The Regulatory Report: 2022 Changes and What You Need to Know in 2023

Helen Walter-Terrinoni
VP Regulatory Affairs
February 7, 2023
The Climate Alliance States and the Biden Administration’s fast-paced regulatory agenda are prioritizing issues critical to the heating, ventilation, air conditioning, refrigeration (HVAC-R), and water heating industry.

- Implementing the American Innovation and Manufacturing (AIM) Act
- Decarbonization
- Energy efficiency
- Chemicals in equipment components or “Articles”
Refrigerant Transition

Hydrofluorocarbon (HFC) Supply Phase-down
Technology Transitions (TT)
Refrigerant Management
Hydrofluorocarbon (HFC) Uses
Fluorocarbon Transitions

- **Montreal Protocol**
  - Agreed in 1987

- **U.S. EPA SNAP Rules**

- **Montreal Protocol Kigali Amendment**
  - Agreed in 2016

- **States regulate HFCs**
  - 2017 to 2021

- **The AIM Act**
  - 2020

*SNAP rules 20 & 21 were remanded back to EPA by DC Circuit Court (2017/2018)
American Innovation and Manufacturing Act of 2020

- Framework rules
  - Refrigerant management including recovery and reclaim
  - Acceleration after 2024, if quota is not used
  - Allows for exports to countries that don't produce HFCs that are adhering to a similar phase-down.
HFC Phasedown

American Innovation and Manufacturing Act of 2020

2011-2013 baseline:
• 2022: 10% reduction
• 2024: 40% reduction
• 2029: 70% reduction
• 2034: 80% reduction
• 2036: 85% reduction

• Mandates phase-down of HFC supply
  • Environmental Protection Agency (EPA) regulation Oct 1, 2021

• Authorizes sector transitions

• Refrigerant management, including recovery and reclaim
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
Balancing Supply and Demand

Where is the additional 25% going to come from?

2024: SNAP Rules ~15% Reduction + Step 1 Petitions

2024: Allocation 40% Reduction
European Union (F-gas) Regulations

End-users were not ready

Montreal Protocol Amendment Europe Impact CO2eq

EU had a similar phase-down step 2018

37.5% 2018

nA5 ex Belarus, Russian Federation, Kazakhstan, Tajikistan, Uzbekistan

Federation, Kazakhstan, Tajikistan, Uzbekistan
The Phase Down Could Be Chaotic

Phase down = Reduced Supply
Economics → Scarcity & Increased Prices

- The Cooling Post 2020
European Impact: Retailers and OEMs

- The Cooling Post 2020
AIM Act Technology Transitions
### Refrigeration Equipment (Proposed Compliance Date 1/1/25)

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>GWP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Process Refrigeration</td>
<td>Systems with refrigerant charge capacities of 200 pounds or greater</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>Systems with refrigerant charge capacities less than 200 pounds</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>High temperature side of cascade systems</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>Chillers</td>
<td>700</td>
</tr>
<tr>
<td>Retail Food Refrigeration</td>
<td>Stand-alone units</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>Refrigerated food processing and dispensing equipment</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>Supermarket systems with refrigerant charge capacities of 200 pounds or greater</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>Supermarket systems with refrigerant charge capacities less than 200 pounds charge</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>Supermarket systems, high temperature side of cascade system</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>Remote condensing units with refrigerant charge capacities of 200 pounds or greater</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>Remote condensing units with refrigerant charge capacities less than 200 pounds</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>Remote condensing units, high temperature side of cascade system</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>Vending machines</td>
<td>150</td>
</tr>
<tr>
<td>Cold Storage Warehouse</td>
<td>Systems with refrigerant charge capacities of 200 pounds or greater</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>Systems with refrigerant charge capacities less than 200 pounds</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>High temperature side of cascade system</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>Ice rinks</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>Automatic commercial ice machines – self contained with refrigerant charge capacities of 500 grams or lower (Note: Does not align with petition)</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>Transport refrigeration – intermodal containers</td>
<td>700</td>
</tr>
<tr>
<td></td>
<td>Residential refrigeration</td>
<td>150</td>
</tr>
</tbody>
</table>
### Foam Blowing Agents (Proposed Compliance Date 1/1/25)

