



Shaping Tomorrow's  
Built Environment Today

**MINUTES (DRAFT)**

**Refrigeration Committee (REF)**

**June 23, 2019**

**Marriott Downtown**

**Kansas City, MO**

*These minutes have not been approved and are not the official, approved record until approved by this committee.*

**MEMBERS PRESENT:**

Martin Dieryckx, *Chair*  
Rajan Rajendran, *Vice-Chair*  
Ayman Eltaloung  
Stephen Gill  
Charles Hon  
Yunho Hwang  
Dustin Lilya  
Sarah Maston, *BOD Ex-O*  
Barbara Minor  
Mick Schwedler, *CO*  
William Walter  
Tony Welter

**MEMBERS NOT PRESENT:**

Walid Chakroun  
Didier Coulomb

**ASHRAE STAFF:**

Steve Hammerling, *MOTS*  
Mike Vaughn, *MORTS*

**GUESTS:**

Karim Amrane  
Adnan Ayub  
Elise Backstrom  
Casey Briscoe  
Marites Calad  
Ina Colombo, *IIAR*  
Jim Caylor  
Bruce Griffith  
Anuj Gupta  
Trent Hunt  
Norihito Inoue  
Rainer Jakobs  
Georgi Kazachki  
Allen Karpman  
Walter Lenzi  
Apichit Lipongpana  
Carlos Mitroga, *Incoming Member*  
Akio Miyara  
Roberto Pereira  
Gustavo Pottker  
Gurunarayana Ravi  
Doug Scott  
Daryl Stauffer  
Shitong Zha

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## MOTIONS

No.	Motion	Page
1	the minutes from the REF Winter Meeting be approved.	1
2	The Refrigeration Committee hereby recommends that ASHRAE officially recognize and promote June 26 as World Refrigeration Day to serve as a means of raising awareness and understanding of the important contribution that refrigeration, air conditioning and heat pumps make globally across many aspects of modern life and society.'	2
3	The Refrigeration Committee join the new MTG.RAC Plant Assessment Guide with Carlos Mitroga as voting member and Walid Chakroun as alternate.	2
4	that REF to approve a seminar program for ORL on the state of the art of refrigeration technologies with lower environmental impact	3
5	REF recommends that the DRSC recommends that Technology Council recommends to the BOD to initiate a revision to the <i>Refrigerants and their Responsible Use</i> position document (PD).	4
6	REF recommends that the DRSC recommends that Technology Council to retire the <i>Ammonia as a Refrigerant</i> position document (PD) when it expires in February 2020.	4
7	REF recommend to OPS to make changes to REF MOP.	6

## ACTION ITEMS – Annual 2019 – Kansas City

No.	Responsibility	Action Item	Status
1	Rajendran	Review strategic plan and align SY 19-20 REF MBOs	
2	REF	Review final report of the R in ASHRAE ad hoc and consider plan to implement activities of interest.	
3	Staff	Arrange for REF to speak to TC Chairs at the TC Breakfast in Orlando	
4	Rajendran	Attend Sunday BOD meeting to read the World Refrigeration Day resolution	complete
5	REF	Imagine one or more new program ideas for REF's SY 20-21 budget to discuss in fall.	
6	Dieryckx, Hon, Eltalouny and Mitroga	Serve as judges for the Briley Award	
7	Kazachki, Hwang	Submit program on 'state of the art of refrigeration technologies with lower environmental impact' for Orlando meeting	
8	Hwang	Hold a Program Subcommittee web conference in late July to discuss program ideas for Orlando. Participants asked to bring 3-4 ideas for discussion	
9	REF	Develop plan to take ownership of the new Refrigeration website and monitor and update content	
10	Staff	Staff was asked to poll for and set up a web meeting to review the newly approved MOP, adding the two new subcommittees and to make assignments	
11	Maston	Review MOP changes and consider how members could be added to REF as non-voting members	

12	REF	Revisit MOP section A2.2 at Winter Meeting to determine criteria for invited liaison organizations	
13	Trent Hunt, Guru Ravi, Adnan Ayub, Georgi Kazachki, and Hon	Review and comment on draft bi-annual report proposal	

#### ACTION ITEMS – Winter 2019 - Atlanta

No.	Responsibility	Action Item	Status
AT-1	<b>Rajendran</b> , Lilya, Hon, Dieryckx, & Rydkin	Explore a change to the name and scope of REF and reorganization of subcommittees.	complete
AT-2	<b>Gill</b> , Chakroun, Rajendran, Maston	Review ROB/MOP changes that could incorporate membership on REF from outside other organizations	complete
AT-3	<b>Dieryckx</b> , Lilya, Rajendran, Hon, Maston, D. Scott, G. Ravi	to work out a more formal proposal on what REF's biannual 'state of the art of refrigeration document' would be and how it could be done and maintained for REF's for next meeting	See KC #12
AT-4	Staff	Share draft ASHRAE strategic plan and four initiatives with REF	complete
AT-5	Gill	Consider program(s) relate to World Refrigeration Day for future conference	complete
AT-6	Coulomb	Develop a program with Peter Domansky for Kansas City on IIR activities	complete
AT-7	REF, Staff	Propose which TC/SSPC they participate on and can serve as REF liaison to.	complete
AT-8	Coulomb	Send harmonized IIR/ASHRAE to REF	complete
AT-9	REF	Review ASHRAE/GCCA MOU and prioritize list of activities.	complete

#### LIST OF ATTACHMENTS

No.	Attachment
A	ASHRAE Strategic Plan 2019-24
B	R in ASHRAE ad hoc final report
C	MTG.RAC proposal
D	UNEP/MTG.RAC background
E	BOD Ex-O report
F	RatRU PD title, purpose and scope
G	UNEP/ASHRAE partnership update
H	CTTC report
I	Regulatory Issues report
J	IIR presentation
K	REF MOP changes
L	Bi-annual REF report



## LIST OF ACRONYMS

AI	Action Item	MOT	Manager of Technical Services
ASHRAE	American Society of Heating, Refrigerating and Air-conditioning Engineers	MOU	Memorandum of Understanding
BOD	Board of Directors	MTG	Multidisciplinary Task Group
CNV	Chair Not Voting	OPS	Operations Subcommittee
CTTC	Chapter Technology Transfer Committee	PAOE	Presidential Award of Excellence
DRSC	Document Review Subcommittee	PD	Position Document
Ex-O	Ex-Officio	RatRU	Refrigerants and their Responsible Use
GCCA	Global Cold Chain Alliance	REF	Refrigeration Committee
IIR	International Institute of Refrigeration	SY	Society Year
IoR	Institute of Refrigeration	TAC	Technical Activities Committee
MBO	Management by Objectives	TC	Technical Committee
MOP	Manual of Procedures	UNEP	United Nations Environment Programme

## **1. CALL TO ORDER**

Chair Martin Dieryckx called the meeting to order at 8:00 AM. Members and guests introduced themselves. Staff confirmed quorum.

## **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](http://www.ashrae.org/about-ashrae/ashrae-code-of-ethics).)

## **3. REVIEW OF AGENDA**

REF would address agenda item #11 after #6

## **4. MINUTES**

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

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

**BACKGROUND:** Minutes were distributed in February 4<sup>th</sup> email.

**MOTION 1 PASSED:** 9-0-0, CNV

## **5. CHAIR'S REPORT – Dieryckx**

A. Motions from Past Meetings Requiring Higher Body Approval

There were no motions from past REF meetings required higher body approval.

B. New Information Items for REF

1. ASHRAE Strategic Plan

The 2019-2024 strategic plan was sent with the meeting agenda and is included here as

**Attachment A.** Maston summarized the plan which includes 4 initiatives, 3 goals and 8 objectives. She asked leadership to look at how SY 19-20 REF MBOs align with plan (**AI #1**).

2. R in ASHRAE BOD ad hoc committee

Trent Hunt led this ad hoc and developed the Refrigeration page of website -

[www.ashrae.org/refrigeration](http://www.ashrae.org/refrigeration). To date there have been 3,070 views with an average view time of 2 minutes, 13 seconds.

The ad hoc's final report (**Attachment B**) includes a list of 1, 3 and 5-year goals for REF to review and consider implementing (**AI #2**). Key notes including the addition of 11 refrigeration related PAOE points, with a minimum of 700 refrigeration-related PAOE points, including having regional refrigeration chairs. REF should plan for a refrigeration theme at every Winter Conference where REF can work with the track chair to help organize.

3. TC reorganization

Maston reported TAC is still working on their TC reorganization plan. Starting in Kansas City the TC Chair Breakfast would be in one room on Sunday morning instead of splitting up by section.

Staff was asked to arrange for REF to speak to TC Chairs at the TC Breakfast in Orlando (**AI #3**). Invite TCs to explain changes to REF structure and to suggest TC liaisons to REF as non-voting members.

#### 4. World Refrigeration Day

It was moved (RR) and seconded (CH) that,

- (2) The Refrigeration Committee hereby recommends that ASHRAE officially recognize and promote June 26 as World Refrigeration Day to serve as a means of raising awareness and understanding of the important contribution that refrigeration, air conditioning and heat pumps make globally across many aspects of modern life and society.'

**MOTION 2 PASSED:** 9-0-0, CNV

Rajendran agreed to attend Sunday BOD meeting to read the resolution (**AI #4**).

Hunt noted a webinar on World Refrigeration Day is available at [www.unenvironment.org/ozonaction/resources/toolkits-manuals-and-guides/webinar-260619-world-refrigeration-day-refrigerants-life-how](http://www.unenvironment.org/ozonaction/resources/toolkits-manuals-and-guides/webinar-260619-world-refrigeration-day-refrigerants-life-how)

#### 5. Other

Dieryckx noted REF had been asked to participate in a new ASHRAE MTG.RAC Plant Assessment Guide. The proposed scope is shown in **Attachment C**. More detail and background is shown in **Attachment D**. Eltaloung explained this effort and the UNEP collaboration that led to this proposal.

It was moved (RR) and seconded (CH) that,

- (3) The Refrigeration Committee join the new MTG.RAC Plant Assessment Guide with Carlos Mitroga as voting member and Walid Chakroun as alternate.

**MOTION 3 PASSED:** 9-0-0 CNV

### **6. VICE-CHAIR'S REPORT – Rajendran**

#### A. Fiscal Report

Rajendran reported next year's REF budget was very similar to current year's budget. REF members were asked to imagine one or more new program ideas for SY 20-21 budget to discuss in fall and winter(**AI #5**).

#### B. MOP/ROB/Reference Manual

MOP changes will be discussed in Strategic Planning section of agenda.

### **7. BOD/TECH COUNCIL REPORTS**

#### A. BOD EX-Officio – Maston

Maston presented the Ex-O presentation (**Attachment E**). Highlights for REF include:

- Introduced Darryl Boyce as ASHRAE president for SY 19-20.
- Asked anyone rolling off REF to suggest to her which committees you may wish to participate on in the next society year. Visit [www.ashrae.org/committee-nominations](http://www.ashrae.org/committee-nominations).

- Highlighted new [www.ashrae.org/refrigeration](http://www.ashrae.org/refrigeration) website.

B. Coordinating Officer – Schwedler

Schwedler thanked REF members for their work and emphasized he wanted to make sure they work with BOD Ex-O and had whatever resources they need for success.

## **8. AWARDS**

A. Milt Garland & Comfort Cooling Awards

There were no submissions for the Milt Garland or Comfort Cooling Award received by the May 1<sup>st</sup> deadline so there would be no award made in Orlando. REF will work to recruit candidates for awards for next May.

B. Briley Award

Dieryckx, Hon, Eltalouny and Mitroga volunteered as judges for the Briley Award. Staff would send articles and scoresheet for judging (**AI #6**).

## **9. SUBCOMMITTEE REPORTS**

A. Refrigeration Education & Outreach Learning Institute (MBO #1)

No report was given. New education subcommittee members will review MBO.

B. Programs – Hwang

1. Approved Kansas City:

- There were no REF or REF sponsored programs for KC

2. Orlando discussion

Track 3 in Orlando is on Refrigeration and Refrigerants. The seminar deadline is August 2<sup>nd</sup>.

It was moved (YH) and seconded (DL),

- (4) that REF to approve a seminar program for ORL on the state of the art of refrigeration technologies with lower environmental impact

### **MOTION 4 PASSED: 9-0-0 CNV**

Kazachki agreed to lead program submission with Hwang to track (**AI #7**).

Rajendran suggested Hwang hold a Program Subcommittee web conference in late July to discuss program ideas for Orlando. Participants would be asked to bring 3-4 ideas for discussion (**AI #8**). Visitors expressing an interest in participating on call included Adnan Ayub and Shitong Zha. It was suggested that all past participants be invited if they wish to attend.

C. Position Document updates

1. *Refrigerants and their Responsible Use* PD

A task group within REF was asked to review the REF position documents and make a recommendation on their future. The task group agreed unanimously on two motions to be presented here.

It is moved (BM) and seconded (CH) that,

- (5) REF recommends that the DRSC recommends that Technology Council recommends to the BOD to initiate a revision to the *Refrigerants and their Responsible Use* position document (PD).

**BACKGROUND:** Significant upgrades to the *Refrigerants and their Responsible Use* document were done in the June 2018 revision. It discusses all main classes of refrigerants, including ammonia. A comprehensive ASHRAE Refrigerants PD Document including key elements from the *Ammonia as a Refrigerant* PD makes most sense. The *Refrigerants and their Responsible Use* PD expires in June 2021 and the *Ammonia as a Refrigerants* PD can stay in place until it retires in February 2020.

REF can recommend a chair and position document committee members in the future. It was suggested members from old ammonia PD be included on future committee.

The title, purpose and scope of the recently revised Refrigerants and their Responsible Use PD is shown in **Attachment F**

**MOTION 5 PASSED:** 9-0-0 CNV

2. *Ammonia as a Refrigerant* PD

It is moved (BM) and seconded (CH) that,

- (6) REF recommends that the DRSC recommends that Technology Council to retire the *Ammonia as a Refrigerant* position document (PD) when it expires in February 2020.

**BACKGROUND:** Key positions from the *Ammonia as a Refrigerant* PD will be incorporated into a revised comprehensive *Refrigerants and their Responsible Use* PD.

**MOTION 6 PASSED:** 9-0-0 CNV

D. UNEP/ASHRAE Partnership (MBO #3)

Eltalouny gave a presentation on the partnership (**Attachment G**). Highlights include:

- ASHRAE/UNEP portal - [www.ashrae.org/professional-development/ashrae-unep-portal](http://www.ashrae.org/professional-development/ashrae-unep-portal)
- Sponsored conferences in Jordan (Sept 2019) and Dubai (Sept 2019)
- UNEP e-learning courses now free to ASHRAE members
- Innovation award in January 2020, submissions due Aug. 15<sup>th</sup> 2019
- Free university course in Refrigerant Management for Future Engineers
- Detailed activities in support of World Refrigeration Day and theme of Refrigerants for Life
- Development of Sustainable Operations and Maintenance of Refrigeration and Air Conditioning Plants with ASHRAE MTG

## **10. OTHER REPORTS**

A. Chapter Technology Transfer Committee (CTTC) Liaison Report

Hon attended CTTC meetings in Kansas City and gave a presentation on behalf of REF. Time was short so Hon referred to **Attachment H** and invited questions and comments. Hon may need two or three other members to support and help prepare report to CTTC.

## B. Regulatory Issue Update

Amrane developed a presentation on regulatory issues (**Attachment I**). Time ran out, but the presentation would be included in the meeting minutes.

## C. Liaisons

### 1. International Institute of Refrigeration (IIR)

Colombo delivered IIR presentation on behalf of Didier Coulomb (**Attachment J**). Highlights include:

- Listed 4 IIR co-sponsored events in SY 18-19
- Upcoming events:
  - ICR 2019 - 25th IIR International Congress of Refrigeration, Aug. 24-30, 2019 in Montreal Canada
  - 6th IIR Conference on Sustainability and the Cold Chain (ICCC 2020), April 15-17, 2020 in Nantes France

### 2. UNEP

Eltalouny referred to earlier UNEP/ASHRAE partnership report

### 3. GCCA liaison report

Doug Scott noted his aim as GCCA liaison would be find activities that could be done with ASHRAE under current 12-year MOU.

### 4. IOR

Gill promoted Rankine 2020 in Glasgow July 26-29, 2020. Abstracts are due September 2019. More information at [www.rankine2020.com](http://www.rankine2020.com).

### 5. Other

Hwang promoted Thermag IX conference in College Park, Maryland June 7-11, 2020. Abstracts are due October 31, 2019. More information at [www.ashrae.org/conferences/ashrae-endorsed-conferences/thermag-ix](http://www.ashrae.org/conferences/ashrae-endorsed-conferences/thermag-ix).

## **11. STRATEGIC ISSUES**

### A. REF Strategic Planning

#### 1. R in ASHRAE

Hunt gave his summary of R in ASHRAE ad hoc report earlier. Rajendran proposed that REF take ownership of the new Refrigeration website and monitor and update content (**AI #9**). Suggestions included:

- Add comfort, dehumidification, etc. to new page.
- Update machine room picture on website now with newer technology
- Regional events not showing up on list of conferences that are linked to refrigeration
- List more TCs beyond 3.1

#### 2. Action Items 1,2,3 from Atlanta

##### 1. Name and scope change for REF

Rajendran distributed draft MOP changes before the committee. Changes include changes to the name of the committee, the responsibility and duties, membership and other changes.

It was moved (RR) and seconded (CH) that,

(7) REF recommend to OPS to make changes to REF MOP.

**BACKGROUND:** Changes are shown in **Attachment K**.

**MOTION 7 PASSED:** 9-0-0 CNV

Rajendran noted there'd be two subcommittees started this year, one on Comfort, another on Process Cold Chain. Members could include people from outside REF as well.

Staff was asked to poll for and set up a web meeting to review the newly approved MOP, adding the two new subcommittees and to make assignments (**AI #10**).

2. REF members from outside organizations (Gill)  
Changes to the REF MOP approved previously addressed adding non-voting members to REF from inside and outside of ASHRAE. Maston agreed to review changes and consider how members could be added to REF as non-voting members (**AI #11**).

REF would revisit MOP section A2.2 at Winter Meeting (add to agenda) to determine criteria for invited liaisons and make sure ASHRAE has MOU or agreement with these organizations (**AI #12**).

3. REF biannual 'state of the art of refrigeration report'  
Dieryckx and a subcommittee developed a draft report (**Attachment L**), intended to be done every two years, as a state of the art of refrigeration report. The report could include a state-of-the-art mapping what's being done in world with refrigeration technology, what's needed in ASHRAE Handbook and Standards, etc. Eltalouny suggested developing criteria for inclusion to show consistency.

Dieryckx asked for comments on his draft, not ready for approval at his time with a goal of approving in Orlando. Trent Hunt, Guru Ravi, Adnan Ayub, Georgi Kazachki, and Hon agreed to review (**AI #13**). Contributors from China, Europe, Asia, Saudi Arabia, etc. where new technology is created.

Dieryckx suggested results from report could be used to suggest new chapters to TCs or new topics REF can add on their own. Planning committee would discussed ideas to rewrite Refrigeration volume of the Handbook.

## **12. NEXT MEETING**

REF will next meet face to face at the ASHRAE Winter Meeting in Orlando, FL on Sunday, February 2020. Program subcommittee is planning on a web meeting in late July.

REF broke for a few minutes to celebrate World Refrigeration Day with a committee photo for the R in ASHRAE website.

## **13. HANDOVER TO NEW CHAIR**

Outgoing chair Dieryckx recognized outgoing member Barbara Minor and thanked her for her contributions to the committee.

Dieryckx welcomed incoming member Carlos Mitroga to the committee and introduced Rajan Rajendran as the incoming REF chair.

Rajendran noted he'd make subcommittee assignments before the Program Subcommittee meeting in late July. Also, he would develop and submit 2019-20 MBOs.

