

# US Refrigerants Outlook

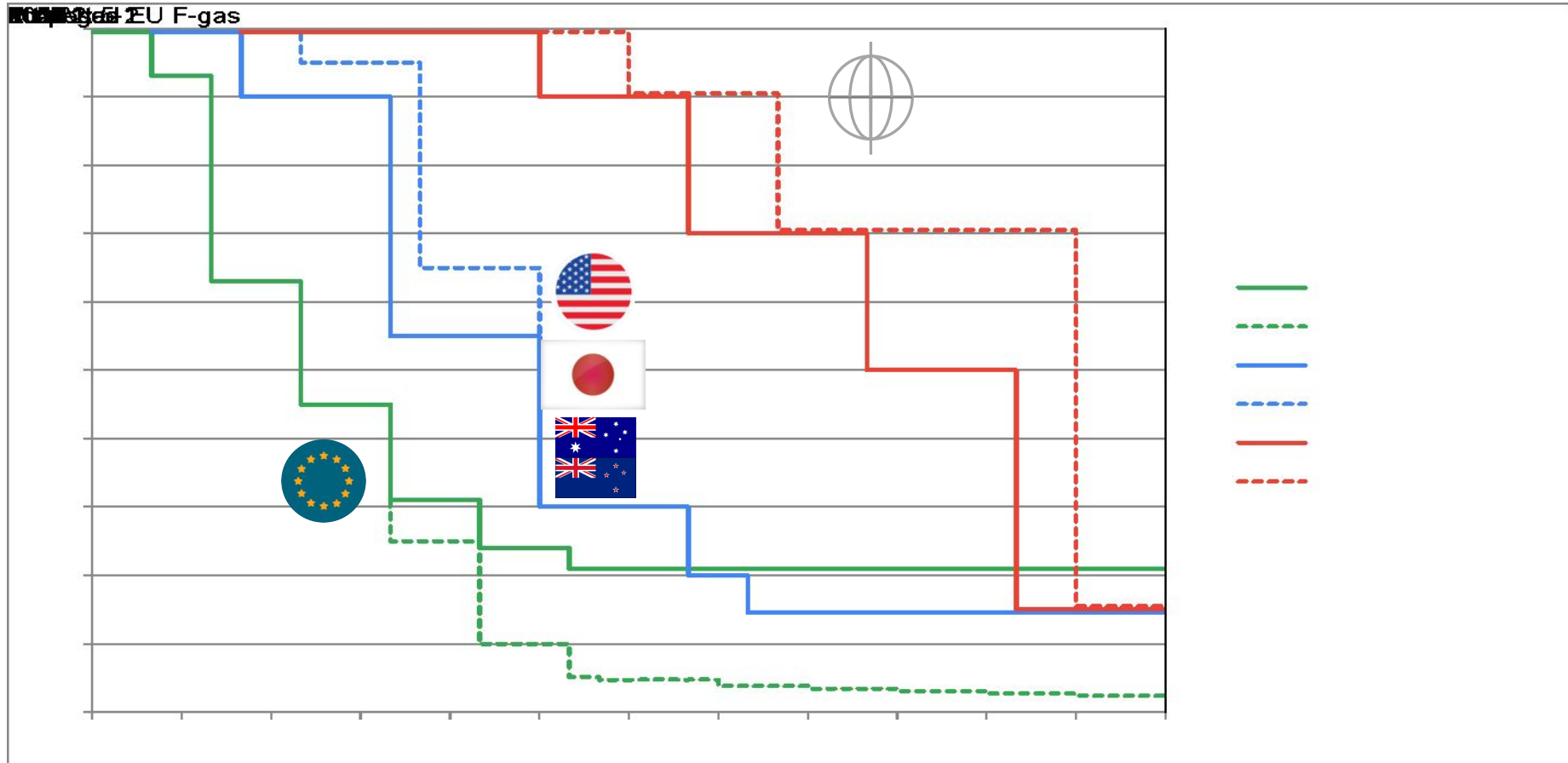
December 2022

**AIM ACT**  
**EPA SNAP**  
**UL 60335-2-89**  
**ASHRAE 15**  
**Building Codes**  
**PFAS**

**embraco**  
**Nidec**

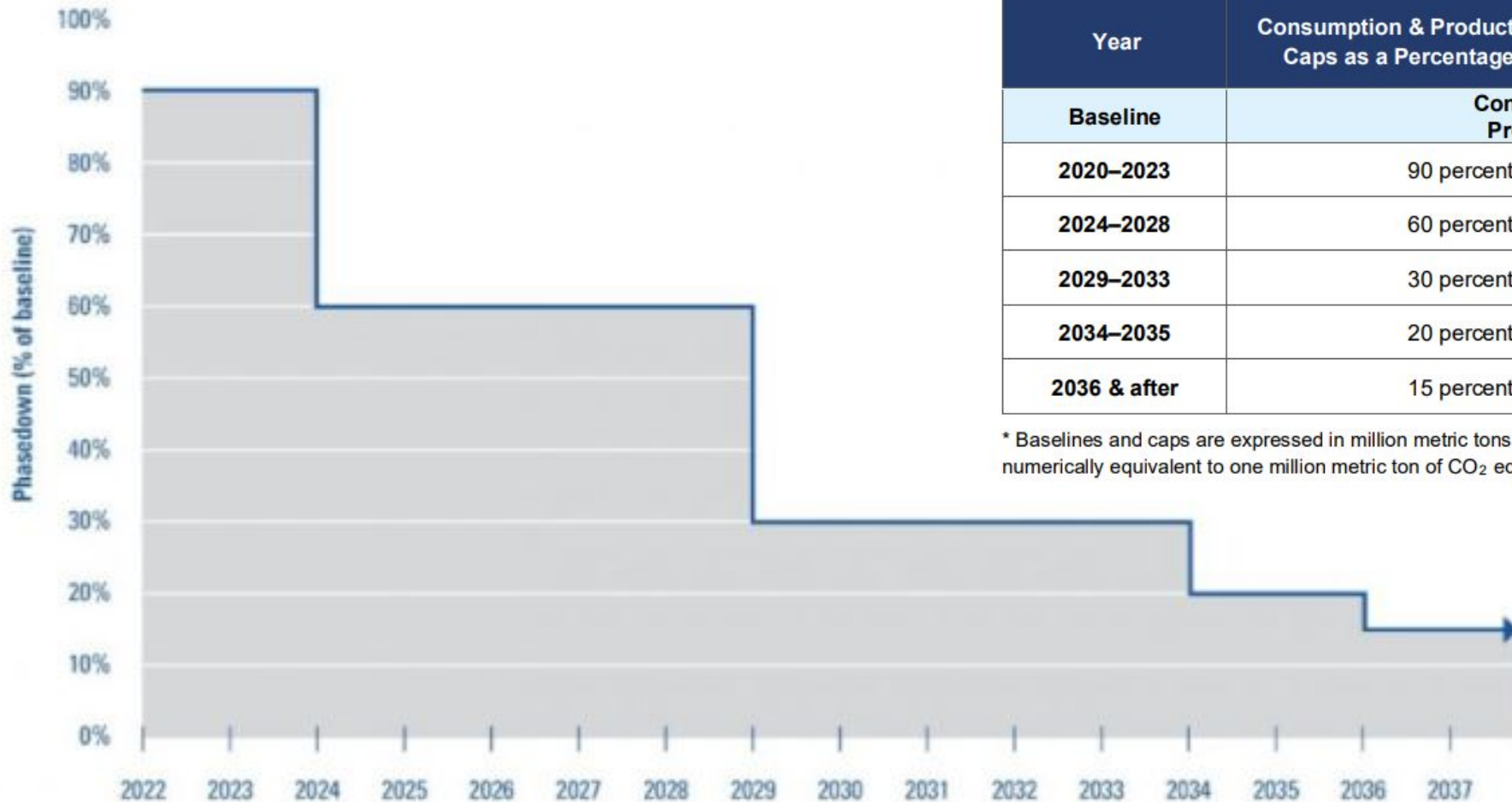
# F-GAS Phase Down Steps – Kigali Amendment

