MEETING MINUTES

ASHRAE TECHNICAL COMMITTEE 9.9
Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment

2026 Winter Meeting

February 1 & 2, 2026

Las Vegas, Nevada

1791 Tullie Circle, N.E./Atlanta, GA 30329
404-636-8400

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

TC/TG/MTG/TRG No. T.C. 9.9 DATE February 1, 2026

TC/TG/MTG/TRG TITLE Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment

DATE OF MEETING Sunday February 1, 2026 LOCATION Caesar's Palace, Octavius 10

VOTING MEMBERS PRESENT	VOTING MEMBERS ABSENT
Dustin Demetriou	Nick Gangemi
Ecton English	
Paul Finch	
John Gross	
Jason Matteson	
Bob McFarlane	
David McGlocklin	
Rick Pavlak	
David Quirk	
Tim Shedd	
Mark Steinke	
Lixia Wu	

CORRESPONDING MEMBERS PRESENT	PROVISIONAL MEMBERS PRESENT
Gregory Alexander	Donovan Aguirre
Mohammad Alkiswani	Tejeshkumar Bagul
Don Beaty	Anke Better-Lout
Rajat Bhagat	Patrick Birbarah
Norm Bourassa	Thomas Bise
Jerrod Buterbaugh	Jesse Buckley
Chris Campbell	Peter De Bock
Brad Cochran	Bobby Dean
Tom Davidson	Phillip Diffley
Ben Dolcich	Viswanathan Ganesh
Ken Duncan	Sumitra Giri
Nicolas Estefanell	Eric Hall

Troy Goldschmidt	Eugene Hoffman
John Groenewold	Amir Ibraheem
Edward Gutowski	Paul Lewis
Lauren Huffman	Carlos Lisboa
Roger Huggins	Stephen Mathai
Vimaldoss Jesudhas	Don Mitchell
Matthew Kaufeler	Santosh Mudunur
Matt Koukl	Scott Munns
Sushil Kumar	Sankar Padhmanabhan
Mark Malkin	Michael Petersen
Guillermo Massucco	Kaustubh Phalak
Michael McKenna	Gustavo Pottker
Saeed Moghaddam	Derek Schmidt
Chris Muller	Raj Setty
Shlomo Novotny	Archan Nimishkumar Shah
Raig Petersen	Ashok Thygarajan
Benjamin Petschke	Philip Yu
Terry Rodgers	George Zhang
Pardeep Shai	
Alkesh Solanki	
Ching-Jen Tang	
David Tootle	
Jim VanGilder	
Jonell Watson	
Eric Yang	
Davide Ziviani	
Wangda Zuo	

GUESTS PRESENT	
Ray Good	Woojin Park
Jung-Tsung Hung	Daniel Pelaez Lizana
Tanya Hutter	Amanda Pertzborn
Isaac Mahderekal	Christopher Popovich
Shannon Murray	Zachary Sarvis
Giuseppe Nardulli	Vali Sorell
Ramesh Navaratnam	John Woollett
Paul Nie	Jacob Yonkers
Olena Olenych	Shitong Zha
Sofia Paramio Martinez	

ATTENDANCE RECORD	
In Person	100
Virtual	10

Published Agenda

TC 9.9 Workshops
(Programs, Research, Handbook, & Encyclopedia)

Time: Sunday - February 1, 2026 4:00 PM – 6:00 PM PST
Location: Caesars Palace, Octavius 10 (PS)
Virtual: https://www.microsoft.com/microsoft-teams/join-a-meeting
Meeting ID: 243 563 127 885 0
Passcode: mT2Xr6aY

Section	Topic	Time	Presenter
Welcome	Welcome & Agenda	10	Mark Steinke
Programs Subcommittee	Workshop Primer	5	Eric Yang
Research Subcommittee	Workshop Primer	5	Brad Cochran
Handbook Subcommittee	Workshop Primer	5	Robert McFarlane Jonell Watson
Publications Subcommittee	Workshop Primer	5	Dustin Demetriou
Workgroup Sessions	Track 1: Encyclopedia Track 2: Handbook Track 3: Programs Track 4: Research	90	Dustin Demetriou Jonell Watson Eric Yang Brad Cochran
	Total Time:	120	Minutes

CALL TO ORDER: 02/01/26 4:03PM PST – Mark Steinke

Welcome & Agenda (Steinke) 4:03PM PST

- Etiquette and procedure
- Attendance QR Code Shared
- Code of Ethics / Values / Diversity / Anti-trust policy
- Explanation of new format for 2/1/26 meeting with workgroup sessions

Encyclopedia Workgroup Session Primer (Demetriou) 4:17PM PST

- Version 2 came out in Oct 2025 - Introduction of Wiki-style format
- A few recent updates ~2 weeks prior to conference (will discuss 2/3/26 TC9.9 Main Meeting)
- A small group has been working to restructure books and other content into the encyclopedia
- Call to Action - Volunteers for various responsibilities maintaining the encyclopedia
- (Outdated PPT shown in meeting, Dustin has a new version with topics broken out differently (shown below in 4 parts). These are the responsibilities needing volunteer coverage.
    - Site Management
    - Content Supervision
    - Topic Editor
    - Content Developer
- By end of 2026 all content should be transitioned into the encyclopedia and have all volunteer positions covered
    - This would allow the tool to move forward with regular content updates
- Call to Action - People needed to make progress over the next 6 months on all encyclopedia content

