

Appendix D. Stakeholder Proposals

1. Proposal from Environmental Investigation Agency (EIA)
2. Proposal from Air-Conditioning Heating and Refrigeration Institute (AHRI)



The Environmental Investigation Agency (EIA) appreciates an opportunity to submit this proposal to support California in meeting its 2030 emission reduction target for hydrofluorocarbons (HFCs) mandated under SB 1383. A two-year delay in the transition of air conditioning equipment under the ARB proposed regulation would result in a failure to meet this 2030 target, unless offset by an alternative proposal. EIA's proposal ('the proposal' hereon) as written may be applied to any type of air conditioning equipment or system covered by the proposed ARB regulation that requires an exemption to the 2023 date for transitioning to a refrigerant with a global warming potential (GWP) less than 750. Under the proposal, equipment manufacturers utilizing an exemption must adhere to a set of requirements to ensure they fully offset any additional HFC emissions as a result of this delayed timeframe primarily through the purchase and use of reclaimed refrigerant.

EIA considers the use of reclaimed refrigerant to directly benefit the climate by preventing the use and eventual emissions of virgin refrigerant in equipment sold onto the market in California.¹ This proposal both offsets any loss in direct emissions as a result of a two-year exemption, while also potentially improving rates of HFC recovery from equipment at end-of-life and increasing viable markets for reclamation.

Proposal Summary

A temporary exemption from the requirement to use <750 GWP refrigerants in new air conditioners would be permitted, provided however, that an equipment manufacturer utilizing the exemption must meet the following requirements for any exempted equipment sold in 2023 and 2024, with the exemption expiring Jan 1, 2025:

- A CO₂ equivalent amount of refrigerant equal to the initial refrigerant charge plus additional service gas for lifetime of exempted equipment must be offset by 2030 through:
 - purchase and use of reclaimed HFC refrigerant in new air conditioning equipment placed on the market in California;
 - enabling recovery, reclamation, and use of reclaimed HFC refrigerant for servicing existing air conditioning equipment within California
 - destruction of HFC-410A refrigerants recovered from air conditioning equipment within California after January 1st, 2023.² Destruction of previously recovered and collected used refrigerant does not qualify as additional.

¹ Consistent with emission reductions claimed under the American Carbon Registry, Methodology for the Quantification, Monitoring, Reporting and Verification of Greenhouse Gas Emissions Reductions and Removals from Certified Reclaimed HFC Refrigerants. See p22. <https://americancarbonregistry.org/carbon-accounting/standards-methodologies/certified-reclaimed-hfc-refrigerants>

² Destruction technologies approved for HFCs by Montreal Protocol is available at: <https://ozone.unep.org/node/1941>

- Amount of lifetime emissions for various air conditioning equipment types are subject to leak rate and lifetime expectancy assumptions consistent with California’s F-Gas emissions inventory, with the exception of variable refrigerant flow (VRF) systems based on a 25% annual leak rate³ over 15-year system lifetime.
- All activities related to the qualified exemption will be subject to verification and reporting through a third-party contracted by the manufacturer, and reported on an annual basis to ARB.
- Non-compliance is subject to strict penalties and fines equivalent to California cost of carbon estimates per CO₂e offset not met.

Example: Manufacturer A sells X air conditioning systems in 2023 that are expected use Y tons over 15 years (including replacement of leaked refrigerant). Manufacturer A is required to verify the use of X*Y tons CO₂e reclaimed gas through a combination of a) use in other new equipment sold in California by 2030 or b) by enabling recovery, reclamation, and subsequent sale for use of reclaimed refrigerant into the California wholesale market for servicing. For option a) emissions could be offset in any type of new AC product currently using HFC refrigerants that are sold into California. Therefore, a manufacturer could meet this requirement through using reclaimed HFC-410A in the exempted equipment itself, or meet this requirement by using a reclaimed lower GWP refrigerant on other equipment produced after 2025, such as reclaimed R32 on its own or as a component of another <750 GWP refrigerant blend, for example. For option b) refrigerant must be recovered from within California.

Proposed Amendment to Draft Regulatory Language

Requirements Applicable to Table 3:

(2) Exceptions

(v) *Temporary Exemption for New Air Conditioning Equipment and Systems using HFC refrigerant >750 GWP*

A temporary exemption applies to new air conditioning (residential and non-residential) equipment and systems until January 1st, 2025, wherein equipment or systems using a refrigerant with a GWP above 750 may continue to enter into commerce after January 1st 2023, only provided the manufacturer fully offsets the *Lifecycle Refrigerant Emissions Equivalency* of refrigerant used in such exempted equipment by December 31st, 2030, through one or a combination of the following qualifying activities:

- a) Purchasing and using *Certified Reclaimed HFC Refrigerant* in new air conditioning equipment and systems placed on the market in California in an amount equivalent to the *Lifecycle Refrigerant Emissions Equivalency* of exempted equipment;
- b) Enabling recovery and subsequent reclamation and use of *Certified Reclaimed HFC Refrigerant* from air conditioning equipment within California. Verification of recovery and subsequent sale of reclaimed refrigerant both to take place within California will be subject to independent third party reporting requirements.

³ In the absence of rigorous data demonstrating a lower leak rate, EIA recommends applying a 25% leak rate for VRF systems consistent with average leak rates for supermarket refrigeration systems with which VRF systems share the most common architectural properties.

- c) In limited cases where a sale to market for reclaimed refrigerant could not be achieved, procuring services to undertake destruction of used HFC refrigerants recovered from air conditioning equipment within the state of California after January 1st, 2023, utilizing a destruction technology approved for HFCs by the Montreal Protocol. Verification of recovery from within California, good faith attempt enable reclamation and use, and subsequent destruction will be subject to independent third-party verification requirements.

