, PA

8:00 AM – 9:30 AM

Seminar 61 (Intermediate)



Building Data Exchange Formats: Sharing Building Data with Ease

Track: Construction, Operation, and Maintenance of High Performance Systems

Room: GWCC, Building B, B313b

Sponsor: 7.6 Building Energy Performance

Chair: **Jim Kelsey**, P.E., Member, kW Engineering, Oakland, CA

1. Green Building XML (gbXML) and Its Role in BIM and Analysis Software Interoperability

Stephen Roth, P.E., Member, Carmel Software Corp., San Rafael, CA

2. Exchanging Home Performance Data with HPXML

Noel Merket, National Renewable Energy Laboratory, Golden, CO

3. BuildingSync: Data Exchange from Commercial Building Energy Audits

Nicholas Long, Member, National Renewable Energy Laboratory, Golden, CO

8:00 AM – 9:30 AM

Seminar 62 (Intermediate)



Room Air Cleaner, Can it Improve IAQ?

Track: The Convergence of Comfort, IAQ, and Energy Efficiency Building

Room: GWCC, Building B, B201

Sponsor: 2.3 Gaseous Air Contaminants and Gas Contaminant Removal Equipment

Chair: Kyung Choi, Member, Clean and Science, Louisville, KY

1. Ozone Reaction with Human Surfaces Due to Ozone-emitting Air Cleaners

Youngbo Won, Student Member, Penn State University, University Park, PA

2. Modern IAQ Monitoring MOS Devices Especially for Residential Environment

Tomohiro Kawaguchi, Figaro Engineering Inc, Osaka, Japan

3. Performances of Electric Air Cleaning Technologies for Gas/Vapor Removal

Chang-Seo Lee, Ph.D., Associate Member, Concordia University, Montreal, QC, Canada

4. Impact of Portable Air Cleaners on Residential IAQ: Testing and Simulation

Thad Ptak, Ph.D., Member, A. O. Smith Corporation, Milwaukee, WI

8:00 AM – 9:30 AM

Seminar 63 (Basic)



The Force is Strong with this One: Facilitating Integrated Project Delivery

Track: The Engineer's Role in Architecture

Room: GWCC, Building B, B315

Sponsor: 7.1 Integrated Building Design

Chair: Marianna Vallejo, Ph.D., Jacobs, Portland, OR

1. Jedi Mind Tricks for Integrated Project Delivery (But First you Must Believe...)

Mitchell Swann, P.E., MDC Systems, Paoli, PA

2. The Force is Strong with This One: Integrated Design Process Perceptions

Michel Tardif, CanmetENERGY, Ottawa, ON, Canada

3. The Force will be with You, Always: Facilitating Success in Integrated Project Delivery

Lianne Cockerton, P.Eng., Martin Roy et Associés, Montreal, QC, Canada

4. Welcome to the Dark Side: Simulation in the Integrated Design Process

Danielle Monfet, Ph.D., École de technologie supérieure, Montreal, QC, Canada

8:00 AM – 9:30 AM

Seminar 64 (Intermediate)**Thermodynamic Limits for Buildings: Part 2***Track: HVAC&R Fundamentals and Applications**Room: GWCC, Building B, B309***Sponsor: 7.4 Exergy Analysis for Sustainable Buildings (EXER)***Chair: Ongun Kazanci, Ph.D., Associate Member, International Centre for Indoor Environment and Energy, Technical University of Denmark, Kgs. Lyngby, Denmark***1. Thermodynamic Limits for Buildings: Energy vs Exergy***Biröl Kilkis, Ph.D., Fellow ASHRAE, Baskent University, Ankara, Turkey***2. When Do the Results of Exergy Analysis Differ from Energy Analysis?***Antash Najib, Student Member, University of California, Davis, CA***3. Exergy Losses in a Hydronic System and How to Avoid Them***Mike Trantham, Member, IMI Flow Design, Dallas, TX***4. Is Work-to-Heat Ratio (WTHR) a Better Metric Than COP for Exergy Analysis?***William Kopko, Member, Johnson Controls, New Freedom, PA*

8:00 AM – 9:30 AM

Seminar 65 (Intermediate)**The Role of Energy Storage for Buildings Integrated with Renewable Energy Systems***Track: Renewables and Natural Systems**Room: GWCC, Building B, B313a***Sponsor: 6.9 Thermal Storage***Chair: Paulo Tabares, Colorado School of Mines, Golden, CO***1. The Necessity of Thermal Energy Storage as Part of Net-Zero Building Design***Karl Heine, Student Member, Colorado School of Mines, Golden, CO***2. Sizing and Dispatch Strategy of a Renewable System for a Cluster of Buildings in a Campus Scale***Mohammad Hassan Fathollahzadeh, Student Member, Colorado School of Mines, Golden, CO***3. Thermal Energy Storage for a Movie Theater with Integrated PV Systems: A Case Study***Marcel Christians, Ph.D., Ice Energy, Santa Barbara, CA*

8:00 AM – 9:30 AM

Workshop 7 (Intermediate)**An Overview of the Newly Published Guideline 36***Track: The Convergence of Comfort, IAQ, and Energy Efficiency Building**Room: GWCC, Building B, B407***Sponsor: 1.4 Control Theory and Application***Chair: Mark Hydeman, P.E., Fellow ASHRAE, Google, Mountain View, CA*

9:45 AM – 10:45 AM

Panel 1 (Basic)

The Cage Match: An Uncommon Approach to Accelerating ASHRAE Standard Development

Track: HVAC&R Fundamentals and Applications

Room: GWCC, Building B, B408

Sponsor: 5.4 Industrial Process Air Cleaning (Air Pollution Control)

Chair: Chris Lowell, Member, Halton Company, Scottsville, KY

1. The Cage Match: An Uncommon Approach to Accelerating ASHRAE Standard Development

Bob Burkhead, Member¹, Chris Fischer², Bruce McDonald, P.Eng., Member³ and Geoff Crosby⁴, (1)Blue Heaven Technology, Louisville, KY, (2)University of Kentucky, Lexington, KY, (3)Consultant, Minneapolis, MN, (4)Lydall, Rochester, NH

9:45 AM – 10:45 AM

Conference Paper Session 17 (Intermediate)

Numerical Techniques for HVAC Design



Track: HVAC&R Fundamentals and Applications

Room: GWCC, Building B, B409

Chair: Ratnesh Tiwari, Ph.D., Member, University of Maryland, College Park, MD

1. Comparison of Approaches for Calculating Annualized Data Center Energy Metrics(AT-2019-C057)

Rehan Khalid, Student Member and Aaron Wemhoff, Villanova University, Villanova, PA

2. Study on the Prediction Models of Temperature and Energy by using DCIM and Machine Learning to Support Optimal Management of Data Center (AT-2019-C058)

Kosuke Sasakura, Takeshi Aoki and Takeshi Watanabe, NTT Facilities, Inc., Tokyo, Japan

3. Cooling System with Low Power Usage Effectiveness Below 1.02x for Server Rooms (AT-2019-C059)

Naoki Aizawa, BEAP, Takasago Thermal Engineering Co.,Ltd., Kanagawa, Japan

9:45 AM – 10:45 AM

Conference Paper Session 18 (Intermediate)

Thermal Comfort in Transportation



Track: HVAC&R Fundamentals and Applications

Room: GWCC, Building B, B313b

Chair: Christopher R. Laughman, Ph.D., Member, Mitsubishi Electric Research Laboratories, Cambridge, MA

1. Novel Ventilation Concepts for Efficient Heating Dynamics of Vehicle Passenger Compartments (AT-2019- C060)

Tobias Dehne, CPMP, Andreas Westhoff and Pascal Lange, German Aerospace Center (DLR) Institute of Aerodynamic and Flow Technology, Göttingen, Germany

2. Numerical Investigation of Thermal Comfort Inside Cruise Ships (AT-2019-C061)

Essam E. Khalil, Ph.D., P.E., Fellow ASHRAE, Ahmed Emad, P.E., Gamal ElHarriry, Ph.D., P.E. and Taher Abou Dief, Ph.D., P.E., Member, Cairo University, Cairo, Egypt

3. Shape Effectiveness of HVAC Outlets on Automobile Thermal Comfort (AT-2019-C062)

Essam E. Khalil, Ph.D., P.E., Fellow ASHRAE, Ahmed ElDegwy, Ibrahim Reda and Taher Abou Dief, Ph.D., P.E., Member, Cairo University, Cairo, Egypt

9:45 AM – 10:45 AM

Seminar 66 (Basic)



How ASHRAE Standard 100 can be Applied to Atlanta's Building Energy and Water Efficiency Ordinance

Track: The Convergence of Comfort, IAQ, and Energy Efficiency Building

Room: GWCC, Building B, B407

Sponsor: 2.8 Building Environmental Impacts and Sustainability, SSPC 100

Chair: Kevin Brown, P.E., Member, ABM Technical Solutions, Atlanta, GA

- 1. How to Use ASHRAE Standard 100 and Seek Compliance**
Curtis Fong, Associate Member, Taylor Engineering, Alameda, CA
- 2. Atlanta's Building Energy and Water Efficiency Ordinance**
Megan O'Neil, City of Atlanta, Atlanta, GA

9:45 AM – 10:45 AM

Seminar 67 (Intermediate)



In Legionella, Measure What Matters: Insights for the Water Quality Practitioner

Track: Common System Issues and Misapplications

Room: GWCC, Building B, B315

Sponsor: 9.6 Healthcare Facilities

Chair: Lan Chi Nguyen Weekes, P.Eng., Member, College La Cite, Ottawa, ON, Canada

- 1. Legionella: State of Science and Regulations**
Lan Chi Nguyen Weekes, P.Eng., Member, College La Cite, Ottawa, ON, Canada
- 2. Why Do I Have to Manage Water? Legionella That's Why?**
Nate Sanders, Liberty Building Forensics Group, Zellwood, FL

9:45 AM – 10:45 AM

Seminar 68 (Advanced)



Integration of Renewable Systems and Natural Ventilation: Control Challenges

Track: Renewables and Natural Systems

Room: GWCC, Building B, B309

Sponsor: 1.4 Control Theory and Application

Chair: Michelle Shadpour, Student Member, SC Engineers, Inc., San Diego, CA

- 1. What to do with all this Energy? The Trick to Tracking and Controlling Green Systems.**
Larry Scholl Jr., Member, Automated Logic, Kennesaw, GA
- 2. Renewable Systems Integration; A Key to Smart Buildings Success**
Michael Pouchak, P.E., Member, Honeywell International, Golden Valley, MN

9:45 AM – 10:45 AM

Forum 2 (Intermediate)

Empirical Verification of Metabolic Heat, Moisture and Contaminant Dissipation Rates from Occupants at Various Activity Levels

Track: HVAC&R Fundamentals and Applications

Room: GWCC, Building B, B201

Sponsor: 2.1 Physiology and Human Environment

Chair: Hui Zhang, Ph.D., University of California at Berkeley, Berkeley, CA

9:45 AM – 10:45 AM

Forum 3 (Advanced)

Environmental Health Trends Impacting HVAC&R

Track: HVAC&R Fundamentals and Applications

Room: GWCC, Building B, B313a

Sponsor: 7.6 Building Energy Performance

Chair: Kishor Khankari, Ph.D., Fellow ASHRAE, AnSight LLC, Ann Arbor, MI

11:00 AM – 12:30 PM

Debate 4 (Intermediate)

Intelligent, Efficient and Resilient Data Centers: What is Needed? Rules of Thumb, Science or Just Technology?

Track: Construction, Operation, and Maintenance of High Performance Systems

Room: GWCC, Building B, B201

Sponsor: 9.9 Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment

Chair: Bahgat Sammakia, Ph.D., Binghamton University, Binghamton, NY

1. **Roger Schmidt, Ph.D., P.E., Member²**, IBM, Poughkeepsie, NY
2. **Kanad Ghose, Ph.D.¹**, Binghamton University, Binghamton, NY
3. **Dereje Agonafer, Ph.D., Member³**, University of Texas at Arlington, Arlington, TX
4. **Mark Seymour, CEng, Member⁴**, Future Facilities Ltd, London, United Kingdom

11:00 AM – 12:30 PM

Technical Paper Session 4 (Intermediate)

Analysis of Building Systems



Track: Construction, Operation, and Maintenance of High Performance Systems

Room: GWCC, Building B, B408

Chair: Bass Abushakra, Ph.D., Member, United States Military Academy, West Point, NY

1. Energy Performance of an Occupancy-Based Climate Control Technology in Guest Rooms (AT-2019-009)

Hyojin Kim, Ph.D., Member, Catholic University of America, Washington, DC

2. Evaluating the Capability of Algebraic Equations in Accurately Determining the First Sighting of a Smoke Layer in a Steady State Fire Condition in Atriums: A CFD Approach (WITHDRAWN)

Ali Hasan, Amanties, Doha, Qatar

3. HVAC System Air Leakage Requirements for Deep Energy Retrofit Projects (AT-2019-010)

Alexander Zhivov, Ph.D.¹, Herman Behls, P.E., Member², Craig Wray, P.Eng., Member³, Larry Smith, P.E.⁴ and Lars-Åke Mattsson⁵, (1)US Army Engineer Research and Development Center, Champaign, IL, (2) Deceased, Formerly, Arlington Heights, IL, (3)Mechanical Engineer, Winnipeg, MB, Canada, (4)Linx Industries, Portsmouth, VA, (5)Lindab Ventilation AB, Båstad, Sweden

4. Representative Layer-by-Layer Descriptions for Fenestration Systems with Specified Bulk Properties Such as U-factor and SHGC (1588-RP) (AT-2019-011)

Yu Joe Huang, Member, White Box Technologies, Inc., Moraga, CA

5. Development of a Reference Building Information Model (BIM) for Thermal Model Compliance Testing (RP-1468) Part-II: Test Cases and Analysis (AT-2019-012)

Jeff Haberl, Member, Texas A & M University, College Station, TX

11:00 AM – 12:30 PM

Conference Paper Session 19 (Intermediate)

Advances in Refrigerants



Track: HVAC&R Fundamentals and Applications

Room: GWCC, Building B, B409

Chair: Lorenzo Cremaschi, Ph.D., Member, Auburn University, Auburn, AL

1. Flammable Refrigerants: Performance Comparison, Safeties and Lessons Learned (AT-2019-C063)

Sean O'Hern, Associate Member, Amir Jokar, Ph.D., P.E., Member, David Anderson, Ph.D., P.E., Michael Cundy, Ph.D., P.E. and Russell Ogle, Ph.D., P.E., Exponent, Inc., Menlo Park, CA

2. Accelerated Life Methodology for Determining Acceptable Chemical Reactivity in HVACR Systems (AT-2019-C064)

Stephen Kujak, Member and Elyse Sorenson, Associate Member, Trane, Ingersoll Rand, La Crosse, WI

3. Impacts of Defrosting Air Cooling Coils (AT-2019-C065)

Richard Love, Ph.D., Associate Member¹, Donald Cleland, Ph.D., Fellow ASHRAE¹, Douglas Reindl, Ph.D., P.E., Fellow ASHRAE², and Todd Jekel, Ph.D., P.E., Member², (1)Massey University, Palmerston, New Zealand, (2)Industrial Refrigeration Consortium, Madison, WI

4. Improved Control of Condensers (AT-2019-C066)

Richard Love, Ph.D., Associate Member¹, Donald Cleland, Ph.D., Fellow ASHRAE¹, Douglas Reindl, Ph.D., P.E., Fellow ASHRAE² and Todd Jekel, Ph.D., P.E., Member², (1)Massey University, Palmerston, New Zealand, (2)Industrial Refrigeration Consortium, Madison, WI

11:00 AM – 12:30 PM

Conference Paper Session 20 (Intermediate)

Energy Efficient Ventilation



Track: The Convergence of Comfort, IAQ, and Energy Efficiency Building

Room: GWCC, Building B, B313b

Chair: Alamelu Brooks, Member, ICF International, Columbia, MD

1. Performance Evaluation of Energy-Efficient Hybrid Ventilation Systems for Office Buildings (AT-2019-C067)

Hisaya Ishino, Ph.D., Member¹, Fumio Nohara², Isao Makimura³, Kimiko Kohri, Ph.D., Member⁴ and Shuzo Murakami, Ph.D., Fellow ASHRAE⁵, (1)Tokyo Metropolitan University, Tokyo, Japan, (2)Nikken Sekkei, Tokyo, Japan, (3)Naguwashi E&TP Laboratory, Kawagoe, Japan, (4)Utsunomiya University, Utsunomiya, Japan, (5)Institute for Building Environment and Energy Conservation, Tokyo, Japan

2. Simulation Study of Infiltration Effects on CO2-Based Demand Controlled Ventilation System with High-Variant Occupancy Schedules (AT-2019-C068)

Siliang Lu, Erica Cochran Hameen, Ph.D. and Omer Karaguzel, Carnegie Mellon University, Pittsburgh, PA

3. Further Simplifying ASHRAE Standard 62.1 for Application to Existing Buildings: Comparing Informative Appendix D and Section 6.2.5.3 with Real-World Data (AT-2019-C069)

Meghan McNulty, P.E., Associate Member, Barry Abramson, P.E., CPMP and BEAP, Member and Pamela Moua-Vargas, Associate Member, Servidyne, LLC, Atlanta, GA

4. Temporal Analysis of Wind Data for Wind Driven Ventilation Assessment (AT-2019-C070)

Yun Zhang, Student Member, James Lo, Ph.D., Member, Sheng Wang, Student Member and Drexel University, Philadelphia, PA

11:00 AM – 12:30 PM

Seminar 69 (Intermediate)



Climate Change Liability for Owners, Designers and Manufacturers

Track: The Engineer's Role in Architecture

Room: GWCC, Building B, B407

Sponsor: 2.5 Global Climate Change, TG2, TRG9, MTG.

