Refrigerant Transition Management and Planning for the Future

June 8, 2023

Call-in Details 1-202-991-0477 ID: 406 534 306#

Today's Host

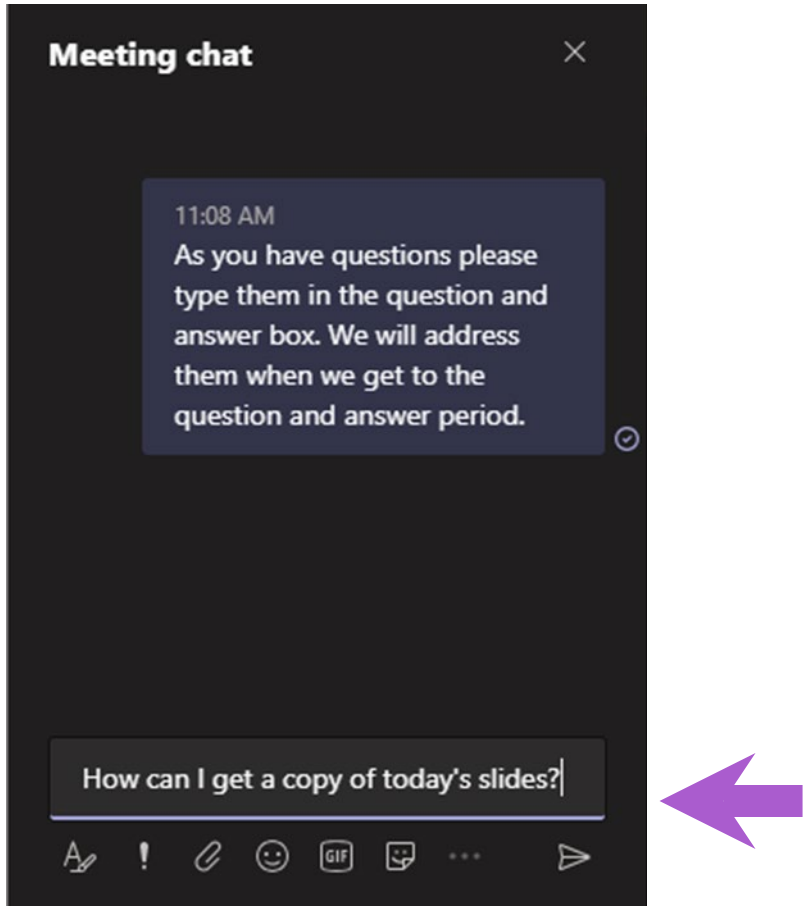
Annie Kee
Environmental Protection Specialist
U.S. Environmental Protection Agency (EPA)
Stratospheric Protection Division
Email: kee.annie@epa.gov

Annie is an Environmental Protection Specialist in the Stratospheric Protection Division (SPD) in EPA's Office of Air and Radiation, where she works on rulemakings under the American Innovation and Manufacturing (AIM) Act and partnership programs. Prior to SPD, she also worked on EPA's SmartWay program, which helps companies advance supply chain sustainability by improving freight transportation efficiency.

Questions

Question and Answer (Q&A) Session

- Participants are muted
- Questions will be moderated at the end
- To ask a question, enter your comment into the chat box



Call-in Details 1-202-991-0477 ID: 406 534 306#

Webinar Feedback and Materials

Feedback Form

- We value your input!
- The link to a feedback form will appear in the chat window

Recording and Slides

- Webinar is being recorded
- Materials will be posted on the GreenChill website under Events and Webinars: www.epa.gov/greenchill
- To receive notification when materials are posted email: EPA-GreenChill@abtassoc.com

Program Overview

www.epa.gov/greenchill

GreenChill is a voluntary partnership program that works collaboratively with the food retail industry to reduce refrigerant emissions and decrease stores' impact on the ozone layer and climate system

GreenChill works to help food retailers:

- Lower refrigerant charge sizes and eliminate leaks
- Transition to environmentally friendlier refrigerants
- Adopt green refrigeration technologies and best environmental practices

Become a GreenChill Partner!

Join your Industry Peers!

GreenChill is actively recruiting new Food Retail Partners

Request a partnership packet

Sign the partnership agreement

Meet eligibility requirements

Become a GreenChill partner!

