



AGENDA

ASHRAE TC 3.1—Refrigerants and Secondary Coolants¹
American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
Palmer House, Salon 7/8 Conference Room
4:15 – 6:30 p.m.

1. CALL TO ORDER (0:08) [allotted time indicated in parentheses]

Introduction of members and guests

ACTION: Quorum determination.

2. AGENDA REVIEW (0:02)

ACTION: Revise/approve the meeting agenda.

3. MINUTES OF THE LAST MEETING (0:02)

Draft minutes of the June 26, 2017 meeting in Long Beach were distributed by e-mail to committee members and posted on the TC web page; they are also attached to this agenda.

ACTION: Revise/approve minutes.

4. ROSTER REVIEW AND ANNOUNCEMENTS (0:05)

Voting Members for this meeting (committee terms expire June 30 of year listed):²

Stephen Kujak, Trane, Chair (2018)

Christopher Seeton, Shrieve Chemical, Vice Chair/Program Subcommittee Chair (2021)

Kevin Connor, Dow Chemical, Handbook Subcommittee Chair (2020)

Debra Kennoy, Arkema (2019), Standards Subcommittee Chair

Barbara Minor, Chemours (2019), MTG Low GWP Liaison

Marc Scancarello, Emerson (2019)

Sean Cunningham, Mexichem Fluor, Webmaster (2020)

Bob Richard, Honeywell (2020)

Bill Kopko, JCI (2021)

Greg Linteris, NIST (2021)

Kapil Chand Singhal, BP Refcool (2021)

Knut Petry, Carrier (non-quorum) (2020)

Kenji Takizawa, AIST (non-quorum) (2020)

Other committee officers (non-voting):

Ken Schultz, Trane, Research Subcommittee Chair

Warren Clough, Carrier, Secretary

Liaisons & Other:

¹ TC 3.1 is concerned with all properties and functions of refrigerants and secondary coolants, including commercial and experimental materials.

² Members may retrieve the complete committee roster from the ASHRAE website:
log on to ASHRAE.org and sign in with your member info (from the “Join or Login” tab at top of page)
the line “Welcome, [your name]” will appear at the very top of the page; click on “My Account”
this brings up your “ASHRAE Member Profile”
click on “Committees” tab (left side of page); this brings up “My Active Committees”
a line with “T-TAC-TC03.01” should appear; click the “roster” link to download a pdf

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

5. RESEARCH SUBCOMMITTEE (:30 total) (Ken Schultz)

5.1 Report from Research Subcommittee Chairs Meeting (0:05)

5.2 Ongoing Research Projects—Status Reports (0:20)

ITEM	ACTION NEEDED	Recent Notes
1717-RP IMPROVE ACCURACY AND REPRODUCIBILITY OF ASTM-E681 TEST METHODS FOR FLAMMABILITY LIMIT MEASUREMENT OF 2L FLAMMABLE REFRIGERANTS	<i>TC3.1 Action: TC 3.1 to vote on final approval based on PMS recommendation on final report</i>	PI/UMd is pressing ASHRAE for final payment; need final report approved. Hoping to vote on final report in Chicago
1507-RP Binary Refrigerant Flame Boundary Concentrations and Databank for Used Binary Pairs in Commercial Refrigerants	<i>TC3.1 Action: None, for information only. Project is closed from TC standpoint.</i>	Technical paper being is drafted

5.3 ASHRAE/AHRI/DOE Collaboration on Flammable Refrigerants Research (0:20)

Three ASHRAE lead projects have been developed to work statement phase and funded by ASHRAE. Here is an update on all projects

ITEM	ACTION NEEDED	Recent Notes
1806-RP FLAMMABLE REFRIGERANTS POST-IGNITION SIMULATION AND RISK ASSESSMENT UPDATE	Contractor – Gexcon – Work progressing PMS Schultz (chair), Omar Abdelaziz, Minor, Linteris, Phil Johnson, Takizawa, Wang. RAC members: Kujak and Khankari <i>TC3.1 Action: None, for information only</i>	Project well underway. PMS meeting regularly. Task 1 complete and report to be issued. PMS needs to review report to vote on moving on to Task 2. Working on completing refrigerant dispersion work.

1807-TRP GUIDELINES FOR FLAMMABLE REFRIGERANT HANDLING, TRANSPORTING, STORING AND EQUIPMENT SERVICING, INSTALLATION AND DISMANTLING	Contractor Navigant Consulting – Work progressing PMS: Fricke (chair), Randy Cooper, Satheesh Kulankara, Mooris, Kashif Nawaz, Wang. <i>TC3.1 Action: None, for information only</i>	Work was completed but added to add Canada and final report being drafted
1808-TRP-C SERVICING AND INSTALLING EQUIPMENT USING FLAMMABLE REFRIGERANTS: ASSESSMENT OF FIELD-MADE MECHANICAL JOINTS	Contractor – Creative Thermal Solutions – Work progressing PMS: Fricke (chair), X Wang, P Geoghegan, D Halel, P Johnson, K Nawaz, M Scancarello, <i>TC3.1 Action: None, for information only</i>	80% of the joints have gone through their endurance testing.

