

**AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING
ENGINEERS, INC.**

1791 Tullie Circle, N.E./Atlanta, GA 30329
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TC/TG/TRG MINUTES COVER SHEET

**Minutes of all TC/TG/TRG Meetings are to be distributed to all persons listed below within
60 days following the meeting.**

These minutes have been approved by this committee.

TC/TG/TRG NO TC 3.1

Date: 25 June 2012

TC/TG/TRG TITLE Refrigerants and Secondary Coolants

DATE OF MEETING 25 June 2012

LOCATION San Antonio, TX

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
Dave Wilson (Chair) – voting	7/2010	Umar Khokhar – CM	7/2011	Julie Majurin – Guest
Debra Kennoy (Vice Chair) – voting	7/2010	Osami Kataoka – CM	7/2006	Kenji Takizawa – Guest
Sean Cunningham (Secretary) – voting	7/2011	Damon Johnson – CM (Provisional)	2/2010	Scott Macleod – Guest
Sonny Sundaresan – voting	7/2008	Kapil Singhal – CM	7/2010	Rajan Rajendran –Guest
Barbara Minor (Research) – voting	7/2010	William Aloys Schulte – CM	10/2010	Laurent Abbas –Guest
Maryline Rassi – voting	7/2010	Karim Amrane – CM	7/1997	Tatsuro Kobayashi – Guest
Don Bivens – voting	7/2010	John Andrepont – CM	7/2001	Hewitt Gaudin – Guest
Bill Walter (Standards) – voting	7/2010	Earl Clark – CM	7/1992	John Senediak –Guest
Kevin Connor (Handbook) – voting	7/2011	Thomas Clemens – CM	7/2001	Knut Petry – Guest
Bruce Badger – CM	7/2010	Denis Clodic – CM	7/2007	Amy Shifflett – Guest
George Kazachki - CM	7/2008	Alan Cohen – CM	7/1999	Michael Foster – Guest
Robert Richard - CM	7/2000			Eugene Chen - Guest
Marc Scancarello - CM	7/2010	Barry Fields – CM	7/2001	Jeng-Shiang Tsaih – Guest
Warren Clough - CM	7/2011	Cynthia Gage – CM	7/1992	Bianca Hydutsky - Guest
Chris Seeton - CM	7/2011	Richard Jacobsen – CM	7/1990	Harrison Skye – Guest
		Jim Lavelle – CM	7/2010	Tom Leck - Guest
		Ken Lilje – CM	7/2001	Robert Fisher - Guest
		Bert McJimsey – CM	7/1997	Craig Grider - Guest
		Nandini Mouli – CM	7/2003	Brijesh Darji? -Guest
		Sunil Nanjundaram – CM	7/2008	Neel Gupte - Guest

		Bjorn Palm – CM	7/2009	Sam Cantrell - Guest
		Thomas Reinarts – CM	7/2002	
		Rajiv Singh – CM	7/2006	
		Steven Szymurski – CM	7/2000	
		Koichi Watanabe – CM	7/2003	
		Tom Watson – CM	7/2004	
		Andrzej Wesolowski – CM	7/1995	
		Xiaomei Yu – CM	7/2008	
		Jing Zheng – CM	7/2003	
		Changiz Tolouee – Provisional CM	9/2011	
		Samuel Sami (Program) – voting	7/2011	
		Stephen Kujak – voting	7/2009	
		Felix Flohr – CM	7/2011	
		Gus Rolotti – CM		
		Alice Riemer – CM	7/2011	
		Mark McLinden – CM	7/2002	

KEY CONTACTS

SPLS Liaison*	Janice Peterson
TAC Chair:	Charles Culp
TAC Section Head:	William Murphy
All Committee Liaisons As Shown On TC/TG/TRG Rosters:	RAC Research: Don Bivens Special Pubs: William Flemming Standards: Douglass Abramson Handbook: Hassan M. Bagheri Chapter Technology Transfer: Mark Tomb Professional Development: John Nix
Manager Of Standards*	Stephanie Reiniche
Manager Of Research & Technical Services	Michael R. Vaughn

