



Shaping Tomorrow's
Built Environment Today

MINUTES

Refrigeration Committee (REF)

June 24, 2018

Hilton Americas

Houston, TX

MEMBERS PRESENT:

Nick Shockley, *Chair*
Martin Dieryckx, *Vice-Chair*
Didier Coulomb
Stephen Gill
Charles Hon
Yunho Hwang
Barbara Minor
Rajan Rajendran
Dave Rule
William Walter, *BOD Ex-O*

MEMBERS NOT PRESENT:

Walid Chakroun
Shamila Nair-Bedouelle
Jason Robbins, *Consultant*
Richard Royal
Ginger Scoggins, *CO*

ASHRAE STAFF:

Steve Hammerling, *AMORTS*

GUESTS:

Karim Amrane
Hitomi Animoto
Jojo Castro
Jim Caylor
Don Cleland
James Curlin
Ayman Eltaloung, *Incoming Member*
Brian Fricke
Niel Hayes
Glenn Hourahan
Allen Karpman
Georgi Kazachki
Dustin Lilya, *Incoming Member*
Cesar Lim
Sarah Maston, *Incoming BOD Ex-O*
Jeff Newel
Shun Ohkubo
Apichit Pongpana
Gustavo Pottker
Ivan Rydkin
Doug Scott
Art Sutherland
Tony Welter, *Incoming Member*
Jim Wolf
Samuel Yana

Table of Contents

Motions	iii
Action Items.....	iii
List of Attachments	iv
List of Acronyms.....	iv
1. Call to Order.....	1
2. Code of Ethics.....	1
3. Review of Agenda.....	1
4. Minutes	1
5. Chair's Report.....	1
6. Vice-Chair's Report.....	2
7. BOD Ex-O / Tech Council Report.....	2
8. Awards.....	2
9. Subcommittees.....	2
A. ASHRAE Learning Institute.....	2
B. Programs.....	2
C. Position Documents.....	3
D. UNEP/ASHRAE Partnership.....	3
10. Other Reports.....	3
A. CTTC Liaison.....	3
B. Consultant Report.....	3
C. Liaisons.....	3
11. Strategic Issues	4
12. Next Meeting.....	5
13. Handover to Chair.....	5
14. Adjournment.....	5

MOTIONS

No.	Motion	Status
1	the minutes from the REF Winter Meeting be approved	PASSED

ACTION ITEMS – Annual 2018

No.	Responsibility	Action Item	Status
1	Staff	Collect Briley Award articles and send to judges	
2	Staff	Send Wolf past GCCA liaison reports	
3	REF	Determine which ASHRAE committees should be included for input on RTOC	
4	Staff	Send TC, SSPC committee list to Dieryckx and Rajendran	
5	Lilya, Rajendran, Hon, Dieryckx, and Rydkin	REF formed ad hoc to further study scope and purpose and recommend changes	
6	REF	Invite interested parties on REF scope discussion and R in ASHRAE to 1 hour meeting during REF meeting in Atlanta	

ACTION ITEMS – Winter 2018

No.	Responsibility	Action Item	Status
1	REF	Send comments on draft ASHRAE Strategic Plan to send to Shockley to collect and send to Tech Council	Complete
2	REF	Solicit nominations for the Milt Garland and Comfort Cooling Awards for May 1 st deadline.	Complete
3	Staff	Promote REF awards (the usual activities, to contact Refrigeration Vice-Chairs (RVCs) and chapter refrigeration chairs)	Complete
4	REF	Recruit DL speakers for CTTC topics of interest	Complete
5	Walter	Review requirements for REF to participate in regulatory public reviews on technical issues	Complete
6	REF	Review and propose changes to REF title/scope for spring conference call	Complete

ACTION ITEMS – Annual 2017

No.	Responsibility	Action Item	Status
LB-9	Hamilton	Prepare and work with REF chair to give a presentation on natural refrigerant perspective to REF at a future meeting	Delete
LV-8	Royal and Robbins	Attend Associate Society Alliance meeting in Las Vegas and report to REF in spring.	Delete
LV-9	Amrane	Develop a presentation from REF to outside groups such as USNC IIR and ASHRAE Associate Society Alliance organizations on how REF can liaise and interact with these sorts of groups	Delete

LIST OF ATTACHMENTS

No.	Attachment
A	BOD Ex-O Presentation
B	Refrigerants and their Responsible Use
C	UNEP/ASHRAE presentation
D	CTTC report
E	MBOs 2016-2017

LIST OF ACRONYMS

AI	Action Item	IIAR	International Institute of Ammonia Refrigeration
ALI	ASHRAE Learning Institute	IIR	International Institute of Refrigeration
AMORTS	Assistant Manager Research & Technical Services	MBO	Management by Objectives
ASHRAE	American Society of Heating, Refrigerating and Air-conditioning Engineers	MOP	Manual of Procedures
BOD	Board of Directors	MTG	Multi-disciplinary Task Group
CNV	Chair Not Voting	NASRC	North American Sustainable Refrigerant Council
CO2	Carbon Dioxide	PD	Position Document
CTTC	Chapter Technology Transfer Committee	PMS	Project Monitoring Subcommittee
DRSC	Document Review Subcommittee	REF	Refrigeration Committee
EPA	Environmental Protection Agency	ROB	Rules of the Board
Ex-O	Ex-Officio	RP	Research Project
GFCCC	Global Food Cold Chain Council	RTOC	Refrigeration Technical Options Committee
GCCA	Global Cold Chain Alliance	SNAP	Significant New Alternatives Policy
GRMI	Global Refrigerant Management Initiative	SSPC	Standing Standard Project Committee
GWP	Global Warming Potential	TC	Technical Committee
HFO	Hydro-Fluoro Olefin	UNEP	United Nations Environment Programme
HVAC&R	Heating, Ventilating, Air Conditioning & Refrigeration		

1. CALL TO ORDER

Chair Nick Shockley called the meeting to order at 8:00 AM. Members and guests introduced themselves. Staff confirmed quorum was met.

2. ASHRAE CODE OF ETHICS COMMITMENT

'In this and all other ASHRAE meetings, we will act with honesty, fairness, courtesy, competence, integrity and respect for others, and we shall avoid all real or perceived conflicts of interests.' (See full Code of Ethics: www.ashrae.org/about-ashrae/ashrae-code-of-ethics.)

3. REVIEW OF AGENDA

No additions or changes were made to the agenda sent prior to meeting.

4. MINUTES

A. It was moved (CH) and seconded (YH) that,

(1) the minutes from the REF Winter Meeting in be approved.

MOTION 1 PASSED: 8-0-0, CNV

BACKGROUND: Minutes were distributed in April 11th email.

5. CHAIR'S REPORT – Shockley

A. Motions from Past Meetings Requiring Higher Body Approval

The following motions from past REF meetings required higher body approval:

- REF recommends to Technology Council, to increase the Committee Travel budget for FY 18-19 from \$7.7k to \$8.4k and to reduce Awards and Certificates budget from \$1.4k to \$0.7k.

The fiscal impact was below the threshold for REF to move funds without Tech Council approval so this will be done administratively.

B. New Information Items for REF

1. ASHRAE 2L Research status updates

The Low-GWP MTG is meeting in Houston to discuss the status of three ASHRAE research projects.

- *1806-RP, Flammable Refrigerants Post-Ignition Simulation and Risk Assessment Update* – Researchers are reviewing the results of testing done. This project is not expected to be completed until the end of 2018 at the earliest.
- *1807-RP, Guidelines for Flammable Refrigerant Handling, Transporting, Storing and Equipment Servicing and Installation* - A draft final report was sent to PMS for review and approval.
- *1808-RP, Servicing and Installing Equipment using Flammable Refrigerants: Assessment of Field-made Mechanical Joints* - A draft final report was sent to PMS for review and approval.