5.4 Proposed Research Projects (0:40)

The following items are on the TC Research Plan:

Item	ACTION NEEDED	Recent Notes
1773-WS IGNITION POTENTIAL FROM ELECTRICAL DEVICES IN COMMERCIAL AND RESIDENTIAL APPLICATIONS USING 2L REFRIGERANTS	RESUBMIT WORK STATEMENT OR DROP. FIRST SUBMISSION OF WS WAS RETURNED BY RAC IN JAN. 2016. RTAR WAS ACCEPTED IN JULY 2015. TOPIC EXPIRES FROM SOCIETY RESEARCH IMPLEMENTATION <u>JULY 1, 2019</u> <i>TC3.1 Action: Currently on Hold. Need review of AHRI8017 before proceeding with action</i>	A decision by the TC was made to put this project on hold till the completion of a related AHRI project is complete. Review of AHRI 8017 needs to occur to identify any gaps before proceeding.
1791-WS HUMIDITY EFFECTS ON BURNING VELOCITY	SUBMIT WORK STATEMENT FIRST DRAFT BEFORE <u>DECEMBER 15, 2017</u> OR TOPIC WILL BE REMOVED FROM DISPLAY ON PLAN. WS MUST BE SUBMITTED AND APPROVED FOR BID BY <u>FEBRUARY 1, 2020</u> OR TOPIC WILL BE DROPPED PERMANENTLY BY RAC. RAC APPROVED RTAR AT 2016 WINTER MEETING. <i>TC3.1 Action: Work statement needs to be resubmitted with changes. If available, TC 3.1 can vote on resubmitting</i>	161209] RAC returned WS w/comments (but have not seen anything). [170130] Rec'd RAC comments. [170308] Forwarded RAC comments to WS authors.
1792-WS ASHRAE STANDARD 34 TOXICITY DATA DOCUMENTATION AND MIXTURE CALCULATION	SUBMIT WORK STATEMENT FIRST DRAFT BEFORE <u>DECEMBER 15, 2017</u> OR TOPIC WILL BE REMOVED FROM DISPLAY ON PLAN. WS MUST BE SUBMITTED AND APPROVED FOR BID BY <u>FEBRUARY 1, 2020</u> OR TOPIC WILL BE DROPPED PERMANENTLY BY RAC. RAC APPROVED RTAR AT 2016 WINTER MEETING. <i>TC3.1 Action: No Action for Information Only</i>	WS was withdrawn after upgrades to the current calculator were performed by Ken Schultz. Std 34 voted to withdrawn
1794-WS THE INCORPORATION OF ODORANTS IN REFRIGERANTS TO IMPROVE LEAK DETECTION	SUBMIT WORK STATEMENT FIRST DRAFT BEFORE <u>AUGUST 15, 2018</u> OR TOPIC WILL BE REMOVED FROM DISPLAY ON PLAN. WS MUST BE SUBMITTED AND APPROVED FOR BID BY <u>OCTOBER 1, 2020</u> OR TOPIC WILL BE DROPPED PERMANENTLY BY RAC. RAC APPROVED RTAR AT 2016 WINTER MEETING. <i>TC3.1 Action: No Action for Information Only</i>	WS resubmitted and being reviewed by RAC in Chicago. Co-funding through CSPC has fallen through. 1794 is going out for bid.
1797-WS ASSESSMENT OF THE A/B TOXICITY CLASSIFICATION USED IN STANDARD 34	RESUBMIT WS OR DROP. RAC RETURNED WS AFTER 2016 ANNUAL MEETING FOR FIRST TIME. RESUBMIT REVISED WS WITH LETTER EXPLAINING HOW RAC'S COMMENTS WERE ADDRESSED IN REVISION WITH NEW TC VOTE OR NOTIFY RAC THAT WS HAS BEEN DROPPED BY TC FOR FURTHER CONSIDERATION. RTAR STAGE SKIPPED - NOT ON PLAN YET. <i>TC3.1 Action: No Action for Information Only</i>	TC revoted on WS and it was resubmitted to RAC for action in Chicago

