

**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.)**

TC/TG/TRG NO TC 3.1 DATE 14 July 2009

TC/TG/TRG TITLE Refrigerants and Secondary Coolants

DATE OF MEETING 21 July 2009 LOCATION Louisville, KY

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
Sean Cunningham (Chair) – <u>voting</u>	07/2008	Kevin Connor (Handbook) – <u>voting</u>	07/2006	Steve Brown – Guest
David Wilson (Vice Chair) – <u>voting</u>	07/2008	Felix Flohr – <u>voting</u> (international)	07/2007	Umar Khokhar – Guest
Don Bivens (Research) – <u>voting</u>	07/2008	Gustavo Rolotti – <u>voting</u>		Julie Majurin – Guest
Samuel Sami (Program) – <u>voting</u>	08/2008	James Lavelle (Standards) – non-voting CM	07/2008	Chun-Cheng Piao – Guest
Ganesan “Sonny” Sundaresan (Journal) – <u>voting</u>	07/2007	Karim Amrane –CM		Chris Seeton – Guest
William Walter – <u>voting</u>	07/2008	John Andrepont –CM		John Senediak – Guest
Debra Kenroy (Secretary) – non-voting CM	08/2008	Earl Clark –CM		Kenji Takizawa – Guest
Barbara Minor (Webmaster) – non-voting CM	07/2006	Thomas Clemens – CM		Gary Zyhowski – Guest
Robert Doerr – CM	07/2008	Denis Clodic - CM		
Georgi Kazachki – CM		Alan Cohen –CM		
Sunil Nanjundaram – CM		Barry Fields – CM		
Robert Richard – CM		Cynthia Gage –CM		
		Richard Jacobsen –CM		
		Osami Kataoka – CM		
		Dominic Kolandayan - CM		
		Steve Kujak – CM		

		Kenneth Lilje –CM		
		Bert McJimsey – CM		
		Mark McLinden – CM		
		Nandini Mouli - CM		
		Thomas Reinarts – CM		
		Rajiv Singh – CM		
		Steven Szymurski – CM		
		Koichi Watanabe – CM		
		Thomas Watson – CM		
		Andrzej Wesolowski – CM		
		Xiaomei Yu – CM		
		Jing Zheng – CM		

KEY CONTACTS

SPLS Liaison*	Janice Peterson
TAC Section Head:	Brian Michael Silvetti
TAC Chair:	Bryan R. Becker
All Committee Liaisons As Shown On TC/TG/TRG Rosters:	RAC Research: Raymond Cohen Special Pubs: Julia Keen Standards: Samuel D. Cummings, Jr Handbook: Hassan M. Bagheri Chapter Technology Transfer: Nancy J. Mitchell-Veeck Professional Development: Tim J. McGinn
Manager Of Standards*	Stephanie Reiniche
Manager Of Research & Technical Services	Michael R. Vaughn

* receives a copy of the TC 3.1 meeting minutes

1. **CALL TO ORDER** (Sean Cunningham, Chair)

- A. Introductions of members and guests – Chair called the meeting to order at 4:25 P.M. and attendees introduced themselves.
- B. Agenda Revision/acceptance
 - i. *Motion to accept the agenda made by W. Walter and seconded by S. Sundaresan and passed 5 / 0 / 0 / 5 CNV*
- C. Establishment of a quorum – There were 6 voting members present out of 9, which constitutes a quorum. Note that one missing member is an international member and his absence is not counted against the quorum determination.

Voting members for this meeting:

Don Bivens
 Kevin Connor (absent)
 Sean Cunningham
 Felix Flohr (International member - absent)
 Gus Rolotti (absent)
 Samuel Sami
 Sonny Sundaresan
 Bill Walter
 Dave Wilson