**14. ADJOURNMENT**

Committee adjourned at approximately 12:10 PM.

DRAFT





# ASHRAE 2019–2024 Strategic Plan At-A-Glance

## Development Process

This plan, developed by the ASHRAE Planning Committee in collaboration with the Board of Directors, will guide the work of the Society during the five-year period from 2019-2024. It was developed during 2018-2019 through a process initiated by a stakeholder engagement exercise involving members of ASHRAE and key industry organizations who gave their views on ASHRAE's position in the industry and its perceived strengths and challenges. With facilitation by the Planning Committee, the board then conducted a brainstorming session to develop preliminary objectives and initiatives. These included both outward-facing issues affecting the industry and society as well as inward-facing issues related to the needs of ASHRAE members and organizational efficiency. The final plan was drafted by the Planning Committee with board oversight following multiple reviews including review by Regional leadership teams. The final phase of development was preparation of implementation and tracking procedures, roll-out and implementation plans, and budget estimates. Communication of the new plan to Councils and committees began in Spring 2019 with formal implementation beginning in July 2019.



## Strategic Plan Outcomes

- Higher levels of member engagement, satisfaction and loyalty
- Increased operational efficiency and market responsiveness
- Demonstrated leadership in meeting societal needs through expanded research, application to practice and strategic partnerships
- Increased awareness of ASHRAE and use of its technical resources among priority stakeholders
- Increased global adaptation of ASHRAE Standards
- Increased breadth in ASHRAE's product offerings

## Core Values



## MISSION

To serve humanity by advancing the arts and sciences of heating, ventilation, air conditioning, refrigeration and their allied fields.

## VISION

A healthy and sustainable built environment for all.





# ASHRAE 2019–2024 Strategic Plan At-A-Glance

## Initiative Area: Built Environment Of The Future

### 1 RESILIENT BUILDINGS AND COMMUNITIES



The cycle of building development, design and construction is moving more rapidly than ever. Key stakeholders in the design and construction process face new challenges of responding to a range of environmental, market and consumer-driven pressures. Increasingly, it is being recognized that “smart” buildings and integrated systems are central to successfully addressing challenges posed by climate change, natural disasters, accidents, disease and terrorism. ASHRAE must stimulate innovation and exploration related to these challenges, and promote best practices that enable adaptability, resilience and recovery of buildings and communities.

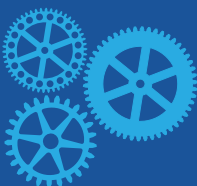
### 2 INDOOR ENVIRONMENTAL QUALITY



The indoor environment is increasingly recognized as the leading priority for built environment, with implications extending beyond simple acceptability of indoor conditions to its influence on productivity, learning and health. The indoor environment of the future identifies and optimizes interactions between air quality, thermal comfort, lighting and acoustics, based on a firm understanding of implications for occupants’ health and wellness. ASHRAE convenes and collaborates with experts and stakeholders across the industry to engage in discussion and exploration of this topic to accelerate collective knowledge in the field. This initiative aims to elevate ASHRAE’s role in facilitating this discussion, generating thought leadership and promoting understanding of indoor environmental quality (IEQ) among practitioners.

## Initiative Area: Future of ASHRAE

### 3 ORGANIZATIONAL STREAMLINING



ASHRAE is a large and complex organization with hundreds of technical standards and managerial committees, supported by a rich network of leaders and subject matter experts. ASHRAE will reach its potential for leadership and influence through an organizational structure that eliminates redundancy, has flexibility to adapt to regional differences, and allocates valued time and resources to the most impactful pursuits. This initiative intends to improve internal governance, volunteer, and staffing structures to ensure a strong connection across the societal organization and its chapters around the globe.

### 4 IMPROVE CHAPTER ENGAGEMENT, CAPACITY AND SUPPORT



ASHRAE must evaluate and develop methods to better engage chapters, regions and the members they serve in an integrated way. A more supportive and proactive strategy for chapter and regional oversight will minimize variability and ensure that all ASHRAE members experience a strong and valuable connection to the local and societal components.

## GOAL 1 Position ASHRAE as an Essential Knowledge Resource for a Sustainable, High-Performance Built Environment

OBJECTIVES	INITIATIVES
a. Utilize a holistic approach to ASHRAE's offerings and activities to drive positive economic, environmental and social impact through innovation in building design and operations	
b. Expand capabilities globally to create, aggregate and disseminate essential information and knowledge focusing on emerging market trends and transformative approaches	

## GOAL 2 Maximize Member Value and Engagement

OBJECTIVES	INITIATIVES
a. Infuse enthusiasm, vitality and diversity throughout ASHRAE events and services	
b. Expand the impact of collaboration and partnerships with industry organizations, universities and government agencies	
c. Leverage technology to increase member engagement, awareness and value	

## GOAL 3 Optimize ASHRAE's organizational structure to maximize performance

OBJECTIVES	INITIATIVES
a. Prototype and launch new approaches that will increase ASHRAE's relevance and speed to market for key offerings	
b. Optimize ASHRAE's organizational systems and structures to increase capacity, efficiency and effectiveness	
c. Cultivate industry and member philanthropy to extend ASHRAE's impact and reach	

#### KEY



Resilient Buildings And Communities



Indoor Environmental Quality



Organizational Streamlining



Improve Chapter Engagement, Capacity and Support

**CTTC REF Report**  
**ASHRAE Annual Conference Kansas City 2019**

**June 21, 2019**

**ASHRAE Refrigeration Committee (REF)**

**Liaison Report to  
Chapter Technology Transfer Committee  
2019 Annual Meetings, Kansas City Missouri**

**Refrigeration Liaison: Charlie Hon**  
**chon@truemfg.com**

## **Regulatory Activities on Refrigerants - EPA**

**The EPA is proposing**

- **to remove Sales Restrictions,**
- **Technician Certification**
  - **Leak Restrictions**  
**of HFCs**

# **CTTC REF Report**

## **ASHRAE Annual Conference Kansas City 2019**

**California has moved forward with the same regulations (SNAP Rules 20 and 21) as those struck down by the US Supreme Court with almost no changes, except final dates.**

# **CTTC REF Report**

## **ASHRAE Annual Conference Kansas City 2019**

### **A consortium of States have formed the “United States Climate Alliance”**

**(The “Alliance” now includes 24 States and more than 55% of  
the US population)**

**(At the last meeting, in January, there were 16 states.)**

**NEW YORK, WASHINGTON, Maryland,  
Connecticut, Oregon, New Mexico and  
Colorado are considering the same actions as  
California**

## **Regulatory Activities on Refrigerants International**

**IEC 60335-2-40 Air Conditioning WG 16 is working toward increased charge sizes for Flammable Refrigerants**

**CANENA WG 10 is working on increased charge sizes for AC equipment**

**IEC 60335-2-89 Refrigeration Equipment was approved (development of a CANENA working group has begun)**

# **CTTC REF Report**

## **ASHRAE Annual Conference Kansas City 2019**

### **Refrigeration Committee**

**REF Webpage: [www.ashrae.org/refrigeration](http://www.ashrae.org/refrigeration)**

**Recent Meeting Minutes**

**Manual of Procedures, Rules of the Board, REF Reference Manual**

**Members First! Newsletters**

**Meeting Sunday June 23, at 8:00 am – 12:00 pm**

**Refrigeration Committee is reviewing possible changes in title, scope and direction. Proposals will be review at the Sunday meeting and sent to the Tech Council and then to the Board for approval.**



## **CTTC REF Report**

### **ASHRAE Annual Conference Kansas City 2019**

**IIF-IIR is hosting the International Congress of Refrigeration meeting in Montreal August 24-30, 2019**

[\*\*http://www.irc2019.org\*\*](http://www.irc2019.org)

**IIFIIR-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](http://www.iifiir.org/medias/medias.aspx?INSTANCE=exploitation&PORTAL_ID=portal_model_instance_News_dossiers_thematiques_en.xml&SYNCMENU=DOSSIER_THEMATIQUE&SETLANGUAGE=EN)

# **CTTC REF Report**

## **ASHRAE Annual Conference Kansas City 2019**

### **IIR-UN Cold Chain Technology Briefs**

#### **Food Production and Processing**

[http://www.iifiir.org/userfiles/file/webfiles/in-depth\\_files/Brief\\_RefrigerationFoodProductionProcessingBD.pdf](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](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](http://www.unep.fr/ozonaction/information/mmcfiles/7940-e-Commercial_professional_and_domestic_refr.pdf)

# **CTTC REF Report**

## **ASHRAE Annual Conference Kansas City 2019**

### **UN Cold Chain Technology Briefs (Continued)**

#### **Transport Refrigeration**

[http://www.iifiir.org/userfiles/file/webfiles/in-depth\\_files/Brief\\_TransportRefrigerationBD.pdf](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](http://www.iifiir.org/userfiles/file/webfiles/in-depth_files/Brief_FishingVesselApplicationBD.pdf)

# **CTTC REF Report**

## **ASHRAE Annual Conference Kansas City 2019**

**There are many new ideas and products in HVAC&R being developed outside of the North American market. The Refrigeration Committee plans start introducing these ideas and products so that the regional committees are made aware of innovations.**

### **Topics to be considered will include:**

- **Refrigerants not presently approved for particular applications by SNAP**
- **New Applications for “Natural Refrigerants”**
- **New Technologies being reviewed outside of the North American Market**
- **Special applications in adverse environments**

# **CTTC REF Report**

## **ASHRAE Annual Conference Kansas City 2019**

- **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**

# **CTTC REF Report**

## **ASHRAE Annual Conference Kansas City 2019**

- **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**

# **CTTC REF Report**

## **ASHRAE Annual Conference Kansas City 2019**

- **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**

# **CTTC REF Report**

## **ASHRAE Annual Conference Kansas City 2019**

- **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**



# **CTTC REF Report**

## **ASHRAE Annual Conference Kansas City 2019**

- **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**

**CTTC REF Report**  
**ASHRAE Annual Conference Kansas City 2019**

**THANK YOU**

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

## 2014 Strategic Plan

### GOALS AND OBJECTIVES: THE STRATEGIC DIRECTION

ASHRAE's four strategic goals—connect, educate, extend, and adapt—serve as broad si  
years. The goals are supported, in each case, by a handful of objectives that further de  
guidance for implementing programs of work and testing and responding to various find  
value proposition” will be an ongoing series of experiments and investments t

Goals	
<b>GOAL - CONNECT</b> and engaged ASHRAE and industry communities.	<b>Foster vibrant, informed</b>
<b>GOAL - EDUCATE</b> that enhance the knowledge and effectiveness of individuals who apply building sciences.	<b>Create learning experiences</b>
<b>GOAL - EXTEND</b> methods to increase awareness, adoption and application of ASHRAE's offerings.	<b>Develop, refine and optimize</b>

**GOAL - ADAPT**

the global community to increase the value, usefulness and accessibility of building sciences and technology.

Work collaboratively within

tatements of what the organization most wants and expects to accomplish over the next several  
 efine specific accomplishments to pursue within the plan horizon. Each objective should provide  
 lings. For example, ASHRAE’s work to “assess and implement methods to strengthen the member  
 hat support the broader goal of a vibrant, informed, and engaged member community.

Objectives
Objective A Develop, implement, and assess methods to strengthen the member value proposition.
Objective B Maximize opportunities for member involvement in Society activities.
Objective A Prototype and experiment with new resources that integrate ASHRAE’s science and technology into building performance and knowledge systems.
Objective B Develop programming and promotions that enable ASHRAE chapters to educate a wider range of audiences.
Objective C Expand educational topics and enhance delivery methods to address the needs of priority audiences, including employers, owners, and operators.
Objective A Augment ASHRAE’s marketing and promotional capabilities to drive higher levels of awareness and uptake of offerings.
Objective B Foster collaborations throughout the building industry to augment the positive impact of ASHRAE’s offerings on building performance.
Objective A Identify and launch pilot programs in select international markets to adapt offerings to address local demand.

Objective B

Work to translate science and technology into practical tools and resources that drive effective building design, operations, and management.

Objective C

Work to translate science and technology into practical tools and resources that drive effective building design, operations, and management.

**Refrigeration Committee**  
**Martin Dieryckx, Chair**  
**Date: 1/13/2019**

Item #	MBO	Status	Date Due	Assigned To	Applicable Strategy #	MBO Comments
<b>Included in Definition of Roles</b>						
1	Develop and Expand Refrigeration Education & Outreach	OPEN	Jan 2019	Chakroun, Hon, Welter	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
2	Support of ASHRAE Developing Economy Objectives	OPEN	June 2019	Minor, Hwang, 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
3	Implementation of UNEP Partnership Goals	OPEN	June 2019	Eltalouny, Coulomb	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
4	ASHRAE policy commentary on REF related issues	OPEN	Jan 2019	Walter, Rajendran, Hon, chair		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
5	Effective communication and operation of the REF Committee	OPEN	June 2019	Gill, Lilya, Chair, Vice chair	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

<b>UPDATE</b>
<p>Awards will be publicized in Insights, on website. Briley award presented in ATL</p> <p>UNEP courses on refrigerants will be made available to ASHRAE members shortly.</p> <p>Refrigerants PD was revised and published.</p> <p>REF sponsored program in ATL, several planned for KC</p>
<p>UNEP work plan with ASHRAE updated for 2019. Others ongoing.</p>
<p>Joint ASHRAE, UNEP, IIR conference on sustainable management of refrigeration technologies in mobile marine and fisheries (Bangkok 2017).</p> <p>Linked to MBO#2 deliverables</p> <p>Refrigerants awareness package</p> <p>low GWP program</p>
<p>REF participated in UN RTOC comment period on behalf of ASHRAE. REF members and related TCs were asked for comment. REF will discuss next review effort when need arises</p>
<p>REF established subcommittee structure to help coordinate liaison activities and assignments.</p> <p>Liaisons with IIR, IIR, GCCA, UNEP assigned.</p> <p>Liaising with ASHRAE TCs, SSPCs as well.</p> <p>Make changes to better promote the scope and activity of the T-REF within the society.</p>



The technical report about “state of the art technology in refrigeration”

**Purpose:**

To prepare a report that clarifies the state of the art technologies used in the different parts of the world and where possible to describe the main driving forces for this technology. It will not describe the research stage products or not in kind technologies. It will describe technologies that are standard used or that are developing fast. The technologies shall be proven to be commercial sustainable for a wider range of products. Demonstration projects or products are not classified as “state of the art” commercial sustainable.

This report will then be used to inform the society and to update the refrigeration handbook where needed. Both the report and the handbook updates will have the effect to use ASHRAE as reference for all engineers and business people.

**Background:**

Today the knowledge about “state of the art” technologies is scattered and not consolidated. As a consequence there is a doubt that the ASHRAE members are aware about technologies in other parts of the world. There is also a lack of confidence that the handbook is up to date.

**Expected effect:**

Once we can establish the report and the handbook, the international membership may get higher interest in the ‘R’ activities of ASHRAE and the updated handbook may get larger international attention. The report may be referenced in other studies and as such it will increase the visibility of ASHRAE. This will also improve the knowledge of engineers and the drive to use latest technologies. This will lead to a global improvement of the sustainability of the ‘R’ , mainly related to energy efficiency, environmental impact and material resource efficiency.

**Consequences:**

In order to achieve a good report the REF committee will need to strengthen the link with the relevant TC’s as well as with international membership. We may need to require at least one member from the USA and one member from other areas in the world for each subgroup, being cold chain and comfort. The report preparation should be the responsibility of a subcommittee. We need to check if input can be retrieved via the TC’s.

For the moment it is too early to evaluate the cost impact for making this report. Research of the state of the art technologies and editing costs may be needed.

**Format and structure of the report:**

The report should be as much as possible contain visualised overviews rather than text.

The report should be split up in 3 main groups , cold chain, comfort and process. Hybrid systems shall be described in each of the groups depending on the primary function of the technology. Within cold chain subgroups may be made such as commercial refrigeration , industrial refrigeration,

.... Within the comfort group also subgroups can be made such as air conditioners ,chillers, water heating.

The aim is to describe the used technologies for the main components in a first section of each main group. Components such as refrigerants, compressors and oils, heat-exchangers, expansion devices, ejectors, expanders, refrigerant circuit controls, oil return technologies are included. Also technologies that are related to the refrigerant circuit efficiency such as pumps, fans, etc.. can be included.

In a second section the combination of the technologies and the driving factors to use these technologies are described.

## MTG PROPOSAL FORM

Return Form to:  
Manager of Research & Technical Services  
ASHRAE  
1791 Tullie Circle, NE  
Atlanta, Georgia 30329-2305  
☎ 404-636-8400 • Fax 404-321-5478  
E-mail: techserv@ashrae.org

**Date:**

10 April 2019

\* Turn in no later than 3 weeks prior to the meeting for consideration by TAC

**MTG Name:**

RAC Plant Assessment Guide

**MTG Scope:**

The MTG will coordinate and oversee the creation of an ASHRAE/UNEP Guide for Refrigeration and Air-Conditioning (RAC) Plant Assessments. The Guide aims to be an international reference for the safe and sustainable operation and maintenance of air-conditioning and refrigeration plants, with special focus on developing markets. The Guide is to form the basis of tools that will verify compliance to recommended practices that can be verified through a point-based qualification or verification scheme. The work will be a cooperative effort with United Nations Environment due to the critical need for such guidance in the developing world with availability of UNEP funding to offset authoring expenses.

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<sup>1</sup>Please see page 2 for an example of a MTG scope.

**Impact on TC/TG/TRGs and Other MTGs:**

The work of this MTG will be to oversee the compiling best practices related to the following areas for 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. Checklists for maintaining equipment to extend life and ensure energy efficient operation
4. Fault detection and preventative maintenance (PM)
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 for operating and/or maintaining the refrigeration and air-conditioning plants.

A number of ASHRAE TCs possess the key knowledge required to be included in such documentation.

Phase I of this effort is already completed. Through the appointment of an ASHRAE Presidential Ad Hoc Committee, a comprehensive specification was developed that categorized the RAC plants to be addressed in this guide. Their work also developed a comprehensive outline of what the content of the Guide should be, addressing each of the operational areas identified above.

Included in the assessment of Phase I was the identification of the ASHRAE, UNEP, and other outside resources and experts needed to complete the development of the guide; a work-breakdown structure (WBS)/schedule for the overall project; and lastly, the business cases for adoption by the end user and by ASHRAE. Phase I was completed in June 2018 and submitted to and approved by the ASHRAE Board of Directors.

Phase II, which this MTG will oversee, is the development of Technical Modules with Resulting Checklists and Procedures. A small authoring team will be selected by ASHRAE and UNEP based on their knowledge of RAC plant operation best practices and authoring ability. The authors' work will be based on the recommendations found in the resources, both of ASHRAE and UNEP, contained in the specification. The goal is to draw heavily from previously developed material contained in the ASHRAE Handbooks, Standards, Guidelines and application guides. However, it is very likely that new material will need to be developed.

The function of the MTG will be to oversee the authoring work, providing review and comment of the technical content as specified for the guide and the technical basis for the planned verification tools.

Technical expertise will be drawn from the following ASHRAE committees:

- T.C. 2.8      Building Environmental Impacts and Sustainability
- T.C. 3.2      Refrigeration System Chemistry
- T.C. 3.6      Water Treatment
- T.C. 3.8      Containment
- T.C. 6.1      Hydronic and Steam Equipment and Systems
- T.C. 7.3      Operation and Maintenance Management

T.C. 7.7	Testing and Balancing
T.C. 7.8	Owning and Operating Costs.
T.C. 8.6	Cooling Towers and Evaporative Condensers
T.C. 8.7	Variable Refrigerant Flow (VRF)
T.C. 8.8	Refrigerant Controls and Accessories
T.C. 9.1	Large Building Systems
T.C. 9.2	Industrial Air Conditioning
T.C. 10.3	Refrigerant Piping

The Refrigeration Committee - Specifically the PMS for RP 1634: Guide for Sustainable Refrigerated Facilities and Refrigeration Systems.

