

Draft Minutes
TC 2.4 Particulate Contaminants/Removal Equipment
Main Committee Meeting
Las Vegas, Tuesday January 31, 2017
3:30-6:00 pm
Pompeian II, Caesars Palace

1. Call to order..... Gemma Kerr
2. Introductions – 8 YEA Members
3. Roll call Zied Driss

Non-Voting Member	Position	Present	Absent	Voting Member	Position	Present	Absent
Gemma Kerr	Chair			Brian Krafthefer			
Mike Corbat	Vice Chair			Bruce McDonald			
Geoff Crosby				Kathleen Owen			
Todd McGrath				John Simenson	Standards Chair		
Rahul Bharadwaj				Brent Stephens	Research Chair		
John Zhang				Mike Waring			
Eric Brodsky	Handbook		X	Keith Chesson			
Bob Burkhead	Webmaster		X	Dara Fedderson	Program Chair		X
Zied Driss	Secretary			Matt Middlebrooks			

Total Present	15
Total Absent	3
Total Voting Members	18

Non-Voting Officers		
Name	Subcommittee	Role
Marilyn Listvan	Publication	Chair
Rahul Bharadwaj	Research	Vice Chair
Donna Sullivan	Program	Co-Chair
Anja Coenen	Standards	Vice Chair
Jenni Wong	Membership	Chair
Tom Justice	Membership	Vice Chair

4. Welcome and opening comments Gemma Kerr
 - a. See **Addendum A** for ASHRAE Code of Ethics
 - b. Conference & Exposition committee liaison 2 items

- i. Request to move the seminar approval process to a 2 stage process instead of, currently, 1 stage process. The request was denied.
 - ii. The committee is positively supporting the idea of, if an activity is rejected at the programs level, then they are prepared to support the activity to be presented at TC allocated time. TC 2.4 and TC 2.3 have a joint time slot on Monday afternoon which could be used for presentations. In the past we did not have a procedure in place to handle programs rejected by C&E. **Gemma will put a procedure in place for TC 2.4 to accommodate programs relevant to the committee, will try to get it done before Long Beach.**
 - c. ASHRAE allowed members access more of their published material. Members could now read the journal and research report online
 - d. Added access to the research journal Science and Technology for the Built Environments.
 - e. 2 document sharing platforms.
 - i. ASHRAE Authoring Portal: It is a secure group document sharing application designed to facilitate editing shared publication such as Handbook Chapter etc...
 - ii. Basecamp: Chair wants to sign the committee up for it and start using it. To be discussed under new business.
 - f. Planning Subcommittee is not in the agenda as the subcommittee meets only once a year. There will be a planning meeting in the summer session. Last planning meeting report action items
 - i. Planning Subcommittee meeting, changes to meet once year. (Done)
 - ii. Reduced the length of time for the Standard Subcommittee. (Done) see Subcommittee report.
 - g. A visitor package "Leaflet" designed for first time attendees has been developed and updated to help new visitors understand the scope and activities of our committee. Further discussed under Old Business in this agenda.
 - h. Update to RoadMap will also be discussed under Old Business.
 - i. Revision to FAQ 112 completed and submitted and accessible from the TC2.4 website
 - j. TC 2.4 will be joining the Air Change Rate MTG and Gemma implemented that further information will be provided down the agenda through the liaison reports.
5. Approval of Saint Louis Minutes Zied Driss
 - a. Motion to Approve – 1st Todd McGrath. 2nd Bruce 14-0-1-3-18 (CNV)
 6. Particle Party..... Keith Chesson lets meet at 7pm
 7. Record of votes taken since Saint Louis Zied Driss
 - a. Nothing to Report, no votes were taken
 8. Liaison Report Pawel Wargocki, RL from RAC
 - a. You can apply for URP (Unsolicited Research Project), bypass RTARs, Work Statements and the TC, and apply directly to RAC. Deadline May, August, December.
 - b. TC 2.4 is doing very well
 - c. The Chair for RAC applied for increasing the funding budget for research. Pawel is encouraging the research committee to submit RTARs, WSs etc... ASHRAE has money.

9. Subcommittee Reports

- a. Membership Subcommittee Report..... Tom Justice (For Jenni Wong)
After the summer meeting
- i. Rolling off: 4 members: Gemma Kerr, Eric Brodsky, Mike Waring, Kathleen Owen
 - ii. Rolling In: Jeff Siegel, Paolo Tronville, Marilyn Listvan, Anja Coenen
 - iii. Board Change: Chair Mike Corbat, Vice Chair Zied Driss, Secretary Jeff Siegel.
- b. Research Subcommittee Report..... Brent Stephens
Met on Sunday with 49 attendees
- i. 3 RTARs were considered by RAC and 3 were accepted.
 - ii. 4 Work statements were considered by RAC and only 1 was accepted – **OURS.**
 - iii. 16 nomination for the new investigator award – one will be selected. 33 proposals are received for the innovative RP. 6 Were accepted go forward.
 - iv. URP criteria are online now – deadline is March 1st.
 - v. 1649, active project, Impact of Higher Efficiency Filtration on IAQ in Residential Environments with Central HVAC. Led by Jeff Siegel. PMS: Tom Justice, Gemma Kerr, Rahul Bharadwaj, John Zhang, Bruce McDonald. Summary was provided at the Research Subcommittee
 - vi. 1734, WS Championed by Paolo Tronville and Geoff Crosby, co-sponsor by SSPC 52.2. WS was submitted before last meeting and approved for bid in December, estimated finish time 2 years and estimated cost is \$180,000. Bids were received and evaluated. The bid will be voted on this meeting.
 - vii. 1756, WS, Led by Brent Stevens, co-sponsored by TC7.5 smart building systems. WS was submitted in May 2016 and conditionally approved in the last RAC. No further approval is required. Estimated finish time is 1.5 years and estimated cost is \$150,000. Waiting to finalize PMS including TC7.5 members.
 - viii. Liaison with 62.2
 1. Considering changing min filtration level from MERV 6 to MERV 8
 2. Published addendum k to allow 20% reduction in the ventilation rate
 3. Brent has a draft for sharing proposed rates reduction
 4. New ESTM standard for testing range hoods for capture efficiency

1734 voting:

Chair asked non- members, subcontractors, bidders and any person with potential conflict of interest to leave the room.

