



MEETING MINUTES

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

2024 Winter Meeting

January 21 & 22, 2024

Chicago, Illinois



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 January 21, 2024
TC/TG/MTG/TRG TITLE Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment
DATE OF MEETING Sunday January 21, 2024 LOCATION McCormick Place West, Chicago, IL

VOTING MEMBERS PRESENT	VOTING MEMBERS ABSENT
Matt Koukl	Bob McFarlane
Mark Steinke	Jason Matteson
Jason Matteson	Mark Monroe
Rick Pavlak	Joe Prisco
Mark Seymour	Paul Finch
John Groenewold	David Quick
	Lixia Wu

CORRESPONDING MEMBERS PRESENT	PROVISIONAL MEMBERS PRESENT
Gwenn Ivester	Cibi Chakravarthy N
Michael Miller	Carlos Lisboa
Roger Schmidt	William Martin
Kamal Mostafavi	Nicolas Ventura
Dustin Demetriou	Philip Yu
Alexandre Kontoyanis	
Don Beaty	
Gerardo Alfonso	
Eric Yang	
Mukul Anand	
Henry Amistadi	
Chris Muller	
Vali Sorell	
David Tootle	
Ali Heydari	
Shlomo Novotny	

Michael Geraghty	
Brad Cochran	
Russell Tipton	
David McGlocklin	
Alex Hubbard	
Tom Davidson	
Norman Bourassa	
Ben Dolcich	
Mustafa Kadhim	
Ashwin Siddarth	
Jim VanGilder	
David Grant	
Timothy Shedd	
Gregory Alexander	
Michael McKenna	
Benjamin Petschke	
Earl Allen	
Jonell Watson	
John Gross	
John Murgida	

GUESTS PRESENT	
Shawn Empkey	Nathan Parkison
Saeed Moghaddam	Lorcán Mooney
Andreas Knoepfler	Keith Lachance
Achim Gotterbarm	Rhonda Johnson
Alon Ashkenai	Jonathan Bastien
Dave Turcotte	Lucas Rae
Howard Neville	Mackenzie Cottle
Mohammad Alkiswani	

ATTENDANCE RECORD	
In Person	51
Virtual	11

PUBLISHED AGENDA

Sunday, January 21, 2024
 TC 9.9 Programs, Research, Handbook & Publications
 6:00 PM – 8:00 PM CST
 Location: McCormick Place West, W179A (1)

Microsoft Teams Meeting
<https://www.microsoft.com/microsoft-teams/join-a-meeting>
 Meeting ID: 260 955 366 554
 Passcode: guxHKr

Attendance
<https://forms.gle/wjboSPgW6yQecKsW8>

Topic		Time	Presenter	In-Person or Virtual
Introduction	Welcome and Introductions	10	Matt Koukl	IP
Programs	2024 Winter Chicago & 2024 Summer Indianapolis	10	Eric Yang	IP
Handbook	Handbook Update	20	Robert McFarlane/ Jonell Watson	V/IP
Research	Research Committee Update	10	Mark Seymour	IP
Publications	Publications Update	10	Don Beaty	IP
Programs	Working session on Program Topics	20	Eric Yang/ Matt Koukl	IP
Research	Research Workshop - Topics Working Session	20	Mark Seymour	IP
Publications	Working Session	20	Don Beaty	IP
Total Time:		120	Minutes	

CALL TO ORDER: 01/21/2024 6:00pm CDT – Matt Koukl

INTRODUCTION – Matt Koukl

- Welcome
 - Main meeting for the first hour
 - Program Topics, Research Workshop Topics, and Online Publications breakout sessions for the second hour
- Meeting Housekeeping
 - Hybrid meetings being recorded for purpose of taking Minutes
 - Teams for Sunday & Monday meetings
 - Virtual Host: Vice Chair – Mark Steinke
 - Virtual Co-Host: Secretary John Gross
 - Projector is sharing content in the room
- Attendance Form
 - Link: <https://forms.gle/wjboSPgW6yQecKsW8>
 - Both in person and virtual attendees to click and fill out the attendance form
 - Must fill out for each meeting (Sunday/Monday)

