

**AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND  
AIR CONDITIONING ENGINEERS, INC.**

1791Tullie Circle, NE / Atlanta, GA30329  
(404) 636-8400

**TC/TG/TRG MINUTES COVER SHEET**

(Minutes of all TC/TG/TRG Meetings are to be distributed to all persons listed below within 60 days following the meeting.)

TC/TG/TRG NO.:	<b>4.10</b>		TC/TG/TRG TITLE:	<b>INDOOR ENVIRONMENTAL MODELING</b>			
DATE OF MEETING:	June 24, 2013		LOCATION:	Denver, CO			
DATE ISSUED:	June 23, 2013		RECORDED BY:	Atila Novoselac			
VOTING MEMBERS	TERM		PRESEN T	OFFICERS		TERM	
	On	Off				On	Off
Srebric, Jelena	09	13	X	Chair	VanGilder, James	11	13
Chen, Qingyan (Yan)	09	13	✓	Vice Chair	Bennett, Jamie	11	13
Kato, Shinsuke (Intl.)	09	13	X	Secretary	Novoselac, Atila	11	13
Bennett, Jamie	11	15	✓	Programs	Koupriyanov, Mikhail	12	N/A
Horstman, Ray	11	15	X	Research	Srebric, Jelena	06	N/A
VanGilder, Jim	11	15	✓	Handbook	Banks, David	05	N/A
Sanchez, Greg	11	15	X	Membership	Wang, Liangzhu (Leon)	11	N/A
Wang, Liangzhu (Leon)	11	15	X	Standards	Ensor, David	05	N/A
Banks, David	11	15	✓	Web Page	Dols, William (Stuart)	07	N/A
Yang, Xudong	12	16	✓	Honors and Awards	Horstman, Ray	05	N/A
Khalifa, Ezzat	12	16	X	ALI	Zhai, John	04	N/A
Zuo, Wangda	12	16	✓				

Technical Committee 4.10 – Indoor Environmental Modeling

<b>MEMBERS</b>	<b>PRESENT</b>	<b>MEMBERS</b>	<b>PRESENT</b>
Adams, Eric	✓	Hernandez, Mark	
Al-Alusi, Thamir		Hirnikel, Daniel	
Anderson, Ren		Horstman, Raymond	
Arens, Edward		Hosni, Mohammad	
Armstrong, Peter		Int-Hout, Daniel	
Axley, James		Jeffers, Gregory	
Baker, A		Jin, Mingang	
Banks, David	✓	Jones, Gordon	
Barakat, Sherif		Jones, Robert	
Barles, Pierre		Kang, Kai	
Beausoleil-Morrison, Ian		Karava, Panagiota	✓
Becker, Bryan		Kato, Shinsuke	
Bennett, James	✓	Kelso, Richard	
Berkoe, Jonathan		Kerr, Carolyn	
Blackmore, Byron		Khalifa, Ezzat	
Chai, John		Kim, Man-Hoe	
Chakroun, Walid		Kirkpatrick, Allan	
Chen, Chun	✓	Knappmiller, Kevin	
Chen, Qingyan(Yan)	✓	Knight, Kelly	
Christianson, Leslie		Kolesnikov, Alexy	
Clark, Daniel		Koupriyanov, Mikhail	✓
Colliver, Donald		Krafthefer, Brian	
Cook, Malcolm	✓	Lavedrine, Isabelle	
Cui, Jie		Lebbin, Paul	
Culp, Charles		Levin, Hal	
DeGraw, Jason	✓	Lin, Chao-Hsin	✓
Djunaedy, Ery		Lin, Cheng-Xian	✓
Dobbs, Gregory		Macdonald, Iain	
Dols, William		Manning, Andy	
Emmerich, Steven	✓	McNeill, James	
Englert, Brian		Melikov, Arsen	
Ensor, David		Meng, Lingjun	
Gadgil, Ashok		Murakami, Shuzo	
Ghia, Urmila		Musser, Amy	✓
Gordon, Elliott		Nawrocki, Tracey	
Grimsrud, David		Nielsen, Peter Vilhelm	
Grot, Richard		Novoselac , Atila	✓
Guan, Yanzheng		Offermann Francis	
Haghighat, Fariborz		Olesen, Bjarne Wilkens	
Hall, John		Pei, Hsien-Sheng	
Hensen, Jan		Petersen, Ronald	
Peterson, Janice		Tzempelikos, Athanasios	

