ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

(DRAFT)

REFRIGERATION COMMITTEE (REF)
MINUTES

Annual Meeting
June 26th, 2011

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

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PRINCIPAL MOTIONS FROM ANNUAL MEETING
MONTREAL JUNE 26th, 2011

No.	Page No.	Motion
1	1	The minutes of the January 30th, 2011 meeting in Las Vegas be approved.
2	4	REF propose a seminar program for Montreal related to Advances and Trends in Natural Refrigerants and Technologies.
3	5	Technology Council not vote on the draft final report of the Refrigerant Management Plan ad hoc until REF can review and comment.
4	6	Technology Council approve the changes to the REF Manual of Procedures (MOP) as shown.
5	6	The REF Reference Manual be revised as shown.

ACTION ITEMS FROM WINTER MEETING
MONTREAL JUNE 26th 2011

No.	Page No.	RESPONSIBILITY	SUMMARY	STATUS
1	2	Siller/Anderson	develop a couple slides on how to implement or obtain PAOE points for CRC training slides. Send to staff	
2	3	REF	send Gage names of speakers on topic of natural refrigerants/safe refrigerant use.	
3	3	Scott/Siller	Forward PAOE suggestions to incoming President in October	
4	3	Scott/Lim	Discuss options for refrigeration reception with Judy Marshall.	
5	3	Scott	Determine how REF/TCs can participate in YEA mixer in Chicago	
6	4	Staff	Send final draft WS 1634 to REF	
7	5	Kazachki	finalize and submit program for Chicago related to Advances and Trends in Natural Refrigerants and Technologies by August 12.	
8	5	REF	Hold conference call to discuss final report from the Refrigerant Management Plan ad hoc committee.	Complete
9	6	Bansal, Jekel, Scott, Groll	Develop presentation for students on opportunities and careers in refrigeration field for Winter Meeting.	
10	6	Staff/Gage	summarize refrigeration resources survey results and present to REF	
11	6	Bansal, Groll, Seeton	Review summary of TC scopes and TC consolidation and make recommendation to REF	

ACTION ITEMS FROM WINTER MEETING
LAS VEGAS JANUARY 30th 2011

No.	Page No.	RESPONSIBILITY	SUMMARY	STATUS
1	2	Staff	Incorporate changes to Milt Garland & Comfort Cooling Awards, MOP, and Reference Manual. Post current versions on REF page of ASHRAE website	Complete
2	2	Staff	Send form for nominating new REF committee members to current REF members.	Complete
3	4	Gage	Send USGBC contact who'd indicated interest in RTAR-1634 to Scott and Anderson	Complete
4	4	Anderson, Pearson, Scott	Continue to pursue opportunities (USGBC, UNEP, CEC, others) for co-funding of RTAR 1634	Complete
5	4	Staff	Send contact information of those that volunteered to help develop WS 1634 to Doug Scott	Complete
6	4	Gage, Scott, Siller, Anderson	Consider drafting a strategic goal related to refrigeration to incorporate into ASHRAE Strategic Plan	Complete
7	4	Siller, Scott, Manole	Participate in CTTC/REF ad hoc committee	Complete
8	5	Kazachki	Finalize and submit seminar program for Montreal on "advances and trends in natural refrigerants and technologies".	Complete
9	6	Gage, Briley Committee	Write Insights article on this year's winner of George Briley Award	Complete
10	6	Hinde, Scott, Anderson, Reindl (or Dettmers or Jekel), Manole, Royal	Develop TPS for Guideline on Commissioning of Refrigeration Systems	Complete

LIST OF APPENDICES

LIST OF ACRONYMS

ABQ	-	Albuquerque
AMORTS	-	Assistant Manager of Research and Technical Services
ASHRAE	-	American Society of Heating, Refrigerating, and Air-conditioning Engineers
BOD	-	Board of Directors
CEC	-	Conferences and Exposition Committee
CO2	-	Carbon Dioxide
CRC	-	Chapters Regional Conference
CV	-	Chair Voting
CTTC	-	Chapter Technology Transfer Committee
EX-O	-	Ex-Officio
HVAC	-	Heating, Ventilation, and Air Conditioning
IIAR	-	International Institute of Ammonia Refrigeration
IIR	-	International Institute of Refrigeration
MBO	-	Management by Objective
MLF	-	Multi-lateral Fund
MOP	-	Manual of Procedures
MOU	-	Memorandum of Understanding
NH3	-	Ammonia
NIST	-	National Institute for Technology and Standards
ODS	-	Ozone Depleting Substances
PAOE	-	Presidential Award of Excellence
PD	-	Position Document
R	-	Refrigeration
RAC	-	Research Administration Committee
REF	-	Refrigeration Committee
RFP	-	Request for Proposals
RTAR	-	Research Topic Acceptance Request
SSPC		Standing Standard Project Committee
TAC	-	Technical Activities Committee
TC	-	Technical Committee
TPS	-	Title, Purpose, Scope
UNEP	-	United Nations Environment Program
USGBC	-	United States Green Building Council
USNC	-	United States National Committee
WS	-	Work Statement
YEA	-	Young Engineers in ASHRAE

MINUTES
REFRIGERATION (REF) COMMITTEE
JUNE 26th, 2011
MONTREAL, QUEBEC, CANADA

MEMBERS PRESENT:
Cynthia Gage, *Chair*
Doug Scott, *Vice Chair*
Pradeep Bansal
Ted Hansen
Todd Jekel
Georgi Kazachki
Cesar Lim
Dan Manole
Kent Anderson, *Consultant*
Don Siller, *Consultant*
Bill Bahnfleth, *Coord. Officer*
Samir Traboulsi, *BOD Ex-O*

GUESTS:
Jeff Berge, *Incoming Member*
Chuck Gulledge, *Incoming Coord. Officer*
David Hinde, *Incoming Member*
Ross Montgomery, *Incoming BOD Ex-O*
Richard Royal, *Incoming Member*
Chris Seeton, *Incoming Member*
Bruce Badger
Tim Dwyer
Steven Freidman
Bruce Griffith
Eckhart Groll
Scott Martin
Apichit L. Pongpana
Doug Reindl
Eric Smith
Tom Watson
Tom Werkema
Bill Williams

MEMBERS NOT PRESENT:
Marc Chasserot
Donald Hay
Norbert Mueller
Andy Pearson

ASHRAE STAFF:
Steve Hammerling, *AMORTS*

1.0 CALL TO ORDER AND ROLL CALL

Chair Cynthia Gage called the meeting to order at approximately 8:00 a.m. Members, incoming members, and guests introduced themselves.

2.0 APPROVAL OF MINUTES

It was moved (CL) and seconded (PB) that,

1. The minutes of the January 30th, 2011 meeting in Las Vegas be approved.

MOTION 1 PASSED: 8-0-0 CV

3.0 REVIEW OF AGENDA

The agenda distributed prior to the meeting (**Appendix 1**) was reviewed.

4.0 CHAIR REPORT

4.1 Motions from Last Meeting

Three motions from the REF meeting in ABQ required approval from a higher committee:

- Reaffirmation of Natural Refrigerants PD – This motion was approved by Technology Council and is pending BOD approval.
- Reaffirmation of Ozone Depleting Substances PD – This motion was approved by Technology Council and is pending BOD approval.

- Disband the Ozone Depleting Substances PD Committee that was working on a revision to the PD – This motion was approved and the PD committee is disbanded.

4.2 New Information Items for REF

4.2.1 **PAOE recommendations**

Gage submitted the following recommendations for PAOE points in the next Society Year to the incoming President (those that were selected are underlined):

1. Points if the Chapter would form & activate a Refrigeration Chair complete with 3 members.
2. Points for given refrigeration (low temperature using NH3, Natural refrigerants etc) seminar or training either on a regular monthly meeting or a regular monthly schedule.
3. Points if a chapter member submits an article on refrigeration in the ASHRAE Journal and is published by the society.
4. Points if a chapter has conducted a Plant Tour to a Cold Storage, Food & Beverage Processing Plant with refrigeration facilities for process cooling.
5. Points if a chapter has conducted a plant tour to a low temperature refrigeration equipment manufacturing facility
6. Points for each Refrigeration handbook chapter reviewed;
7. Points for each Milt Garland award and/or Comfort Cooling award submittal
8. Points for having a project designed and installed within your region by an ASHRAE member using alternative refrigerants such as CO2 or ammonia.
9. Points for the CTTC of a chapter giving a lecture or speech on safe refrigeration use or promotion of ozone friendly refrigeration systems.
10. Points for CTTC visiting high schools to promote the refrigeration field.

Anderson noted this was a nice achievement as it was the first time REF was successful in getting suggested PAOE points added. To help support chapters, it would be helpful to develop guidance for chapters on how they can obtain all of these points. Activities can be combined to maximize points.

Action Item 1 - Siller/Anderson - develop a couple slides on how to implement or obtain PAOE points for CRC training slides. Send to staff

4.2.2 **Briley article for webpage**

Gage reported she'd negotiated for the most recent George Briley Award winning article to be posted for free download from the Refrigeration page of the ASHRAE website (www.ashrae.org/refrigeration). Richard Royal's article, Heat Recovery in Retail Refrigeration is posted there now.

4.2.3 **Other**

Gage noted she'd made recommendations for additions to the to the ASHRAE Strategic Plan under Direction 1: ASHRAE will lead the advancement of sustainable building design and operations:

- Develop guides and other tools to advance the sustainability of refrigeration systems and applications.
- In buildings with refrigeration applications, integrate the optimization of these systems into net-zero design guidance and incorporate their operation into building performance metrics and ratings.

Gage asked for speakers on natural refrigerants. Volunteers include Seeton (risk management), Bansal, Lim, Mueller, Hinde, Scott, Kazachki, IIAR guys, and Jekel/Dettmers/Reindl

Action Item 2 – REF –send Gage names of speakers on topic of natural refrigerants/safe refrigerant use.

Badger noted that the 2L subcommittee of SSPC 15 is preparing an addendum to the standard related to ventilation of mechanical room. There may be added ventilation and monitoring requirements and a broadened occupancy category for 2L refrigerants. Badger asked all to participate in the public review when issued.

In summary of Chair's report, Gage pointed out the success in recommending PAOE points and Strategic Plan items were attributable to giving specific ideas and topics. Anderson suggested REF do this every year going forward in October (or earlier) and that REF not assume items will continue or roll over. Siller commented these recommendations can go through CTTC's Operations subcommittee in parallel to REF's submission.

Action Item 3 – Scott/Siller – Forward PAOE suggestions to incoming President in October

5.0 VICE CHAIR REPORT

5.1 Fiscal Report

Scott reported there is a small stable budget for REF committee travel, staff support and awards. As of May there was ~$31k in actual costs versus ~$28k in budget. There is a placeholder in the REF budget for the USNC/IIR membership with no funds in budget.

Scott raised an idea to reinstate the refrigeration reception. Such an event may be a good way to reach out to Young Engineers in ASHRAE (YEA) and TC's. REF can request the budget to fund this from ASHRAE or see if the session can be commercially sponsored. It was noted that a day/time would need to be scheduled carefully to not overlap with refrigeration related TC or region activities

Action Item 4 – Scott - Discuss options for refrigeration reception with Judy Marshall.

Action Item 5 – Scott – Determine how REF/TCs can participate in YEA mixer in Chicago

5.2 1634-WS

REF submitted WS-1634, Guide for Sustainable Refrigerated Facilities and Refrigeration Systems, (**Appendix 2**) to the Research Administration Committee (RAC). The WS was cosponsored by TCs 10.1 and 10.5. RAC conditionally approved this WS at their Annual Meeting on Saturday with comments to be addressed in the development of the RFP. The following conditions were listed:

- $250k of the $400k project budget should be obtained via co-funding
- Improve definition and details of milestones/deliverables
- Fix editorial comments related to the scope

Bansal noted that comments and discussion in RAC were positive. They suggested pursuing the project in smaller phases if co-funding does not materialize. Anderson noted co-funding from the multi-lateral fund (MLF) of UNEP is being sought. ASHRAE

has memorandum of understanding (MOU) with UNEP to work together on various efforts. Funding from UNEP will not be considered until later this year but if approved this would be UNEP's first co-funded project. Having this WS approved will help the prospects of UNEP approval.

Action Item 6 – Staff - send final draft of WS-1634 to REF

6.0 OTHER REPORTS

6.1 BOD Ex-Officio / Coordinating Officer

BOD EX-Officio Traboulsi will communicate REF's success in stepping up role of R in ASHRAE to the BOD. The PAOE points and Strategic Plan suggestions are great. REF can aim to match the 25% presence in the handbook in other areas (PAOE, program, etc).Traboulsi thanked REF for a successful year.

Incoming BOD Ex-O Gulledge introduced himself to the committee noting he is a past chair of CTTC.

Coordinating Officer Bahnfleth addressed committee noting he was pleased with progress over the last year. The MBOs and brainstorming sessions designed to challenge REF have gone well.

6.2 CTTC Liaison

Siller attended CTTC meetings at the Annual meeting as the REF liaison. REF's report to CTTC is included with these minutes as **Appendix 3** and will be posted on the REF website. CTTC has a newly formed Refrigeration Promotion Subcommittee and approved an R in ASHRAE award to recognize chapter performance on refrigeration-related activities. It was suggested REF's PAOE recommendations be consistent or support award criteria to encourage chapter participation.

6.3 Consultant Report

Anderson updated REF on Refrigerants conference efforts. He noted that he'd met with CEC and NIST (co-sponsor of past ASHRAE Refrigerant Conferences), and NIST was interested in hosting and cosponsoring again. Piotr Domanski agreed to chair the conference tentatively scheduled for October 2012. The conference, with an anticpated attendance of ~200, would feature invited peer reviewed papers with focus on the new generation of refrigerants, the related technology and applications, and impact on energy and environment. Anderson noted REF should reach out to TC's 3.1 and 2.5 to solicit topic ideas and papers.

6.4 Programs

Kazachki noted the seminar proposal submitted for Montreal was not approved but CEC suggested resubmitting for Chicago.

It was moved (GK) and seconded (CL) that,
2. REF propose a seminar program for Montreal related to Advances and Trends in Natural Refrigerants and Technologies.

MOTION 2 PASSED: 8-0-0, CV

BACKGROUND: Speakers to be developed and submitted at a later date. Seek co-sponsorship with TC's 8.1, 3.1, & 10.7

Action Item 7 – Kazachki –finalize and submit program for Chicago related to Advances and Trends in Natural Refrigerants and Technologies by August 12.

Several other refrigeration related programs in Montreal were in a Refrigeration track and are listed below:

- Conference Paper Session 6: Utilizing Refrigerant Management Strategies with Lower Global Warming Potential
- Seminar 26: The Prevention of Condensation Problems in Mechanical Insulation Systems
- Seminar 27: Toward Net Zero Energy Refrigeration
- Seminar 29: Bridging the Disconnect between HVAC and Refrigeration Design in an Ice Arena
- Seminar 39: Walk-in Coolers: Measuring and Modeling Performance
- Technical Paper Session 7: Prevention of Compressor Short Cycling in Direct-Expansion (DX) Rooftop Units Part 1 and 2

6.5 Refrigerant Management Plan Ad Hoc

Lim summarized the final report of the ad hoc committee on an ASHRAE Refrigerant Management Plan. The draft final report is included as **Appendix 4.** REF briefly reviewed the report but the draft plan was not distributed or reviewed by REF prior to the Annual Meeting.

It was moved (PB) and seconded (DS) that,
3. Technology Council not vote on the draft final report of the Refrigerant Management Plan ad hoc until REF can review and comment.

MOTION 3 PASSED: 7-0-1*, CV

BACKGROUND: REF wishes to review and comment on the final report prior to implementation or any further action by Technology Council in response to the final report. Lim abstained as a member of the ad hoc.

Action Item 8 – **REF** - Hold conference call to discuss final report from the Refrigerant Management Plan ad hoc committee.

6.6 Liaisons

Werkema presented a Refrigeration Committee Issue Update. The presentation is included as **Appendix 5**.

7.0 2010-2011 MBOs

A final report on the 2010-2011 Society Year's Management by Objectives (MBO) will be reported to Technology Council and is included with these minutes as **Appendix 6.**

7.1 Webpage

Gage summarized changes to the REF page of the ASHRAE website, www.ashrae.org/refrigeration. A layout for the new page is included as **Appendix 7**. Staff will work to update periodically with guidance from committee.

7.2 Refrigeration Presentation

Jekel reported on behalf of Mueller that a rough outline had been made for a presentation to students highlighting careers and opportunities in refrigeration. Jekel is looking for input from those that interact with students more frequently.

Action Item 9 – Bansal, Jekel, Scott, Groll – develop presentation for students on opportunities and careers in refrigeration field for Winter Meeting.

7.3 Survey

Gage described an effort to survey ASHRAE membership to gain feedback on how/if ASHRAE refrigeration products and services meet their professional needs. 500+ responses to the survey have been collected and will be analyzed to see what additional refrigeration products and services are needed. An outline of the summary is shown in **Appendix 8**.

Action Item 10 – Staff/Gage - summarize refrigeration resources survey results and present to REF

8.0 AWARDS

8.1 Milt Garland & Comfort Cooling Awards

The Award subcommittee decided to not award a Milt Garland Award. No submissions were received for the Comfort Cooling Award.

8.2 Award procedure changes

Discussion postponed to 9.1.2 below.

9.0 UNFINISHED BUSINESS

9.1 Brainstorming

9.1.1 Refrigeration Strategic Goal for ASHRAE Strategic Plan

Gage reported earlier on efforts to get refrigeration topics in the ASHRAE Strategic Plan.

Gage referred to the TC realignment proposal (**Appendix 9)** sent prior to the meeting. The suggestion is to consider moving all REF related TC's reside in sections 3 and 10. Bahnfleth noted any reorganization should result in a measureable increase in TC performance. The value here may be in indentifying TCs that should be interacting with TCs. Scott noted TC 10.9 voted to join 10.5. Also, 10.4 voted to disband and continue work under 10.1. This reduction may help focus groups and assure quorum/membership obligations are met. Some felt a TC consolidation would help TC's be more efficient, assure they get quorum and adequate members to accomplish their work with handbook, standards, research, etc. A review of relevant TC scopes and possible TC consolidation may be more effective option. The topic was tabled until TAC gives more feedback on draft proposal.

Action Item 11 – Bansal, Groll, Seeton - Review summary of TC scopes and TC consolidation and make recommendation to REF

Gage encouraged committee to pursue and advance other action items and topics identified from brainstorming session in Las Vegas (**Appendix 10**).

9.1.2 MOP/Reference Manual Revisions

Proposed MOP and Reference Manual revisions **(Appendix 11, Appendix 12)** were sent prior to the meeting. Gage summarized changes and asked for vote.

It was moved (PB) and seconded (CL) that,

4. Technology Council approve the changes to the REF Manual of Procedures (MOP) as shown.

MOTION 4 PASSED: 8-0-0, CV

BACKGROUND: Appendix 11 shows markup of the REF MOP with changes indicated.

It was moved (TH) and seconded (PB) that,

5. The REF Reference Manual be revised as shown.

MOTION 5 PASSED: 8-0-0, CV

BACKGROUND: Appendix 12 shows markup of REF Reference Manual with changes indicated.

9.2 Commissioning Guideline

Special Projects subcommittee is considering a project submitted by Bill Harrison. This is still in the formation stages and would run concurrent to refrigeration commissioning efforts of REF. REF is listed as the cognizant committee. A REF MBO for next year was developed to help support this effort.

10.0 NEW BUSINESS

Groll invited all to attend the USNC/IIR meeting on Tuesday. Minutes from past meetings are available upon request.

Gage noted there would be an opportunity to request thank you letters for employers will come soon via email. Keep an eye out for this email from ASHRAE.

11.0 TRANSITION

11.1 2011-2012 MBO review and assignments – Scott

Scott proposed MBOs for SY 2011-2012 as shown in **Appendix 13.**

11.2 Mentor assignments – Gage

Gage made the following mentor assignments for incoming members:

- Jeffrey Berge – to be determined
- David Hinde - Dan Manole
- Richard Royal – Todd Jekel
- Chris Seeton – Cesar Lim

11.3 Recognize outgoing members – Gage

Gage recognized out-going members Norbert Mueller, Donald Hay, Kent Anderson and Georgi Kazachki with a certificate of appreciation.

Scott recognized Cynthia Gage as outgoing chair of REF. The committee thanked Cynthia for her efforts over her term on REF.

12.0 ACTION ITEM REVIEW

Action items would be sent out after the meeting and included in the minutes.

13.0 NEXT MEETING

The next meeting of REF will take place in Chicago, Illinois on January 22nd, 2012. Technology Council will be meeting in the fall. Scott will determine need for interim conference call and schedule as needed.

14.0 ADJOURNMENT

The REF meeting was formally adjourned at approximately 12:00 p.m.

