



Proposed Rule 2304

Marine Port Indirect Source Rule

Working Group Meeting

Join Zoom Webinar Meeting
- from PC or Laptop
<https://scaqmd.zoom.us/j/97476055135>
Zoom Webinar ID: 974 7605 5135
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August 24, 2022, 1:00 PM

Agenda



Summary of Previous Working Group Meeting



Recent Staff Activities



Ocean-Going Vessel (OGV) Emissions



Potential Emission Reduction Opportunities for OGVs



Next Steps



Discussion

Summary of Previous Working Group Meeting

Potential rule applicability, as it relates to business operations

- Who coordinates with carriers of ships, trucks, and trains
- Ability of industry to phase in cleaner equipment
- Infrastructure planning needs & utility demand

Potential rule structure considerations

- Staff is exploring multiple rules by terminal type (ex: PR 2304.1, PR 2304.2, etc.)

Parent companies of shipping lines have ownership stake, via other subsidiaries, in 11 of 13 container terminals at POLA/POLB

- Opportunity for consolidated decision-making to address multiple emission sources

Recent Staff Activities

On-going discussions with Pacific Merchant Shipping Association (PMSA) & its members

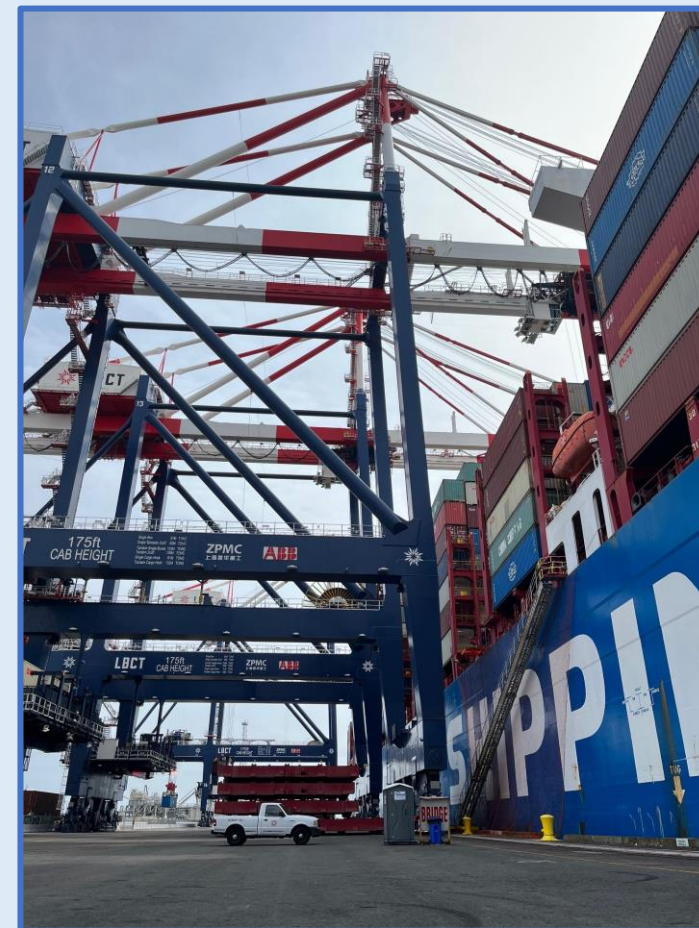
- Goals are to better understand business relationships and ongoing air quality/climate initiatives among port entities

Terminal tours and site visits

- Recent focus on operations at container terminals (10 out of 13 visited)
- Also visited 2 dry bulk, 1 liquid bulk, and 1 RoRo terminal






Rule concept development

- Rule concept must reflect how each potentially-regulated entity controls/influences each emission source
- Staff considering a staggered approach for rulemaking by terminal type, focusing first on container terminals