1802-WS DEFINING THE 2 / 2L FLAMMABILITY BOUNDARY IN STANDARD 34	SUBMIT WORK STATEMENT FIRST DRAFT BEFORE MAY 15, 2018 OR TOPIC WILL BE REMOVED FROM DISPLAY ON PLAN. WS MUST BE SUBMITTED AND APPROVED FOR BID BY JULY 1, 2020 OR TOPIC WILL BE DROPPED PERMANENTLY BY RAC. RAC APPROVED RTAR AT 2016 WINTER MEETING. <i>TC3.1 Action: Work statement needs to be submitted. If available, TC 3.1 can vote on submitting</i>	[170106] BMinor needs to step back as WS author; DKennoy has taken the lead. 1st draft circulated to WST. [170113] Draft WS circulated to TC for review and comment; address at Las Vegas mtg.
NO RTAR DIELECTRIC PROPERTIES OF LOWER GWP REFRIGERANTS	New RTAR - <i>TC3.1 Action: Review RTAR and potentially take vote to move to RAC for approval.</i>	Julie Majurin author

5.5 Update of TC Research Plan (0:05)

A spreadsheet summarizing the TC research plan has been posted on the TC web page; it is under the “Research” tab at: <https://tc0301.ashraetcs.org/documents.php>. This version includes attachments, including current versions of the RTARs and WS.

6. HANDBOOK (FUNDAMENTALS) SUBCOMMITTEE (0:10) (Kevin Connor)

TC 3.1 is responsible for Chapters 29 (Refrigerants), 30 (Thermophysical Properties of Refrigerants), and 31 (Physical Properties of Secondary Coolants) in the Handbook of Fundamentals.

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

Chapter 29- Refrigerants (Lead—Steve Kujak)

Chapter 30- Thermophysical Properties of Refrigerants (Lead—Mark McLinden)

Chapter 31- Physical Properties of Secondary Coolants (Lead—Kevin Connor)

Handbook subcommittee is meeting at Chicago to start coordinating efforts.

ACTION: For information only, TC to take action as necessary. Do we need to schedule a recurring Handbook Meeting?

7. PROGRAM (0:10) (Chris Seeton)

7.1 Programs at the Chicago Meeting:

Monday, Jan 22 1:00 PM - 2:30 PM AHR Expo Session 4 (Intermediate)

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

@ Expo Room: S101B

Sponsor: 3.1 Refrigerants and Secondary Coolants, MTG.LowGWP Lower Global Warming Potential Alternative Refrigerants

Chair: Steven Eckels, Ph.D., Member, Kansas State University Institute for Environmental Research, Manhattan, KS This seminar focuses on the fundamentals of flammability, issue in handling flammable refrigerants and ASHRAE and industry funded research into flammable refrigerants.

Product and standard changes needed to handle flammable refrigerants are also discussed.

1. Flammable Refrigerant Basics Stephen Kujak
2. Flammability: A Continuum Vs. Discrete Boundary Gregory Linteris, Ph.D.
3. AHRI Flammable Refrigerant Research Xudong Wang, Ph.D.
4. Developing Guidelines for Flammable Refrigerant Use William Goetzler and Matt Guernsey

Monday, Jan 22 2:45 PM - 3:45 PM AHR Expo Session 6 (Basic)

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

@ Expo Room: S101B

Sponsor: 3.1 Refrigerants and Secondary Coolants, 8.2 Centrifugal Machines
Chair: Christopher Seeton, Ph.D., Member, Shrieve, The Woodlands, TX New lower and low GWP next generation refrigerants are being offered in equipment today in the market place. This seminar focuses on the type of new equipment being offered with lower GWP refrigerants and also includes retrofitting of equipment with high GWP HFC's with lower GWP refrigerants. Seminar topics include discussions on new equipment in the area of chillers, unitary, commercial refrigeration, portable HVAC&R equipment and retrofitting of existing R404A commercial refrigeration with lower GWP refrigerants.

1. Low GWP Refrigerant Alternatives for Chillers Barbara Minor,
2. Low GWP Systems for Commercial Refrigeration K.C. Kolstad, CANCELED
3. Key Learnings from Conversions of Commercial Refrigeration Systems to Low GWP Alternatives Charles Allgood, Ph.D.,

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, The American Society of Thermal and Fluids Engineers (ASTFE) and the U.S. National Committee of the International Institute of Refrigeration (IIR).

Chair: Lorenzo Cremaschi, Ph.D., Member, Auburn University, Auburn, AL This session introduces the audience to heat transfer characteristics, energy performance, safety and trade-off aspects of the low GWP refrigerants used in heat exchange equipment of air conditioning and refrigeration systems. The speakers provide an overview of several case-studies with low GWP refrigerants and with natural refrigerants, and they discuss modeling, simulation and laboratory performance testing. Real world applications and performance under field type conditions are presented. This session provides the background information for the follow up forum panel discussion of Part 2 of this session.

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

From the previous session, this panel forum is a roundtable panel on lower GWP refrigerants within the context of the Kyoto Protocol. The audience has the opportunity to ask questions, offer case studies, propose ideas and discuss solutions on low GWP refrigerants for heat transfer equipment, air conditioning and heat pump systems.