*receives a copy of the TC 3.1 meeting minutes

MEETING MINUTES

1. CALL TO ORDER (Dave Wilson, Chair)

- A. Introductions of members and guests – Chair called the meeting to order at 4:30 P.M. and attendees introduced themselves.
- B. Agenda Revision/acceptance
Motion to approve was made by S. Sundaresan and seconded by D. Kennoy.
Motion passed: 8 / 0 / 0 / 8 (CV)
(For / Against / Abstain / Total [Chair Voting [CV] or Chair Not Voting [CNV]])
- C. Establishment of a quorum – There were 8 voting members present out of 11, which constitutes a quorum (Note that D Bivens joined the meeting at 4:45pm to make 9 VM)

Voting members for this meeting:

Steve Kujak - absent
Sonny Sundaresan - present
Bill Walter - present
Dave Wilson - present
Maryline Rassi – present
Debra Kennoy – present
Sean Cunningham – present
Barbara Minor – present
Don Bivens – present
Kevin Connor – present
Samuel Sami - absent

2. APPROVAL OF CHICAGO, IL JANUARY 2012 MEETING MINUTES

Motion to approve draft minutes with minor spelling edit was made by B. Minor and seconded by S. Sundaresan.
Motion passed: 8 / 0 / 0 / 8 (CV)

3. CHAIRMAN'S ANNOUNCEMENTS (D. Wilson)

A. Section 3 Meeting Report

- i. Hightower Award
Recognizes outstanding technical leadership and contributions on a TC / TG / TRG during the past society year excluding research and standards activities. Website with additional information will be in the minutes. Deadline: September 1, 2012
- ii. TC Volunteers needed.
The Conferences and Exhibitions Committee (CEC) is looking for qualified volunteers to serve as technical session chairs and reviewers of session papers for future technical programs
- iii. Registration fee for speakers:

.A \$95 registration fee for speakers will begin at the Dallas meeting.

iv. “Thank You” Letters

Ronald Jarnagin (ASHRAE President) will send letters to employers thanking them for supporting the volunteer work during 2011 – 2012 if requested. Additional information will be sent via e-mail in July.

v. TC Subcommittee meetings via conference calls and web meetings.

ASHRAE has several licenses that can be used for these meetings free of charge. Contact Mike Vaughn for details.

vi. New ASHRAE terminology WIKI launched

Over 6,000 definitions for terms in ASHRAE publications can be found on ASHRAEwiki.

vii. Deadlines for Conference submissions:

Dates	January 26 – 30, 2013	June 22 – 26, 2013
Location	Dallas, TX	Denver, CO
Website	www.ashrae.org/dallas/	www.ashrae.org/denver/
Conference paper abstract / Conference paper session proposals	Due March 19, 2012	-----
Conference paper abstract / full technical papers	-----	Due September 24, 2012
Conference papers submitted for review	Due July 9, 2012	
Seminar and Forum session proposals	Due August 13, 2012 (need chair, speaker, abstract, speakers' bio, learning objectives, questions / answers)	Due February 11, 2013
Track 1	HVAC&R Systems & Equipment	
Track 2	HVAC&R Fundamentals & Applications	
Track 3	Standards, Guidelines, & Codes	
Track 4	Energy Conservation	
Track 5	Refrigeration	
Track 6	Large Building Design	
Track 7	Facility Management: Operations, Tech and Energy Improvements	
Track 8	Special Interest Track	

B. Roster Review

Summary of TC3.1 membership and changes, effective July 1st 2012.

12 Voting members for Dallas (January 2013): Debbie Kennoy (2014), Barbara Minor (2014), Samuel Sami (2015), Kevin Connor (2015), Sean Cunningham (2015), Steve Kujak (2013), Maryline Rassi (2014), Mark McLinden (2016), Chris Seeton (2016), Warren Clough (2016), Felix Flohr (Intl. NQM-2014), Alice Riemer (Intl. NQM-2014).

Officers serving from 2012-07-01 through 2014-06-30 are - Chair: Debbie Kennoy, Vice Chair: Mark McLinden, Secretary: Sean Cunningham.