Paolo Tronville, PES Chair received 3 bids in December, sent to PES members the different offers. PES Membership Paolo Tronville, Brian Krafthefer, Geoff Crosby, Mike Waring, Tom Justice and Bruce McDonald The PES Choice of the contractor was confirmed by vote. The evaluation sheet will be submitted to RAC.

Motion to Approve the selection made by 1734 PES

1st Bruce McDonald. 2nd Matt Middlebrook 14-0-0-4-18 (CNV)

Note John Zhang left the room.

- ix. For full Report see Addendum B
- c. Standards Subcommittee Report..... John Simenson
 - Meeting went for 1 hr instead of 2hrs. 29 Attendees
 - i. Republication of 52.2, 2017 included all (8) addenda since 2012. Only addendum H was not approved
 - ii. GPC 35: A working draft been started with a Goal to submit draft by June 2017. Still waiting for RP 1734 with an estimated 2 years for completion.
 - iii. US TAG ISO TC 142. Most activity with Working Group 3. ISO 16890 was published as of December 2016. Netherland and UK adopted it, will take the rest of Europe 18 months to switch and sunset EN779. Plenary Meeting will be in Paris September 28, 2017.
 - iv. UL 900 met on Sunday informally – 4 proposed changes.
 - v. For full report see Addendum C
- d. Program Subcommittee Report..... Donna Sullivan
 - Abstracts due Monday February 06 2017
 - i. Workshop in Vegas chaired by Geoff Crosby for TC 5.4, speakers Bruce McDonald and Bob Burkhead. Went well about 120 attendees.
 - ii. Long Beach June 24 to 28th (5 programs in the pipeline)
 - 1. Workshop, resubmittal by Rahul Bharadwaj
 - 2. Seminar, KJ Choi, Do you know what you are breathing?
 - 3. Seminar, Russ Taylor, Low-Cost multi-use sensor for buildings
 - 4. Seminar, Brian Krafthefer, In the year 2035, will filtration be alive?
 - 5. Debate, Marilyn Listvan, Filtration does it matter? Opposing views Denis Stanke vs Donald Thornburg or Bob Burkhead.
 - iii. See Addendum D for full report of upcoming proposals
- Motion to approve programs sponsorship and co-sponsorship
 - 1st Brian Krafthefer. 2nd Rahul Bharadwaj 12-0-1-5-18 (CNV)
- Brent Stevens and John Zhang left the meeting
- e. Publications Subcommittee Report..... Marilyn Listvan
 - i. Joint TC 2.4 and TC 2.3 time slot meeting on Monday 3:15-4:15 will be used to accommodate programs for presentations.
 - ii. Send papers that you find interesting to Marilyn to add to TC website and Linked in page.
- f. Web Master..... Bob Burkhead (Gemma will report instead)
 - i. Committee related documents have been updated and posted on TC website. Including (Agenda, Rooms Assignment, Minutes)
 - ii. Need to hear from you Suggestions, comments editorial and related matters to improve TC 2.4 webpage.
- g. Handbook..... Eric Brodsky (Gemma will report instead)
 - i. Chapter 29 was published in 2016, next publication is 2019.
 - ii. For full report see Addendum E
- 10. Reports from other TC liaisons
 - a. 62.1 – Need a liaison – Marwa Zaatari volunteered
 - b. 62.2 – Brent Stephens – Check Research Subcommittee report above.
 - c. EHC – Lan Chi Weekes - the Nano particle seminar had 20 to 30 attendees
 - d. TC 2.4 will join 2 MTGs

- i. IAST (impact of ASHRAE Standard and Technology on Energy Savings Performance), 25 members, liaison Geoff Crosby. Introductory conference call asking for input and metrics.
 - ii. ACR (Air Change Rate) Liaison, Steve Nicholas, 2 conference calls, discussion about terminology and definitions of contaminant and air change rate.
- e. TRG (IAQP): Need volunteers to provide some text to go to their Standard 62.1 appendix
 - i. List of contaminants for IAQ to use as guide by designers
 - ii. Not health related contaminants rather indicator contaminants related to HVAC
- f. ISO TC 142 US TAG – Rahul Bharadwaj: 43 Attendees, no quorum, standard activity, advisory panel 4 reported on committee draft 21083. Committee went through extensive list of comments and disapproved comments.
- g. ISO TC 142 WG3 – Don Thornburg. Will meet in Paris in September to discuss any changes
- h. ISO TC 142 WG12 – Geoff Crosby, nothing to report. GPC 29, Barney Burroughs: Barney GPC 29 Risk Assessment for exception events “Bio Terrorism”. Out for revision Significant upgrades in Gas Phase & Particulate Phase filters which will require update in the risk assessment documentation. Documents will be put out for public review in the next meeting. Cognizant committee TG2 building security need volunteers from TC 2.4 contact, Barney Burroughs or Scott Campbell.

11. Old Business

- a. Road Map: Extension for the committee to review and comment. The Chair will send out a letter ballot to vote to put the Road Map on the TC website. A straw poll was conducted with the majority in the room in favor.
- b. Leaflet: To summarize Handbook, RP, Programs etc... The document will require continuous update and maintenance.