The establishment of a MTG is the most efficient method to monitor progress of the authoring committee. Selection of the Chair of the MTG must be someone with both good project management abilities and strong interpersonal skills.

#### ***MTG Roster:***

Requirements below apply to MTG Rosters Only:

- \* Only one person from each TC/TG/TRG or non-TC group participating in MTG may serve as voting member.
- \* The Chairs or leaders of participating TC/TG/TRG s or non-TC groups will designate the MTG member to represent their group with a vote on the MTG.
- \* Alternate Members are nominated by the MTG Chair, and there are no restrictions on the number or affiliations of nominees
- \* Alternate Members are expected to participate in MTG activities and attend meetings when possible.
- \* An Alternate Member normally has no right to vote at the MTG level, but can vote at the MTG subcommittee level
- \* An Alternate Member may be given proxy authority, however, by a MTG voting member to vote in his or her absence so that groups participating in the MTG are always represented in a MTG vote.
- \* Chair & Vice Chair are not required to be ASHRAE members, but it is preferred.

	<i>Position</i>	<i>Person's Name:</i>	<i>TC/TG/TRG or Non-TC Group Affiliation</i>	<i>ASHRAE Member #</i>
1	<b>Chair:</b>			
2	<b>Vice-Chair:</b>			
3	<b>Voting Member:</b>			
4				
5				
6	<b>Alternate Member:</b>			
7				
8				
9				
10				

**T A C   U S E   O N L Y :**

Date Received: \_\_\_\_\_ Date Sent to TAC/FP: \_\_\_\_\_ Meeting Date: \_\_\_\_\_ Approved?    Yes    No

## **Stage I Report: ASHRAE-UNEP Assessment Guide for Sustainable Operations and Maintenance of Refrigeration and Air Conditioning Plants**

### **I. Background:**

At the ASHRAE 2017 Winter Conference, the UN Environment Programme (UNEP) and ASHRAE launched their Biennium Joint Work Plan of 2017-2018 which is titled “Working beyond High-GWP Refrigerants.” One of the main elements of the new work plan is to develop an assessment program for the sustainable operation and maintenance of refrigeration and air-conditioning plants.

There are several programs, around the globe, for certifying field technicians, many of which are focusing on refrigerant management. UNEP and AHRI currently have a joint initiative to develop a globally recognized and accepted qualification program that sets minimum requirements for management of refrigerants through the supply chain network and its relevant operations. This program is known as the Refrigerant Driving License (RDL). The RDL intends to offer a globally accepted qualification which will be an industry driven program for the management of refrigerants. Although the RDL doesn’t intend to overrule any existing relevant governmental certification scheme, it can offer a structured framework for developing countries without such a certification program.

The value of such programs is critical as low-GWP alternatives become available to the market. Many of these solutions have flammability concerns and compliance with safe-handling practices are necessary to eliminate risks to humans and to property. Environmental regulations are also mandating increased tracking and reporting of refrigerant inventory and leakage in systems.

The value of RDL cannot be understated but it is important to understand its limitations. It is focused on the practices of the service technician. In many situations, a gap exists in the knowledge of how to operate and maintain refrigeration and air-conditioning plants/systems, especially medium and large scale ones, in a sustainable, efficient and safe manner.

The project to create ASHRAE/UNEP Guide for Refrigeration and Air-Conditioning (RAC) Assessment aims to develop an international reference for the safe and sustainable operation and maintenance of air-conditioning and refrigeration plants, with special focus on developing markets, and that compliance to these practices can be verified through a point-based qualification or verification scheme.

### **II. Overview of the Project:**

This ambitious project would entail the compilation of best practices related to the following areas for 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. Checklists for maintaining equipment to extend life and ensure energy efficient operation
4. Fault detection and preventative maintenance (PM)

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 for operating and/or maintaining the refrigeration and air-conditioning plants

As with any UNEP project, the resulting guide will be provided free-of-charge to the intended users. Two important business cases need to be developed in order to ensure the success of such an offering. The first is to develop the content of the guide in such a way that end users will see a positive economic case in implementing the recommendations within it. The second business case that needs to be made is that ASHRAE must be able to develop revenue streams that exceed ASHRAE's Contribution to the costs to develop and maintain the guide.

### **III. Work Plan:**

The work is to be completed in 4 separate stages with formal approval "gates" at the end of each stage.

- Stage I: Specification and Business Case Development
- Stage II: Development of technical modules with resulting checklists and procedures
- Stage III: Formal review and pilot of the guide in practice.
- Stage IV: Launch and outreach

#### **Stage I: Specification and Business Case Development**

The result of this stage of the work is the subject of this report. The goals of this stage were to develop a comprehensive specification that will include: categorizing the RAC plants that will be addressed in this guide then developing a comprehensive outline of its content, identification of the ASHRAE, UNEP, and other outside resources and experts needed to complete the development of the guide, a work-breakdown structure (WBS)/schedule for the overall project, and, lastly to develop the business cases for adoption by the end user and by ASHRAE.

#### **Stage II: Development of Technical Modules with Resulting Checklists and Procedures**

Based on the recommendations for the resources contained in the specification, Stage II will be the organized development of the technical content as specified for the guide and any other materials needed for its marketing and distribution. Technical expertise will be drawn from the following ASHRAE committees:

- T.C. 2.8 Building Environmental Impacts and Sustainability
- T.C. 3.2 Refrigeration System Chemistry
- T.C. 3.6 Water Treatment
- T.C. 3.8 Containment
- T.C. 6.1 Hydronic and Steam Equipment and Systems
- T.C. 7.3 Operation and Maintenance Management
- T.C. 7.7 Testing and Balancing
- T.C. 7.8 Owning and Operating Costs.
- T.C. 8.6 Cooling Towers and Evaporative Condensers



- T.C. 8.7 Variable Refrigerant Flow (VRF)
- T.C. 8.8 Refrigerant Controls and Accessories
- T.C. 9.1 Large Building Systems
- T.C. 9.2 Industrial Air Conditioning
- T.C. 10.3 Refrigerant Piping

The Refrigeration Committee - Specifically the PMS for **RP 1634: *Guide for Sustainable Refrigerated Facilities and Refrigeration Systems.***

The establishment of a Multidisciplinary Task Group (MTG) within the Technical Activities Committee (TAC) structure may be the most efficient method to monitor progress with the selected contractor. Selection of the Chair of the MTG must be someone with both good project management abilities and strong interpersonal skills. The goal is to draw heavily from previously developed material contained in the ASHRAE Handbooks, Standards, Guidelines and application guides. However, it is very likely that new material will need to be developed. This will likely be the longest stage of the project. At the end of this stage the MTG should vote to submit the guide content to be formally reviewed (Stage III).

#### **Stage III: Formal Review and Pilot of the Project.**

In this stage, the developed guide will be reviewed by an independent committee representing the targeted users and technical experts who were not involved in its development. Any concerns or comments will be provided to the Stage II team with a detailed explanation of concerns or suggestions for improvement.

Once the content passes the formal review process, the guide should be piloted at 2 or more locations for a duration of at least 6 months. Installations that have year round loads would be preferred to ensure the maximum amount of run hours under various load conditions. Locations for the pilots should be identified during Stage II. Sites that have a variation of climate zones or levels of humidity should be considered to make sure a variety of conditions and situations are encountered to serve as benchmark applications.

During the pilot period, a Voice of the Customer (VOC) exercise should be conducted by ASHRAE Publishing and Education Department to gather input from potential users, government officials, service providers, and equipment manufacturers in order to provide data for the final stage of the project, Stage IV.

#### **Stage IV: Launch and Outreach**

Based on the original user business case developed in Stage I and the VOC data gathered in Stage III, a targeted marketing campaign should be created by ASHRAE with the cooperation and support of UNEP. The purpose would be to accelerate the voluntary adoption as well as market the guide to government code officials in the hope that compliance with it be made mandatory. Seminars providing an overview of the benefits of this guide could be provided within certain regions by local ASHRAE chapter members or through a web-based interface. Training for facility managers, operating engineers, and service technicians on the details and benefits of the guide should be developed. UNEP may also want to hold regional seminars to promote the guide to Ozone officers and Environmental officials from targeted countries. Lastly, the ASHRAE

Publications Committee should review and package materials that can be sold to support the implementation of the guide in various regions.

#### IV. Formal Specification

##### A. HVAC&R System Classification and Equipment included in this guide:

###### 1. Indirect Systems

Indirect systems cool a secondary fluid, such as a building chilled water loop, or in an industrial application, a process cooling loop. These centralized systems typically use air-cooled or water-cooled chillers, but could use heat recovery chillers, heat pumps, absorption chillers, or other types of equipment. The applications covered are:

- Both heat pump as well as dedicated cooling installations (follow Chapter 3 of Systems & Equipment Handbook – Central Cooling and Heating Plants)
- Commercial/Industrial systems covered would include centralized chilled water systems (including secondary fluids), large scale process chillers, heat pumps (chillers and split systems), and absorption chiller applications.
- Commercial Refrigeration plants (distributed refrigeration plants - excluding Supermarket systems).

###### 2. Direct Systems

Systems that are in direct contact with the conditioned space. These systems are typically used for smaller commercial applications or multi-residential buildings. This equipment includes split systems (AC and Heat Pump), VRF systems, packaged rooftop units, PTACs, etc. The applications covered are:

- Multi-unit Residential and Light Commercial systems (packaged roof-top systems and commercial split systems).
- **Not covered-** single unit residential splits, mini-splits, through-the-window AC units, spot coolers, supermarket distributed systems, and direct fired boilers.

###### 3. VRF Systems

Multiple-Zone VRF systems are to be considered a special case of Direct Systems because the routine maintenance procedures are limited and similar to other direct systems. However these systems themselves are very complex. VRF systems will follow procedures for annual and preventative maintenance as that are similar to other direct systems. VRF designs work within the refrigeration side as an integrated package and are not readily available for remote exterior monitoring for performance.

*Recommendation to the Stage II committee is to reach out to ASHRAE TC 8.7 for information for Preventative Maintenance (PM) management and energy performance methodology.*

##### B. Dimensions of Practice

1. Safe Storage and proper handling of refrigerants (and secondary fluids like glycol, etc.)

Mindset: Refrigerant is an asset and not a consumable.

Covered Topics:

- Storage quantity limits
- Separate storage for oxygen, nitrogen & acetylene tanks if within same mechanical room.
- To minimize environmental impact, protect worker safety and insure efficient operation of equipment, it is critical to handle refrigerants and secondary fluids properly. The guide should provide detailed information about:
  - Refrigerant/Secondary Fluid storage – storage location including protection from weather, storage temperature limits, inspecting containers, safety devices on containers (e.g. pressure relief), define storage differences between ASHRAE Standard 34 safety classes (A1, A2L, A3, B1, etc.)
    - Store refrigerant drums/cylinders out of direct sunlight and away from heat sources.
    - Store refrigerant inventory in a monitored/alarmed space with leak detector and emergency ventilation.
    - Inspect cylinders and drums at delivery; verify/log weight of product received.
    - Store refrigerant in a secure location.
    - Use of telltale rupture disk assembly under relief valves.
    - Regular check on holding pressure
    - Store upright in original container
    - Secure containers
    - Store in well ventilated area
    - Store below 50°C, <80% filled or (60% if T >50°C).
    - Use protective cap on cylinders
    - ID refrigerant that has been used and recovered for future use
    - Secure chained area for cylinder storage within Plant
  - Refrigerant/Secondary Fluid handling – Personal Protective Equipment (PPE) when handling containers, safely moving containers, filling/charging procedures.
  - Mechanical Equipment Room (MER) storage area for Refrigerant transfer Equipment, cylinder storage, maintenance tools & materials.
- Machinery rooms are required to have a leak detection system activated to alarm based on refrigerant toxicity or flammability.
- Mechanical Room ventilation is functional, (see Appendix 2), to insure adequate air exchange.

Reference Documents:

- ANSI/ASHRAE 15-2016 has Section 8 on leak detection and ventilation of machine rooms and Section 11 on storage and handling of refrigerants
- ANSI/ASHRAE 34-2016 has lists of refrigerants and their safety classification

- ASHRAE Guideline 6-2015 has additional information on refrigerant properties and definitions of terms associated with refrigerants
- Material Safety Data Sheets (MSDS's) provide information on shipping, storage and handling of specific refrigerants/SFs
- Refer to ASHRAE Standards 34 and 15, ISO 817 and 5149, EN 378
- Above list not exclusive to all possible references on this topic.

Measures of Success:

- Success is defined as no environmental incidents, safety incidents or refrigerant leakage during storage and handling of refrigerants/Secondary Fluids

2. Periodic leak checking and proper documentation (include record keeping, documentation of repairs, compliance with local reporting requirements, etc.)

Mindset: No Leak is acceptable - the goal should be zero.

Covered Topics:

It is very important to monitor HVAC&R systems for leaks, preferably on a preventative basis, so leaks are discovered and repaired before significant leakage or performance reduction occurs. Prevention of leaks has environmental, safety and performance benefits. Therefore, the guide should include recommendations such as:

- How often to check for leaks as part of a preventative maintenance program and repair leaks immediately
- Document leak location and repair information and closely monitor refrigerant/secondary fluid usage
- Understand and follow regulatory leak reporting requirements
- Install permanent, continuous leak sensor systems in machine rooms and other locations for early detection
- Minimize leakage during fluid transfer when installing, servicing or decommissioning equipment. Never intentionally vent refrigerant.
- Understand and implement additional leak detection protocols for flammable and/or toxic refrigerants
- Above list not exclusive to all possible references on this topic.

Informational References or Useful Resources Documents:

- US EPA Section 608 of the Clean Air Act – has specific requirements for leak prevention and reporting for CFCs, HCFCs and HFCs.
- ANSI/ASHRAE 15-2016 - has section on leak detection and ventilation of machine rooms
- ASHRAE Standard 147 - identifies common sources of leaks and leak paths in equipment

Measures of Success:

- Success is having systems which are well maintained by proactively checking for, repairing and documenting leaks, driving toward zero leak systems. Target leak rates for various types of equip. will be identified.

### 3. Maintenance practices to extend equipment life and maintain performance

Mind Set: Proactive vs. Reactive

Covered Topics for all Equipment Types (Centralized, Direct, and VRF):

- Monitor level of System Fluids-Oils, refrigerants, and secondary fluids.
- Performance monitoring and system benchmarking before and after maintenance operations.
- Checklist of routine equipment maintenance tasks (examples of items):
  - Cleaning of Condenser and Evaporator Surfaces (coils)
  - Visual inspection of piping and connections for leaks and wear.
  - Monitor/Replace filter-drier cores to keep refrigerant dry.
  - Benchmark compressor/motor vibration signature and trend condition over time.
  - Conduct a thorough evacuation and dehydration of the equipment after maintenance per Original Equipment Manufacturer (OEM) recommendations prior to charging with refrigerant.
- Checklists for Annual/Semi Annual Equipment PM Inspections and Maintenance tasks (examples of items):
  - Eddy current test chiller tubes for evaporator and condenser heat exchangers.
  - Leak test air-cooled condenser and evaporator coils using soap-bubble test or electronic detection device.
  - Meg Ohm test motors annually during annual maintenance, record for historical reference trending.
  - Water cooled condensers-pull condenser strainer annually or as required based upon operation logs of strainer pressure-drop or system performance.
  - Preventative maintenance practices for condenser and chilled water pumps (chillers).
  - Perform pump and tower fan preventative maintenance. Follow OEM guidelines for greasing motor and bearings as required (open drive systems).
  - Test refrigerant charge and oil for acid and water concentration.
  - Replace lubricating oils per OEM recommendation (where applicable).
- Checklists for Electric Infrastructure PM Practices (examples of items):
  - Electric Switchgear annual testing, thermal imaging of equipment for heat points including buss bars, power contacts, contactors.
  - Verify annually Building Automation (BAS) controls operation for starting/shutdown for plant equipment.

- Check calibration of temperature and pressure probes and adjust accordingly.
- Checklists for Pneumatic control PM and Operation & Maintenance (O&M) (examples of items):
  - Insure refrigerant air-drier is functional with annual condenser coil cleaning.
  - Change oil, filter as noted in manufacturer O&M.

Reference Documents:

- ISO 5149-4 2014, Refrigerating systems and heat pumps — Safety and environmental requirements — Part 4: Operation, maintenance, repair and recovery.
- OEM Service and Maintenance Manuals.

Measures of Success:

- Increase equipment uptime
- Maintained Energy Efficiency
- Elimination of unplanned outages
- Overall O&M cost reductions
- Reduction in refrigerant loss
- A comprehensive log of system performance, refrigerant loss, maintenance operations, etc., over time.

4. Energy Efficient Operation

Mind Set: An efficient plant is an economical and sustainable plant.

Covered Topics:

- Dash Boarding: Continuous monitoring/trending of evaporator/condenser pressures; heat exchanger approach temperatures, etc. versus design operating envelope. Monitor unit energy performance and operate most efficient machines to satisfy load.
- Verification of Plant Efficiency compared to Plant baseline (or 1<sup>st</sup> time measurement) to include:
  - Plant power including any auxiliary starters, drives, pumps, and fans, where applicable.
  - Total cooling delivered in BTUH via measurement of evaporator inlet and exit temperatures and flow. Method of measurement will depend on equipment type.
  - Measurement verification total energy (power in Watts/BTUH = Kilowatts/BUTH
  - Measurement protocols can be incorporated into Building Automation Systems (BAS) where possible.
- Regular Operational logs shall measure & document Equipment Performance Measuring:

- Operation:
  - Chillers: CHWST & CHWRT, including CHW pressure Drop across heat exchanger (or Flow if CHW flow meter installed) , CWST/CWRT, including CW pressure Drop across heat exchanger (or Flow if CW flow meter installed) / Evaporator & Condenser Refrigerant Pressures/ Evaporator liquid temperature/ Condensed Liquid temperature/ Oil Pressure/ Discharge Temperature
  - DX and VRF Systems: Suction and discharge temperature and pressure, subcooling, superheat, indoor air flow.
- Electrical Operation: Ampacity and/or Capacity/ Frequency/ Voltage, compressor power.
- Pumps (chilled water systems):
  - Inlet/Outlet Pressures & Pressure drop across strainer
  - Amps/volts/frequency (if VFD used)
- Tower Fan(s) (chilled water systems):
  - Amps/Volts/Frequency (if VFD used)

Referenced Documents:

- RP 1634 (Guide for Sustainable Refrigerated Facilities and Refrigeration Systems)
- ASHRAE Guideline 22 (Instrumentation for Monitoring Central Chilled-Water Plant Efficiency)

Measures of Success:

- Minimizing total Energy Use: Btu/hr or Btu/year
- Minimizing Operation Costs: Energy, water, maintenance, etc.

5. Commissioning, Recommissioning, Retro-commissioning, Specification.

Mindset: If you are not measuring, you are only practicing.

Covered Topics:

- Commercial and industrial facilities are dynamic; load changes, performance degradation, end-user demands or changes all create a need to periodically re-evaluate system performance and make adjustments. The sustainable operation and maintenance (O&M) of refrigeration and air-conditioning installations requires an intimate knowledge of equipment together with a firm understanding of the facility demand on those installations. Hence, commissioning is an integral and essential component for sustainable O&M throughout the life-cycle of the equipment.
- Commissioning is the process of ensuring that systems are designed, installed, functionally tested, and capable of being operated and maintained to perform in conformity with the design intent. It begins with planning and includes design, construction, start-up, acceptance and training, and can be applied throughout the life of the equipment.
- Recommissioning is the process of periodically repeating commissioning activities as needed when end-user demands change (e.g., facility additions, technology

improvements) or after significant time has passed. Recommissioning identifies opportunities to correct equipment and/or system deficiencies.