Notification, Reporting, and Third-Party Verification Requirements:

To comply with this temporary exemption, a manufacturer will undertake to contract with an independent third party in an audit and annual report certifying completion of qualifying activities to be counted toward offset of a Lifetime Refrigerant Emissions Equivalency. Requirements for notification, reporting, selection of an independent third party, and annual reporting are as follows:

- A manufacturer must notify CARB of their intent to utilize an exemption by January 31st, 2022 and provide the following information:
 - List of equipment models by type and amount of HFC-410A charge for which seeking an exemption
 - Intended estimate of equipment sales and resulting estimated Lifetime Refrigerant Emissions Equivalency
 - Name of proposed third-party verifier(s) for undertaking reporting
- Selection of a third-party verifier by the manufacturer will be carried out in accordance with meeting following annual reporting and verification requirements for an annual report and subject to approval by CARB.
- Submission of an annual report by an independent third party on behalf of a manufacturer certifying completion of all qualifying activities and transactions relevant to recovery, collection, purchase, sale, and use of Certified Reclaimed HFC Refrigerant or destruction counted towards offset of Lifetime Refrigerant Emissions Equivalency. Annual report to be submitted to ARB, by March 31st of the calendar year following each calendar year in which such qualifying activities were undertaken. The report will at minimum, certify an audit undertaken to confirm for each manufacturer:
 - Number and type of exempted air conditioning equipment placed on the market in 2023 and 2024, quantity and type of >750 GWP refrigerant used, and resulting calculated Lifecycle Refrigerant Emissions Equivalency;
 - Quantity of HFC-410A refrigerant verified as having been recovered from air conditioning equipment within California broken out by each entity involved in recovery and collection activities;
 - Amount of Certified Reclaimed HFC Refrigerant purchased, broken out by each individual EPA certified reclaimer and quantity used in new equipment or sold into wholesale market for use in California;
 - Number and type of any new equipment sold in which Certified Reclaimed HFC refrigerant was used, and refrigerant types and quantity in metric tons;
 - Quantity and type of refrigerant verified as recovered from equipment in California after January 1st, 2021 for subsequent verified destruction broken out

by entity undertaking destruction, quantity destroyed, and description and efficacy of destruction method(s) utilized.

Added Definitions

“*Lifecycle Refrigerant Emissions Equivalency*” means the total CO₂ equivalency of an amount of refrigerant used over the expected lifetime of air conditioning equipment or systems. This includes both the amount of refrigerant initially added into equipment upon manufacture and/or installation and the cumulative average amount of refrigerant added to replace leaked refrigerant over its expected lifetime, according to the following assumptions by equipment category:

- Self-contained room air conditioners including window units, portable air conditioners and PTACs shall be assumed to have a 12-year lifetime and an average annual leak rate of 2%.
- Air conditioning systems for commercial use that employ variable refrigerant flow systems will be assumed to have a 15-year lifetime and average annual leak rate of 25%.
- Unitary air conditioning systems for residential use will be assumed to have a 15-year lifetime and 5% annual leak rate.
- Unitary air conditioning systems designed for commercial use containing less than 50lbs of refrigerant will be assumed to have a lifetime of 15 years and an annual leak rate of 10%.
- Unitary air conditioners for commercial use containing more than 50lbs of refrigerant will be assumed to have a 15-year lifetime and an average annual leak rate of 7%.

“*Certified reclaimed HFC refrigerant*” means used (recovered) HFC refrigerant that has been reclaimed by an EPA-certified reclaimer to meet the AHRI 700-2015 Standard for Specifications for Fluorocarbon Refrigerants by an EPA certified reclaimer, and tested by an AHRI certified refrigerant testing laboratory to meet the AHRI Standard.

Conclusion

California must act to address refrigerant emissions through policies aimed at scaling up refrigerant management, recovery, reclamation, and destruction — a near-term, cost-effective approach that would have immediate and significant climate benefits. This proposal introduces a useful mechanism to offset emissions under an exemption to the current ARB proposed rule, but would be merely a small start to addressing this issue. The new market for recovering and reclaiming HFCs from air conditioning equipment will further support ARB in finalizing additional standalone rulemakings to increase HFC recovery, reclamation and destruction, including but not limited to consideration of a sales ban on high-GWP refrigerants for servicing and an extended producer responsibility scheme to support rebates for refrigerant recovery. More information regarding the potential mitigation and cost-effectiveness of recovering and destroying HFC refrigerants is available in EIA’s report, *Search Reuse & Destroy: How States Can Take the Lead on a 100 Billion Ton Climate Problem*.⁴

Contact: Christina Starr, Climate Policy Analyst, cstarr@eia-global.org

⁴ EIA Report available at: <https://eia-global.org/reports/20190214-search-reuse-destroy>



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September 18, 2020

Elizabeth Scheele
California Air Resources Board
1001 I Street, Sacramento, CA 95814
P.O. Box 2815, Sacramento, CA 95812

Re: AHRI Comments Regarding California Air Resources Board Draft Proposed Regulation: *Prohibitions on Use of Certain Hydrofluorocarbons in Stationary Refrigeration, Stationary Air-conditioning, and Other End Uses*

Dear Ms. Scheele,

On behalf of the Air-Conditioning, Heating and Refrigeration Institute (AHRI) I respectfully submit the following proposal in response to California Air Resources Board (CARB) Draft Proposed *Regulation: Prohibitions on Use of Certain Hydrofluorocarbons in Stationary Refrigeration, Stationary Air-conditioning, and Other End Uses*.

AHRI is the trade association representing manufacturers of heating, cooling, water heating, and commercial refrigeration equipment. More than 300 members strong, AHRI is an advocate for the industry and develops standards for and certifies the performance of many of the products manufactured by our members. In North America, the annual output of the HVACR and water heating industry is worth more than \$44 billion. In the United States, the industry supports 1.3 million jobs and \$256 billion in economic activity annually.