The GreenChill Partnership Process

epa.gov/greenchill/about-greenchill-corporate-emissions-reduction-program

Upcoming GreenChill Webinars

July 13 | Refrigerant Codes and Standards

Presenters from the International Institute of Ammonia Refrigeration will discuss refrigerant codes and standards.

Registration link will be available soon: www.epa.gov/greenchill/events-and-webinars

- We are planning GreenChill's 2023 webinar series. Have ideas for a webinar or would you like to present? Email GreenChill@epa.gov
- To join our webinar invitation list, email EPA-GreenChill@abtassoc.com

Learn More

www.epa.gov/greenchill

GreenChill@epa.gov

@EPAair

Today's Speaker…

Leia Waln

Leia Waln
Associate Partner at DC Engineering
Refrigerant Compliance Program Manager
at Refrigerant Management Solutions
Phone: (406) 218-2196
Email: lwaln@dcengineering.net

Leia has over 12 years of experience working with retail end users and contractors to manage their refrigerant usage, refrigerant compliance, and reporting. Leia is considered a retail industry refrigerant compliance and reporting subject matter expert, is a leading consultant to the North American Sustainable Refrigeration Council (NASRC), and provides consulting to some of the largest supermarket chains operating in the U.S.

Glenn Barrett

Glenn Barrett
Sr. Associate Partner at DC Engineering
Technical Engineering Lead/Manager at Refrigerant Management Solutions
Phone: (208) 493-0085
Email: gbarrett@dcengineering.net

Glenn is a veteran in commercial refrigeration design, construction, commissioning, and refrigerant compliance. He provides industry insights on supermarket energy modeling, measurement and verification, and controls, and is a consultant and speaker on natural refrigerant system design, deployment, and best practices.

Refrigerant Transition Management and Planning for the Future

Presented by DC Engineering

Learning Objectives

- The Why?
  - Regulatory drivers
  - Effect of HFC phasedown on price of hydrofluorocarbon (HFC) and hydrofluoroolefin (HFO) blended refrigerants
- Ideas for how to manage the refrigerant transition
  - Where to start
    - Strategic planning
    - Documentation – "You can't manage what you can't measure"
    - Budgeting
- Key aspects of a holistic refrigerant strategy
  - Corporate-wide
  - New facilities
  - Existing facilities

THE WHY?

Regulatory Drivers and Refrigerant Price Trends

Regulatory Drivers

Federal American Innovation and Manufacturing (AIM) Act

- HFC Phasedown
- Proposed Technology Transition Rule
- Upcoming Management of Regulated Substances

Additional State Regulations (e.g. California and Washington)

- Global Warming Potential (GWP) thresholds
- Refrigerant Management Program

NASRC HFC Policy Tracker:
https://nasrc.org/hfc-policy

California, Washington and EPA Rulemaking Comparison

Category	California Code of Regulations Title 17 §95374	Washington Draft HFC Rule (01/27/23 Version)	EPA Proposed Technology Transitions Rule*
GWP Limits – **Most Refrigeration** (new)	150 GWP >50 lb. charge (not all sizes)	150 GWP >50 lb. charge (not all sizes)	Varies
GWP Limits – **Most Air Conditioning** (new)	750 GWP including chillers	750 GWP excluding chillers	Varies

* EPA's Technology Transitions Rule is not final and proposed restrictions are subject to change. For more information, see www.epa.gov/climate-hfcs-reduction/technology-transitions-restrictions-use-certain-hydrofluorocarbons-under

Regulatory Drivers
Enforcement

Any government agency that passes regulations is going to have a mechanism to enforce those regulations

Examples of settlements:

Regulatory Agency	Year	Company	Violation	Settlement	Attorney's Fees & Manpower Cost
EPA	2013	Grocer A	Failure to promptly repair leaks; failure to keep adequate records	$4,700,000	$$$$
EPA	2014	Grocer B	Failure to promptly repair leaks; failure to keep adequate records	$2,335,000	$$$$
EPA	2016	Grocer C	Failure to promptly repair leaks; failure to keep adequate records	$2,500,000	$$$$
EPA	2019	Grocer D	Failure to promptly repair leaks; failure to keep adequate records	$4,500,000	$$$$
California Air Resources Board	2021	Grocer E	Failure to promptly repair leaks; failure to accurately register and report; failure to keep adequate records	$3,825,000	$$$$