PROGRAMS – Eric Yang

- Conference has 1 workshop and 3 seminars
 - 3 completed today
 - Wednesday is session on Liquid Cooling Book release
- Upcoming Conferences
 - Tracks for Indianapolis
 - Fundamentals and Applications
 - HVAC&R Systems and Equipment
 - Research Summit
 - Professional Development
 - Electrification: Possibility and Pitfalls
 - Artificial Intelligence and the Built Environment
 - Building Life Cycle Assessment
 - Legislation, standard, codes, and guidelines
 - Submission deadlines for Indianapolis
 - February 26, 2024 for Debate, Panel, Seminar, Forum, Workshop
 - April 1, 2024 for Conference Paper Accept/Revise/Reject Notifications
 - TC is willing to co-sponsor submissions with other TCs
 - Sessions today were standing room only
 - TC will work to better communicate due dates and opportunities, as well as notifying the TC about the sessions in time for scheduling
- 2023 ASHRAE Summer Program – Tampa
 - Sponsored by TC 9.9
 - Panel 1: Future Data Center: Road Map to Liquid Cooling Facility Design and Implementation and Operation - Chair: John Groenewold
 - Time: June 25 11:00 AM – 12:30 PM EDT Sunday
 - Seminar 34: The Impact of Hot and Humid and Corrosive Environment on Data Center Equipment: Recent Research Activities on Data Centers – Chair: Eric Yang
 - Time: June 26 11:00 AM – 12:00 PM EDT Monday

- Seminar 62: Coupling Simulation Tools for Fast and Accurate Indoor Environmental Models for Assessing Potential Energy Impacts of System Design and Operation
 - Time: June 28 9:45 AM – 10:45 AM EDT Wednesday - Chair: Liang Chung Lo (TC4.10, TC9.9)
- Seminar 67: Blockchain and the HVAC Industry: It's Not All About Cryptocurrencies
 - Time: June 28 11:00 AM – 12:30 PM EDT Wednesday – Chair: Stephen Roth (TC9.9, TC1.5)
- For any future Panels or Seminars. Contact both the TC9.9 Program Chair and the TC9.9 Chair
 - This allows for TC9.9 to be aware, assist, and publicize the events
- 2024 ASHRAE Winter Program – Chicago
 - TC9.9 Focused Tracks
 - Suggested ideas to fit into Tracks
 - Refrigerant management & best practices – Refrigerants track
 - Decarbonization strategies in data centers – Decarbonization track
 - Liquid cooling technologies – workshop sessions – Hydronic Systems track
 - Design Build vs Design bid build approach – Project Delivery Methods track
 - MER Option – System & Equipment track
 - Important Dates
 - Wednesday, August 2, 2023 | Debate, Panel, Seminar, Forum, Workshop, and Debate Proposals Due
 - Program types
 - Seminars:
 - Feature presentations on subjects of current interest.
 - No papers attached to seminars.
 - Require Learning Objectives, Q&A
 - Workshops:
 - Provide a series of short presentations on a topic requiring specific expertise.
 - Have an increased emphasis on audience participation and training in a specific set of skills.
 - Do not require Learning Objectives, Q&A
 - Panel Discussion
 - Feature a broad range of subjects and explore different perspectives on industry related topics.
 - This session format includes a panel of 3-6 speakers each addressing a facet of the session topic, followed by an interactive discussion lead by the session chair.
 - Debates
 - Highlight hot-button issues commonly faced by ASHRAE members. Industry experts, either on teams or as individuals, argue opposing sides of an issue, concluding with position summaries and audience feedback.
 - Forums
 - “Off-the-record” discussed held to promote a free exchange of ideas.
 - Allow individuals to speak confidentially without concern of criticism.
 - There are no papers attached to forums.
- Maintain a current program idea list
 - <https://docs.google.com/document/d/1trRC9wgVLDt4kbZC35uY6rikrVY3kAjK8DkeldB9McY/edit?usp=sharing>