D. Roster Review

2008 – 2009		2009 - 2010		
	Position		Position	Roll-off date
Sean Cunningham	Chair / ALI Coordinator	Sean Cunningham	Chair / ALI Coordinator	30JUN2010
David Wilson	Vice Chair	David Wilson	Vice Chair	30JUN2011
Kevin Connor	Handbook Subcommittee Chair	Kevin Connor	Handbook Subcommittee Chair	30JUN2010
Don Bivens	Research Subcommittee Chair	Don Bivens	Research Subcommittee Chair	30JUN2012
Samuel Sami	Program Subcommittee Chair	Samuel Sami	Program Subcommittee Chair	30JUN2010
Felix Flohr	International Member	Felix Flohr	International Member	30JUN2011
Gus Rolotti	Member	Gus Rolotti	Member	30JUN2010
Ganesan Sonny Sundaresan	Member	Ganesan Sonny Sundaresan	Member	30JUN2012
William Walter	Member	William Walter	Member	30JUN2012
		Stephen Kujak	Member	30JUN2013
Debra Kennoy	Secretary – Non-Voting	Debra Kennoy	Secretary – Non-Voting	
Barbara Minor	Webmaster – Non-voting	Barbara Minor	Webmaster – Non-voting	

S. Cunningham, K. Connor, S. Sami, and G. Rolotti will roll off of TC 3.1 after the next Annual meeting in June 2010. S. Sami indicated that he would be amenable to reappointment.

2. APPROVAL OF 26 JANUARY 2009 MEETING MINUTES

Corrections noted:

- D. Kennoy updated the identification of the ASHRAE contacts.
- S. Szymurski noted that the footer had the wrong meeting information.

*S. Sundaresan motioned and W. Walter seconded to accept minutes as modified.
Motion passed 6 / 0 / 0 / 6 (CV)*

3. CHAIRMAN'S ANNOUNCEMENTS (Sean Cunningham)

A. Section 3 Meeting Report

- 1) Thank you letters
ASHRAE will send thank you letters to employers in appreciation for time spent advancing ASHRAE. They can be requested on-line through the ASHRAE website.
- 2) Hightower Award reminder
Individuals can be nominated based on technical leadership such as activity on technical committees.
- 3) Upcoming events
Climate 2010 in Turkey
Natural Refrigerants - in Sydney, Australia April 12 – 14 in 2010
- 4) Voting Member – Non-Quorum
ASHRAE recognizes the difficulty of some to travel to every meeting. They are considering a new category called voting member – non-quorum. There will be a maximum of 2 members per committee. This would be directed towards international members, retired members, etc. If this is enacted, the International Member category would be eliminated.

B. Roster review

- 1) Members rolling off in July 2010:
 - Sean Cunningham, Samuel Sami, Kevin Connor, Gus Rolotti
 - After the next Annual Meeting (June 2010):
 - Chair: D. Wilson
 - Vice chair: D. Kennoy
 - Secretary: open

- 2) The committee will need a secretary and voting members. Members must have been a Corresponding Member for one year. Contact the chair if interested.

4. Research Subcommittee (Don Bivens) - see Appendix 1

- a. Report from Research Subcommittee Chairs Meeting
D. Bivens will maintain the required forms for the research activities for TC 3.1
- b. Completed Research Projects
2 projects completed in the last 6 months:
 - i. Partitioning of Non-Condensable Gases in Refrigerant Liquid and Vapor Phases (1303-TRP)
 - ii. Identification and Evaluation of Working Fluids for High Temperature Heating Applications (1308-TRP)
- c. Ongoing Projects
 - i. Binary Refrigerant Flame Boundary Concentrations (1507-RFP)
 - i. Description: databank for useful binary pairs in commercial refrigerants (60 C and 100 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. Committee: Bob Richard, Debra Kennoy, Sonny Sundaresan as PES.
 - iii. Status:
Bids were received for this project. A closed meeting will be held at the end of this TC 3.1 meeting to review the bids and allow members to vote. Results are confidential and must be filed with RAC to complete the process. ASHRAE will notify the winning bidder.
 - ii. Energy and Performance of Secondary Coolant Low Temperature Refrigerant Systems (1484-RP)
 - i. Description: Literature Research and Industry Review (includes model identification and verification vs operating systems)
 - ii. Committee: Kevin Connor, Xudong Wang, D. Bivens, and David Hinde (TC 10.7) as PMS.
 - iii. Other information: Eckhard Groll – PI, with Joe Poland/Travis Horton
 - iv. Status:
E. Groll requested a no-cost extension from July to December 2009. They found extensive work being done in Europe by Linde / Carrier. The student is working there for 3 months. The result should be a stronger report.
Motion to extend work for 3 months at no cost to ASHRAE made by S. Sundaresan and seconded by W. Walter. Motion passed: 5 / 0 / 0 / 5 (CNV)
- d. RTARs