% CO2 eqv emissions for refrigerants placed on the market vs 2015 baseline



139\* Countries Ratified Kigali Agreement , EU is Leading In F-Gas Regulations

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



**HFC Phasedown Schedule and Consumption & Production Allowance Caps**

Year	Consumption & Production Allowance Caps as a Percentage of Baseline	Estimated Consumption and Production Allowance Caps in MMTEVe*
<b>Baseline</b>		<b>Consumption: 303.89 MMTEVe Production: 382.55 MMTEVe</b>
<b>2020–2023</b>	90 percent	Consumption: 273.5 Production: 344.3
<b>2024–2028</b>	60 percent	Consumption: 182.3 Production: 229.5
<b>2029–2033</b>	30 percent	Consumption: 91.2 Production: 114.8
<b>2034–2035</b>	20 percent	Consumption: 60.8 Production: 76.5
<b>2036 &amp; after</b>	15 percent	Consumption: 45.6 Production: 57.4

\* Baselines and caps are expressed in million metric tons of exchange value equivalent (MMTEVe), which is numerically equivalent to one million metric ton of CO<sub>2</sub> equivalent (MMTCO<sub>2</sub>e).

# Timeline



BSR/ASHRAE Addendum I to ANSI/ASHRAE Standard 15-2019  
First Public Review Draft  
**Proposed Addendum I to Standard 15-2019, Safety Standard for Refrigeration Systems**  
First Publication Public Review (October 2021)  
(Draft shows Proposed Changes to Current Standard)



National Building Code



**Dec 27th, 2020**

AIM Act  
EPA has authority to regulate HFC's

**Sep 23rd, 2021**

EPA Rule Allowance Allocation and Trading Program

**Oct 27th, 2021**

UL publishes the new standard  
UL 60335-2-89

**August 2022**

new Addendum I incorporated into ASHRAE 15

**July 2023 (?)**

SNAP list update

**2024 (?)**

State building code adoption of the higher charge limits.

# Refrigerants scenario: A3 - A2L charge increase & HFC phasedown



The new UL 60335-2-89 (2nd Ed) standard raises the charge limit in commercial plug-in  
It will also include dispensing units

EPA would need to follow suit in its SNAP (Significant New Alternatives Program) before the new limits could be implemented in the U.S.

Timing: SNAP approval expected in July 2023



On September 23, 2021, EPA issued a final rule “*Phasedown of Hydrofluorocarbons: Establishing the Allowance Allocation and Trading Program under the American Innovation and Manufacturing (AIM) Act.*”  
The AIM Act directs EPA to phase down **production** and **consumption** of HFCs to 15% of their baseline levels in a stepwise manner by 2036 through an allowance allocation and trading program.



ASHRAE SSPC15 committee has approved the proposal to incorporate the new UL standard in ASHRAE 15

BSR/ASHRAE Addendum I to ANSI/ASHRAE Standard 15-2019

**First Public Review Draft**  
**Proposed Addendum I to Standard 15-2019, Safety Standard for Refrigeration Systems**  
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Addendum I was published August 2022

## National Building Code



State building code adoption of the higher charge limits in plug-in cases.

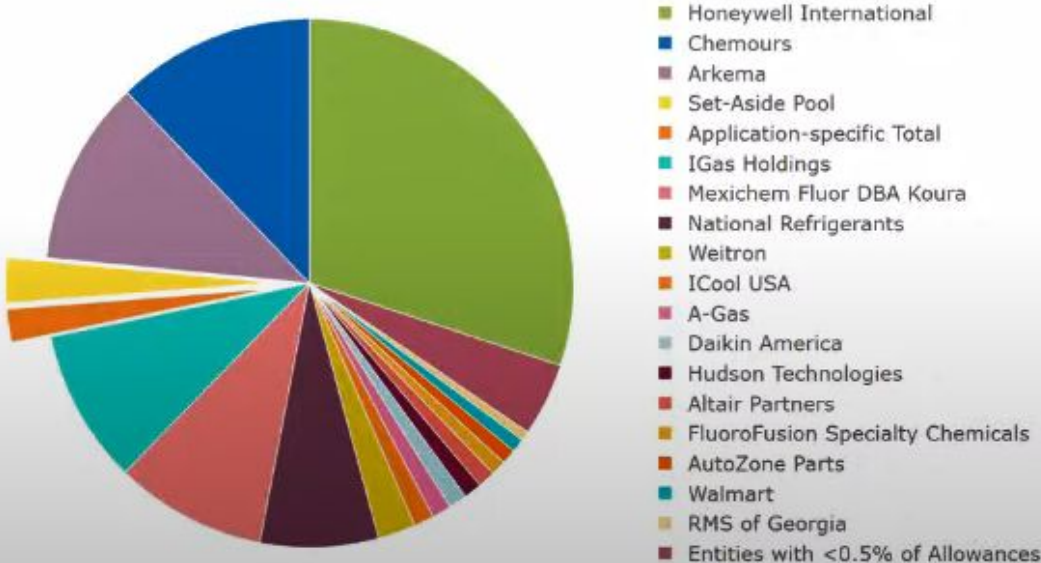
Question: should plug-in cases fall under the building code jurisdiction?

