



1791 Tullie Circle, N.E./Atlanta, GA 30329
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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 February 5, 2018

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

DATE OF MEETING January 22, 2017 LOCATION Chicago, Il

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

DISTRIBUTION: All Members of TC/TG/MTG/TRG plus the following:	
TAC Section Head: Jay Kohler	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		
Stephen Spletzer	Patrick Coughlan	
Michael Petersen	Niels B. dstrop	
Tom Leck	Amir Jokar	
Ken Schultz	Brian Kipp	
Julie Majurin	Hitoshi Hostimoto	
Sonny Sundaresan	Joshua Hughes	
Alice Riemer	Stacy Anderson	
Xudong Wang	Scott Wujek	
Rob Low	Osami Kataoka	
Chihiro Furuta	John Withouse	
Greg Smith		
Elyse Sorenson		
Mary Koban		

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
 Jay Kohler, Johnson Controls, 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 4:17 PM. Members and guests introduced themselves. The meeting was held in Chicago at the Hilton Palmer House Salon 7/8 Conference Room.
- B. Establishment of a quorum, 10 out of 13 voting members were present.

Voting members for this meeting:

Stephen Kujak- present
Kevin Connor- present
Debra Kennoy- present
Barbara Minor- present
Sean Cunningham- present
Bob Richard- present
Kenji Takizawa- present
Chris Seeton- present
Bill Kopko- present
Kapil Chand Singhal- present
Marc Scancarello- absent
Knut Petry- absent
Greg Linteris- absent

2. AGENDA REVIEW

No corrections were noted.

*Motion to approve the Chicago draft agenda was made by Debra Kennoy and seconded by Chris Seeton
Motion passed: 10 / 0 / 0 / CV. (For / Against / Abstain / Total [Chair Voting [CV] or Chair Not Voting [CNV]])*

3. APPROVAL OF LONG BEACH, JUNE 2017 MEETING MINUTES

No corrections were noted.

*Motion to approve the Long Beach draft minutes was made by Debra Kennoy and seconded by Sean Cunningham.
Motion passed: 10 / 0 / 0 / CV. (For / Against / Abstain / Total [Chair Voting [CV] or Chair Not Voting [CNV]])*

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

A. Section 3 Meeting Report

The Chairs report is provided in the TC 3.1 ASHRAE website.

B. Roster Review

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

Position	Members
Chair , voting	Chris Seeton
Vice Chair, voting	Julie Majurin
Program Subcommittee Chair, VC, voting	Michael Peterson
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
Member Non-Quorum, voting	Kenji Takizawa

Other committee officers (non-voting):

Kenneth Schultz, Ingersoll Rand, MTG-GWP Liaison and Research Subcommittee Chair
 Webmaster, Ingersoll Rand voting, Steve Kujak

Liaison update

- TAC Section Head Jay Kohler- Jay provided an update on Section 3. His responsibility is to support TC 3.1. Jay rolls off as section head July 1st 2018.
- Standards- need to take action on Guideline 6 at this meeting.
- MTG- (Barb Minor) doing awesome work!

5. RESEARCH (Ken Shultz)

A. Report from Research Subcommittee Chairs Meeting

Breakfast meeting Highlights

- There are 4 deadlines for submitting RTARS and WS's- March, May, August, and December 15th.
- When completing research the PMS chair should work with the contractor to complete the Disposition of ASHRAE Research Form. This gets sent to MORTS.
- Two RTARS were submitted and accepted with comments from RAC.
- Two Work Statements were returned with comments.
- Seven Work Statements are ready to be released for bid this spring.
- Innovative Research Grant- 4 preliminary submitted, one will be selected
- To co-sponsor an RTAR or Work Statement formal votes are needed from both TC's. Members from the TC also need to be represented on the PMS.

B. Status of current research projects

1507-RP "Binary Refrigerant Flame Boundary Concentrations"

Contractor: Safety Consulting Engineers

Status- Final report has been completed. Technical paper is being written and it should be completed by June.

Action: None

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

Contractor: University of Maryland, with Peter Sunderland as the P.I.

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

Status- The PMS approved the report. Contractor is currently writing a technical paper. Structure of the report is atypical and is not in a standard report format. Technical paper is being written.

Action: Disposition form needs to be filled out and turned into RAC. Voting members will vote on the final report by letter ballot.

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- Task 1 report is complete and is being reviewed by the PMS. The MTG low GWP PMS will provide a go/no go decision by end of February.

Action: PMS is reviewing the report. No action required by the TC.

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- The contractor updated the draft report adding the practice of refrigerant handling in Canada. PMS is reviewing the report. It will be sent to the MTG low GWP PMS for vote by April.

Action: PMS needs to review the report. No action required by the TC.

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

Contractor- Creative Thermal Solutions

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

Status- Work is still in progress. There is a slight delay in completion of this project. Contractor should have a final report by March. MTG low GWP PMS is scheduled to vote by May.

Action: PMS is monitoring the progress. No action required by the TC.

