ASHRAE TC 9.10 Laboratory Systems
Toronto (Annual 2022)
Tuesday, June 28, 2022
Meeting Minutes

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.
1791 TULLIE CIRCLE, N.E./ATLANTA, GA 30329
404-636-8400

TC/TG/TRG MINUTES COVER SHEET

TC/TG/TRG NO	9.10	DATE	January 28, 2021
TC/TG/TRG TITLE	Laboratory Systems		
DATE OF MEETING	June 28, 2022	LOCATION	Toronto

Voting Members Present	Term Expires	Members Absent	Term Expires	Ex-officio members and additional attendance
Guy Perreault (Chair)	2022	Mary Foutz	2023	John Castelvecchi
Robert Weidner	2025	Lloyd Le	2023	Lou Hartman
Brad Cochran	2022			Jason Atkisson
John Varley	2024			Roland Charneux
Christine Reinders-Caron	2023			Brendan Dingman
Eric Ballachey	2022			Gregory Gross
Kelley Cramm	2025			Traci Hanegan
Kenneth Crooks	2025			Charles Henck
Jacob Edmondson	2022			Kurt Monteiro
Brent Fullerton	2022			Ryan Parker
Kishor Khandari	2024			Rachel Romero
Glenn Friedman	2024			Douglas Ross
Martin Stangl	2023			Walter Schwarz
Wei Sun	2025			Gordon Sharp
				Ryan Soo
				Andrew Stout
				Kevin Belusa

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Voting Members Present	Term Expires	Members Absent	Term Expires	Ex-officio members and additional attendance
				Wade Conlan
				Henry Hays
				Kenneth Kuntz
				Mark Malkin
				Ali Salim Shirazi
				Jordan Beardy-Singh
				Pierre Luc Baril
				Kristopher Geyson
				Luke Fersconi
				Tom Checkfield
				Matt Gaedtke
				Bob Valbrecht
				Mike Craig
				Amanda Kribeby
				Oliver Perrault
				Justin Garner

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DISTRIBUTION

All Members of TC/TG/TRG plus the following:	
TAC Section Head: Brad Cochran	
TAC Chair: Larry Smith	
All Committee Liaisons As Shown On TC/TG/TRG Rosters:	
Standards Liaison: Rick Heiden Manager of Research & Technical Services: Mike Vaughn	
Research liaison: Paolo Tronville	

Call to order 3:30 PM / Introductions

Guy reviewed the ASHRAE Code of Ethics.

Guy gave introduction to TC9.10 and reviewed high level objectives of the committee.

Individual introductions were made by in room and virtual participants.

Quorum is met 14 of 16 members present.

Membership Update (Brad Cochran)

Current Leadership

Chair – Guy Perreault
Vice-Chair – Robert Weidner
Secretary – John Castelvecchi

Rolling off June 30, 2022

- Brad Cochran
- Jacob Edmondson
- Brent Fullerton
- Eric Ballachey

Rolling on July 1, 2022

- Rachel Romero
- Chris Kirchner

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Approval of Las Vegas meeting minutes (John Castelvecchi)

- Minutes from the 2022 Winter Hybrid meeting in Las Vegas were emailed previously.
- Comments on 2022 Winter Hybrid meeting Minutes:
    - None
    - Minutes were approved at the meeting.

Section Head Report (Brad Cochran)

- Update on Manual of Procedures (MOPS)
    - Need to keep balance on committee including retirees who retain a financial interest in a firm.
    - Voting members of Technical Committees must be ASHRAE members.
    - New Task Group TG9.Space to look at building environment outside the Earth.
    - Hybrid meetings will continue based on demand by members.
    - Subcommittees will meet virtually.
    - Recognized Guy Perreault for his service as Chair to the committee.

SPC110 Presentation (Tom Smith)

- Tom Smith presented on the progress of the research they have been doing on new test gases and diffusers for replacing SF6 as a test gas for use in Standard 110.
- They have about 6 months left of testing of diffusers for use with IPA.
- Then there will be 6 months of round robin testing.
- After the round robin testing their will be 6 months to write the test procedures.
- A copy of the presentation is attached at the end of the minutes.

I2SL Presentation (Gordon Sharp)

- Gordon Sharp presented on I2SL's Lab Decarbonization Scorecard and Certification Program.
- They have a Laboratory Benchmarking Tool (LBT) with 925 laboratories currently in the database.
- They a working on a method of scoring and normalizing for different laboratory types.
- A copy of the presentation is attached at the end of the minutes.

Program Subcommittee (Christine Reinders-Caron)

- See sub-committee report attachment.
- 14 attendees
- 1 sponsored seminar on Demand Control Ventilation
- 1 Co-sponsored seminar on Ventilation Effectiveness
- 1 sponsored Forum on Decarbonization
- 7 ideas for Atlanta programs
- 2 ideas for Tampa programs
- August 9th is deadline for program seminars for Atlanta.
- Conference Paper abstracts submitted will be notified on August 15th of acceptance or rejection for Atlanta.

Research Subcommittee (Bob Weidner)

- See sub-committee report on attachment.
- 17 in Attendance
- RP 1780 – Test Method to develop a Methodology to Evaluate Cross Contamination of Gaseous Contaminants within Total Energy Wheels – Project was awarded to University of Saskatchewan. Literature review is complete, project schedule is extended to December 2022.
- TRP 1835 Characterizing the Performance of Entrained Flow Stacks– Only 1 bidder responded. Bidder approved 13/0/0 CNV in executive session. Moved by Brad Cochran, seconded by Martin Stangl.
- Future Research
    - Surveying of sources of contamination of existing labs.
    - SF-6 Replacement follow up research.
    - DCV in labs
    - Ventilation Effectiveness
    - Use of Analytics to better operate Labs.
- RP 1833 on Air Changes ongoing. Final report due in July

Laboratory Classification (Guy Perreault)

- Need members.
- Tom Smith is working on reorganization of LVDL Table 3
- Consider a Forum to get member feed back on document.

Standard 110 (Tom Smith)

- All sections updated except tracer gas.

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Laboratory Design Guide (Ken Kuntz)

- See attached minutes.
- 19 attendees
- Working on Guide a little over 4 years
- Chapters Complete
    - Chapter 3: Design Process
    - Chapter 5: Laboratory Hood Design-may re-open
    - Chapter 11: Controls
    - Chapter 14: Laboratory Commissioning Process
    - Chapter 16: Microbiological and Biomedical Laboratories
- Working on editing the following chapters.
    - Chapter 4: Laboratory Planning
    - Chapter 7: Process Cooling
    - Chapter 8: Air Treatment
    - Chapter 9: Exhaust Stack Design
    - Chapter 12: Airflow Patterns and Testing Procedures
    - Chapter 18: Sustainable Design
    - Chapter 20 (new): Ventilation Effectiveness
- Tom Smith is looking at how to reorganize to provide orderly flow and less duplication between chapters.
- Looking for someone to take over leadership of this subcommittee.

Handbook Subcommittee (Lou Hartman)

- Finalized at subcommittee today.
- Vote for approval will be by email ballot. (Note approved by email ballot)

Journal (Roland Charneaux)

- Two articles in Journal in last 2 months.
- One was questionable on review.

ALI Courses (John Varley)

- Lab Design – Taught the class on Sunday, 12 attendees.
- John is planning on teaching the course until 2024, looking for a replacement, contact John Varley
- Lab Controls – Paperwork submitted to ASHRAE. Still finalizing class.
- Laboratory Exhaust Course – Not given in Toronto. Given virtually 2-3 times per year.