- Contact Eric Yang for
 - Program ideas
 - Co-sponsorship from other TCs
 - Other submission help
 - Email: ericyangcem@gmail.com
- Q: What is the difference between Panel discussion and Workshop?
 - A: Workshop is a series of talks vs Panel is one presentation with one topic. Key difference is more audience inputs with a workshop
- Q: Can we get an online location to share ideas?
 - A: Yes. We will use a google form link to keep an updated list of ideas and participation
 - A: Can use Basecamp. Most found this difficult to use

HANDBOOK UPDATE – Jonell Watson

- Jonell now working with Bob McFarlane on Handbook. Contact info as follows:
 - Bob McFarlane: mcfarlane@smwllc.com
 - Jonell Watson: Jonell.watson@accenture.com
- TC9.9 responsible for Chapter 20 of the Applications Handbook "Data Centers and Communications Facilities"
 - What is the target audience for the chapter?
- General discussion --> foundational information
 - Don't want to duplicate content found in other TC publications
 - Due to update cycles, can't be as current as other publications
 - History of the evolution of the industry
 - Considered as "fundamental reference" for engineering guidance, whether for new engineers or engineers new to the market
 - This feedback is critical due to the wide variety of content that has been provided to Handbook subcommittee for inclusion in the chapter
 - Handbook last published in 2023, with refresh cycle starting now.
 - Drafts due 4/1/26 for 2027 publication
 - TC board must approve the draft before submission to ASHRAE - 6/27/26
- Call for Volunteers
 - Do not have to be member of TC9.9 or ASHRAE
 - Primary reviewers to be SME (Subject Matter Experts)
 - 3-5 hrs per topic
 - Need for reviewers who can verify cross-references and harmonization within ASHRAE and outside bodies.
 - 8 hrs per topic
- Tasks
 - Update technical understanding within your expertise
 - Review texts for consistency
 - Basic grammatical and spelling review
- Ways to volunteer
 - Signup sheets in meeting today
 - Virtual signup sheet on <http://tc0909.ashraetcs.org/> under "TC 9.9 2024 Winter Meeting Presentations & Information"
 - Email Bob or Jonell
- Separate signup sheets for:
 - Authors and Reviewers
 - Crosscheck content

- Cross-check will identify topics where content resides in multiple locations within the handbooks. This will prompt discussion between TC9.9 and associated TC to determine roles and responsibilities for updating content.
- Signing up will get you access to the ASHRAE "Authoring Portal"
- Written permission is required for all illustrations and figures, preferably in perpetuity.

RESEARCH COMMITTEE – Mark Seymour

- Corrosion Impact - Coastal Regions
 - Motivations
 - Is sea salt a contributor to ITE failures in coastal locations
 - Can the DC envelope be expanded if we know the interactions?
 - Trying to get approval for research
 - Previous work statement 1913 rejected
 - Has been resubmitted addressing primary objections
- New Items
 - TC 7.9 Proposed Research
 - TC 7.9 possible partnership with impact of commissioning on operational uptime
 - TC 9.9 interest level to co-sponsor?
 - CFM modeling guidance for flow resistance
 - Inconsistency in application of CFD modeling for airflow through DC
 - TC 4.10 proposing research on airflow resistances in general for CFD modeling
 - TC 9.9 interest level to co-sponsor?
 - External Flow
 - There are a lot of variables in atmospheric behavior, resulting in time-averaged simulation
 - Loss of transient flows
 - Concern around accuracy for life-safety items
 - Seems to work well for thermal modeling
 - External modeling becoming much more common in DC projects
 - Proposed research to characterize critical factors, dos and don'ts of modeling, etc
- Support for Refrigerant Ignition and Flammability
 - Impact of A2L refrigerants in deployments
 - A2Ls already being used in VRF, air-cooled chillers, etc.
 - Hyperscalers are asking for them due to ultra-low GWP.
 - Can the work statement and effort assist in guiding the industry through this change?
 - Impacts on equipment sizes and refrigerant charges.
 - Need for codes across NA to facilitate seamless adoption
 - Is this really ASHRAE 15's realm?
 - Std 15-2022 includes clear calculations for flammability limits
 - Refrigerant charges and ASHRAE 15 calcs could eliminate availability of equipment in high density applications
 - Refrigerant Management (placement of isolation/service valves) is a possible "out". This is extensively used by VRF manufacturers.
 - Valves are currently under development
 - A2L's will be required by 2025 in some states for CRACs, and 2027 for the balance.
 - What would be the test case for this type of research?
 - Airflow volumetric flow rates assist in dilution, and ASHRAE 15 calcs are dilution calculations.
 - Can CFD be used to evaluate concentrations and dispersion?