- Retro-commissioning is the application of the commissioning process to existing equipment and facilities which had not been formally commissioned with the goal of improving how equipment and systems work together. This may help resolve problems due to oversights or omissions made during the original design and/or construction of the building or problems that have developed during the life of the equipment. Retro-commissioning improves building O&M procedures to enhance overall equipment and systems performance.

This section shall provide a fundamental understanding (awareness) of the benefits of commissioning, recommissioning, and retro-commissioning with examples of typical problems that are often uncovered during the commissioning process. As a minimum, the following commissioning topics shall be addressed:

- Planning (When)
- Funding (Budgeting allowance criteria, payback expectations)
- People Involvement (Who)
- Instrumentation/Tools
- Testing (Benchmarking equipment/system performance, objectives, participants, etc.)
- Results/Repairs/Retest (Analysis and corrective actions)
- O&M Training
- Commissioning Documentation
- Monitoring Performance/Energy Utilization
- Case Histories

#### Reference Documents:

- ASHRAE Guideline 0, The Commissioning Process
- ASHRAE Guideline 0.2-2015, The Commissioning Process for Existing Systems and Assemblies
- ASHRAE Guideline 1.1-2007 – HVAC & R Technical Requirements for the Commissioning Process
- ASHRAE GPC 1.2P Proposed Guideline. Technical Requirements for the Commissioning Process for Existing HVAC&R Systems and Assemblies
- ASHRAE GPC 1.3P – Proposed Guideline. Building Operation and Maintenance Training for the HVAC&R Commissioning Process
- ASHRAE Guideline 1.4-2014 -- Procedures for Preparing Facility Systems Manuals
- ASHRAE Standard 202-2013, Commissioning Process for Buildings and Systems
- ASHRAE Standard 184-2016 - Method of Test for Field Performance of Liquid-Chilling Systems (ANSI Approved).

#### Measures of Success:

- Benchmark Data- ability to look back at performance over time.



- Records management: Refrigerant leakage- Indication of how well your leak management program is working.

#### 6. Minimum Requirements for Tools and Servicing Equipment

Mind Set: Be safe and be prepared.

##### Covered Topics:

- Properly sized evacuation/dehydration equipment.
- Cold trap for servicing large industrial machines.
- Refrigerant transfer equipment.
- Rotary brush tube cleaning system with properly sized brushes for tube ID and geometry; brush OD gage for checking/discarding worn brushes.
- Refrigerant Management/Leak detection equipment.
- Refrigerant and oil analysis sampling kits or access to analysis service.
- Portable refrigerant monitor for working in confined spaces on HVAC/Refrigerant equipment
- Technician Instrumentation & Hand Tools
- Electrical Measurement Devices (Digital Multi-meter / Amp Probe)
- Basic Hand tools acceptable to properly maintaining, servicing the type of equipment application. Should include assorted wrenches & socket sets, screwdrivers, pliers.
- Thermometers (pocket) and/or electronic thermal image
- Safety Equipment- Personal Protection Equipment

##### Reference Documents:

- UNEP Refrigerant Driver's License
- UNEP Guide to maintenance practices
- OEM literature

##### Measures of Success:

- Lower system down time and better performance.
- Fewer safety incidents or refrigerant releases
- Ready for all potential service needs on-site

#### 7. Proper Disposal Procedures for equipment and all fluids (refrigerants, glycol, Li-Br, oils, etc.)

Mindset: Protect the environment, worker and community safety in compliance with local requirements.

##### Covered Topics:

Good practice can be identified, but compliance to local laws and procedures must be take precedence. Documentation is important here also. Examples include:

- Puncture non-refillable cylinders to prevent reuse and/or inappropriate use.
- Transfer of refrigerant liquid and vapor evacuation to approved recovery vessels.
- Disposition of fluids removed from HVAC&R systems must be done in a manner to protect the environment, worker and community safety. These actions are usually taken according to local and national laws. Therefore, the guide should address:
  - Defining terminology such as the difference between recovery (removal of a fluid from equipment and collection in a container), recycle (on site reuse of a fluid with modest cleanup (e.g. oil removal, then reuse on site), reclaim (off site cleanup of a fluid, including composition adjustment for blends, and reuse), and disposal/destruction (off site final disposition of a fluid, by e.g. incineration)
  - Identifying when disposal may be necessary because a fluid has become badly contaminated with other products and no longer meets the acceptance specifications of reclaimers. Licensed waste disposal firms are typically available for this purpose. The qualifications of these firms should be checked before sending them used refrigerants.
  - Outlining any special requirements for flammable or toxic refrigerants/Secondary Fluids
  - Emphasizing that no refrigerant should be intentionally vented into the atmosphere.

#### Reference Documents:

- Refrigerant replacement utilized shall comply with AHRI 700-2016 – Specification for Refrigerants describes the purity specifications that new and reclaimed refrigerants should meet to be suitable for sale or resale to the industry
- ASHRAE Standard 147-2013, Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment and Systems.

#### Measures of Success:

- Refrigerant is recycled, or reclaimed and reused where purity requirements can be met. No refrigerant is intentionally vented into the atmosphere.

### 8. Competencies of Operating and Servicing Personnel

Mind set: Train to maintain and sustain.

#### Covered topics:

Competence is the ability of an individual to do a job properly. A competency is a set of defined behaviors that provide a structured guide enabling the identification, evaluation and development of the skills in individual employees.

In the Refrigeration and Air conditioning engineering field, competencies would include, but not limited to acquiring the following:

- Fundamentals:
  - Demonstrated mechanical aptitude and functional behavior.
  - Basic understanding of thermodynamics and refrigeration cycles.
  - Basic understanding of electricity, electrical power distribution.
  - Plant Safety Practices and Procedures. Basic understanding of sustainability objectives, minimizing environmental footprint, etc.
  
- Specialized Knowledge:
  - Understanding of typical systems within an HVAC&R plant. Including various types of pumping loops, fan curves and operation, Cooling tower and condenser heat rejection systems.
  - Understanding of the operating procedures and characteristics of various types of equipment encountered in an HVAC&R installation.
  - General maintenance requirements and procedures for vapor-compression, absorption, and the accompanying ancillary systems needed to support the HVAC&R plant.
  - General understanding of the general types of vapor compressor types (centrifugal, scroll, reciprocating, and rotary).
  - Proper refrigerant handling procedures.
  - Understanding of the importance and proper use of personal protective Equipment (PPE).

Reference Documents:

- Operator/Service Technician Course Outline- AHRI- published a guideline.
- UNEP Published Best Practice and Manuals of Operation.
- UNEP/AHRI/ASHRAE Refrigerant Driver's License (RDL)

Measures of Success:

- Lower system down time and better performance.
- Fewer safety incidents or refrigerant releases
- Full-redundancy & back-up for operating & servicing personal

## V. **Business Case:**

The ASHRAE/UNEP Guide for RAC Plant Assessment enables refrigeration and ac installations to achieve efficient, sustainable performance. The guide's value becomes critical as low-GWP alternatives become available to the market. Many of these solutions have flammability concerns and compliance with safe handling practices are necessary to eliminate risks to humans and to property. Regulations are also mandating increased tracking and reporting of refrigerant inventory and leakage in systems.

### A. **Market Segmentation and Communication of Value Statement**

The consumers of information delivered through the ASHRAE UNEP Guide for RAC Plant Assessment are service technicians and plant operating managers. All materials must effectively communicate to both audiences and must be easily used by them.

For the guide to achieve its desired impact, however, decision makers must be targets of communications that explain the value of the guide's implementation. Clear value statements will be developed and appropriate communication vehicles established for the following market segments of decision makers:

#### 1. End-Users

- Comprehensive program with all information in a no cost guide.
- Way of achieving reductions in refrigerant emissions as well as reductions in energy use - Method for documenting these/showing compliance.
- Reductions in operating costs, improved up-time, and lower service/maintenance expenses.
- Way of achieving reductions in refrigerant emissions as well as reductions in energy use- Method for documenting these/showing compliance.
- Reductions in operating costs, improved up-time, and lower service/maintenance expenses.

#### 2. Governments

- Model for establishing requirements and compliance path for emission reductions
- Engagement by ASHRAE GGAC committees at local level
- Comprehensive guidance.
- Sections of the guide could provide the basis for safety and sustainability regulations with minimal effort and local expertise. (Local ASHRAE GGAC members at the Chapter level could be instrumental in achieving this).

#### 3. Suppliers (as a distribution channel)

- Availability of information that promotes most efficient design.
- Better performing equipment rooms are characterized by more efficient equipment.

- Guidance to select the competencies that lead to the best performing projects among a wide diversity of options.

When the ASHRAE UNEP Guide for RAC Plant Assessment is market-ready, effective communication of the above value statements needs to communicate to the respective identified market. A common value proposition for all segments is that the ASHRAE UNEP Guide for RAC Plant Assessment offers a Product Suite for Acceptable O&M that is comprehensive and is reliable.

## **B. O&M Practices Check List and Supporting Documentation**

The final product offered will include checklists that state recommended practices, which will be the most useful part to the end user, and other supporting information. To appeal to the user market, the checklist will be in an easy to use format with support documentation that has heavily illustrated guidance and minimum text. The checklist will be available in printed form and as an online form that is device responsive and accessible in offline mode. Examples of check list content are contained in Appendix 1 and Appendix 2

1. Checklist attributes are as follows:
  - Print format easy for technician to have on job site.
  - Poster format for plant display
  - Print format for plant reference library
  - Online format usable on tablets and phones
  - Offline format usable on tablets and phones
2. The support documentation will include “Good Practice” Guidance” to support the checklist covering:
  - Safe Storage and proper handling of refrigerants (and secondary fluids like glycol, etc.)
  - Periodic leak checking and proper documentation (include record keeping, documentation of repairs, compliance with local reporting requirements, etc.)
  - Maintenance Practices to extend Equipment life and maintain performance (Proactive or Predictive Reliability Based?) Should include checklists, PM, and FD analysis where applicable).
  - Energy Efficient Operation (Separated from above to include Dash boarding, etc.)
  - Commissioning and Recommissioning of system (mechanical system, not entire building)
  - Periodic review of system to compare performance to design intent and initial performance.
  - Identifying issues and adjusting as loads and equipment use change.

- Minimum Requirements for Tools and Servicing Equipment- Training must be emphasized. It can be an important part of justifying a business case at the ASHRAE level.
- Proper Disposal Procedures for equipment and all fluids (refrigerants, glycol, Li-Br, oils, etc.). (Good practice can be identified, but compliance to local laws and procedures must be take precedence. Documentation important here too.)
- Competencies of Operating and Servicing Personnel. (Must define a minimum, training is an opportunity-discussed in business case).
- The checklist and supporting documentation will be a deliverable of the project.

#### **C. O&M On-Line Resource Center**

ASHRAE will explore establishing an on-line resource center to support use of the guide. In fact, the guide might be distributed through the resource center as a component there of free content. Other related content – whether freely available or sold – that is identified in the initiative’s scoping document will be made available through the on line resource center.

Access to content may be structured as “pay as you go” or some may be behind a subscription based firewall. Country based pricing may be considered to promote access in developing countries. Free viewing (view but not printable or downloadable) for selected resources will be considered.

Documents may be included in whole or also partially in cases where only a portion of the document is relevant. Relevant pricing (or non-pricing) will be applied. The list of publications to be considered for inclusion include:

ANSI/ASHRAE 15-2016  
 ANSI/ASHRAE 34-2016  
 ASHRAE Guideline 6-2015  
 Material Safety Data Sheets (MSDS’s)  
 ISO 817 and 5149, EN 378  
 EPA Section 608 of the Clean Air Act  
 ASHRAE Standard 147  
 ASHRAE Guideline 0  
 ASHRAE Guideline 0.2-2015  
 ASHRAE Guideline 1.1-2007  
 GPC 1.2P Proposed Guideline.  
 GPC 1.3P – Proposed Guideline  
 Guideline 1.4-2014  
 ASHRAE Standard 202-2013  
 ASHRAE Standard 184-2016  
 ISO 5149-4 2014— Part 4: Operation, maintenance, repair and recovery.  
 UNEP Refrigerant Driver’s License  
 UNEP Guide to maintenance practices  
 AHRI 700-2016

ASHRAE Standard 147-2013

AHRI Operator/Service Technician Course Outline

UNEP Published Best Practice and Manuals of Operation

ASHRAE Sustainability Guide for Refrigeration

Additional Materials Available from UNEP:

- Guide Servicing Practices (Guide)
- International Standards in Refrigeration & Air-Conditioning (Booklet)

National Certification Schemes for Refrigeration & A/C (Booklet)

Series of Factsheets on safety, flammability and high pressure refrigerants

ASHRAE-UNEP Factsheet on Refrigerants Designation and Classification

Short educational videos on good practices (Mobile App)

ASHRAE-UNEP E-Learning Course: Refrigerant Literacy

University Course for Mechanical Engineering Undergraduates (under update)

Universal Training Kit (with AREA)

ASHRAE-UNEP E-Learning Course: Management of Refrigerants

UNEP-IIR Cold Chain Technology Briefs

#### **D. O&M Training**

A supplemental training course will be proposed for development by the ASHRAE Learning Institute. The course will be made available by ASHRAE as an instructor-led course, scheduled at ASHRAE events and available for onsite scheduling. This course is envisioned as a multi-day course covering all the areas addressed in the guide.

The course will cover the principles that apply along with providing instruction for implementation of the checklist and its accompanying support documentation. Course must be designed for technician level which requires heavy illustration to convey content. Video will likely be incorporated to show hands on practices.

The course will be adapted for web based, on-demand, interactive training through the ASHRAE eLearning Center.

#### **E. Market Acceptance Factors**

The market factors below will require consideration and review as the guide moves through development and becomes ready for market release. During development, the guide needs to be continually examined for its satisfying the drivers for acceptance and avoiding the obstacles for acceptance.

##### **1. Drivers for Guide Acceptance**

Government regulation related to technology

Operational price increases

Public pressure

Comprehensiveness

Ease of access

Early success stories

Professional recognition

Industry recognition

2. Obstacles to Development and Acceptance

Communication of tangible benefits to decision maker  
Lack of governmental requirement for adoption  
Depth of product suite  
Cost of suite elements offered for sale  
Ease of use  
Time needed to use or train  
Recognition earned from the certificate  
Language  
Internet access

**F. Product Development**

1. Contractor-Led Checklist Development

It is recommended that a contractor be retained to develop the guide: Its O&M Practices Check List and Supporting Documentation. Content creation will be guided by the scoping document developed by the Stage I Presidential Ad Hoc.

While volunteer development offers a low cost advantage, it would also require a longer development lead time and could introduce contradictory guidance. Similarly, ASHRAE Research provides a funding source, the required approval and development processes can also result in a long time line for delivery to market due to reporting needs and changes to volunteers sitting on approving bodies.

Instead, it is recommended content creation will be accomplished through an authoring agreement between the contractor and ASHRAE Publications.

2. MTG Oversight

It is recommended that the contractor will be selected by a newly appointed MTG that draws from relative ASHRAE Technical Committees and includes members of the current ASHRAE Presidential Ad Hoc. The MTG will provide technical review of the work and approval at the various stages of approval.

3. Staged Development and Timeline

The following stages of approval will be in place:

- Stage I: Specification and Business Case Development (Finalized June 2018)
- Stage II: Development of technical modules with resulting checklists and procedures (9 months from funding approval and contractor selection)
- Stage III: Formal review and pilot of the guide in practice. (6 months from completion of Stage II)
- Stage IV: Launch and outreach (3- 6 months from Completion of Stage III)



4. Overall Project Responsibility

Overall project responsibility for the project will rest with the ASHRAE UNEP Coordination Committee.

**H. SUMMARY**

As low-GWP alternatives become available to the market, there is a critical need for recommended practices to be properly understood and applied, especially in developing countries.

The ASHRAE-UNEP Assessment Guide for Sustainable Operations and Maintenance of Refrigeration and Air Conditioning Plants will be ASHRAE UN Environment partnership to address this need globally.

To be successful, two levels of acceptance must be achieved. One level is the decision maker to whom the need and value proposition must be communicated based on risk and benefit. Decision makers include end users, government and suppliers (who can serve as a distribution channel). The second level is the consumer of the needed guidance, service technicians and plant operating managers. The guidance must be presented in a manner which is suited to their practicing needs.

The guide will be built around checklists that state recommended practices. To appeal to the consumer market (technicians and plant managers), the checklists will be in an easy to use format with support documentation that has heavily illustrated guidance and minimum text. The checklists will be available in printed form and as on-line forms that are device responsive and accessible in off-line mode. The guide will be made freely available.

Development is to be done in four separate stages with formal approval “gates” at the end of each stage with launch and outreach expected in the 2019 calendar year.

Cost of guide development will be shared between ASHRAE and UN Environment

### **Appendix 1: Sample Check list for proper Maintenance for a Chilled Water System:**

- ✓ Periodically sample, analyze, monitor and trend key variables in refrigeration system fluids as indicators of fluid (system) health – e.g., water treatment (hardness, pH), compressor lube oil (elemental analysis, viscosity, wear debris, moisture, acid number, etc.), refrigerant condition (water content, high boiling residue, non-condensable, volatile impurities, acid number, etc.) and secondary fluid condition (freeze point, pH, reserve alkalinity, inhibitor levels, degree of contamination, etc.).
- ✓ Collect/review/compare machine operating data against design prior to annual overhaul to identify performance issues to be investigated/resolved during maintenance outage (water side pressure drops vs flow, heat exchanger approach temperatures, compressor discharge temperature, condenser/evaporator pressure, oil pressure/temperature, etc.
- ✓ On machines equipped with hot gas bypass valve, prior to maintenance shutdown verify valve is not leaking hot gas to evaporator by monitoring downstream temperature (thermocouple under insulation)
- ✓ Annual cleaning of heat transfer surfaces (airside coils, waterside tubes).
- ✓ Visual inspection of condenser/evaporator tubes before and after brushing.
- ✓ Visual inspection of chiller water-box division baffles and gaskets prior to cleaning for visual evidence of bypassing due to corrosion, gasket deterioration, baffle-to-tube sheet cracked welds.
- ✓ Monitor/Replace filter-drier cores to keep refrigerant dry.
- ✓ Benchmark compressor/motor vibration signature and trend condition over time.
- ✓ Eddy-current test condenser and evaporator tubes on aging equipment periodically especially condensers utilizing surface water.
- ✓ Maintain refrigeration insulation system and vapor barrier hermetic integrity to avoid corrosion under insulation and potential for refrigerant loss.
- ✓ Monitor for evidence of condensation and/or ice on refrigerant or secondary coolant piping distribution systems indicating inadequate or compromised insulation systems and replace as needed.
- ✓ Minimize ambient moisture ingress to equipment open for maintenance by limiting open connections, installing temporary covers (polyethylene film or gasketed covers) at end of the shift.
- ✓ Conduct a thorough evacuation and dehydration of the equipment after maintenance per OEM recommendations prior to charging with refrigerant.

- ✓ Transfer refrigerant from equipment to secure storage tanks for extended idle periods to avoid potential for refrigerant loss.  
Avoid using high pressure water blasting to clean tubes or tube-sheets and only under strict supervision when necessary.
- ✓ Tagging of all refrigerant connections disturbed during maintenance to facilitate targeted leak checking during the evacuation/dehydration.

