



VOLUME 8, ISSUE 10

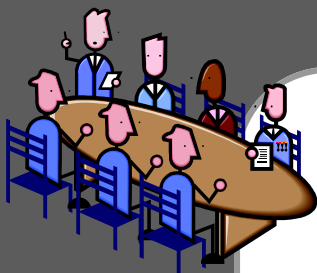
JUNE 2014

**INSIDE  
THIS ISSUE:**

<b>Officer / Committee List</b>	<b>2</b>
<b>President's Message</b>	<b>3</b>
<b>ASHRAE Picnic</b>	<b>4</b>
<b>Student Activities Message</b>	<b>5</b>
<b>Job Postings</b>	<b>6</b>
<b>ASHRAE 2014 Annual Conf.</b>	<b>7</b>
<b>ASHRAE Scholarships</b>	<b>15</b>
<b>Student Applica- tion</b>	<b>16</b>
<b>Learning Opportunities</b>	<b>18</b>
<b>Society News</b>	<b>20</b>



*(refer to page 7)*



## Chapter Officers

### President

Robert J. Wind, Jr. PE  
585-341-3172  
rwind@ibceng.com

### President Elect

Edward J. Burns  
585-739-7548 / 872-9172(fax)  
ejb@mechtechhvac.com

### Vice President/Tech

Christina Walter  
585-486-2148  
cmwalter@trane.com

### Secretary

Jeff Close, PE  
585-289-6816 / 218-0737(fax)  
jeff.close@pres-services.com

### Treasurer

William J. Clark  
585-303-0729  
william.clark@DayAutomation.com

## Committee Chairs

### CTTC / Programs

Jeff Wiedrick 585-232-5137 x354  
jwiedrick@bergmannpc.com

### CTTC / TEGA

Tom Burke  
amtburke@yahoo.com

### CTTC / Refrigeration

Michael Nohle 585-216-9016  
mikenohle@aol.com

### Historian

Lee Loomis 585-262-2870/262-4156(fax)  
leeloomis46@gmail.com

### Membership

Jake Hall 585-869-5125  
jhall@proairplus.com

### YEA

Matt Kremers 585-398-8018  
mkremers@mcsmms.com

## Board of Governors

Jim Browe (3)  
585-697-0836  
jbrowe@rfpeck.com

Beth Smith (3)  
585-272-0110  
bsmith@vpsupply.com

Eric Smith (2)  
585-381-3360  
esmith@turnerengineering.com

Paul Kenna, PE (2)  
585-295-3114  
Paul.Kenna@carrierenterprise.com

Scott Edwards (1)  
585-486-2156  
scott.edwards@trane.com

Mike Benedict (1)  
585-490-2661

### Student Activities

Chris Lukasiewicz 585-381-3360  
clukasiewicz@turnerengineering.com

### Newsletter Editor

Scott Edwards  
scott.edwards@trane.com

### Attendance & Reception

Timothy Duprey 585-205-0073  
dupreyt@ifsinc.net

### Building Simulation User's Group (BSUG)

Bill Bishop 585-325-6004  
wbishop@pathfinder-ea.com

### Research Promotion

Paul Kenna 585-295-3114  
Paul.Kenna@carrierenterprise.com

### Webmaster

Kevin Wind 585-263-1280  
kwind@rochester.rr.com

## President's Message

Well the year has gone by quickly. This is my last opportunity to write this article. It culminates many months as the chapter president and many years on the chapter board. I want to thank all of the other board members and committee chairpersons who make everything that the chapter does possible. I leave the chapter in capable hands. Ed Burns will be taking over as the chapter president.

Last month we concluded with our annual golf tournament and picnic. The weather cooperated and it was a good day to be away from the office with friends and co-workers. Of course, I would be remiss if I didn't mention that the golf outing and picnic are accomplished in great part to the efforts of Jim Browe. We all have a tendency to take for granted the time and effort it takes to orchestrate an event like this and for the last several years Jim has been the person to take this on.

For those of you that I did not see at the picnic, I want to wish you a wonderful summer off from ASHRAE.

*Rob Wind, PE, 2013-2014 President*





Rob Wind receives a *Certificate of Appreciation* for years of service



*Jim Browe earns the 2013-2014 Realto Cherno Award. Thank you for your many years of service to ASHRAE and the Rochester HVAC&R community.*

*Thank you to all the Rochester Chapter Past Presidents! We appreciate all your efforts.*

## STUDENT ACTIVITIES



### Do you know the benefits of being an ASHRAE Student Member?

- **Monthly ASHRAE Journal** exploring issues such as indoor air quality, energy management, solar developments, and more.
- **ASHRAE Insights** monthly newspaper devoted to news and information about the Society at every level including news of special interest to students.
- **The HVAC&R Industry eNewsletter** for weekly industry news and information.
- **SmartStart Program** to ease into full membership dues over a three year period after graduation.
- **Opportunities** to participate in the Student Design Project Competition, Grants-in-Aid, Society and Local Scholarships, and Student Branch Activities.
- Access to **The Student Zone** web page which offers valuable career and educational resources.
- **ASHRAE Publication Discounts** at the ASHRAE Student Store including ASHRAE books, standards, reports, charts, and more.

### Do you know anyone that could benefit from being an ASHRAE Student Member?

- Join over 5,000 other students taking advantage of ASHRAE benefits today at <https://ashrae.org/membership--conferences/join-now>.

### Visit the Student Zone at <https://ashrae.org/membership--conferences/student-zone> to learn about:

- Design Competition
- Scholarships and Grants
- New Faces of Engineering – College Edition
- K-12 Activities
- Membership Benefits and Meetings
- Educational Resources
- Student Activities
- Student News
- Student Branches
- ASHRAE's SmartStart Program



## Job Postings & Help Wanted



Although there are no job posting for this month's newsletter, this section of the newsletter is reserved for those firms wishing to advertise their desires to hire from the Chapters Membership.

If you are interested in utilizing this FREE service provided by the Rochester Chapter, please contact our Chapter President, Rob Wind (585.341.3172) or by email [rwind@ibceng.com](mailto:rwind@ibceng.com).

This service is available to ASHRAE members for any local firm in our industry looking for knowledgeable persons in the HVAC&R industry.

## 2013-2014 Presidential Award of Excellence Summary

Chapter #	Chapter Name	Chapter Members	Member Promotion	Student Activities	Research Promotion	Chapter Technology Transfer	History	Chapter Operations	Chapter PAOE Totals
11	Rochester	239	275	0	445	0	100	0	820

## Like us on Facebook!

Visit our new Facebook page by searching for "ASHARE Rochester" on Facebook. Any ideas for additions or improvements email to Mark Kukla at [mark@airsystemsbalancing.com](mailto:mark@airsystemsbalancing.com). Keep up to date with current events and photos from recent meetings.

# 2014 ASHRAE Annual Conference

June 29–July 2 | Seattle

# Technical Program



## Tracks:

**Ground Source Heat Pumps  
HVAC&R Fundamentals and  
Applications**  
HVAC&R Systems and Equipment

**Indoor Environment  
Installation, Commissioning,  
Operations and Maintenance  
Professional Skills**

**Refrigeration  
Research Summit  
Standards, Guidelines and Codes**

**Sunday, June 29,  
8 a.m. – 9 a.m.**

### SEMINAR (INTERMEDIATE)

**I've Met All the Standards and  
People are Still Complaining: Now  
What Do I Do?**

**Track: Indoor Environment**

**Sponsor: SGPC 10, Environmental Health Committee**  
Chair: Eric W. Adams, Ph.D., Member, Carrier, Syracuse, NY

It may not be enough to meet environmental standards individually. The quality of the environment is driven by interactions among the factors that are often considered unrelated. Understanding the interactions of indoor air quality, thermal environment, noise, and light within the built environment is critical for achieving occupant satisfaction within a building. For example, humidity has IAQ perception, contaminant control and thermal comfort effects that are covered discretely in standards 62 and 55, but in very different ways. Materials and systems used to address one problem may cause or may help another. This seminar provides examples of interactions and IEQ concerns that arise even when the basic environmental acceptability standards are met.

**Saving Too Much Energy?**

Mark Jackson, University of Texas, Austin, TX

**My Building is So Cold in Summer and So Hot  
in Winter - What's Going On?**

Chandra Selvar, Ph.D., Fellow ASHRAE, National University of Singapore, Singapore, Singapore

### SEMINAR (BASIC)

**Step 1: Assessing a Project Site for  
Geothermal Heat Pump Applications**

**Track: Ground Source Heat Pumps**

**Sponsor: 06.08 Geothermal Heat Pumps and  
Energy Recovery Applications, NGW4**

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

The first step on every geothermal heat pump project is assessing the project site for ground heat exchanger viability. This includes understanding the local regulatory requirements, permitting and hydrogeology. It also requires the design engineer to estimate through calculation or testing the local formation properties and the size and type of ground heat exchanger. The speakers in this session discuss both the science and engineering for selecting and developing site data application for designing a ground heat exchanger on a commercial project.

**Site Characterization for Geothermal Heat  
Pump Systems**

John Rymner, PV Grosser Consulting, Bohemia, NY

**Ground Heat Exchanger Design Considerations  
for Proper Integration with the Building System**  
Warren (Trey) Austin III, P.E., Member, Geo Energy Services, Littleton, CO

### SEMINAR (BASIC)

**Sustainable Career Design: A  
Holistic Approach**

**Track: Professional Skills**

Chair: Richard King, P.E., Member, Peninsula Engineering, Orlando, FL

Just as sustainable buildings require a holistic approach for success, so do sustainable careers. An overall vision and specific goals need to be well defined. All systems—personal life, professional life, family life—interact and maintaining proper balance requires careful planning as well as continual maintenance. Technical competency as well as soft skills must be considered. This seminar evaluates how to define a sustainable career and how to maintain work-life balance as challenges are encountered. Motivation, natural abilities, personality types and interpersonal relationship are discussed as they impact individual careers.

**Design and Construction: Defining Your  
Sustainable Career**

Megan M Toth, P.E., Member, Integrated Environmental Solutions, Atlanta, GA

**Operation and Maintenance: Career Awareness  
and Adaptation**

Nathan Kegel, Member, Integrated Environmental Solutions, Plymouth, MN

### WORKSHOP (INTERMEDIATE)

**Development of an ASHRAE Energy  
Guideline for Historical Buildings**

**Track: Standards, Guidelines and Codes**

**Sponsor: 04.04 Building Materials and Building  
Envelope Performance, Historical Committee,  
GPC 34, 01.12 Moisture Management in Buildings**

Chair: David Arnold, Ph.D., Fellow Life Member, London South Bank University, London, United Kingdom

ASHRAE is preparing a guideline for use by architects, engineers, and building owners for the energy efficient preservation or rehabilitation of historic buildings. The guideline will focus on design, operation, and maintenance of energy-using systems that do not compromise historical preservation. The guidance includes advice, recommendations and sources of further information for: envelope rehabilitation and restoration; energy efficient HVAC systems that provide acceptable indoor environmental quality, and energy-efficient lighting.

**Refurbishment of 100-Year-Old Neo Classic  
Office Building, Athens, Greece**

Constantinos A. Barlas, Ph.D., P.E., Member, Institute of Environmental Research and Sustainable Development, Athens, Greece

**Wayne Aspinall Federal Courthouse: GSA's  
First NZEB is Also a Historic Building**  
Martin Wieland, P.E., Member, General Services Administration, Washington, DC

### WORKSHOP (INTERMEDIATE)

**Effects of Contaminants on  
Refrigeration System Performance**

**Track: Refrigeration**

**Sponsor: 03.03 Refrigerant Contaminant Control**  
Chair: Warren Clough, Member, Carrier Corp., Syracuse, NY

Contaminants in a HVAC&R system can be very detrimental and can at some point impact the performance, reliability, or eventually lead to a catastrophic failure. There are standards in place to minimize the level of contaminants that enter into a system. For example, AHRI 700 is an industry standard that controls the level of

refrigerant impurities. Should a system become contaminated there are products designed to remove and control the levels allowed. Some contaminants introduced cannot be system controlled and have resulted in fatalities. Therefore, steps have to be taken to avoid such contaminants from being introduced.

**Various System Contaminants, their Sources,  
and Tools to Eliminate Them**  
Christopher Reeves, Associate Member, Parker Hannifin Corporation, Washington, MD

**Updates to AHRI 700 Specification for  
Refrigerants and the Level of Acceptable  
Impurities**  
Robert W. Yost, Member, National Refrigerants, Rossmore, NJ

### WORKSHOP (INTERMEDIATE)

**Exergy: Exposing the Flaw in  
Energy Conservation as an  
Exclusive Solution to Sustainability**  
**Track: HVAC&R Fundamentals and  
Applications**

**Sponsor: 07.04 Exergy Analysis for Sustainable  
Buildings, 06.05 Radiant Heating and Cooling**

Chair: Robert Bean P.(Eng.) R.E.T., Member, Indoor Climate Consultants Inc., Calgary, AB, Canada

This workshop is an introduction to exergy and an exergy management model-based CO<sub>2</sub> emissions calculation that may be instrumental in expanding the CO<sub>2</sub> analysis view in Standard 189.1. Discussion follows to expand upon basic fundamentals and applications.

**The ABC's of Exergy**  
Robert Bean P.(Eng.) R.E.T., Member, Indoor Climate Consultants Inc., Calgary, AB, Canada

**Exergy Dimension of CO<sub>2</sub> Analysis and  
Standard 189.1**

Bilal Kikis, Ph.D., Fellow ASHRAE, Baskent University, Ankara, Turkey

### WORKSHOP (INTERMEDIATE)

**Optimizing VRF Content in the  
Systems Handbook**

**Track: HVAC&R Systems & Equipment**

**Sponsor: 08.07 Variable Refrigerant Flow**  
Chair: Douglas A. Tucker, Member and Andrew Moore, Associate Member, Mitsubishi Electric, Duluth, GA

VRF remains a very "hot" topic with very high interest levels. The session is intended to review the current VRF chapter in the ASHRAE Systems Handbook with the attendees to define areas that need clarification and/or improvement. The current chapter represents the first time that VRF was officially presented to the engineering community in the Handbook. The various sections of the VRF chapter are represented in a PowerPoint presentation to facilitate the discussion about the key areas of system type, system operation, and system design and installation. Also, the current state of VRF in the industry is presented.

**Optimizing VRF Content in the Systems  
Handbook**  
Paul L. Doppel, Mitsubishi Electric, Suwanee, GA

**Optimizing VRF Content in the Systems  
Handbook**  
Brian Bogdan, LG Electronics, Alpharetta, GA

### WORKSHOP (BASIC)

**You've Got it Under Control:  
Understanding Sequences of  
Operation**

**Track: Installation, Commissioning,  
Operation and Maintenance**

**Sponsor: 01.04 Control Theory and Application,  
07.03 Operation and Maintenance Management**  
Chair: Angela Lewis, Ph.D., P.E., Associate Member, Facility Engineering Associates, Fairfax, VA and Michael Bobker, Member, CUNY Institute for Urban Systems, New York, NY

Controls are integral to building design, commissioning and operations and maintenance. This workshop provides an interactive opportunity to learn about using owner project requirements to develop control sequences from experienced controls professionals. After a brief overview of why controls are important and control sequences, participants work in small groups to develop parts of control sequences for different building system scenarios, such as a basic fan, variable air volume and air cooled chiller with constant flow. This workshop is geared towards Young Engineers in ASHRAE (YEA) and those looking to gain basic knowledge of controls.

**Why Controls Are Important**

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

**An Overview of Sequences of Operation**

Barry B. Bridges, P.E., Life Member, Sabesta Blomberg, Rosville, MN

**Sunday, June 29,  
9:45 a.m. – 10:45 a.m.**

### Technical Plenary

**Bullitt Center: A Net Positive  
Building That Functions Like A Tree**

Denis Hayes, President and CEO, Bullitt Center

This Technical Plenary discusses the problems and opportunities associated with "net positive" commercial construction, using the Bullitt Center as an illustration of what is currently possible. Hayes is probably best known for having been national coordinator of the first Earth Day when he was 20. Internationally, he is recognized for having expanded Earth Day to more than 180 nations. During the administration of former U.S. President Carter, Hayes directed the federal National Renewable Energy Laboratory. At the Bullitt Foundation, Hayes leads an effort to mold the American Pacific Northwest into a global model of sustainability.

**Sunday, June 29,  
11 a.m. – 12:30 p.m.**

### TECHNICAL PAPER SESSION (INTERMEDIATE)

**Theoretical Approaches to Air  
Quality for Specific Locations and  
Two Phase Flow Through Pipe**

**Track: HVAC&R Fundamentals and  
Applications**

Air quality issues can vary greatly depending on the requirements for a given location. This session presents theoretical methods for determining the effects on air quality by various contaminants and theoretical methods of assessment. This session also presents a theoretical method for determining two phase media through pipe.

**Incident Response Monitoring Technologies for  
Aircraft Cabin**

John E. Havermans, Ph.D., TNO Applied Environmental Chemistry, Delft, Netherlands

**Methods for Calculation of Evaporation from  
Swimming Pools and Other Water Surfaces**  
Mirza Shah, Consultant, Reading, CT

**Phase Splitting Algorithm for Ice Slurry Flow  
Pressure Drop in Straight Pipe Flow**

Tingjie Zhang, Ph.D., Member, Dalian University of Technology, Dalian, China

**Determination of the Effect of Humidity on the  
Probability of ESD Failure or Upset in Data Centers**  
Mahdi Moradian, Missouri University of Science and Technology, Rolla, MO

### CONFERENCE PAPER SESSION (INTERMEDIATE)

**Indoor Environmental Quality  
Analysis of Healthcare, Clean  
Room, Residence and Vehicular  
Applications**

**Track: Indoor Environment**

**Sponsor: 09.11 Clean Spaces, 09.06 Healthcare  
Facilities**

Visit [www.ashrae.org/seattle](http://www.ashrae.org/seattle) for updated conference information.



## 2 2014 ASHRAE Annual Conference Technical Program

The exhaled air of infected people can be one of the sources of pollutants and respiratory viruses. The exhaled air comes from respiratory events such as the breathing, coughing, sneezing, and talking. One new ventilation concept was developed to protect people from epidemic respiratory diseases, namely protected occupied zone ventilation (POV). This session also challenges the requirements of current ventilations codes with performance based demand control ventilation alternatives for healthcare and mini-environment and clean rooms. The session presents new approach with periodic reversible supply and exhaust air for vehicular spaces.