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Liaison Reports

- TC 1.4 Control Theory & Applications (Jim Coogan)
  - No Report
- TC 2.2 Plant and Animal Environment
  - Nothing lab related
- TC 4.3 Ventilation and Infiltration (Martin Stangl)
  - RTAR: Enhance the current Stack Height Reduction Factor Methodology for Plume Dispersion Calculations for stacks from screen heigh to 2.5 x screen height.
  - PTAR: Enhanced guidance on modeling external flows with CFD
  - Handbook – Enhanced guidance on modeling external flows with CFD.
  - Program: looking for help in getting programs accepted.
- TC 5.1 Fans Systems (Brent Fullerton)
  - Need New Research projects
  - RP for Belt Drive Loss project extended to Atlanta due to COVID
- TC 5.3 Room Air Distribution (Kishor Khankari)
  - Nothing to Report
- TC 7.6 Building Energy Performance
  - No Report
- TC 7.9 Commissioning (Justin Garner)
  - Std 230 Commissioning Process for Existing Buildings and Systems has been voted our for publication.
- TC 9.2 Industrial Air Conditioning (Eric Ballachey)
  - No Report
- TC 9.6 Healthcare (Traci Henegan)
  - Nothing specific to labs
- TC 9.7 Educational Facilities (Roland Charneuz)
  - No Report
- TC 9.11 Clean Spaces (Roland Charneux)
  - Discussion on DCV and ventilation effectivenss
- MTG ACR (Kishor Khankari)
  - Seminar 52: Without Ventilation Effectiveness, Air Change per Hour is Just a Number being presented in Totonto.
  - RP 1833 Air Change Rates ongoing
  - RWS 1936 co-funded by Price is under development.
  - White paper on Air Change Rate where to use and where not to use is under development.
- Standard 62.1 Ventilation for IAQ (Brendon Burley)
  - The following addenda were approved for Public Peer Review (PPR:
    - DA19-0026 regarding updates to Section 5.7 Ozone Generating Devices

        - 62.1e 2nd PPR regarding new Section 5.11 Evaporatively Cooled Building – Humidity Limits.
    - The following was approved for public release (APR)
        - DA19-0027 regarding updates to Mechanically Cooled Buildings – Humidity Limits.
    - The following programs were approved for sponsorship or co-sponsorship
        - Panel: How to evaluate existing buildings for ventilation, using Informative Appendix K, Section 7 – Ventilation for Existing Buildings
        - Seminar: ASHRAE Standard 62.1 – Indoor Air Quality Procedure: 2-22 Updates and Application
        - Seminar: The Effect of Building on Occupant Health
        - Seminar: Enhanced Room Air Movement: Infection, Comfort & Energy Effects
    - The following topics with potential impacts on laboratories were discussed in subcommittee
        - Refrigerated Spaces
        - Ventilation Controls for Air Quality Emergencies
- 90.1 Energy Efficiency (Jason Atkisson)
    - No Report
- SMACNA
    - No Report
- NFPA 45 (Ken Crooks)
    - NFPA 45 2023 edition has completed the 2nd revision draft during committee meeting in April. All public comments and subcommittee inputs have been processed (many rolling forward into future edition). NFPA board is the review the 2nd revision drat later this year with an expected approval and then formal release date of January 2023.
- NSF
    - No Report
- ISPE
    - No Report
- AIHA/ASSP Z9.5 (Tom Smith)
        - Published in April 2022
        - Thanks to Jim Coogan for his hard work.
- I2SL (Gordon Sharp)
    - Next conference is October 16-19, 2022.
- Environmental Health Committee
    - Need Liason

Old business

- None Reported

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New business

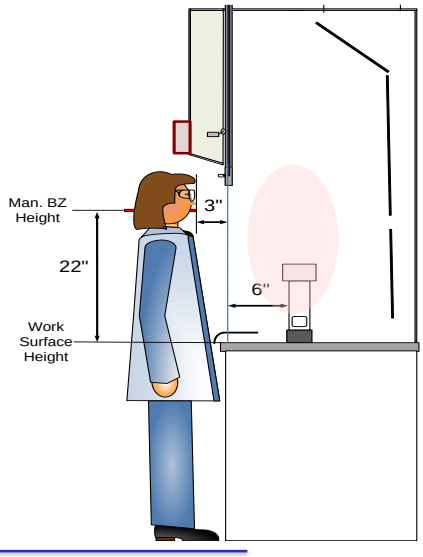
- Tom Smith reported AIHA is looking at emission rates from animals & bedding in vivariums.
- February 4-8, 2022 – Next meeting in Atlanta.
- Subcommittees will be held virtually in the future before the ASHRAE meeting.
- Need a liaison for the Decarbonization MTG.
- Adjourned to Executive Session to review RTP 1835 Characterizing the Performance of Entrained Flow Stacks. Moved by Brad Cochran, Seconded by Martin Stangl. Approved 13/0/0 CNV

Meeting adjourned at 5:30 pm.

1

The ASHRAE 110 Tracer Gas Test intended to simulate Hood Use and Contaminant Generation

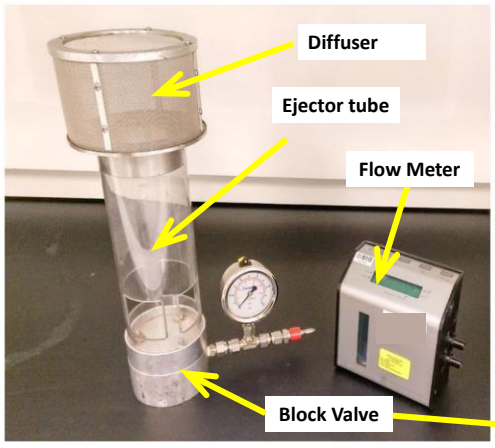
- **Simulate Person with Mannequin at Sash Opening**
- **Generate Sulfur Hexafluoride (SF6) at 4 LPM**
- **Measure Breathing zone (BZ) Concentrations**
- **Determine Control Level**
  - 4 AM < 0.05 ppm
  - 4 AI < 0.1 ppm
  - 4 AU < 0.1 ppm

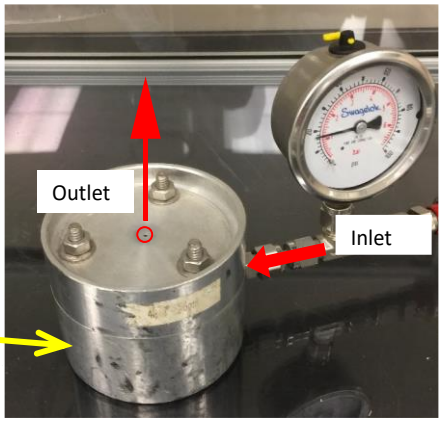


3Flow

2

ASHRAE 110 Tracer Gas Ejector designed to regulate and discharge SF6 at 4 lpm



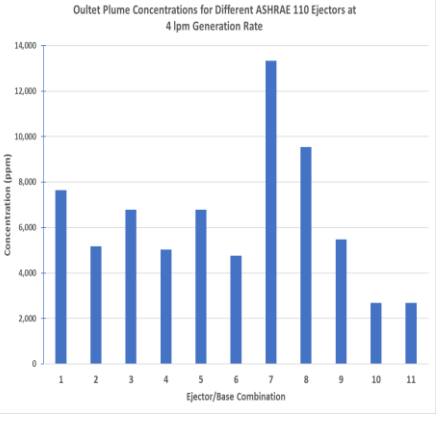


3

ASHRAE 110 Ejectors were evaluated to determine outlet flow and concentrations

- 6 Ejector Tubes and 4 Block Nozzles
- Tests at 4 lpm SF6 Generation Rate

Ejector No.	Base No.	SF6 Flow lpm	Induced Flow cfm	Induced Flow lpm	Calculated Diffuser Conc. ppm
E1A	B1A	4	18.3	523	**7642**
E1A	B2A	4	27.1	774	**5171**
E2A	B1A	4	20.6	589	**6784**
E2A	B2A	4	27.8	794	**5036**
E3A	B1A	4	20.6	589	**6784**
E3A	B2A	4	29.4	840	**4760**
E4A	B1A	4	10.5	300	**13328**
E4A	B2A	4	14.7	420	**9533**
E4A	B2A	4	25.5	729	**5485**
E4B	B2B	4	52.0	1486	**2691**
E4C	B2C	4	52.0	1486	**2691**



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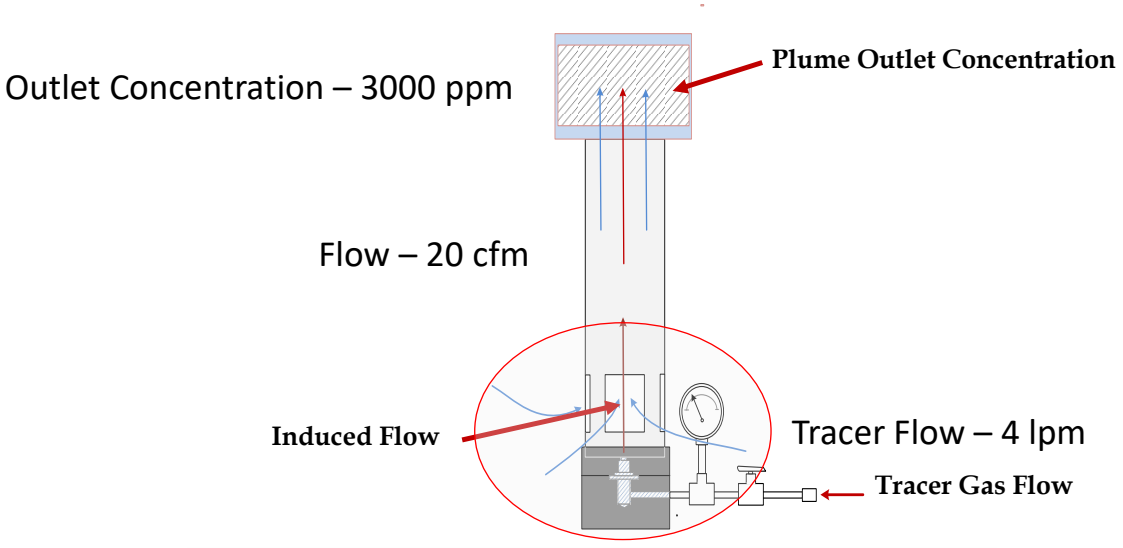
Characterizing the Ejector revealed an average outlet plume concentration



