The Refrigerant Transition Journey: From Chaos to Order

Helen Walter-Terrinoni

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What we'll discuss…

- The American Innovation and Manufacturing (AIM) Act
- An orderly transition: lessons learned in Europe
- Petitions for sector-based controls
- SNAP listings
- Update on product and application standards
- Update on the adoption of standards into building codes
- Information on storage, transportation, and handling codes and regulations
- Q&A

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The American Innovation and Manufacturing (AIM) Act of 2020

How to Not Only Survive, but "win" the hydrofluorocarbon (HFC) Phasedown

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Regulations

How did we get to the AIM Act

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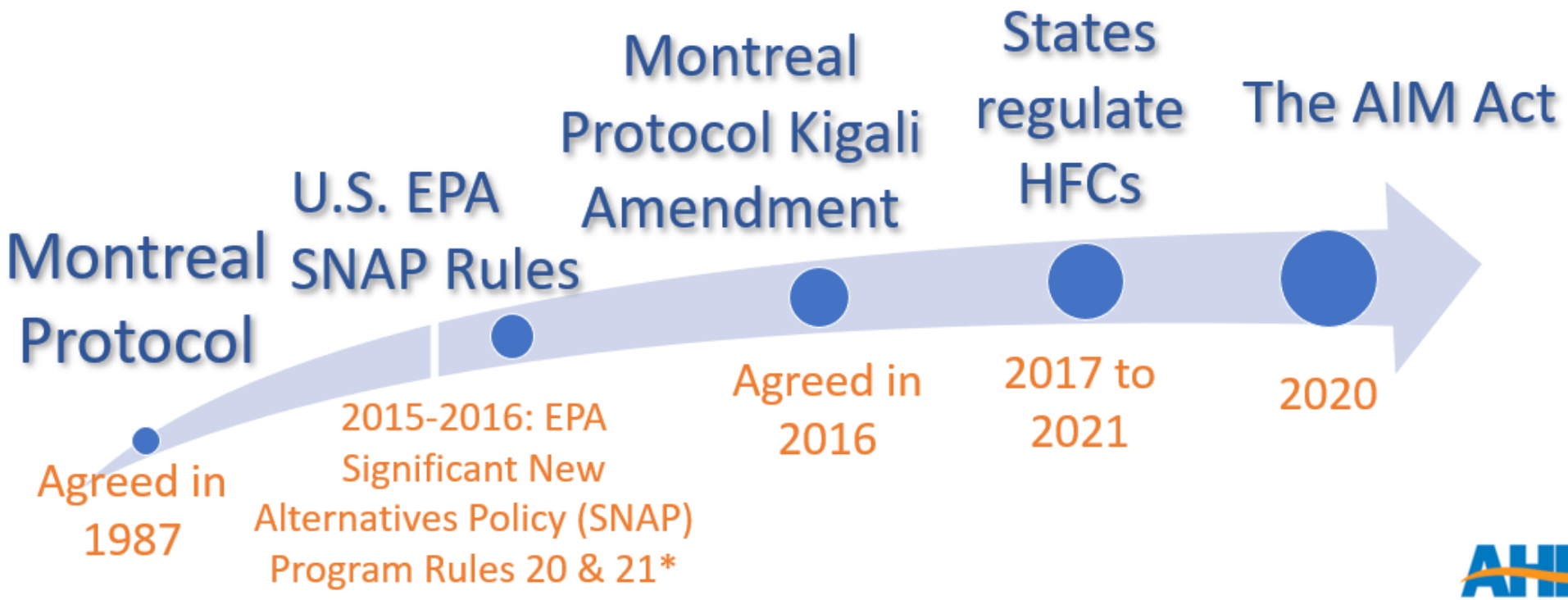
Refrigerant Transition



*SNAP rules 20 & 21 were remanded back to EPA by DC Circuit Court (2017/2018)

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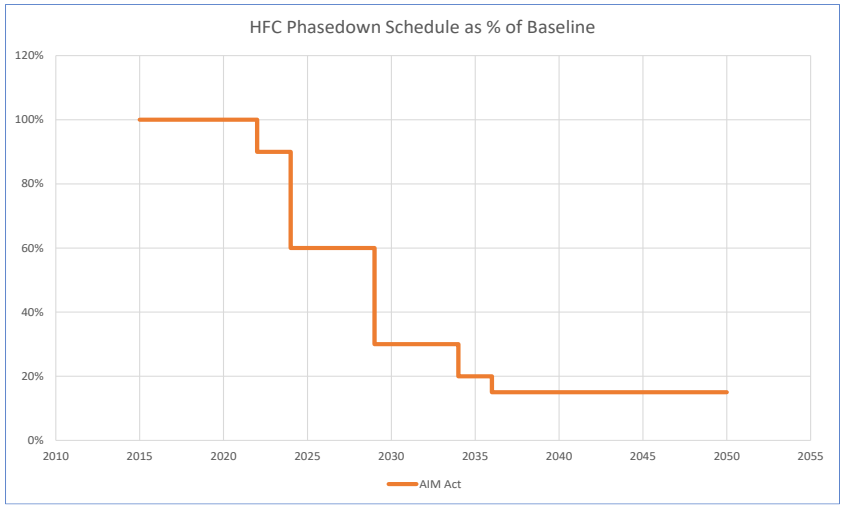
Climate Alliance States:

- Hydrofluorocarbon (HFC) use regulations
  - SNAP Rules 20 & 21 (12 states)
  - California and Washington State
    - Air Conditioning 750 GWP Limit in 2025
    - Commercial Refrigeration 150 GWP Limit in 2022 (2026 in Washington)
- Refrigerant Management Regulations

American Innovation and Manufacturing Act of 2020

- Mandates production and consumption phase-down of HFCs
  - Environmental Protection Agency (EPA) regulation Oct 1, 2021
- Allows sector transitions
- Refrigerant management including recovery and reclaim
  - Stakeholder meeting April 26, 2022



2011-2013 baseline:

- 2022: 10% reduction
- 2024: 40% reduction
- 2029: 70% reduction
- 2034: 80% reduction
- 2036: 85% reduction

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HFC Allowance Allocation Final Rule

- The AIM Act is based on Title VI of the Clean Air Act
  - Production and consumption constrained over time
- Final rule sets baselines and allocation methodologies
  - Allocation methodologies might change in 2024
- Final rule also imposes new enforcement requirements
  - Concerns about illegal imports and environmental justice
- Allowances for 2022 allocated by separate action
  - Production and import in '22 prohibited without allowances

HFC Allowance Allocation Final Rule, *con't*

- The AIM Act's baseline mirrors the Kigali Amendment
  - Production and consumption phase down is also the same
- For 2022-23, allowances allocated for 90% of the baseline
  - Next stepdown is significant: 60% of the baseline in 2024
- An allowance corresponds to 1 MTEVe (in 0.1 units)
  - Allowances weighted by exchange value (CO_2-equivalent)
- Producers hold production and consumption allowances
  - Importers only need to hold consumption allowances

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HFC Allowance Allocation Final Rule, *con't*

- Allowances allocated only to entities operating in 2020
  - Allocation based on average of 3 highest years in 2011-2019
- Special allowances given to 6 sectors named in AIM Act
  - 'Application Specific Allowances' only usable in each sector
- Some allowances set aside for new entrants
  - Allowances not transferable and distributed pro rata if unused
- Allowances can be traded, but subject to a 5% 'offset'
  - For every 100 allowances traded, EPA takes 5 allowances

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HFC Allowance Allocation Final Rule, *con't*

- Compliance and enforcement a rising priority for EPA
  - Illegal imports and 'dumping' an issue in the past
- Third party auditing and data disclosure now required
  - Most HFC production and consumption data will be public
- Refillable cylinders and QR codes phased in by 2027
  - EPA delayed effective dates of these requirements in final rule
- Administrative consequences lets EPA dock allowances
  - Loss of allowances in addition to civil or criminal penalties

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HFC Allowance Allocation Final Rule, *con't*

- HFC-23 emissions prohibited by October 1, 2022
  - Capture required for at least 0.99% of HFC-23 emissions
- Final rule excludes HFCs contained in imported products
  - Consistent with past practice but drawing new opposition
- Limited authorization for int'l allowance transfers
  - Production allowances tradable to 'Kigali-compliant' countries
- EPA found elevated health risks near HFC plants
  - No environmental justice action taken but will be revisited

Near-Term HFC Regulatory Considerations

- EPA next will turn to sector-based control petitions
  - New rules to ban high GWP HFCs in certain product categories
- Sector-based controls include federal and state standards
  - Plus, definition of product categories not always clear
- Tightening supply will boost demand for reclaimed HFCs
  - New rules likely to increase recovery and minimize leaks
- Low GWP substitutes subject to additional barriers
  - SNAP approval and building code changes needed

EPA: Determine baseline and mandatory allocations for exemptions

- Rules governing….
  - Metered-dose inhalers
  - Defense sprays*
  - Marine and trailer structural composite preformed polyurethane foam*
  - Electronic gases
    - Etchant for semiconductor material or wafers
    - Cleaning of chemical vapor deposition chambers within the semiconductor manufacturing sector
  - Mission-critical military end uses such as fire suppression

*Included in SNAP Rules 20 and 21

There is a temporary prohibition on states enforcing rules with respect to exempted products through 12/27/25.