More projects could be forthcoming after this round of projects is completed. Shockley commented this research was done relatively quickly and those involved should be commended.

2. Global Refrigerant Management Initiative (GRMI) updates

Ayman noted the GRMI met at the Winter Meeting but not in Houston. The GRMI has approved their charter, bylaws and dues structure and is not focused on developing their

work plan. They are developing a Refrigerant Driver's License program that would not necessarily be a regulatory or certification program but can be adopted by AHJs if desired.

3. Thank You Letters to Employers

Members can request ASHRAE thank you letters to your employer if interested. Directions will be emailed after meeting.

6. VICE-CHAIR'S REPORT – Dieryckx

A. Fiscal Report

No other changes were made beyond the shifting of funds from awards to committee travel.

B. MOP/ROB/Reference Manual

No changes for this meeting to these documents.

7. BOD/TECH COUNCIL REPORTS

A. BOD EX-Officio – Walter

Walter presented the Ex-O presentation (**Attachment A**). Highlights include:

- Members are asked to nominate REF members at www.ashrae.org/nominate. Due mid-February 2019. Walter noted 2-4 nominations are often needed to fill just one open position.
- ASHRAE Associate Society Alliance investigating an evolution into a Global HVAC&R Alliance.
- New ALI courses on Refrigerant Management and Refrigerant Selection

8. AWARDS

A. Milt Garland & Comfort Cooling Awards

No nominations were received for the Milt Garland or Comfort Cooling Awards by the May 1st deadline.

B. Briley Award

Articles for the next George C. Briley Award will be collected by staff, reviewed by chair for eligibility, and sent to a subcommittee for voting in the fall (**AI #1**). Incoming members are typically asked to serve as judges. The award will be presented at the REF meeting in Atlanta.

9. SUBCOMMITTEE REPORTS

A. ASHRAE Learning Institute (ALI) – **Royal**

Royal was not in attendance and there was no progress to report on this effort.

B. Programs – **Hwang**

1. Houston

REF sponsored Seminar 71 - *Recent Advances in Solid-State Cooling Technologies* was approved for the annual meeting.

2. Atlanta

REF discussed a number of programs for the Winter Meeting. The following programs were discussed and would need to be submitted before Aug. 3rd deadline:

- Training for sustainable refrigeration design guide (RP-1634)
- Recent advancements RPs and technologies
- Links between refrigerant and system efficiency
- Magnetic / solid state alternative technologies
- Previously rejected programs

Noted there are three tracks for Atlanta at least somewhat related to refrigeration that may house the REF programs.

C. Position Document (PD) Updates

1. *Refrigerants and their Responsible Use* PD

Rajendran reported that the PD committee reviewed and responded to 20+ comments from DRSC and other groups. There were three comments still being worked on and being discussed here in Houston that can be resolved here. REF had no additional comments and agreed the PD should go forward to Tech Council. The approved version of the PD is included as **Attachment B**.

D. UNEP/ASHRAE Partnership – **Nair-Bedouelle**

Eltaloung reported on the UNEP partnership on behalf of Nair-Bedouelle and highlighted activities in a presentation (**Attachment C**):

- Main theme of 2017-18 Work Plan with ASHRAE was Working Beyond High-GWP Refrigerants. A new plan is in development
- ASHRAE/UNEP developed courses on Refrigerants Literacy and Refrigerant Management. These will be made available through ASHRAE as well.
- UNEP/ASHRAE launching an Innovation in Refrigerant Management award.
- UNEP is developing a university course on refrigerant management for future engineers. ASHRAE will help promote through student branches. 17 universities have committed to introducing the course

10. OTHER REPORTS

A. Chapter Technology Transfer Committee (CTTC) Liaison Report – **Hon**

Hon attended CTTC meetings in Houston (**Attachment D**). Hon noted many grass roots members are not aware of regulatory issues that impact their work. EPA SNAP requirements for allowable leak reductions are being reduced significantly January 1, 2019. There may be an opportunity to educate ASHRAE membership in refrigerant management.

An ad hoc committee (Dieryckx, Rajendran, Eltaloung, Hon, Rydkin) would explore what can be done in ASHRAE to promote awareness of best practices for refrigerant monitoring and management. This could be a research project, survey, publication, etc.

B. Consultant Report

Doug Scott provided update on RP-1634, *Guide for Sustainable Refrigerated Facilities and Refrigeration Systems*. This REF sponsored project is completed and the publication is available in the ASHRAE bookstore. It's been ten years since the initial idea for the book. Scott asked REF to consider how the book will be supported and maintained going forward. REF, TC 10.1 and TC 10.5 can discuss a plan to maintain.

C. Liaisons

1. TCs & SSPCs

REF will continue to liaison with relevant ASHRAE TCs and SSPCs. Shockley asked members to continue to attend meetings and report as appropriate.

2. International Institute of Refrigeration (IIR) - **Coulomb**

Next congress will be the 25th International Congress of Refrigeration will be August 2019 in Montreal. Over 1,000 abstracts have been received so far.

IIR held 1st Conference on Application of HFO Refrigerants in September 2018 in Birmingham UK.

3. International Institute of Ammonia Refrigeration (IIAR) – **Rule**
Rule noted IIAR is developing updates to their ARM - Ammonia Refrigerant Management program, and the CO2 handbook.

IIAR is introducing an Academy of Natural Refrigerants. This is a step in working towards professional designation certification.

The next IIAR conference will be March 2019 in Phoenix. They will partner with the North American Sustainable Refrigerant Council (NASRC).

A number of IIAR Standards are in review. Rule asked for members to watch and participate in public reviews.

4. Global Cold Chain Alliance (GCCA) liaison report
No liaison report from GCCA was submitted. Jim Wolf noted he was appointed as the new liaison and would attend GCCA meetings going forward. Wolf was seeking guidance on what he should report to GCCA and vice-versa. Staff agreed to send him past GCCA liaison reports (**AI #2**).
5. Other
Rajendran noted he would be REF's liaison to the Global Food Cold Chain Council (GFCCC) going forward. Information on the organization can be found at www.foodcoldchain.org.

11. STRATEGIC ISSUES

- A. 2016-17 MBO Updates – MBO leaders
Shockley would report updates on MBOs to Tech Council (**Attachment E**)
- B. REF Strategic Planning
Dieryckx summarized REF's plan to participate in a technical review of the UNEP Refrigeration Technical Options Committee (RTOC) report later this year. This the first effort related to REF's broader aim to serve as a resource to ASHRAE (from a technical perspective) on regulations that impact ASHRAE members. The RTOC is expected in August and there will be two months to respond. REF will determine which ASHRAE committees should be included for input (**AI #3**). Staff would send committee list to Dieryckx and Rajendran (**AI #4**). Dieryckx noted all feedback would be reported, no consensus is necessary. Eltalouny suggested a link to previous RTOC's be sent to give proper context.

R in ASHRAE

REF discussed a review of the Refrigeration Committee title and scope:

2.420 REF Committee

2.420.001 SCOPE AND PURPOSE:

The Refrigeration Committee shall encourage advancement of refrigeration technology and its application.

Comments from the conversation include:

- Perception is REF is on refrigeration business industry issues, not technology. Can REF 1) better clarify/promote what REF does 2) better clarify where refrigeration business is in ASHRAE

- Definition of Refrigeration is broader than just industrial applications. REF can cover thermodynamic definition (refrigeration cycle), not just applications. Is scope reference to applications too limiting?
- TC 1.6 definition of refrigeration:
 - (1) any use of mechanical- or absorption-refrigerating machinery for applications other than the comfort of human beings. Compare to cooling. (2) process of extracting heat from a substance or space by any means, usually at a low temperature.
- Goal to distinguish REF from other ASHRAE TCs and other committees
- Should focus not be just on changing scope, but clarifying scope to promoting who we are and what REF does
- List of 5 hot topics ASHRAE can deal with
- REF needs to better reach out to TCs
- Input from Chapter Refrigeration chairs can be sought as well
- Could REF have a subcommittee focused on commercial refrigeration or different areas of R?
- REF formed ad hoc to further study scope and purpose and recommend changes (**AI #5**). The ad hoc to be chaired by Lilya and include Rajendran, Hon, Dieryckx, and Rydkin
- Invite interested parties on REF scope discussion and R in ASHRAE to 1 hour meeting during REF meeting in Atlanta (**AI #6**).