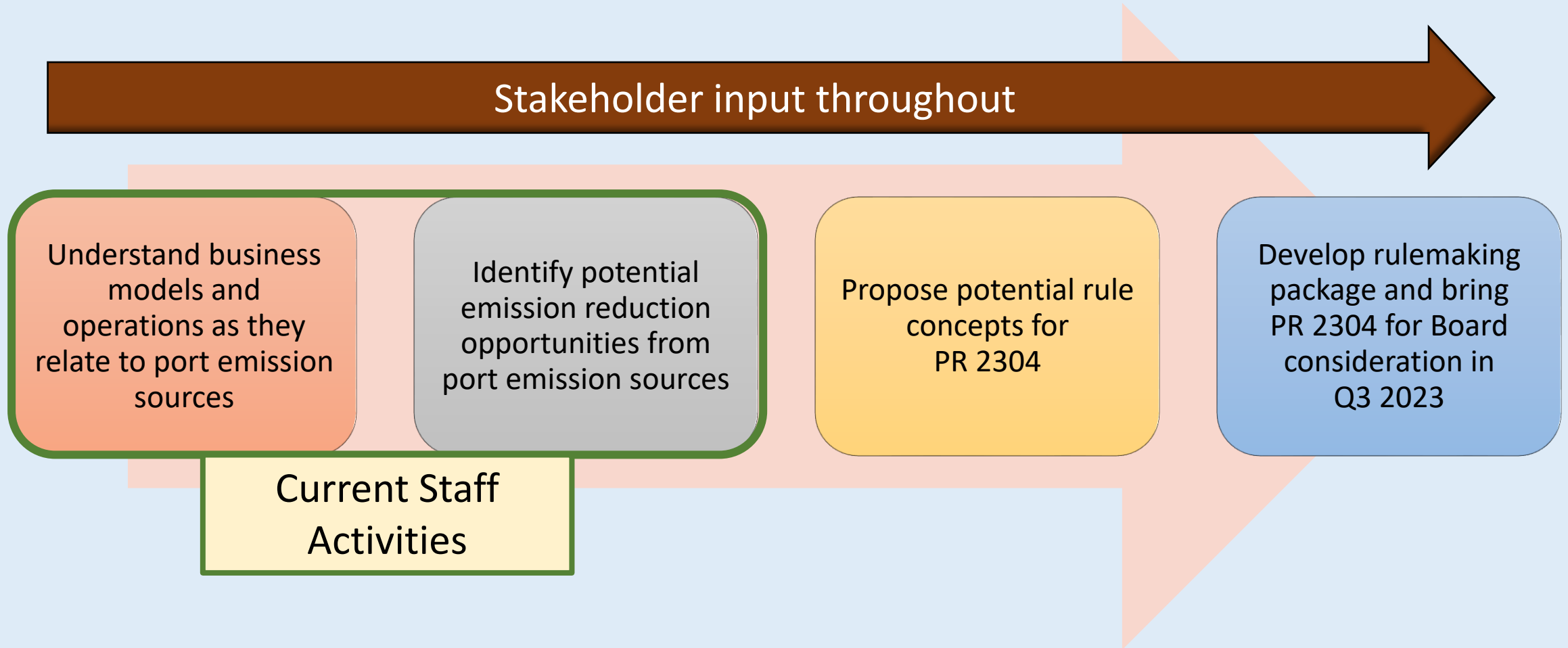


Coordination of Business Operations

- In general, the shipper decides how cargo is booked into and moved through a terminal (i.e. ship, truck, rail)
- Ports own and control land and associated infrastructure where terminal operators and cargo carriers operate

Emission Source	Dispatch Decisions	Role of POLA & POLB
OGVs 	<ul style="list-style-type: none"> • Shipper chooses the carrier and route; (<i>*some shippers pay a premium for “green transportation”</i>) • Ocean Carrier dispatches specific vessels 	<ul style="list-style-type: none"> • Provides incentives to vessel operators for reducing ship emissions (<i>Vessel Speed Reduction Program, Green Ship Program</i>) • Assesses fees to ensure movement of cargo through port complex
Drayage Trucks 	<ul style="list-style-type: none"> • Trucking companies dispatch specific trucks or contract with independent owner/operators 	<ul style="list-style-type: none"> • Controls truck access (drayage registry) • Assesses fees for Clean Truck Fund
Rail Locomotives 	<ul style="list-style-type: none"> • Railroads dispatch specific locomotives 	<ul style="list-style-type: none"> • Contracts with railroads for Ports-owned rail lines and facilities
Harbor Craft 	<ul style="list-style-type: none"> • Agent of Ocean Carriers coordinate with tug operators • Harbor Craft Operator dispatches harbor craft 	<ul style="list-style-type: none"> • Leases Ports-owned docks to CHC operators
CHE 	<ul style="list-style-type: none"> • Terminal Operator moves cargo on-terminal 	<ul style="list-style-type: none"> • Works with terminal operators and utilities for onsite infrastructure project delivery (funding, permitting, etc.)

Approach to Establishing Regulatory Concept Proposal for PR 2304



Working Group Meeting Focus: Ocean Going Vessels (OGV)

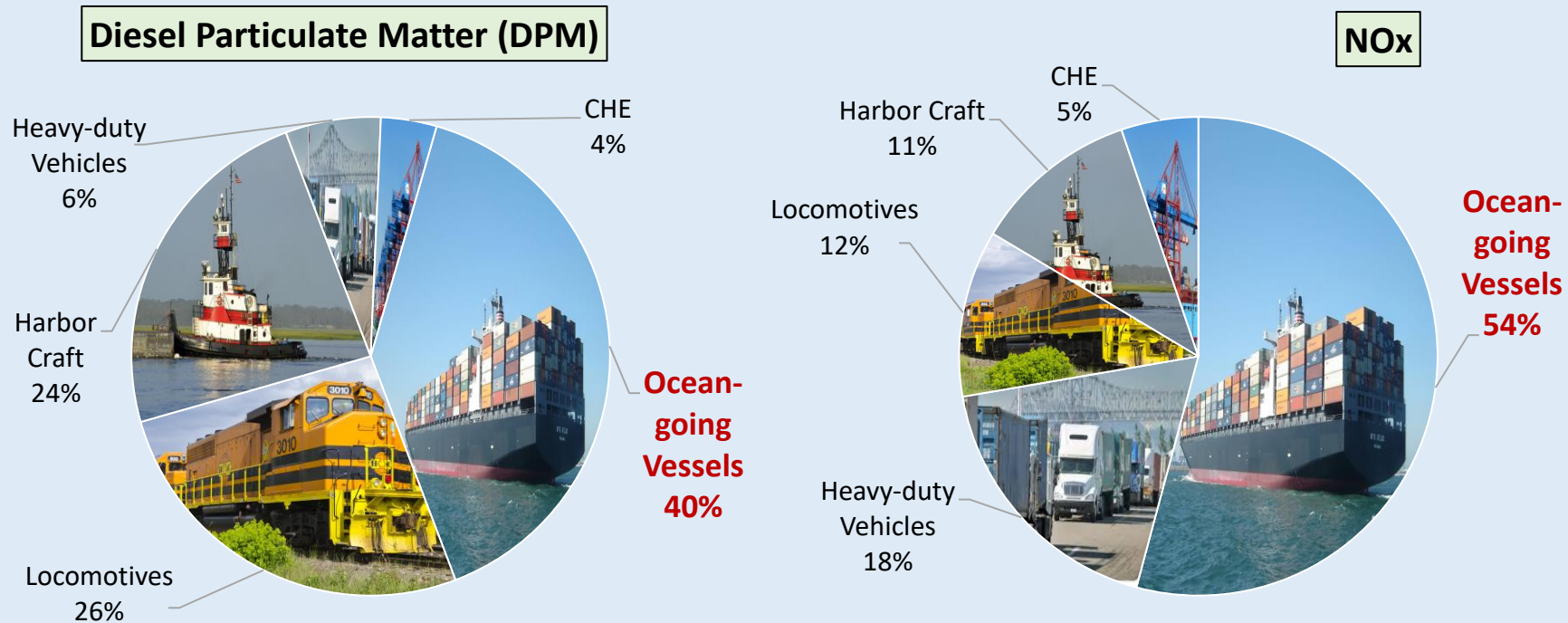
- Important to understand ports' largest emission source in detail
 - Staff is not proposing prescriptive requirements for vessels in ISR
 - Goal is to evaluate options that can potentially be considered within ISR

- Discussion today:

- Inventory and Performance of Existing Technologies
- Existing Regulatory Framework
- Upcoming Technologies