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: Work Statement is still on hold. AHRI-8017 project is now complete. Need to decide if further work on ignition potential is needed or are there any gaps that need to be understood.

Decision needs to be made by 7/1/2019 before RAC drops this proposed work. TC will review the AHRTI report to decide if further work is warranted.

Action: TC to review and decide if this work statement should continue to move forward. Look at the FRS research gaps as well.

1791-WS "Humidity effects on burning velocity"

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

Status: This work statement is on hold. MTG 1806 (Flammable Refrigerants Post-Ignition Simulation and Risk Assessment) study is conducting work with burning velocity and humidity. Can data be extracted from this work with GEXCON? Eight refrigerant blends were tested. Tube method vs. bomb method compared reasonably well with dry refrigerant. PMS will review and revise the work statement.

Action: Pull data out from the GEXCON report for review then revise work statement where gaps exist.

1792-WS "ASHRAE 34 Toxicity data documentation and mixture calculation"

PMS: S Sundaresan (lead), B Richard, J Majurin

Status: Work statement was withdrawn after upgrades to the current ASHRAE Standard 34 calculator were made by Ken Schultz. Standard 34 voted to withdraw this research.

Action: Remove from the Research list. No action required by the TC.

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. CPSC was interested in supporting this research activity, but later said they were not able to co-sponsor.

Action: RAC approved this work statement and it will go out for bid this Spring.

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.

Action: Waiting for approval to move forward with research.

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: No progress has been made on this work statement.

Action: Deb Kennoy to pick up again and move this work statement forward by May 15th 2018 or it will get removed from the research plan.

E. Other Research

Effect of lubricant on the flammability of refrigerants

This research idea has been on hold waiting for other on-going work to be completed. Lubricant appears to suppress flammability. Question was raised about high oil concentrations above 3%. There seems to be no interest to move it idea forward. This will be removed from the research list.

Understanding of energy transfer from ignition sources to refrigerant gases

This research has been on hold until other on-going work is completed. AST is conducting work in this area. This will be removed from the research list.

Electrical properties of new refrigerants

An RTAR was drafted by Julie Majurin which was circulated to the committee for consideration at Long Beach. A test method already exists, but the test equipment no longer available. TC voted on this RTAR.

Motion to approve RTAR on Electrical Properties of New Refrigerants was made by [Barbara Minor](#) and seconded by [Debra Kennoy](#).

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

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

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.

New Project- Working Group 7 project is requiring equations of state data.

They need it for R-1234ze(E), R-1233zd(E), and R-1234yf. Question raised was, do the equations of state need to fit the existing data or do they need new data? WG is looking for financial support.

6. HANDBOOK (Kevin Connor)

Chapters are early in the cycle for 2021. Handbook committee will now use the authoring portal site. Need to find a Handbook meeting time. It will be moved to Sunday.

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.

7. PROGRAM (Chris Seeton)

A. Current Program Session (Chicago 2018)

AHR EXPO Section 3 Refrigerant Mini Track (1/22/18)

Some Low GWP Next Generation Refrigerant will be Flammable: What does it mean to be Flammable?

Session 4, Room S101B: 1:00 pm to 2:30 pm

Sponsor TC 3.1, Co-Sponsor Low GWP MTG

1. Flammable Refrigerant Basics – Stephen Kujak, Trane, Ingersoll Rand
2. Flammability: A Continuum Vs. Discrete Boundary – Gregory Linteris, National Institute of Standards and Technology
3. AHRI Flammable Refrigerant Research – Xudung Wang, AHRI

4. Developing Guidelines for Flammable Refrigerant Use – William Goetzler & Matt Guernsey, Navigant

Next Generation of Lower or Low GWP Next Generation HVAC&R Equipment

Session 6, Room S101B: 2:45PM to 3:45PM

Sponsor TC 3.1, Co-Sponsor TC 8.2

1. Low GWP Refrigerant Alternatives for Chillers – Barbara Minor, Chemours
2. Low GWP Systems for Commercial Refrigeration – K.C. Kolstad, Cancelled
3. Key Learning from Conversions of Commercial Refrigeration Systems to Low GWP Alternatives – Charles Allgood, Chemours

Tuesday Jan 23, 8:00 AM - 9:30 AM Seminar 35 (Intermediate)

Low GWP Refrigerants in Heat Exchange Equipment: Part 1, Introduction and Case Studies

Room: Hilton Palmer Monroe

Sponsor: MTG.LowGWP Lower Global Warming Potential Alternative Refrigerants, 1.3 Heat Transfer and Fluid Flow, TCs 1.3, 3.1, 8.4, 8.5, 8.11.

1. Simulated Thermal Performance of Flooded Evaporators with R1234ze (and others) Vs. R134a with Oil Effects John Thome, Ph.D.
2. Low Environmental Impact Refrigerants for Air-Conditioning, Chiller and Refrigeration Applications Ankit Sethi
3. Recent Developments in Low GWP Refrigerants for Refrigeration and Air Conditioning Joshua Hughes
4. Comparative Analysis of Conventional Shell Side Ammonia Flooded Evaporator versus New Concept Direct Expansion Evaporator Zahid Ayub, Ph.D.
5. Heat Exchanger Performance of Low GWP Refrigerants in Chillers Kenneth Schultz, Ph.D.