12. NEXT MEETING

REF will hold a fall web meeting if needed in the Fall. REF will next meet face to face at the ASHRAE Winter Meeting in Atlanta, GA on Sunday, January 13, 2019 from 8a-12pm.

An idea was proposed to give 1 hour in Atlanta to discuss the REF scope and invite interested parties within ASHRAE.

13. HANDOVER TO NEW CHAIR

A. Recognize Outgoing Members

Shockley recognized outgoing REF members Jason Robbins, Shamila Nair-Bedouelle and Richard Royal. He welcomed incoming REF chair Martin Dieryckx. Dieryckx recognized Shockley with a certificate of appreciation for his service to REF and ASHRAE.

B. Recognize Incoming Members

Dieryckx recognized incoming members Ayman Eltalouny, Dustin Lilya, Sarah Maston, and Tony Welter. William Walter would stay on the committee now as a voting member.

C. 2018-19 MBOs

Dieryckx will submit his MBOs for upcoming Society Year to Tech Council at upcoming meeting.

14. ADJOURNMENT

Committee adjourned at approximately 12:00 PM.




 2018 ASHRAE ANNUAL CONFERENCE
 Houston, TX | June 23-27, 2018

ASHRAE UPDATE

ExO Report to Committees

2018 ASHRAE Annual Meeting
Houston



In all your interactions at these meetings please remember...

Code of Ethics

"As members of ASHRAE or participants in ASHRAE committees, we pledge to act with honesty, fairness, courtesy, competence, integrity and respect for others in our conduct."



Attend President's Luncheon



Monday, June 25

2018-2019 ASHRAE President
Sheila Hayter



ASHRAE Wants You!

- Nominations for appointed standing committees are sought annually.
- Speak with your committee ExO if your appointed term is ending and you wish to be nominated for another Committee (beginning **July 1, 2019**)
- Self-nomination is also encouraged
- Nominations are due by mid-February 2019
- Councils are elected by the Board of Directors, but nominations are needed.



Presidential Ad Hoc

Ethics Enforcement Procedures Task Group

Ethics Enforcement Procedures Task Group will review and recommend changes to ROB 3.980 Enforcement Procedures for Violation of the ASHRAE Code of Ethics. In addition, the Task Group will address procedures for Ethics allegations against Officers and/or BOD members. The Task Group may also consider making the review investigation more independent from ASHRAE leadership.

Ethics Policy Report: During Annual Meeting

Regional Staff Support Analysis Task Group

The Regional Staff Support Analysis Task Group is to study the placement of hired representatives (regional staff) in ASHRAE Regions to support volunteer programs, with particular focus on advocacy.

Regional Staff (admin vs. advocacy and possible pilot in 2018-19)



Nomination Process Ad Hoc

The purpose of the **Nomination Process Ad Hoc** is to:

- Reviews all documents of the Nominating Committee including the By-laws, Board-Approved Rule's and Nominating Committee Manual of Procedure and reference manual for current relevance.
- Review election procedures of similar organizations (ASME, ASHE, etc.).
- Determine if one nominee per office on the member ballot is appropriate.
- Determine if we should consider cancelling the tenet of "the job seeks the person, the person does not seek the job."
- Determine if the balance of at-large and regional members of the Nominating Committee is optimal.

Members Council

- Exploring the potential bylaws change tied to the petition
- Considering new membership models (4)

Nominating Committee

- Ad hoc committee is reviewing the nominations process (is not addressing bylaws petition issues)



ASHRAE Associate Society Alliance

- Met in Brussels, Belgium **April 22-23**
- Encourages more effective and fruitful exchange of knowledge and ideas among professionals engaged in the arts and sciences of HVAC&R
- Currently investigating an evolution into a Global HVAC&R Alliance



ASHRAE's Commercialism Policy

ASHRAE's Commercialism Policy allows for Society activities that fulfill the mission of technological advancement with adherence to business plans that generate income to offset operational expenses such as AHR Exposition, ASHRAE periodicals, website and Society conference events such as the welcome party, luncheons, registration kits and receptions.

Principles for Managing Advertising and Sponsorships

Content should be labeled as advertising or sponsored.

Use of commercial names and logos shall not be done in ways that imply ASHRAE endorsement, approval or certification of products or services.

The inclusion of commercial information shall be done in a fair and unbiased way so as to avoid explicit promotion of a product or commercial entity.

Adhere to accepted business practices specified by the U.S. Federal Trade Commission and recognized publishing authorities.

Activities including events at chapter meetings shall be managed in such a fashion as to prevent an atmosphere where commercial entities are encouraged to critique one another in the public forum.

For additional guidance:

ashrae.org/about/governance/ashrae-commercialism-policy-and-guidelines



New and Enhanced Resources

- Building EQ Web Portal – **December 2017**
- Advanced Energy Design Guide for K-12 School Building – Achieving Zero Energy – **January 2018**
- Redesigned ashrae.org – **February 2018**
- ASHRAE 365 year round app – **May 2018**
- Handbook PDFs Now in Technology Portal – **June 2018**
- HVAC Designer certification launch – **June 2019**



Recent Publications

- ANSI/ASHRAE/ACCA 211, Standard for Commercial Building Energy Audits
- ASHRAE GreenGuide, 5th edition
- ASHRAE Design Guide for Cleanrooms
- ASHRAE Design Guide for Air Terminal Units
- ASHRAE Guide for Sustainable Refrigerated Facilities and Refrigeration Systems
- Advanced Energy Design Guide for K-12 (Achieving Zero Energy)
- Residential Indoor Air Quality Guide
- 90.1 Portal—Interactive online 90.1 User's Manual that includes Standard 90.1—a new way to use 90.1
- Spanish Translations: Standard 100, Standard 90.1, Hospital Design Guide



Upcoming Publications

- Design Guide for Duct Systems (**Winter 2019**)
- Design of Datacom Equipment Centers, 3rd Edition (**Summer 2018**)
- Designers' Guide for District Cooling Guide, 2nd edition (**Winter 2019**)
- Engineering Management Guide (**Fall 2018**)
- High-Performance Buildings Simplified Textbook (**Spring 2019**)
- Multifamily Residential Buildings Guide (**Spring 2019**)
- Owners' Guide for District Cooling (**Winter 2019**)
- Residential IAQ Guide (**Summer 2018**)
- 2018-IgCC Powered by 189.1 (**Summer 2018**)



New ASHRAE Learning Institute Courses

- Advanced Design for Net Zero Buildings
- Consulting Engineering Essentials
- Cool Thermal Energy Storage Systems
- The Future of Refrigerants: Challenges and Opportunities (MENA) (Dubai Training Center)
- Introduction to Refrigerants
- Latest in High Performance DOAS Systems
- Optimizing Indoor Environments to Increase Building Value
- Refrigerant Selection
- Refrigerant Management
- Save 30% Complying with 90.1-2013



PEC 2017-18 Focus: *Strategies to Improve Content Access*

Enhance member access using online delivery

- Technology Portal for *ASHRAE Journal*, Research Reports, Conference Papers
- Handbook PDFs added to Technology Portal to eliminate CDs
- Standard 90.1 Portal to Pair Standard with Users Manual

Expand content available electronically

- Free Online Access to *Science & Technology for the Built Environment*, ASHRAE's journal of archival research

Use web-based tools to optimize volunteer time

- 27 of 62 Handbook Chapter Authoring Teams using Authoring Portal for 2019 Handbook

Customize training and translate publications applying business models

Trackable delivery of Handbooks to more countries



See You There!