HCDH, TC4.1, TC4.2, TC7.6

Chair: Elizabeth Tomlinson, P.E., Member, U.S. General Services Administration, Washington, DC

1. US National Climate Assessment

Kenneth Kunkel, Ph.D., NOAA, North Carolina Institute for Climate Studies, Asheville, NC

2. ASHRAE TC4.2 Climatic Information Uncertainties: Historic Vs Projected Data

Drury Crawley, Ph.D., BEMP, Fellow ASHRAE, Bentley Systems, Inc., Washington, DC

3. Climate Change Liability

Kevin Haroff, Esq., J.D., Marten Law, San Francisco, CA

4. Safeguarding Assets for a Robust and Relevant Practice

Ann Kosmal, F.A.I.A., LEED AP BD +C, CPHC, PDC, U.S. General Services Administration, Washington, DC

11:00 AM – 12:30 PM

Seminar 70 (Intermediate)



Development of High-Reliability, Low-Cost, Occupancy Presence, Counting and CO2 Sensor Technologies and ASHRAE Testing Standards/Guidelines

Track: The Convergence of Comfort, IAQ, and Energy Efficiency Building

Room: GWCC, Building B, B309

Sponsor: 7.5 Smart Building Systems

Chair: Kristen Cetin, Ph.D., P.E., Associate Member, Iowa State University, Ames, IA

1. ARPA-E SENSOR Program Overview and Goals: Development of High-Reliability, Low-Cost Occupancy Sensor Development and Testing

Jennifer Gerbi, Ph.D., ARPA-E, Washington, DC

2. Commercial and Residential Building Occupancy Presence and Counting Sensor Technologies: Goals and Efforts to Date

Zheng O'Neill, Ph.D., P.E., Member, University of Alabama, Tuscaloosa, AL

3. Innovative CO2 Sensor Development for Commercial Buildings: Goals and Efforts to Date

Jeff Rhoads, Ph.D., Purdue University, West Lafayette, IN

4. Development of Guidelines/Standards for Occupancy Sensor Testing: ASHRAE's Role

Kristen Cetin, Ph.D., P.E., Associate Member, Iowa State University, Ames, IA

11:00 AM – 12:30 PM

Seminar 71 (Intermediate)



How to Ensure that Your Building Control Improvements Actually Last

Track: Construction, Operation, and Maintenance of High Performance Systems

Room: GWCC, Building B, B315

Sponsor: 7.6 Building Energy Performance

Chair: Scott Hackel, P.E., Member, Seventhwave, Madison, WI

1. Key Steps to Improving Persistence of Commissioning

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

2. Observations and Results from a Field Study of Retrocommissioning Persistence

Xiaohui Zhou, Ph.D., Member, Seventhwave, Madison, WI

3. Stories from the Field: Working with Facility Managers toward Persistent Improvements

Jason Jones, Member, Aerobuild, Chicago, IL

4. Persistence of Savings Isn't a Side Issue: Using New Tech to Make Sure Savings Show Up at the Meter

Jim Kelsey, P.E., BEAP, Member, kW Engineering, Oakland, CA

Tech Program

11:00 AM – 12:30 PM

Workshop 8 (Intermediate)



How to Model Thermal Bridging Using Clear Transmittance Method

Track: The Engineer's Role in Architecture

Room: GWCC, Building B, B313a

Sponsor: 4.4 Building Materials and Building Envelope Performance

Chair: Wahid Maref, Ph.D., Member, ETS-Montreal, Montreal, QC, Canada

1. Improving Heat Loss Calculations Using Linear Transmittance

Peter Adams, P.Eng., Member, Morrison Hershfield, Thornhill, ON, Canada

2. Thermal Bridges

Chris Schumacher, Member, RDH Building Science Laboratories, Waterloo, ON, Canada

SOCIETY COMMITTEE MEETINGS

Most society committee meetings are located at the Omni in the meeting space in both the North and South Towers. A few meetings may be located at the Georgia World Congress Center (GWCC). Please see pages 3–12 for meeting space floor plans and descriptions on how to access the meeting room floors.

The floor levels and venue names are indicated in parenthesis in the listing below. Subcommittees are indented in the listing below. Rooms will be set as best as possible as indicated in the parentheses beside the committee, i.e., (20/20) will accommodate at least 20 people at the conference table and at least 20 chairs for the audience. Any audiovisual or electrical ordered will be listed. If AV is not ordered in advance there is no guarantee it will be available onsite.

MEETING SPACE FLOOR AND VENUE KEY

North Tower (North) at the Omni: M1, M2, M3, M4, N6

South Tower (South) at the Omni: Atrium Terrace (AT)

Georgia World Congress Center (GWCC) Building A (Bldg A): 3 and 4

Georgia World Congress Center (GWCC) Building B (Bldg B): 2, 3 and 4

The “Schedule” section in the ASHRAE 365 app lets you create your own schedule as well as filter committee meetings by date, time, room and committee type (Standing, Technical, Project).

AEDG Steering Committee (10/10) Electric

Mon. (1/14) 2:15 pm – 5:00 pm Beechnut (M3, North), Omni

Airborne Infectious Diseases PD Committee (20/20) Screen/Electric

Mon. (1/14) 6:30 pm – 8:30 pm Redwood (M1, North), Omni

Appointments Roadmap (24/0) Screen/Electric

Sun. (1/13) 7:00 am – 8:00 am Spruce (AT, South), Omni

ASHRAE Foundation (30/10) Screen/Electric

Mon. (1/14) 7:30 am – 9:30 am Spruce (AT, South), Omni

ASHRAE Foundation Executive Committee (10/5) Electric

Sat. (1/12) 1:30 pm – 3:00 pm Dogwood B (M1, North), Omni

ASHRAE/AHRI Joint Exposition Policy Committee (25/10) Electric

Sun. (1/13) 9:00 am – 11:00 am Redwood (M1, North), Omni

ASHRAE Associate Society Alliance (70/70) Screen

Mon. (1/14) 4:15 pm – 6:00 pm Internat'l EF (M2, North), Omni

ASHRAE Associate Society Alliance Subcommittee (40/15) Screen

Sun. (1/13) 1:30 pm – 4:30 pm Pine (AT, South), Omni

ASHRAE-REHVA Coordination Meeting (12/0)

Sun. (1/13) 11:00 am – 12:00 pm Redwood (M1, North), Omni

Board of Directors (33/75) Screen/Electric

Sun. (1/13) 1:30 pm – 5:30 pm Grand D/E (M4, North), Omni

Wed. (1/16) 2:00 pm – 6:00 pm Grand D/E (M4, North), Omni

Building Energy Quotient Committee (15/15) Screen/Electric

Sun. (1/13) 8:30 am – 11:30 am Sycamore (M2, North), Omni

bEQ Methodology (10/5) Screen/Electric

Sat. (1/12) 11:00 am – 12:45 pm Beechnut (M3, North), Omni

bEQ Business Development (10/5) Screen/Electric

Sat. (1/12) 1:15 pm – 3:00 pm Beechnut (M3, North), Omni
Building EQ Portal Demonstration

Sun. (1/13) 3:00 pm – 4:00 pm A404 (4), Bldg A, GWCC

Buildings XIV Committee (30/0)

Sun. (1/13) 9:00 am – 12:00 pm Birch (AT, South), Omni

Certification (14/12) Screen/Electric

Sat. (1/12) 8:00 am – 12:00 pm Cottonwood A (M1, North), Omni

Chapter Technology Transfer Committee (30/15) Screen/Electric

Fri. (1/11) 8:00 am – 12:00 pm Grand A (M4, North), Omni

Sat. (1/12) 9:00 am – 12:00 pm Grand A (M4, North), Omni

Chapter Technology Transfer Member Services (15/15) Screen

Fri. (1/11) 1:00 pm – 5:00 pm Grand A (M4, North), Omni

Chapter Technology Transfer Operations (10/15) Screen

Fri. (1/11) 1:00 pm – 5:00 pm Cypress (M2, North), Omni

Chapter Technology Transfer Mixer (75/0) Screen

Fri. (1/11) 5:15 pm – 6:30 pm Grand A (M4, North), Omni

Chapter Technology Transfer Executive Subcommittee (5/0) Screen

Sat. (1/12) 8:00 am – 9:00 am Grand A (M4, North), Omni

CIBSE/ASHRAE Liaison (25/10) Electric

Wed. (1/16) 10:00 am – 12:30 pm Redwood (M1, North), Omni

CLIMA 2019 (12/0) Screen

Sat. (1/12) 12:15 pm – 1:30 pm Cottonwood B (M1, North), Omni

College of Fellows (25/35) Screen

Sun. (1/13) 10:00 am – 12:00 pm Spruce (AT, South), Omni

College of Fellows: Advisory Committee (15/5)

Sun. (1/13) 9:00 am – 10:00 am Spruce (AT, South), Omni

Conferences and Expositions Committee (30/10) Screen/Electric

Sat. (1/12) 8:00 am – 3:00 pm Grand B (M4, North), Omni

Conferences and Expositions Executive (30/5)

Fri. (1/11) 1:00 pm – 3:30 pm Grand B (M4, North), Omni

Conferences and Expositions Annual and Winter Meetings (30/5)

Fri. (1/11) 3:45 pm – 6:00 pm Grand B (M4, North), Omni

Development Committee (24/15) Screen/Electric

Mon. (1/14) 9:45 am – 11:45 am Spruce (AT, South), Omni

DRCs/RMCRs (30/25)

Fri. (1/11) 11:00 am – 1:00 pm Grand C (M4, North), Omni

Wed. (1/16) 12:00 pm – 2:00 pm Grand C (M4, North), Omni

Directors-At-Large Meeting (10/0)

Wed. (1/16) 12:00 pm – 2:00 pm Cypress (M2, North), Omni

Electronic Communications Committee (14/10) Screen/Electric

Sat. (1/12) 11:00 am – 3:00 pm Sycamore (M2, North), Omni

Environmental Health Committee (20/20) Screen

Mon. (1/14) 2:15 pm – 6:15 pm Redwood (M1, North), Omni

Environmental Health Executive (20/20) Screen

Mon. (1/14) 7:00 am – 8:00 am Redwood (M1, North), Omni

Environmental Health Handbook/Policy (20/20) Screen

Mon. (1/14) 8:00 am – 10:00 am Redwood (M1, North), Omni

Environmental Health Program/Research (20/20) Screen

Mon. (1/14) 10:00 am – 12:00 pm Redwood (M1, North), Omni

Executive Committee (12/25) Screen/Electric

Sat. (1/12) 8:30 am – 1:00 pm Magnolia (M2, North), Omni

Wed. (1/16) 7:30 am – 9:00 am Magnolia (M2, North), Omni

Thurs. (1/17) 7:30 am – 11:00 am Willow (M4, North), Omni

Finance Committee (12/20) Electric

Fri. (1/11) 8:00 am – 12:00 pm Grand B (M4, North), Omni

Finance Investment Subcommittee (4/0)

Thurs. (1/10) 5:00 pm – 7:00 pm

Cottonwood A (M1, North), Omni

Finance Planning Subcommittee (8/8) Electric

Thurs. (1/10) 5:00 pm – 7:00 pm

Cottonwood B (M1, North), Omni

Government Affairs Committee (35/30) Screen/Electric

Sat. (1/12) 8:00 am – 12:30 pm Grand C (M4, North), Omni

GAC: Policy and Programs Subcommittee (15/10) Screen/Electric

Fri. (1/11) 8:00 am – 9:00 am Pine (AT, South), Omni

GAC: Member Mobilization Subcommittee (15/10) Screen/Electric

Fri. (1/11) 9:15 am – 10:15 am Pine (AT, South), Omni

GAC: Global Affairs Subcommittee (15/10) Screen/Electric

Fri. (1/11) 10:30 am – 11:30 am Pine (AT, South), Omni

GAC: Nominating Subcommittee (15/10) Screen/Electric

Fri. (1/11) 10:30 am – 11:30 am Birch (AT, South), Omni

GAC: Rules Subcommittee (15/10) Screen/Electric

Fri. (1/11) 11:45 am – 12:45 pm Pine (AT, South), Omni

GAC: Maps Ad Hoc Subcommittee (15/10) Screen/Electric

Fri. (1/11) 11:45 am – 12:45 pm Birch (AT, South), Omni

GAC: Training (30/10) Screen/Electric

Fri. (1/11) 2:00 pm – 3:00 pm Pine (AT, South), Omni

GAC: Executive Subcommittee (20/15) Screen/Electric

Fri. (1/11) 3:15 pm – 4:45 pm Pine (AT, South), Omni

Handbook Committee (30/15) Screen/Electric

Sun. (1/13) 10:30 am – 1:00 pm Dogwood A (M1, North), Omni

Handbook Excom (5/5)

Sat. (1/12) 1:00 pm – 2:00 pm Willow (M4, North), Omni

Handbook Strategic Planning (5/5)

Sat. (1/12) 2:00 pm – 3:00 pm Willow (M4, North), Omni

Handbook Electronic Media (5/0)

Sun. (1/13) 8:00 am – 9:00 am Cypress (M2, North), Omni

Handbook Functional (5/0)

Sun. (1/13) 8:00 am – 9:00 am Dogwood A (M1, North), Omni

Handbook International (5/0)

Sun. (1/13) 8:00 am – 9:00 am Juniper (M2, North), Omni

Handbook Training Workshop (50/0) Screen

Sun. (1/13) 8:00 am – 9:00 am Walnut (M3, North), Omni

Handbook 2020 HVAC Systems and Equipment TCs/Volume

Subcommittee (15/0)

Sun. (1/13) 9:00 am – 10:00 am Juniper (M2, North), Omni

Handbook 2021 Refrigeration TCs/Volume Subcommittee (15/0)

Sun. (1/13) 9:00 am – 10:00 am Dogwood A (M1, North), Omni

Handbook 2022 HVAC Applications TCs/Volume Subcommittee (15/0)