Our understanding:

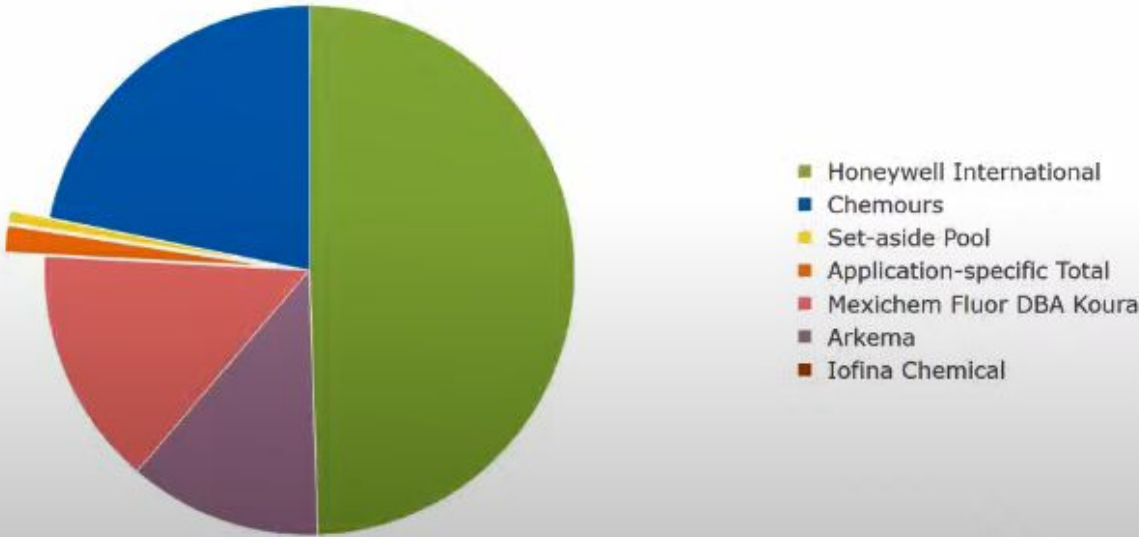
- Yes, for both new and existing buildings you cannot place the equipment with higher charge until Building Codes are updated

The building model code should be updated in 2024 (to be confirmed).

### HFC Consumption Allowances for 2022



### HFC Production Allowances for 2022



# US/Canada Product Safety Standards Status

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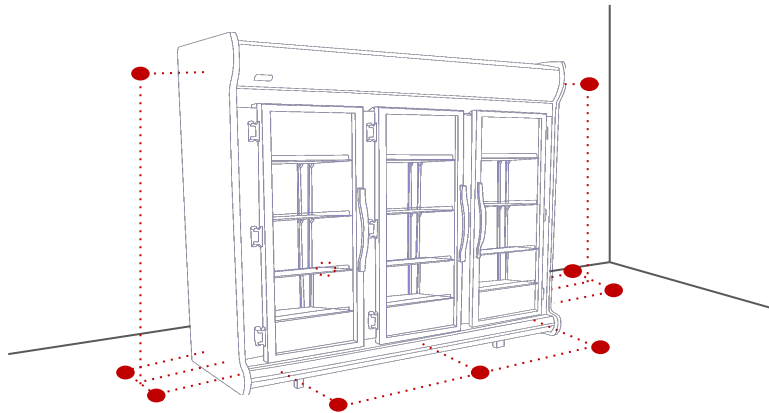
- **UL 60335-2-89** and **CSA C22.2 60335-2-89** update was prepared by **CANENA** Working Group 12
- 2<sup>nd</sup> Edition of both standards will replace:
  - UL 1995 / CAN/CSA-C22.2 No. 236 Heating and Cooling Equipment
  - CSA C22.2 No.120 Refrigeration Equipment
  - UL 471 Commercial Refrigeration and Freezers
  - UL 427 Refrigerating Units
  - UL 412 Refrigeration Unit Coolers
- **New UL -89 Standard** edition was published on **Oct,27 2021**
- **Addendum I of Ashrae 15** was published in **Aug,31 2022**
- New UL standard, to enter in force, it has to be declared acceptable by **EPA (SNAP)** and **Building Codes**.



# NEW UL 60335-2-89 CHARGE LIMIT FOR FLAMMABLES



- **Max refrigerant charge** for each circuit **13\*LFL** for open cabinets and **8\*LFL** for cabinets with doors or drawers



Refrigerant	LFL [kg/m <sup>3</sup> ]	13*LFL	8*LFL
R290 (A3)	0.038	0.494 kg	0.304 kg
R454C (A2L)	0.293	3.809 kg	2.344 kg

- >>> **Additional requirements** must be fulfilled.
- >>> Surrounding concentration test of **Annex CC** mandatory.

- **Requirements** for systems **below 150g** are **not** changing
- **Commercial Ice Makers** are now part of the standard **scope**
- **Remote Systems** with **more than 150g** of flammables are **allowed** only with **A2L** refrigerants