- 2018 Congressional Clean Energy Expo and Policy Forum
July 10, 2018 – Washington, DC – eesi.org/briefings/view/expo2018
- 2018 Building Performance Analysis Conference and SimBuild
September 26-28, 2018 – Chicago, IL – ashrae.org/BuildPerform2018
- AHR Expo Mexico
October 2-4, 2018 – Mexico City, Mexico – AHRExpMexico.com
- The Third International Conference on Efficient Building Design
October 4-5, 2018 – Beirut, Lebanon – ashrae.org/Beirut2018
- Chillventa
October 16-18, 2018 – Nurnberg, Germany – chillventa.de
- Greenbuild
November 16-18, 2018 – Chicago, IL – Greenbuildexpo.com
- 2019 ASHRAE Winter Conference and AHR Expo
January 12-16, 2019 – Atlanta, GA – ashrae.org/Atlanta and ashrae.org/AHRExp2019



Questions?

Please let your ExO know how and where
you'd like to serve next!



© 2017 ASHRAE (www.ashrae.org). For personal use only. Additional reproduction, distribution, or transmission in either print or digital form is not permitted without ASHRAE's prior written permission.



ASHRAE Position Document on Refrigerants and their Responsible Use

Approved by ASHRAE Board of Directors

Reaffirmed by ASHRAE Technology Council

Expires January 31,
20XX

ASHRAE
1791 Tullie Circle, NE • Atlanta, Georgia 30329-2305
404-636-8400 • fax: 404-321-5478 • www.ashrae.org

© 2017 ASHRAE (www.ashrae.org). For personal use only. Additional reproduction, distribution, or transmission in either print or digital form is not permitted without ASHRAE's prior written permission.

COMMITTEE ROSTER

Rajan Rajendran (Chair)

Emerson Climate Technologies, Inc.
Dayton, Ohio

Martin Dieryckx

Daikin Europe NV
Oostende, Belgium

Piotr A. Domanski

National Institute of Standards and
Technology
Gaithersburg, MD

Ayman El-Talouny*

International Partnerships
OzonAction – Montreal Protocol
UN Environment
Regional Office for West Asia
Manama, Bahrain

Glenn Hourahan

Air Conditioning Contractors of America
Arlington, VA

Allen Karpman

Arkema Inc.
King of Prussia, PA, USA

Barbara Minor

The Chemours Company
Wilmington, Delaware

Shamila Nair-Bedouelle

OzonAction - Montreal Protocol
UN Environment, Economy Division
Paris, France

- Nonvoting, contributing member

© 2017 ASHRAE (www.ashrae.org). For personal use only. Additional reproduction, distribution, or transmission in either print or digital form is not permitted without ASHRAE's prior written permission.

HISTORY OF REVISION/REAFFIRMATION/WITHDRAWAL DATES

The following summarizes this document's revision, reaffirmation, or withdrawal dates:

1/25/2012—BOD approves Position Document titled *Refrigerants and their Responsible Use*

7/2/2014—Technology Council approves reaffirmation of Position Document titled *Refrigerants and their Responsible Use*

X/X/20XX—Technology Council approves revision of Position Document titled *Refrigerants and their Responsible Use*

Note: ASHRAE's Technology Council and the cognizant committee recommend revision, reaffirmation, or withdrawal every 30 months.

ABSTRACT

Refrigeration and air conditioning provide many benefits to society, but these benefits have environmental and societal consequences. Many of them stem directly from the refrigerant chosen and its management during the life of the equipment. Environmental concerns have caused ozone-depleting potential (ODP), global warming potential (GWP), energy efficiency, and life-cycle climate performance (LCCP)^[4] to become important factors in the design and use of equipment. This often results in conflicts between choices: for example, if a lower GWP refrigerant is less efficient than the fluid it replaces, any direct global warming benefit may be offset by increased energy consumption. Additionally, flammability and toxicity play a key role and many of the lower GWP refrigerants are one or both. It is important, therefore, for ASHRAE to play a key role in guiding the choices being made for new refrigerants.

ASHRAE's position is that the selection of refrigerants and their operating systems should be based on a holistic analysis of multiple criteria. ASHRAE promotes the responsible use of refrigerants, during the processes of design, manufacturing, operation and servicing of systems as well as at the end of life. ASHRAE also supports and is committed to the efforts to advance technologies that minimize impact on the environment while enhancing performance, containment of refrigerants, cost effectiveness, and safety of employees and the public.

Note: ASHRAE position documents are approved by the Board of Directors and express the views of the Society on a specific issue. The purpose of these documents is to provide objective, authoritative background information to persons interested in issues within ASHRAE's expertise, particularly in areas where such information will be helpful in drafting sound public policy. A related purpose is also to serve as an educational tool clarifying ASHRAE's position for its members and professionals, in general, advancing the arts and sciences of HVAC&R.

© 2017 ASHRAE (www.ashrae.org). For personal use only. Additional reproduction, distribution, or transmission in either print or digital form is not permitted without ASHRAE's prior written permission.

CONTENTS

ASHRAE Position Document on Refrigerants and their Responsible Use

SECTION	PAGE
Executive Summary.....	6
1 Issues.....	7
2 Background	7
2.1 Overview.	7
2.2 ASHRAE's Role.....	8
2.3 Policy (Includes Standards and Codes)	8
2.4 Education	9
2.5 Research and International Perspective.....	9
3 Positions and Recommendations.	9
3.1 ASHRAE Positions	9
3.2 ASHRAE Commitments.....	10
3.3 Recommendations.....	10
References	12

EXECUTIVE SUMMARY

“Refrigerants are the working fluids in refrigeration, air-conditioning, and heat-pumping systems. They absorb heat from one area, such as an air-conditioned space, and reject it into another, such as outdoors, usually through evaporation and condensation, respectively.”

—ASHRAE Handbook—Fundamentals^[1]

Refrigeration and air conditioning made many of the technological advances we enjoy today possible and in that way have been highly beneficial. These benefits, however, carry environmental and societal consequences, many of which stem directly from the refrigerant selected for each application. This document represents ASHRAE's position on the selection and management of refrigerants during the life and at end of life of heating, ventilating, air-conditioning, and refrigerating (HVAC&R) equipment, and ASHRAE's recommendations for moving forward in the rapidly changing landscape of refrigerant selection.

Throughout the history of air conditioning and refrigeration, numerous substances have been used as refrigerants^[2], and for many years refrigerant choice was not of primary concern when selecting equipment. This changed over the last three decades as choosing a refrigerant has become increasingly more complex due to the new environmental criteria applied to refrigerant selection which resulted in many new substances and blends being invented, tested and commercialized. Earlier generations of commercial refrigerants were mostly fluorinated gases—chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs). They contributed to the depletion of stratospheric ozone and are being phased out globally under the international treaty called The Montreal Protocol^[3]. CFCs and HCFCs have largely been replaced with hydrofluorocarbons (HFCs), some of which have high GWP and are being restricted as the world deals with global climate change. More recently, fluorinated alternatives referred to as hydrofluoroolefins (HFOs) have been introduced. They have zero ODP and very low GWP, but some of them are mildly flammable.

Non-fluorinated refrigerants (frequently referred to as “natural”) include ammonia, carbon dioxide, hydrocarbons, water, and air. Some of them have been used for many decades with varying degrees of adoption. Although their GWP is very low, “natural refrigerants” are not free of other concerns, such as corrosion, toxicity, high pressures, high flammability, or in some cases lower operating efficiencies.

There are also other single components and blends (mixtures of different refrigerants from same or different class/group) that are available as transitional or long-term solutions with different flammability and GWP value characteristics.

