

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

1791 Tullie Circle, N.E./Atlanta, GA 30329  
**404-636-8400**

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 31 January 2011

TC/TG/TRG TITLE Refrigerants and Secondary Coolants

DATE OF MEETING 28 June 2010

LOCATION Albuquerque, NM

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
Sean Cunningham (Chair) – <i>voting</i>	07/2008	Felix Flohr – <i>voting</i> (international)	07/2007	Masood Ali - Guest
David Wilson (Vice Chair) – <i>voting</i>	07/2008	Gustavo Rolotti – <i>voting</i>	08/2008	Els Baert - Guest
Kevin Connor (Handbook) - <i>voting</i>	07/2006			Hank Bagheri – Guest (Handbook)
Don Bivens (Research) – <i>voting</i>	07/2008	Karim Amrane –CM		Warren Clough - Guest
Samuel Sami (Program) - <i>voting</i>	08/2008	John Andrepont –CM		Roderick Jackson – Guest
Ganesan “Sonny” Sundaresan (Journal) – <i>voting</i>	07/2007	Bruce Badger – CM		Umar Khokhar – Guest
Steve Kujak – <i>voting</i>	07/2009	Earl Clark –CM		Mary Koban – Guest
William Walter (Standards) – <i>voting</i>	07/2008	Thomas Clemens – CM		Hans-Joachim Kretschmar – Guest
		Denis Clodic – CM		Ness Lakdawala – Guest
Debra Kenroy (Secretary) – non-voting CM		Alan Cohen –CM		Travis Lumpkin – Guest
Barbara Minor (Webmaster) – non-voting CM		Barry Fields – CM		Julie Majurin – Guest
		Cynthia Gage –CM		John Neel – Guest
Robert Doerr – CM		Richard Jacobsen –CM		Chris Seeton – Guest
Osami Kataoka – CM		Damon Johnson – CM (Provisional)		Takashi Shibanuma - Guest
Georgi Kazachki – CM		James Lavelle – CM		Kenji Takizawa – Guest
Mark McLinden – CM		Kenneth Lilje –CM		Ed Vineyard – Guest
Maryline Rassi – CM (Provisional)		Bert McJimsey – CM		
Robert Richard – CM		Sunil Nanjundaram – CM		

Marc Scancarello – CM		Bjorn Palm – CM		
		Thomas Reinarts – CM		
		Rajiv Singh – CM		
		Kapil Chand Singhal –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 Chair:	Charles Wilkin
TAC Section Head:	William Murphy
All Committee Liaisons As Shown On TC/TG/TRG Rosters:	RAC Research: Raymond Cohen Special Pubs: John Clark Standards: Douglass Abramson Handbook: Hassan M. Bagheri Chapter Technology Transfer: Jennifer Leach Professional Development: Filza Walters
Manager Of Standards*	Stephanie Reiniche
Manager Of Research & Technical Services	Michael R. Vaughn

\* receives a copy of the TC 3.1 meeting minutes

**These final minutes have been approved by this committee.**

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

- A. Introductions of members and guests – Chair called the meeting to order at 4:15 P.M. and attendees introduced themselves.
- B. Agenda Revision/acceptance
  - i. *Motion to accept the agenda was accepted unanimously. There was no formal vote.*
- C. Establishment of a quorum – There were 8 voting members present out of 10, 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 - present  
Kevin Connor - present  
Sean Cunningham - present  
Steve Kujak - present  
Samuel Sami - present (arrived 4:35)  
Sonny Sundaresan - present  
Bill Walter - present  
Dave Wilson - present

**2. APPROVAL OF JANUARY 2010 MEETING MINUTES**

*Motion to accept the minutes as modified (Handbook Section 5.b.c to be modified to read “K. Connor” rather than “K. Cannon”) was made by S. Sundaresan and seconded by W. Walter.*

*Motion passed: 7 / 0 / 0 / 8 (CNV)*

**3. CHAIRMAN’S ANNOUNCEMENTS** (Sean Cunningham)

**A. Section 3 Meeting Report**

- 1) “Help Wanted”  
This is a new feature being added to the ASHRAE website. It offers committees a place to post requests for assistance. Examples include a situation where technical help is needed with an RTAR or volunteers are needed to review a handbook section.
- 2) Meetings scheduled outside of the ASHRAE venue  
ASHRAE is seeing an increasing number of teleconferences and webinars held. This is encouraged.
- 3) Thank you letters  
Anyone who would like to have a participation thank you letter sent to their employers can request one through the ASHRAE website. The address is [www.ASHRAE.org/thankyouletter](http://www.ASHRAE.org/thankyouletter)

