

An Industry Perspective on the HFC Phase Down: Where We Go From Here

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For Discussion Today

Kigali Amendment

- Status in U.S.
- Other potential avenues

U.S. State Activities

- California
- Other states

Refrigerant Research

- Latest Projects
- Future Plans

Next Steps

- Building Code Process
- Technician Training

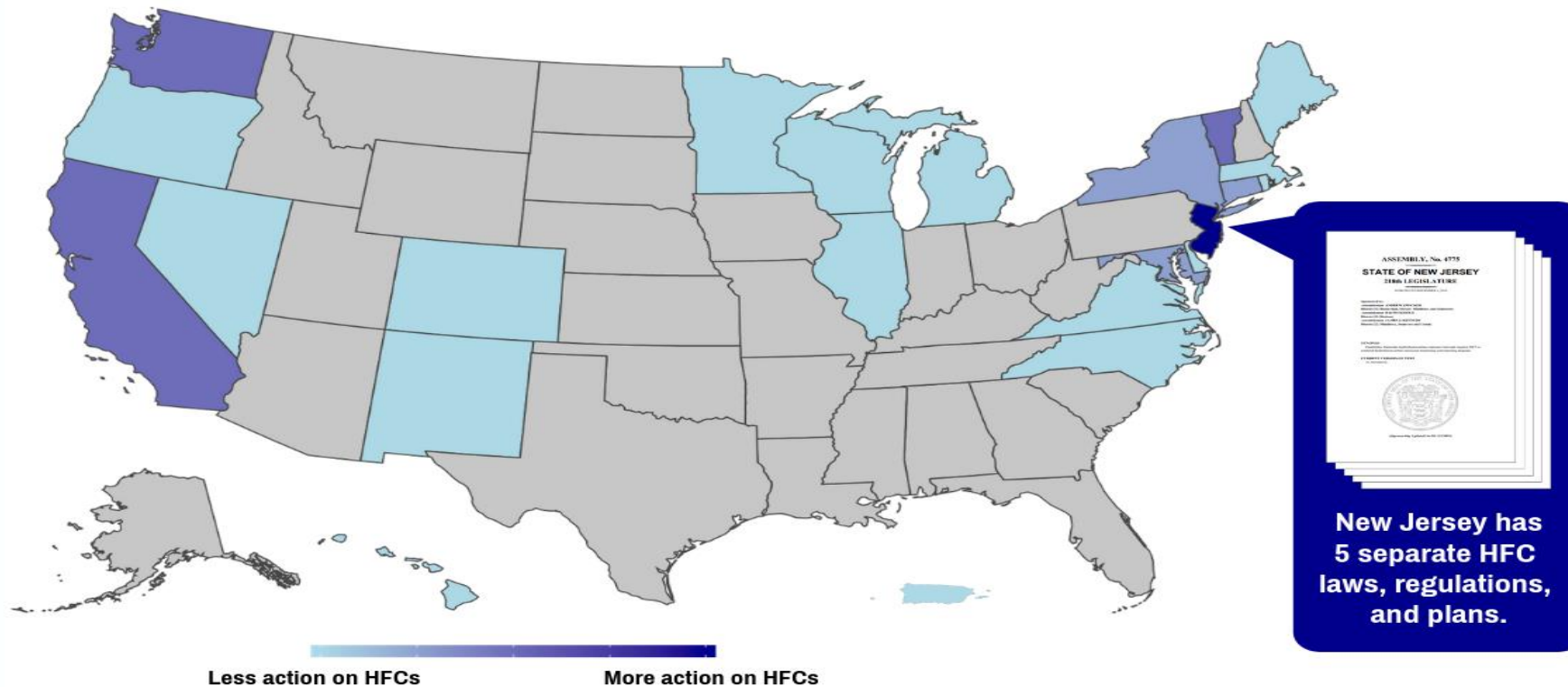
Kigali Amendment: Current U.S. Status

- Treaty is under consideration by the White House
 - AHRI and others continue to talk with White House, agency staff, and Senators about industry's support for the ratification of the amendment
- At the same time, we are exploring legislation that will implement a national phase-down without ratification
- Industry continues to move forward toward implementation, regardless of the fate of the treaty