<table>
<thead>
<tr>
<th>Material</th>
<th>GWP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polystyrene – extruded boardstock and billet</td>
<td>150</td>
</tr>
<tr>
<td>Phenolic insulation board and bunstock</td>
<td>150</td>
</tr>
<tr>
<td>Rigid polyurethane – slabstock and other</td>
<td>150</td>
</tr>
<tr>
<td>Rigid polyurethane – appliance foam</td>
<td>150</td>
</tr>
<tr>
<td>Rigid polyurethane – commercial refrigeration and sandwich panels</td>
<td>150</td>
</tr>
<tr>
<td>Rigid polyurethane – marine flotation foam*</td>
<td>150</td>
</tr>
<tr>
<td>Rigid polyurethane – low pressure, two component spray foam</td>
<td>150</td>
</tr>
<tr>
<td>Rigid polyurethane – one-component foam sealants</td>
<td>150</td>
</tr>
<tr>
<td>Flexible polyurethane</td>
<td>0</td>
</tr>
<tr>
<td>Integral skin polyurethane</td>
<td>0</td>
</tr>
<tr>
<td>Polystyrene – extruded sheet</td>
<td>0</td>
</tr>
<tr>
<td>Polyolefin</td>
<td>0</td>
</tr>
<tr>
<td>Rigid polyurethane and polyisocyanurate laminated boardstock</td>
<td>0</td>
</tr>
</tbody>
</table>

### Comfort Cooling

<table>
<thead>
<tr>
<th>Category</th>
<th>GWP</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chillers – comfort cooling</td>
<td>700</td>
<td>1/1/2025</td>
</tr>
<tr>
<td>Residential and light commercial air conditioning and heat pump systems</td>
<td>700</td>
<td>1/1/2025</td>
</tr>
<tr>
<td>Residential dehumidifiers</td>
<td>700</td>
<td>1/1/2025</td>
</tr>
<tr>
<td>Residential and light commercial air conditioning – variable refrigerant flow systems</td>
<td>700</td>
<td>1/1/2026</td>
</tr>
</tbody>
</table>

EPA AIM Act TT
Comfort Cooling and Foams:

**PROPOSED**
Note: Slight change to GWP limits compared to AHRI petitions
<table>
<thead>
<tr>
<th>Refrigeration Refrigerant Bans (Proposed Compliance 1/1/25)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Automatic commercial ice machines – self-contained with</strong></td>
</tr>
<tr>
<td><strong>refrigerant charge capacities more than 500 grams</strong></td>
</tr>
<tr>
<td><strong>Automatic commercial ice machines – remote</strong></td>
</tr>
<tr>
<td><strong>Transport refrigeration – road systems</strong></td>
</tr>
<tr>
<td><strong>Transport refrigeration – marine systems</strong></td>
</tr>
</tbody>
</table>
Vending Machines, Automatic Commercial Ice Machine (ACIM), Units

- Flammable refrigerant limit for equipment in public corridors and lobbies is 3x the lower flammability limit (LFL)

- Typical A2L approx. 900 g

- This limits charge size for Vending Machines/ACIM

- Commercial kitchen, open flame 20 ft restriction

- Propane 114 g (UL: 114 g propane per refrigerant loop-ask for clarification, and that EPA permit 114 g per loop as well)
New Refrigerants must be approved by EPA and standards adopted into building codes
Significant New Alternatives Policy (SNAP) Program Rule 25

On July 28, 2022, EPA published the proposed rule listing refrigerants for chillers and dehumidifiers, acceptable subject to use conditions in the refrigeration and air conditioning sector for chillers.

Docket Number: EPA-HQ-OAR-2021-0836.

SNAP Rule 25 Fact Sheet.

EPA also proposed to update safety standards from SNAP Rule 19.
EPA Listings for Refrigerants

UL 60335-2-89 published Oct 27, 2021

EPA must review and incorporate requirements and any necessary deviations into use conditions or listing limits.

Many, many applications to process.
Standards and Building Codes Relationships

United States/Canada Refrigerant Safety Classification
- ASHRAE 34
- ASHRAE 15

United States Application Safety Standard
- UL 484
- UL 1995
- UL 60335-1
- UL 60335-2-40

ASHRAE

International Electrotechnical Commission (IEC)
- IEC 60335-1
- IEC 60335-2-24
- IEC 60335-2-40
- IEC 60335-2-89

Model Building Codes
- International Mechanical Code (IMC)
- International Residential Code (IRC)
- International Fire Code (IFC)

International Code Council (ICC)

Model Building Codes
- Uniform Mechanical Code (UMC)

International Association of Plumbing and Mechanical Officials (IAPMO)