7.2 Future program plans

Future Technical Tracks

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
Professional Skills	The Convergence of Comfort, IAQ and Energy Efficiency
Research Summit	Building Integrated Renewables and Natural Systems
HVACR Control Freaks	The Engineers Role in Architecture.
HVACR Analytics	

Important Dates

- Friday, February 9, 2018: Program (Seminar, Forum, Workshop, Debate and Panel) Proposals Due
- Friday, February 9, 2018: Revised Conference Papers/Final Technical Papers Due

Past Program Ideas

“How to design systems with refrigerants – “The perils and pitfalls of NOT using Guideline 6”, Steve Kujak
Leak detection technologies and sensors; potential co-sponsor with TC 3.8
Seminar on R404A replacements (TC 10.7 is leading and submitting)
Results from AREP II testing (Alternative Refrigerant Evaluation Program, organized by AHRI—Air Conditioning, Heating, and Refrigerating Institute
Workshop on A/B toxicity classification. (Wait until proposed research project is started; give an update on progress and get feedback.)
Montreal Protocol – Phase out of R22. Tom Leck to chair. Houston most probable
Motion sponsor a seminar “Regulations Governing the Impending Refrigerant Change, European F-gas, Kigali Agreement and CARB : Update and Experiences Learned.” Sonny Motion, Debbie 2 nd . 9-0-0-CV (shecco, CARB, EPA, EU retail building owner, Honeywell EU, DuPont EU etc. Derek Hamilton (shecco)
Was not able to get sufficient buy-in from proposed speakers to submit. This is approved and may carry forward to Houston.

***ACTION:** Discuss program ideas, identify session chairs and vote on approving or co-sponsor sessions.*

8. STANDARDS (0:05) (Debbie Kennoy)

TC 3.1 is the cognizant technical committee for ASHRAE Standards 34, Guideline 6, and Guideline 39 (formerly Standard 177p).

8.1 ANSI/ASHRAE Standard 34, Designation and Safety Classification of Refrigerants.

Action: Update from Debbie Kennoy

8.2 ASHRAE Guideline 6, Refrigerant Information Recommended for Product Development and Standards

In accordance with the requirements of Section 13 of the Standards Committee Reference Manual (3/21/2017), TC 3.1 (the cognizant Technical Committee) is asked to vote to recommend to the Standing Reaffirmation Subcommittee (SRS) of the Standards Committee whether the subject standard should be

- Revised,
- Reaffirmed, or
- Withdrawn

When the TC recommends reaffirmation, the TC should include in its recommendation to SRS a Units Format Plan. Instructions are attached (Units Policy). In addition, the TC should review the references and their impact in the body of the main text of the reaffirmation draft. Updated references needed to implement the standard shall only include reaffirmations of the referenced standard. Referenced standards that have been revised in lieu of reaffirmed cannot be updated in a reaffirmation. In addition, the TC shall determine whether or not the standard/guideline complies with the requirement that all standards shall be written in mandatory language and all guidelines shall be written in informative language. If the standard/guideline does not comply with this requirement, the TC shall not recommend reaffirmation, but instead shall recommend revision so the standard/guideline can be brought into compliance. (Reference enclosure titled ASHRAE Guide to Writing Standards in Mandatory Language.)

Action: TC 3.1 to vote on revising, reaffirming or withdrawing GL6. If voting to revise, form subcommittee to rework guideline.

8.3 ASHRAE Guideline 39p (formerly SPC-177p), Method of Test for Measuring Fractionated Compositions of Refrigerant Blends (Bob Richard)

This MOT was converted to a Guideline. It was sent out for a 45-day public review (March 4 – May 9, 2016). No comments were received.

Action: Update from Bob Richards

9. WEB SITE (0:02) (Sean Cunningham)

ASHRAE has migrated the TC web sites to a new format, and the TC 3.1 web site is now in the 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>

10. OLD BUSINESS

None

11. NEW BUSINESS

11.1 Steve Ferguson – ASHRAE Manager of Codes – Discussion of how your TC might be able to get involved with ASHRAE Standards Development, US Model Code Development, and International Standards Development.(0:10)

ASHRAE is finding that many members of ASHRAE Technical Committees may not be aware of how ASHRAE is involved with these activities. He would like to give a brief overview of what ASHRAE does, how TCs might be able to get involved, and answer any questions TC members may have.

11.2 125 Year Historical Celebration for ASHRAE

Is there any topic 3.1 would like to collaborate on to support this celebration. 30 page limit on conference papers.

12. NEXT MEETING

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

13. ADJOURN

ATTACHMENTS:

1. Draft minutes: Long Beach
2. Research Plan: