



Welcome!

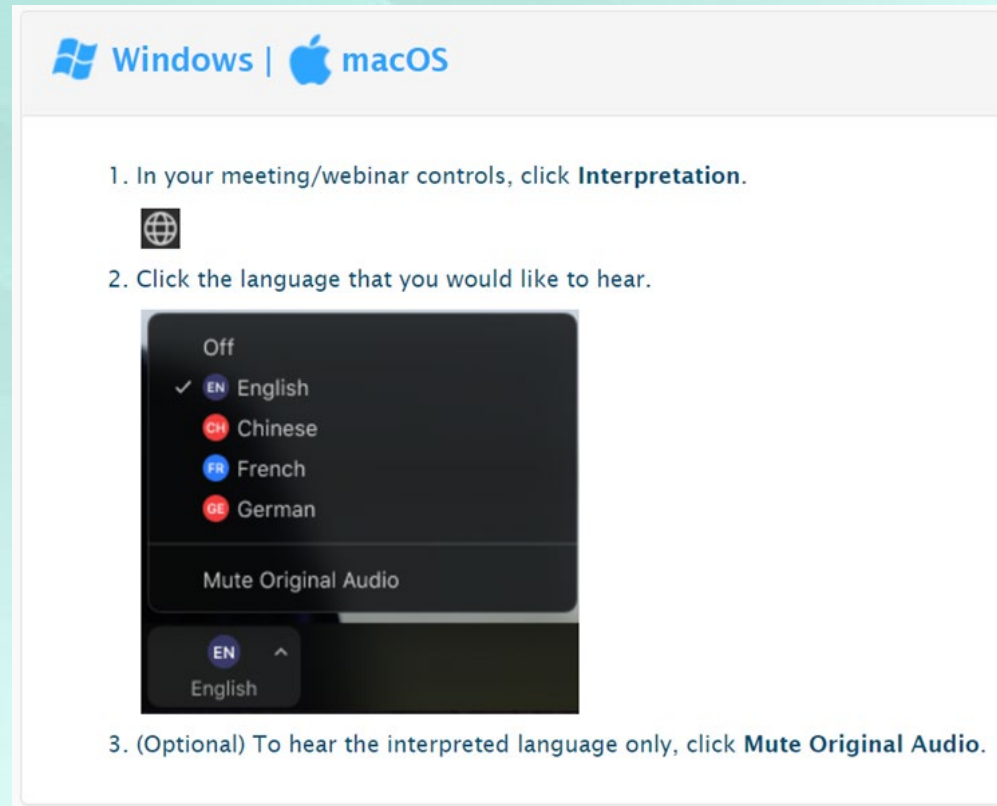
¡Bienvenidos!

The workshop will start at 1:02 P.M

El taller empezará a las 1:02 P.M.

Listening to Language Interpretation

- In your meeting/webinar controls, click **Interpretation**. (located at bottom of screen)
- Click the language that you would like to hear. Options for this meeting are English and Spanish.
- To only hear the interpreted language, click **Mute Original Audio**.



- En los controles de su reunión/seminario web, haga clic en **Interpretación**. (ubicado en la parte inferior de la pantalla)
- Haga clic en el idioma que le gustaría escuchar. Las opciones para esta reunión son inglés y español.
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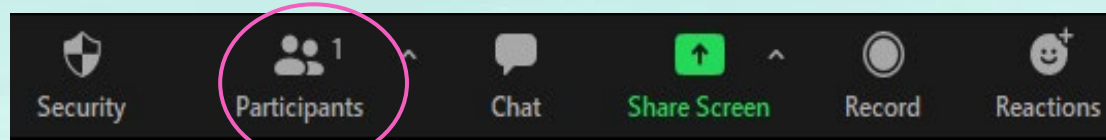
Before We Get Started

- Please **mute** and **rename** yourself.

First Name, Last Name - Affiliation

- Affiliations: Community Organization / Agency / Air District / Company / Resident / etc.

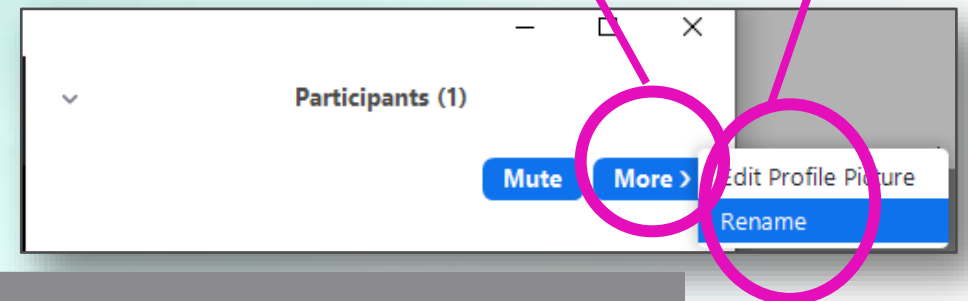
Need help? - let us know in the Q&A.

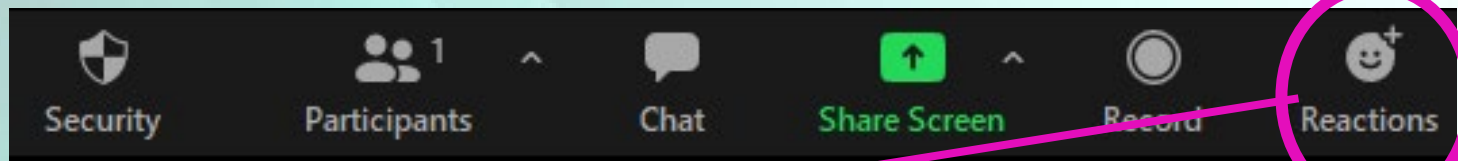
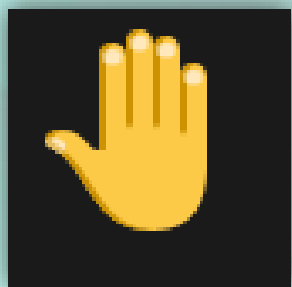


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To Rename

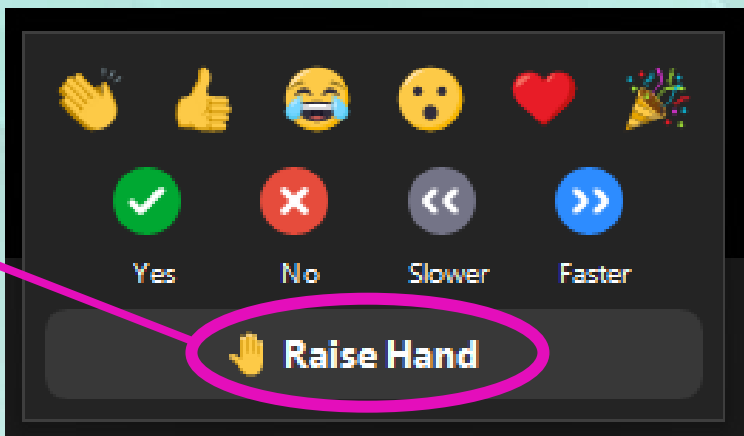
1. Press **Participants**.
2. Locate your name and press the ellipses (...) or "more".
3. Select **rename**.



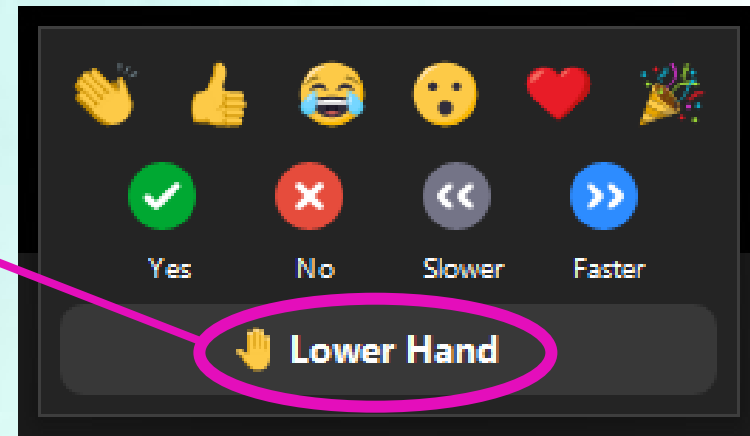


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Raise & Lower Your Hand

1. Press the **Reactions** button on the **Zoom Menu Bar**.
2. Press the **Raise Hand Button**. When raised, the button will say "**Lower Hand**."
3. Press the **Lower Hand Button** to lower your hand again.
4. Callers press #2



Transport Refrigeration Units (TRU) Regulation Updates Workshop

July 2025

Agenda

- **TRU Airborne Toxic Control Measure (TRU ATCM)**
 - 2022 TRU ATCM Amendments Implementation Update
 - Next Rulemaking Updates
 - Discussions
- **Draft TRU Baseline Emissions Inventory**
 - Methodology
 - Discussion





2022 TRU ATCM Amendments Implementation Update

2022 TRU ATCM Amendments

- Adopted in 2004
- Amended in 2010, 2011, and 2022
- February 24, 2022
 - Approved by CARB's Board
- July 18, 2022
 - Approved by the Office of Administrative Law
- October 1, 2022
 - Effective Date

Key Elements of the 2022 TRU ATCM Amendments

December 31, 2022

Requirement	Applicable Facility	Truck TRU	Trailer TRU	Domestic Shipping Container TRU	Railcar TRU	TRU Generator Set
Model year 2023 or newer TRUs must meet particulate matter emission standard of 0.02 g/hp-hr or lower			✓	✓	✓	✓
Model year 2023 or newer TRUs must use refrigerant with global warming potential $\leq 2,200$ or use no refrigerant at all		✓	✓	✓		

Key Elements of the 2022 TRU ATCM Amendments Cont.

December 31, 2023

Requirement	Applicable Facility	Truck TRU	Trailer TRU	Domestic Shipping Container TRU	Railcar TRU	TRU Generator Set
Report all TRUs operating in California		✓	✓	✓	✓	✓
Registration and reporting requirement for applicable facility	✓					
TRU and applicable facility registration fees every 3 years*	✓	✓	✓	✓	✓	✓
CARB compliance label requirement		✓	✓	✓	✓	✓
Zero-emission fleet requirement of 15% per year**		✓				

*On December 4, 2023, a California trial court prohibited CARB from collecting fees included in the 2022 TRU ATCM amendments at this time.

** U.S. EPA did not act on the zero-emission truck TRU fleet requirement to replace at least 15% of diesel-fueled truck TRUs with zero-emission truck TRUs annually.

United States Environmental Protection Agency (U.S. EPA) Action



- January 3, 2025
 - U.S. EPA waived federal preemption for portions of CARB's TRU Regulation, but did not act on the zero-emission TRU requirements.

What Does this Mean for Original Equipment Manufacturers and California Dealers?

- TRU Original Equipment Manufacturers:
 - May manufacture new diesel-fueled truck TRUs for sale or use in California
 - Must be otherwise compliant with the TRU ATCM
- California Dealers:
 - May sell newly-manufactured diesel-fueled truck TRUs
 - Must be otherwise compliant with the TRU ATCM



What Does this Mean for Truck TRU Owners and Owner/Operators?



- Not required to turnover their diesel-fueled truck TRU fleet to zero-emission
- May purchase newly-manufactured diesel-fueled truck TRUs from California dealers that are otherwise compliant with the TRU ATCM
- Truck TRUs manufactured after December 31, 2022 must use a refrigerant with global warming potential $\leq 2,200$ or no refrigerant at all
- Must meet reporting and labeling requirements

Truck TRU Implementation Summary

- Diesel truck TRU owners and owner/operators are not required to purchase zero-emission truck TRUs
- Truck TRU owners and owner/operators can still use their diesel-fueled truck TRUs
- Engine model year 2014 and older diesel-fueled truck TRUs were subject to the ultra-low-emission in-use performance standard (ULETRU) seven years after the engine model year
- Engine model year 2015 and newer diesel-fueled truck TRUs are not currently subject to an in-use standard or compliance deadline until a more stringent standard is adopted
- Diesel truck TRU owners and owner/operators may purchase newly-manufactured diesel-fueled truck TRUs from California dealers
- Newly-manufactured diesel-fueled truck TRUs may be used until a more stringent standard is adopted
- All other requirements included in the 2022 Amendments will be implemented as authorized
- Not required to pay TRU operating fees at this time
- See the FAQ for additional information



Next Steps - TRU ATCM

- Continue 2022 TRU ATCM Amendments implementation
- Continue stakeholder outreach and provide updates on the [TRU Program Page](#)
- Encourage use of the cleanest technology available
- For any additional questions or comments regarding the 2022 TRU ATCM Amendments, please contact the ARBER Help Line at:
 - Email: arber@arb.ca.gov
 - Phone number: (888) 878-2826

Discussion



Please **raise your hand** to speak or submit your question to the Q&A.



Please **state your name** and **affiliation**.



Next TRU Rulemaking Update

Non-Truck TRUs



Trailer
TRU



Domestic
Shipping
Container
(DSC) TRU



Railcar TRU



TRU
Generator
Set

Next TRU Rulemaking

- Goals:
 - Achieve zero-emissions
 - Will consider truck TRUs and non-truck TRUs
 - Updated zero-emission concepts
- New goal for Board consideration
 - 2029
- Staff are soliciting info on zero-emission truck TRUs
 - Technology
 - Fleet operations



Current Work: Concept Development and Outreach



- TRU concept updates
- Stakeholder meetings and site visits
- Community outreach and environmental justice planning


Next Steps - TRU Rulemaking

- Determine timing and specifics for future TRU action
- Continue to refine concepts and analysis
- Future workshop - to be determined
- Submit any additional questions or comments on TRU activities at:
 - Email (implementation): arber@arb.ca.gov
 - Email (rulemaking): freight@arb.ca.gov

Resources


TRU Program Webpage

<https://ww2.arb.ca.gov/our-work/programs/transport-refrigeration-unit>




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< BACK TO ALL PROGRAMS

Transport Refrigeration Unit

About

News

Resources

New Regulation Development

2022 Non-Truck TRU Fleet Survey

Meetings & Workshops

Technology Assessments

Advisories

FAQs

Funding Assistance

Compliance Information

Forms

Transport Refrigeration Units (TRU) are refrigeration systems powered by diesel internal combustion engines designed to refrigerate or heat perishable products that are transported in various containers, including truck vans, semi-truck trailers, shipping containers, and railcars.

MORE ABOUT THIS PROGRAM >

2022 Amendments to the TRU ATCM

New amendments to the TRU ATCM are effective October 1, 2022. CARB staff have prepared a Regulatory Advisory on the 2022 Amendments (Español) to assist with the new requirements. Additional implementation-related information is available on the TRU Compliance Information Webpage, including a Frequently Asked Questions (Español) document.






CARB staff have posted the application form for Compliance Extensions Based on Unavailability of Compliance Technology on the TRU Forms page.


LEARN MORE


Resources Cont.

TRU Incentives Webpage

<https://ww2.arb.ca.gov/our-work/programs/transport-refrigeration-unit/tru-funding-assistance>



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News

Resources

New Regulation Development

2022 Non-Truck TRU Fleet Survey

Meetings & Workshops

Technology Assessments

Advisories

FAQs

Funding Assistance

Compliance Information

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Funding programs supporting the accelerated deployment of cleaner transport refrigeration units (TRU) are a crucial component of California's efforts to promote sustainability in the freight sector. The list below includes funding programs, both active and under development, which may provide funding for cleaner TRUs, as well as supporting electric charging or fueling infrastructure. Each of these programs have different funding requirements, application timelines, and limited funding availability. CARB encourages interested stakeholders to act early and utilize funding while it is available.

Clean Off-Road Equipment Voucher Incentive Project

The Clean Off-Road Equipment Voucher Incentive Project features a streamlined voucher process for buyers to receive funding that will offset the higher costs of clean, commercial ready zero-emission equipment including terminal tractors, transport refrigeration units, cargo-handling equipment, and more.

Contact Information
<https://californiacore.org/contact-outreach/>
Email: info@californiacore.org
CORE's Toll- Free Hotline: 1-866-919-CORE or 1-866-919-2673
Available Mon-Fri, 9am-5pm PT. Se habla español.

AB 617 Community Air Protection Incentives

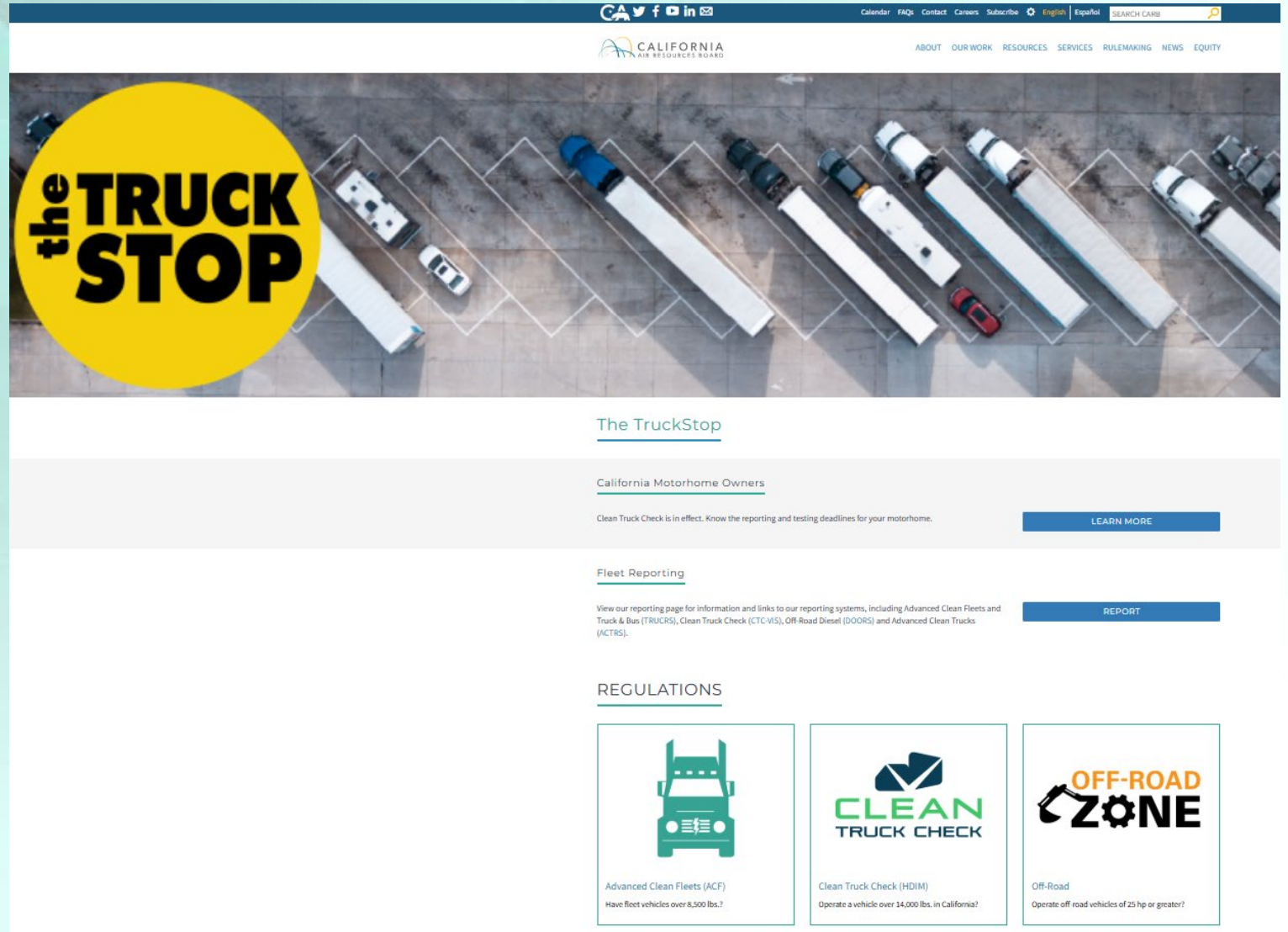
AB 617 Community Air Protection Incentives are available for projects that result in immediate air quality benefits to the most impacted communities across the State. The Community Air Protection Incentives 2019 Guidelines, approved by the Board in May 2019, represent CARB's next steps in taking advantage of new opportunities for incentives to help clean up sources of air pollution.

Contact Information
Email: AB617Incentives@arb.ca.gov

Resources Cont.

The TruckStop

<https://ww2.arb.ca.gov/our-work/programs/truckstop-resources/truckstop>



The screenshot displays the CARB website's 'the TRUCK STOP' section. At the top, a dark blue header contains social media icons and a search bar. Below this, a white navigation bar lists links: ABOUT, OUR WORK, RESOURCES, SERVICES, RULEMAKING, NEWS, and EQUITY. The main banner features an aerial view of a parking lot with several semi-trucks, overlaid with a large yellow circle containing the text 'the TRUCK STOP'. Below the banner, three sections are visible: 'California Motorhome Owners' with a 'LEARN MORE' button, 'Fleet Reporting' with a 'REPORT' button, and 'REGULATIONS' which includes three boxes for 'Advanced Clean Fleets (ACF)', 'Clean Truck Check (HDIM)', and 'Off-Road'.

the TRUCK STOP

The TruckStop

California Motorhome Owners

Clean Truck Check is in effect. Know the reporting and testing deadlines for your motorhome.