#### A Simultaneous Consideration of Energy and Ventilation in Healthcare

Travis R. English, PE, Member, Kaiser Permanente, Oakland, CA

#### Analysis of Air Change Rates and System Configuration on the Performance of a Mini-Environment Cleanroom

Kishor Khankar, Ph.D., Member, AnSight LLC, Ann Arbor, MI

#### Field Study on Effectiveness of Periodic Reversible Supply Exhaust Ventilation Strategy

Essam E. Khalil, Ph.D., Fellow ASHRAE, Ahmad Fahim, Ph.D., PE, Member, Ahmad Osama, PE, and Esmal EBilaly, Ph.D., PE, (1)Cairo University, Cairo, Egypt, (2) HBRG, Cairo, Egypt

#### Feasibility Study of an Innovative and Compact Residential HRV/ERV/Economizer Based Ventilation System

Agustin Cit, Student Member, Jun Zhang and Alan Fung, Ryerson University, Toronto, ON, Canada

#### Experimental Study of the Cross Infection Risk due to the Cross-flow of Exhaled Airflows and a Plane Jet with the Protected Occupied Zone Ventilation

Guangyu Cao, Ph.D., Associate Member, Peter V. Nielsen, Ph.D., Chunwen Xu and Rasmus L. Jensen, Ph.D., (1)VTT Technical Research Centre of Finland, Espoo, Finland, (2)Aalborg University, Aalborg, Denmark, (3)Human University, Changsha, China

### CONFERENCE PAPER SESSION (INTERMEDIATE)

#### Ground Source Heat Pump System Performance Case Studies in Different Climates Around the World

Track: *Ground Source Heat Pumps and Geothermal Heat Pumps and Energy Recovery Applications*

Presentations include a description of a novel residential hybrid GSHP system, studies of system performance for a range of climates and system designs, and new experimental measurements of a system in an arctic environment.

#### Ground Source Heat Pump Efficiency in Cold Climates

Robbin L. Garber Slaght, PE, Associate Member, Ronald Danner, Ph.D. and Andrew Roaf, (1)Cold Climate Housing Research Center, Fairbanks, AK, (2) Alaska Department of Natural Resources, Fairbanks, AK, (3)Alaska Geothermal LLC, Fairbanks, AK

#### Development of a Renewable Ground Loop System

Toshiyuki Hino, Dr.Eng., Affiliate and Ryozo Ooka, Dr.Eng., Associate Member, The University of Tokyo, Tokyo, Japan

#### Evaluation of the Applicability of Heat Pump Systems in Residential Buildings with Different Insulation Standards Located in Different Climate Regions in the US

Lars P. Jungnickel, Dr.Eng., Associate Member, University of Michigan, Ann Arbor, MI

#### Economic Analysis of Ground Source Heat Pumps in North Carolina

William Makhyoun, Hamad Honari, Student Member, William Brinker and Kasey Hoover, North Carolina Sustainable Energy Association, Raleigh, NC

#### Effect of Residential Ground Source Heat Pump System Design on Emissions in Sweden

Janette Spritz, Ph.D., PE, Amy Wong, and Sigrild E. A. Sævi, Ph.D., Member, (1)Oklahoma State University, Stillwater, OK, (2)Swedish Centre for Shallow Geothermal Energy, Lund, Sweden

### SEMINAR (INTERMEDIATE)

#### IT Equipment Power and Cooling Trends and Deployment Best Practices

Track: *HVAC&R Systems & Equipment*  
 Sponsor: *09.09 Mission Critical Facilities, Technology Spaces and Electronic Equipment Chair: Nick Gangemi, Member, Facility Gateway Corp, Penfield, NY*

IT equipment power and cooling trends continue to push the limits in the industry, primarily due to packaging density, high performance computing, and mass scale out deployment. This seminar highlights the latest power and cooling trends, and then focuses on associated deployment best practices at the server level while evaluating the existing and emerging room level cooling solutions and technologies.

#### IT Equipment Power and Cooling Trends and Deployment Best Practices

Jason Matteson, IBM, New York, NY

#### IT Equipment Power and Cooling Trends and Deployment Best Practices

Robin Steinbrocher, Intel, New York, NY

#### IT Equipment Power and Cooling Trends and Deployment Best Practices

David Moss, Dell, Inc., Austin, TX

### SEMINAR (INTERMEDIATE)

#### Vivarium Environment: Objectives, Requirements, and Possibilities

Track: *Indoor Environment*

Sponsor: *02.02 Plant and Animal Environment, 09.10 Laboratory Systems*

Chair: James Coogan, PE, Member, Siemens, Buffalo Grove, IL

Indoor environmental requirements for an animal research facility are driven by a complex of special objectives. In addition to the health and comfort of the workers, designers must address the living environment of the animals. This includes all thermal comfort variables, air contamination, and daily lighting patterns. Improper animal environment can undermine research and destroy productivity. The seminar discusses basic objectives, current standards, traditional design approaches and new technical solutions.

#### Laboratory Animal Facility Guidelines and Effective Air Change Rates

Carol Donovan, Associate Member, Sebastia Blomberg & Associates, Woburn, MA

#### Slashing Vivarium Energy Use by Up to 60%

Gordon Sharp, Member, Alrcuity, Inc., Newton, MA

#### Assuring Environmental Conditions for Animal Research

Faui Fuson, Member, Siemens Industry, Buffalo Grove, IL

### SEMINAR (ADVANCED)

#### Simulation Model Development for Building Control and Operation

Track: *Research Summit*

Sponsor: *01.04 Control Theory and Application, 07.05 Smart Building Systems*

Chair: Jin Wen, Ph.D., Member, Drexel University, Philadelphia, PA

Four conference papers focusing on the development, validation, and calibration of building energy and dynamic system simulation models are presented in this session. The presented simulation models include 1) new testbeds used to study and develop building control, operation, and fault diagnosis strategies; and 2) new energy forecasting models. Real building measurements are used in most of the studies to validate or calibrate the models. How to utilize such testbeds and models for building control and operation is discussed.

#### Development of a Probabilistic Graphical Energy Performance Model for an Office Building

Zheng Chen, Ph.D., PE, Member, The University of Alabama, Tuscaloosa, AL

#### Net-zero Energy Impact Building Clusters Emulator for Operation Strategy Development

Xiaojun X, Student Member, Drexel University, Philadelphia, PA

#### A Tool for Evaluating Fault Detection and Diagnostic Methods for Fan Coil Units

Shrikouh Pouranfar, Ph.D., Drexel University, Philadelphia, PA

#### Comparison of Simulated and Measured Energy Use using Energy Audits

Joshua D. Rhodes, Student Member, The University of Texas at Austin, Austin, TX

### SEMINAR (INTERMEDIATE)

#### Update on ASHRAE's Expanded and Enriched Green Building Tools

Track: *Standards, Guidelines and Codes*

Sponsor: *02.08 Building Environmental Impacts and Sustainability*

Chair: Janice K. Means, PE, Member, Lawrence Technological University, Southfield, MI

Seminar attendees are alerted to the latest revisions to noteworthy ASHRAE publications recognized as significant tools in the design and operation of high performance buildings. All chapters of the 4th edition of ASHRAE's GreenGuide have been revised and the chapters on indoor environmental quality and Architecture have been totally rewritten. A new chapter on Sustainable Sites was also added to the fourth edition ANSI/ASHRAE/USGBC Standard 189.1 has been fine tuned to specify greater energy savings and other changes as green building technologies evolve. The newest set of the Advance Energy Design Guides now boasts saving 50% energy improvement over that specified by ANSI/ASHRAE/IESNA Standard 90.1-2004 Energy Standard for Buildings Except Low-Rise Residential Buildings.

#### Changes to Standard 189.1: Standard for the Design of High Performance Green Buildings

TM Lawrence, Ph.D., PE, Member, University of Georgia, Athens, GA

#### Advanced Energy Design Guides: Leading the Way for Energy Savings

Faui A. Torbellini, Ph.D., Member, National Renewable Energy Laboratory, Golden, CO

#### What's New in the 4th Edition of the ASHRAE GreenGuide?

TM Lawrence, Ph.D., PE, Member, University of Georgia, Athens, GA

### SEMINAR (ADVANCED)

Track: *Installation, Commissioning, Operation and Maintenance*

#### Cooling Potential with Increased Night Ventilation in Low Energy Buildings

Sponsor: *06.03 Central Forced Air Heating and Cooling Systems, 02.01 Physiology and Human Environment, TC4.3*

Chair: Max Sherman, Lawrence Berkeley National Laboratory, Berkeley, CA

In post-occupancy studies of low energy buildings elevated temperature levels is a commonly reported problem. Ventilative cooling can be an attractive and energy efficient solution to reduce peak load and energy use in new and existing residential buildings. Equipment required for ventilative cooling in residential buildings is available and has been shown to be cost-effective in many climates. The seminar presents the concept of ventilative cooling together with studies of the potential impact on energy consumption and indoor environment in different climatic regions.

#### Ventilative Cooling Needs and Outdoor Night Cooling Potential

Per Høisberg, Aalborg University, Aalborg, Denmark

#### Evaluation of Different Concepts for Ventilative Night Cooling by Building Simulations

Angela Simone, Ph.D., Member, Danish Technical University, Kgs. Lyngby, Denmark

#### Residential Ventilative Cooling Technology Status and Applications

David Springer, Member, Davis Energy Group, Davis, CA

Sunday, June 29,  
1:30 p.m. – 3 p.m.

### TECHNICAL PAPER SESSION (INTERMEDIATE)

#### Super Insulated Retrofit Strategies, Climatic Design Conditions and Convection Enhancements

Track: *Research Summit*

Sponsor: *04.04 Building Materials and Building Envelope Performance, 04.01 Load Calculation Data and Procedures*

This session begins with analysis of the climatic data utilized to determine building HVAC loads. The next two papers explore insulation strategies needed to keep occupants comfortable. The last paper presents formation to enhance surface convection.

#### Thermal Design of Window-Wall Interface in Wall Energy Retrofits Using High Performance Vacuum Insulation

Jan Kozny, Ph.D., Member, Sustainable Energy Systems, Cambridge, MA

#### Experimental and Numerical Investigation of Surface Convection Enhancement by a V-Formation Delta-Winglet Array in a Developing Channel Flow

Jing He, Ph.D., Haatcraft Worldwide Refrigeration, Lawrenceville, GA

#### Energy Codes and the Evolution of Fenestration: 20 Years of NFRC Ratings in Seattle

John Hogan, PE, Member, Consultant, Seattle, WA

#### Temperature Trends for Locations Listed in the Tables of Climatic Design Conditions in the 2013 Handbook – Fundamentals

Dexter Thevenard, Ph.D., PE, Member, Numerical Logistics Inc., Waterloo, ON, Canada

### TECHNICAL PAPER SESSION (INTERMEDIATE)

#### Analysis and Modeling of Unitary and Room Air Conditioners and Heat Pumps

Track: *Refrigeration*

Sponsor: *08.11 Unitary and Room Air Conditioners and Heat Pumps*

This session evaluates energy savings and economic potential for unitary and room air conditioners and heat pumps.

#### Generalized Performance Maps for Single and Dual Speed Residential Heat Pumps

Simbarashe Nyika, Student Member, Purdue University, West Lafayette, IN

#### Generalized Performance Maps for Variable Speed Ducted Residential Heat Pumps

Simbarashe Nyika, Student Member, Purdue University, West Lafayette, IN

#### Staging Packaged Air Conditioning Units to Improve Energy Efficiency and Humidity Control by Reducing Cycling Losses

Seth Parker, University of Dayton, Dayton, OH

#### Engineering and Economic Analysis of Air Conditioners in the Kingdom of Saudi Arabia: Upgrading the Minimum Energy Performance Standards

John Proctor, PE, Proctor Engineering, San Rafael, CA

### CONFERENCE PAPER SESSION (INTERMEDIATE)

#### Evaluation and Optimization of Variable Refrigerant Flow Systems, Fan Coil Units, Packaged Terminal AC Unit Fan Blowers, Variable Speed Compressor Heat Pumps and Chiller Plant Components

Track: *HVAC&R Systems & Equipment*

Sponsor: *08.11 Unitary and Room Air Conditioners and Heat Pumps, 06.01 Hydronic and Steam Equipment and Systems, 08.07 Variable Refrigerant Flow*

Space temperature adjustment of a VRF system is evaluated with respect to thermal comfort and energy conservation. Fan coil fault detection and diagnostic method modeling results is described. Improvement in system energy performance as a result of using a blower at a lower speed to deliver the designed airflow is reported. The energy conservation benefits of variable speed compressors in heat pumps are introduced. Optimization of chiller plant components including single-stage centrifugal compressor, shell-and-tube evaporator and condenser, cooling tower with variable-speed fan and cooling water pump are described.

#### Effect of the Set-Point Temperature on Indoor Thermal Comfort and Energy Demand in Office Building

Taeju Park, M.D., Student Member, Doosam Song, Ph.D., Member, Kwang Kang, Dr.Eng., Student Member, Gyeonmin Kang, Dr.Eng., Student Member, Brian S. Kim, Dr.Eng., Member, and Hyejung Cho, Ph.D., (1) Sungkyunkwan University, Suwon, South Korea, (2) Samsung Electronics Co. Ltd., Suwon, South Korea

#### Tools for Evaluating Fault Detection and Diagnostic Methods for Fan Coil Unit

Shrikouh Pouranfar, Ph.D., Jin Wen, Ph.D., Daniel Veronica, Member, Naohui (Joe) Zhou and Fan Liu, Ph.D., Student Member, (1)Drexel University, Philadelphia, PA, (2)National Institute of Standards and Technology, Gaithersburg, MD, (3)Iowa Energy Center, Ames, IA, (4)Iowa Energy Center, Ankeny, IA

#### Impact of the Blower on the System Performance of a 5-Ton Air Conditioner

Pang Yin, Student Member, James F. Sweeney, Associate Member and Michael Pate, Ph.D., PE, Member, Texas A&M University, College Station, TX

#### Field Study of Performance, Comfort, and Sizing of Two Variable-Speed Heat Pumps Installed in a Single 2-Story Residence

Jeffrey D. Mumf, Adewale O. Oluosun, Anthony C. Gaff and Roderick K. Jackson, (1)Oak Ridge National Laboratory, Oak Ridge, TN, (2)Georgia Institute of Technology, Atlanta, GA

#### Optimal Model-based Control of Chiller Tower Fan and Cooling Water Pump

Amir A. Qureshi, Student Member, Hassan Javed, Affiliate, PR, Armstrong, Ph.D., Member and Atshin Afshar, Ph.D., Member, Institute of Science and Technology, Abu Dhabi, United Arab Emirates

### CONFERENCE PAPER SESSION (INTERMEDIATE)

#### Refrigeration Research Advancements and the Application to Heat Pump and Transport Systems

Track: *Refrigeration*

This session presents a number of studies in refrigeration research including low GWP refrigerants on heat pump systems, CO<sub>2</sub> compatibility as a refrigerant and the measurement of nanoparticle concentration in binary liquids. The session will also address the life-cycle performance for transport refrigeration and the system damages that occur from spike pressures and shock waves.

#### Refrigeration Systems Failures Due to Sudden Evaporation and Condensation Processes

Amir Jolani, Ph.D., PE, Member, Erik W. Christiansen, Ph.D., PE and Ali Raza, PE, Exponent Inc. Thermal Systems Practice, Los Angeles, CA

#### Life Cycle Climate Performance Model for Transport Refrigeration/Air-Conditioning Systems

Dennis M. Nasuta, Associate Member, Robert Srinath, Member, Ming Zhang, Ph.D., Member, Cara Martin, Associate Member and Jan Muehlebauer, Member, (1) Continuum Thermal Systems, LLC, College Park, MD, (2) Ingersoll Rand, Minneapolis, MN

#### Stability of Candidate Lubricants for CO<sub>2</sub> Refrigeration

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



#### Concentration Measurement Technique of Binary Liquids Containing Colloidal Suspension of Nanoparticles

Marjani Fahar, Student Member and Todd Otiancar, Ph.D., Member, The University of Tulsa, Tulsa, OK

**The Influence of Climate Conditions on Life Cycle Climate Performance of Low GWP Refrigerant Based Heat Pumps**  
Pavel Malmström and Rammatolan Khodabandeh, KTH Royal Institute of Technology, Stockholm, Sweden

#### SEMINAR (ADVANCED)

### Advances in Simulation Research for the Design and Operation of Natural and Mixed Ventilation Systems

**Track: Research Summit**

**Sponsor: 04.10 Indoor Environmental Modeling, 04.07 Energy Calculations**

**Chair: Wangde Zuo, Ph.D., Member, University of Miami, Coral Gables, FL**

Natural and mixed mode ventilations are considered to be an energy efficient way to provide building cooling. However, it is difficult to estimate and achieve the desired performance due to the complexity of the system. This seminar introduces the advance in simulation research to enable the optimized design and operation of buildings with natural and mixed mode ventilation.

#### Design and Advanced Air Flow Simulation of Naturally Ventilated Theatres

Malcolm J. Cook, Ph.D., Member, Loughborough University, Loughborough, United Kingdom

**Natural and Mixed Ventilation Energy Efficiency Optimization Via Integrated CFD and Building Performance Simulation**

Marja S. Todorovic, VEA INVI Ltd., Zug, Switzerland

**Considering Wind Effects when Designing for Natural Ventilation**

James Lo, Ph.D., Student Member, National Institute of Standards and Technology/University of Texas at Austin, Gaithersburg, MD

**Energy Modeling and Predictive Control Strategies for Efficient Mixed-mode Cooling using Natural Ventilation**

Panagiotis Karava, Ph.D., Member, Purdue University, West Lafayette, IN

#### SEMINAR (INTERMEDIATE)

### Demand Control Ventilation (DCV) for Multiple-Zone VAV Systems: Problem Solved

**Track: Indoor Environment**

**Sponsor: 04.03 Ventilation Requirements and Infiltration**

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

ASHRAE RP 1547 was an extensive project to develop and test DCV strategies. This seminar provides the background for the project and describes three control strategies that were developed. Energy and airflow mass balance simulations were conducted to test the performance of the three theoretical strategies.

**The Background and Methodology for Simulating the Proposed CO<sub>2</sub>-Based Demand Control Ventilation Strategies (RP 1547)**

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

**The Proposed Control Strategies and their Corresponding Energy Performance (RP 1547)**

Xingbin Lin, Ph.D., Associate Member, Nairant Inc., Wheaton, IL

**A First Step: Resetting Outdoor-air Intake Flow Based on Zone DCV and System Ventilation Efficiency**

Dennis Stankis, Life Member, Triana (Retired), LaCrosse, WI

**DCV in Multiple Space Systems: Implementation in System Design and Controls**

Slava Taylor, PE, Fellow ASHRAE, Taylor Engineering, Atlanta, GA

#### SEMINAR (INTERMEDIATE)

### GEO 2.0: From the Ground Up, an Overview of the Updated ASHRAE GSHP 'Blue Book'

**Track: Ground Source Heat Pumps**

**Sponsor: 06.08 Geothermal Heat Pumps and Energy Recovery Applications**

**Chair: David Dinsie, PE, Member, Tennessee Valley Authority, Chattanooga, TN**

The ASHRAE book, Ground Source Heat Pumps: Design of Geothermal Systems for Commercial and Institutional Buildings, was published in 1997. Much has changed since 1997. ASHRAE RP-1674 provided new information not previously available to designers. Two new chapters include: 1) a hydro-geological primer and overview of drilling methods 2) a summary of recent field studies and listing of notable installations. New appendices cover topics of well testing, analysis, performance, drilling methods and problems. The book authors present overview of the updated book and include example design procedures and demonstrations of spreadsheet software included with the book purchase.