Model Building Codes
- NFPA 1 Fire Code

National Fire Protection Association (NFPA)

Some are national adoptions of international standards (sometimes with national differences)

Building Codes
- State
  - Local
  - Municipal

International Product Safety Standards

United States Product Safety Standards

AHRI - we make life better*
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
Refrigerant Management: How do we look at it differently?
Refrigerant Charge

• More energy efficient equipment can require the use of larger charge sizes of refrigerant
• Heat pumps can require larger charges of heat transfer fluids than air conditioning alone
• Low global warming potential (GWP) refrigerants typically require smaller charges
• All of this makes balancing supply and demand more critical


Reducing Demand to Balance Supply

OEM/End-user Toolbox

• Use low-GWP refrigerants in new equipment (transition!!)
• 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!
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
Traditional Problem-Solving Tools May Help

- Methodologies that might help:
  - Fishbone diagram
  - Traditional fault tree analysis / why tree?

- Interview supply chain, especially technicians?

- Pilot solutions?
AHRI Refrigerant Recovery Survey

Individual surveys focused on your area of expertise:
- For contractors/technicians
- For distributors
- For reclaimers

Vivian Cox (vcox@ahrinet.org), or me (hwalter-terrinoni@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

✓ 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.
✓ ¾ 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
✓ National model code updates
We have more work to do

• Increasing refrigerant recovery and reclaim use.
• EPA listing for refrigeration
• Building Codes: Adoption of code changes by remaining states
• DOT and shipping of chillers, horizontal cylinders, and mid-sized systems
US Climate Alliance States

Climate Alliance is composed of 25 US States

Twelve states are moving faster than US EPA and proposing to follow SNAP 20/21 and other changes

CA and WA

CO, DE, MD MA, ME, NJ, NY, RI, VA, VT
California Air Resources Board (CARB)

**A/C - 750 GWP limit for new systems**

- **Window Units & Dehumidifiers**
  - Jan 1, 2023

- **Chillers**
  - Jan 1, 2024

- **Residential & Light Commercial systems**
  - Jan 1, 2025

- **VRF/VRV Systems**
  - Jan 1, 2026

Commercial & industrial refrigeration also have impending regulations.

*Proposed Amendments to CARB’s HFC Regulation*

New Requirements for Stationary Refrigeration and Air Conditioning

DECEMBER 10, 2020
California SB 1206 (Sen. Skinner)

• Originally prohibited a person from offering for sale or distribution bulk HFCs or bulk blends containing HFCs that exceed a 1,400 GWP limit beginning January 1, 2025, and a 750 GWP limit beginning January 1, 2030

• Requires CARB to conduct a rulemaking establishing a deadline for transitioning to ultra-low GWP refrigerants

• Amended to set limits of 2,200 GWP in 2025, 1,500 GWP in 2030, and 750 GWP in 2033
Preparing for a Low Carbon Future
2015: United Nations Framework Convention on Climate Change (UNFCCC)

Paris Climate Agreement

- Reduce greenhouse gases (GHGs) to limit global warming to < 2 °C, and try to limit the increase to 1.5 °C.
- Non-binding (no compliance obligation)
- Independent Nationally Determined Contributions (INDCs)
2021 UNFCCC Conference of the Parties (COP) 26
Glasgow Agreement
1.8°C

- Pledge to phase-down coal power
- China-U.S. agreement to “work together”
- International carbon trading deal setting rules to stop double-counting offsets (Article 6)
- Calls for an end to inefficient fossil fuel subsidies
- >100 countries agreed to slash methane emissions (including U.S.)
- Greater scrutiny of emissions
- Commitment to stronger plans next year (current plans 2.4°C)
- Support for parties struck by catastrophic climate events
- Banks committed to decarbonize assets
2022: United Nations Climate Change Conference (UNFCCC) Sharm el-Sheikh: Addressing the impacts of Climate Change

• Funding arrangements for loss and damage associated with the adverse effects of climate change
• Matters related to the least developed countries
• Agreed upon metrics, climate observation program, administrative matters
Biden’s Climate Goal:
50% - 52% reduction from 2005 GHG baseline by 2030
2020 GHGs 21% less than 2005

• 100% carbon pollution-free electricity by 2035.

• Cut emissions and energy costs for families by supporting efficiency upgrades and electrification in buildings.

• Reduce emissions from:
  • Transportation, industrial processes, forests and agriculture
  • Reduce non-CO2 greenhouse gases: i.e., methane, hydrofluorocarbons

• Invest in innovation.