Handbook Workgroup Session Primer (McFarlane) 4:24PM PST

- Handbook must be voted out completely by TC9.9 Annual Meeting (Austin, TX)
    - Need to complete ALL updates
- List of unassigned topics were displayed
    - Call to action – Volunteer reviewers for each unassigned topic
    - Bob McFarlane walked through ALL of the open topics individually
- Call to Action - Need (2) people who haven't done editing yet, to do secondary reviews of edited material
- Lauren Huffman - Question – What are the differences between encyclopedia & handbook?
    - Bob McFarlane - Answer - Encyclopedia has more depth, handbook is quick reference. PRINTED handbook is a legal reference in court; not true with encyclopedia (at this time).

Programs Workgroup Session Primer (Yang) 4:35PM PST

- Workgroup intends to discuss the ideas that have been proposed for next conference
- Workgroup intends to attach names for each section of each track
- TC9.9 has been working on creating some mini-tracks (Lead – Mark Steinke)
    - TC9.9 would like to start setting up those mini tracks
- Previous on CDU commissioning - may expand on that base (Steinke)
- For the 2026 Winter Conference, 6 of 15 TC9.9 proposed programs were accepted
- Call to Action - People interested in programs (proposing content, volunteering to speak, etc.) may participate in the Programs Workgroup Session

Research Workgroup Session Primer (Cochrane) 4:38PM PST

- TRP-1913_Corrosion impact on ITE in Datacenters in coastal regions (Chris Muller)
  - Research awarded in Summer 2025. Project underway.
- TRP-1972_D2C Resiliency (Tom Davidson)
  - Bids received and being reviewed by PES
- WS-1956_Compact CFD Modeling for Thin Flow Resistances (Jim Van Gilder)
  - TC 4.10 owned, TC 9.9 co-sponsored
  - Having difficulty getting RAC approval. We will try once more.
- RTAR - Effective dispersal volume & ceiling height
  - Under RAC review
- RTAR - Guidelines for Dispersion modeling
  - Awaiting TC 9.9 vote
- RTAR in Development - Flow velocity limits for erosion (Steinke)
- RTAR Proposed - Digital twin for DC environments for liquid cooling (Heydari)

Will discuss how to get involved in research in the work group
Clarification that you need to bring research idea(s) to get involved (Cochrane)

- ASHRAE doesn't do research; they sponsor research

Call to separate in-person attendees into (4) workgroups - 4:43PM PST

IT SUBCOMMITTEE meeting tomorrow morning 9-11:00AM PST in Caesar's Palace, Pompeian III

MAIN MEETING for TC 9.9 is tomorrow 2:30pm to 7:00PM PST in Caesar's Palace, Octavius 10

MEETING ADJOURNED: 02/01/26 6:00PM PST – Mark Steinke

1791 Tullie Circle, N.E./Atlanta, GA 30329
404-636-8400

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

TC/TG/MTG/TRG No. T.C. 9.9 DATE February 2, 2026

TC/TG/MTG/TRG TITLE Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment

DATE OF MEETING Monday February 2, 2026 LOCATION Caesar's Palace, Octavius 10

VOTING MEMBERS PRESENT	VOTING MEMBERS ABSENT
Dustin Demetriou	Nick Gangemi
Ecton English	
Paul Finch	
John Gross	
Jason Matteson	
Bob McFarlane	
David McGlocklin	
Rick Pavlak	
David Quirk	
Tim Shedd	
Mark Steinke	
Lixia Wu	

CORRESPONDING MEMBERS PRESENT	
Gregory Alexander	Matt Koukl
Gerardo Alfonso	Sang Lee
Mohammad Alkiswani	Carlos Lisboa
Mukul Anand	Mark Malkin
Paul Artman	Will Martin
Bradley Baumann	Michael McKenna
John Bean Jr.	David Meadows
Don Beaty	David Moss
Paul Bemis	Chris Muller
Norm Bourassa	Giuseppe Nardulli
Jerrod Buterbaugh	Shlomo Novotny
Chris Campbell	Michael Ohadi

Brad Chen	Melissa Olson
Brad Cochran	Jun Kyu Park
Tom Davidson	Mark Pavol
Ben Dolcich	Cosimo Pecchioli
Ken Duncan	Craig Petersen
Charles Freda	Benjamin Petschke
Jeff Garry	Joe Prisco
Art Giesler	Terry Rodgers
Sumitra Giri	Justin Seter
Paul Glanville	Pardeep Shahi
David Grant	Oumou Sidibe
John Groenewold	Alkesh Solanki
Edward Gutowski	Vali Sorell
Juwan Ha	Jeff Stein
Ali Heydari	Ching-Jen Tang
Hugh Hudson	Justin Todd
Roger Huggins	David Tootle
Vimaldoss Jesudhas	Willem Van Der Meer
Ram Karki	Jonell Watson
Nitin Karwa	Eric Yang
Matthew Kaufeler	Wangda Zuo