Refrigeration Committee Meeting Agenda
Sunday, June 26, 2011 --- 8:00 AM – 12:00 PM
Fairmont Hotel - Gatineau (C)

1.0 CALL TO ORDER
2.0 ROLL CALL & INTRODUCTIONS
3.0 APPROVAL OF MINUTES- Winter Meeting – Las Vegas, NV January 30, 2011
4.0 REVIEW OF AGENDA
5.0 CHAIR'S REPORT – Gage
- 5.1 Motions from Last Meeting Requiring Higher Body Approval
  - 5.1.1 Reaffirmation of *Natural Refrigerants* PD – approved
  - 5.1.2 Reaffirmation of *Ozone Depleting Substances* PD - approved
  - 5.1.3 Disband ODS PD Committee – approved
- 5.2 New Information Items for REF
  - 5.2.1 PAOE recommendations for 2011-2012
  - 5.2.2 Briley article for webpage
  - 5.2.3 Other

6.0 VICE CHAIR'S REPORT – Scott
- 6.1 Fiscal Report
- 6.2 1634-RTAR, Guide for Sustainable Refrigerated Facilities and Refrigeration Systems

7.0 OTHER REPORTS
- 7.1 BOD EX-Officio/Coordinating Officer - Traboulsi/Bahnfleth
- 7.2 CTTC Liaison - Siller
- 7.3 Consultant Report (Refrigerants Conference) – Anderson
- 7.4 Programs – Kazachki
- 7.5 Technology Council – Ross Montgomery
- 7.6 Refrigerant Management Ad Hoc – Danny Halel
- 7.7 Liaisons

8.0 2010-2011 MBOs
- 8.1 Webpage – Lim
- 8.2 Refrigeration presentation – Mueller
- 8.3 Survey - Gage

9.0 AWARDS
- 9.1 Milt Garland discussion & vote – Mueller
- 9.2 Formalize Chapter approval

10.0 UNFINISHED BUSINESS
- 10.1 Brainstorming
  - 10.1.1 Refrigeration Strategic Goal for ASHRAE Strategic Plan
  - 10.1.2 MOP/Reference Manual Revisions
- 10.2 Commissioning Guideline - Scott

11.0 NEW BUSINESS
12.0 TRANSITION
- 12.1 2011-2012 MBO review and assignments – Scott
- 12.2 Mentor assignments – Gage
- 12.3 Recognize outgoing members - Gage

13.0 ACTION ITEMS REVIEW
14.0 NEXT MEETING – January 22, 2012 - Chicago, Illinois
15.0 ADJOURNMENT

WORK STATEMENT #1634
SPONSORING TC/TG/SSPC: Refrigeration Committee
CO-SPONSORING TC/TGs:
TC 10.1 – Custom Engineered Refrigeration Systems
TC 10.5 – Refrigerated Distribution & Storage Facilities

Title:
Guide for Sustainable Refrigerated Facilities and Refrigeration Systems
Executive Summary:
The Guide will be an important new international reference with valuable recommendations, methods and examples. Subjects include refrigeration system and facility design, cooling loads, equipment choices and performance modeling—all within the framework of sustainability and life-cycle design. The methods and concepts addressed in the Guide will be practical and actionable, to answer questions now facing designers, contractors and operators. The Guide will have a global perspective, recognizing the rapid growth of the "food chain" in developing and recently developed countries, where refrigerant and system choices are viewed with a "clean sheet", offering a timely opportunity to provide valuable guidance.
Applicability to the ASHRAE Research Strategic Plan:
The proposed project has broad alignment with the ASHRAE Strategy Research Plan. The following lists some of the specific goals of the Strategic Research Plan that this project will address:

"Goal 1: Maximize the actual operational energy performance of buildings and facilities." Refrigeration systems generally operate year-round and must maintain design storage or product temperatures at all times, resulting in large safety factors, often with attendant inefficiencies during "average" operation. For refrigerated warehouses, food processing facilities and supermarkets, refrigeration is commonly the largest energy end-use. In a global context, refrigeration is increasing rapidly as modern "cold chains" are being built in developing countries to feed an increasingly urban population. The Guide will describe improved design techniques, examine the use of performance modeling tools, and address benchmarking and performance measurement methods, all of which help to maximize energy efficiency.

"Goal 2: Progress toward Advanced Energy Design Guides (AEDG) and cost-effective net-zero-energy (NZE) buildings." The design of refrigeration systems and refrigerated facilities is commonly performed by design-build contractors or owner staff and a small number of specialized engineers, with existing codes primarily addressing safety, not energy efficiency. This is fundamentally different from commercial buildings and HVAC design, with its large A&E community and extensive code-prescribed design framework. The Guide will provide analysis methods and metrics as well as case study examples that support progress towards net-zero-energy design, and will also address the inherent thermal storage capability in refrigerated storage facilities (i.e. Needed Research example 4).

"Goal 8: Facilitate the use of natural and low global warming potential (GWP) synthetic refrigerants and seek methods to reduce their charge." The Guide will include design and analysis guidance and examples of reduced charge systems using indirect fluids such as glycol or phase-change CO_2, as well as methods for using natural or low GWP refrigerants in low charge systems or non-traditional applications. A methodology to evaluate direct (leakage) and indirect (energy use) global warming impact of alternative refrigeration designs will be included.

"Goal 10: Significantly increase the understanding of energy efficiency, environmental quality and the design of buildings in engineering and architectural education." The Guide will be suitable for use by engineering programs and training courses. The content will be valuable to students studying the design, interactions and performance of refrigerated facilities and refrigeration systems. Sustainable design and the need to improve utilization of global food sources are two topics of high interest and attraction to many engineering students. Moreover, new engineers entering the industry view computerized simulation and analysis methods as a natural (and necessary) part of the engineering process.

Application of Results:
The proposed Guide will not directly affect existing Handbook or other publications. The Guide will reference Handbook chapters as appropriate to maintain continuity and context. The intent of the Guide will be to thoroughly explain the subject matter without repeating detailed information that already exists in other readily available ASHRAE publications. The information in the Design Guide would be suitable for use in an ASHRAE short course or e-Learning program.
Refrigeration Handbook Chapter 5 (Component Balancing in Refrigeration Systems) could very likely be rewritten with a broader scope and more modern analytical basis using information developed for the Guide. Elements from the Guide may also be used in future updates to Refrigeration Chapter 23 (Refrigerated-Facility Design) and Chapter 24 (Refrigerated-Facility Loads) for consistency and/or where the Guide shows the need for expanded technical content.
While refrigeration systems and facilities have not been subject to building efficiency standards in the past, this is changing. Recent Federal Walk-in appliance standards for Walk-in Coolers and Freezers have become law and state (i.e. California) building standards for refrigerated warehouses have now taken effect. In spite of the existent difficulties (e.g. lack of component standards and most systems custom-designed from components) additional standards for warehouses, walk-ins and supermarket refrigeration

systems are being advanced. The Guide will bring forward new system design methodology and analysis methods for refrigeration systems and refrigerated facilities, contributing to a more informed approach to appliance and building standards.
ASHRAE Standards for refrigeration equipment have not been widely utilized by industry (e.g. Standards 20, 22, 23, 25, and 64). No ASHRAE or AHRI standards for refrigeration condensers, evaporator coils or condensing units are referenced in manufacturers' literature. Only commercial refrigeration compressors are tested to standards and published with certified ratings (with a very important discrepancy between rated and applied conditions). The recent work to develop a Federal Walk-in Cooler and Freezer energy performance standard as required by the Energy Independence and Security Act of 2007 (EISA), suffered from the lack of appropriate existing standards or sufficient technical involvement to fully address the interactions between refrigeration system components. This standards-making for refrigeration equipment and systems is occurring with limited ASHRAE involvement. While the Guide will not discuss standards directly, it will seek to educate and explain the complexities and interactions that exist with a component-based systems and related controls, in contrast to packaged equipment.
There are no existing college texts that address design and analysis of refrigerated facilities or energy efficient refrigeration system design. The Guide can be by college courses from several perspectives—including courses related to refrigerated facility (building) design and those focused on system design.
Based on the needs of broad-based international ASHRAE membership, the rapid growth of refrigerated facilities in developing countries and the interest expressed by the United Nations Environment Programme (UNEP) including potentially providing significant funding, the Guide will include a strong international emphasis. With UNEP involvement, translations would include the six official UN languages: English, Spanish, French, Arabic, Chinese and Russian.

State-of-the-Art (Background):
ASHRAE, through the Advanced Energy Design Guide (AEDG) series and other publications as well as the ASHRAE energy standards, has provided extensive information for sustainable design of commercial buildings. Even though they have high energy intensity and operation continuously, refrigerated facilities and refrigeration systems have not been addressed. Energy and building codes generally treat refrigeration as "process loads" (the California Title 24 standard for Refrigerated Warehouses is a recent exception). The Guide will provide information suitable for use in ASHRAE learning materials and programs, though ASHRAE Learning Institute, Workshops or other channels. The Guide will be valuable to international members, particularly in developing countries with rapid cold chain development.
The ASHRAE "Design Essentials for Refrigerated Storage Facilities" completed under RP-1214 provides an introduction and overview of refrigerated warehouse construction features and will be complimentary with the proposed Guide. Past ASHRAE research has examined design refrigeration loads, component performance and methods for improving energy efficiency. Less work has been undertaken to evaluate refrigeration system interactions, energy optimization methods and performance metrics from a life-cycle perspective.
A large gap exists between system design practice, focused on peak design loads, and operating performance in facilities, which is often, at best, evaluated on a very simplified kWh/SF basis. The Guide intends to "fill-in" this gap in terms of conceptual discussion, technical methods, metrics and examples.
The current design practice for refrigerated facilities and systems reflects several inherent characteristics:

- Perishable product requires 100% design including worst-case weather and load conditions.
- Loads and operations change over time and many facilities operate for decades.
- Many refrigeration system components (e.g. evaporators, condensers, condensing units) are not rated to a published standard and ratings are not certified, unlike most packaged HVAC equipment. There is no established method for evaluating components when combined as a system.
- For components that are rated to a standard and certified (e.g. commercial refrigeration compressors), the rating point is often different from the common-practice operating conditions, and no adjustment factors or design methodology has been advanced by industry to address these discrepancies. Several examples of this issue were presented in a January 2010 Seminar in Albuquerque titled "Ratings vs. Actual Performance in Refrigeration Systems".

Based on the preceding factors, system designs often replicate what worked on prior projects, use rules-of-thumb, or rely on individual expertise gained through many years of work in a particular industry sector. Load calculations and equipment selection methods remain very conservative to allow for these unknown factors; in system operations, equipment performance, as well as current and future owner expectations. Owners and contractors are naturally risk-averse when design must maintain conditions in spite of numerous unknowns.
Energy modeling is almost never used as part of the design process for a refrigerated facility unless funded by utility programs or (recently) required for LEED certification. Consequently, investment choices are more likely to be determined on the basis of first cost and/or expert opinion than through life-cycle analysis.
Technical analysis of refrigeration systems has not kept pace with modern business practice, which in other disciplines requires precise and measurable performance to support marginal financial analysis, as well as metrics to manage ongoing operating costs on the basis of expected vs. actual performance.
The use of the refrigeration cycle for heating or dual use (cooling and heating) has gained attention in recent years, including industrial and commercial systems using natural refrigerants (ammonia and CO2), with potentially large benefits in both operating costs and total-carbon reduction. The use of both heating and cooling energy streams from a refrigeration system may be one of the most tangible opportunities to reduce total energy consumption in commercial and industrial facilities. The refrigeration system design practice and analysis methods which will be described in the Guide are directly applicable to these "high lift" refrigeration

and heat pumping systems. The opportunities for energy savings could remain unrealized unless the required engineering methods are advanced.

Rapid change has occurred in the global "food chain"; from food production and processing, to logistics and distribution, to retailing. Corporations are becoming much more sophisticated and analytical in order to remain competitive and meet demands of their customers. Expectations include: more precise technical tools to accomplish stringent design practice where each design option must be justified financially; methods and targets for measurement of actual performance vs. expectations; and a means to accomplish continuous process improvement.

The existing energy modeling tools for refrigeration systems include the following:

- DOE2.2R, originally developed in 2000 by J.J. Hirsch & Associates. DOE2.2R uses traditional text-based model development and requires a high skill level. A refrigeration version of the eQUEST graphical interface is available but lacks automated refrigeration system development wizards and component libraries necessary for broad use as a routine analysis tool.
- EnergyPlus 6.0 (2010), developed by DOE has recently incorporated supermarket refrigeration capability.
- EPRI Supermarket Simulation Tool 3.0, developed in 2000, but no longer supported by EPRI.
- TRNSYS, a parallel developed DOE software originally focused on simulation of solar-thermal, has been used to simulate HVAC and refrigeration systems.

The existing refrigeration simulation tools and needs were discussed in a June 2009 ASHRAE Forum titled "What is Needed for the Advancement of Refrigeration Computer Simulation". Input from the Forum was considered in development of this RTAR.

The development and use of commissioning for refrigeration systems and refrigerated facilities lags behind commissioning of HVAC systems and commercial buildings. Commissioning, when employed, is often limited to post-startup fine tuning. ASHRAE Guideline 0 and Guideline 1 do not address refrigeration systems explicitly. The available technical methods for commissioning for commercial and industrial refrigeration systems are very limited and do not have a clear relationship to system performance or energy efficiency metrics. The CIBSE Commissioning Code R:2002 for Refrigerating Systems is the only commissioning guide for refrigeration systems identified to date, and does not include procedures related to defining or testing system efficiency.

The Guide will provide information usable in developing refrigeration commissioning procedures; to more effectively define initial owner needs, relationship of system design practice to owner requirements, technical methods for validating component and system operation, and overall performance vs. design expectations.

The recent Federal Walk-in Cooler and Freezer performance standard development is instructive. Misunderstanding in regulatory efforts that consider refrigeration systems as a single "appliance" will potentially result in a failure to realize the intended efficiencies of the regulations. The Guide will help provide a better understanding of refrigeration system component, interactions and related system engineering.

Advancement to the State-of-the-Art:

The Guide will provide a conceptual framework, specific analytical methods and examples to encourage technical advancement in several areas:

- Advance the use of mass flow based refrigeration system design and system balance calculations, both for large complex industrial system and for commercial systems (e.g. supermarkets and food outlets) with accurate methods for factors such as productive and non-productive superheat impacts, and understanding of system balance at off-design and part load conditions. The Guide will allow engineers to immediately adopt these new techniques by defining methodologies and providing examples. The Guide will also identify opportunities for future research that could be funded as additional projects in the future.
- Establish a greater emphasis on system operation throughout the year and incorporation of annual energy modeling in design decision-making; allowing more consistent consideration of fundamental design choices and component options as part of life-cycle alternatives analysis.
- Renew consideration of heat recovery from refrigeration systems and use of engineered heat pumping systems, by providing analytical methods to evaluate high-lift refrigeration and heat pumping cycles as an alternative to conventional heating plants, from both site and source energy perspectives.

Supermarkets and similar commercial refrigeration systems once used heat recovery whenever possible; with heat recovery in all US supermarkets meeting at least two-thirds of annual heating needs in the 1970's and 80's. Since then, heat recovery has declined markedly, due to increased refrigerant cost and concern for refrigerant leakage, as well as changes in store demographics (e.g. growth of big box supermarket retailers). Current heat recovery likely accounts for 10% or less of national store heating needs. Heat recovery has similarly declined in other industrial and commercial applications with available heat from refrigeration. System design options will be described in the Guide to achieve heat recovery with little or no impact on refrigerant charge. In addition, an analytical framework will be provided to compare the total impact of electric and thermal energy use, as well as the impact of refrigerant emissions on a total-carbon footprint for a facility [The analysis technique will focus on the methodology and provide and example, rather than seek to determine exact indirect or direct carbon conversion factors].

Large energy savings are possible through application of improved system design practice; use of new system types and technologies which are currently cost effective using a life-cycle perspective; employing advanced control strategies; and incorporating real-time performance monitoring to achieve continuous energy improvement. Compared with current standard practice, the potential savings through use of advanced energy efficient refrigeration systems and control methods can reach 20-50% in refrigerated warehouses and 20-35% in retail food stores.

Building codes are beginning to incorporate requirements for refrigerated facilities and systems. Codes typically begin with mandatory requirements and eventually evolve toward a performance method (i.e. where the building meets or is better than a minimum "energy budget" defined through energy simulation) as technical information and methods allow. Owners, contractors and engineers generally prefer a performance path, allowing trade-offs between various design choices. The Guide will help develop the system modeling methods that would be needed to include a performance option in energy codes for refrigerated facilities.

Justification and Value to ASHRAE:

ASHRAE members involved with refrigerated facility design, construction or operation will utilize the Guide to address the increasing common expectation that the facility design process explicitly consider "sustainability". The owner interest may take the form of LEED certification, desire for a more holistic design and commissioning process, or simply the expectation to predict and delivery lower energy use and lower operating cost.

The Guide will include a significant amount of guidance in the form of examples, case studies and simplified "how to" tools. The Guide is expected to be of interest and be utilized by many individuals who may not currently be ASHRAE members but who are involved in refrigeration, particularly in developing and recently developed countries.

Analysis methodologies, analysis tools and sample calculations described in the Guide will be provided electronically (i.e. Excel) on a CD provided with the Guide allowing users to gain immediate and practical utility without additional training or building their own tools. As an example of this intent: The explanation of mass-flow based system design and an example spreadsheet would allow adoption by a design engineer or allow a supermarket chain to specify that their refrigeration systems be designed by their system vendors (or consulting engineers) following the "ASHRAE mass-flow based design methodology".

The Guide will emphasize ASHRAE's role in refrigeration, particularly related to sustainability, research and advancement of standards for components and systems. With regulatory attention turning to refrigeration efficiency, the technical rigor offered through ASHRAE involvement gains greater importance.

The Guide will consider global needs in developing and recently developed countries with a high rate of "food chain" growth, notably India and China. These areas will see a high rate of near-term growth and also often include expansion by major international food chain firms and retailers as well as firms based in the developing countries. Facility and system design, refrigerant choices and other policies often are viewed with a "clean sheet" in these countries, offering a timely opportunity for ASHRAE to provide valuable guidance.

Objectives:

The Guide will serve designers, contractors and operators of refrigerated facilities and industrial and commercial refrigeration systems. The intent is that this Guide will be of broad interest in this sector – in addition to designers, contractors, and operators, it will also be of value to educators, utilities, policy makers and others involved in the energy efficiency and sustainability "business".

Refrigeration systems are now evaluated as part of the efficiency potential in projects seeking high efficiency levels and certification, rather than a "pass through" process load. The phase-out of HCFCs and the phase-down of HFCs will create a high level of interest in alternative refrigerants and system designs. Efficiency regulations, adoption of high efficiency "green" codes by states or local jurisdictions, and corporate adoption of sustainable policies that require a change in design premise from expert "rule of thumb" to a greater utilization of computerized energy analysis and life-cycle optimization.

Design of sustainable facilities and systems require consideration of fundamental design choices such as facility orientation, utilization of the building site and work-flow options; building design including insulation, door design and locations, infiltration management and methods to reduce internal cooling loads; cooling system design options including refrigerant choice, system configuration (two-stage, single-stage, split-systems, "rack" systems, indirect options, etc.), condenser and evaporator selections, including part-load optimization and system balance topics; control systems for energy efficiency and load management; on-site energy and resource options such as photovoltaic (PV) generation, water re-use and heat recovery; and other operational topics. The means to analyze and compare options for these topics will be addressed, with evaluation of life-cycle costs and greenhouse gas (GHG) impacts.

The Guide will consist of five primary sections:

1. Refrigerated Facility Design and Cooling Loads
2. Refrigeration System Components and System Design
3. Controls and Control Strategies
4. Energy Modeling and Performance Analysis
5. Commissioning, Operations and Benchmarking

Information in the Guide will be used for design of new facilities, expansions and remodels, as well as providing guidance on improvements and operating methods that may also be applied to existing facilities.

The phase-out of HCFC-22 and the phase-down of HFC refrigerants provide opportunities for change to more sustainable alternatives; however alternatives may be less efficient and more costly to operate. The Guide will provide methods to compare direct and indirect GHG contribution, as well as provide example system alternatives (e.g. low charge systems, ammonia or indirect CO2) that reduce HFC use without excessive increased energy cost

The fact that nearly all refrigeration systems are custom engineered and constructed of components, rather than being sold as "packages", is a fundamental characteristic of this industry and is important concept in developing the Guide. The information provided and methods defined will be "actionable"; that is, consistent with the questions and options that are considered by designers, contractors and operators.

The Guide will be published as either a softbound book or in a 3-ring binder, in addition to being available in electronic form for downloading from the ASHRAE web site. Tables and spreadsheets used in the Guide will also be provided electronically for increased utility and flexibility.

Scope/Technical Approach:

Consistent with the objectives described in the previous section, development of the Guide will be accomplished through research of the existing literature and other available information in the industry, and through application of available analysis tools and methods by the researcher in order to draw relevant conclusions, show comparative results and provide examples methodologies. The information will be presented in a manner that is useful to designers and operators of both new and existing facilities.

The scope of the Guide is intended to cover:

- Refrigerated warehouses from small warehouses (e.g. 5-10,000 SF) using multiple split-systems or parallel rack systems up to the largest refrigerated distribution facilities.
- Industrial refrigeration systems used in food plants and other large processing facilities, commonly using ammonia refrigerant, but not limited to ammonia.
- Light industrial and commercial engineered refrigeration systems, including those used in supermarkets (e.g. central or distributed parallel compressor units, as well as indirect systems).

The scope does not include supermarket display cases or the space heating and cooling analysis of supermarkets and other commercial facilities. Although there are potentially valuable opportunities for heat recovery and other HVAC system integration, this content is deferred to a possible future edition.

The scope does not include detailed design criteria such as pipe and valve sizing, vessel design and sizing, required practice for safety and code compliance, or other information necessary for engineering and construction of a specific facility.

Bidders should anticipate, but not expect or assume, that field data or other information may be provided by other sources to contribute to the development of the Guide.

An essential element of the Guide is to incorporate an international perspective; both in utilizing information and methodologies from all resources globally, and in creating a document that is usable in countries and climates outside the US. *In developing their proposals, bidders are to anticipate the Guide will be translated into multiple languages as noted previously and plan to provide content in a manner that will simplify translation, but actual translation is not part of the scope of this Work Statement.*

The Guide will contain, at a minimum, the information listed below. The order and organization of information may be changed, based on information presented and approved in the development phase of the project.

Note that the proposed project scope and design should consider the objectives and other comments in the preceding sections of the Work Statement, and is not solely limited to the following description.

Initial Project Design

A detailed project design document will be prepared as the first deliverable and submitted for review by the PMS, following literature research and preceding actual document preparation, including the following information:

- Literature survey results, resource communications, and summary of findings.
- Outline of major sections, chapters and chapter sub-sections, with a detailed description of proposed content and reader expectations for each chapter, with a clear delineation of content that is to be primarily adapted from existing sources (including the sources to be used) vs. content that will be newly developed by the project team.
- Explanation of the energy modeling and performance analysis tools to be evaluated and proposed for use in the Guide, and details concerning how they will be employed for examples and for developing conclusions and recommendations.

Refrigerated Facility Design and Cooling Loads

Refrigeration equipment is often observed to operate at a relatively small fraction of its design capacity. Historically, refrigeration loads calculations have used relatively simple methods and have included multiple safety factors (e.g. SF/Ton, xx% safety factor, 18-hour run time). A more accurate understanding and expression of cooling loads is an essential precursor to improvements in system design and operations.

Facility Development and Design

1. Provide a description and outline the "ideal" development and design process for a refrigerated facility, including explanation and expected value from the following elements:
    a. Design team definition and initial conference or charrette objectives to identify owner objectives and accomplish multidisciplinary brainstorming of design options.
    b. Analysis methodology, tools, information, and expectations, in order to support owner and design-team decision-making process at each stage of project development.
2. Provide examples and explanation of facility construction options (with a global breadth):
    a. General configuration and operational design: high rise and automation vs. standard construction and material handling equipment; fit with re-use and reclaimed locations vs. greenfield construction
    b. Facility orientation, box location options, use of refrigerated docks, vestibules
    c. Material handling and routing considerations and methods for traffic analysis to consider as part of design process
    d. Insulation and vapor barrier materials, including investigation of non-traditional materials, sustainability considerations and future trends
    e. Facility life, future use and construction materials considerations for sustainability

This information requires international scope and detail to include facility configurations, construction materials and operational practices throughout the world; and will include specific attention to efficient and effective design practice for hot-humid and very cold climates.

