



New Rulemakings to Reduce HFC Emissions from Stationary Air-Conditioning and Refrigeration

California Air Resources Board Workshop October 24, 2018

1

Today's Agenda



- CARB Presentation
 - Background
 - Rulemaking 1: Stationary Air Conditioning
 - Rulemaking 2: Stationary Refrigeration
- Questions/Comments and Open Discussion (after each rulemaking presentation)
- During presentation, webcast viewers can submit questions/comments to: sierrarm@arb.ca.gov

2

Background



- ❖ Why regulate hydrofluorocarbons (HFCs)?
- ❖ HFC emissions – what is California already doing to reduce HFCs?
- ❖ How will CA meet the HFC emissions target – 40% reduction by 2030?



3

Why Regulate & Reduce HFC Emissions?



Not just HFCs, emissions of all greenhouse gases in California must be reduced:

- AB 32 (2006): Reduce GHG emissions to 1990 levels by 2020
- SB 32 (2016): Reduce GHG emissions 40% below 1990 levels by 2030
- Governor's Executive Order B-55-18 (2018): California must be carbon neutral - zero net GHG emissions by 2045.
- HFCs from refrigeration and AC contribute to GHG emissions
- HFCs not included in cap and trade
- SB 1383 specifically requires 40% reduction in HFC emissions

4



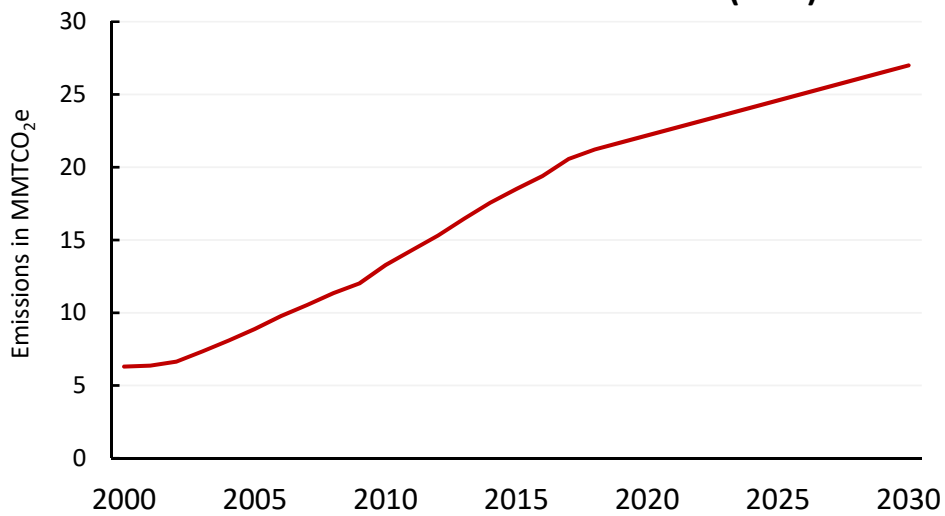
HFC Emissions

5

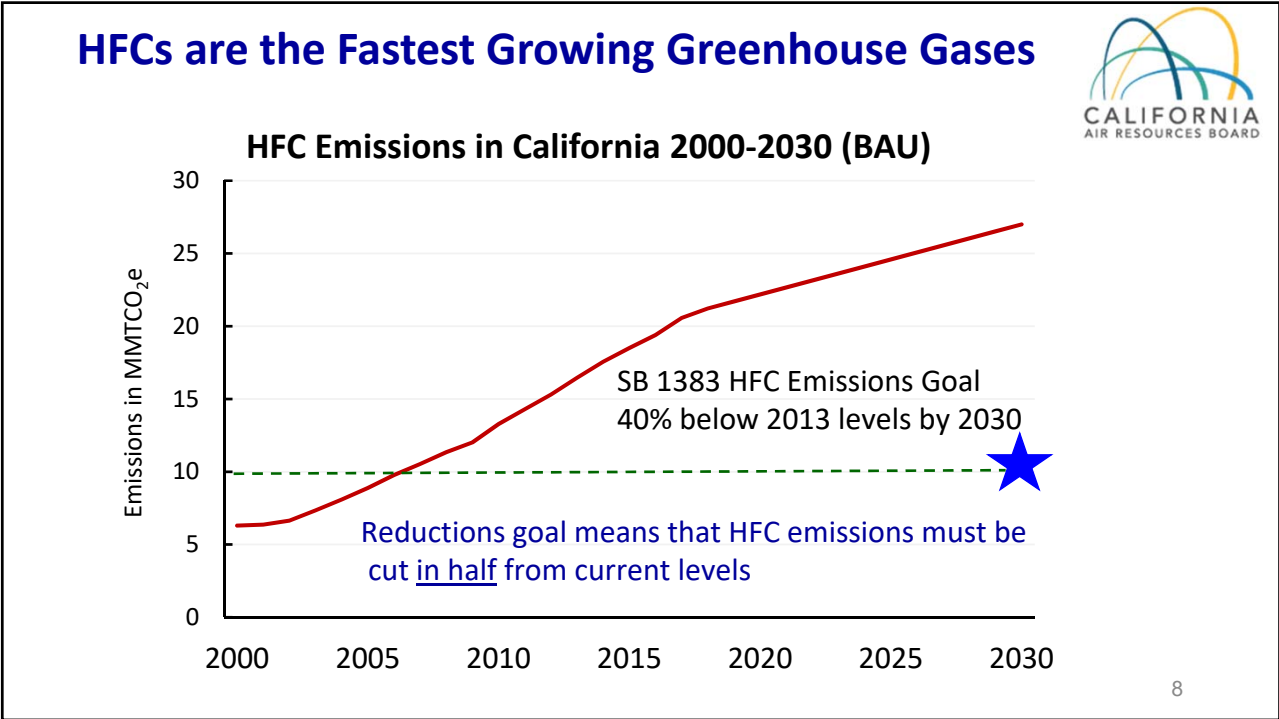
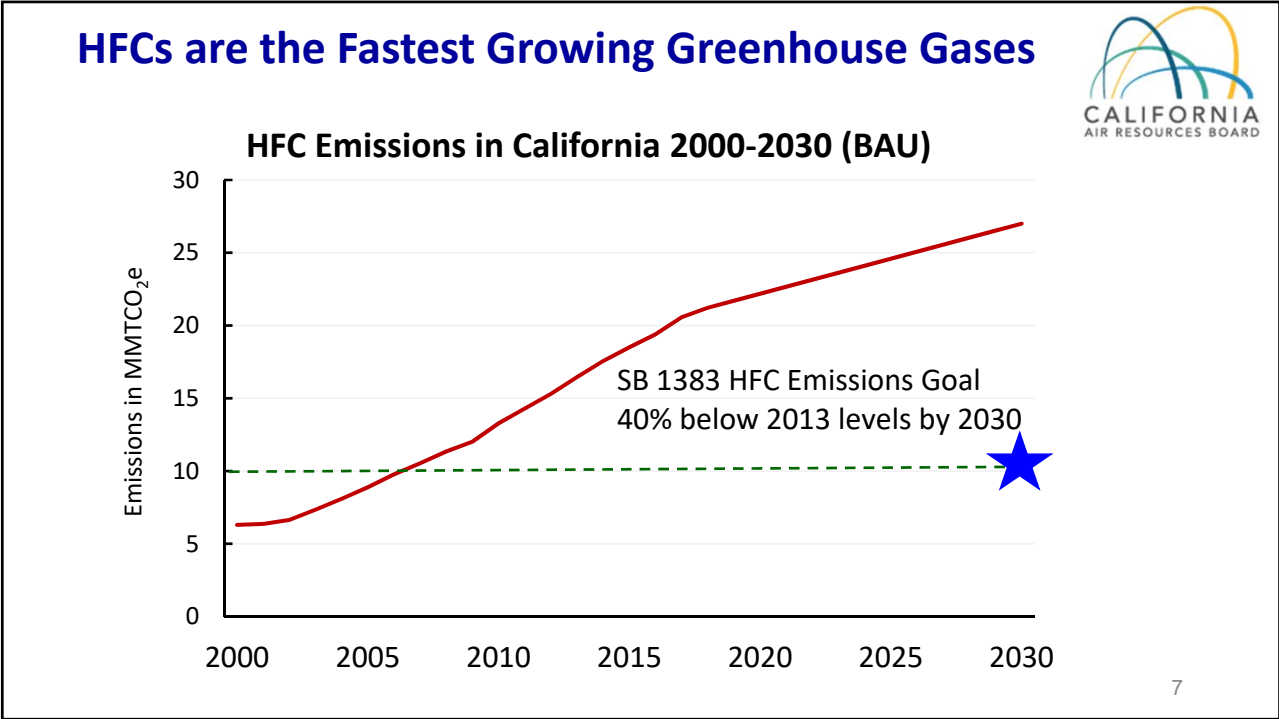
HFCs are the Fastest Growing Greenhouse Gases