The energy that refrigeration systems consume is often produced from fossil fuels which results in emissions of CO₂, a contributor to global climate change. This indirect effect, associated with electricity generation, frequently presents a larger environmental carbon footprint impact than the direct effect of refrigerant emissions. The selection of refrigerants and their operating systems should thus be based on a holistic analysis of multiple criteria. All refrigerants have trade-offs, and it is important for users to know these limitations when selecting the appropriate fluid for their application.

ASHRAE's position on responsible selection and use of refrigerants and our commitments are outlined in the following document. But as new technology develops ever more rapidly and our understanding of environmental effects of technology grows, ASHRAE recommends and is committed to continuing and intensifying efforts in the following areas:

- *Research and Standards Development*
- *Improved Design and Equipment Applications*

- *Improved Field Practices and Training*
- *Regulatory Guidelines and Measures*

Sustainability means looking forward, and ASHRAE will continue to be at the forefront of HVAC&R development.

1.0 ISSUES

Choosing a refrigerant for a given HVAC&R application has become increasingly complex. Environmental concerns have caused ODP, GWP, energy efficiency, and LCCP to become important factors for consideration. Some countries have developed regulatory constraints, international protocols, or voluntary agreements in response. Since the implementation of the 1987 Montreal Protocol, CFCs and HCFCs containing chlorine (e.g., CFC-11, CFC-12, HCFC-22, R-502, HCFC-123) are being phased out due to their ODP. In October 2016, the Kigali amendment to the Montreal Protocol was negotiated over concerns about climate change, prompting transitions to lower GWP options as well.

The need for lower GWP refrigerants has led to increased development and utilization of flammable options to meet GWP targets. As a result, safety standards are being reassessed and updated to reflect the increasing interest in flammable or mildly flammable working fluids. Even as standards are being developed and research into new fluids is underway, the shift from HFCs to lower GWP candidates is underway in both developed and some developing nations.

While each class of refrigerants has favorable performance and/or environmental aspects, none present an ideal solution. Several HFO and HFC blends have been developed to optimize performance and minimize negative aspects. So-called “natural refrigerants” such as ammonia, hydrocarbons and carbon dioxide have issues as well, including flammability, toxicity, high pressures, or, in some cases, lower operating efficiencies, depending on the fluid. All the next generation refrigerants present a new level of refrigerant management challenge during the working life of the equipment.

End-of-life disposal of refrigeration and air-conditioning systems is another important issue. At the end of life of an equipment, refrigerant should be safely recovered and recycled when possible and disposed of in accordance with applicable regulations.

2.0 BACKGROUND

2.1 Overview

Refrigeration and air conditioning provide a broad range of benefits to society, including the preservation of food, comfort cooling and heating of occupied spaces (home, work and transport), and temperature/humidity control of industrial processes. The vast majority of refrigeration and air-conditioning equipment operates via the application of the vapor-compression cycle, and such cycles require a working fluid or refrigerant to operate. Refrigerants are therefore at the heart of most modern refrigeration and air-conditioning equipment, and the refrigerant selection has significant impact on the cost, safety, reliability, performance, and energy consumption of the equipment.

A refrigerant must satisfy a number of technical requirements related to safety, chemical stability, environmental properties, thermodynamic characteristics, compatibility with materials

of construction^[6], as well as impact on total system cost. There is no single set of optimum characteristics (especially for thermodynamic properties), and often there are tradeoffs among desirable characteristics. Thus, a variety of refrigerants having a range of properties is needed to meet the requirements of various applications.

A broad range of fluids has been used as refrigerants over the past century, and the current usage is dominated by a range of fluorinated chemicals, such as HFCs, in addition to hydrocarbons and several inorganic compounds, including ammonia and carbon dioxide (CO₂)^[2]. An earlier generation of refrigerants, the CFCs and HCFCs, contained chlorine and was capable of reaching and releasing free chlorine molecules in the stratosphere thereby damaging the ozone layer. This resulted in the phase out of the CFC and ongoing phase out of HCFC refrigerants under the Montreal Protocol. And now, global climate change concerns have focused attention on the HFC refrigerants. With the European Union regulation on certain fluorinated greenhouse gases (EU F-Gas) ^[7], and other recently enacted regulations in various countries, HFCs are now facing restrictions, and/or phase-downs. This trend to reduce the global warming impact of HFCs culminated in the Kigali Amendment to the Montreal Protocol in October 2016^[8].

The net climate impact of a refrigerant is dependent on direct and indirect effects. The direct effect is from the global warming potential and amount of a refrigerant emitted to the atmosphere (either from a leak, accident, or from improper handling or disposal). The indirect effect is associated with the energy consumed during the operation of HVAC&R equipment. Over the operating life of the equipment, this indirect effect, which occurs as a result of the CO₂ produced by fossil fuel power plants, is usually much greater than the direct effect due to the GWP of the refrigerant itself. The refrigerant is contained within a sealed system and is not intended to be emitted to the atmosphere under normal operation and with proper end-of-life disposal. In actual practice, systems are subject to leakage and require proper maintenance to minimize losses. Operation of a system with a lower than the design refrigerant charge results in increased energy use. Both direct and indirect effects are considered in metrics such as Total Equivalent Warming Impact TEWI^[5] and LCCP. It should be recognized that the total climate impact of an operating refrigeration system can increase if the replacement lower GWP refrigerant has a lower energy efficiency as applied in the system.

A more thorough discussion of the history, the classes of refrigerants, their attributes, tradeoffs, and means of mitigating risks associated with their use are available in the literature.

2.2 ASHRAE's Role

ASHRAE has a direct interest in the refrigerant transitions because the operation of much of the HVAC&R equipment depends on refrigerants. ASHRAE contributed to the successful effort to phase out the ozone-depleting CFC and HCFC refrigerants, and it has a significant role to play in encouraging the proper and safe use of refrigerants going forward. ASHRAE plays an active role in the following areas: policy, research, standards, codes, guidelines, technology transfer and education.

2.3 Policy (Includes Standards, Codes and Guidelines)

ASHRAE plays a major role in the development of voluntary standards and guidelines governing the application and use of all types of refrigerants. Other organizations adopt the technical requirements developed by ASHRAE into various codes and regulations. The most relevant ASHRAE standards dealing with refrigerants are ANSI/ASHRAE Standard 34, *Design-*

nation and Safety Classification of Refrigerants^[10], ANSI/ASHRAE Standard 15, *Safety Standard for Refrigeration Systems*^[11], and ANSI/ASHRAE Standard 147, *Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment*^[12].

2.4 Education

ASHRAE plays an important role in providing technical information on the proper application of refrigerants and in educating the technical community. These activities are carried out through research, handbooks, journals, technical meetings, special publications, educational training and digital media. Local ASHRAE chapters also host refrigerant-related programs and speakers. Technical activities in this area are addressed within ASHRAE by the Refrigeration Committee, by committees responsible for the maintenance and updating of the standards mentioned above, and by numerous technical committees^[13].

2.5 Research and International Perspective

ASHRAE is unique among technical engineering societies in sponsoring an extensive member-supported research programs. The research plan for the Society includes items to facilitate the application of lower GWP refrigerants, to investigate methods to reduce refrigerant charge in systems, and to improve system efficiency. For example, ASHRAE has been actively involved in several research programs to understand the safety implications and to develop mitigation plans for use of flammable and mildly flammable refrigerants^[14]. These results are beneficial in the development of safety standards to enable the transition to the next generation of refrigeration technology. Some of this research has been performed jointly with the American Heating and Refrigeration Institute (AHRI) and the US Department of Energy (DOE).

Another major focus of ASHRAE's activities is on improving the energy efficiency of buildings. Reducing the heating and cooling load of buildings implies smaller HVAC&R systems with smaller amounts of refrigerant and lower indirect climate impacts resulting from electricity generation.