For more than a decade, AHRI has worked to support regulations to reduce the consumption and production of hydrofluorocarbons (HFCs). Our members strongly supported the agreement to amend the Montreal Protocol on Substances that Deplete the Ozone Layer to phase down HFC production and consumption as a proven, predictable, and practical approach to a transition away from refrigerants with high global warming potential (GWP). We have worked cooperatively with state regulators and environmental non-governmental organizations (E-NGOs) in an attempt to harmonize regulations, and we are working closely with both foreign and domestic governments to prepare and successfully execute the safe and orderly transition to low-GWP refrigerants.

We thank the CARB technical staff for working with AHRI and for addressing many of our concerns during the rule-making process.

The California state legislature mandated a reduction of emissions of hydrofluorocarbons by 40% by 2030 compared to 2013 through Senate Bill (SB) 1383 signed into law in September 2016. Although the California state legislature mandated specific HFC transitions (SB-1013 enacted in 2018), those provisions were insufficient to reach this ambitious goal, which requires a transition faster than the timeline included in the Kigali HFC Amendment to the Montreal Protocol. As a result, CARB has included a provision in the draft regulation (July 22, 2020) limiting the use of air conditioning refrigerants having a global warming potential of 750 or greater on January 1, 2023.¹

“Air-conditioning (new) equipment, residential and nonresidential Refrigerants with a GWP of 750 or greater Prohibited as of January 1, 2023”

¹ Proposed Regulation Order Prohibitions on Use of Certain Hydrofluorocarbons in Stationary Refrigeration, Stationary Air-conditioning, and other end uses
<https://ww2.arb.ca.gov/sites/default/files/2020-07/DRAFT%20CA%20SNAP%20Amendments-Reg%20Text.pdf>

In 2018, AHRI and the Natural Resources Defense Council (NRDC), along with several individual companies, requested that CARB adopt a January 1, 2023 transition date in response to CARB's 2017² workshop proposing a transition date of January 1, 2021. The January 1, 2023 date was proposed to align with the date of a Department of Energy (DOE) efficiency standards change which mandated a transition in the same timeframe to enable manufacturers to make a single transition.

This transition will require the use of refrigerants with a different flammability classification than the incumbent refrigerant (R-410A). Although the suitable alternatives are considered as having lower flammability (Class A2L) according to the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE),³ a modification to the building codes is required to enable the use of these alternatives. Code modifications must be made far enough in advance that manufacturers, who work with a three- to five-year design cycle, have the certainty necessary to design and produce compliant equipment.

The consensus safety standards that need to be adopted into code are:

- Underwriters Laboratories (UL) 60335-2-40, which is a product listing standard
- ASHRAE 15, which describes installation requirements for equipment
- ASHRAE 15.2 (proposed), which extracts the residential installation requirements from ASHRAE 15.

It is important to note that industry's proffer of a 2023 transition date was premised on the expectation that safety standards and building codes would be timely, and orderly, updated to reflect changing technology. That did not occur.

The building codes do not yet enable the use of low GWP refrigerants.

The air conditioning industry is now in a challenging situation in the State of California. In 2019, the Uniform Mechanical Code (UMC) was not updated through the International Association of Plumbing and Mechanical Officials (IAPMO) process to enable the use of low GWP refrigerants by adopting the necessary safety standards. California traditionally adopts the UMC on a three-year cycle and then makes modifications as needed. Although AHRI strongly advocated for the UMC to be updated to include the relevant safety standards during this cycle, the modifications did not receive the necessary votes in favor of the proposed changes.

California normally adopts modifications to the building code on a triennial cycle, but the state also has an off-cycle process for proposing and adopting modifications to the building codes, known as the intervening code adoption cycle, between each triennial code update. A handful of state agencies, including California Department of Forestry and Fire Protection (CalFIRE), have the authority to propose code changes during the intervening code adoption cycle. Neither CalFIRE, nor any other agency, submitted a proposal to adopt the relevant safety standards into the California building code update that will go into effect in July 2021.

The next available California Building Standards Commission (CBSC) code cycle to ensure safety standard adoption, will have an effective date of January 1, 2023. These delays mean that the earliest new building codes will be available for review by manufacturers will be January 2022. With the design changes necessary to transition to low GWP refrigerants, January 2022 is too late to prepare for the transition.

There are over 4 million products listed in AHRI's Directory of Certified Product Performance with over 9 million new products sold and installed annually in homes and businesses maintained by over 400,000 technicians. All products are regulated by the U.S. Department of Energy and must meet federal energy standards Federal regulations recognized complexities in stationary air conditioning products by requiring 5-year lead times from

² Public Workshop on Rulemaking Proposal: High Global Warming Potential Refrigerant Emissions Reductions California Air Resources Board October 24, 2017 https://ww3.arb.ca.gov/cc/shortlived/meetings/10242017/public_workshop_snap-california_10-24-17_presentation.pdf?_ga=2.182187808.621576105.1573738237-276427812.1565094831

³ ASHRAE 34 documents refrigerant classifications.

promulgation of final efficiency regulations versus 3 years for other regulated products to allow for sufficient time to redesign, test, manufacturer, distribute, educate, and install equipment. Twelve months⁴ is simply not enough time to design, build, certify and bring a compliant product to market.

AHRI has worked tirelessly to develop and disseminate information related to the safe transition to low GWP refrigerants.

Over the past five years, AHRI, in cooperation with the U.S. Department of Energy (DOE), CARB and other concerned stakeholders have invested nearly \$7 million in research⁵ into the behavior and safe use of next generation refrigerants. This research has been used in the development of the safety standards as well as in development of training and in preparation for the transition.

In 2019, AHRI also launched the Safe Refrigerant Transition Task Force^{6,7} to address concerns related to the transition evaluating the end-to-end supply chain for conversion readiness, to identify needs, and resolve issues or make recommendations to enable the safe use of low-GWP refrigerants in a timely manner to meet regulatory requirements.

AHRI has provided significant information to CalFIRE, which has convened a working group to discuss the safety standards and the changes needed to the building codes to enable the use of low GWP refrigerants in hopes that harmonizing legislation would have enabled the necessary code changes by year end to comply with the January 2023 transition.