- Should TC9.9 get involved?
- 2027 date is the Install Date for the equipment in question and must therefore be addressed ASAP.

PUBLICATIONS – Don Beaty

- Get back to timely updates
- Original goals
 - Quicker content updates
 - Greatly increase # of people accessing our content
- Obstacles
 - TC chose to use a Wikipedia platform, but ASHRAE doesn't have that skillset. ASHRAE would have to outsource, driving cost of subscription up.
- Solution
 - Switched to Sharepoint platform in alignment with ASHRAE.
 - Looks like subscription could be provided at \$5/mo
- Original Concept
 - Books 1, 3 & 4
 - Add additional books
- Revised Concept
 - Books 1, 2 & 4
 - Already converted and on Sharepoint
 - Book 3 to be modified
 - Do not convert the other books, and rather integrating the content into Sharepoint incrementally.
- User Navigation Options
 - Multi-level TOC Search
 - Index Search
 - Traditional word/phrase generic Search
- TOC example displayed
- Call for members to take content over the next couple of days and mapping the content to one of the topics shown in the TOC.
- TC will seek volunteers much more aggressively than to date to provide content feedback by Indianapolis.
- In upcoming workshop breakouts, "homework" will be handed out for members to review and execute.
 - Handout identifies topics to which we want to map the content in the existing books
 - Request is to read the chapter handed out to each attendee and provide input on how the information "maps" by end of meeting tomorrow
- A second round of handouts for review and markup will be handed out tomorrow.
- Virtual Attendees will be asked to assist on other chapters after today and tomorrow

PROGRAM TOPICS WORKING SESSION – Eric Yang

- List of program topic suggestions
 - Fundamentals and Applications
 - Liquid Cooling Design Considerations and Challenges in data Centers
 - Liquid Cooling Water Quality and Filtration Requirements
 - HVAC&R Systems and Equipment
 - Modular Electrical Room Design in Data Centers

- Thermal Storage Requirement for Liquid Cooled Data Centers
 - Single-phase and Two-phase Immersion Design for Ultra High-Density Deployment
- Artificial Intelligence and the Built Environment
 - Data Center Design Challenges for AI Applications
- Research Summit
 - Present the Recent Research
- Building Life Cycle Assessment
 - Case Study of Recent Life Cycle Assessment in Data Center
- Suggested program topics to submit for Indianapolis
 - Dashboards and Instrumentation best practices - delivery of actionable data
 - Best Practices for Integrating Heat Rejection of Liquid Cooling Equipment in CFD
 - Freeze protection for water side economizers
 - Heat Rejection and Heat Island Effect of High Density Data Centers
 - Interaction of ITE and RDHX with one another (by ITE manufacturers and RDHX manufacturers)
 - Include in-row coolers in discussion
 - Acoustic Concerns for Data Centers (outdoor environmental - community and wildlife)
 - Heat Recovery Case Studies and Ideas
 - Liquid Cooling Seminar (Russ Tipton, Ali Hedari)
 - Challenges
 - Solutions
 - Sustainability
 - Workshop on Use Cases for Liquid Cooling Technology Deployments
 - How to size, how to evaluate, etc
 - TCS Loop Fluids, Selections, Maintenance, Life Cycle
 - Monitoring and Control of Electrical Infrastructure
 - CFD Modeling Best Practices (Compact Models)
 - Energy Efficiency and 90.4 MLC
 - Implementation of Data Centers based on Thermal Guidelines - CRAH/CRAC airflow rates vs dT and capacities
 - Cooling and Airflow tradeoffs for micro data centers
 - Heat Recovery and Thermal Energy Networks
 - "Everything you know about fluids is wrong"
 - Cost Optimization of Cooling Systems
 - Risk Management in the Design of Data Centers, specifically in high density
 - Probability and blast radius of a failure
 - Concurrent Maintainability in Liquid Cooling
 - Request virtual attendees email Eric Yang with additional suggestions
 - 2 Phase Cold plates
 - PFAS Chemicals, European Regulations, and the Roadmap for NA

