



1791 Tullie Circle, N.E./Atlanta, GA 30329
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DRAFT

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. TC 3.1 DATE July 10, 2018

TC/TG/MTG/TRG TITLE Refrigerants and Secondary Coolants

DATE OF MEETING June 25, 2018 LOCATION Houston, TX

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
Steve Kujak (Chair /Research liaison) – voting	2016-2018	Debra Kennoy (Standards)	2016-2019	Warren Clough (Secretary)
Kevin Connor (Handbook)	2016-2020	Knut Petry (non-quorum) – voting	2016-2020	Ken Shultz (Research)
Sean Cunningham (Webmaster)	2016-2020	Kapil Chand Singhal	2017-2021	
Chris Seeton (VC, Programs)	2017-2021			
Bill Kopko	2017-2021			
Bob Richard	2016-2020			
Barbara Minor	2017-2019			
Marc Scancarello	2015-2019			
Greg Linteris	2017-2021			
Kenji Takizawa (non-quorum)	2016-2020			

DISTRIBUTION: All Members of TC/TG/MTG/TRG plus the following:	
TAC Section Head: Barbara Minor	SHx@ashrae.net Where x is the section number
All Committee Liaisons As Shown On TC/TG/MTG/TRG Rosters (Research, Standards, ALI, etc.)	See ASHRAE email alias list for needed addresses.
Mike Vaughn, Manager Of Research & Technical Services	MORTS@ashrae.net

Corresponding Members and Guests		
Brian Frike	Hitoshi Hostimoto	Chris Campo
Tom Leck (CM)	Joshua Hughes (CM)	Joe Karnaz
Ken Schultz (CM)	John Withouse	Casy Scruggs
Julie Majurin (CM)	Omar Abdel	Pranar Godbole
Sonny Sundaresan (CM)	Angel Mendez	Tyler Knazar
Georgi Kazachki (CM)	Rosine Rohatgi (CM)	Carolina Solano
Xudong Wang	Shelby Kent	
Lydia Dobler	Hewitt Gaudin	
Patrick Coughlan	Roberto Urrego (CM)	
Greg Smith	Sarah Kim	
Elyse Sorenson (CM)	Warren Clough (CM)	
Shitong Zha	Morgan Herried	
Scott Wujek (CM)	Dave Wilson (CM)	

KEY CONTACTS

Liaisons:

Steve Kujak, Trane, RAC Liaison
 Barbara Minor, Chemours, MTG Low GWP Liaison
 Michael Vaughn, ASHRAE Staff Liaison
 Niels Bidstrup, Grundfoss Management, Standards Liaison
 Barbara Minor, Chemours, TAC Section Head
 Guy Frankenfield, DN Tanks, 2021 Handbook Liaison
 Kelley Cramm, Henderson Engineers, TAC Chair
 James Bochat, Commissioning Concepts, ALI/PDC
 Tracey Jumper, Jump Start Building Commissioning, Chapter Technology Transfer

MEETING MINUTES

1. CALL TO ORDER (S. Kujak, Chair)

- A. Chair, Steve Kujak, called the meeting to order at 4:15 PM. Members and guests introduced themselves. The meeting was held at the Hilton Americas in Houston in Grand E.
- B. Establishment of a quorum, 10 out of 13 voting members were present.

Voting members present:

1. Stephen Kujak
2. Kevin Connor
3. Barbara Minor
4. Sean Cunningham
5. Bob Richard
6. Kenji Takizawa
7. Chris Seeton
8. Bill Kopko
9. Marc Scancarello
10. Greg Linteris

Voting members absent:

1. Knut Petry
2. Debra Kennoy
3. Kapil Chand Singhal

2. AGENDA REVIEW

No corrections were noted.