3. Address lighting systems and control options, including technologies suitable for cold storage applications and controls based on occupancy or scheduled traffic.
4. For major warehouse construction elements (e.g. insulation and doors) provide a summary and explanation of nominal rating conditions, performance rating standards and relevant correction factors, and address adjustment factors (de-rating) for applied and operating conditions. Considerations include but are not limited to the following:
    a. Insulation performance at applied temperatures
    b. Effect of moisture infiltration to insulation, from what may be considered "normal" over time (if any) and what is excessive and detrimental from a thermal or structural standpoint
    c. Investigate available methods or potential for in-situ insulation testing (various roof, walls, floor configurations) and describe how this may be used for new construction (e.g. acceptance testing) and evaluation of insulation in existing facilities.

Cooling Loads

1. Describe the refrigeration load components that apply to refrigerated facilities and provide background, explanation and examples to describe:
    a. How various loads are characterized and determined, in terms of owner expectations for facility functionality, operational variables and contingencies.
    b. Explain how simply defined "instantaneous" loads are affected by transients, storage, delays and other factors; coupled with how and when they become loads on zone equipment (e.g. evaporators) and system equipment. Explain sources and transformation of latent loads and how they are evaluated to determine design loads.
    c. Relationships between various load components and safety factors (explicit percentages or as a consequence of design and selection methodology), including implications of different refrigeration system types, facility types and sizes, operational differences (e.g. shift or batch loads vs. continuous operation), etc.
    d. Weather selection and assumptions, including: different sources of weather data and methods for developing a design day; taking into consideration that peak DBT, WBT and wind velocity occur on different days in weather files; with recommendations and examples.
2. Loads components include but are not limited to the following:
    - Envelope loads including mass effects of different wall types, solar effect, etc.
        - Floor loads in freezers and coolers is of particular importance, including effect of faculty size, adjacent spaces and climate location
    - Equipment loads in refrigerated spaces
    - Infiltration and ventilation loads over the range of applications
    - Production loads for processing equipment
    - Storage loads of raw and finished product
3. The applications range from commercial refrigeration applications like small warehouses to large industrial refrigeration systems for food processing. Operational practices include store hours, production scheduling, sanitation shift practices, etc.
4. Address characterization of system loads (e.g. defrost, parasitic gains, pump heat, etc.) that do not directly result from productive space loads.
    a. Develop an approach and examples that clearly delineate the parasitic loads from primary loads (some elements may be somewhat arbitrary) and address the calculation of these loads and the degree to which they can be controlled as part of the system and control design process and/or as part of facility operations, including:
        i. Fan power (and consequent heat); noting that fan power varies both as a consequence of air-circulation rate and the specific efficiency of the evaporator coils.
5. Describe a methodology (developed with new categories and definitions as required) and provide examples for relating the design loads in space(s) to the associated system/zone equipment and plant equipment, for various facility sizes and types, as well as equipment types.
    a. Include explanation of design to address product pull-down load or transient peaks that may occur intermittently and locally within a space (i.e. design at one evaporator is different than impact on the central plant due to diversity).
    b. Equipment variations include number of evaporators, defrost choices, how an evaporator(s) served by central plants are different than a "split-system", etc.
    c. Include recommendations and methodology for spaces have multiple operating temperatures (e.g. convertible boxes).
    d. Include recommendations and design practice methodology for evaluating and accommodating future expansion, operational changes and other contingencies. *Flexibility allows longer facility life, which itself is a sustainability goal.*
    e. Include methodology or recommendations to separate actual anticipated load from reserve equipment requirements at a component level (e.g. planning for out of service equipment) in contrast to across-the-board oversizing.
6. Investigate a system design methodology which employs appropriate equipment de-rating to actual expected performance, rather than using safety factor to take the place of equipment de-rating.

Refrigeration System Components and System Design

Refrigeration system component selection and system design choices reflect the fact that most refrigeration systems are custom-designed for each application and build from components rather than packaged systems. The Guide should provide information and methodology concerning refrigeration system designs that have minimum facility life-cycle cost by addressing the following:

- Provide an organized, hierarchical process to identify potential system design choices based on:
  - Facility size, type and operations
  - Climate location
  - Other factors
- Provide examples of system design options and study and advantages and disadvantages
- Explanation, example tools and methodologies for system design and comparison (not energy analysis, but methods for component analysis, system balancing or options evaluation)

Refrigeration System Design

1. Address refrigerant and system options, with key design features and design point efficiency comparison, including but not limited to the following:
   a. General description of system types and advantages, disadvantages and common application
      i. Direct expansion (commonly halocarbon)
      ii. Liquid overfeed and flooded (commonly ammonia)
      iii. Carbon dioxide system designs
      iv. Direct vs. indirect systems (both single phase and phase-change)
   b. Ammonia systems including options for low-charge direct ammonia systems and ammonia in indirect systems
   c. Indirect systems (glycol, CO2 phase-change, etc.), including utilization of indirect systems in conjunction with halocarbon, ammonia or low-GWP primary refrigerants in both industrial and non-industrial applications
   d. Retrofit options for existing HCFC-22 systems, both direct-expansion and recirculated types
   e. Applications for transcritical CO2, such as predominantly low ambient locations
2. Study, characterize and develop recommendations to define air circulation rate in a refrigerated walk-in or warehouse space as a separate and explicit design parameter, rather than simply a consequence of the evaporator coil selected to meet the cooling load most economically.
   Note: In contrast to HVAC design, the airflow or air-change rate in most refrigerated facilities is not calculated prior to equipment selection. The airflow (per unit capacity) is more commonly a variable left up to the evaporator coil manufacturer. Airflow per ton varies widely, along with fan power, resulting in selections with a great excess of airflow compared with other comparable facilities. Since additional research is needed in this area, the Guide will only explain, provide examples and "set the stage" for future technical development. The initial information in the Guide, though, should be sufficiently detailed for help facility designers address and (begin to) optimize air flow as an independent design variable.
3. For major refrigeration system components provide a summary and explanation of nominal or catalog conditions, rating standards and adopted certification (to the extent they existing) and published correction factors, and address adjustment factors (de-rating) for applied and operating conditions.
   An important change in industry practice to be promoted by the Guide is a reduction in general safety factor and the broadly acknowledged oversizing that exists in many (not all) refrigeration industry sectors. The process of "right sizing" is a key element of sustainability in that resources and capital cost can be optimized along with energy usage. Understanding actual performance vs. nominal values is an important engineering precursor to reducing safety factor.
4. Develop, define and provide examples for mass-flow based system design.
   a. Cooling loads and refrigerant properties at boundary of refrigerated load used to determine productive refrigeration and required mass flow
   b. Compressor mass flow determined based on compressor conditions (i.e. actual superheat), including recommendations for use where compressor rating conditions are far different from operating conditions, as is the case with commercial halocarbon systems
   c. Explain variations and proper treatment of non-productive heat gain realized as superheat and when realized as additional mass flow (e.g. two-phase and indirect systems)
   d. Define methodology for compressors selection as well as overall system design

Note: It is not intended that the Guide must follow the exact order and separation of System Components and System Design as shown here. The Guide should be developed in the manner which is most informative and useful, without redundancies.

Refrigeration System Components

1. Address each system component in terms of design choices and energy efficiency implications, including but not limited to these topics.
   a. Compressor types
   b. System types: DX, recirculated, flooded, direct vs. indirect
   c. Condensing methods
   d. Etc.

2. Investigate system components that have been newly introduced for new refrigerants or energy efficient system designs, and consider from an international perspective. The component investigation should be broadly focused and while proprietary devices should be avoided, the intent should be to describe a broad set of solutions that may be considered by designers. The scope is not intended include detailed application data or engineering criteria.
3. Compressors
    a. Compressor types and typical applications
    b. Options for small ammonia systems, including hermetic designs
    c. Small centrifugal compressors and potential applications
    d. CO2 compressors: transcritical in low ambients, cascade systems, both commercial and industrial examples
4. Condensers
    a. Condenser specific efficiency parameter development, examples and guidance
    b. Air-cooled ammonia condensers – key example of system choices and energy analysis
        i. Compare with NH3 vs. HFC air-cooled system; total equivalent CO2 example
    c. Air-cooled vs. evaporative-cooled comparisons and recommendations
        i. Address energy, water cost use, cost embedded energy, other factors
    d. Hybrid condensers (air and evap. or evap-precooling)
    e. Water-cooled condenser coupled with fluid cooler or cooling tower
        i. Advantages and disadvantages, including reasons for use such as HFC charge reduction or non-traditional ammonia applications
        ii. Comparison of design and average operating approaches, compared with an evaporative condenser
5. Evaporators
    a. Describe evaporator types and applications
        i. Penthouse applications, advantages and design topics
        ii. Other considerations for performance optimization
    b. Defined defrost options and define defrost effectiveness parameter(s) and how to calculate defrost load for design purposes and for operating analysis
    c. Describe system impacts of gas defrost and methods to reduce parasitic load and improve defrost efficiency and effectiveness
    d. Evaporator specific efficiency parameter development, examples and guidance
    e. Close approach evaporator design; guidance on optimizing compressor benefit vs. additional fan power
    f. Direct expansion topics: DX with ammonia, use of electronic valves and improved distribution, use of liquid-suction heat exchangers
6. Vessels
    a. Provide examples of vessel configurations to provide flash cooling and cascaded liquid supply through multiple temperatures, with calculation of efficiency gains
    b. Describe pros and cons of pumped vs. pressure fed recirculated systems, with the intent of providing an understanding of fundamental system processes and defining the means for a designer to perform an analytical comparison of a given application, rather than determining whether one method or the other is necessarily better
7. Valves
    a. Describe various electronic regulators, with advantages and potential for improved efficiency and system integration
        i. Electronic suction regulators
        ii. Electronic expansion valves

Controls and Control Strategies

The Guide should address controls and control strategies from a life-cycle perspective, which includes consideration of:

- Control definition, selection and design as an integral element of overall system design; meaning the control construct and methods are to be fully coordinated with the mechanical system design and facility operations, rather than being addressed only after the mechanical design is a "given".
- Explain and define control methods (inputs, logic, outputs) in a manner that allows broad understanding and promotes consistency: for equipment and control functional specification, hourly energy analysis, system commissioning, and ongoing maintenance and continuous optimization. (The objective is to integrate control thinking throughout the process, rather than control methods remaining obscure concepts and being left to the control vendor.)
- Implementation of controls and control strategies on existing facilities as well as during new construction.
- Address interactions between efficiency measures and operating practices, and provide recommendations to reduce total energy and other resource use (gas, water, etc.).
- Suitability for different size and type facilities should be indicated along with potential savings and ease of implementation in both new and existing equipment. Controls and strategies that are specific only to industrial refrigerated warehouses/large facilities and to those specific to commercial systems supermarkets should be noted, vs. those that may be applied to facilities of any type or size.
- Information should include a description of the relevant parameters to be measured and controlled, and important implementation considerations (installation, programming, commissioning).

1. Provide description, explanation of applicability and example savings calculations of control methods, including but not limited to the following:

   High-Side Controls:
   - Floating head pressure strategies including evaluation of different setpoint methods and variable speed condenser control
   - Suction group control automation and compressor part load control (e.g. variable speed)
   - System optimization through subcooling, flash-cooling and liquid cascading
   - Water-saving strategies for evaporative condensers

   Low-Side Controls:
   - Variable speed and other types of evaporator fan control
   - Suction setpoint automation and integration with other controls (e.g. evaporator fan controls)
   - Evaporator staging strategies
   - Electronic evaporator pressure regulator controls
   - Defrost control strategies and demand defrost methods
   - Liquid refrigerant pumping strategies and energy saving opportunities (e.g. cold climates)
   - Pumping controls related to secondary fluid systems
   - Electronic expansion valves and evaporator superheat control (optimizing low superheat/high SST and/or high superheat/high enthalpy difference)

   Facility Controls:
   - Refrigeration and heat recovery control to minimize total energy consumption
   - Warehouse lighting controls using motion sensors or other technologies
   - Door heater controls
   - Humidity/condensation control of dock areas
   - Scheduling of non-time-sensitive processes
   - Monitoring, fault detection and alarms based on evaluation of system efficiency
   - System diagnostics to improve maintenance and system efficiency
   - Control of thermal storage; opportunities and applicability to different facilities

2. Controls and Control Strategy Descriptions:
   a. Summarize the state-of-the art control methods and typical system architectures
   b. Provide detailed listing of control methods/strategies that have potential to improve system efficiency and/or sustainability including level of technical difficulty, ease of implementation, equipment requirements, and control limitations, and suitability to specific system architectures
   c. Evaluate each method from feasibility, energy, and other resource perspective to provide understanding of impact of method and ease of application to different facility types and sizes such that end users can understand which methods can be applied to their specific facility and what level of effort and cost would be required to do so.

Energy Modeling and Performance Analysis

Sustainable design requires analysis of the facility, refrigeration plant and other systems, including hourly analysis for a typical year as well as considering performance over the life of the facility. Since this is relatively uncommon in refrigerated facilities, the justification and value resulting from this detailed facility modeling must be demonstrated, along with methodology and examples.

1. Provide a general explanation of energy modeling methods and how energy modeling relates to peak design cooling loads, describing how cooling load components vary through time, including the characteristics of various envelope designs (e.g. slow and fast constructions), building internal loads, and process or fixture loads. Provide a fundamental description of how various cooling loads become equipment loads, and variations with different types of loads and systems. New nomenclature (if required), figures and examples should be used to help describe the effect of delays, transients and other factors. This information should clearly describe the differences between a correctly calculated design load and the hourly loads realized by refrigeration systems.
2. Provide a description and example calculation methods (primarily using spreadsheets, which will also be included in the Guide resources) for the preparation of data inputs required for modeling. This information should explain and show how information available from manufacturer data sheets or from ASHRAE Handbooks or other resources are applied, including methods and recommendations for adjustments necessary to achieve accurate energy modeling, such as:
   a. Adjustments to catalog rating values to correct for applied vs. catalog conditions
   b. Effect of normal operating transients and cycling and how they are addressed in a time-step (e.g. hourly) simulation model
   c. Methods to allow for normal performance degradation such as contaminants, fouling and aging, and recommendations for key factors related to various system components
3. Describe the general methodology for creating the simulation inputs or files utilized by common hourly simulation tools, including: definition of spaces, zones and related loads and operations; components, systems and controls associated with cooling zones; components and controls associated with central plants; and other elements. Provide examples of simulation inputs and options for various key simulation components.

4. Describe reports that can be created in order to evaluate energy model and provide examples of reports to use for validation of load calculations, component performance and control operation, including an explanation of how the reports are evaluated to confirm an effective simulation.
5. Describe useful modeling methodologies for evaluation of alternative designs including parametric runs and incremental analysis. Explain and provide examples of interactive measures and how the order of analysis can affect conclusions. Provide recommendations concerning the sequencing of comparative analysis of related or interactive measures.
6. Include an explanation, sample modeling methodology and example results of how thermal mass in a refrigerated facility can be use manage electric demand.
7. In addition to explaining the use of hourly simulation tools provide recommendations on the use of spreadsheet tools for energy analysis, including advantages and disadvantages.
8. Address the general nature, advantages and disadvantages, and potential uses of other modeling methods and techniques; such as equation solvers or mathematical optimization software. Investigate and explain how these tools may be applied in evaluate new facility options or system alternatives. Also, evaluate how these methods may have a different form of applicability to existing facilities, by utilizing the available system operating data.

Commissioning, Operations and Benchmarking

Commissioning, operations and benchmarking are important for newly constructed facilities as well as for existing facilities, which in many countries represent the largest opportunity for sustainability gains.
The Guide will address these topics, including but not limited to the following:

Commissioning:

1. Include a general outline and description of the commissioning management process (based on existing ASHRAE documents for HVAC systems), sufficient for designers, owners and contractors to utilize in planning the commissioning of a refrigerated facility. This should include a description of the "end-to-end" process, definition of responsibilities and references to ASHRAE documents and tools.
    a. Since a large percentage of refrigerated facilities are owner-designed or contractor design-build projects, the nature of responsibilities and relevant expertise is substantially different than that for typical commercial buildings and HVAC systems. Examples of how responsibilities can be allocated should take this fact into account.
2. Explain how acceptance testing can be employed to validate system operation vs. expected performance, including component level testing and overall system performance testing.
    a. Discuss component balancing and explain how refrigeration system balance points can be calculated and compared with actual operation to evaluate component performance

    Note: The commissioning content in the Guide will be of a summary nature (with international context) and will focus on how other work in the Guide (e.g. sustainability concepts and efficiency measures) relate to commissioning, based on the assumption that ASHRAE will separately undertake a project to develop a detailed refrigeration commissioning guide.

Operations:

1. Address the importance of operating efficiency with examples and methodology showing life-cycle cost analysis of example facilities, showing the comparison of building costs, equipment costs and various operating costs. Address operational factors, how they affect life-cycle cost and other sustainability topics, including but not limited to:
    a. Describe and quantify effect of contaminants and fouling, along with methods for removal and continuous maintenance:
        i. Air and non-condensable gases, water in refrigerant (include discussion of non-condensables in halocarbon systems and methods for removal under emissions regulations)
        ii. Oil in heat exchangers
        iii. Condenser surface fouling
        iv. Etc.
    b. Methods for refrigerant recovery, recycling and reclamation to avoid emissions and to allow required system maintenance
    c. Describe concept of continuous improvement and identify maintenance-related opportunities to improve sustainable operations and optimize life-cycle cost
2. Define and provide examples of the monitoring and metering points that are needed (as part of original design or if retrofitted) in order to measure performance and allow effective long-term maintenance of operational efficiency. Include a range of "levels" from use of normal control system parameters to additional metering methods for precise real-time performance monitoring.

Benchmarking:

1. Provide a thorough explanation of benchmarking and how it relates to refrigerated facilities and refrigeration systems, addressing and where applicable incorporating the following considerations:
    a. Refrigerated facilities are mostly unique and there is little potential for statistically valid reference samples; thus an important expectation is that benchmarking be defined in a manner that is useful and valid for the users of this document, and not defined by what might be appropriate for commercial buildings

   b. Incorporate the concept of Best Practices—what does that mean for refrigerated facilities and systems, in the context of facility design, system vintage, operations, location, etc?
   c. Incorporate the concept of expectations vs. actual performance—how can the best expected performance of a particular facility be defined and then actual performance be measured and variance expressed?
   d. Normalization methods and peer comparisons
2. Provide a definition of performance perspectives and metrics:
   a. Performance based on production or capacity (e.g. kWh per ton of production; kWh per pallet space)
   b. Efficiency (e.g. kW/Ton), considered with different levels of system equipment being included
   c. Use of key indicators to compare expected vs. actual operation (e.g. expected condenser approach during actual operations to actual approach)
3. Describe methods for real-time comparison of usage vs. modeled performance

Deliverables/Where Results Will Be Published:

Progress, Financial and Final Reports, Research or Technical Paper(s), and Data shall constitute required deliverables ("Deliverables") under this Agreement and shall be provided as follows:

a. Progress and Financial Reports

Progress and Financial Reports, in a form approved by the Society, shall be made to the Society through its Manager of Research and Technical Services at quarterly intervals; specifically on or before each January 1, April 1, June 10, and October 1 of the contract period.

Furthermore, the Institution's Principal Investigator, subject to the Society's approval, shall, during the period of performance and after the Final Report has been submitted, report in person to the sponsoring Technical Committee/Task Group (TC/TG) at the annual and winter meetings, and be available to answer such questions regarding the research as may arise.

a. Final Report

A written report, design guide, or manual, (collectively, "Final Report"), in a form approved by the Society, shall be prepared by the Institution and submitted to the Society's Manager of Research and Technical Services by the end of the Agreement term, containing complete details of all research carried out under this Agreement. Unless otherwise specified, six copies of the final report shall be furnished for review by the Society's Project Monitoring Subcommittee (PMS).

Following approval by the PMS and the TC/TG, in their sole discretion, final copies of the Final Report will be furnished by the Institution as follows:

- An executive summary in a form suitable for wide distribution to the industry and to the public.
- Two bound copies
- One unbound copy, printed on one side only, suitable for reproduction.
- Two copies on CD-ROM; one in PDF format and one in Microsoft Word.

c. HVAC&R Research or ASHRAE Transactions Technical Paper

One or more papers shall be submitted first to the ASHRAE Manager of Research and Technical Services (MORTS) and then to the "ASHRAE Manuscript Central" website-based manuscript review system in a form and containing such information as designated by the Society suitable for publication. Papers specified as deliverables should be submitted as either Research Papers for HVAC&R Research or Technical Paper(s) for ASHRAE Transactions. Research papers contain generalized results of long-term archival value, whereas technical papers are appropriate for applied research of shorter-term value, ASHRAE Conference papers are not acceptable as deliverables from ASHRAE research projects. The paper(s) shall conform to the instructions posted in "Manuscript Central" for an ASHRAE Transactions Technical or HVAC&R Research paper. The paper title shall contain the research project number (XXXX-RP) at the end of the title in parentheses, e.g., (XXXX-RP).

Note: A research or technical paper describing the research project must be submitted after the TC has approved the Final Report. Research or technical papers may also be prepared before the project's completion, if it is desired to disseminate interim results of the project. Contractor shall submit any interim papers to MORTS and the PMS for review and approval before the papers are submitted to ASHRAE Manuscript Central for review.

d. Data

The Institution agrees to maintain true and complete books and records, including but not limited to notebooks, reports, charts, graphs, analyses, computer programs, visual representations etc., (collectively, the "Data"), generated in connection with the Services. Society representatives shall have access to all such Data for examination and review at reasonable times. The Data shall be held in strict confidence by the Institution and shall not be released to third parties without prior authorization from the Society, except as provided by GENERAL CONDITION VII, PUBLICATION. The original Data shall be kept on file by the Institution for a period of two years after receipt of the final payment and upon request the Institution will make a copy available to the Society upon the Society's request.

e. Project Synopsis

A written synopsis totaling approximately 100 words in length and written for a broad technical audience, which documents 1. Main findings of research project, 2. Why findings are significant, and 3. How the findings benefit ASHRAE membership and/or society in general shall be submitted to the Manager of Research and Technical Services by the end of the Agreement term for publication in ASHRAE Insights

The Society may request the Institution submit a technical article suitable for publication in the Society's ASHRAE JOURNAL. This is considered a voluntary submission and not a Deliverable.

All Deliverables under this Agreement and voluntary technical articles shall be prepared using dual units; e.g., rational inch-pound with equivalent SI units shown parenthetically. SI usage shall be in accordance with IEEE/ASTM Standard SI-10.

f. Initial Project Plan
A detailed project design document will be prepared as the first deliverable and submitted for review by the PMS, following literature research and preceding actual document preparation, as described under Scope/Technical Approach.

g. Chapter Draft Submittals
Chapter drafts will be submitted on a quarterly basis in the order defined in the approved Project Plan, for review by the PMS. Chapter drafts should be at least 75% complete and include brief explanations of the remaining content.

h. Guide Draft Submittal
A draft of the complete Guide will be submitted within _____ months of the approval of the Project Plan, with at least 90% completion, and including explanations of the remaining content.

i. Changes Summary Report
The contractor will maintain a summary document tracking of all changes to the content being included in the Guide chapters and sections from the approved Project Plan to the submittal of the completed Guide draft document. The Changes Summary Report will be submitted with the quarterly Progress Report. The intent of this document is to maintain a start-to-finish record of changes, decision-points and any open issues on a sufficiently granular level.

j. Handbook Changes
The Final Report will include a summary of all elements in the Guide that comprise or provide materials for potential updates to Handbook chapters.