MEETING ADJOURNED: 01/21/24 7:55 pm CST – Matt Koukl



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 January 22, 2024
TC/TG/MTG/TRG TITLE Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment
DATE OF MEETING Monday January 22, 2024 LOCATION McCormick Place West, Chicago, IL

VOTING MEMBERS PRESENT	VOTING MEMBERS ABSENT
Matt Koukl	Mark Monroe
Robert McFarlane	Joe Prisco
Paul Finch	David Quirk
Mark Seymour	Lixia Wu
Jason Matteson	
John Groenewold	
Rick Pavlak	
Mark Steinke	

CORRESPONDING MEMBERS PRESENT	PROVISIONAL MEMBERS PRESENT
Larry Ollice	J. Patrick Carpenter
Norm Bourassa	Joe Furman
Adenilson Belizario	Darren Smith
Wangda Zuo	Baron Noviyanto
Charles Freda	Baron Noviyanto
Dan Donahoe	Mladen Nikolic
Edward Tsui	Paulo Presotto
Philip Yu	Pooya Navid
Dustin Demetriou	Glenn Brenneke
Gerardo Alfonso	Carlos Lisboa
Mark Malkin	Alex Hubbard
Dave Turcotte	Earl Allen
Don Beaty	Chris Campbell
Kamal Mostafavi	Matthew Mumpower
Tom Davidson	Brian DeLeon
Ali Heydari	Will Martin

Michael Ohadi	Nan Chen
Rani Doughty	Nick Yunshu Xu
Matt Archibald	
Adenilson Belizario	
Mukul Anand	
Hugh Hudson	
Mark Fisher	
Roger Schmidt	
John Murgida	
Edward Gutowski	
David McGlocklin	
Vali Sorell	
Suren Babu	
John Gross	
Timothy Startt	
Henry Amistadi	
Russell Tipton	
Michael McKenna	
Eric Yang	
Dave Moss	
John Peterson	
Vinod Narayanan	
Jonell Watson	
Aaron Wemhoff	
Mustafa Kadhim	
Ecton English	
Justin Seter	
Melissa Olson	
David Tootle	
John Dumler	
Michael Hathorne	
Chris Muller	
Ben Dolcich	
Dave Meadows	
Michael Miller	
Roger Jones	
Timothy Shedd	
Mark Pavol	
David Grant	
Michael Geraghty	
Sang Lee	
Shlomo Novotny	
John Bean	
Ashwin Siddarth	
Gregory Alexander	
Benjamin Petschke	
Michael Hathorne	

GUESTS PRESENT	
Fabio Clavijo	Alkesh Solanki
Steve harrington	Alon Ashkenai
Galen Gerig	Jonathan Bastien
Kristin Fletcher	Rohit Dhumane
Laura Collazo Carballude	Shawn Empkey
Jerry Yeh	Gustavo Pottker
Henry Huang	Eric Self
Harold Simmons	Lucas Rae
Geoff Crosby	Chuck Lehn
Clifford Federspiel	Maria Suarez
Rhonda Johnson	Matt Snider
Keith Lachance	

ATTENDANCE RECORD	
In Person	85
Virtual	27

PUBLISHED AGENDA

Monday, January 22, 2024
 TC 9.9 Main Meeting, IT & Publications Workshops
 2:30 PM – 7:00 PM CST
 Location: McCormick Place West, W184bc (1)