## **Appendix 2: Example of Annual PM Checklists**

- ✓ Annual PM including cleaning condensers (water cooled tubes heat exchangers and Air cooled Condensers)
  - Following inspection of water cooled heat exchanger mechanically cleaning should calcium deposits remain on inside diameter of tube surface acid cleaning may be determined to be a secondary process.
  - Eddy current test chiller tube for evaporator and condenser heat exchangers. Eddy testing provides an improved method of determination of tube wall and tube support conditions.
- ✓ Meg Ohm test motors annually during annual maintenance, record for historical reference trending. Meg Ohm testing of chillers and equipment (stand-alone VFD's) requires disconnecting semi-conductors from motor wiring to insure accuracy.
- ✓ Refrigerant and oil analysis sampling taken during operating season evaluated by certified chemist, lab or manufacturer to determine chemical content of the refrigerant and/or oil provides non-invasive annual testing to compare with manufacturers factory standards. Where extremes are found further consultation with chiller manufacturer should be taken.
- ✓ Water cooled condensers pull condenser strainer annually or as required based upon Operations Logs of strainer pressure drop or system performance.
- ✓ Water cooled, clean cooling towers annually.
- ✓ Water Treatment Management;
  - Water systems maintain both Open Loop and closed loop treatment. Insure minimal total dissolved solid levels at +/- 1,000-1,200 ppm, pH range 8.0 – 9.0.
  - Water treatment criteria for water RAC's ultimately adhere to conditions installed.
- ✓ Condenser & Chilled water pumps perform Pump & Tower fan PM follow OM guidelines for greasing motor and bearings as required.
  - Pumps utilized for variable flow or air disconnect Variable frequency drive electrically, vacuum interior & check tightness of electrical power connections
- ✓ Refrigerant Management System;
  - Regularly during annual inspections verify pick up sensing filter(s) are clean.
  - Annually have refrigerant specific calibration test performed by either in house or out sourced certified firm. Insure refrigerant monitor TEL levels are calibrated for alarming for the refrigerant utilized, See ASHRAE Standard 15 & ASHRAE Standard 34).

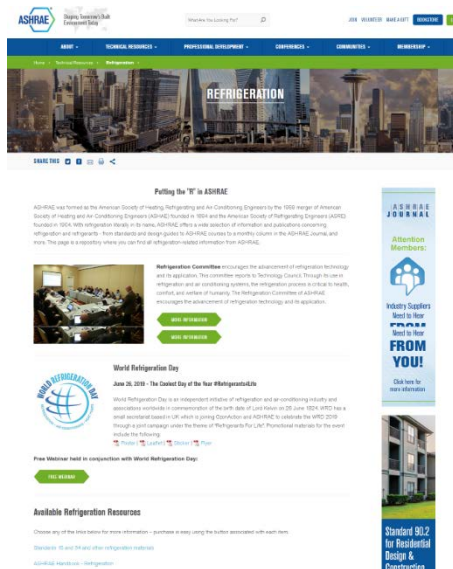
- Annually test refrigerant management system for functionality of fan emergency purge exhaust and non-emergency ventilation exhaust and/or Air Handler Make Up (if provided).
  - Emergency Purge exhaust;  $CFM = 100 \times G^{(0.5)}$  where G equals the largest chiller quantity (e.g., Refrigerant charge = 1,600 lbs. So,  $100 \times [1,600^{(0.5)}] = 100 \times 40$  OR 4,000 CFM
  - Normal MER Ventilation;  $0.5 \text{ CFM} / \text{Square Foot} = \text{RAC MER CFM}$  (e.g. Quantity 3 500 Ton Chillers comprise a RAC plant of nominally 1,750 SF.  $1,750 \text{ SF} \times 0.5 = 875 \text{ cfm}$  RAC MER ventilation exhaust
- Where Refrigerant Management system utilizes a 100% Air Handling Make Up unit monthly verify condition of filters. Where RAC MER outside Air Louvers are installed bi annually inspect for debris at louvers.
- Where Refrigerant Management System alarms MER within plant and external to plant entrances verify system safety sequences annually in testing protocol.
- Self-Contained Breathing Apparatus or SCBA, if utilized;
  - Annual verification of functional operation, Safety officer testing for appropriate form fit of those utilizing equipment. (Note: see regulatory requirements).
- Electric Infrastructure;
  - Electric Switchgear preventive maintenance annual testing, thermal imaging of equipment for heat points including buss bars, power contacts, contactors.
- ✓ Verify annually Building Automation (BAS) controls operation for starting/shutdown for plant equipment.
- ✓ Where plant utilizes pneumatic control verify air compressor operation for O&M PM. Insure refrigerant air drier is functional with annual condenser coil cleaning. Change oil, filter as noted in manufacturer O&M.

**Appendix 3: List of Stage I Ad Hoc Members:**

<b><u>Name</u></b>	<b><u>Affiliation</u></b>	<b><u>Position</u></b>
Mr. William F. McQuade, P.E., LEED AP	Johnson Controls	Chair
Prof. Essam Eldin Khalil, PhD	Cairo University	Member
Prof. Radhey S. Agarwal	Indian Institute of Technology, Hauz Khaz	Member
Ms. Barbara Minor,	The Chemours Company	Member
Mr. Robert L. Bates	DuPont Engineering	Member
Mr. Richard H. Rooley, FREng	Rooley Consultants	Member
Mr. Ayman Taha Hussein	United Nations Environment Programme	Member
Mr. John I Vucci	University of Maryland	Member
Mr. William F. Walter	Carrier Corporation	Member
Steve Comstock	ASHRAE Staff	
Mike Vaughn	ASHRAE Staff	

# ASHRAE REFRIGERATION PAGE

[ashrae.org/refrigeration](http://ashrae.org/refrigeration)



On May 16, 2019 ASHRAE announced the launch of a webpage to encourage the advancement of refrigeration technology and its application.

The new Refrigeration webpage, referred to as the “R” in ASHRAE, highlights the Society’s commitment to supporting the role of refrigeration worldwide. The webpage features resources information and publications concerning refrigeration and refrigerants such as standards, design guides, ASHRAE courses and more.

## Traffic Since Inception

- 3,070 unique pageviews
- 2:13 average minutes spent reading the page
- Listed as seventh result on Google for the generic search term “refrigeration” and as **first** result when ASHRAE is put in as a keyword.


### Refrigeration - ashrae


<https://www.ashrae.org/technical-resources/refrigeration>


Refrigeration Committee encourages the advancement of refrigeration technology and its application.

This committee reports to Technology Council. Through its ...


- Top five countries, in order by pageviews:

 United States

 Brazil

 Canada

 India

 Mexico

**MANUAL OF PROCEDURES**  
**for**  
**REFRIGERATION**  
**TECHNOLOGY COMMITTEE**  
**for Comfort, Process and Cold-**  
**Chain**

REVISED: June 20159



**MANUAL OF PROCEDURES  
FOR  
REFRIGERATION  
TECHNOLOGY COMMITTEE for  
Comfort, Process and Cold-Chain**

**FOREWORD**

The Refrigeration Technology Committee for Comfort, Process and Cold-Chain(~~REF~~CPCCC) is a General Standing Committee of the Society and operates under the direction of the Board of Directors and Technology Council. The Rules of the Board (ROB) for the Refrigeration Technology Committee for Comfort, Process and Cold-Chain(REFCPCCC) is its constitution. Proposed changes to the ROB and its appendices must be approved by the Board of Directors.

This Manual of Procedures (MOP) describes mandatory operational rules and interpretations of policy that the REFCPCCC body must operate under to achieve their assigned responsibilities. It is designed to complement the ROB by providing methods and procedures under which to operate. The MOP, and revisions thereto, following approval by the Committee, shall be submitted to Technology Council or designated council subcommittee for approval. (ROB 96-02-18-07)

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- Part 4 Operations

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- Part 2 Responsibilities of the Chair
- Part 3 Responsibilities of the Vice Chair
- Part 4 Responsibilities of the Staff Liaison

**SECTION C - DUTIES OF VOTING MEMBERS**

- Part 1 Responsibilities

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**SECTION D - COMMITTEE LIAISONS**

- Part 1 Selection
- Part 2 Duties
- Part 3 Liaison Reports

**SECTION E – COMMITTEES**

- Part 1 Selection and Operations

## **SECTION A - REFRIGERATION TECHNOLOGY COMMITTEE FOR COMFORT, PROCESS AND COLD-CHAIN - GENERAL**

### Part 1 Responsibilities/Duties

The Refrigeration Technology Committee for Comfort, Process and Cold-Chain (REFCPCC) shall encourage advancement of refrigeration technology and its -implementationapplication in Comfort, Process and Cold-Chain applications. (ROB 520-160-002)

- A1.1 The Committee shall promote refrigeration education and development at the chapter, regional and international levels of the Society.
- A1.2 The Committee shall recommend projects and programs related to refrigeration to Technology Council.
- A1.3 The Committee shall maintain liaison with ASHRAE Chapters and other general committees within ASHRAE regarding refrigeration subjects.
- A1.4 The Committee shall assist and advise the TCs and TGs with refrigeration-oriented goals.
- A1.5 The Committee shall maintain contact and encourage technology transfer with other refrigeration-oriented international and technical societies.
- A1.6 The Committee shall assist CTTC, as appropriate, with refrigeration-oriented activities.
- A1.7 The Committee shall be technology agnostic in its activities, in the sense that it is inclusive to all methods of transferring energy from a colder to a warmer object.

### Part 2 Membership

- A2.1 General Information
- o Committee members should be comfort, process and cold-chain refrigeration technology-oriented persons.
  - o Membership should include a cross-section of the refrigeration industry.
  - o Committee members are selected by the President Elect and approved by the BOD.
  - o Service on this committee for the members is intended to be for a 3-year term.
  - o Service on this committee for the Chair, Vice Chair, BOD ex-officio and Coordinating Officer is intended to be for a one-year term. For the sake of maintaining continuity, Chairs will remain as one-year members for one year after ending the term of Chair.
  - o The Chair of the Committee is a non-voting member of, and reports for the Committee to, Technology Council.
- A2.2 Composition
- o The Refrigeration Committee shall consist of 12 voting members including the Chair, and a Vice Chair.
  - o Non-voting board ex-officio and a coordinating officer shall be assigned.
  - o Non-voting members from liaison associations shall be assigned.
  - o Non-voting chairs of liaison committees shall be assigned.
  - o One member of the committee shall serve as a liaison to the Chapter Technology Transfer Committee.
  - o Non-voting consultants as appropriate.
  - o

### Part 3 Meetings



shammerling

2019-06-13 14:24:32

Change name of committee throughout? Refer to committees to reflect changes?

A1.X - list point about technology agnostic to assure coverage beyond vapor compression Assure technology transfer adequately covered in MOP

AI - members on call edit and send to Steve Monday/Tuesday to compile

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A3.1 The Committee shall have two (2)-scheduled meetings annually at the Society Winter and Annual meetings. Additional electronic meetings may be held at the call of the Chair.

#### Part 4 Operations

A4.1 Specifics of Committee operations are detailed in the Reference Manual.

### **SECTION B - CHAIR, VICE CHAIRS AND STAFF LIAISON**

#### Part 1 Selection

B1.1 The Chair and Vice Chair of REF~~CPCC~~ are nominated by the President-elect of the Society from the current membership of REF~~CPCC~~ and approved by the Board of Directors to serve one-year terms commencing at the close of the next annual meeting of the Society.

#### Part 2 Responsibilities of the Chair

- B2.1 Preside over all meetings of the ~~REFCPCC~~~~Refrigeration Committee~~ committee.
- B2.2 Coordinate and direct the activities of the Vice Chair and those of the voting members through MBOs and other assignments.
- B2.3 Organize REF~~CPCC~~ subcommittees as necessary to satisfy the needs of the committee as indicated in the REF~~CPCC~~ Reference Manual.
- B2.3 Prepare the agenda for all ~~REFCPCC~~~~Refrigeration Committee~~ meetings.
- B2.4 See that minutes are recorded for all ~~REFCPCC~~~~Refrigeration Committee~~ meetings.
- B2.5 Prepare reports to be submitted to Technology Council at each Council meeting.
  - o Included in the Annual Meeting report shall be a final report of the committee's MBOs . A copy of the MBOs shall also be sent to the Refrigeration BOD Ex-O and to AMORT.
  - o The Annual Meeting report shall also include the MBOs prepared by the incoming chair (See B3.7). These two reports on MBOs will show the council what the committee accomplished during the Society year that is ending and what is planned for the upcoming year.
- B2.6 Annually submit to the President-Elect of ASHRAE recommendations for a Chair, a Vice Chair, and replacement members for any members who are leaving the committee for any reason.
- B2.7 Recommend one member of the committee to serve as a consultant of the CTTC committee.
- B2.8 Appoint liaisons to TCs, TGs, SSPCs and any other refrigeration-related committees.

- B2.9 Appoint at the final meeting of the Fiscal Year a mentor for each new incoming member of the committee.

### Part 3 Responsibilities of the Vice Chair

- B3.1 In the absence of the Chair, assume the chair at scheduled or called meetings of the ~~REFCPCC committee~~ ~~refrigeration Committee~~.
- B3.2 In the event the Chair is unable to perform the duties of that office, assume all duties of the Chair until a successor is selected.
- B3.3 The Vice Chair shall serve as a member of the Planning Subcommittee of Technology Council.
- B3.4 The Vice Chair shall prepare a budget for the ~~REFCPCC~~ ~~refrigeration Committee~~ and review expenditures.
- B3.5 Encourage refrigeration technology transfer within the Society by working with the Research Administration Committee Research Liaisons, and with the Technical Activities Committee Section Heads, particularly Section 10, to stimulate: (a) programs at Society Meetings, (b) research projects and (c) technical committee membership.
- B3.6 Be responsible for regular review of the ~~Refrigeration Committee~~ ~~REFCPCC~~'s Rules of the Board Procedures and make recommendations for revisions.
- B3.7 Prepare and submit MBOs for upcoming year.  
Management By Objectives,(MBO)  
Prior to the Society annual meeting, the committee vice chair or the individual who will be the next year's chair will prepare MBOs for the REF~~CPCC~~ committee for the next year and present these objectives to the REF~~CPCC~~ committee for review at the committee meeting held during the Society annual meeting. The MBOs will be included in the REF~~CPCC~~ committee's report to the Technology Council at the annual meeting as an information item, and a copy of the MBOs will be sent to the Refrigeration BOD Ex-O and AMORT. A suggested format for committee MBOs can be found in the Reference manual.
- B3.8 Perform other duties, which may be assigned by the Chair.

### Part 4 Responsibilities of the Staff Liaison

- B4.1 Attend all meetings of the committee.
- B4.2 Perform assignments made by the Chair.

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- B4.3 Prepare draft of minutes, submitting to Chair and Vice Chair for comments.
- B4.4 Update Rules of the Board and Manual of Procedures at the direction of the Committee. When appropriate, distribute to Committee members for review and possible update.
- B4.5 Distribute materials to the members for regular meetings of the Committee.
- B4.6 Assist with budget preparation.
- B4.7 Provide support for all awards presented by the Committee.
- B4.8 Post materials as directed by the Chair to the Committee's webpage.
- B4.9 Maintain and update the TC Activities Report for the webpage.

## **SECTION C - DUTIES OF VOTING MEMBERS**

### **Part 1 Responsibilities**

- C1.1 Attend all meetings of the ~~REFCPCC~~Refrigeration Committee.
- C1.2 Perform MBO tasks and other duties as assigned by the Chair.
- C1.3 Encourage ~~REFCPCC~~Refrigeration Committee formation and activity in each chapter through liaison with CTTC. One member shall also serve as a liaison to the Chapter Technology Transfer Committee.
- C1.4 Recommend, via the President-Elect Advisory Committee, criteria for Chapter Refrigeration activities in the Presidential Award of Excellence program.
- C1.5 Report regional activities at the Annual and Winter meetings of the Refrigeration Committee.
- C1.6 Assist and advise the TCs, TGs and SSPCs with refrigeration-oriented goals including (a) programs at Society Meetings, (b) research projects and (c) technical committee membership.
- C1.7 Voting members may be required to serve as Committee Liaisons. (See Section D)
- C1.8 Annually, determine the winners of the REF Awards
  - o Milton W. Garland award
  - o Refrigeration Comfort Cooling award

- George Briley ASHRAE Journal Article Award
- C1.9 Sponsor or cosponsor programs at Society meetings on refrigeration to educate ASHRAE members as specified in A1.1.

## **SECTION D – COMMITTEE LIAISONS**

### **Part 1 Selection**

- D1.1 The ~~REFCPCC~~refrigeration Committee shall provide liaisons to represent the Refrigeration Committee at CTTC, TCs, TGs, SSPCs, committees and other refrigeration related ASHRAE activities such as programs and workshops.

### **Part 2 Duties**

- D2.1 The liaisons will provide a written report to the ~~REFCPCC~~refrigeration Committee on all pertinent refrigeration-related issues and information as related to the other committees. These reports shall be presented at the Annual and Winter meetings. A summary of the activities of each liaison shall be included with the ~~REFCPCC~~refrigeration Committee minutes.
- D2.2 The members appointed to CTTC will assist chapter and regional activities in the field of refrigeration.
- a. Provide recommendations to the ~~REFCPCC~~refrigeration Committee for PAOE point criteria in refrigeration for the President-Elect Advisory Committee.
  - b. Assist all CTTC RVCs with CRC workshop materials and presentations pertaining to refrigeration.
- D2.3 Liaise with other Society Committees (see A1.3) and identify refrigeration related speakers/presenters for their programs when requested.

## **SECTION E – SUBCOMMITTEES**

- E1.1 Standing Subcommittees of the ~~REFCPCC~~refrigeration Committee are organized by the Chair as necessary to satisfy the needs of the committee.
- E1.2 Ad hoc subcommittees may be appointed by the Chair of the committee with the approval of ~~REFCPCC~~refrigeration Committee.
- E1.3 The Chair shall form additional subcommittees as needed to conduct the business of the ~~REFCPCC~~refrigeration Committee in a practical and efficient manner. As conditions change, the Chair



may dissolve these subcommittees. Both their appointment and dissolution requires approval of ~~REFCPCCefrigeration~~ Committee.

E1.4 The Chair shall appoint the members and chair of each subcommittee, with the consent of ~~REFCPCCefrigeration~~ Committee. The chair of each subcommittee must be a member of ~~REFCPCCefrigeration~~ Committee. At least three subcommittee members should be members of the ~~REFCPCCefrigeration~~ Committee, but the Chair may appoint additional subcommittee members who are not members of the ~~REFCPCCefrigeration~~ Committee when there is a need for members who have expertise and experience in certain areas that are of immediate importance and not available from the ~~REFCPCCefrigeration~~ Committee members.

E1.5 Subcommittee members are appointed for the Society year. If a member's term of service on the committee continues into the next Society year, they may be re-appointed to the same or different subcommittee by the incoming Chair.

E1.6 The subcommittees shall meet at least two (2) times per year at the Annual and Semi-Annual Society meetings.

E1.7 The subcommittee Chair shall report subcommittee activities at the appropriate point in the agenda of the ~~REFCPCCefrigeration~~ Committee meeting and provide a written report to be included in the report for Tech Council.



# ASHRAE UPDATE

## ExO Report to Committees

### 2019 ASHRAE Annual Conference



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

## Code of Ethics

*“As members of ASHRAE or participants in ASHRAE activities, we pledge to act with honesty, fairness, courtesy, competence, integrity and respect for others in our conduct. We will avoid conflicts of interest, and behavior that is discriminatory and/or harassing.”*



[ashrae.org](http://ashrae.org)

# President's Luncheon



**Monday, June 24**  
**12:15 – 2:00 pm**

*Building for People and Performance.  
Achieving Operational Excellence.*

**ASHRAE President 2019-20**  
**Darryl K. Boyce, P.Eng**



[ashrae.org](http://ashrae.org)



# Nominations Welcome

- 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
- If a person is completing his or her term on a committee in June 2019, the next appointed committee term would begin on **July 1, 2020**
- Self-nomination is also encouraged
- Nominations are due by **mid-February 2020**
- Councils are elected by the Board of Directors, but nominations are welcomed

For more information, visit: [ashrae.org/committee-nominations](https://ashrae.org/committee-nominations)



# ASHRAE Nominations

ASHRAE website links are available for Board Officer and Director recommendations, nominations to Board-elected Standing Committees and Councils and appointments to Committees.