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American Innovation and Manufacturing Act of 2020: “To Do List”

Consumption Doesn't Mean What You Think It Means

Consumption =

Production + Imports - Exports

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Consumption Doesn’t Mean What You Think It Means

Consumption is Supply not Demand

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Allocations

- What are allocations?
- Who gets to make the rules around how allocations are used?
- What do allocations mean for retailers and original equipment manufacturers (OEMs)?

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How was Allocation Determined?

- EPA collected data on production and consumption to set baselines
  - Production Baseline: 382.55 MMTEVe
  - Consumption Baseline: 303.89 MMTEVe
- EPA establishes a total allowance pool equal to 90% of the baseline
  - For future step downs, the baseline is multiplied by 60%, 30%, 20%, and 15%
- EPA allocating allowances for 90% of baseline for 2022-2023
  - Production Allowances: 344.3 MMTEVe
  - Consumption Allowances: 273.5 MMTEVe
- Allowances allocated only to entities operating in 2020
  - Allocation based on average of 3 highest years in 2011-2019
  - These allowances cannot be banked and do not carry forward

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How do I purchase an HFC?

- For 2022 and 2023, “current” manufacturers and importers of HFCs have been granted allocation to sell HFCs limited by an allocated number of exchange units or CO_2 eq units based on their production and importing history.
- “Current” supply chains should still be available, but there may be some limitations in the quantities of HFCs available

→ Talk to your suppliers early about your HFC needs. Companies with allocation can be found in the Allocation Rule

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Imported Products Containing HFCs

- EPA did not create a 2011 – 2013 baseline and allocation system for the import of products containing HFCs noting that data may not be readily available.
- Imported products containing HFCs will be regulated in the phase-down in the country of manufacture.
  - As of today, 126 countries have ratified the Kigali Amendment to the Montreal Protocol including China, South Korea, Japan, Mexico and other countries.
  - There is a non-participating country trade provision in the AIM Act.
- Imported products containing HFCs will also be regulated by sector-based (demand-side) regulations as requested by the petition.
  - This could be as GWP limits or bans on specific HFCs in certain products.
- Creating a baseline and phase-down in the US for products containing HFCs would create a 3rd regulation for the same HFCs!
- There may be additional anti-dumping limitations for imported product containing HFCs.

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Importing Reclaimed Refrigerant

- Reclaimed refrigerant can be imported in products or equipment without an allocation.
- Imported products containing reclaimed HFCs will also be regulated by sector-based (demand-side) regulations as requested by the petition. This could be as GWP limits or bans on specific HFCs in certain products.
- An allocation is needed to import any bulk reclaimed refrigerant.

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Background Information

- The U.S. Environmental Protection Agency (EPA) released the final publication in the *Federal Register* establishing the allowance allocation and trading program under the American Innovation in Manufacturing (AIM) Act for the phasedown of hydrofluorocarbons (HFCs effective November 4, 2021.

On October 1, 2021, EPA issued allowances for the production and consumption of HFCs for calendar year 2022.

- Allowances are necessary for producing or importing HFCs starting January 1, 2022, consistent with the methodology in the final rule "Phasedown of Hydrofluorocarbons: Establishing the Allowance Allocation and Trading Program under the American Innovation and Manufacturing Act" signed September 23, 2021.
  - The EPA can allocate 90 percent of the production and consumption baselines for HFCs.
  - Beginning in 2024, EPA will only be able to allocate 60 percent of the production and consumption baselines.
  - For calendar years 2022 and 2023, EPA will allocate 344.3 MMTEVe of production allowances and 273.5 MMTEVe of consumption allowances. These allowances cannot be banked and do not carry forward.
  - HFC allowances can be found here. EPA also posted a pre-publication version of the *Federal Register* notice announcing the issuance of allowances. More on the final rule can be found here.

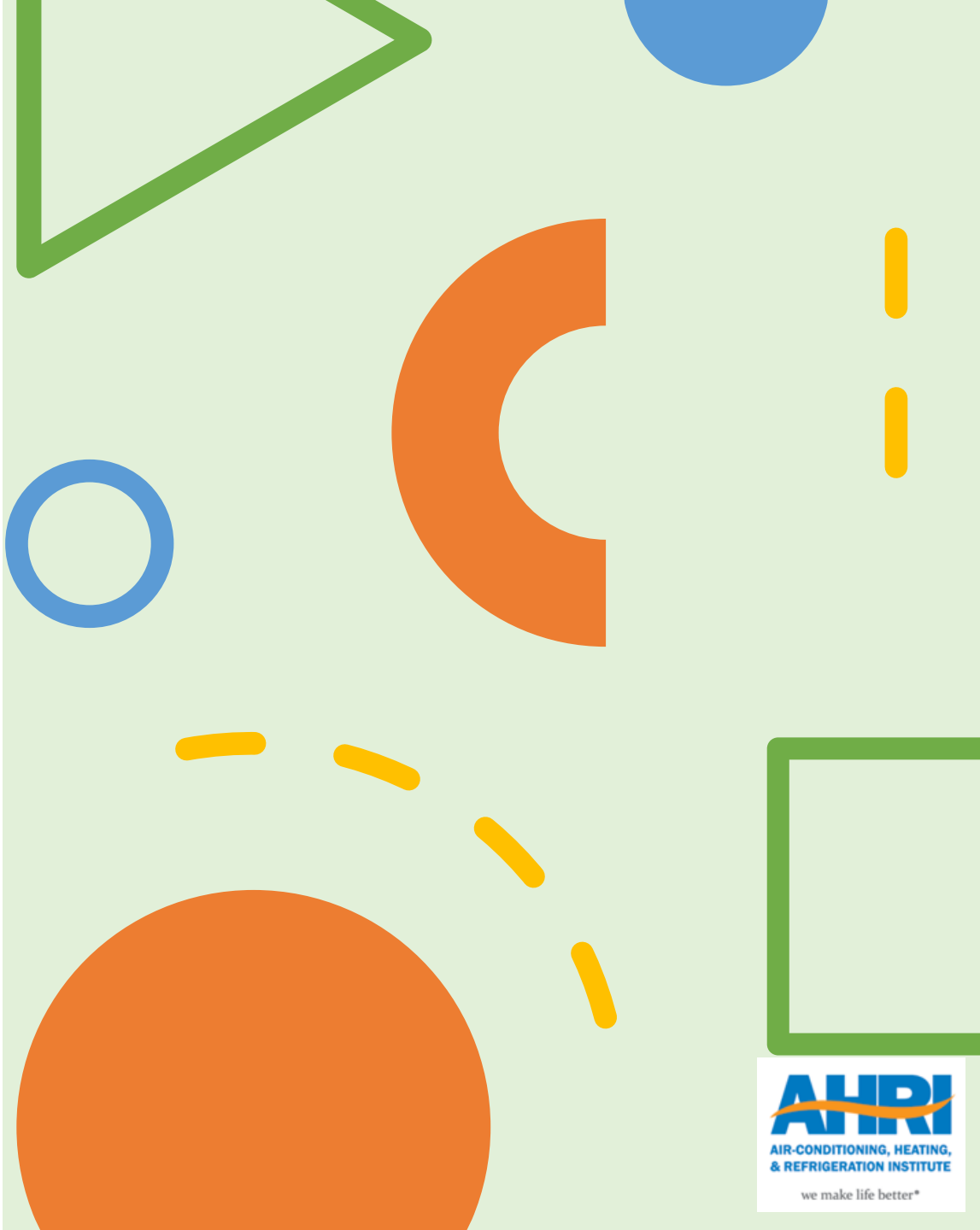
International Panel on Climate Change (IPCC) 7th Assessment Report (AR)

- The International Panel on Climate Change (IPCC) periodically updates the values for global warming potential (GWP)
  - Each Assessment Report results in new GWP values based on new information from atmospheric scientists or, in the case of the IPCC 7th AR, a modification to the calculation using "effective" radiative forcing extending the timeline used.
  - The new values are higher for many HFCs.
- The entire world regulates based on the 2007 IPCC AR4 which has a GWP for R-32 of 677 and R-410 A of 2088.
  - The AIM Act specifically requires the use of AR4
  - The new assessments are too frequent for regulators to re-regulate based on these changes
  - If regulators were to update GWPs in regulations, they would also need to update all baseline numbers on the same basis.
  - The relative GWPs rarely shift between reports and the same good HFC alternatives would be needed for compliance
  - Even if a relative change were made, design cycles and equipment lifetimes are too long to re-work designs to pivot to the latest numbers

The HFC allocation phase-down is designed to create an economic supply imbalance with demand.