#### HVAC Equipment and Closed Loop System Design

Steve Kavanaugh, Ph.D., Fellow ASHRAE, University of Alabama, Tuscaloosa, AL

**Groundwater Systems, Hydrology and Wells**  
Kevin Rafferty, PE, Member, Modoc Point Engineering, Mammoth Falls, OR

#### SEMINAR (INTERMEDIATE)

### Operating and Maintaining Oil-Free Centrifugal Chillers

**Track: Installation, Commissioning, Operation and Maintenance**

**Sponsor: 06.02 Centrifugal Machines**

**Chair: Phillip Johnson, PE, Member, Delkin Applied, Staunton, VA**

Oil-free centrifugal chillers have been on the market for more than a decade. Some chilled water plants have these chillers installed beside other conventional oil-lubricated centrifugal chillers, while other installations use only oil-free centrifugal chillers. During that time, manufacturers, owners, and operators have accumulated experience regarding maintenance practices, performance trend logs, service records, and reliability. This session shares those lessons learned and best practices by comparing and contrasting operating and maintenance issues of conventional and oil-free centrifugal chillers.

#### Comparative Application and Maintenance Aspects of Oil-Free Chillers

Paul Kostov, Smart, Victoria, Australia

**State of the Industry in Oil-Free Compressors: What's Oil Really Got To Do With It?**

W. Ryan Galster, Member, Triana, La Crosse, WI

**Operating and Maintaining Oil-Free Centrifugal Chillers**

Gabriel Peters, Bullock, Logan & Associates, Inc., Elk Grove Village, IL

**Sunday, June 29,  
3:15 p.m. – 4:45 p.m.**

#### SEMINAR (INTERMEDIATE)

### Ground Source Heat Pump System Case Studies

**Track: Ground Source Heat Pumps**

**Sponsor: 06.08 Geothermal Heat Pumps and Energy Recovery Applications**

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

University science buildings are typically the highest net energy users on a campus. This project combined a centralized geothermal heating/cooling plant, a dedicated outside air system, active chilled beams, thermally-massive radiant heating/cooling and self-learning adaptive controls. The system is designed to use geothermal loop water directly for sensible cooling without needing a chiller. A magnetic-bearing chiller provides chilled water for the DOAS unit and hot water for heating. Net on-site energy consumption for the first year of operation was 64 kWh per square foot.

**Geothermal HVAC Case Study: Davis Building, University of Findlay**

Stephen A. Hamstra, PE, Member, Greensteves LLC, Zealand, MI

**Geothermal HVAC Case Study: Success in K-12 Schools and Nation's Largest Net Zero School**

Don Fenn, PE, Member, Image Engineering Group, Ltd., Grapevine, TX

**Geothermal HVAC Case Study: Fast Food Restaurant, Pensacola, FL**

Greg Trinker, PE, Member, Reading Linden Burr Consulting Engineers, Houston, TX

**Monday, June 30,  
8 a.m. – 9:30 a.m.**

#### TECHNICAL PAPER SESSION (INTERMEDIATE)

### Boreholes: Vertical Ground Heat Exchangers

**Track: Research Summit**

**Sponsor: 06.08 Geothermal Heat Pumps and Energy Recovery Applications**

This session explores vertical ground heat exchanger spacing, configuration, depth, quality control and effects of weather.

**Evaluation of the Thermal Performance of Two Non-standard Borehole Configurations**

Michel Barriac, Ph.D., Member, Ecole Polytechnique De Montreal, Montreal, QC, Canada

**Effects of Unequal Borehole Spacing on the Required Borehole Length**

Mazzimo Cimmino, Student Member and Michel Barriac, Ph.D., Member, Polytechnique Montreal, Montreal, QC, Canada

#### Quality Control Assessment of Vertical Ground Heat Exchangers

Jasmin Raymond, Student Member, Université Laval, Laval, QC, Canada

**Effects of Weather Parameters on Vertical Ground Heat Exchanger Design**

Fazl Rizq, PEng., Member, Ryerson University, Toronto, ON, Canada

#### TECHNICAL PAPER SESSION (INTERMEDIATE)

### Theoretical and Real-World Application of Energy Saving Techniques

**Track: HVAC&R Systems & Equipment**

**Sponsor: 06.02 District Energy, 06.05 Radiant Heating and Cooling**

**Chair: Chuck Curlin, PE, Member, Shultz Engineering Group, Charlotte, NC**

Energy conservation starts with theoretical calculations and then test cases for energy conserving technologies. This session will describe some analytical methods for future technologies and a case study for a new technology designed for energy conservation.

**Design, Installation, and Results of Variable Frequency Drives at a Mid-Sized Power Generation Facility**

James Mathias, Ph.D., PE., Associate Member, Southern Illinois University, Carbondale, IL

**Virtual Flow Meter to Estimate the Water Flow Rates in Chillers**

Eric McDonald, Concordia University, Montreal, QC, Canada

**Analytical Expression for Transient Heat Transfer in Concrete Core Activation**

Wesley S. Soutar, Ph.D., Fellow ASHRAE, University of Laval, Campus De Noyon, Saint-Jean-de-la-Rive, Québec, Canada

**An Absorption Chiller System Using Lithium Bromide and Water as Working Fluids: Energy Analysis**

Sanjeev Anand, Sudhir Tyagi, Yathesh Anand, and Anshuk Gupta

#### CONFERENCE PAPER SESSION (INTERMEDIATE)

### Occupant Diversity Profiles, Particulate and VOC Measurement, Climate Data and BCHP

**Track: Research Summit**

This session explores control system knowledgebase using the self-configuration method. A new method for predicting building combined cooling heating and power application potential is presented. Sound climate data is a critical component of HVAC design, system sizing and energy consumption estimates. This study evaluated the effects of future climate conditions on existing HVAC systems and facility infrastructure. This session ends with a study that will allow workers to monitor in real time the energy consumed by their PC, printer, heating and lighting.

**Self-Configuration of Building Control System Using Knowledgebase**

Yan Chen, Student Member and Stephen Traddo, Ph.D., PE, Member, The Pennsylvania State University, University Park, PA

**Principal Component Analysis for BCHP Application Potential**

Bo Lin, Student Member, Chen Zhao, Ph.D.† and James Peinhart, Ph.D.†, †The Pennsylvania State University, State College, PA, ‡Princeton University, NJ, §The Pennsylvania State University, University Park, PA

**Impacts of Climate Variability on Energy at a NASA Space Center**

Lee DeBalla, PE, Member, Scott Schueller, PE, Member and Doug Ahl, Ph.D., Energy Center of Wisconsin, Madison, WI

**Multizone Particulate and VOC Measurements in Two Lab Houses Under Operation of Different Whole-Building Ventilation Systems**

Armin Radd, Member, ABT Systems LLC, Annville, PA

**Development of Empirical Occupancy Diversity Profiles for Office Environments Using Information Communication Technology Systems**

Hu Huailin, Ph.D., Associate Member, Chad Miller, Student Member and Fran Stephen, Student Member, Portland State University, Portland, OR

#### SEMINAR (INTERMEDIATE)

### Documentation and Contract Administration in Tendered and Design/Build Ground-Coupled Heat Pump Projects

**Track: Ground Source Heat Pumps**

**Sponsor: 06.08 Geothermal Heat Pumps and Energy Recovery Applications**

**Chair: Ed Lorenz, Associate Member, GeoOptimize Inc, Winnipeg, MB, Canada**

Construction documentation and contract administration for tendered projects need to be clear and concise to ensure the design intent of a ground-coupled heat pump (GCHP) system is met. This is also true of design/build GCHP projects, but there is more leeway to work with the client and contractors to meet the design intent as cost-effectively as possible. This seminar considers the documentation and contract administration

requirements of a tendered project and how that can differ from a design/build project.

**Construction Docs for Design-Loop Ground Heat Exchangers: System Installation, Meet Design Intent**

Ryan Carda, PE, Geococonnectors Inc, Elton, SD

**Closed Loop Ground Heat Exchanger (GHX) Contract Administration**

Terry Proffer, Major Geothermal, Wheatridge, CO

**Design-Bid Documentation Requirements for Specifications and Drawings of GCHP Systems**

Warren (Trey) Austin II, PE, Member, Geo Energy Services, Littleton, CO

#### SEMINAR (INTERMEDIATE)

### Indoor Air Quality in Retail Stores: Research and Applications

**Track: Indoor Environment—Health, Comfort and Productivity**

**Sponsor: Environmental Health Committee, 04.03 Ventilation Requirements and Infiltration**

**Chair: David Grimsrud, Ph.D., Fellow Life Member, University of Minnesota, Minneapolis, MN**

This session presents the results of recent contaminant and ventilation rate research in several types of retail stores. This is new and late-breaking information since up to now, most air quality research has been conducted in homes, offices and special research chambers. Common themes among the papers in this session are that most spaces meet the Standard 62.1 rates, yet some contaminant levels are relatively high, in particular where cooking takes place.

**Indoor Air Quality in Retail Stores: Implications for Ventilation Exposure, and Energy Use (RP-1696)**

Jeffrey Siegel, Ph.D., University of Toronto, Toronto, ON, Canada

**Characterization of Air Exchange Rates (AER) and Associated Occupant Survey Outcomes in Retail Stores (RP-1696)**

Yang Seon Kim, Student Member, The Pennsylvania State University, University Park, PA

**Contaminant Levels and Source Strengths in California Retail Stores**

Wanyu R. Chan, Ph.D., Lawrence Berkeley National Laboratory, Berkeley, CA

#### SEMINAR (INTERMEDIATE)

### Occupant Behavior in Buildings

**Track: Indoor Environment**

**Sponsor: 04.07 Energy Calculations, 02.01 Physiology and Human Environment**

**Chair: Tianshen Hong, Ph.D., PE, Member, Lawrence Berkeley National Laboratory, Berkeley, CA**

Technologies alone do not necessarily guarantee low energy buildings. Occupant behavior plays an essential role in the design and operation of buildings, but it is quite often oversimplified. Occupant behavior refers to an occupant's movement and responses to discomfort, when his/her comfort needs are not met. Occupant behavior varies with time, space, individual and is influenced by social context. It is stochastic, complex, and multidisciplinary. Having a better understanding and modeling of occupant behavior in buildings can improve the accuracy of building simulations and guide the design and operation of buildings. This seminar highlights related behavior research at various institutes.

**The New IEA EBC Annex 66 on Occupant Behavior**

Da Yan, Tsinghua University, Beijing, China

**Agent-based Modeling of Occupant Behavior**

Clinton J. Andrews, Ph.D., PE, Member, Rutgers, The State University of New Jersey, New Brunswick, NJ

**Overview of Occupant Behavior Research at DTU**

Blaine W. Olesen, Ph.D., Technical University of Denmark, Kgs. Lyngby, Denmark

**A Technical Framework to Describe Occupant Behavior in Buildings**

Tianshen Hong, Ph.D., PE, Member, Lawrence Berkeley National Laboratory, Berkeley, CA

#### SEMINAR (INTERMEDIATE)

### Using ASHRAE Standard 105-2014 for Determining, Expressing, and Comparing Building Energy Performance and Greenhouse Gas Emissions

**Track: Standards, Guidelines and Codes**

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

**Chair: Keith I. Emerson, PE, Member, Tri State Generation and Transmission Association, Westminster, CO**

ASHRAE Standard 105-2014 provides a common basis for reporting and expressing building energy performance, for comparing design options, and for comparing energy

Early-bird conference registration deadline is April 27.



## 4 2014 ASHRAE Annual Conference Technical Program

performance in terms of energy resources used and greenhouse gas emissions created, both across buildings and for energy efficiency measures within buildings. This seminar provides an overview and discusses new provisions related to primary energy performance and greenhouse gas emissions.

**Standard 106 Overview and New Provisions**  
Adam W. Hinge, P.E., Member, Sustainable Energy Partnerships, Tarrytown, NY

**Options For Determining Primary Energy Performance**  
Neil P. Leslie, P.E., Member, Gas Technology Institute, Des Plaines, IL

**Evaluating Greenhouse Gas Emissions Using Standard 106**  
Michael Doru, Ph.D., Member, National Renewable Energy Laboratory, Golden, CO

## WORKSHOP (BASIC)

**Debate: The HVAC Procurement Process Contravenes the ASHRAE Code of Ethics**

Track: Professional Skills

Sponsor: College of Fellows, 01.07 Business, Management & General Legal Education

Chair: Victor Goldschmidt, Fellow ASHRAE, Consultant, Northport, MI

College of Fellows series of debates. The complex procurement method for buildings holds conflicts among the technical, program and commercial objectives of designers, contractors, manufacturers, owners and tenants. These dynamic conflicts often result in processes which are expedient rather than professionally correct. The resulting buildings often fail to meet owners' expectations. Is this expectation of failure normal, and is it the way things have to be? Is the ASHRAE Code of Ethics relevant and honored more in the breach than in fact?

**Team 1**  
Larry Solei Vogel, P.E., Fellow/Life Member, Don Beatty, P.E., Fellow ASHRAE, and Richard Rooley, Presidential Fellow Life Member, (1) Consulting Engineer, Bala Cynwyd, PA, (2) DLB Associates, Baltimore, MD, (3) Rooley Consultants, Buco, United Kingdom

**Team 2**  
E. Michael Swann, P.E., Member, Ross Montgomery, Fellow ASHRAE and Bill Coad, P.E., Presidential Fellow Life Member, (1) MDC Systems, Paoli, PA, (2) Quality Systems and Technology Inc., Fairfax, VA, (3) Coad Engineering Enterprises, St. Louis, MO

Monday, June 30,  
9:45 a.m. – 10:45 a.m.

## SPECIAL SESSION (BASIC)

**Geothermal Heat Pump Track Keynote Presentation**

Track: Ground Source Heat Pumps

Chair: Gary Phetteplace, Ph.D., P.E., Member, GWA Research LLC, Lyme, NH

The Keynote Address kicks off the Track on Geothermal Heat Pumps (GHPs, aka Ground-Source Heat Pumps) to be presented at this conference. While this session focuses on market conditions for GHP sessions that follow will range from the basics of site selection and system design to operational experience and topics of current research in the field.

**The Geothermal Heat Pump Industry: Market Barriers and Market Drivers**

Douglas Dougherty, Geothermal Exchange Organization, Washington, DC

## SPECIAL SESSION (BASIC)

**Research Summit Keynote Address**

Track: Research Summit

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

Featured presentation for the Research Summit Track

**Big Data, Bigger Challenges and Greater Opportunities**

Krishnan Govil, Ph.D., Member, Pacific Northwest National Laboratory, Seattle, WA

## SPECIAL SESSION (BASIC)

**Are We Putting Enough Energy Into Making Buildings Healthy?**

Track: Indoor Environment

Chair: Thomas H. Kuehn, Ph.D., Fellow ASHRAE, University of Minnesota, Minneapolis, MN

Keynote presentation for the Indoor Environment Track by ASHRAE President Bill Bahnfleth

**Are We Putting Enough Energy into Making Buildings Healthy?**

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

Monday, June 30,  
11 a.m. – 12 p.m.

## TECHNICAL PAPER SESSION (INTERMEDIATE)

**New Energy-Efficient Technologies for Hydronic Heating & Cooling Systems**

Track: Research Summit

Sponsor: 06.01 Hydronic and Steam Equipment and Systems

Escalating electrical costs and increased pressures to reduce consumption are driving research to provide new technologies for HVAC systems. These studies show new approaches to increase energy efficiency for hydronic heating and cooling systems.

**VAV System Integrated with Thermal Storage System: Application to Residential Buildings**  
Ahmed Charif Magr, University of Wyoming, Laramie, WY

**Deluge Evaporative Cooling Performance of Wavy Fin and Tube Inclined Heat Exchangers**

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

**Condensing Boiler and Vapor Vacuum Heating System Combo**

Igor Zhadanovsky, Ph.D., Applied Engineering Consulting, Newton, MA

## SEMINAR (BASIC)

**Ground Source Heat Pumps: Historical Perspective and Track Overview**

Track: Ground Source Heat Pumps

Sponsor: 06.08 Geothermal Heat Pumps and Energy Recovery Applications

Chair: Gary Phetteplace, Ph.D., P.E., Member, GWA Research LLC, Lyme, NH

This session has two overall objectives and a separate speaker addressing each. The first speaker addresses the history of Ground Source Heat Pumps (GSHP) providing an overview of the many ways the technology has been applied and some of the approaches that have been tried, including many that have failed or were eclipsed by others. The second speaker provides an overview of the contents of the many sessions within the GSHP/Geothermal Track which has been assembled by TO6 B for this conference.

**History of Geothermal Heating and Cooling Systems**

Steve Smith, EnerTech Global, LLC, Greenfield, IL

**Overview of the Geothermal Track at This Meeting**

Gary Phetteplace, Ph.D., P.E., Member, GWA Research LLC, Lyme, NH

## SEMINAR (INTERMEDIATE)

**New EPA Guidance for Moisture and Humidity Control in Buildings**

Track: Indoor Environment

Sponsor: 01.12 Moisture Management in Buildings  
Chair: Ray Patenaude, P.E., Member, The Holmes Engineering Group, Tierra Verde, FL

Persistent and excessive dampness from rainwater and plumbing leaks and from short-comings in HVAC design can create severe indoor air quality problems and sometimes health risks for building owners and occupants. To reduce such risks, the US EPA has published guidance for architects, engineers and building operators with respect to managing moisture and humidity. These presentations provide practical, actionable suggestions for each of the professional disciplines. The information will also prove useful to any building occupant or homeowner who has had the unfortunate experience of living or working in a building that has a dampness or high humidity problem.

**The New EPA Guidance for Moisture Control: Its Background, Process and Purpose**

Laura Kolb, US Environmental Protection Agency, Washington, DC

**Top 10 Tips and Traps from New EPA Guidance for Managing Moisture in Building Design, Construction and Operation**

Terry Brennan, Camruden Associates, Westmoreland, NY

**Top 10 Tips and Traps from New EPA Guidance for Managing Moisture and Humidity in HVAC System Design, Installation and Operation**  
Law Hartman III, Fellow ASHRAE, Mason, Grant, Portsmouth, NH

## SEMINAR (INTERMEDIATE)

**Optimizing Operating Staff Capabilities and Energy Efficiency with Commissioning**

Track: Installation, Commissioning, Operation and Maintenance

Sponsor: 07.09 Building Commissioning

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

A comprehensive commissioning process provides a facility's staff with information necessary to efficiently operate building systems. A formal monitoring based commissioning (MBCx) effort is also useful in investigating operational issues, troubleshooting, determining actions required to permanently correct the problem, reducing the frequency of issue recurrence, and improving equipment maintenance due to wear and tear on equipment. This session provides a case study where the commissioning process optimized the efficient facility that was delivered, and reviews the benefits of MBCx in achieving peak building system performance throughout a facility's lifetime.

**Using Monitoring Based Commissioning to Improve the Capabilities of O&M Staff**

H. Jay Enck, Member, Commissioning & Green Build Solutions Inc., Buford, GA

**Chiller Plant Optimization through Proper Commissioning**

Norman Nelson, P.E., Member, CH2M Hill, Portland, OR

## SEMINAR (INTERMEDIATE)

**Pressure Independent Control Valves and Balance**

Track: HVAC&R Systems & Equipment

Sponsor: 07.07 Testing and Balancing

Chair: Gaylon Richardson, Fellow ASHRAE, Engineered Air Balance, Houston, TX

Pressure Independent Control Valves (PICV) exist in the "in-between world" of flow control valves. In some forms they are considered as replacements to balancing devices. In other forms they do not perform as balance devices are supposed to perform. This seminar addresses PICV valves and balance and proper applications of this type of control and achieving balance.