Sun. (1/13) 9:00 am – 10:00 am Cypress (M2, North), Omni

Handbook Volume Subcommittees (25/0) Screen/Electric

Sun. (1/13) 10:00 am – 10:30 am Dogwood A (M1, North), Omni

Historical Committee (20/0) Screen/Electric

Sun. (1/13) 8:30 am – 12:00 pm Hazelnut (M3, North), Omni

Honors & Awards (15/5) Screen/Electric

Sun. (1/13) 1:00 pm – 5:00 pm Birch (AT, South), Omni

Mon. (1/14) 2:15 pm – 5:30 pm Birch (AT, South), Omni

IAQ2020 (20/0) Screen/Electric

Tues. (1/15) 12:00 pm – 2:00 pm Chestnut (M3, North), Omni

IEQ-GA (20/0) Screen/Electric

Tues. (1/15) 2:30 pm – 4:00 pm Chestnut (M3, North), Omni

Indoor Air Quality PD (10/0) Screen/Electric

Tues. (1/15) 9:00 am – 10:00 am Pecan (M3, North), Omni

Life Member Executive Board Meeting (10/0)

Tues. (1/15) 9:00 am – 11:00 am Chestnut (M3, North), Omni

Life Members Lunch (40/0) Screen

Tues. (1/15) 12:00 pm – 1:30 pm Maple A (AT, South), Omni

Members Council (33/50) Screen/Electric

Tues. (1/15) 8:15 am – 12:00 pm Pine (AT, South), Omni

Members Council Region Operations Subcommittee (15/10) Electric

Sat. (1/12) 8:00 am – 12:00 pm Cottonwood B (M1, North), Omni

Members Council Planning Subcommittee (15/10) Electric

Sun. (1/13) 8:00 am – 12:00 pm Cottonwood A (M1, North), Omni

Membership Models Ad Hoc (10/5)

Thurs. (1/10) 4:00 pm – 5:00 pm Cottonwood A (M1, North), Omni

Membership Promotion (24/15) Screen/Electric

Sat. (1/12) 8:00 am – 4:00 pm Birch (AT, South), Omni

Membership Promotion Subcommittees (20/10) Screen/Electric

Fri. (1/11) 1:00 pm – 6:00 pm Magnolia (M2, North), Omni

Nominating (48/0) Screen/Electric

Sun. (1/13) 7:30 am – 12:00 pm Pine (AT, South), Omni

PEAC (12/15) Screen/Electric

Tues. (1/15) 12:00 pm – 2:00 pm Cottonwood A (M1, North), Omni

Planning (25/75) Screen/Electric

Fri. (1/11) 1:00 pm – 6:00 pm International F (M2, North), Omni

Professional Development (15/15) Screen/Electric

Mon. (1/14) 8:00 am – 12:00 pm Juniper (M2, North), Omni

Publications Committee (14/10) Screen/Electric

Sun. (1/13) 8:00 am – 12:00 pm Pecan (M3, North), Omni

Publications Planning Subcommittee (5/5)

Sat. (1/12) 10:00 am – 12:00 pm Willow (M4, North), Omni

Publishing and Education Council (35/30) Screen/Electric

Tues. (1/15) 8:00 am – 12:00 pm Grand C (M4, North), Omni

Publishing and Education Council Fiscal (17/8) Screen

Mon. (1/14) 2:00 pm – 3:30 pm Walnut (M3, North), Omni

Publishing and Education Council Functional (17/8) Screen

Mon. (1/14) 3:30 pm – 5:00 pm Walnut (M3, North), Omni

Refrigeration Committee (20/20) Screen

Sun. (1/13) 8:00 am – 12:00 pm Hickory (M3, North), Omni

Refrigeration Excom (20/20) Screen

Sun. (1/13) 7:00 am – 8:00 am Hickory (M3, North), Omni

Region-at-Large (40/0) Screen

Mon. (1/14) 2:15 pm – 4:15 pm Grand C (M4, North), Omni

Research Administration Committee (25/20) Screen/Electric

Sat. (1/12) 8:00 am – 3:00 pm A304 (3), Bldg A, GWCC

Wed. (1/16) 7:00 am – 11:00 am Spruce (AT, South), Omni

Research Promotion (25/5) Electric

Sat. (1/12) 7:30 am – 1:00 pm Dogwood B (M1, North), Omni

Research Promotion Executive (10/0) Electric

Fri. (1/11) 2:00 pm – 6:00 pm Maple A (AT, South), Omni

Research Promotion Subcommittee (10/0) Electric

Sat. (1/12) 2:00 pm – 3:00 pm Cottonwood A (M1, North), Omni

Residential Building Committee (20/20) Screen/Electric

Mon. (1/14) 8:30 am – 11:30 am Magnolia (M2, North), Omni

Residential Building Committee: Conferences Subcommittee (8/5)

Sun. (1/13) 8:30 am – 9:30 am Willow (M4, North), Omni

Residential Building Committee: Programs Subcommittee (8/5)

Sun. (1/13) 9:30 am – 10:30 am Willow (M4, North), Omni

Residential Building Committee: Technical Subcommittee (8/5)

Sun. (1/13) 10:30 am – 11:30 am Willow (M4, North), Omni

Residential Building Committee: Publications Subcommittee (8/5)

Sun. (1/13) 1:00 pm – 2:00 pm Willow (M4, North), Omni

Residential Building Committee: Stakeholders Subcommittee (8/5)

Sun. (1/13) 2:00 pm – 3:00 pm Willow (M4, North), Omni

Resiliency Position Document (15/0) Electric

Sun. (1/13) 3:00 pm – 4:30 pm Walnut (M3, North), Omni

Scholarship Trustees (10/3) Screen/Electric

Tues. (1/15) 8:00 am – 12:00 pm Beechnut (M3, North), Omni

Society Rules (10/20) Screen/Electric

Tues. (1/15) 2:00 pm – 6:00 pm Beechnut (M3, North), Omni

Standards Committee (30/20) Screen/Electric

Sat. (1/12) 8:00 am – 1:00 pm Dogwood A (M1, North), Omni

Wed. (1/16) 7:30 am – 10:00 am Grand D/E (M4, North), Omni

Standards: Executive Committee (10/10) Screen/Electric

Fri. (1/11) 8:00 am – 12:00 pm Willow (M4, North), Omni

StdC Training Adhoc (10/10) Screen/Electric

Fri. (1/11) 12:00 pm – 1:00 pm Willow (M4, North), Omni

Standards: ILS/ISAS (10/3) Screen/Electric

Fri. (1/11) 1:00 pm – 4:00 pm Pecan (M3, North), Omni

Standards: PPIS (6/10) Screen/Electric

Fri. (1/11) 2:00 pm – 6:00 pm Willow (M4, North), Omni

Standards: SPLS (20/20) Screen/Electric

Fri. (1/11) 2:00 pm – 6:00 pm International E (M2, North), Omni

Standards PPIS (6/10) Screen/Electric

Tues. (1/15) 11:00 am – 2:00 pm Magnolia (M2, North), Omni

Standards SPLS (20/10) Screen/Electric

Tues. (1/15) 2:00 pm – 4:00 pm Magnolia (M2, North), Omni

Standards SRS (8/4) Screen/Electric

Tues. (1/15) 5:00 pm – 6:00 pm Magnolia (M2, North), Omni

Student Activities Committee (25/10) Screen/Electric

Sat. (1/12) 8:00 am – 3:00 pm Spruce (AT, South), Omni

Student Activities Centralized Training (10/5) Screen/Electric

Fri. (1/11) 8:30 am – 9:30 am Juniper (M2, North), Omni

Student Activities Executive (10/5) Screen/Electric

Fri. (1/11) 9:30 am – 11:30 am Juniper (M2, North), Omni

Student Activities K-12/STEM (20/5) Screen/Electric

Fri. (1/11) 12:00 pm – 2:00 pm Juniper (M2, North), Omni

Student Activities ABET (15/5) Screen/Electric

Fri. (1/11) 2:00 pm – 4:00 pm Sycamore (M2, North), Omni

Student Activities Post High (20/5) Screen/Electric

Fri. (1/11) 2:00 pm – 4:00 pm Juniper (M2, North), Omni

Student Activities Design Competition (15/5) Screen/Electric

Fri. (1/11) 4:00 pm – 6:00 pm Juniper (M2, North), Omni

Student Activities Grants (15/5) Screen/Electric

Fri. (1/11) 4:00 pm – 6:00 pm Sycamore (M2, North), Omni

Student Branch Advisor Congress (30/0) Screen

Mon. (1/14) 10:00 am – 11:45 am Dogwood B (M1, North), Omni

Student Congress (30/0) Screen

Mon. (1/14) 10:00 am – 11:45 am Dogwood A (M1, North), Omni

Student Welcome (360/0) Screen

Sat. (1/12) 1:00 pm – 3:00 pm International EF (M2, North), Omni

Student/YEA Mixer (300/0)

Sat. (1/12) 5:00 pm – 6:30 pm International EF (M2, North), Omni

Student Program (420/0) Screen

Sun. (1/13) 8:00 am – 3:00 pm International EF (M2, North), Omni

Technical Activities Committee (25/20) Screen/Electric

Sat. (1/12) 8:00 am – 3:00 pm A303 (3), Bldg A, GWCC

Wed. (1/16) 7:00 am – 10:00 am Birch (AT, South), Omni

Technology Council (40/20) Screen/Electric

Wed. (1/16) 9:00 am – 12:00 pm Grand B (M4, North), Omni

Technology Council Special Projects (10/5) Screen/Electric

Tues. (1/15) 8:00 am – 9:00 am Birch (AT, South), Omni

Technology Council: Operations (25/15) Screen/Electric

Tues. (1/15) 9:00 am – 10:30 am Birch (AT, South), Omni

Technology Council: Document Review (10/10) Screen/Electric

Tues. (1/15) 10:30 am – 11:30 am Birch (AT, South), Omni

UNEP ASHRAE Coordinating Committee (12/20) Screen

Sat. (1/12) 5:30 pm – 6:30 pm Hazelnut (M3, North), Omni

Young Engineers in ASHRAE Committee (25/15) Electric

Sat. (1/12) 8:00 am – 3:00 pm Pine (AT, South), Omni

YEA Hospitality (125/0)

Sun. (1/13) 4:00 pm - 6:00 pm Grand A (M4, North), Omni

notes

TC/TG/SPC MEETINGS

The ASHRAE Technical Committees, Project 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.

Abbreviations:

GPC = Guideline Project Committee

MTG = Multidisciplinary Task Group

RP = Research Project

SPC = Standard Project Committee

SSPC = Standing Standard Project Committee

TC = Technical Committee

TG = Task Group

TRG = Technical Research Group

Finding your Meeting Location:

Committee meetings are located in meetings room in both the Omni and the Georgia World Congress Center (GWCC). Please see pages 3–12 for meeting space floor plans and descriptions on how to access the meeting room floors. **The floor levels and venue names are indicated in parenthesis in the listing below.** Subcommittees are indented in the listing below. Rooms will be set as best as possible as indicated in the parentheses beside the committee, i.e., (20/20) will accommodate at least 20 people at the conference table and at least 20 chairs for the audience. Any audiovisual or electrical ordered will be listed. If AV is not ordered in advance there is no guarantee it will be available onsite.

Meeting Space Floors and Venues Key

North Tower (**North**) at the Omni: M1, M2, M3, M4, N6

South Tower (**South**) at the Omni: Atrium Terrace (AT)

Georgia World Congress Center (GWCC) Building A (Bldg A):
3 and 4

Georgia World Congress Center (GWCC) Building B (Bldg B):
2, 3 and 4

*Embassy Suites (ES): Lobby

*SSPC 90.1 and its subcommittees are the **only** meetings taking place at the ES, across the street from the Omni.

The “Schedule” section in the ASHRAE 365 app lets you create your own schedule as well as filter committee meetings by date, time, room and committee type (Standing, Technical, Project).

TECHNICAL COMMITTEES (TCS)

TC/TG Chair’s Breakfast Section 1 (27/4)

Sun. (1/13) 6:30 am – 8:00 am Grand C (M4, North), Omni

TC/TG Chair’s Breakfast Section 2 (21/4)

Sun. (1/13) 6:30 am – 8:00 am Magnolia (M2, North), Omni

TC/TG Chair’s Breakfast Section 3 (13/4)

Sun. (1/13) 6:30 am – 8:00 am Willow (M4, North), Omni

TC/TG Chair’s Breakfast Section 4 (17/4)

Sun. (1/13) 6:30 am – 8:00 am Cypress (M2, North), Omni

TC/TG Chair’s Breakfast Section 5 (21/4)

Sun. (1/13) 6:30 am – 8:00 am Redwood (M1, North), Omni

TC/TG Chair’s Breakfast Section 6 (19/4)

Sun. (1/13) 6:30 am – 8:00 am Grand B (M4, North), Omni

TC/TG Chair’s Breakfast Section 7 (19/4)

Sun. (1/13) 6:30 am – 8:00 am Cottonwood B (M1, North), Omni

TC/TG Chair’s Breakfast Section 8 (25/4)

Sun. (1/13) 6:30 am – 8:00 am Dogwood B (M1, North), Omni

TC/TG Chair’s Breakfast Section 9 (25/4)

Sun. (1/13) 6:30 am – 8:00 am Dogwood A (M1, North), Omni

TC/TG Chair’s Breakfast Section 10 (15/4)

Sun. (1/13) 6:30 am – 8:00 am Sycamore (M2, North), Omni

MTG Chair’s Breakfast Section MTG (19/4)

Sun. (1/13) 6:30 am – 8:00 am Juniper (M2, North), Omni

TC Program Subcommittee Training (30/0) Screen

Tues. (1/15) 11:15 am – 12:00 pm A409 (4), GWCC, Bldg A

Research Subcommittee Chairs (121/0) Screen

Mon. (1/14) 6:30 am – 9:00 am Grand D/E (M4, North), Omni

TC 1.1 Thermodynamics and Psychrometrics (12/15)

Mon. (1/14) 2:15 pm – 4:15 pm B204 (2), GWCC, Bldg B

TC 1.2 Instruments and Measurements (12/0)

Tues. (1/15) 1:00 pm – 3:30 pm Cottonwood B (M1, North), Omni

TC 1.3 Heat Transfer and Fluid Flow (15/25)

Tues. (1/15) 1:00 pm – 3:30 pm A405 (4), GWCC, Bldg A

TC 1.3/8.5 Research Subcommittee (12/38) Screen/Electric

Sun. (1/13) 3:00 pm – 7:00 pm A405 (4), GWCC, Bldg A

TC 1.4 Control Theory and Application (20/80) Screen/Electric

Tues. (1/15) 1:00 pm – 3:30 pm A302 (3), GWCC, Bldg A

TC 1.4 YEA/Education (10/15) Screen/Electric

Sun. (1/13) 2:00 pm – 3:00 pm B319 (3), GWCC, Bldg B

TC 1.4 Control Components and Applications (15/15) Screen/Electric

Sun. (1/13) 3:00 pm – 4:00 pm B319 (3), GWCC, Bldg B

TC 1.4 Programs (15/15) Screen/Electric

Sun. (1/13) 4:00 pm – 5:30 pm B319 (3), GWCC, Bldg B

TC 1.4 Research (15/20) Screen/Electric

Mon. (1/14) 2:00 pm – 4:00 pm Hazelnut (M3, North), Omni

TC 1.4 Handbook (8/10) Screen/Electric

Mon. (1/14) 4:00 pm – 6:00 pm Hazelnut (M3, North), Omni

TC 1.4 Executive (10/0) Screen/Electric

Tues. (1/15) 8:30 am – 9:30 am Willow (M4, North), Omni

TC 1.4 RP-1711 Advanced Sequences of Operation for HVAC Systems – Phase II Central Plants and Hydronic Systems (10/5) Screen/Electric

