


CARB/ AHRI Reclaim Proposal Calculations and Reporting

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Regulatory Calculations

The bottom of the slide features two horizontal blue bars. The first bar is a solid blue rectangle spanning most of the width. The second bar is a lighter blue rectangle that starts to the right of the first bar's end, creating a staggered, overlapping effect.

2023-2024 Greenhouse Gas Impact (GHGi)

- Greenhouse Gas Impact (GHG_i) reflects the impact of placing a refrigerant higher than 750 GWP 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 to determine impact)
- CO₂ eq units

Greenhouse Gas Impact (GHG_i)

R-410A installed in new equipment (Tonnes) x Difference between GWP of R-410A and regulatory GWP limit (750) x SRIA leak rate x SRIA lifetime

abc Tonnes x (2088 GWP – 750 GWP) x SRIA leak rates x SRIA emissions rate

= [1338 x abc] CO₂ equivalent tonnes x 14.02 yrs x 4.33%

2022-2030 Greenhouse Gas Adjustment (GHG_A)

Greenhouse gas credit (GHG_A) is a credit for reduction in refrigerant charge size and refrigerant GWP less than 750 GWP used in new equipment sold between January 1, 2022 and January 1, 2030.

- $GHG_A = [\sum (Charge \times [750 - GWP]) \text{ for equipment designed to use a refrigerant less than 750 GWP shipped to and not exported from California} + RCR] \times SRIA \text{ Leak Rate} \times SRIA \text{ Equipment Lifetime}$

2022-2030 Greenhouse Gas Adjustment

$$GHG_A = [\sum (Charge \times [750-GWP]) + RCR] \times SRIA \text{ Leak Rate} \times SRIA \text{ Equipment Lifetime}$$

2022 – 2030 Inherent Refrigerant-based Charge Reduction

The inherent refrigerant charge reduction is the ratio of the average liquid and vapor densities* of refrigerant for the new and base (R-410A) refrigerants for refrigerants close in operating pressure such as R-32 and R-454B x (1-20%)

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

Liquid density when exiting the condenser and vapor density when entering the condenser

2022-2030 Refrigerant Charge Reduction Adjustment (RCA)

Table A1 Refrigerant-based charge size reduction

Refrigerant	Charge Size Relative to Current R-410A Charge
R-32	80.0%
R-454B	85.4%

Inherent refrigerant-based charge reductions above for refrigerants compared to R-410A

2022-2030 charge adjustment

- *Refrigerant-based charge reduction is based on the R-32 reduction observed in Australia [Cold Hard Facts 3](#) (2018).*
 - Australia observed a 20% reduction for R-32

Reporting 2022- 2030

The total volume of refrigerant having a GWP greater than 750 that is shipped to and not exported from California.

The total volume of refrigerant having a GWP less than 750 that is shipped to and not exported from California.

The company's RCA

The company's GHG_A

The company's GHG_I

The quantity of recovered refrigerant that the company has enabled and the methodology used to enable its recovery.

The quantity of reclaimed refrigerant used in new equipment.

The number of compliance credits purchased from another entity along with the name and contact information for that entity.

Compliance Progress by Year (2022 to 2030) =

+ R-410A tonnes x
(2088-1338)

- <750 GWP refrigerant
tonnes x (750-GWP)

- <750 GWP
Refrigerant tonnes x
(1-RCR)%

- Recovered
refrigerant x GWP

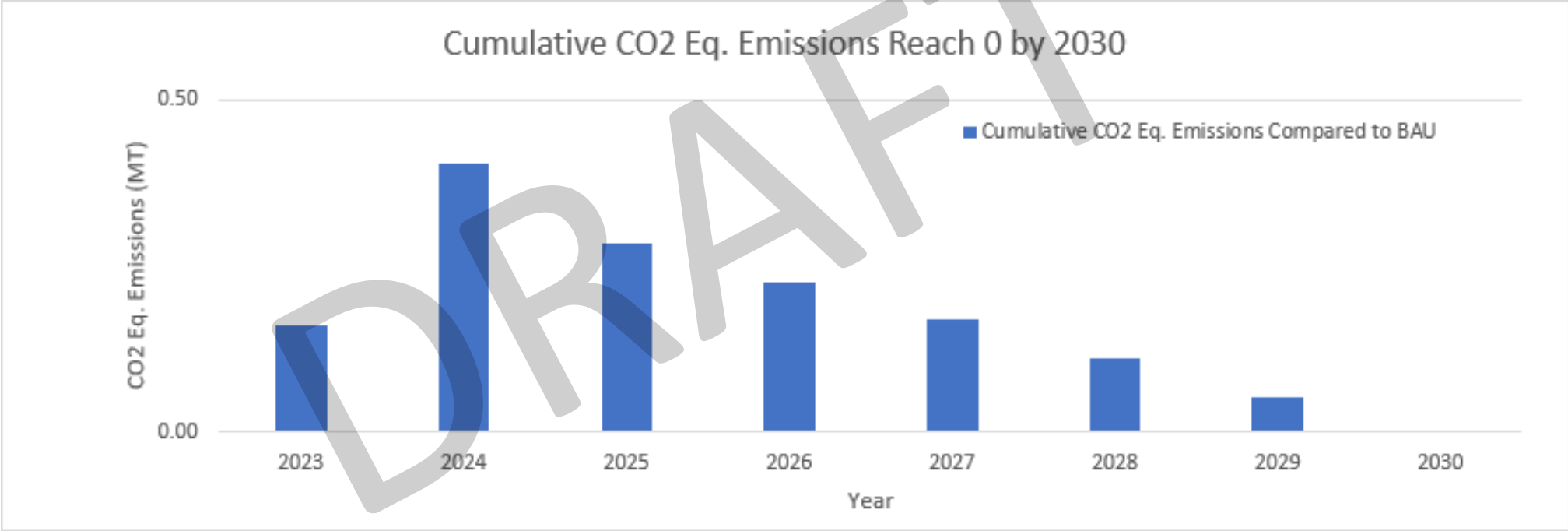
- Reclaimed refrigerant
used in new
equipment x GWP