However, due to the pandemic, legislation is no longer a practicable option, and the best outcome from CalFIRE's working group is a code change that will be only be finalized by January 2022.

The entire supply chain is facing the challenge of the COVID-19 pandemic.

The pandemic has disrupted businesses and preparations for the 2023 transition. Based on an AHRI member survey, with representation from the entire industry of essential heating and cooling equipment manufacturers, the pandemic had directly led to at least temporary closures of manufacturing facilities for sixty percent of members by April 2020 and over eighty percent of members are experiencing reduced manufacturing capacity. Most members have been forced to furlough staff to address the economic impact of the COVID-19.

The pandemic has also changed the long-term outlook of the industry. Half of the industry has experienced lower availability of resources for research & development, resulting in the postponing of 2020 investment for new products as planned. Some resources have been reallocated to address supply chain disruptions (e.g. qualification of alternate components). Other resources have been unavailable for other reasons (e.g. furlough or social distancing requirements). Over 80 percent of respondents are experiencing supply chain disruptions. By mid-April, one-third of AHRI members were already unable to consistently source parts, components, and supplies needed to manufacture equipment. Additionally, almost half of the respondents were experiencing delays in equipment safety and performance certifications.

⁴ Unions and contractor organizations have indicated to AHRI that they need eighteen to twenty-four months for training prior to the transition.

⁵ Research results can be found at this website. <http://www.ahrinet.org/Resources/Research/AHRI-Flammable-Refrigerants-Research-Initiative>

⁶ Differences in the properties of next generation refrigerants (e.g., flammability and toxicity) may require changes to current practices to minimize risk while meeting regulations. Some new refrigerants are historic products that have not been used in some time or that will be used with larger charge sizes (e.g. ammonia and hydrocarbons)

⁷ More information about the AHRI Safe Refrigerant Transition Task Force see the following website. <http://www.ahrinet.org/SafeRefrigerant>

To combat COVID-19, manufacturers have taken important steps like social distancing, moving to remote work, and providing additional healthcare support to ensure the safety and wellbeing of their employees, prevent the spread of illness, and comply with state requirements. These steps, however, have led to reduced staffing and resources.

AHRI proposes that CARB delay the 750 GWP limit until January 1, 2025 with the following provisions and commitments.

As a result of the challenges related to the building codes and the pandemic, AHRI is seeking a delay in the January 1, 2023 transition date limiting GWP of refrigerant to below 750 to January 1, 2025 with a limit of 750 GWP. AHRI understands that CARB still needs to meet the statutory mandate and makes the following proposal to compensate for a delay until January 1, 2025.

AHRI Proposal

Air conditioning (AC) original equipment manufacturers (OEMs) will enable refrigerant recovery from 2022 to 2030 to offset the quantity of refrigerant higher than 750 GWP the OEM placed in new equipment shipped to and not exported from California in 2023 and 2024 in carbon dioxide (CO₂) equivalent (eq) units (using CARB's Standardized Regulatory Impact Assessment (SRIA) leak rates and equipment lifetimes), GHG_i). The amount to be offset will be adjusted up or down (GHG_a) to recognize the refrigerant used in new equipment sold between 2023 and 2030 by: (1) Changes in refrigerant charge size and (2) Refrigerant GWP less than 750 GWP.

OEMs may facilitate recovery, purchase or use reclaimed refrigerant, or enable the destruction of recovered refrigerant in the equivalent quantity in CO₂ eq units from 2022 to 2030 to compensate.

Details of the proposal are provided in Attachment 1. The proposal will enable the recovery and use of reclaimed refrigerant for servicing which will encourage best practices necessary for a safe transition to lower GWP refrigerants and to prepare for the Kigali HFC phase-down nationally. It also broadens industry engagement in the effort to reduced HFC emissions to those most able to reduce them.

Finally, AHRI thanks CARB for the continued dialogue to find a practical way forward to meet California's ambitious climate goals. Please contact Helen Walter-Terrinoni at hwalter-terriononi@ahrinet.org or 302-598-4608.

Sincerely,

Helen Walter-Terrinoni

Helen Walter-Terrinoni
Vice President, Regulatory Affairs
Air-Conditioning, Heating, and Refrigeration Institute

Attachment:

Air Conditioning, Heating and Refrigeration Institute (AHRI) Air Conditioning Proposal Background Document and Proposed Regulatory Text

Background

Building codes in California currently prohibit the use of commercially available refrigerants for air conditioning (AC) with a global warming potential (GWP) less than 750 GWP. The Air Conditioning, Heating and Refrigeration Institute (AHRI) has worked tirelessly to update the codes to comply with a proposed 2023 transition requirement in hopes that this would align with energy efficiency changes mandated by the Department of Energy (DOE). DOE typically allows 5 years for a transition to take place, but AC manufacturers (AC OEMs) committed through AHRI to transition within 2 years of the building codes being finalized in California to try to meet their commitment to the California Air Resource Board in 2018 in their request to delay the transition from 2021. It has become clear that the codes will not be updated by January 1, 2021 since AB 3316, the legislation that would have required that the building codes be updated, did not move forward with this requirement. The next opportunity for a change to the building code is January 1, 2023.

In light of the delay in the necessary code changes and the challenges in preparing for a transition due to the pandemic, the California Air Resources Board must delay the transition date for the 750 global warming potential (GWP) limit for air conditioning refrigerants in new equipment in California until January 1, 2025.

AHRI proposes the following to help recover lost 2023 and 2024 emissions because of this delay.

AHRI Proposal:

Air conditioning (AC) original equipment manufacturers (OEMs) will enable refrigerant recovery from 2022 to 2030 to offset the quantity of refrigerant higher than 750 GWP the OEM placed in new equipment shipped to and not exported from California in 2023 and 2024 in carbon dioxide (CO₂) equivalent (eq) units (using CARB's Standardized Regulatory Impact Assessment (SRIA) leak rates and equipment lifetimes), GHG_i). The amount to be offset will be adjusted up or down (GHG_A) to recognize the refrigerant used in new equipment sold between 2023 and 2030 by: (1) Changes in refrigerant charge size and (2) Refrigerant GWP less than 750 GWP.

OEMs may facilitate recovery, purchase or use reclaimed refrigerant, or enable the destruction of recovered refrigerant in the equivalent quantity in CO₂ eq units from 2022 to 2030 to compensate.

In spite of best efforts by AHRI, the building codes will not enable the use of low GWP refrigerants in sufficient time to allow for an orderly transition in 2023 in California. AHRI members are willing to help recover lost 2023 and 2024 emissions by enabling better refrigerant recovery. It has been well-established that recovery of refrigerants at the end of life of equipment is minimal both in the U.S. and internationally. Although SB1013 requires CARB to reduce emissions of HFCs by 40% in 2030, AHRI believes that their work to enable better refrigerant recovery will lay the

groundwork by developing supply chains and practices to improve recovery long-term enabling meeting and possibly exceeding the required reduction in emissions in 2030.

There is limited supply of R-410A available in the near term and so there is a limit as to the total amount that could be reclaimed due to the timing of equipment nearing the end-of-life. Additional credits could be considered depending upon the ultimate availability of supply. However, AHRI believes that with this proposal, CARB has an opportunity to lead the country in the effort to increase the use of reclaimed refrigerant and could build on this with future efforts to reduce emissions in 2030 by significantly improving recovery rates.

This proposal was developed to allow options and credits (GWP and charge size) for air conditioning manufacturers similar to those allowed in the proposed regulation for retailers in their selection and use of commercial refrigeration equipment.

The following information is provided as background to this proposal.

Availability of R-410A for Recovery in California

Using CARB’s estimated market volumes in 2017, AHRI estimates of R-410A that would be removed from the market and could be, at least in-part, recovered based on CARB’s model. Note that not all refrigerant can or will be recovered and there are losses during the recovery process. In addition, it has been estimated that 0.5 to 30% of refrigerants are lost during the reclamation process in part due to recovery practices.

Estimated Metric Tons	2021	2022
Refrigerant at end-of-life	1711	1763

Note that not all refrigerant can or will be recovered and there are losses during recovery and an estimated 0.5% to 30% losses during the reclamation process largely dependent on recovery practices

Estimated Metric Tons	2025	2026	2027	2028	2029	2030
Refrigerant at end-of-life	1844	1813	1668	1427	1128	3428

Note that not all refrigerant can or will be recovered. There are losses during recovery and an estimated 0.5% to 30% losses during the reclamation process largely dependent on recovery practices

If California contractors reclaimed 10% of the total R-410A reclaimed nationally, then California would have reclaimed approximately 118 tons of R-410A last year.¹ In the United States, 8,410

¹ According to sector-based equipment reporting in the Energy Information Administration (EIA)’s Commercial Building Energy Consumption Survey and Residential Energy Consumption Survey, between 8.5 and 12 percent of any HVACR product sector’s market share is in California.

metric tons of refrigerant were reclaimed in 2019. Of that amount, 1,177 metric tons of R-410A were reclaimed.²^[OBJ]

California Refrigerant Market

AHRI reviewed public and internal data to estimate the refrigerant market in California. By blending multiple approaches and using a wide variety of corroborated data sources, AHRI estimates that there are approximately 60,000-63,000 metric tons of R-410A in California and that approximately 6,600-7,200 metric tons of R-410A are shipped to California each year.

- Approximately 2,700-3,100 metric tons of R-410A are used for servicing existing equipment in California each year.
- Approximately 3,800-4,300 metric tons of R-410A are used for charging new units entering service in California each year.

AHRI took three approaches to calculate the refrigerant use in California: (1) Equipment Shipment-Based Approach, (2) California Air Resources Board (CARB) Model-Based Approach, and (3) Refrigerant Shipment-Based Approach.

Equipment Shipment-Based Approach

AHRI used publicly available data from the Energy Information Administration (EIA)'s 2012 [Commercial Building Energy Consumption Survey](#) (CBECS) and 2015 [Residential Energy Consumption Survey](#) (RECS) and queried the data for residential AC, commercial AC, commercial heat pumps, and chillers. The weighted sums of each installation within the United States were used as the baseline of installed equipment. That data was then split into census divisions identified within CBECS and RECS. Population-weighted subsets of data were extracted for California to estimate the installed base of each type of equipment within the state. These baselines installed unit estimates were multiplied by California's growth rate from its Standardized Regulatory Impact Assessment (SRIA) to estimate the installed HVACR equipment base in 2023 (Appendix 1).

AHRI used refrigerant distributions from the Environmental Protection Agency (EPA)'s refrigerant [Vintaging Model guidance document](#) (page 230) to simulate the distribution of refrigerant type in each installation.³

Charge sizes, equipment lifetime, and leak rate were estimated from AHRI and DOE literature and California's SRIA.⁴

² Summary of Refrigerant Reclamation Trends. Environmental Protection Agency. Accessed from <https://www.epa.gov/section608/summary-refrigerant-reclamation-trends>.

³ AHRI set up a probabilistic model that took the refrigerant distributions for each type of equipment in EPAs Vintaging Model guidance. These distributions were summed for all equipment to find a weighted average for the proportion of each refrigerant in the installed base. These proportions were used in AHRI's calculations to estimate the R-410A installed base in California.

⁴ DOE offers factsheets for [AC equipment](#), [chillers](#), [heat pumps](#), and their respective lifetimes. Refrigerant charge guidelines can be found in [AHRI Standard 340/360](#) and [AHRI Standard 210/240](#). California's SRIA includes this information for its measurement of HVACR equipment in California.

AHRI used this information and recorded the following parameters:

	Residential AC Units	Commercial AC Units	Commercial Heat Pump Units	Chillers
Equipment lifetime (years)	15	15	15	30
Charge Size (lbs) ⁵	8.157	38	38	100
Leak Rate (per year) ⁶	5%	5%	5%	5%
R410A Installed Market Share	86%	86%	86%	30%
R22 Installed Market Share	14%	14%	14%	0%
R134a Installed Market Share	0%	0%	0%	70%
R404A Installed Market Share	0%	0%	0%	0%

The leak rate was multiplied by the charge size and total number of units installed in California to estimate the amount of refrigerant used for servicing existing equipment per year. The result was multiplied by the proportion of equipment with R-410A to estimate the amount of R-410A used for servicing existing equipment each year, which was 2,736 metric tons per year.

Total number of units installed in California were divided by each installation's respective equipment lifetime to estimate the number of new units per year. This was multiplied by charge size and proportion of equipment with R-410A to estimate the amount of R-410A used for charging new equipment each year, which was 3,861 metric tons per year.

California Air Resources Board (CARB) Model-Based Approach

AHRI reviewed CARB's November 2017 HFC Emission Factors modeling document to estimate the amount of refrigerant used in new equipment and for service in California. The total number of installed units were multiplied by refrigerant charge size to estimate the installed base of refrigerant. AHRI assumed a 5% leak rate and a 15-year lifetime based on the SRIA to calculate refrigerant used for service and to charge new equipment in California.

The leak rate was multiplied by the charge size and total number of units installed in California to estimate the amount of refrigerant used for servicing existing equipment per year. Approximately 3,000 metric tons of refrigerant are used for servicing existing equipment in California.

Total number of units installed in California were divided by each installation's respective equipment lifetime to estimate the number of new units per year. Approximately 4,000 metric tons of refrigerant are used for charging new equipment installed in California each year.

⁵ Shipment-weighted average based on California's SRIA and AHRI's [public shipment data](#).

⁶ [Clodic](#) (2010) estimates leak rates for HVACR equipment. These leak rates are consistent with the SRIA.

Refrigerant Shipment-Based Approach

AHRI reviewed refrigerant consumption data from the [Consumer Cost Impacts of U.S. Ratification of the Kigali Amendment](#) to estimate the amount of refrigerant used in California each year. Total exports of refrigerant were subtracted from total imports and production of refrigerant to estimate the total amount of refrigerant used each year. AHRI split the proportion of different types of equipment into census divisions identified within CBECS and RECS. Population-weighted subsets of data were extracted for California to estimate the installed base of each type of equipment within the state.

Based on this approach, approximately 4,200 metric tons of refrigerant are used for servicing existing equipment in California and approximately 3,058 metric tons of refrigerant are used for charging new equipment installed in California each year.

Economic Impact of AHRI's Recovery Proposal

Based on the range of refrigerant used in new equipment (3,800-4,300 metric tons per year) and the reduction in charge size and GWP from new refrigerants, between 426⁷ and 1,850 metric tons of refrigerant must be recovered to offset the CO₂ equivalent for R-410A being used in California in 2023 and 2024 rather than a refrigerant with a GWP below 750.⁸

AHRTI Project 8018 found that cost to recover refrigerant ranges from \$1.20-\$1.60 per pound.⁹ The cost to the industry to offset the use of R-410A for 2023 and 2024 will range from approximately \$1,127,000 to \$7,232,000.

It is AHRI's understanding that shipping fluorocarbons costs approximately \$0.05 per pound.¹⁰ This will add approximately \$46,900-\$226,000 in shipping costs to the industry.

The total cost to manufacturers for recovery of refrigerant is estimated to cost between \$1,174,000 to \$7,458,000.¹¹

⁷ See attached spreadsheet for more details.

⁸ AHRI assumed that 3,800-4,300 metric tons per year of R-410A refrigerant were installed between 2023 and 2025, resulting in a total installed refrigerant base between 7,600-8,600 metric tons of refrigerant during this time. These values were multiplied by 5.6% and 21.5%, respectively to obtain a range of refrigerant recovery needed to meet CARB's goals.

⁹ [AHRI Project 8018 Final Report](#). January 2016. Page 15 and 24. Canada and Australia have had success with their refrigerant recovery and reclaim programs. In the research report, AHRI found that a \$1.20-\$1.59 per pound of refrigerant rebate was needed to incentivize the recovery of refrigerant (\$3.50 CAD per kg and \$5 AUD per kg, respectively).

¹⁰ Shipping costs are minimal, however both [AHRI Project 8018](#) and an [ACHR News survey of refrigerant recovery businesses](#) (Reclaim Survey: Where to Go, What it Costs, 2008) found minor shipping costs are still included within the business costs associated with refrigerant recovery and reclamation.

¹¹ AHRI multiplied the cost per pound of recovery by the pounds of refrigerant recovery needed to estimate recovery costs. Shipment costs per pound of refrigerant were also multiplied by the refrigerant recovery needed to estimate shipping costs. These two values were summed to calculate total cost to industry.

Finally, AHRI understands that contractors can pay up to \$25 per cylinder to return refrigerant to a distributor.¹² In the future, contractors would likely save the \$25 refrigerant recovery fee. Contractors are responsible for the cost of dedicated recovery cylinders.¹³ Since these cylinders typically carry 24 pounds of refrigerant, between 18 and 78 cylinders will need to be returned.¹⁴ Contractors may already own these cylinders.

Please note that AHRI is working to refine the economic information and will provide additional data if it would be helpful.

Administrative Controls

AHRI understands that CARB requires any proposal to be enforceable and easy to administer. AHRI proposes that equipment manufacturers self-certify and declare their progress to CARB annually, subject to auditing by CARB upon request. This will create a minimal burden to the industry (less than 24 hours per year) and ensure CARB will achieve its GHG reduction goals

Examples of Compliance Options

OEMs may enable or facilitate the recovery of refrigerant at the end of life by a number of actions including but not limited to the following. OEMs may combine these options. Other options may not have been explored at this writing.