Identification of Potential Opportunities for Additional Emission Reductions

Port Emission Sources

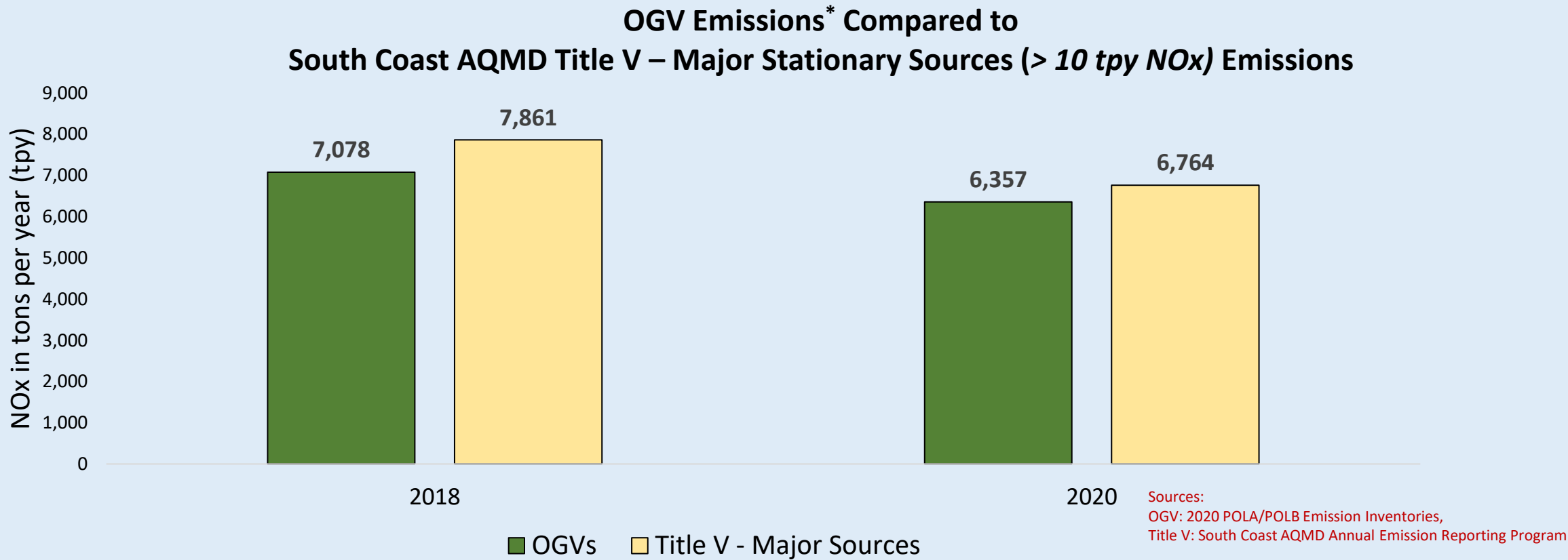


* POLA/POLB OGV inventory domain includes activity within 40 nm from Point Fermin and out to South Coast Air Basin overwater boundary

Emissions inventory to be used for PR 2304 rulemaking may differ from POLA/POLB inventories

- OGV emissions out to South Coast boundary (i.e. out to 100 nm from shoreline)
- Need to forecast for future years
- SIP* inventory methodology