Subcommittee chairs are - Research: Barbara Minor, Standards: Dave Wilson, Program: Chris Seeton, Handbook: Kevin Connor, Webmaster: Sean Cunningham.

Dropping off TC 3.1 Voting Members to Corresponding Members: Dave Wilson, Bill Walter, Don Bivens, Sonny Sundaresan.

TC 3.1 Liaisons: Alternative Lower Global Warming Potential Refrigerants: B. Minor (Primary), S. Cunningham (Alternate).

New Corresponding Members: Knut Petry, Som Shresta, Chun-cheng Piao, Parmesh Verma, Hans-Joachim Kretzshmar.

Deleted members of TC 3.1 (Non-responsive or Not interested): Umar Khokhar, Bert McJimsey, Nandini Mouli, Koichi Watanabe, Andrej Wesolowski, Xiaomei Yu

4. Research Subcommittee (Barbara Minor)

A. Report from Research Subcommittee Chairs Meeting. Budget for 2012 research projects has been increased to approximately \$2 million. Barbara Minor noted pipeline of projects for TC 3.1 starting to run dry, need more RTAR, WS submissions this year. There will be a Research Track at the ASHRAE 2013 annual meeting in Denver. Research manual has been updated and gives greater guidance on RTAR and Work Statement preparations.

B. Ongoing Project Reports

a. Binary Refrigerant Flame Boundary Concentrations (1507-RP)

- i. Description: databank for useful binary pairs in commercial refrigerants (60 C and 100 C, 50% relative humidity @ 23 C). Identify standard flammable mixture for confirming accuracy of data from flame test apparatus. To aid assessment of new refrigerant blends for SSPC 34.
- ii. Project Monitoring Subcommittee: D. Kennoy, T. Leck, R. Richard, S.Sundaresan, X. Wang
- iii. Status: Testing completed. Draft report expected August 2012.

b. Assessment of Burning Velocity Test Methods (1583-RP)

- i. Description: evaluate burning velocity test methods for precision and accuracy; investigate ways to simplify the methods and reduce costs without sacrificing quality.
- ii. Project Monitoring Subcommittee: D. Kennoy, B. Minor, R. Richard, W. Walter, X. Wang
- iii. Status: Project was awarded to AIST during 3Q2010.
The project testing is completed and report is ready for TC3.1 vote. It was noted that for refrigerants with BV < 4 cm/sec, the vertical tube method may not be acceptable for getting an accurate BV value, and the only conclusion that can be made is that the BV is <10 cm/sec with this method. Cost data for the different BV methods has been assessed, together with cost reduction ideas.

Motion to approve project report was made by B. Minor and seconded by D. Bivens.

Motion passed: 9 / 0 / 0 / 9 (CV)

(For / Against / Abstain / Total [Chair Voting [CV] or Chair Not Voting [CNV]])

c. Study of Input Parameters for Risk Assessment of 2L Flammable Refrigerants in Stationary Applications and Commercial Refrigeration (1580-RP)

- i. Description: develop critical input data which can be used in risk assessments for residential air conditioning, heat pumps and small commercial refrigeration applications in occupied spaces; identify and determine refrigerant charge sizes, leak rates and leak scenarios, potential ignition sources and whether these sources are capable of igniting 2L refrigerants.
- ii. Project Monitoring Subcommittee: D. Kennoy, B. Minor, C. Seeton, S. Sundaresan, W. Walter, X. Wang
- iii. Status: Project was awarded to Navigant. Started June 2011 with expected report in September 2012. CFD modeling work completed. Will next run actual leak tests, where model predicts LFL would be exceeded.

C. Approved Research Projects

a. Assessment of Alternative Approaches to Predicting the Burning Velocity of Refrigerants (1584-RP)

- i. Description: identify technically acceptable parameters to accurately predict or estimate the burning velocity of refrigerants; a reliable, less expensive approach to burning velocity will reduce the cost of safety classification and increase the participation in the development of new refrigerant candidates that may be only mildly flammable.
- ii. Project Monitoring Subcommittee: S. Cunningham, D. Kennoy, B. Minor, R. Richard, X. Wang (ARTI representative)
- iii. Status: Principal investigator Dr. Hammed Metghalchi, Northeastern University. Project began Nov. 2011 and is on target with expected completion date

September 2012. Project will conduct some MIE tests to improve data for correlation to burning velocity.