Tuesday, Jan 23 9:45 AM - 10:45 AM Debate 2 (Basic)

Low GWP Refrigerants in Heat Exchange Equipment

Track: Heat Exchange Equipment

Room: Hilton Palmer Adams

Sponsor: MTG.LowGWP Lower Global Warming Potential Alternative Refrigerants, 1.3 Heat Transfer and Fluid Flow, TCs: 3.1, 8.4, 8.5, 8.11, The American Society of Thermal and Fluids Engineers (ASTFE), and the U.S. National Committee of the International Institute of Refrigeration (IIR).

Chair: Omar Abdelaziz, Ph.D., John Thome, Ph.D., Zahid Ayub, Ph.D., Kenneth Schultz, Ph.D., Ankit Sethi, and Joshua Hughes

Future Program discussion

Houston is already pretty much booked. It will be difficult to submit and abstract now and get it approved. The plan is to do another LGWP mini track in Atlanta (Winter 2019). Consider AHRTI FRS projects for this track. Below is the start of an outline for the refrigeration mini-track:

Overview

Equipment & Systems	Fluids	Regulations and Codes	Research
Hxers 1.3&8.11	Refrigerants - 3.1	California 2020, do we care?	Flammability
Compressors 8.1	Chemistry 3.2	Flammability	
Design Guidelines	Contaminants 3.3	EU changes	
R404A	Lubricants 3.4	EPEE - European Partnership for Energy & Environment	
R410A		Standards - what's needed?	
Unitary		Containment TC 3.8	
TC 8s			
TC 10s		Tech training	
<u>Topic</u>	<u>Responsible Person</u>	<u>Meeting</u>	
TC 3.1			
Update on Product Standards	Hansen, Rodgers, Dorman,		
TC 3.2			
Accelerated life predictions	Elyse and Steve	Atlanta	
TC 3.3			
Contaminant Control	TBD	Atlanta	
TC 3.4			
Purdue topics -> Seminar	TBD	Atlanta	
TC 3.8			
Tech training	Danny	Atlanta	
AHRI Leak sensor Tech			
Leak Measurement Std		Atlanta	

Program tracks Houston and Atlanta

June 2018—Houston	January 2019—Atlanta
HVAC&R Systems and Equipment	Systems and Equipment
Fundamentals and Applications	Fundamentals and Applications
District Energy and Cogeneration Plants	Refrigeration
Safeguarding your HVACR System	Construction, Operation, and Maintenance of High Performance Systems
Residential: Modern Buildings in Hot, Humid Climates	Common System Options and Misapplications
Commissioning— Optimizing New & Existing Buildings and their Operation	The Convergence of Comfort, Indoor Air Quality, and Energy Efficiency
Research Summit	Building Integrated Renewables and Natural Systems
HVACR Control Freaks	The Engineer's Role in Architecture
HVACR Analytics	

8. STANDARDS (Debra Kennoy)

- A. ASHRAE Standard 34, *Designation and Safety Classification of Refrigerants* (D. Kennoy)
 - Four refrigerants for BOD approval in Chicago
 - Two applications were re-submitted for review due to deficiencies
 - One application had a comment from the PPR
 - No new refrigerant applications submitted for Chicago
 - Revisions to the standard are now being worked on since there were no new applications

- B. ASHRAE Guideline 6
- Up for revision
 - There was a major re-write conducted three years ago
 - Vote to reaffirm

Motion to was made to reaffirm Guideline 6 by Barbara Minor and seconded by Sean Cunningham.

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

- C. ASHRAE Guideline 39p (formerly SPC-177P), *MOT Fractionation Measurement of Refrigerant Blends* (R. Richard)
- Available in the bookstore

- D. ISO 817
- Received a new refrigerant application for review. The 817 MA will need to determine is the process for approving this application. Applicant requested this not go through ASHRAE 34.

9. WEB SITE (Sean Cunningham)

ASHRAE has migrated the TC websites to a new format, and TC 3.1 website is now in this new format. Our web page has the agenda for the current meeting, minutes from past meetings, slides from past presentations, and more. The new URL for the TC 3.1 web page is:

<https://tc0301.ashraetcs.org>

Agenda, Minutes and research plan are loaded on the website. Presentations can be added to the website as well.

10. OLD BUSINESS

None

11. NEW BUSINESS

125 Year Historical Celebration for ASHRAE- Refer to the Chairs breakfast summary sheet. An abstract will be written on the history of refrigerants. This needs to be submitted by March.

12. NEXT MEETING

2018 ASHRAE Annual Meeting; Houston June 23-27th, 2018.
TC 3.1 will meet Monday, June 25th, 2018.

13. MEETING ADJOURNED at 6:15 pm.