*Motion to approve the Chicago draft agenda was made by Barb Minor and seconded by Bob Richard
Motion passed: 9 / 0 / 0 / 9 / CV. (For / Against / Abstain / Total [Chair Voting [CV] or Chair Not Voting [CNV]])
Greg Linteris was not present at the time for the vote*

3. APPROVAL OF CHICAGO, JANUARY 2018 MEETING MINUTES

No corrections were noted.

*Motion to approve the Chicago draft minutes was made by Barb Minor and seconded by Bob Richard
Motion passed: 8 / 0 / 1 / 9 / CV. (For / Against / Abstain / Total [Chair Voting [CV] or Chair Not Voting [CNV]])
Mark Scancarello abstained – was not present at the last meeting
Greg Linteris was not present at the time for the vote*

4. CHAIRMAN'S ANNOUNCEMENTS (S. Kujak, Chair)

- A. Section 3 Meeting Report
 - RAC is implementing use of Basecamp. This would be a useful tool for organizing research activity.
 - RAC is always looking for new members.
 - There is an "RTAR like" document being implemented for developing Design Guides.
 - The Chairs full report will be available on the TC 3.1 ASHRAE website.

B. Roster Review

Summary of TC 3.1 membership and changes, effective July 1st 2018

<u>Position</u>	<u>Members</u>
Chair, voting	Chris Seeton
Vice Chair, voting	Julie Majurin
Standards Subcommittee Chair, voting	Debra Kennoy
Handbook Subcommittee Chair, voting	Kevin C Connor
Secretary, voting	Elyse Sorenson
Voting	Bill Kopko
Voting	Barbara Minor
Voting	Marc Scancarello
Voting	Bob Richard
Voting	Greg Linteris
Voting	Kapil Chand Singhal
Voting	Warren Clough
Voting	Sean Cunningham
Member Non-Quorum, voting	Kenji Takizawa

Other committee officers (non-voting):

Kenneth Schultz, MTG-GWP Liaison and Research Subcommittee Chair

Program Subcommittee Chair, Michael Peterson

Webmaster, Steve Kujak

Research, Steve Kujak

Liaison update

- TAC Section Head Jay Kohler-
 - o Section Head, Jay Kohler, thanks Steve Kujak for his service as the chair of TC 3.1.
 - o There will be a new RAC section head starting 7/1/18 taking over for Jay Kohler.
 - o Notify Tara Thomas for any roster changes.

5. RESEARCH (Ken Shultz)

A. Report from Research Subcommittee Chairs Meeting

Breakfast meeting Highlights

- RAC considered 3 RTARS- one accepted, one rejected, one conditionally accepted
- RAC Consider three WS's- all conditionally accepted
- One innovative research grant approved
- 25 Grants awarded out of 106
- RTAR's, WS's, and TRP's bids are needed by Dec 3rd if they are to be considered for the Atlanta meeting.
- There is a change to the current RTAR form, adding a section called plain English abstract. This is a high level summary of the research being requested.

B. Status of current research projects

1717-RP “Improve Accuracy and Reproducibility of ASTM E-681 Flammability Test Method for Flammability Measurement of 2L Flammable Refrigerants”

PMS: Consists of D Kennoy (lead), S Cunningham, S MacLeod, B Minor, R Richard, and XWang.

Status- Project has been completed and closed. It has been posted to the ASHRAE website.

Action: None

1507-RP “Binary Refrigerant Flame Boundary Concentrations”

Contractor: Safety Consulting Engineers

Status- This work is essentially completed other than some administrative details. It will be added to the ASHRAE website shortly.

Action: None

1794-WS “The Incorporation of Odorants in Flammable Refrigerants to Improve Leak Detection and Safety”

PMS: M Scancarello (lead), V Baish, J Majurin, E Clark

Status: RAC approved this work statement. TRP was sent out for bid. One bid was received. PMS was okay with the contractor. This will go into an executive session for vote to approve after the meeting.