Motion to Approve the leaflet with minor updates
 1st Brian Krafthefer. 2nd Mike Corbat 12-0-1-5-18 (CNV)

12. New Business

Announcements:

- Plenary meeting on Saturday, Vijay was inducted as a fellow of TC2.4
- Rahul: Advanced Filtration Technologies (AFS) Conference, heavily focused on filtration, will be this spring April in Kentucky Louisville
- Professors could send their student at “0” cost registration as long as they have posters for presentation. There will be competition with a scholarship for poster presenters. There are many Networking events including Monday at Churchill Downs. Tuesday there will be a tour of Blue Heaven Technologies. People interested in exhibits need to contact Rahul the conference chair.
- Basecamp: the secure doc sharing platform is free if you are added by the chair. Gemma to sign up the committee for basecamp. A straw poll was conducted with majority accepting it.

13. Adjournment at 5:35 pm

Action Items are Bold and Italicized

Addendum A

ASHRAE Code Of Ethics (Approved by ASHRAE Board of Directors January 30, 2013)

1.140.001.1 As members of ASHRAE or participants in ASHRAE committees, we pledge to act with honesty, fairness, courtesy, competence, integrity and respect for others in our conduct.

- A. Efforts of the Society, its members, and its bodies shall be directed at all times to enhancing the public health, safety and welfare.
- B. Members and organized bodies of the Society shall be good stewards of the world's resources including energy, natural, human and financial resources.
- C. Our products and services shall be offered only in areas where our competence and expertise can satisfy the public need.
- D. We shall act with care and competence in all activities, using and developing up-to-date knowledge and skills.
- E. We shall avoid real or perceived conflicts of interest whenever possible, and disclose them to affected parties when they do exist.
- F. The confidentiality of business affairs, proprietary information, intellectual property, procedures, and restricted Society discussions and materials shall be respected.
- G. Each member is expected and encouraged to be committed to the code of ethics of his or her own professional or trade association in their nation and area of work.
- H. Activities crossing national and cultural boundaries shall respect the ethical codes of the seat of the principal activity.

Addendum B
ASHRAE RESEARCH SUBCOMMITTEE MEETING MINUTES
Las Vegas, NV
TC2.4 – Particulate Air Contaminants/Removal Equipment

Sunday, January 29, 2017
3:00 – 5:00 PM
Location: Messina/Caesars/(Prom)

1. Call to Order. Brent Stephens (Chair) called the meeting to order at 3:01 pm.
2. Introductions. 49 people were present according to the sign-in sheet.
3. Chair reviewed the agenda.
4. Chair's Comments:
 - a. Chair reviewed goals of TC 2.4 research subcommittee:
 - i. Always have one funded project. We are on track to succeed in this over the next couple of years.
 - ii. Chair reminded that the committee considers research on particulate air filtration as well as the "nature of particulate contaminants" broadly
 - b. Chair reviewed administrative research reminders:
 - i. RAC deadlines for RTARs and WSs (M-A-D: May 15, August 15, and December 15)
 - ii. ASHRAE has research money to spend and RAC wants to fund more applied research
 - iii. Updated research manual is now posted online
 - iv. Some recent changes to URP, IRG, and GIA
 1. Grant in Aid (GIA) award proposals are now due in March instead of December
 2. Unsolicited research proposals (URPs) are back with clearer guidelines for writing and for proposal evaluation
 3. Innovative research grant (IRG) projects are back
5. RAC liaison report:
 - a. Pawel Wargocki (RAC liaison) gave a short update for the subcommittee. RAC has a training module for PMS members coming online, and 1st training will be after this conference in a webinar. Our TC research subcommittee is performing outstandingly. We will soon have 3 funded projects, although we should work to increase the output of RTARs to keep it going. RAC has a list of 9 or 10 projects that will be going for bid.
6. Chair briefly updated on active projects (there is currently one project in progress):
 - a. 1649-TRP Impact of Higher Efficiency Filtration on IAQ in Residential Environments with Central HVAC. PI: Jeff Siegel, University of Toronto. PMS: Tom Justice, Rahul Bharadwaj, Bruce McDonald, John Zhang, and Gemma Kerr. PMS met Saturday January 28, 2017.
 - i. The PI presented updates and took questions for approximately 40 minutes. A summary of the PI's update is as follows: The project is really attempting to understand residential filtration. Sample of 20 homes, each visited 9 times over the course of 1 year. Each house gets 4

filters: MERV 8 (electret and non-electret), MERV 11 (electret), and MERV 14 (electret). All electret filters are from the same manufacturer. Filters are installed in a random order in each home. They are about 2 months into the year of testing. Measurements include: flow and pressure drop; in-situ efficiency at beginning and end of each installation (10 nm to 30 μm ambient PM, with PM mass estimates); small filter integrated efficiency as well (providing TSP mass estimates and size resolution); in-situ removal effectiveness tests (e.g., indoor/outdoor ratios); continuous low-cost PM monitoring using an optical sensor; continuous run-time and heating/cooling operation monitoring with motor on/off sensor and supply air T/RH; and finally, full 52.2 tests are run on all four filters used in this study (in Bob Burkhead's lab). Early findings to date include: Homes have a variety of operating approaches and very little standardization. There are challenges measuring in-situ removal efficiency of larger particles, so the team has to generate them (there just aren't enough in the air upstream in the first place). Also challenges with alternating upstream/downstream measurements, so they now have 2 WAPS particle counters to do simultaneous measurements. Initial filter pressure drops are approximately: MERV 8 from 20 to 80 Pa; MERV 8e from 40 to 60 Pa, MERV 11e from 30 to 60 Pa, MERV 14e from 20 Pa to 90 Pa. The flow rate is strongest correlation to pressure drop; high flow \rightarrow high pressure. After 6 weeks or so, filter pressure drop increased by as little as 5% or so to as much as 6 times or so. Most between 5% and 150% (the 6x was a clear exception). Overall summary: the project is underway and going well. They have ironed out their protocols and are now focusing on data collection and analysis.