European Union (EU) Fluorinated Gas (F-Gas) Regulation

Effect of HFC Phasedown on Refrigerant Prices

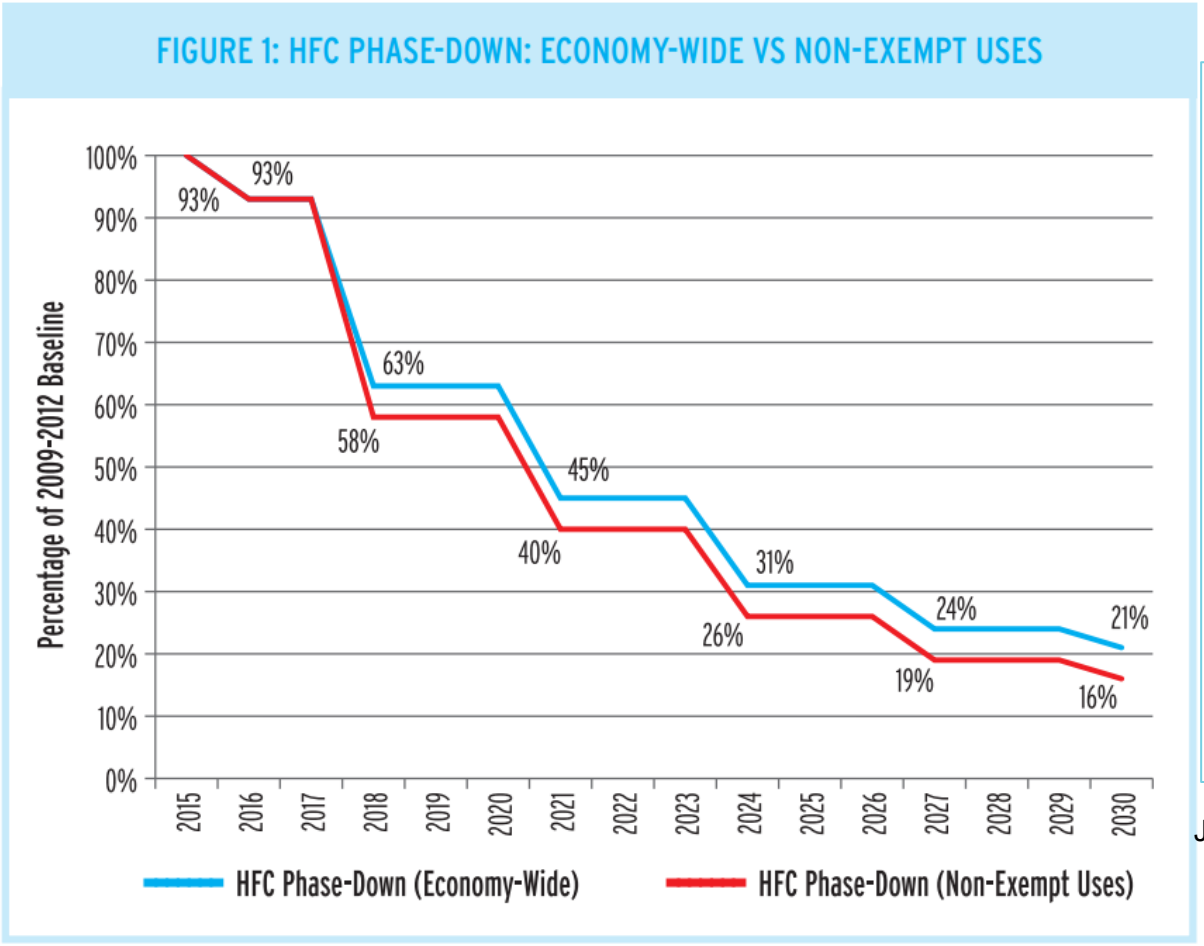
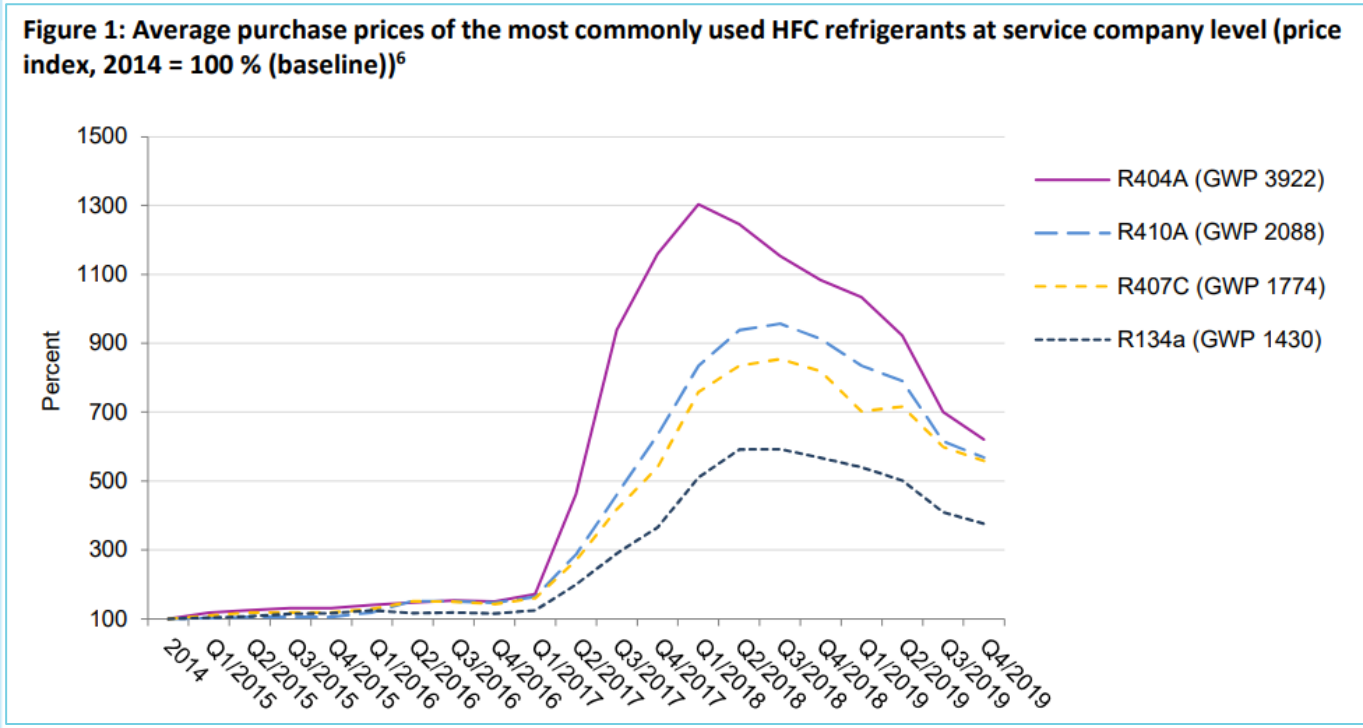