3.0 POSITIONS AND RECOMMENDATIONS

ASHRAE acknowledges that the use of HVAC&R systems has environmental consequences and ASHRAE is committed to making these systems sustainable. Because of their environmental impacts, ASHRAE holds to the principle that refrigerants should be used prudently to provide best value to society.

3.1 ASHRAE Positions

ASHRAE's position on responsible selection and use of refrigerants is as follows:

- Selection of refrigerants and their systems must be based on a holistic analysis including energy efficiency and performance attributes, environmental impacts, employee and public safety, and economic considerations. A refrigerant should not be selected based on any one single factor such as GWP, operating pressure, flammability, etc. The wide range of HVAC&R applications and their requirements throughout the world necessitates a variety of refrigerants to meet these needs.
- To limit direct and indirect impact on the environment, emissions of refrigerants should be reduced through research, education, improved design, manufacturing/construction of equipment, field commissioning, maintenance

procedures, decommissioning, and enforcement of applicable standards and regulations.

- Where possible refrigerants should be safely recovered for reuse, recycle, reclamation or destruction during service or at end of life of the equipment. Refrigerant inventory and management programs should be implemented to closely track refrigerant use.

ASHRAE encourages and supports the ongoing effort to develop new refrigerants and improve the application of existing refrigerants to meet these criteria.

3.2 ASHRAE Commitments

ASHRAE is committed, in a timely manner, to:

- Supporting research to develop and advance HVAC&R technologies and practices that minimize impact on the environment while enhancing performance, cost effectiveness, and safety.
- Developing and revising guidelines and standards that improve energy efficiency, safety, and reduce refrigerant emissions.
- Supporting responsible refrigerant use through education, information dissemination, and proper training.
- Working with societies, universities, private industry, government agencies and international organizations to promote responsible use of refrigerants.

3.3 Recommendations

Policy, Research, Education and Training

In order to support responsible design and use of refrigerants, ASHRAE also recommends efforts in the following areas for governmental and non-governmental institutions:

Research, Standards and Guidelines Development

- Promote research and development programs for investigating and adoption of lower GWP refrigerants to achieve better LCCP.
- Evaluate flammable refrigerants to understand the safety implications, mitigation techniques, and to develop safe use standards, practices and training.
- Support the development, update and/or adoption of relevant standards and guidelines that facilitate the deployment of lower GWP refrigerants.

Improved Design and Equipment Applications

- Balance the safety, energy efficiency, cost, and environmental impact for refrigerants using a consistent and comprehensive methodology across all refrigerants and system types using benchmarks like LCCP or TEWI.
- Advance the design and development of refrigeration and air conditioning equipment that facilitate reduced refrigerant charge and emissions.
- Develop tools, equipment, methodologies and practices to minimize or prevent refrigerant loss during installation, operation, maintenance, and decommissioning of refrigeration systems.

Improved Field Practices and Training

- Introduce and manage on-site emissions prevention measures including, but not limited to, improved system tightness for leak prevention, good commissioning and installation practices, regular leak checking, monitoring, labeling and record keeping. These elements can be incorporated as part of a comprehensive refrigerant management

program.

- Establish reclamation programs that promote refrigerant recovery, recycling (reuse), reclamation and safe disposal practices, including at end of equipment life.
- Develop and enact certification program for specialists (practitioners) in relation to setting benchmarks and competencies of good practices.
- Promote the introduction of corporate social responsibility policies and programs in relation to the responsible use of refrigerants.
- Introduce training programs about lower GWP refrigerants and their responsible use for different stakeholders.

Regulatory Guidelines and Measures

- Develop relevant measures that promote the use of lower total system GWP (refrigerant charge multiplied by the GWP of the refrigerant) and energy efficient HVAC&R systems.
- Introduce procedures and guidelines, working with United Nations Environmental Programme (UNEP) and other organizations and regulatory bodies, to enable sustainable procurement policies that promote the deployment of lower total system GWP and their responsible use while commissioning, operation and servicing HVAC&R systems.

REFERENCES

- 1 ASHRAE. 2017. *ASHRAE Handbook—Fundamentals*. Atlanta: ASHRAE.
- 2 Calm, J.M. 2008. The next generation of refrigerants—Historical review, considerations, and outlook. *Int. J. Refrigeration* 31: 1123–33.
- 3 UNEP, The Montreal Protocol on Substances that Deplete the Ozone Layer. <http://ozone.unep.org/en/treaties-and-decisions/montreal-protocol-substances-deplete-ozone-layer> (accessed August 8, 2017)
- 4 IIR 2016. Guideline for Life Cycle Climate Performance, International Institute of Refrigeration, http://www.iifir.org/userfiles/file/about_iir/working_parties/WP_LCCP/08/Booklet-LCCP-Guideline-V1.2-JAN2016.pdf (accessed July 20, 2017)
- 5 AIRAH, 2012. Methods of Calculating Total Equivalent Warming Impact (TEWI) 2012. Australian Institute of Refrigeration, Air Conditioning and Heating. https://www.airah.org.au/Content_Files/BestPracticeGuides/Best_Practice_Tewi_June2012.pdf, accessed August 28, 2017.
- 6 McLinden, M.O., and D.A. Didion. 1987. CFCs: Quest for Alternatives. *ASHRAE J.* 29:32– 42.
- 7 EU, 2014. European Parliament. Regulation (EU) No 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006.
- 8 UNEP, 2016. Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, Kigali, 15 October 2016. <http://ozone.unep.org/en/handbook-montreal-protocol-substances-deplete-ozone-layer/41453>
9. Calm, J.M., and G.C. Hourahan. 2007. Refrigerant data update. *HPAC Engineering* 1:50–64
10. ASHRAE. 2016. ANSI/ASHRAE Standard 34-2016, Designation and Safety Classification of Refrigerants. Atlanta: ASHRAE.
11. ASHRAE. 2016. ANSI/ASHRAE Standard 15-2016, Safety Standard for Refrigeration Systems. Atlanta: ASHRAE.
12. ASHRAE. 2013. ANSI/ASHRAE Standard 147-2013, Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment and Systems
13. American Society of Heating, Refrigerating and Air-Conditioning Engineers. <https://www.ashrae.org/>
14. <https://www.ashrae.org/about/news/2016/ashrae-ahri-doe-partner-to-fund-flammable-refrigerant-research>



Report to Ref. Committee

ASHRAE - UN Environment Cooperation Follow-up on 2017-2018 Work Plan

ASHRAE Annual Conference
Houston, TX
23-27 June 2018

Main theme of 2017-2018 Work Plan Working Beyond High-GWP Refrigerants

Main Goals

Actions

Advocacy and Knowledge Sharing

- Global Conferences and Events
- Refrigerants Awareness Package
- Low- GWP Innovation Award Program

Training, Education and Practice

- Online Training Program on Refrigerants
- Contemporary Learning Tools for Universities
- Assessment Program for RAC Plants

Example of cooperation in conferences and events



UN ENVIRONMENT COORGANIZES THE FIRST INTERNATIONAL CONFERENCE ON SUSTAINABLE MARINE AND FISHERIES REFRIGERATION TECHNOLOGIES FOR OZONE AND CLIMATE PROTECTION

1. International Conference on Sustainable Technologies of RAC in Marine/Off-Shore Fisheries Sectors, Bangkok- Thailand (April 2017)
2. International Conference on District Cooling for Urban Development, Sharm Al-Sheikh, Egypt (Sept 2017)
3. ASHRAE Developing Economies Conference, Delhi, India (Nov 2017)
4. Panel Session at ISHRAE REFCOLD (UNEP-ASHRAE-IIR-GFCCC) (Nov-208)
5. Several Side Events at Montreal Protocol Meetings