Motion to approve the PMS recommendation on a contractor to RAC on the investigation of odorants in Flammable refrigerants to improve leak detection and safety was made by Marc Scancarello and seconded by Chris Seeton

Motion passed: 10 / 0 / 0 / 10 / CV. (For / Against / Abstain / Total [Chair Voting [CV] or Chair Not Voting [CNV]])

Three voting members were absent- Debra Kennoy, Knut Petry (non-quorum), and Kapil Chand Singhal

Action: TC 3.1 Executive Session- TC voted to approve the contractor. PMS will move forward with this research.

C. AHRI/ASHRAE/DOE Collaboration on Flammable Refrigerants Research

Three projects were developed into work statements and are being funded by ASHRAE.

1806-RP “Flammable Refrigerants Post-Ignition Simulation and Risk Assessment Update”

Contractor- Gexcon, PI is Scott Davis

PMS: PES K Schultz (chair), O Abdelaziz, B Minor, G Linteris, P Johnson, K Takizawa, XWang

Status- Project is still on-going. Task #1 is complete. PMS feels more work is required on the model. Task #2 will start with a pilot study to determine the sensitivity of the model created. From this pilot, the PMS may recommend further work. The PMS will meet with the contractor to decide on the specifics of the pilot study. This will take approximately 6 months.

Action: PMS and contractor to work out the details of the pilot study to test the model.

1807-TRP “Guidelines for Flammable Refrigerant Handling, Transporting, Storing, and Equipment Servicing, Installation and Dismantling”

Contractor- Navigant Consulting

PMS: B Fricke (lead), R Cooper, S Kulankara, W Mooris, K Nawaz, XWang.

Status- Work is complete and a draft report has been issued for review.

Action: PMS will review the final report for approval.

1808-TRP “Servicing and Installing Equipment using Flammable Refrigerants: Assessment of Filed-made Mechanical Joints”

Contractor- Creative Thermal Solutions

PMS: B Fricke (lead), XWang, P Geoghegan, D Halel, M Scancarello, K Nawaz

Status- Work is complete and a draft report has been issued for review.

Action: PMS will review the final report for approval.

D. Proposed Research Projects

1773-WS “Ignition Potential from Electrical Devices in Commercial and Residential Applications using 2L Refrigerants”

PMS: W Clough (Lead), M Scancarello, B Minor, E Smith, K Takizawa, R Richard.

Status- Review the current draft work statement with a focus on commercial electrical sources, revise as necessary, and send to the TC for a vote.

Action: Review the drafted work statement with the PMS.

1791-WS “Humidity effects on burning velocity”

PMS: D Kennoy (lead), R Richard, J Majurin, T Leck, F. Flohr, X. Wang (AHRI)

Status: The work statement needs to be resubmitted with the changes recommended by RAC. Vote can be taken after the changes are made.

Action: PMS to evaluate the 1806-RP (Flammable Refrigerants Post-Ignition Simulation and Risk Assessment Update) results before finalizing the work statement.

1797-WS “Risk Assessment Investigations to Develop Alternative Acute Toxicity Classification Approaches to the A or B Chronic Toxicity Classification of Refrigerants used by ASHRAE 34.”

PMS: D Kennoy, G Rusch, G Jepson, C Seeton, S Kujak.

Status: Work statement was revised and it was resubmitted to RAC for approval at the fall meeting.

Action: RAC to review the work statement.

1802-WS “Defining the 2/2L Flammability Boundary in Standard 34”

PMS: D Kennoy (lead), F Flohr, B Richard, S Kujak, G Linteris, S Spletzer, XWang

Status: A work statement needs to be submitted. Steve will pick this up and move forward.

Action: Write a work statement for review by the TC.

1851-RTAR "Electrical Properties of New Refrigerants"

PMS: Majurin, Schultz, Johnson, Baker, Leyderman

Status: This RTAR was accepted with some comments. It was suggested to add lubricants when writing this work statement.

Action: Write a work statement for review by the TC.