PROVISIONAL CORRESPONDING MEMBERS PRESENT	
Adam Abubakar	Lihong Lao
Aguirre Donovan	Paul Lewis
Hyeunguk (Henry) Ahn	Haopeng Liu
Ashley August	Meraj Mohebi
Tejeshkumar Bagul	Santosh Mudunur
Alireza Behfar	Scott Munns
Patrick Birbarah	Bush Nazri
Thomas Bise	Robert (Alan) Neely
Dustin Bremner	Chris Newton
Anke Breyer-Lout	Sankar Padhmanabhan
Federico Chalupa	Kaustubh Phalak
Sean Cornelious	Gustavo Pottker
Peter de Bock	Abdur Rahman Quadri
Bobby Dean	Ali SalimShirazi
Phillip Diffley	Derek Schmidt
Ryan Gallagher	Archan Nimishkumar Shah
Viswanathan Ganesh	Harold Smith
Rachel Guo	Ashok Thygarajan
Eric Hall	Brian Weston
Matt Hatley	Cheng-Min Yang
Matthew Hochstein	Jake Yu
Eugene Hoffman	Philip Yu
Lauren Huffman	George Zhang
Tanya Hutter	Collin Zimmerman

Amir Ibraheem	
Samy Krim	

GUESTS PRESENT	
Tyler Abbott	Aidan McFall
Cory Abramowicz	Ahmed Megahed
Elias AlJariri	Natascha Milesi Ferretti
Jeff Autor	Olena Olenych
Kyle Ayotte	Divya Pandya
Sun woong Baek	James Paschal
Mark Baines	Daniel Pelaez Lizana
Ravi Bandaru	Eric Peterson
Joshua Buzzell	Duncan Phyfe
Kyle Chien	Kaushik Raj
Austin Chung	Gautham Ramchandran
Scott Duncan	David Rose
Keith Dunnavant	Karim Shalash
Galen Gerig	Matt Sigler
Dalia Ghaddar	Frank Silva
Marcus Hassen	Jon Snowden
John Huby	Leila Srinivasan
HanYun Jhang	David Starr
Christopher Johnson	Rich Supkowski
Edith Luveina Joseph	David Taylor
Philip Kaae	Arturo Thur de Koos
Aliaksei Karol	Yash Trivedi
Luke Klusmeyer	Dianthe Van Weerden
Eric Krouse	Nicholas Ventura
George Land	Brian Weston
Jake Lindberg	Zhiyao Yang
Clive Ling	Chandra Yelamanchili
Jim Link	Shitong Zha
Isaac Mahderekal	Rui Zhang
Deba Maitra	Hui Zhao
Roger Mancilla	Yajing Zhao

ATTENDANCE COUNT	
In Person	167
Virtual	33

Published Agenda

TC 9.9 Main Committee Meeting

Time: Monday - February 2, 2026 2:30 PM – 7:00 PM PST
Location: Caesars Palace, Octavius 10 (PS)
Virtual: https://www.microsoft.com/microsoft-teams/join-a-meeting
Meeting ID: 254 214 740 423 9
Passcode: aV3uh7bs

Section	Topic	Time	Presenter
Welcome	Welcome, Agenda, & Meeting Etiquette	10	Mark Steinke
Introductions	TC 9.9 T.P.S., Structure, New Officers, Subcommittee Chairs, Voting Members, & In-Person Attendees Introductions	35	Mark Steinke
TC 9.9 Membership	Review of Membership Statistics	10	John Groenewold
TC 9.9 Activity	Recorded Votes Website Updates	15	Mark Steinke Ecton English
Liaison Reports	Standard 90.1 Standard 90.4 OCP	25	Rick Pavlak Marcus Hassen Matt Koukl
SSPC127 Addn. B	Release Review	10	David McGlocklin
Handbook Subcommittee	Updates on Chapter Progress	15	Robert McFarlane Jonell Watson
Programs Subcommittee	2026 Winter & Summer Meetings Other Updates	15	Eric Yang
BREAK		20	
Special Presentation	RP1890 Presentation	20	George Land
Standards Subcommittee	Updates	5	Rick Pavlak
International Subcommittee	Updates LinkedIn Statistics	5	Paul Finch
Publications Subcommittee	Encyclopedia Updates Tech Briefs	15	Don Beaty
Research Subcommittee	Updates RTARs	15	Brad Cochran
IT Manufacturers Subcommittee	Updates	30	Dustin Demetriou
	Total Time:	245	Minutes

CALL TO ORDER: 02/02/26 2:34PM PST – Mark Steinke

Welcome/Agenda/Etiquette (Steinke)

- Meeting start 2:34PM (some tech difficulties around podium mic, WIFI and camera)
- Issue with online audio not working. Resolved at 2:39PM.
- Ethics/value statement
- In-person attendees = 153; Online attendees = 68 (Taken visually for in-person)