[LEARN MORE](#)

Fleet Reporting

View our reporting page for information and links to our reporting systems, including Advanced Clean Fleets and Truck & Bus (TRUCKS), Clean Truck Check (CTC-VIS), Off-Road Diesel (DOORS) and Advanced Clean Trucks (ACTRS).

[REPORT](#)

REGULATIONS

Advanced Clean Fleets (ACF)
Have fleet vehicles over 8,500 lbs.?

CLEAN TRUCK CHECK
Clean Truck Check (HDIM)
Operate a vehicle over 14,000 lbs. in California?

OFF-ROAD ZONE
Off-Road
Operate off road vehicles of 25 hp or greater?

Discussion



Please **raise your hand** to speak or submit your question to the Q&A.



Please **state your name** and **affiliation**.



Transport Refrigeration Unit (TRU) Emissions Inventory

July 2025

What is a TRU? Why are They Important?

- TRUs are refrigeration systems that provide temperature control and air flow for goods in trucks, trailers, railcars, and shipping containers.
- A TRU generator set is a generator that provides electricity for a refrigeration system.
- Most TRUs and TRU generator sets run on **diesel**, which create pollutants like diesel **particulate matter** (PM) and **oxides of nitrogen** (NOx). This can have significant health impacts particularly when many TRUs are running at the same location, like food distribution facilities.



What is an Emissions Inventory?

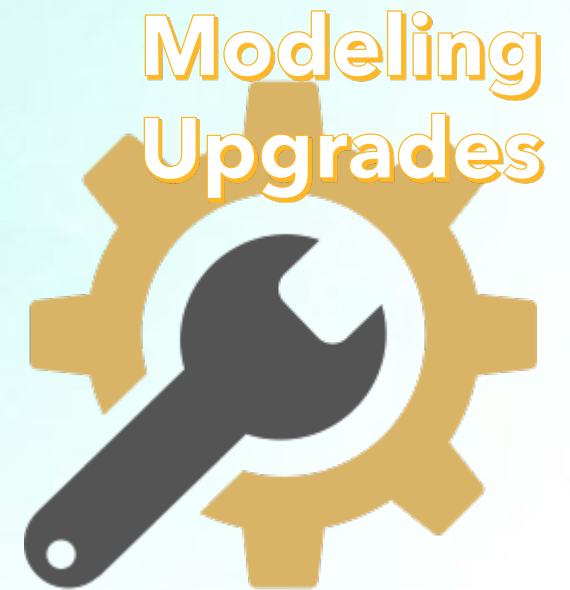
An emissions inventory accounts for:

- *Population* or number of TRUs being used
- *Activity* or how many hours per year the engine runs
- *Model year* or age of the engine
- *Rated power* or the size of the engines used
- *Load factor* or how hard the equipment is run on average
- *Emission factor* or the average emissions per unit work of the engine

These variables can be used to determine the total annual emissions from all equipment for a given region and year.

TRU Inventory Update

- The current TRU emissions inventory was last updated to include the 2022 Amendments (referred to as 2021 Emissions Inventory) to the TRU Air Toxic Control Measure in 2022
- Updates broadly include emissions factors from in-use testing, newer certification data, TRU registration data, updated growth forecasts, and improved fleet level specificity



Categories: Equipment Types

CARB delineates TRUs into five categories:

- **Trailer TRU:** Most common TRU type, attached to trailers generally pulled by semi-trucks.
- **TRU Generator Set:** Provides power to a non-integrated refrigeration unit.
- **Truck TRU:** Used to cool single-body trucks, generally used on shorter routes.
- **Railcar TRU:** Supply refrigeration to refrigerated boxcars pulled by locomotives.
- **Domestic Shipping Container (DSC) TRU:** TRUs that refrigerate a shipping container, often intermodal.

Both Trailers TRUs and TRU Generator Sets are split into:

- **In-State :** Registered to a company based in California.
- **Out-of-State :** Registered to a company based out-of-state (OOS).



Population

- Air Resources Board Equipment Registration (ARBBER) is an online registration program for TRUs used in California.
- New draft TRU emissions inventory uses **January 2024** ARBER data.
- The 2021 Emissions Inventory expanded reporting requirements to newly require reporting of out-of-State TRUs.
- First annual reporting deadline: Dec 31st, 2023
 - Previous inventory estimated **131,200** out-of-State Trailer TRUs, based on trucking patterns.
 - January 2024 ARBER data shows **141,500** out-of-State Trailer TRUs.
 - No longer any adjustment for out-of-State Trailer TRU populations, instead ARBER reporting is used directly with modification.

CA.GOV California Environmental Protection Agency
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ARBBER: AIR RESOURCES BOARD EQUIPMENT REGISTRATION

****Please ensure your ARBER account is current and accurate. New Regulatory requirements for TRUs start December 31, 2023****

WELCOME TO ARBER, THE ARB EQUIPMENT REGISTRATION PROGRAM

ARBBER is an online registration program for the Drayage Truck and Transport Refrigeration Unit Regulations. Please review the online system and regulation requirements before attempting to use ARBER.

View the [Online Registration System Requirements](#).

Program Contacts
For general ARBER questions, send an email to arber@arb.ca.gov

Drayage Truck Registration -
Toll-Free Helpline: 1-888-247-4821
Direct Line: 1-916-322-2277
Email: drayagetruck@arb.ca.gov
See the [Drayage Truck Program](#).
See the [Help Pages](#).

Transport Refrigeration Unit and Generator Set Registration -
Toll-Free Helpline: 1-888-878-2826
Email: arber@arb.ca.gov
See the [Transport Refrigeration Unit Program](#).
See the [Help Pages](#).
See the [Compliance Extension Forms](#).

Other Diesel Program Contacts -
[Contact the Diesel Hotline](#)

LOGIN

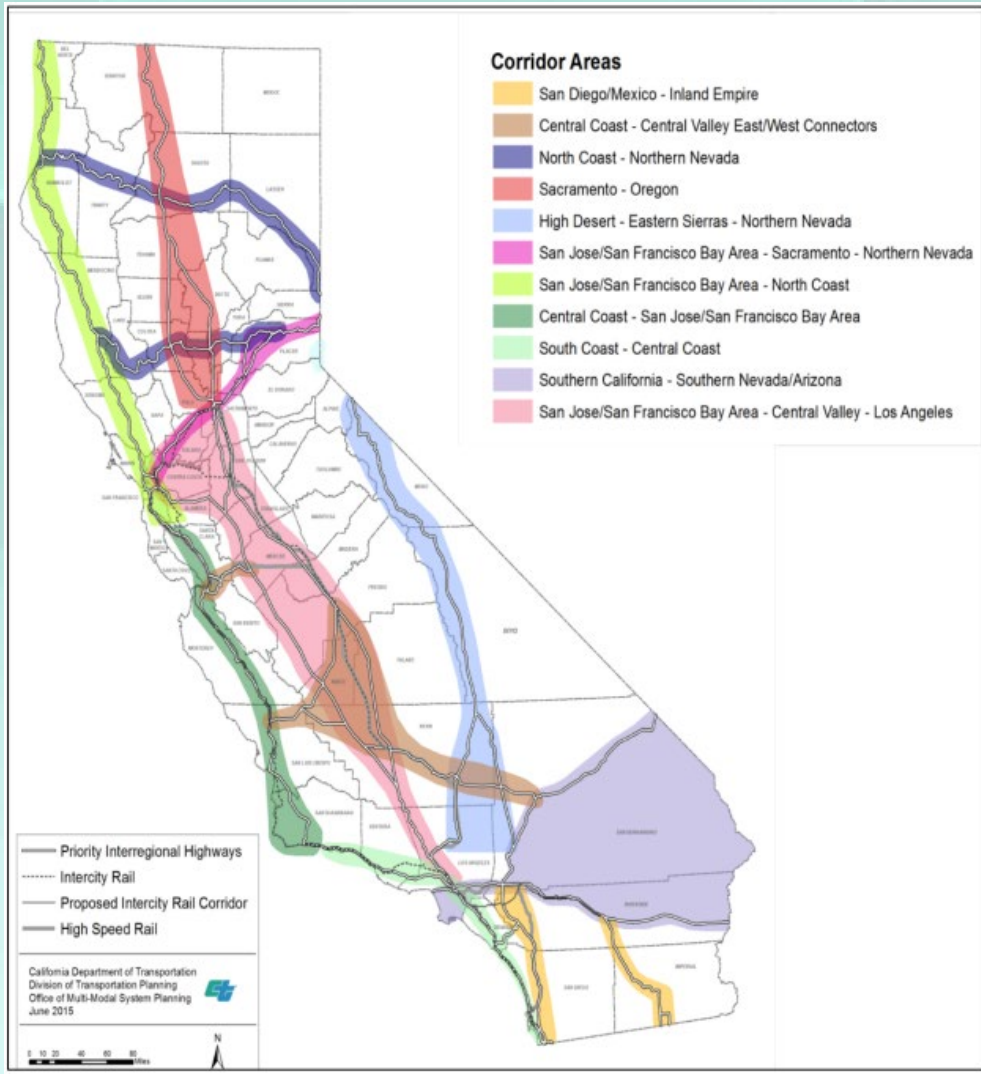
User Id:
Password: (case-sensitive)

[I Forgot My Password](#)

Don't have an ARBER account?
Click the button below to sign up for a new User and Company account.

Important Information for First Time Users -
In order to use ARBER, you must first set up a user and company profile. If you are a company that manages equipment that are owned by other companies, first create your company profile and then contact the appropriate ARB program contact to complete your setup.