E. Other Research

Re-evaluate Calibration of 200L to 12 L flammability limits for borderline cases

Status: An RTAR was drafted by Bob Kopko. SSPC 34 Flammability Sub-committee needs to review the RTAR and decide how to move forward with this drafted document. It was sent to the SSPC 34 Flammability sub-committee for review.

F. Research Plan- A spreadsheet summarizing the TC research plan will be posted on the TC web page; it is under the "Research" tab at: <https://tc0301.ashraetcs.org/documents.php>.

6. HANDBOOK (Kevin Connor)

The 2017 revisions are complete. The next revision will be for the 2020 edition.

Chapter 29 (Refrigerants), Steve Kujak will lead.

Chapter 30 (Thermophysical Properties of Refrigerants), M McLinden will lead.

Chapter 31 (Physical Properties of Secondary Coolants), K Connor will lead.

Looking for new content to add to the handbook. Need to start compiling the information for the next 18 months.

7. PROGRAM (Chris Seeton)

A. Current Program Session (Houston 2018)

There were no TC 3.1 sponsored sessions presented at this conference.

Program tracks Atlanta and Kanas City

January 2019—Atlanta	June 2019- Kanas City
Systems and Equipment	Systems and Equipment in the Built Environment
Fundamentals and Applications	Fundamentals and Applications
Refrigeration	Optimization in HVAC&R
Construction, Operation, and Maintenance of High Performance Systems	Commissioning New & Existing Buildings
Common System Options and Misapplications	Occupant Health & safety

The Convergence of Comfort, Indoor Air Quality, and Energy Efficiency	Modeling Throughout the building Life Cycle
Building Integrated Renewables and Natural Systems	Professional Development
The Engineer's Role in Architecture	Research Summit
	Radiant Heating & Cooling Mini-Track

B. Future Program discussion

- There are plans to hold an AHRI Flammability mini-conference in the first half of October to provide an update on the research activity.
- Below is a summary of topics for future ASHRAE meetings.