Reduced Supply Economics

- Scarcity
- Increased Prices



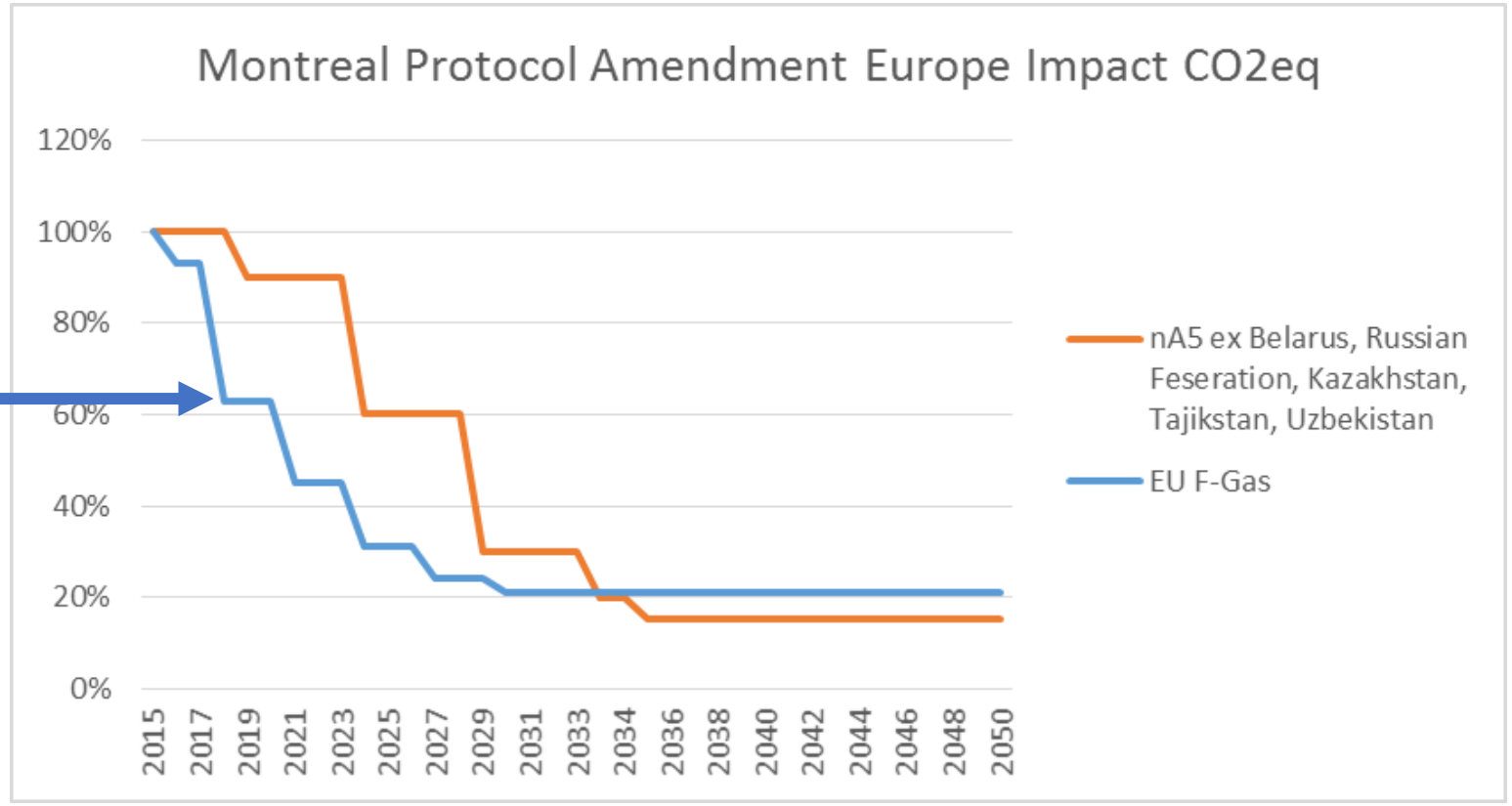
A Chaotic Transition

Lessons Learned in Europe

European Union Fluorinated Gas (F-Gas) Regulations

Retailers were not ready.

37.5% 2018



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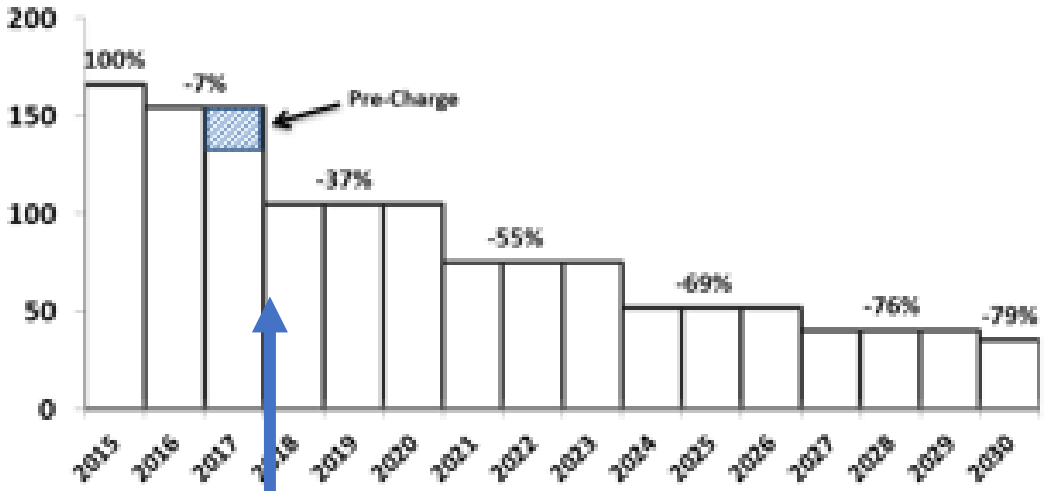
Europe (EU-28) F-Gas II

Cap basis: CO2 Eq MT

CO_2e sales 2009-2012



Bottom Line:

Very little sector control prior to 2020 created chaotic transitions in 2018

- **Equipment Ban:**
  - **2015:** HFC ≥150; refrigerators/freezers – foam & refrigerant
  - **2015:** HFC ≥ 2500; commercial refrig/freezers
  - **2020:** HFC ≥ 2500; stationary refrigeration
    HFC ≥ 150; movable room air conditioners
  - **2020:** HFC ≥ 150; XPS FOAM
  - **2022:** HFC ≥ 150; commercial refrigerators/freezers
  - **2023:** HFC ≥ 150; PU FOAM
  - **2025:** HFC ≥ 750; single split air conditioners
- **Service Ban:**
  - **2020:** Prohibit Service and maintenance of refrigeration equipment with a min charge size of 40 tonnes CO2-equivalent with refrigerants ≥2500 GWP

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European Union Fluorinated Gas Regulations

- Bottom Line:
  - 37.5% transition in 2018
    - Refrigerants unavailable
    - Prices increased
  - Manufacturers, retailers, distributors etc.
    - **Waiting to transition**
    - **Unprepared**
    - Late sector-based controls