Introductions (Steinke)

- TC 9.9 Title, Purpose and Scope (TPS)
- Basic ASHRAE structure "flow chart"
- Explanation of TC purpose
- Why TC 9.9 was founded (Don Beatty) [1995-2005]
    - Convergence of data centers and telecom (telecom transition from switching to ISP)
    - Cell tower explosion
    - Dot-com boom
    - “Pizza box” servers replacing mainframes
    - Transition from liquid to air cooling
    - When TC 9.9 formed, ASHRAE had no clue about data centers. Mainframe images from 1960s still in use
    - TC 9.9 Solutions
        - Step #1 – Transition IT OEMs from proprietary to common thermal guidelines
        - Step #2 - Publish vendor neutral, system agnostic content in layman’s terms
        - Step #3 - Become known as global trusted source
    - TC 9.9 Publications
        - Phase 1 - Published a new DATACOM book each year.
        - Phase 2 – New books plus book revisions slowed the pace over time. TC 9.9 unintentionally became lethargic due to all this work along with the new development of SSPC 90.4 and associated work
        - Phase 3a – Convert consolidated published books to Online Encyclopedia
        - Phase 3b – Transition from book-level revisions to snippet-level rapid revisions
    - TC 9.9 pillars
        - Pillar #1 – IT OEMs develop and agree on current & future HW needs
        - Pillar #2 – Cross section of manufacturers, users, designers, constructors, commissioning agents translate HW needs into layman’s terms
        - Pillar #3 – Remain unbiased, vendor neutral, system agnostic
        - Pillar #4 – Highlight useful life infrastructure discrepancy (IT v. Cooling v. Power v. Building)
    - Finished at 2:58PM

- TC 9.9 Structure (Steinke) and Membership Profile
- Recognize previous chairs
    - Shoutout Matt Koukl – Outgoing TC 9.9 Chair (2023-2025)
        - Oversaw Handbook update
        - Oversaw release of 90.4-2025, Thermal Guidelines 5th edition
        - Oversaw move from printed DATACOM books to Online Encyclopedia
- Officers and subcommittee chairs with email aliases for contact information
- Voting membership presentation (13 members, has been some transitions)

- In person attendees verbal self-introductions (3:08PM)
    - Completed 3:37PM (29m for introductions)
    - New Headcount = 158 in-person attendees (3:33PM)

TC9.9 Membership (Groenewold)

- Statistics
- Provisional Corresponding Member (PCM)
  - First step when joining TC9.9
  - 2 yr term, no participation limits
  - Must participate to move up to Corresponding Member
  - If not participating, will be dropped off the TC membership after 2 years
- Corresponding Member (CM)
  - Expected to participate
  - May serve as officer/chair/voting
- Voting Member (VM)
  - Must be CM to become a VM
  - 4 yr term
  - Only one VM per company
- Roster Update 736 members up from 639 (2025 annual mtg)
- YEA up to 126 from 100
- PCM up to 306 from 259
- CM up to 406 from 357
- Attendance is also increasing over time
- Roster will update in April for SY26/27
  - Based on attendance/participation/contact emails
  - Email delivery failures may impact membership (KEEP EMAIL UPDATED)
- Finished at 3:43PM

TC 9.9 Activity (Society Year 2025/2026)

- SY runs from July 1, 2025 - June 30, 2026
- New officers installed
  - Mark Steinke (chair)
  - John Gross (vice chair)
  - Chris Campbell (secretary)
- Paul Finch installed as International subcommittee chair
- Matt Koukl installed as OCP liaison (new)
- Made updates to Standard 90.4-2025
  - Has been published; is available in ASHRAE bookstore
- Released Datacom Encyclopedia V2
  - Began quarterly updates (Q4 2025)
- 5 votes held SY 25/26 (all were PASSED)
  - Discontinue printed datacom books
  - TC 9.9 RTAR on effective refrigerant dispersion volume
  - Approval of minutes (24 winter, 24 annual, 25 winter)
  - Approval of draft minutes from 2025 annual meeting
  - Approval of Q4 2025 quarterly encyclopedia updates
- Presented updated TC9.9 Publication Timeline with all publications shown (Steinke)
  - Shows slowing of books, but increase of standards and technical papers over time
  - Recent start of tech briefs and encyclopedia updates
- Website Updates (Ecton English)
  - Typical usage spike near conferences
  - TC 9.9 has the most visited TC website
  - 448 subscribers to the Datacom Online Encyclopedia (as of Summer 2025)
    - Looking to get access to the ASHRAE database for updated count
  - Comments about how other TCs with websites have postcards with QR in the conference bookstore
    - Question whether TC 9.9 has postcards in the bookstore

        - Response that we have had postcards in past, not sure about this conference but they should be there (Demetriou)
    - Complete at 3:55PM

Proposed topical conference (Steinke)