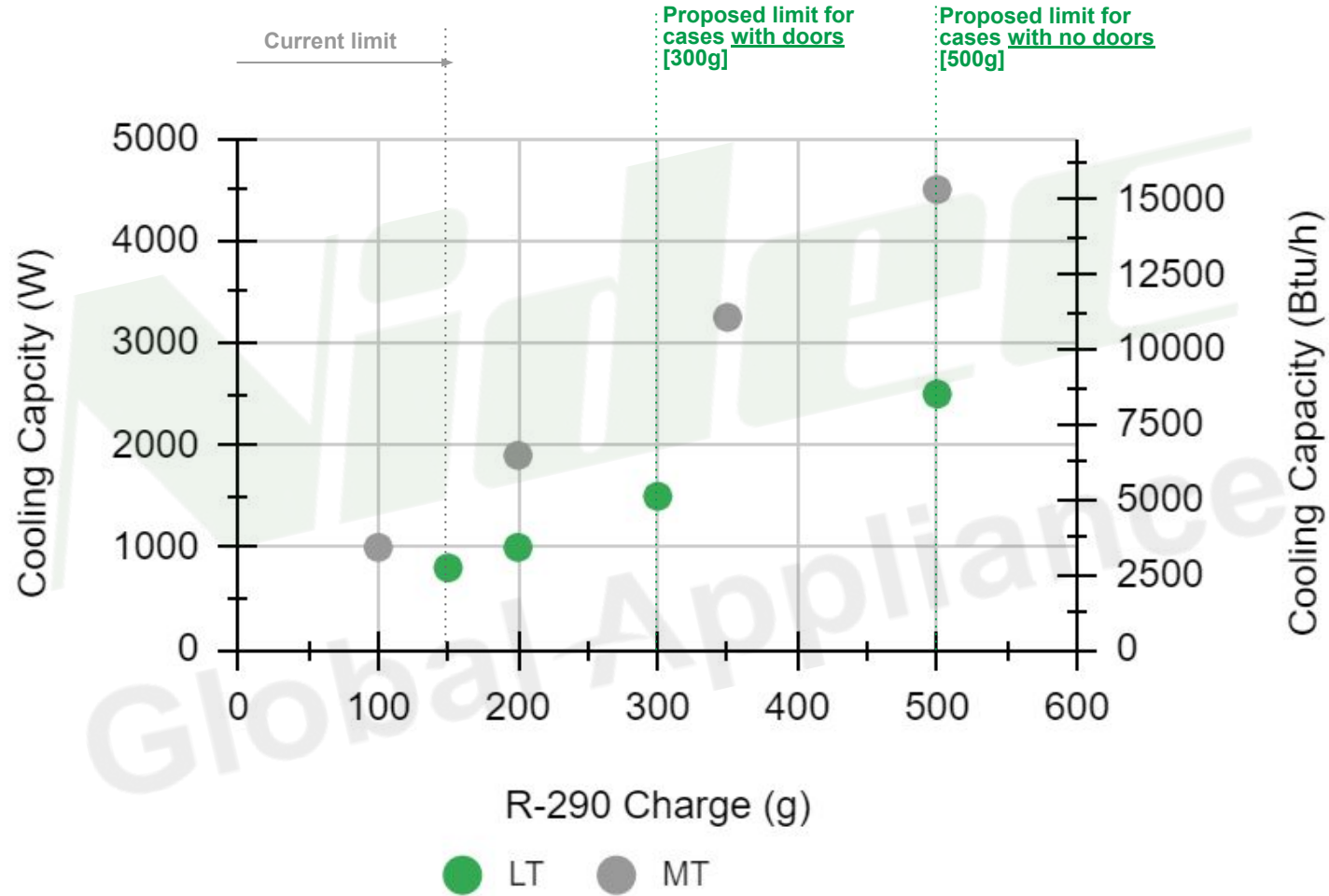


# Charge Limits For Class A2L and A3 (UL ed.2 vs IEC ed.3)



	Max Charge [IEC -89 ed.3]		Max Charge [UL -89 ed.2]			
	A2L (R454C)	A3 (R290)	open cabinets		cabinets with doors	
			A2L (R454C)	A3 (R290)	A2L (R454C)	A3 (R290)
refrigerated display and storage cabinets	1.2 kg	0.5 kg	3.8 kg	0.5 kg	2.3 kg	0.3 kg
refrigerated trolley cabinets	1.2 kg	0.5 kg			2.3 kg	0.3 kg
service counters and self-service counters	1.2 kg	0.5 kg	3.8 kg	0.5 kg	2.3 kg	0.3 kg
blast chillers and blast freezers	1.2 kg	0.5 kg			2.3 kg	0.3 kg
commercial ice-makers	1.2 kg	0.5 kg	3.8 kg	0.5 kg		
factory assembled walk in coolers/freezers		out of scope			2.3 kg	0.3 kg
split commercial refrigeration systems	0.15 kg	0.15 kg	up to 76 kg	out of scope	up to 76 kg	out of scope
partial units used in field-erected systems		out of scope	up to 76 kg	out of scope	up to 76 kg	out of scope
dispensing units		out of scope	3.8 kg	0.5 kg	2.3 kg	0.3 kg
commercial refrigeration systems up to 15000 voltage		out of scope	3.8 kg	0.5 kg	2.3 kg	0.3 kg
commercial refrigerators and freezers for use in fuel dispensing facilities	1.2 kg	0.5 kg	3.8 kg	0.5 kg	2.3 kg	0.3 kg
appliances located in public corridors and lobbies	1.2 kg	0.5 kg	0.876 kg	0.12 kg	0.876 kg	0.12 kg

# Regulatory Landscape: Refrigerants Charge Increase



Proposed limits may enable us to cover most of the potential self-contained applications with fractional Hp

# EQUIPMENTS COVERED BY UL 60335-2-89

**BOTTLE COOLERS**



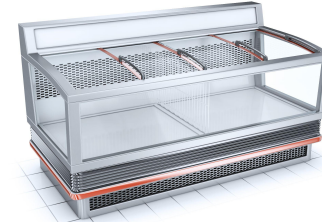
**BLAST FREEZERS**



**ICE-CREAM FREEZERS**



**GONDOLA CABINETS**



**RECH-IN CABINETS**



**ICE MAKERS**



**NEW**

**PREPARATION COUNTERS**



**SERVE-OVER CABINETS**



**MULTI-DECK CABINETS**



**GELATO COUNTERS**



**DISPLAY CABINETS**



**ICE-CREAM MARKERS**



**UL 621**

**LAB EQUIPMENT**



**UL 61010-2-011**

**WATER DISPENSER**



**UL 399**

**VENDING MACHINES**



**UL 541**

**WALK-IN COLD ROOMS**



# FLAMMABLES LIMITS IN UL STANDARDS

Product (Vertical) Standard	Product Type	In Force	R290 Limit	Withdraw	In Preparation/Released	R290 Limit
Household Refrigerators and Freezers		UL 60335-2-24:2022	150	N/A	No Change	150
Commercial Refrigerators and Freezers	Self-contained and remote	UL 471:2019	150	2022	UL 60335-2-89:2019 2nd Edition	300/500
Refrigeration Units	eg. Monoblocks	UL 427:2017	300	2022	UL 60335-2-89:2019 2nd Edition	300/500
Ice Makers		UL 563:2020	150	2024	UL 60335-2-89:2019 2nd Edition	500
Vending Machines		UL 541:2020	150	N/A	No Change	150
Refrigeration Unit Coolers		UL 412:2018	N/A	2022	UL 60335-2-89:2019 2nd Edition	A2L Only
Heating and Cooling Equipment	eg. Commercial Remote Systems	UL 1995:2015	N/A	2024	UL 60335-2-89:2019 2nd Edition	A2L Only
Ice Cream Makers		UL 621:2010	N/A	N/A	No Change	?
Drinking Water Coolers		UL 399:2020	60	N/A	UL 399:20XX	114
Electric Clothes Dryers		UL 2158: 2021	N/A	N/A	No Change	?
Electrical Heat Pumps, Air-conditioners and Dehumidifiers		UL 60335-2-40:2019	114	N/A	UL 60335-2-40:2022	114
Heating and Cooling Equipment	Field Erected AC Remote Systems	UL 1995: 2015	N/A	2024	UL 60335-2-40:2019	A2L Only
Room Air Conditioners		UL 484:2019	114	2024	UL 60335-2-40:2019	114

## ASHRAE 15 Addendum I

- **Addendum I** is incorporating requirements for commercial refrigeration applications using A3 refrigerants.