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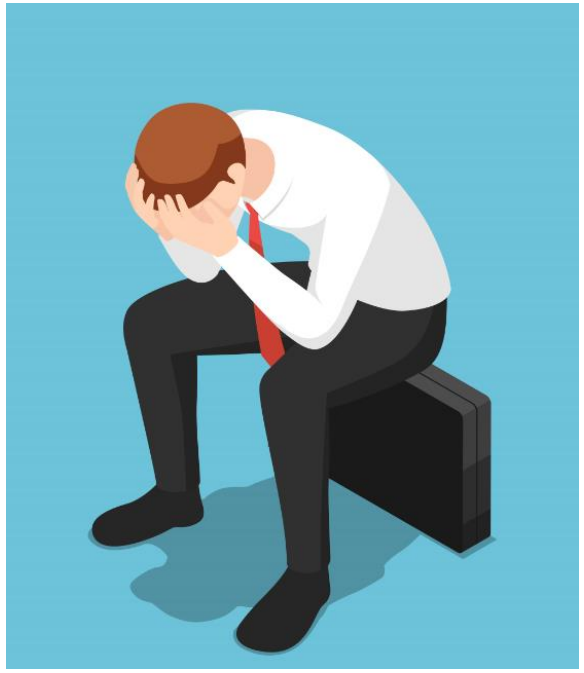
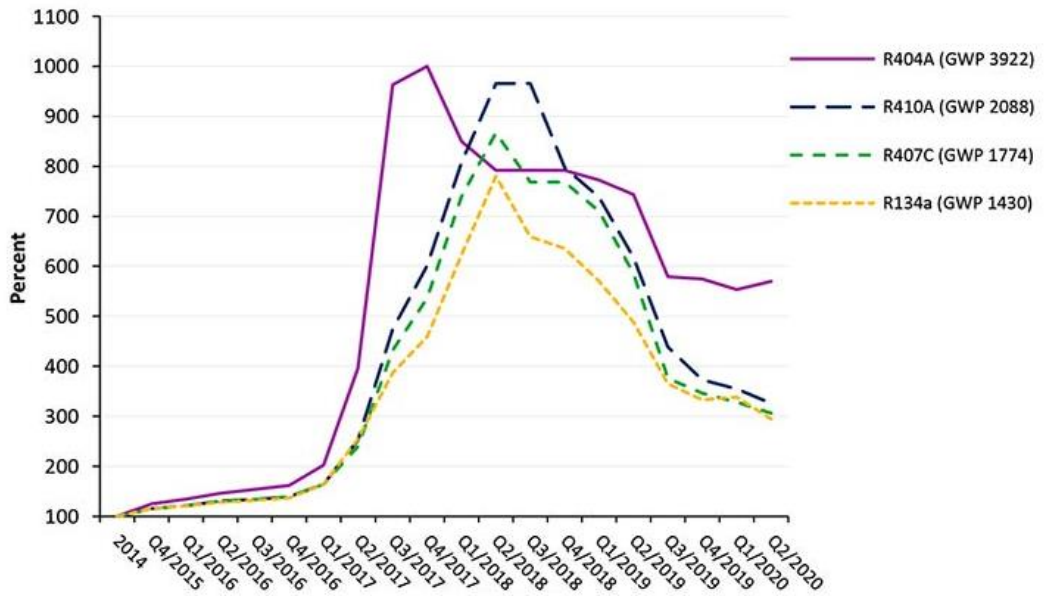
European Impact: Retailers and OEMs



- The Cooling Post 2020

Refrigerant demand and prices

29 SEP 2020



Average purchase prices reported by three large refrigerant distributors. Prices are indexed to the baseline year 2014

EUROPE: The effects of Covid-19 are held at least partly responsible for a fall in refrigerant demand and prices in the quarter to September.

The refrigerant price trends are recorded in the latest report from German consultancy Öko-Recherche.

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How do we proceed with an orderly transition ?

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There are options.

Doing nothing isn’t one of them.

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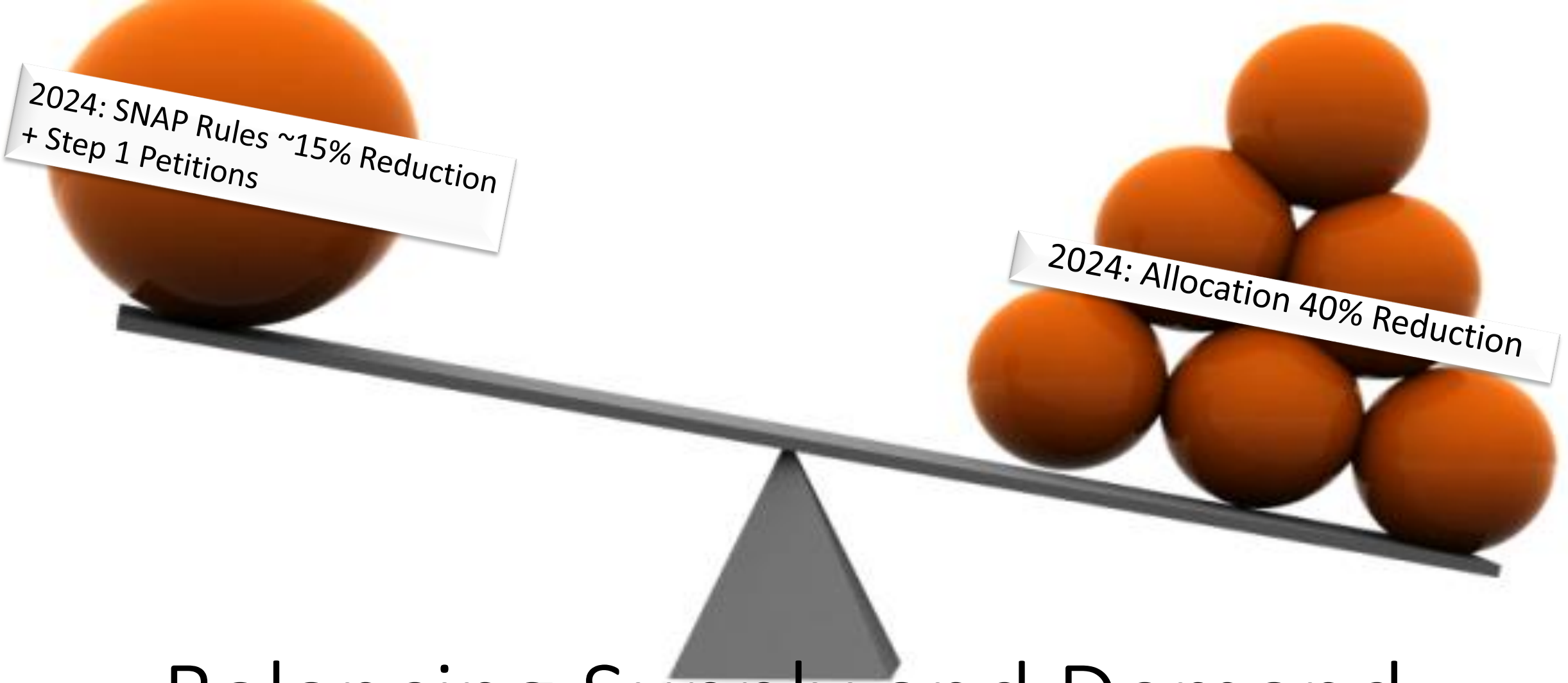

Balancing Supply and Demand

Where is the additional 25% going to come from?

Reducing Demand to Balance Supply

A Toolbox Approach to Reduction in HFCs

Are there bold actions that I should consider?

Can I solve this problem alone?

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Reducing Demand to Balance Supply

- OEM/End-user Toolbox
  - Use low-GWP refrigerants in new equipment
  - Consider smaller charge sizes
  - Retrofit existing equipment, A1 -> lower GWP A1
  - Reduce leaks
  - Use recovered/reclaimed refrigerant

Bottom Line: Future compliance depends on starting now!

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Sector-based controls

Sector-based Controls

Regulations limiting hydrofluorocarbon (HFC) use for a specific family of products such as remote condensing units

- Global Warming Potential (GWP) limits
- HFC or refrigerant blend bans
  - Significant New Alternatives Policy (SNAP) Program Rules 20 & 21
  - AHRI Petitions

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HFC Petitions

EPA is granted petitions 180 days after they were filed on April 13, 2021

EPA will determine rulemaking process and initiate the rulemaking, completing petitions within two years of granting the petition.

Earliest effective date is one year after publication of final regulation.

Petitions have been filed with EPA

NRDC/IGSD – Reinstate SNAP Rules 20 & 21 under AIM
AHRI – Air Conditioning 750 GWP 2025; Refrigeration Step 1, Refrigeration Step 2
EIA – All California requirements
AHAM – AC, dehumidifiers 750 GWP
IGSD – Auto DIY
DuPont – XPS 134a transition
CPI – PU Foam SNAP Rules
IIAR – Commercial Refrigeration
HCPA – Aerosol SNAP Rules
Climate Alliance States – SNAP Rules and California requirements

Proposed Industry Transition Dates

REFRIGERATION APPLICATIONS

Product Category (New Equipment[1])	AR4 GWP Limit	Transition Date
Standalone/Self-contained Refrigeration Systems	SNAP Rules 20/21 Prohibitions	January 1, 2022
Remote Refrigeration Systems (> 50 lbs. refrigerant charge)	1500	January 1, 2022
Remote Refrigeration Systems (<= 50 lbs. refrigerant charge)	2200	January 1, 2022
Industrial and Processing Refrigeration (w/o chillers)	1500	January 1, 2022
ACIM (> 50 lbs. refrigerant charge)	2200	January 1, 2022
Transport Refrigeration	2200	January 1, 2023

Exceptions: ACIM < 50lbs charge, Medical, Scientific and Research Applications

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Proposed Industry HFC Phase-down Regulations

AIR CONDITIONING AND INDUSTRIAL PROCESS REFRIGERATION (IPR)		
Chillers	AR4 GWP Limit	Transition Date
Chillers (designed for chilled fluid leaving temperature > +35 ° F)	≤750	January 1, 2024
Chillers (designed for chilled fluid leaving temperature ≤+35 ° and > -10° F)	≤1500	January 1, 2024
Chillers (designed for chilled fluid leaving temperature ≤-10 ° to -50 ° F)	≤2200	January 1, 2024
Chillers (< 20lbs charge) (designed for chilled fluid leaving temperature <+35 ° F)	≤2200	January 1, 2024
Exceptions: Chillers <-50 F, Medical, Scientific and Research Applications		