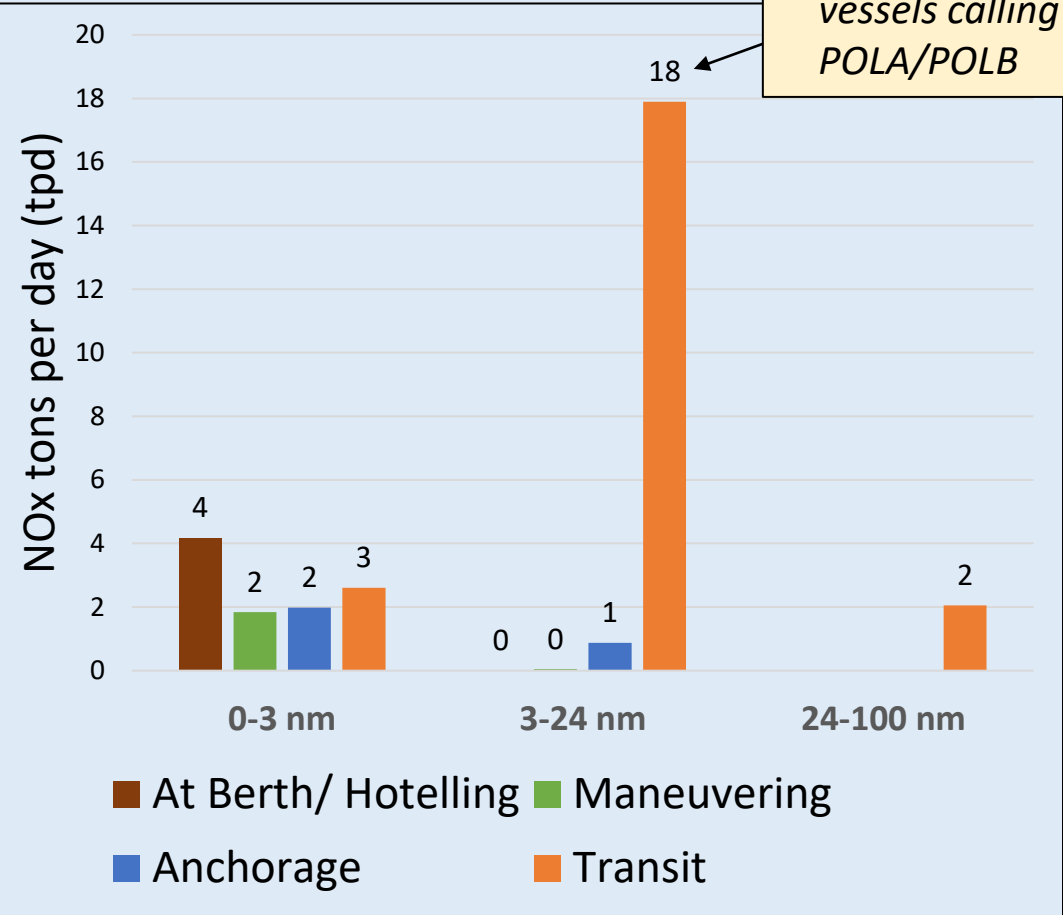