• Enhance carbon sinks.
U.S. Department of Energy Building Technologies Office (BTO) 2021 Peer Review

Current Research Trends

- Fault Detection Assessment & Mitigation
- Advanced Sensors for Scalable Load Management System
- Modeling Demand Response for HVAC
- A3 Refrigerant Sensors
- Assessing Flexible Building Loads
- Data Analysis for Energy Reduction in Grid-Interactive Buildings

Sensors & Transactive Controls

- Low-GWP Refrigerants
- Heat Pump Technology
- Energy Storage
- Cybersecurity

- Energy Efficiency

- Max Efficiency Retrofit Furnaces
- Reducing Plug Load Electricity Footprint
- Grid Resilient, Fuel Flexible Heating Systems
- Separate Sensible and Latent Cooling
- Water-Spray-Cooled Isothermal Compression
- Compact Flooded Evaporators for Commercial Refrigeration
- Cyber Defense Systems for Grid-Interactive Efficient Buildings (Several Ongoing Projects)
- Hybrid HVAC with Thermal Energy Storage
- Heat Pump Water Heater with Embedded Energy Storage
- Phase Change Material for Building Thermal Storage (PCM Projects)
- Flammable Refrigerant Leak Event Risk Mitigation
- Low-GWP Vending Machines
- Direct Expansion Heat Pump for GWP <150
- Cold Climate Integrated HP
- Fuel Flexible HP
- Electro-Chemical Looping HP
- Wall-Embedded Multi-Functional HP
- Polymer Composite Heat Exchangers made by Low-Cost Additive Manufacturing
- High Performance Membrane Heat Exchangers for HVAC
- High Power Density Magnetocaloric and Elastocaloric Cooling Systems
- Membrane-Based Dehumidification
- Electrostatic Dehumidification
DOE Energy Efficiency Rulemakings

Recently closed or comments submitted:

1. Direct Heating Equipment (DHE): Final Determination: Amended standards unwarranted
2. Consumer Furnace Fans
3. Commercial Three-Phase CAC/HP TP
4. VRF Multi-split Systems TP NOPR
5. Electric Motors Scope and TP
6. Automatic Commercial Ice Makers TP
7. Circulator Pumps
8. Dedicated Purpose Pool Pumps TP and Scope
9. Manufactured Housing standard
10. Commercial Fans and Blowers Standards Proposal
11. Water Heaters TP
12. Single Package Vertical Air Conditioners and Single Package Vertical Heat Pumps TP
13. Miscellaneous Refrigeration Products standards (pTSD)
14. Direct Expansion-Dedicated Outdoor Air Systems (DOAS) ECS NOPR
15. Air Cleaners Standards and TP RFI
16. Commercial Warm Air Furnace Test Procedure NOPR
17. Computer Room Air Conditioner Test Procedure NOPR
18. Electric Motors ECS PTSD
19. VRF Standards NOPR
20. Computer Room Air Conditioner Energy Conservation Standards NOPR
DOE Energy Efficiency Rulemakings (cont)

Recently closed or comments submitted:
21. Consumer Boiler Test Procedure NOPR: 5/16
22. Consumer WH TSD: 5/16
24. Direct Heating Equipment TP Final Rule: Compliance 11/16 (Pub 5/20)
25. Air Cooled, Three-Phase, Small Commercial Air Conditioners and Heat Pumps With a Cooling Capacity of Less Than 65,000 Btu/h ECS NOPR: 5/31
27. ACIM ECS Preliminary TSD: 6/7
28. Commercial and Industrial Pumps TP: 6/11
30. Small Electric Motors ECS RFI: 6/20
31. WICF TP NOPR: 6/21
32. Commercial Package AC/HP TP RFI: 6/24
33. Commercial Furnace ECS NOPD: 6/27
34. Commercial Boilers ECS pTSD: 7/5
35. Furnace Fans TP NOPR: 7/12
36. Direct Heating Equipment ECS RFI: 7/22
37. Commercial Water Heaters ECS NOPR: 8/1
38. Residential WH TP SNOPR: 8/4
39. PTAC Notice of Proposed Determination: 8/23
40. Commercial Refrigeration TP NOPR: 8/29
41. Commercial Refrigeration ECS pTSD: 8/29
42. Walk-in Coolers and Freezers ECS pTSD: 8/29