3Flow

5

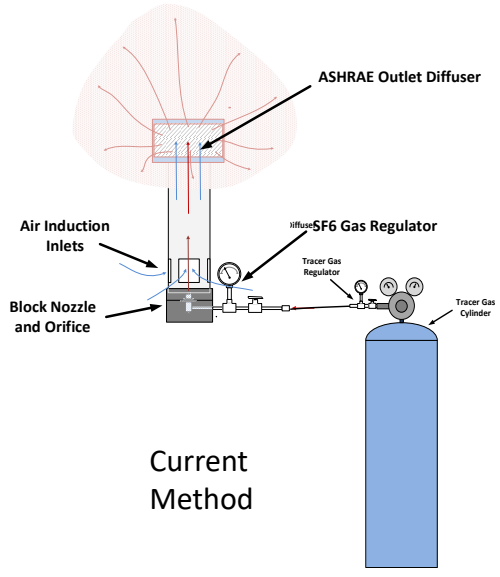
Isopropanol can be generated and easily detected

- Controlled Concentration of IPA
- Detection using Photoionization Detector
- Inexpensive and readily available

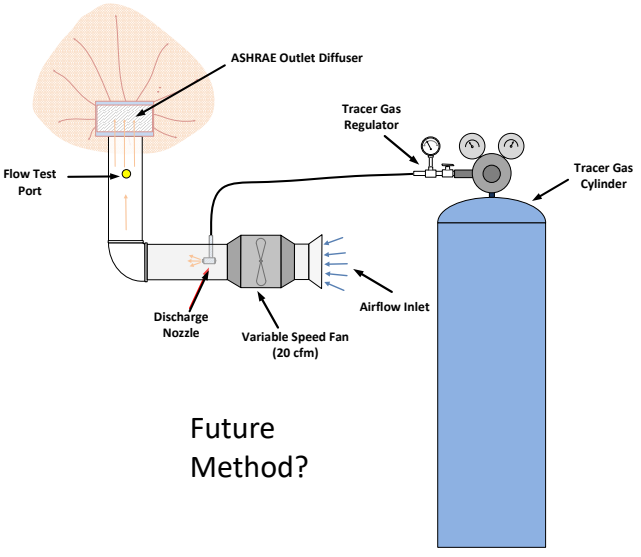
3Flow

6

Tracer Ejector Options



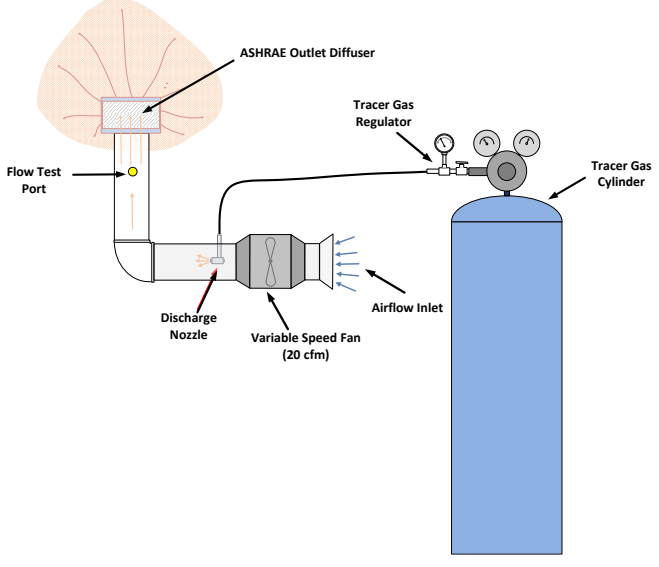
Current Method

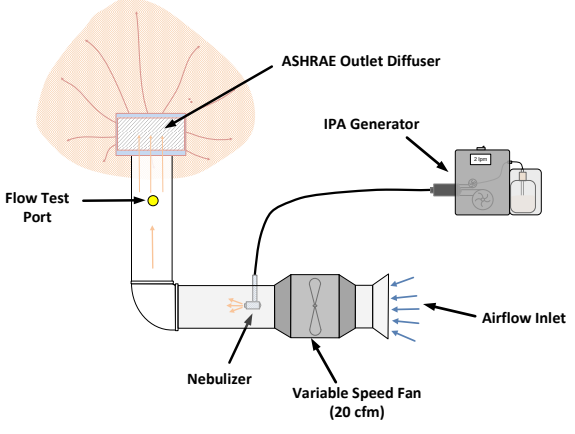


Future Method?

7

Future Tracer Ejector Options





8

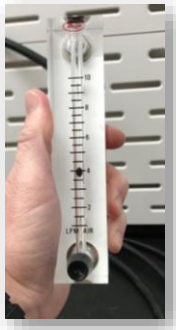
SF6 Test Setup

New 3D Printed Ejector Existing ASHRAE 110 Diffuser Bonnet, Exact dimensions, 15" off work surface, ($2000-$5000)

Standard Hoses & Fittings ($100)

Readily Available In-Line Fan ($200), Hazardous Duty Mechatronics, 1.7" Inlet Orifice.

Dwyer 0-10 LPM flow regulator ($70)



9

Propylene Set-up with Mannequin and PID

Propylene pressure regulator ($75)

Propylene tank ($50) in hood to eliminate potential for room contamination

RAE Systems UltraRae 3000VC ($6,000)

10

Hazardous Location Fan Inside 3D Ejector

Cooling Fan (up to 90 CFM, reduced to 20 CFM with 1.7″ Dia. Intake Hole)

…Mechatronics

…Oriental Motor

Purchased from McMaster-Carr ($200)

Slim Line 115v, 4.69″ SQ. x 1.5″ Thick

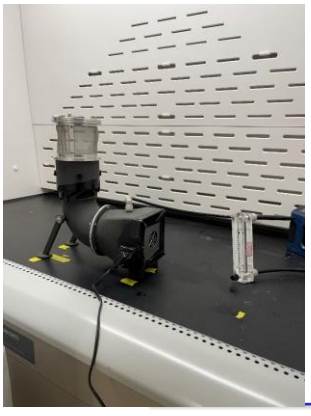
Hazardous Duty

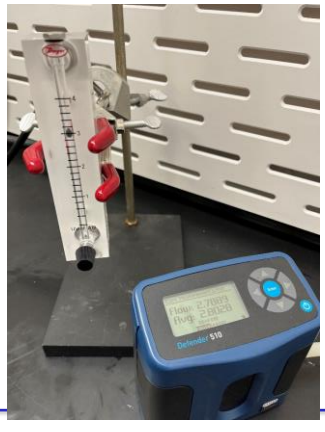
3Flow

11

Typical Pictures of Checking Flowrate With Dry-Cal for SF6-Std.-Ejector & SF6/Propylene for 3D-Ejector

Allows for checking an inconsistent ejector, Existing or 3D Printed. Measures flowrate regardless of gas density





3Flow

12

Smoke Plume Visualization

Plume at 60 fpm
- 20 CFM
- Dimensionally similar to Existing Ejector (HxWxD)
- 5000 ppm
- Height 5” above
- Width 15”-17”
- Front 2.5”-3”
- Plume shrinks at 80-100 fpm

3Flow

13

Smoke Plume Visualization

Plume at 60 fpm
- 20 CFM inlet fan
- Dimensionally similar to Existing Ejector (HxWxD)
- 5000 ppm
- Height 5” above
- Width 15”-17”
- Front 2.5”-3”
- Plume shrinks some at 80-100 fpm

3Flow

14

Standard Ejector with 4LPM Dry-Cal Setup Shown with Propylene Tank & Dry-Cal

Use Dry-Cal to Confirm 4LPM

- Existing 2016 Ejector w Dry-Cal Calibration
- Dimensionally similar to Existing Ejector (HxWxD), SF6 or Propylene
- 5000 ppm
- Height 5” above
- Width 15”-17”
- Front 2.5”-3”
- Plume shrinks some at 80-100 fpm