**The PICV: A Discussion on the History, Theory, and Application**

James Hester, Member, Danboss Heating, Baltimore, MD

**Field Testing Pressure Independent Control Valves: The Balancer's Perspective**

Justin Garner, Member, Engineered Air Balance, Houston, TX

**PICV Valves and Balancing: System Level Discussion of Valve Application and Alternatives to PICV Application**

Mark C. Hegberg, Member, Mechanical Equipment Inc, Chicago, IL

## FORUM (INTERMEDIATE)

**Building Energy Policies Around the World**

Track: Standards, Guidelines and Codes

Sponsor: ASHRAE Associate Society Alliance, 02.08 Building Environmental Impacts and Sustainability

Chair: Ashish Rakheja, P.E., Member, Regional Managing Director, AECOM India Pvt. Ltd., New Delhi, India; Thomas E. Watson, P.E., Presidential Fellow Life Member, Daikin Applied, Staunton, VA

Energy use in buildings is responsible for more than 30% of global CO<sub>2</sub> emissions and has significant role in climate change mitigation, given the large potential savings in both new and existing buildings. For new buildings, energy policies are central element in achieving these potential savings. Such policies need to be dynamic and ambitious and they need to be supported by a policy package with long-term targets of achieving zero or positive energy for all new construction. This forum aims to discuss on the dynamic and ambitious building Energy Policies around the world. AASA member speakers from different countries are invited to discuss on the Energy Efficiency policies.

## WORKSHOP (INTERMEDIATE)

**The Impact of Change Orders and the Damages That They Can Cause**

Track: Professional Skills

Sponsor: 07.02 HVAC&R Contractors and Design Build Firms, 01.07 Business, Management & General Legal Education

Chair: Michael Connor, P.E., Member, Connor Engineering Solutions, Alpharetta, GA; Michael McLaughlin, P.E., Associate Member, Southland Industries, Dulles, VA

This workshop is an interactive session where three real-life change order examples are given from three different contract perspectives: design/build, design/build, and integrated project delivery. The audience is presented the scenarios, and then broken up into smaller groups to discuss the merits of the change order proposal and what if anything should be awarded to the contractor including monetary compensation and/or extensions of time. After the individual group discussions, the audience comments are compared and contrasted to the actual result and reasoning behind the real outcome.

**Destroying the Myth "Contractors Do Not Like Change"**

James Fields, Member, Superior Mechanical Services, Inc., Greensboro, NC

**So Happy Together: Scope Change, Design Refinement, or Field Condition**  
E. Mitchell Swann, P.E., Member, MCC Systems, Paoli, PA

## WORKSHOP (INTERMEDIATE)

**VAV Reheat Verses Active Chilled Beams and DOAS Workshop**

Track: HVAC&R Fundamentals and Applications

Sponsor: 06.01 Hydronic and Steam Equipment and Systems, 06.05 Radiant Heating and Cooling

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

Several recent articles claim that dedicated outdoor air systems plus active chilled beam systems are superior to variable air volume reheat systems on energy efficiency, first cost and air quality. Other articles paint a different picture and have found that a well-designed VAV system with reheat (including dual maximum zone controls, supply air temperature reset, duct static pressure reset and CO<sub>2</sub> controls in high intensity spaces) is hard to beat. This workshop explores both HVAC systems as they relate to first cost, thermal comfort, indoor air quality, energy use, floor to floor height, maintenance, and flexibility.

**Comparing Performance: Active Chilled Beam + DOAS or VAV Reheat**

Steve Taylor, P.E., Fellow ASHRAE, and Peter Simmonds, Ph.D., Fellow ASHRAE, (1) Taylor Engineering, Alameda, CA, (2) Stantec, Sherman Oaks, CA

**To Beam or Not to Beam?**

Peter Simmonds, Ph.D., Fellow ASHRAE, Stantec, Sherman Oaks, CA

Monday, June 30,  
2:15 p.m. – 3:45 p.m.

## SEMINAR (BASIC)

**"I Know That I Should Be Doing BIM, But ...": How BIM is Practically Being Introduced and Used by People like YOU to Move Their Projects and Businesses forward Towards a Connected and Collaborative BIM World**

Track: HVAC&R Fundamentals and Applications

Sponsor: 01.05 Computer Applications, MTG, BIM Building Information Modeling

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

This seminar includes presentations from a range of practicing engineering consultants where they show how they have taken hold of the BIM way of working, explaining some of the challenges and the current (and potential) benefits to their business, profession, and user, and environment.

**Are You Ready to Take the BIM Plunge? The Top Ten Things You Need to Know**  
Ra Setty, P.Eng., Member, Setty and Associates, Wash.ington, DC

**Taking the First Step Toward Realizing the Value of the "Information" in BIM: Moving Beyond 3D Drafting**  
Dennis Knight, P.E., Member, Whole Building Systems, LLC, Channahon, IL

**What Keeps Some Consultants Away from BIM? Should It?**

David Branson, P.E., Member, Compliance Services Group, Lubbock, TX

Monday, June 30,  
4 p.m. – 5:30 p.m.

## SEMINAR (BASIC)

**BIM in Action: Beyond CAD**

Track: Professional Skills

Sponsor: 07.01 Integrated Building Design, BIM-MTG, 01.05 Computer Applications

Chair: Krishnan Govil, Ph.D., Member, Pacific Northwest National Laboratory, Seattle, WA

Building Information Modeling (BIM) has gained wide acceptance by the building industry as a productivity enhancement vehicle by creating a single electronic repository of building data. This BIM model can be used from the earliest design stages of architectural modeling to commissioning and construction completion. In several instances, the BIM model is seen as a living digital representation of the building that is updated and maintained throughout the life of the building. This session features BIM industry experts that have implemented BIM

Visit [www.ashrae.org/seattle](http://www.ashrae.org/seattle) for updated conference information.



requirements in real-life projects and provide tips and tricks for ASHRAE members to work with BIM models

**BIM for Constructability and Clash Detection**  
Michael Smith, P.Eng., Integration Corporation, Houston, TX  
**The Evolution of BIM from Design to Construction: Case Studies**  
Ra Satty, P.Eng., Member, Satty and Associates, Washington, DC

**BIM Workflow for Energy Modeling**  
Chien Si Hartman, Carmel Software Corporation, San Rafael, CA

**Tuesday, July 1,  
8 a.m. – 9:30 a.m.**

**CONFERENCE PAPER SESSION  
(INTERMEDIATE)**

**Energy Use and Technologies of High Performance Buildings**  
*Track: Research Summit*

*Sponsor: 04.10 Indoor Environmental Modeling, 05.03 Room Air Distribution*

It is evident that none of the influencing factors alone, including region, climate, technologies and building size, is determinant of the EUI. Achieving high energy performance calls for a holistic approach of integrated design and operation by considering climate, technology, operation and maintenance as well as human behavior

**Revisit of Energy Use and Technologies of High Performance Buildings**

Chang Yu, Ph.D. and Tianzhan Hong, Ph.D., Member, Lawrence Berkeley National Laboratory, Berkeley, CA  
**Energy Performance of Major Types of Building Envelope in the Hot Summer and Cold Winter Zone of China**

Yun Zhang, Guocui He, Ph.D. and Sanming Zhang, Zhejiang University, Hangzhou, China  
**Performance Based Building System Evaluation for DOE Energy Asset Score**

Suorlya Goal, Nora Wang, Michael Rosenberg and Yushali Mendon, Member, Pacific Northwest National Laboratory, Richland, WA

**Development of a Probabilistic Graphical Energy Performance Model for an Office Building**

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

**Advanced Lighting Controls: A New Frontier in BMS**

Edwin Poland, DNV KEMA, Wheaton, IL

**CONFERENCE PAPER SESSION  
(INTERMEDIATE)**

**Monitoring of Ground Source Heat Pump Systems**  
*Track: Ground Source Heat Pumps*

*Sponsor: 06.08 Geothermal Heat Pumps and Energy Recovery Applications*

Careful monitoring of ground source heat pump systems can provide a wealth of information—providing guidance for future designs as well as allowing performance of the monitored system to be optimized. Presentations in this session describe monitoring of four real world systems.

**Eight Years of Operation of 616-Ton Geothermal Nursing Home in Northern Tier**

Carl D. Ohio, Member, Water Energy Distributors, Inc., Hampstead, NH

**Real-World Geothermal: Measured Performance and New Approaches**

Stephen A. Hamstra, P.E., Member, Greensieves LLC, Zealand, MI  
**Case Study of a Central GSHP System in a Warehouse**

Xiaobing Liu, Ph.D., Member and Mini Malhotra, Oak Ridge National Laboratory, Oak Ridge, TN

**Importance of Monitoring GSHP System Operation**

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

**SEMINAR (INTERMEDIATE)**

**Airborne Particle and Bacteria Control Technologies and Flow Demand Control for Energy Conservation in Critical and Controlled Environments**

*Track: Indoor Environment*  
*Sponsor: 09.11 Clean Spaces, 09.06 Healthcare Facilities*

*Chair: Peter B. Gardner, P.E., Member, Torcon, Inc., Red Bank, NJ*

Reduction of airborne particle and microbial contaminations has been one of the main focuses in design and operation of critical and controlled environments such as cleanrooms, labs, operating rooms and isolation rooms, etc., while these environments typically consume much higher energy than office spaces. The speakers present recent developments and innovative practices: Particle generation and dispersion by human

transfer loss then apply it in high temperature cooling and low temperature heating system. The seminar introduces the current progress of Annex 59

**The Effects of Patient Movement on Particles Dispersed by Coughing in a Calm Indoor Environment**

Yanzheng (Don) Guan, Ph.D., P.E., Member, Alamelu Ramesh, P.E., Member and Farhad Memarzadeh, Ph.D., P.E., Member, National Institutes of Health, Bethesda, MD

**Infection Control in Hospitals by Real-time Bacteria Control**

Rupert Mack, P.E., Member, Weiss Klimatischnik GmbH, Reiskirchen Understruth, Germany

**Clean Environment Energy Conservation by Flow Demand Control Based on Particle Sensing**

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

**SEMINAR (INTERMEDIATE)**

**Chiller Efficiency and 90.1: Where Do We Go From Here?**

*Track: Standards, Guidelines and Codes*  
*Sponsor: 08.02 Centrifugal Machines*

*Chair: Susanne Hanson, Member, Trane, LaCrosse, WI*

90.1-2013 raised chiller efficiency for most equipment types and sizes, and the Standard is now believed to be approaching technological or cost-justification limits. This seminar explains the 90.1-2013 changes and identifies the constraints of present technology, including the impact of past and future refrigerant transitions. Where are the remaining opportunities for advancing chiller efficiency in a cost-justified Standard? Regional requirements, system efficiency, operational requirements, enforcement and certification, and in situ monitoring will be discussed.

**90.1 Chiller Efficiency: Today and Future**

Richard Lord, Member, Carrier Corp., Murfreesboro, TN

**90.1 Chiller Efficiency and the Real World**

Paul Kozlov, Smart, Victoria, Australia

**SEMINAR (ADVANCED)**

**Energy Efficiency in Commercial Foodservice: Experiences with LEED and Energy Modeling**

*Track: Professional Skills*  
*Sponsor: 05.10 Kitchen Ventilation*

*Chair: Don Fisher, P.Eng., Associate Member, PG&E Food Service Technology Center, San Ramon, CA*

A motivating force for "sustainability" in the restaurant business is the energy and water savings. The foodservice industry has embraced the LEED building labeling program with tempered enthusiasm. But designing a LEED restaurant or commercial kitchen is not without its challenges. Up to 75% of the energy consumed in a foodservice facility is driven by the process loads. A modeler needs a comprehensive understanding of the process loads if one is to derive accurate predictions for energy use in a restaurant. This seminar presents real-world experiences with foodservice LEED projects and energy modeling. **Estimating Food Process Loads: Loaded with Uncertainty**

Yaron A Smith, P.E., Associate Member, Smith Energy Engineers, Niles, CO

**Experiences in Designing and Constructing a LEED Cafeteria on the NREL Campus**

Rick M. Langner, National Renewable Energy Laboratory, Golden, CO

**Practical Approaches to Developing and Using Energy Models for LEED Restaurants**

Adam R Jarboe, Member, YUM! Global Engineering, Louisville, KY

**SEMINAR (ADVANCED)**

**IEA EBC Annex 59: High Temperature Cooling and Low Temperature Heating in Buildings**

*Track: HVAC&R Fundamentals and Applications*

*Sponsor: 06.03 Central Forced Air Heating and Cooling Systems, 06.05 Radiant Heating and Cooling*

*Chair: Bjarne Olesen, Technical University of Denmark, Copenhagen, Denmark*

It is important to minimize temperature differences in heating, ventilation and air conditioning (HVAC) systems because high differences result in reduced efficiencies and therefore increased energy use. Annex59 is thus starting from a new perspective and from this is developing a novel concept for analyzing HVAC systems in buildings. The ultimate goal of the Annex is hence to: Build up new concept of analyzing HVAC system from the perspective of reducing mixture loss and

transfer loss then apply it in high temperature cooling and low temperature heating system. The seminar introduces the current progress of Annex 59

**Introduction of IEA ECBCS Annex 59**

Yi Jiang, Tsinghua University, Beijing, China

**Cooling Load Extraction: Radiant vs. Air System**

Stefano Corral, Politecnico di Torino, Torino, Italy

**Energy Monitoring of Thermally Activated Building Systems Coupled to Geothermal Heat Pumps**

Vincent Lemort, University of Liège, Liège, Belgium

**SEMINAR (INTERMEDIATE)**

**Indoor Air Quality and Comfort: Ventilation and Air-Conditioning**

*Track: Indoor Environment*  
*Sponsor: 05.03 Room Air Distribution, Publishing and Education Council*

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

This session offers a select group of recently published papers from the ASHRAE's HVAC&R Research regarding new developments in ventilation and air-conditioning technology to include research of displacement ventilation with a radiant floor heating/cooling system, and human response to convective and radiant cooling.

**Human Response to Local Convective and Radiant Cooling in a Warm Environment**

Arsen K. Malinov, Ph.D., Fellow ASHRAE, Technical University of Denmark, Lyngby, Denmark

**Experimental Study including Subjective Evaluations of Mixing and Displacement Ventilation Combined with Radiant Floor Heating/Cooling System**

Angela Simons, Ph.D., Member, Denmark Technical University, Kgs Lyngby, CA, Denmark

**Stratum Ventilation: A Solution to Elevated Room Temperature**

John Zhang Lin, Ph.D., City University of Hong Kong, Hong Kong, Hong Kong

**SEMINAR (INTERMEDIATE)**

**Tools and Methods to Manage Laboratory and Research Facilities for Effective and Efficient Long-term Operations**

*Track: Installation, Commissioning, Operation and Maintenance*

*Sponsor: 09.10 Laboratory Systems*

*Chair: Carol Donovan, Associate Member, Sebaste Blomberg & Associates, Woburn, MA*

Research facilities and biosafety laboratories present a unique challenge to designers, owners, and operators with their inherent complexity of systems, health and safety requirements, regulatory compliance, energy use intensity and environmental impacts. These mission critical facilities require continuous monitoring and commissioning and a team approach to communications between operators and users to ensure maximum system reliability and safe operations. The presenters in this seminar provide perspectives to broaden our understanding of how complex laboratory systems and operations can be combined with quality facility management and commissioning to achieve effective and efficient long-term operations.

**Annual Biocontainment Performance Verification**

Scott Rupp, Kansas State University, Manhattan, KS

**Use of Specialized Commissioning Tests to Maximize Performance of VAV Lab Ventilation Systems**

Thomas Smith, Member, Exposure Control Technologies, Inc., Cary, NC

**12 Things You Need to Know About Monitoring-Based Commissioning (MBCx)**

Craig Engelbrecht, Siemens Technologies, Buffalo Grove, IL

**Annual Biocontainment Performance Verification**

Scott Rupp, Kansas State University, Manhattan, KS

**Use of Specialized Commissioning Tests to Maximize Performance of VAV Lab Ventilation Systems**

Thomas Smith, Member, Exposure Control Technologies, Inc., Cary, NC

**12 Things You Need to Know About Monitoring-Based Commissioning (MBCx)**

Craig Engelbrecht, Siemens Technologies, Buffalo Grove, IL

**Annual Biocontainment Performance Verification**

Scott Rupp, Kansas State University, Manhattan, KS

**Use of Specialized Commissioning Tests to Maximize Performance of VAV Lab Ventilation Systems**

Thomas Smith, Member, Exposure Control Technologies, Inc., Cary, NC

**12 Things You Need to Know About Monitoring-Based Commissioning (MBCx)**

Craig Engelbrecht, Siemens Technologies, Buffalo Grove, IL

**Annual Biocontainment Performance Verification**

Scott Rupp, Kansas State University, Manhattan, KS

**Use of Specialized Commissioning Tests to Maximize Performance of VAV Lab Ventilation Systems**

Thomas Smith, Member, Exposure Control Technologies, Inc., Cary, NC

**12 Things You Need to Know About Monitoring-Based Commissioning (MBCx)**

Craig Engelbrecht, Siemens Technologies, Buffalo Grove, IL

**Annual Biocontainment Performance Verification**

Scott Rupp, Kansas State University, Manhattan, KS

**Use of Specialized Commissioning Tests to Maximize Performance of VAV Lab Ventilation Systems**

Thomas Smith, Member, Exposure Control Technologies, Inc., Cary, NC

**12 Things You Need to Know About Monitoring-Based Commissioning (MBCx)**

Craig Engelbrecht, Siemens Technologies, Buffalo Grove, IL

**Annual Biocontainment Performance Verification**

Scott Rupp, Kansas State University, Manhattan, KS

reduce costs in cleanroom construction, energy consumption, and maintenance; and another presentation reveals new ASHRAE research findings of room pressure control technologies and airflow use and the newly released ASHRAE "Pressure Differential Table" for cleanrooms

**Computational Tool for Energy Consumption Prediction for Cleanroom Facilities and Applicability Study for Standards and Design Guides**

Shih-Chiang Hsu, Ph.D., Member, Chang Kang Chang and Yi Sun Chang, National Tsing Hua University of Technology, Taipei, Taiwan

**Good Practices of Contamination Control in Clean Manufacturing: Case Study and Beyond**

Vinod P (V.P.) Gupta, P.E., Member, SM, St. Paul, MN

**Updated Cleanroom Design Guidelines from Recent ASHRAE Pressure Differential and Airlock Studies**

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

**SEMINAR (INTERMEDIATE)**

**Developing Airflow and Thermal Models for Data Centers: Comparing and Contrasting the Design and Operation Use Cases**

*Track: HVAC&R Fundamentals and Applications*

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

*Chair: Nick Gangemi, Member, Facility Gateway Corp., Fenfield, NY*

Enterprise data centers require significant cooling. CFD modeling can be used for a variety of tasks from conceptual design, through assessment, to operational deployment decisions to maximize the data hall availability, capacity and efficiency. With increasing use, a variety of tools and modeling strategies have been developed. What can be achieved, and how quickly, will depend on the modeling tool sophistication and the user's modeling decisions. This session looks at concept and operation to enable prospective users to understand the different approaches for different uses and the skills they will need to be effective.