Chair	Topic Area	Sponsor	Seminar Title	Presentation Title	Speaker
	Regulatory	MTG LowGWP	Refrigerant Regulation Implementation and Impacts	Montreal Protocol Update	
	Regulatory	MTG LowGWP	Refrigerant Regulation Implementation and Impacts	EU F-Gas Impacts	
	Regulatory	MTG LowGWP	Refrigerant Regulation Implementation and Impacts	US GHG Regulation or CARB	
	Regulatory	Refrigeration, MTG Low GWP	Refrigerant Regulation Implementation and Impacts	IIR and UNEP Update	
	Standards and Codes	MTG LowGWP, 3.1	Products Standards Incorporation of 2L Refrigerants	Update on IMC UMC Code Corporate of 2L's	
	Standards and Codes	MTG LowGWP, 3.1	Products Standards Incorporation of 2L Refrigerants	UL 60335 - 2-40 Requirements for 2L Refrigerants	Bill Hansen
	Standards and Codes	MTG LowGWP, 3.1	Products Standards Incorporation of 2L Refrigerants	Standard 15 Updates and Progress on 2L Refrigerants	Rusty Thorpe
	Standards and Codes	MTG LowGWP, 3.1	Products Standards Incorporation of 2L Refrigerants	Standard 15 Updates and Progress on 2L Refrigerants for Unitary Products	Jim Vershaw
	Standards and Codes	MTG LowGWP, 3.1	Products Standards Incorporation of 2L Refrigerants	UL 60335 - 2-89 Requirements for 2L Refrigerants	
	Flammability Research	AHRI, 3.1	Whole Room Testing	AHRTI-9007: Benchmarking Risk by Whole Room Scale Leaks and Ignitions Testing for A2L Refrigerants	
	Flammability Research	AHRI, 3.1	Whole Room Testing	AHRTI-9007-02: Benchmarking Risk by Whole Room Scale Leaks and Ignitions Testing for A3 Refrigerant	
	Flammability Research	MTG LowGWP	Whole Room Testing	1806	
	Flammability Research	AHRI, 3.1	Whole Room Testing	NFPA A3 Testing (Need to confirm)	
	Flammability Research	AHRI, 3.1	Whole Room Testing	Daikin UL Testing (Need to confirm)	
	Flammability Research	AHRI, 3.1	Whole Room Testing	Carrier furnace utility closet testing (Need to confirm)	
	Flammability Research	AHRI, 3.1	Refrigerant Detection	AHRTI-9009: Leak Detection of A2L Refrigerants in HVACR Equipment	
	Flammability Research	AHRI, 3.1	Refrigerant Detection	Assess Refrigerant Detector Characteristics for Use in HVACR Equipment	
	Flammability Research	AHRI, 3.1	Refrigerant Detection	DRNL Stick n Peel Low Cost Refrigerant detectors development	
	Flammability Research	AHRI, 3.1	Servicing and Practice	RDL and NATE	
	Flammability Research	MTG LowGWP	Servicing and Practice	ASHRAE-WS 1807: Guidelines for Flammable Refrigerant Handling, and Equipment Servicing and Installation	
	Flammability Research	MTG LowGWP	Servicing and Practice	ASHRAE-WS 1808: Servicing and Installing Equipment using Flammable Refrigerants: Assessment of Field-made Mechanical Joints	
	Flammability Research	AHRI, 3.1	Servicing and Practice	NFPA Firefighters	
	Flammability Research	AHRI, 3.1	Charge Limits and Leaks Rates	AHRTI-9012: Determination of Liquid/Vapor Composition of Refrigerant Escaping from Refrigerating Equipment During ON and OFF Cycles	
	Flammability Research	AHRI, 3.1	Charge Limits and Leaks Rates	ORNL Project: Investigate the Proper Basis for Setting Charge Limits of A2L, A2, and A3 for Various Types of Products	
	Flammability Research	AHRI, 3.1	Charge Limits and Leaks Rates	R290 CONCENTRATIONS ARISING FROM LEAKS IN ROOM AIR CONDITIONERS	Daniel Colbourne
	Flammability Research	AHRI, 3.1	Charge Limits and Leaks Rates	MINIMUM AIRFLOW RATES TO DILUTE R290 CONCENTRATIONS ARISING FROM LEAKS IN ROOM	Daniel Colbourne
	Flammability Research	AHRI, 3.1	Charge Limits and Leaks Rates	SAFE DESIGN OF R290 DUCTED AIR-CONDITIONING EQUIPMENT	Daniel Colbourne
	Flammability Research	3.1	Flammability Fundamentals	Burning velocity and predictive tools - Greg	
	Flammability Research	3.1	Flammability Fundamentals	Burning velocity and test methods - Greg	
	Flammability Research	3.1	Flammability Fundamentals	Hot Surface Ignition Testing - Patrick	
	Flammability Research	3.1	Flammability Fundamentals	Quenching Distance Work - Kenji	
	Flammability Research	3.1	Flammability Fundamentals	A2 and A2L Risk Assessments - Sarah	
	Systems	3.2, 3.3, 3.4	HFO System Chemistry & Impacts	Chemistry of Retrofits with Low GWP refrigerants	
	Systems	3.2, 3.3, 3.4	HFO System Chemistry & Impacts	Life Cycle of HFO Refrigerants	
	Systems	3.2, 3.3, 3.4	HFO System Chemistry & Impacts	Low GWP Refrigerants and Lubricants: What you need to know.	
	Systems	3.2, 3.3, 3.4	HFO System Chemistry & Impacts	Estimating Accelerated Chemical Stability Using Equipment Operation	
	Systems	3.2, 3.3, 3.4	HFO System Chemistry & Impacts	Thermal, Chemical and Materials Compatibility of Refrigerants and Lubricants Through the Years	
Pagahnjak Omar	Application and Hardware	8.1	Compressors		
	Application and Hardware	8.4	Heat Exchangers		
	Application and Hardware	8.11	Unitary Design		
	Application and Hardware	3.1	LBL A3 Work		
	1st IIR HFO Conference				
	1st IIR HFO Conference				
	1st IIR HFO Conference				
	Purdue				
	Purdue				
	Purdue				
	Kobe Conference				
	Kobe Conference				
	Kobe Conference				
	Student Research	Universities			
	Student Research	UM, IL, OSU, Missouri, Purdue			
	Student Research	Others			
	Refrigerant Containment	3.8	Refrigerant Management UNEP		
	Refrigerant Containment	3.8	Refresher Course SSPC147 - Reducing Emissions		
	Refrigerant Containment	3.8			
	Panel Discussion		Conducting Retrofits - Low GWP Refrigerants		
	Panel Discussion				
	Panel Discussion				
	Refrigeration Systems	10.7	Life After R404A		
	Refrigeration Systems	10.7	Advances in Low GWP Refrigeration System Architectures		