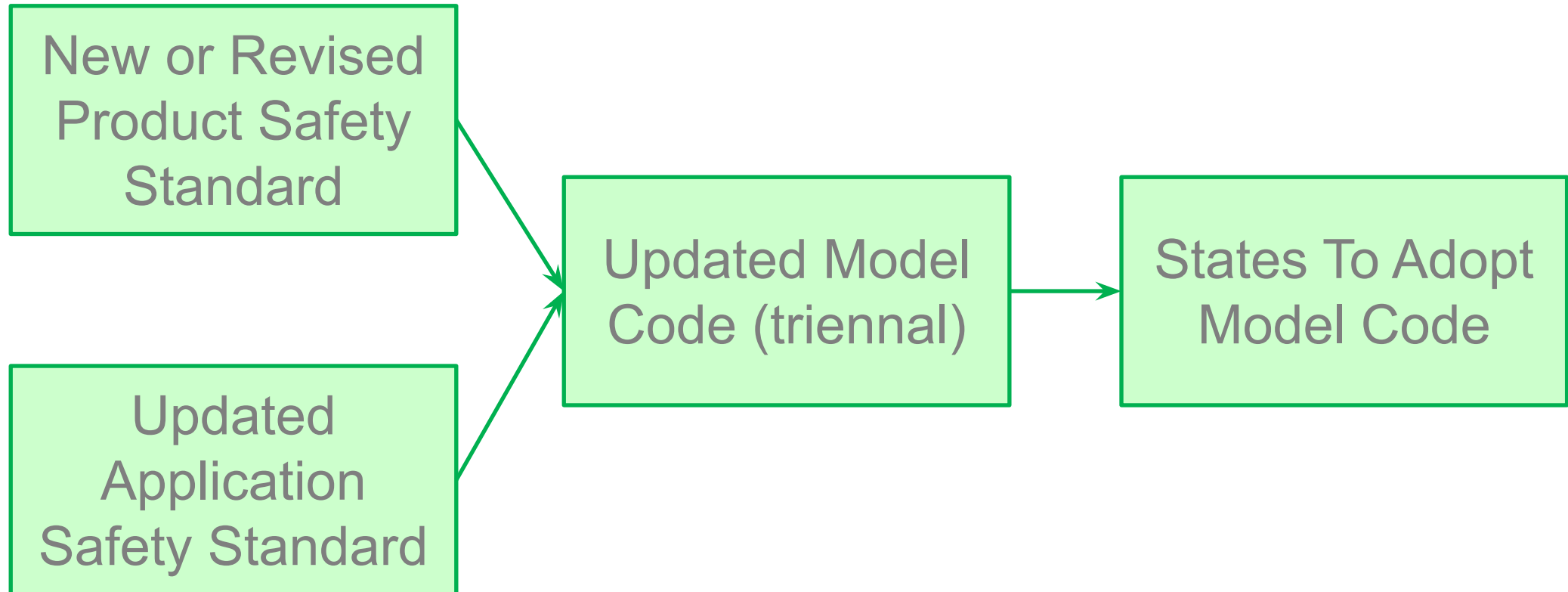
**7.5.3 Higher-Flammability Refrigerants.** Group A3 and B3 *refrigerants shall not* be used except where *approved by the AHJ.*