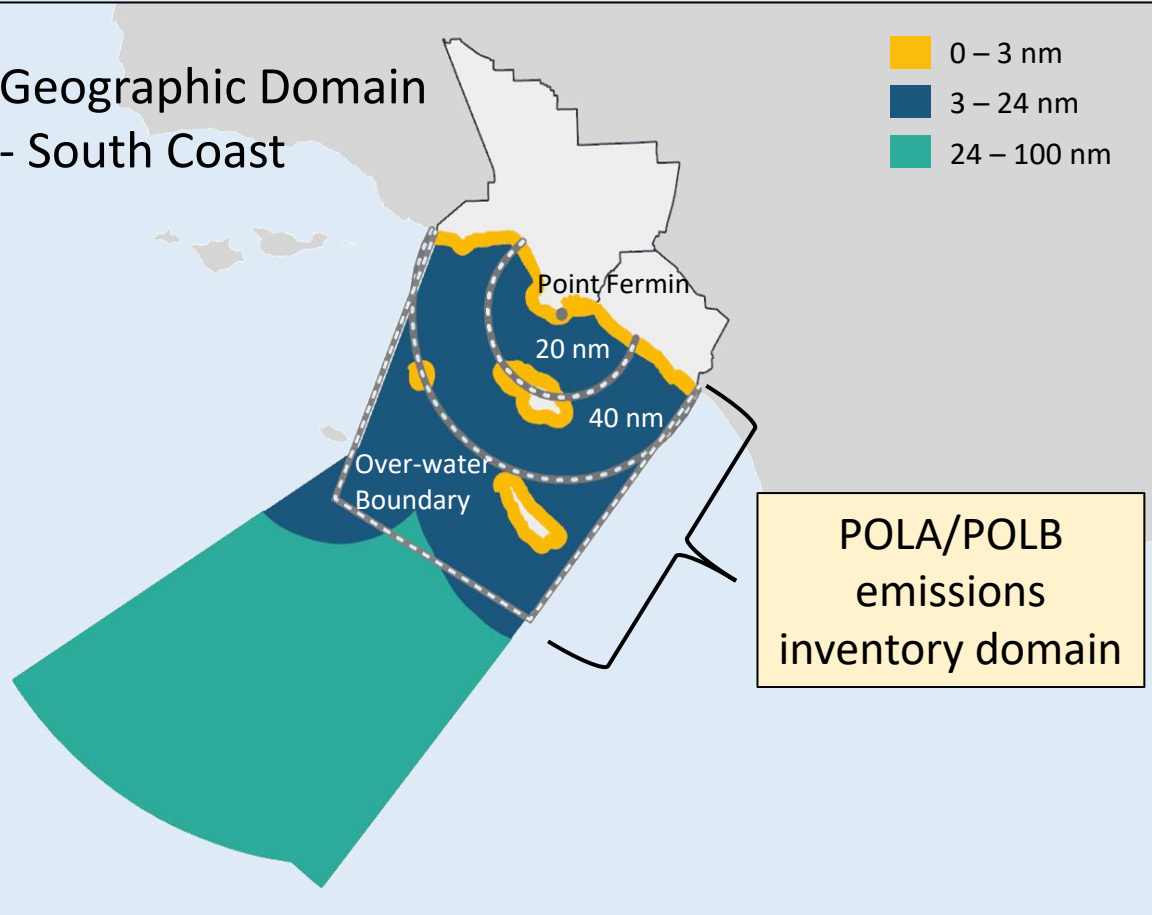
OGVs are a Major NOx Emission Source