Level of Effort:

The estimated cost for the project is approximate $400,000. Approximately 60-75% of this budget is expected to come from UNEP and 25-40% from ASHRAE. The project is expected to require a project team with 3-4 participates, including a lead researcher responsible for integration and document management, along with 2-3 additional senior researchers in order to gain the span of knowledge covering industrial and commercial refrigeration sectors, as well as providing the necessary international perspective. The project is expected to involve a total of 30 man-months and require 24 months for completion.

This budget does not include translation of the Guide into the additional languages required by UNEP.

Other Information to Bidders (Optional):

Proposal Evaluation Criteria:

1. Contractor's understanding of Work Statement as revealed in proposal. 15%
   a) Logistical problems associated
   b) Technical problems associated
2. Quality of methodology proposed for conducting research. 15%
   a) Organization of project
   b) Management plan
3. Contractor's capability in terms of facilities. 10%
   a) Managerial support
   b) Data collection
   c) Technical expertise
4. Qualifications of personnel for this project. 30%
   a) Project team 'well rounded' in terms of qualifications and experience in related work (Note 1)
   b) Project manager person directly responsible; experience and corporate position
   c) Team members' qualifications and experience
   d) Time commitment of Principal Investigator
5. Student involvement 5%
   a) Extent of student participation on contractor's team
   b) Likelihood that involvement in project will encourage entry into HVAC&R industry
6. Probability of contractor's research plan meeting the objectives of the Work Statement. 20%
   a) Detailed and logical work plan with major tasks and key milestones
   b) All technical and logistic factors considered
   c) Reasonableness of project schedule
7. Performance of contractor on prior ASHRAE or other projects. 5%
   (No penalty for new contractors.)
8. Other_____

Note 1: Qualification of the project team to provide a broad and balanced perspective, incorporating experience with large and small facilities; ammonia and halocarbon systems; design, energy analysis, operations; new construction and existing facilities.

References:

(Import or expand the RTAR list of references to any articles, papers, books, etc., that were used in preparing the Work Statement and/or that would be of assistance to the bidders. All listed references should be readily available to contractors.)

ASHRAE January 2010 Seminar: "Ratings vs. Actual Performance in Refrigeration Systems".
ASHRAE June 2009 Forum: "What is Needed for the Advancement of Refrigeration Computer Simulation".
ASHRAE Green Guide, The Design, Construction and Operation of Sustainable Buildings, Second Edition 2006.
CIBSE Commissioning Code R:2002, The Chartered Institute of Building Services Engineers London, 2002.
ASHRAE "Design Essentials for Refrigerated Storage Facilities" completed under RP-1214

Authors:

Jojo Castro
David Hinde
Todd Jekel
Andy Pearson
Doug Scott

If any of the Work Statement authors plan to bid on the project, care must be taken to avoid actual or perceived conflict of interest. In particular, the requirements of the Work Statement should not be tailored to a unique Work Statement author's facility, equipment, or capability that is not reasonably available to other bidders. If WS authors bid on the project, they must identify themselves as such in their proposals, and the evaluators must satisfy themselves that these preparers did not gain an unfair advantage before their proposal may be considered. If it is determined that a submitted proposal does exhibit a conflict of interest, then that proposal should be identified, not evaluated, and written reasons given along with evaluations of the other proposals.

CTTC REF Consultant Report 2010-11
ASHRAE Annual Conference – Montreal 2011

ASHRAE Refrigeration Committee (REF)

Report to Chapter Technology Transfer Committee

2011 Annual Conference, Montreal, Quebec, Canada

REF Consultant: Donald A. Siller, P.E.
Donsiller@aol.com

June 24, 2011

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CTTC REF Consultant Report 2010-11
ASHRAE Annual Conference – Montreal 2011

TOPICS

- **Refrigeration Update**
- **Chapter Program Support**
- **Advance Chapter Interest in Refrigeration**

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CTTC REF Consultant Report 2010-11
ASHRAE Annual Conference – Montreal 2011

- **Refrigeration Update**
  - **Conference Paper Session 6 – Sunday, 6/26/11, 1:30 – 3:00 p.m.**
    - **Title: "Utilizing Refrigerant Management Strategies with Lower GWP"**
    - **Topics: – Microchannel Evaporators**
      - **Study of Ind'l. and Comm'l. Systems with Natural Refrigerants**
      - **Study of R-134a in Supermarket Refrigeration System**
      - **New Results for Low GWP Fluid Development**

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CTTC REF Consultant Report 2010-11
ASHRAE Annual Conference – Montreal 2011

- **Refrigeration Update**
  - **Seminar 27 (Intermediate) – Monday, 6/27/11, 8 – 9:30 a.m.**
    - **Sponsors: TC 10.08 (Refrigeration Load Calculations)**
      TC 10.05 (Refrigerated Distribution and StorageFacilities)
    - **Title: "Toward Net Zero Energy Refrigeration"**
    - **Topics: – Strategies for Low Greenhouse Gas Emissions and Energy Consumption in Supermarket Refrigeration Systems**
      - **Minimizing Energy Usage: Best Practice Design for a Refrigerated Warehouse**
      - **The Net Zero Food Plant**

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CTTC REF Consultant Report 2010-11
ASHRAE Annual Conference – Montreal 2011

- **Refrigeration Update**
  - **Seminar 29 (Intermediate) – Monday, 6/27/11, 9:45 – 10:45 a.m.**
    - **Sponsor: TC 10.02 (Automatic Icemaking Plants and Skating Rinks)**
    - **Title: "Bridging the Disconnect between HVAC and Refrigeration Design in an Ice Arena"**
    - **Topics: – Innovative Refrigeration Systems for Ice Rink Applications**
      - **Integration of HVAC Systems for Ice Arenas**

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CTTC REF Consultant Report 2010-11
ASHRAE Annual Conference – Montreal 2011

- **Refrigeration Update**
  - **Seminar 40 (Intermediate) – Tuesday, 6/27/11, 8:00 – 9:30 a.m.**
    - **Sponsors: REF; TC 10.07 (Comm'l. Food and Beverage Cooling Display and Storage)**
    - **Title: "Walk-In Coolers: Measuring and Modeling Performance"**
    - **Topics: – Application of Tracer Gas in Measuring Infiltration Rates in Walk-Ins.**
      - **Understanding Infiltration and Key Contributing Factors**
      - **Lab Analysis of Cooling Loads and Effects of Evaporator Fan Speed Variations on Performance of Walk-Ins**
      - **Walk-In Performance Modeling and Validation of Simplified Performance Rating Methods**

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CTTC REF Consultant Report 2010-11
ASHRAE Annual Conference – Montreal 2011

- Refrigeration Update
  - Technical Paper Session 7 (Basic) – Tuesday, 6/28/11, 9:45 – 10:45 a.m.
    - Title: "Prevention of Compressor Short Cycling in Direct Expansion (DX) Rooftop Units, Part 1 and Part 2"
    - Topics: – Part 1: Theoretical Analysis and Simulation
      – Part 2: Field Investigation

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CTTC REF Consultant Report 2010-11
ASHRAE Annual Conference – Montreal 2011

- Refrigeration Update
  - Refrigeration Management Program
    - ASHRAE in cooperation with other organizations established an Ad Hoc Committee to help develop a Program to Manage Refrigerants throughout their Life Cycle.
      - REF assisted in defining Scope, Objectives and Membership of the Ad Hoc Committee
      - Goals of Committee
        - Develop a concept for a National Refrigerant Management Program
        - Specify Actions ASHRAE can take to Support Development and Implementation of Program
        - Final Report to REF is due at the Annual Conference in Montreal

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CTTC REF Consultant Report 2010-11
ASHRAE Annual Conference – Montreal 2011

- Refrigeration Update
  - Research Project is under development: "Guide for Sustainable Refrigerated Facilities and Refrigeration Systems"
    - RTAR was Approved by RAC
    - Work Statement was Approved by REF, TC 10.01 and TC 10.05
    - Work Statement will be submitted to RAC at the Annual Conference in Montreal
    - ASHRAE requested UNEP co-funding since the "Guide" can have universal application

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CTTC REF Consultant Report 2010-11
ASHRAE Annual Conference – Montreal 2011

- Refrigeration Update
  - ASHRAE Position Documents on Refrigerants
    - REF is the cognizant Committee for Position Documents on Refrigerants
    - REF and Society have Reaffirmed and Approved:
      - Ammonia as a Refrigerant PD
      - Natural Refrigerants PD
      - Ozone Depleting Substances PD
        Note: ODS PD Committee has been Disbanded

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CTTC REF Consultant Report 2010-11
ASHRAE Annual Conference – Montreal 2011

- Refrigeration Update
  - ASHRAE Guideline for Commissioning of Refrigeration Systems
    - REF developed a Proposal and submitted it to the Special Projects Committee requesting Funding
    - Guideline as proposed is intended to cover Refrigerating Systems in Low and Medium Temperature Commercial Applications
    - The Guideline will emphasize how commissioning Commercial Refrigeration Systems differs from commissioning Commercial HVAC Systems; and will provide needed Guidance on the Special Requirements of commissioning Commercial Refrigeration Systems
    - Not intended to cover Refrigeration Systems used in Transport, Industrial or Process Refrigeration Applications

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CTTC REF Consultant Report 2010-11
ASHRAE Annual Conference – Montreal 2011

- Refrigeration Update
  - Refrigerants Conference
    - Will be co-sponsored by ASHRAE and NIST
    - Scheduled for Fall 2012
    - Title: "Advances in Low Global Warming Potential Refrigerants" (Being Developed)
  - Expanding the Scope of REF
    - A Brainstorming Session was held during the REF meeting at the Winter Conference in Las Vegas
    - Further discussions will take place during the REF meeting at the Annual Conference in Montreal

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CTTC REF Consultant Report 2010-11
ASHRAE Annual Conference – Montreal 2011

- Chapter Program Support
  - New REF Webpage
    - Implemented by Annual Meeting in Montreal
    - Organized by Duties of the REF
      - What's New: Highlights Recent Activities of REF
      - Committee Operations
        - REF Reports to Technology Council
        - Manual of Procedures (link)
        - Rules of Board (link)
        - Reference Manual (link)
        - Recent Meeting Minutes (link)

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CTTC REF Consultant Report 2010-11
ASHRAE Annual Conference – Montreal 2011

- Chapter Program Support
  - New REF Webpage
    - Chapter Resources
      - Program Materials Developed by REF to support Chapter Refrigeration Programs, with Links to each
        - Hosting a Successful Chapter Refrigeration Meeting (Being Developed)
        - Sister Refrigeration Organizations
        - ASHRAE Refrigeration Speakers List
        - ASHRAE Distinguished Lecturers (Refrigeration Topics)

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CTTC REF Consultant Report 2010-11
ASHRAE Annual Conference – Montreal 2011

- Chapter Program Support
  - New REF Webpage
    - Chapter Resources
      - Refrigeration Technology Awards Administered by the REF to recognize the Designers and Owners of Refrigeration Projects which exhibit Innovation and/or New Technologies with Links to:
        - "Milton W. Garland Commemorative Refrigeration Award for Project Excellence" to be Voted on at the REF Meeting in Montreal
        - "Refrigeration Comfort Cooling Award for Project Excellence"

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CTTC REF Consultant Report 2010-11
ASHRAE Annual Conference – Montreal 2011

- Chapter Program Support
  - New REF Webpage
    - Chapter Resources
      - REF Activities of Interest to Chapters are Reported with Links to:
        - Member First! Webpage
        - Winter Conference REF Report to CTTC
        - Annual Conference REF Report to CTTC

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CTTC REF Consultant Report 2010-11
ASHRAE Annual Conference – Montreal 2011

- Chapter Program Support
  - New REF Webpage
    - Member Resources: The REF assists and advises Technical Committees and Task Groups from Section 10.0 and 3.0 with Refrigeration-oriented Goals
    - Links provide Members with Information on Refrigeration-related Activities such as:
      - Refrigeration TC Activity Report
      - Technical Committee Webpage
      - Refrigeration Handbook (purchase)
      - Other Refrigeration Educational Products

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CTTC REF Consultant Report 2010-11
ASHRAE Annual Conference – Montreal 2011

- Chapter Program Support
  - New REF Webpage
    - The REF seeks to promote Refrigeration Education and Training to Students and seasoned Practitioners, through links to
      - Educational Opportunities including:
        - Schools with Refrigeration Courses or Training
        - Refrigeration as a Career (New Program Being Developed)
        - Refrigeration Training thru ASHRAE
      - Technology Transfer such as:
        - Refrigeration Programs and Seminars at ASHRAE Annual and Winter Conferences
        - "George C. Briley ASHRAE Journal Award" for Best Refrigeration-related Article published during the preceding Society Year, presented at the REF Meeting during the Annual Conference

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CTTC REF Consultant Report 2010-11
ASHRAE Annual Conference – Montreal 2011

- Chapter Program Support
  - Refrigeration is one Activity Chosen to Promote the 2011/2012 Presidential Theme, "Sustaining ASHRAE thru Leadership," emphasizing the Role ASHRAE Members play as Leaders in Sustainable Design and Practices
    - PAOE Points emphasize Chapter Refrigeration Activities:
      - 50 Points – Each Program on Natural Refrigerants; or Safe Refrigerant use (Std. 15, 34)
      - 50 Points – Each Refrigeration Tour
      - 50 Points – Establishing Chapter Refrigeration Committee with at least (2) Members
      - 25 Points – Chapter Presentation by REF Member
      - 25 Points – Joint Meeting with Sister Organization
      - 25 Points – Each Activity to Promote Refrigeration in K – 12

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CTTC REF Consultant Report 2010-11
ASHRAE Annual Conference – Montreal 2011

- Chapter Program Support
  - A New Program is being Developed by the REF, "Hosting a Successful Refrigeration Meeting."
  - Included will be:
    - Tours of Refrigeration Systems
    - Chapter Refrigeration Training
    - General Refrigeration Programs
    - Targeted Programs with Sister Organizations
    - Including Student Chapters

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CTTC REF Consultant Report 2010-11
ASHRAE Annual Conference – Montreal 2011

- Advance Chapter Interest in Refrigeration
  - A Link to the Refrigeration Technical Committee Activity Report is posted on the REF Webpage
  - REF MBOs for 2011-2012 will continue to emphasize:
    - Continue to Strengthen REF Partnership with CTTC
    - Continue to Improve Communication with and Support for the Chapters

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CTTC REF Consultant Report 2010-11
ASHRAE Annual Conference – Montreal 2011

- Advance Chapter Interest in Refrigeration
  - REF Survey to Membership
    - Survey to be Mailed Prior to, but will not Close until After, the Annual Conference in Montreal
    - Survey Questions include Checklists
      - What Aspects of Refrigeration Encountered in Job?
      - What Refrigeration Resources Used in Job?
      - What Refrigeration Programs would be Valuable?
    - Survey Questions Ask:
      - Does ASHRAE Provide Refrigeration Resources Needed?
      - Where do you get required Refrigeration Resources?

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CTTC REF Consultant Report 2010-11
ASHRAE Annual Conference – Montreal 2011

- Advance Chapter Interest in Refrigeration
  - REF Survey to Membership
    - REF Survey includes Rating Scales to Score Effectiveness of ASHRAE Refrigeration Resources
      - Journal Articles
      - Standards and Guidelines
      - Design Guides
      - Handbook Chapters
      - Educational Resources
      - Research
      - Conference Technical Papers
      - Conference Seminars
      - Refrigeration Awards Programs

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CTTC REF Consultant Report 2010-11
ASHRAE Annual Conference – Montreal 2011

- Advance Chapter Interest in Refrigeration
  - REF Survey to Membership
    - Please Respond to the Surveys and Encourage our Grassroots Members to Respond
    - Thanks for your Participation and for Your Support

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CTTC REF Consultant Report 2010-11
ASHRAE Annual Conference – Montreal 2011

THANK YOU

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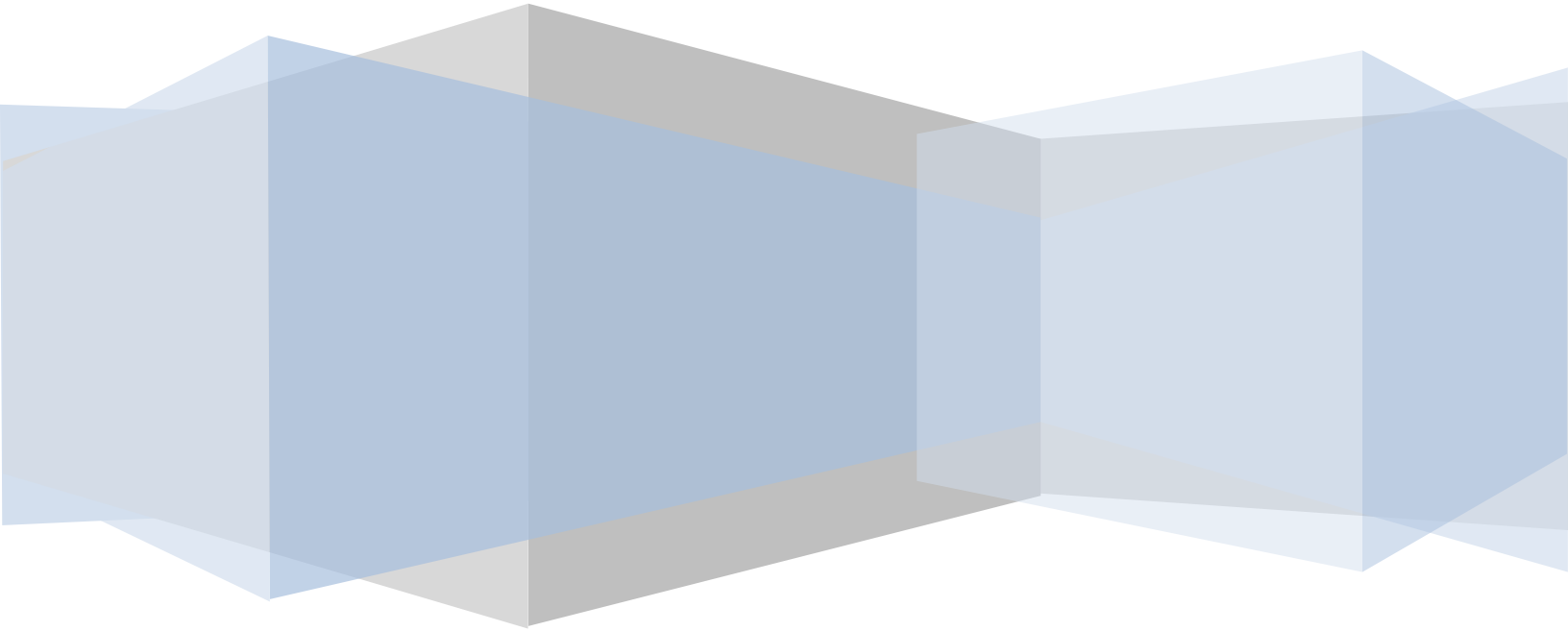
REFRIGERANT MANAGEMENT PLAN

Ad Hoc to Tech Council

28 June 2011



Final Report

EXECUTIVE SUMMARY

Refrigeration and air conditioning applications are growing worldwide, as well as in the United States, since they are critical contributors to the health, comfort, and welfare of humanity. However, the use of refrigerants has consequences for the environment (e.g. ozone depletion and climate change) if the refrigerants are not properly selected and managed throughout their lifecycle. Proper cradle to grave management is necessary to minimize the environmental impact and to ensure that suitable refrigerants are used by the HVAC&R industry to meet growing demand.

In the United States of America, every household has at least one refrigerator; over 90% have central A/C or heat pump systems. Nearly all passenger vehicles are equipped with air-conditioning. There are over 35,000 commercial systems in supermarkets and big box stores, and, thousands of truck and bus air-conditioning and refrigeration systems on the roads. In addition, there are reefer ships, and thousands of commercial chillers and heat pumps used in commercial, industrial and institutional applications. All of these applications utilize refrigerants – either synthetics such as CFCs (existing systems only), HCFCs, HFCs and HFOs or refrigerants based on naturally occurring compounds such as ammonia, hydrocarbons, and carbon dioxide.

Direct refrigerant emissions are estimated by the EPA to represent about 3% of global greenhouse gas emissions. The Indirect Effect (power plant emissions due to the power generated to operate HVAC/R equipment) is, overall, a larger portion of Climate Change Emissions than the Direct Effect, and is minimized by the use of the most efficient refrigerant available for the equipment and its application. Therefore, for all but high emission applications, the efficiency of the refrigerant will have a greater bearing on environmental impact than the GWP of the refrigerant. Nevertheless, even if the most efficient refrigerants and equipment technologies are used, refrigerant releases to the environment should be minimized in order to minimize the total environmental impact. It is to this objective that the Committee directs its work.

This committee agrees that an international plan is preferred. It is also the opinion of the committee that we start with a plan specifically tailored for the United States and as we show an industry commitment within the US, we can begin to work with other countries as requested or appropriate to assist in developing their refrigerant management plans.

1. GOAL

Develop a concept for a national refrigerant management program and specify actions which ASHRAE can take to support development and implementation of the plan.

2. OBJECTIVES

- Identify Stakeholders and their role
- Identify existing programs and evaluate the pros and cons of each
- Voluntary (Self Directing) or Mandatory (Federal Mandate)
- Create a timeline for implementation
- Determine the means for funding of this program
- Identify current ASHRAE programs, research and documents that can apply
- Determine the role of ASHRAE in this endeavour

3. SCOPE

A nationwide Refrigerant Management Plan, preferably voluntary in nature, is required to provide guidance and assistance to enable the HVAC&R industry to exercise proper environmental responsibility for the refrigerants under its stewardship. Refrigerants however are used in many industries other than HVAC&R. This report covers the usage by the HVAC&R industry and the total production and imported amounts of the refrigerants in the study. These include all CFC, HCFC, HFC and HFO refrigerants.

Not in Scope: The scope does not include natural refrigerants (i.e. Propane, iso-butane), organic refrigerants (i.e. Ammonia, CO_2).

Justification for Scope

HFO's and blends containing HFOs, though relatively new to the HVAC&R industry, are sold and distributed via the same channels as traditional refrigerants and, thus, included in the Scope. These refrigerants are typically low in GWP and their acceptance and use by the industry is rising.

Natural refrigerants as well as organic refrigerants are not in Scope. This is due to the fact that they are sold and distributed differently than standard refrigerants. In addition, the majority of these refrigerants are not used in the HVAC&R industry. These could be included in the future, based on the needs of the industry.