- i) Assessment of Burning Velocity Test Methods (RTAR 1583)
- (1) This is an approved RTAR.
 - (2) B. Minor will head this activity.
 - (3) Volunteers for participation:
S. Cunningham, R. Richard, S. Szymurski, K. Takizawa
 - (4) *TC vote: 9 / 0 / 0 (previous meeting)*
estimated cost: \$80,000 (\$40,000 per contractor) - potential co-sponsor: AHRI
estimated duration: 12 months
 - (5) Work statement needs to be prepared and submitted to TC 3.1 (to D. Bivens and S. Cunningham). It needs to be letter balloted by TC 3.1. Submittal date is 15SAug09 for consideration in January 2010.
- ii) Alternative Approaches to Predicting the Burning Velocity of Refrigerants (RTAR 1584)
- (1) This is an approved RTAR.
 - (2) D. Kennoy will head this activity.
 - (3) Volunteers for participation:
S. Cunningham, R. Richard, S. Szymurski
 - (4) *TC vote: 9 / 0 / 0 (previous meeting)*
estimated cost: \$60,000 - potential co-sponsor: AHRI
estimated duration: 9 - 12 months
 - (5) Work statement needs to be prepared and submitted to TC 3.1 (to D. Bivens and S. Cunningham). It needs to be letter balloted by TC 3.1. Submittal date is 15Aug09 for consideration in January 2010.
- iii) Risk Assessment of 2L Flammable Refrigerants in Stationary Applications and Commercial Refrigeration. (RTAR 1580)
- (1) B. Minor distributed copies of a draft work statement for consideration
 - (2) Following Research Subcommittee discussion, a few modifications were made such as:
 - (a) Add 1234ze (trans isomer)
 - (b) Reduce step 5 – develop the framework for a risk assessment rather than the actual risk assessment

Motion to accept the modified Work Statement 1580 as presented by B. Minor was made by S. Sundaresan and seconded by S. Sami. Motion failed: 3 / 2 / 0 (CNV). Need 2/3 of vote. Why 5, not 6 votes?
 - (3) Further discussion took place during the TC 3.1 meeting. A few points were made:
 - (a) actual risk assessments are better performed by the interested OEM
 - (b) there could be legal concerns with section 6
 - (4) path forward - B. Minor will perform the following:
 - (a) drop sections 5 and 6
 - (b) reduce budget proportionally
 - (c) change the title to better reflect revised contents
 - (d) make any other necessary changes to align with the above modifications

Motion to approve the work statement contingent on the above changes was made by S. Sundaresan and seconded by W. Walter. Motion passed: 6 / 0 / 0 (CNV).

e. On Hold

- i. Fractionation testing and error analysis for refrigerant blends (supports SSPC 34) Continuing on hold until new SPC 177P (MOT Fractionation Measurement of Refrigerant Blends) committee determines if needed for further research.

f. Non-Prioritized Research Suggestions

- i. Identification of new fluids for high temperature energy conversion applications (CHP/ organic Rankine cycle); also low grade heat recovery. See completed project report 1308-RP.
 - (1) 1303 is a completed project.
 - (2) S. Sami wants high temperature applications. He will make literature available. He will work with D. Bivens to put together an RTAR.
 - (3) Steve Brown will also work on this.
- ii. What are required properties needed to design equipment and rooms for use of flammable refrigerants, particularly 2L flammable refrigerants
 - (1) There is a Standard 15 ad hoc committee formed to address this. Members include B. Minor and D. Wilson.

g. New suggestion

- i. Risk Assessment of 2L flammable refrigerants in applications using large quantity refrigerants such as centrifugal chillers, supermarket racks, sea containers
 - (1) There was an interest expressed in developing this idea into an RTAR
 - (2) RTAR to be prepared by members of TC8.2, 10.7, TC3.1
David Hinde, Phillip Johnson, Norbert Mueller, Minor (?)

h. ASHRAE RESEARCH GOALS LIAISONS - update

- i. Natural Refrigerants and Charge Reduction (Liaison: B. Minor)
 - i. Cooperation and communication with this group has been problematic.
 - ii. Zayoub document – presenting at RAP (Research Advisory Panel)
 - iii. Goal is to ensure fairness
- ii. HVACR Components Research (Liaison: S Sundaresan)
 - i. There have been 2 conference calls.
 - ii. Sonny volunteered to prepare a work statement on the need for industry-wide research on the malfunction of expansion devices in order to improve specific components of HVAC&R systems.