Microsoft Teams Meeting
 Meeting ID: 291 876 005 411
 Passcode: jzsPBb

Attendance
<https://forms.gle/wjboSPgW6yQecKsW8>

	Topic	Time	Presenter(s)	In-Person or Virtual
Welcome	Welcome, Agenda Review, Hybrid Meeting Etiquette	5	Matt Koukl	IP
Introductions	Introductions of All In-Person Attendees, Officers, Voting Members and Subcommittee Chairs	10	Matt Koukl	IP
Membership	Details of TC 9.9 Membership	5	John Groenewold	IP
Liaison Reports				
	Standard 90.1	5	Rick Pavlak	IP
	Standard 90.4	5	Rick Pavlak	IP
	SPC-127 / AHRI 1360	5	David McGlocklin	IP
	Decarbonization Task Force	5	Lixia Wu	IP
Break		20		
Handbook	Handbook Support	5	Jonell Watson	IP
Research	Research Update/Topic Discussion	10	Mark Seymour	IP
Research	Filtration Efficiency	5	Geoff Crosby	IP
Webmaster	Website	5	Ecton English	V
Publications	Operation of Web publications	10	Don/ Ecton	IP
Presentation	Liquid Cooling Challenges	20	John Gross	IP
IT Subcommittee & Publications	IT Hardware Energy Efficiency	10	Tim Shedd	IP
	Liquid Cooling Book	10	Dustin Demetriou	IP
	S-Class	15	Paul Artman	IP
	Liquid Cooling <u>Redundancy RTAR</u>	10	Dave Quirk	IP
	Wetted Materials RTAR	10	Tim Shedd/Mark Steinke	IP
	Power Trends	10	Mark Steinke	IP
	Other work Items			
	- External CFD RTAR - Chip BC for Cold Plate - Marine corrosion - Thermal Guideline Brief	10	Mark Seymour / Mark Steinke / Roger Schmidt / Dustin Demetriou	IP
Work Session	Publications Work Session	60	Don Beatty	IP
Total Time:		240	Minutes	

CALL TO ORDER: 01/22/2024 2:31pm CDT – Matt Koukl

INTRODUCTION – Matt Koukl

- Welcome
 - MK reviewed agenda
 - MK reviewed website
 - MK read TC9.9 Overview (TP&S)
- Housekeeping
 - MK notified the attendees the meeting is being recorded for the purpose of taking Minutes.
 - MK reviewed virtual attendance etiquette
 - MK reviewed attendance recording
- Attendance Form
 - Link: <https://forms.gle/wjboSPgW6yQecKsW8>
 - Both in person and virtual attendees to click and fill out the attendance form
 - Must fill out for each meeting (Sunday/Monday)
- Membership
 - MK reviewed membership links on TC9.9 website
 - John Groenewold (JG) reviewed membership process, from submission to provisional corresponding member, to corresponding member.
 - Board & Chairs - 12
 - Corresponding Members - 365
 - Provisional Corresponding Members - 123
 - Total – 500
- MK reviewed recent board votes
 - Meeting minutes approved
 - Publication of Book 4 approved
 - Work Statement for Sea Salt Corrosion Research approved
- Liaison Reports
 - 90.1 - Rick Pavlak
 - 90.1-2024 will reference 90.4-2022
 - 90.1-2022 references 90.4-2019
 - 90.1-2019 references 90.4-2016
 - ASHRAE lobbies IECC to reference 90.1 which then codifies 90.4 by reference.
 - Push to decarbonization and path to net zero.
 - SSPC 90.1 has issued addenda I for 2 advisory public review.
 - Will be voluntary if approved - provides an alternate path to compliance
 - Std 100 (for existing buildings) has both energy and decarbonization options for improving building.
 - Calculation methodologies are not the same as with 90.1 - ASHRAE recognizes and is working to harmonize
 - Std 240 on Decarbonization is going out for public review in February but does not include calculation methods.
 - Separate task force working on addressing this within 18 months.
 - 90.4 - Rick Pavlak
 - Working to publish in 2025 to be in sync with 90.1-2025