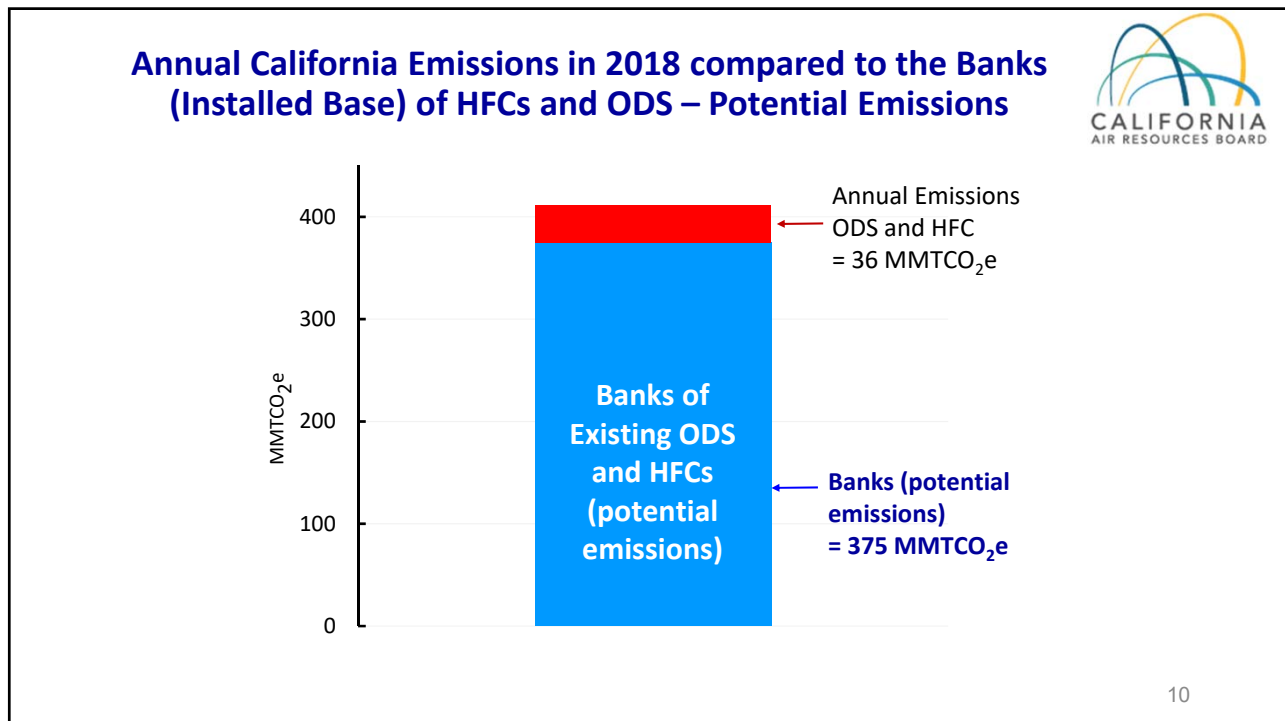
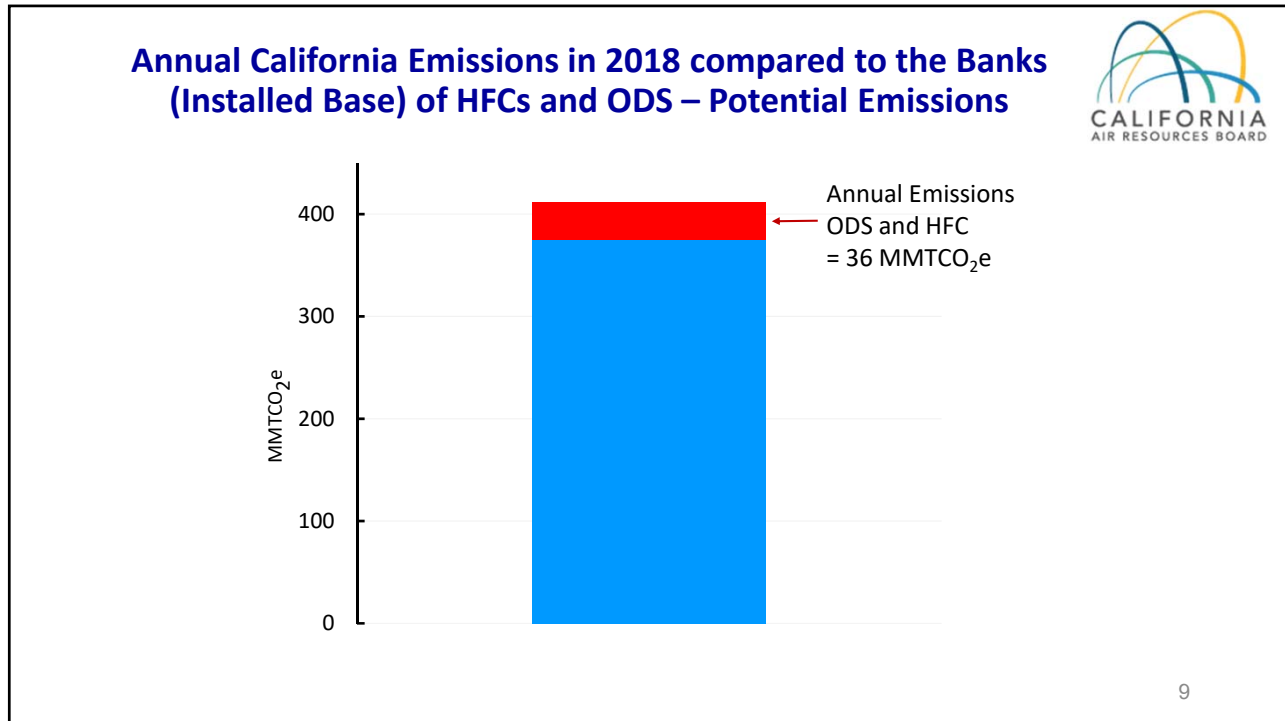


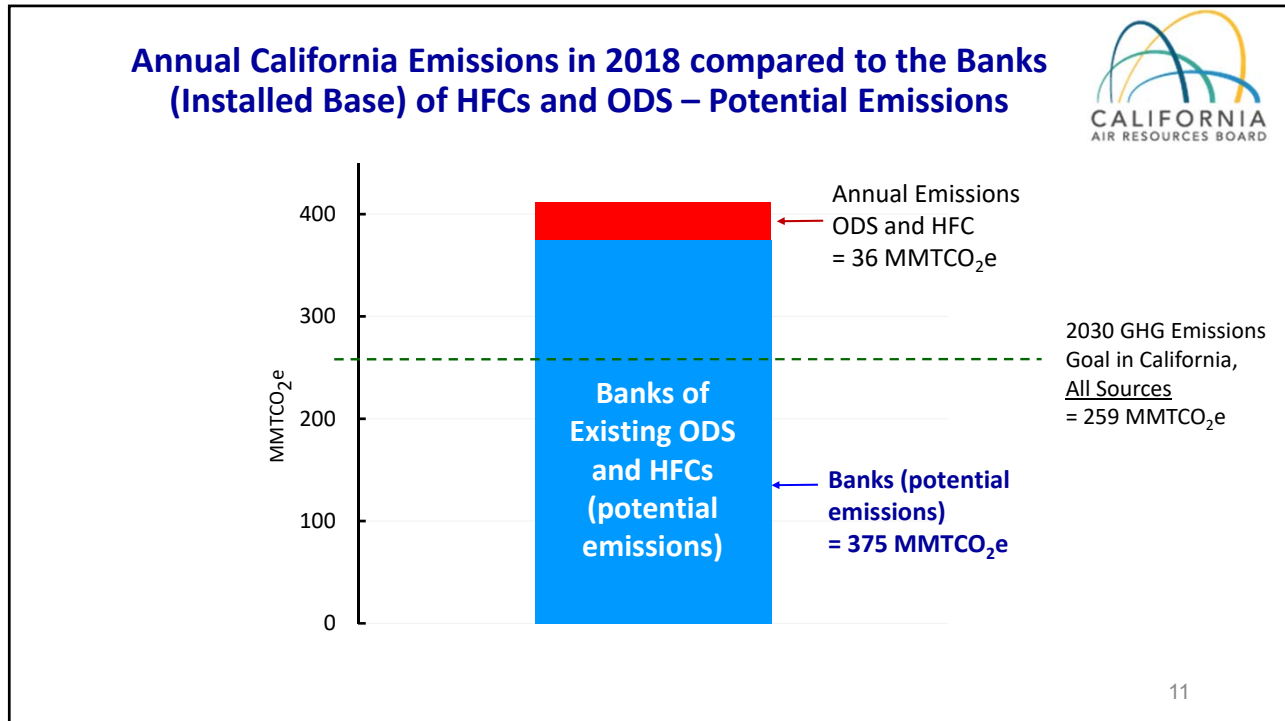
HFC Emissions in California 2000-2030 (BAU)



6







What is California Already Doing to Reduce HFCs?

12

Current HFC and ODS Measures



- **Regulations adopted under AB 32:**
 - Refrigerant Management Program (RMP)
 - Motor Vehicle AC: Advanced Clean Cars low-GWP AC, and Small Can Recycling for DIYers
 - Consumer product aerosol propellants
 - Semiconductor manufacturing F-gas reductions
- **Cap-and-Trade offset protocol** for ODS capture and destruction

13

Current HFC Measures (cont.)



California SNAP Regulation (March 2018) prohibits certain high-GWP HFCs in retrofit and new refrigeration equipment and foam

- Continues previous U.S. EPA SNAP prohibitions for:
 - Supermarket (retail food) refrigeration
 - Remote condensing units
 - Stand-alone (self-contained) units
 - Refrigerated vending machines
 - Five of 17 foam end-use sectors

14

Current HFC Measures (cont.)

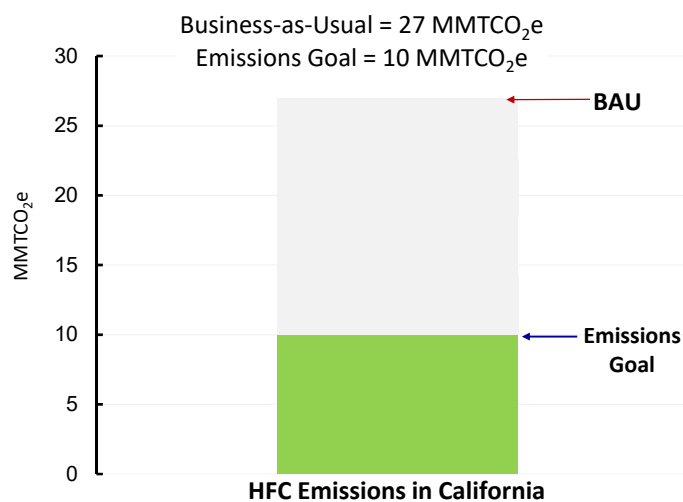


SB 1013, the “California Cooling Act” (September 2018)

- Adopted SNAP Rules 20 and 21 prohibitions into State law
- Not previously covered in CARB March 2018 regulation: Chillers, residential refrigerator-freezers, 12 of 17 foam end-use sectors, and aerosol propellants
- Establishes an incentive program for low-GWP refrigeration
- MVAC is addressed separately by the Clean Cars Program

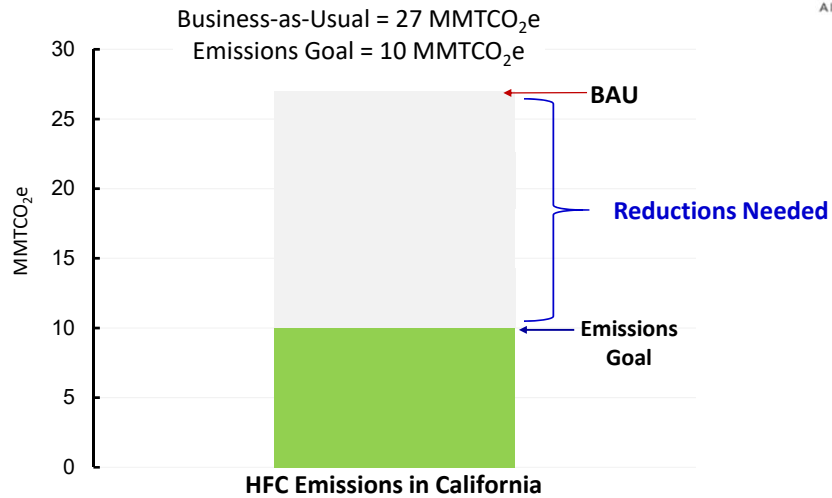
15

How will California meet SB 1383?



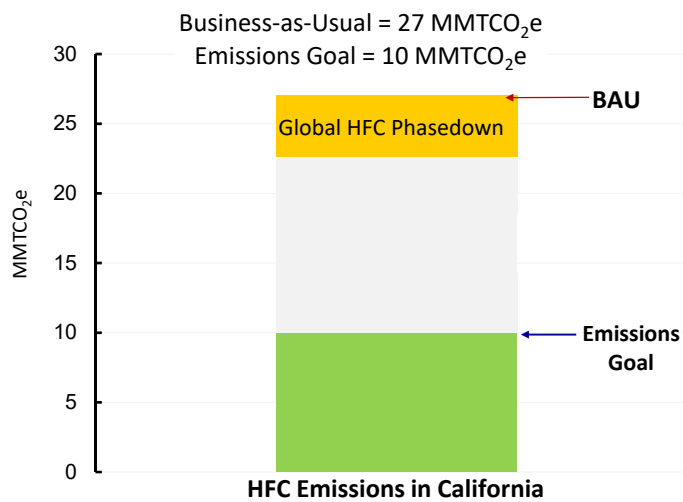
16

How will California meet SB 1383?



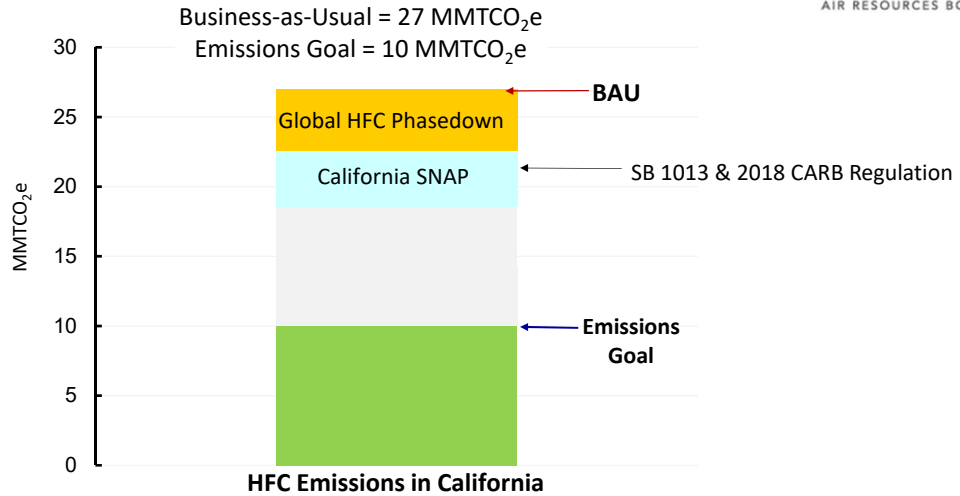
17

How will California meet SB 1383?

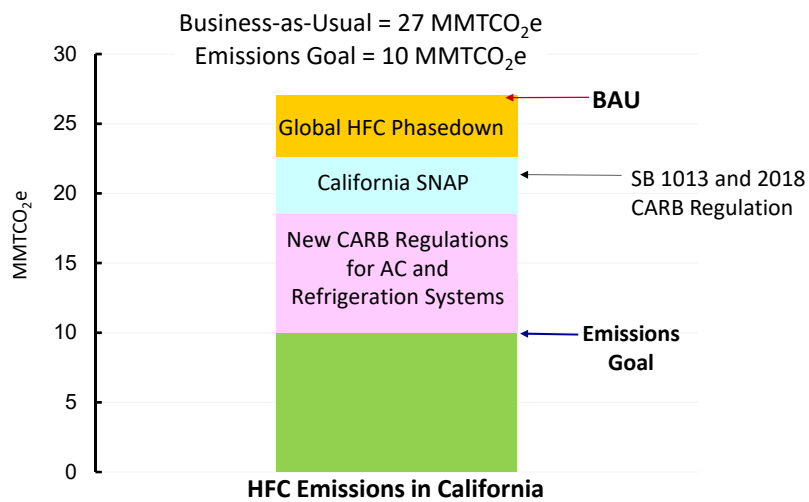


18

How will California meet SB 1383?



How will California meet SB 1383?

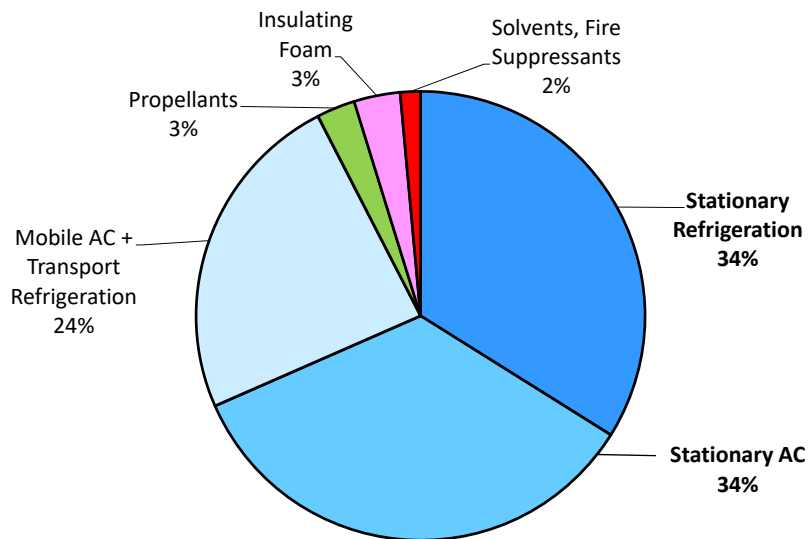




Why Focus on Stationary Refrigeration and Stationary Air-Conditioning?

21

Total HFC Emissions in California in 2018 estimated at 21 MMTCO₂e – 68% are from Stationary Air Conditioning and Stationary Refrigeration



22

CARB Actions Align with Other Countries



- **European Union F-Gas Regulation began January 1, 2016**
 - Prohibitions on high-GWP HFCs in new equipment
- **Canada Has Adopted HFC Prohibitions similar to SNAP**
- **Additional U.S. States Proposing to Adopt SNAP Prohibitions**
 - Delaware
 - Maryland
 - Connecticut
 - New York

23



Rulemaking 1 Stationary Air Conditioning: New System Prohibition

24

Industry Agrees to Lower-GWP AC beginning 2023



September 14, 2018

Chair Mary Nichols
California Air Resources Board
1001 I Street
PO Box 2835
Sacramento CA 95812

Dear Chair Nichols,

The signatories to this letter support pragmatic, predictable, and cost-effective measures that allow the California Air Resources Board (CARB) to meet the state's hydrofluorocarbon (HFC) emissions reductions target as defined in California Senate Bill 1383 – a 40 percent reduction in 2030 from 2013 levels. The following measures provide industry with certainty and sufficient time to comply with the new obligations.

We support policies to limit use of HFCs in air conditioning technologies provided they include the following. CARB should:

- Implement California Senate Bill 1013 limits on HFCs in air conditioning technologies, namely the bans on certain refrigerants in building chillers in 2024.
- Adopt an additional regulation prohibiting refrigerants with a global warming potential (GWP) in excess of 750 in all new air conditioners of all other types and capacities, excluding those covered by SB 1013, starting January 1, 2023. Implement this prohibition based on the date of manufacture, with a sell-through period of six (6) months.
- Allow the distribution of products from California to other states in which they are legal for sale in cases in which California's regulations differ from those of other states.

In addition to supporting the policies above, we also:

- Support robust enforcement and strong disincentives for non-compliance for HFC measures.

- Signed by; American Heating & Refrigeration Institute (AHRI) national trade group representing equipment and chemical manufacturers; Natural Resources Defense Council (NRDC); six major manufacturers; and two major chemical companies

25

Industry Agreement Request of CARB



- Prohibit refrigerants with a **GWP $\geq 750^1$** in all new air conditioners beginning **January 1, 2023**.
 - Based on date of manufacture
 - 6 month sell-through period
 - Allow distribution through California to other states
- Exclude chillers—Implement the SB 1013 bans on certain HFCs in chillers (2024)

¹100-Year GWP values from the 4th IPCC Assessment Report (AR4)

26

Industry Agreement Industry Commits to...



- Support robust enforcement and strong disincentives for noncompliance for HFC measures
- Work to complete safety standards and strongly support adoption into building codes as quickly as possible
- Support other states and municipalities adopting HFC prohibitions similar to California
- Support CARB working with CEC to encourage proper installation, commissioning, maintenance and servicing of HVACR systems

27

Industry Agreement Benefits



“ We believe these measures balance **environmental benefit** with **minimizing the cost impact** on consumers, all while providing **adequate time** for manufacturers, distributors, and contractors to prepare for a **safe and efficient transition** to lower-GWP technologies”

“We believe that our recommendations will help continue the tradition of California’s leadership in technology and environmental regulations while providing **market certainty** which will benefit consumers and the industries that serve them.”

28

Rulemaking 1: New AC Rulemaking



- **January 1, 2023** –Prohibit refrigerants with a **GWP ≥ 750** in new residential and commercial AC (excluding chillers)

Room AC Units
window/wall & portable



**Packaged Terminal AC/
Packed Terminal Heat Pumps**



**Other Residential AC
and Heat Pumps**
ducted (central AC) or ductless
(e.g., mini-splits, multi-splits)

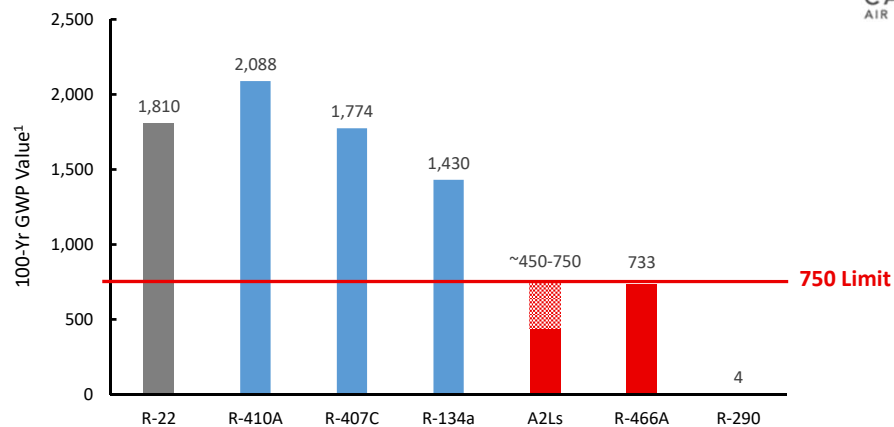


Other Commercial AC
rooftop units



29

What are the Refrigerant Options?