D. New Work Statements - None

E. Proposed RTARs

a. Phase 2 of 1584-RP

- i. Description: Investigate more deeply MIE, hot surface ignition, 2L flame instability, kinetic mechanisms and/or other flammability characteristics relevant to class 2L refrigerants, which can be used in risk assessments.
- ii. Sonny Sundareson, Bob Richard, Debbie Kennoy volunteered to review. More work is required to understand this complex area before developing a possible RTAR.

b. Phase 2 of 1580-RP

- i. Investigate what is needed to determine safe charge limits for 2L refrigerants in US HVACR designed equipment.
- ii. Samuel Yana Motta and Barbara Minor volunteered to assess after first phase of project is completed.

F. Research Plan (See Attachment)

Motion to approve project report was made by B. Minor and seconded by D. Bivens.

Motion passed: 9 / 0 / 0 / 9 (CV)

(For / Against / Abstain / Total [Chair Voting [CV] or Chair Not Voting [CNV]])

G. ASHRAE Research Goals Liaisons Reports

Alternative Lower Global Warming Potential Refrigerants - the first lower GWP MTG meeting was held Saturday, June 23. They are still working on adding new members to the roster who represent interested TCs. The primary goal of the MTG is to improve communication between the TCs on research projects related to lower GWP refrigerants. The MTG decided not to define what is meant by "lower GWP" because the definition is relative to the current refrigerant being replaced in a given application.

5. HANDBOOK SUBCOMMITTEE (Kevin Connor)

A. The revision to chapters 29/30/31 have been approved by TC3.1. ASHRAE will send updated sections to lead authors for final review.

- a. Chapter 29 – S. Cunningham (lead reviewer) and Don Bivens
Draft changes have been approved by TC letter ballot (10/0/0/10, 1 no reply)
- b. Chapter 30 – M. McLinden (lead reviewer)

- Draft changes have been approved by letter ballot (10/0/010, 1 no reply)
- c. Chapter 31 – K. Connor (lead reviewer)
Draft changes have been approved by letter ballot (11/0/0/11)

6. PROGRAM (Chris Seeton)

- a) San Antonio 23 – 27 June 2012. Program themes have been eliminated starting with this conference. Program items related to TC 3.1:

- i) Sponsoring **SEMINAR 11**: Standards Development for 2L Flammable Refrigerants:

Sunday, June 24, 11:00 AM-12:30 PM, Room: 007C. Chair: Bill Walter.

1. ASHRAE Standard 15: Proposed Changes to Incorporate 2L Refrigerants - Phillip Johnson

2. EN 378, ISO 5149, IEC 60335-2-40: Proposed Changes to Incorporate 2L Refrigerants - Els Baert

3. UL's Effort to Harmonize Product Safety Requirements for A2L, A2, and A3 Refrigerants - Brian Rodgers

- ii) Sponsoring **FORUM 5**: Safety Requirements for Class 2L Refrigerants:

Tuesday, June 26, 9:45 AM-10:45 AM, Room: 007A. Chair: Chris Seeton.

This forum will provide an opportunity for interested parties to discuss the appropriate use of Class 2L refrigerants.

- iii) Cosponsoring (with TCs 8.1 & 10.7) **SEMINAR 50**: Design, Performance and Efficiency Impact of Low-GWP Refrigerants on Systems and Components

Tuesday, June 26, 11:00 AM-12:30 PM, Room: 007D. Chair: Georgi S. Kazachki.