**Airflow and Thermal Modeling for the Design of Data Centers**

James VanSloer, P.E., Member, Schneider Electric, Billerica, MA

**Calibration: Developing a Useful Airflow and Thermal Model to Maximize DC Availability Capacity and Efficiency**

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

**SEMINAR (INTERMEDIATE)**

**Controls**  
*Track: HVAC&R Systems & Equipment*  
*Sponsor: 01.04 Control Theory and Application, Publishing and Education Council*

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

This session offers a select group of recently published papers from the ASHRAE's HVAC&R Research on new developments in model predictive controls and virtual airflow meters.

**Implementation of Model Predictive Control for an HVAC System in a Mid-Size Commercial Building**

Russell Taylor, Ph.D., Member, United Technologies Research Center, East Hartford, CT

**Investigations of a Virtual Airflow Meter Using Projected Motor and Fan Efficiencies**

Gang Wang, Ph.D., University of Miami, Coral Gables, FL

**SEMINAR (INTERMEDIATE)**

**Liquid Desiccant Dehumidification as a Way to Enhance IAQ and DOAS System Performance**

*Track: HVAC&R Systems & Equipment*  
*Sponsor: 08.12 Desiccant Dehumidification Equipment and Components*

*Chair: Michael S. Sherber, P.E., Member, PPL SavageALERT, Inc., Rocky Hill, CT*

This session describes how liquid desiccant systems can enhance indoor air quality and the performance of dedicated outside air systems (DOAS) in building HVAC systems.

**Improving Indoor Air Quality with Liquid Desiccant Air Conditioning**

Phil C. Farnse, Ph.D., Member, Advantix Systems, Sunrise, FL

**First Results of Testing and Demonstration Program of a Membrane Liquid Desiccant DOAS System**

Peter Vandermolen, Associate Member and Eric Kozubal, Member, INTRAC Technologies, Woburn, MA, (R) National Renewable Energy Laboratory, Golden, CO

**SEMINAR (INTERMEDIATE)**

**What The Well?**  
*Track: Ground Source Heat Pumps*  
*Sponsor: 06.08 Geothermal Heat Pumps and Energy Recovery Applications*

*Chair: Chris Gray, P.E., Member, Southern Company, Birmingham, AL*

The Research Summit will present innovations in HVAC&R research.



## 6 2014 ASHRAE Annual Conference Technical Program

Believe it or not, for geothermal heat pump systems to be GEOTHERMAL heat pumps, they must tie into the Earth... Yup, it's true! The series of GSHP sessions continue with a focus on considerations for components outside the building. Design considerations for closed loop systems including material selection, sizing, and applicable codes are covered. Following this is a discussion of surface water heat pumps and a research update on surface water heat exchangers. Finally a highly experienced driller shares common pitfalls made during well/loop design and give some suggestions to save time and money.

**Closed Loop Ground Heat Exchangers from the Ground Up (or Down)**  
Kim T. Misner, PE, Member, CM Engineering, Inc., Columbia, MO

**Design Tools for Surface Water Heat Pump Systems**  
Jeffrey Sottler, Ph.D., PE, Oklahoma State University, Stillwater, OK

**Geothermal Design Effects on Installation**  
Russell Burns, LoopTech International, New Waverly, TX

**WORKSHOP (INTERMEDIATE)**

**A Multi-Dimensional View of HVAC Maintenance**

**Track: Installation, Commissioning, Operation and Maintenance**

**Sponsor: 07.03 Operation and Maintenance Management**

**Chair: Robert G. Baker, Fellow ASHRAE, BBI Consulting Service, Riverview, FL**

Standard 180 (Inspection and Maintenance of Commercial Building HVAC Systems), first published in 2008 has achieved broad acceptance. In addition, it is referenced in both the UMC and IMC. Codes and groups in California have put considerable effort into building utility incentive programs around it designed to improve the level and quality of maintenance of rooftop units in that state. This seminar explores the success of the various applications of the standard from different vantage points; the Design Engineer, Service Provider, Building Owner and Regulatory Authority.

**The Contractor/Service Provider**  
Mike Gallagher, PE, Member, Western Allied Corp., Santa Fe Springs, CA

**The Building Owner/Engineer**  
Richard A. Davis, Member, NASA, Cleveland, OH

**Tuesday, July 1,  
11 a.m. – 12:30 p.m.**

**TECHNICAL PAPER SESSION (INTERMEDIATE)**

**Air Distribution Analysis of Terminal Units and VAV System Control**

**Track: Research Summit**

**Sponsor: 05.03 Room Air Distribution**

These papers are meshed together on two simple topics: variable air volume (VAV) terminal units and diffusers. Two papers are based on the performance of VAV boxes and how they assist in energy reduction and personal comfort. Two others discuss the impact of the air pattern and distribution in the space. And finally a session that ties these together to utilize static pressure reset.

**Energy Efficient Static Pressure Reset in VAV Systems**  
Yin Ma, University of Dayton, Dayton, OH

**Numerical Study of a Ventilation System Based on Wall Confluent Jets**  
Satoru Janabara, Linköping University, Linköping, Sweden

**Preliminary Test and Analysis of a Stirling Engine Based Residential Tri-generation System at TRCA Archetype Sustainable House**  
Navid Barami, Ryerson University, Toronto, ON, Canada

**Characterizing Airflow and Power of VAV Series Fan-Powered Terminal Units from Component Data: Part 1**

Peng Yin, Student Member, Texas A&M University, College Station, TX

**Characterizing Airflow and Power of VAV Series Fan-Powered Terminal Units from Component Data: Part 2**

Peng Yin, Student Member, Texas A&M University, College Station, TX

**CONFERENCE PAPER SESSION (INTERMEDIATE)**

**Methods to Predict and Verify Outstanding IEQ**

**Track: Indoor Environment**

Design of superior indoor environments requires attention to several factors including lighting, sound, air movement, contaminant

transport and thermal comfort. The papers in this session describe models, laboratory tests and field measurements that advance the state-of-the-art in indoor environmental design.

**Effect of Wall Exhaust and Spill Locations on Indoor Air Quality in a Chemical Laboratory**  
Essam E. Khalil, Ph.D., Fellow ASHRAE, Sami Morad, Dr.ing., Mahmoud Fouad, Dr.ing., Member and Ayman Shabaan, PE,Eng., Cairo University, Cairo, Egypt

**Annual Daylight Glare Evaluation for Typical Perimeter Offices: Simulation Models Versus Full Scale Experiments Including Shading Controls**

Ying Chien Chan, Student Member, Iason Konstantos, PE, Student Member and Athanasios (Thanos) Tzampelakos, Ph.D., Member, Purdue University, West Lafayette, IN

**Transport of Respiratory Aerosols in Patient Corridors Subject to Directional and Non-Directional Airflow: A Case Study**  
Ehsan S. Mousavi Riz, Student Member and Kevin R. Grosskopf, Ph.D., Associate Member, University of Nebraska, Lincoln, NE

**Assessment of the Indoor Environmental Quality in a Dutch Daycare Center**

Mark de Waard, Wim Zeller and Prokrijvan Dijksh, (1)TU Eindhoven, Eindhoven, Netherlands, (2)BBA, Rotterdam, Netherlands

**Determining Annoyance Thresholds of Tones in Noise**

Jennifer M. Francis, Joonhee Lee and Lily M. Wang, Ph.D., Member, University of Nebraska, Omaha, NE

**CONFERENCE PAPER SESSION (INTERMEDIATE)**

**New Developments in Simulation and Modeling of Ground Heat Exchangers**

**Track: Ground Source Heat Pumps**

**Sponsor: 06.08 Geothermal Heat Pumps and Energy Recovery Applications**

Simulation and modeling of ground heat exchangers is commonly used for both design and energy calculations of ground source heat pump systems. This session covers new developments in simulation and modeling of ground heat exchangers and interpretation of thermal response tests used to estimate thermal conductivity for simulation and design of ground heat exchangers.

**A New Hybrid Model for Bore Field Heat Exchangers Performance Evaluation**

Damien T. S. Picard, Ph.D., Catholic University of Leuven (KU Leuven), Leuven, Belgium

**The Effect of Natural Convection on Thermal Response Test**

Wonjun Choi and Ryozo Ooka, Ph.D., Affiliate, University of Tokyo, Tokyo, Japan

**Experimental Validation of a Numerical Model for the Thermal Response of a Borehole Field**  
Patricia Monzó, PE,Eng., Félix Ruiz Calvo, PE,Eng., José Acuña, Ph.D., and Carla Montagud, Ph.D., (1) Royal Institute of Technology, Stockholm, Sweden, (2) Universitat Politècnica de València, Valencia, Spain

**An Alternative to ASHRAE's Design Length Equation for Sizing Borehole Heat Exchangers**  
Mohammadamin Akhmetov and Michel Bernier, Ph.D., Member, Ecole Polytechnique de Montreal, Montreal, QC, Canada

**CONFERENCE PAPER SESSION (INTERMEDIATE)**

**Fire and Smoke Safety Design for Large and Tall Buildings**

**Track: HVAC&R Fundamentals and Applications**

**Sponsor: 05.06 Control of Fire and Smoke**

Proper design of a smoke control system requires that specific fire scenarios including design fires need to be analyzed, taking into account the characteristics of each project. Fire data on temporal combustion characteristics that define design fires, such as heat release rates, temperatures, radiant heat flux, smoke and composition of fire gases for different fire scenarios are indispensable in carrying out fire safety engineering analysis and design of buildings. This session also presents a hand calculation method of analyzing high-rise smoke movement based on an analytical model and its solution to the coupled heat and mass transfer through shafts.

**Design Fires for Large and Tall Buildings**  
John H. Kote, Ph.D., PE., Fellow ASHRAE, Fire and Smoke Consulting, Leesburg, VA

**Results of Fire Experiments to Quantify Residential Design Fires**

Alex Sivaliya, Ph.D., Ahmad Kashaif, Ph.D., PE., Member and Gary Loughhead, Ph.D., National Research Council Canada, Ottawa, ON, Canada

**A Hand Calculation Method of Smoke Movement through High-Rise Building Shaft**  
Daniel (Danny) Qi, Student Member, Langshan (Luon) Wang, Ph.D., Member and Radu Zmeureanu, Ph.D., Member, Concordia University, Montreal, QC, Canada

**CONFERENCE PAPER SESSION (INTERMEDIATE)**

**Evaluating Building Performance for Real Cost Saving Options**

**Track: Installation, Commissioning, Operation and Maintenance**

**Sponsor: 07.06 Building Energy Performance, 07.09 Building Commissioning**

This session provides building energy modeling ideas to reduce the difference between modeled energy consumption with metered energy consumption and how these models can be used to evaluate energy conservation methods during the measurement and verification process. It also addresses quantitative airtightness testing that is required in some energy codes and ways to maximize boiler efficiency at part-load conditions.

**Building Enclosure Airtightness Testing in Washington State: Lessons Learned About Air Barrier Systems and Large Building Testing Procedures**

Graham Fitch, PE,Eng., Associate Member, RDH Building Engineering Ltd., Vancouver, BC, Canada

**Targeted Calibration of Energy Models for Existing Buildings**

Ery Dunaevy, Ph.D., Member and Kevin Van Den Wyndenberg, University of Idaho, Boise, ID

**Use Calibrated Whole Building Energy Model to Disaggregate Retrofit Savings and Evaluate Demand-Response Strategies**

Ke Xu, Ph.D., Associate Member, James Fraihaut, Ph.D., Fajam Digiosaphal, Ph.D., Scott Wagner and Mark Stutzman, Member, (1)The Pennsylvania State University, Philadelphia, PA, (2)The Pennsylvania State University, University Park, PA

**Case Study: Optimization of an Industrial Steam Boiler System Operation**

Bai Zhang, Ph.D., Student Member, Yunhua Li, Ph.D., Student Member and Mingsheng Liu, Ph.D., PE., Member, Best-Tech Inc., Omaha, NE

**SEMINAR (INTERMEDIATE)**

**Advances in Low GWP Refrigerants**

**Track: Refrigeration**

**Sponsor: 03.01 Refrigerants and Secondary Coolants, MTG: Lower GWP Alternative Refrigerants**

**Chair: Barbara Minor, Member, DuPont, Wilmington, DE**

Significant progress is being made in the development and testing of low GWP alternatives to HFC and HCFC refrigerants. This seminar focuses on applications of refrigerant development, including air conditioning, high temperature heat pumps and refrigeration. Of particular concern is development of new refrigerants for air conditioning that perform well at high ambient temperatures. Some regions are just beginning their transition away from HCFC-22 and are looking for low GWP HCFC-22 alternatives with similar performance. Considerations for the Development of Sustainable Refrigerants for Air Conditioning  
Thomas J. Leok, Ph.D., Member, DuPont de Nemours and Company, Wilmington, DE

**Refrigerant/Lubricant Properties of New Low GWP Options**  
Gregory Smith, Honeywell, Buffalo, NY

**Zero-ODP, Low-GWP Working Fluids for High Temperature Heat Pumps**  
Konstantinos Kontomaris, Ph.D., Member, DuPont, Wilmington, DE

**Sustainable Refrigerant Solutions for HVAC&R**  
Laurent Abbas, Ph.D., Associate Member, Arkema Inc., King of Prussia, PA

**SEMINAR (INTERMEDIATE)**

**Gain Market Recognition by Elevating Your Firm's Brand & Social Media for Business: Are YOU Taking Advantage of It?**

**Track: Professional Skills**

**Sponsor: Electronic Communications Committee**  
Chair: Karine Leblanc, Member, US Air Conditioning Distributors Engineering, City of Industry, CA

Gaining market recognition in today's technology-obsessed world is easy when you position yourself as a technical expert by writing white papers, trade publication articles or even posting your ideas on social media sites. With 1 billion Facebook users, 645M Twitter users and 370 more apps, it's no wonder that businesses are moving forward with the social media era—ASHRAE being one of them. This session proves to you WHY you need to be published and WHAT it takes to make it happen.

**The Who, What, Where, When and Why of Getting Published**  
Mind L. Buzman, Zisman Media, Chicago, IL

**What Works and What Doesn't Work**  
Mary Moore, Member, Sylla Hennessy Group, Fairfax, VA

**Reputoring it All**  
Tony Kempa, Environmental Systems Design, Chicago, IL

**Social Media for Business: Are You Taking Advantage of It?**  
Karine Leblanc, Member, US Air Conditioning Distributors Engineering, City of Industry, CA

**SEMINAR (INTERMEDIATE)**

**Measuring Commercial HVAC Performance through Load-Based Testing**

**Track: Standards, Guidelines and Codes**

**Sponsor: 08.11 Unitary and Room Air Conditioners and Heat Pumps, co: 8.7, 07.06 Building Energy Performance**

**Chair: Mira Vovies, Member, Bonneville Power Administration, Portland, OR**

Load-based testing is intended to better represent the energy consumption of HVAC equipment in real-world conditions, especially variable capacity and climate-specific systems and accessories. Rather than testing at a fixed entering condition, load-based testing targets various loads and ambient conditions, to develop a performance map for the system. It is also intended to capture the impact of accessories, like economizers, variable speed components, staging, evaporative strategies and control algorithms. This seminar covers the need for unitary commercial equipment load-based testing and several approaches to develop system performance maps.

**The Shortcomings of Traditional Single-Number Efficiency Metrics, and the Potential Value of a Load-Based Rating Method**

Dan Berman, Member, Western Cooling Efficiency Center, Davis, CA

**Research to Develop and Use a Load-Based Method of Test**

Field Hart, PE, Member, Pacific Northwest National Laboratory, Richland, WA

**Load-Based Testing of Variable Refrigerant Flow Systems**

Ron Dimitrovo, Ph.D., Member, EPRI, Knoxville, TN  
**Laboratory and Field Performance Testing of Climate-Appropriate Commercial Air Conditioners**

Jonathan Woolley, Member, University of California, Davis

**Tuesday, July 1,  
1:30 p.m. – 3 p.m.**

**SEMINAR (INTERMEDIATE)**

**Case Studies of Energy Reduction in Existing Buildings: Lessons Learned on How Involving Owners and Operators in Design and Execution Creates Successful Long Term Results**

**Track: Installation, Commissioning, Operation and Maintenance**

**Sponsor: 09.01 Large Building Air-Conditioning Systems**

**Chair: Rachel Romero, Associate Member, NREL, Golden, CO**

This seminar presents three case studies illustrating how involving owners and operating/maintenance personnel during design and construction results in buildings that are more successful and perform better over the long term. When planning and designing for energy efficient systems, projects benefit significantly from user and operator input. Operating and maintenance personnel have experiences that most designers do not. Their insight is critical to a successful project, especially for integrated design and sustainability. A higher education laboratory, an electric company headquarters building, and a government office building focus on lessons learned from the project.

**Saving Energy in the Electric Company Headquarters Building, Rebuilding HVAC Systems while Occupied**

John Kuempel Jr., PE, Member, DeBra Kuempel, Mechanical/Electrical, Chino, OH

**Commissioning and Maintaining a Building during a Floor-By-Floor Renovation**  
Steven Norkas, EMCOR Government Services, Arlington, VA

**Retrofits for Laboratory Buildings**  
Kellie P. Cramm, PE, Member, Henderson Engineers, Lenexa, KS

**Tuesday, July 1,  
3:15 p.m. – 4:45 p.m.**

**SEMINAR (ADVANCED)**

**The Road to Success With the New Refrigeration Commissioning Guide**

**Track: Refrigeration**

**Sponsor: Refrigeration Committee, TC10.7, TC3.01, TC2.8, 08.01 Positive Displacement Compressors**

**Chair: Georgi S. Kazachki, Ph.D., Fellow ASHRAE, Dayton Phoenix Group, Inc., Dayton, OH**

Refrigeration systems account for a



significant portion of commercial building energy use and are often the largest energy end use in food and beverage facilities. The goal of this seminar is to introduce the newly developed Refrigeration Commissioning Guide for Commercial and Industrial Systems and to illustrate the benefits of its proper application.

#### Development of the New Refrigeration Commissioning Guide

Richard R. Royce, PE, Member, Walmart, Bentonville, AR  
Commissioning during Planning and Design  
Caleb Carl Nelson, PE, Member, CTA, Missoula, MT  
Commissioning during Construction and Installation  
Bryan Bellor, PE, Member, Source Refrigeration and HVAC, Anaheim, CA

Commissioning During Start-up and First-Year Operation  
Jason Robbins, PE, Member, Walgreens, Springfield, IL

## Wednesday, July 2, 8 a.m. – 9:30 AM

### TECHNICAL PAPER SESSION (INTERMEDIATE)

#### CFD and Hand Calcs: Fan Pressure, Duct Fittings, and Smoke Control

Track: Research Summit

Sponsor: 05.06 Control of Fire and Smoke, 05.01 Fans

When analyzing the effects of air flow and pressures within a duct or a large open space, analytics or CFD modeling can be utilized. In this session, the improved computational relations, effects of airflow disturbances, and smoke control are addressed.