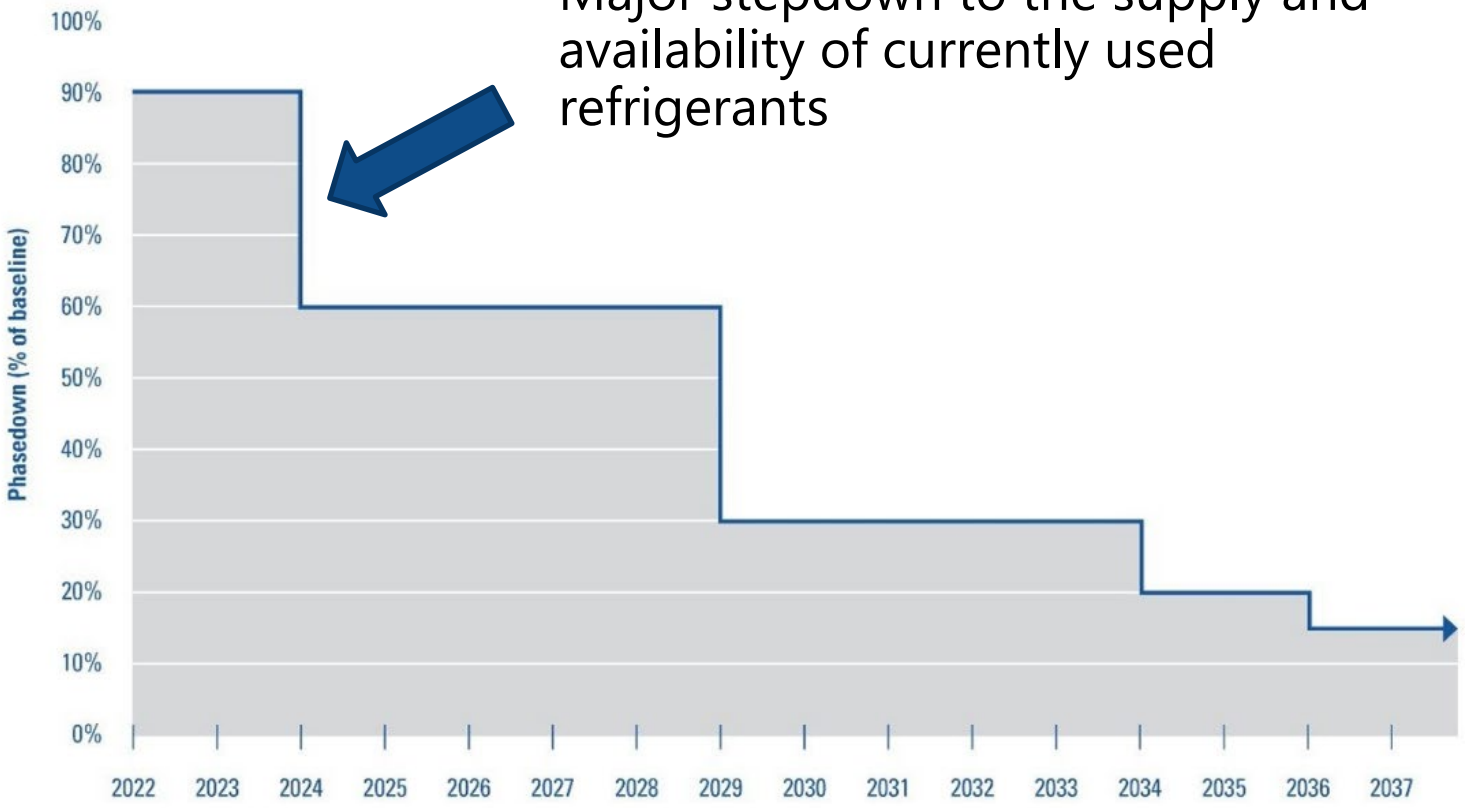
Figure 1: EU F-Gas Regulation Handbook: Keeping Ahead of the Curve as Europe Phases Down HFCs