5. HANDBOOK SUBCOMMITTEE (Sean Cunningham for Kevin Connor)

Nothing to report

6. PROGRAM (Sam Sami)

- A. Louisville, 20-24 June 2009: Program packages due first week of February 2009
Technical/Symposia papers due September 2008
- i) Seminar 47: R-22 Retrofit of R-22 in A/C
 - a. Of the original presenters, only DuPont presented in this seminar
 - b. S. Sundaresan prepared an presentation on materials compatibility and oil return in R-22 retrofits to also present in this seminar
 - ii) The forum on ISO 817 (to be chaired by Bill Walter) was not approved
 - iii) Seminar 57: Systems with Natural Refrigerants: Components and Field Experience
 - a. Co-sponsor with TC 8.1 and TC 10.7
- B. Orlando, 23-27 January 2010: Program packages (seminar) due to ASHRAE by 10JUL09. (Presented in order of priority defined by TC 3.1 during this meeting)
- i) Forum: 2L and What To Do With It. Chairman Bill Walter.
 - a. See if the cognizant TC for SSPC 15 will co-sponsor.
 - ii) Seminar: Advances in Refrigeration and Secondary Coolants. Chairman Sam Sami.
 - a. Volunteers: Purdue University, K. Connor, G. Rolotti
 - b. G. Kazachki may be able to present something here if needed
 - iii) Forum: ASHRAE Standard 34 400 and 500 Series Blends – Do We Need the Distinction? Chairman Dave Wilson
 - iv) Seminar: Systems with Natural Refrigerants – Components and Field Experience
 - a. Requested by ASHRAE Refrigeration Committee
- C. Albuquerque, 26-30 June 2010: Program packages due in February 2010
- TC will discuss this during the January 2010 meeting.
- D. Other information
- v) New ASHRAE policy – conference paper
 - a. ≤ 8 pages in length
 - b. papers are managed and reviewed by the TC
 - c. will replace Transactions in the long term

Motion to approve the program plan was made by W. Walter and seconded by S. Sami. Motion passed: 5 / 0 / 0 (CNV).

7. STANDARDS (Sean Cunningham for Jim Lavelle)

ASHRAE TC 3.1 Refrigerants and Secondary Coolants
Final Minutes – June 2009 (Louisville, KY)

A. SPC-177P for Measuring Fractionated Compositions of Refrigerant Blends (Bob Richard)

- SPC 177P is moving along
 - GC procedure and draft for fractionation – good information derivable from round robin studies
 - A draft MOT to identify test apparatus is in progress
 - 2012 is the target for an MOT on fractionation for public review

B. ASHRAE Standard 34, *Designation and Safety Classification of Refrigerants* (Bill Walter)

- Meeting of full committee immediately after this meeting.
- Topics:
 - Addendum 34 w (classification of R-1234yf as A2) move forward with unresolved commenter.
 - Addendum 34z (extend rules for numbering refrigerants to include ethane and propene based refrigerants) – further discussion to a resolution
 - 3 new continuous maintenance proposals in progress

C. ISO Standard 817, *Refrigerants – Number Designation* (Bob Doerr)

ISO 817 has been held up due to missed deadlines. Hoping for a public review beginning this summer then a meeting to review comments in January 2010.

8. WEB SITE (Barbara Minor)

- The web site is active.
- Suggestion: post the Research Plan.