#### Improvement of Computational Relations for Fan Pressures in HVAC Systems

Mihail Nudelman, Hill Mechanical Services, Vernon Hills, IL  
Analyzing the Effects of Air Flow Disturbances on Measurement and Control Equipment  
Positioned Downstream and Close to an Air Duct Elbow for the Purpose of Optimizing System Performance using a CFD Technique  
Ali Hasan, Parsons Int. Inc., Doha, Qatar

Critical Ventilation Velocity and Smoke Control: Part 1, A Preliminary Analysis of Uncertainty  
Kai Kang, Ph.D., Member, KAI Consulting Engineers, Nanjing, NJ

Critical Ventilation Velocity and Smoke Control: Part 2, Application Considerations using Example of Jet Fan Ventilation  
Kai Kang, Ph.D., Member, KAI Consulting Engineers, Nanjing, NJ

### CONFERENCE PAPER SESSION (INTERMEDIATE)

#### Radiant Cooling, District Energy and Multi-Objective Optimization

Track: Research Summit

Sponsor: 07.06 Building Energy Performance

Residential buildings with high performance thermal enclosure and thermal mass have been demonstrated to have minimal (3°F to 4°F) daily temperature swings. When such buildings are constructed on concrete slab foundations it is possible to cool the mass using radiant distribution and to use the floor mass to delay the delivery of cooling to times when lower outdoor temperatures favor the performance of air-to-water vapor compression cooling systems (chillers or reverse cycle heat pumps). This session also investigates the extent to which the procedure options of stepwise regression analysis influence the measurements of variables sensitivities.

Improving EER with Off Peak Radiant Cooling  
David Springer, Member, Davis Energy Group, Davis, CA  
Investigating the Potential of Residential District Energy  
Nelson Pumo, Ph.D., Member, Vicente Bortone, PE<sup>1</sup>, Juan Carlo Zambrano, PE<sup>2</sup>, Affari<sup>3</sup> and Alayari Zambrano<sup>4</sup>, (1)The University of Texas at Tyler, Tyler, TX, (2) Johnson Controls Inc., Lenexa, KS, (3)Universidad Nacional Experimental de Technia, San Cristobal, Venezuela

Polymeric Hollow Fiber Heat Exchangers: Liquid-to-Gas Application  
Ilya Astroussi and Miroslav Raudensky, Brno University of Technology, Brno, Czech Republic

A Comparison of Approaches to Stepwise Regression Analysis for Variables Sensitivity Measurements Used with a Multi-Objective Optimization Problem  
Mengchao Wang and Jonathan Wright, Loughborough University, Loughborough, United Kingdom

### CONFERENCE PAPER SESSION (INTERMEDIATE)

#### Natural Ventilation, UFAD, Dilution Ventilation Systems and Thermal 3-D Modeling

Track: Research Summit

With the focus on low energy and sustainable buildings today, building

designers, engineers and researchers alike increasingly attempt to incorporate natural ventilation, UFAD and whole building dilution in innovative building practices. Implementing effective energy saving measures for the building's HVAC system can reduce building energy consumption, reduce peak demand, and improve building comfort for the occupants. A fully automatic approach to construct a 3-D thermal model of the building interior, which can potentially be used for automated building retrocommissioning will also be addressed.

#### Wind-Driven Airflow through Various Building Openings: Preliminary Results from Experimental Fluid Mechanics Using Particle Image Velocimetry

L. James Lo, Ph.D., Member, National Institute of Standards and Technology, Gaithersburg, MD  
Automatic Generation of Thermal 3D Point Clouds of Building Interiors  
Omar Orefice, Ph.D. and Avidah Zakhor, Ph.D., University of California, Berkeley, Berkeley, CA

#### Multizone Air Change and Airflow in Two Houses under Operation of Different Whole-Building Ventilation Systems

Armin Rudd, Member, ABT Systems LLC, Annville, PA  
Performance Study of an Underfloor Air Distribution System in an Education Building to Identify Building Energy Efficiency Improvement Opportunities  
Juan Zhao, Ph.D., Associate Member, Vasily Khrmalenko and James Watt, Texas A&M University, College Station, TX

### CONFERENCE PAPER SESSION (INTERMEDIATE)

#### Retro-Commissioning Effectiveness

Track: Installation, Commissioning, Operation, Maintenance of Existing Buildings  
Sponsor: 07.09 Building Commissioning, TRG7 Tools for Sustainable Building Operations, Maintenance and Cost Analysis

Retrocommissioning, as a systematic process for identifying and improving less-than-optimal energy performance in an existing building's equipment and control systems, is arguably one of the most cost effective strategies for reducing energy consumption in buildings. Possible detectable HVAC deficiencies in energy consumption data are explored. Development of a building cluster emulator for building/building and building/grid operation optimization are introduced.

#### Residential HVAC Commissioning through Energy Consumption Data Analysis

Writen S. Catin, Student Member and Alla Novoselco, Ph.D., Member, University of Texas at Austin, Austin, TX  
Corridor Pressurization System Performance in Multi-Unit Residential Buildings  
Lorne Fioratti, Student Member and Graham Finch, P.Eng., Associate Member, RHM Building Engineering Ltd., Vancouver, BC, Canada

Net-Zero Energy Impact Building Clusters Emulator for Operation Strategies Assessment  
Xiwang Xu, Student Member and Jin Wen, Ph.D., Member, Drexel University, Philadelphia, PA

The Potential Energy Efficiency of a Hybrid Designed House: A Post-Occupancy Case Study on the Heating and Cooling System  
Shan He and Ulrich Passer, Iowa State University, Ames, IA

The Investigation into Retro-Commissioning Effectiveness in Tropical Climate  
Liliana Marjanovic Halburd, Ph.D.<sup>1</sup> and Challa Veru Kumar, Member<sup>2</sup>, (1) University College London, London, United Kingdom, (2) Energy Conservation Sg (Comfort Management Pte. Ltd.), Singapore

### SEMINAR (INTERMEDIATE)

#### Extending ASHRAE's Impact: How Savings Verification Software Tools Implement Guideline 14's Methods to Raise Investor Confidence

Track: Standards, Guidelines and Codes

Sponsor: 04.07 Energy Calculations  
Chair: Chris Balbach, RE, Member, Performance Systems Development, Ithaca, NY

ASHRAE Guideline 14 provides savings verification methods that increase investor confidence in building efficiency projects. However, widespread acceptance of its methods is still lacking. Open-source and proprietary software verification tools have gained popularity and bridge this gap, but stakeholders have little guidance in assessing their accuracy. This seminar demonstrates public domain tools capable of generating ASHRAE compliant savings estimates. A recently completed project that developed methods and a protocol for testing these tools are discussed. The need for a standard method of test for inverse modeling tools is explored.

User-Friendly M&V based on ASHRAE Guidelines with a Free and Flexible Spreadsheet Add-in  
William Kuran, PE, Member, NorthWest, Inc., Lake Oswego, OR

#### Cost-Effective Accurate and Free Public Domain Building Energy Performance and Savings Analysis Tool

David A. Jumo, Ph.D., PE, Member, Quantum Energy Services & Technologies, Inc., Berkeley, CA

#### Unlocking Automated M&V: Assessment of Energy Baseline Model Accuracy

Jessica Granderson, Ph.D., Lawrence Berkeley National Laboratory, Berkeley, CA

### SEMINAR (INTERMEDIATE)

#### Ground Source Systems Commissioning and Closeout: Unique Issues, Avoiding Fatal Flaws and Ensuring Client Satisfaction

Track: Ground Source Heat Pumps

Sponsor: 06.08 Geothermal Heat Pumps and Energy Recovery Applications, 07.09 Building Commissioning

Chair: Cary Smith, Member, Sound Geothermal Corp., Sandy, UT

High performance ground source systems require a little TLC to properly bring them online and ensure that the system meets the design intent and owner's needs. This process begins during the design phase and continues through construction and start-up. The design team, commissioning agent, and general contractor need to be invested and engaged with the project. Properly executed, this will result in a well-tuned building system and a happy client. This seminar addresses some of the to-dos and not-to-dos during the process.

#### Commissioning and Close-Out Tips for Geothermal Heat Pump Systems: Addressing GHP Nuances to Meet the Design Intent and Owners Project Requirement

Michael Kuk, Member, Sleban Energy Associates, Chicago, IL

Best Practices for a Well-Integrated Geothermal Heat Pump System  
Lisa Maline, PE, Member, Maline Engineering Corporation, Sacramento, CA

Did the Client Get What They Were Promised?  
Kurt T. Bell, PE, Member, Harris Consulting Engineers, Las Vegas, NV

### SEMINAR (INTERMEDIATE)

#### Optimized Controls Strategies for Radiant Heating and Cooling

Track: HVAC&R Fundamentals and Applications

Sponsor: 06.05 Radiant Heating and Cooling  
Chair: Michael P. O'Rourke, Member, Barcol Air Ltd, Denver, CO

This seminar discusses and presents real-world design examples of how to apply controls to assure energy efficiency in radiant heating and cooling projects. Issues such as zoning, Standard 55 requirements as well as discussions of condensation controls and low mass vs. high mass system control issues are presented.

#### Condensation Avoidance and Optimizing Radiant Controls for Radiant Slab Systems

Daniel H. Nail, PE, Member, Thornton Tomasett Group, New York, NY

Residential Controls for Active Radiant Systems  
Hayden, PE, Member, gbH Engineering, Norfolk, VA

Occupant Comfort Control through Radiant Systems  
Peter Simmonds, Ph.D., Fellow ASHRAE, Stanco, Sherman Oaks, CA

Control of Radiant Systems for Energy Efficiency  
Fater Rumsey, Rumsey Energy Innovations, Oakland, CA

### SEMINAR (INTERMEDIATE)

#### Performance Monitoring: Get the Energy Savings You Were Promised

Track: Installation, Commissioning, Operation and Maintenance

Sponsor: 01.04 Control Theory and Application  
Chair: Marcelo Acosta, P.Eng., Member, Armstrong Fluid Technologies, Toronto, ON, Canada

Current energy performance standards require complex systems which more often than not are misunderstood by the construction, operations and maintenance teams. This leads to buildings never performing as promised or beginning to underperform soon after commissioning due to undetected malfunctions and operation misunderstandings. The speakers present the findings of a study by the Univ. of California quantifying the resulting energy waste: available solutions of different complexity and effectiveness; a successful solution implemented in large university campus in Massachusetts; and how the new ASHRAE Guideline 13 section on Performance Monitoring facilitates including preventive measures into building systems design.

Monitoring Based Commissioning: A Must in a World of High Energy Efficiency  
Mark Galsinger, Member, Armstrong Fluid Technologies, Toronto, ON, Canada

Achieve Savings and Rebates: Using Automated Diagnostics  
Dr. Nicholas T. Bayraktar, Ph.D., KGS Buildings, LLC, Cambridge, MA

Specifying Performance Monitoring with ASHRAE Guideline 13  
Dave Kamm, PE, Member, RMH Group, Lakewood, CO

## Wednesday, July 2, 9:45 a.m. – 10:45 a.m.

### CONFERENCE PAPER SESSION (INTERMEDIATE)

#### Demand Shifting, Duct Sealing and Particulate Concentrations: Three Peas in a Pod?

Track: Research Summit

This eclectic session starts with a new use of phase change materials to shift demand in cold storage facilities. Next come results from measurement of different sizes of particulate concentrations in two dozen hospital rooms followed by results from applying and testing a new duct sealing technology suitable for use in ducts with large leaks. What connects these papers? Each presents significant research results without a close companion topic among the research papers submitted.

#### A Paradigm Shift in Cold Storage Design: Using Thermal Mass and PCMs to Shift Demand off-Peak

R. Gary Black, PE<sup>1</sup> and Raymond C. Cole, PE, Member<sup>2</sup>, (1)University of California, Berkeley, Berkeley, CA, (2)Axiom Engineers, Monterey, CA

Airborne Particulate Concentrations in Hospital Rooms  
Larry Dlugosz, Ph.D., Member, NOAA, Silver Springs, MD

Cost Effective Lining Technology for Sealing and Rehabilitation of Deteriorated HVAC Ducts  
Ashis Kumar Roy<sup>1</sup>, Chris Bartlett<sup>2</sup>, Shrawan Alam, Ph.D.<sup>1</sup>, Eric N. Ailouche, Dr.Eng.<sup>1</sup> and Ravi Gorhala, Ph.D.<sup>1</sup>, (1) Louisiana Tech University, Ruston, LA, (2) Steven Winter Associates Inc., Norwalk, CT

### CONFERENCE PAPER SESSION (INTERMEDIATE)

#### Improving on the Fundamentals

Track: HVAC&R Fundamentals and Applications

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

These papers explore changes in three areas of Fundamentals: ASHRAE Standard 55 for thermal comfort and airflow perception; new methods for evaluating sound in ductwork; and energy conservation measures that utilize voltage reductions in residential air-conditioning systems.

#### Airflow Perception and Draught Rating for Varying Thermal Conditions

Ahmet Ugursal, Ph.D., Charles Culp, PE, Fellow ASHRAE, and Louis G. Tassinary, Ph.D., Texas A&M University, College Station, TX

Residential Split-System Performance in Utility Voltage Reduction Operation  
Arin Galvaz, Tam Short, John Bush, Associate Member, and Ron Domitrovic, Ph.D., Member, EPRI, Knoxville, TN

Analysis of Flow, Temperature, and Sound Propagation in HVAC Ducts Using Two-Ports  
Tamer Enaydi, Ph.D.<sup>1</sup>, Mina Waghi<sup>2</sup> and Mats Alam, Ph.D.<sup>3</sup>, (1)Alin Shams University, Cairo, Egypt, (2)KTH Marcus Wallenberg Laboratory, Stockholm, Sweden

### SEMINAR (BASIC)

#### Basics of HVAC Noise Control: Environmental Noise Impact and Mitigation

Track: HVAC&R Fundamentals and Applications

Sponsor: 02.06 Sound and Vibration Control  
Chair: Erik Miller Klein, PE, Member, SSA Acoustics, LLC, Seattle, WA

Environmental noise from exterior and exterior ventilating equipment is a common challenge and issue for engineers and equipment manufacturers. This session explores the current and future of environmental noise codes, how the presence of tones in environmental noise is a common cause for complaints, and feasible noise control options for the exterior equipment.

Environmental Noise Codes: Current and Future  
Erik Miller Klein, PE, Member, SSA Acoustics, LLC, Seattle, WA

The Presence of Tones in Environmental Noise  
Jennifer Francis, Student Member and Lily M. Wang, Ph.D., Member, University of Nebraska - Lincoln, Omaha, NE

Noise Control Solutions for Rooftop Equipment  
Dan LaForgia, Member<sup>1</sup> and Sami Ekhsazi<sup>2</sup>, (1)Vibro Acoustics, New York City, NY, (2)Vibro Acoustics, Markham, ON, Canada

The Technical Program will be held at the Washington State Convention Center.



## 8 2014 ASHRAE Annual Conference Technical Program

## SEMINAR (INTERMEDIATE)

## Central Plant GCHP Systems

Track: Ground Source Heat Pumps

Sponsor: 06.08 Geothermal Heat Pumps and Energy Recovery Applications

Chair: Michel Bernier, Ph.D., Member, Ecole Polytechnique De Montreal, Montreal, QC, Canada

Central plant GCHP systems use central water-to-water equipment to move thermal energy between the ground coupled heat exchanger, a chilled water loop, and a hot water loop. Here, the term "central plant" implies the mechanical equipment is in one centralized location and does not imply a campus is served. Real-life examples of central plant GCHP systems are presented in this seminar with an emphasis on design issues and on potential advantages of such system over decentralized GCHP systems.

## Central Plant GSHPs: Basic Considerations and Approaches

Scott F. Haackl, PE, Associate Member, Energy Center of Wisconsin, Madison, WI

## Central Plant GCHP for High Energy Efficiency Commercial Buildings

Roland Charneau, P.Eng., Fellow ASHRAE, Pageau Morel et Associés Inc., Montreal, QC, Canada

## SEMINAR (ADVANCED)

## Modeling Industrial Spaces

Track: Indoor Environment

Sponsor: 04.10 Indoor Environmental Modeling

Chair: Chao Hsin Lin, Ph.D., Fellow ASHRAE, The Boeing Company, Seattle, WA

There are specific ventilation requirements for various industrial indoor environments. The objectives of this seminar are: 1) to share the experience of applying numerical modeling techniques currently practiced or under development for industrial ventilation applications; and 2) to demonstrate the state-of-the-art of industrial ventilation and environmental control by using computational fluid dynamics tools and techniques.

## Indoor Environment and Energy Analysis for a Winery Building

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

## Exposure Control and Sustainability in Large Aircraft Painting Facilities

James S. Bennett, Ph.D., Member, NIOSH, Cincinnati, OH

## Reducing Hazardous Fume Concentration in Industrial Workplaces by CFD Analysis

Reza Ghias, Ph.D., Member, Southland Industries, Dulles, VA

## SEMINAR (BASIC)

## Radiant Heating and Cooling

System Design 101:

A Step-by-Step Approach

Track: HVAC&amp;R Fundamentals and Applications

Sponsor: 06.05 Radiant Heating and Cooling

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

The seminar takes designers through a step-by-step thermal-to-hydraulic calculation for a single zone embedded pipe radiant floor heating and cooling zone. Included will be discussion on how to use the Figure 9 Design Graph for Sensible Heating and Cooling with Floor and Ceiling Panels from the ASHRAE Handbook—HVAC Systems and Equipment.

## 12-Step Design Process for Embedded Pipe Radiant Systems

Robert Bean P(Eng.), R.E.T., Member, Indoor Climate Consultants Inc., Calgary, AB, Canada

## SEMINAR (INTERMEDIATE)

## Successfully Applying Sorption Technologies for Fun and Profit

Track: HVAC&amp;R Systems &amp; Equipment

Sponsor: 08.05 Adsorption and Heat Operated Machines

Chair: Erwin Gercek, P.E., Associate Member, Real Engineering Services LLC, Totowa, NJ

In this session, recent developments from efforts to develop gas-fired water heaters for residential and commercial applications are presented. In addition, comprehensive design considerations for ammonia-water binary system equipment are introduced for commercial manufacturers.

## Gas-fired Heat Pump Water Heaters

Kylie Glasserwamp, Ph.D., Student Member, Oak Ridge National Laboratory, Knoxville, TN

## Design Considerations for Ammonia-Water Binary System Equipment for Commercial Manufacturers

Samuel Leggett, Associate Member, Luvata HTS Americas, Granada, MS

## WORKSHOP (INTERMEDIATE)

## Achieving High Delta T: Keys to High-Performance District Energy Systems

Track: HVAC&amp;R Fundamentals and Applications

Sponsor: 06.02 District Energy

Chair: Lucas B. Hyman, P.E., Member, Goss Engineering, Inc., Corona, CA; John S. Andrepont, Life Member, The Cool Solutions Company, Lisle, IL

This workshop addresses the topic of water temperature differential ( $\Delta T$ ) and its impact on district energy (hot and chilled water) systems. The impact of  $\Delta T$  is amplified in district energy systems. The workshop discusses issues resulting from poor  $\Delta T$  in a district energy system including a reduction in capacity and an increase in pumping energy. Common causes of low  $\Delta T$  are discussed along with mitigation strategies through two case studies which demonstrate how system  $\Delta T$  can be improved and even surpass design  $\Delta T$ , including how thermal storage benefits from high system  $\Delta T$ .

Wednesday, July 2,  
11 a.m.–12:30 p.m.