## B. Roster review

2009 – 2010		2010 – 2011 (as of 01JUL2010)		
	Position		Position	Roll-off date
Sean Cunningham	Chair / ALI Coordinator	David Wilson	Chair	30JUN2012
David Wilson	Vice Chair	Debra Kennoy	Vice Chair	30JUN2014
Kevin Connor	Handbook Chair	Umar Khokhar	Secretary	30JUN2014
Don Bivens	Research Chair	Barbara Minor	Research Chair	30JUN2014
Samuel Sami	Program Chair	William Walter	Standards Chair	30JUN2012
Felix Flohr	International Member	Don Bivens	Member	30JUN2012
Stephen Kujak	Member	Stephen Kujak	Member	30JUN2013
Gus Rolotti	Member	Maryline Rassi	Member	30JUN2014
Ganesan Sundaresan	Member	Ganesan Sundaresan	Member	30JUN2012
William Walter	Member			
Debra Kennoy	Secretary – Non-Voting	Samuel Sami	Program Chair - Non-Voting	
Barbara Minor	Webmaster – Non-voting	Kevin Connor	Handbook Chair - Non-Voting	
		Sean Cunningham	Webmaster – Non-Voting	
		Felix Flohr	International Member – Non-Voting	

Members rolling off in 01JUL10:

Sean Cunningham, Kevin Connor, Gus Rolotti, Samuel Sami

### 4. Research Subcommittee (Don Bivens) - see Attachment 1

- a. Report from Research Subcommittee Chair's Meeting
  - i. The availability of money to finance research projects is currently limited. Nineteen Tentative Research Projects were approved but held back for this reason. They are expected to be cleared by next spring.
  - ii. The Strategic Plan for ASHRAE Research (2010 – 2015) is finalized and available on the ASHRAE website. Justification for research programs is based on the contained goals. Several current TC 3.1 projects cite Goal #8 of the plan.
  - iii. The ASHRAE Research Manual will be updated in the next few weeks.
  
- b. Completed Research Projects
 

2 projects recently completed

  - 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-RP)

- 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. Project Monitoring Subcommittee: Bob Richard, Debra Kennoy, Sonny Sundaresan, S. Szymurski, T. Leck
- iii. Status:  
Project was awarded to Safety Consulting Engineers (SCE) in the 4<sup>th</sup> quarter of 2009.

Status (June 2010):

A. Kusmierz gave a status report: There has been good progress.

- The literature search has been completed and the findings shared with the PMS.
- The lab flammability test apparatus was checked for proper operating conditions and test results by testing a refrigerant binary pair of known flammable composition (R-32/134a at 40/60 (%m/m)).
- Members of the PMS visited the test facility and reviewed the test apparatus and identified initial binary pairs (7 of 10) to be evaluated.
- Additional time to complete the study (no cost) was requested since testing begun later than anticipated.

*Motion to approve a no cost extension for 1507-RP to 15JAN2011 was made by D. Wilson and seconded by D. Bivens.  
Motion passed: 7 / 0 / 0 / 8 (CNV).*

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

Status (June 2010):

Work on this project is complete. The second draft of the final report has been circulated, reviewed, with comments returned. An acceptable final report is expected shortly. This final report must be published in order for the project to be completed.

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

- i. This is an approved tentative Research Project.
- ii. B. Minor will head this activity.
- iii. Volunteers for Project Evaluation Subcommittee:

D. Kennoy, B. Minor, R. Richard, S. Szymurski, K. Takizawa  
iv. *TC vote: 9 / 0 / 0 (previous meeting)*

estimated cost: \$80,000 (\$40,000 per contractor) - potential co-sponsor:  
AHRI  
estimated duration: 12 months

Status (June 2010):

This went out for bid with four received and reviewed. There will be a closed meeting at the end of the meeting today for review.

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

- i. This is an approved Work Statement.
- ii. B. Minor will head this activity.
- iii. Volunteers for Project Monitoring Subcommittee:  
Kennoy, B. Minor, S. Sundaresan, B. Walter, D. Wilson
- iv. *TC vote: 6 / 0 / 0 / 9 (3 ballots not returned)*

estimated cost: \$250,000  
estimated duration: 12 months

Status (June 2010):

While this was approved, funding was not immediately available. This should be funded by the spring of 2011.

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

- i. This is an approved Work Statement.
- ii. D. Kennoy will head this activity.
- iii. Volunteers for Project Monitoring Subcommittee:  
S. Cunningham, D. Kennoy, B. Minor, R. Richard, S. Szymurski
- iv. *TC vote: 9 / 0 / 0 (previous meeting)*

estimated cost: \$60,000 - potential co-sponsor: AHRI  
estimated duration: 9 - 12 months

Status (June 2010):

While this was approved, funding was not immediately available. This should be funded by the spring of 2011.