Population In-State vs. Out-of-State



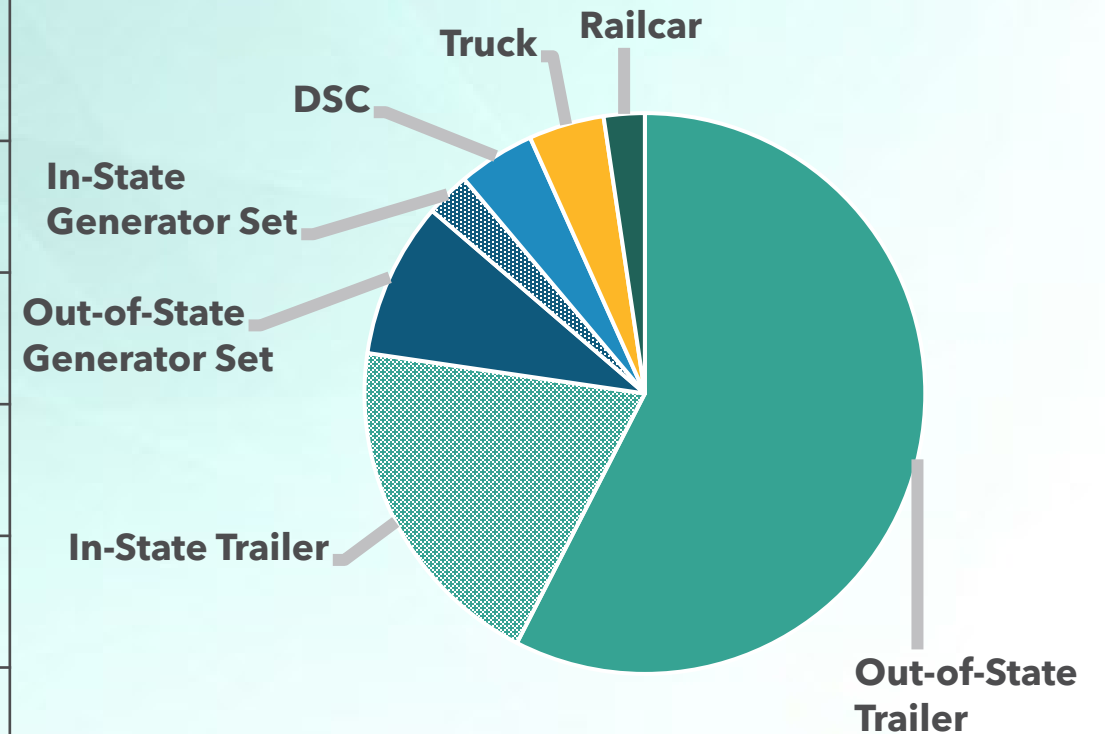
California Freight Corridors: Caltrans

- TRUs and generator sets are owned by a mix of California-based companies that primarily operate in-State, and out-of-State companies that visit California.
- CARB uses the **ARBER registration company address** to determine in-State vs out-of-State.
- ARBER also provides home state of trailer registration
 - **Analysis:** Less than 2% difference between in-State and out-of-State designations if DMV data is used instead of company address.
- Truck TRUs are modeled as in-State due to shorter routes, and railcar and DSCs modeled as primarily out-of-State due to use on longer freight corridors.

2024 Population by Equipment Type

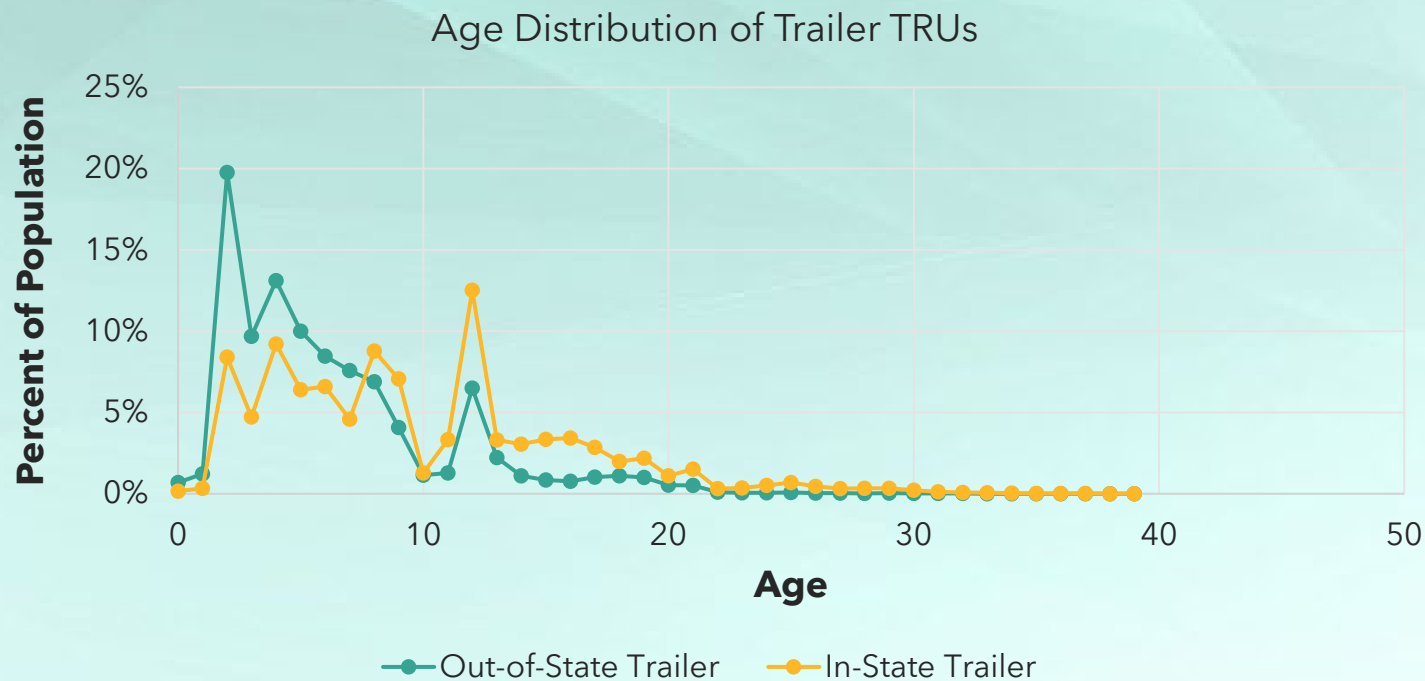
- Majority of population is Trailer TRUs, followed by Generator Sets.

TRU Type	In-State	Out-of-State	Percent of TRUs
Trailer TRU	48,600	141,500	77%
Generator Set	6,300	22,100	12%
DSC TRU	-	10,900	4%
Truck TRU	10,700	-	4%
Railcar TRU	-	5,800	2%



Population Age Distribution

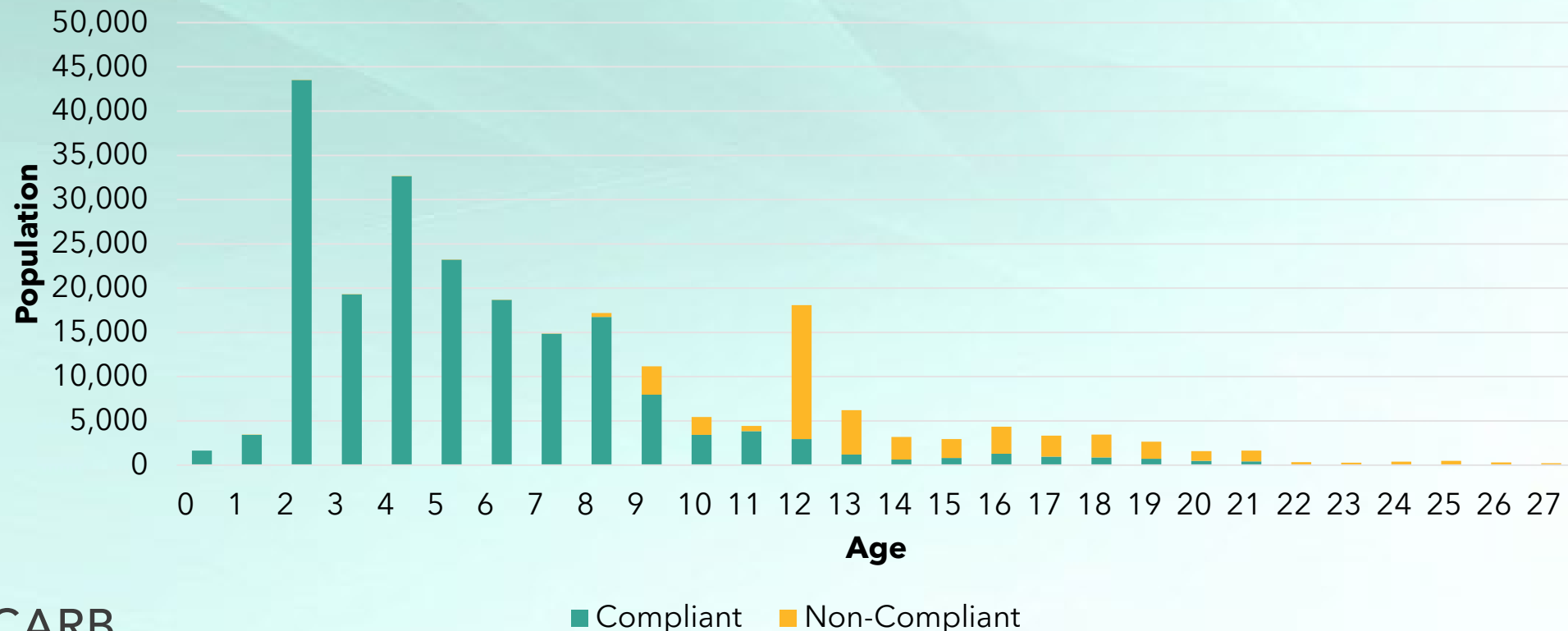
- Each equipment type has a different age distribution, with out-of-State fleets of Trailer TRU and Generator Sets generally younger on average than in-state fleets.



Equipment Type	In-State Average Age	Out-of-State Average Age
Trailer TRU	9.8	6.3
Generator Sets	9.4	6.4
Truck TRU	7.7	7.7
Railcar TRU	4.7	4.7
DSC TRU	2.4	2.4

Population by Age and Compliance Status

- 18 percent of all registered TRUs are not compliant with TRU ATCM.
- Inventory excludes a small number of TRUs from ARBER that were age 28 or older.
 - Data from CARB's enforcement program showed these older TRUs were likely not in service.



Activity

- No planned changes from previous inventory
- Activity data based on surveys of facilities and telematics data
 - **All Trailer TRUs, Generator Sets, Railcar and DSC:** 2018 telematics data and 2011 facility survey data weighted averages
 - **Truck TRUs:** 2011 facility survey data

Data Source	Cumulative TRU Time Represented	TRU Units Represented	Average Annual Hours	Time-weighted Average Hours
Facility Survey - Trailers	1,100,000 Hours (125 years)	5,535 Trailers	1,712	2,201
Telematics Data - Trailers	870,000 hours (99 years)	811 Trailers	2,876	2,201
Facility Survey - Trucks	92,000 hours (11 years)	459 Trucks	1,360	1,360

Activity: In-State Fraction

- Draft inventory carries forward existing methodology that adopts in-State operation fraction to EMFAC data for trucks
- Operation fraction comes from International Registration Plan (IRP) data, which provides information on where trucks drive

Category	Annual Activity Inside and Outside California (hours)	IRP Data - Portion Inside California (%)	Average Annual Activity Inside California (hours)
In-State Trailer TRU and Generator Sets	2,201	78.0%	1,719
Out-of-State Trailer TRUs and Generator Sets*, Railcar* and DSC*	2,201	12.4%	272
Truck TRU	1,360	100%	1,360

*Updated for this inventory, previously modeled with 1,000 annual hours total (including operation inside and outside California)

Engine Rated Power

- The engine rated power is based on each **engine model** reported in ARBER, and the manufacturer's rated horsepower (HP) for each model.

Category	Average Horsepower: Below 23 HP	Average Horsepower: 23 to 25 HP	Average Horsepower: 25 HP and Over
In-State Trailer TRU	-	24.8	33.8
Out-of-State Trailer TRU	-	24.7	33.7
All Generator Sets	-	24.8	33.2
Railcar and DSC	-	24.7	33.7
Truck TRU	17.2	-	-

Load Factor

- No changes since the 2021 Emissions Inventory
- Based on certification cycle data, which was previously corroborated with telematics data
- Efficiency improvements in trailer TRUs over 25 HP resulted in reduced load factors for MY 2013 and newer

TRU Category	Below 23 HP	Between 23 and 25 HP	Over 25 HP: 2012 and Older	Over 25 HP: 2013 and Newer
All Trailer TRUs	-	0.46	0.46	0.38
All Generator Sets	-	0.33	0.33	0.27
Truck TRUs	0.56			
Railcar TRU	-	0.46	0.46	0.38
DSC TRU	-	0.46	0.46	0.38

Emission Factors

- Emission factors represent the average amount of pollutant per hour for each brake-horsepower
- Previous inventories used engine certification data from manufacturers, measured in laboratory conditions, not during real-world operation
- New draft inventory uses NO_x emission factors measured from in-use operation of TRUs
- PM, hydrocarbons (HC), and reactive organic gases (ROG) continue to use certification data as it remains the best available source for those pollutants



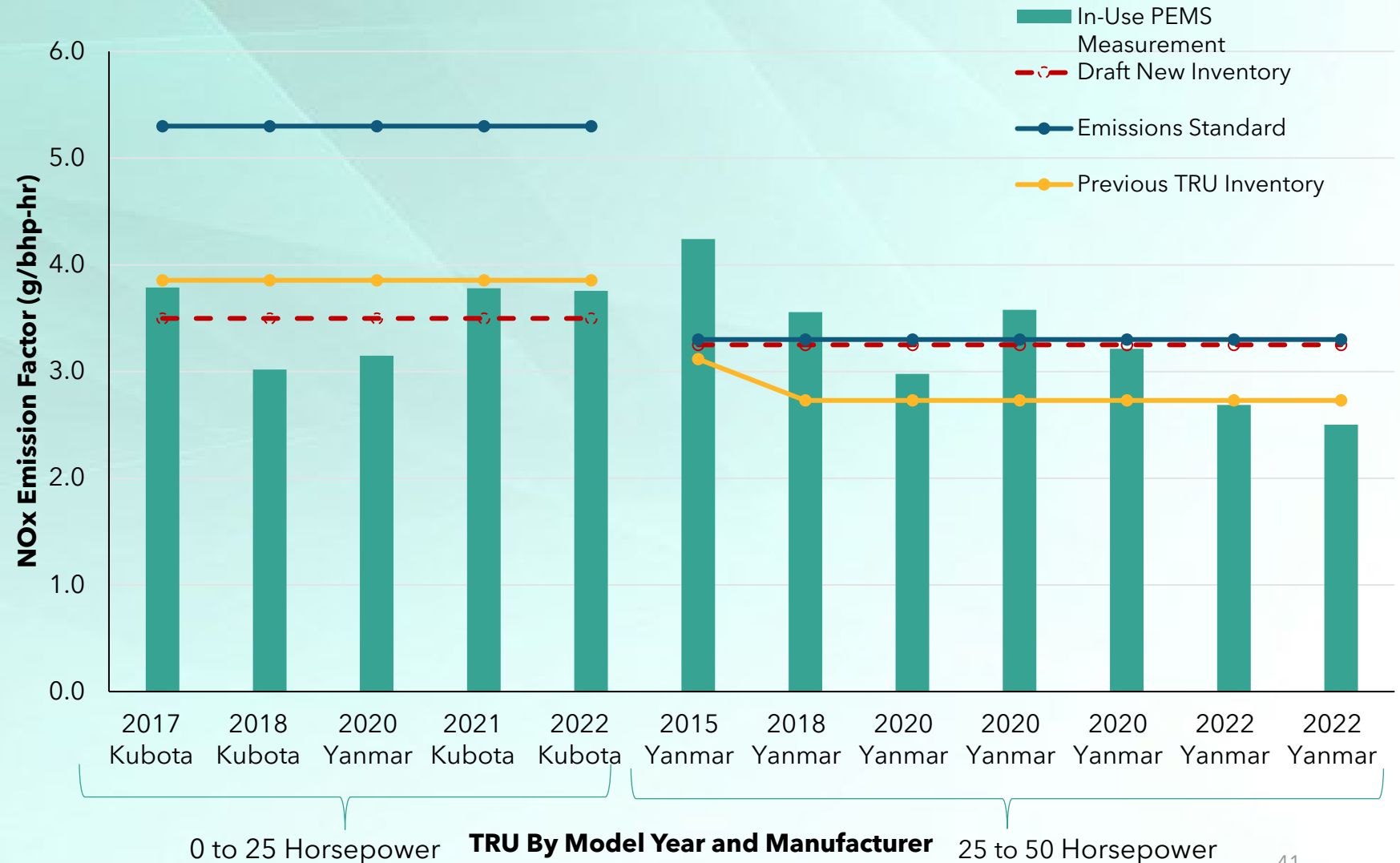
In-use Emissions Testing of TRUs using Portable Emissions Measurement Systems (PEMS)

- CARB ran an in-house emissions testing program from 2020-2024 at the Depot Park Facility in Sacramento, California.
- Test modes included cycle-sentry and continuous flow, both with the door open and closed
- Each test was 1 hour, repeated 3 times
- 12 TRUs tested spanning MY 2012 to 2022



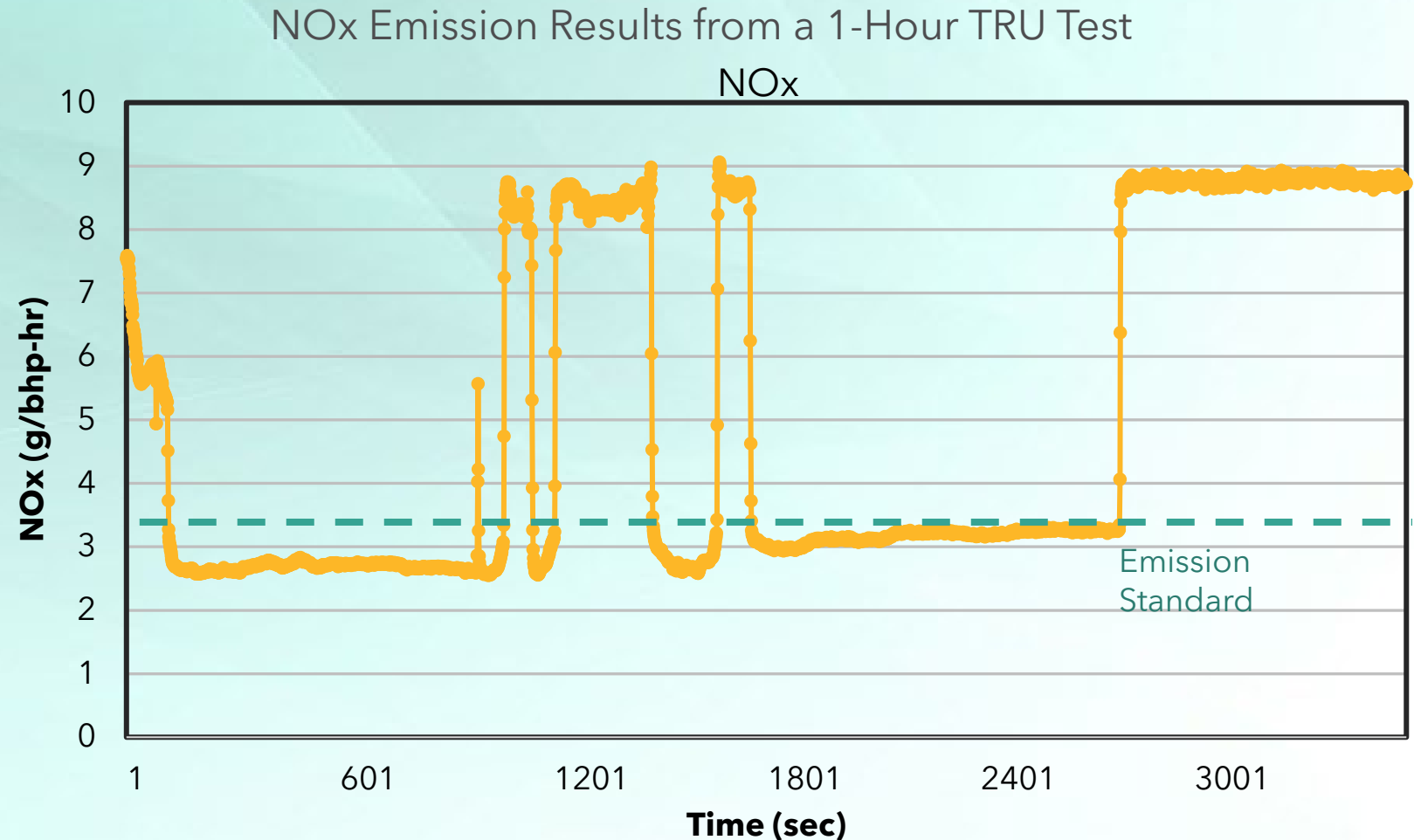
TRU NOx Emission Testing Results

- PEMS emissions factors (green bars) were averaged across units within horsepower bin (0-25 and 25-50) to generate red dashed line
- Relative to previous inventory (yellow line), new draft inventory emissions factors are:
 - 0-25 hp: 9% lower
 - 25-50 hp: 19% higher



One-Hour TRU Test Showing High-NOx Period

- NOx emissions widely fluctuated during tests – CARB staff used average
- Some TRUs had higher NOx emissions toward end of the one-hour test
- Future consideration:
 - Average results could have been higher if testing continued for a longer period