1. Advances in Low-GWP Refrigerants for Stationary Systems - Brett L. Van Horn

2. Analysis of Low-GWP Refrigerants in Existing Compressor Technologies for Refrigeration Systems - Samuel Yana Motta

3. Transient Performance Evaluation of Automotive Secondary Loop Systems with Low-GWP Fluids - Yunho Hwang

4. Prospective of Low-GWP Refrigerants - J. Steen Brown

Suggested Future Program Topic:

- b) Dallas 26-30 January 2013: Seminar and Forum proposals due 8/13/2012

- i) Seminar – Code Official, Contractor, Fire Marshall: feedback on use of 2L classified refrigerants - Chris Seeton
 - ii) Seminar - Industry efforts to evaluate Low(er) GWP refrigerants (MTG) – B. Minor
 Advances in LGWP refrigerants Part II: (AREP) – same title as Sem 50. Seminar – Design Performance and Efficiency Impact on Low GWP Refrigerants on system and/or components.
 - iii) RP-1484 Report Secondary fluids in refrigeration systems (special session track - Transactions) – Eckhard Groll
- c) Denver 22 – 26 June, 2013: Conference Papers due 9/24/2012
- Seminar and Forum Proposals due 2/11/2013
- i) Flammability studies of 2L Refrigerants – Conference Papers
 - (1) CFD modeling of R-32 with leak and ventilation scenarios – Dennis Dorman
 - (2) Hot surface ignition testing of 2L refrigerants – Yana Motta / Richard
 - (3) BV tests methods – Takizawa (Transactions)
 - ii) Tech Session (co-sponsor, lead TC 3.2) compatibility of refrigerants – Conf. Paper
 - (1) AHRI compatibility work
 - (2) Spauschus ASHRAE project
 - (3) ETL work (John Senediak)
 - iii) Industry efforts to evaluate LowER GWP refrigerants (MTG) – Minor - Seminar
- a. Other Program Ideas
- a. High Glide Refrigerants. Assess after Purdue Conference.
 - b. AHRI Material Compatibility project
 - c. Glide – what is it and how it affects design, use, service

Motion to approve Program for Dallas was made by B. Minor and seconded by B. Walter.

Motion passed: 9 / 0 / 0 /9 (CV)

(For / Against / Abstain / Total [Chair Voting [CV] or Chair Not Voting [CNV]])

7. STANDARDS (Bill Walter)

a. Guideline 6

i. Team met yesterday. Aligning definitions with other ASHRAE documents.

b. ASHRAE Standard 34, Designation and Safety Classification of Refrigerants (W. Walter)

i. Responding to comments on Addendum m, Addition of an informative note to Section 9, Application Instructions.

ii. Standards Committee approved addendum z (Bubble point / dew point definitions), addendum aa (Azeotropic evidence requirement), addendum ab (R-433a table addition)

iii. Addenda p,q,r,s,t,u,v and y have been added to the ASHRAE website

iv. An updated list of refrigerants was submitted to the IMC, with a request to add a footnote for 2L classified refrigerants.

c. ISO Standard 817, Refrigerants –Designation and Safety Classification (W. Walter)

i. Possible publication at end of 2012 or early 2013.

d. SPC-177P, MOT Fractionation Measurement of Refrigerant Blends (R. Richard)

i. On-going.

8. WEB SITE (Sean Cunningham)

Meeting minutes and presentations are posted on the ASHRAE website.

9. OTHER BUSINESS

10. MEETING ADJOURNED

Motion to adjourn. Motion passed by general consensus.

Attachment 1
TC 3.1 Annual Objectives for 2011-2012 Society Year

Objective	Completion Date
Bidder Selection TRP-1584 (Methods for Predicting Burning Velocity of 2L Refrigerants)	7/2011
Complete RP-1507 (Binary Flame Boundary Concentrations)	9/2011
Complete RP-1583 (Assessment of Burning Velocity Test Methods)	3/2012
Complete RP-1580 (Input Parameters for Risk Assessment of 2L Refrigerants)	5/2012
Chair Recommendations TC Roster for 2012 year to Section Head	1/2012
Review Handbook Chapters 29, 30, 31 for changes, appoint reviewers, start revisions	7/2011
Robust Research Plan development and submittal to MORTS	1/2012, 6/2012
New RTAR and Work Statement submissions to MORTS	8/2011, 12/2011
Submit \geq 1-2 Program Forum/Seminar/Tech paper proposals for Chicago, San Antonio	8/2011, 2/2012
Participate in Research Liaison Document Development and Ad Hoc Committees	ongoing
Annual review/update of FAQs and TC website, maintain active member communications	ongoing