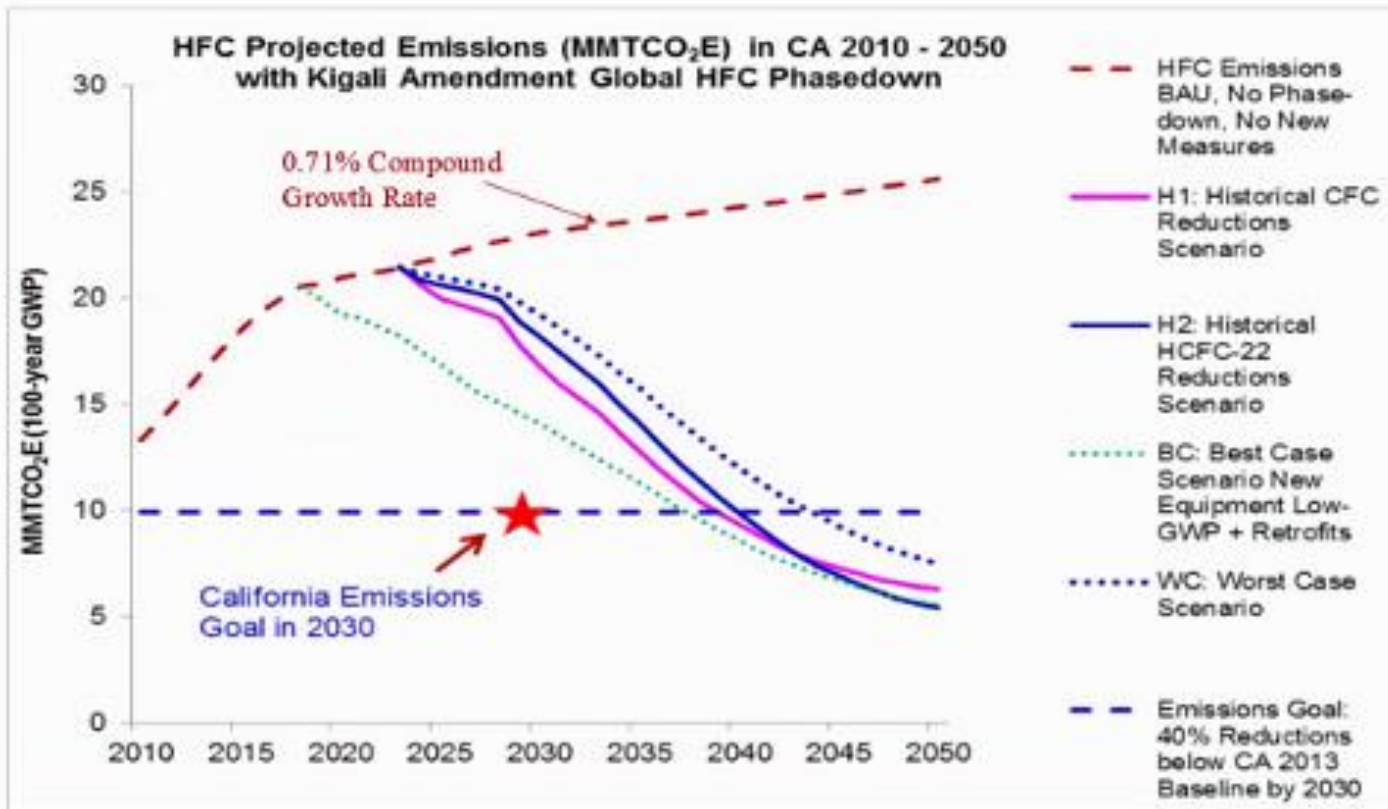
U.S. State Activities

22 states and Puerto Rico have committed to reducing emissions of Short-Lived Climate Pollutants (SLCPs) by joining the U.S. Climate Alliance.

7 of those states have proposed or enacted **13** different laws, regulations, and plans for HFCs since 2018.



California Statutory Activities



- SB 1383 statutory requirement to reduce emissions by 40% by 2030 compared to 2013
 - The rest of the world regulates based on refrigerant production and consumption rather than emissions

Bottom Line: California's goals are 5-10 years ahead of the Kigali Amendment

California Air Resources Board (CARB)



**California SNAP
(CaSNAP)**

Adopted SNAP 20 &
21, recordkeeping
and disclosure
statements

Published December
2018, effective
January 2019

Under
development

**HFC Emissions
Reduction
Measures I & II**

Rulemaking #1 –
Stationary AC

Rulemaking #2 –
Stationary
Refrigeration &
Refrigerant
Management Plan

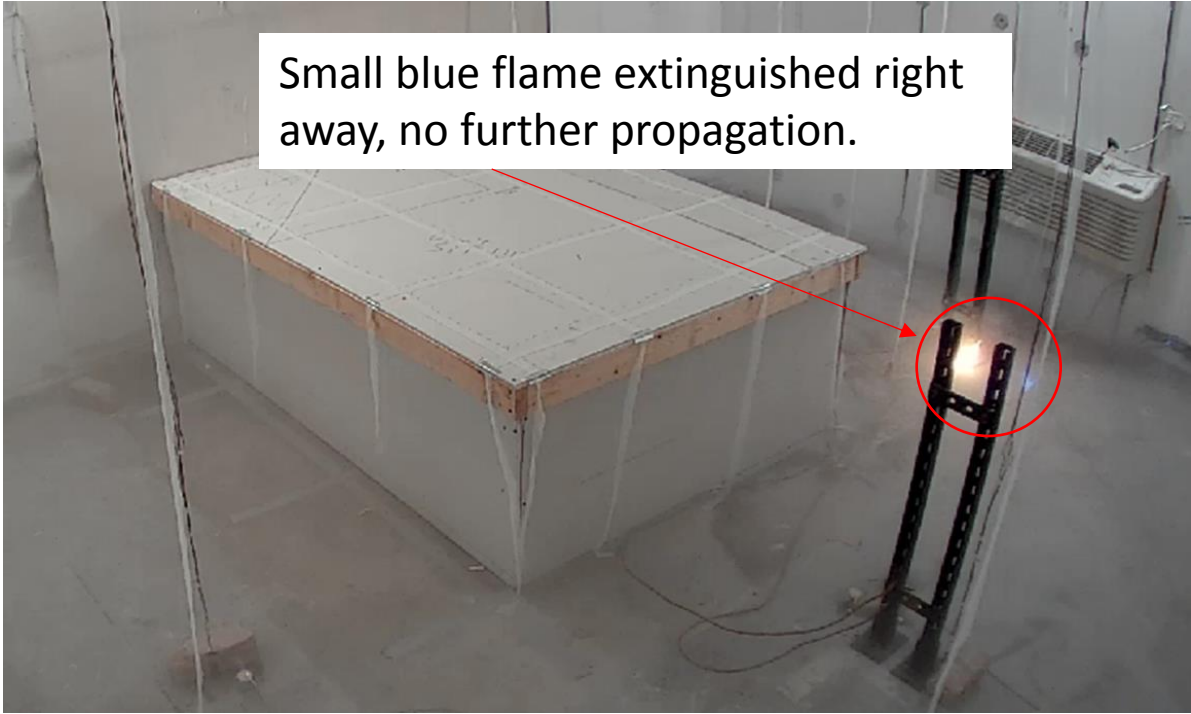
Refrigerant Research: Current Status; Future Plans

AHRTI Project 9007 Whole Room Scale Testing

- Both A2L and A3 refrigerant tests are complete
- Designed to understand the ignition event severity not probability of event