- Data Centers and AI Integration Conference (DRAFT working title)
- Joint effort between TC 9.9 and SSPC 90.4
- Chair (Steinke; TC 9.9 chair), Vice-Chair (Hassen; SSPC 90.4 chair)
- CEC ExCom Approved Topical Conference
- Target December 2026 or March 2027 (location TBD)
- Steering committee already formed and topics under discussion
- Need help on topics
    - Content generation
    - Talks / presentations
    - Raise awareness
- Imminent RFP for cities and venues (lead by ASHRAE CEC) (Hassen)
- Significant outlay by ASHRAE on funding; will probably look for sponsors (Hassen)
- Complete 3:59PM

TC 9.9 How to get involved (Steinke)

- Check the TC 9.9 website
- Contact officers for help (alias emails provided)
- Trying to make more self-serve enabled (stay tuned for future updates)

Liaison Reports

- **90.1 (Pavlak)**
    - Over 100 addenda (106)
    - New version is expected to be published in early 2026 (will be 2025 edition). Lots of editing is in progress.
    - Appendices M/N/O need review by TC 9.9 / SSPC 90.4 (Net Zero Bldgs.)
        - Make sure these won't apply to data centers as that may be disruptive
    - 90.1 has 2028-2031 work plan to break standard into (2) pieces
        - Energy Efficiency (Traditional 90.1; minus net zero)
        - Net Zero Operational Carbon (Will be called '90.1 E')
            - Follows ASHRAE leadership goal of net zero operational carbon by 2031
- **90.4 (Hassen)**
    - 90.4-2025 is published! Available in bookstore.
    - 90.1-2025 will be able to reference 90.4-2025 as an alternative compliance path (IMPORTANT)
    - 90.4 Addendum D - Did not make it into 2025 standard
        - Air-cooled chiller / liquid cooling baseline models
        - Adds definition for liquid cooling
        - Adds components for makeup water/sewer cost
        - MLC value refinements
        - Adjusts MLC threshold from 300kW to 1MW
        - 2nd public review (ISC) pending
    - Will be a new addendum developed on tradeoffs between energy efficiency and water conservation (spun out of Addendum D)
    - Center of Excellence for Building Decarb (CEBD) - Publishing framework on AI data centers. Lead by Pacific Northwest National Lab. Targeting June 2026 publication.
        - 10 proposed chapters with assigned authors and 2/3 reviewers
        - Still looking for SMEs in each category for review
        - Call to action - More reviewers
    - US Congressional Briefing December 2025
        - Sponsored by congressman from Virginia 10th district

        - Includes Loudoun County (data center "capital of the world")
    - Much interest on Capitol Hill. Lots of discussion.
        - Lots of commercial opportunity due to rapid growth in AI data center projects
        - Local grassroots efforts across the country against data center projects near residential areas
    - Covered in governmental affairs update
    - Another congressional briefing planned for March 2026 (Indoor Environmental Quality)
  - New cooperation agreement between ASHRAE TC 9.9 / SSPC 90.4 / SSPC 127 and The Green Grid (TGG)
    - TGG has new 'water usage intensity' metric
    - TGG has some other new IT-centered metrics as well
  - Marketing working group has a funding request (approved) for local chapter and university outreach
  - SSPC 90.4 committee is working on 2028 work plan (deliverable for 2026 annual conference)
  - Complete 4:14PM

- **OCP (Koukl)**
  - Explanation "Why collaborate?"
    - Wider knowledge base
    - Educate - Avoid duplication of work
    - Collaborate on shared/aligned roadmap
    - Communicate published work and publicizing
  - Memorandum of Understanding (MOU) was signed already
  - Quarterly meetings between TC 9.9 leadership and OCP Cooling Environments Project
    - Also ties in with EE HPC working group
  - Current activities
    - Fluid velocity RTAR (ASHRAE)
    - TCS Fluid Mixing RTAR (ASHRAE)
    - Looking to expand engagement with OCP Data Center Facilities (DCF) group
  - Complete 4:18PM

- **SSPC 127 Addendum B (McGlocklin)**
  - Explain scope of SSPC 127
    - Liquid Cooling Subcommittee
      - Finished Addendum B
        - With ASHRAE Publications Committee – Release in ~ 1 week
        - Method of test for Liquid to Liquid (L2L) CDUs
      - Working on Addendum C
        - Will review in committee meeting
        - Method of test for Liquid to Air (L2A) CDUs
      - After Addendum C (L2A) is complete, committee will work on other topologies
        - Immersion & 2-Phase
    - Air Cooling Subcommittee
      - Monthly meetings with AHRI 1360 to align with ASHRAE 127
      - Move some rating metrics and other details between standards
      - Future ASHRAE 127 Addendum D to harmonize with AHRI 1360
    - Call to action – Meeting 2/3/26 8:00AM-12:00PM
    - ASHRAE Addendum B (referenced above) explanation
      - Completion took 2 years
      - Added 17 new definitions – liquid cooling terminology
      - New entry for classifications section for L2L CDU
      - New section on calculations and conversions
      - Test requirements

        - Data to be recorded
        - Test procedures
            - Table 9-1 test points
        - Reporting of results
        - Nomenclature
        - References
        - Informative appendix – application testing
        - Normative appendix – measurement points diagram
    - Completed 4:22PM