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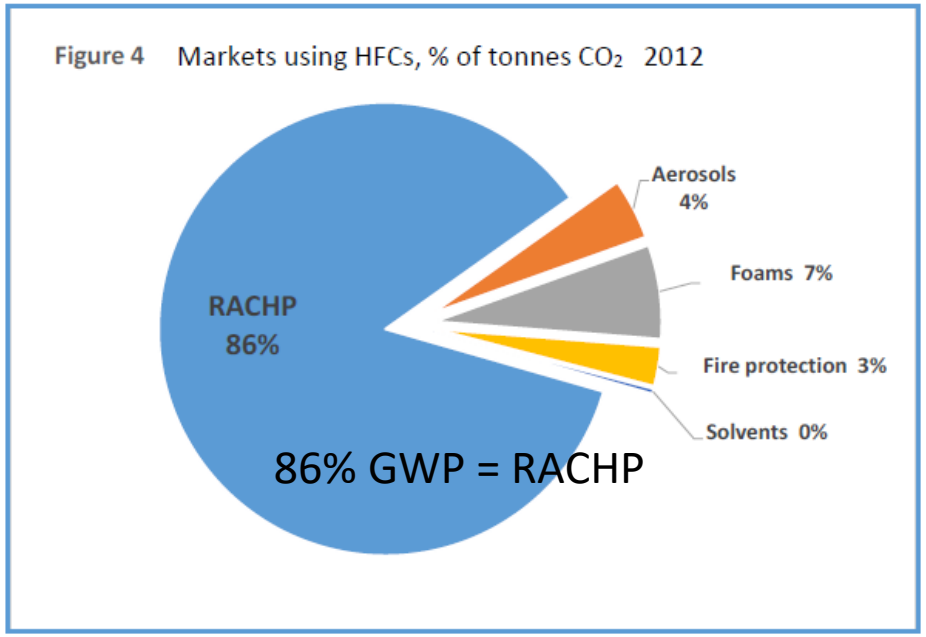
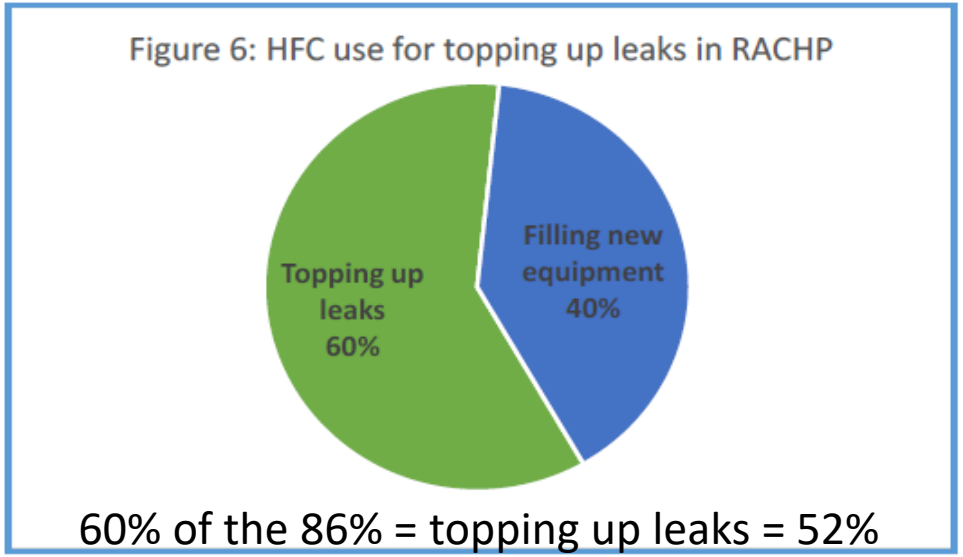
United Nations Environment Program Fact Sheet

- Most significant global issue is **leaky stationary refrigeration and air conditioning** equipment

Global: ~52% of global "GWP" is used to charge leaking equipment





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Enabling New Refrigerants: Safety Standards and Building Codes Refrigerant Listings

New Refrigerants must be approved by EPA and standards adopted into building codes.

Enabling Refrigerants

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HFCs have been used in many market sectors.

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SNAP Approval for Alternatives

- EPA SNAP program must complete a comparative analysis for all replacements.
- Stakeholders submit SNAP Applications here.
- EPA evaluates the application for completeness and either
  - Requests additional information OR
  - Sends applicant a “Completeness Letter”
- EPA finishes comparative analysis and publishes a determination of listing status in the Federal Register. A list of alternatives with their status can be found here.

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EPA Allows Flammable Refrigerants Provided Safety Standards are Followed

Residential and light commercial air conditioning (May 2021)

Smaller equipment (window units and PTACS) (2015)

Chillers (2012)

Self-contained refrigeration (A3 higher flammability refrigerants) (2012)

Auto air conditioning (2011)

EPA is well-aware of the urgent needs for SNAP listings for compliance with the AIM Act.

- EPA received the Petition for smaller equipment such as dehumidifiers
- EPA is aware of the California Air Resources Board (CARB) transition dates
- CARB is aware of the need to comply with EPA SNAP listing

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SNAP 23 Rule Published in the Federal Register

Residential and light commercial air conditioning and heat pumps

- R-452B, R-454A, R-454B, R-454C, R-457A, R32†
- Acceptable subject to use conditions including safety standards

† EPA previously listed R-32 as Acceptable Subject to Use Conditions for self-contained room air conditioners (April 10, 2015; 80 FR 19454)

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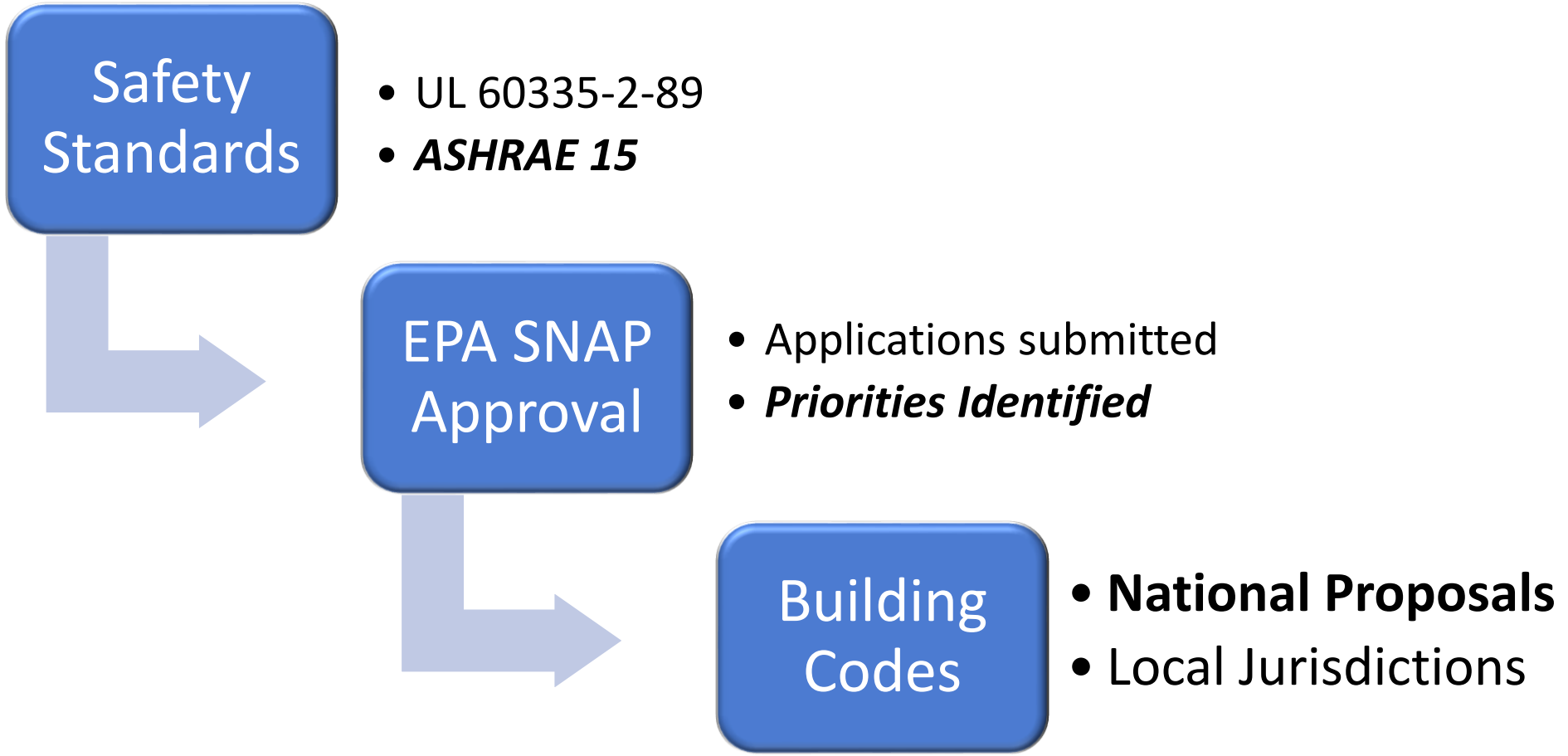
U.S. standards and building codes are starting to allow new refrigerants