7. Work Statement activity between meetings

- a. 1734-WS, Reproducing the Typical Urban Atmospheric Aerosol in Laboratory for Air Filter Loading – Champions: Paolo Tronville and Geoff Crosby, Cosponsored by SSPC 52.2
 - i. Project went out to bid December 2016 with estimated duration of 24 months and cost of \$180,000. Three proposals were submitted, and selection will be made on Tuesday at 2.4 main meeting.
- b. 1756-WS, Evaluation of low-cost particle sensors for indoor air quality monitoring in smart building systems – Champion: Brent Stephens, Cosponsored by TC 7.5 Smart Building Systems
 - i. WS conditionally accepted with minor comments at the last RAC meeting in Fall 2016. The project only needed approval of RAC liaison (Pawel Wargocki) to go out for bid; Pawel approved just before this meeting. The PES was finalized at this meeting and the plan is to submit the final approved WS by February 14, 2017, so the project will go out for bid in the May 2017 cycle. Estimated duration: 18 months; estimated cost: \$150,000.

8. RTAR activity between meetings

- a. 1626-RTAR Energy Implications of Air Filtration in Commercial Buildings. Group working on it off and on includes: Dara Fedderson (champion), Brent Stephens, Brian Krafthefer, Jeff Siegel, Zied Driss, Paolo Tronville, Geoff Crosby, and Michael Waring.

- i. There was no progress on this between meetings. (Dara Fedderson is out on maternity leave). There was still discussion at this meeting on whether to push as an energy and filters project (which we think RAC may not want to hear) or to turn this into an in-situ systems assessment project that has a filtration component. Other suggestions include: reaching out to TC 5.1 (Fans) for co-sponsoring, which Jeff Siegel and Brent Stephens volunteered to do at this meeting; changing the title to something more direct and different from prior submissions and similar projects; there is still GPC interest in co-sponsoring; and sending the prior comments to Pawel (he generally supports the project idea). The RTAR ultimately will need very clear statements about how this project has not been done before.
- b. 1784-RTAR on Round Robin tests with 52.2. Accepted with comments last meeting. Authors are now working on WS. Anja Coenen from Freudenberg was previously champion, but now needs to step down. Thad Ptak volunteered to take over. 52.2 has identified others with an interest in co-sponsoring as well.
- c. Effect of HVAC systems on airborne viral species fate, transport, control, and infection risk – (Champion: Parham Azimi, with Al Vatine and Zied Driss).
 - i. There was been no activity for at least two meetings in a row, so this idea will be dropped from further meeting agendas.

9. Cosponsored Projects (for reference only)

- a. TC 2.1 – 1624-RP Effective Energy Efficient School Classroom Ventilation (Bid won by DANISH TECHNOLOGICAL INST. - Aarhus, Denmark). No one had updates on this and the decision was made to remove this from the next meeting agenda.

10. Chair briefly summarized other roles/activities that this subcommittee needs to be filling:

- a. Publishing and communicating research outcomes
 - i. ASHRAE Journal articles based on previous TC 2.4 research
 - ii. ASHRAE Handbook updates based on previous TC 2.4 research

11. Work time on any RTAR, WS, and other proposals for remainder of the meeting time

- a. Impact on performance (efficiency and pressure drop) of air filters in high humidity and free moisture conditions.
 - i. Bob Burkhead, Dave Matier, Paolo Tronville, Kathleen Owen, and Rahul Bharadwaj had all expressed interest at some point, with Bob championing. However there has been no progress.
- b. Embedded sensors in filters. (Brian Krafthefer is interested in sensors and nanotechnology embedded in filters. Progress?).
 - i. No progress.
- c. Develop a test method to evaluate the longevity efficiency of electrostatically charged media as an alternative to IPA discharge method (Champion: Rahul Bharadwaj with help from Al Vatine and John Zhang. Thad. Dan, John Horns, Vijay also)

- i. Rahul had put together a rough draft before last meeting, but it still needs a lot of work and there has been no progress since last meeting. Zied Driess also volunteered to help.
- d. Developing a database of commercial and residential filtration stats -- efficiency, pressure drop, etc. (Brent Stephens). Some prior interest here from Kathleen Owen.
 - i. No activity. Plan is to remove from next meeting agenda.
- e. Potential for adding filtration into the guidelines for new MTGs for system design in (a) cold climates and (b) hot, dry climates. Also interested in bringing in TC 2.3. Possibility for literature review project.
 - i. Tom Justice updated on the MTG guideline process. Not sure that this is really a research project but 2.4 membership may be interested in helping the MTGs out.
- f. Beginning of the end of MERV (new room-level test procedure): Bob Burkhead champion.
 - i. No progress. Bob was not present to discuss.
- g. What are typical indoor particle size distributions? Typical indoor generation in different types of buildings. Would be a literature review project.
 - i. Several (Monroe Britt, Vijay, Geoff Crosby, and Brent Stephens) all agreed to send papers to Paolo summarizing typical distributions of particle emissions resulting from widely varying indoor sources.
 - ii. Monroe Britt brought up the point that there is no such thing as a typical indoor particle size distribution because every building is so different; so if anything, this could be a review project that provides statistical distributions on particle size distributions indoors.
- h. New ideas:
 - i. Vijay made proposal for a 52.3 method based on PM mass. No volunteers.
 - ii. Vijay also said he gets feedback on why are standards so complicated? How can they be made simpler? Not clear what project could result from that.