Technical Committee 4.10 – Indoor Environmental Modeling

Phillips, Duncan		VanderMeulen, Paul	
Rahai, Hamid		VanGilder, James	✓
Rimmer, Julian		Von Kempster, Diotima	
Rivers, Richard		Walton, George	
Rogers, Lisa		Wang, Liangzhu	
Sanchez, Greg		Wang, Xinlei	
Sawachi, Takao		Waring, Michael	
Schwarz, Walter		Wark, Christopher	
Seppanen, Olli		Willman, Alexander	
Sestak, George		Yang, Xudong	✓
Shaw, Chia-Yu		Yoshizawa, Susumu	
Sinclair, Ray	✓	Zhai, Zhiqiang	
Sleiti, Ahmad		Zhang, Dexian	
Sohn, Chang		Zhang, Jianshun	
Srebric, Jelena		Zhang, Tengfei (Tim)	✓
Tan, Liangcai		Zhang, Wei	
Teichman, Kevin		Zhang, XuanHang (Simon)	
Tompkins, Dean		Zhang, Yuanhui	
Topp, Claus		Zhang, Zhao	
Tronville, Paolo		Zuo, Wangda	✓
Tully, Bradley			

**ADDITIONAL ATTENDANCE**

Lo, James	✓	Manda, Prudhvi	✓
Ratcliff, Mike	✓	Ghias, Reza	✓
Papa, Ramon	✓	Yousaf, Rehan	✓
Lee, W. Victoria	✓		

**Society Liaisons, etc.**

**PRESENT**

LeViseur, Suzanne	TAC Section Head		
Meredith, David	Prof. Devt. Committee		
Henderson, Hugh	Research Liaison		
Reeves, George	Standards Liaison		
Hosni, Mo	Program Liaison		
Bahnfleth, William	TAC Chairman		
Ferguson, Kimball	Special Publications Liaison		
Ramspeck, Claire	Staff Liaison (Standards)		
Gulledge, Charles E.	TEGA Liaison		
Vaughn, Michael	Staff Liaison (Research)		
Aswegan, James	Handbook Liaison	✓	
Bilderbeck, Mike	TAC Section 4 Head	✓	

**Call to order - Chairman: (Jim Van Gilder)** at 2:03 p.m.

**Welcome and Introductions**

**Roll call (Atila Novoselac in name of Leon Wang) – voting members**

VanGilder, Jim	Yes	Horstman, Ray	No
Chen, Qingyan (Yan)	Yes	Srebric, Jelena	No
Khalifa, Ezzat	No	Wang, Liangzhu (Leon)	No
Bennett, Jamie	Yes	Banks, David	Yes
Zuo, Wangda	Yes	Kato, Shinsuke (Intl.)	No
Sanchez, Greg	No	Yang, Xudong (Internat.)	Yes

**6//10:** Six out of ten non-international voting members.  
Chair, Jim VanGilder, counted for quorum. **Quorum achieved!**

Non-voting officers present: Atila Novoselac (Secretary), Mikhail Koupriyanov (program)

Discussion and comments on minutes from the last ASHRAE meeting in Dallas, TX  
Call Approval of San Antonio minutes

**Vote: (6-0-0-10)**  
**Dallas minutes approved!**

**Announcements (Jim VanGilder)**

- In the Chair’s Breakfast there was a discussion about the issues we had with Conference paper approvals for Denver. (We had, at least, 3 papers rejected despite the fact that only minor revisions were requested by reviewers. After discussions with the Track Chair, we had all re-instated.) Our concerns were relayed to a CEC representative who will look into the process, primarily, how authors can always be provided with ample time to address reviewer’s comments in the future.
- The 2013-2014 Roster will be in effect after Denver (July 1, 2013). Nominations are sought for the 2013-2014 Hightower Award which recognizes outstanding technical leadership and contributions on a TC/TG/TRG during the past Society year. Please contact the TC Chair for more information.
- TAC has developed a new summary sheet of ASHRAE awards that makes it easier for deserving members to be recognized.
- New TAC presentation template for TC members to use with local Chapters. All TC members are encouraged to give presentations to their local chapters. The template is posted on the Technical Committee page of the ASHRAE website for download <http://www.ashrae.org/standards-research--technology/technical-committees>
- TAC would like ALL TC members to declare their employment discipline prior to the start of the new Society year on July 1, 2013 by going to the “Members Only” section and entering their employment discipline information.
- Some Electronic and Present (E&P) meetings were held in Denver on a beta-test basis. TC4.10 could get on the list for E&P for our main meeting in the future if there is sufficient interest. There

is also the opportunity to hold phone or web-based subcommittee meetings in lieu of traditional on-site subcommittee meetings.