3Flow

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Comparison Results – All Inclusive

Comparison Results: Standard 2016 Ejector & New 3D Printed Ejector Compared with both gases (SF6 & Propylene)

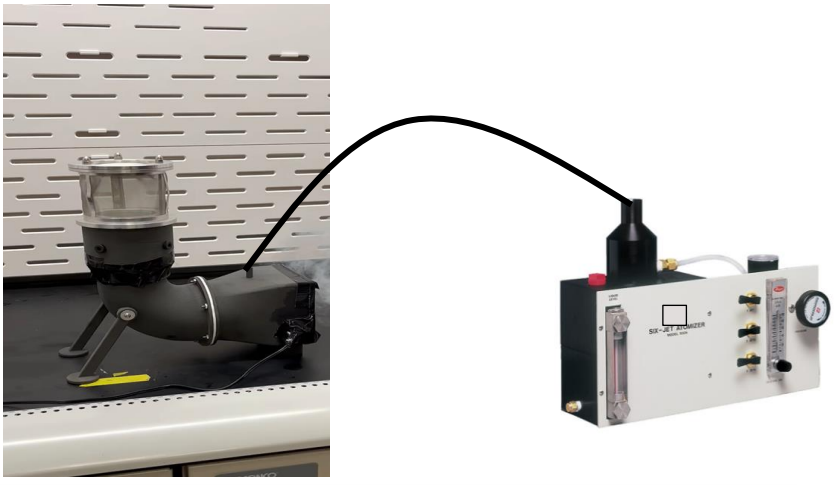
			PPM Left SF6	PPM Center SF6	PPM Right SF6	PPM SME SF6		PPM Left Propylene	PPM Center Propylene	PPM Right Propylene	PPM SME Propylene
	Face Vel (fpm)										
Standard Ejector	45	Avg.	X	X	X	0.000	Avg.	X	X	X	0.00
		Max.	X	X	X	0.000	Max.	X	X	X	0.00
Standard Ejector	40	Avg.	0.000	0.000	0.000	0.023	Avg.	0.00	0.00	0.00	0.42
		Max.	0.000	0.000	0.000	1.659	Max.	0.00	0.00	0.00	33.11
							Avg.	X	X	X	2nd 0.00
							Max.	X	X	X	2nd 0.00
Standard Ejector	35	Avg.	0.000	0.000	0.000	X	Avg.	0.00	0.00	0.06	X
		Max.	0.000	0.000	0.000	X	Max.	0.00	0.00	2.63	X
Standard Ejector	30	Avg.	0.000	0.007	0.000	X	Avg.	0.00	0.01	0.59	X
		Max.	0.000	0.367	0.000	X	Max.	0.00	0.14	12.33	X

			PPM Left SF6	PPM Center SF6	PPM Right SF6	PPM SME SF6		PPM Left Propylene	PPM Center Propylene	PPM Right Propylene	PPM SME Propylene
	Face Vel (fpm)										
3D Printed Ejector	45	Avg.	X	X	X	X	Avg.	X	0.00	X	0.00
		Max.	X	X	X	X	Max.	X	0.00	X	0.00
3D Printed Ejector	40	Avg.	0.000	0.000	0.000	0.013	Avg.	0.00	0.02	0.00	0.20
		Max.	0.000	0.000	0.000	0.967	Max.	0.00	0.82	0.00	20.74
							Avg.	X	2nd 0.01	X	2nd 0.02
							Max.	X	2nd 0.45	X	2nd 2.18
3D Printed Ejector	35	Avg.	0.000	0.001	0.000	X	Avg.	0.00	1.08	0.00	X
		Max.	0.000	0.034	0.000	X	Max.	0.00	42.41	0.00	X
3D Printed Ejector	30	Avg.	0.000	0.015	0.056	X	Avg.	0.00	X	0.23	X
		Max.	0.000	0.469	0.792	X	Max.	0.00	X	11.12	X

3Flow

16

Method of generating and discharging alternative tracer (Isopropyl Alcohol)



3Flow

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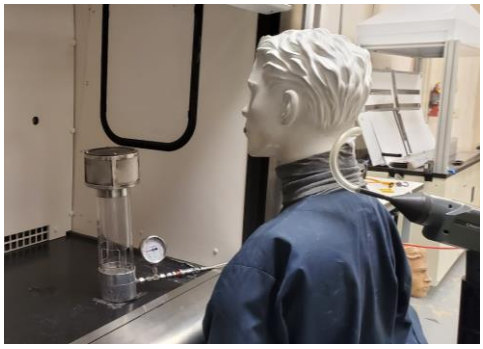
New design for tracer gas ejector by Labconco

3Flow

18

Comparison Tests between SF6 and IPA



19

Comparison Tests between SF6 and IPA

- **IPA Generation Rate = 2.2 lpm**
- **Ejector Flow Rate = 20 cfm**
- **Diffuser Outlet Concentration = 3885 ppm**

20

Comparison Tests between SF6 and IPA

Test Condition	Control Level	Left		Center		Right	
		SF6 ppm	IPA ppm	SF6 ppm	IPA ppm	SF6 ppm	IPA ppm
Sash Full Open Face Velocity – 80 fpm Minimum Flow – 200 cfm	Average	0.00	0.0	0.00	0.0	0.00	0.0
	Maximum	0.01	0.0	0.01	0.0	0.01	0.0
Sash Full Open Face Velocity – 50 fpm Minimum Flow – 100 cfm	Average	0.00	0.03	0.00	0.0	0.00	1.40
	Maximum	0.00	2.9	0.01	0.0	0.01	113.5
Sash Full Open Face Velocity – 50 fpm Minimum Flow – 100 cfm With 50 fpm cross drafts	Average	0.01	2.91	0.13	0.0	0.05	0.0
	Maximum	0.60	214.5	1.31	0.0	1.02	0.0

Test Condition SME Tests	Control Level	SME Center	
		SF6 ppm	IPA ppm
Sash Full Open Face Velocity – 80 fpm Minimum Flow – 200 cfm	Average	0.00	0.0
	Maximum	0.01	0.0
Sash Full Open Face Velocity – 50 fpm Minimum Flow – 100 cfm	Average	0.00	1.61
	Maximum	0.01	103.6
Sash Full Open Face Velocity – 50 fpm Minimum Flow – 100 cfm With 50 fpm cross drafts	Average	0.16	0.6
	Maximum	1.54	15.3

3Flow

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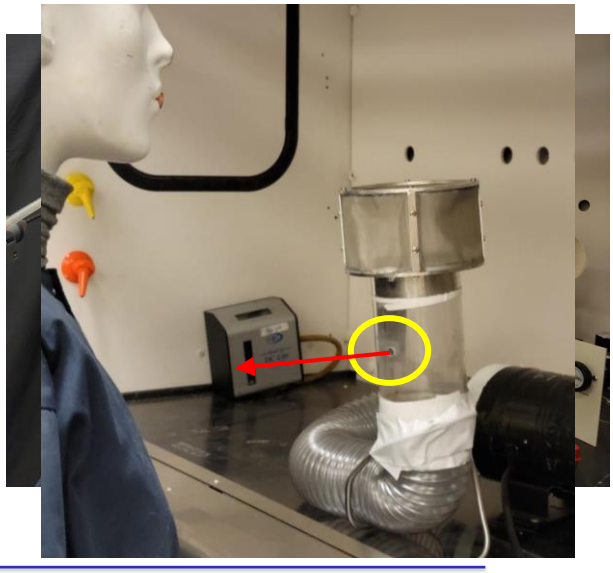
Possible reason for differences between SF6 and IPA

Test Condition SME Tests	Control Level	SME Center	
		SF6 ppm	IPA ppm
Sash Full Open Face Velocity – 80 fpm Minimum Flow – 200 cfm	Average	0.00	0.0
	Maximum	0.01	0.0
Sash Full Open Face Velocity – 50 fpm Minimum Flow – 100 cfm	Average	0.00	1.61
	Maximum	0.01	103.6
Sash Full Open Face Velocity – 50 fpm Minimum Flow – 100 cfm With 50 fpm cross drafts	Average	0.16	0.6
	Maximum	1.54	15.3



3Flow

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SKAN Test Method uses IPA with multiple points of generation and collection