Other:
• ASRAC Charter renewed (April 16, 2022)
• Commercial Boilers Final Rule Supplemental Response to Comments (April 20, 2022)
DOE Energy Efficiency Final Rules/Determination

Test Procedures:
1. DOAS Test Procedure Final Rule: Effective 8/26, all DOAS energy efficiency representations must be made by 7/24/23
2. Electric motors Test Procedure Final Rule: Effective 30 days after publication, all EM energy efficiency representations must be made within 180 days of publication. (Mfgr. may petition for additional 180 days.)
3. Circulator Pumps Test Procedure Final Rule: Effective 30 days after publication, all EM energy efficiency representations must be made within 180 days of publication. (Mfgr. may petition for additional 180 days.)

Standards:
1. Final Rule Pertaining to Standards for Manufactured Housing, Compliance 1 year after publication

Determinations:
1. Notice of Final Determination Pertaining to Air Cleaners as a Covered Consumer Product (July 15, 2022)
2. Final Determination: Miscellaneous Gas Products as a Covered Consumer Product
NRCAN Amendment 18/19

Pre-consultation process for Amendments 18 and 19 beginning

Technical bulletins have been posted – Comments were due September 15

- Central air conditioners and central heat pumps (3-phase)
- Large air conditioners and heat pumps
- Electric water heaters
- Gas-fired water heaters [with Electric water heaters]
- Oil-fired water heaters [with Electric water heaters]
California Energy Commission (CEC)

- Air Filters
- Commercial and Industrial Fans
- On March 3rd, CEC opened a docket for the 2025 rulemaking
- 22-BSTD-01: 2025 Energy Code Pre-Rulemaking
- Proposals listed here.
Electrification Policies

**Eliminating access to fossil-fuel**
- Bans on infrastructure for new developments
- Utility no longer pays for natural gas connection
- Remove fossil-fuel equipment from incentive programs

**Electric-only**
- State regulatory mandates
- EnergyStar electric-only
- City electric equipment in all buildings
- Decarbonization building codes or other code mandates

**Zero NOx policies**
- Air Quality Regulations
- Toxic Substances Control Act Petition
- Clean Air Act State Plan (SIP)
- Sierra Club petition to EPA Clean Air Act Endangerment Finding

**Phase-down of GHGs**
- New legislative authority to reach greenhouse gas targets
- Clean Heat Standard

**Energy efficiency**
- Performance Path Energy Building Codes
- Net Zero Building Energy Codes
- Furnace Energy Conservation Standard at Department of Energy

**Incentives**
- IRA
- Utilities
- States
Decarbonization Patchwork continues to develop with numerous policies
Will electrification lead to reductions in greenhouse gas emissions?

Electric Equipment + Low GHG Grid

“100% carbon pollution-free electricity by 2035.”

→ Reduced GHGs

https://www.visualcapitalist.com/how-green-state-or-province/
Climate Alliance(s)
Two Climate Alliances: One for states and one for cities

States meet weekly to share strategies

Bipartisan Coalition of 25 Governors
- 62% of the U.S. economy
- 56% of the U.S. population
- 43% of U.S. GHG emissions

States and cities are committed to advancing the goals of the Paris Agreement, reduce GHG emissions
- 26-28% below 2005 levels by 2025
- 50-52% below 2005 levels by 2034
States are moving in different directions.

There are very broad levels of activity and interest on how, and whether, to approach decarbonization

- “All-in” (~37% of installed heating)
- “It’s complicated” (~28% of installed heating)
- Bans on natural gas bans (~33% of installed heating)
- No Action (~4% of installed heating)

* Louisiana banned local bans on natural gas infrastructure and is also a member of the U.S. Climate Alliance
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**Incentives**
- IRA
- Utilities
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Affordable, reliable access to essential heating and cooling while reducing greenhouse gas emissions
How do we work with all stakeholders to address gaps?
Perfluoroalkyl and polyfluoroalkyl substances (PFAS): A Primer
EPA Screens Chemicals Based on Criteria Specified in the Toxic Substances Control Act (TSCA) Section 6(b)(1)(A)

- The hazard and exposure potential of the chemical substance;
- Persistence and bioaccumulation;
- Potentially exposed or susceptible subpopulations;
- Storage near significant sources of drinking water;
- The conditions of use or significant changes in the conditions of use of the chemical substance; and
- The volume or significant changes in the volume of the chemical substance manufactured or processed.
United States
Ensure science-based decision-making: National PFAS Testing Strategy