Julia Kleinschmidt, Barbara Gschrey (Öko-Recherche), Stéphanie Barrault (CITEPA) - March 2020

AIM Act
Phasedown of HFC Production and Consumption

The following illustrates the HFC production and consumption phasedown schedule as outlined in the AIM Act.



www.epa.gov/climate-hfcs-reduction/final-rule-phasedown-hydrofluorocarbons-establishing-allowance-allocation

Estimating the Cost of Refrigerant Leaks

Keep it in the PIPES!

Facility Name	System Name	Equipment Type	Refrigerant Blend	Full Charge Amt (lbs.)	Leak Rate Per Year	2020 $/lb.	2023 $/lb.	2028 $/lb.	2020 Total Value of Leaked Refrigerant	2023 Total Value of Leaked Refrigerant	2028 Total Value of Leaked Refrigerant	2023 Increase in Cost per 100 Facilities	2028 Increase in Cost per 100 Facilities
Facility 1	RACK A	Refrigeration	R-404A	920	25%	$ 8.73	$ 40.00	$ 115.00	$ 2,008	$ 9,200	$ 26,450	$ 719,210	$ 2,444,210
Facility 1	RACK B	Refrigeration	R-134A	1620	25%	$ 8.71	$ 22.00	$ 65.00	$ 3,528	$ 8,910	$ 26,325	$ 538,245	$ 2,279,745
Facility 1	RACK C (HVAC/REF)	HVAC/Refrigeration	R-410A	1000	25%	$ 8.71	$ 28.00	$ 100.00	$ 2,178	$ 7,000	$ 25,000	$ 482,250	$ 2,282,250
Facility 1	RACK D (HVAC)	HVAC	R-407C	725	25%	$ 11.18	$ 30.00	$ 100.00	$ 2,026	$ 5,438	$ 18,125	$ 341,113	$ 1,609,863

Additional Refrigerant Costs to Repair Leaks ---> **$ 2,080,818** **$ 8,616,068**

Based on sample above, for every 100 facilities with similar refrigerant use profiles:

- Without leak mitigation, costs are expected to increase dramatically for leak repairs
  - 2023: Estimated increase in costs of $2.1 million (MM)/year
  - 2028: Estimated increase in costs of $8.6MM/year
- Financial benefits of leak mitigation
  - 2023 reducing leak rates from 25% to 10% can reduce costs by $1.3MM/year
  - By 2028 reducing leak rates from 25% to 10% can reduce costs by $5.2MM/year

Talk to your refrigerant suppliers, OEMs, and contractors – what are they seeing and what do they expect to happen?