## ❖ Board Officer and Director Recommendations

Link closes for the following Society year each **September 25<sup>th</sup>**

## ❖ Board-elected Standing Committee and Council Nominations

Link closes for the following Society year each **September 15<sup>th</sup>**

## ❖ Standing Committee Nominations, appointed by the President-Elect

Link closes for the following Society year each **February 15<sup>th</sup>**

For more information, visit: [ashrae.org/committee-nominations](https://ashrae.org/committee-nominations)

# ASHRAE 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 imply ASHRAE endorsement, approval or certification of products or services.

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

Content shall 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 to prevent an atmosphere in which commercial entities are encouraged to critique one another in the public forum.

For more information, visit: [ashrae.org/commercialism](https://ashrae.org/commercialism)



[ashrae.org](https://ashrae.org)

# Presidential Ad Hocs

## *Standards Membership Model Ad Hoc*

- In response to member requests for more flexibility in determining the benefit associated with ASHRAE membership, investigating potential membership business models
- Final report will be submitted in Kansas City
- Implementation will require collaboration among Finance Committee, Members Council and Publishing & Education Council

## *Smart Grid Design Guide Ad Hoc*

- Developing Smart-Grid Application Guide to provide building owners, managers, and designers with guidance on the smart grid, applicable regulations, and how to operate their building in the smart-grid environment
- Publication planned for Fall 2019

## *Event Sponsorship Presidential Ad Hoc Committee*

- Increasing event sponsorship revenue, thereby reducing conference registration fees, without violating the ASHRAE Commercialism Policy
- Appointed April 1, 2019
- Implementation will require coordination among advertising sales team, Development Committee and identified Society members



ashrae.org



# Government Outreach Days

**All ASHRAE Members are invited to participate – Get Involved!**



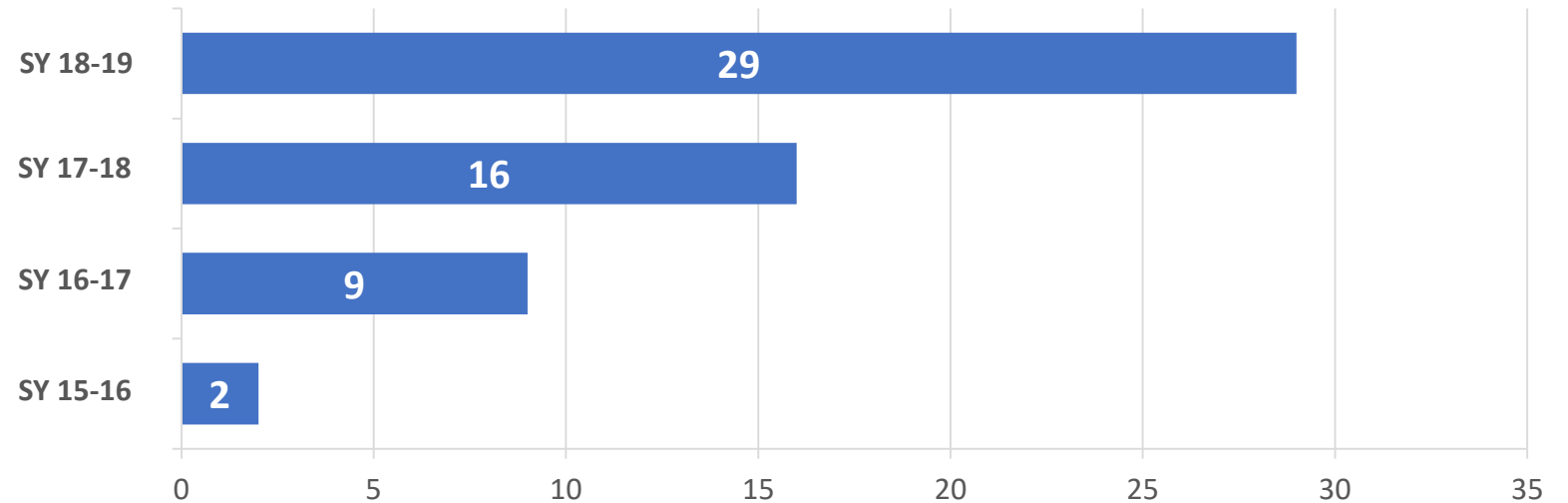
**157 Member  
Participants**



**290 Meetings**



**Government Outreach Day Events are Growing!**



Advocacy resources available in **ASHRAE 365** and [ashrae.org/advocacytoolkit](https://www.ashrae.org/advocacytoolkit)



[ashrae.org](https://www.ashrae.org)

# Signed Memoranda of Understanding

Society Year 2018-2019



- American Institute of Architects (**AIA**)



- American Society of Plumbing Engineers (**ASPE**)



- U.S. Department of Energy (**DOE**)



- International District Energy Association (**IDEA**)



- International Facility Management Association (**IFMA**)



- Japanese Society of Refrigerating and Air Conditioning Engineers (**JSRAE**)



- New Buildings Institute (**NBI**)



- Pakistan HVACR Society (**Pakistan HVACR Society**)



- Society of Air-Conditioning and Refrigeration Engineers of Korea (**SAREK**)



- Vietnam Society of Refrigeration and Air-Conditioning Engineers (**VISRAE**) *Pending*



[ashrae.org](http://ashrae.org)

# ASHRAE's New Global HQ



**180 Technology Parkway  
Peachtree Corners, Ga**

- Building campaign to help fund the new HQ is underway
- Aims to be a net-zero-energy ready office
- Showcase for the latest HVAC&R equipment and technology
- Retrofitted new HQ building will have a zero carbon footprint
- Move expected by October 2020

Design team members were chosen based on an RFP, competitive bids and committee interviews. The design team includes: McLennan Design, Houser Walker Architecture and Integral Group.

Project Management: Collins Project Management

Construction Manager at Risk: Skanska

Commissioning Agent: Epsten Group

For more information, visit: [ashrae.org/newhq](https://ashrae.org/newhq)

# “R” In ASHRAE



## ASHRAE Launches All New Refrigeration Page

With refrigeration literally in its name, ASHRAE offers a wide selection of information and publications concerning refrigeration and refrigerants – from standards and design guides to ASHRAE courses as well as a monthly column in ASHRAE Journal, and more.

ASHRAE and the International Institute of Refrigeration (IIR) announced on April 11, 2019 the establishment of new definitions for five refrigeration keywords, which are:

- **Cooling**
- **Refrigeration**
- **Chilling**
- **Freezing**
- **Cold Chain**

For more information, visit: [ashrae.org/refrigeration](https://ashrae.org/refrigeration)

# World Refrigeration Day

## The Coolest Day of the Year June 26, 2019



- ASHRAE endorses the first World Refrigeration Day
- The day raises awareness of refrigeration, air conditioning and heat pumps and their role in modern society to a wider audience
- Free Webinar on June 26, 2019, “Refrigerants for Life: How Refrigerants Affect Modern Life”
- #Refrigerants4Life

For more information and to register for the free webinar, visit: [ashrae.org/refrigeration](https://ashrae.org/refrigeration)



# New Strategic Plan

## Strategic Plan 2019–2024



### MISSION

To serve humanity by advancing the arts and sciences of heating, ventilation, air conditioning, refrigeration and their allied fields.

### VISION

A healthy and sustainable built environment for all.

### Find out more about the new plan

Attend Seminar 27: ASHRAE's 2019 Strategic Plan:  
Development, Initiatives and Implementation  
Monday, June 24 from 9:45–10:45 AM  
Kansas City Convention Center, Room 2105



[ashrae.org](http://ashrae.org)

# Strategic Plan At-A-Glance

## Initiative Area: Built Environment Of The Future

**1** RESILIENT BUILDINGS  
AND COMMUNITIES

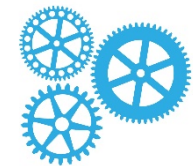


**2** INDOOR  
ENVIRONMENTAL  
QUALITY



## Initiative Area: Future Of ASHRAE

**3** ORGANIZATIONAL  
STREAMLINING



**4** IMPROVE CHAPTER  
ENGAGEMENT, CAPACITY  
AND SUPPORT



**Strategic Plan At-A-Glance**  
available for download **beginning 7/1/19**  
[ashrae.org/strategicplan](http://ashrae.org/strategicplan)



[ashrae.org](http://ashrae.org)

# Recent Publications

- ASHRAE Design Guide for Cool Thermal Storage, Second Edition
- ASHRAE Guideline 34-2019 – Energy Guideline for Historic Buildings
- Advancing DCIM with IT Equipment Integration (ASHRAE Datacom Series, Book 14)
- Advanced Energy Design Guide for Small to Medium Office Buildings: Achieving Zero Energy
- Standard 218-2019, Method of Test for Lubricant and Refrigerant Miscibility Determination
- Standard 30-2019, Method of Testing Liquid Chillers
- Standard 41.8-2016 (RA 2019), Standard Methods for Liquid Flow Measurement
- Standard 15-2019, Safety Standard for Refrigeration Systems
- Standard 34-2019, Designation and Safety Classification of Refrigerants
- Standard 150-2019, Method of Testing the Performance of Cool Storage Systems
- Humidity Control Events in Perioperative Care Areas (free white paper from TC 9.6)
- Water-Cooled Servers Common Designs, Components, and Processes (free white paper from TC 9.9)
- Spanish translations: Standard 188-2018, Thermal Guidelines for Data Processing Environments, 4th ed.



To purchase publications, visit: [ashrae.org/bookstore](https://ashrae.org/bookstore)



[ashrae.org](https://ashrae.org)



# Upcoming Publications

- Smart Grid Application Guide for Building Professionals (Fall 2019)
- HPB Simplified (textbook) (Fall 2019)
- ASHRAE Design Guide for Multifamily Residential Buildings (Fall 2019)
- ASHRAE Design Guide for Ventilation of Hazardous Spaces (Fall 2019)
- Nearly ZEB Hospitals Guide Book (co-published w/RHEVA) (Fall 2019)
- HVAC Design Guide for DOE Nuclear Facilities, 2nd ed. (Fall 2019)
- A Practitioner's Guide to Engineering Management (Fall 2019)
- Smart Grid Application Guide (Late 2019)
- ASHRAE Design Guide for Tall, Supertall and Megatall Buildings Design Guide 2nd ed. (Late 2019)
- Air-Conditioning System Design Manual, 3rd ed. (Late 2019)
- Design Considerations for Datacom Equipment Centers, 3rd ed. (Datacom 3) (Late 2019)
- ASHRAE Design Guide for Hot-Climate Buildings (Late 2019)
- Natural Ventilation Design Guide (Jan 2020)
- Design Guide for Combustion Turbine Inlet Air Cooling Systems, 2nd ed. (Jan 2020)
- ASHRAE Design Guide for Duct Systems (January 2020)
- 125th Anniversary books: Evolution of Components and Design Build Practices after 1900; Proclaiming the Truth, 2nd ed.; Adventures in Heat & Cold; Twentieth Century of Air Conditioning (January 2020)



ashrae.org

# ASHRAE Learning Institute (ALI)

## New Courses



- Advanced Design for Net Zero Buildings
- Choosing the Right Energy Code for Your Project: IECC 2018 or ASHRAE 90.1-2016
- How Smart, Efficient, Sustainable Systems Lead to Improved Resilience
- Thermal Energy Storage Systems for Air Conditioning

## The following courses are being offered during the Annual Conference:

- Effective Presentation for Positive Results
- Guideline 36: Best in Class HVAC Control
- IgCC and ASHRAE Standard 189.1 Technical Provisions
- Laboratory Exhaust Stacks: Safe and Energy-Efficient Design
- Solar PV & Thermal Systems Analysis and Design

For more information, visit: [ashrae.org/education](https://ashrae.org/education)



[ashrae.org](https://ashrae.org)

# ASHRAE eLearning

- PDHs/CEUs: Most courses recognized by AIA and GBCI
- Train on your own schedule from any computer with internet access
- No special software required
- Free tracking reports
- More than 90 courses, including:
  - [Introduction to Refrigerants](#) **NEW!**
  - [Refrigerant Selection](#) **NEW!**
  - [Refrigerant Management](#) **NEW!**



For the complete course catalog, visit: <https://elearning.ashrae.org>

# Certified HVAC Designer (CHD) Certification

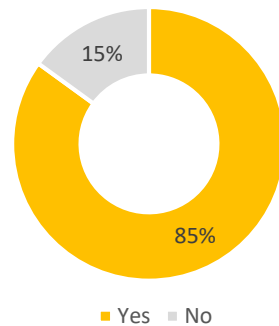
## Launched March 2019

The CHD certification validates competency of the HVAC Designer working under the responsible charge of an engineer.

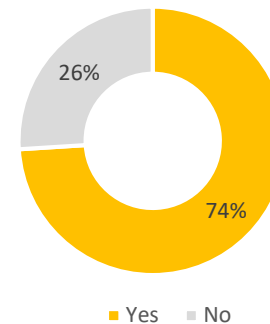
## Industry Need & Demand

In an “Industry Need” survey, ASHRAE Member respondents agreed the CHD is:

### A Worthwhile Professional Development Goal



### A Tool to Identify Competent New Hire Prospects



View the **NEW CHD** video here: [ashrae.org/chd#video](https://ashrae.org/chd#video)



[ashrae.org](https://ashrae.org)

# Advanced Energy Design Guides

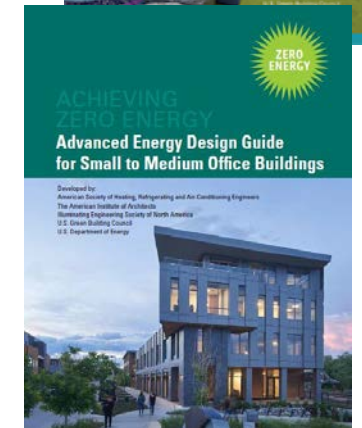
- Roughly **630,000 total copies of 12 published guides** in circulation
- ***Advanced Energy Design Guide for K-12 School Buildings – Achieving Zero Energy* – Published January 2018**

Applicable to all sizes and types of K-12 school construction

- ***Advanced Energy Design Guide for Small to Medium Office Buildings – Achieving Zero Energy* – Published June 2019**

Applicable to office buildings 10,000 to 100,000 ft<sup>2</sup> with a building height of less than 75 feet.

- ***Advanced Energy Design Guide for Multifamily Residential Buildings – Achieving Zero Energy* – In Development**



For more information, visit: [ashrae.org/freeaedg](https://www.ashrae.org/freeaedg)

[ashrae.org](https://www.ashrae.org)

# Building EQ

## Take your building to the next level beyond benchmarking

- Online data entry and submission
- Metered data exchange from ENERGY STAR® Portfolio Manager
- Consistent, streamlined process to conduct ASHRAE Level 1 Energy Audit
- Auto-populated audit reports aligned with ASHRAE Standard 211
- Measured data and actionable recommendations to improve building energy performance
- French translation now available for use

For more information, visit: [ashrae.org/BuildingEQ](https://ashrae.org/BuildingEQ)



[ashrae.org](https://ashrae.org)



# Online Standards Review Database

Launched in September 2018, the online standards review database allows members and non-members access to public review drafts for standards, guidelines, and addenda and to submit comments.

## The new system offers:

- single sign-on feature
- new dashboard which highlights items that require attention, provides quick links to individual / committee comments, continuous maintenance proposals and outstanding ballot results



For more information, visit: [ashrae.org/publicreviews](https://ashrae.org/publicreviews)

# Publishing/Education Strategies to Improve Content Access

## Enhance member access using online delivery

- **ASHRAE Technology Portal** for *ASHRAE Journal*, Research Reports, Conference Papers, Seminars
- Handbook PDFs added to **ASHRAE Technology Portal** to eliminate CDs
- 90.1 Portal syncs the 2016 standard with the user's manual plus red-line version

## 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

- 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

For more information, visit: [ashrae.org/technology-portal](https://ashrae.org/technology-portal)



[ashrae.org](https://ashrae.org)



# See You There!

- International Congress of Refrigeration 2019  
*August 24-30, 2019 – Montréal, Québec, Canada*
- 2019 ASHRAE Building Performance Analysis Conference  
*September 25-27, 2019 – Denver, CO*
- 7<sup>th</sup> International Conference on Energy Research and Development  
*November 19-21, 2019 – State of Kuwait*
- Greenbuild International Conference and Expo  
*November 20-22, 2019 – Atlanta, GA*
- 2019 Building XIV International Conference  
*December 9-12, 2019 – Clearwater, FL*

For more information, visit: [ashrae.org/conferences](https://ashrae.org/conferences)



@ Greenbuild Expo

# Questions?

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



[ashrae.org](http://ashrae.org)

# Program Subcommittee of Refrigeration Committee

## Submission Due date for

### 1. Program Topics to Submit for 2020 Winter (due date is August 2, 2019)

REF discussed a number of programs in the past. The following programs can be discussed more in detail:

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

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

### 2. 2020 Winter Program

"The 2020 ASHRAE Winter Conference features following eight tracks.

1. HVAC&R Fundamentals and Applications
2. Systems and Equipment
3. Refrigeration and Refrigerants
4. Cutting Edge Approaches
5. High Efficiency Design and Operation
6. Big Data and Smart Controls
7. Ventilation, IAQ and Air Distribution Systems
8. Standards, Guidelines and Codes

Deadlines are:

~~Monday, March 18, 2019: Conference Paper Abstracts, Technical Papers and Paper Session Requests Due~~

~~Monday, April 22, 2019: Conference Paper Abstract Accept/Reject Notifications~~

**Monday, June 17, 2019: Website Opens for Seminar, Workshop, Forum, Debate, and Panel Proposals**

Monday, July 8, 2019: Final Conference Papers Due - Submitted for Review

Friday, July 26, 2019: Conference Paper Accept/Revise/Reject Notifications

Friday, August 2, 2019: Seminar, Workshop, Forum, Debate, and Panel Proposals Due

Friday, August 9, 2019: Revised Conference Papers/Final Technical Papers Due

Friday, August 26, 2019: Conference and Technical Paper Final Accept/Reject Notifications

Friday, October 4, 2019: Seminar, Workshop, Forum, Debate, and Panel Accept/Reject Notifications

### **3. Past sponsored programs (2017 Annual to 2019 Winter)**

#### **2017 Annual (1 Workshop and 1 seminar)**

##### **Workshop 7: Status of Standards and Codes in the USA, In View of the Application of Low GWP Refrigerants**

Sponsor: REFRIGERATION COMMITTEE

Chair: Steven Eckels

1. Status of ASHRAE 15, Related Codes and SNAP, Phillip Johnson, P.E., Member, Daikin Applied, Staunton, VA
2. Status of UL Standards and Related Codes, Brian Rodgers, Member, Underwriters Laboratories, Northbrook, IL

##### **Seminar 50: High Efficiency Commercial Refrigeration Systems with Natural Refrigerants**

Sponsor: 10.7 Commercial Food and Beverage Refrigeration Equipment, Refrigeration Committee, TC8:1 Positive Displacement Compressors; TC3.1 Refrigerants and Secondary Coolants

Chair: Georgi Kazachki

1. Doing It All Efficiently with CO<sub>2</sub> Refrigeration Anywhere in the World, Klaas Visser, P.E., Affiliate, KAV Consultants Pty Ltd, Kangaroo Flat, Australia
2. Design and Performance Validation of Ultralow Charge Ammonia Cascade System for Retail Food Environment, Karthick Kuppusamy, Heatcraft-Kysor/Warren, COLUMBUS, GA
3. Opportunities for Utilizing Two-Phase Ejectors to Increase Efficiency of Commercial Refrigeration Systems Using Natural Refrigerants, Stefan Elbel, Ph.D., Member, Creative
4. Packaged Ammonia/CO<sub>2</sub> Systems for Refrigeration, Scott Mitchell, Associate Member, Southern California Edison, Irwindale, CA

#### **2018 Winter (1 Workshop and 1 seminar)**

##### **Workshop 5: Status of Standards in Europe and the Relation to IEC, ISO in View of the Application of Low GWP Refrigerants**