• Starting list of PFAS
• Dividing PFAS into categories
• Assembling existing toxicity data
• Initial test candidate identification
• Potential tests
• Phases implementation

• Prioritizing chemicals that are manufactured commercially that are lacking toxicity data that have specific structures of concern.
EPA "whole agency approach" for addressing PFAS, titled "PFAS Strategic Roadmap: EPA's Commitments to Action 2021-2024"

• Prioritize protection of disadvantaged communities
• Ensure science-based decision-making:
  • updating guidance on PFAS destruction and disposal,
  • evaluating options for addressing air emissions of PFAS,
  • and identifying opportunities to take broader actions on categories of PFAS.
• Consider the Lifecycle of PFAS account for potential contamination pathways and the impacts on drinking water, wastewater treatment plants, and farming
• Reduce PFAS discharges to waterways (Get upstream) and gather new data on the prevalence, use, and effects of additional PFAS chemicals.
• Hold Polluters Accountable for legacy and ongoing contamination by advancing efforts to designate PFAS as hazardous substances
• Other Agencies and Department have developed goals related to PFAS
Reduce PFAS discharges to waterways: Reporting Requirements

• U.S. EPA is considering requiring reporting of PFAS, excluding refrigerants and TFA, retroactively from 2011.
  • Requires manufacturers and importers to document, report, and retain records of PFAS manufacturing and import in any year since January 1, 2011.
  • Does not exclude chemicals in “articles” or components and parts, such as articles containing PFAS as part of surface coatings.
  • Currently accepting comments on re-evaluation of cost analysis

TSCA Section 8(a)(7) Reporting and Recordkeeping Requirements for Perfluoroalkyl and Polyfluoroalkyl Substances Notice of Proposed Rulemaking (NOPR)
Hold Polluters Accountable: Proposed Designation of PFOA and PFOS as CERCLA Hazardous Substances

• Designate PFOA and PFOS, including their salts and structural isomers, as hazardous substances under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or Superfund.

• Increase transparency around releases of these harmful chemicals and help to hold polluters accountable for cleaning up their contamination.

• Immediately report releases of PFOA and PFOS that meet or exceed the reportable quantity to the National Response Center and local responders.
  • Entities would not be required to report past releases of PFOA or PFOS as they were not yet listed as hazardous substances.
Definitions
Article

- Article “means a manufactured item (1) which is formed to a specific shape or design during manufacture, (2) which has end use function(s) dependent in whole or in part upon its shape or design during end use, and (3) which has either no change of chemical composition during its end use or only those changes of composition which have no commercial purpose separate from that of the article, and that result from a chemical reaction that occurs upon end use of other chemical substances, mixtures, or articles; except that fluids and particles are not considered articles regardless of shape or design.”

- Title 40, Chapter I, Subchapter R, Part 704, Subpart A, §704.3
Maine Per- and Polyfluoroalkyl Substances (PFAS) Regulations
Chemicals Policy (PFAS) - Maine

• Maine LD 1503
  • Contains definition of PFAS as "Perfluoroalkyl and polyfluoroalkyl substances" or "PFAS" means substances that include any member of the class of fluorinated organic chemicals containing at least one fully fluorinated carbon atom.
  • By January 1, 2023, the law will require any manufacturer of a product for sale in the State that contains intentionally added PFAS to provide notification, including product descriptions, purpose of the PFAS added to the product, the amount of PFAS used, and other administrative information on the product and manufacturer.
  • By January 1, 2030, the law requires that a person may not sell, offer for sale or distribute for sale in this State any product that contains intentionally added PFAS, unless the department has determined by rule that the use of PFAS in the product is a currently unavoidable use.

• Status:
  • Enacted on July 15, 2021.
Maine DEP Second Stakeholder Meeting

• DEP working to clarify reporting requirements and program implementation based on comments received
  • **Categories**: The 2\textsuperscript{nd} draft proposes Global Product Classification (GPC) brick codes for reporting, rather than the UPC codes proposed in the first draft.
  • **Fees**: The 2\textsuperscript{nd} draft proposes fees of $250 for the first 3 notifications by a company and $50 for each notification thereafter.
  • **Currently Unavoidable Use**: The 2\textsuperscript{nd} draft includes definitions adding clarity to how DEP will consider currently unavoidable uses.
  • **Carpet Definition**: The second concept draft clarifies which products are prohibited from sale in 2023 as carpet or rugs. Program email address: PFASProducts@maine.gov
International
European Evaluation