- CEC is seeking qualified volunteers from TCs as potential Technical Session chairs and reviewers of session papers. Interested members can contact the TC Chair.
- TAC has developed new TC-activity-reporting and TC-attendance forms that should be used from Denver onward.
- We made a special acknowledgment of the new members joining the TC meeting.
- ASHRAE President – Tom Watson – has offered to send letters to the employers of TC volunteers this year thanking them for supporting their employee's service on an ASHRAE TC during Society year 2012-2013. Committee members should be receiving an email on this topic and also may contact the TC Chair for more information.
- There are many upcoming conferences that can be found on the ASHRAE website.

### **Membership (Atila Novoselac in name of Leon Wang)**

- Changes in voting membership from Summer 2013 Meeting:
  - Rolling off: Stuart Dols, Amy Musser
  - Rolling on: Xudong Yang, Ezzat Khalifa, Wangda Zuo, Cheng-xian (Charlie) LinThe new voting member list after the summer 2013 meeting (11 + 2):
  - Jim VanGilder, Jamie Bennett, Atila Novoselac, Liangzhu (Leon) Wang, Ray Horstman, David Banks, John Zhai, Chengxian (Charlie) Lin, Mo Hosni, Wangda Zuo, Ezzat Khalifa
  - Non-quorum Voting members: Xudong Yang, Malcolm Cook
- Changes in officers after the Summer 2013 Meeting:
  - Secretary Jamie Bennett became Chair
  - Secretary Atila Novoselac become Vice Chair
  - Leon Wang became Secretary
  - Chengxian (Charlie) became Membership Chair (instead of Leon Wang)
  - Wangda Zuo became Research Chair (instead of Jelena Srebric)
  - James Lo become Handbook Subcommittee Chair (instead of David Banks)
  - James Lo become Web Page Administrator (instead of Stuart Dols)

### **Research (Wangda Zuo in name of Jelena Srebric)**

The research subcommittee met on Sunday (06/23) at 5:00-6:00 pm. There were 18 attendees in the meeting. Revolving submission deadlines: May 15<sup>th</sup>, August 15<sup>th</sup>, and December 15<sup>th</sup>.

- Current RP reports
  - PMS of RP 1512 (CFD resources for particle modeling)
    - The project report is submitted to the PMS and PMS need to vote and provide suggestion. Only one PMS member was present and the vote will happen over the email.
  - PS of RP 1458-RP (Modeling Person-to-Person Contaminant Transport in a Mechanically Ventilated Room) meets on Sunday from 2:30-3:30. PMS members reported on the project. On schedule and satisfied PMS. Draft of final report ready for review in September.
- Work Statements:
  - None at this time.

Technical Committee 4.10 – Indoor Environmental Modeling

- Current RTARs:
  - 1675-RTAR (Experimental Benchmark Data for Data Center Numerical Modeling). Jim prepared the Work Statement. It needs some minor changes and the TC voting members will vote by emails by August 15th.
  
- New RTARs:
  - Guidelines for the Accurate Use of CFD for Modeling Naturally Ventilated Indoor Spaces” Malcolm Cook and Panagiota Karava continue their work on RTAR. James Lo will help with this effort.
  
- Co-sponsored projects:
  - RP-1675 is co-sponsored by TC9.9
  
- Request for Support on RTAR/WS
  - TC 4.7 is developing a RTAR/WS titled “Assess and Implement Natural and Hybrid Ventilation Models in Whole-building Energy Simulations (Phase Two)” based on RP-1456 (First Phase). The lead author is Joe Huang from TC 4.7. They are looking for support from TC 4.10. Malcolm Cook, James Lo, Panagiota Karava are interested in it.
  - TC 9.6 is asking for co-sponsorship of RTAR “Improving Hospital Operating Room Air Distribution using Alternative Unidirectional Diffusers and Air Curtain Systems”. Research committee is in favor of that and TC votes yes on that.
  - TC 4.1 is looking for 1 volunteer from TC 4.10 for the RTAR on developing a simple method for load calculation in large space. Related to TC 4.10 is to understand the characteristics of the airflow in the space and the resulting stratification temperature profile is linked very directly to what percentage of the equipment load can be assumed to convert directly to driving the stratification. Mikhail Koupriyanov is volunteer for that.