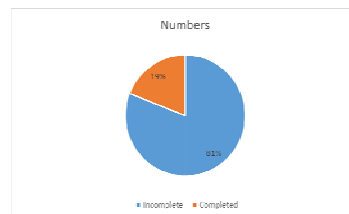
ASHRAE- UNEP Online Courses



ASHRAE- UNEP Online Courses



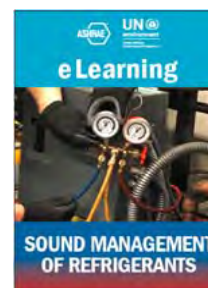
Description	Numbers
Total Enrolled	241
Total Completed	46



Observations/Recommendations

- Outreach Plan and Campaigning
- Participants need to be reminded to complete the course

ASHRAE- UNEP Online Courses



Launch by
Sept 2018

Module #	Status
Module I	Complete
Module IV	Module IV: Part 1 - Programming/SME Review Complete. Instructional Designer is working on final edits Module IV: Part 2 - Programming/SME Review Complete. Instructional Designer is working on final edits Module IV: Part 3 - Programming/SME Review Complete. Instructional Designer is working on final edits
Module 2	1st Draft complete. SMEs will review
Module 3	Programming in Progress
Module 5	Audio Recording/Programming in Progress

UNEP/ASHRAE Assessment Program Sustainable Operations and Maintenance of Refrigeration and Air Conditioning Plants



This ambitious project would entail the compilation of best practices related to the following areas related to the operation and management of air-conditioning and refrigeration systems/plants:

1. Safe storage and proper handling of refrigerants
2. Periodic leak checking and proper documentation
3. Checklist for maintaining equipment to extend life and maintain energy efficiency
4. Fault detection and preventative maintenance
5. Proper commissioning and recommissioning practices to optimize system performance
6. Minimum required servicing equipment and tools
7. Proper disposal of equipment and reclamation of refrigerant at end of product life.
8. Competencies of personnel/companies responsible of operating and/or maintaining the refrigeration and air-conditioning plants

UNEP/ASHRAE Award Program Innovation in Refrigerant Management

- ▶ **INNOVATION** - UN Environment and ASHRAE developing an international award for innovative design, research or practice of lower-GWP Refrigerant Management technologies or practices in developing countries.
- ▶ **AWARENESS** - Purpose is to increase awareness of how sound refrigerant practices contributes to mitigation of climate change through recognition of individuals who design and/or conceive innovative technologies in refrigeration management.
- ▶ **COMMUNICATION** - Important output is communication of innovation techniques through ASHRAE publishing vehicles and chapter/member network so the innovation can be adopted industry wide.

Official Launch by Nov-2018



UN environment
United Nations
Environment Programme

University Course

Refrigerant Management





M1
M2
M3
M4
M5

Special University Course for Future Engineers












Free UN Environment Refrigerant Management for Future Engineers Course

Congratulations you are among those select ASHRAE members who have been selected to pilot the course. ASHRAE is excited to make this information available to the academic community.

After this form is filled out, signed and returned, a link to an FTP site will be sent to you to download the following:

Introduction.docx	1,489 KB
Sample Course Syllabus.docx	840 KB
Cover Page Activities.docx	769 KB
Cover Page Lectures Notes.docx	768 KB
Cover Page presentations.docx	777 KB
Module 1 Activities.docx	43 KB
Module 1 Notes.docx	1,843 KB
Module 1 pptx	12,288 KB
Module 2 Activities.docx	41 KB
Module 2 Notes.docx	768 KB
Module 2 pptx	7,447 KB
Module 3 Activities.docx	25 KB
Module 3 Notes.docx	487 KB
Module 3 pptx	1,814 KB
Module 4 Activities.docx	54 KB
Module 4 Notes.docx	283 KB
Module 4 pptx	1,072 KB
Module 5 Activities.docx	36 KB
Module 5 Notes.docx	5,340 KB
Module 5 pptx	5,893 KB
UNEP University Course - all materials- Dec-2017.pdf	30,352 KB

Free UN Environment Course Piloting Agreement

Please print all but the signature and return to Julie Hart at jhart@ashrae.org

Instructor Name:

Instructor Email:

Name of Institution:

Name of Department that course will be offered:

Address:

City:

Country:

Please indicate if this course will be a required or an elective course.

Required ☐ Elective ☐

Number of credits that will be earned:

Number of students registered for the course:

The course material may be used in its entirety or sections of it with minor modifications. If you do make changes, include a description of the changes on a Usage Form that will be sent to you after the course is presented. Content may be translated if translated content is made available to ASHRAE with the understanding that ASHRAE and UN Environment may then use the translation without restrictions. The content you will transmit may only be used for use at an institution of higher or vocational training, not for commercial nor non-academic use.

Signature:

On November 8, 2017, the first flyer for a free UN Environment Refrigerant Course was offered to 479 ASHRAE Student Branch Advisors.

There were 41 interested respondents; five of which were forwarded the flyer from others.



All 41 were sent the form the message requesting a completed piloting agreement.

To date 17 returned the completed form and were sent the link to the FTP site to download the course.

On April 3, 2018 493 ASHRAE Student Branch Advisors. This included the previous Advisors but also some new people and with some corrected addresses but not the people who had agreed to pilot the program.


Countries	
2	Brasil
4	Canada
1	Egypt
4	India
1	Indonesia
1	Lebanon
1	Pakistan
1	Peru
1	Philippines
1	Republic of Singapore
1	Serbia
1	Turkey
2	UAE
3	USA

Beyond the 2017-2018 ASHRAE-UNEP Workplan...

Twinning of National Ozone Officers & National Energy Policymakers

- Cooperation on delivery of workshops for 147 developing countries in both 2018 and 2019
- Training of NOOs and Energy Officials on EE and RAC
- Development of Online Course in EE in RAC
- Production of supporting publications
- Etc.





CTTC REF Report
ASHRAE Annual Conference – Houston 2018

June 22, 2018

ASHRAE Refrigeration Committee (REF)
Liaison Report to
Chapter Technology Transfer Committee
2018 Annual Conference, Houston TX

REF Liaison: Charles Hon
 chon@truemfg.com

1

CTTC REF Report
ASHRAE Annual Conference – Houston 2018

Regulatory Activities on Refrigerants - EPA
Lawsuit - U.S. EPA SNAP

U.S. District Court of Appeals decision to limit use of HFCs under SNAP

EPA lacks sufficient authority to regulate HFCs under Section 612 of CAA

NRDC, Honeywell, Chemours filed petition for rehearing en banc of the panel decision

Vacatur of EPA's SNAP 20 rule will be held in abeyance until the D.C. Circuit makes a determination on the petition for rehearing, and potentially, on the merits of the case.

2

CTTC REF Report
ASHRAE Annual Conference – Houston 2018

Regulatory Activities on Refrigerants - CARB
(California Air Resources Board)

Short-lived climate reduction strategy approved

Regulations started in October 2017 – two rulemakings

Rulemaking #1 Proposes adoption of SNAP rules 20 and 21 – CARB will rely on EPA SNAP regulations if Supreme Court Decision upholds rule 20

Proposed Regulations effective late 2018

3

CTTC REF Report
ASHRAE Annual Conference – Houston 2018

EPA SNAP Requirements for Leak Reductions
Annual Leak Rate Reductions Effective 1/1/2019

Appliance Type	Current Leak Rate	2019 Allowable Leak Rate
Industrial Process Refrigeration	35%	30%
Commercial Refrigeration	35%	20%
Comfort Cooling	15%	10%
All Other Appliances	15%	10%

4

CTTC REF Report
ASHRAE Annual Conference – Houston 2018

Technical References:
REF Webpage: www.ashrae.org/refrigeration
 Recent Meeting Minutes
 Manual of Procedures, Rules of the Board, REF Reference Manual
 Members First! Newsletters