- Addenda a to the 2022 Std (currently out for vote by voting members) to be sent out for public review.
 - Will change to the TP&S to be able to include resources:
 - Non-renewable
 - Renewable
 - Water
 - Expect it to be out for public review in March
- SSPC 127/AHRI 1360 - David McGlocklin
 - 127
 - SSPC revised TP&S to include liquid cooling
 - New subcommittees (air and liquid)
 - Air Subcommittee has been working to harmonize 127, 37, and 1360
 - Liquid Subcommittee has been working on MoT for liquid-to-liquid CDUs over the last 6 months
 - 1360
 - Working on TP&S update to include liquid
 - Should be updated when current version is approved
 - Monthly meetings on harmonization
 - Making strong progress on harmonization
- SSPC 300/GP1.6 - Terry Rodgers
 - Terry not able to attend, so this is skipped
- Decarbonization Task Force - Lixia Wu

HANDBOOK - Jonell Watson

- Reviewed update of Handbook and opportunity for individuals to get involved (do not need to be committee or ASHRAE members)
- Work is broken down by topic - approximately 100 topics.
- Reviewed the three main ways to contribute to the effort.

RESEARCH – Dustin Demetriou and Mark Seymour

- IT Subcommittee discussions
 - Liquid Cooling Resiliency RTAR - Dave Quirk
 - Effectively an X-factor for liquid cooled servers
 - Solving for resiliency on hybrid systems
 - Thermal storage
 - UPS
 - Secondary loads on air-cooled systems
 - Working to avoid overprovisioning of MEP
 - Near term goals do not go straight to X-factor
 - Working on normalized capacitance, etc
 - Develop methods for modeling
 - Wetted Materials - Tim Shedd
 - Methods of Test for compatibility
 - Specifically for aqueous DLC systems
 - DLC fluid failure modes
 - Material compatibility inhibitor packages and other options
 - Leverage MoTs to best extent possible for fluids requiring similar performance
 - Development of a list of common materials against which to test

- Ultimately roll up into SSPC 127
 - Want to immediately develop a MoT for biological fouling
 - ASHRAE recommendation for erosion limits for coolant velocities
- External CFD RTAR
 - MK to lead the generation of the RTAR
- Sea Salt Corrosion RTAR approved and will go out to bid after a few clarifications
- Call for additional research topics
 - Norm Bourassa LBNL - TC4.2 Climate Change Future Weather Map for Heat Pump Performance. NB expressed desire to widen effort to include other building systems. They have indicated willingness to include additional buildings.
 - Alon Ashkenai- Method of Test for TIMs
 - Bob McFarlane - development of a guideline or nomograph for selecting realistic battery duration based on thermal rise and UPS thermal self-shutdown.
 - John Murgida - CO2 Refrigeration appears to be gaining use because of CO2's GWP of 1, although has operational safety concerns.
- ASHRAE GPC 35 - trying to determine the energy consumption by filtration
- Will be publishing guideline this summer based on work provided by Purdue
- Lab test meant to generate real-world data based on filter loading and outside air

BREAK - 3:42pm, reconvene at 4:10pm

TAC Update - Brad Cochrane

- Section head
- Need to get activity forms in before the end of the day tomorrow
- New roster form coming out in 1-2 weeks, due back February 29
- Have found a small percentage of TC participants attending chapter and regional meetings
 - 1000 TC members, 500 are in TC9.9
 - TAC trying to figure out how to get participation in TCs
- Only 1% are Fellows (typically 3-5% in other industry)
 - Requires endorsement from existing Fellows
 - Looking for
 - Requirements
 - Doesn't have to be actively involved in ASHRAE, but has to have significantly impacted industry
 - Must have provided distinctive contribution to furthering industry
 - Recommend a ** chair
- New MTG voted and approved (MTG Gen AI)
 - Will coordinate activities to support AI
 - Set standards for how within a society we use AI
 - How to use AI to aid in design and operation of HVAC and facilities
 - How to ensure ASHRAE publications are being accurately representing and using AI
 - Recommend appointing a liaison
 - Expect it to start before Indianapolis
 - TC9.13 has been formed to address environmental controls and standards for extraterrestrial location