Bottom Line: We have input into how quickly these move

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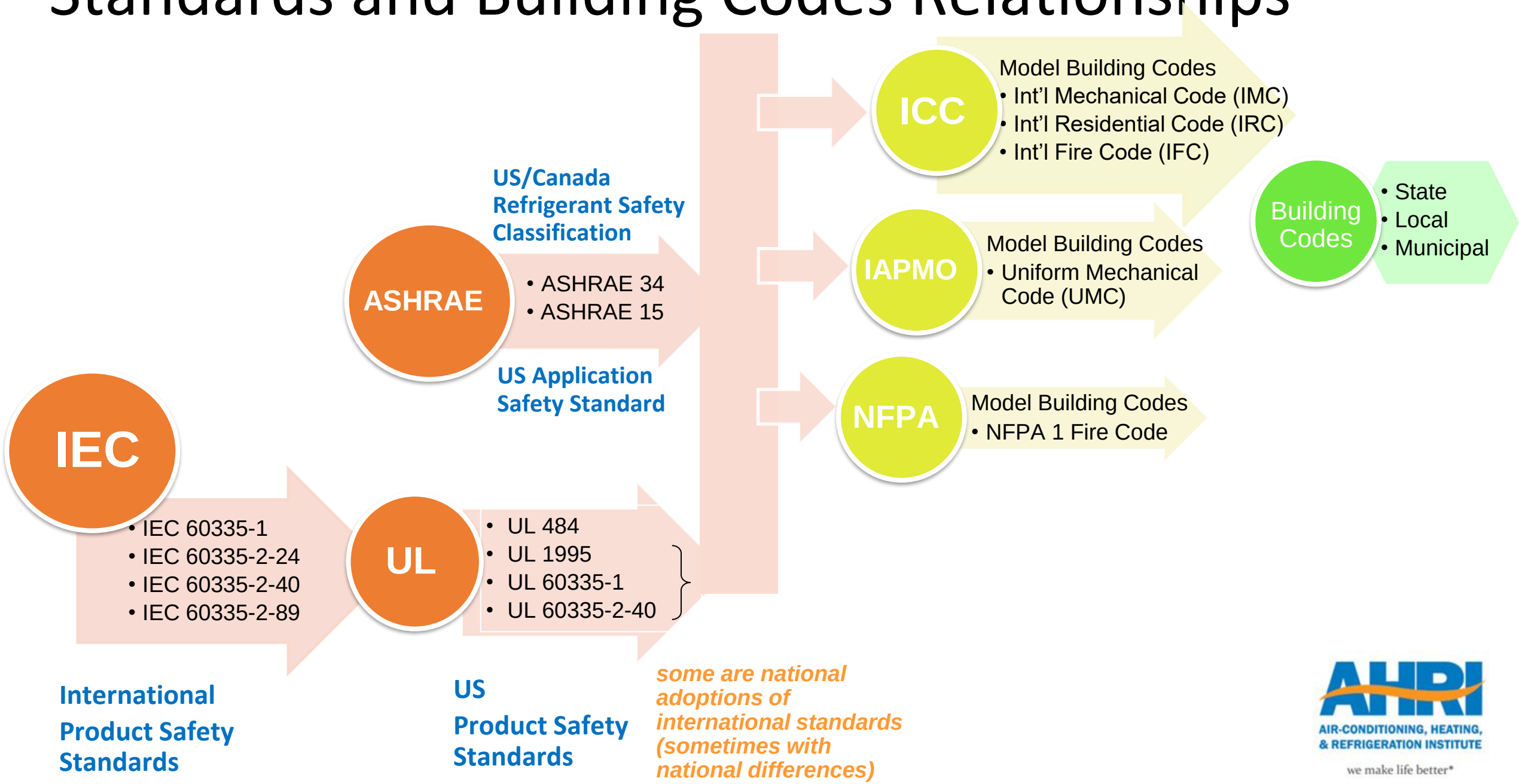
Standards and Building Codes Relationships



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UL Standards-History of incorporating flammable refrigerants

UL 250 – Household Refrigerators

- Initial proposal March 17, 1993, Supplement SA published **August 25, 2000**.
- Similar to requirements in IEC 60335-2-24 (pub. 88?)

UL 471 – Commercial Refrigerators

- Initial proposal August 31, 2000
- Unilever/Ben and Jerry's interest; re-initiated interest late 2007; Supplement SB pub **October 24, 2008**
- Similar to requirements in IEC 60335-2-89

UL 541 – Refrigerated Vending Machines

- Published requirements **December 30, 2011.**

UL 484 – Room Air Conditioners

- Flammable requirements published requirements in **October 21, 2011.**
- UL 60335-2-40 will supersede UL 484

UL 60335-2-40- Household and Similar Electrical Appliances

- Flammable refrigerant (A2/A3) requirements in second edition **2017**
- A2L flammable refrigerants incorporated in third edition, published **2019**
- The current working group (WG) working on fourth edition.

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Refrigerant Charge Limits

A2L Charge Sizes:
13 x LFL ~ 4 kg [8.8 lb]
52 x LFL ~ 16 kg [35 lb]
260 x LFL ~ 78 kg [172 lb]

A3 Charge Sizes:
8 x LFL ~ 300 g [0.67 lb]
13 x LFL ~ 500 g [1.1 lb]

- IEC Standard 60335-2-89 ed. 2.0 now allows charge limits for R-290 (an A3) up to **494 g (1.10 lb)** and for A2L refrigerants to **1.2 kg (2.6 lb)** in self-contained equipment only.
  - Only up to 304 g (0.670 lb) in closed equipment (doors or drawers)

- In the UL proposal, A2L refrigerants can be used in field-erected “remote” systems with charge sizes up to about 78 kg (172 lb), with additional safety measures required

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Two Key US Standards

UL 60335-2-40

Standard for Household And Similar Electrical Appliances - Safety - Part 2-40: Particular Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers

- Will incorporate several current UL Standards (UL 484, UL 1995) because other standards will sunset in future
- Will cover many different types of equipment (PTACs, Dehumidifiers, Chillers, etc.)
- Active effort to complete 4th edition

UL Standard

ASHRAE 15

Safety Standard for Refrigeration Systems

- Broad application/installation standard
- Standard covers equipment under UL 60335-2-40, UL 60335-2-89, etc.

These two standards are complementary and typically used together when equipment is made and installed in residential and commercial applications

Technicians will have information available in manufacturer literature

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Key Concepts in HVAC Standard UL 60335-2-40

Limit Refrigerant Charge

Refrigerant Charge Limits
(UL60335-2-40 Annex GG 1.2)
m1, m2, m3
R32 m1=4.1 lbs., m2=26.8 lbs., m3=134.1 lbs.
R-454B m1= 4.0 lbs., m2= 26.0, m3=130.2 lbs.

Minimum Area Check (A_{min})
(UL60335-2-40 Annex GG)
- Safety factor of 4
- Or safety factor of 2 with additional measures

Reduce Refrigerant Leaks

Section 22 and 101.DVG Refrigerant Piping
- Protected lines
- Qualified joints (ISO 14903)
- Field pressure test
- Additional requirements for VRF

Eliminate Ignition Sources

Ignition Source Isolation
- Per Annex FF

No Competent Ignition
- Sources in unit and ducts

Per 22.116, Annex KK, 22,117

Detect Leaks and Take Action

Factory Installed Refrigerant Detection System
- UL60335-2-40 Annex LL, Annex MM
- UL qualification testing
- UL approved
- Safety Circuit Approved
- Factory Calibrated
- Self Test Routine (1once/hr.)
- Fail safe mode with fan on
- Field inspection feature

Active mitigation for leaks
Detect, circulate and dilute
Annex GG

Install and Service

Service Training
Annex DD installation guidelines
Annex MM repair of leak detection system

Labeling and Literature
Per UL60335-2-40 Section 101, Annex DD

2022 Model Building Code Submissions

- ICC
  - ASHRAE 15 addenda
  - UL 60335-2-40 and UL 60335-2-89
- IAPMO
  - Standards Council Meeting on December 9th mechanical joints/fittings
  - ASHRAE 15 submission
    - Addendum L modifies portions of the document to incorporate requirements for commercial refrigeration applications with the use of A2L, A2 and A3 refrigerants
    - Addendum G rewrites refrigerant concentration limits, volume calculations and defines new terms which help installers better understand how to apply the standard
    - Addendum M expands use of mechanical ventilation strategy to human comfort applications using A2L refrigerants
  - UL 60335-2-40 and UL 60335-2-89