- d. Work Statements  
None.

e. Non-Prioritized Research Suggestions

- i. SPC 177P has identified an urgent need to request research funding for fractionation testing and error analysis for refrigerant blends in support of SSPC 34. An RTAR will be prepared. Steps needed to try to fast track this project will be investigated.

Volunteers to prepare the RTAR: J. Dieckmann, D. Kennoy, A. Kusmierz, R. Richard

- ii. No activity reported on the RTAR for Risk Assessment of 2L Flammable Refrigerants in applications using large quantities of refrigerants such as centrifugal chillers, supermarket racks, and sea containers to date. This RTAR was initially discussed in June 2009. Mark Adams (Chair of TC 8.2) agreed to take over this effort and begin with drafting the RTAR. He solicited volunteers to contact him and Sonny Sundaresan agreed to help.

Note that there is an Ad Hoc group for Standard 15 that is also considering this. Additionally, AHRI is looking at risk assessment work. There may be a possibility for co-funding.

f. ASHRAE RESEARCH GOALS LIAISONS - update

- i. Natural Refrigerants and Charge Reduction (Liaison: B. Minor)  
This is completed.

g. ACKNOWLEDGEMENT

TC3.1 acknowledged with gratitude the efforts put forth by Don Bivens in chairing the Research Subcommittee. B. Minor agreed to take over this position.

**5. HANDBOOK SUBCOMMITTEE (Kevin Connor)**

- a. A new team is in place.
  - i. Chapter 29 – S. Cunningham (lead reviewer)
    - i. Cynthia Gage volunteered to help. She can handle the environmental properties.
    - ii. Don Bivens agreed to help.
  - ii. Chapter 30 – M. McLinden (lead reviewer)
  - iii. Chapter 31 – K. Connor (lead reviewer)
- b. Need to begin mapping out changes needed for each chapter.
- c. Will need the final text by late 2012.
- d. Additional volunteers will be welcome.

- e. CD Plus is no longer available. The handbook on-line is available for spreadsheets, animation, etc.

**6. PROGRAM (Samuel Sami)**

A. Albuquerque, 26-30 June 2010

- i) Seminar 41: Natural Refrigerants: A Roadmap to Refrigeration for the Future  
Chair: Georgi Kazachki  
Cosponsor with Refrigeration Committee and TC 10.07  
Presenters: KAV Consulting (Australia), Kysor Warren, University of Illinois at Urbana-Champaign, University of Maryland

B. Las Vegas, 29 January – 02 February 2011: Program packages due 06AUG10 for seminar

- i) Seminar: Building a Sustainable Future By Removing Barriers for Low GWP Refrigerants.  
Chair Barbara Minor  
Volunteers: ARTI (possible review of regulations and standards for low GWP refrigerants), Arkema, NIST  
Note: this seminar was originally requested for June 2010 but not accepted  
TC 3.1 Priority: 1
- ii) Forum: Implementation of 2L Refrigerants (provisional title)  
B. Minor to contact Standard 15 to discuss and to see if interested as a co-sponsor  
TC 3.1 Priority: 2
- iii) Seminar: Cycles, Systems, and Conformance with Natural and Low GWP Refrigerants  
Requested by ASHRAE Refrigeration Committee  
Co-sponsors: TC 3.1, TC 10.7, and TC 8.1 (possible)

C. Montreal, June 2011

To be addressed in January 2011

Note: TC 3.1 was approached to sponsor a seminar entitled Cradle to grave: Refrigerant Tracking Program for January 2011. However, it was identified as more properly associated with TC 3.8 and was passed to this TC. TC 3.1 to be a cosponsor.

*Motion to approve the program plan was made by S. Sami and seconded by W. Walter.*



Motion passed: 7 / 0 / 0 / 8 (CNV).

**7. STANDARDS (Sean Cunningham for Jim Lavelle)**

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

- SPC 177P has identified 2 issues
  - Needs to go back to SSPC 34 and its Flammability Subcommittee. Looking for a better definition of experimental verification of fractionation. The goal is to be able to use VLE data alone without fractionation in certain cases like binaries and some ternary systems especially those where the WCFF is in the initial vapor or liquid.
  - Seeking funding to investigate and validate proposed test apparatus
  - Paperwork will be prepared (RTAR)
    - Team to prepare RTAR will meet via teleconference in 3 weeks

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

- Meeting of full committee immediately after this meeting.
- 3 of 4 addenda were approved
  - modification of the OEL of R-1234yf from 400 ppm to 500 ppm received two comments

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

ISO 817 is out for public review at DIS. Comments are due 23JUL2010.