12. Adjournment. Meeting adjourned at 4:45 pm.

Addendum C
TC 2.4 STANDARDS SUBCOMMITTEE
MEETING MINUTES

Monday 4:15PM – 5:15PM, January 30, 2017
Sicily/Caesars/(Emp)
Las Vegas, NV

1. CALL TO ORDER

- A. Introductions
- B. Chair's comments
- C. Review proposed agenda

2. UPDATE ON STANDARDS, GUIDELINES, AND MTGS WITHIN SCOPE OF TC 2.4

- A. SSPC 52.2 - Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size (Michael Corbat)
 - Republication (ASHRAE 52.2-2017), includes Addenda A through I, but not H.
 - Addendum A: MERV table
 - Addendum B: release rate
 - Addendum D: relative humidity
 - Addendum C: OPC specifications
 - Addendum E: "MERV" only used in reporting and labelling if entire procedure included
 - Addendum F: Inclusion of efficiency test data in the summary report is required
 - Addendum G: Appendix K – two stage systems
 - ~~Addendum H: Adding E ranges to MERV # statement~~
 - Addendum I: A2 Fine Test Dust has replaced SAE Standard J726 test dust
- B. GPC 35P - Method for Determining the Energy Consumption Caused By Air-Cleaning and Filtration Devices (Geoff Crosby)
 - 3 points:
 1. Working draft started: evaluating the methodology, rough draft submission by June 2017.
 2. TRP-1734: Research proposals for loading aerosols moving forward: how to generate submicron dust. 3 bids received, one selected by PES, to be voted on at TC 2.4. 2 years to complete
 3. Revise work plan to ASHRAE to include a two year delay

3. ASHRAE LIAISONS

- A. TC 2.3 Gaseous Air Contaminants And Gas Contaminant Removal Equipment (Kathleen Owen)
 - 2.9 and 2.3: discussion about filters with multiple technologies included
 - ii. SSPC 145.1 - Laboratory Test Method for Assessing the Performance of Gas-Phase Air Cleaning Systems: Loose Granular Media
 - Continuous maintenance.

- iii. SSPC 145.2 - Laboratory Test Method for Assessing the Performance of Gas-Phase Air Cleaning Systems: Air Cleaning Devices
 - RTAR going out: literature research: how to include electronic devices.
- B. TC 2.9 Ultraviolet Air And Surface Treatment (Matt Middlebrooks)
 - TC 2.9 is drafting a guideline on how to handle various methodologies in the same element
 - ii. SSPC 185.1 - Method of Testing UVC Lights for Use in Air Handling Units or Air Ducts to Inactivate Airborne Microorganisms
 - Continuous maintenance.
 - iii. SSPC 185.2 - Method of Testing Ultraviolet Lamps for Use in HVAC&R Units or Air Ducts to Inactivate Microorganisms on Irradiated Surfaces
 - Continuous maintenance
- C. TC 5.4 Industrial Process Air Cleaning (Bruce McDonald)
 - i. SPC 199P - Method of Testing the Performance of Industrial Pulse Cleaned Dust Collectors
 - 199 was published in June 2016
 - Workshop was done as ASHRAE Las Vegas (22, 23 people attended the workshop, mostly new faces)
- D. TC 9.6 Healthcare Facilities (Zied Driss)
 - Well attended meeting: 3.5 hours, 40 people
 - Handbook section: attempts to republish, has almost nothing about filtration and considering changing
 - ii. SSPC 170 - Ventilation of Health Care Facilities
 - Meeting tomorrow.
- E. SSPC 62.1 - Ventilation for Acceptable (Commercial) Indoor Air Quality (Charlie Seyffer)
 - The 4IAQP TRG which is under Standard 62.1, is charged with recreating the procedure and submitting such to the main committee for authentication was also active. The primary concentration of their meeting on Sunday morning was creating a list of common airborne contaminants that must be addressed to make the procedure practicable. The TRG plans on meeting every two weeks between ASHRAE Meetings. Dean Thompkins leads that Committee.
 - Proposals will be submitted through the TRG to increase the MERV 11 reference presently in the Standard to MERV 13. Likewise, there will be a proposal to change the ozone statement in the Standard. The TRG most likely will be seeking support from both TC 2.4 and 2.3. Look for notice between this meeting and the Long Beach Meeting
- F. SSPC 62.2 - Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings (Brent Stephens, Tom Justice)
 - Changing minimum filtration from MERV 6 to MERV 8.
 - Addendum K published.
 - Other addenda may be going out for public review

- New ASTM standard for testing residential ranges
- G. SSPC 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings
 - No update.
- H. SPC 180 - Standard Practice for Inspection and Maintenance of Commercial-Building HVAC Systems (Phil Maybee)
 - Schedule to re-write for 2018.
- I. SSPC 189.1 - ANSI/ASHRAE/USGBC/IES Standard for the Design of High-Performance, Green Buildings Except Low-Rise Residential Buildings – *inclusion of IAQ?* (Charlie Seyffer)
 - Committee has been active with almost 20 addenda adopted for the current document. None of the addenda are directly related to concerns or guidance from TC 2.4
 - Side note: under the United States Green Buildings Council (USGBC), TC 2.4 and TC 2.3 are directly represented on a committee charged with beefing up the USGBC efforts related to using the IAQP. The increased participation here may be what is driving the renewed IAQP interest in Standard 62.1
- J. SPC 189.3P - Design, Construction and Operation of Sustainable High Performance Health Care Facilities
 - No update.
- K. US TAG to ISO/TC 142 - Cleaning equipment for air and other gases (Rahul Bharadwaj)
 - No quorum at Saturday's meeting
 - Advisory Panel 3
 - ISO16890 is published as of end of 2016. Look at revisions over the course of the next year. The standard has been adopted in Netherlands and UK.
 - Advisory Panel 4
 - The AP4 was recently requested to review Letter Ballots associated with ISO/CD 21083 parts 1 & 2.
 - Based on a consensus of the AP4 voted to Disapprove with comments (there was extensive commenting).
 - Advisory Panel 5
 - ASHRAE 199 has been published
 - Start the vote for the activation of preliminary work item 16313-1 Still need to work out some things in Part 1 of and most of the issue have already been addressed. Part 2 is being handled by the Japanese delegation.
 - New work item proposal based on ASHRAE 199. A demonstration of 199 was held at Blue Heaven technologies after the Plenary meeting, and was helpful.
 - Advisory Panel 6