9. OTHER BUSINESS

none

10. MEETING ADJOURNED – 5:50 PM

Committee members remained for a closed session - review of bids for Binary Refrigerant Flame Boundary Concentrations (1507-RFP)

APPENDIX 1

TC 3.1 RESEARCH PLAN (2008 – 2009 - 2010)
With modifications at Louisville meeting on June 22, 2009

ASHRAE Research Projects		
	Project Title	Comments/Status
2002-2003 Research Plan	Partitioning of Non-Condensable Gases In Refrigerant Liquid & Vapor Phases (1303-TRP)	Project completed. R.C. Cavestri PI. <u>Minor</u> , Rolotti, Richard - PMS. Poster presentation at Salt Lake City meeting.
2003-2005 Research Plan	Identification And Evaluation Of Working Fluids For High Temperature Heating Applications. (1308-TRP)	Project completed. Steven Brown PI. <u>Minor</u> , Watson, Meurer, Pucciano (TC 9.4) – PMS. Poster presentation by Brown at Salt Lake City meeting.
2006-2009 Research Plan	1507-RFP: Binary Refrigerant Flame Boundary Concentrations and databank for useful binary pairs in commercial refrigerants (60 C and 100 C). Identify standard flammable mixture for confirming accuracy of data from flame test apparatus. To aid assessment of new refrigerant blends for SSPC 34.	Project rewritten with clarified work statement. Bid proposals being evaluated 6/22/09. Committee: <u>Bob Richard</u> , Debra Kennoy, Sonny Sundaresan as PES.
2006-2009 Research Plan	1484-RP: Energy and Performance of Secondary Coolant Low Temperature Refrigeration Systems – Literature Research and Industry Review (includes model identification and verification vs operating systems)	Project underway. Eckhard Groll – PI, with Joe Poland/Travis Horton. <u>Kevin Connor</u> , Xudong Wang, D. Bivens, and David Hinde (TC 10.7) as PMS. Completion by 12/2009
Priority	(Potential research projects)	
	Burning Velocity Method Survey and Cost, Error, and Ease of Use Analysis	
1	RTAR: Assessment of Burning Velocity Test Methods	To provide method evaluation and burning velocity data with error analysis for flammable refrigerants, to be used in future risk assessments and flammability classification methodology (as in ISO 817). RTARs approved. <u>Minor</u> and Kennoy to draft Work Statements with Szymurski, Richard, Cunningham.
3	RTAR: Assessment of Alternative Approaches to Predict Burning Velocity of a Refrigerant	
2	RTAR: Risk Assessment of 2L Flammable Refrigerants in Stationary Applications (occupied spaces) a) residential a/c & heat pumps b) commercial refrigeration	Stationary refrigeration & a/c applications, risk assessment, what constraints on systems for safe use such as ventilation, charge size, electrical, etc. a/c. Draft WS by <u>Minor</u> for TC3.1 vote on 6/22/09
On hold pending SPC 177P	Fractionation testing and error analysis for refrigerant blends (supports SSPC 34)	Continuing on hold until new SPC 177P (MOT Fractionation Measurement of Refrigerant Blends) committee determines if need for further research. Robert Richard reports possible need for RTAR by 2010.

TC 3.1 Non-prioritized Research Suggestions
Updated June 22, 2009 at Louisville meeting

Non-Prioritized Research Projects (long range)		
	Secondary fluids for refrigeration: properties of low temperature secondary coolants such as formate/acetate water solutionsreconsider after completion of 1484-RP	Property data in vendor literature, but wide variation in values, possibly due to additives, and/or analytical procedures.
	Identification of new fluids for high temperature energy conversion applications (CHP/ organic Rankine cycle); also low grade heat recovery. See completed project report 1308-RP.	Identify TCs with interest in CHP to determine fluid needs (TCs 1.1, 1.3, 1.10). Dr. Sami possible draft RTAR.
	What are required properties needed to design equipment and rooms for use of flammable refrigerants, particularly 2L flammable refrigerants.	Std 15 ad hoc committee formed to evaluate (Minor, Hinde)
	Low GWP refrigerant properties, stability, materials compatibility – receive summary of papers on this topic scheduled for NIST conference late June, 2009	Would be a testing program; Evaluate need based on NIST conference papers.
	Ice Slurry Properties.....Thermal Storage	Interest?
	Lubricants for carbon dioxide	TC 3.4 preparing RTAR
New June 22, 2009	Risk Assessment of 2L flammable refrigerants in applications using large quantity refrigerants such as centrifugal chillers, supermarket racks, sea containers	RTAR to be prepared by members of TC8.2, 10.7, TC3.1; David Hinde, Phillip Johnson, Norbert Mueller, Minor (?)