4. BACKGROUND

Refrigeration and air conditioning applications are growing worldwide since they are critical contributors to the health, comfort, and welfare of humanity. Federal and State governments will require the industry to take environmental responsibility for all refrigerants introduced into the environment therefore it is preferable to "lead the solution" than wait for governments to mandate a solution. The Federal EPA through the Clean Air Act and States such as California, have shown that they are willing to take the initiative and deal with the consequences to the environment and the industry if the refrigerants are not managed throughout their lifecycle by a voluntary means. The HVAC&R industry has the opportunity build a voluntary program that will meet the needs of the Federal and State governments, the Clean Air Act, the environment and the industry. As a signer of the Montreal Protocol, each country must have a Refrigerant Management Plan in place within 2-3 years in order to receive funding. Over 150 nations have signed the Montreal Protocol, to date only 39 countries have functioning plans. Section 9 reviews nine of these plans including:

- Canada
- Philippines
- Japan
- Poland
- Brazil
- China
- Korea
- Norway
- Australia

As the HVAC&R industry develops in the United States of America, it has become apparent that a better plan to track refrigerants throughout their lifecycle is required. As a reference to better understanding the lifecycle of a refrigerant please refer to ANNEX B. As a major technical contributor to the HVAC&R industry, ASHRAE can serve a unique role in this plan.

5. REQUIRED INFORMATION

- Current listing of all refrigerants per ANSI/ASHRAE Standard 34-2010 - See Annex A.
- List of all Stakeholders

Professional and Trade Organizations and Environmental Groups, such as:

- Air Conditioning Heating &Refrigeration Institute (AHRI)
- Air Conditioning Contractors of America (ACCA)
- American Council for Energy-Efficient Economy (ACEEE)
- American Society of Heating Refrigeration Air Conditioning Engineers (ASHRAE)
- Association of Home Appliance Manufacturers (AHAM)
- Food Marketing Institute (FMI)
- Refrigeration Service Engineers Society (RSES)
- International Association of Refrigerated Warehouses (IARW)
- Heating Air Conditioning & Refrigeration Distributors International (HARDI)
- Refrigerating Engineers and Technicians Association (RETA)
- Retail Industry Leaders Association (RILA)
- Society of Automotive Engineers (SAE)
- Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI)

Federal and State Agencies

- Environmental Protection Agency (EPA)
- Department of Energy (DOE)
- Department of Transportation (DOT)
- Occupational Safety and Health Administration (OSHA)

Environmental

- Sierra Club
- Natural Resources Defense Council (NRDC)
- Center for Energy and Environmental Policy (CEEP)
- Alliance for Responsible Atmospheric Policy (ARAP)

Code Agencies

- National Fire Protection Agency (NFPA)
- International Code Council (ICC)
- International Association of Plumbing and Mechanical
- Officials (IAPMO)
- Underwriters Laboratories (UL)

Other Stakeholders

- Refrigerant Manufacturers
- Distributors/Wholesalers
- Refrigerant Importers and Exporters
- Service Companies

6. APPLICATION

In order for a nationwide plan to be implemented, it is imperative that all Stakeholders be identified. Once identified, each Stakeholder needs to be placed in a subgroup that matches their area of expertise. These areas could be:

- Original Equipment Manufacturers
- Field Installed Service Personnel
- Users
- Distributors/Wholesalers
- Recycle Recovery Reclaim Equipment Manufacturers and Reclaimers
- Trade Associations
- Importers and Exporters
- Refrigerant Producers
- Disposal Facilities
- Leak Detection Equipment
- Fire Suppression
- Environmental

To ensure the success of a national refrigerant management program, it is imperative to have support from all the Stakeholders. Once identified, each Stakeholder group will be asked to appoint/nominate an individual to serve on the Refrigerant Management Committee (RMC). Each Stakeholder must be committed to developing and implementing a successful national refrigerant management program. The refrigerant management committee will develop the framework for the program, which will include but is not limited to, establishing a process for participation, creating a funding model, report procedures, education and marketing.

The committee would develop the purpose and scope of the RMC as well as approve the work of the subgroups. Each subgroup would be responsible for setting up the "reporting structure" for the entire life of the refrigerant in their subgroup. It is vitally important that each subgroup work with the other subgroups to develop consistent procedures especially from their vendor and their customer. One of the first goals of the RMC is to determine the

subgroups and to develop effective communication guidelines. In addition, the RMC will continue to develop strategies knowing that the long term goal is to go international with this plan.

Once the RMC has been established examples of their benefits could be:

- Reduce refrigerant leak rates
- Minimize environmental impact
- Conserve HFC's & HCFC's
- Protection of the HVAC&R industry
- Track refrigerant life cycle
- Improve overall Energy Efficiency of Systems
- Charge minimization
- Voluntary (Self Directing) or Mandatory (Federal Mandate)
- Recommend any future needs that ASHRAE can provide
- Public awareness
- Develop a standard reporting form and structure to all Stakeholders and the RMC
- Ensure responsible use
- Way for all stakeholders to be more confident in the Montreal Protocol

The RMC would work closely with the Stakeholders to:

1. Ensure compliance with applicable Federal Regulations
2. Obtain information relating to total production, import and export of CFC, HCFC, HFC and HFO refrigerants.
3. Raise the general public awareness of the environmental issues and the economic impact of ODP and GWP.
4. Organize a promotional program to encourage the public to have its HVAC&R systems serviced by a certified technician.
5. Work closely with the non-HVAC&R industries to understand the challenges and develop opportunities for reduction of emissions.

   One option is to develop a three stage plan:

   Stage One – Concentrate on Stakeholders that are aware of and participant in the HVAC&R industry and use CFC, HCFC, HFC and HFO refrigerants.

   Stage Two – Add Stakeholders that use CFC, HCFC, HFC and HFO refrigerants but are not in the HVAC&R industry (e.g. Foamers, Fire Fighting etc.)

   Stage Three – Add Stakeholders that use natural refrigerants in and out of the HVAC&R industry.

Stage One


OEM
Political
Field Installed - Service
Environmental
Users
Refrigerant Management Committee
Leak Detection Equipment
Reclaim/ Disposal
Referigerant Producers
Import/ Export
Trade Associations

7. REPORTING PERIODS

Each subgroup would make reports to the RMC twice per year. These reports could include but are not limited to:

- Refrigerant by type coming into their domain.
- Refrigerant by type that has been destroyed.
- Refrigerant by type that has been released to the atmosphere.
- Refrigerant by type that has been put in the bank.
- Changes to their procedures to better develop the tracking of each refrigerant type.
- Changes in technology that reduce leaks or that detects them sooner.

8. CHALLENGES

All plans have challenges to overcome. Building consensus and support with industry and government Stakeholders is imperative. The goal is to engage all Stakeholders and educate them on the goals of the program. Identifying and understanding these challenges, developing education system and procedures addressing these challenges, and encouraging Stakeholders to take a leadership role will be the crucial to its success. Five challenges have been identified and are outlined below:

Financial:

- Investing in technology that may not have short term payback.
- Performing retrofits of CFC or HCFC systems with alternative refrigerants with lower GWP ratings. Retrofits are expensive if performed to suitable levels.
- Investing in travel and time to participate.
- FUNDING OF THIS PROGRAM IS PARAMOUNT. The RMC will need to prepare a schedule. See Section 10.

Disclosure/Reporting:

- Stakeholders not understanding the industry and therefore limiting their buy-in.
- Sharing information that can be construed as Confidential Business Information (CBI).
    - We might consider using a third party to gather CBI and disseminate it.

Technology:

- Utilizing computer and telecommunication capability to network with others hardware and offer inventory management, real time tracking and other tailor-made services.
- Utilizing the best available technology to find leaks, prevent leaks and monitor for leaks.

Distribution:

- Understanding the cold chain and refrigerant use and storage in the HVAC&R industry
- Understanding the refrigerant use and storage outside the HVAC&R industry.

Political:

- It may be thought that a program of this magnitude would be easier to implement if there are federal requirements dictating the provisions. However, the time required developing, implementing and tracking compliance of Federal regulations may be prohibitive. Developing a program that is self-regulating will take a focused group of people that all have a stake in the game. Developing the pros and cons early in the process for this is essential. With strong participation from the Stakeholders, a plan could be implemented in 3 to 4 years. Having said that, support from the Federal EPA and State EPA/DNR is required in order for this initiative to succeed.

- Existing standards and codes already exist to monitor refrigerant paths, see the list in ANNEX C.

The five areas above need to be addressed first by the RMC, then by each subgroup. Identifying these will bring a more consistent plan across all subgroups.

9. OTHER PROGRAMS

There are a number of plans worldwide that manage refrigerants. Each is unique and developed to fit the circumstances within their country. An overview of some of the programs is noted below.

Country	Advantages	Disadvantages
Australia	• Website: https://www.refrigerantreclaim.com.au • Non-profit organization • Industry driven and managed • Recovers, reclaims and destroys surplus refrigerant • Provides rebates for contractors • Operates a national collection service • Has strong regulatory support regarding handling, buying/selling, training, etc • Importers must have license…fee helps support the management of the program • Link to financial report - https://www.refrigerantreclaim.com.au/AR06/income.html • All refrigerant entering Australia (charged equipment and bulk) is subject to a levy • Includes all refrigerants, regardless of sector	• Anticompetitive issues. RRA is the only business of its type in Australia and the program has had to deal with complaints of anticompetitive.
Canada	• Website: www.refrigerantmanagement.ca • Non-profit organization • Industry driven – voluntary • Industry funded and managed – manufacturers/importers/reclaimers pay an environmental levy to Refrigerant Management Canada (RMC) on a quarterly basis. • Disposal only • Costs passed down the retail change. End-user ultimately pays the cost for refrigerant disposal. • Simple and easy to use. Removed barriers to ensure the HVAC/R industry uses program. • Built program on existing infrastructure. • Managed by the HVAC/R industry allows the freedom for the program to grow and adapt to the changing times. • Industry has a strong environmental program to show Stakeholders and government that they are in compliance with the regulations. • Strong marketing environmental (green)benefits for participants	• No regulatory backdrop to level playing field and reduce free riders • Environmental levy applied to the sales of HCFCs, HCFC blends and reclaimed HCFCs. The phase-out of HCFCs is reducing the funds collected. • Small pool to draw on for funding. • Difficult to determine volumes and therefore plan budgeting…RMC has seen higher than expected volumes. • Only includes refrigerant from the HVAC/R industry.
Poland	• Website: http://www.prozon.org.pl/ • Non-profit organization • nationwide recovery and reclamation network • Industry supported • Fairly strong regulatory support	• Limited to recovery and reclamation. • Issues with funding. Here is a quote from an email received from Prozon “one of the key problems to Polish distributors - the matter of competitiveness. Distributors participating in the voluntary levy system would be in worse position in terms of price competitiveness than those who would not participate”

Norway	• Website: http://www.returgass.no/ • Handles reclamation and destruction • Primary system in Norway • An environmental fee charged on imported refrigerants. • Offers an incentive to encourage participation • Handles all refrigerant types • Government compensates for refrigerant destroyed.	• Owned and operated by parent company Isovator. • Experienced difficulty reconciling quantities received with quantities destroyed.
Japan	• Two sided approach: 1)Establish a refrigerant management program and 2)Accelerate R & D for low Global Warming Potential refrigerants. • A cross industry Refrigerant Management Forum is proposed with the following: Establish the Refrigerant Management System Establish the traceability of distributed refrigerants Establish refrigerant management technology • New technical guidelines regarding leak prevention • A new certification for engineers handling refrigerants	• Program still proposed • Program looks at all under the CO_2 microscope. • Complying with existing regulations • Low GWP barriers • Training • Lack of consistency among Refrigerant Production – Manufacturing and Demand.
Philippines	• Website http://www.denr.gov.ph/index.php/laws-and-policies.html • Government regulated • Non-profit organization • Industry driven and managed • Recovers, reclaims and reprocessing (For CFC's only) • Reclaim units are given for free to Service Shops • Operates a national collection service under a non-profit organization • Has strong regulatory support regarding handling, buying/selling, training, etc • Importers must have license…for control purposes • Funding are available like grants from the World Bank to replace Chillers that are not energy efficient (CFC & HCFC)	• Poor regulatory control due to lack of personnel to police the whole industry. • No program yet for HCFC Phase-out and HFC Phase- down (DENR is asking UNEP to fund this through the MLF)
China	• HCFC's Phase Out Management Plan (HPMP) – two subsectors – Manufacturing and Maintenance • Relevant management regulations and measures were made concerning production, use, import and export of ODS and related products. • Strict stipulations were made about refrigerants reuse and recycle.	• Federally run. • Slow to discuss HFC's
Korea	• Manage CFCs, HCFCs and HFCs • Reduce the import of refrigerants • Establish an advanced refrigerants system by destroying waste refrigerants • Create refrigerant management industry	• Proposed regulation
Brazil	• Implementing a PBH = Brazilian Plan for HCFC elimination – major focus on foams (R-141b). • Include financial incentives to promote recovery, recycling, reclaiming and/or destruction and to develop low-GWP compounds and products that use low GWP products • Minimize market disruption • A new Federal Law 12.014/09 creates a National Fund on Climate Changes.	• Total elimination of HCFC in 2040 • Phase down – not a phase-out of HFC production • Provide time for transition to alternative refrigerants

10. ASHRAE ACTIONS

1. Appoint a committee to finalize a list of Stakeholders.
2. Contact Stakeholders and determine their commitment to a RMP.
3. Hold a meeting of the committed Stakeholders and develop the following:
    a. Scope
    b. Subgroups
    c. Develop a list of Challenges and Risks and evaluate them
    d. Review existing or proposed programs that exist
    e. Identify existing ASHRAE as well as Stakeholders guidelines and standards that can be used to provide guidance for the industry. See Annex C for a small list.
    f. Develop a communication plan for all subgroups that will allow for consistent communication between subgroups and the RMC.
    g. Develop a plan to finance the program. See Section 11 as a guideline.

NOTE 1: Initial cost to ASHRAE will be minimal as long as the above is scheduled during standard ASHRAE meetings.

NOTE 2: This group should report directly to Technology Council.

NOTE 3: This group should work with TC 3.1 *Refrigerants and Secondary Coolants* and TC 3.8 *Refrigerant Containment* to develop a Research Topic Acceptance Request (RTAR). The RTAR could cover research in the following areas:

i. All users of CFC, HCFC, HFC and HFO refrigerants not just HVAC&R,
ii. User usage of these refrigerants.
iii. Existing standards that may be affected by the work of this committee.
iv. In-depth existing program study, determining advantages, disadvantages, risks, roadblocks, challenges and oversights.
v. Determine best course of action to incentivise reclamation and destruction rather than venting.
vi. Does this program help the ASHRAE Research Committee in meeting Goal 8 *Facilitate the use of natural and low global warming potential (GWP) synthetic refrigerants and seek methods to reduce their charge* and Goal 9 *Support the development of improved HVAC&R components ranging from residential through commercial to provide improved system efficiency affordability, reliability and safety*, of the ASHRAE Strategic Plan 2010-2015.

The reporting structure would be directly to Technology Council as well as any of the Stakeholders who wish to know. The RMC would develop a standard means to

communicate the actions taken and results of the metrics taken. The RMC will also consider where the various refrigerant management activities would reside within ASHRAE.

11. FINANCIAL

In order to be successful, the refrigerant management program should achieve a high rate of refrigerant recovery. Possible incentives for responsible management of used refrigerants include (1) direct economic incentives or (2) command and control regulations. These two options are discussed below in more detail.

Direct Economic Incentives

In this option, an excise tax or a levy is applied to the production and/or import of virgin and reclaim refrigerants. In the case of an excise tax, the proceeds go to the government, while in the case of a levy the proceeds are directed back to the industry. The advantages and disadvantages can be summarized as follows:

	Advantages	**Disadvantages**
Excise Tax	• Increased refrigerant recovery • Funding collected at time of production, reclaim or import. • Costs passed down the retail chain to the end-user • Level playing field for all involved, free riders virtually eliminated. • Tax could be less on reclaim refrigerant to promote the use of reclaim refrigerants • Subsidy could come from the government to promote destruction	• Increase cost of virgin and reclaim refrigerants • Penalize industry as revenues provides no direct benefit to industry • Require large impact on price to achieve results
Levy	• Increased refrigerant recovery • Proceeds go back to industry to offset costs of recovery, reclaim and destruction • Reclaimed refrigerants become more valued relative to virgin refrigerants and less costly to produce. • Costs passed down the retail chain to end-user • Subsidy could come from the government to promote destruction.	• Increase cost of virgin and reclaim refrigerants • Collection of levy and management of the fund • Establishment of incentives • Free riders

Command and Control Regulations

In this option, mechanisms are put in place to implement enforcement actions for violations of the regulations. This would be similar to the current regulations under section 608 of the Clean Air Act (CAA) for CFCs and HCFCs. Advantages and disadvantages are summarized below:

	Advantages	Disadvantages
Command & Control Regulations	• Low cost impact on consumers	• Economic costs to contactors • Difficult to enforce • Expected low level of compliance (based on experience with CFCs and HCFCs)

12. Timeline

6mo.	• Tech Council to form a Committee to determine Stakeholders and draft Charter. • Committee should generate a script for phone calls to potential Stakeholders to explain the program and why we need their participation and support.
1 yr.	• All Stakeholders are contacted to explain the program and see if they wish to participate - (use script). • Set up meeting of Stakeholders - (suggest at the next ASHRAE meeting). • Develop list and obtain copies of existing programs throughout industry. • Determine involvement of regulatory agencies – Does this need to be federally mandated.
18 mo.	• 1st meeting of RMC - Determine Scope, Charter, Membership, Stakeholder Groups. • Determine role of each Stakeholder group and their role in the program. • Assign deliverables to Stakeholder groups. • Understand distribution networks. • Develop plan for improved destruction • Develop list of Challenges and Risks. • Review existing programs for pros, cons, advantages, disadvantages, what worked, what didn't work. • Develop communication plan including metrics for each Stakeholder group. • Develop a plan to finance this project. • Develop Research requirements.
24 mo.	• Review and further develop lists from above. • Further develop the requirements for financing. • Develop plans with cognizant TC's to insure commitment. • Develop required RTAR to Research Committee. • Start tracking metrics
30 mo.	• Finalize assessments of existing programs

	• Continue to evaluate metrics for each Stakeholder group
36 mo.	• Finalize metrics and implement communication plan • Develop plan for Stage 2 • Re-evaluate financial plans and determine feasibility of long term sustainability

13. Document Distribution

Name	Organization	Name
Refrigerant Management Plan Ad Hoc Committee to Technology Council	ASHRAE	Danny Halel – Chair April Gucciardo Barbara Minor Cesar Luis Lim Karim Amrane Keilly Witman Van Baxter Warren Beeton Tom Watson Tom Werkema
Technology Council	ASHRAE	Mr William P. Bahnfleth, PhD, PE - Tech Council Chair Mr. Ross D Montgomery, PE - Tech Council Vice-Chair Mr Hugh F Crowther - Member/DAL Prof Timothy C Dwyer - Member/DAL Mr Samir R Traboulsi, PhD, PE -Member/DAL Ms Martha J Hewett -Member/Past RAC chair Mr Bodh R Subherwal, PE -Member/Past Standards Mr Donald M Brundage, PE - Member/Past TAC Mr Daniel C Pettway - Member/Past DRC Mr Michael F Beda - Member-At-Large Mr Arthur L Giesler - Member-At-Large Mr Arthur D Hallstrom, PE BEMP -Member-At-Large Mr Lawrence J Schoen - Environmental Health Chair Dr Cynthia L Gage - Refrigeration Chair Dr. James E Braun, PhD - RAC Chair Mr Hugh I Henderson, Jr - RAC Vice-Chair Mr H Michael Newman - Standards Chair Ms Carol E Marriott, P. Eng. - Standards Vice Chair Mr Charles C Wilkin, PE - TAC Chair Dr Charles H Culp, III - TAC Vice-Chair

		Ms Claire Ramspeck - Staff Liaison
Refrigeration Committee	ASHRAE	Cynthia Gage, Chair Doug Scott, Vice-Chair Pradeep Bansal Marc Chasserot Teddy Hansen Donald Hay Todd Jekel Georgi Kazachki Cesar Lim Dan Manole Norbert Mueller Andrew Pearson Kent Anderson, Consultant Don Siller, Consultant Samir Traboulsi, BOD Ex-Officio William Bahnfleth, Coordinating Officer

14. Prepared by

Danny Halel – Chair
April Gucciardo
Barbara Minor
Cesar Luis Lim
Karim Amrane
Keilly Witman
Van Baxter
Warren Beeton
Tom Watson
Tom Werkema

ANNEX A

ASHRAE NO.	Chemical Name	Molecular Formula
R-11	Trichlorofluoromethane	CCl_3F
R-12	Dichlorodifluoromethane	CCl_2F_2
R-12B1	Bromochlorodifluoromethane	$CBrClF_2$
R-13	Chlorotrifluoromethane	$CClF_3$
R-13B1	Bromotrifluoromethane	CF_3Br
R-14	Tetrafluoromethane	CF_4
R-21	Dichlorofluoromethane	$CHFCl_2$
R-22	Chlorodifluoromethane	$CHClF_2$
R-23	Trifluoromethane	CHF_3
R-30	Dichloromethane	CH_2Cl_2
R-31	Chlorofluoromethane	CH_2FCl
R-32	Difluoromethane	CH_2F_2
R-40	Chloromethane	CH_3Cl
R-41	Fluoromethane	CH_3F
R-113	1,1,2-Trichlorotrifluoroethane	$C_2F_3Cl_3$
R-114	1,2-Dichlorotetrafluoroethane	$C_2F_4Cl_2$
R-115	Chloropentafluoroethane	C_2F_5Cl
R-116	Hexafluoroethane	C_2F_6
R-123	2,2-Dichloro-1,1,1-trifluoroethane	$C_2HF_3Cl_2$
R-124	2-Chloro-1,1,1,2-tetrafluoroethane	C_2HF_4Cl
R-125	Pentafluoroethane	C_2HF_5
R-134a	1,1,1,2-Tetrafluoroethane	$C_2H_2F_4$
R-141b	1,1-Dichloro-1-fluoroethane	$C_2H_3FCl_2$
R-142b	1-Chloro-1,1-difluoroethane	$C_2H_3F_2Cl$
R-143a	1,1,1-Trifluoroethane	$C_2H_3F_3$
R-152a	1,1-Difluoroethane	$C_2H_4F_2$
R-218	Octafluoropropane	C_3F_8
R-236ea	1,1,1,2,3,3-Hexafluoropropane	$C_3H_2F_6$
R-245fa	1,1,1,3,3-Pentafluoropropane	$C_3H_3F_5$
R-C318	Octafluorocyclobutane	C_4F_8
R-400	R-12/R-114 (60/40 wt%)	Blend
R-401A	R-22/R-152a/R-124 (53/13/34)	Blend
R-401B	R-22/R-152a/R-124 (61/11/28)	Blend
R-401C	R-22/R-152a/R-124 (33/15/52)	Blend
R-402A	R-125/R-290/R-22 (60/2/38)	Blend
R-402B	R-125/R-290/R-22 (38/2/60)	Blend
R-403A	R-290/R-22/R-218 (5/75/20)	Blend
R-403B	R-290/R-22/R-218 (5/56/39)	Blend
R-404A	R-125/R-143a/R-134a (44/52/4)	Blend