WEBMASTER

- Skipped

PUBLICATIONS

- Already covered

PRESENTATIONS

- Design Considerations and Challenges on Liquid Cooling Applications of Data Centers - John Gross
- Advancements in Liquid Cooling Applications for Data Centers - Paul Artman
 - Drivers for liquid cooling and temperatures for S-class
 - Currently the floor is set to S30
 - Heat Reuse challenge is managing the workload and the processor loading as it is currently very transient
 - What is appetite for flow control and dT management - difficult to adopt due to adoption at scale, interoperability, and control loop challenges
 - Trend to do liquid to air due to supply chain and readiness issues, but is challenging to get to lower S temps

IT SUBCOMMITTEE AND PUBLICATIONS – Dustin Demetriou

- IT Hardware Energy Efficiency - Tim Shedd
 - Want to try to characterize the energy efficiency of a server
 - Have been efforts for 20 years (ITUE, for example) to do this, but with less than satisfactory results
 - Significant number of factors affecting energy efficiency and percentage used for compute, making it difficult to characterize
 - Does increase in power actually yield higher efficiency?
 - Efficiency of processor (FLOPS/W) is rapidly improving
 - Software lack of evolution partially negates the gains from the hardware
 - Utilization rate of server impacts efficiency
 - Disaggregated power supplies (rack-level power supplies rather than chassis-level) is showing gains in efficiency, but with tradeoffs
 - Server fan efficiency gains over the last few generations
 - Need to review the solution holistically to determine if the entire end-to-end solution is actually more efficient
 - There is a lot of work going on around adaptive cooling and active power management
 - Server customers care intensely about power consumption/efficiency
- Liquid Cooling Book
 - Book approved by committee and sent to ASHRAE for publication
 - Converted to online format for publication via SharePoint
 - Going through mechanics to get it running
 - Over 200 comments addressed
 - Mostly new graphics
 - Seminar 63 - revealing the book
 - Overview of the key new content
- S-Class
 - Refer to above under Presentation by Paul Artman
- Liquid Cooling Redundancy RTAR
 - Refer to above under Research by Dave Quirk
- Wetted Materials RTAR
 - Refer to above under Research
- Silicon Boundary Conditions/Power Trends - Mark Steinke
 - Overview of the disruption of silicon power/thermal trends
 - Need to update roadmaps

- Add information around workload impacts
 - Update rack-level trends
 - Update Power Trends Book
 - Produce the Thermal Reporting Template for the Boundary Conditions
 - Need to execute quickly, probably going straight into the Online Format
- Sea Salt Corrosion Research - Roger Schmidt
 - Finally approved after 4 years
 - Putting out bids in the next 3 months (6 potential bidders)
 - Probably a 2-3 year project
 - Co-sponsored by TC 2.3 (Gaseous Air Contaminants), TC2.4 (Particulate Contaminants)
 - No specific content by ASHRAE on Marine Environments in general, despite 50% of human population living in Marine Environments.
 - RAC have recognized the lack of information on Marine Environments and feel this will be more widely applied.

WORK SESSION - Don Beatty

- Mission to provide timely updates about ITE changes impacting data center infrastructure
- Strategy to execute the online delivery of the content has changed due to coordination with ASHRAE
- Moved to a SharePoint platform, which will enable subscriptions around \$5/mo or less
- Original Concept
 - Convert books 1, 3, & 4
 - Create online version of all other books until all online
- Revised Concept
 - Use Book 3 as the template/TOC for the remainder of the books
 - Migrate content from the other books by reviewing each paragraph and assigning to a pertinent topic under the Book 3 TOC
- Focus is on speed-to-market
- Three navigation options
 - Multi-level TOC
 - Index Search
 - Traditional word search of entire search
- Table of Contents updated from last night's meeting
 - Attendees to review a chapter and indicate to which topic the content fits
- Progress
 - Change format from 6x9 to dynamic size and orientation, including smart phone
 - Redesigned layout
 - Changed fonts
 - Reduced paragraph sizes
 - Adjusted or replaced images
 - Completed books 1, 3, & 4
 - Setup and Experimentation on SharePoint
 - SharePoint prototyping
 - SharePoint manual import of Books 1, 3, & 4
 - Formatting, respacing, etc
 - Presented current SharePoint site
 - Goal is to go-live in March after testing with Voting Members and Officers

CALL TO CLOSE: 01/22/24 6:15 pm EDT – Matt Koukl