- GHG_A^* of compliance
adjustments purchased
from another entity

* $\text{GHG}_p = \Sigma(\text{Charge} \times \text{GWP})$ shipped to and not exported from California

Reporting Example

Net emissions must sum to 0 or less by 2030



CO2 Equivalent Emissions (MT) (Change from BAU - 750 GWP baseline in 2023)									
Year	2022	2023	2024	2025	2026	2027	2028	2029	2030
Net Emissions	0.00	0.16	0.24	-0.12	-0.06	-0.06	-0.06	-0.06	-0.06
Cumulative Emissions	0.00	0.16	0.40	0.28	0.23	0.17	0.11	0.05	0

Reporting Example

OEMs report volume of refrigerant used in different applications each year.

Reporting Example for 2023, Emissions Data Represents Change from BAU - 750 GWP baseline in 2023	
Type of Refrigerant End-Use	Volume (Metric Tons)
R-410A used in new equipment	400
Reclaimed R-410A used in new equipment	100
Recovery of R-410A in existing equipment	50
Use of <750 GWP refrigerant (R-32)	50
Use of <750 GWP refrigerant (R-454B)	50
Use of <750 GWP refrigerant (R-466A)	0
Total Amount of Refrigerant Used	600

Reporting Example

Refrigerant volume is multiplied by its GWP and leak rate to calculate emissions

Reporting Example for 2023, Emissions Data Represents Change from BAU - 750 GWP baseline in 2023		
Type of Refrigerant End-Use	Volume (Metric Tons)	CO ₂ Eq. Emissions (MT) (Volume * GWP * [Lifetime * Leak Rate])
R-410A used in new equipment	400	0.32 (Debit compared to baseline)
Reclaimed R-410A used in new equipment	100	-0.08 (Credit compared to baseline)
Recovery of R-410A in existing equipment	50	-0.06 (Credit)
Use of <750 GWP refrigerant (R-32)	50	-0.01 (Credit)
Use of <750 GWP refrigerant (R-454B)	50	-0.01 (Credit)
Use of <750 GWP refrigerant (R-466A)	0	0
Net Amounts	600	0.16 (Net debit in 2023)

Reporting Example

Refrigerant volume is also multiplied by reclaim and shipping costs

Reporting Example for 2023, Emissions Data Represents Change from BAU - 750 GWP baseline in 2023			
Type of Refrigerant End-Use	Volume (Metric Tons)	Cost to OEMs (\$1.40/lb reclaim)	Cost to Reclaimers (\$0.05/lb shipping)
R-410A used in new equipment	400	N/A	\$0
Reclaimed R-410A used in new equipment	100	\$308,640	\$11,020
Recovery of R-410A in existing equipment	50	\$154,320	\$5,510
Use of <750 GWP refrigerant (R-32)	50	N/A	\$0
Use of <750 GWP refrigerant (R-454B)	50	N/A	\$0
Use of <750 GWP refrigerant (R-466A)	0	N/A	\$0
Net Amounts	600	\$462,970	\$16,530

Reporting Example

OEMs report refrigerant volume, by end-use, each year until 2030.

Tons of Refrigerant (Tons) (Change from BAU - 750 GWP baseline in 2023)										
	Responsible Party	2022	2023	2024	2025	2026	2027	2028	2029	2030
R-410A used in new equipment	OEMs	0	400	500	0	0	0	0	0	0
Reclaimed R-410A used in new equipment	OEMs	0	100	100	0	0	0	0	0	0
	Reclaimers	0	0	0	0	0	0	0	0	0
	OEMs	0	50	50	50	0	0	0	0	0
Recovery of R-410A in existing equipment	Reclaimers	0	0	0	0	0	0	0	0	0
	Contractors	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0
Use of <750 GWP refrigerant (R-32)	OEMs	0	50	50	300	300	300	300	300	300
Use of <750 GWP refrigerant (R-454B)		0	50	50	50	50	50	50	50	50
Use of <750 GWP refrigerant (R-466A)		0	0	0	0	0	0	0	0	0
Total Refrigerant		0	600	700	350	350	350	350	350	350