- They are working on a new flat sheet test standard and are currently working to align it with ISO 16890 methodology. They are also going to perform a study on effects of a horizontal vs vertical test stand.
- Advisory Panel 9
 - The working group made some progress on ISO 29461 parts 2, 5 and 6, lot of back and forth with Part 6:
 - a. Part 2: pulse clean system
 - b. Part 5: marine/off-shore
 - c. Part 6: pulse clean element
 - Interim meeting in Dec., Chris/Donaldson proposed combining Part 2 and Part 6 into single system. Part 2 concept would go away.
- Advisory Panel 11
 - Very good meeting in Atlanta. Members from 14 countries
 - Split the standard (pwi 17970) into 2 parts:
 - a. Evaluation of initial performance of portable room cleaners
 - b. Evaluation of lifetime performance of portable room cleaners.
 - 13th ISO Plenary meeting – 2017: Monday 25th September 2017 to Thursday 28th September 2017 in Paris at Paris La Defense
- L. GPC 23 - Guideline for the Design and Application of Heating, Ventilation and Air Conditioning Equipment for Rail Passenger Vehicles
 - No update. Guideline published – no longer meeting?
- M. Environmental Health Committee (Barney Burroughs)
 - No update.
- N. GPC 29 - Guideline for the Risk Management of Public Health and Safety in Buildings
 - No update.
- O. MTG.O&MEE, Operations And Maintenance Activities That Impact Energy Efficiency
 - No update.
- 4. OLD BUSINESS**
 - A. Report of Working Group Regarding: Proposal for new standard regarding residential filter test method (Tom Justice)
 - No update.
 - B. TC 9.3 Research Project, Commercial Aircraft Cabin Air Quality Study (1262-RP): multi-year research project (\$2.4MM)
 - Publication of Phase II expected in 2017.
- 5. NEW BUSINESS**
 - TC 2.3 standards: forum to understand new document/appendix to evaluate combination of different cleaning devices. TC 2.9 has also discussed this issue.
 - How to measure the performance of a cleaning train at the same time?

- Forum: get the three groups together and figure out whether this is a guideline, standard or something else?
- Put issue forward to main meeting or TC 2.4 Program

6. INFORMATION EXCHANGE

- A. AFS (KJ Choi, Rahul Bharadwaj)
- 2017 AFS Spring Conference, *Advanced Filtration Technologies*
 - April 10-13, 2017, Galt House, Louisville, KY
 - 2017 AFS Fall Conference
 - September 18-20, 2017, Marriott St. Louis Airport, St. Louis, MO
- B. CEN/TC 195 - Air filters for general air cleaning (Paolo Tronville)
- Plenary Meeting in March 2016
 - No other meetings since then
 1. Balloted TC 142, current draft issues
 2. Proposal: study discussing: Standardized air handling unit to evaluate ageing OR how to make measurements in existing systems
 3. ISO 29463 ongoing vote to replace old standard (EN 1822)
 - EN ISO 16890: must be published by each CEN country by June 2017, but they have 18 months to withdraw the EN779.
- C. EUROVENT (Paolo Tronville)
- Much more frequent meetings, they are modifying the energy classification 4/21 to 16890 efficiency rating.
 - Developing a guide to air filtration (similar to NAFA air filtration guide), Paolo has not seen a working draft
 - May 10th, 2017 next meeting
- D. IEST – Institute of Environmental Sciences and Technology (Vijay)
- No update.
- E. INDA – International Nonwovens Development Association (Tom Justice)
- Filtration 2017
 - October 10-12, 2017, Navy Pier, Chicago, IL
- F. NAFA (Stephen Nicholas)
- 2017 NAFA Technical Seminar
 - April 4-6, 2017, Galt House, Louisville, KY
- G. ISO/TC 22/SC 34 - Road vehicles - Propulsion, powertrain and powertrain fluids (Paolo Tronville, Bruce McDonald)
- i. WG3 – Air filters
 - Continuing to work ISO 12103, parts 3 and 4, submicron soot and salt aerosol.
 - ii. WG11 – Filtration performance of closed crankcase ventilation systems
- H. UL 900 (Randall Haseman)
- Informal filtration people part of industry group for UL900 (Don, Bob, Vijay, Tom Justice)
 - How to make changes to UL900.
 - 4 proposed changes to the document

- Instead of 5 filters, and all five have to pass: Take an average of the 5 tested filters.
 - Eliminate spark count.
 - Add specification for the blower / motor.
 - Proposal to merge ULC (Canada) and UL900 together.
- I. IAQ Meetings (Jeffrey Siegel)
 - Nothing going on.
 - J. FILTECH Expo and Conference
 - March 13-15, 2018, Cologne, Germany
 - K. Indoor Air Conference
 - 2018 in Philadelphia June just before ASHRAE meeting
 - L. American Association for Aerosol Research
 - October 16 to 20, 2017 in Raleigh, NC
 - M. Nano conference by NC State and INDA
 - No info.
 - N. Asia Filtration Show
 - No info.
 - O. World Filtration Congress
 - i. WFC 13 has been awarded to San Diego, April 20-24, 2020