Rapid Robot-Aided On-site Testing of Fume Cupboards

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Abstract

Although containment testing of fume cupboards (FC) according to the standards EN 14175-3 (2019) or ANSI/ASHRAE 110 (2016) is well established for type testing, its application is currently much less accepted and practised for evaluating containment on-site. Few of the several million FC in the market have been tested at installation and commissioning, and even less undergo verification of containment during their service life in the laboratories. Several reasons have led to this unsafe situation. To address this challenge, a new concept has been developed to allow for rapid on-site testing of FC to gain knowledge as to the functional efficiency as well as to safety aspects for the operator. The concept consists of a movable robot-aided test equipment that can be installed quickly to the FC in running labs. Multiple sensors detect the tracer gas isopropanol. Within a test run of only 10-min data is collected to quantify containment at the sash opening and to determine purge efficiency. The method reveals impact from interfering effects such as draughts, air distribution, and movements and from equipment installed, and is a tool for the optimization of operating conditions of a lab. This article presents an advanced alternative to the existing containment tests, particularly for on-site testing. The method assesses not only proper operation of the FC in its environment, but also the suitability of a FC for a given use under aspects of health and safety evaluation.

https://academic.oup.com/annweh/advance-article-abstract/doi/10.1093/annweh/wxac043/6610959)

3Flow

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International Institute for Sustainable Laboratories®

Preliminary Report on a Lab Decarbonization Scorecard & Certification Program


J Craig Venter Institute

The Current Challenge to Rate Lab Performance

- **A major gap in bldg. sustainability ratings**
  - ✓ **No current rating system adequately covers labs**
    - *LEED, Green Globes, ILFI Zero Carbon, Energy Star*
    - *ASHRAE bEQ tried to cover labs but methodology was very simple*
  - ✓ **Traditionally labs have been too complex & varied**
    - *Lab buildings can be rated by these systems but not as labs*
    - *LEED Platinum Labs can be major sources of carbon emissions*
    - *USGBC ended an effort with I2SL for a LEED for Labs program*
  - ✓ **Energy Star scores many building types but not labs**

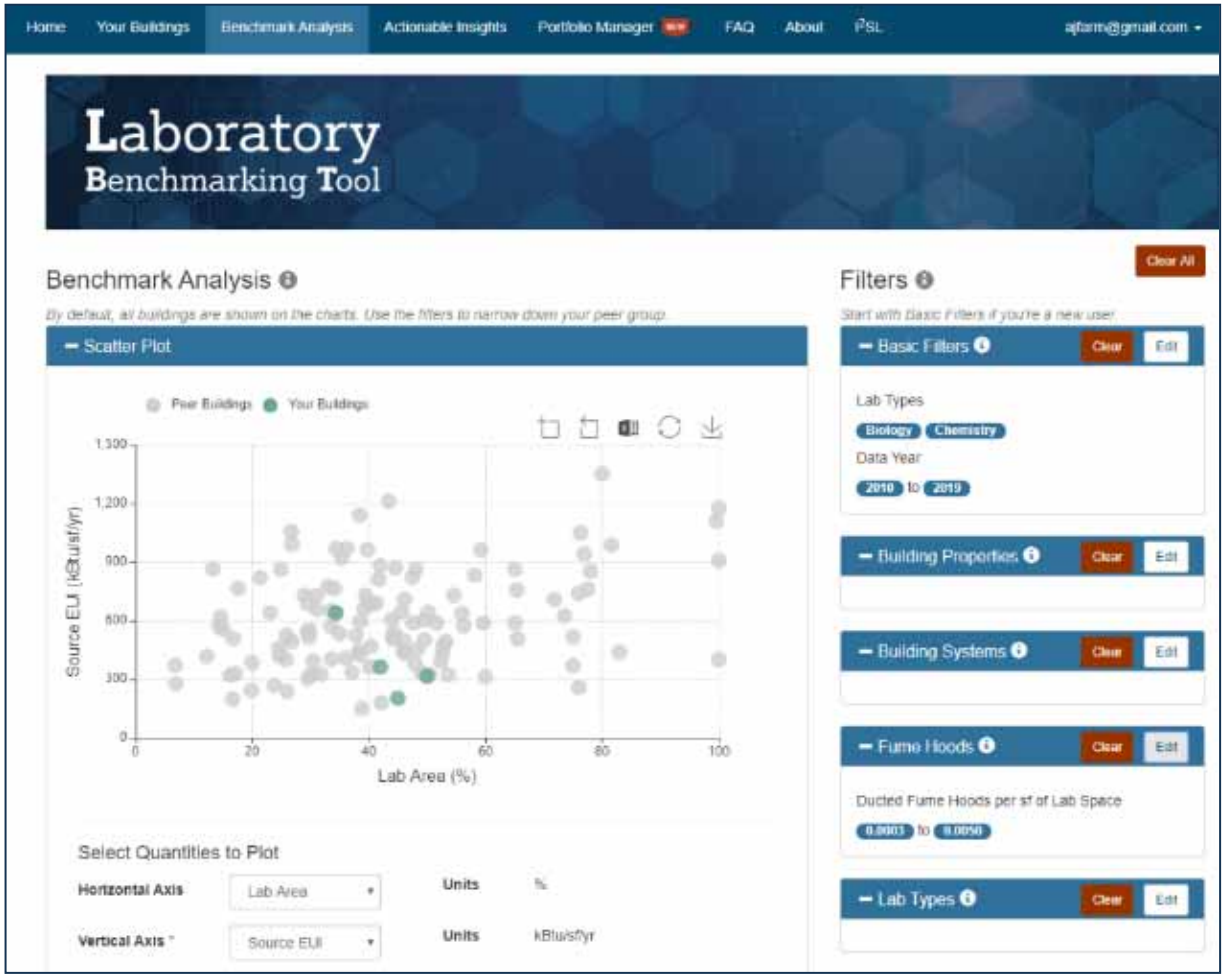
No effective means today to comparatively score labs against each other in terms of either energy or carbon

Why is Scoring a Lab's Performance so Difficult?

- **Labs are not a monolithic group:**
  - ✓ Chemistry, biology, physics, vivariums,...
  - ✓ Teaching, research, mfg., pilot plant, QC…
  - ✓ Academic, government, pharma, chemical..
  - ✓ Mixed use – various disciplines in one lab…
  - ✓ Density of fume hoods & exhaust devices…
  - ✓ Specialty lab equipment, ULT freezers…
  - ✓ Special functions: BL3/4, Clean rooms….
- **Also need to factor in climate zones**
- **I2SL Lab Benchmarking Tool (LBT):**
  - ✓ Filters on above parameters
  - ✓ Sample size often small & expertise needed

Although the LBT is a powerful tool it can't yet provide repeatable, easy to obtain scores

The Current I2SL Benchmarking Tool



The world's largest lab bldg. energy database: >925 lab buildings (5-10% of US total) & >150 million square feet. Jointly developed and operated by LBNL and I2SL.

New* LBT Modules for More Functionality

- **Actionable Insights Module**
  - ✓ Uses building data to generate ideas for energy efficiency projects
  - ✓ Funded by Siemens
- **Portfolio Manager® Module**
  - ✓ Connect to EPA ENERGY STAR® Portfolio Manager
  - ✓ Automatic data importing
- **Operational Practices Module**
  - ✓ Extends benchmarking to operational practices & policies
- **Internationalization of the LBT****
  - ✓ Metric units, Int'l climate zones, countries

* Added in 2019, **by 10/2022

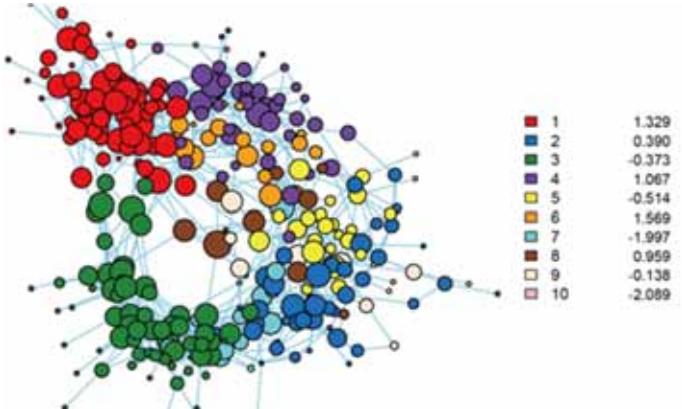
The LBT is a powerful, easy to use lab benchmarking tool

I2SL is Looking to Start a Major New Initiative:

- **Lab Decarbonization Scorecard & Certification Program**
  - ✓ **An Energy Star like rating & certification, but….**
    - *Focused exclusively on lab buildings & buildings containing labs*
    - *Initially scoring energy use intensity & operational carbon*
    - *Future goal of scoring embodied carbon*
  - ✓ **Would cover designs, new labs, & existing lab buildings**
  - ✓ **Self certification & validated, third party certification**
  - ✓ **Public recognition program to celebrate top scoring labs**
  - ✓ **Potential to significantly enhance Actionable Insights**
    - *Quantitative savings estimates & improvement priority rankings*

Foundation based on the I2SL LBT

- **Lab scoring is possible based on the LBT data:**
  - ✓ **Linear regression analysis solves small subset issue**
    - *Similar to methods used by Energy Star to create it's scoring*
    - *Could also use energy & carbon modeling*
    - *Paul Mathew & his LBNL BPD group to focus on analysis*
  - ✓ **Targeted data collection can fill other gaps**
  - ✓ **Accuracy further increased w/ expert knowledge from the I2SL lab community & technical advisory groups**
- **Not a small effort, but doable: *We Got This!***



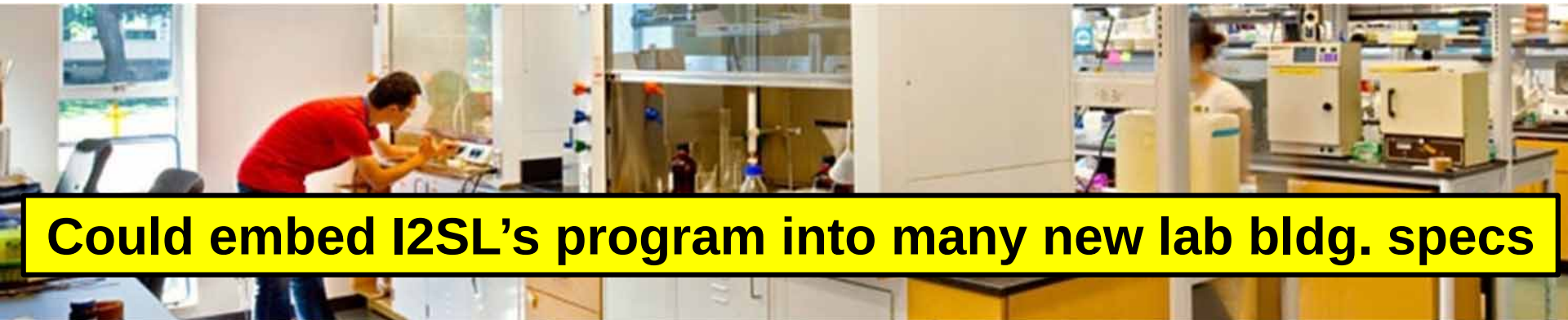
Filling Market Needs: Existing Lab Buildings

- **Compare labs on quantitative apples to apples basis**
  - ✓ **Score compares labs independent of lab type & uses**
    - *Compare energy & decarbonization performance towards zero*
  - ✓ **Determines which labs have most to gain from a retrofit**
  - ✓ **Allows labs to be compared to themselves over time.**
    - *When scoring standards change, would allow using older stds.*
  - ✓ **Some of this can be done now, but requires expertise**
    - *Scores will be repeatable, so can compare across organizations*

“If you can't measure it, you can't manage it.”- P Drucker

Filling Market Needs: New Lab Buildings

- **Quantitative carbon performance design stds.**
  - ✓ **Owners can specify energy & carbon emissions perf.**
  - ✓ **Scoring can be done based on modeled energy use**
    - *Allows transparency and more certainty in reaching objectives*
  - ✓ **Similar to spec'ing an EnergyStar score or LEED level**
    - *Energy Star has a "Target Finder" program to compare design performance to an Energy Star score (but not for labs)*



Could embed I2SL's program into many new lab bldg. specs

Filling Other Market Needs: Recognition

- **Lab owners could be recognized for superior perf.**
  - ✓ **Third party certification would validate scoring as well as check labs for acceptable health & safety operation**
  - ✓ **Public recognition:**
    - *Plaques and "on building" recognition*
    - *I2SL promotion and awards for top scorers plus cross promotion*
- **Provides quantitative means to assess ESG* actions**
  - ✓ **SEC has proposed rules that would require accurate assessment of carbon emissions**
  - ✓ **For labs our scoring and certification would allow companies to highlight & point to certified performance**

***ESG = Environmental, Social, and Governance**

Preliminary Schedule for Initiative

- **May 2022:**
  - ✓ **I2SL Board approved completing a business plan**
- **July 2022:**
  - ✓ **I2SL Board to vote on officially creating this program**
  - ✓ **Open applications for Technical Advisory Councils**
- **October 2022:**
  - ✓ **Announcements & technical meetings at I2SL Annual Conf.**
- **2nd half 2023: Estimated release of program's 1st phase**
  - ✓ **Energy use & carbon emissions scoring**

Questions?

If you are interested in applying to be on one of our TAC's contact: Gordon Sharp, President@I2SL.org

ASHRAE TC 9.10 Laboratory Systems
Program Sub Committee
Monday June 27, 11:00-12:00
Meeting Minutes

Program Sub Committee Meeting, Toronto Annual Meeting 2022

Attendees: (14)

Christine Reinders	Ken Crooks	Pierre Luc Baril
Tom Smith	Robert Weidner	Martin Stangl
Guy Perreault	Ryan Parker	Kevin Belusa
Brendan Burley	Lloyd Le	Glenn Friedman
Greg Gross	Olivier	

Programs

Sponsored Programs:

Forum 3: Decarbonization in Laboratory Buildings
Chair: Rachel Romero
Monday June 27 11:00-12:00 EDT
Sheraton Centre Toronto, Dominion North (2)

Seminar 45: Critical Ventilation in Critical Facilities: Demand Control Ventilation
Chair: Rachel Romero
Wednesday June 29 9:45-10:45 EDT
Sheraton Centre Toronto, Dominion South (2)

Co-Sponsored Programs:

Seminar 54: LIVESTREAM: Without Ventilation Effectiveness, Air Change per Hour Is Just a Number
Chair: Roland Charneux
Wednesday June 29 11:00-12:30 EDT
Sheraton Centre Toronto, Grand East (LC)

Future ASHRAE Conferences

February 4-8, 2023 – Atlanta, GA – Technical Chair – Gary Debes
June 24 – 28, 2023 – Tampa, FL – Technical Chair – Bert Phillips
January 20-24, 2024 – Chicago, IL – Technical Chair – Suzanne LeViseur
June 22-26, 2024 – Indianapolis, IN – Technical Chair – Brian Fronk

Toronto Statistics

- Total Presentations: 249
- Conference Paper Sessions: 16 (54 papers)
- Poster Sessions: 3 (19 posters)
- Virtual Paper Sessions: 2 (13 papers)
- Seminar Sessions: 50 (152 presentations)
- Workshop Sessions: 1; Debate Sessions: 2
- Forum Sessions: 3; Panel Sessions: 4
- 10 Livestream sessions

ASHRAE TC 9.10 Laboratory Systems
Program Sub Committee
Monday June 27, 11:00-12:00
Meeting Minutes

Future Programs Discussion

Atlanta:

Sponsor:

1. Results of RP 1780 - Test Method to develop a Methodology to Evaluate Cross Contamination of Gaseous Contaminants within Total Energy Wheels
2. Safety Objectives & Operations & Effectiveness – By Safety topics or Job titles – Jim Coogan
    a. Safety – EH&S
    b. Engineering – Design Engineer
    c. Operations - Facilities Operator
3. Forum on the energy savings you think you are getting but you are not – Tom Smith
    a. Exhaust Fan Flo, Energy Savings vs Fume Hood Flow & VAV sensitivity expectations, sensitivity
4. Demand Control Ventilation – Sub Committee out of Research
5. Airflow control performance – Jim Coogan
6. Decarbonization – Effect on labs – Seminar following Toronto Forum – Rachel
7. Panel on Z9.5 standard update will be published – Jim Coogan Chair

Co-Sponsor:

Atlanta – BPI Air Cleaning Post COVID – Robert Weidner perhaps co-sponsor

Tampa:

1. Embodied Carbon study on Ducted vs Ductless fume hoods. Project with Arup at Northeastern – Ken Crooks
2. Unfamiliar Hazards - 3D Printing, Nano Science, (w/Environmental Health & Safety)

Speaker Resources

https://www.ashrae.org/conferences/speaker-resources
https://www.ashrae.org//File%20Library/Conferences/Speaker%20Resources/SpeakersManual_0718.pdf