**Exceptions to 7.5.3:**

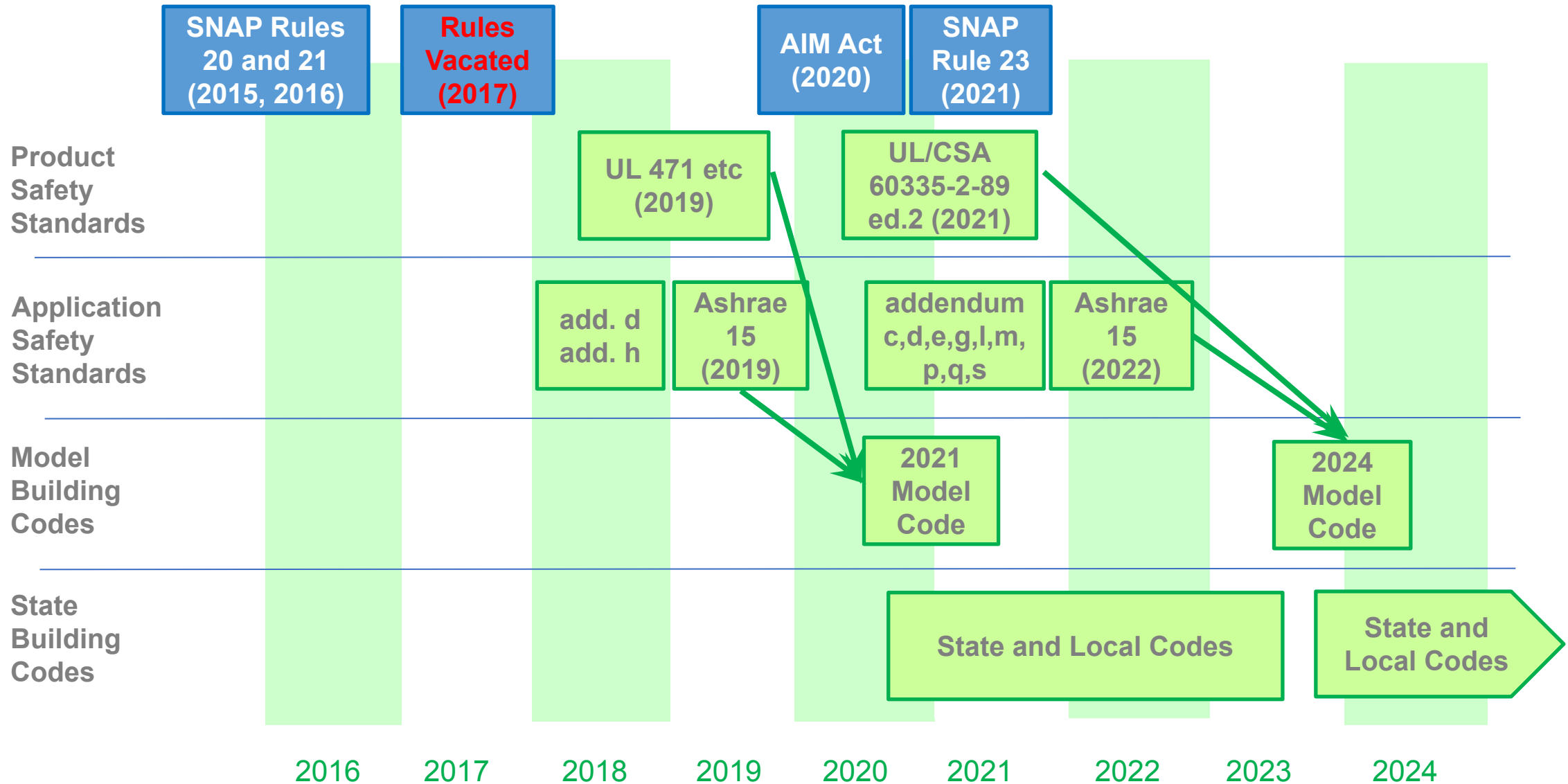
1. This restriction does not apply to laboratories with more than 100 ft<sup>2</sup> (9.3 m<sup>2</sup>) of space per person.
2. This restriction does not apply to industrial *occupancies*.
3. This restriction does not apply to *listed self-contained systems* containing no more than 0.331 lb (150 g) of Group A3 *refrigerant*, provided that the equipment is installed in accordance with the listing and the *manufacturer's* installation instructions.
4. This restriction does not apply to equipment listed to UL 60335-2-89/CSA C22.2 No. 60335-2-89 containing no more than  $0.459 \times LFL$  (lb), where *LFL* is in pounds per 1000 ft<sup>3</sup> ( $13 \times LFL$  [kg], where *LFL* is in kg/m<sup>3</sup>) of Group A3 *refrigerant*, provided that the equipment is installed in accordance with the listing and the *manufacturer's* installation instructions. Refrigeration systems containing more than  $0.141 \times LFL$  (lb) ( $4 \times LFL$  [kg]) in an *independent circuit shall not* be installed within 20 ft (6 m) of an open flame.
5. This restriction does not apply to equipment listed to UL 60335-2-40/CSA C22.2 No. 60335-2-40 containing no more than  $0.106 \times LFL$  (lb) ( $3 \times LFL$  [kg]) of Group A3 *refrigerant*, provided that the equipment is installed in accordance with the listing and the *manufacturer's* installation instructions.
6. This restriction does not apply to refrigeration systems located in *machinery rooms* or outdoors.



# The US Code Adoption Process

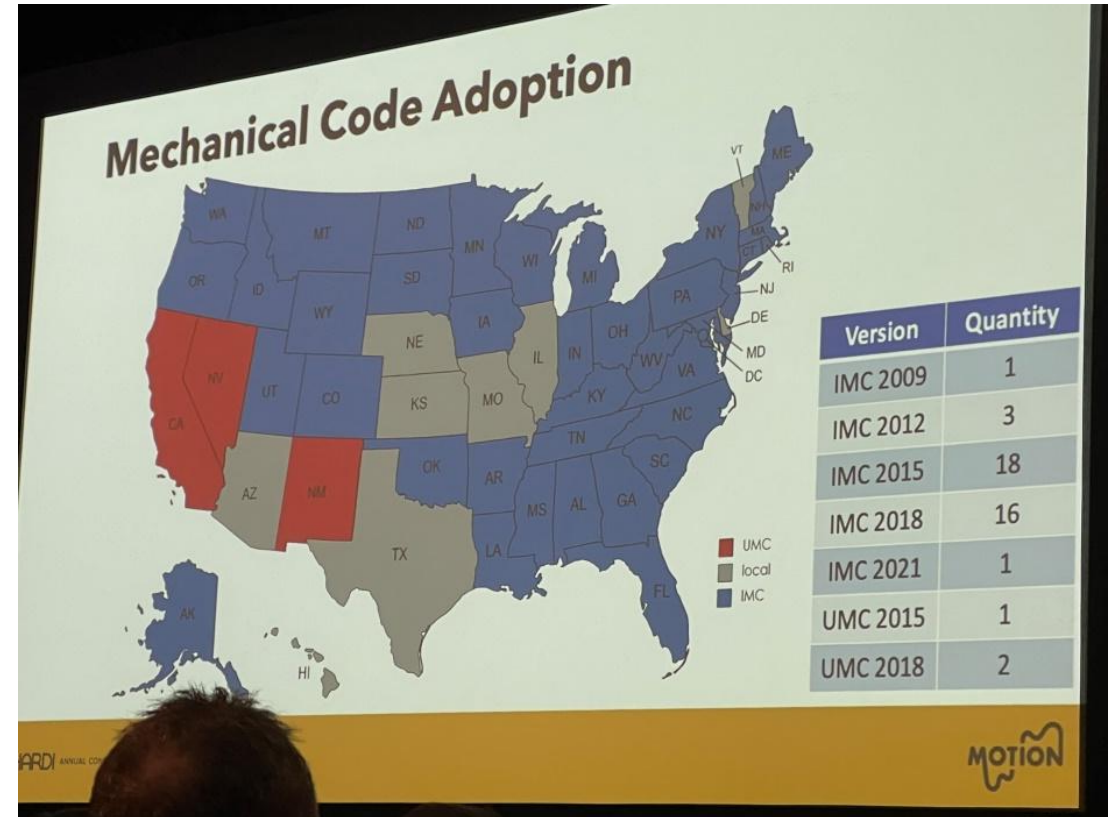
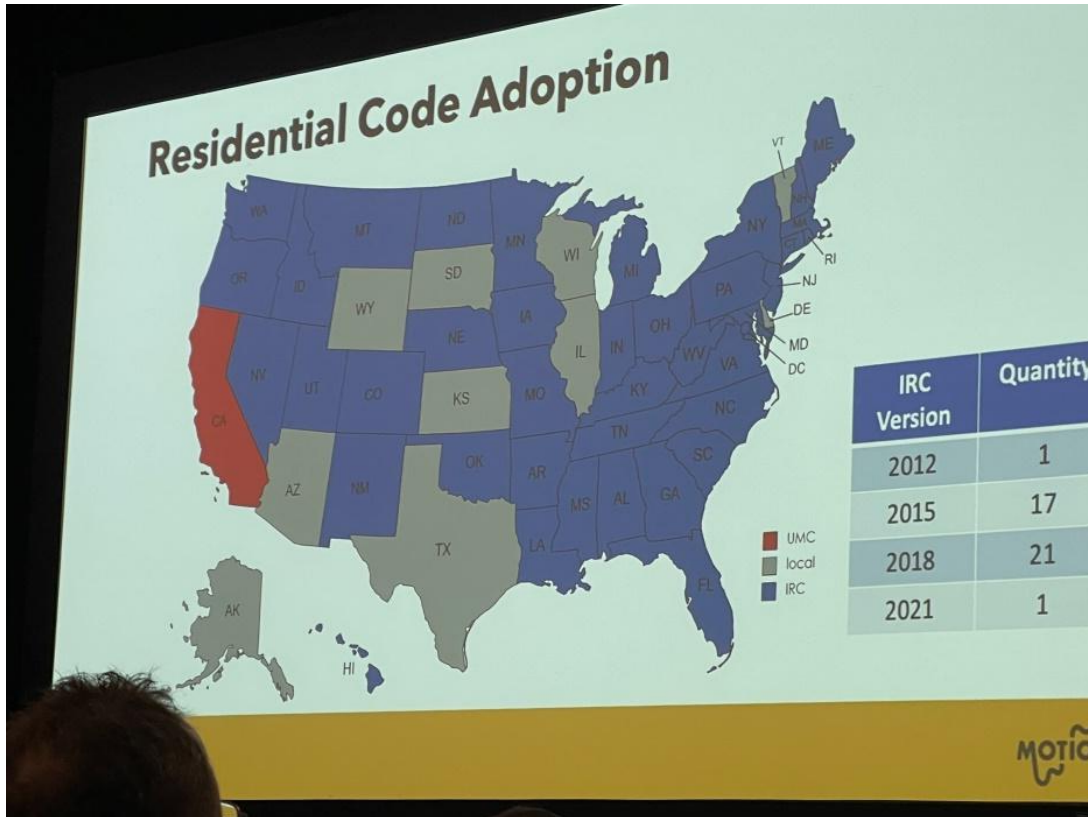