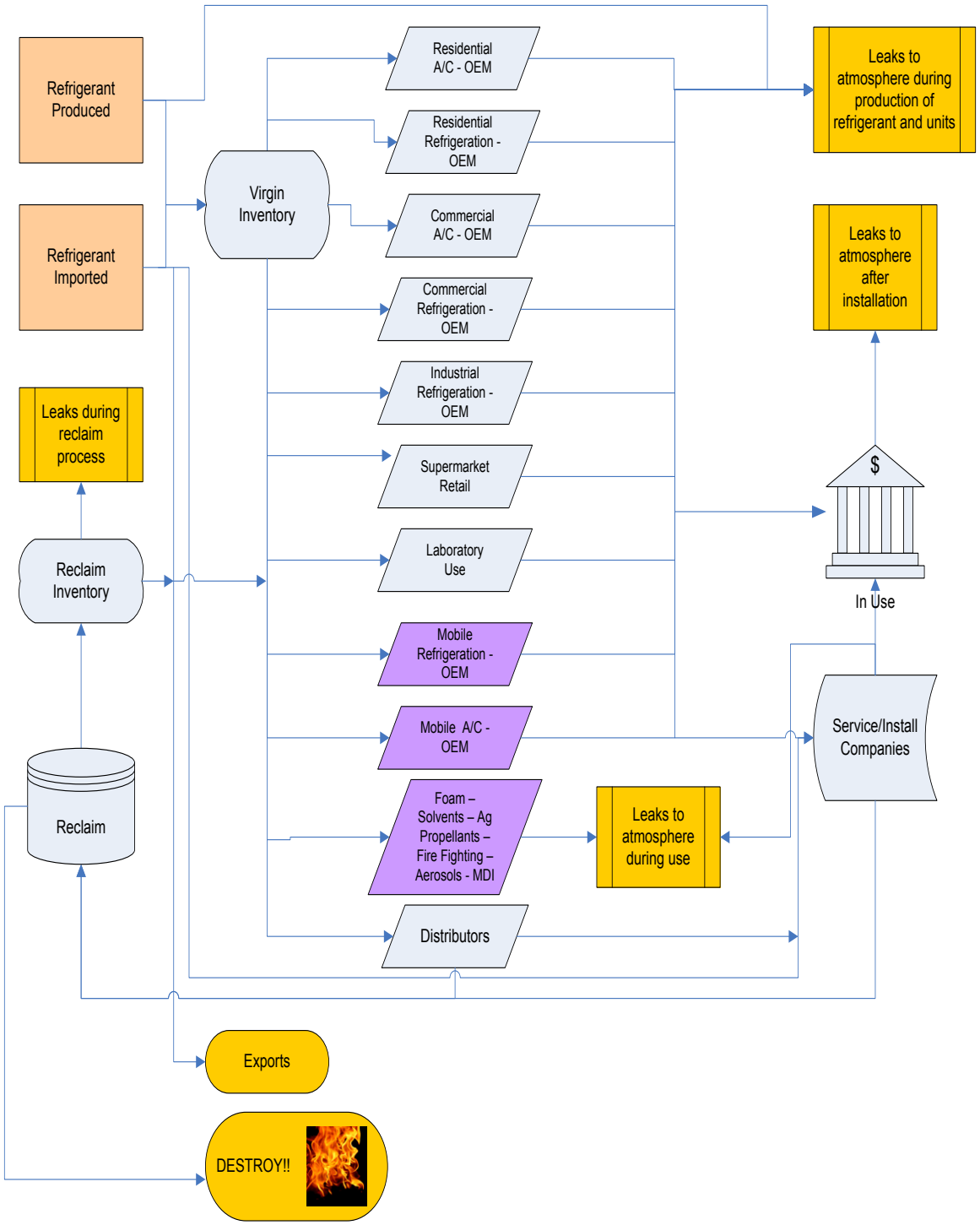
R-405A	R-22/R-152a/R-142b/R-C318 (45/7/5.5/42.5)	Blend
R-406A	R-22/R-600a/R-142b (55/04/41)	Blend
R-407A	R-32/R-125/R-134a (20/40/40)	Blend
R-407B	R-32/R-125/R-134a (10/70/20)	Blend
R-407C	R-32/R-125/R-134a (23/25/52)	Blend
R-407D	R-32/R-125/R-134a (15/15/70)	Blend
R-407E	R-32/R-125/R-134a (25/15/60)	Blend
R-408A	R-125/R-143a/R-22 (7/46/47)	Blend
R-409A	R-22/R-124/R-142b (60/25/15)	Blend
R-409B	R-22/R-124/R-142b (65/25/10)	Blend
R-410A	R-32/R-125 (50/50)	Blend
R-410B	R-32/R-125 (45/55)	Blend
R-411A	R-1270/R-22/R-152a (1.5/87.5/11)	Blend
R-411B	R-1270/R-22/R-152a (3/94/3)	Blend
R-412A	R-22/R-218/R-142b (70/5/25)	Blend
R-413A	R-218/R-134a/R-600a (9/88/3)	Blend
R-414A	R-22/R-124/R-600a/R-142b (51/28.5/4.0/16.5)	Blend
R-414B	R-22/R-124/R-600a/R-142b (50/39/1.5/9.5)	Blend
R-415A	R-22/R-152a (82/18)	Blend
R-415B	R-22/R-152a (25/75)	Blend
R-416A	R-134a/R-124/R-600 (59/39.5/1.5)	Blend
R-417A	R-125/R-134a/R-600 (46.6/50.0/3.4)	Blend
R-418A	R-290/R-22/R-152a (1.5/96/2.5)	Blend
R-419A	R-125/R-134a/R-E170 (77/19/4)	Blend
R-420A	R-134a/R-142b (88/12)	Blend
R-421A	R-125/R-134a (58/42)	Blend
R-421B	R-125/R-134a (85/15)	Blend
R-422A	R-125/R-134a/R-600a (85.1/11.5/3.4)	Blend
R-422B	R-125/R-134a/R-600a (55/42/3)	Blend
R-422C	R-125/R-134a/R-600a (82/15/3)	Blend
R-422D	R-125/R-134a/R-600a (65.1/31.5/3.4)	Blend
R-423A	R-134a/R-227ea (52.5/47.5)	Blend
R-424A	R-125/R-134a/R-600a/R-600/R-601a (50.5/47/.9/1/.6)	Blend
R-425A	R-32/R-134a/R-227ea (18.5/69.5/12)	Blend
R-426A	R-125/R-134a/R-600/R-601a (5.1/93/1.3/.6)	Blend
R-427A	R-32/R-125/R-143a/R-134a (15/25/10/50)	Blend
R-428A	R-125/R-143a/R-290/R-600a (77.5/20/.6/1.9)	Blend
R-500	R-12/R-152a (73.8/26.2)	Blend
R-501	R-22/R-12 (75/25)	Blend
R-502	R-22/R-115 (48.8/51.2)	Blend
R-503	R-23/R-13 (40.1/59.9)	Blend
R-504	R-32/R-115 (48.2/51.8)	Blend
R-505	R-12/R-31 (78/22)	Blend

R-506	R-31/R-114 (55.1/44.9)	Blend
R-507	R-125/R-143a (50/50)	Blend
R-508A	R-23/R-116 (39/61)	Blend
R-508B	R-23/R-116 (46/54)	Blend
R-509A	R-22/R-218 (44/56)	Blend
R-1112a	1,1-Dichloro-2,2-difluoroethylene	$C_2Cl_2F_2$
R-1113	Chlorotrifluoroethylene	C_2ClF_3
R-1114	Tetrafluoroethylene	C_2F_4
R-1120	Trichloroethylene	C_2HCl_3
R-1130	cis-1,2-Dichloroethylene	$C_2H_2Cl_2$
R-1132	1,1-Difluoroethylene	$C_2H_2F_2$
R-1140	Chloroethylene	C_2H_3Cl
R-1141	Fluoroethylene	C_2H_3F
R-1216	Hexafluoropropylene	C_3F_6
R-1234yf	2,3,3,3-Tetrafluoropropene	$C_3H_2F_4$

ANNEX B

REFRIGERANT LIFE CYCLE **June 2011**

CRADLE to GRAVE



Annex C

Applicable Standards and Codes

- ANSI/ASHRAE 15 – Safety Code for Mechanical Refrigeration
- ANSI/ASHRAE 147 – Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment and Systems
- ANSI/ASHRAE 34 – Number Designations and Safety Classification of Refrigerants
- ANSI/ASHRAE 41.1 – 2008 Flowmeter Test Methods for Mass Flow Measurement of Volatile Refrigerants
- ANSI/ASHRAE 90.1- Energy Standard for Buildings Except Low-Rise Residential Buildings
- ANSI/ASHRAE 189.1- Standard for the Design of High-Performance Green Buildings Except Low Rise Residential Buildings
- ASHRAE Guideline 6 – Format for Information for Refrigerants
- AHRI Guideline K (1997) – Containers for Recovered Fluorocarbon Refrigerants
- AHRI 580 – Performance of Non Condensable Gas Purge Equipment for Use with Low Pressure Centrifugal Chillers
- AHRI 700-9 – Specification for Fluorocarbon Refrigerants
- AHRI 740-98 – Refrigerant Recovery/Recycling Equipment
- UL 1995 – Heating and Cooling Equipment
- SAE J 2763-2008 – Test Procedure for Determining Refrigerant Emissions from Mobile Air-Conditioning Systems
- SAE J 2772-2011 – Measurement of Passenger Compartment Refrigerant Concentrations Under System Refrigerant Leakage Conditions
- SAE J2788-2010 – HFC-134a Recovery/Recycling Equipment and Recovery/Recycling /Recharging for Mobile Air Conditioning Systems
- SAE J2810-2007 – HFC-134a Refrigerant Recovery Equipment for Mobile Automotive Air-Conditioning Systems
- SAE J2843-2011 – Recovery/Recycling/Recharging Equipment for Flammable Refrigerants for Mobile Air Conditioning Systems
- SAE J2851-2011 - HFO-1234yf Refrigerant Recovery Equipment for Mobile Automotive Air-Conditioning Systems
- ISO 13043:2011 – Road Vehicles – Refrigerant systems used in mobile air conditioning systems (MAC) – Safety requirements.
- US EPA Clean Air Act
- Guide for Sustainable Refrigerated Facilities and Systems

ANNEX D - RECOMMENDATIONS for ACTIONS by TECHNOLOGY COUNCIL

1. Appoint a committee to finalize a list of Stakeholders.
2. Contact Stakeholders and determine their commitment to a RMP.
3. Hold a meeting of the committed Stakeholders and develop the following:
    a. Scope
    b. Subgroups
    c. Develop a list of Challenges and Risks and evaluate them
    d. Review existing or proposed programs that exist
    e. Identify existing ASHRAE as well as Stakeholders guidelines and standards that can be used to provide guidance for the industry. See Annex C for a small list.
    f. Develop a communication plan for all subgroups that will allow for consistent communication between subgroups and the RMC.
    g. Develop a plan to finance the program. See Section 11 as a guideline.

NOTE 1: This group should report directly to Technology Council.
NOTE 2: This group should work with TC 3.1 *Refrigerants and Secondary Coolants* and TC 3.8 *Refrigerant Containment and* TC 4.4 *Building Materials and Building Envelope Performance* to develop a Research Topic Acceptance Request (RTAR). The RTAR could cover research in the following areas:

vii. All users of CFC, HCFC, HFC and HFO refrigerants not just HVAC&R,
viii. User usage of these refrigerants.
ix. Existing standards that may be affected by the work of this committee.
x. In-depth existing program study, determining advantages, disadvantages, risks, roadblocks, challenges and oversights.
xi. Determine best course of action to incentivise reclamation and destruction rather than venting.
xii. Does this program help the ASHRAE Research Committee in meeting Goal 8 *Facilitate the use of natural and low global warming potential (GWP) synthetic refrigerants and seek methods to reduce their charge* and Goal 9 *Support the development of improved HVAC&R components ranging from residential through commercial to provide improved system efficiency affordability, reliability and safety*, of the ASHRAE Strategic Plan 2010-2015.

The reporting structure would be directly to Technology Council as well as any of the Stakeholders who wish to know. The RMC would develop a standard means to communicate the actions taken and results of the metrics taken. The RMC will also consider where the various refrigerant management activities would reside within ASHRAE.

Refrigeration Committee Issue Update

Tom Werkema
Montreal
June 26, 2011

Climate Change – 2011

- 2011 – Meeting of Parties in Durban, South Africa
  - At least three additional meetings–one in Bonn, Germany, one Bangkok, one ?
  - Most countries "sliding" on commitments made in Cancun
  - Spent most of April meeting discussing "size of the table"
    - Developing Countries insisting on dealing with Kyoto Protocol
      - Russia, Japan, Canada – not interested in 2nd Commitment period
  - $30B commitment fund by 2015, 1/3rd from US
    - Will US Fund?
    - Obama committed to support the 2015 $100b fund
    - First meeting on how to spend the fund delayed 6 months
      - First meeting results minimal since S. Africa didn't show

US – 2009 emissions

- Total emissions up about 7.4% since 1990
  - Average annual increase 0.4%
  - KP – 7% decrease
    - Average 2008-2012
  - Down 2.9% in 2008, 6% down in 2009
    - 2009 lowest levels since 1995
  - Climate commitment by Pres. Obama – 17% below 2005 in 2020
    - About halfway to that goal

Congress Climate Change

- President Obama conceded cap & trade is dead
  - "We may end up having to do it in chunks, as opposed to some sort of comprehensive omnibus legislation."
- Republicans focused on EPA GHG Regulations

Senate:	53 D	47 R	House:	197 D	242 R
2012 re-election	23 D	10 R			all

Congress Climate Change

- 12 bills introduced to limit EPA – all rejected
  - EPA budget currently $10.3 B
  - Foreign aid, research $3 B
- Debate continues for Debt Ceiling, 2012 Budget
- Climate/Energy Czar left the White House

US EPA – Major Activity

- Determined GHG subject to Clean Air Act in January, 2011 (3/29/10)
- Auto GHG standards for cars and 'light-duty trucks' thru 2016 (4/1/10)
  - 62 MPG in 2025
- GHG Reporting Rule
  - First reports due March 30, 2011 (deferred to Sept 30, 2011)for 2010 calendar year
    - EPA on-line reporting system not ready
- Power Plants GHG Reduction – July 26, 2011 proposal, May 26, 2012 final
  - Oil Refineries – December 10, 2011 proposal, November 10, 2012 final

US EPA – Major Activity

- 2nd US Circuit Court of Appeals – allow GHG emitters to be sued
  - "public nuisance"
  - Administration weighed-in against appeals court in decision in appeal to Supreme Court
  - Supreme Court heard case April 20
    - Decision announced Monday – not allowed
- 156 lawsuits filed on the major EPA regulations
  - US Circuit Court of Appeals for the District of Columbia declined to establish injunction

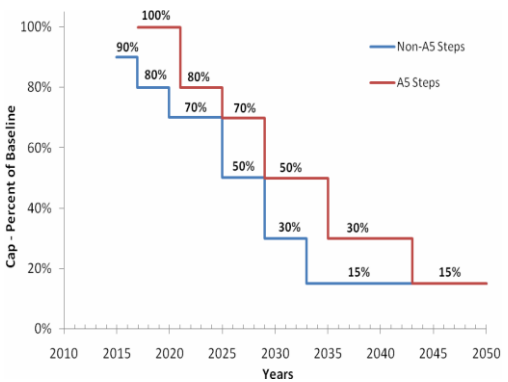
California

- Air Resources Board released cap & trade allocation design
  - "full steam ahead"
  - On-line in 2012
- Court sided with environmental justice advocates contending CARB broke law by not reviewing alternative emissions reduction before establishing C & T
- CARB rules on hold pending review
  - Mary Nichols (ARB Chair) – still expect C & T on Jan 1, 2012

Montreal Protocol HFC Amendment Proposals - 2011

C-M-US Amendment

- Baseline 2005-2008, HFCs plus 85% HCFCs
- Decline steeper and still hits 15% in 2033
- Imports/exports banned to non parties to this Protocol
- 20 chemicals including 2 HFOs
- 20 Parties must ratify to enter into force, or on 1/1/13 whichever is later – 90 days thereafter
  - 70 ratifications for import/export bans entering into force



Micronesia HFC Amendment

- Developed countries:
  - baseline 2004-2006 HCFCs plus HFCs
  - Phase down 15% every 3 years beginning in 2014
  - 15% in 2029, 10% in 2031
- HFC-23 control measures, exempting CDM projects
- Developing countries
  - 6 year grace period
  - Baseline 2007-2009 HCFC only
  - Incremental costs paid by MLF
- Includes 2 HFOs

REF MBO's – C. Gage, Chair 2010-2011

	OBJECTIVE	Strategic Direction	Responsibility	Planned Completion	Status
1.0	**Perform a gap analysis on ASHRAE Refrigeration products and services**	**1&2**			
1.1	Identify existing Refrigeration-related products and services (education, certification, standards, guidelines, publications, webinars, documents)		**Jekel,** Hay, Kazachki	Oct'10	Completed. Summary in LV minutes
1.2	Survey Technical Committees for needs		Liaisons	Feb'11	Survey distributed just prior to MTL meeting
1.3	Solicit input from ASHRAE regions, chapters, and members		**Gage** & Staff	Feb'11	Survey distributed just prior to MTL meeting
1.4	Identify needs for International members/chapters	4.14	**Chasserot**, Lim, Bansal	Dec'10	Ongoing
1.5	Identify gaps appropriate for ASHRAE and develop recommendations		**Scott,** Mueller**,** Manole, Hansen	May'11	Preliminary results from refrigeration survey are coming in. ~600 replies
2.0	**Enhance communications with members/chapters**				**complete**
2.1	Expand content on Refrigeration Committee webpage including links to ASHRAE refrigeration resources	3.4	**Lim**, Manole	Jan'11	New content developed, and additional materials gathered. Webpage to be updated before new SY.
2.2	Review and update refrigeration materials available on society website for chapter use	3.4	**Hay**, Hansen, Chasserot	May'11	Complete. Updated materials to be posted before new SY
2.3	Coordinate appropriate communication vehicle with CTTC and initiate	3.2	Siller, Scott	Dec'10	REF very active with CTTC over last SY. REF Liaison to CTTC reappointed for 2011/12 to maintain momentum.
2.4	Ensure recognition of members at the chapter level*	3.1	**Gage**	Dec'10	Complete. Internal procedures were remedied to deliver MG and CC awards to Chapters' local recipients.
3.0	**Advance interest in Refrigeration**	**3.2**			
3.1	Develop presentation on importance/challenges of Refrigeration for Student Activities Webpage	3.2	**Mueller**, Jekel, Bansal	Jun'11	Ongoing. Outline developed.
3.2	Develop engagement with YEA	3.2	**Gage**	Feb'11	Complete. Dialogue initiated but will be continued next SY
4.0	**Support and coordinate Society refrigeration activities**				**complete**
4.1	Organize programs on sustainable refrigeration for annual and semi-annual meetings	1.8	**Kazachki**	on-going	Complete.
4.2	Promote and solicit entries for refrigeration awards: Garland, Comfort Cooling, and Briley		Awards	on-going	Briley Award presented in Las Vegas. Submissions received for Milt Garland award but none awarded..
4.3	Review assigned Society position papers/statements/documents and initiative revisions, as needed		All	on-going	Complete. ODS and Natural Refrigerants PDs reaffirmed.
5.0	**Advance sustainable refrigeration facilities**		All		RTAR approved by RAC in Las Vegas. WS approved pending funding in Montreal

Refrigeration Committee

Through its use in refrigeration and air conditioning systems, the refrigeration process has become critical to the health, comfort, and welfare of humanity. The Refrigeration Committee of ASHRAE encourages the advancement of refrigeration technology and its application.

What's New?

This section will highlight recent resources or activities of the Refrigeration Committee.

- **Refrigeration Survey** - Click here to provide REF your valuable input on ASHRAE's refrigeration-related resources and services
- Members First! Technology Council Newsletter, March 2011, vol. 2011, issue 1

Committee Operations

Committee operations are set by Section 2.420 of the Rules of the Board (ROB) and by the Manual of Procedures (MOP). Supporting information and procedures are located in the Reference Manual. This Committee reports to Technology Council.

- Rules of the Board (ROB) (PDF)
- Manual of Procedures - revised January 2011 (MOP) (PDF)
- REF Reference Manual – revised Jan. 2011 (PDF)
- 2011 Las Vegas Winter Meeting Minutes (PDF)
- 2010 Albuquerque Annual Meeting Minutes (PDF)
- 2010 Orlando Winter Meeting Minutes (PDF)
- 2009 Louisville Annual Meeting Minutes (PDF)
- 2009 Chicago Winter Meeting Minutes (PDF)
- 2008 Salt Lake Annual Meeting Minutes (PDF)

Committee Resources

To support the Chapters, the Refrigeration Committee has developed materials to assist in presenting refrigeration-themed programs.

- Tips on Hosting a Successful refrigeration-focused ASHRAE Chapter Meeting
- Sister Refrigeration Societies
- Refrigeration Speaker's List
- ASHRAE Distinguished Lecturer Program
- Past Refrigeration Related Technical Committee Programs

Technology Awards are a significant aspect of Chapter operations. The Refrigeration Committee annually administers two such awards which recognize the refrigeration-relevant achievements of designers and owners for innovation and/or new technologies.

- Introducing the ASHRAE Refrigeration Awards
- Milton W. Garland Commemorative Refrigeration Award for Project Excellence

- Refrigeration Comfort Cooling Award for Project Excellence
- 2009-10 George C. Briley Award winning article – *Heat Recovery in Retail Refrigeration* by David Hinde

Refrigeration Committee activities of potential interest to the Chapters are reported through the *Members First!* newsletter and to the Regional Vice Chairs during the Chapter Technology Transfer Committee meeting at the annual and winter conferences.

- Members First! Newsletters
- REF report to CTTC - ASHRAE Winter Conference 2011 (PPT)

Member Resources

The Refrigeration Committee assists and advises Technical Committees and Task Groups with refrigeration-oriented goals. Relevant TCs are primarily from Sections 3 and 10. These links provide Society members with summaries of on-going activities performed by these Refrigeration TCs.