## TECHNICAL PAPER SESSION

## (INTERMEDIATE)

## Improving Building Energy Consumption

Track: HVAC&amp;R Fundamentals and Applications

Sponsor: 04.07 Energy Calculations, 06.09

Thermal Storage

The papers in this session are focused on energy consumption and value. There is a session on the benefits of ice storage systems. Using energy simulation to address building energy is discussed as well. Finally, business value models are analyzed for a true representation of the financial goals of the study.

## Improving Accuracy of Building Energy Modeling Simulation Programs with Weather File Compensation Factors

Benjamin Wall, University of Massachusetts Amherst

## Business Value as the Driver for Management of Building Energy Assets

Nicola Salahi, Rutgers, the State University of New Jersey, Piscataway, NJ

## Optimizing Building Energy Footprint using Integrated Reliability and EnergyPlus Simulation Approach

Khashayar Mahani, Rutgers, the State University of New Jersey, Piscataway, NJ

## TECHNICAL PAPER SESSION

## (INTERMEDIATE)

## Control Theories: Tested

Track: Indoor Environment

Sponsor: 01.04 Control Theory and Application

The five papers presented in this session provide an array of control strategies to improve how they operate. Analysis and research are shared in regards to calibration and accuracy, air side economizers, energy reduction, and adaptive logic.

## Reducing Energy in HVAC Engineering

KH Chan

## Robust Adaptive Control for a Class of Nonlinear Systems using Backstepping Method

Zouair Farouk

## Sensor Data Management, Validation, Correction and Provenance for Building Technologies

Charles Castillo, Ph.D., Affiliate, Oak Ridge National Laboratory, Oak Ridge, TN

## Energy Analysis, Optimal High Limit Control and Engineering Approach of Air-Side Economizers

Gang Wang, Ph.D., P.E., Member, University of Miami, Coral Gables, FL

## TECHNICAL PAPER SESSION

## (INTERMEDIATE)

## Optimization of Ground Coupled Heat Exchangers and Heat Pumps

Track: Ground Source Heat Pumps

Sponsor: 06.08 Geothermal Heat Pumps and Energy Recovery Applications, 06.08 Geothermal Heat Pumps and Energy Recovery Applications

The first presentation presents the time constant modeling of geothermal heat pumps at compressor start up. The aim of the second presentation is to show how the number and positioning of boreholes for a given area can affect the fluid and ground temperature variations and the required borehole length.

## One- and Two-Time Constant Models to Predict the Capacity of Geothermal Heat Pumps in Cycling Conditions

Mehal Barbir, Ph.D., Member, Ecole Polytechnique De Montreal, Montreal, QC, Canada

## Analysis of the Energy Performance and Control Optimization of a GSHP Installation

Javier Genova Vazquez, Universidad Politécnica de Valencia, Valencia, Spain

## Should the Optimization Horizon in Optimal Control of Ground Coupled Heat Pump Systems Cover the Inter-seasonal Time Scale?

Stefan Antonov, KU Leuven, Heverlee, Belgium

## Experimental Validation of Ground Heat Exchanger Design Methodologies using Real Monitored Data

James R. Cullin, Student Member, Oklahoma State University, Stillwater, OK

## CONFERENCE PAPER SESSION

## (INTERMEDIATE)

## HVAC Systems and Equipment Analysis

Track: HVAC&amp;R Systems &amp; Equipment

This session explores the operation of variable refrigerant flow (VRF) heat pumps, under floor air distribution (UFAD), solar assisted residential micro-trigeneration, wasting of water and energy in residential hot water distribution systems, and thermal load error propagation due to inaccurate inputs in commercial buildings.

## Error Propagation in Commercial Building Load Calculation

Sande Escobar, Ph.D., Associate Member, Aris Shah, Cullin Sam and Niru Kumar, Hewlett Packard, Palo Alto, CA

## Field Comparison Study of Indoor Environment Quality in Office Buildings with Underfloor Air Distribution and Overhead Ventilation Systems

Boualem Ouazla, Ph.D., Alexandra Thompson, Ph.D., Daniel Booth, P.Eng., and Michel Tardif, P.Eng., Member, (1) National Research Council Canada, Ottawa, ON, Canada, (2) CarmentEnergy Natural Resources Canada, Ottawa, ON, Canada

## Energetic, Environmental and Economic Modelling of a Solar Assisted Residential Micro-Trigeneration System in a Mediterranean Climate

Simon Paul Borg, Ph.D., Nicolas James Kelly, Ph.D., and Vincent Buhagiar, Ph.D., (1) University of Malta, Msida, Malta, (2) University of Strathclyde, Glasgow, United Kingdom

## Near Real-Time Monitoring of Residential Hot Water Distribution System Performance

J.D. Lutz, P.E., Member, Lawrence Berkeley National Laboratory, Berkeley, CA

## A New Model to Simulate Energy Performance of VRF Systems

Tianzhen Hong, Ph.D., P.E., Member, Xudong Peng, Ph.D., P.E., Member, Chen Schmitt, Ujing Wang, Ph.D., P.E., Shinichi Kasahara, Yoshinori Yura, and Ryohki Hinojima, (1) Lawrence Berkeley National Laboratory, Berkeley, CA, (2) Daikin Industries, Osaka, Japan, (3) Daikin US Corporation, Irvine, CA

## CONFERENCE PAPER SESSION

## (INTERMEDIATE)

## Fundamentally Important Design Issues

Track: HVAC&amp;R Fundamentals and Applications

Sponsor: 04.02 Climatic Information, 04.05

Ventilation Requirements and Infiltration

These papers span the breadth of fundamentals. Firstly by evaluating the tools that we use to determine loads: analyzing the ASHRAE weather data including localized effects like urban heat island and the effects of moisture on porous insulation materials. Then case study analysis of tunnels on I-90 in Seattle review smoke management after adding HOV lanes and the balance of ventilation and fire suppression in life safety measures.

## Smoke Management Systems Upgrades for I-90 Tunnels in Seattle

Igor Maevski, Member, Bob Josephson, P.E., Raymond C. Klein, P.E., Member, Yuan U. P.E., Member, Doug Haight, P.E., Zak Griffin, P.E., and Jarrod Alston, P.E., Member, (1) Jacobs Engineering, New York, NY, (2) Jacobs Engineering, Seattle, WA, (3) WSDOT, Seattle, WA, (4) Arup, Cambridge, MA

## The Effects of Ventilation Systems on Fixed Fire Suppression Systems in Tunnels

David Byungjin Nahm, Associate Member, Yuan U. P.E., Member and Igor Maevski, Ph.D., P.E., Member, Jacobs Engineering, New York, NY

## CFD Modeling of Moisture Evolution in Three Phases Subject to Sharp Change of Boundary Temperature

Lei Chen, Teri Zhang, Ph.D., Member and Shuang Wang, Ph.D., Dalian University of Technology, Dalian, China

## An Evaluation of ASHRAE's Climatic Design Conditions Against Actual Long-Term Recorded Weather Data

Joe Huang, Member, White Box Technologies, Moraga, CA

## SEMINAR (INTERMEDIATE)

## The IAQ Procedure Is Alive and Well: Updates Related to Standard 62.1, TRG4, IAQP, and LEED v4.0

Track: Standards, Guidelines and Codes

Sponsor: 02.03 Gaseous Air Contaminants and

## Gas Contaminant Removal Equipment, SSPC

62.1, SSPC 145, TRG4, IAQP, 02.04 Particulate Air Contaminants and Particulate Contaminant Removal Equipment

Chair: Christopher O. Muller, Member, Purafil Inc., Doraville, GA

The IAQ Procedure has been an "on-again, off-again" method of determining the required outdoor ventilation rates in Standard 62.1-2013. There has been renewed interest in using this method for the purposes of energy conservation and improving and maintaining IAQ. This seminar provides an update on currently activities related to the IAQ Procedure with regard to Standard 62.1, ASHRAE Technical Resource Group 4IAQP, LEED EQp08, and a recent case study describing successful application of the IAQP.

## ASHRAE Standard 62.1: The IAQ Procedure and the Concept of Additivity

Dennis Starina, Member, Trane (Retired), La Crosse, WI

## The IAQ Procedure and Contaminants of Concern: Who, What, Where and Why?

Charles Seyffer, Member, Camfil, Rivdale, NJ

## LEED Certification and the IAQ Procedure: It Can Be Done

Charlene Bayer, Ph.D., Member, Georgia Tech Research Institute, Atlanta, GA, USA and Hygiene Sciences LLC, Atlanta, GA

## A Practical Example of the IAQ Procedure in Practice

Scott Williams, Target Corp., Minneapolis, MN

## CONFERENCE PAPER SESSION

## (INTERMEDIATE)

## New Professional Skills, Codes and Ethics

Track: Standards, Guidelines and Codes

Sponsor: 01.07 Business, Management &amp; General Legal Education

To fulfill the demand for Net Zero Energy Buildings there is a need for synergy between the architectural and engineering domain. Designers that adhere to the Water Efficiency recommendations listed in ASHRAE 189.1 and the IgCC should see positive results in their water use calculations for commercial building applications that use energy-efficient cooling towers, closed circuit coolers and evaporative condensers for their HVAC systems. This session shows through actual residential energy use data that the implementation of the codes are yielding the energy reductions that were expected.

## Integral Design a New Necessary Professional Skill for Architect and HVAC-Engineers to Cope with Their New Roles for Sustainable Development

Wim Zeller, TU Eindhoven, Eindhoven, Netherlands

## Interpreting and Applying Cooling Tower Water Efficiency Design Recommendations in Sustainable Building Codes

Daryn S. Cina, Member, EIA/PCO, Inc., Tarrytown, MD

## Ethical Practice for Consulting Engineers

Stephen W. Duda, P.E., Fellow ASHRAE, Ross &amp; Baruzzi, Inc., St. Louis, MO

## Verification of the Energy Savings from the Implementation of the Residential Building Codes in Texas

Juan Carlos Baltazar Churilo Mao, Student Member and Jeff Haberl, Texas A&amp;M University, College Station, TX

## SEMINAR (BASIC)

## Air-to-Air Energy Recovery Ventilation Standards Overview

Including the Applicable ASHRAE 90.1 Changes and the Upcoming ISO Standard

Track: Standards, Guidelines and Codes

Sponsor: 05.05 Air-to-Air Energy Recovery

Chair: Ronnie Moffitt, P.E., Member, Trane, Inc., Lexington, KY

The session educates the audience on the standards and guideline applicable to air-to-air energy recovery. The changes in ASHRAE 90.1-2013 that relate to Air-to-Air Energy Recovery will be presented. Attendees learn what additional applications are now covered. AHRI Standard 1060, Guideline W and Guideline V will be presented along with an overview on the benefits of the AHRI ERV Certification Program. A review of ASHRAE 84-2013 is presented as well as a preview of ISO Standard 16494

## 90.1-2013 Changes Related to Air-to-Air Energy Recovery

Paul Pieber, P.Eng., Member, Venmar CES, St. Leonard d'Arson, QC, Canada

## Benefits of the AHRI ERV Certification Program

Helen Davis, P.E., Member, AHRI, Arlington, VA

## Overview of ASHRAE 84-2013 and Preview of ISO-16494

Matthew L. Friedlander, Member, Rensair LLC, Madison, WI





#### Tips for ASHRAE Scholarship Applicants

Make sure ...

- You meet all applicable criteria
- You read the application carefully and answer all questions completely and honestly.
- The application and all required documents are submitted or postmarked on or before the applicable deadline.
- Your application is NEAT, legible (typed or handwritten clearly), and proper English (correct grammar and spelling) is used when responding to essay questions.
- To take time to submit a brief, non-required introductory cover letter
- You are clear and thorough when stating goals and financial need.
- You contact the nearest ASHRAE chapter for an interview with the Student Activities Chair or other officer to learn more about the Society.
- You find out if your school hosts an ASHRAE student branch.
- You contact ASHRAE headquarters if you have any questions and to ensure your application has been completed and submitted properly.



More information on the scholarship and details on how to apply can be found at [www.ashrae.org/scholarships](http://www.ashrae.org/scholarships).





Shaping Tomorrow's  
Built Environment Today

# Student Membership Application

## What You'll Get With Your ASHRAE Student Membership!

### What's "Cool" In ASHRAE

- ASHRAE maintains standards for indoor air quality
- ASHRAE promotes energy efficiency, savings and recovery
- ASHRAE reports on building controls, automation and integration
- ASHRAE focuses on green building issues and green technology
- ASHRAE promotes solar and other alternative energy sources
- ASHRAE offers certification programs, online learning opportunities and courses and seminars at ASHRAE Conferences

### How Can ASHRAE Help You?

- Provide access to new technology
- Offer professional development opportunities
- Create opportunities for networking
- Offer online continuing education programs and eLearning programs

### Student Member Benefits

- Access to members-only web pages
- Discounts on ASHRAE Handbooks
- Monthly ASHRAE Journal - print and digital
- HVAC&R Industry and Society Connections eNewsletters
- Discounted ASHRAE Annual and Winter Conference registration (AHR Expo, Student Program, Technical Sessions)
- Virtual online HVAC&R resume posting, job and internship searching program

### ASHRAE Student Member Opportunities

- Society and chapter-level scholarships for both undergraduate and graduate engineering students
- Discounts for student members on select publications, go to [www.ashrae.org/studentbookstore](http://www.ashrae.org/studentbookstore) for more information
- Student Design Competition
- Networking with local ASHRAE Chapters
- Senior Undergraduate Project Grant Program
- At the student branch level, you'll enjoy meeting other students with similar interests - if your school hasn't yet started a student branch, take charge and contact a faculty member and ask for help on getting started!

You can continue your student membership after college with the SmartStart Program. The SmartStart program locks in the price of student dues for the first year of membership after graduation.

Visit [www.ashrae.org/students](http://www.ashrae.org/students)  
to join online!





FIRST NAME: [grid]

LAST NAME: [grid]

DATE OF BIRTH (mm/dd/yyyy) [grid]/[grid]/[grid]

Current Mailing Address: (this will be where all correspondence will be sent unless otherwise specified)

Street Address: \_\_\_\_\_ Apt. # \_\_\_\_\_ City: \_\_\_\_\_

State/Province: \_\_\_\_\_ Postal Code: \_\_\_\_\_ Country: \_\_\_\_\_

Email: \_\_\_\_\_ Alternate email: \_\_\_\_\_ Phone: \_\_\_\_\_

Permanent Mailing Address: (during the Summer Months and after graduation)

Check if Current Address is the same as Permanent Address

Street Address: \_\_\_\_\_ Apt. # \_\_\_\_\_ City: \_\_\_\_\_

State/Province: \_\_\_\_\_ Postal Code: \_\_\_\_\_ Country: \_\_\_\_\_

Email: \_\_\_\_\_ Alternate email: \_\_\_\_\_ Phone: \_\_\_\_\_

ASHRAE protects contact information provided by its members and customers. To view ASHRAE's privacy policy, visit [www.ashrae.org/privacypolicy](http://www.ashrae.org/privacypolicy).

All student applicants must have the name and member number of an ASHRAE member serving as their student sponsor. If your Student Branch Advisor is an active Associate or Full member, he/she can serve as your sponsor. If you need assistance locating a sponsor, please email [students@ashrae.org](mailto:students@ashrae.org) or call 678-539-1212. Also, you must list the name, phone and email address of your faculty advisor or course instructor.

Sponsor Name: \_\_\_\_\_ ASHRAE Member #: \_\_\_\_\_

Advisor/Instructor: \_\_\_\_\_ Phone: \_\_\_\_\_

Email: \_\_\_\_\_

I would like to participate in the activities of the \_\_\_\_\_ ASHRAE Chapter.

School Name: \_\_\_\_\_

Street Address: \_\_\_\_\_ City: \_\_\_\_\_ State: \_\_\_\_\_

Country: \_\_\_\_\_ Postal Code: \_\_\_\_\_

Expected Graduation Date: \_\_\_\_\_

Full time:  Part time:  Degree: \_\_\_\_\_

Classification: Freshman  Sophomore  Junior  Senior  Masters/PhD.

ASHRAE Student Membership \$20.00 USD

ASHRAE Handbook - Fundamentals  I-P  SI

(you will receive the most current edition of Fundamentals)

More than 900 pages of HVAC&R technical information and it includes the CD! (List Price \$199)

Student Member Price: \$49.00 USD \$ \_\_\_\_\_ USD

CD Only: \$39.00 USD Total \$ \_\_\_\_\_ USD

\*Additional books are available at [ashrae.org/studentbookstore](http://ashrae.org/studentbookstore)

\*Please allow up to 30 days to receive new member packets. For U.S. book orders, allow 3-5 business days from processing. For international locations and Canada, allow 7-10 business days from processing.

To receive your subscription to the ASHRAE Journal, please answer the following questions by entering the appropriate codes in the spaces provided.

Which best describes your firm?

- 11. Consulting Engineering
- 12. Architect/Architectural & Eng Services
- 15. Design/Build
- 21. Contractor
- 26. Property Mgmt & Dev
- 31. Industrial Facility
- 41. Commercial Facility
- 42. Government, Healthcare, Education
- 43. Utility
- 51. Manufacturer/HVAC&R Equipment
- 61. Manufacturer's Representative
- 62. Sales Engineering
- 71. Wholesaler or Distributor
- 83. Library
- 84. Technical, Professional or Trade Association

Which best describes your title?

- 86. Student
- 91. Other (Please Specify)
- B. President
- C. Partner
- D. Associate
- E. Owner
- F. Vice President
- G. Vice President Eng. Chief Engineer
- K. Design Engineer
- L. Project/Application Engineer
- O. Facility Engineer/Manager
- R. Research/Development Engineer
- S. Sales Engineer, Sales
- S. Purchasing Agent
- T. Drafter
- U. Estimator
- W. Technician
- X. Instructor, Professor
- Y. Student
- Z. Librarian
- ZZ. Other (Please Specify)

ASHRAE Society Dues include \$6.00 for ASHRAE Journal. This amount is not deductible from Membership dues.

\*\*Please complete the ENTIRE application to ensure accuracy. Incomplete applications will NOT be processed.\*\*

Method of payment:  VISA / Master Card  American Express  Diner's Club  Check or money order enclosed\*

Card Number: \_\_\_\_\_ Expiration Date: \_\_\_\_\_ CVV No. \_\_\_\_\_ Amount: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Print Name (as it appears on card): \_\_\_\_\_

\*Checks will be accepted in U.S. and Canadian funds. Credit Card payments will be accepted in U.S. funds only.





*Your technical training provider presents...*  
**Air Conditioning Fundamentals 2014**

**Target Audience:** Essentially anyone who wants to broaden their base in fundamentals will greatly benefit.

- Any Direct or Indirect AM who has not had the opportunity to attend GTP
  - Perhaps a local new hire salesperson - that can't commit to 6-months at GTP
  - Someone who was promoted from within
  - A new hire that came from outside our industry
- Any BAS AE, PM, PA, Application Specialist or Estimator who wants to broaden their base in the fundamentals

**Primary Benefit:** Students will enjoy learning as much practical knowledge as possible about Air Conditioning Fundamentals. Students won't waste a great deal of time in theory. The typical student can immediately apply what he/she learns upon returning to their office. Past attendees have enhanced their overall confidence and found many ways to apply their recently acquired knowledge.