- OEMs may use reclaimed refrigerant in new AC systems during 2023 and 2024
- OEMs may include contractual agreement that distributors return a certain amount of recovered refrigerant to reclaimers
- OEMs may include contractual agreement that distributors sell a certain amount of recovered refrigerant to reclaimers
- OEMs may provide incentives to their channel partners to recover refrigerant
- OEMs may provide incentives to their channel partners to use reclaimed refrigerant.
- OEMs may buy credits for recovery / reclaim from competitors or reclaimers.

Finally, OEMs may convert a portion of their products in 2023 and 2024 to a low GWP refrigerant.

¹² [ACHR News survey of refrigerant recovery businesses](#) (Reclaim Survey: Where to Go, What it Costs, 2008) found cylinder return as a typical cost of business.

¹³ AHRI reviewed currently available recovery cylinders on the market and found costs ranged between \$180-\$500.

¹⁴ [Examining Recovery Cylinder Capabilities](#). 2007. *ACHR News*.

Air Conditioning, Heating and Refrigeration Institute (AHRI)

Proposed Regulatory Text for the Air Conditioning Refrigerant Transition in California

- (i) Air Conditioning Equipment, Stationary installed in the state of California may only contain refrigerants having a global warming potential (GWP) of less than 750 by January 1, 2025.
- (ii) Air conditioning (AC) original equipment manufacturers (OEMs) will enable refrigerant recovery from 2022 to 2030 to offset the carbon dioxide (CO₂) equivalent units (EQ) quantity from refrigerant with a GWP higher than 750 GWP the OEM placed in new equipment shipped to and not exported from California in 2023 and 2024 in carbon dioxide (CO₂) equivalent (eq) units (using CARB's Standardized Regulatory Impact Assessment (SRIA) leak rates and equipment lifetimes), (Greenhouse Gas Impact or GHG_i). The amount to be offset will be adjusted up or down (Greenhouse Gas Adjustment or GHG_A) to recognize the refrigerant used in new equipment sold in California between 2023 and 2030 by:
 - a) Changes in refrigerant charge size and
 - b) Refrigerant GWP less than 750 GWP.
- (iii) Definitions
 - a. Air Conditioning Equipment, Stationary: "Air-conditioning Equipment" or "Air-conditioning System" means equipment that cools or dehumidifies spaces in residential or non-residential settings, for comfort cooling and other purposes, including but not limited to room air conditioning such as window units, packaged terminal air conditioners (PTAC), packaged terminal heat pumps (PTHP), and portable air conditioners; central air conditioners (i.e., ducted); non-ducted systems (both mini and multi splits); packaged rooftop units; water-source and ground-source heat pumps; and dehumidifiers. Air-conditioning also includes computer room and data center cooling and remote condensing units for comfort cooling applications. Chillers are defined separately from "air-conditioning equipment." For the purposes of this regulation, "air-conditioning equipment" applies to stationary air-conditioning equipment and does not apply to mobile air-conditioning, including those used in vehicles, rail and trains, buses, aircraft, watercraft, recreational vehicles, recreational trailers, and campers.
 - b. Enable refrigerant recovery: includes facilitating recovery, purchasing or using reclaimed refrigerant, or enabling the destruction of recovered refrigerant.
 - c. Greenhouse Gas Adjustment (GHG_A): $GHG_A = [\Sigma(\text{Charge} \times [750-\text{GWP}]) \text{ for equipment designed to use a refrigerant less than 750 GWP shipped to and not exported from California} + \text{RCR} \times \text{charge}] \times \text{SRIA Leak Rate} \times \text{SRIA Equipment Lifetime}$
 - d. Greenhouse Gas Impact (GHG_i): $GHG_i = \Sigma(\text{Charge}) \times (2088-\text{GWP}) \text{ for equipment designed to use a GWP greater than 750 shipped to and not exported from California from January 1, 2023 and January 1, 2025} \times \text{SRIA leak rate} \times \text{SRIA equipment lifetime}$
 - e. $GHG_p = \Sigma (\text{Charge} \times \text{GWP}) \text{ shipped to and not exported from California}$
 - f. Original equipment manufacturer: Company that fabricates air conditioners or other products

- g. Reclaim¹⁵: To reprocess recovered refrigerant to at least the purity specified in the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standard 700-2016 and to verify this purity using the analytical methodology prescribed in the standard. Per EPA Section 608, Reclamation requires specialized machinery not available at a job site or auto repair shop. The technician will recover the refrigerant and then send it either to a general reclaimer or back to the refrigerant manufacturer.
- h. Recover¹⁶: To remove refrigerant in any condition from an appliance and store it in an external container without necessarily testing or processing it in any way.
- i. Recycle¹⁷: When referring to a refrigerant, recycle means to extract refrigerant from an appliance (except MVACs) and clean refrigerant for reuse in equipment of the same owner without meeting all the requirements for reclamation. In general, recycled refrigerant is refrigerant that is cleaned using oil separation and single or multiple passes through devices, such as replaceable core filter-driers, which reduce moisture, acidity, and particulate matter.
- j. Refrigerant Charge Reduction (RCR) - The inherent refrigerant charge reduction is the ratio of the average liquid and vapor densities of refrigerant multiplied by 80% based on the observed charge size reduction of 20%.¹⁸

$$\text{Inherent charge reduction} = \frac{(\text{Liquid Density} + \text{Vapor Density}) \text{ for new refrigerant}}{(\text{Liquid Density} + \text{Vapor Density}) \text{ for base refrigerant}} \times (1 - 20\%)$$

Refrigerant charge size reduction table¹⁹

Refrigerant	Charge Size Relative to Current R-410A Charge
R-32	80%
R-454B	85.4%

- (iv) GHG_i will be compensated for as GHG_A and GHG_p of recovered, destroyed, installed reclaimed refrigerant enabled by the OEM. The remaining commitment calculated as GHG_i - GHG_A - GHG_p of enabled refrigerant must be zero by January 1, 2030
- (v) Reporting Requirements: On or before April 1, 2023 and each April 1 thereafter until the OEM has shown compliance, AC OEMs that ship equipment into California that will not be exported from shall register in the R3 database and provide the following information:
 - a) Name of Company.
 - b) Company Federal Tax Identification Number.