- ASHRAE Refrigeration Handbook Chapters and Sponsoring ASHRAE Technical Committee (PDF)
- ASHRAE Technical Committees web pages
- ASHRAE Refrigeration Handbook
- Refrigeration Applications - ASHRAE Journal articles
- Refrigeration Technical Committees Activity Report
- ASHRAE Research – current refrigeration related research
- ASHRAE Standards – current refrigeration related standards and guidelines

Learning Resources

The Refrigeration Committee of ASHRAE seeks to promote refrigeration education and development at all levels of the society. Whether you are a potential student or already in your career, these links will provide information on educational opportunities.

- ASHRAE Learning Institute Courses
- ASHRAE meeting Seminar DVDs

The Refrigeration Committee encourages technology transfer. One method is through sessions at the ASHRAE annual and winter conferences. Another is through recognition of the best refrigeration-related article published in the ASHRAE Journal through the Committee's George C. Briley ASHRAE Journal Article Award. Here are the most recent presentations and winner.

- Past Refrigeration Related Technical Committee Programs
- 2009-10 George C. Briley Award winning article – *Heat Recovery in Retail Refrigeration* by David Hinde

ASHRAE's Refrigeration Committee (REF) is a standing committee of ASHRAE whose purpose is to encourage the advancement of refrigeration technology and its application. This committee is set up to represent and enhance the 'R' in ASHRAE. The Refrigeration Committee is interested to hear from the members whether ASHRAE and REF are providing the refrigeration-related resources and services which the grassroots members need in their profession. To do this, REF has developed a very short survey. Information from this survey will be used by REF to improve support to the Chapters and as appropriate to assist ASHRAE in developing additional resources for its members. Please respond to the survey even if you do not work directly in a refrigeration-related area as your input will be helpful as well.

Thank you for your time, and if you have additional comments or suggestions not covered by the survey, please forward those to REFcomments@ashrae.net.

Sincerely,
Cynthia Gage
Chair, ASHRAE Refrigeration Committee

1. Are you a member of your local chapter?
   Yes/No
   If yes, which one?
   If yes, go to next question. If no, skip to 4

2. What types of refrigeration-related presentations would be of value to your chapter? Please elaborate if necessary.
   Field visit to refrigerated facility
   Presentation of specific applications
   Presentation on refrigeration practices
   Presentation on ASHRAE's refrigeration-related Standards and resources

3. How can the Refrigeration Committee improve communications and/or support to local ASHRAE Chapters?

4. Are you a member of an ASHRAE Technical Committee?
   Yes/No
   If yes, which one(s)

5. What aspects of refrigeration do you encounter in your job?
   Commercial applications (supermarkets, food service, etc)
   Industrial cooling applications
   Refrigeration system design
   Refrigeration system operation and maintenance
   Refrigeration code compliance
   Refrigerants (HCFCs, HFCs, Ammonia, CO2, HFOs)
   Refrigerant management
   None
   Other (Explain below):

6. In your job, do you utilize any of the following refrigeration resources?
   ASHRAE Standards and Guidelines
   ASHRAE Handbooks
   Energy analysis tools
   Other references:

7. Does ASHRAE provide the refrigeration resources you need?
   Yes/No
   If no, what is needed?

8. Where do you currently get the technical refrigeration resources you need in your profession?

9. Please score and comment on your use of the following **ASHRAE refrigeration-related** resources. Score each on the following scale:

1- Don't use/Not applicable 2 – More/improved resources are needed 3- Some resources available but could be improved or more might be useful 4- Currently existing resources are adequate

ASHRAE Journal Articles
Standards and Guidelines
Design Guides
Handbook chapters
Educational Resources
Refrigeration-related ASHRAE Research
Conference Technical Papers
Load Calculation Tools
Energy Analysis Tools
Software
Refrigerant Selection Tools
LEED or comparable Refrigeration Energy Rating Tool
Professional Certification Programs
Commissioning Tools
Case Study Examples
Refrigeration Awards and Recognition.

Further comment/list additional resources needed

Agenda Item 10.1A

Proposed Scope and TC Reorganization

Refrigeration Committee encourages the advancement of refrigeration technology and its application.
This includes refrigeration materials, processes (Section 3), systems and applications (Section 10).

Section 3.0 — Refrigeration Materials and Processes

- TC 3.1 Refrigerants and Secondary Coolants
- TC 3.2 Refrigerant System Chemistry
- TC 3.3 Refrigerant Contaminant Control
- TC 3.4 Lubrication
- TC 3.5 Management of Lubricant in Circulation (Orig. 10.10)
- ~~TC 3.6 Water Treatment~~ *
- TC 3.8 Refrigerant Containment
- ~~TG3 HVAC&R Contractors and Design Build Firms~~ (now TC 7.2)

Section 10.0 -- Refrigeration Systems and Applications

- TC 10.1 Custom Engineered Refrigeration Systems
- TC 10.2 Automatic Icemaking Plants and Skating Rinks
- TC 10.3 Refrigerant Piping
- TC 10.4 Ultra-Low Temperature Systems and Cryogenics
- TC 10.5 Refrigerated Distribution and Storage Facilities
- TC 10.6 Transport Refrigeration
- TC 10.7 Commercial Food and Beverage Cooling Display and Storage
- TC 10.8 Refrigeration Load Calculations Move to Section 4?
- TC 10.9 Refrigeration Application for Foods and Beverages
- ~~TC 10.10, Management of Lubricant in Circulation~~ Move to 3.5
- TC 10.10 Residential Refrigerators and Food Freezers (Orig. 8.9) or Unitary Refrigeration Systems (includes R/F, icemakers, beverage machines)

*Move TC 3.6 to Section 7 -- Building Performance as TC 7.10 (or 7.4) Building Water Treatment

Scope
Technical Committee 3.6 is concerned with water treatment for building water systems including scale, corrosion and microbiological control (except sewage drainage systems) and the impacts of water treatment on building operations, maintenance, sustainability, energy efficiency, human health, and water resource conservation.

Agenda Item 10.1
Potential Committee Actions identified in Brainstorming Session

1. Develop a formal definition or scope to communicate to Tech Council and Membership which expands REF's scope.
   - In REF's scope, what is meant by "refrigeration technology and its application"?
   - Should be action item to review list and make recommendations, look at consolidation of section 10 TCs?
   - TC 8.9 (residential refrigerator/freezers) should be in section 10. Should this TC include beverage and vending machines?

Action: See draft "Proposed Scope and TC Reorganization"

2. REF should focus recommendations for PAOE.

Action: See "Recommended PAOE Activities".

3. How should REF interface with other refrigeration-oriented societies?
   - Should REF expand role with sister societies (IIR, IIAR)?
   - Can reps from other orgs come to REF to work with ASHRAE?
   - How can REF reach out to these sister societies?
   - Can or should REF coordinate with associate societies (ASES, RSES, RETA, IARW)?

Action: Staff and Chair identified and reviewed the Societies which have been assigned formal ASHRAE liaisons (See attached "2010-2011 ASHRAE INTERSOCIETY REPRESENTATIVES"). As first step, Staff will collect and provide appropriate Liaisons' reports (GCCA, IIR) to REF members for information and consideration.
Further options: 2011-2012 MBOs

4. Should there be liaisons or consultants with RAC, CEC, Handbook, TAC, Members Council, ad hoc committees, Standards, Special Projects, building performance metrics, AEDGs, EUI group, etc?
   - Are more REF members (voting or nonvoting) needed to perform these tasks?
   - How to increase the number of refrigeration experts in ASHRAE leadership (Technology Council and BOD).

Action: CEC has been approached and is very interested in having a liaison to help with the Refrigeration Track at the annual and winter meetings. RAC has approached REF and is interested in having a liaison.
Further action: Should we formalize liaisons with these committees? Should liaisons (including CTTC) be voting members of REF?

4. How should REF interface with TCs?
   - Should this be broadened to SPC's (15, 34, 90.1, 100, 189.1, beyond?)
   - Staff can help collect TC Activity Sheets from TCs and send to REF.

Action: Chair reviewed activity sheet format and concluded that there isn't sufficient detail to be informative.
Further actions: New CEC and RAC liaisons could gather some relevant information. Additional ideas?

5. Can we enhance rating programs to incorporate refrigeration energy efficiency and sustainability?
   - REF should request to participate and be involved in ASHRAE's work related to energy and EUI.
   - LEED certification and related ASHRAE design guidance information on refrigeration are not robust.

Action: Design guide and commissioning guideline are initial steps. Additional steps?

6. Should there be refrigerant labeling? (Beyond standard 34 to label products)
7. Could ASHRAE promote some sort of refrigeration certification?
8. REF can help to nominate speakers or volunteer themselves for the DL list.
9. Can REF do a Society level award for best refrigeration related chapter?

Role of CEC liaison as proposed by CEC

1) Help identify reviewers for refrigeration papers
2) Help identify session Chairs
3) Help Refrigeration Track Chair to keep people on schedule

Role of RAC liaison as proposed by RAC

1) Help in evaluating potential research projects within the refrigeration area (attend Sat RAC meeting)
2) Help identify co-funding for ASHRAE sponsored research
3) Coordinate with REF activities and initiatives

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~~SECTION E – CONSULTANTS~~

SECTION A - REFRIGERATION COMMITTEE - GENERAL

Part 1 Responsibilities/Duties

A1.4 The Committee shall assist and advise the TCs and TGs with refrigeration-oriented goals. ~~in recruiting qualified members and carrying out their tasks.~~

A1.6 The Committee shall assist CTTC, as appropriate, ~~for~~ with refrigeration-oriented activities.

Part 4 Operations

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

SECTION B - CHAIR, VICE CHAIRS AND STAFF LIAISON

Part 2 Responsibilities of the Chair

B2.2 Coordinate and direct the activities of the Vice Chair and those of the voting members through MBOs and other assignments.

B2.3 ~~The Chair shall o~~Organize REF subcommittees as necessary to satisfy the needs of the committee as indicated in the REF Reference Manual.

B2.9 Appoint at the final meeting of the Fiscal Year a mentor for each new incoming member of the committee. ~~See Refrigeration Committee Reference Manual.~~

~~B2.10 Prepare and submit material for the Members First Newsletter highlighting REF developments and activities after the Winter and Annual Meetings~~.

Part 3 Responsibilities of the Vice Chair

B3.4 The Vice Chair shall prepare a budget for the Refrigeration Committee and review expenditures. ~~In consultation with the Technology Council, the REF Committee, the Director of Technology, and the AMORT, the Vice Chair shall prepare recommended budgets for the operation of the REF Committee for the coming fiscal year for consideration by the REF Committee and Technology Council. Details can be found in the Technology Council MOP and/or Reference Manual.~~

~~Periodically, the Vice Chair shall review with the AMORT expenditures and budget allocations and shall take any action he/she deems necessary, in cooperation with the Executive Vice President and the Director of Technology, to stay within the established budget.~~

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 committee for the next year and present these objectives to the REF committee for review at the committee meeting held during the Society annual meeting. The MBOs will be included in the REF committee's report to the Technology Council at the annual meeting as an information item, and a copy of the MBOs s will be sent to the Refrigeration BOD Ex-O and AMORT. A suggested format for committee MBOs can be found in the Reference manual.

Part 4 Responsibilities of the Staff Liaison

B4.5 Distribute materials to the members for regular meetings of the Committee.

- ~~To all members, minutes of prior meeting, agenda for current meeting, ASHRAE travel voucher, and other pertinent information.~~
- ~~To new committee members, Rules of the Board, Manual of Procedure, Reference Manual and other background material.~~

B4.6 ~~The staff liaison shall a~~Assist with budget preparation.

~~B4.7 The staff liaison shall distribute the MBOs.~~

B4.~~8~~7 Provide support for all awards presented by the Committee. ~~The staff liaison shall review the ASHRAE Journal for the prior society year to identify (in consultation with the Chair) qualified refrigeration articles for the George Briley Award.~~

B4.~~9~~8 Post materials as directed by the Chair to the Committee's webpage. ~~The staff liaison shall procure all awards given by the Refrigeration Committee and shall mail awards to any winners not present at the Society meeting.~~

B4.~~10~~9~~The staff liaison shall m~~Maintain and update~~distribute~~ the TC Activities Report for the webpage.

SECTION C - DUTIES OF VOTING MEMBERS

Part 1 Responsibilities

C1.2 Perform MBO tasks and other duties as assigned by the Chair.

C1.~~2~~3 Encourage 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.~~3~~4 Recommend, via the President-Elect Advisory Committee, criteria for Chapter Refrigeration activities in the Presidential Award of Excellence program.

C1.~~4~~5 Report regional activities at the Annual and Winter meetings of the Refrigeration Committee.

C1.~~5~~6 Assist and advise the TCs, TGs and SSPCs with refrigeration-oriented goals ~~in recruiting qualified members and carrying out their tasks.~~including (a) programs at Society Meetings, (b) research projects and (c) technical committee membership.

C1.~~6~~7 Voting members may be required to serve as Committee Liaisons. (See Section D)

C1.~~7~~8 Annually, determine the winners of the REF Awards
- Milton W. Garland award
- Refrigeration Comfort Cooling award
- George Briley ASHRAE Journal Article Award

C1.~~8~~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 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.

~~SECTION E – Consultants~~

~~Part 1: Selection~~

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SECTION A: ABREVIATIONS AND ACRONYMS

~~SSPC Standing Standard Project Committee~~

SECTION B: OPERATIONS

This section provides details to activities of the Committee members as presented in the Manual of Procedures.

B.1. Chair Activities

Under MOP B2.5, the following reports are to be submitted to Technology Council:

i) Management By Objectives (MBOs)

- 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.
- The Annual Meeting report shall also include the MBOs prepared by the incoming chair (See MOP 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.

ii) Article for Member's First Newsletter

- Quarterly (or when requested by Tech Council), the Chair must prepare a report for publication in the Members First Newsletter. This report shall update the developments and activities of the Refrigeration Committee which may impact or interest the membership.

B.2. Vice Chair Activities

Under MOP B3.4, the Vice Chair is responsible for budget preparation and review expenditures.

- In consultation with the Technology Council, the REF Committee, the Director of Technology, and the AMORT, the Vice Chair shall prepare recommended budgets for the operation of the REF Committee for the coming fiscal year for consideration by the REF Committee and Technology Council. Details can be found in the Technology Council MOP and/or Reference Manual.
- Periodically, the Vice Chair shall review with the AMORT expenditures and budget allocations and shall take any action he/she deems necessary, in cooperation with the Executive Vice President and the Director of Technology, to stay within the established budget.

Under MOP B3.7, the Vice Chair must prepare MBOs (Management By Objectives) for the upcoming year.

- 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 committee for the next year and present these objectives to the REF committee for review at the committee meeting held during the Society annual meeting.
- The MBOs will be included in the REF 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 Section C of this manual.

B.3 Staff Liaison Activities

Under MOP B4.5, the Staff Liaison distributes the following materials for the meetings:

- To all members, minutes of the prior meeting, agenda for current meeting, MBO list(s), travel voucher and other pertinent information.
- To new committee members, Rules of the Board, Manual of Procedures, this Reference Manual, and other background material.
- Provide society liaison reports to REF

Under MOP B.4.7, the Staff Liaison supports the award processes through the following:

- Procures all award materials given by the Refrigeration Committee
- Mails award materials to any winners not present at the Society meeting.
- Briley Award
    - Reviews the ASHRAE Journal for the prior society year to identify (in consultation with the Chair) qualified refrigeration articles for the George Briley Award.
    - Distribute articles to Briley Award Subcommittee, and collect and summarize ratings from the subcommittee.
- Milt Garland Award and Comfort Cooling Awards
    - Receive submissions and distribute to the Milt Garland and Comfort Cooling Awards Subcommittee.
    - Collect and summarize ratings from Awards Subcommittee.

~~SECTION B – REVISIONS TO RULES AND PROCEDURES~~

~~*(This Section is for Informational Purposes Only)*~~

~~Part 1: Revisions to Rules of the Board~~

~~B1.1 Proposed changes (additions and deletions) to Rules of the Board (ROBs) shall be submitted by committees, councils and Board members. Changes proposed by a committee shall be submitted through the body to which it reports; councils and Board members may submit proposed changes directly to the Board of Directors.~~

~~B1.2 To propose a change to an existing ROB~~

~~Present the current ROB with changes marked by double underlining to designate words proposed to be added and strikethrough to designate words proposed to be deleted. A proposed change, as a minimum, shall include the complete ROB number (e.g., 2.106.001.2), the proposed change(s) marked as indicated above, and the reason(s) for the change(s).~~

~~B1.3 To propose a new ROB, present the wording for the new rule and include a statement indicating a recommended placement of the new rule within the ROB organization. Examples:~~
~~*It is recommended that this rule be placed in ROB Volume 1, Policies.*~~
~~*It is recommended that this rule be placed in ROB Volume 2, Publishing and Education Council.*~~

~~B1.4 To propose rescinding an existing ROB, include in the recommendation the ROB volume in which the rule is located, the rule number or other identification code, and the wording of the rule to be rescinded.~~

~~B1.5 Proposed changes to Society-wide policies and procedures (e.g., Travel Reimbursement Policy, Election and Appointment Procedures) shall follow the same procedure as for changes to ROBs.~~

~~**Part 2 – Revisions to Manuals of Procedures (MOP)**~~

~~B2.1 Revisions to this MOP must be approved by this committee and by Technology Council or designated council subcommittee.~~

SECTION E: MILTON W. GARLAND COMMEMORATIVE REFRIGERATION AWARD FOR PROJECT EXCELLENCE

Description

The award shall be known as the Milton W. Garland Commemorative Refrigeration Award for Project Excellence. Refrigeration shall be defined as any use of mechanical refrigeration machinery for application other than human comfort. In general, this will be for food processing and preservation as well as industrial applications. It could also apply to refrigeration used in manufacturing processes, life support in extreme environments, recreational facilities, or other non-comfort cooling applications. The award shall be made to both the designer and the owner of *a non-comfort cooling refrigeration application that incorporates new technology in a unique manner*.

The winning project selected by the Refrigeration Committee from the Chapter nominees shall receive the following:

- The designer of the winning project shall receive a plaque at a Society Winter Meeting.
- The project's owner shall receive a plaque to be presented at a refrigeration program meeting of the chapter.

Additionally, chapters will receive the following recognitions:

- The chapter nominating the winning project shall receive a felt patch to go on the chapter award banner. Patch will be presented at the CRC following the Society award presentation.
- All chapters submitting a nomination shall be awarded ribbons at the following year's CRC.

Submission Criteria

The Milton W. Garland Commemorative Refrigeration Award is open to all who think their projects or other projects with which they are familiar, have achieved some distinction.

- Projects nominations may be prepared by the designers, architects, engineers, owners, or suppliers.
- There must be an ASHRAE linkage to the nominee (the prime designer is a member, the installer is a member, the firm is Golden Circle, or the owner, supplier, etc., is a member).
- The nominator must inform and have approval from the owner of the installation that the entry may be published. (The owner's name may be withheld for privacy.) A release to this effect must be obtained from the owner of the project (see Submission Form).
- All projects must be submitted within the thirty-six (36) preceding months of the initial operation date of the system.
- Each Chapter may only have one submittal and may devise their own method(s) for selecting their submission.

Submission Format

The chapter's eight (8) page submittal shall be as follows:

- The front cover shall be the Milt Garland Award Submission Form.
- The second 8 ½ x 11" page shall contain no more that a two paragraph overview of the project with a brief explanation of the factors supporting the nomination.
- The next four 8 ½ x 11" pages shall contain a description of the project typed in 12 point font. The page shall be double-spaced with ¾" left and right margins, and 1" top and bottom margins.
- The last two pages of the project shall consist of two 8 ½ x 11" sheets containing drawings, plans, schematics, or pictures of the project which will give the judges a clear understanding of the merits of the project.

Submission Process

Submissions must be sent by the Chapter President to the Refrigeration Committee Staff Liaison (amorts@ashrae.net) by May 1st to be considered for that year's competition. Chapters should also submit a copy of their submission to Chapter Technology Transfer Committee (CTTC) Regional Vice-Chair (RVC) for informational purposes as well.

Refrigeration Awards Subcommittee – Membership and Responsibilities

The Chair of the Refrigeration Committee shall select three members who have at least two years of service on the Committee to serve on the Milt Garland and Comfort Cooling Awards Subcommittee.

- The Awards Committee shall develop a brief article calling for award nominations to be published in the Jan/Feb Insights. Develop email blast for distribution to chapters (from CTTC as well as from REF) coordinated by ASHRAE staff.
- The Awards Subcommittee shall judge the Milt W. Garland Commemorative Refrigeration Award submissions using the scoring chart in Table 1.
- Scores shall be delivered to the Refrigeration Committee Staff Liaison no later than 14 days prior to the Refrigeration Committee's meeting at the Society annual conference.
- Shortly after the winner is notified, the Awards Subcommittee shall convey the documentation accompanying the nominated and the winning projects to the ASHRAE *Journal* editor for potential publication.

Staff Liaison Responsibilities

The Refrigeration Committee Staff Liaison shall provide support through the following activities:

- Receive submissions and distribute to the Awards Subcommittee.
- Collect and summarize ratings for review and voting by the full committee at the Society annual meeting.
- Procure all award and recognition materials as shown above for the Milt Garland Award and mail such materials to all recipients not present at the Society meeting.

MILTON GARLAND AWARD SUBMISSION FORM

1. Name of building or project: _____

Location: _____ **Initial Date of Operation:** _____

Chapter Submitting: _____

_____

2. **Linkage (ASHRAE member with significant role in project**):

a. Name: _____

Last *First* *Middle*

_____

Membership Number: _____

b. Address (including country): _____

_____

City *State/Province* *Zip/Country Code*

_____

c. Office Telephone: _____ d. E-mail address: _____

e. Company: _____

f. Member's Role in Project: _____

3. **Designer (if different from above)**

a. Name: _____

Last *First* *Middle*

_____

ASHRAE Membership Number (if applicable): _____

b. Address (including country): _____

City *State/Province* *Zip/Country Code*

c. Telephone: Office d. E-mail address:

e. Company:

4. **Owner's** release:

I certify that I am the owner or the authorized representative of this project, and hereby grant permission to ASHRAE to use all the enclosed data and information in the judging and subsequent publicity of this project.