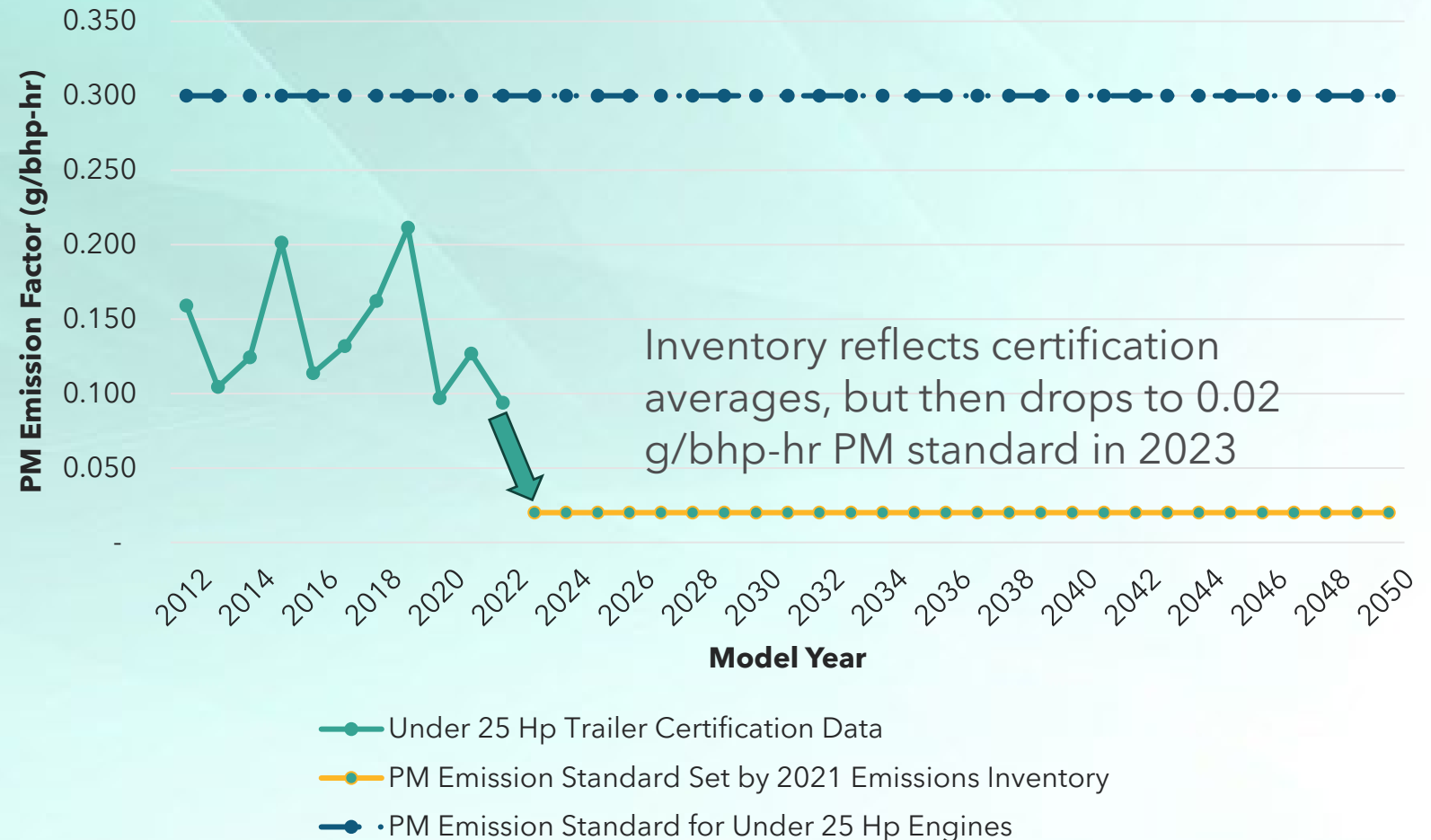


Certification Data

- For PM, HC, and ROG emissions factors, CARB staff continued to use engine certification data
- Each engine manufacturer must test engines following a specific engine cycle and report the results to both the U.S. Environmental Protection Agency and CARB
- CARB staff used ARBER data to determine engine families
- Draft new TRU inventory incorporates additional certification data for MY 2020-2024 engines
- Population of engine families in ARBER was used to weight emission factors

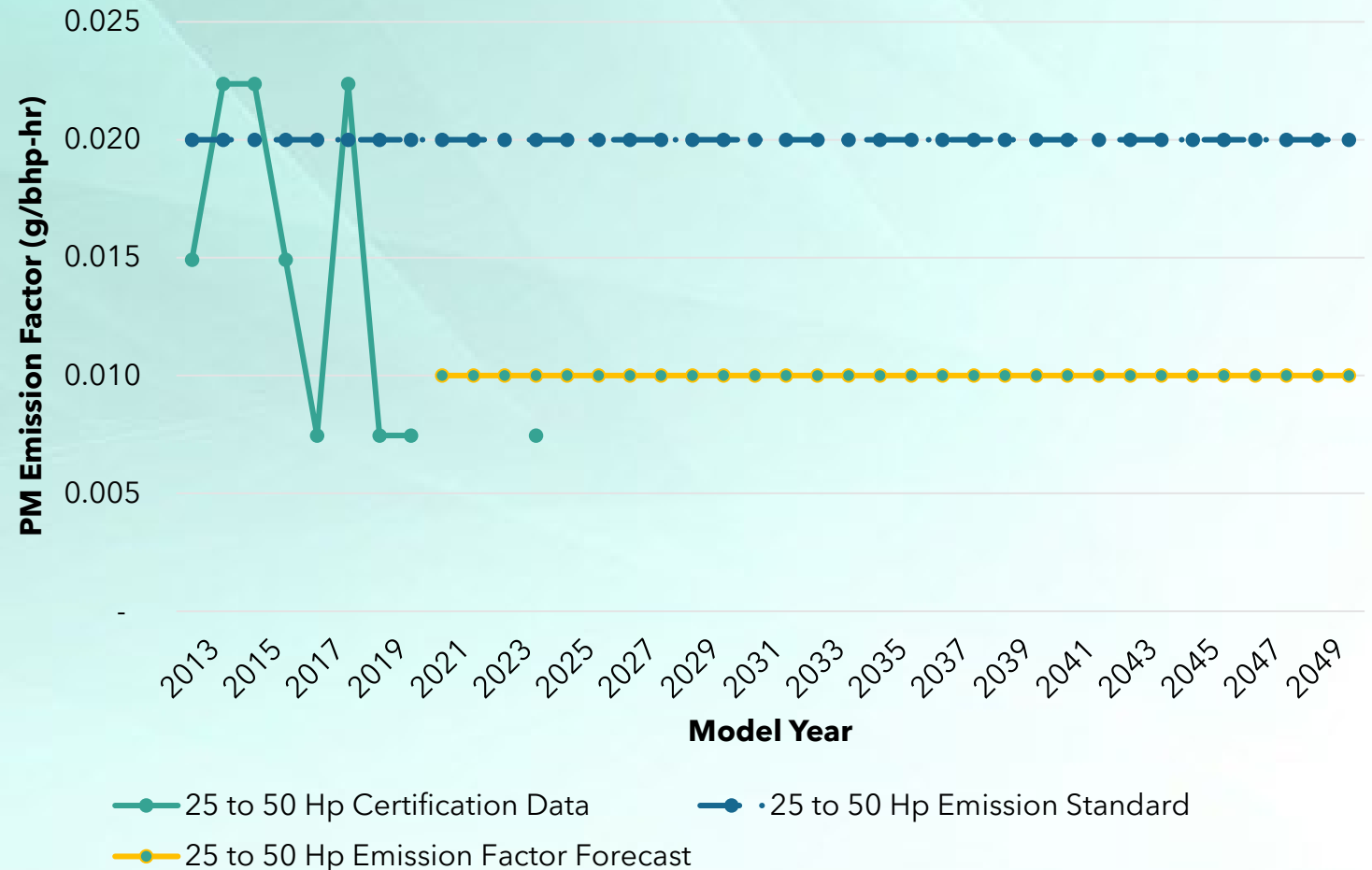
PM Emission Factors for Trailers Under 25 Horsepower

- The 2021 Emissions Inventory set a standard of 0.02 g/bhp-hr, aligning with 25 to 50 horsepower emission standards.
- Inventory is using certification data up to and including model year 2022
- Model year 2023 and later set to 0.02 g/bhp-hr standard



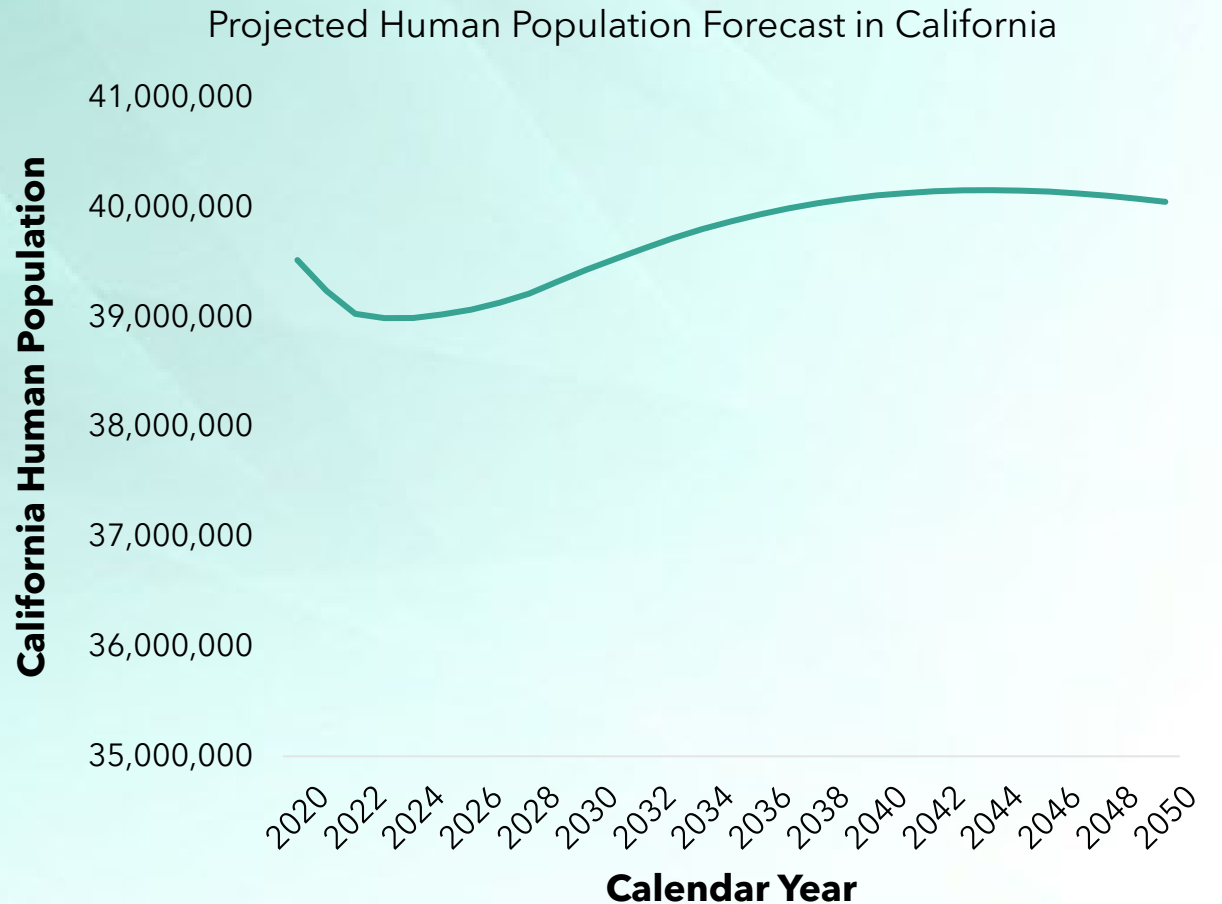
PM Emission Factors 25-50 Horsepower

- Certification data is lower than certification standards for TRUs over 25 horsepower
- Certification data from 2020-2024 showed an average of 0.01 g/bhp-hr compared to the standard of 0.02 g/bhp-hr.