C. Program votes

TC 10.7 is looking to TC 3.1 to co-sponsor a seminar titled, "Life after R404A and Advantages in Low GWP Refrigeration Systems Architectures."

*Motion to approve co-sponsoring with TC 10.7 a seminar on "Life after R404A and Advantages in Low GWP Refrigeration Systems Architectures" was made by Chris Seeton and seconded by Sean Cunningham.
Motion passed: 10 / 0 / 0 / 10 / CV. (For / Against / Abstain / Total [Chair Voting [CV] or Chair Not Voting [CNV]])*

Flammability Research- Flammability fundamentals for next generation low GWP refrigerants- Topic could include burning velocity predictive tools, burning velocity test methods, hot surface ignition testing, quenching distance work, and A2L and A2 risk assessment

*Motion to approve a seminar titled, "Flammability fundamentals for next generation low GWP refrigerants" by Barb Minor and seconded by Marc Scancarello.
Motion passed: 10 / 0 / 0 / 10 / CV. (For / Against / Abstain / Total [Chair Voting [CV] or Chair Not Voting [CNV]])*

Codes and Standards Activity

*Motion to approve working with MTG to co-sponsor a seminar on Codes and Standards was made by Chris Seeton and seconded by Barb Minor.
Motion passed: 10 / 0 / 0 / 10 / CV. (For / Against / Abstain / Total [Chair Voting [CV] or Chair Not Voting [CNV]])*

Barb agreed to be the liaison.

8. STANDARDS (Debra Kennoy)

- A. ASHRAE Standard 34, *Designation and Safety Classification of Refrigerants* (S. Cunningham)
 - SSPC 34 will be reviewing three new refrigerant applications.
- B. ASHRAE Guideline 6
 - This guideline was just renewed.
- C. ASHRAE Guideline 39p (formerly SPC-177P), *MOT Fractionation Measurement of Refrigerant Blends* (R. Richard)
 - No update

9. WEB SITE (Sean Cunningham)

<https://tc0301.ashraetcs.org>

Agenda, Minutes and Research Plan are located on the website. Presentations can be added to the website as well.

10. OLD BUSINESS

125 Year Historical Celebration for ASHRAE- Team will write an Abstract titled, "History of refrigerants" Barb Minor and Steve Kujak will draft an abstract for consideration at the Orlando or Austin 2020 meetings. Deadline for the abstract is December 7, 2018. Don Bivens and Andy Pearson were also mentioned that may be interested in helping with this paper.

11. NEW BUSINESS

Barb Minor was recognized for the receiving the 2018 SCI Perkin Medal. This award recognizes her contributions in the research and development of new lower GWP refrigerants.

12. NEXT MEETING

2019 ASHRAE Winter Meeting; Atlanta January 2019.
TC 3.1 will meet Monday, January 14th, 2019.

13. MEETING ADJOURNED at 6:10 pm.