7. APPENDIX – ATTENDANCE

	Name	Company/Address	Email
1	John Simenson (Chair)	Johns Manville	john.simenson@jm.com
2	Anja Coenen (Vice-Chair)	Freudenberg	anja.coenen@freudenberg-filter.com
3	Tim McDiarmid	Air Techniques International	tmediarmid@atitest.com
4	Don Largent	Air Techniques International	dlargent@atitest.com
5	Joel Davis	AAF Flanders	jdavis@aafintl.com
6	David Christopher	HDK Industries	davidc@hdkind.com
7	Dan Haas	Clarcor	dhaas@clair.com
8	Don Thornburg	Camfil	don.thornburg@camfil.com
9	Paolo Tronville	Politecnico Di Torino - DENERG	paolo.tronville@polito.it
10	Michael Corbat	Custom Filter	mcorbat@customfilter.net
11	Bruce McDonald	Retired	brucesfilterteststandards@live.com
12	Keith Chesson	Clarcor	kchesson@clair.com
13	Len Duello	Georgia-Pacific	len.duello@gapac.com
14	Tim Johnson	TSI	tim.johnson@tsi.com
15	Kate Cerully	TSI	kate.cerully@tsi.com
16	Rahul Bharadwaj	AAF Flanders	rbharadwaj@aafintl.com
17	Donna Sullivan	Lydall	dsullivan@lydall.com
18	Zied Driss	Camfil	zied.driss@camfil.com
19	Kyung-Ju Choi	Clean & Science	kchoi228@gmail.com
20	Matt Middlebrooks	FGL	mmiddlebrooks@filtrationgroup.com
21	Geoff Crosby	Lydall	gcrosby@lydall.com
22	Todd McGrath	Glasfloss Industries	tmcgrath@glasfloss.com
23	Kathleen Owen	RTI	mko@rti.org
24	Mick Flom	3M	mflom@mmm.com
25	Mustafa Ozturk	Fibrix	mozturk@fibrix.com
26	Volker Haendler	Freudenberg	volker.haendler@freudenberg-filter.com
27	Andrea Yarbrough	Freudenberg	andrea.yarbrough@freudenberg-filter.com
28	Peter McKinney	Carrier/StrionAir	pmckinney@strionair.com
29	Bill Graney	Stantec	bill.graney@stantec.com

Addendum D

TC 2.4 Program Subcommittee Meeting Minutes

January 31, 2017 10-11 AM Caesars – Pisa (Prom)

Sub-Com Co-chairs: Dara Feddersen and Donna Sullivan

In attendance: Donna Sullivan, Tim Johnson, Michael Corbat, Jeff Siegel, Mick Flom, Len Duello, KJ Choi, Brian Krafthefer, Matt Ball, Russell Taylor, Kathleen Owen, Don Thornburg, Gemma Kerr, Paolo Tronville, John Simenson, Vivekamand Gauv, Chyltol Jolliffe and Marilyn Listvan

Program(s) completed in Vegas:

Workshop 3 TC 5.4 8-9am Sunday “Sitting Around Collecting Dust: Evaluating Industrial Dust Collector Performance” – Chair: Geoff Crosby; Speakers: Bruce McDonald and Bob Burkhead

Long Beach: The call for papers is closed. Currently, 85 Conference Papers are currently under review. (Conference papers were Due January 16, 2017)

Updates from Chair’s Breakfast:

- The current program booklet does not reference the TC #; hope to reinstate.
- The publication time slot from 3:15 – 4:15 is a shared time slot alternating between TC 2.3 & 2.4 Publications. We can also use this slot to cover topics that weren’t selected and hold a forum or a short program. Gemma will follow up on the process with CEC Liaison Chris Balbach
- ASHRAE is looking for volunteers to review papers. If interested contact Tony Giometti @ ASHRAE
- Anyone who has a rejected proposal can resubmit. You must state that it is a resubmittal and ASHRAE will prioritize accordingly.

Debate, Forum, Workshop, Panel Discussion, and Seminar Proposals: Due February 6, 2017

- Track 1: Fundamentals and Applications
Track Chair: Frank Schambach Email: frankschambach@mindspring.com
It’s back to the basics! This track provides the foundation for design and construction of HVAC&R components and their application. This track seeks papers and programs of varying levels to provide discussion on theories, models, designs and shared experiences. Topics may range from fan laws and psychometrics to room air distribution and heat transfer and much more.
- Track 2: HVAC&R Systems and Equipment
Track Chair: Jennifer E. Leach Email: pennst8jen@yahoo.com
What system and equipment are best for my building? Selection of equipment and design of systems is critical for effective HVAC&R operation and usually has more than one right answer. This track will provide engineers, designers, contractors, owners and building operators the tools to properly design, select and operate traditional, non-traditional and hybrid equipment and systems. The papers and programs within this track may range from basic concept to the technical analysis of system performance.
- Track 3: Refrigeration
Track Chair: Vikrant Aute Email: vikrant@umd.edu

The refrigeration cycle is a key component to our daily needs, as it is used for thermal comfort, food storage, creating ice and medicinal needs. There have been numerous improvements and changes to refrigeration systems and refrigerants to accommodate the increased system efficiency and reduce environmental impact. This track seeks papers and programs that address the wide range of developments and applications of refrigerants, including alternative lower-GWP refrigerants, variable refrigerant flow applications, refrigerant management and food storage.

- Track 4: Building Life Safety Systems

Track Chair: Robert Alan Neely Email: alan_neely@pghcorning.com

Building life safety systems are critical in commercial facilities to protect building occupants from fires and power outages. This track focuses on building egress, fire protection systems, fire alarms, emergency lighting, fire and smoke barriers, and special hazard protection and describes key factors to consider when designing these life safety systems. Papers and programs are sought to evaluate design strategies for the life safety systems noted above along with building specific life safety systems, such as gas detection systems, kitchen ventilation and smoke evacuation systems, etc.

- Track 5: Controls

Track Chair: Melanie Derby Email: derbym@ksu.edu

This track will explore smart building systems and how they can be incorporated into commercial facilities to help reduce energy consumption and improve occupant comfort. As owners and designers incorporate more controls systems with web and cloud access into buildings, there is a concern that this allows more opportunities for hackers to gain access into sensitive and confidential databases. The track will include programs about effective building controls, integration of multiple building systems (ie HVAC, lighting, security, water consumption, etc), along with measures to keep this information safe, while maintaining the flexibility of remote control/access of building systems.