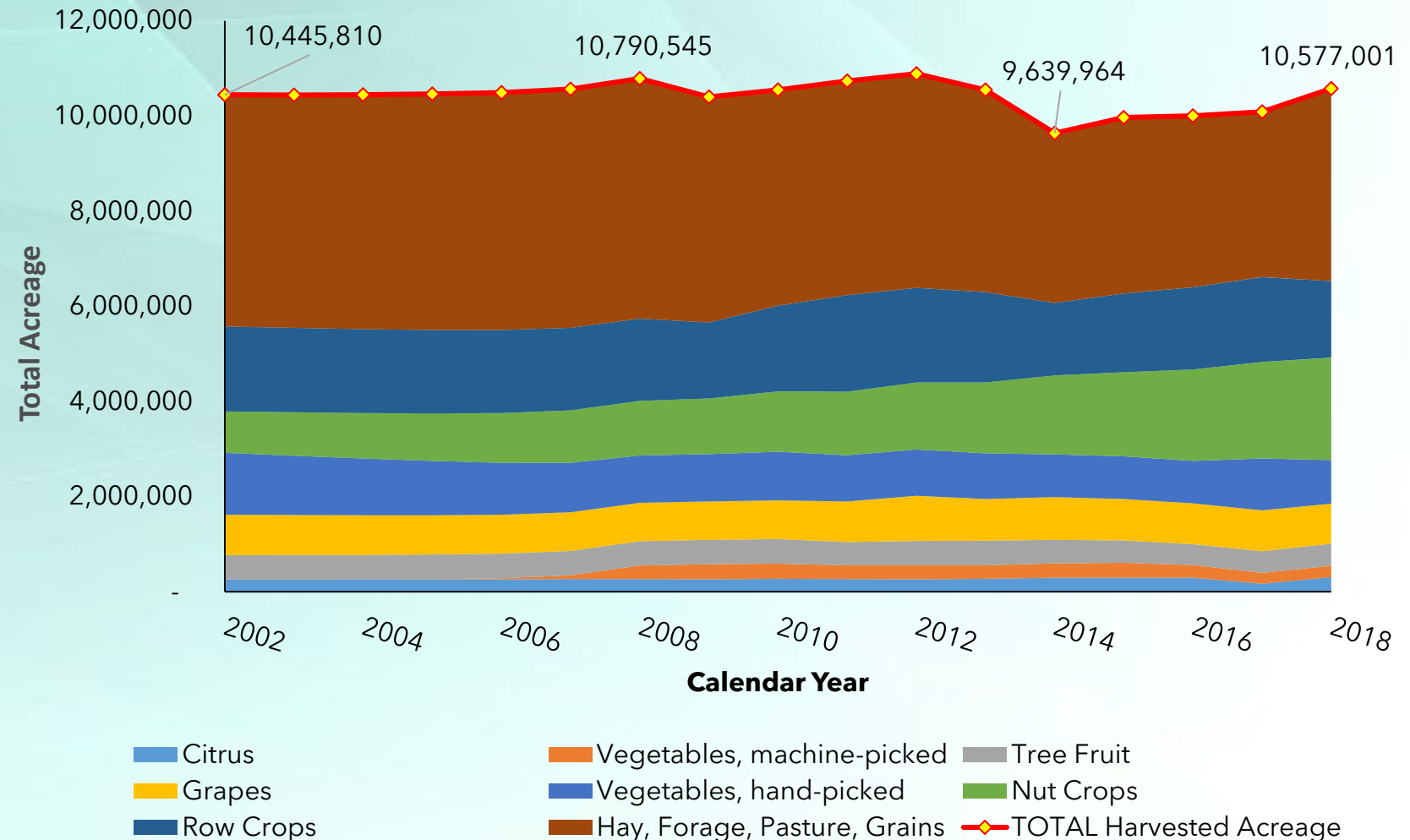
Growth: Population Forecasts

- TRU growth factors based on California population growth (showing an increased demand for frozen goods in California) and agricultural production (showing an increased supply of frozen goods to transport out-of-state).
- Current growth projection comes from California's 2022 population projection from the California Department of Finance.
- The total growth from 2023-2050 is about 1%, or 0.03% annually.



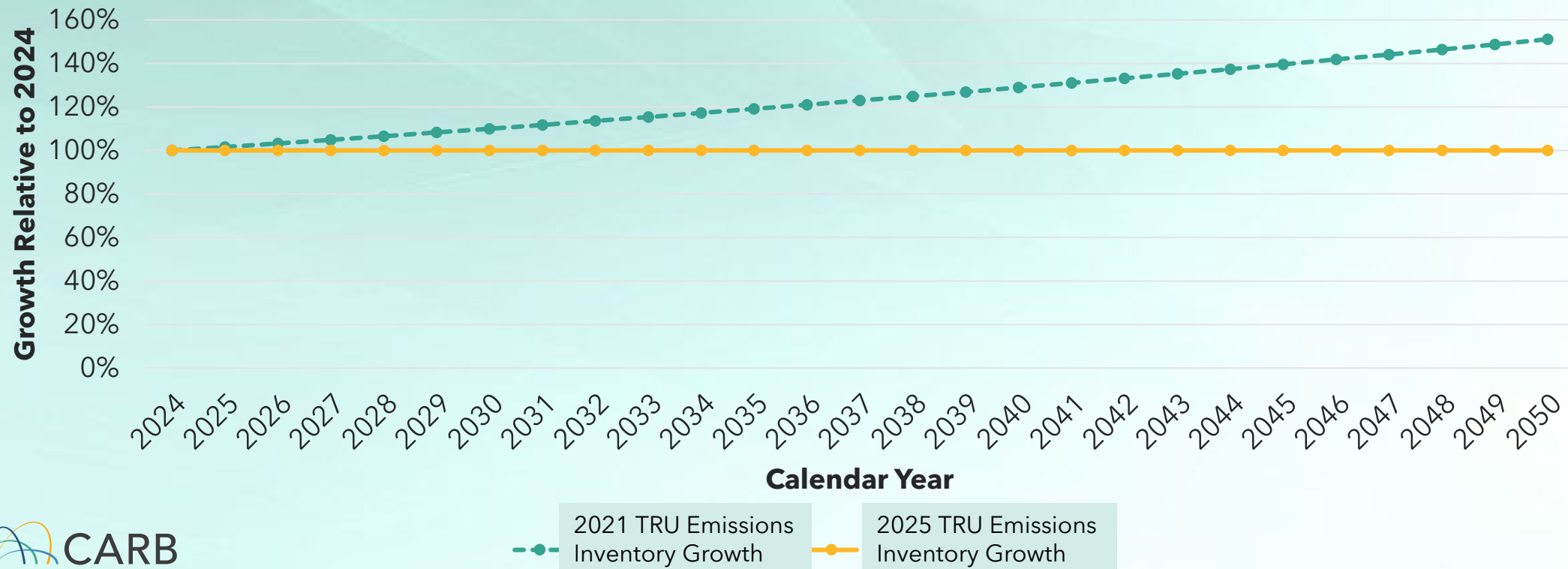
Growth: Agricultural Production

- County Agricultural Commissioners' data reports that the total acreage of California's farms has been relatively flat from 2002 to 2018, suggesting little change in amount of goods exported
- As a result, TRU population and activity forecast projects zero growth
- Staff is still investigating data sources and are open to input



Growth: 2021 Emissions Inventory vs. 2025 Emissions Inventory

- Previous emission inventory showed 1.6 percent annual growth based on economic forecasts of the frozen goods sector.
- Draft new inventory has no growth applied based on the population and production metrics
- Difference between inventories is based on the previous inventory using an economic forecast, which can reflect an increases in prices, vs consumption or volume method which is not showing similar growth



Forecasting Equipment Replacement

- Population turnover is the process of forecasting the age of equipment to better understand future emissions.
- The TRU forecast is from base year 2024 to 2050.
- Future year equipment is projected by fleet age distribution observed in base year 2024.
- Each TRU fleet is modeled individually:
 - Fleets with many newer TRUs turn over quickly, to newer equipment, staying relatively new
 - Fleets with older equipment purchase less often, may purchase used TRUs