Handbook Sub (McFarlane/Watson)

- Thanks given for working sessions on 2/1/26 evening TC 9.9 meeting
- Explanation about the importance of the handbook
    - The most important product of ASHRAE
    - The basis for ASHRAE codes and standards
    - Updates go into the online version, don't go into the PDF/print until publication
    - The public face of our TC
        - The quality of our chapter (Ch 20) reflects the quality of TC 9.9
- TC 9.9 information (Datacom) is found in HVAC Applications Handbook
    - There are (4) Handbooks: Fundamentals, Refrigeration, Applications, HVAC & Equipment
    - Each handbook is published on 4 yr cycle (one book updates each year)
    - Ch 20 - Data Centers and Communications Facilities
- Chapter 20 (HVAC Applications Handbook) Update Progress
    - 29 initial reviewers
    - Thanks given to 24 reviewers who completed their reviews
    - Applications Handbook won't publish until 2027
    - All revisions secondary edits due April 30, 2026
    - Handbook Chair review by May 31, 2026
    - Approval by TC board by Jun 27, 2026
    - Call to action for help on BICSI Std 002 and BICSI 009
        - Gerardo offered to help (Jonell captured)
    - Concern - We need to look at overlaps with other chapters and/or standards
        - This effort was started in some way previously, but didn't really happen
- Open the floor for questions (Emails for Bob & Jonell)
- Complete 4:36PM

Programs Sub (Yang)

- 6 conference papers and 1 seminar accepted for this Las Vegas conference
    - 15 total submitted papers (6 were accepted)
    - Seminar 46 - 2/3/26 3:15-4:45PM
        - This seminar was not published in list of programs; need to do lesson learned to avoid in future
        - Not sponsored by TC 9.9 but very applicable to data centers
    - There were other various sessions that TC 9.9 should have co-sponsored but that didn't happen. Need to gather lessons learned here as well.
- Want to develop TC 9.9 mini tracks (3+ sessions) moving forward
    - 5 Proposed Mini Track Options
        - Urgent TC 9.9 Topics – Encyclopedia, Updates, Alerts
        - FWS/TCS – CDU Testing, Velocity, Fluid Quality, Filtration, Maintenance
            - Was submitted for Las Vegas Conference, but was not accepted by CEC
        - Commissioning – FWS/TCS, Best Practices, Pre-ITE, Post-ITE
        - Energy Efficiency – Power Trends, Best Practices, Heat Recovery / Reuse

        - Emerging Technologies – ARPA-E COOLERCHIPS, Quantum Compute
- Overview of Conference tracks for Austin, TX shared
    - Look to the ASHRAE website or meeting PPT slides for details
- Feb 25, 2026 - Due date for programs (ASHRAE Annual Meeting 2026; Austin, TX)
    - Debates, panels, seminars, forums and workshops proposals due
    - Conference papers and extended abstracts due
- Estimated May 24-25 due date for conference paper abstracts (Austin, TX)
- Contact Eric Yang (ericyangcem@gmail.com) for support

BREAK (4:46PM)

Special Presentation (RP1890 - Flushing) (George Land; PurgeRite)

- Title – Minimum Flow Velocities for Purging Air and Debris From Hydronic Piping Systems
- Technical Committee Sponsors for RFP-1890
    - TC 6.8 – Geothermal Heat Pump and Energy Recovery Applications
    - TC 6.1 – Hydronic and Steam Equipment and Systems
    - TC 6.2 – District Energy
- Objectives
    - Find minimum average fluid velocity to remove debris
    - Find and visualize the average fluid velocity required to entrain air
    - Consider Copper, HDPE and Steel pipes with vertical and horizontal elbows
    - Consider HDPE ground loops and slinky loops (geothermal)
    - Consider a wide range of debris types and sizes from sand to large bolts
- Shared visual examples of debris found in data center FWS and TCS systems
- BSRIA BG29 being used as common reference for DCs
    - Appears to come from Cranfield and Lawrence (1973)
    - Moving debris on bottom surface of horizontal pipe
    - Debris size 0.375"
    - Does not account for pipe fittings or vertical risers
- This study considered small rock (easy), steel ball (average), hex bolt (difficult)
- Study included Steel, HDPE and Copper piping
- Test Method 1 - Drop debris sample into an established flow stream
- Test Method 2 - Multiple samples loaded dry pipe, flooded and flushed with increasing velocity. Measure captured debris at each velocity.
- Results
    - Key factors increasing flushing velocity requirements
        - Pipe size
        - Debris mass / drag area
        - Fluid density / viscosity
        - Wall roughness
        - Surface discontinuities (i.d. mismatches require a lot of velocity)
        - Fitting type (horizontal pipe, horizontal elbow, vertical pipe, vertical elbow, blind tee)
    - All systems typically have a vertical elbow (not necessarily always a blind tee) so that's the baseline
    - Shared charts of probability distributions on flushing velocities
    - Shared video of a bolt getting stuck on a weld and then moving past
    - Shared recommendations of minimum flush velocity based on testing
        - Less than 2" nominal pipe diameter – Recommend 4 ft/s minimum
        - 2"-10" nominal pipe diameter – Recommend 7 ft/s minimum
        - Greater than 10" nominal pipe diameter – Recommend 10 ft/s minimum
        - Higher than BSRIA BG29 - to accommodate difficulty to flush through vertical elbows
        - Duration = 6 round trips minimum (not 6 system volumes of turnover)
        - Avoid dead legs (or keep < 2 pipe diameters if needed)