# US Standard/Code Status For Flammables (A2L, A2, A3)





# Mechanical and Residential Code Adoption

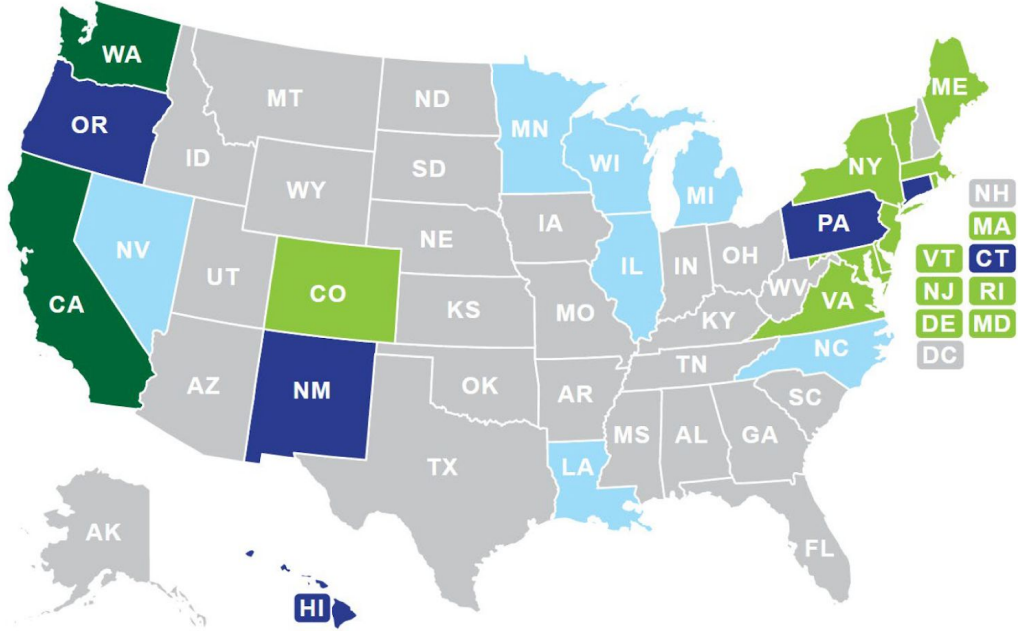


State Code Adoption Will Cover Both AC and Commercial Systems

# US Climate Alliance Actions

## Map of Regulatory Status by State

All of the colored states are part of the US Climate Alliance. See a summary of each state below.



■ SNAP + Additional GWP Limits ■ SNAP 20/21 Signed Into Law ■ SNAP 20/21 Pending ■ US Climate Alliance Member