¹100-Year GWP Values are from the 4th IPCC Assessment Report (AR4)

■ Being phased out under the Montreal Protocol

■ Refrigerants under 750 GWP

30

Residential and Commercial AC Options < 750 GWP



■ Available ▲ Pending C&S¹ Approvals □ Under development

Refrigerant	GWP	Room AC	Packaged Terminal AC/Packaged Terminal Heat Pumps	Other Residential AC & Heat Pumps (Central & Split)	Other Commercial AC ²
A1 HFCs (R-466A)	< 750	□	□	□	□
Mid-GWP A2Ls (R-32)	450-750	■	■	▲	▲
R-290 (Propane)	4	▲	▲		

¹Codes & standards

²This category does not include chillers.

□ A1: nonflammable ■ A2L: slightly flammable ▲ A3: flammable

Challenges



- **Codes and Standards**—completion of relevant codes and standards and adopting into building codes
- **Awareness and Training**—service technicians need to be trained to install and service low-GWP refrigerants and systems

Who is Affected?



- Stationary AC equipment manufacturers
- Refrigerant manufacturers
- Residential and commercial buildings
- Service technicians

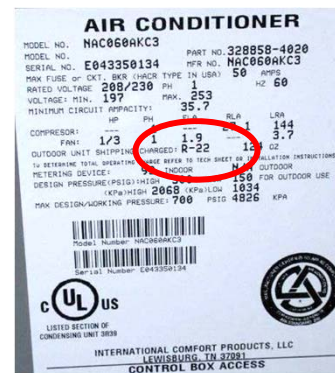


33

How Will this Regulation be Enforced?



- Recordkeeping for Manufacturers (Reporting on Request)
- Disclosure or Labeling by Manufacturers
- Auditing by CARB



34

What is needed for Rulemaking?



- **Cost Analysis** – completed 6 months prior to board hearing
 - Capital costs, upfront costs and ongoing costs
 - Number of manufacturers and other impacted business in CA
 - Small business impacts
 - Sales in CA (specific equipment lines for CA?)
 - Additional costs to consumers
 - Cost-savings (over what time period?)
 - Baseline
- **Stakeholder input is key**

35

Next Steps – Preliminary Timeline Stationary AC Rulemaking

Public workshops and Stakeholder meetings	Winter 2018 – Summer 2019
Economic Impact Assessment	June 2019
Staff Report (ISOR)	October 2019
45-Day public comment opens	October 2019
Board Meeting	December 2019
Regulation Effective Date	January 2023



36

Contact Information



CARB Staff Leads for the Rulemakings:

- **Kathryn Kynett** – AC rulemaking
Phone: (916) 322-8598
Email: kathryn.kynett@arb.ca.gov
- **Richie Kaur** – Stationary Refrigeration / RMP Amendments rulemaking
Phone: (916) 323-1506
Email: richie.kaur@arb.ca.gov
- **Glenn Gallagher** – Both rulemakings
Phone: (916) 327-8041
Email: glenn.gallagher@arb.ca.gov

CARB Supervisors for the Rulemakings:

- **Pamela Gupta (Manager)**
Phone: (916) 327-0604
Email: pamela.gupta@arb.ca.gov
- **Michael FitzGibbon (Branch Chief)**
Phone: (916) 323-2389
Email: Michael.fitzgibbon@arb.ca.gov
- **Shannon Martin Dilley (Legal Counsel)**
Phone: (916) 322-3940
Email: shannon.dilley@arb.ca.gov

Important Links

CARB HFC Reduction Measures: <https://ww2.arb.ca.gov/our-work/programs/hfc-reduction-measures>

CARB Refrigerant Management Program: <https://ww2.arb.ca.gov/our-work/programs/refrigerant-management-program>

37



Thank you for your attention!

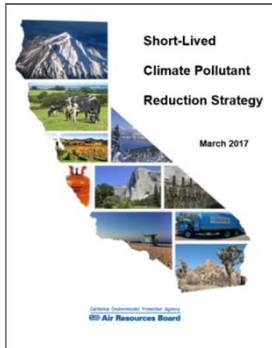
Questions and comments welcome

Emailed questions: sierrarm@calepa.ca.gov

38



Rulemaking 2: Stationary Refrigeration / RMP Amendments



39



Refrigerant Management Program (RMP) Overview

40

RMP – Regulated Entities



- Facilities with systems containing > 50 lb refrigerant with a GWP \geq 150
 - Commercial refrigeration – retail outlets (supermarkets, grocery stores, etc.), wholesalers
 - Industrial refrigeration – manufacturing or processing
 - Cold Storage – warehouses, packaging and storage facilities
- Refrigerant distributors and wholesalers
- Refrigerant reclaimers
- Service technicians

41

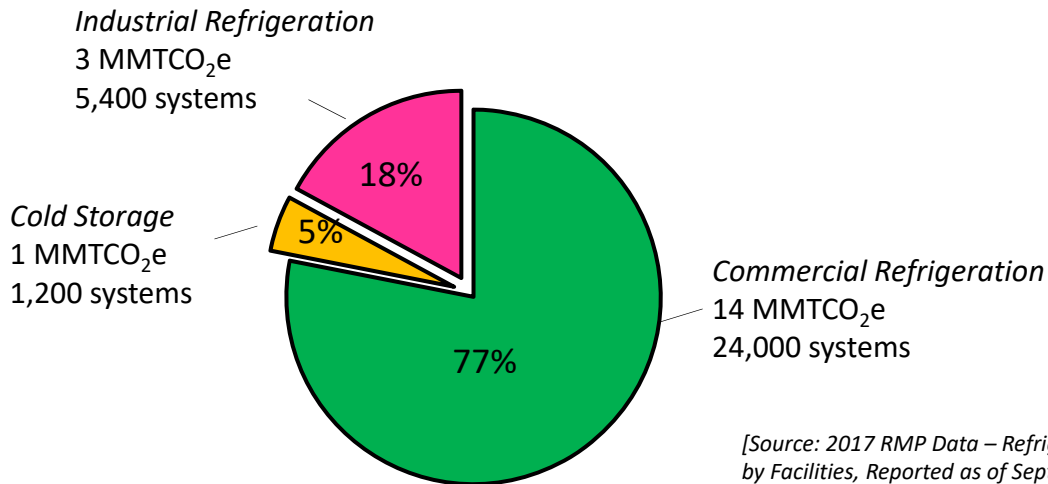
RMP – Reporting and other Requirements



- Facilities with systems containing > 50 lb refrigerant with a GWP \geq 150
 - Register with CARB
 - Report refrigerant type, full charge, operational status
 - Report refrigerant purchased, used and shipped for reclaim
 - Leak inspections, repair and recordkeeping – depending on system size
- Distributors/wholesalers – report bulk refrigerant purchased, sold and shipped to reclaimers
- Reclaimers – report bulk refrigerant reclaimed (total and in CA), shipped out of state for reclaim and refrigerant destroyed
- Service technicians – certified to conduct leak repairs

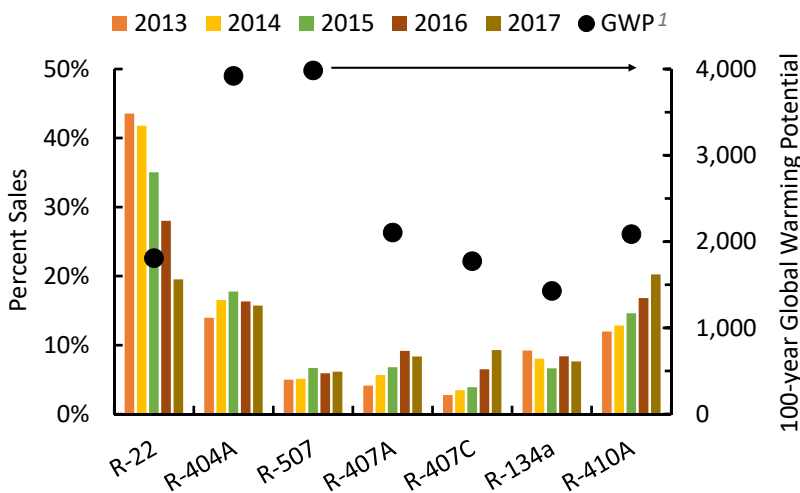
42

RMP – Full charge contained in systems



43

RMP – Refrigerant Sales Trends in California



Annual reported sales for 2013 – 2017 :
11 – 15 million pounds

7 refrigerants represent an average of 90 % of all sales for 2013 – 2017

¹100-Year GWP Values are from the 4th IPCC Assessment Report (AR4)

Source: RMP Data – Sales by Distributors / Wholesalers, Reported as of Sept 1, 2018]

44

Proposed Rules



1. January 1, 2022: no sales or installation of **new systems** containing a refrigerant with a GWP of 150 or greater (applies to systems containing more than 50 lb of refrigerant)
 - Potential exemption – hybrid systems (case-by-case)

2. January 1, 2022: no sales, distribution, or import for use in California, of **virgin refrigerants** with a GWP of 1500 or greater
 - Potential exemption 1 – Reclaimed refrigerants allowed (discussed later)
 - Potential exemption 2 – R-410A for servicing stationary AC

3. Some changes to existing RMP regulation
 - Technician requirements
 - Improve clarity
 - Add definitions
 - Align with federal rule 608

45

Who are affected by this new regulation?



- Refrigeration equipment manufacturers
- Refrigerant manufacturers
- Refrigerated facilities with systems containing > 50 lb refrigerant
 - Commercial refrigeration - retail food (supermarkets, grocery stores etc.), wholesalers
 - Industrial refrigeration - manufacturing or processing of food and non-food items
 - Cold Storage - warehouses, packaging and storage facilities
- Refrigerant distributors and wholesalers
- Refrigerant reclaimers
- Service technicians

46

Reclaimed Refrigerants



CARB is inclined towards allowing use of reclaimed high-GWP refrigerants

- Pros
 1. Existing equipment is not stranded
 2. Encourages refrigerant recycling and proper recovery practices
- Cons
 1. Illicit use of virgin refrigerant in CA imported for other states
 2. Illicit purchases across the borders
 3. Misuse of virgin refrigerant as reclaimed refrigerant

47

Potential enforcement options for reclaimed refrigerants



- Appropriate labeling
- Additional reporting to CARB for reclaimed refrigerants
 - Distributor/Wholesalers, Reclaimers and Facilities
 - Report pounds of each reclaimed refrigerant (GWP > 1500) transacted (purchased, sold, sent for reclaim – as applicable)
 - Provide names, addresses and contact information of all entities involved in the transaction
 - Technician record-keeping
 - Records of reclaimed refrigerant purchases and use in servicing/sales for RMP-regulated systems

48



Potential Challenges and Benefits

49



Potential Challenges

- Added initial cost for new equipment
- Local permitting agencies must be educated on the low-GWP refrigerants
- Energy efficiency concerns for the hottest climates
- Service technicians need to be trained to install and service low-GWP refrigerants and systems

50

Benefits



- Reduction of regulatory requirements (RMP-exempt below GWP 150, only a one-time registration required)
- Provides regulatory certainty
- Cheaper refrigerants (especially natural)
- Cost of low-GWP systems will decrease with increased number of installations and upcoming HFC phasedown
- Improved energy efficiency as technology continues to progress
- Sustainable, low-emission business practices

51



If California requires low-GWP refrigerants, which refrigerants can be used?

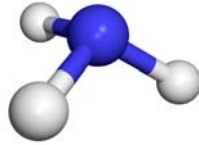
low-GWP: GWP < 150

52

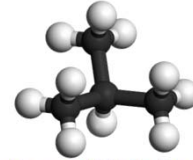
Some current and potential low-GWP options for refrigeration



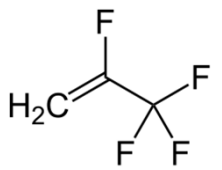
Carbon Dioxide (R-744)
GWP = 1



Ammonia (R-717)
GWP = 0



Hydrocarbons (HC): Propane (R-290), isobutane (R-600a)
GWP < 5



HFOs (GWP ≤ 10)

Hydrofluoro-olefins (HFOs) are HFCs that have unsaturated bonds and break down quickly in the atmosphere resulting in no ozone-depleting and little global warming.