Atlanta Winter 2023 Conference Deadlines

- **Tuesday August 9, 2022** – Debate, Panel, Seminar, Forum, Workshop Proposals Due
- **Monday August 15, 2022** – Conference Paper Abstract Accept / Revise / Reject Notifications
- **Monday August 29, 2022** – Revised Conference Papers, Technical Papers Due
- **Friday September 23, 2022** – Conference Paper Accept / Reject Notifications
- **Monday October 10, 2022** – Debate, Panel, Seminar, Forum Workshop Accept / Reject Notifications

Atlanta Tracks & Track Chairs February 2023

1. **Fundamentals and Applications:** Anoop Peediayakkan
2. **HVAC&R Systems and Equipment:** Billy Austin
3. **Refrigeration & Refrigerants:** Brian Fronk
4. **Grid Resilience & Thermal Storage:** Nohad Boudani
5. **Pathways to Zero Energy Emissions & Decarbonization:** Som Shrestha
6. **Multifamily & Residential Buildings:** Lina Maged Hashem
7. **Building Simulation & Virtual Design in Construction:** Suzanne LeViseur
8. **Operations & Maintenance:** Alekhya Kaianathbhatta
9. **Mini Track – Innovative responses to supply chain challenges**

ASHRAE TC 9.10 Laboratory Systems
Program Sub Committee
Monday June 27, 11:00-12:00
Meeting Minutes

Tampa Tracks & Track Chairs June 2023

1. HVAC Systems & Equipment
2. Fundamentals and Applications
3. Professional Development
4. Research Summit
5. Decarbonization
6. Future Proofing the Built Environment
7. Building Automation and Control Systems

Draft – Tampa Annual 2023 Conference Deadlines
Conference Paper Schedule reduced by 2.5 months

- Tuesday August 9, 2022 – Call for Abstracts
- Thursday December 2, 2022 – Paper Abstracts Due
- Wednesday December 28, 2022 – Conference Paper Abstract Accept/Reject Notifications
- Monday Feb. 27, 2023 – Debate, Panel, Seminar Form, Workshop Proposals Due
- Thursday March 30, 2023 – Conference Papers Due – Submitted for Review
- Friday April 14, 2023– Debate, Panel, Seminar, Forum Workshop Accept / Reject Notifications
- Wednesday April 24, 2023– Conference Paper Abstract Accept / Revise / Reject Notifications
- Monday May 8, 2023– Revised Conference Papers, Technical Papers Due
- Monday May 22, 2023 – Conference Paper Accept/Reject Notifications
- Friday June 2, 2023 – PowerPoint presentations due

ASHRAE 9.10 Research Subcommittee Summer 2022 Meeting Minutes (6/27/22)

Minutes

1. ***17 Attendees (See List at end of minutes)***
2. ***1780-RP Research Project*** *(Test Method to develop a Methodology to Evaluate Cross Contamination of Gaseous Contaminants within Total Energy Recovery Wheels)* ***Presentation: University of Saskatchewan – Easwaran Krishnan***
    a. ***Status of Research Project including Findings & Path Forward***
    b. Literature Review – Complete
    c. Project schedule is being extended to December 2022; Testing is taking longer than anticipated requiring the extended completion date.
3. ***1835-TRP Update-****1835-TRP (Characterizing the Performance of Entrained Flow Stacks) – Brad C. (CPP)*
    a. Project went out to bid on March 30, 2022
    b. Bids were due on Monday May 16, 2022
    c. There was only one bidder
    d. Evaluation to be completed at 2022 Summer Meeting by the PES; 6/28/22 - Post Meeting Note: PMS scored the bidder to satisfy the ASHRAE requirements. 9.10 Committee approved bidder as recommended by PMS in closed session.
4. ***Research Projects still under consideration***
    a. RTAR for "Survey of sources of contamination in existing labs" Roland C. and Tom Smith (Still on hold but getting to the point of moving forward).
    b. 1573 (SF-6 Replacement Gas) Follow-up Research Project to address additional scope not addressed in SF-6 Replacement Study (Bob Weidner and Tom Smith to develop RTAR post SF6 Research). No further research needed.
    c. Demand Control Ventilation in labs to reduce air flow rates
    d. Ventilation Effectiveness for Labs – Variety of Groups doing this work - I2SL, ASHRAE MTG ACR, SP 129
    e. Using Analytics to help better operate buildings
5. ***Review of pertinent on-going research outside 9.10***
    a. RP 1833 – Air Change Rates – Almost Complete; vote in next two weeks
    b. Work Statement 1936 – Air Change Rates vs. Effectiveness – In preparation – co-funded by Price; MTG ACR
    c. 3D Printing Hazardous Issues (nano particles, chemicals, fumes, etc.) – TC 9.7 discussing; what is all in a maker space.
    d. Labs being used in Higher Education (TC 9.7) – No Update
6. ***New Research Topics for consideration:***
    a. Hourly data on lab plug loads needed; are metrics available?

Research Project Activity Notes (On-going Discussion):

1780-RP (Test Method to develop a Methodology to Evaluate Cross Contamination of Gaseous Contaminants within Total Energy Recovery Wheels) – Roland C.

1. RP 1780 was awarded to University of Saskatchewan.
2. The PMS: Bob W. (Chair), Roland C. (WS Author), Nick Agopian, Brendon Burley, Hoy Bohannon

3. Project Status
    a. Literature Review – Complete
    b. Project schedule is being extended to December 2022.
    c. Testing is taking longer than anticipated requiring the extended completion date.
4. Presentation at Summer Meeting by U of S

Work Statements:

1835-TRP (Characterizing the Performance of Entrained Flow Stacks) – Brad C. (CPP)

1. Project went out to bid on March 30, 2022
2. Bids were due on Monday May 16, 2022
3. Ohio State University was the lone bidder
4. Evaluation to be completed at 2022 Summer Meeting by the PES

Research topics in progress, initiated or under consideration:

1. ***RTAR to "Survey of sources of contamination in existing labs" Roland C. and Tom Smith (Still on hold but getting to the point of moving forward).*** More info available. Difficult to define this research but on-going risk assessments on-going will provide additional insight in characterizing contaminants; learning more to a point that an RTAR can be moved forward. More to be learned and how much do sources emit. Provide guidance on how to deal with the sources of emissions. 9.11 Study – Define Air co (7 Years Old); Smart Labs – Compilation of Data; 3-Flo's Database. What does the risk assessment findings translate to ventilation effectiveness.
2. RP 1833 on Air Change Rates: MTG committee encompassing several TC's looking into the why's and where's of Air Change Rates – Literature research on-going as first phase. ***Report was accepted PI – AEI – Roger Lautz & Clemson University; Papers and session are anticipated soon.***
3. 9.7 Higher Education – working on RTAR looking for TC9.10 to Co-sponsor specifically research for "Labs being used in higher education". ***Bob W. to check with Keith Hammelman who is the liaison.***
4. 1573 Follow-up Research Project to address additional scope not addressed in SF-6 Replacement Study (Bob Weidner and Tom Smith to develop RTAR post SF6 Research). *New generator required so waiting to see if RTAR is needed.* ***ASHRAE 110 running tests with alternative generators; plume generation methods with lots of promise.***
5. 3D Printing, Laser Issues – emerging issues brief, parallel studies on-going at AIH. Kishor involved. 62, 9.10, Industrial Ventilation; Environmental Health. *No ownership of this to date; Would 9.7 be interested in taking on. Health consequences unknown. (nano particles and chemicals). Industrial Ventilation 30th Edition does not address 3D printing and laser printing. Elliott Horner – UL colleagues did presentations. There is a UL test standard, 2904, for assessing particle and chemical emissions. UL teamed with Georgia Inst. of Tech for a 2-year study.* ***Health & Safety Groups - No update!***
6. Demand Control Ventilation in labs to reduce air flow rates; how is this verified? Sensors installed improperly, never properly tested or maintained. *Tom Smith AHIA Z 9.5 will include modulation and response to occupancy with other sensing (CO2, particles, chemical, etc.) Test Methodology not available at this time. Mechanism of challenge. TC 9.11 has a RP on-going that may help. Sensor location is important based on room airflow conditions (or duct averaging). Ventilation effectiveness. Sensor response. Kishor, Bob to assist. Kishor to pull 9.11 WS;* ***Willing to help: Gordon Sharp, Wei Sun (9.11 RP Lead – 3D and Tracer Gas studies); Kishor would be key to this moving forward. No update! Test Procedure would be useful! 9.11 Project was a***

success and Wei Sun is interested in doing one for labs. Kishor recommends subcommittee - need a leader! Hot topic – Rachel Romero to help organize the subcommittee; Bob W. to assist.