**Current Status of TC 4.10 RTARs, WSs, and Projects.**  
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<b>Project s</b>	<b>PMS</b>	<b>Title</b>	<b>Status</b>
1512-RP	Jamie Bennett PMS Chair	CFD Resource Decisions in Particle Transport Modeling, PI: Atila Novoselac	<ul style="list-style-type: none"> <li>• Report submitted</li> <li>• Request an email vote to conclude the project</li> </ul>
1458-RP	Julian Rimmer PMS Chair	Modeling Person-to-Person Contaminant Transport in a Mechanically Ventilated Room, PI: Yan Chen	<ul style="list-style-type: none"> <li>• Project on schedule within the budget</li> <li>• Draft of final report ready for review in September</li> </ul>
<b>Bidding</b>	<b>PMS</b>	<b>Title</b>	<b>Status</b>
We have no projects out for bid at this time.			
<b>WSs</b>	<b>Author(s)</b>	<b>Title</b>	<b>Status</b>
We have no work statements currently.			
<b>RTARs</b>	<b>Author(s)</b>	<b>Title</b>	<b>Status</b>
1562-RTAR	Wangda Zuo	Development of Boundary Models for Particulate Matters Deposition at Solid Surfaces of Indoor Environment	<ul style="list-style-type: none"> <li>• Dropped</li> </ul>

New	Malcolm Cook (Panagiota Karava, and James Lo)	CFD Boundary Conditions for Modeling Naturally Ventilated Indoor Spaces	• Check with LBNL if it has been done, then pursue accordingly
New	Ray Horstman	CFD Prediction of Sparse Particle Distributions	• Chao will check with Ray
New	Bin Zhao	Modeling Particulate Surface Sorption	• New lead author recommended by Xudong
<b>Co-Sponsor</b>	<b>TC</b>	<b>Title</b>	<b>Status</b>
RP-1675 is co-sponsored by TC9.9			

List of recently finished projects by TC 4.10

- 1487-RP “Developing Rack Boundary Conditions for CFD Modeling,” PI: John Zhai, January 2012
- 1321-RP “Modeling VOC Sorption of Building Materials and Its Impact on Indoor Air Quality - Phase II (second phase of RP-1097),” PI: Xudong Yang, April 2010
- 1271-RP “Modeling Low Velocity Large Scale Fluctuating Flows in Ventilated Spaces at Transitional Reynolds Numbers,” PI: Yan Chen, July 2009

**Handbook (James Lo in name of David Banks)**

The Program Subcommittee met briefly on Sunday (06/23), from 4:30-5:00pm

- Review: in Chicago, TC 4.10 voted to continue with current fundamentals chapter. If we want to consider an Applications Chapter for 2015 we need to apply to have such a chapter created.
- On Sunday subcommittee discussed alternatives to a new Applications Chapter but decided to start the process to put together a proposed outline for the new application chapter. This proposal will be submitted before the NY winter meeting to our current Fundamental handbook Liaison, Larry Akers
- Yan Chen, Jim VanGilder, Eric Adams, David Banks, Leon Wang and Malcolm agree to take a look of the outline and contribute to the content. James Lo will lead the effort on the draft. The finished draft will sent to Jamie (TC chair by 7/1) then to VMs for an email vote. If passed, the draft will be sent to Larry Akers (our handbook Liaison)
- If the Handbook committee vote to accept our proposal, we will need to turn in the actual content by 7/31/2014 (to make the 2015 Application Handbook)
- Our current Fundamental deadline for any change is 5/17/2016

**Program (Mike Koupriyanov)**

The Program Subcommittee met on Sunday (06/23), from 3:30-4:30p.

**Deadlines:**

Conference	Type	Seminar	Paper Abstract	Full Technical Paper	Final Conference Paper
New York 2014	Winter	Aug. 13, 2013	March 15, 2013	April 19, 2013	July 2, 2013
Seattle 2014	Summer	Feb. 13, 2014	Sept. 23, 2013	Sept 23, 2013	January 9, 2014

- Denver Program (conference in progress)

Technical Committee 4.10 – Indoor Environmental Modeling

- o TC 4.10 Sponsored program for the Dallas conference

Conference Paper Modeling Thermal Comfort in the Indoor Environment

Mike Koupriyanov

Speakers: Mike Anderson, Jordan Clark, Leon Wang, Malcolm Cook

Seminar Modeling Transient Airflows

Amy Musser

Speakers: Simon Zhang, Mike Koupriyanov, James Lo

Seminar Reduced Order Modeling

Jim VanGilder

Speakers: Mingang Jin, Jim VanGilder, Xudong Yang

Following program:

<b>ASHRAE New York, Winter 2014</b>			
Seminar	Design and Performance Evaluation for Buildings with Natural Ventilations – Part 1	Wangda Zuo	Samuel Brunswick Narija Todorovic Andrew Persily Ray Sinclair (substitute)
Seminar	Design and Performance Evaluation for Buildings with Natural Ventilations – Part 2	Wangda Zuo	Leon Glicksman Malcolm Cook Panagiota Karava
Seminar	Modeling Industrial Spaces	Chao-Hsin Lin	Yan Chen Reza Ghias Jamie Bennet
Conference Paper	Air/Contaminant Flow in Personal Microenvironment and PV Systems	Ezzat Khalifa	Ezzat Khalifa Arsen Melikov Peter Nielsen Shinsuke Kato Ed Arens (CBE)
Seminar	Data Centers Applications	Jim VanGilder	Shaun Fitzgerald David Banks John Zhai Ezzat Khalifa

<b>ASHRAE Seattle, Summer 2014</b>			
<b>Session Type</b>	<b>Session Title</b>	<b>Session Chair</b>	<b>Contributing Authors</b>
Seminar	Ventilation Energy Consumption, Industrial Ventilation/Sustainability	Ray Sinclair	Jamie Bennet Yan Chen Panagiota Karava (tentative) Leon Wang
Conference Paper	CFD in Healthcare	Wangda Zuo	Malcolm Cook Jamie Bennet John Zhai
Conference Paper	Airflow Modeling on the Cheap (Open Source etc) resource optimized CFD	Jim VanGilder	Jason DeGraw James McNeil Leon Wang
GPI	Heating in Cold Climates	TBA	TBA

<b>New Ideas for Papers, Seminars</b>			
<b>Session Type</b>	<b>Session Title</b>	<b>Session Chair</b>	<b>Contributing Authors</b>
	Indoor environmental modeling in low energy buildings		
	Hybrid Ventilation, Mixed Mode cooling		
	Displacement Ventilation in High Heat gain Applications		
	Advances in Indoor Environmental Modeling		
	CFD in Dangerous Hands (CFD NC17 Edition)		
	CFD for Design Optimization (Room scale)		
	High CO2 (other contaminants) levels in schools tied to productivity		
	Processing CFD data (different interpretation of results)		
	GMP criteria (manufacturing, indoor environment) – good manufacturing practice		

**New York 2014 - Tracks**

Track 1: Systems and Equipment

Track 2: Fundamentals and Applications

Track 3: Indoor Environmental Health/Indoor Environmental Quality

Track 4: Building Information Systems; Integrating Technology for Control, Management, Optimization and Efficiency

Track 5: International Design

Track 6: Improving Building Performance through Commissioning, Operation and Maintenance

Track 7: Hydronic System Design for Efficiency and Large Buildings

Track 8: Tall Buildings: Performance Meets Policy

**Standards/Guidelines (Jim VanGilder in name of Jim David Ensor).**

No change.

**Web site activity (James Lo in name of Stuart Dols):**

No change.

**Report of relevant activities in other TCs**

TC1.2 *Instruments and Measurements* - Arsen Melikov

TC2.1 *Physiology and Human Environment* - Diotima Von Kempster

Ray attended the TC 2.1 meeting: modeling of multi zone body

TC2.3 *Gaseous Air Contaminants/Removal Equipment* - Gemma Kerr

TC2.4 *Particulate Air Contaminants/Removal Equipment* - Dave Ensor

TC4.3 *Ventilation Requirements and Infiltration* – need for a new representative

TC4.7 *Load Calculation and Energy Modeling* - need for a new representative

TC5.3 *Room Air Distribution* - John Jenssen

TC5.6 *Control of Fire and Smoke* – Kai Kang

TC5.8 *Industrial Ventilation* – Jamie Bennett

TC9.3 *Transportation* - Ray Horstman

TC9.6 *Healthcare Facilities* – James Mcneil

TC9.9 *Mission Critical Facilities* – Jim VanGilder

**Honors and Awards (Ray Horstman)**

No discussion. (Discussed at the beginning of the meeting).

**New Business**

- Chao-Hsin Lin will arrange TC 4.10 members for Boeing Tour during Seattle meeting, Jamie is to collect names and sent it to Chao-Hsin at least 1 month before the Seattle meeting. We will revisit this in NY meeting

**Agenda Suggestions for Next Meeting**

Same.

**APPENDIX A: DESCRIPTION OF TC'S SCOPE (FROM WEBSITE)**

TC 4.10 is concerned with developing, evaluating and recommending procedures for predicting indoor environmental conditions including thermal, acoustical, illumination, and air quality for new or existing buildings.