Typed Name:

Signature: Date:

(Signatures must be on form submitted to ASHRAE)

Title:

Company:

City *State/Province* *Zip/Country Code*

Office Telephone: E-mail address:

TABLE 1: SCORING CHART

FOR
MILTON W. GARLAND COMMEMORATIVE REFRIGERATION AWARD

		Evaluation	Points		
Problem	A1. **Complexity of Problem**			A. **Problem**	
				Ext. Difficult	100%
	Subtotal: **PROBLEM** - Maximum 20 Points	Sum =		Very Difficult	75%
				Difficult	50%
				Not Difficult	30%
Concept	B1. **Concept** - Maximum 10			B. **Concept**	
				Superior	100%
	B2. **Integrated Design** - Maximum 5			Excellent	67%
				Very Good	53%
	B3. **Sustainability** - Maximum 5			Good	47%
				Fair	33%
	B.4. **Originality** – Maximum 10				

	Subtotal: **CONCEPT** - Maximum 30 Points	Sum =		
Solution	C1. **Performance Criteria Achieved** - Maximum 30			C. **Solution**
	C2. **Energy Effectiveness** - Maximum 5			Superior 100% Excellent 67%
	C3. **Budget Restrictions** - Maximum 5			Very Good 53% Good 43%
	C4. **Ease of Maintenance** - Maximum 10			Fair 33%
	Subtotal: **SOLUTION** - Maximum 50 Points	Sum =		
	DISCRETIONARY BONUS* - Maximum 10			
	GRAND TOTAL			

*Reasoning for Bonus:

~~1. he award shall be known as the Milton W. Garland Commemorative Refrigeration Award for Project Excellence.~~

~~2. The award shall be made to both the designer and the owner of a non-comfort cooling refrigeration application that incorporates new technology in a unique manner.~~

~~3. Submission must be received by the Refrigeration Committee staff liaison (tse@ashrae.net) by May 1st to be considered for that year's competition. The Refrigeration Committee shall select three members who have at least two years of service on the Committee to be the judges of the projects. The award will be presented at the Winter Meeting. Chapters should submit copy to Chapter Technology Transfer Committee (CTTC) Regional Vice-Chair (RVC) for informational purposes as well.~~

~~4. The winning recipient selected by the Refrigeration Committee from the Chapter nominees shall receive the following:~~

~~A. The designer shall receive a plaque at a Society Winter Meeting.~~

~~B. The project's owner shall receive a plaque to be presented at a refrigeration program meeting of the chapter.~~

~~C. The chapter nominating the winning project shall receive a felt patch to go on the chapter award banner. Patch will be presented at the CRC following the Society award presentation.~~

~~D. All chapters submitting a nomination shall be awarded ribbons at the following year's CRC.~~

~~E. The documentation accompanying the nominated and the winning projects will be made available to~~

the ASHRAE *Journal* and to *Insights*.

5. The chapter's eight (8) page submittal shall be as follows:

   A. The front cover shall be the submission form.

   B. The second 8 ½ x 11" page shall contain no more that a two paragraph overview of the project with a brief explanation of the factors supporting the nomination.

   C. The next four 8 ½ x 11" pages shall contain a description of the project typed in 12 point font. The page shall be double spaced with ¾" left and right margins, and 1" top and bottom margins.

   D. The last two pages of the project shall consist of two 8 ½ x 11" sheets containing drawings, plans, schematics, or pictures of the project which will give the judges a clear understanding of the merits of the project.

6. The selection criteria shall be re-evaluated by the Society Refrigeration Committee every thirty-six (36) months beginning with the date of acceptance of this criteria.

ELIGIBILITY

1. Refrigeration shall be defined as any use of mechanical refrigeration machinery for application other than human comfort. In general, this will be for food processing and preservation as well as industrial applications. It could also apply to refrigeration used in manufacturing processes, life support in extreme environments, recreational facilities, or other non-comfort cooling applications.

2. All projects must be submitted within the thirty-six (36) preceding months of the initial operation date of the system.

3. The Milton W. Garland Commemorative Refrigeration Award is open to all who think their projects or other projects with which they are familiar have achieved some distinction. Projects may be submitted by the designers, architects, engineers, owners, or suppliers. The nominator must inform and have approval from the owner of the installation that the entry may be published. The owner's name may be withheld for privacy.

4. A release must be obtained from the owner of the project.

5. Each Chapter may only have one submittal and may devise their own method(s) for selecting their submission.

6. There must be an ASHRAE linkage to the nominee (the prime designer is a member, the installer is a member, the firm is Golden Circle, or the owner, supplier, etc., is a member).

7. The scoring of the project at the Society level will be per Appendix A, Scoring Chart.

MILTON GARLAND AWARD SUBMISSION FORM

1. **Name of building or project:** _____
   Location: _____ **Initial Date of Operation:** _____
   Chapter Submitting: _____
   _____

2. **Linkage (ASHRAE member with significant role in project)**:

   a. Name: _____

Last First Middle

Membership Number:

b. Address (including country):

City State/Province Zip/Country Code

c. Office Telephone: d. E-mail address:

e. Company:

f. Member's Role in Project:

3. **Designer (if different from above)**

a. Name:

Last First Middle

ASHRAE Membership Number (if applicable):

b. Address (including country):

City State/Province Zip/Country Code

c. Telephone: Office d. E-mail address:

e. Company:

4. **Owner's** release:

I certify that I am the owner or the authorized representative of this project, and hereby grant permission to ASHRAE to use all the enclosed data and information in the judging and subsequent publicity of this project.

Typed Name:

Signature: Date:

(Signatures must be on form submitted to ASHRAE)

Title:

Company:

City State/Province Zip/Country Code

Office Telephone: E-mail address:

SCORING CHART
FOR
MILTON W. GARLAND COMMEMORATIVE REFRIGERATION AWARD

		Evaluation	Points	
Problem	A1. **Complexity of Problem**			A. **Problem**
				Ext. Difficult 100%
	Subtotal: **PROBLEM** - Maximum 20 Points	Sum =		Very Difficult 75%
				Difficult 50%
				Not Difficult 30%
Concept	B1. **Concept** - Maximum 10			B. **Concept**
				Superior 100%
	B2. **Integrated Design** - Maximum 5			Excellent 67%
				Very Good 53%
	B3. **Sustainability** - Maximum 5			Good 47%
				Fair 33%
	B.4. **Originality** - Maximum 10			
	Subtotal: **CONCEPT** - Maximum 30 Points	Sum =		
Solution	C1. **Performance Criteria Achieved** - Maximum 30			C. **Solution**
				Superior 100%
	C2. **Energy Effectiveness** - Maximum 5			Excellent 67%
				Very Good 53%
	C3. **Budget Restrictions** - Maximum 5			Good 43%
				Fair 33%
	C4. **Ease of Maintenance** - Maximum 10			
	Subtotal: **SOLUTION** - Maximum 50 Points	Sum =		
	DISCRETIONARY BONUS - Maximum 10			*
	GRAND TOTAL			

Reasoning for Bonus:

SECTION F: REFRIGERATION COMFORT COOLING
AWARD FOR PROJECT EXCELLENCE

Description

The award shall be known as the Refrigeration Comfort Cooling Award for Project Excellence and will encourage those studying it to expand their interest in and appreciation for comfort cooling applications. Refrigeration shall be defined as any mechanically produced cooling utilized in a comfort cooling application. The award shall be made to both the designer and the owner of *a comfort coo1ing refrigeration application which highlights innovation and/or new technologies.*

The winning project selected by the Refrigeration Committee from the Chapter nominees shall receive the following:

- The designer of the winning project shall receive a plaque at a Society Winter Meeting.
- The project's owner shall receive a plaque to be presented at a refrigeration program meeting of the chapter.

Additionally, chapters will receive the following recognitions:

- The chapter nominating the winning project shall receive a felt patch to go on the chapter award banner. Patch will be presented at the CRC following the Society award presentation.
- All chapters submitting a nomination shall be awarded ribbons at the following year's CRC.

Submission Criteria

The Refrigeration Comfort Cooling Award is open to all who think their projects or other projects with which they are familiar, have achieved some distinction.

- Projects nominations may be prepared by the designers, architects, engineers, owners, or suppliers.
- There must be an ASHRAE linkage to the nominee (the prime designer is a member, the installer is a member, the firm is Golden Circle, or the owner, supplier, etc., is a member).
- The nominator must inform and have approval from the owner of the installation that the entry may be published. (The owner's name may be withheld for privacy.) A release to this effect must be obtained from the owner of the project (see Submission Form).
- All projects must be submitted within the thirty-six (36) preceding months of the initial operation date of the system.
- Each Chapter may only have one submittal and may devise their own method(s) for selecting their submission.

Submission Format

The chapter's eight (8) page submittal shall be as follows:

- The front cover shall be the Refrigeration Comfort Cooling Award Submission Form.
- The second 8 ½ x 11" page shall contain no more that a two paragraph overview of the project with a brief explanation of the factors supporting the nomination.
- The next four 8 ½ x 11" pages shall contain a description of the project typed in 12 point font. The page shall be double-spaced with ¾" left and right margins, and 1" top and bottom margins.
- The last two pages of the project shall consist of two 8 ½ x 11" sheets containing drawings, plans, schematics, or pictures of the project which will give the judges a clear understanding of the merits of the project.

Submission Process

Submissions must be sent by the Chapter President to the Refrigeration Committee Staff Liaison (amorts@ashrae.net) by May 1st to be considered for that year's competition. Chapters should also submit a copy of their submission to Chapter Technology Transfer Committee (CTTC) Regional Vice-Chair (RVC) for informational purposes as well.

Refrigeration Awards Subcommittee – Membership and Responsibilities

The Chair of the Refrigeration Committee shall select three members who have at least two years of service on the

Committee to serve on the Milt Garland and Comfort Cooling Awards Subcommittee.

- The Awards Committee shall develop a brief article calling for award nominations to be published in the Jan/Feb Insights.
- The Awards Subcommittee shall judge the Refrigeration Comfort Cooling Award submissions using the scoring chart in Table 2.
- Scores shall be delivered to the Refrigeration Committee Staff Liaison no later than 14 days prior to the Refrigeration Committee's meeting at the Society annual conference.
- Shortly after the winner is notified, the Awards Subcommittee shall convey the documentation accompanying the nominated and the winning projects to the ASHRAE *Journal* editor for potential publication.

Staff Liaison Responsibilities

The Refrigeration Committee Staff Liaison shall provide support through the following activities:

- Receive submissions and distribute to the Awards Subcommittee.
- Collect and summarize ratings for review and voting by the full committee at the Society annual meeting.
- Procure all award and recognition materials as shown above for the Refrigeration Comfort Cooling Award and mail such materials to all recipients not present at the Society meeting.

REFRIGERATION COMFORT COOLING AWARD SUBMISSION FORM

1. Name of building or project:

Location: **Initial Date of Operation:**

Chapter Submitting:

2. **Linkage (ASHRAE member with significant role in project**):

a. Name:

Last *First* *Middle*

Membership Number:

b. Address (including country):

City *State/Province* *Zip/Country Code*

c. Office Telephone: d. E-mail address:

e. Company:

f. Member's Role in Project:

3. **Designer (if different from above)**

a. Name:

Last *First* *Middle*

ASHRAE Membership Number (if applicable):

b. Address (including country):

City *State/Province* *Zip/Country Code*

c. Telephone: Office d. E-mail address:

e. Company:

4. **Owner's** release:

I certify that I am the owner or the authorized representative of this project, and hereby grant permission to ASHRAE to use all the enclosed data and information in the judging and subsequent publicity of this project.

Typed Name:

Signature: Date:

(Signatures must be on form submitted to ASHRAE)

Title:

Company:

City *State/Province* *Zip/Country Code*

Office Telephone: E-mail address:

TABLE 2: SCORING CHART
FOR
REFRIGERATION COMFORT COOLING AWARD

		Evaluation	Points	
Problem	A1. **Complexity of Problem**			A. **Problem**
	Subtotal: **PROBLEM** - Maximum 20 Points	Sum =		Ext. Difficult 100%
				Very Difficult 75%
				Difficult 50%
				Not Difficult 30%
Concept	B1. **Concept** - Maximum 10			B. **Concept**
	B2. **Integrated Design** - Maximum 5			Superior 100%
	B3. **Sustainability** - Maximum 5			Excellent 67%
	B.4 Originality – Maximum 10			Very Good 53%
	Subtotal: **CONCEPT** - Maximum 30 Points	Sum =		Good 47%
				Fair 33%

Solution	C1. **Performance Criteria Achieved** - Maximum 30			C. **Solution**	
				Superior	100%
	C2. **Energy Effectiveness** - Maximum 5			Excellent	67%
				Very Good	53%
	C3. **Budget Restrictions** - Maximum 5			Good	43%
				Fair	33%
	C4. **Ease of Maintenance** - Maximum 10				
	Subtotal: **SOLUTION** - Maximum 50 Points	Sum =			
	DISCRETIONARY BONUS* - Maximum 10				
	GRAND TOTAL				

*Reasoning for Bonus:

1. The award shall be known as the Refrigeration Comfort Cooling Award for Project Excellence and will encourage those studying it to expand their interest in and appreciation for comfort cooling applications.

2. The award shall be made to both the designer and the owner of a comfort coo1ing refrigeration application which highlights innovation and/or new technologies.

3. Submission must be received by the Refrigeration Committee staff liaison (tse@ashrae.net) by May 1st to be considered for that year's competition. The Refrigeration Committee shall select three members who have at least two years of service on the Committee to be the judges of the projects. The award will be presented at the Winter Meeting. Chapters should submit copy to Chapter Technology Transfer Committee (CTTC) Regional Vice-Chair (RVC) for informational purposes as well.

4. The winning recipient selected by the Refrigeration Committee from the Chapter nominees shall receive the following:

A. The designer shall receive a plaque at a Society Winter meeting.

B. The project's owner shall receive a plaque to be presented at a refrigeration program meeting of the chapter.

C. The chapter nominating the winning project shall receive a felt patch to go on the chapter award banner. Patch will be presented at the CRC following the Society award presentation.

D. The documentation accompanying the nominated and the winning projects will be made available to the Journal and to the Insights.

The chapter's eight (8) page submittal shall be as follows:

A. The front cover shall be the submission form.

The second 8-1/2" x 11" page shall contain no more than a two paragraph overview of the project with a brief explanation of the factors supporting the nomination.

The next four 8-1/2" x 11" pages shall contain a description of the project typed in 12- point font. The page shall be double-spaced with 3/4" left and right margins, and 1"top and bottom margins.

The last two pages of the project shall consist of two 8-1/2" x 11" sheets containing drawings, plans, schematics, or pictures of the project which will give the judges a clear understanding of the merits of the understanding of the merits of the project.

The selection criteria shall be re-evaluated by the Society Refrigeration Committee every thirty-six (36) months beginning with the acceptance of this criteria.

ELIGIBILITY

Refrigeration shall be defined as any mechanically produced cooling utilization project comfort cooling applications.

All projects must be submitted within thirty-six (36) months of the initial operation date of the system.

The Refrigeration Comfort Cooling Award is open to all who think their projects or other projects with which they are familiar have achieved some distinction. Projects may be submitted by the designers, architects, engineers, owners, or suppliers. The nominator must inform and have approval from the owner of the installation that the entry may be published. The owner's name may be withheld for privacy.

4. A release must be obtained from the owner of the project.

5. Each Chapter may have only one submittal and may devise their own method(s) for selecting their submission.

6. There must be an ASHRAE linkage to the nominee (the prime designer is a member, the installer is a member, the firm is Golden Circle, or the owner, supplier, etc., is a member). Please specify on form.

The scoring of the project at the Society level will be per the "Scoring Chart".

SCORING CHART
FOR
REFRIGERATION COMFORT COOLING AWARD

		Evaluation	Points		
Problem	A1. **Complexity of Problem**			A. **Problem**	
				Ext. Difficult	100%
	Subtotal: **PROBLEM** – Maximum 20 Points	Sum =		Very Difficult	75%
				Difficult	50%
				Not Difficult	30%
	B1. **Concept** - Maximum 10			B. **Concept**	

				Superior	100%
	B2. **Integrated Design** - Maximum 5			Excellent	67%
				Very Good	53%
	B3. **Sustainability** - Maximum 5			Good	47%
				Fair	33%
	B.4 Originality - Maximum 10				
	Subtotal: **CONCEPT** - Maximum 30 Points	Sum =			

	C1. **Performance Criteria Achieved** - Maximum 30			C. **Solution**	
				Superior	100%
Solution	C2. **Energy Effectiveness** - Maximum 5			Excellent	67%
				Very Good	53%
	C3. **Budget Restrictions** - Maximum 5			Good	43%
				Fair	33%
	C4. **Ease of Maintenance** - Maximum 10				
	Subtotal: **SOLUTION** - Maximum 50 Points	Sum =			
	DISCRETIONARY BONUS - Maximum 10			*	
	GRAND TOTAL				

Reasoning for Bonus:

COMFORT COOLING AWARD SUBMISSION FORM

1. Name of building or project:
Location: Initial Date of Operation:
Chapter Submitting:

2. **Linkage (ASHRAE member with significant role in project)**:
a. Name:
Last First Middle

Membership Number:
b. Address (including country):

City State/Province Zip/Country Code

c. Office Telephone: d. E-mail address:
e. Company:
f. Member's Role in Project:

3. **Designer (if different from above)**

a. Name: _____

Last First Middle

ASHRAE Membership Number (if applicable):

b. Address (including country): _____

City State/Province Zip/Country Code

c. Telephone: Office d. E-mail address:

e. Company:

4. **Owner's** release:

I certify that I am the owner or the authorized representative of this project, and hereby grant permission to ASHRAE to use all the enclosed data and information in the judging and subsequent publicity of this project.

Typed Name:

Signature: _____ Date: _____

(Signatures must be on form submitted to ASHRAE)

Title:

Company: _____

City State/Province Zip/Country Code

Office Telephone: E-mail address:

SECTION H – REVISIONS TO RULES AND PROCEDURES

(This Section is for Informational Purposes Only)

Part 1: Revisions to Rules of the Board

H1.1 Proposed changes (additions and deletions) to Rules of the Board (ROBs) shall be submitted by committees, councils and Board members. Changes proposed by a committee shall be submitted through the body to which it reports; councils and Board members may submit proposed changes directly to the Board of Directors.

H1.2 To propose a change to an existing ROB

Present the current ROB with changes marked by double underlining to designate words proposed to be added and strikethrough to designate words proposed to be deleted. A proposed change, as a minimum, shall include the complete ROB number (e.g., 2.106.001.2), the proposed change(s) marked as indicated above, and the reason(s) for the change(s).

H1.3 To propose a new ROB, present the wording for the new rule and include a statement indicating a recommended placement of the new rule within the ROB organization. Examples:
It is recommended that this rule be placed in ROB Volume 1, Policies.
It is recommended that this rule be placed in ROB Volume 2, Publishing and Education Council.

H1.4 To propose rescinding an existing ROB, include in the recommendation the ROB volume in which the rule is located, the rule number or other identification code, and the wording of the rule to be rescinded.

H1.5 Proposed changes to Society-wide policies and procedures (e.g., Travel Reimbursement Policy, Election and Appointment Procedures) shall follow the same procedure as for changes to ROBs.

Part 2 Revisions to Manuals of Procedures (MOP)

H2.1 Revisions to this MOP must be approved by this committee and by Technology Council or designated council subcommittee.

REFRIGERATION COMMITTEE MBOs – D. Scott, Chair 2011-2012

Revised 6/15/11

	OBJECTIVE	Strategic Direction	Responsibility	Planned Completion	Status
1.0	**Promote refrigeration-related programs, conferences and future research**				
1.1	Promote and coordinate a two-day ASHRAE/NIST Refrigerants Conference, working with CEC.		**Anderson** (consultant), Berge	3Q 2012	
1.2	Solicit additional expert speakers on refrigeration topics for Distinguished Lecturer program and the Refrigeration Committee Speaker List.		All, **Chasserot**	TBD	
1.3	Evaluate results of 2010-2011 gap-analysis and develop recommendations and priorities for changes or new products and services and research needs.		**Pearson**, Hinde, Jekel, Seeton, Royal	Nov-11	
1.4	Coordinate with the refrigeration track program chair and refrigeration-related TC program subcommittee chairs to help improve refrigeration program quality and continuity from meeting to meeting.		**Hinde**, Chasserot, Bansal	Ongoing	
1.5	Survey international chapters on needs for future programs, conferences and research. Summarize findings.		Lim, **Bansal**	Jan-12	
2.0	**Promote chapter-level activities and educational outreach**				
2.1	Coordinate with CTTC to determine resources and implement programs to enhance chapter activities in refrigeration.		**Siller**, Manole, Bill Williams (CTTC)	Ongoing	
2.2	Identify one or more national retail and refrigerated warehouse chains to develop a pre-defined refrigeration technical tour which can be used by chapters across the country.		**Hansen**, Royal	Nov-11	
2.3	Develop criteria for 1-2 sustainable refrigeration design projects for student design competitions.		Jekel, Pearson, **Berge**	Mar-12	
2.4	Work with TCs to develop the design of 2-3 hands-on, low-cost refrigeration projects for introductory college lab classes and post on REF web page.		**Manole**, Seeton, Hansen	Nov-11	
2.5	Promote and solicit award applications for Milton Garland, Comfort Cooling and Briley awards, including ASHRAE Insights articles.		**Lim**, Hansen, Bansal	Ongoing	
2.6	Maintain and update information available on REF web site.		TBD, Staff	Ongoing	
2.7	Submit recommendations for 2012-2013 PAOE criteria for Chapter refrigeration activities to President-Elect.		Siller, Scott	TBD	
3.0	**Support "Guide for Sustainable Refrigerated Facilities and Refrigeration Systems"**				
3.1	Complete workstatement WS 1634 and identify a Proposal Evaluation Subcommittee members.		Bansal, Castro, Hinde, Royal, Scott		WS completed
3.2	Coordinate efforts to obtain co-funding commitment.		Anderson (consultant)	3-4Q 2011	
3.3	Identify Project Monitoring Subcommittee members and oversee research project (if awarded).		TBD	TBD	
4.0	**Support development of commissioning process and methods for refrigeration**				
4.1	Coordinate with Special Project committee to support developing of refrigeration commissioning guidelines.		Pearson, Scott	Jan-12	
4.2	Coordinate with TCs to promote involvement and technical contributions to development of refrigeration commissioning methods and technical procedures.		Hinde, **Jeckel**, Manole, Siller	Ongoing	
5.0	**Coordinate with other refrigeration-related technical organizations**				
5.1	Maintain a formal committee liaison with key refrigeration-related technical organizations including IIAR, GCCA/IARW, RETA, and potential others.		Scott, Liaisons	Ongoing	
5.2	Establish a committee liaison with Food Marketing Institute (FMI) and increase supermarket engagement.		Hinde	Nov-11	
6.0	**Promote and coordinate direction of refrigeration activities within Society**				
6.1	Refine and maintain a refrigeration topics coordination report to summarize-refrigeration related activities and make available on REF web site to all related TCs and standards committees. Coordinate with TAC.		Jekel, Hinde, **Seeton,** Staff	Ongoing	
6.2	Coordinate with TAC, RAC and Standards committees to communicate needs and opportunities, and respond to needs of other Society committees.		Jekel, Lim, Scott	Ongoing	
6.3	Review and update position documents and other papers assigned to committee as required.		TBD	Ongoing	