- Track 6: Commissioning: Optimizing New and Existing Buildings and their Operation

Track Chair: Dennis Alejandro Email: denzjac@yahoo.com

High efficiency building systems come at a cost, and after the owner's initial investment it is important to verify that the system components are operating as the designer intended. Secondly, the systems need to be operated properly to reach and maintain the system efficiency levels. This track seeks papers and programs providing lessons learned and recommendations for successful commissioning projects. This track also seeks case studies of existing buildings with a retro-commissioning plan to reduce energy consumption and evaluate the payback of these modifications.

- Track 7: Net Zero Energy Buildings: The International Race to 2030

Track Chair: Jason DeGraw Email: jason.degraw@nrel.gov

Title 24 and Architecture 2030 have ambitious goals for all commercial buildings in California to be Net Zero Energy (NZE) by the year 2030. This track will assist the design team and owners to evaluate various systems (including HVAC, building envelope, lighting, domestic water and renewable energy system), design strategies, construction measures and building operation to achieve NZE. The programs within the track will also explore the advancing code and regulations that countries around the world are implementing to reduce building energy consumption.

- Track 8: Residential Buildings: Standards Guidelines and Codes

Track Chair: Kimberly Pierson Email: kdpwildcat@gmail.com

ASHRAE is known for its standards and design guidelines and their evolution to improving the built environment and its systems. This track will inform designers, contractors and owners of the current requirements and upcoming changes to ASHRAE's low-rise residential guidelines: Standard 90.2, Standard 62.2 and Guideline 24. This track also seeks papers and programs for cutting-edge residential systems and the incorporation of ASHRAE standards in the design.

- Track 9: Research Summit

Track Chair: Ann Peratt Email: ann.peratt@gmail.com

The fifth annual Research Summit brings together distinguished researchers to present the latest research results. Papers are requested on the following topics: 1) building science research that addresses the performance of buildings systems and occupant usage and 2) renewable energy research and its impact as we move towards net zero energy buildings.

Annual Conference Long Beach, CA June 24-28, 2017

Conference Program Chair: Ann Peratt Email: ann.peratt@gmail.com

Long Beach Proposals:

Type	Title	Co-Sponsor	Chair
Seminar	Low-Cost multi-use sensors for buildings: detect possible hazardous biological or chemical agents Includes 4 speakers	2.4,2.3	Russ Taylor
Forum	In the year 2035, will filtration be alive? (What will it look like?)...or Back to the Future, what will Filtration look like?	2.4	Brian Krafthefer
Seminar	Do you know what you are breathing: Indoor Air Contaminants	2.4, 2.3	KJ Choi - resubmit

Workshop	Gambling With Your Filter Costs: Considerations for Total Costs of Ownership	2.4	Geoff Crosby - resubmit
Debate	Filtration Doesn't Matter Moderator: Marilyn Listvan Panelist: Jeff Siegel, Denis Stanke, Don Thornburg, Matt Middlebrooks (?)	2.4, 2.3	Marilyn Listvan

Action items: Marilyn will work with Jeff to submit Debate program.

Proposals: Chicago & Beyond

Type	Title	Co-Sponsor	Chair
Forum	Climate degradation effects on filtration	2.4	Brian Krafthefer
Forum/ Workshop	Guideline 29 (Building security, Chem. Bio)	TG2 (looking for 2.4 cosponsor)	Scott Campbell Or Barney Burroughs
Conf. Paper	How can filters be rated by their PM (PM1, PM2.5, PM10) performance?	52.2	Thad Ptak, Brent, Michael Waring, D. Thornburg
Seminar	You bet your life: Particulate matter matters!!	2.5, EHC?, IEQ-GA	Marilyn Listvan – Bill Bahnfleth, C Seyffer, Singer
Seminar	Smart Filters (Sensors & Filter Operations) Consider after TC 2.3 RTAR is completed	2.4, 2.3,	Brian Krafthefer – Brent and Michael Waring?
Workshop	Future Filtration Needs (Fines & Ultra fines/ VOCs)		Kathleen Owen, R. Vijayakumar, Paolo Tronville
Panel	Multi-technology air cleaners: 1. Gas 2. Particle 3. UV Bio aerosol	2.3, 2.4, 2.9	Kathleen Owen, Ashish Mathhur, Brian Hopindort

Begin a Debate Submission: **New Type Added**

1 moderator, 60-90 minutes, 3-4 panelists, no individual presentations

Begin a Forum Submission:

1 moderator – 60 min, no presentations

Begin a Panel Submission: **New Type Added**

1 moderator, 60-90 minutes, 3-6 participants, no individual presentations

Begin a Seminar Submission:

1-2 presentations - 60 min; 3-4 presentations – 90 min

Begin a Workshop Submission:

One chair and two presenters (max), 60-minute length only, 30 minutes for presentations and 30 minutes for discussion. Open format

Addendum E

**ASHRAE MEETING MINUTES – Las Vegas
TC 2.4 - Particulate Contaminants/Removal Equipment**

Handbook Subcommittee Meeting Draft

Sat. Jan 27, 2017 1:00 – 2:30

1. Call to order 1:00 PM Eric Brodsky, Chair
2. Introductions
3. Attendees (8): Gemma Kerr, Len Duello, Michael Corbat, Zied Driss, David Christopher, Keith Chesson, Eric Brodsky
4. Session Notes
Chapter 29 was republished in 2016, the next update will be 2020

The chapter was discussed with the following comments.

- a. Eric will distribute the most recent chapter to attendees for review and to recommend areas that need updates.
 - b. Potential area for updating include
 - Adding information about ASHRAE Research 1691 Modeling the impact of Residential HVAC filtration on indoor particles of outdoor origins
 - Adding information about ASHARE Research 1649 IAQ and Energy Implications of High Efficiency Filters in Residential Buildings
 - c. Changes in ISO status
 - d. Including information on industrial applications
5. Other Business- The committee is looking for a Deputy Handbook Chair.

Meeting adjourned --2:00

Prepared by Eric Brodsky,
Draft Minutes submitted: 1/31/17