¹⁵ <https://www.epa.gov/section608/definitions-section-608-terms>

¹⁶ <https://www.epa.gov/section608/definitions-section-608-terms>

¹⁷ <https://www.epa.gov/section608/definitions-section-608-terms>

¹⁸ Cold Hard Facts 3 for The Australian Government by The Expert Group
<https://www.environment.gov.au/system/files/resources/bd7fa5d0-8da1-4951-bd01-e012e368d5d0/files/cold-hard-facts3.pdf>

- c) Company mailing address including a street address, city, state, and zip code.
- d) Company location address including a street address, city, state, and zip code.
- e) Company contact person.
- f) Company contact person phone number.
- g) Company contact person e-mail address; and
- h) Compliance Information:
 - i) The total volume of refrigerant having a GWP greater than 750 that is shipped to and not exported from California.
 - ii) The total volume of refrigerant having a GWP less than 750 that is shipped to and not exported from California.
 - iii) The company's RCR
 - iv) The company's GHG_I
 - v) The company's GHG_A
 - vi) The GHG_p of and quantity of recovered refrigerant that the company has enabled, and the methodology used to enable its recovery.
 - vii) The GHG_p of and quantity of reclaimed refrigerant used in new equipment.
 - viii) The GHG_p compliance credits purchased from another entity along with the name and contact information for that entity.

(vi) Recordkeeping Requirements. As of the effective date of this subarticle, any person who ships equipment into California that will not be exported from California from January 1, 2022 to January 1, 2030 shall maintain for five years and make available, upon request by the California Air Resources Board's Executive Officer, the following records:

- a) The means by which the GHG_I is calculated.
- b) The means by which the GHG_A is calculated.
- c) The GHG_p and quantity of recovered refrigerant that the company has enabled, and the methodology used to enable its recovery.
- d) Each refrigeration system charge reduction, including the full charge size before a refrigerant charge reduction and after a refrigerant charge reduction.
- e) The GHG_p and quantity of reclaimed refrigerant used in new equipment.
- f) The GHG_p compliance credits purchased from another entity along with the name and contact information for that entity.
- g) The calculations and spreadsheets used to create the reported information under section 95375(4); and
- h) The recordkeeping requirements of section 95375(5) shall include documentation including but not limited to, invoices, receipts, records of shipments, plans, or work details, that are generated or supported by information from a third party, such as a service technician or refrigerant reclaimer.

AHRI Proposal to Require the Use of Reclaimed Refrigerants on January 1, 2025

On July 31, 2020, AHRI proposed that CARB require the use of reclaimed refrigerant for servicing in California starting on January 1, 2025. CARB informed AHRI that it was unlikely that they would be able to implement this proposal. As this proposal could provide a significant emissions reduction in 2030. AHRI has provided the proposal here to encourage stakeholder feedback around this beneficial concept.

Proposal to Prohibit the Use of Newly Produced Refrigerant to Service Equipment in California January 1, 2025

AHRI proposes that CARB delay the 750 GWP limit until January 1, 2025 with the following provisions and commitments.²⁰

As a result of the challenges related to the building codes and the pandemic, AHRI is seeking a delay in the January 1, 2023 transition date limiting GWP of refrigerant to below 750 to January 1, 2025 with a limit of 750 GWP. AHRI understands that CARB still needs to meet the statutory mandate and makes the following proposal to compensate for a delay until January 1, 2025.

AHRI Proposal

- January 1, 2025
 - 750 GWP limit for newly manufactured stationary air conditioning equipment, understanding that safety standards and the California codes need to be aligned
 - Prohibit the sale, re-sale, transfer and/or import for use in California of newly produced R-410A, except for export from California
- Require the collection of all refrigerants at end-of-life
- Require reclaimed refrigerant to meet purity requirements of AHRI 700 standard
- Allow nationally reclaimed R-410A to be used in California²¹
- Equipment manufacturers will promote and encourage the recovery of R-410A through education of their service and dealer networks

A “Seller” of R-410A must report sales to CARB as a registered seller. Registered “Reclaimers” of R-410A must also report sales to CARB. Any “Reclaimer” or “Seller” must keep records of any sales to end-users. This should provide a mechanism to check reports from both “Sellers” and “Reclaimers”²² which should ease the enforcement burden and ensures compliance and attainment of necessary emission reductions.

²⁰ AHRI made this proposal in a meeting on July 22, 2020 to CARB and is formalizing the proposal through this correspondence.

²¹ If we assume an average lifetime of air conditioning equipment of approximately 20 years, then 5% are replaced annually and that refrigerant can be reclaimed for use which precisely matches the need for servicing refrigerant if leak rates approximately 5% (including emissions during servicing equipment). Although, this seems like a perfect match, there are additional losses during the reclaim process, so additional reclaim will be needed from other states to support California.

²² An initial and ending inventory could also be reported annually to further check transactions.

Reclaim would be used for servicing equipment instead of new equipment because of the logistical challenges regarding equipment manufacturing facilities which are not designed to use multiple types of refrigerants. Also, equipment sales are not segregated by state. Generally, equipment is sold to wholesale distributors and the location of final installation is unknown to manufacturers which could result in newly produced refrigerant entering California. This also prevents concerns of labeling units as “new” while containing reclaimed refrigerant.

This proposal more than compensates for the two-year delay requested by AHRI. In addition, the required use of reclaimed refrigerant for servicing also encourages best practices necessary for a safe transition to lower GWP refrigerants and to prepare for the Kigali HFC phase-down nationally. It also broadens industry engagement in the effort to reduced HFC emissions to those most able to reduce them.