## EU REACH DIRECTIVE UPDATE PROPOSED PFAS BAN

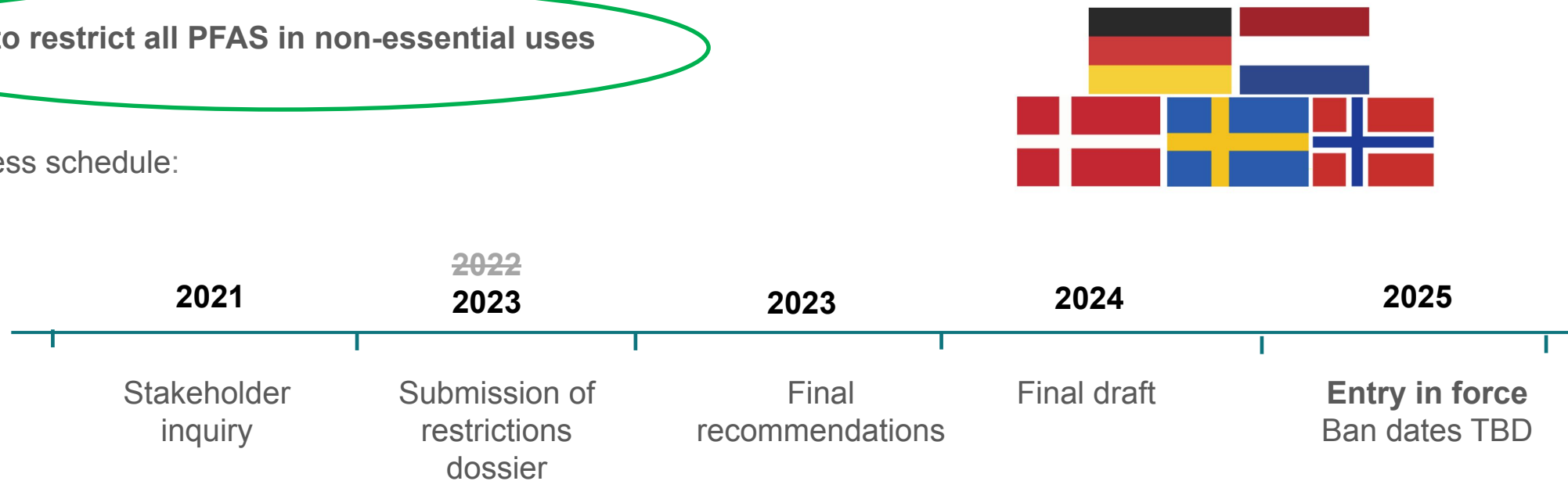
# News About EU REACH Directive

In 2020, Germany, the Netherlands, Norway, Sweden and Denmark agreed to prepare a joint **REACH** (Registration, Evaluation, Authorization and Restriction of Chemicals) proposal **restricting the use of PFAS**. PFAS—Per- and Polyfluoroalkyl substances—are a complex group of more than 5000 chemicals that have been linked to **environmental contamination and negative health effects in humans**.



**Aim to restrict all PFAS in non-essential uses**

Process schedule:



# PFAS Definition\*

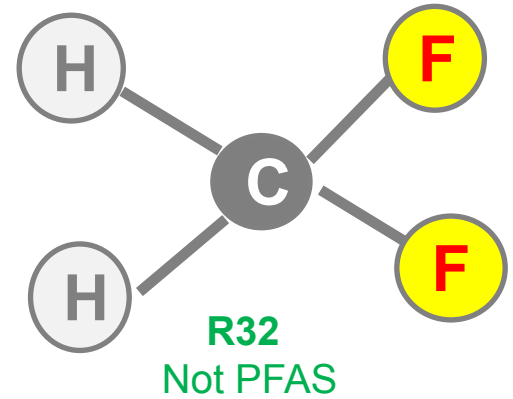
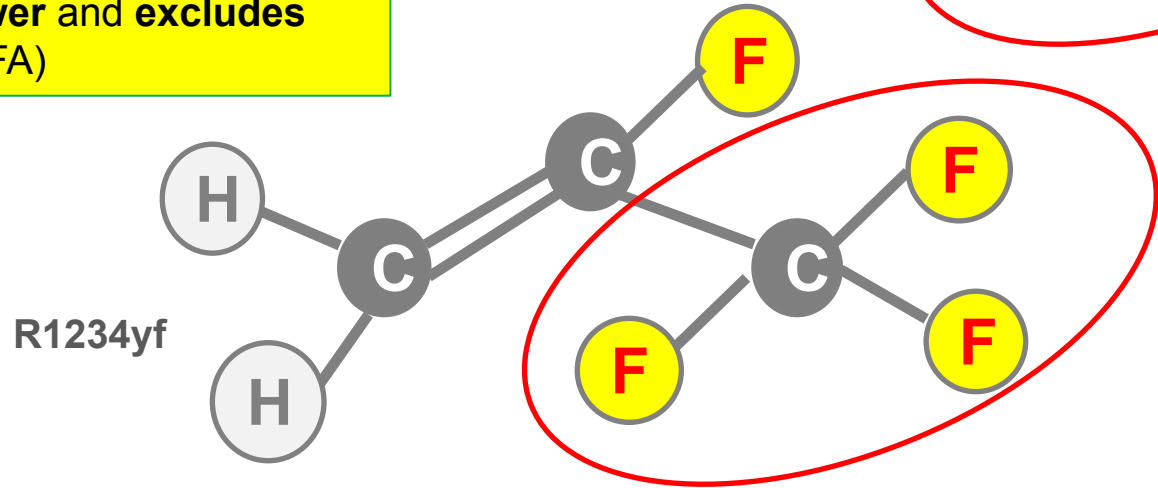
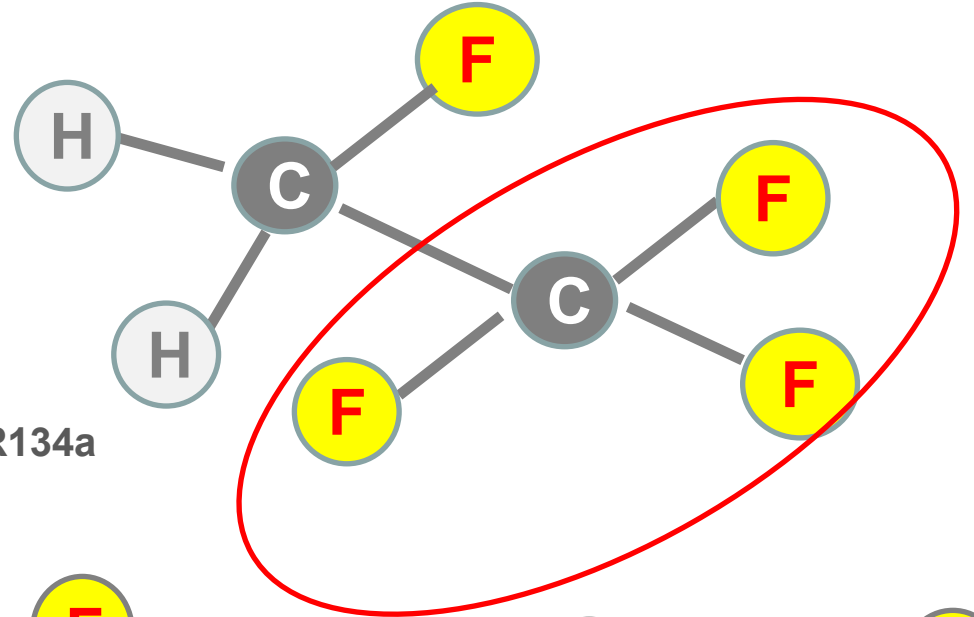
Examples:

PFAS = Per-and polyfluoroalkyl substances

All substances with at least one fully fluorinated  $-CF_2-$  or  $-CF_3$  group (without any H/Br/Cl/I-atom bound to it)

5,000 – 10,000 different PFAS

\*In US the **EPA** definition is **much narrower** and **excludes** refrigerants and trifluoroacetic acid (TFA)



**Most Of HFC Refrigerants (A1, A2L) Can Be Affected By PFAS Ban**