**Course Offerings (Rochester, NY):** (these classes are 3-days; Tuesday - Thursday)

- [ ] Jun 17-19 'Airsides Fundamentals-II' (Duct Design, Fans & Fan Laws & Acoustics)
- [ ] Aug 19-21 'Systems Fundamentals' (HVAC Systems, Dehumidification, IceStorage-LowTempAir, Bldg Pressurization)

**Course Offerings (Harrisburg, PA):** (these classes are 3-days; Tuesday - Thursday)

- [ ] Feb 18-20 'Airsides Fundamentals-I' (Load Design and Psychrometrics)
- [ ] Mar 18-20 'Refrigeration Fundamentals' (Refrig Basics, Refrig Piping, Refrig & Our Environment)
- [ ] Apr 15-17 'Energy Efficient Design Fundamentals' (Chiller-Side, Air-Side, System Controls, Energy Recovery, VRF)
- [ ] May 20-22 'Product Fundamentals' (AHU, WSHP, RTU, Chillers, Fan Coils, UV, VRF)

*Note: For more information about each of these classes, log onto [BeckerLearning.com](http://BeckerLearning.com)*

**Registration Deadline:** Each course will be filled on a first-come-first-reserved basis (established by receipt of payment).

**Contact:** Joe Becker, Becker Learning / 106 Needlewood Drive / Harrisburg, PA 17112  
Phone: (585) 317-0000 Email: [Joe@BeckerLearning.com](mailto:Joe@BeckerLearning.com)

**More Details for 3-day courses:**

**Where:** We will hold the 3-day classes at the local hotels listed below. These hotels will hold a block of rooms at the Becker Learning discounted price up until 15-days before the class - so please make your reservations right away. All you need to do is let them know that you are part of the Becker Learning group.

- \* Rochester, NY (Greece): Homewood Suites at 400 Center Place Drive, Rochester, NY 14615 - (585) 865-8534 at the Becker Learning rate of \$114/night
- \* Harrisburg, PA: The Holiday Inn Express at 4021 Union Deposit Road, Harrisburg, PA 17109 - (717) 561-8100 at the Becker Learning rate of \$103/night

**Time:** We will start each morning at 8:00 AM and end by 5:00 PM (except Thursday when we end by 4:00 PM for travelers)

**Food:** Lunch, mid-morning and mid-afternoon snacks & drinks are provided.

**What is not included:** Transportation, other meals & lodging.

**Travel: Arrival:** Since the seminar starts at 8:00 a.m., plan to arrive the night before.

**Departure:** You can book flights out of Rochester as early as 5:30 p.m. on Thursday since our Hotel is less than 10-miles from the airport. Harrisburg flights should be booked after 6:00 pm as the hotel is a bit farther (about 30-minutes) from the airport.



**Registration:** Please fill out this form for each person attending, and mail it along with a **Check** or **Purchase Order** (made out to 'Becker Learning') to:

**Becker Learning / 106 Needlewood Drive, Harrisburg, PA 17112**

**Payment Deadline:** Complete Payment must be received prior to the start of the class.

2014 Courses: Rochester, NY: <input type="checkbox"/> Airside-II <input type="checkbox"/> Systems	
(check all that apply) Harrisburg, PA: <input type="checkbox"/> Airside-I <input type="checkbox"/> Refrigeration <input type="checkbox"/> Energy <input type="checkbox"/> Products	
Name: _____	Title: _____
Trane Office: _____	
Address: _____	
Phone: (     )	Email: _____

Type	# of Courses	\$/course	Total Cost \$	Check # or PO #
3-day		\$1,100		

*Authorizing Person*

Printed Name	Signature	Date

**\*\*\*If a PO is given, full payment must be received prior to the first day of class.**

**Cancellation Policy:**

- If someone cancels 60-days prior to the start of the class => no cancellation charge.
- If someone cancels 30-60 days prior to the start of class => 50% cancellation charge
- If someone cancels less than 30-days before the start of class, or simply doesn't show up => charged the full amount

**Teaching Methodology:**

Similar to the way Joe taught nine classes in the Graduate Training Program of The Trane Company, students will learn a concept and then immediately apply this new knowledge with an application problem. Quiz/testing will also be used to measure the overall effectiveness of the teaching. In this way, the program receives continual improvement through direct feedback.

**About the Instructor:**

Joe Becker is a graduate of the University of Wisconsin-Madison with degrees in Naval Science and Industrial Engineering (1979). He is also a Graduate from the U.S. Naval Nuclear Power School at Mare Island, California (1975). Joe is a registered Professional Engineer (Wisconsin 1990).

After nine years in the Navy, Joe resigned his Commission in the Civil Engineer Corps. Since graduating from Trane's GTP class of 83-II, he worked as a Systems Engineer in C.D.S., Marketing Engineer in the Variable Air Volume Product Group, Manager of Technical Training in GTP, Sales Engineer, Sales Manager in Rochester/Syracuse & Regional Sales Manager for the NE Territory.

Joe currently works part-time for Trane's East Territory & provides technical training through Becker Learning.





# News

---

1791 Tullie Cir. NE | Atlanta, Ga. 30329-2305 | 404-636-8400 | [www.ashrae.org](http://www.ashrae.org)

For Release:  
May 13, 2014

Contact: Jodi Scott  
Public Relations  
678-539-1140  
[jscott@ashrae.org](mailto:jscott@ashrae.org)

## **Organizations Announce Commitment to Promote Resilient Buildings**

Washington, D.C. – Leaders of America’s design and construction industry – along with building owners and operators – for the first time have agreed to incorporate resilience in planning, building materials selection, design, construction and operational techniques to make the nation’s aging infrastructure more safe and secure. Resilience is defined as the ability to prepare and plan for, absorb, recover from and more successfully adapt to adverse events.

The leadership of almost two-dozen leading design and construction industry associations with more than 700,000 members generating almost \$1 trillion in GDP today used the occasion of “Building Safety Month” to issue a joint statement on resilience, which can be found at <https://www.ashrae.org/File%20Library/doclib/statement.pdf>.

The statement was unveiled at a press conference at the National Building Museum, where a major exhibition titled *Designing for Disaster* presents design and building solutions for disaster mitigation, opened May 11.

“We recognize that natural and man-made hazards pose an increasing threat to the safety of the public and the vitality of our nation,” reads the statement, in part. “We further recognize that contemporary planning, building materials, design, construction and operational techniques can make our communities more resilient to these threats.”

The leadership committed their design and construction sector organizations to significantly improve the resilience of the nation’s entire built environment through research into new materials, construction procedures and other methods to improve the standard of practice. Among other things, they also committed the industry to educating itself through continuous learning; to advocating for effective land use policies; to responding to disasters alongside first responders; and to planning for future events, with a strategy for fast recovery.

ASHRAE has been engaged in the area of resilience for a number of years. Its guidance includes ASHRAE Guideline 29-2009, “Guideline for the Risk Management of Public Health and Safety in Buildings;” the “Report of Presidential Ad Hoc Committee for Building Health and Safety under Extraordinary Incidents” developed after the events of Sept. 11, 2001; and guidance related to seismic restraint, including the “Practical Guide to Seismic Restraint, 2nd Edition” and ANSI/ASHRAE Standard 171-2008, Method of Testing Seismic Restraint Devices for HVAC&R Equipment.

“The built environment industry strives to design, construct and operate buildings to withstand both natural disasters and man-made hazards,” ASHRAE President Bill Bahnfleth said. “We must use the knowledge gleaned from disasters like the Tohoku earthquake and tsunami, Superstorm Sandy, last year’s Oklahoma City tornado and others, as well as predictions of the effects of climate change, to our advantage to save lives and infrastructure in the future. ASHRAE is pleased to stand beside these other organizations in making this commitment to protect the public and building stock.”

*Continued on next page*



***Continued from previous page***

In addition to ASHRAE, here is a list of organizations signing onto the joint statement on resilience:

American Council of Engineering Companies

American Institute of Architects

American Planning Association

American Society of Civil Engineers

American Society of Interior Designers

American Society of Landscape Architects

American Society of Plumbing Engineers

Associated Builders and Contractors

Associated General Contractors of America

Building Owners and Managers Association

International Code Council

International Interior Design Association

Lean Construction Institute

National Association of Home Builders

National Institute of Building Sciences International Facility Management Association

National Society of Professional Engineers

Royal Institute of Chartered Surveyors

Urban Land Institute

U.S. Green Building Council

ASHRAE, founded in 1894, is a building technology society with more than 50,000 members worldwide. The Society and its members focus on building systems, energy efficiency, indoor air quality, refrigeration and sustainability. Through research, standards writing, publishing, certification and continuing education, ASHRAE shapes tomorrow's built environment today.

---





# News

1791 Tullie Cir. NE | Atlanta, Ga. 30329-2305 | 404-636-8400 | [www.ashrae.org](http://www.ashrae.org)

For Release:  
May 15, 2014

Contact: Jodi Scott  
Public Relations  
678-539-1140  
[jscott@ashrae.org](mailto:jscott@ashrae.org)

## **ASHRAE Continues Work on Legionellosis Standard; Fourth Public Review Draft Slated for Summer**

ATLANTA – Nearly 40 years after Legionnaires' Disease first gained public attention, the disease remains common throughout the world. Recent cases include outbreaks in Australia, Canada and the United States.

As a result, ASHRAE continues work on what would be the first set of standardized requirements specific to the building industry for management of the risks associated with amplified growth of and exposure to *Legionella*.

Standard 188P, *Legionellosis: Risk Management for Building Water Systems*, currently under development, will identify risk factors for growth and exposure along with measures to mitigate that risk. The standard will help facility managers/owners understand how to evaluate the design and operation of their building water systems to reduce the risk of Legionellosis.

Tom Watson, chair of the Standard 188P committee, said he is optimistic that a fourth public review draft, which has been substantially rewritten from previous versions, will be approved and made available during the summer.

"The new version of the standard will provide the building community with reasonable and practical methods to control exposure to the bacterium that could cause harm," Watson said. "Effective design, maintenance and operational procedures that avoid amplification and dissemination of *Legionella* are necessary throughout the life of a building to reduce the risk of the disease."

Watson highlighted several changes that may be part of the upcoming public review draft. They include:

- Removal of HACCP (Hazard Analysis and Critical Control Points) terminology; some of the principles of the HACCP process may be included in the new draft
- Environmental *Legionella* testing considerations
- Revision of the standard to align with recently approved changes to the standard's title, purpose and scope, chiefly around systematic management of risks associated with potential exposure to *Legionella*

Watson noted that standards under development are not available for use by anyone and proposed language is made available during public reviews for the purpose of commenting only.

"We recognize there is much interest in this standard and its requirements," he said. "However, as the committee moves forward with writing the standard, the provisions in the current draft are subject to change between now and the final published version. Use of the technical details of the proposed standard could lead to actions and expenditures being taken that may not fall under the final requirements of the published standard."

To learn more about actions regarding ASHRAE standards, visit [www.ashrae.org/listserv](http://www.ashrae.org/listserv). There, ASHRAE provides subscriptions to a variety of listserves, including one for Standard 188P, that enable interested parties to stay up to date with the latest news, publication offerings, and various other Society activities.

ASHRAE, founded in 1894, is a building technology society with more than 50,000 members worldwide. The Society and its members focus on building systems, energy efficiency, indoor air quality, refrigeration and sustainability. Through research, standards writing, publishing, certification and continuing education, ASHRAE shapes tomorrow's built environment today.





# News

---

1791 Tullie Cir. NE | Atlanta, Ga. 30329-2305 | 404-636-8400 | [www.ashrae.org](http://www.ashrae.org)

For Release:  
May 19, 2014

Contact: Jodi Scott  
Public Relations  
678-539-1140  
[jscott@ashrae.org](mailto:jscott@ashrae.org)

## **DOE Takes First Step in Updating National Reference Standard for Commercial Buildings to 90.1-2013**

ATLANTA – Preliminary analysis from the U.S. Department of Energy (DOE) shows that the ASHRAE/IES's 2013 energy efficiency standard contains energy savings over the 2010 standard of 8.5 percent source energy and 7.6 site energy. This is the first step by the DOE in issuing a ruling that could establish the 2013 standard as the commercial building reference standard for state building energy codes.

In an announcement in the May 13 edition of "The Federal Register," DOE attributes the greater energy savings to improvements in ANSI/ASHRAE/IES Standard 90.1-2013, *Energy Standard for Buildings Except Low-Rise Residential Buildings*, related to better lighting, fans, commercial refrigeration, boilers and controls.

The DOE is now receiving comments on the preliminary determination. More information can be found at <http://www.energycodes.gov/regulations/determinations>.

If the preliminary determination is finalized, then states would be required to update their codes to meet or exceed the 2013 standard. Currently, states must meet or exceed the 2010 standard, which serves as the commercial building reference standard for state building energy codes under the federal Energy Conservation and Production Act.

The DOE noted that the 2013 standard contains 52 positive impacts on energy efficiency that were incorporated into the analysis. These impacts included changes made through the public review process in which users of the standard comment and offer guidance on proposed requirements. Specifically the major positive impacts include:

- Control requirements for lighting alternations
- New requirements for individual fans
- Reduction of energy usage for large boilers
- Reduction of fan energy usage
- New efficiency requirements for commercial refrigeration
- More controls in more spaces and reduction of time to reduction or shut off of those controls
- Reduction of lighting power density in most building types

ASHRAE, founded in 1894, is a building technology society with more than 50,000 members worldwide. The Society and its members focus on building systems, energy efficiency, indoor air quality, refrigeration and sustainability. Through research, standards writing, publishing, certification and continuing education, ASHRAE shapes tomorrow's built environment today.

---





# News

---

1791 Tullie Cir. NE | Atlanta, Ga. 30329-2305 | 404-636-8400 | [www.ashrae.org](http://www.ashrae.org)

For Release:  
May 21, 2014

Contact: Jodi Scott  
Public Relations  
678-539-1140  
[jscott@ashrae.org](mailto:jscott@ashrae.org)

## **ASHRAE Guideline on HVAC Equipment for Rail Passenger Vehicles Open for Comment**

ATLANTA – The unique challenges required for HVAC design in rail passenger vehicles are being addressed in a proposed guideline from ASHRAE now open for public comment.

Guideline 23P, *Guideline for the Design and Application of HVAC Equipment for Rail Passenger Vehicles*, establishes recommended design and application guidelines to provide an acceptable level of performance and safety for HVAC equipment used on rail passenger vehicles.

The proposed guideline is open for public comment until June 30, 2014. To read the proposed standard or to submit comments, visit [www.ashrae.org/publicreviews](http://www.ashrae.org/publicreviews).

"Recognizing that the basic principles of HVAC design do not change significantly for different applications, we attempted to focus recommendations to address the items that are unique to rail vehicle HVAC design," Ken Hesser, committee chair, said. "It is hoped that the recommendations made will result in a common base for new design efforts and foster constructive debate and ongoing research to validate or refine the information provided. Current inconsistent design approaches and widely varying requirements for similar applications have resulted in minimal standardization, excessive development efforts required for similar equipment and the resulting inefficiency and disproportionately high cost of equipment."

Challenges unique to rail vehicles vs. buildings include:

- Designing equipment to be significantly more mechanically robust to withstand the dynamic shock and vibration environment
- Maintaining comfort with rapidly changing passenger loads and quickly changing environmental conditions (tunnels, stations etc.)
- Maintaining reliable operation in dirty environments
- Ability to continue operation when exposed to extreme transient thermal conditions in tunnels and when positioned adjacent to other heat generating equipment
- High tolerance for rapid supply voltage fluctuation and frequent power interruptions/restarts
- Tight packaging of high capacity equipment in limited spaces.
- Sizing capacity to accommodate rapid cool down/heat up when vehicles are parked without power for extended periods.

The guideline applies to passenger carrying rail vehicles. These include three broad categories of rail vehicles or service: urban includes subways, street cars and light rail; commuter (sometimes referred to as regional or suburban) includes primarily electric multiple units (electrically powered from overhead catenary or third rail) and locomotive hauled trains that transport passengers from the suburbs to metro areas; and intercity trains that are typically the locomotive hauled long distance trains. Hesser noted there are hybrid variations of these three general categories such as metros that operate in both urban and commuter type service.

"We attempted to include a wide cross section of persons including equipment suppliers, vehicle builders, service operators and independent consultants so we hope that this inclusive process will lead to widespread use of the guideline throughout the North American passenger railcar industry," he said.

---





# News

---

1791 Tullie Cir. NE | Atlanta, Ga. 30329-2305 | 404-636-8400 | [www.ashrae.org](http://www.ashrae.org)

For Release:  
June 13, 2014

Contact: Jodi Scott  
Public Relations  
678-539-1140  
[jscott@ashrae.org](mailto:jscott@ashrae.org)

## 2014 ASHRAE Handbook Focuses on Refrigeration

ATLANTA – The 2014 *ASHRAE Handbook—Refrigeration*, which covers refrigeration equipment and systems for applications other than human comfort, is now available for purchase.

The 51 chapters in this volume include information on cooling, freezing, and storing food; industrial applications of refrigeration; and low-temperature refrigeration.

"The 2014 ASHRAE Refrigeration Handbook continues to provide the practicing refrigeration engineer with the data and information necessary to safe and efficient processing and storage of food and pharmaceuticals but the Handbook is evolving," Dan Dettmers, volume chair, said. "With the industry's growing interest in the category of 'natural' refrigerants, the dedicated technical committees have updated the Handbook chapters on ammonia and carbon dioxide refrigeration systems. These chapters, traditionally focused on industrial systems, are finding new fans in the commercial realm as zero ozone depletion potential/global warming potential refrigerants are requested by our customers."

Updates and changes to the 2014 volume include:

- Reworking of insulation tables in Chapter 10, Insulation Systems for Refrigerant Piping, to comply with ASTM Standard C680-10.
- Extensive reorganization of Chapter 2, Ammonia Refrigeration Systems, to reflect current practices.
- Addition of new sections on additives and process chemicals to Chapter 6, Refrigerant System Chemistry.
- Addition of moisture isotherm data for R-290 and R-600a and a new section on system sampling Chapter 7, Control of Moisture and Other Contaminants in Refrigerant Systems.
- Expansion of the focus on hydrofluorocarbons and addition of chemical information and guidance on retrofits to Chapter 12, Lubricants in Refrigerant Systems.

The ASHRAE Handbook is published in two editions: inch-pound (I-P) units of measurement and the International System of Units (SI).

The new 2014 volume is also available as one of the four current volumes included in the ASHRAE Handbook Online. Members can subscribe for \$29 (list \$269) and get immediate, searchable access to all four volumes in both I-P and SI units.

The cost of the 2014 *ASHRAE Handbook—Refrigeration*, which includes the CD is \$199, in I-P or SI. The 2014 ASHRAE Handbook CD, which contains both the I-P and SI editions, costs \$179.

To order, contact ASHRAE Customer Contact Center at 1-800-527-4723 (United States and Canada) or 404-636-8400 (worldwide), fax 678-539-2129, or visit [www.ashrae.org/bookstore](http://www.ashrae.org/bookstore).

ASHRAE, founded in 1894, is a building technology society with more than 50,000 members worldwide. The Society and its members focus on building systems, energy efficiency, indoor air quality, refrigeration and sustainability. Through research, standards writing, publishing, certification and continuing education, ASHRAE shapes tomorrow's built environment today.

---