- Five European states agreed to prepare a joint restriction proposal to limit risks from a wide range of Perfluoroalkyl and polyfluoroalkyl substances (PFAS) 5/11/20
- PFAS defined as “Substances that contain at least one aliphatic -CF2- or -CF3 element”
- “Aim to restrict all PFAS in non-essential uses”
- The possible date of entry into force of this restriction is expected in 2025
- Essential use exemptions, similar to the process used in the Montreal Protocol, under consideration
- January 13, 2023, National authorities of Denmark, Germany, the Netherlands, Norway and Sweden submitted a proposal to the European Chemicals Agency (ECHA) to restrict per- and polyfluoroalkyl substances (PFAS) under Registration, Evaluation, Authorization, and Restriction of Chemicals (REACH)
European Essential Use Concept for PFAS

The Chemicals Strategy for Sustainability Towards a Toxic-Free Environment will “define criteria for essential uses to ensure that the most harmful chemicals are only allowed if their use is necessary for health, safety or is critical for the functioning of society and if there are no alternatives that are acceptable from the standpoint of environment and health.”

Schedule

• Comment period will open soon and there will be targeted interviews.
• REACH consultation ended 4/15/22
• Impact Assessment of REACH Regulation completed September 2022.
• Commission to present proposal for the REACH revision by year end.
Perfluorooctane sulfonate (PFOS) and Perfluorooctanoic acid (PFOA)

• 2017: Canadian Environmental Protection Act, 1999 (CEPA) and by Prohibition of Certain Toxic Substances Regulations
• 2018: Australian study to examine PFAS contamination and potential implications for human health
• 2019: Stockholm Convention "decided to eliminate production and use of two important toxic POPs, PFOA..." as recommended by the United Nation's Stockholm Convention's Persistent Organic Pollutants Review Committee; later adding "Perfluorohexane sulfonic acid (PFHxS), its salts, and PFHxS-related compounds"
Questions
Back-up Slides
Refrigerants and Firefighter Tactical Considerations

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.

https://training.ulfightersafety.org
Designated by firefighters for firefighters

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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.)
AHRI Refrigerant Webinar Series

- 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

- AHRI Safe Refrigerant Transition Task Force webinar series
- Safe Refrigerant Transition Task Force Newsletter

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Sector Transition Petitions Rulemaking Starts

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
Training

Snippet of content from recent monthly newsletter

- Monthly updates regarding refrigerant transition
- Registration is fee via website sign-up at https://www.magnetmail.net/actions/subscription_form.cfm?user_id=AHRI&subId=1949
- AHRI is working with two organizations to bring additional training directly to AHJs and installers.
ASHRAE 34 Refrigerant Safety Classifications

### ASHRAE 34 Classification

<table>
<thead>
<tr>
<th>Flammability</th>
<th>A3</th>
<th>B3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher Flammability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flammable</td>
<td>A2</td>
<td>B2</td>
</tr>
<tr>
<td>Lower Flammability</td>
<td>A2L</td>
<td>B2L</td>
</tr>
<tr>
<td>No Flame Propagation</td>
<td>A1</td>
<td>B1</td>
</tr>
</tbody>
</table>

- Refrigerant transition will require lower (A2L) and higher (A3) flammability refrigerants to comply with regulations
- Lower flammability or A2L refrigerants are characterized as having a low flame speed (BV < 10 cm/sec) and lower heat of combustion (HOC)
- Higher flammability refrigerants (A3) include hydrocarbons such as propane and butane that have higher flame speeds and HOC

### Hazards for current and future refrigerants

- Combustion products for all fluorinated refrigerants include HF gas and HF acid after water is used
- Oxygen Deprivation is possible in tight and enclosed spaces
- Frostbite is possible due to quickly releasing liquid refrigerant
- PPE including SCBA is a necessary part of firefighting
AHRTI – 8017 A2L Potential Residential Ignition Sources

No Ignition when tested with
- cigarette insertion
- barbeque lighter
- plug & receptacle
- light switch
- hand mixer
- cordless drill
- friction spark
- hair dryer
- toaster
- hot plate insertion
- space heater insertion

Bottom Line: Open flames can be ignition sources for A2L refrigerants.