The Cost of Refrigerant Leaks

Keep it in the PIPES!

THE GREENCHILL PARTNERSHIP

Financial Impact Calculator - The Cost of Refrigerant Leaks*

1) Cost to Replace Leaked Refrigerant		
1. Refrigerant type:	R-404A	click inside the yellow box and select the refrigerant from the drop-down menu
2. Amount of refrigerant leaked (in pounds):	100	type number of pounds in yellow box
3. Price per pound that you pay for refrigerant:	$115.00	for $7.00, type in 7.00

2) Sales/Profit		
1. Item to be sold (milk, frozen peas, hotdogs, etc.)	milk	type the name of the product in the yellow space
2. Units (gallons, pounds, packs, ounces, etc.)	gallons	type the unit of the product in the yellow space
3. Sales price per unit	$4.34	for $3.50, type in 3.50
4. Profit margin per unit sold (in percent):	2.03	for 1%, type in 1; for 2.03%, type in 2.03

Cost to replace leaked refrigerant:	*$11,500*

You have to sell **130,531** *gallons of milk*
to pay the replacement cost of **100** *pounds of refrigerant*

*This calculator deals solely with refrigerant replacement costs. There are of course, other costs incurred due to refrigerant leaks, such as service technician costs for parts and labor, costs due to decreases in energy efficiency when the refrigeration system is not properly charged, and food spoilage costs.

Refrigerant Leaks – Profit Margin Impact

- For every 100 lbs. of leaked refrigerant, a supermarket would need to sell an additional:
  - 130,531 gallons of milk
  - 993,864 lbs. of bananas
  - 188,000 loaves of bread
  - 56,650 six-packs of beer (IPA)

MANAGING THE REFRIGERANT TRANSITION

Where to Start

Where to Start
Strategic Planning

Review Current Plan/Approach to Refrigerant Management	▪ Establish your vision, understand and communicate your company goals ▪ Identify administrative plan ▪ Identify technical resources and field support
Compliance Evaluation and Strategy	▪ Evaluate what low and ultra-low GWP refrigerants are available ▪ Evaluate your facilities and equipment to identify opportunities ▪ Develop strategies and plan to remove ozone-depleting and high-GWP refrigerants from your operation ▪ Understand and evaluate natural and low-GWP refrigerant options
Reduce Leaks	▪ Develop a comprehensive leak mitigation strategy ▪ Identify and actively address leaking equipment

Where to Start

Tactical Action - Documentation "You can't manage what you can't measure"

Gather and maintain a database of your facility, appliance, and installation/service/end-of-life information

- Manageable level of visibility
- Important for managing leaks and a necessity for compliance reporting
- Examples of information required:
  - Facility Information: Facility name, facility address, contact information
  - Appliance Information: Type/end use, manufacturer, model number, serial number, installation date, refrigerant type, full charge amount
  - Installation/Service/End-of-Life Information: Date of service, refrigerant use (additions and removals), leak rates, refrigerant leaks & repairs, initial and follow-up verification tests, leak inspections, technician EPA certification information
- Ability to accurately calculate leak rates
- Periodic reporting at specified intervals
- Ongoing data capture
- Maintain records; typically 3 to 5 years depending on regulatory requirement

Where to Start

Tactical Action - Documentation "You can't manage what you can't measure"

Refrigerant Tracking Metrics

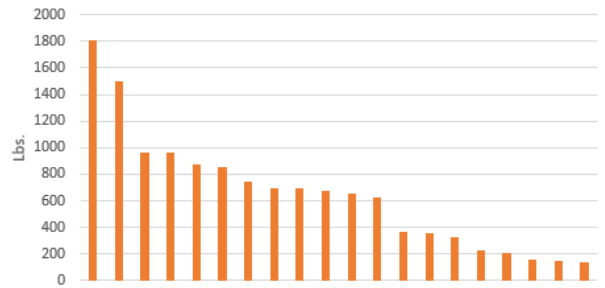
- Prioritizing facilities by leak rate and cost of leaking refrigerant
- Ability to identify/record/track where on the appliance the leak occurred
- Develop leak thresholds to define when/where to act