ATTACHMENT 2 - Current TC 3.1 Research Plan 2011-2012

ASHRAE Research Projects		
	Project Title	Comments/Status
Current Research ASHRAE	<p>1507-RP: Binary Refrigerant Flame Boundary Concentrations and databank for useful binary pairs in commercial refrigerants. Identify standard flammable mixture for confirming accuracy of data from flame test apparatus. Databank to aid assessment of new refrigerant blends for SSPC34.</p>	<p>Project nearing completion, finish 2/12 \$15K extension granted for added tests PI is A. Kusmierz. PMS: <u>Bob Richard</u>, Debra Kennoy, Sonny Sundaresan, Xudong Wang and Tom Leck</p>
	<p>1583-TRP: Assessment of Burning Velocity Test Methods</p>	<p>PI presented update 1/23/12 to TC Research project in progress, finish 3/12 Project monitoring subcommittee: <u>B. Minor</u>, D. Kennoy, R. Richard, W. Walter, X. Wang</p>
	<p>1580-TRP: Input Parameters for Risk Assessment of 2L Flammable Refrigerants in Stationary Applications a) residential a/c & heat pumps b) small commercial refrigeration</p>	<p>PI presented update 1/23/12 to TC Research Scheduled completion May, 2011 PMS subcommittee: <u>B. Minor</u>, D. Kennoy, C. Seeton, W. Walter, S. Sundaresan, and X Wang</p>
	<p>1584-TRP: Assessment of Alternative Approaches to Predict Burning Velocity of a Refrigerant</p>	<p>PI presented update 1/23/12 to TC Research Project began Nov, 2011 PMS subcommittee: <u>D. Kennoy</u>, B. Minor, R. Richard, S. Cunningham, Xudong Wang, Kenji Takizawa</p>
AHRTI	<p>Fractionation testing and error analysis for refrigerant blends in support of SSPC34 SPC-177P title is: MOT Fractionation Measurement of Refrigerant Blends</p>	<p>Project in progress with AHRTI Complete March, 2012 Contractor - Safety Consulting Engineers AHRTI PMS <u>R. Richard</u>, B. Minor S. Kujak, M. Scancerello, X. Wang M. McLinden</p>

Non-Prioritized Research Suggestions		
	Project Title	Comments/Status
New Idea Prepare RTAR	Phase II of 1584-RP to investigate more deeply MIE, hot surface ignition, 2L flame instability, kinetic mechanisms and/or other flammability characteristics relevant to 2L flammable refrigerants which would be useful to understand risks	Sonny Sundaersan (Lead), Bob Richard Debbie Kennoy, Greg Linteris
New Idea Prepare RTAR	Phase II of 1580-RP to investigate what is needed to determine safe charge limits for 2L refrigerants in US HVACR designed equipment vs Europe designs where work has been done. Consider input of UL working groups	Sam Yanamotta (Lead), Barbara Minor, other volunteers?
	Implications for Use of High Glide Refrigerants	Proposed seminar for Chicago meeting. Not accepted - resubmit? (Sundaersan - Seminar Chair)
	Phase II for RP-1484 - Energy and Performance of Secondary Coolant Low Temperature Refrigeration Systems	Working to finalize paper for ASHRAE presentation (Groll)
	Phase II for 1507-RP: Binary Refrigerant Flame Boundary Concentrations and databank for useful binary pairs in commercial refrigerants.	Some variability was identified in ASTM E681 when testing low flammability refrigerants May need another research project to resolve
RTAR prepared	Risk Assessment of 2L flammable refrigerants in applications using large quantity of refrigerants such as centrifugal chillers, supermarket racks, sea containers, etc.	RTAR approved but placed on hold because AHRI has a risk assessment in progress. Will wait until AHRI project is complete.