Ignition Sources
- hot wire, safety match, lighter flame insertion, leak impinging on candle
Perfluorooctane sulfonate (PFOS) and Perfluorooctanoic acid (PFOA)
Some references

https://www.epa.gov/sites/production/files/2017-12/documents/ffrofactsheet_contaminants_pfos_pfoa_11-20-17_508_0.pdf
https://www.cdc.gov/biomonitoring/PFOA_FactSheet.html
https://www.atsdr.cdc.gov/pfas/health-effects/us-population.html
Active Mitigation for Leaks that exceed set point
- De-energize equipment per 8.13.6.2
- Visual and audible alarms per 8.13.10
- Detect and exhaust per section 8.13.11
  - Mechanical ventilation
  - Electric motors shall not be in ducts; fan rotating elements shall be nonferrous or non-sparking
- Makeup air ducts required
- Exhaust inlets within one foot of lowest point for refrigerants heavier than air; one foot from ceiling if lighter than air
- Exhaust to outdoors
- Level 1 and Level 2 ventilation rates if set point based upon OEL or RCL, respectively

Routine Inspection & Leak Checking
CARB EPA Section 608 > 50 lb as function of charge

Safety / Ventilation Control Interface & Inspection

Refrigerant Detector per 8.13.9
- Detect each refrigerant designation
- Response times
- Set points less than RCL or OEL or upper limit of detector
- Automatic self-testing
- Tested during installation and annually, for set points and response times

Electrical Protection

No Flame-Producing Device or Hot Surfaces Above 1290°F
in units, rooms or ducts per 8.13.1

Chiller 1

Chiller 2

Remote Control

Refrigerant Detectors

Exhaust Fan

Chiller 1

Chiller 2

Relief Valves Vented Outdoors
And refrigerant relief on waterside

Red Pantone Service Port
EPA requirement

Revised/Increased Ventilation as function of charge
Industry Readiness

What Actions Can I Take Now?

- Establish an Accurate Inventory and Baseline
- Develop a Refrigerant Transition Roadmap
- Set and Govern Standards for Future Equipment Purchases
- Track and Monitor Leaks through Service Programs
# Proposed Industry Transition Dates

## REFRIGERATION APPLICATIONS

<table>
<thead>
<tr>
<th>Product Category (New Equipment(^1))</th>
<th>AR4 GWP Limit</th>
<th>Transition Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standalone/Self-contained Refrigeration Systems</td>
<td>SNAP Rules 20/21 Prohibitions</td>
<td>January 1, 2022</td>
</tr>
<tr>
<td>Remote Refrigeration Systems (&gt; 50 lbs. refrigerant charge)</td>
<td>1500</td>
<td>January 1, 2022</td>
</tr>
<tr>
<td>Remote Refrigeration Systems (&lt;= 50 lbs. refrigerant charge)</td>
<td>2200</td>
<td>January 1, 2022</td>
</tr>
<tr>
<td>Industrial and Processing Refrigeration (w/o chillers)</td>
<td>1500</td>
<td>January 1, 2022</td>
</tr>
<tr>
<td>ACIM (&gt; 50 lbs. refrigerant charge)</td>
<td>2200</td>
<td>January 1, 2022</td>
</tr>
<tr>
<td>Transport Refrigeration</td>
<td>2200</td>
<td>January 1, 2023</td>
</tr>
</tbody>
</table>

Exceptions: ACIM < 50lbs charge, Medical, Scientific and Research Applications
## Proposed Industry HFC Phase-down Regulations

<table>
<thead>
<tr>
<th>Chillers (designed for chilled fluid leaving temperature &gt; +35 °F)</th>
<th>AR4 GWP Limit</th>
<th>Transition Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20lbs charge (designed for chilled fluid leaving temperature &lt;=+35 °F)</td>
<td>≤2200</td>
<td>January 1, 2024</td>
</tr>
<tr>
<td>Chillers (designed for chilled fluid leaving temperature ≤+35 ° and &gt; -10 °F)</td>
<td>≤1500</td>
<td>January 1, 2024</td>
</tr>
<tr>
<td>Chillers (designed for chilled fluid leaving temperature ≤-10 ° to -50 °F)</td>
<td>≤2200</td>
<td>January 1, 2024</td>
</tr>
</tbody>
</table>

Exceptions: Chillers < -50 F, Medical, Scientific and Research Applications
EPA: Determine baseline and mandatory allocations for exemptions

- Framework regulation
  - 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
- Fire suppression in mission-critical military end uses

*States may need to take action regarding preemption provision for products included in SNAP Rules 20 and 21

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