Tues. (1/15) 9:30 am – 10:30 am Willow (M4, North), Omni

TC 1.5 Computer Applications (25/25) Screen/Electric

Mon. (1/14) 6:30 pm – 9:00 pm B319 (3), GWCC, Bldg B

TC 1.5 1801-TRP, Standardizing and Utilizing ASHRAE Online BIM Data Exchange Protocols (6/0)

Sunday (1/13) 11:30 am – 12:30 pm Willow (M4, North), Omni

TC 1.5 Cyber Security (15/5) Electric

Sun. (1/13) 4:00 pm – 5:00 pm B208 (2), GWCC, Bldg B

TC 1.5 Emerging Applications (15/5) Electric

Sun. (1/13) 5:00 pm – 6:00 pm B208 (2), GWCC, Bldg B

TC 1.5 Program (15/5) Electric

Sun. (1/13) 6:00 pm – 7:00 pm B208 (2), GWCC, Bldg B

TC 1.5 Research (15/5) Electric

Sun. (1/13) 7:00 pm – 8:00 pm B208 (2), GWCC, Bldg B

TC 1.5 Handbook (15/5) Electric

Mon. (1/14) 6:00 pm – 6:30 pm B319 (3), GWCC, Bldg B

TC 1.6 Terminology (15/3) Screen/Electric

Mon. (1/14) 8:00 am – 11:00 am Sycamore (M2, North), Omni

TC 1.7 Business, Management & General Legal Education (20/5)

Mon. (1/14) 10:15 am – 12:00 pm A306 (3), GWCC, Bldg A

TC 1.7 Code of Ethics (8/8) Screen/Electric

Sat. (1/12) 2:00 pm – 4:00 pm A409 (4), GWCC, Bldg A

TC 1.8 Mechanical Systems Insulation (20/10) Screen/Electric

Mon. (1/14) 4:15 pm – 6:30 pm Chestnut (M3, North), Omni

TC 1.8 Handbook Ch 23 (15/10) Screen/Electric

Sun. (1/13) 8:00 am – 10:30 am B207 (2), GWCC, Bldg B

TC 1.8 Program (15/5) Screen/Electric

Sun. (1/13) 10:30 am – 11:00 am B207 (2), GWCC, Bldg B

TC 1.8 Research (20/10) Screen/Electric

Sun. (1/13) 11:00 am – 12:00 pm B207 (2), GWCC, Bldg B

TC 1.9 Electrical Systems (8/4)

Tues. (1/15) 3:30 pm – 6:00 pm B318 (3), GWCC, Bldg B

TC 1.10 Combined Heat and Power Systems (20/10) Electric

Tues. (1/15) 2:30 pm – 4:00 pm B301 (3), GWCC, Bldg B

TC 1.10 PMS 1762-RP (20/10) Electric

Tues. (1/15) 12:30 pm – 1:30 pm B301 (3), GWCC, Bldg B

TC 1.10 Handbook, Program, Research, Membership Subcommittees (20/10) Electric

Tues. (1/15) 1:30 pm – 2:30 pm B301 (3), GWCC, Bldg B

TC 1.11 Electric Motors and Motor Control (13/7)

Tues. (1/15) 1:00 pm – 3:30 pm Pecan (M3, North), Omni

TC 1.12 Moisture Management in Buildings (20/20) Electric

Sat. (1/12) 1:00 pm – 3:00 pm A301 (3), GWCC, Bldg A

TC 1.12 Research, Program, Handbook, Standards (16/20) Electric

Sat. (1/12) 8:00 am – 11:30 am A301 (3), GWCC, Bldg A

TC 1.13 Optimization (20/5)

Sun. (1/13) 1:00 pm – 3:00 pm Hickory (M3, North), Omni

TC 2.1 Physiology and Human Environment (15/10) Electric

Tues. (1/15) 1:00 pm – 3:30 pm A304 (3), GWCC, Bldg A

TC 2.2 Plant and Animal Environment (10/5) Screen/Electric

Mon. (1/14) 4:15 pm – 6:30 pm A306 (3), GWCC, Bldg A

TC 2.3 Gaseous Air Contaminants and Gas Contaminant Removal Equipment (30/30) Screen

Tues. (1/15) 1:00 pm – 3:30 pm B208 (2), GWCC, Bldg B

TC 2.3 Research (25/20) Screen/Electric

Sun. (1/13) 5:00 pm – 7:00 pm Redwood (M1, North), Omni

TC 2.3 Handbook (8/4) Screen/Electric

Mon. (1/14) 4:15 pm – 5:30 pm Pecan (M3, North), Omni

TC 2.3 Planning (15/3) Electric

Tues. (1/15) 6:30 am – 8:00 am B208 (2), GWCC, Bldg B

TC 2.3 Programs (15/5) Screen/Electric

Tues. (1/15) 12:00 pm – 12:45 pm B208 (2), GWCC, Bldg B

TC 2.4 Particulate Air Contaminants and Particulate Contaminant Removal Equipment (18/50) Screen/Electric

Tues. (1/15) 3:30 pm – 6:00 pm B208 (2), GWCC, Bldg B

TC 2.4 Handbook (18/0) Screen/Electric

Sat. (1/12) 12:30 pm – 1:30 pm Grand A (M4, North), Omni

TC 2.4 1649-RP PMS (5/25) Screen/Electric

Sat. (1/12) 1:30 pm – 2:30 pm Grand A (M4, North), Omni

TC 2.4 1734-RP PMS (18/25) Screen/Electric

Sun. (1/13) 12:30 pm – 1:30 pm Redwood (M1, North), Omni

TC 2.4 1756-RP PMS (18/25) Screen/Electric

Sun. (1/13) 1:45 pm – 2:45 pm Redwood (M1, North), Omni

TC 2.4 Research (18/30) Screen/Electric

Sun. (1/13) 3:00 pm – 5:00 pm Redwood (M1, North), Omni

TC 2.4 Program (18/25) Screen/Electric

Mon. (1/14) 3:15 pm – 4:15 pm B319 (3), GWCC, Bldg B

TC 2.4 Standards (18/25) Screen/Electric

Mon. (1/14) 4:15 pm – 5:15 pm B319 (3), GWCC, Bldg B

TC 2.5 Global Climate Change (20/10)

Tues. (1/15) 1:30 pm – 3:30 pm Hazelnut (M3, North), Omni

TC 2.5 Research, Programs (5/15) Electric

Mon. (1/14) 2:15 pm – 4:15 pm Pecan (M3, North), Omni

TC 2.5 Fundamentals Chapter (10/0)

Tuesday (1/15) 10:30 am -11:30 am Willow (M4, North), Omni

TC 2.6 Sound and Vibration (25/45) Screen/Electric

Mon. (1/14) 2:15 pm – 4:15 pm A405 (4), GWCC, Bldg A

TC 2.6 Vibration Control (15/10) Electric

Sun. (1/13) 8:00 am – 9:00 am Cottonwood B (M1, North), Omni

TC 2.6 Publications (15/10) Electric

Sun. (1/13) 9:00 am – 10:00 am Cottonwood B (M1, North), Omni

TC 2.6 Hot Topic (15/10) Electric

Sun. (1/13) 10:00 am – 11:00 am Cottonwood B (M1, North), Omni

TC 2.6 Research (15/10) Screen

Sun. (1/13) 11:00 am – 12:00 pm Cottonwood B (M1, North), Omni

TC 2.6 Hot Topic 2 (15/10) Screen

Sun. (1/13) 1:00 pm – 2:00 pm Cottonwood B (M1, North), Omni

TC 2.6 Programs (15/5) Screen

Sun. (1/13) 2:00 pm – 3:00 pm Cottonwood B (M1, North), Omni

TC 2.6 Executive Committee (7/0) Screen

Sun. (1/13) 3:00 pm – 4:00 pm Cottonwood B (M1, North), Omni

TC 2.7 Seismic, Wind and Flood Resistant Design (17/24) Screen/Electric

Tues. (1/15) 3:30 pm – 6:00 pm Juniper (M2, North), Omni

TC 2.7 Flood Resistance Design Subcommittee (15/10) Screen/Electric

Tues. (1/15) 10:00 am – 12:00 pm Juniper (M2, North), Omni

TC 2.7 Publications, Research, Programs and Long Range Planning (15/10) Screen/Electric

Tues. (1/15) 1:00 pm – 3:30 pm Juniper (M2, North), Omni

TC 2.8 Building Environmental Impacts and Sustainability (15/30) Screen/Electric

Sun. (1/13) 5:30 pm – 7:00 pm A304 (3), GWCC, Bldg A

TC 2.8 Water-Energy Nexus (5/10) Screen/Electric

Sun. (1/13) 1:00 pm – 2:00 pm A304 (3), GWCC, Bldg A

TC 2.8 Existing & Future Bldg Challenges (8/10) Screen/Electric

Sun. (1/13) 2:00 pm – 2:30 pm A304 (3), GWCC, Bldg A

TC 2.8 International (5/10) Screen

Sun. (1/13) 2:30 pm – 3:00 pm A304 (3), GWCC, Bldg A

TC 2.8 Research (8/10) Screen/Electric

Sun. (1/13) 3:00 pm – 4:00 pm A304 (3), GWCC, Bldg A

TC 2.8 Programs (5/10) Screen/Electric

Sun. (1/13) 4:00 pm – 4:30 pm A304 (3), GWCC, Bldg A

TC 2.8 Handbook (5/10) Screen/Electric

Sun. (1/13) 4:30 pm – 5:00 pm A304 (3), GWCC, Bldg A

TC 2.9 Ultraviolet Air and Surface Treatment (40/20)

Mon. (1/14) 10:00 am – 12:00 pm Pine (AT, South), Omni

TC 2.9 Programs (20/10) Electric

Sat. (1/12) 8:00 am – 10:00 am Chestnut (M3, North), Omni

TC 2.9 Standards (20/10) Electric

Sun. (1/13) 8:00 am – 10:00 am Chestnut (M3, North), Omni

TC 2.9 Handbook (20/5)

Sun. (1/13) 10:00 am – 12:00 pm Chestnut (M3, North), Omni

TC 2.9 Research (20/10) Electric

Mon. (1/14) 8:00 am – 10:00 am Pine (AT, South), Omni

TC 2.10 Resilience and Security (20/10) Electric

Tues. (1/15) 11:00 am – 12:00 pm Spruce (AT, South), Omni

TC 2.10 Standards (20/10)

Tues. (1/15) 9:00 am – 10:00 am Spruce (AT, South), Omni

TC 2.10 Handbook (20/10)

Tues. (1/15) 10:00 am – 11:00 am Spruce (AT, South), Omni

TC 3.1 Refrigerants and Secondary Coolants (10/30) Screen/Electric

Mon. (1/14) 4:15 pm – 6:30 pm B201 (2), GWCC, Bldg B

TC 3.1 Research (30/40) Screen/Electric

Sun. (1/13) 4:00 pm – 6:00 pm A404 (4), GWCC, Bldg A

TC 3.1 Program (30/40) Screen/Electric

Mon. (1/14) 10:30 am – 12:00 pm Grand B (M4, North), Omni

TC 3.2 Refrigerant System Chemistry (12/40) Screen/Electric

Mon. (1/14) 2:15 pm – 4:15 pm A301 (3), GWCC, Bldg A

TC 3.2 Research (30/40) Screen/Electric

Sun. (1/13) 4:00 pm – 6:00 pm A404 (4), GWCC, Bldg A

TC 3.2 Program (30/40) Screen/Electric

Mon. (1/14) 10:30 am – 12:00 pm Grand B (M4, North), Omni

TC 3.3 Refrigerant Contaminant Control (14/25)

Tues. (1/15) 3:30 pm – 6:00 pm B204 (2), GWCC, Bldg B

TC 3.3 Research (30/40) Screen/Electric

Sun. (1/13) 4:00 pm – 6:00 pm A404 (4), GWCC, Bldg A

TC 3.3 Program (30/40) Screen/Electric

Mon. (1/14) 10:30 am – 12:00 pm Grand B (M4, North), Omni

TC 3.4 Lubrication (30/15) Screen/Electric

Tues. (1/15) 1:30 pm – 3:30 pm B204 (2), GWCC, Bldg B

TC 3.4 Research (30/40) Screen/Electric

Sun. (1/13) 4:00 pm – 6:00 pm A404 (4), GWCC, Bldg A

TC 3.4 Program (30/40) Screen/Electric

Mon. (1/14) 10:30 am – 12:00 pm Grand B (M4, North), Omni

TC 3.6 Water Treatment (25/15)

Tues. (1/15) 1:00 pm – 3:30 pm Spruce (AT, South), Omni

TC 3.6 Handbook, Program, Research Subcommittee (20/5) Electric

Sun. (1/13) 3:00 pm – 5:00 pm A301 (3), GWCC, Bldg A

TC 3.8 Refrigerant Containment (9/5)

Mon. (1/14) 4:15 pm – 6:30 pm Pine (AT, South), Omni

TC 3.8 Research (30/40) Screen/Electric

Sun. (1/13) 4:00 pm – 6:00 pm A404 (4), GWCC, Bldg A

TC 3.8 Program (30/40) Screen/Electric

Mon. (1/14) 10:30 am – 12:00 pm Grand B (M4, North), Omni

TC 4.1 Load Calculation Data and Procedures (20/10)

Mon. (1/14) 2:15 pm – 4:15 pm Grand A (M4, North), Omni

TC 4.1 RP-1729 PMS (8/5) Screen/Electric

Sun. (1/13) 8:00 am – 9:00 am Redwood (M1, North), Omni

TC 4.1 Handbook (15/10)

Sun. (1/13) 3:00 pm – 4:00 pm Sycamore (M2, North), Omni

TC 4.1 Research (15/10)

Sun. (1/13) 4:00 pm – 5:00 pm Sycamore (M2, North), Omni

TC 4.1 Programs (15/10)

Sun. (1/13) 5:00 pm – 6:00 pm Sycamore (M2, North), Omni

TC 4.1 Standards (15/10)

Sun. (1/13) 6:00 pm – 7:00 pm Sycamore (M2, North), Omni

TC 4.2 Climatic Information (20/10) Screen/Electric

Tues. (1/15) 1:00 pm – 3:30 pm B207 (2), GWCC, Bldg B

TC 4.2 1745 PMS (10/5) Screen/Electric

Sun. (1/13) 1:00 pm – 2:00 pm Beechnut (M3, North), Omni

TC 4.2 Handbook (10/5) Screen/Electric

Sun. (1/13) 2:30 pm – 3:30 pm Beechnut (M3, North), Omni

TC 4.2 Program (10/5) Screen/Electric

Sun. (1/13) 3:30 pm – 4:30 pm Beechnut (M3, North), Omni

TC 4.2 1847-TRP PES (10/0) Screen/Electric

Sun. (1/13) 5:00 pm – 7:00 pm Beechnut (M3, North), Omni

TC 4.2 Research (10/5) Screen/Electric

Mon. (1/14) 4:15 pm – 6:30 pm Willow (M4, North), Omni

TC 4.3 Ventilation Requirements and Infiltration (12/30) Screen

Mon. (1/14) 4:15 pm – 6:30 pm A301 (3), GWCC, Bldg A

TC 4.3 RP-1819 (6/4) Screen/Electric

Tues. (1/15) 8:00 am – 9:00 am Juniper (M2, North), Omni

TC 4.4 Building Materials and Building Envelope Performance (40/10) Screen/Electric

Mon. (1/14) 2:15 pm – 4:15 pm B301 (3), GWCC, Bldg B

TC 4.4 PMS 1696-RP (20/10) Screen/Electric

Sun. (1/13) 10:00 am – 11:30 am B306 (3), GWCC, Bldg B

TC 4.4 PMS 1759-RP (20/10) Screen/Electric

Sun. (1/13) 11:30 am – 12:30 pm B306 (3), GWCC, Bldg B

TC 4.4 Program (30/15) Screen/Electric

Sun. (1/13) 1:00 pm – 2:30 pm B306 (3), GWCC, Bldg B

TC 4.4 Handbook (30/15) Screen/Electric

Sun. (1/13) 2:30 pm – 3:30 pm B306 (3), GWCC, Bldg B

TC 4.4 Research (30/15) Screen/Electric

Sun. (1/13) 3:30 pm – 5:00 pm B306 (3), GWCC, Bldg B

TC 4.4 Standards (30/15) Screen/Electric

Sun. (1/13) 5:00 pm – 5:30 pm B306 (3), GWCC, Bldg B

TC 4.5 Fenestration (15/15) Screen

Tues. (1/15) 2:00 pm – 4:00 pm Cottonwood A (M1, North), Omni

TC 4.7 Energy Calculations (25/50) Screen/Electric

Tues. (1/15) 6:00 pm – 8:30 pm Dogwood A (M1, North), Omni

TC 4.7 RP 1661 PMSC (5/3) Electric

Sun. (1/13) 4:00 pm – 6:00 pm A306 (3), GWCC, Bldg A

TC 4.7 Simulation and Component Models (20/10) Electric

Mon. (1/14) 6:00 pm – 7:30 pm B306 (3), GWCC, Bldg B

TC 4.7 Data-Driven Models (20/10) Electric

Mon. (1/14) 7:30 pm – 9:00 pm B306 (3), GWCC, Bldg B

TC 4.7 Multi-scale Building Energy Modeling (20/10) Electric

Tues. (1/15) 3:30 pm – 5:00 pm Dogwood A (M1, North), Omni

TC 4.7 Handbook (15/0) Electric

Tues. (1/15) 5:00 pm – 6:00 pm Dogwood A (M1, North), Omni

TC 4.10 Indoor Environmental Modeling (30/15) Electric

Mon. (1/14) 2:15 pm – 4:15 pm A404 (4), GWCC, Bldg A

TC 4.10 RP-1675 PMS (5/10) Screen/Electric

Sun. (1/13) 2:00 pm – 3:00 pm Hazelnut (M3, North), Omni

TC 4.10 Program (20/10) Electric

Sun. (1/13) 3:00 pm – 4:00 pm Hazelnut (M3, North), Omni

TC 4.10 Handbook (20/10) Electric

Sun. (1/13) 4:00 pm – 5:00 pm Hazelnut (M3, North), Omni

TC 4.10 Research (20/10) Electric

Sun. (1/13) 5:00 pm – 6:00 pm Hazelnut (M3, North), Omni

TC 5.1 Fans (15/45) Screen

Mon. (1/14) 4:15 pm – 6:30 pm A404 (4), GWCC, Bldg A

TC 5.1 Handbook (12/15) Screen/Electric

Sun. (1/13) 2:00 pm – 3:00 pm Cottonwood A (M1, North), Omni

TC 5.1 Research (12/15) Screen/Electric

Sun. (1/13) 3:00 pm – 4:00 pm Cottonwood A (M1, North), Omni

TC 5.1 Program (12/15) Screen/Electric

Sun. (1/13) 4:00 pm – 4:30 pm Cottonwood A (M1, North), Omni

TC 5.1 Hot Topics (16/15) Screen/Electric

Sun. (1/13) 4:30 pm – 6:00 pm Cottonwood A (M1, North), Omni

TC 5.2 Duct Design (13/35) Screen/Electric

Tues. (1/15) 3:30 pm – 6:00 pm A301 (3), GWCC, Bldg A

TC 5.2 Duct Fitting Data Base- Inter Subcommittee (8/8) Screen/
Electric

Sun. (1/13) 3:00 pm – 7:00 pm Azalea (N6, North), Omni

TC 5.2 Duct Design Subcommittees (30/15) Screen/Electric

Mon. (1/14) 8:00 am – 12:00 pm B207 (2), GWCC, Bldg B

TC 5.3 Room Air Distribution (30/30) Screen/Electric

Tues. (1/15) 1:00 pm – 3:30 pm Dogwood A (M1, North), Omni

TC 5.3 Handbook (20/10) Screen/Electric

Sat. (1/12) 8:00 am – 3:00 pm A306 (3), GWCC, Bldg A

TC 5.3 1741-RP Understanding Fan Coil Components and How
They relate to Energy Consumption And Energy Modeling (7/10)
Screen/Electric

Sat. (1/12) 12:00 pm – 2:00 pm Oak (Lobby, South), Omni

TC 5.3 Research (25/10) Screen/Electric

Sun. (1/13) 8:00 am – 10:00 am B301 (3), GWCC, Bldg B

TC 5.3 Programs (25/10) Screen/Electric

Sun. (1/13) 10:00 am – 12:00 pm B301 (3), GWCC, Bldg B

TC 5.4 Industrial Process Air Cleaning (Air Pollution Control) (11/6)

Mon. (1/14) 2:15 pm – 4:15 pm A306 (3), GWCC, Bldg A

TC 5.5 Air-to-Air Energy Recovery (30/10) Screen/Electric

Tues. (1/15) 3:30 pm – 6:00 pm B306 (3), GWCC, Bldg B

TC 5.5 Handbook, Program, Research (12/6) Screen/Electric

Mon. (1/14) 4:15 pm – 6:30 pm B318 (3), GWCC, Bldg B

TC 5.6 Control of Fire and Smoke (23/30)

Mon. (1/14) 4:15 pm – 6:30 pm Dogwood B (M1, North), Omni

TC 5.6 Program/Research/Handbook (12/20)

Sun. (1/13) 3:00 pm – 6:30 pm Hickory (M3, North), Omni

TC 5.7 Evaporative Cooling (20/10)

Mon. (1/14) 4:15 pm – 6:30 pm A405 (4), GWCC, Bldg A

TC 5.7 Programs, Handbook, Research, Standards and Design
Guide (6/6)

Sun. (1/13) 5:00 pm – 7:00 pm Chestnut (M3, North), Omni

TC 5.9 Enclosed Vehicular Facilities (40/20) Screen/Electric

Tues. (1/15) 3:30 pm – 6:00 pm Grand B (M4, North), Omni

TC 5.9 Program, Standards, Handbook, Research (10/10) Electric

Tues. (1/15) 1:00 pm – 3:30 pm Grand B (M4, North), Omni

TC 5.10 Kitchen Ventilation (20/15) Screen

Mon. (1/14) 6:30 pm – 7:30 pm A304 (3), GWCC, Bldg A

TC 5.10 RP-1614 PMS Meeting (5/10) Screen/Electric

Sun. (1/13) 3:00 pm – 4:30 pm A305 (3), GWCC, Bldg A

TC 5.10 RP-1778 PMS Meeting (5/10) Screen/Electric

Sun. (1/13) 4:30 pm – 6:00 pm Spruce (AT, South), Omni

TC 5.10 Handbook (20/10) Screen/Electric

Mon. (1/14) 2:00 pm – 3:30 pm A304 (3), GWCC, Bldg A

TC 5.10 Program (20/10) Screen/Electric

Mon. (1/14) 3:30 pm – 4:30 pm A304 (3), GWCC, Bldg A

TC 5.10 Research (20/10) Screen/Electric

Mon. (1/14) 4:30 pm – 6:30 pm A304 (3), GWCC, Bldg A

TC 5.11 Humidifying Equipment (10/5) Screen/Electric

Mon. (1/14) 2:15 pm – 4:15 pm Cottonwood B (M1, North), Omni

TC 5.11 Humidifying Equipment Research/Handbook

Subcommittees (10/5) Screen/Electric

Sun. (1/13) 3:00 pm – 5:00 pm Willow (M4, North), Omni

TC 6.1 Hydronic and Steam Equipment and Systems (20/25) Screen/Electric

Tues. (1/15) 1:00 pm – 3:30 pm B306 (3), GWCC, Bldg B

TC 6.1 Handbook (12/8) Screen/Electric

Sun. (1/13) 5:00 pm – 6:00 pm B317 (3), GWCC, Bldg B

TC 6.1 Chilled Water Plant (10/6) Screen/Electric

Sun. (1/13) 6:00 pm – 7:00 pm B317 (3), GWCC, Bldg B

TC 6.1 Program (12/8) Screen/Electric

Mon. (1/14) 2:15 pm – 3:15 pm B317 (3), GWCC, Bldg B

TC 6.1 Research (12/8) Screen/Electric

Mon. (1/14) 3:15 pm – 4:15 pm B317 (3), GWCC, Bldg B

TC 6.2 District Energy (30/20) Screen/Electric

Sun. (1/13) 3:00 pm – 5:00 pm B207 (2), GWCC, Bldg B

TC 6.2 Programs, Research, Handbook (30/20) Screen/Electric

Sun. (1/13) 1:00 pm – 3:00 pm B207 (2), GWCC, Bldg B

TC 6.3 Central Forced Air Heating and Cooling Systems (20/12)

Tues. (1/15) 1:00 pm – 3:30 pm A409 (4), GWCC, Bldg A

TC 6.5 Radiant Heating and Cooling (17/10)

Mon. (1/14) 2:15 pm – 4:15 pm B202 (2), GWCC, Bldg B

TC 6.5 Radiant Heating and Cooling: Research, Handbook, Programs (15/25) Screen/Electric

Sun. (1/13) 3:00 pm – 5:00 pm A409 (4), GWCC, Bldg A

TC 6.6 Service Water Heating Systems (30/30) Electric

Mon. (1/14) 4:15 pm – 6:30 pm A305 (3), GWCC, Bldg A

TC 6.6 Research, Handbook and Program (15/15) Electric

Mon. (1/14) 2:15 pm – 4:15 pm A305 (3), GWCC, Bldg A

TC 6.7 Solar and Other Renewable Energies (20/55) Screen

Tues. (1/15) 1:00 pm – 3:30 pm A305 (3), GWCC, Bldg A

TC 6.7 Research, Standards, Programs and Handbook (20/8) Electric

Mon. (1/14) 4:15 pm – 8:30 pm Spruce (AT, South), Omni

TC 6.8 Geothermal Heat Pump and Energy Recovery Applications (16/25) Screen/Electric

Tues. (1/15) 3:30 pm – 6:00 pm A305 (3), GWCC, Bldg A

TC 6.8 Handbook: Geothermal Energy (12/15) Electric

Sun. (1/13) 4:00 pm – 5:00 pm Cottonwood B (M1, North), Omni

TC 6.8 Programs (12/8) Electric

Sun. (1/13) 5:00 pm – 6:30 pm Cottonwood B (M1, North), Omni

TC 6.8 Research (12/16) Electric

Mon. (1/14) 4:15 pm – 6:00 pm Cottonwood B (M1, North), Omni

TC 6.8 Energy Recovery Applications (9/9) Electric

Tues. (1/15) 8:00 am – 9:00 am Chestnut (M3, North), Omni

TC 6.9 Thermal Storage (30/20) Screen/Electric

Mon. (1/14) 4:30 pm – 6:00 pm B207 (2), GWCC, Bldg B

TC 6.9 Standards/SPC 150 (30/20) Screen/Electric

Mon. (1/14) 2:15 pm – 2:40 pm B207 (2), GWCC, Bldg B

TC 6.9 Programs (30/20) Screen/Electric

Mon. (1/14) 2:40 pm – 3:10 pm B207 (2), GWCC, Bldg B

TC 6.9 Handbook (30/20) Screen/Electric

Mon. (1/14) 3:10 pm – 3:30 pm B207 (2), GWCC, Bldg B

TC 6.9 Research (30/20) Screen/Electric

Mon. (1/14) 3:30 pm – 3:50 pm B207 (2), GWCC, Bldg B

TC 6.9 Long Range Planning and Website (30/20) Screen/Electric

Mon. (1/14) 3:50 pm – 4:10 pm B207 (2), GWCC, Bldg B

TC 6.10 Fuels and Combustion (20/10) Screen/Electric

Tues. (1/15) 3:30 pm – 6:00 pm Birch (AT, South), Omni

TC 6.10 Handbook, Research, and Program (10/5) Screen/Electric

Mon. (1/14) 2:15 pm – 4:15 pm B318 (3), GWCC, Bldg B

TC 7.1 Integrated Building Design (25/10)

Mon. (1/14) 8:15 am – 10:00 am Dogwood B (M1, North), Omni

TC 7.2 HVAC&R Construction & Design Build Technologies (10/5)

Sun. (1/13) 10:00 am – 12:00 pm Cypress (M2, North), Omni

TC 7.3 Operations and Maintenance Management (25/7) Screen/Electric

Tues. (1/15) 1:00 pm – 3:30 pm Grand A (M4, North), Omni

TC 7.3 Education & Training (7/5) Screen/Electric

Sun. (1/13) 1:30 pm – 3:00 pm Pecan (M3, North), Omni

TC 7.3 Standards and Program (20/10) Screen/Electric

Mon. (1/14) 2:15 pm – 4:15 pm Hickory (M3, North), Omni

TC 7.3 Research and Handbook (20/10) Screen/Electric

Mon. (1/14) 4:15 pm – 6:30 pm Hickory (M3, North), Omni

TC 7.3 RP-1650 PMS (6/0)

Tues. (1/15) 8:00 am – 9:00 am Pecan (M3, North), Omni

TC 7.4 Exergy Analysis for Sustainable Buildings (EXER) (14/8)

Sun. (1/13) 8:00 am – 10:00 am Magnolia (M2, North), Omni

TC 7.5 Smart Building Systems (11/50) Screen/Electric

Tues. (1/15) 3:30 pm – 6:00 pm A405 (4), GWCC, Bldg A

TC 7.5 Fault Detection & Diagnosis (40/10) Screen

Sun. (1/13) 2:30 pm – 3:15 pm B301 (3), GWCC, Bldg B

TC 7.5 Enabling Technologies (30/10) Screen

Sun. (1/13) 3:15 pm – 4:00 pm B301 (3), GWCC, Bldg B

TC 7.5 Smart Grid (20/10) Screen

Sun. (1/13) 4:00 pm – 4:45 pm B301 (3), GWCC, Bldg B

TC 7.5 Handbook (15/10) Screen

Sun. (1/13) 4:45 pm – 5:30 pm B301 (3), GWCC, Bldg B

TC 7.5 Program (20/10) Screen

Sun. (1/13) 5:30 pm – 6:00 pm B301 (3), GWCC, Bldg B

TC 7.5 Buildings Operations and Dynamics (30/10) Screen

Mon. (1/14) 4:15 pm – 5:15 pm B301 (3), GWCC, Bldg B

TC 7.5 Research (30/10)

Mon. (1/14) 5:15 pm – 6:00 pm B301 (3), GWCC, Bldg B

TC 7.6 Building Energy Performance (15/30) Screen/Electric

Tues. (1/15) 1:00 pm – 3:30 pm A301 (3), GWCC, Bldg A

TC 7.6 Federal Buildings (10/5) Screen

Sat. (1/12) 9:00 am – 3:00 pm A405 (4), GWCC, Bldg A

TC 7.6 Federal Buildings (10/5) Screen/Electric

Sun. (1/13) 9:00 am – 12:00 pm B208 (2), GWCC, Bldg B

TC 7.6 Research (8/4) Screen/Electric

Sun. (1/13) 1:00 pm – 2:00 pm B208 (2), GWCC, Bldg B

TC 7.6 Commercial Building Energy Audit (15/10) Screen/Electric

Sun. (1/13) 2:00 pm – 3:00 pm B208 (2), GWCC, Bldg B

TC 7.6 Handbook (15/5) Screen/Electric

Sun. (1/13) 3:00 pm – 4:00 pm B208 (2), GWCC, Bldg B

Building Data Exchange Meeting (20/0)

Mon. (1/14) 8:00 am – 10:00 am Dogwood A (M1, North), Omni

TC 7.6 Monitoring and Energy Performance (15/20) Screen/Electric

Mon. (1/14) 2:15 pm – 4:15 pm Sycamore (M2, North), Omni

TC 7.6 Energy Management (12/12) Screen/Electric

Mon. (1/14) 4:15 pm – 5:15 pm Sycamore (M2, North), Omni

TC 7.6 Standards and Programs (12/5) Screen/Electric

Mon. (1/14) 5:15 pm – 6:15 pm Sycamore (M2, North), Omni

TC 7.6 Executive (10/2) Electric

Mon. (1/14) 6:15 pm – 7:00 pm Sycamore (M2, North), Omni

TC 7.7 Testing and Balancing (9/14) Screen

Mon. (1/14) 2:15 pm – 4:15 pm Pine (AT, South), Omni

TC 7.7 Program, Handbook, Research (8/3) Screen/Electric

Sat. (1/12) 8:00 am – 10:30 am Beechnut (M3, North), Omni

TC 7.8 Owning and Operating Costs (20/6) Electric

Mon. (1/14) 2:15 pm – 4:15 pm Dogwood B (M1, North), Omni

TC 7.9 Bldg Commissioning (40/20) Screen/Electric

Sun. (1/13) 3:00 pm – 5:00 pm Grand C (M4, North), Omni

TC 7.9 Handbook, Programs, Research (10/15) Electric

Sat. (1/12) 7:00 am – 10:00 am Willow (M4, North), Omni

TC 8.1 Positive Displacement Compressors (12/14)

Tues. (1/15) 3:30 pm – 6:00 pm Pecan (M3, North), Omni

TC 8.1 Research and Programs (10/5) Electric

Sun. (1/13) 5:00 pm – 6:00 pm Walnut (M3, North), Omni

TC 8.2 Centrifugal Machines (20/8) Screen/Electric

Mon. (1/14) 2:15 pm – 4:15 pm Spruce (AT, South), Omni

TC 8.2 Programs, Research, and Handbook (16/10) Screen/Electric

Sun. (1/13) 5:00 pm – 7:00 pm A305 (3), GWCC, Bldg A

TC 8.3 Absorption and Heat Operated Machines (20/10) Electric

Mon. (1/14) 3:30 pm – 6:00 pm Magnolia (M2, North), Omni

TC 8.3 Research/Handbook (15/15) Electric

Mon. (1/14) 2:15 pm – 3:30 pm Magnolia (M2, North), Omni

TC 8.4 Air-to-Refrigerant Heat Transfer Equipment (20/10) Screen/Electric

Tues. (1/15) 3:30 pm – 6:00 pm A302 (3), GWCC, Bldg A

TC 8.4 Research/Standards/Handbook (30/15) Screen

Mon. (1/14) 6:30 pm – 8:30 pm Dogwood B (M1, North), Omni

TC 8.5 Liquid to Refrigerant Heat Exchangers (20/20) Screen

Mon. (1/14) 4:15 pm – 6:30 pm B308 (3), GWCC, Bldg B

TC 1.3/8.5 Research Subcommittee (12/38) Screen/Electric

Sun. (1/13) 3:00 pm – 7:00 pm A405 (4), GWCC, Bldg A

TC 8.6 Cooling Towers and Evaporative Condensers (20/5)

Mon. (1/14) 2:15 pm – 4:15 pm Juniper (M2, North), Omni
 TC 8.6 Handbook/Program/Research (12/5)

Mon. (1/14) 9:00 am – 10:00 am Pecan (M3, North), Omni

TC 8.7 Variable Refrigerant Flow (20/75) Screen/Electric

Mon. (1/14) 4:15 pm – 6:30 pm A410 (4), GWCC, Bldg A

TC 8.7 Programs Met via conference call prior to Conference

TC 8.8 Refrigerant System Controls and Accessories (10/10) Screen/Electric

Tues. (1/15) 1:00 pm – 3:30 pm B318 (3), GWCC, Bldg B

TC 8.8 Handbook, Research and Programs (5/5) Electric

Sun. (1/13) 6:00 pm – 7:00 pm Cottonwood A (M1, North), Omni

TC 8.9 Residential Refrigerators and Food Freezers (6/10)

Mon. (1/14) 2:15 pm – 4:15 pm Azalea (N6, North), Omni

TC 8.10 Mechanical Dehumidification Equipment and Heat Pipes (16/10)

Tues. (1/15) 3:30 pm – 5:00 pm B319 (3), GWCC, Bldg B

TC 8.10 Program/Handbook/Research/Standards (25/5) Screen/
 Electric

Tues. (1/15) 1:00 pm – 3:30 pm B319 (3), GWCC, Bldg B

TC 8.11 Unitary and Room Air Conditioners and Heat Pumps (20/30)

Mon. (1/14) 4:15 pm – 6:30 pm B204 (2), GWCC, Bldg B

TC 8.11 PMS Meeting: RP-1721 Oil Return/Retention in Unitary
 Split System Gas Lines (5/20) Screen/Electric

Sun. (1/13) 2:00 pm – 3:00 pm B318 (3), GWCC, Bldg B

TC 8.11 Handbook, Program, Research (12/25) Screen/Electric

Sun. (1/13) 3:00 pm – 6:30 pm B318 (3), GWCC, Bldg B

TC 8.12 Desiccant Dehumidification Equipment and Components (15/15)

Mon. (1/14) 2:15 pm – 4:15 pm Chestnut (M3, North), Omni

TC 9.1 Large Bldg Air-Conditioning Systems (14/15) Screen/Electric

Tues. (1/15) 1:00 pm – 3:30 pm Cypress (M2, North), Omni

TC 9.1 Handbook, Program, Research (15/4) Electric

Tues. (1/15) 12:00 pm – 1:00 pm Cypress (M2, North), Omni

TC 9.2 Industrial Air Conditioning and Ventilation (25/10) Screen/Electric

Tues. (1/15) 1:00 pm – 3:30 pm Pine (AT, South), Omni

TC 9.2 Nuclear Subcommittee (6/6)

Mon. (1/14) 11:00 am – 12:00 pm Forsythia (N6, North), Omni

TC 9.3 Transportation Air Conditioning (30/10) Screen/Electric

Mon. (1/14) 4:15 pm – 5:45 pm B208 (2), GWCC, Bldg B

TC 9.3/SSPC 161 Joint Research Subcommittee (30/10) Screen/
 Electric

Mon. (1/14) 8:00 am – 9:00 am B208 (2), GWCC, Bldg B

TC 9.3 Rail/Mass Transit Subcommittee (30/10) Screen/
 Electric

Mon. (1/14) 2:15 pm – 3:45 pm B208 (2), GWCC, Bldg B

TC 9.3 Handbook Subcommittee (30/10) Screen/Electric

Mon. (1/14) 3:45 pm – 4:15 pm B208 (2), GWCC, Bldg B

TC 9.4 Justice Facilities (12/5) Electric

Sun. (1/13) 3:00 pm – 5:00 pm Pecan (M3, North), Omni

TC 9.4 Handbook & Design Guide (12/5) Electric

Sun. (1/13) 5:00 pm – 7:00 pm Pecan (M3, North), Omni

TC 9.6 Healthcare Facilities (35/150) Screen/Electric

Sun. (1/13) 5:00 pm – 7:00 pm A302 (3), GWCC, Bldg A

TC 9.6 Healthcare Water (35/45) Screen/Electric

Sun. (1/13) 9:00 am – 10:00 am Grand B (M4, North), Omni

TC 9.6 Infectious Diseases (35/60) Screen/Electric

Sun. (1/13) 10:00 am – 12:00 pm Grand B (M4, North), Omni

TC 9.6 Research (35/45) Screen/Electric

Sun. (1/13) 1:00 pm – 2:00 pm Grand B (M4, North), Omni

TC 9.6 Handbook (35/45) Screen/Electric

Sun. (1/13) 2:00 pm – 3:00 pm Grand B (M4, North), Omni

TC 9.6 Healthcare Energy (35/45) Screen/Electric

Sun. (1/13) 3:00 pm – 4:00 pm Grand B (M4, North), Omni

TC 9.6 Program (35/45) Screen/Electric

Sun. (1/13) 4:00 pm – 5:00 pm Grand B (M4, North), Omni

TC 9.7 Educational Facilities (15/10) Screen/Electric

Sun. (1/13) 1:00 pm – 3:00 pm Sycamore (M2, North), Omni

TC 9.8 Large Bldg Air-Conditioning Applications (20/10)

Mon. (1/14) 2:15 pm – 4:15 pm B201 (2), GWCC, Bldg B

TC 9.8 Handbook/Research/Programs (10/5) Screen/Electric

Mon. (1/14) 9:00 am – 11:00 am B318 (3), GWCC, Bldg B

TC 9.8 Indoor Grow Facilities (10/5)

Mon. (1/14) 11:00 am – 12:00 pm B318 (3), GWCC, Bldg B

TC 9.9 Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment (25/125) Screen/Electric

Mon. (1/14) 2:15 pm – 7:00 pm A302 (3), GWCC, Bldg A

TC 9.9 Programs, Handbook and Research (15/125) Screen/Electric

Sun. (1/13) 5:00 pm – 7:00 pm A301 (3), GWCC, Bldg A

TC 9.9 PMS RP-1755 (8/8) Screen/Electric

Mon. (1/14) 7:30 am – 9:00 am Pecan (M3, North), Omni

TC 9.9 IT Equipment Manufacturers Subcommittee Working Group (20/5) Screen/Electric

Mon. (1/14) 8:00 am – 12:00 pm Chestnut (M3, North), Omni

TC 9.10 Laboratory Systems (20/60) Screen/Electric

Tues. (1/15) 3:30 pm – 6:00 pm B308 (3), GWCC, Bldg B

TC 9.10 RP-1573 PMS Monitoring Subcommittee (20/10) Screen

Sun. (1/13) 1:00 pm – 3:00 pm B204 (2), GWCC, Bldg B

TC 9.10 Standards (30/10) Screen

Sun. (1/13) 3:00 pm – 3:30 pm B204 (2), GWCC, Bldg B

TC 9.10 Research (20/10) Screen

Sun. (1/13) 3:30 pm – 4:15 pm B204 (2), GWCC, Bldg B

TC 9.10 Program (20/10) Screen

Sun. (1/13) 4:15 pm – 5:00 pm B204 (2), GWCC, Bldg B

TC 9.10 Handbook (20/10) Screen

Tues. (1/15) 1:00 pm – 1:45 pm B308 (3), GWCC, Bldg B

TC 9.10 Design Guide (20/10) Screen

Tues. (1/15) 2:30 pm – 3:30 pm B308 (3), GWCC, Bldg B

TC 9.11 Clean Spaces (30/45) Screen/Electric

Mon. (1/14) 3:00 pm – 5:00 pm Grand B (M4, North), Omni

TC 9.11 Energy Efficiency (10/5) Screen

Sun. (1/13) 3:00 pm – 4:00 pm Magnolia (M2, North), Omni

TC 9.11 Research (10/5) Screen

Sun. (1/13) 4:00 pm – 5:00 pm Magnolia (M2, North), Omni

TC 9.12 Tall Buildings (8/8) Screen/Electric

Sun. (1/13) 12:15 pm – 2:00 pm B319 (3), GWCC, Bldg B

TC 10.1 Custom Engineered Refrigeration Systems (30/10)

Mon. (1/14) 2:15 pm – 4:15 pm B308 (3), GWCC, Bldg B

TC 10.2 Automatic Ice Making Plants and Skating Rinks (10/6) Electric

Mon. (1/14) 4:30 pm – 6:30 pm B317 (3), GWCC, Bldg B

TC 10.3 Refrigerant Piping, Controls and Accessories (20/10) Screen/Electric

Tues. (1/15) 1:00 pm – 3:30 pm Hickory (M3, North), Omni

TC 10.5 Refrigerated Processing and Storage (15/10)

Tues. (1/15) 3:30 pm – 6:00 pm Hazelnut (M3, North), Omni

TC 10.6 Transport Refrigeration (10/15) Screen/Electric

Mon. (1/14) 4:45 pm – 7:00 pm B202 (2), GWCC, Bldg B

TC 10.6 Handbook (5/5) Screen/Electric

Mon. (1/14) 7:00 pm – 9:30 pm B202 (2), GWCC, Bldg B

TC 10.7 Commercial Food and Beverage Refrigeration Equipment (24/30)

Mon. (1/14) 2:15 pm – 4:15 pm International EF (M2, North), Omni

TC 10.7 Program (10/10) Electric

Sun. (1/13) 5:15 pm – 6:00 pm Juniper (M2, North), Omni

TC 10.7 Research (10/10) Electric

Sun. (1/13) 6:00 pm – 6:45 pm Juniper (M2, North), Omni

TC 10.7 Handbook (10/10)

Sun. (1/13) 6:45 pm – 7:15 pm Juniper (M2, North), Omni

TC 10.8 Refrigeration Load Calculations (10/10)

Sun. (1/13) 3:00 pm – 5:00 pm A302 (3), GWCC, Bldg A

TASK GROUPS (TG), TECHNICAL RESOURCE GROUPS (TRG), AND MULTIDISCIPLINARY TASK GROUPS (MTG)

TRG4.IAQP – Indoor Air Quality Procedure (12/8) Screen/Electric

Sun. (1/13) 10:30 am – 12:00 pm Walnut (M3, North), Omni

TRG9 Cold Climate Building Design Guide (12/3) Screen/Electric

Wed. (1/16) 9:00 am – 11:00 am Sycamore (M2, North), Omni

MTG Chair's Breakfast Section MTG (19/4)

Sun. (1/13) 6:30 am – 8:00 am Juniper (M2, North), Omni

MTG.BIM Building Information Modeling (20/0) Screen

Mon. (1/14) 10:15 am – 12:00 pm Walnut (M3, North), Omni

MTG.EBO Effective Building Operations (10/0)

Tues. (1/15) 9:00 am – 10:00 am Juniper (M2, North), Omni

MTG.HCDG Hot Climate Design Guide (20/0)

Sun. (1/13) 8:00 am – 9:00 am Birch (AT, South), Omni
MTG.HCDG Hot Climate Design Guide Workshop (20/0) Screen/
Electric

Wed. (1/16) 8:00 am – 10:00 am Hickory (M3, North), Omni

MTG.HWBE Health and Wellness in the Built Environment (20/10) Screen/Electric

Tues. (1/15) 12:00 pm – 2:00 pm Walnut (M3, North), Omni

MTG.IAST Impact of ASHRAE Standards and Technology on Energy Savings/Performance (16/12) Electric

Sat. (1/12) 1:00 pm – 2:30 pm Magnolia (M2, North), Omni

MTG.LowGWP Low GWP Refrigerants (26/36) Screen/ Electric

Sun. (1/13) 5:00 pm – 6:00 pm Grand C (M4, North), Omni

Wed. (1/16) 10:00 am – 12:00 pm Grand C (M4, North), Omni

MTG.LowGWP Research Update (20/30) Screen/Electric

Sun. (1/13) 12:00 pm – 2:00 pm Grand C (M4, North), Omni

MTG.LowGWP Codes and Standards (20/15) Screen/Electric

Tues. (1/15) 1:00 pm – 3:30 pm Birch (AT, South), Omni

MTG.OBB Occupant Behavior in Buildings (30/10) Screen

Mon. (1/14) 8:00 am – 10:00 am Grand B (M4, North), Omni

STANDARD PROJECT COMMITTEES (SPC) AND STANDING STANDARD PROJECT COMMITTEES

PC Chairs Training Breakfast (104/0) Screen

Sun. (1/13) 7:30 am – 9:00 am Grand A (M4, North), Omni

SSPC 15 Safety Standard for Refrigeration Systems (25/60) Screen/Electric

Sun. (1/13) 1:00 pm – 5:00 pm B308 (3), GWCC, Bldg B

SSPC 15 Safety Standards for Refrigeration Systems Rewrite
(25/60) Screen/Electric

Sat. (1/12) 1:00 pm – 3:00 pm A410 (4), GWCC, Bldg A

SSPC 15 Safety Standards for Refrigeration Systems Ad Hoc and
Rewrite (25/60) Screen/Electric

Sun. (1/13) 8:00 am – 12:00 pm B308 (3), GWCC, Bldg B

SSPC 15 Subcommittee 15.2 Safety Standard for Refrigeration
Systems in Residential Applications (15/15) Screen/Electric

Tues. (1/15) 8:00 am – 12:00 pm Sycamore (M2, North), Omni

SPC 17 Method of Testing Capacity of Thermostatic Refrigerant Expansion Valves (combined with SPC 158.1/SPC 158.2/SPC 28) (5/5) Electric

Sun. (1/13) 5:00 pm – 7:00 pm Willow (M4, North), Omni

SPC 23.2 MOT of Positive Displacement Compressors and Compressor Units that Operate at Supercritical Pressures of the Refrigerant (10/3) Screen

Mon. (1/14) 10:00 am – 12:00 pm Beechnut (M3, North), Omni

SPC 24 Method of Testing for Rating Evaporators Used for Cooling Liquids (6/10) Screen/Electric

Mon. (1/14) 8:00 am – 10:00 am Azalea (N6, North), Omni

SPC 28 MOT Flow Capacity of Refrigerant Capillary Tubes (6/5) Electric

Sun. (1/13) 5:00 pm – 7:00 pm Willow (M4, North), Omni

SSPC 30 Method of Testing Liquid Chillers (15/5) Screen/Electric

Mon. (1/14) 7:00 am – 10:00 am Walnut (M3, North), Omni

SSPC 34 Designation and Safety Classification of Refrigerants (15/45) Screen/Electric

Mon. (1/14) 6:30 pm – 10:00 pm Grand A (M4, North), Omni
SSPC 34 Designation and Nomenclature Subcommittee (14/21)
Screen/Electric

Sat. (1/12) 7:00 am – 10:00 am A305 (3), GWCC, Bldg A
SSPC 34 Flammability Subcommittee (16/45) Screen/Electric

Sat. (1/12) 10:00 am – 3:00 pm A305 (3), GWCC, Bldg A
SSPC 34 Toxicity Subcommittee (10/25) Screen/Electric

Sun. (1/13) 6:30 pm – 10:00 pm A404 (4), GWCC, Bldg A

SPC 37 MOT for Rating Electrically Driven Unitary Air-Conditioners and Heat Pump Equipment (15/20) Screen/Electric

Wed. (1/16) 8:00 am – 12:00 pm Walnut (M3, North), Omni

SSPC 41 Standard Methods for Measurement (21/10) Electric

Sun. (1/13) 1:00 pm – 3:00 pm Magnolia (M2, North), Omni
41.3, Standard Methods for Pressure Measurement (15/5) Screen/
Electric

Sun. (1/13) 10:00 am – 12:00 pm Magnolia (M2, North), Omni
41.13 Standard Methods for Fuel Heating Value Measurement
(10/5) Screen/Electric

Mon. (1/14) 8:00 am – 10:00 am Cottonwood A (M1, North), Omni
41.6, Standard Methods for Humidity Measurement (15/8) Screen/
Electric

Mon. (1/14) 10:00 am – 12:00 pm Cottonwood A (M1, North), Omni
41.11, Standard Methods for Power Measurement (15/5) Screen/
Electric

Mon. (1/14) 2:15 pm – 4:15 pm Cottonwood A (M1, North), Omni
41.4, Standard Methods for Proportion of Lubricant in Liquid
Refrigerant Measurement (7/4) Screen/Electric

Mon. (1/14) 4:15 pm – 6:15 pm Cottonwood A (M1, North), Omni
41.10, Standard Methods for Refrigerant Mass Flow Measurement
Using Flowmeters (15/10) Screen/Electric

Tues. (1/15) 8:00 am – 10:00 am Cypress (M2, North), Omni
41.1, Standard Methods for Temperature Measurement (15/10)
Screen/Electric

Tues. (1/15) 10:00 am – 12:00 pm Cypress (M2, North), Omni

SSPC 52.2 Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size (20/30) Screen/Electric

Sat. (1/12) 8:00 am – 12:00 pm A410 (4), GWCC, Bldg A

SSPC 55 Thermal Environmental Conditions for Human Occupancy (17/6) Screen/Electric

Sat. (1/12) 8:00 am – 3:00 pm Cypress (M2, North), Omni

Sun. (1/13) 9:00 am – 12:00 pm B319 (3), GWCC, Bldg B

SSPC 62.1 Ventilation for Acceptable Indoor Air Quality (30/30) Screen/Electric

Sat. (1/12) 8:00 am – 12:00 pm Oak (Hotel, South), Omni
Sun. (1/13) 1:00 pm – 7:00 pm Dogwood A (M1, North), Omni

SSPC 62.1 IAQ Guideline (15/15) Screen/Electric

Fri. (1/11) 8:00 am – 12:00 pm Hickory (M3, North), Omni

SSPC 62.1 Administration (15/15) Screen/Electric

Fri. (1/11) 1:00 pm – 5:00 pm Walnut (M3, North), Omni

Sat. (1/12) 1:00 pm – 3:00 pm Walnut (M3, North), Omni

SSPC 62.1 Research and Education (15/15) Screen/Electric

Fri. (1/11) 1:00 pm – 5:00 pm Hickory (M3, North), Omni

Sat. (1/12) 1:00 pm – 3:00 pm Hickory (M3, North), Omni

SSPC 62.1 Buildings, Systems and Equipment (15/15) Screen/Electric

Fri. (1/11) 1:00 pm – 5:00 pm Chestnut (M3, North), Omni

Sat. (1/12) 1:00 pm – 3:00 pm Chestnut (M3, North), Omni

SSPC 62.1 Ventilation (15/15) Screen/Electric

Fri. (1/11) 1:00 pm – 5:00 pm Hazelnut (M3, North), Omni

Sat. (1/12) 1:00 pm – 3:00 pm Hazelnut (M3, North), Omni

SSPC 62.1 Natural Ventilation Working Group (15/15) Screen/Electric

Tues. (1/15) 8:00 am – 12:00 pm Hickory (M3, North), Omni

SSPC 62.2 Ventilation and Acceptable IAQ in Residential Buildings (30/20) Screen/Electric

Fri. (1/11) 9:00 am – 2:30 pm Redwood (M1, North), Omni

Sat. (1/12) 8:00 am – 3:00 pm Redwood (M1, North), Omni

SSPC 62.2 Envelope Subcommittee (20/20) Screen

Fri. (1/11) 2:30 pm – 5:00 pm Redwood (M1, North), Omni

SSPC 62.2 IAQ Subcommittee (12/20) Screen

Fri. (1/11) 2:30 pm – 5:00 pm Cottonwood A (M1, North), Omni

SSPC 62.2 System Subcommittee (12/20) Screen

Fri. (1/11) 2:30 pm – 5:00 pm Cottonwood B (M1, North), Omni

SPC 70 Method of Testing the Performance of Air Outlets and Air Inlets (13/15) Screen/Electric

Mon. (1/14) 8:00 am – 12:00 pm B319 (3), GWCC, Bldg B

SSPC 72 Method of Testing Open and Closed Commercial Refrigerators and Freezers (20/20) Screen/Electric

Sun. (1/13) 1:00 pm – 5:00 pm B317 (3), GWCC, Bldg B

SPC 79 Method of Testing for Fan-Coil Units (5/10) Screen/Electric

Sat. (1/12) 8:00 am – 12:00 pm Hickory (M3, North), Omni

SPC 84 Method of Testing Air-to-Air Heat/Energy Exchangers (16/8) Screen/Electric

Tues. (1/15) 1:00 pm – 3:30 pm B317 (3), GWCC, Bldg B

SSPC 90.1 Energy Eff. Design of New Bldg. (50/60) Screen/Electric

Sat. (1/12) 8:00 am – 12:00 pm Legacy (Lobby), ES

Sun. (1/13) 9:00 am – 12:00 pm Legacy (Lobby), ES

Mon. (1/14) 8:00 am – 12:00 pm Legacy (Lobby), ES

SSPC 90.1 Envelope (15/30) Screen/Electric

Fri. (1/11) 9:00 am – 10:00 pm Salon I (Lobby), ES

Sat. (1/12) 1:00 pm – 8:00 pm Salon I (Lobby), ES

Sun. (1/13) 1:00 pm – 8:00 pm Salon I (Lobby), ES

SSPC 90.1 Lighting Subcommittee (12/10) Screen/Electric

Fri. (1/11) 9:00 am – 10:00 pm Salon III (Lobby), ES

Sat. (1/12) 1:00 pm – 7:00 pm Salon III (Lobby), ES

Sun. (1/13) 1:00 pm – 8:00 pm Salon III (Lobby), ES

SSPC 90.1 Mechanical Subcommittee (25/25) Screen/Electric

Fri. (1/11) 9:00 am – 10:00 pm Legacy (Lobby), ES

Sat. (1/12) 1:00 pm – 7:00 pm Legacy (Lobby), ES

Sun. (1/13) 1:00 pm – 8:00 pm Legacy (Lobby), ES

SSPC 90.1 ECB Subcommittee (12/18) Screen/Electric

Fri. (1/11) 4:00 pm – 9:00 pm Salon IV (Lobby), ES

Sat. (1/12) 1:00 pm – 5:00 pm Salon IV (Lobby), ES

Sun. (1/13) 1:00 pm – 6:00 pm Salon IV (Lobby), ES

SSPC 90.1 Envelope Working Group (10/20) Screen/Electric

Fri. (1/11) 4:00 pm – 6:00 pm Salon V (Lobby), ES

Sat. (1/12) 4:00 pm – 6:00 pm Salon V (Lobby), ES

SSPC 90.1 Format & Compliance Subcommittee (6/6) Electric

Fri. (1/11) 5:00 pm – 10:00 pm Boardroom (Lobby), ES

Sat. (1/12) 1:00 pm – 5:00 pm Boardroom (Lobby), ES

Sun. (1/13) 4:00 pm – 7:00 pm Boardroom (Lobby), ES

SSPC 90.1 Renewables Working Group (20/20) Screen/Electric

Sun. (1/13) 3:00 pm – 5:00 pm Salon V (Lobby), ES

SSPC 90.2 Energy Efficient Design of New Low Rise

Residential Buildings (24/10) Screen/Electric

Mon. (1/14) 2:15 pm – 6:15 pm Dogwood A (M1, North), Omni

Tues. (1/15) 1:00 pm – 5:00 pm Redwood (M1, North), Omni

SSPC 90.2 Envelope (10/5) Screen/Electric

Mon. (1/14) 6:30 pm – 9:30 pm Dogwood A (M1, North), Omni

Tues. (1/15) 8:00 am – 12:00 pm Redwood (M1, North), Omni

SSPC 90.2 Lighting (3/3) Electric

Mon. (1/14) 6:30 pm – 9:30 pm Cottonwood A (M1, North), Omni

Tues. (1/15) 8:00 am – 12:00 pm Cottonwood A (M1, North), Omni

SSPC 90.2 Mechanical (5/3) Screen/Electric

Mon. (1/14) 6:30 pm – 9:30 pm Cottonwood B (M1, North), Omni

Tues. (1/15) 8:00 am – 12:00 pm Cottonwood B (M1, North), Omni

SSPC 90.4 Energy Standard for Data Centers and

Telecommunications Buildings (20/20) Screen/Electric

Sat. (1/12) 7:30 am – 12:00 pm A409 (4), GWCC, Bldg A

Mon. (1/14) 8:00 am – 12:00 pm A409 (4), GWCC, Bldg A

SPC 97 Sealed Glass Tube Method to Test the Chemical Stability of Materials for Use Within Refrigerant Systems (8/10) Screen/Electric

Tues. (1/15) 8:30 am – 10:00 am B301 (3), GWCC, Bldg B

SSPC 100 Energy Efficiency in Existing Buildings (20/10)

Screen/Electric

Tues. (1/15) 8:00 am – 12:00 pm Walnut (M3, North), Omni

SSPC 100 - Operation and Maintenance (WG3) (5/5) Screen/Electric

Sun. (1/13) 8:00 am – 10:00 am Beechnut (M3, North), Omni

SSPC 100 Alternative to EUI (WG5) (16/10) Screen/Electric

Sun. (1/13) 12:00 pm – 2:00 pm Cypress (M2, North), Omni

SSPC 100 International Target Table and Climate Zones (WG4) (5/5) Screen/Electric

Sun. (1/13) 4:00 pm – 6:00 pm Cypress (M2, North), Omni

SPC 105-2014R Standard Methods of Determining, Expressing, and Comparing Building Energy Performance and Greenhouse Gas Emissions (12/10) Screen/Electric

Sun. (1/13) 4:00 pm – 8:00 pm Maple A (AT, South), Omni

SPC 110 Methods of Testing Performance of Laboratory Fume Hoods (20/10) Screen

Tues. (1/15) 1:45 pm – 2:30 pm B308 (3), GWCC, Bldg B

SPC 111 Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation and Air-Conditioning Systems (12) (8/4) Screen/Electric

Tues. (1/15) 8:00 am – 12:00 pm Azalea (N6, North), Omni

SPC 113 Method of Testing Room Air Diffusion (10/10) Screen/Electric

Mon. (1/14) 2:00 pm – 3:15 pm B319 (3), GWCC, Bldg B

SPC 118.1 Method of Testing for Rating Commercial Gas, Electric and Oil Service Water Heating Equipment (10/15) Screen/Electric

Sun. (1/13) 9:00 am – 11:00 am B317 (3), GWCC, Bldg B

SPC 118.2 Method of Testing for Rating Residential Water Heaters (15/15) Electric

Tues. (1/15) 1:00 pm – 5:00 pm Sycamore (M2, North), Omni

SPC 124 MOT/Rating Combined Space-Heating & Water Heating Appliances (17/10) Electric

Tues. (1/15) 9:00 am – 12:00 pm B208 (2), GWCC, Bldg B

SPC 127 Method of Testing for Rating Air Conditioning Units Serving Data Center (DC) and Other Information Technology Equipment (ITE) Spaces (12/10) Screen/Electric

Tues. (1/15) 1:00 pm – 5:00 pm Willow (M4, North), Omni

SPC 130 Laboratory Methods of Testing Air Terminal Units (5/20) Screen/Electric

Tues. (1/15) 8:00 am – 10:00 am Maple A (AT, South), Omni

SSPC 135 BACnet (15/5) Electric

Thurs. (1/10) 8:00 am – 5:00 pm Cottonwood B (M1, North), Omni

SSPC 135 BACnet (25/5) Electric

Fri. (1/11) 8:00 am – 5:00 pm Dogwood A (M1, North), Omni

Fri. (1/11) 8:00 am – 5:00 pm Dogwood B (M1, North), Omni

SSPC 135 BACnet (40/10) Electric

Sat. (1/12) 8:00 am – 3:30 pm A404 (4), GWCC, Bldg A

SSPC 135 BACnet (25/5) Electric

Sun. (1/13) 8:00 am – 5:00 pm Dogwood B (M1, North), Omni

Sun. (1/13) 8:00 am – 5:00 pm Oak (Lobby, South), Omni

SSPC 135 BACnet (40/10) Electric

Mon. (1/14) 8:00 am – 12:00 pm International EF (M2, North), Omni

SSPC 140: Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs (15/15) Screen/Electric

Mon. (1/14) 2:15 pm – 6:15 pm Cypress (M2, North), Omni

SSPC 145 Test Method for Assessing the Performance of Gas Phase Air Cleaning Equipment (10/15) Screen/Electric

Sun. (1/13) 12:00 pm – 3:00 pm A409 (4), GWCC, Bldg A

SPC 146 Method of Testing and Rating Pool Heaters (7/5) Electric

Tues. (1/15) 10:00 am – 12:00 pm B301 (3), GWCC, Bldg B

SSPC 147 Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Systems (6/5) Screen/Electric

Tues. (1/15) 8:00 am – 12:00 pm B319 (3), GWCC, Bldg B

SPC 150-2000: Method of Testing for Performance of Cool Storage Systems/TC 6.9 Standards (30/20) Screen/Electric

Mon. (1/14) 2:15 pm – 2:40 pm B207 (2), GWCC, Bldg B

SPC 153 Method of Test for Mass Flow Capacity of Four-Way Refrigerant Reversing Valves (5/5) Electric

Mon. (1/14) 10:00 am – 12:00 pm Azalea (N6, North), Omni

SSPC 154 Ventilation for Commercial Cooking (10/15) Screen/Electric

Sun. (1/13) 9:00 am – 1:00 pm B318 (3), GWCC, Bldg B

SPC 155P MOT for Rating Commercial Space Heating Boiler Systems (17/10) Screen/Electric

Sun. (1/13) 1:00 pm – 5:00 pm Chestnut (M3, North), Omni

SPC 158.1 MOT for Capacity of Refrigerant Solenoid Valves (6/5) Electric

Sun. (1/13) 5:00 pm – 7:00 pm Willow (M4, North), Omni

SPC 158.2 MOT Capacity of Refrigerant Pressure Regulators (5/5) Electric

Sun. (1/13) 5:00 pm – 7:00 pm Willow (M4, North), Omni

SSPC 160 Criteria for Moisture Control Design Analysis in Buildings (30/20) Screen/Electric

Tues. (1/15) 8:00 am – 12:00 pm Dogwood A (M1, North), Omni

SSPC 161 Air Quality within Commercial Aircraft (25/15) Screen/Electric

Mon. (1/14) 9:00 am – 12:00 pm B208 (2), GWCC, Bldg B

SSPC 161/TC 9.3 Joint Research (25/15) Screen/Electric

Mon. (1/14) 8:00 am – 9:00 am B208 (2), GWCC, Bldg B

SPC 164.4 Method of Test for Commercial/Industrial Adiabatic Humidifiers (10/5) Screen/Electric

Mon. (1/14) 9:00 am – 11:00 am Forsythia (N6, North), Omni

SSPC 169 Climatic Data for Building Design Standards (10/5) Screen/Electric

Mon. (1/14) 10:00 am – 12:00 pm Pecan (M3, North), Omni

SSPC 170 Ventilation of Healthcare Facilities (23/75) Screen/Electric

Mon. (1/14) 4:00 pm – 6:00 pm B306 (3), GWCC, Bldg B

Tues. (1/15) 8:00 am – 1:00 pm B306 (3), GWCC, Bldg B

SSPC 170 Ventilation of Health Care Facilities, Natural Ventilation Work Group (15/15) Screen/Electric

Mon. (1/14) 2:15 pm – 4:00 pm B306 (3), GWCC, Bldg B

SPC 182 MOT Absorption Water-Chilling and Water-Heating Packages (6/6) Screen/Electric

Mon. (1/14) 10:00 am – 12:00 pm Birch (AT, South), Omni

SPC 184 Method of Test for Field Performance of Liquid-Chilling Systems (9/6) Screen/Electric

Tues. (1/15) 8:00 am – 10:00 am Magnolia (M2, North), Omni

SSPC 185 Methods of Test to Inactivate Microorganisms in HVAC Systems with UV-C Lights (8/5) Electric

Sat. (1/12) 8:00 am – 10:30 am Sycamore (M2, North), Omni

SSPC 188 Legionellosis: Risk Management for Building Water Systems (40/20) Screen/Electric

Tues. (1/15) 8:00 am – 12:00 pm B207 (2), GWCC, Bldg B

Tues. (1/15) 3:30 pm – 5:30 pm B207 (2), GWCC, Bldg B

Wed. (1/16) 8:00 am – 12:00 pm Dogwood B (M1, North), Omni

SSPC 189.1 ASHRAE/USGBC/IES Standard for the Design of High-Performance Green Buildings except Low-Rise Residential Buildings (67/50) Screen/Electric

Tues. (1/15) 8:00 am – 10:00 am International EF (M2, North), Omni

Wed. (1/16) 8:00 am – 12:00 pm International EF (M2, North), Omni

SSPC 189.1 Working Group 6 (Water Use) (30/20) Screen/Electric

Tues. (1/15) 10:00 am – 12:30 pm Dogwood B (M1, North), Omni

SSPC 189.1 Working Group 7 (Energy Efficiency) (67/30) Screen/Electric

Tues. (1/15) 10:00 am – 1:00 pm International EF (M2, North), Omni

SSPC 189.1 Working Group 9 (Materials and Resources) (30/20) Screen/Electric

Tues. (1/15) 1:00 pm – 3:00 pm Dogwood B (M1, North), Omni

SSPC 189.1 Working Group 8 (IEQ) (30/30) Screen/Electric

Tues. (1/15) 1:00 pm – 4:00 pm Grand C (M4, North), Omni

SSPC 189.1 Working Group 7.5 (30/30) Screen/Electric

Tues. (1/15) 1:30 pm – 4:30 pm International EF (M2, North), Omni

SSPC 189.1 Working Group 5 (Site Sustainability) (30/20) Screen/Electric

Tues. (1/15) 4:00 pm – 6:00 pm Grand C (M4, North), Omni

SSPC 189.1 Working Group 10 (20/20) Screen/Electric

Tues. (1/15) 5:00 pm – 7:00 pm Dogwood B (M1, North), Omni

SSPC 189.3 Design, Construction and Operation of Sustainable High Performance Health Care Facilities (20/20) Screen/Electric

Mon. (1/14) 8:00 am – 12:00 pm B317 (3), GWCC, Bldg B

SPC 190 Method of Testing for Rating Indoor Pool Dehumidifiers (20/15) Electric

Sun. (1/13) 1:00 pm – 2:00 pm Walnut (M3, North), Omni

SPC 191 Standard for the Efficient Use of Water in Bldg And Mechanical Systems (6/4) Screen/Electric

Sun. (1/13) 9:00 am – 12:00 pm B204 (2), GWCC, Bldg B

SPC 193 Method of Test for Determining the Airtightness of HVAC Equipment (7/0)

Tues. (1/15) 3:30 pm – 4:30 pm A409 (4), GWCC, Bldg A

SPC 196 Method of Test for Measuring Refrigerant Leak Rates (7/10) Screen/Electric

Sun. (1/13) 6:00 pm – 10:00 pm Cypress (M2, North), Omni

SPC 198 Method of Test for Rating DX-Dedicated Outdoor Air Systems for Moisture Removal Capacity and Moisture Removal Efficiency (20/15) Electric

Sun. (1/13) 12:00 pm – 1:00 pm Walnut (M3, North), Omni

SPC 204P Method of Test for Rating Micro Combined Heat and Power Devices (16/18) Electric

Mon. (1/14) 6:30 pm – 9:30 pm Magnolia (M2, North), Omni

SPC 205 Standard Representation of Performance Simulation Data for HVAC&R and Other Facility Equipment (20/25) Screen/Electric

Tues. (1/15) 8:00 am – 12:00 pm B308 (3), GWCC, Bldg B

SPC 205 Standard Representation of Performance Simulation Data for HVAC&R and Other Facility Equipment Working Groups (20/20) Screen/Electric

Sun. (1/13) 9:00 am – 12:00 pm A409 (4), GWCC, Bldg A

SPC 207P Laboratory Method of Test of Fault Detection and Diagnostics for Airside Economizers (20/10) Screen/Electric

Mon. (1/14) 8:00 am – 10:00 am Maple A (AT, South), Omni

SPC 207P: Draft Revisions Working Group (10/5) Screen/Electric

Mon. (1/14) 10:00 am – 12:00 pm Maple A (AT, South), Omni

SPC 207P: Verification Working Group (10/5) Screen/Electric

Mon. (1/14) 4:30 pm – 6:30 pm Maple A (AT, South), Omni

SPC 207P: Next Steps (10/5) Screen/Electric

Mon. (1/14) 6:30 pm – 8:30 pm Maple A (AT, South), Omni

SPC 210 Method of Testing for Rating Commercial Walk in Cooler and Freezer Equipment (6/30) Screen/Electric

Mon. (1/14) 8:00 am – 12:00 pm Hickory (M3, North), Omni

SPC 211P Standard for Commercial Building Energy Audits (20/10) Screen/Electric

Mon. (1/14) 8:00 am – 12:00 pm Hazelnut (M3, North), Omni

SPC 213P Method of Calculating Moist Air Thermodynamic Properties (10/5)

Tues. (1/15) 8:00 am – 12:00 pm B317 (3), GWCC, Bldg B

SPC 216 MOT for Determining Application Data of Overhead Circulator Fans (11/10) Screen/Electric

Mon. (1/14) 2:15 pm – 5:15 pm A409 (4), GWCC, Bldg A

SPC 217 Non-Emergency Ventilation in Enclosed Road, Rail and Mass Transit Facilities (15/15) Screen/Electric

Tues. (1/15) 7:00 am – 12:00 pm B318 (3), GWCC, Bldg B

SPC 218P – MOT for Lubricant and Refrigerant Miscibility Determination (9/5) Screen/Electric

Mon. (1/14) 10:00 am – 12:00 pm B204 (2), GWCC, Bldg B

SPC 219 Method of Testing the Ability of Liquid Line Filter Driers or Absorbents to Remove Organic Acid (5/4) Screen/Electric

Mon. (1/14) 10:00 am – 12:00 pm Willow (M4, North), Omni

SPC 220P Method of Testing for Rating Small Commercial Blast Chillers, Chiller Freezers and Freezers (12/8) Screen/Electric

Mon. (1/14) 4:15 pm – 6:30 pm Grand A (M4, North), Omni

SPC 221 Test Method to Measure and Score the Operating Performance of an Installed Constant Volume Unitary HVAC System (10/25) Screen/Electric

Tues. (1/15) 9:00 am – 11:00 am A409 (4), GWCC, Bldg A

SPC 224P Standard for the Application of Building Information Modeling (20/0) Screen

Mon. (1/14) 5:30 pm – 7:00 pm Birch (AT, South), Omni

SPC 225P Methods for Performance Testing Centrifugal Refrigerant Compressors and Condensing Units (7/5) Screen/Electric

Tues. (1/15) 8:00 am – 10:00 am Hazelnut (M3, North), Omni

SSPC 300 Commissioning Process for Buildings and Systems (20/20) Screen/Electric

Mon. (1/14) 8:00 am – 12:00 pm Grand A (M4, North), Omni
SSPC 300 Guideline 0 subcommittee, The Commissioning Process (16/12) Screen/Electric

Sat. (1/12) 10:00 am – 11:30 am Juniper (M2, North), Omni

SSPC 300 Guideline 1.1 subcommittee, The HVAC Commissioning Process (16/12) Screen/Electric

Sat. (1/12) 12:00 pm – 1:30 pm Juniper (M2, North), Omni

SSPC 300 Standard 202 subcommittee, The Commissioning Process for Buildings and Systems (16/12) Screen/Electric

Sat. (1/12) 1:30 pm – 3:00 pm Juniper (M2, North), Omni

SSPC 300 Guideline 1.4 subcommittee, Systems Manual (10/10) Screen/Electric

Sun. (1/13) 10:00 am – 12:00 pm Juniper (M2, North), Omni

SSPC 300 Guideline 1.6 subcommittee, Data Center

Commissioning (18/12) Screen/Electric

Sun. (1/13) 12:30 pm – 2:30 pm Juniper (M2, North), Omni

ASABE/ASHRAE X653 Recommended Practice for Heating, Ventilation and Air Conditioning (HVAC) Products Used in Indoor Plant Growth and Development (10/10) Screen/Electric

Sun. (1/13) 9:00 am – 4:00 pm A306 (3), GWCC, Bldg A

GUIDELINE PROJECT COMMITTEES (GPC) AND STANDING GUIDELINE PROJECT COMMITTEES (SGPC)

GPC 4-2008R Preparation of Operating and Maintenance Documentation for HVAC&R Systems (6/2)

Sun. (1/13) 8:00 am – 12:00 pm Azalea (N6, North), Omni

GPC 14 Measurement of Energy, Demand and Water Savings (10/6) Screen/Electric

Sun. (1/13) 6:00 pm – 10:00 pm Walnut (M3, North), Omni

GPC 22 Instrumentation for Monitoring Central Chilled Water Plants (8/4) Screen

Tues. (1/15) 10:00 am – 12:00 pm Pecan (M3, North), Omni

GPC 27 Measurement Procedures for Gaseous Contaminants in Commercial Buildings (10/10) Screen/Electric

Sun. (1/13) 3:00 pm – 5:00 pm Juniper (M2, North), Omni

GPC 29 Guideline for Risk Management (8/4)

Sun. (1/13) 1:00 pm – 5:00 pm Forsythia (N6, North), Omni

GPC 32 Sustainable, High Performance Operations & Maintenance (6/4)

Sat. (1/12) 12:00 pm – 1:00 pm Cottonwood A (M1, North), Omni

GPC 35 Method for Determining the Energy Consumption Caused By Air-Cleaning and Filtration Devices (11/40) Screen/Electric

Mon. (1/14) 8:00 am – 12:00 pm B308 (3), GWCC, Bldg B

GPC 36P High Performance Sequences of Operation for HVAC Systems (20/30) Screen/Electric

Mon. (1/14) 8:00 am – 12:00 pm B306 (3), GWCC, Bldg B

GPC 37 Upper Room Ultraviolet Germicidal (UV-C) Devices to Control the Transmission of Airborne Pathogens (20/12) Electric

Sat. (1/12) 10:00 am – 12:00 pm Chestnut (M3, North), Omni

GPC 41P Design, Installation and Commissioning of Variable Refrigerant Flow Systems (22/10) Electric

Mon. (1/14) 8:00 am – 12:00 pm B301 (3), GWCC, Bldg B

SGPC 10 Interaction Affecting the Achievement of Acceptable Indoor Environments (10/50) Screen

Sun. (1/13) 9:00 am – 12:00 pm Grand C (M4, North), Omni

SGPC 13 Specifying Bldg Automation Systems (15/15) Screen/Electric

Sat. (1/12) 8:00 am – 12:00 pm Hazelnut (M3, North), Omni

OTHER

US TAG to ISO/TC 142 Cleaning Equipment for Air and other Gases (36/30) Screen/Electric

Sat. (1/12) 2:30 pm – 3:15 pm Grand C (M4, North), Omni

ISO TC142/WG11 and IEC/TC 59/PT 63086 (30/0) Screen/Electric

Wed. (1/16) 1:00 pm – 5:00 pm Grand A (M4, North), Omni

Joint US TAG to ISO/TC 163 and US Tag to ISO/TC 205 (20/15) Screen/Electric

Tues. (1/15) 1:00 pm – 3:00 pm A404 (4), GWCC, Bldg A

ISO 817 MA (23/11) Screen/Electric

Tues. (1/15) 8:00 am – 12:00 pm A304 (3), GWCC, Bldg A

ISO 817 MA-Flammability (15/10) Screen/Electric

Sun. (1/13) 9:00 am – 11:00 am A304 (3), GWCC, Bldg A

ISO 817 MA-Toxicity (15/10) Screen/Electric

Mon. (1/14) 8:00 am – 9:00 am A304 (3), GWCC, Bldg A

ISO 817 MA - Designation (15/10) Screen/Electric

Mon. (1/14) 9:00 am – 10:15 am A304 (3), GWCC, Bldg A

gbXML Advisory Board (10/0)

Mon. (1/14) 2:00 pm – 3:00 pm Grand B (M4, North), Omni

USNC/IIR (20/20) Screen

Tues. (1/15) 2:00 pm – 4:00 pm Walnut (M3, North), Omni

USNT/IEA (20/10) Screen

Tues. (1/15) 4:00 pm – 6:00 pm Walnut (M3, North), Omni

Initial Meeting for IEA Heat Pump Program Annex for Advanced Cooling/Refrigeration Systems Technology Development (30/0)

Fri. (1/11) 1:00 pm – 5:00 pm Spruce (AT, South), Omni

Initial ANNEX Meeting for Heat Pump Systems with Low-GWP Refrigerants (20/0)

Sat. (1/12) 8:00 am – 12:00 pm Walnut (M3, North), Omni