Net Gas Added Last 365 Days

Number of Appliances with Refrigerant Added During Last 365 Days

136

Net Gas Added During Last 365 Days by Appliance (Top 20 Appliances)

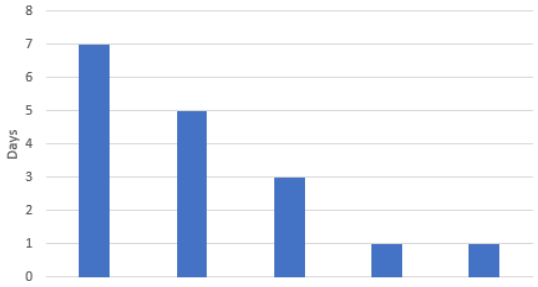


Unrepaired Leaks

Number of Appliances with an Unrepaired Leak

5

Days Since Leak Detected by Appliance

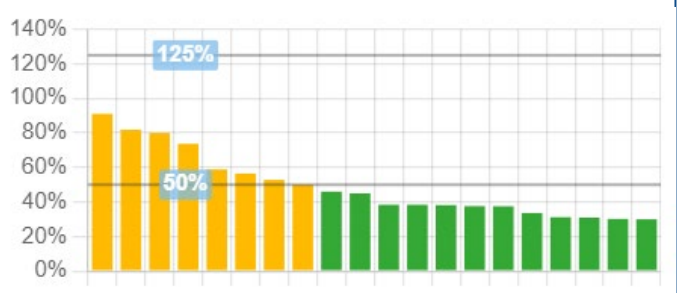


Calendar Year Leak Rates (CYLR)

Number of Appliances with a CYLR ≥ 50%

8

Calendar Year Leak Rate by Appliance (Top 20 Appliances)



Where to Start
Budgeting

- Changes to operational costs due to refrigerant phasedown
  - Refrigerant price increases
  - Refrigerant availability
  - Increased focus on leak mitigation and leak rate reduction
- Refrigerant retrofits and system replacements
  - Design, installation, equipment (refrigerant)
  - Contractor availability and experience; the better contractors may charge more
- New equipment
  - Price increases due to additional design and system complexities
  - Studies and designs using natural refrigerants
  - Leak mitigation for A2Ls
- Tracking, reporting and metrics
  - Software
  - New hires/consultant

HOLISTIC APPROACH

Holistic Approach
Corporate-wide

- Gather and review data for what you currently have
  - Existing facilities, appliances, and service history
- Define goals and establish milestones
  - Corporate-wide leak rate
  - Leak mitigation – What actions are you taking?
  - Retrofit/replace appliances (ozone-depleting and high-GWP refrigerants, chronically leaking appliances, etc.)
- Develop metrics – measurement and verification of results
- Manage costs and risks
  - Lowest first cost / highest risk; medium first cost / medium risk; highest first cost lowest risk
  - Consider factors such as availability and increase in cost of refrigerants
  - Energy use
- Training
  - Educate internal team members and management on the refrigerant transition; who, what, when, where, why
  - Engineers, construction/maintenance managers, installation/service technicians

Holistic Approach
New Facilities

- **Identify refrigeration designs that meet your needs**
- Transition away from high-GWP refrigerants
  - Engineering and financial analysis to determine what will work best for you
  - Some states already prohibit the use of certain high-GWP refrigerants
- Consider life cycle costs and emissions
  - Look at both direct and indirect emissions – do they meet your organization's targets?
  - First costs, maintenance costs, refrigerant costs (leaks), energy costs
- Define your cost difference between refrigeration design options
- Future Proof – Regulatory landscape is fluid
  - New facilities should meet or exceed current and proposed EPA targets
  - Some states already mandate GWP levels below proposed EPA targets