UN information and Useful Links Index
http://www.iifiir.org/medias/medias.aspx?INSTANCE=exploitation&PORTAL_ID=portal_model_instance_News_dossiers_thematiques_en.xml&SYNCMENU=DOSSIER_THEMATIQUE&SETLANGUAGE=EN
 The next two slides contain recent additions to this UN information base

5

CTTC REF Report
ASHRAE Annual Conference – Houston 2018

UN Cold Chain Technology Briefs (2018)

Food Production and Processing
http://www.iifiir.org/userfiles/file/webfiles/in-depth_files/Brief_RefrigerationFoodProductionProcessingBD.pdf

COLD STORAGE AND REFRIGERATED WAREHOUSES
http://www.iifiir.org/userfiles/file/webfiles/in-depth_files/Brief_ColdStorageRefrigeratedWarehouseBD.pdf

Commercial, Professional and Domestic Refrigeration
http://www.unep.fr/ozonaction/information/mmcfiles/7940-e-Commercial_professional_and_domestic_refr.pdf

6

CTTC REF Report
ASHRAE Annual Conference – Houston 2018

UN Cold Chain Technology Briefs (Continued)

Transport Refrigeration
http://www.iifiir.org/userfiles/file/webfiles/in-depth_files/Brief_TransportRefrigerationBD.pdf

Fishing Vessel Applications
http://www.iifiir.org/userfiles/file/webfiles/in-depth_files/Brief_FishingVesselApplicationBD.pdf

7

CTTC REF Report
ASHRAE Annual Conference – Houston 2018

Wednesday, June 27, 11:00 a.m. - 12:30 p.m. Seminar 71

Recent Advances in Solid-State Cooling Technologies

Room: 372BE

1. **CaloriCool: Caloric Materials Consortium: Creating Materials Foundation for Caloric Cooling and Heat Pumping Technologies**
 Vitalij K. Pecharsky, Iowa State University, Ames, IA
2. **Electrocaloric Cooling: Current States and Future Perspective**
 Qiming Zhang, Penn State University, University Park, PA
3. **Overview of Elastocaloric Cooling**
 Yunho Hwang, Member, University of Maryland, College Park, MD

8

CTTC REF Report
ASHRAE Annual Conference – Houston 2018

- **REF Webpage with Links**
 - REF Resources/Chapter Program Support
 - To Support Chapters, REF has Developed Refrigeration-themed Program Materials
 - "Tips on Hosting Successful Refrigeration-focused ASHRAE Chapter Meeting"
 - **ASHRAE Distinguished Lecturers (DL) list (edited to include only Refrigeration Topics)**
 - **ASHRAE Refrigeration Speakers list (expanded for improved geographic coverage in developing countries)**
 - Kindred Refrigeration Organizations

9

CTTC REF Report
ASHRAE Annual Conference – Houston 2018

- **REF Webpage**
 - Refrigeration Technology Awards by REF
 - Recognize the Designer and Owner of the Refrigeration Project exhibiting the Best Innovation and/or New Technology with Links to:
 - "Milton W. Garland Commemorative Refrigeration Award for Project Excellence"
 - "Refrigeration Comfort Cooling Award for Project Excellence"
 - Awarded at Plenary Session during Annual Conference

10

CTTC REF Report
ASHRAE Annual Conference – Houston 2018

- **Chapter Program Support – Efforts Underway**
 - **Encourage Expert Refrigeration Speakers for DL Program**
 - Encourage Refrigeration Programs with broad appeal to Chapters
 - **Develop list of Refrigeration Programs and Speakers with wide appeal**

11

CTTC REF Report
ASHRAE Annual Conference – Houston 2018

- **Advance Chapter Interest in Refrigeration**
 - REF seeks to promote Refrigeration Education and Training for Students and Seasoned Practitioners
 - Technology Transfer Programs
 - Refrigeration Programs at ASHRAE Conferences
 - "George C. Briley ASHRAE Journal Award"
 - Best Refrigeration-related Article
 - Awarded at REF Meeting, Winter Conference

12

CTTC REF Report
ASHRAE Annual Conference – Houston 2018

- **Advance Chapter Interest in Refrigeration**
 - REF continues to work with and thru CTTC to Identify and Develop Resources and Implement Programs to enhance Chapter Refrigeration Activities including:
 - Work with the TCs to develop Hands-on, Low Cost Refrigeration Projects for College Lab Classes
 - Present Seminars at ASHRAE Conferences on Refrigeration Topics
 - Promote and solicit applications for Milt Garland, Comfort Cooling, and George Briley Refrigeration Awards
 - Submit recommendations to CTTC for PAOE criteria for Chapter Refrigeration Activities
 - Strongly encourage RVCs to actively promote strong Chapter participation in the recently approved "R in ASHRAE" Award

13

CTTC REF Report
ASHRAE Annual Conference – Houston 2018

THANK YOU

**For your Participation & Support
of ASHRAE Activities**

14

Refrigeration Committee

Nick Shockley, Chair

Date:1/21/2018

Item #	MBO	Status	Date Due	Assigned To	Applicable Strategy #	MBO Comments	UPDATE
Included in Definition of Roles							
1	Develop and Expand Refrigeration Education & Outreach	OPEN	1/21/2018	Royal, Rule	1c, 3d	i) Broadcast info on Milton Garland comfort cooling & Briley Awards in ASHRAE Insights and Members Newsletter. Solicit award submissions from Chapters ii) Organize ALI Subcommittee. Assist in the development of programs for regional chapters on refrigeration concepts. Liaise with YEA. Royal developing course proposal with ALI. iii) Update position document on ammonia iv) revise Refrigerants and their Responsible Use PD	Awards will be publicized in Insights, on website REF exploring ALI course PD on Ammonia revision was approved by BOD Refrigerants PD was reaffirmed and is being revised.
2	Support of ASHRAE Developing Economy Objectives	OPEN	6/24/2018	Minor, Coulomb	4a, 4b, 3b	i) REF and UNEP co-sponsored workshops and/or seminars on environmental and safety concerns of alternative refrigerants for developing countries ii) Develop guidance on available alternatives or resources which promote energy efficient alternatives iii) Support dissemination of GRMI principles to developing countries	REF exploring deliverables requested from Ad Hoc report. Programs relevant to developing economies planned for Houston. ASHRAE is on GRMI steering committee.
3	Implementation of UNEP Partnership Goals	OPEN	Ongoing	Nair-Bedouelle, Robbins	4a, 4b	i) ASHRAE & UNEP will explore opportunities to promote responsible and sound management of refrigerants ii) ASHRAE and UNEP to cooperate and coordinate efforts related to energy efficiency in the buildings sector iii) ASHRAE through its Distinguished Lecturer (DL) program will work with UNEP to provide speakers to collaborative activities between UNEP and ASHRAE chapters/sections	Joint ASHRAE, UNEP, IIR conference on sustainable management of refrigeration technologies in mobile marine and fisheries (Bangkok 2017). Linked to MBO#2 deliverables Refrigerants awareness package low GWP program
4	ASHRAE policy commentary on REF related issues	OPEN	24-Jun-18	assign in Chicago		i) Recommend what positions, if any, ASHRAE should take on public policy where feedback is sought by the governing agency (EPA, DOE, etc.) ii) Present recommendations to Tech Council and/or ASHRAE BOD for review and approval	REF discussed in Chicago. Will comment on UN RTOC to model how REF can participate.
5	Effective communication and operation of the REF Committee	OPEN	Ongoing	Shockley, Dieryckx, past Chairs	2a, 2b, 2c	i) Assure Technical Committee alignment ii) Development of a Planning Subcommittee for REF (current and future leadership) iii) Continued collaboration with other REF related organizations	REF established subcommittee structure to help coordinate liaison activities and assignments. Liaisons with IIR, IIAR, GCCA, UNEP assigned. Liaising with ASHRAE TCs, SSPCs as well