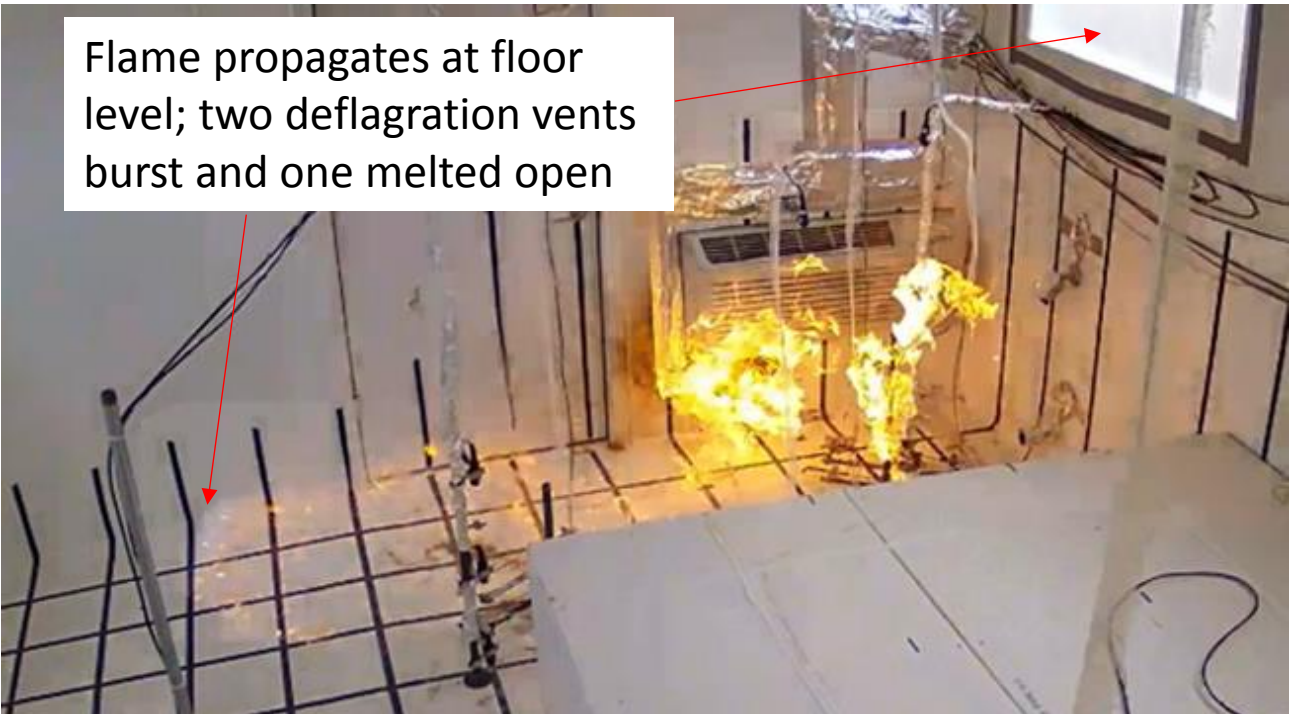
Equipment	A2Ls	A3 (R290)
PTAC	X	X
Mini-split		X
RTU	X	
Residential AC	X	
Reach-in cooler	X	X
Walk-in	X	
Service error and elec. feedthrough failure	X	

PTAC: A2L vs A3 at m1 charge per UL-60335-2-40



Small blue flame extinguished right away, no further propagation.

R452B, 1920 grams, 47.4 g/sec
No mitigation
LFL = 11.9% v/v



Flame propagates at floor level; two deflagration vents burst and one melted open

R290, 114 grams, 21 g/sec
No mitigation
LFL = 2.1% v/v

Reach-in cooler testing: R290 at 200g

- Door-opening test per IEC 60335-2-89



Start of high speed flame



27 milliseconds after start of high speed flame

The high speed flame has extended 3.5 m from the cooler in 27 milliseconds or 130 m/s.
The camera view changed due to the pressure wave impacting the camera's wall.

R-290 Test Findings and Observations

- IEC/UL 60335-2-40 (for air-conditioning equipment)
 - Raising the current m1 (114g for R290) charge limit should be carefully considered especially for floor or near floor mounted products.
 - Any potential ignition sources should be avoided underneath installed units and near the projected area at floor level.
 - Air flow requirements as a mitigation method should be carefully considered.
- IEC/UL 60335-2-89 (for refrigeration equipment)
 - The use of the door-opening test and the duration of test should include empirical validation.
 - Top-mount condensing units are less likely to produce a flammable cloud near floor level compared to bottom-mount ones

New research projects

Assess refrigerant
detector
characteristics for
use in HVACR
equipment

ASHRAE:
Combustion
byproducts risk
study

Assess the
effectiveness of
mitigation
requirements

Next Steps

Continued Challenges

Regulatory and safety
barriers on using A2L and A3
refrigerants in homes and
buildings