        - Avoid concentric reducers (eccentric preferred)
        - Avoid bottom-takeoff small diameter branches
        - Avoid pipe discontinuities
        - Prevent introduction of debris!
            - There's no velocity that will guarantee cleanliness
    - RP status
        - Data collection is complete
        - Draft report is under review by ASHRAE PMS
        - Conference paper will be presented at 2026 ASHRAE Annual Conference (Austin)
    - Question from Dave Quirk about working fluid used
        - Answer = pure water
    - Question from Dave Quirk on corrections for PG25
        - Answer = no results to give guidance from this study
    - Comment from John Gross that projects in his purview are all being flushed with pure water
        - Clarification – Flush water is Reverse Osmosis water skids (Gross)
        - George Land comments that they typically flush with water that meets the glycol compatibility specification for mixing PG-water blends.
    - Question online about whether there was any consideration of Reynolds number
        - George Land comments that Reynolds number changes with pipe size and is not a very helpful metric. Was more effective to follow BSRIA BG29 trendline shape; albeit offset by new guidance

Special Presentation (RP1913 - Sea Salt Corrosion) (Lihong Lao; Syracuse University)

- Shared 3 components of corrosion mechanisms
    - SO2 Pollution
    - Airborne Salinity
    - Time of Wetness (humidity)
- Objective - understand the effects of gas, salt pollution and moisture in the air on IT reliability in coastal regions
- 6 tasks within the project
    - Task #1 - Literature review (9-12/2025)
    - Task #2 - Develop test facility (1-8/2026)
    - Tasks #3 & #4 - Running experiments (4/2026 – 6/2027) & (4-8/2027)
    - Task #5 - Develop updated thermal guidelines (7-8/2027)
    - Task #6 - Write reports and papers (7-8/2027)
- Project schedule 9/2025 to 8/2027
- Research team members shared
- Shared in-kind contributions that were provided to support research
- Finished literature review
- Identified possible test conditions
    - Sea salt
    - Sulfur dioxide (SO2)
    - Temp and Humid
    - Wet/Dry cycles
- Shared the oxidation mechanism (chemistry) behind sea salt corrosion
- Had to evaluate the reduction in sea salt concentration based on inland distance
- Had to evaluate the reduction in sea salt concentration from outdoor to inside the DC
- Used both equations (literature) and GEM satellite data to compare two methodologies
- Eventually will get inside DCs and be able to validate
- Had to estimate the SO2 concentration inside the DC
- Will work to align with ASHRAE 1755-RP
- Used literature and global climatic data to estimate temp/humidity
- Used literature to estimate humidity fluctuations (wet/dry cycle) during 24h cycles
- Developing test facility (Jan 2026)

- Run experiments (4/26-6/27)
- Investigate effects of humidity change (4-8/2027)
- Total nearly 200 material coupons being tested
- Will use methods to evaluate results
    - Coulometric reduction
    - Visual inspection with color index
    - Corrosion tests
    - Salt deposition
    - Impact of bias (opt)
- Call to action
    - Request for access to coastal DC for monitoring
        - John Gross volunteered to help with Mississippi Power (who offered to host coupons). Recommended to make sure they put coupons into areas that are NOT protected by active carbon filtration.
    - Request some help engaging with pure air filtration

Research Sub (Cochran)