7. Ventilation effectiveness – I2SL research on-going; Potential collaboration; Multiple research projects needed. What is VE for Labs? Define VE and assessment. Need volunteers – 5.3 Air Distribution; 9.7 Healthcare; Price Manufacturing representative; Guiding principles for good ventilation. Focus on labs. Test Procedure would be useful! Ventilation Effectiveness Outcomes and Validation. ***No update!***

8. Using Analytics and to integrate to help better operate buildings. Need a lead! How much is it being used in HVAC market and lab market? Used more significantly in Industrial. What is the research angle to be addressed? Check with Cx Group – TC 7.9.; NREL (Rachel); I2SL has Best Practice Guide on this subject; U of Cal, Irvine has done research; Smart Labs. ***No update!***
9. *Work Statement 1936 (Kishor, Jim C. Roland) Air change rates vs. effectiveness of ventilation. Room geometry, obstructions to airflow; source generation. A stepping-stone to future research; looking for a co-fund source.*

<u>Attendees:</u>

1. ***Brad Cochran***
2. ***Guy Perreault***
3. ***Pierre Luc Baril from Pageau Morel***
4. ***Martin Stangl - RWDI***
5. ***Kevin Belusa, AirGenuity Inc.***
6. ***Gina Semerad from JB&B (NYC)***
7. ***Robert Weidner***
8. ***Greg Gross, CPP***
9. ***Ken Kuntz***
10. ***Easwaran Krishnan, University of Saskatchewan.***
11. ***Olivier Perreault***
12. ***Jason Atkisson, Affiliated Engineers***
13. ***Ryan Parker, RWDI***
14. ***Lloyd Le***
15. ***Ali Shirazi (PCM)***
16. ***Tom Smith - 3Flow***
17. ***Jake Edmondson, New York University Abu Dhabi***

TC 9.10 Laboratory Systems
Design Guide Subcommittee Meeting, Tuesday June 28th
Meeting Timeslot 2:15pm to 3:25pm Eastern
Minutes

Attendees: Guy Perrault, Brad Cochran, Dan Fraiser, Greg Gross, Henry Hays, Jason Atkisson, Ken Crooks, Rachel Romero, Robert Weidner, Roland Charneux, Ryan Parker, Tom Smith, Brooks Stout, Jake Edmondson, John Castelvecchi, Jordan Beardy-Singh, Kevin Belusa, Martin Stangl, Luke F.

-Review goal of sub-committee

Complete revision 3 of the Design Guide
Edit and revise a few chapters at a time until complete
Add content as necessary

-Reminder of Design Guide Process and Basecamp

- *Location: TC 9.10 basecamp, Docs & Files, Subcommittees, Design Guide*
- *Current unedited chapter versions are in "Version 2"*
  If you don't see it, it's being edited, look in version 3
- *Latest edited versions are in "Version 3"*
  Chapter leads will post current chapter edits (Version 3)
  Note color codes; Red-currently being edited
  Yellow – Edits complete and under review
  Green- Edits completed
- *Deadlines – After the chapter lead has agreement from the team on edits, they will post the chapter in the Version 3 folder and "turn the color yellow for under review" and announce to the TC at the following meeting that it is ready for review. If no items are brought up by the meeting after that, the chapter will be completed and turned green.*
- *Chapter leads or SC chair will post the final chapter edits to the ASHRAE Authoring Portal*
- *SC chair will post Agenda and notes from meetings on Basecamp site*

New Business – Chapter Report-Outs (5-10 min each)
Chapter Lead Report Outs / Group Discussion: (List of chapter leads & team at bottom of agenda)

-Table of Contents: Tom Smith

Tom reviewed all of the design guide for content and flow.
Found multiple examples where topics are covered multiple times and don't always agree i.e. air change rates,
Suggested rearranging chapter order and sections to improve flow. Group agrees with re-organization
Suggestion is to cut/paste content to new organization/order and eliminate redundancy after individual chapters are cleaned up.
Ventilation effectiveness is big topic that is not fully vetted yet, mention in design process section. Include air diffusers.

-Chapter 4: Laboratory Planning, Brooks Stout

Cleaned up language and updating references.

High level review during sub-committee meeting
Group to review content posted in Basecamp

-Chapter 5: Exhaust Hoods, Kurt Rindoks
Reviewing comments received

-Chapter 7: Process Cooling, Jason Atkisson
Work in progress, still editing
Expand load for water cooled equipment (compressors, sterilization, etc.)

-Chapter 8: Air Treatment, Bob Weidner
Work to begin shortly

-Chapter 9: Exhaust Stack Design, Brad Cochran
Making progress, finding multiple references to consolidate.
Refer to new Table of Contents for re-organization

-Chapter 12 Airflow Patterns and Pressurization ~~and Testing~~ ~~Procedures~~, Wei Sun
Rename chapter and focus on airflow patterns and pressurization
Break out testing into a new chapter (New chapter testing lead by Tom Smith)
Move airflow patterns "higher" up in order (refer to new table of content suggestions)
Move whole chapter to after chap. 5 or 6?

-Chapter 17: CFD Modeling of Laboratory Ventilation, Kishor Khankari

-Chapter 18: Sustainable Lab Design, Rachel Romero
Re-evaluate based upon new Table of Contents

-Chapter 20 (new): Ventilation Effectiveness, Kishor Khankari
Mention ventilation effectiveness in design process chapter. May be pre-mature for chapter by itself (topic still under discussion by many groups)
Recommend writing chapter for review by others.

-Additional chapters or Smart Guide content for editing?
Ideas for additional content (running list):
-O&M chapter harmonized with other ASHRAE publications
-How design guide applies to Z9.5 and where it applies – adding to chapter 9
-Additional Chapter: Lab Classification-How to use, free download (add to smart guide)
- How to specify a lab – incorporate into chapters 3 & 4
-Air Cleaners – adding to chapter 8
-How to develop the basis of design

-New Sub-Committee Chair
Open position

Chapter Team List

Completed
Edits underway
Started
Not Started

Chapter	Title	Chapter Lead	Edit/Review Team
1	**Introduction**	Bob Weidner	
2	**Background**	Bob Weidner	
3	**Design Process**	Chris Kirchner	John Castelvecchi, Wade Conlan, Doug Ross
4	**Laboratory Planning**	Brooks Stout	Harris Sheinman, Danny Sanchez
18	**Sustainable Design**	Rachel Romero	Brooks Stout, Chris Kirchner, Tao Zhang, Roland Charneux
5	**Exhaust Hoods**	Kurt Rindoks	Larry Meisenzhal, John Castelvecchi, Brooks Stout, Ken Kuntz, Tom Smith
6	**Primary Air Systems**		Bob Weidner, Brendon Burley, Charles Murphy, Wei Sun
12	**Airflow Patterns and Pressurization**	Wei Sun	Tom Smith, Salil Sansare, Dan Fraiser, Jim Coogan
21	**Testing**	Tom Smith	
7	**Process Cooling**	Jason Atkisson	Brooks Stout, Charles Murphy
8	**Air Treatment**	Bob Weidner	Rami Alkahlil, Charles Murphy
9	**Exhaust Stack Design**	Brad Cochran	Ken Kuntz, Glenn Friedman, Martin Stangl
10	**Energy Recovery**		Bob Weidner, Brendon Burley, Chris Kirchner, Glenn Friedman, Charles Murphy
11	**Controls**	John Castelvecchi	Guy Perrault, John Garrett Neubauer, Brendon Burley, Brad Cochran, Doug Ross, Ken Kuntz, Jim Coogan, Wei Sun
20-NEW	**Ventilation Effectiveness**	Kishor Khankari	Salil Sansare
13	**O&M for Ventilation and Exhaust systems**		Carol Donovan, Tom Smith, Harris Sheinman
14	**Laboratory Commissioning Process**	Daniel Frasier	Carol Donovan, John Garrett Neubauer, Tom Smith, Wade Conlan, Glenn Friedman, Harris Sheinman, Mike Amstadt
15	**HVAC System economics**		Rajendera Kapoor, Tao Zhang

16	**Microbiological and Biomedical Laboratories**	Daniel Frasier	Carol Donovan, Rami Alkahlil, Harris Sheinman, Wei Sun
17	**CFD Modeling of Laboratory Ventilation**	Kishor Khankari	Brad Cochran, Chris Kirchner
SG	**Smart Guide**	Christine Reinders	Rachel Romero
NEW	**Lab Classification – How to use Guide (placed in smart guide)**	Danny Sanchez	Adam Bare
Add to 5	**Exposure Control Devices**	Tom Smith	Salil Sansare, Harris Sheinman