Continued Challenges

Available vs.
commercially
available refrigerants
and equipment

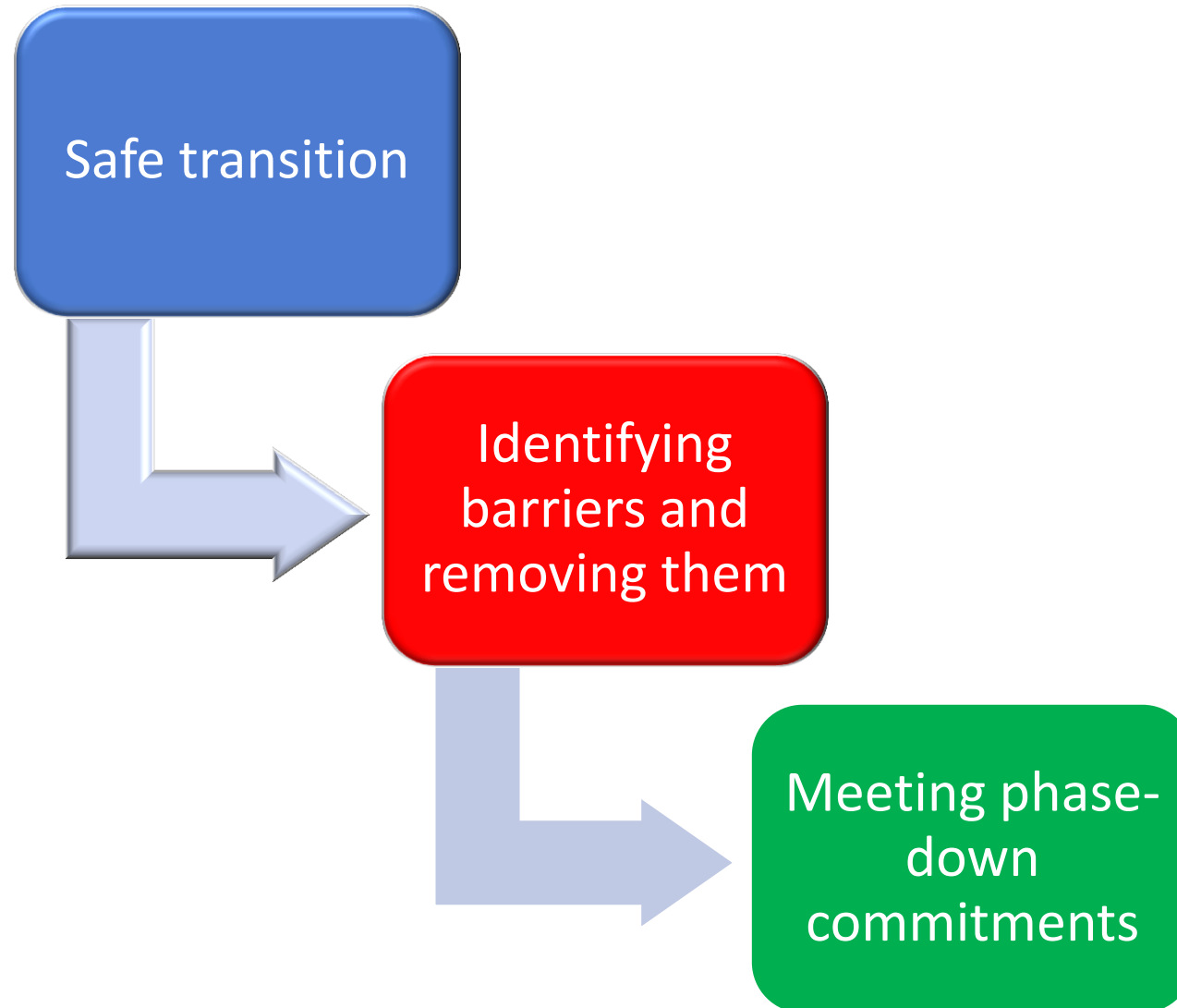
Continued Challenges

Knowledge of new technologies is non-existent for most distributors, technicians, engineers, building owners, and consumers

Status of Key Standards

- **ASHRAE-15, 2016**
 - Addendum d (published in Oct, 2018): A2Ls for human comfort
 - Addendum h (published in Oct, 2018): 2Ls for machinery room
- **UL 60335-2-40, Edition 3: Fully enable A2Ls**
 - Ballot approval of the standard passed in Feb, 2019. 160 comments need to be formally responded before the publication
 - Goal: Ready for publication on or before Sep 24, 2019
- **UL 60335-2-89, Edition 1 (published in Sep 2017): allows 150g of any flammable refrigerants**
 - Edition 2 will be based on IEC 2-89 Edition 3 which would allow ~500g R290 and 1.2kg A2Ls.
 - The IEC 2-89 Edition 3 is in its approval process. However, UL 2-89 may have its deviation and have different charge requirement.

Industry is focused on...



Education and Training

UNEP-AHRI Refrigerant Driving License

- Aims to ensure safe management of refrigerants, especially in Article 5 nations
- Creates a global network to support safe handling