**8. WEB SITE (Barbara Minor)**

- Meeting minutes are now posted on the ASHRAE website.

**9. OTHER BUSINESS**

None

**10. MEETING ADJOURNED – 5:40 PM**

*Motion to adjourn was made by W. Walter and seconded by S. Sami. Motion passed by general consensus.*

TC 3.1 went into a closed session meeting to review bids for 1583-RP.

ATTACHMENT 1

TC 3.1 RESEARCH PLAN  
Updated 28JUN2010

<b>ASHRAE Research Projects</b>		
	<b>Project Title</b>	<b>Comments/Status</b>
<b>Current Research</b>	<b>1507-RP: Binary Refrigerant Flame Boundary Concentrations and databank for useful binary pairs in commercial refrigerants.</b> Identify standard flammable mixture for confirming accuracy of data from flame test apparatus. Databank to aid assessment of new refrigerant blends for SSPC 34.	Project awarded to Safety Consulting Engineers PI is A. Kusmierz. PMS: <u>Bob Richard</u> , Debra Kennoy, Sonny Sundaresan, Steve Szymurski, and Tom Leck
<b>Current Research</b>	<b>1484-RP: Energy and Performance of Secondary Coolant Low Temperature Refrigeration Systems</b> Literature Research and Industry Review	Final draft under review. PI is E. Groll with Joe Poland/Travis Horton PMS: <u>K. Connor</u> , Xudong Wang, D. Bivens, D. Hinde
<b>Tentative Research Projects (TRPs)</b>		
Priority 1	<b>1583-TRP: Assessment of Burning Velocity Test Methods</b>	To provide methods evaluation and burning velocity data with error analysis for flammable refrigerants. Project evaluation subcommittee: <u>B. Minor</u> , D. Kennoy, R. Richard, W. Walter, S. Szymurski PES to evaluate submitted bids on June 28, 2010.
Priority 2	<b>1580-TRP: Risk Assessment of 2L Flammable Refrigerants in Stationary Applications</b> <b>a) residential a/c &amp; heat pumps</b> <b>b) small commercial refrigeration</b>	Waiting on selection for funding. TRP subcommittee: B. Minor, D. Kennoy, D. Wilson, W. Walter, S. Sundaresan, and ARTI person
Priority 3	<b>1584-TRP: Assessment of Alternative Approaches to Predict Burning Velocity of a Refrigerant</b>	Waiting on selection for funding. TRP subcommittee: D. Kennoy, B. Minor, R. Richard, S. Cunningham, and ARTI person.

**TC 3.1 Non-prioritized Research Suggestions**  
**Updated 28JUN2010**

<b>Non-Prioritized Research Suggestions</b>		
	<b>Project Title</b>	<b>Comments/Status</b>
<b>Previously on hold pending SPC177P</b>	<b>Fractionation testing and error analysis for refrigerant blends in support of SSPC34</b>  <b>SPC-177P title is:</b> MOT Fractionation Measurement of Refrigerant Blends	SPC 177P committee has determined need for RTAR for fractionation testing and concentration measurements RTAR to be prepared by R. Richard, D. Kennoy, A. Kusmierz, J. Dieckmann
<b>On hold</b>	<b>Secondary fluids for refrigeration:</b> properties of low temp. secondary coolants such as formate/acetate water solutions; reconsider after completion of 1484-RP	Property data in vendor literature, but wide variation in values. Sundaresan to evaluate current state of data/needs.
	<b>Lubricants for carbon dioxide refrigeration systems.</b>	Sundaresan to review recent PhD thesis on topic.
	<b>Identification of new fluids</b> for high temperature energy conversion applications (CHP/organic Rankine cycle); also low grade heat recovery.	Identify TCs with interest in CHP to determine fluid needs (TCs 1.1, 1.3, 1.10). S.Sami, K.Kontomaris, J.Kaufman.
	<b>What is required for design of equipment and rooms</b> for safe use of low flammability refrigerants, particularly those classified as 2L?	ad hoc committee of B. Minor, D. Wilson, D. Hinde evaluating this question with Standard 15 committee personnel
	<b>Low GWP refrigerant properties:</b> stability, materials compatibility, other data needs.	Continue reviewing data in newly published papers. M. McLinden & others
	<b>Ice Slurry Properties for Thermal Storage Applications</b>	No current interest expressed.

	<b>Risk Assessment of 2L flammable refrigerants</b> in applications using large quantity of refrigerants such as centrifugal chillers, supermarket racks, sea containers, etc.	Possible interest by TCs 8.2, 10.7, 3.1 for RTAR. Mark Adams to take lead, with assistance from D. Hinde, S Sundaresan, K. Kontomaris, P. Johnson
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