Sponsor: Refrigeration Committee

Chair: Martin Dieryckx

1. Changes and Work in Progress in IEC 61D and IEC 61C Related to Implementation of Low GWP Substances, Brian Rodgers, Underwriters Laboratories, Northbrook, IL
2. Changes and Work in Progress in European Standards for Low GWP Substances and Relation to ISO and IEC, Els Baert, Member, Daikin Europe NV, oostende, Belgium

### **Seminar 45: What In The World? Global Refrigerant Regulations Explained By Experts from Around the Globe**

Sponsor: MTG.LowGWP Lower Global Warming Potential Alternative Refrigerants, Refrigeration Committee, UNEP

Chair: Jason Robbins

1. The Kigali Amendment: What Does It Actually Do and Why Should I Care?, Andrea Voigt, Member, The European Partnership for Energy and the Environment, Brussels, Belgium
2. US Refrigerant Regulatory Updates, ASHRAE Standard 15 and UL Safety Standards Bill Hansen, P.E., Member<sup>1</sup> and Jason Robbins, P.E., Member<sup>2</sup>, (1)Ingersoll Rand, La Crosse, WI, (2)McDonald's, Romeoville, IL
3. Refrigerant Regulations in Asia, Tetsuji Okada, Japanese Refrigeration and Air Conditioning Industry Association (JRAIA), Tokyo, Japan
4. Refrigerant Regulations in Developing Countries, Ayman Eltalouny, Member, OzonAction Programme at UN Environment, Manama, Bahrain
5. Refrigerant Regulatory Updates in Europe, Martin Dieryckx, Member, Daikin Europe NV, Oostende, Belgium

## **2018 Annual (1 seminar)**

### **Seminar 71: Recent Advances in Solid-State Cooling Technologies**

Sponsors: Refrigeration Committee, 1.1 - Thermodynamics and Psychrometrics and 8.1 Positive Displacement Compressors; 10.7 Commercial Refrigeration

Chair: Georgi Kazachki

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 by Qiming Zhang, Penn State University, University Park, PA
3. Overview of Elastocaloric Cooling, Yunho Hwang, Member, University of Maryland, College Park, MD

## **2019 Winter (2 seminars)**

### **Seminar 40: Update on Global Policies and Programs for Best Use of Refrigerants**

Chair: Yunho Hwang

- Montreal Protocol and UNEP Program Update, Ayman Eltalouny, UNEP)
- EU F-Gas Regulation Update, Didier Coulomb, IIR
- IIR Refrigerant Program Update, Didier Coulomb, IIR
- US GHG Regulation and EERE Program Update,: Antonio Bouza, DOE (Absent due to government shut down)

### **Seminar 23 - Advances in Low-GWP Refrigeration System Architectures**

Sponsor: 10.7 Commercial Food and Beverage Refrigeration Equipment, Refrigeration Committee

Chair: Georgi Kazachki

1. Micro-Distributed Systems, Timothy Anderson, Hussmann, Bridgeton, MO
2. Application of CO<sub>2</sub> Transcritical Advanced Technologies in Hot Climates, Shitong Zha, Ph.D., Member, Heatcraft, Stone Mountain, GA
3. Combining HFO's with Various System Architectures to Reduce Energy Use and Emissions in Commercial Refrigeration, Gustavo Pottker, Member, Honeywell - Buffalo Research Laboratory, Buffalo, NY

## **2019 Annual**

None

# ASHRAE - UN Environment Cooperation

## An update on ongoing workplan

**ASHRAE Annual Conference**  
**Kansas City, June 2019**



# 2019-2020 Workplan

## Refrigerant Management for Developing Economies



# 2019-2020 Workplan – Refrigerant Management for Developing Economies

## Objectives Level

**Advocacy,  
Empowering national  
decision-makers,  
Knowledge Sharing  
and Technical Support**

**1 –**

## Programs Level

- 1 – Refrigerant Literacy**
- 2 – Sound Management of Refrigerant**
- 3 – Sustainable Operation & Management of RAC Installations**
- 4 – Technical Capacity Building**

## Activities Level

**EventsEvents  
Online Tools  
Focused Guides  
Support Services  
Awards and Certification**

	Events	Online Tools	Focused guides	Support Services	Award and Certification
Refrigerants Literacy	Development of Instructor Led version of Refrigerant Literacy course	Dedicated Web Site for Access all tools	Series of Fact Sheets and quizzes using Refrigerants Literacy course	Master Trainers for F2F Literacy Sessions	Recognition and Certification Products
	Train-the-trainers Sessions for F2F Training	Online promotional campaign			
	Special F2F Sessions, at ASHRAE Conferences, for ASHRAE Chapters in A5 countries	Latin American Spanish Translation (Completed) + African French Translation (Ongoing)			
Sound Management of Refrigerants	Development of Instructor Led version of Sound Management Refrigerant course	Dedicated Web Site for Access all tools (Same as above)	Series of Fact Sheets and quizzes using Sound Management Course	Master Trainers for F2F Sound Management Course Sessions	Recognition and Certification Products
	Train-the-trainers Sessions for F2F Training	Online promotional campaign			
	Special F2F Sessions, at ASHRAE Conferences, for ASHRAE Chapters in A5 countries	Latin American Spanish + African French Translation			
Sustainable O&M of RAC Installations	Special sessions at ASHRAE Conferences/Events	Online version with step-by-step guide on how to implement the guide	Interntional Guide for Sustianble O&M of RAC Installations	Master Trainers Program	Certified Individuals completed the program
	Special events at MOP/OEWG		Development of quick guides extracted from the Guide		Low-GWP Innovation Award Program.
	Promotional events at local level in A5 countries (NOUs and ASHRAE Chapters)				Certificate program for facilities that have achieved sustainable O&M practices.
Capacity Building	High Ambient Symposium	Special Mobile App on Refrigerants designtion, classiification and selection against applications	Update regularly the “Refrigerants Classification and Designation” factsheet for policy makers.	Promotion Campaign on the University Course and feedback tool	Promotion of women in AC&R program by identifying ASHRAE members as role models.
	Local events in A5 countries to be led by ASHRAE Chapters in cooperation with NOUs	Special Mobile App on Refrigerants and Safety Standards	Fact sheet on flammability research and development standards		

# Overview of ongoing activities

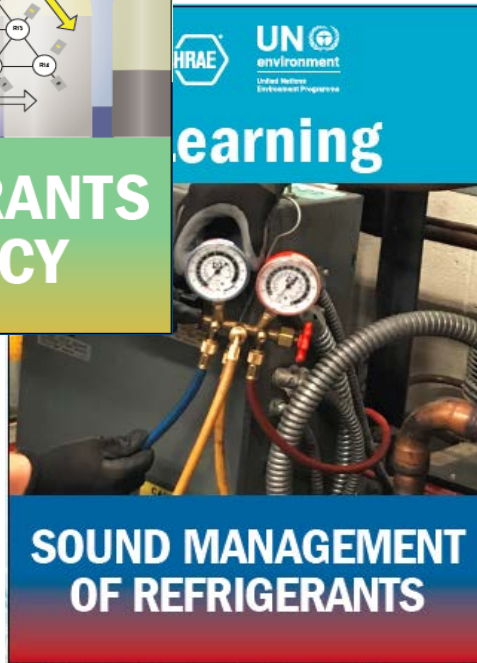
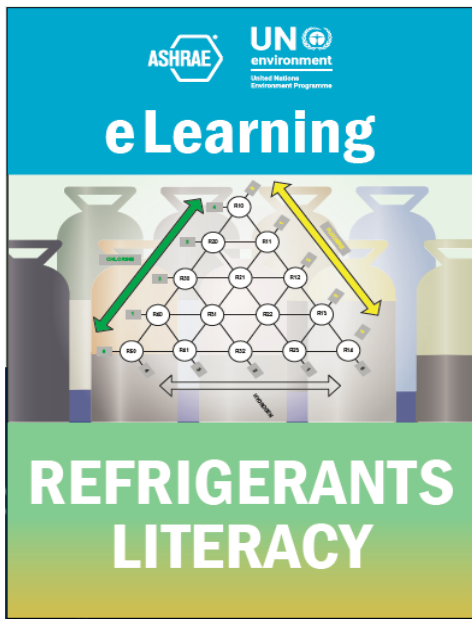
# Joint Events



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

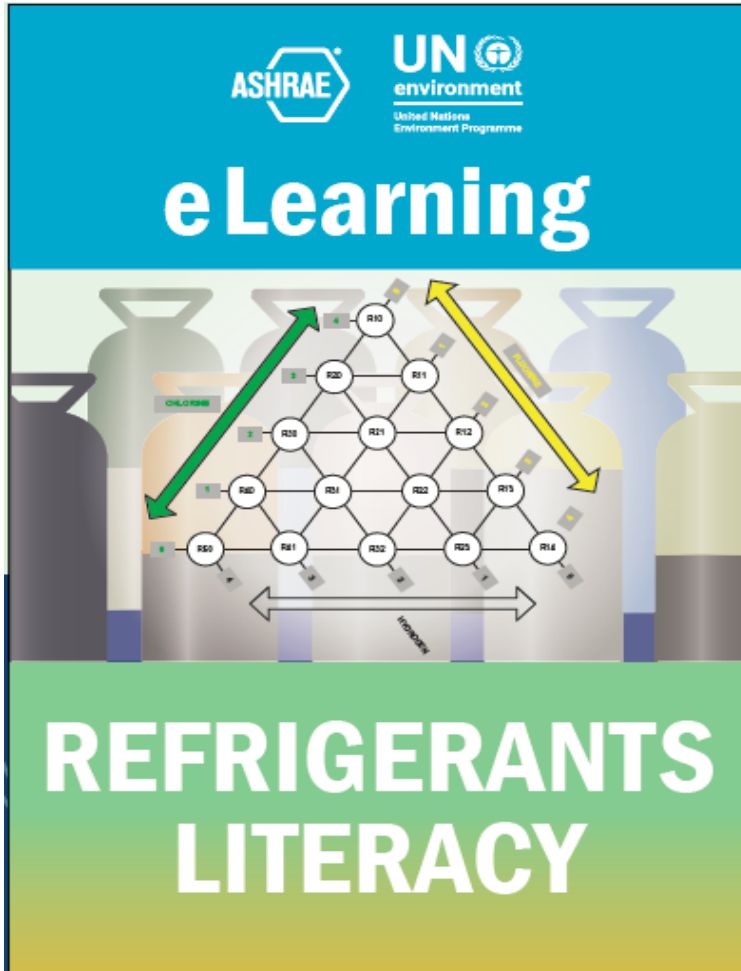
## Examples - Cooperation in conferences and events with partners (2017-2019)

Event	Date – Venue
International Conference on Sustainable Technologies of RAC in Marine/Off-Shore Fisheries Sectors,	Bangkok (April 2017)
International Conference on District Cooling for Urban Development,	Sharm Al-Sheikh, Egypt (Sept 2017)
ASHRAE Developing Economies Conference,	Delhi (Nov 2017)
Side Event at Montreal Protocol Meetings,	Montreal (2017) Ecuador (2018)
ASHRAE presentation at UNEP Seminar at REFCOLD in on Cold Chain in Article 5 Countries.	Ahmedabad, India Nov 2018
Alternative Lower GWP technologies for High ambient temperature countries	Atlanta, Jan 2019
Technical Conference on HVAC&R Codes for Developing Economies (CRC-RAL)	Jordan, Sept 2019
Sixth High Ambient Symposium on Alternative for High ambient countries	Dubai, Sept 2019



# Online Courses





## Vital Statistics

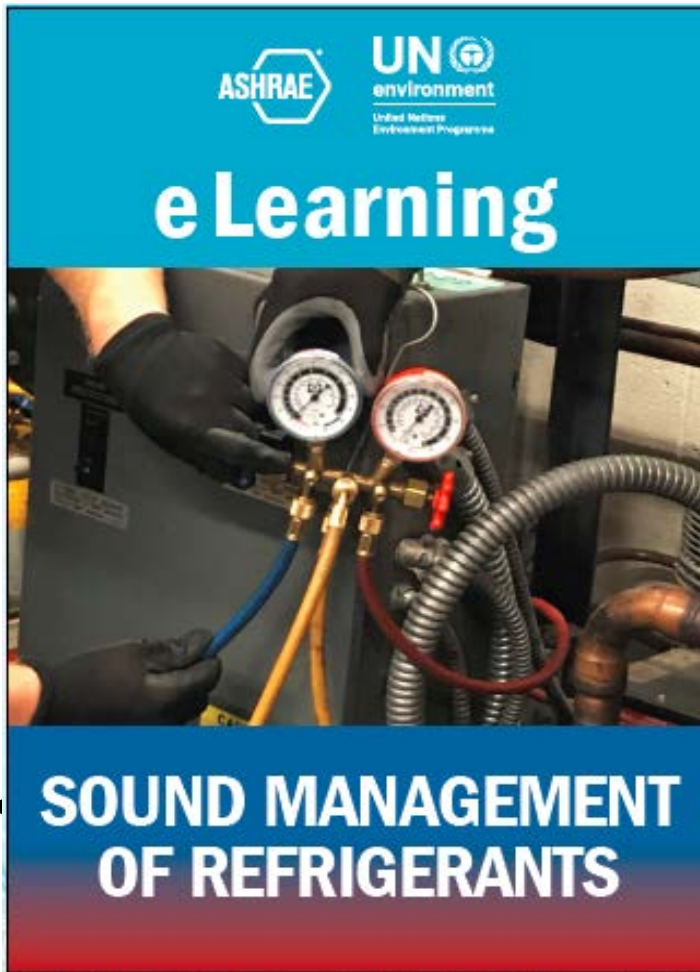
Course Launch	July 2017
Course Modules	4
Course Length	4.5 hrs
Enrollees	920

## Versions

English

Spanish

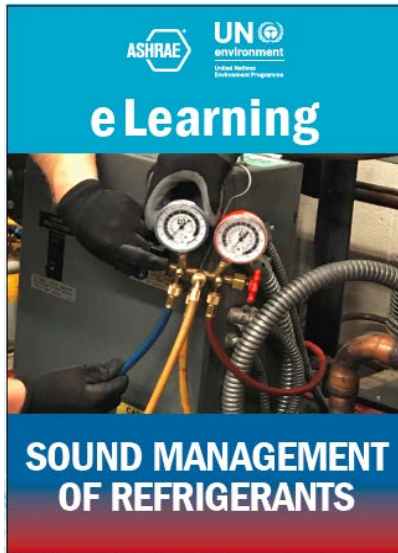
French



### Vital Statistics

Course Launch	December 2018
Course Modules	5
Course Length	6.5 hrs
Knowledge Checks	44
Final Exam Questions	681





Module #	Module Titles
Module 1	Environmental Issues and Refrigerant Management
Module 2	ASHRAE Refrigerant Designation, Numbering and Classification
Module 3	Lubricants Oils for Refrigeration Systems
Module 4	Good Service Practice:  Part 1: Refrigerant Recovery, Recycle, and Reclaim (3 R's), Equipment and Cylinders  Part 2: Tools and Equipment for Service and Repairs  Part 3: HVACR Systems
Module 5	Safety Aspects for Refrigerants and Containers

# Innovation Award



# UN Environment / 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 technologies for refrigeration and air-conditioning applications 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 Jan 12 2019



# UN Environment / ASHRAE Award Program

## Innovation in Refrigerant Management

### 2019 AWARD

- ▶ **SUBMISSIONS** – January 1 to Aug 15, 2019
- ▶ **JUDGING** – Judges selected by the Liaison Committee
- ▶ **SELECTION** – Selection reported to ASHRAE Honors & Awards Committee, June '19
- ▶ **PRESENTATION** – To be determined by UN Environment at one of its meetings.
- ▶ **PUBLICITY** – Displays at conferences, news for UN and ASHRAE use and dissemination, ASHRAE Journal technical article
- ▶ **BENEFITS**
  - Dissemination of successful ideas that can be replicated in developing countries
  - Encouragement of innovation through peer recognition
  - Recognition of ASHRAE commitment to low GWP refrigerants use
  - Fulfillment of UN Environment objective of capacity building

# University Course



## Refrigerant Management



M1

M2

M3

M4

M5

Special University Course for  
Future Engineers





## Free Refrigerant Management for Future Engineers Course

### Seeking Instructors to Pilot Refrigeration Management Course

ASHRAE has been chosen to distribute a university level course developed by UN Environment on Refrigerant Management for engineering students.

ASHRAE is seeking instructors willing to pilot the course in their curricula. Instructors will be provided with lecture notes, activity sheets, and course presentations. There is no cost to access the course.

Over the last two decades UN Environment has been involved in training programs offered to field engineers and service technicians on refrigeration good practices including emissions reduction with a focus on hands-on practices.

This new course is first of its kind by UN Environment to offer comprehensive scientific information at the academic level. Future engineers will be offered the skills required to manage refrigerants soundly, as well as, technical and policy aspects associated with the refrigeration and air-conditioning industry.

UN Environment is especially interested in identifying instructors in developing countries.

### Course Outline



#### MODULE 1 - 4 WEEKS

REFRIGERATION & AIR CONDITIONING INDUSTRY, EVOLUTION OF REFRIGERANTS & ENVIRONMENTAL IMPACTS



#### MODULE 2 - 3.5 WEEKS

ALTERNATIVE REFRIGERANTS FOR DIFFERENT SECTORS & LUBRICANTS



#### MODULE 3 - 3 WEEKS

CONTAINMENT OF REFRIGERANTS, SERVICE & MAINTENANCE OF AIR CONDITIONING & REFRIGERATION SYSTEMS



#### MODULE 4 - 2 WEEKS

SAFE USE & HANDLING OF REFRIGERANTS



#### MODULE 5 - 2 WEEKS

RELATED STANDARDS AND CODES OF SYSTEMS AND SUBSTANCES

If interested, please contact Julie Harr at [jharr@ashrae.org](mailto:jharr@ashrae.org) with your name, email, institution, city, country and when you anticipate that you would be able to use the course.

# ASHRAE-UNEP Portal

URL: <https://www.ashrae.org/professional-development/ashrae-unep-portal>







[eLearning](#) [Fact Sheets](#) [University Course](#) [News & Events](#) [Workplan](#) [Lower GWP Award](#)

A joint ASHRAE and UN Environment award promotes innovative design, research and practice by recognizing people who have developed or implemented innovative technological concepts applied in developing countries to minimize global warming potential (GWP) through refrigeration and air-conditioning management. Entries for the 2019 award are being accepted until August 15.

Information and submission details:

[LEARN MORE](#)



# ASHRAE MEMBER ACCESS CONTINUED...



eLearning   Fact Sheets   **University Course**   News & Events   Workplan   Lower GWP Award

## Free Refrigerant Management for Future Engineers Course

ASHRAE has been chosen to distribute a university level course developed by UN Environment on Refrigerant Management for engineering students.

There is no cost to access the course and use the course materials. Instructors are provided with lecture notes, activity sheets, and course presentations.

Over the last two decades

UN Environment has been involved in training programs offered to field engineers and service technicians on refrigeration good practices including emissions reduction with a focus on hands-on practices.

This new course is first of its kind by UN Environment to offer comprehensive scientific information at the academic level. Future engineers will be offered the skills required to manage refrigerants soundly, as well as, technical and policy aspects associated with the refrigeration and air-conditioning industry.

### Course Outline



#### MODULE 1 - 4 WEEKS

REFRIGERATION & AIR CONDITIONING INDUSTRY, EVOLUTION OF REFRIGERANTS & ENVIRONMENTAL IMPACTS



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ALTERNATIVE REFRIGERANTS FOR DIFFERENT SECTORS & LUBRICANTS



#### MODULE 3 - 3 WEEKS

CONTAINMENT OF REFRIGERANTS, SERVICE & MAINTENANCE OF AIR CONDITIONING & REFRIGERATION SYSTEMS



#### MODULE 4 - 2 WEEKS

SAFE USE & HANDLING OF REFRIGERANTS



#### MODULE 5 - 2 WEEKS

RELATED STANDARDS AND CODES OF SYSTEMS AND SUBSTANCES



## UNEP Refrigerant Management Course

### Course Sample Materials Registration

Register to get access to the course sample materials. To register, please select "Register Now" button:

[Register Now!](#)

### Full Course Registration

Full course registration requires previously completed registration for course sample materials.