- Last quarter, ASHRAE RAC reviewed (3) work statements, (3) RTARs and (3) TRPs
    - ASHRAE TC 9.9 is overrepresented compared to other TCs
    - TRP-1913 - per previous review, this is now an RP
    - TRP-1972 - Will have TC 9.9 voting after this meeting to approve selected bidder
    - WS-1956 - Compact CFD Modeling Guidance for Thin Flow Resistances
        - Jim VanGilder discussed the backstory
            - Originated to model airflow through floor tiles
            - Still is relevant for ASHRAE beyond this particular application
        - TC4.10 is the cognizant TC, TC 9.9 is co-sponsor
        - Difficulty getting RAC to buy-in. Need RAC to sponsor by roughly March '26; otherwise, it may be dropped due to a RAC time limit (2 yrs) and require restarting from the beginning
        - Trying to take one more opportunity to submit to RAC by March 2026
    - RTAR #### - Effective dispersal volume - flammable refrigerant releases
    - RTAR #### - Guidelines for DC external dispersion modeling
        - TC 4.10 and TC 4.3 are Co-sponsoring TCs
        - Need TC 9.9 vote by March 2026
- RTAR in development - Flow Velocity limits for erosion control (Steinke)
    - Will be submitted in new online portal by March 2026
- Proposed RTAR - Digital twin for DC environments for liquid cooling (Heydari)
    - Brought up in ASHRAE 2025 Annual Conference: No known new developments
- Proposed RTAR - NEW at conference. Determine information to allow PUE calculations for AI DCs. Transient conditions in AI training clusters, which doesn't align with typical chiller ratings. Concept to develop load profile for application testing of chillers.
- Proposed RTAR - NEW at conference. Mixing of organic and inorganic PG25 formulations. Still forming scope and goals on this. (Tanya Hutter)
- Brad provided guidance on how RTARs work and how to participate
    - Flowchart shown on PPT showing how RPs are developed from idea to contract.
    - RTAR = Research Topic Acceptance Request
        - This is developed from initial idea
        - Once approved, develop a Work Statement (WS)
        - If WS is approved, then RAC will form Project Evaluation Subcommittee (PES) and send out RFP
        - PES reviews bids and recommends winner
        - Sponsor TC(s) votes to approve bid considering recommendations
        - Then, Project Monitoring Subcommittee (PMS) is formed [often same as PES]
        - PMS and Project Investigator (PI) have regular meetings
        - PMS provides progress reports to TC(s)
        - PI provides a technical paper once project is complete

    - PMS reviews final report and submits to TC(s) for approval
        - Paper goes to MORTS and gets included in ASHRAE Manuscript Central
- There are meetings (PMS) that are open to the public.
- Complete 6:12PM

International Subcommittee (Finch)

- TC 9.9 LinkedIn site launched June 2018
    - Purpose – To raise awareness and relevance of TC 9.9, provide greater access globally
    - Relevance – Thirst for guidance and standards now with data center expansion
    - There are nearly 3,000 followers (doubled in past 12m)
    - Geographic snapshot of followers confirms global reach
- European Commission are referencing some of TC 9.9 work (ex: Thermal Guidelines)
- ASHRAE UK Chapter (ashrae.uk/about/) started in 2025
- CIBSE Data Centre Interest Group started in 2025
- Next Steps - Expand international updates to include Middle East, North Africa (MENA) and APAC
    - Call to action – Anyone who can provide information from MENA, APAC

Publications Subcommittee (Demetriou)

- Explained value statement on the encyclopedia
- Explained feedback was given on the encyclopedia at ASHRAE 2025 Annual conference (was in a state of BETA-like, kind of version 1.5)
    - Actionable on many things, some things limited by Microsoft SharePoint functionality
    - 'like' and 'comment' features have some strange behavior that isn't always able to be modified
    - Version 1 was basically the books in electronic format
    - Version 2 is wiki-style page
    - Reference to Datacom Books has been removed (no longer relevant)
        - There is still a dropdown menu to allow for some division by "book"
        - All versions of all books (PDF) are still available for view-only
    - Topics are grouped into (6) on the main page
    - Bottom of main page shows Technical Alerts and What's New sections
    - Under the "about TC 9.9…" menu, can find how to "cite" this as a source of info properly
    - Can find full listing of all topic pages under 'encyclopedia index'
        - This is not a hierarchy, but just a list of pages
    - At the bottom of every article, there is a version menu at the bottom for revision control
        - Old versions are 'saved' as PDFs
    - Question: Can subscribers be notified of updates
        - Answer: Unclear, but as of now, no. Need to follow this with ASHRAE.
- Completed 6:37PM

IT Manuf. Subcommittee (Demetriou)

- Presented the sub structure and details on meeting format including a new, monthly meeting
- Presented the updates to wetted materials
    - Copper alloys
    - Elimination of tape pipe sealants
    - Updated plastics/elastomers (PVDF, FKM, etc.)
    - Moved all the footnotes into the table to avoid them getting missed (common issue)
- Presented the updates to fluid quality
    - Turbidity
    - Coverage of PG25
- Presented the updates to filtration
    - 25 micron as the typical filtration level

    - Add beta ratio (filtration efficiency) on filters
    - Side stream provision w/o filter size recommendation
- Presented the concerns related to usage of UL 62368-1
- 2029 NEC is undergoing a major structural change (Joe Prisco)
    - Going from 9 chapters to 20+ chapters
    - Chapter 23 will have many articles (sections)
        - Call to action – ASHRAE 90.4 and or TC 9.9 experts to help
        - Looking at electrical safety of liquid cooled systems
            - Power distribution equipment
            - Associated controls, sensors, and actuators
            - Fault detection and protective interfaces
            - Electrical separation from liquids
        - Need something written up (1st draft) by End February 2026
        - Will persist into 2027, but need to get started
        - Currently meet every Mon/Thurs at 10AM EST
- Presented the IT Subcommittee publishing goals (tech bulletins)
    - Monthly IT Sub meeting will be focused on writing the tech bulletins
    - Developed a Google Drive to collaborate on it, looking for alternatives for future
    - We should align Programs with our tech briefs in the future
- Completed 7:02PM

CALL TO CLOSE: 02/02/26 7:02 PM PST – Mark Steinke