Current low-GWP systems being used in California



End-Use Sector	System Sizes	Low-GWP Options Currently Available
Supermarkets and grocery stores	Large (≥ 2000 lb)	transcritical CO ₂ (t-CO ₂)
	Medium (200 – 2000 lb)	t-CO ₂ , HC/CO ₂ , NH ₃ /CO ₂
	Small (50 – 200 lb)	t-CO ₂
Cold storage warehouses and Industrial refrigeration	Large (≥ 2000 lb) Medium (200 – 2000 lb)	Majority already use NH ₃ others: NH ₃ /CO ₂ , HFO



70+ supermarkets in California using low-GWP refrigerants in 2018

The global transition to low-GWP refrigerants is underway...



- Ammonia has been used for cold storage and industrial refrigeration for 150 years
- Toxicity-related safety concerns have been addressed by using low charge systems

Low charge ammonia installations around the world

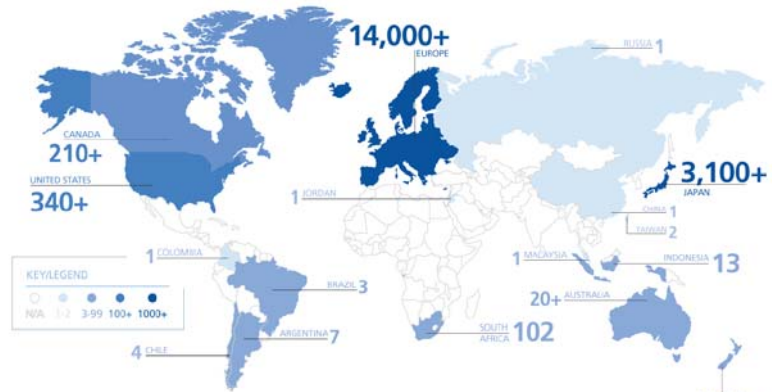


[Shecco, Atmosphere America 2018]

The global transition to low-GWP refrigerants is underway...



- European Union (EU) has implemented similar HFC reduction measures
- Japan, Canada and Australia have HFC phase-down regulations
- Other U.S. states are planning to follow in CA's footsteps
- Low-GWP refrigeration technology is growing quickly across all climate zones, including high ambient temperatures



Number of transcritical CO₂ Stores Across the Globe (Feb 2018)

[Shecco, Atmosphere America 2018]

Some manufacturers are selling low-GWP systems in the U.S.



Equipment Manufacturer	Type of Equipment or Sector of Use	Distribution Area
HillPhoenix	Industrial/commercial refrigeration display cases, walk-ins, CO ₂ transcritical and cascade systems	North America, Europe
Carrier	Commercial refrigeration	North America
Husmann Corporation	Display cases and refrigeration systems	U.S., Mexico, Australia, New Zealand, China
Johnson Controls	Refrigeration systems, air-conditioning and transport refrigeration systems	Global
Star Refrigeration	Industrial and commercial refrigeration	U.S., Europe

57



Incentive Funding

58

Incentive funding for low-GWP technologies




- SB 1013 directed the creation of an incentive program
- Reduction of SLCPs, especially HFCs, is highlighted in CARB's Three-Year Investment Plan
 - Presentation to the Board on November 15th
- **Stakeholder feedback on investment priorities is welcome**
- Aligned with the Investment Plan, the Administration's Budget proposal for FY2019-20 will be released in early January 2019
- Legislature decides the final budget around mid-2019

59



Timeline for the Rulemaking

60



Next Steps – Preliminary Timeline	
Stationary Refrigeration/RMP Amendments Rulemaking	
Public workshops and Stakeholder meetings	1 st workshop: October 2018
	Technical working group meetings Late 2018 – Mid 2019
Economic Impact Assessment	September 2019
Staff Report (ISOR)	February 2020
45-Day public comment opens	February 2020
Board Meeting	March 2020
Regulation Effective Date	January 2022

61

Technical Working Groups – Some topics to be discussed



- Challenges faced – Learn from experiences of supermarkets and other facilities that have already made the transition to low-GWP systems
 - Costs – Get inputs from equipment manufacturers and early adopters
 - Service technician training – Understand the current training programs
 - Safety – Ongoing education and awareness, where applicable
 - Other topics suggested by stakeholders
- Please contact us if you are interested in participating in these working groups.



CARB Rulemaking Process

63

Overview of CARB Rulemaking



- **Regulation Development**
 - Stakeholder Engagement
 - Internal Consultation (Economics, Enforcement, Small Businesses, Environmental Justice, CEQA)
- **Standardized Regulatory Impact Assessment** (if total economic impacts exceed \$50 million)
- **Notice Package**
 - Economic Impact Assessment
 - Staff Report (Initial Statement of Reasons - ISOR)
 - Proposed Regulation Order
 - 45-Day Notice
- **45-Day Public Comment Period**
- **Board Hearing**
- **15-Day Changes**
- **Final Statement of Reasons (FSOR)**
- **Adoption**

64

Comments and Questions



We appreciate your feedback.

- During this meeting, webcast viewers can submit questions and comments to:
sierrarm@calepa.ca.gov

65

Contact Information



CARB Staff Leads for the Rulemakings:

- **Kathryn Kynett** – AC rulemaking
Phone: (916) 322-8598
Email: kathryn.kynett@arb.ca.gov
- **Richie Kaur** – Stationary Refrigeration / RMP Amendments rulemaking
Phone: (916) 323-1506
Email: richie.kaur@arb.ca.gov
- **Glenn Gallagher** – Both rulemakings
Phone: (916) 327-8041
Email: glenn.gallagher@arb.ca.gov

CARB Supervisors for the Rulemakings:

- **Pamela Gupta (Manager)**
Phone: (916) 327-0604
Email: pamela.gupta@arb.ca.gov
- **Michael FitzGibbon (Branch Chief)**
Phone: (916) 323-2389
Email: Michael.fitzgibbon@arb.ca.gov
- **Shannon Martin Dilley (Legal Counsel)**
Phone: (916) 322-3940
Email: shannon.dilley@arb.ca.gov

Important Links

CARB HFC Reduction Measures: <https://ww2.arb.ca.gov/our-work/programs/hfc-reduction-measures>

CARB Refrigerant Management Program: <https://ww2.arb.ca.gov/our-work/programs/refrigerant-management-program>

66



Thank you for your attention!

Questions and comments welcome

Emailed questions: sierrarm@calepa.ca.gov