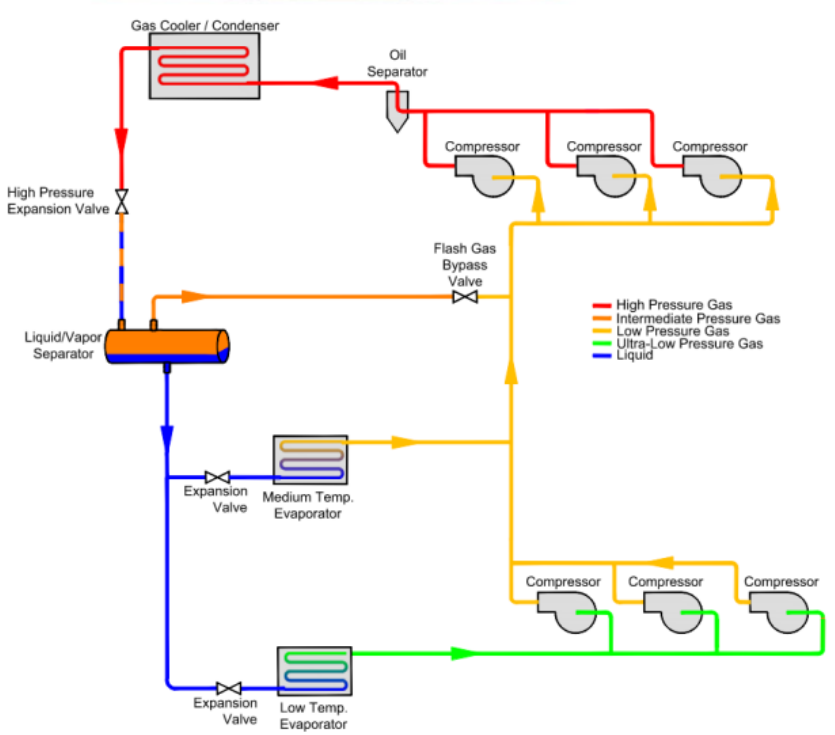
Refrigerant Type	Intergovernmental Panel on Climate Change (IPCC) AR4 100-year GWP
R-404A	3,922
R-407A	2,107
R-407C	1,774
R-407F	1,825
R-410A	2,088
R-507	3,985

100-year GWP Values: https://ww2.arb.ca.gov/resources/documents/high-gwp-refrigerants

Holistic Approach
New Facilities

- **New facility refrigeration system considerations**
- Multiple system design options
  - Distributed Systems
    - Micro-distributed with carbon dioxide (CO_2), propane, synthetic (A2Ls?)
    - Medium-sized with CO_2, synthetic (A2Ls?)
  - Centralized Systems
    - Synthetic (A2Ls?)
    - CO_2 Transcritical
    - Secondary Loop System - Glycol
    - Cascade System
- Natural refrigerants or synthetic A2L's
  - CO_2
    - Ejectors, parallel compression, adiabatic gas cooler
    - Direct expansion, liquid overfeed
    - Heat reclaim
  - A2Ls
    - Charge size limits
    - Leak detection
    - System layout and configuration

CO2 Transcritical System Schematic



Source: https://www.epa.gov/greenchill/events-and-webinars

Holistic Approach
Existing Facilities

- Identify and prioritize/budget for replacement of appliances with high leak rates that use a high-cost refrigerant
- Consider interim retrofit from ozone-depleting or high-GWP/high-cost refrigerants to a lower-GWP/lower cost refrigerant
- Implementing new facility low-GWP/no GWP solutions in existing facilities
  - Phasing complications in operating facilities (remodels)
  - Apply lessons learned from new facilities to existing facilities and vice versa
- How does the size of the project dictate the best solution?
- Refrigerant "banking" and "buy back"
- Develop an actionable plan to reduce refrigerant use
  - Reduce charge sizes and leaks
  - Inspect what you expect and recalibrate

Holistic Approach

Existing Facilities – One Approach to the Transition

How can we transition from a centralized parallel rack system with a high-GWP/high-cost refrigerant?

- Stores typically remain open during remodels
- During remodels, the construction phasing plan is vastly more complicated

Eat the elephant in smaller bites; a modular approach with multiple smaller refrigeration systems using low-GWP/no GWP refrigerants

- Remodels
  - Transition by department or case lineup
  - Stage in a system over multiple years or multiple "projects"
- "Chronically" leaking equipment
  - Identify, prioritize, budget – REPLACE
  - Incrementally replace the worst leaking equipment and line sets

DISCUSSION

Contacts

Speakers

- Glenn Barrett, DC Engineering
  Gbarrett@dcengineering.net
- Leia Waln, DC Engineering
  lwaln@refrigerantmanagementsolutions.com

GreenChill

- Annie Kee, U.S. EPA
  kee.annie@epa.gov

Webinar Materials Posted!

Content from recent GreenChill webinars is posted on the Events and Webinars page:
www.epa.gov/greenchill/events-and-webinars

Join our webinar invitation list or request today's slides: EPA-GreenChill@abtassoc.com

Access past webinar slides and recordings: www.epa.gov/greenchill/events-and-webinars