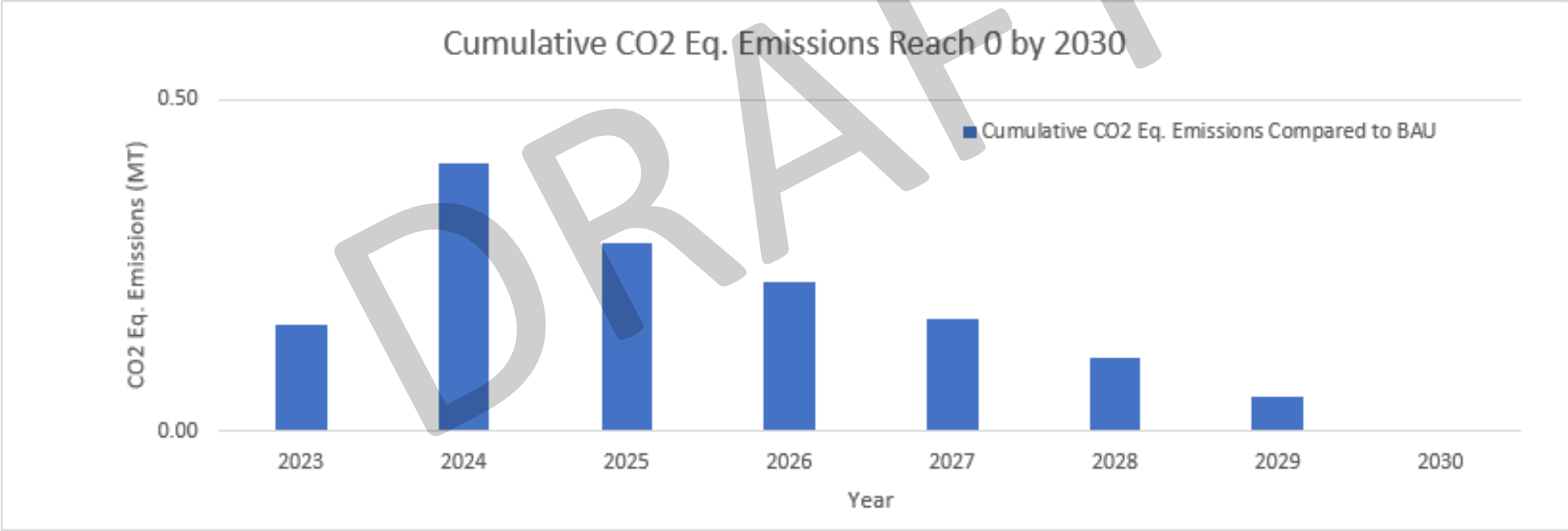
Reporting Example

- Emissions calculated based on volume, GWP, and leak rate.

CO2 Equivalent Emissions (MT) (Change from BAU - 750 GWP baseline in 2023)										
	Responsible Party	2022	2023	2024	2025	2026	2027	2028	2029	2030
R-410A used in new equipment	OEMs	0.00	0.32	0.41	0.00	0.00	0.00	0.00	0.00	0.00
Reclaimed R-410A used in new equipment	OEMs	0.00	-0.08	-0.08	0.00	0.00	0.00	0.00	0.00	0.00
	Reclaimers	0	0	0	0	0	0	0	0	0
Recovery of R-410A in existing equipment	OEMs	0.00	-0.06	-0.06	-0.06	0.00	0.00	0.00	0.00	0.00
	Reclaimers	0	0	0	0	0	0	0	0	0
	Contractors	0	0	0	0	0	0	0	0	0
Use of <750 GWP refrigerant (R-32)	OEMs	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Use of <750 GWP refrigerant (R-454B)		0	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Use of <750 GWP refrigerant (R-466A)		0	0	0	0	0	0	0	0	0
Charge Size Reduction (R-32)	OEMs	0	-0.01	-0.01	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03
Charge Size Reduction (R-454B)		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Charge Size Reduction (R-466A)		0	0	0	0	0	0	0	0	0
Net Emissions		0.00	0.16	0.24	-0.12	-0.06	-0.06	-0.06	-0.06	-0.06

Reporting Example

Net emissions must sum to 0 or less by 2030



CO2 Equivalent Emissions (MT) (Change from BAU - 750 GWP baseline in 2023)									
Year	2022	2023	2024	2025	2026	2027	2028	2029	2030
Net Emissions	0.00	0.16	0.24	-0.12	-0.06	-0.06	-0.06	-0.06	-0.06
Cumulative Emissions	0.00	0.16	0.40	0.28	0.23	0.17	0.11	0.05	0

- Total costs calculated based on volume

[illegible]

Reporting Example

- Results for Manufacturer A.

2022-2030 Proposal Results	
Total Refrigerant Installed (all types)	3,400 Metric Tons
R-410A Recovery Enabled	350 Metric Tons
Net Emissions by 2030	0 CO ₂ Eq. Emissions
Cost to OEM (Recovery)	\$1,080,250
Cost to Reclaimers (Shipping)	\$38,580