To register for the full course materials, please enter the e-mail address below that was used for the previous registration. Please select "Register Now" button.

E-Mail Address:

[Submit](#)

### UNEP Refrigerant Management Course Guidance

The Refrigerant Management Course is a university level course developed by UN Environment for engineering students. ASHRAE distributes the course and promotes its use by ASHRAE Student Branch Advisors and other instructors globally. Its use is restricted for educational purposes in academic settings.

Register to review for course sample materials.

In order to register for the full course material, please provide the email address used for registration of course sample materials.



**eLearning**

**Fact Sheets**

**University Course**

**News & Events**

**Workplan**

**Lower GWP Award**

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ASHRAE and UNEP have partnered to create web-based, interactive learning courses that earn certificates for successful completion. The learning platform tracks your progress, allowing you to take courses in stages when time is available. Learning checks throughout courses prepare you for a final exam.

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## **Refrigerants Literacy (SI), 4.5 PDHs - (Spanish Version)**

This course offers basic understanding about refrigerants types, policies, classifications and management practices. It is aimed at non-specialists in the field, such as facility managers, policy makers, and other individuals who are involved in refrigerant issues from a non-technical perspective. It also, however, can serve as an introduction to refrigerant basics for

# ASHRAE MEMBER ACCESS CONTINUED...

## Refrigerants Literacy (SI), 4.5 PDHs - (Spanish Version)

This course offers basic understanding about refrigerants types, policies, classifications and management practices. It is aimed at non-specialists in the field, such as facility managers, policy makers, and other individuals who are involved in refrigerant issues from a non-technical perspective. It also, however, can serve as an introduction to refrigerant basics for those new to the industry.

### Course Access Instructions

This course is available only to ASHRAE members and to those who have been provided a code by UNEP.

Click on **ENROLL NOW** to begin the enrollment process.

If you already have an account with ASHRAE, enter your **email address** and **password** and click the **“Submit”** button.

If you do not have an existing account with ASHRAE, click on **“Create an account”** and enter the required information to create an account.

Next, enter the enrollment code in the box that says, **“Enrollment Key”** and click on **“Enroll me.”** to complete the enrollment process.

If you are an ASHRAE member and do not have an enrollment code, visit [ASHRAE eLearning Center](#) to get your enrollment code. The code can be used to access all 3 UNEP-ASHRAE eLearning courses.



ENROLL NOW

Non-members can access courses on similar topics under the Refrigerants subject in the [ASHRAE eLearning Catalog](#).



LEARN MORE

# ASHRAE MEMBER ACCESS CONTINUED...

## ❖ Refrigerants Literacy (SI), 4.5 PDHs - (Spanish Version) ←



### Course Access

This course is available only to ASHRAE members and to those who have been provided an enrollment code by UNEP.

To enroll in the course, enter the enrollment code in the box that says, "**Enrollment Key**" and click on "**Enroll me.**"

If you are an ASHRAE member and do not have an enrollment code, please visit [ASHRAE eLearning Center](#) to get your enrollment code. The code can be used to access all 3 UNEP-ASHRAE eLearning courses.

Non-members can access courses on similar topics under the Refrigerants subject in the [ASHRAE eLearning Catalog](#).

### Course Description

This course offers a basic understanding of refrigerants types, policies, classifications and management practices. It is aimed at non-specialists in the field, such as facility managers, policymakers, and other individuals who are involved in refrigerant issues from a non-technical perspective. It also, however, can serve as an introduction to refrigerant basics for those new to the industry. The course consists of four lessons.

Lesson 1 covers refrigerants types and addresses environmental considerations. Lesson 2 deals with refrigerant classifications including ASHRAE Standards 15 and 34. Lesson 3 addresses refrigeration selection, including residential and small commercial applications. Lesson 4 covers Refrigerant Management, including the development of a management plan, containers, storage, and recovery, recycling, and reclamation.

Enter your access  
code here

### ▼ Access Course with Code

Enrollment key  ☐ Unmask

Enroll me

After entering the  
access code, click  
on "Enroll me"  
button

# Launching Now...



# WORLD REFRIGERATION DAY 2019

UN Environment OzonAction, (ASHRAE), and the World Refrigeration Day Secretariat are campaigning for the first World Refrigeration Day (WRD), on 26 June 2019 with the theme of:

## REFRIGERANTS FOR LIFE





# REFRIGERANTS FOR LIFE

Whether you are an individual, government, private sector, institution, NGO, etc. you can use any of the following material to join the campaign.

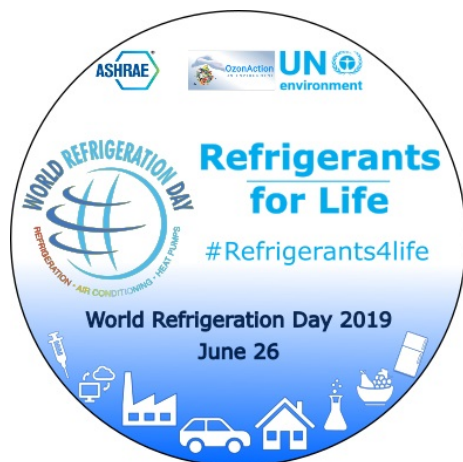
You can download related materials

- Sticker [English](#) | [French](#) | [Spanish](#)
- Poster [English](#) | [French](#) | [Spanish](#)
- Leaflet [English](#) | [French](#) | [Spanish](#)

**WEBINAR ON 26 JUNE 2019 - 9:00 - 10:30 EDT on Wednesday 26 June 2019**

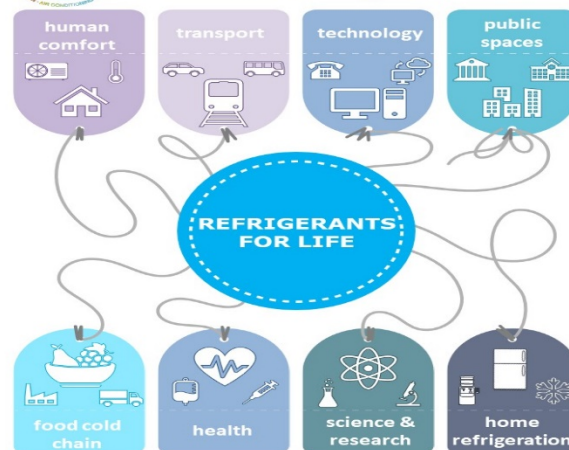
**“Refrigerants for Life: How Refrigerants affect Modern Life**

<https://register.gotowebinar.com/register/8929574132452185347>



World Refrigeration Day - 26 June 2019

#Refrigerants4Life



<sup>1</sup>IIR, "29th Informatory Note on Refrigeration Technologies: The Role of Refrigeration," 2015, "UN Environment, IIR,  
"Cold Chain Technology Brief: Commercial, Professional, and Domestic Refrigeration," 2018, "UN Environment,  
"Refrigeration, Air-Conditioning, and Heat Pumps Technical Options Committee: 2018 Assessment Report," 2018.

**Context**

- Domestic refrigerators use 65% less energy than 15 years ago<sup>1</sup>.
- 4 million refrigerated trucks & 600 million m<sup>3</sup> of refrigerated warehouses help preserve 400 million tonnes of food each year<sup>2</sup>.
- 2+ billion domestic refrigerators & freezers (with 170 million produced annually) consuming 4% of global energy<sup>3</sup>.
- 5.6 billion air-conditioners in use by 2050, tripling the sector's energy demand<sup>2</sup>.

**Environmental Issues and Safety**

- Most commercially available refrigerants contribute to global warming and/or ozone depletion if released.
- Newer energy efficient equipment can save owners money and reduce greenhouse gas emissions.
- Alternative refrigerants are available but some have flammability, high-pressure or toxicity that require proper management.
- Efficient operation and management of cold chain applications curbs food loss and enhances food security.

**What Action is Needed**

- Careful refrigerant selection, system design, and management of operation can reduce refrigerant emissions and save energy costs.
- Selecting lower global warming potential refrigerants for new systems, where feasible, and promote relevant research.
- Promoting recovery, reuse, reclamation of refrigerants and prohibiting release into the atmosphere.
- Using certified companies and individuals to ensure good practice and servicing, and safe use of flammable refrigerants.

# REFRIGERANTS FOR LIFE



## WORLD REFRIGERATION DAY 2019





# REFRIGERANTS FOR LIFE WEBINAR



World Refrigeration Day  
UN Environment – OzonAction  
ASHRAE

## Webinar

9:00 – 10:30 am EDT on Wednesday 26 June 2019



## Refrigerants for Life: How Refrigerants Affect Modern Life

Modern life relies significantly on applications and systems of refrigeration and air-conditioning. Nowadays it is almost impossible to find a building or facility without cooling, heating, or chilling applications. The first half of the 20<sup>th</sup> Century saw advancements in chemistry and mechanical engineering; with this came the development of “fluorinated refrigerants”. As a result, the use of refrigeration and air-conditioning expanded exponentially to cover all aspects of life and in different types of buildings and facilities e.g. residential, commercial, industry, and even transport. It also extended to cover critical sectors of modern life such as health and telecommunications.

Over the last three decades, the world has realized that the most safe and efficient fluorinated refrigerants that were used for decades, contribute negatively to global warming and ozone depletion and threaten life on earth. Because of this, governments and industry engaged in legal and research efforts to find alternatives in order to control refrigerant emissions, while maintaining the pace of human development and quality of life. Several international agreements concluded, and a new generation of refrigerants has been introduced over the last few decades resulting in several challenges that need to be overcome.

This Webinar intends to capture the overall global picture of policies, research, and trends of using refrigerants in different applications while presenting the role of industry, governments, and individuals in ensuring the Responsible Use of Refrigerants.

### OPENING THE SESSION

<b>Sheila Hayter</b> ASHRAE President	<b>James S. Curlin</b> Acting Head of OzonAction, UN Environment	<b>Stephen Gill</b> World Refrigeration Day Secretariat
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### KEYNOTE SPEAKERS

**Didier Coulomb**  
Director General  
International  
Institute of  
Refrigeration

**Ray Gluckman**  
Director  
Gluckman  
Consulting

**Andy Pearson**  
Group Managing  
Director  
Star Refrigeration  
Ltd

**Rajan Rajendran**  
Chairman  
Refrigeration  
Committee  
ASHRAE

**Andrea Voigt**  
Director General  
EPEE – The  
European  
Partnership for  
Energy and the  
Environment

### MODERATORS

<b>Stephen Gill</b> World Refrigeration Day Secretariat	<b>W. Stephen Comstock</b> Manager of Business Development EMEA, ASHRAE
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*Support to*

# Refrigerant Driving License (RDL)

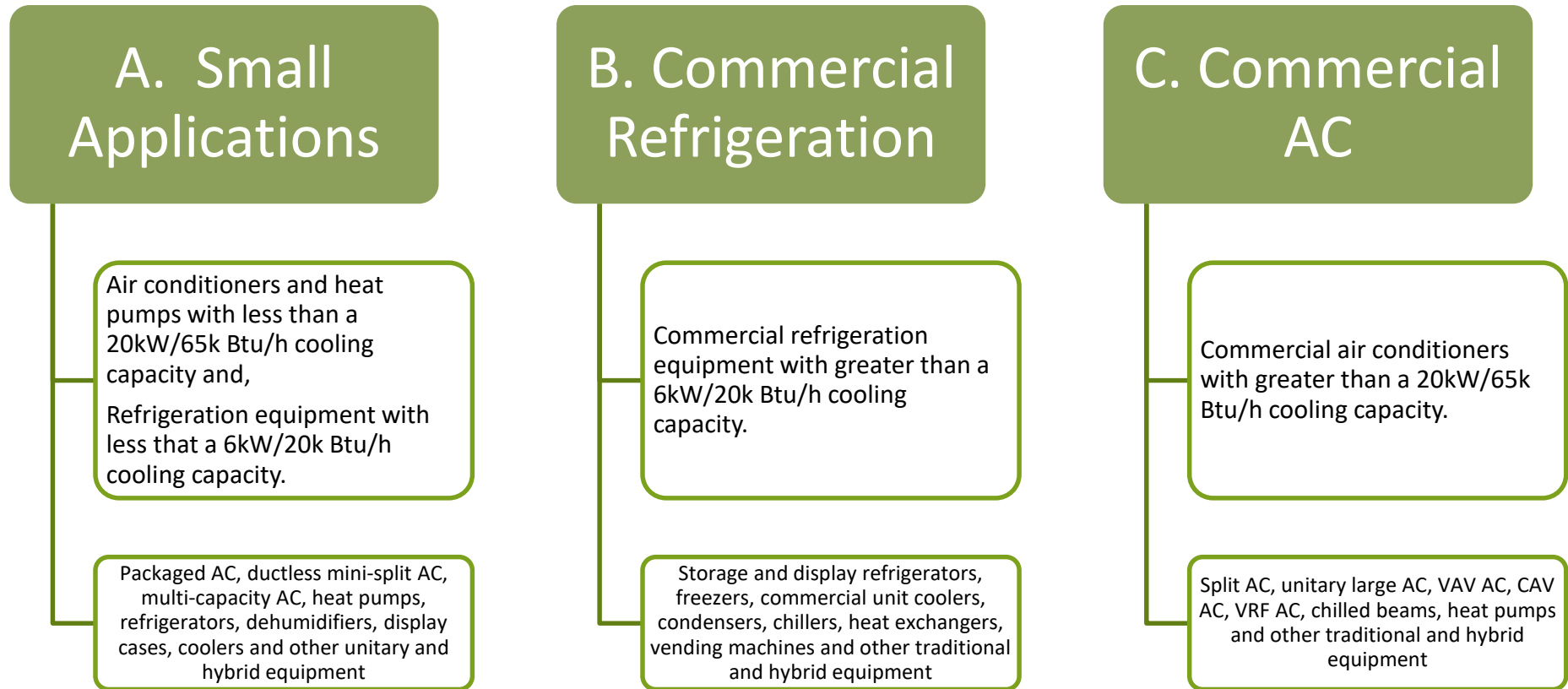




# Refrigerant Driving License (RDL)



# The RDL program encompasses three categories of equipment



- Pilot Stage starts June 2019 continues till end of the year in 6 countries:

**Grenada, Suriname, Trinidad and Tobago, Rwanda, Maldives & Sri Lanka**

- ASHRAE Expert identified to part of the Pilot stage international master trainers

- Launching and rolling out to all countries by 2020

# K-CEP Program



## 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.



# Upcoming...

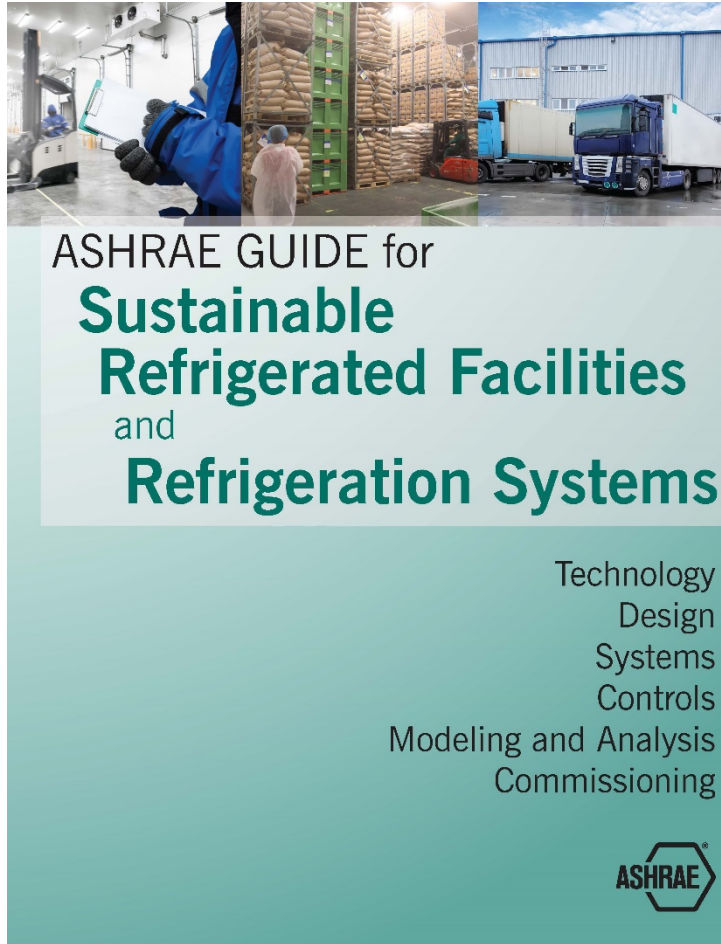
## Sustainable Operations and Maintenance of Refrigeration and Air Conditioning Plants

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

# ASHRAE sustainable Refrigerated Facilities Guide

## Summary/Brief for Developing Economies



## Sustainability: Not a Fixed Target

- Depends upon circumstances of the facility
- How to specify, design, build, operate
- Covers the Basics, Facility Design, Heat Load Calculation, System Design, Control Strategies, Energy Modelling, Performance Analysis, Commissioning.
- Methods to evaluate design and operational decisions for their own circumstances.
- Access to online tools for estimating heat load, COP, engine room energy use, and a design scorecard.





## Task Group recommendation for *Refrigerants and their Responsible Use* PD

### MOTION 1:

It is recommended that the Refrigeration Committee recommends that the Document Review Subcommittee recommends that Technology Council recommends to the BOD to initiate a revision to the *Refrigerants and their Responsible Use* position document (PD).

Yes	No	Abstain

Name:

Reason for Negative/Abstaining Vote(s):

### BACKGROUND:

Significant upgrades to the *Refrigerants and their Responsible Use* document were done in the last revision (June 2018) and it discusses all main classes of refrigerants, including ammonia. Therefore, it makes sense to have one comprehensive ASHRAE Refrigerants Position Document. Key elements from the *Ammonia as a Refrigerant* PD related to ASHRAE positions can be incorporated into a comprehensive Refrigerants PD. The *Refrigerants and their Responsible Use* PD expires in June 2021 and the *Ammonia as a Refrigerants* PD can stay in place until it retires in February 2020.

REF can recommend a chair and position document committee members at the Annual Meeting.

The title, purpose and scope of the recently revised *Refrigerants and their Responsible Use* PD is shown here:

#### Title:

- Refrigerants and Their Responsible Use

#### Purpose:

- To inform ASHRAE members, policymakers and the building industry about the major issues related to the use of refrigerants in HVAC&R equipment and systems and complement other Position Documents dealing in a more detailed way with narrower aspects of refrigerant application.

#### Scope:

- Consider all refrigerant classes in a balanced manner.
- Limit discussion to refrigeration applications, i.e., exclude other applications of refrigerant materials as blowing agents, solvents, fire suppressants.
- Discuss all major technical and policy considerations for refrigerant selection and use.
- Address secondary effects of refrigerant use including energy consumption, climate change and other environmental impacts, safety and health.
- Recommend actions in the areas of research, standards development, guidance and public policy.

## Task Group recommendation for *Refrigerants and their Responsible Use* PD

### MOTION 2:

It is recommended that the Refrigeration Committee recommends that the Document Review Subcommittee recommends that Technology Council to retire the *Ammonia as a Refrigerant* position document (PD) when it expires in February 2020.

Yes	No	Abstain

Name:

Reason for Negative/Abstaining Vote(s):

**BACKGROUND:**

Key elements from the *Ammonia as a Refrigerant* PD related to ASHRAE positions will be incorporated into a revised comprehensive *Refrigerants and their Responsible Use* PD.