Turnover Methodology

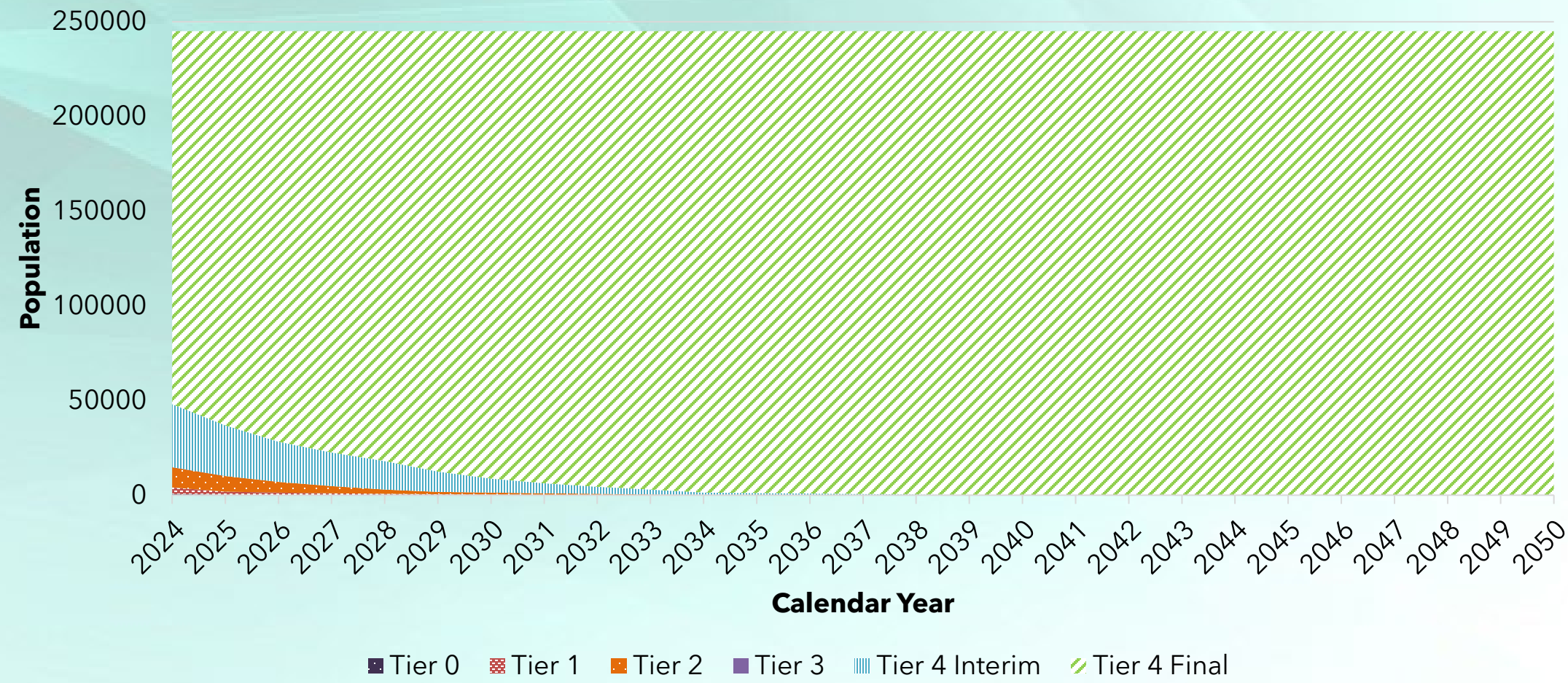
1. Identify the **average age** in each individual fleet.
2. Identify the **minimum age** within each individual fleet.
3. Turnover occurs when the **average age of the fleet is exceeded**.
4. The new equipment is based on the **minimum age** within each fleet.
 - If a fleet buys used equipment, the “new” equipment will turnover to the minimum age within the fleet.

Example Turnover

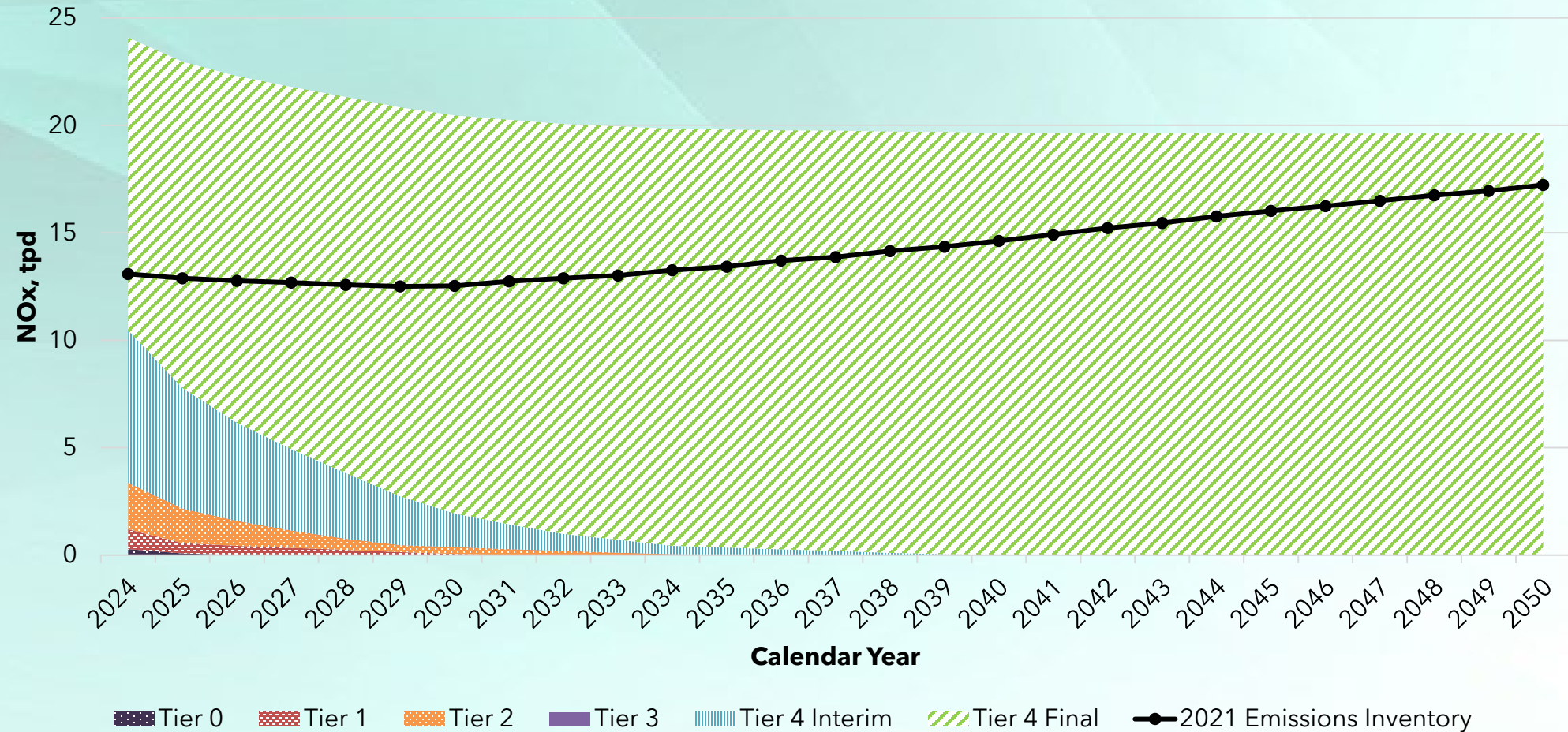
A fleet with 5 TRUs, with 12 years old average age, and 7 years old minimum age in base year

Calendar Year	TRU 1	TRU 2	TRU 3	TRU 4	TRU 5	Avg Age Before Turnover	Avg Age After Turnover
2024	Age 7	Age 9	Age 12	Age 16	Age 16	12	-
2025	Age 8	Age 10	Age 13	Age 17	Age 17-7	13	11
2026	Age 9	Age 11	Age 14	Age 18	Age 8	12	-
2027	Age 10	Age 12	Age 15	Age 19-7	Age 9	13	10.6
2028	Age 11	Age 13	Age 16	Age 8	Age 10	11.6	-
2029	Age 12	Age 14	Age 17-7	Age 9	Age 11	12.6	10.6

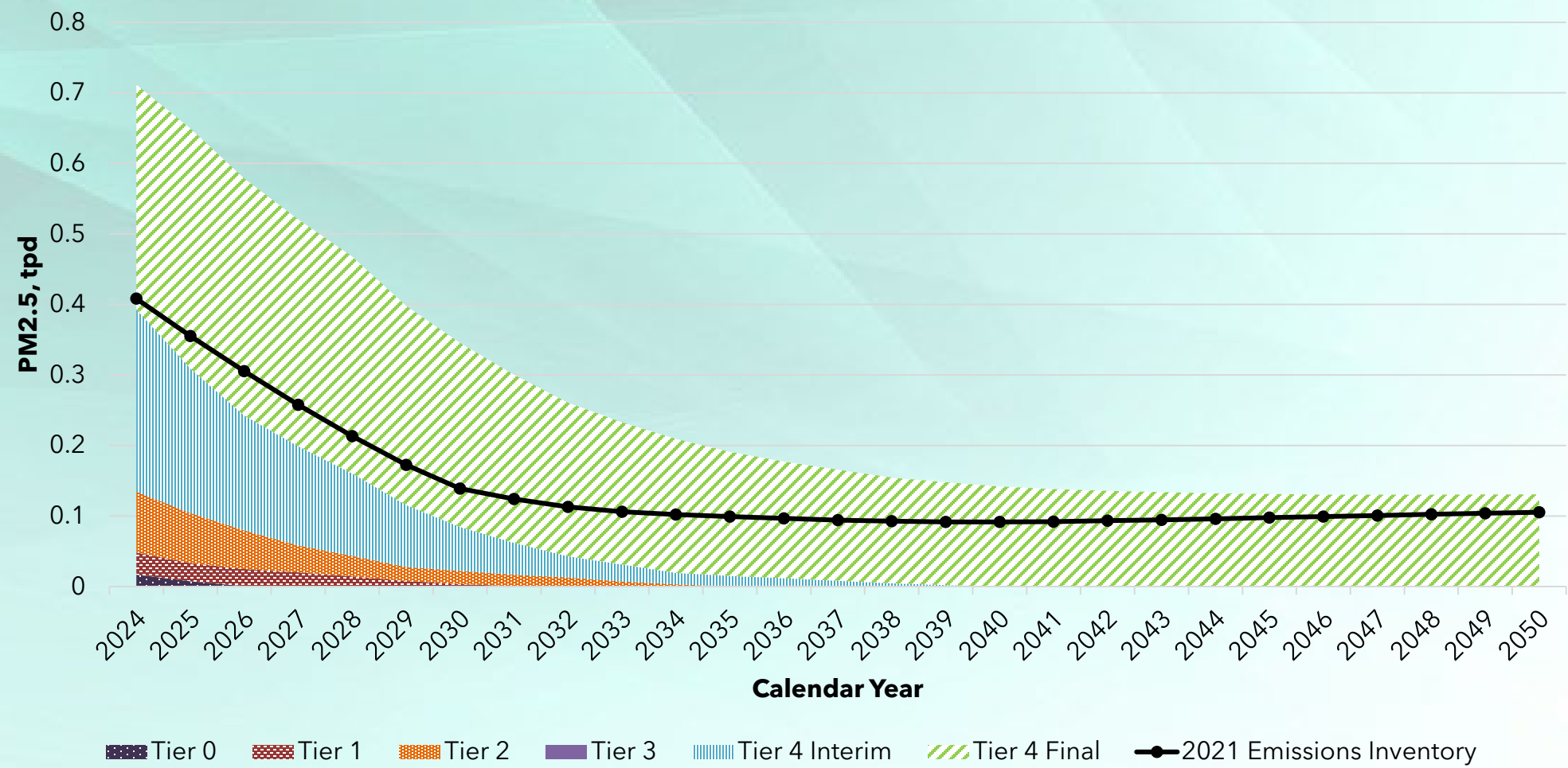
Results: Population



Results: NOx



Results: PM2.5



Discussion



Please **raise your hand** to speak or submit your question to the Q&A.



Please **state your name** and **affiliation**.

Contact Info

- Submit any additional questions or comments on TRU activities at:
 - Email (inventory): elizabethmazmanian@arb.ca.gov
 - Email (implementation): arber@arb.ca.gov
 - Email (rulemaking): freight@arb.ca.gov



Thank You!