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Building Codes

- Proposals to update “reference standards” submitted to the International Code Council
  - Technical Committee meets in April
  - Consent agenda publishes August
  - Publication early 2023
- IAPMO
  - Proposals submitted to adopt standards (again)
  - Technical Committee meets in May
  - Full membership meets September
  - Publication mid-2023

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Model Building Code Adoption

- Model codes are revised and published on a three-year cycle
  - (2012, 2015, 2018, 2021*, 2024,* …)
- Some states and/or local jurisdictions adopt model building codes
  - States are on different adoption schedules
  - States can adopt safety standards directly or model codes or a combination of both
- Typically, there are processes incorporate changes to the model building codes in the state adoption process

Bottom Line: Codes WG will need to work quickly to ensure A2L/A3 use is allowed in states and local jurisdictions

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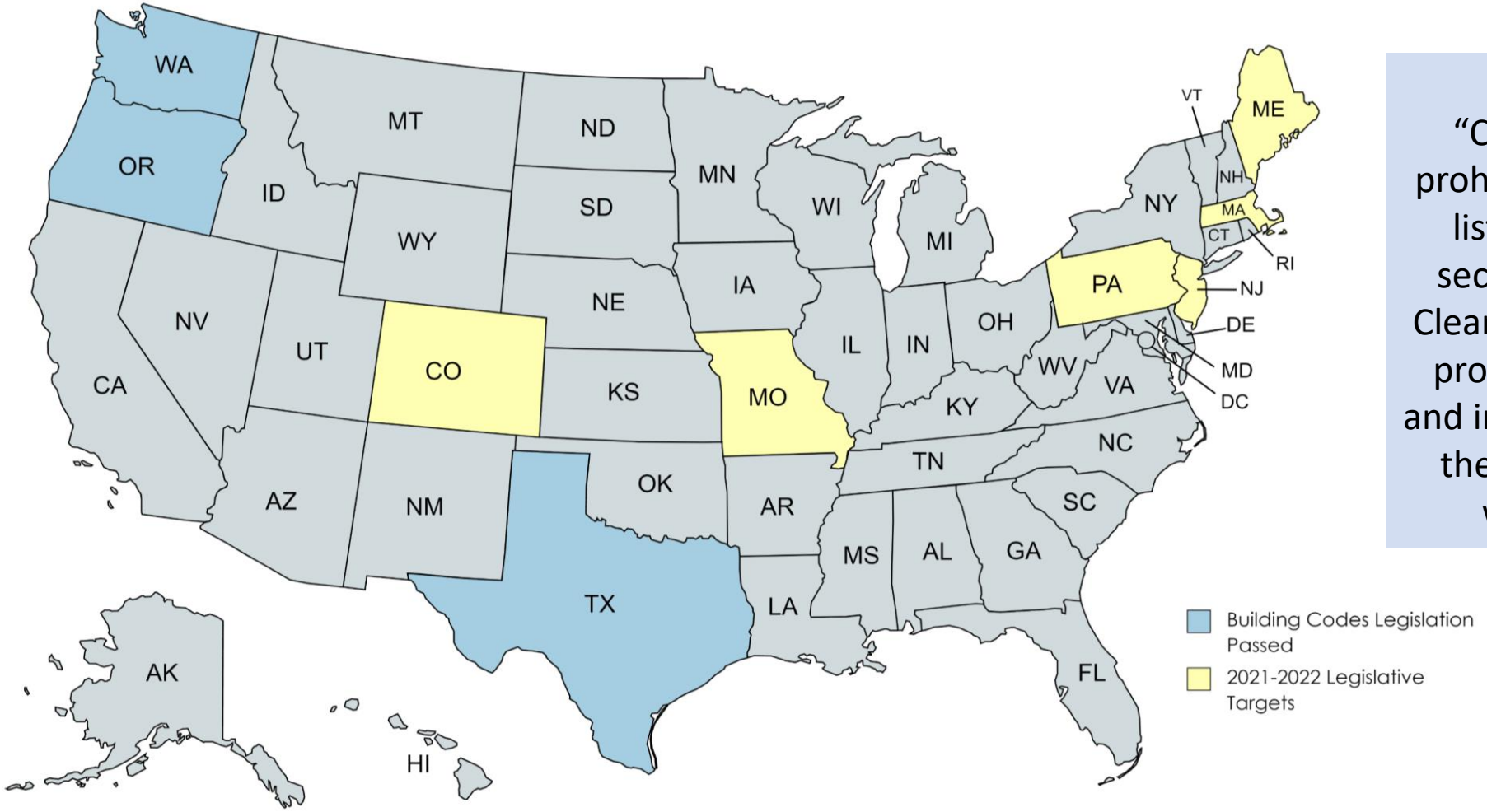
A2L Building Code State Legislative Update



Model Language:
"Code provisions shall not prohibit the use of refrigerants listed as acceptable under section 7671k of the federal Clean Air Act (42 U.S.C. 7671k), provided equipment is listed and installed in accordance with the use conditions imposed within section 7671k."

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Safe Handling

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OSHA Extends NPR Deadline

- February 16, 2021, OSHA published NPRM to modify the Hazard Communication Standard (HCS) to align with the United Nations' Globally Harmonized System of Classification and Labelling of Chemicals (GHS) Revision 7.
- Comments and attachments, can be submitted electronically to www.regulations.gov identified by Docket No. OSHA-2019-0001.
  - November 22 to submit new data and information
  - December 22 to submit final briefs and comments

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Safe Refrigerant Transition Task Force (SRTTF) Federal Agency Activities

Department of Transportation

- Cylinder storage
- < 25 lb. Letter of interpretation
- 25 lbs. to 50 lbs. Special permit
- >50 lbs. Special permit

Occupational Safety and Health Administration

- Global Harmonized System (GHS) Purple Book 7

HRAI Transportation and Storage

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Safe Refrigerant Transition Task Force: Special Permit Details Status

- ✓ Horizontal shipment of cylinders
  - ✓ Request for horizontal shipment of ASHRAE A2L/GHS category 1B division 2.1 flammable gas cylinders
- ✓ Refrigerating machines containing 20 kg ASHRAE A2L/ GHS category 1B refrigerants
  - ✓ Exemption to 49 CFR subchapter C as refrigerating machines and components thereof containing 20 kg (44 pounds) or less of Group A1 refrigerant covered under § 173.307(a)(4)(iv).
- Refrigerating machines containing 2200 kg ASHRAE A2L/ GHS category 1B refrigerants
  - Exempted from specification packaging requirements under 49 CFR § 173.306(5)(e) (i through viii)

Refrigerant Recovery

- Best in class: 40%
- U.S. Climate Alliance States willing to test options
- If you're interested, contact Helen Walter-Terrinoni or Vivian Cox at hwalter-Terrinoni@ahrinet.org or vcox@ahrinet.org

We've come a long way…

2019

- States developing disparate regulations
- Safety standards unavailable for next generation refrigerants
- New refrigerants not allowed by EPA
- Building codes not enabling new solutions
- Training needed
- Questions around transportation

2022

- ✓Federal regulation through the American Innovation and Manufacturing (AIM) Act
- ✓Safety standards updated
- ✓EPA listed refrigerants for air conditioning
- ✓International Code Council (ICC) National Model Codes enabled the use of next generation refrigerants and storage.
  - ✓ 1/3 of AC systems are sold into states that have addressed building codes through regulation or legislation
- ✓Training available for technicians and first responders
- ✓Department of Transportation (DOT) Letter of Interpretation up to 25 pounds of charge

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We have more work to do…

- AIM Act petitions for sector-based controls.
- Increasing refrigerant recovery and reclaim use.
- EPA listing for refrigeration
- Building Codes
  - International Code Council (ICC) Uniform Mechanical Code (UMC) adoption of latest standards (e.g. UL-60335-2-89, ASHRAE 15)
  - Adoption of code changes by remaining states
  - International Association of Plumbing and Mechanical Officials (IAPMO) Uniform Mechanical Code
- DOT and shipping of chillers, horizontal cylinders, and mid-sized systems
- Enabling refrigerants in Canada and Mexico!

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>$ 7 Million in Research on Flammable Refrigerants

- Testing
  - AHRTI-9007: Benchmarking Risk by Whole Room Scale Leaks and Ignitions Testing
  - AHRTI-9013: A2L Consequence Study
  - AHRTI-9012/Oak Ridge National Laboratory (ORNL): Real-world Leak Assessments of Alternative Flammable Refrigerants
  - AHRTI-9008: Investigation of Hot surface Ignition Temperature (HSIT) for A2L Refrigerants
  - AHRI-8017: Investigation of Energy Produced by Potential Ignition Sources in Residential Application
- Modeling
  - ASHRAE-1806: Flammable Refrigerants Post-Ignition Simulation and Risk Assessment Update
  - ORNL: Investigate the Proper Basis for Setting Charge Limits of A2L, A2, and A3 for Various Types of Products
  - NIST: Modeling tools for low-GWP Refrigerant Blends Flammability
- Servicing
  - ASHRAE-1807:Guidelines for Flammable Refrigerant Handling, Transporting, Storing and Equipment Servicing, Installation and Dismantling
  - ASHRAE-1808: Servicing and Installing Equipment using Flammable Refrigerants: Assessment of Field-made Mechanical Joints
- Detection
  - AHRTI-9009: Leak Detection of A2L Refrigerants in HVACR Equipment

*This is not a comprehensive list (excludes NFPA, Japan, Europe, Manufacturers, etc.)

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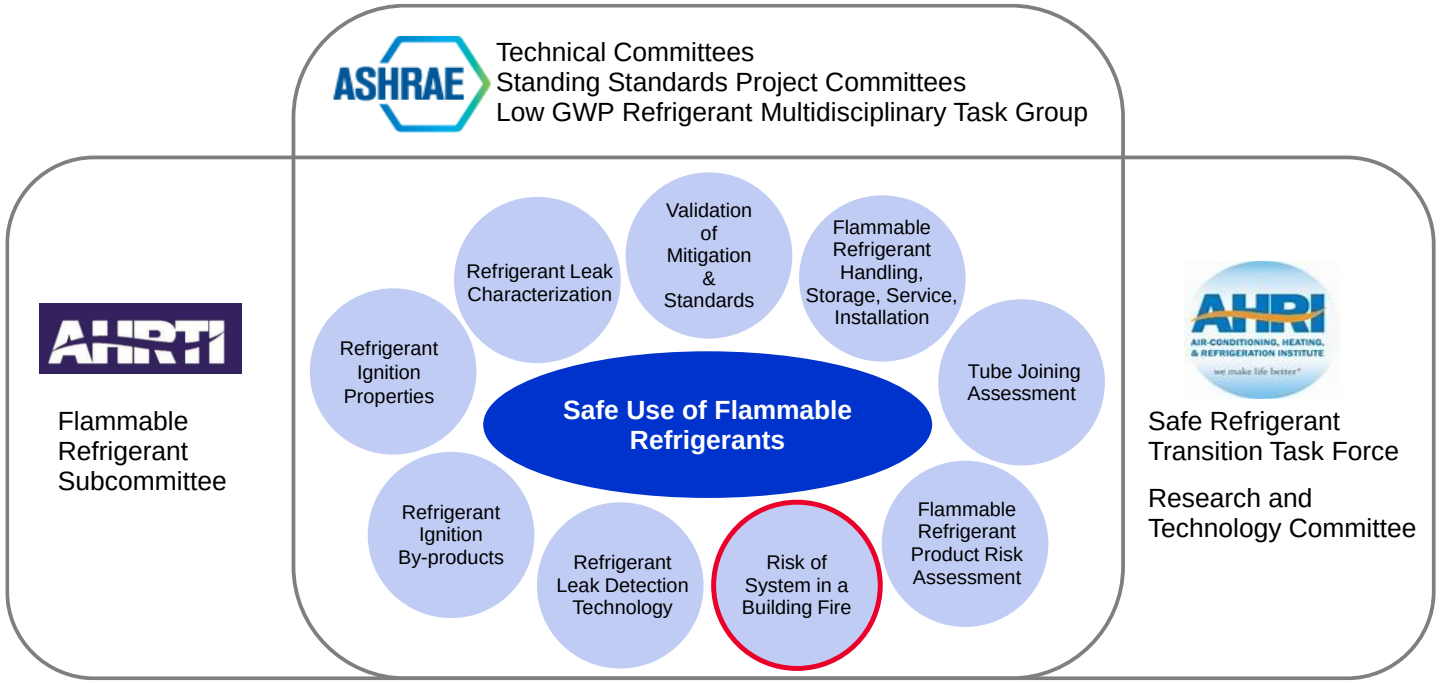
Refrigerants and Firefighter Tactical Considerations



https://training.ulfirefightersafety.org

Designed by firefighters for firefighters

First project of its kind related to fire impinging on refrigerants and equipment to provide practical information for first responders for the purpose of developing training

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- AHRI Safe Refrigerant Transition Task Force webinar series
- HVACR technician training: ACCA, ESCO, and North American Technician Excellence (NATE).
- Safe Refrigerant Transition Task Force Newsletter

- Webinar 1: Air Conditioning Applications
- Webinar 2: Commercial Refrigeration Applications
- Webinar 3: Understanding Refrigerant Sensors
- Webinar 4: Predictive Tools for Refrigerant Behaviors
- Webinar 5: Refrigerant Ignition in Open Flame/Hot Surfaces: Has Anything Fundamentally Changed?
- Webinar 6: A2L Refrigerant Behavior in a Structure Fire
- Webinar 7: Refrigerant Detection Systems 101
- Webinar 8: Servicing A2L Refrigerant Systems
- Webinar 9: A2L Refrigerants and Tactical Considerations for Firefighters
- Webinar 10: Codes and Standards "Unlocked"
- Webinar 11: Joint Types and A2L Refrigerants
- Webinar 12: HVACR Equipment Needed for the Safe Refrigerant Transition

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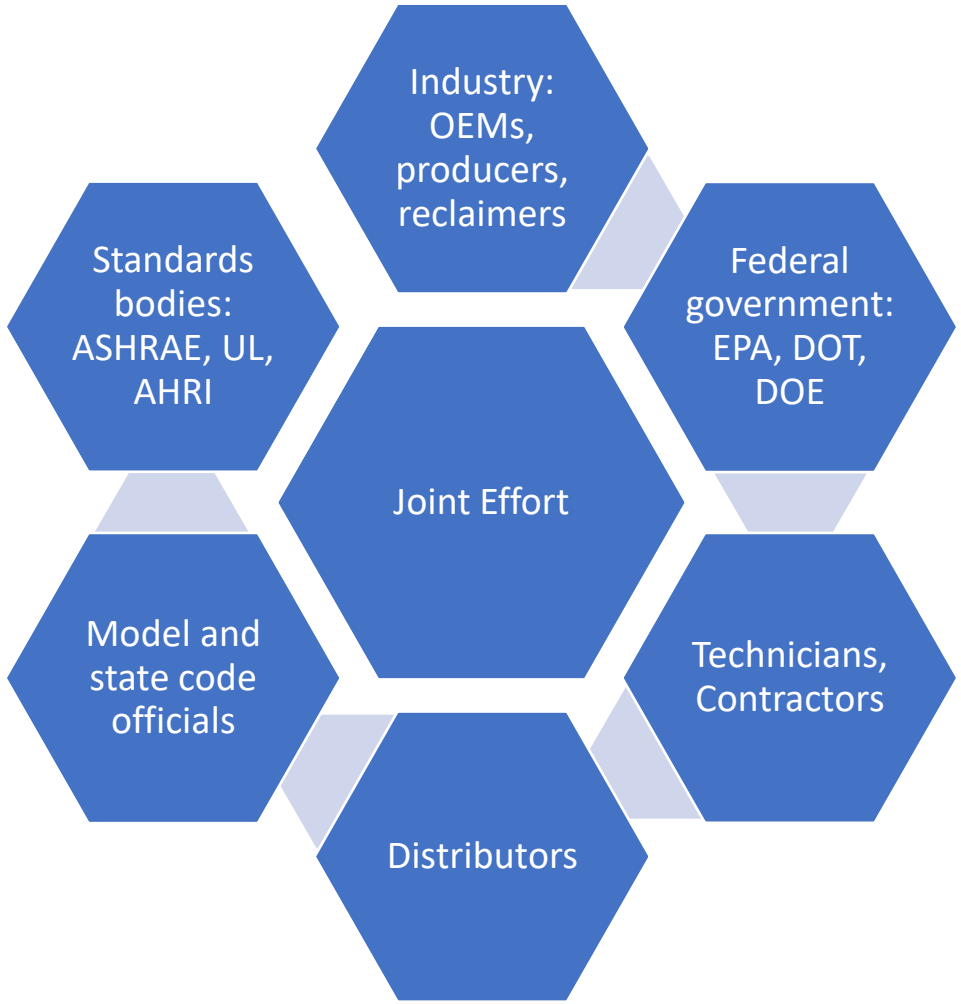
How will we do it?



- AHRI Safe Refrigerant Transition Task Force continues to work with all stakeholders to address barriers to a safe and orderly transition

- Contact Mary Koban if you are interested in participating: mkoban@ahrinet.org

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Thank-you!

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