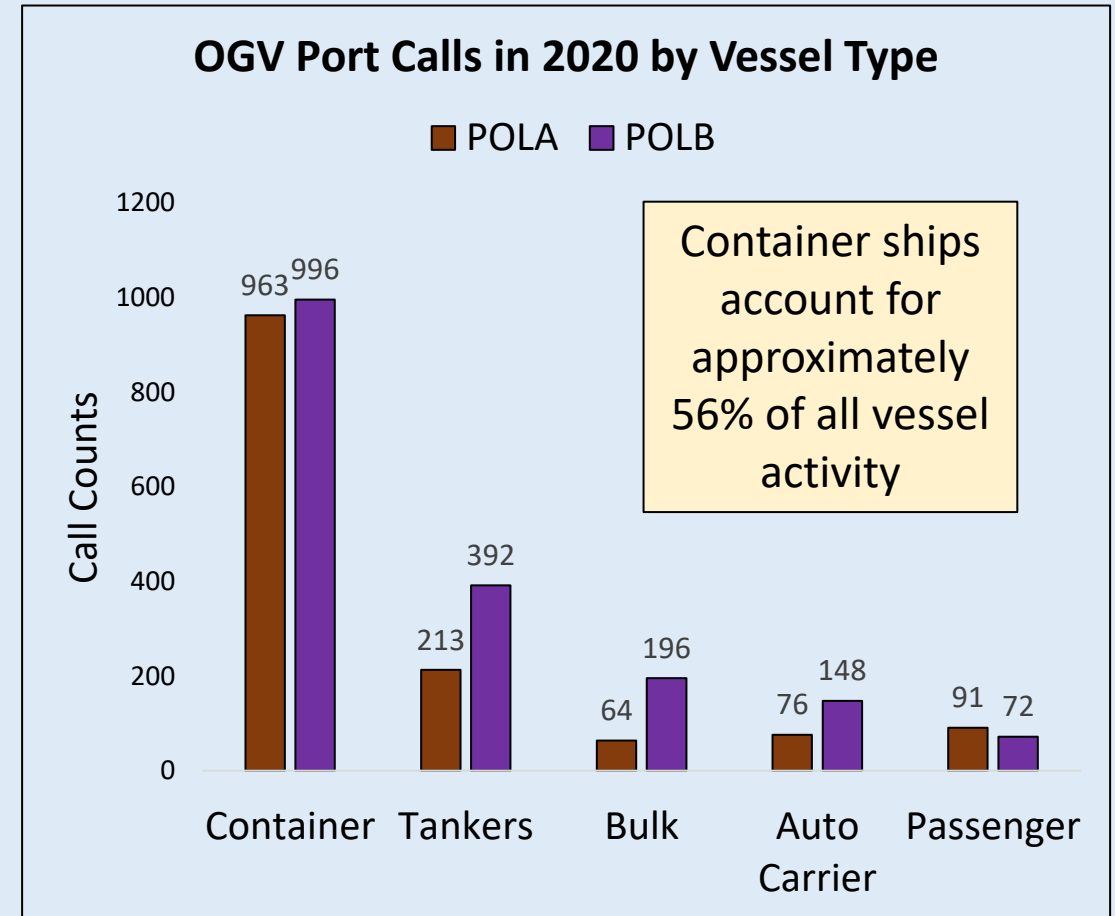
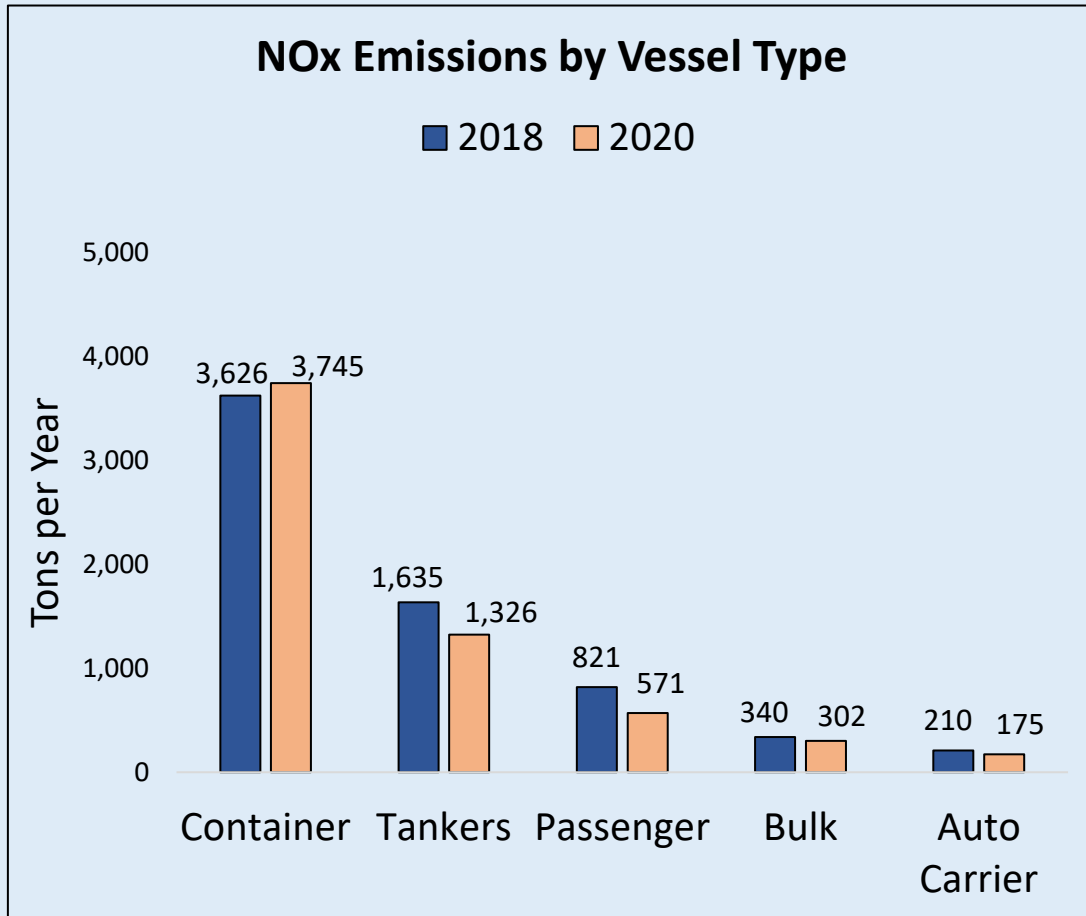
* OGV emissions in SIP inventory attributed to San Pedro Bay Ports are higher than POLA/POLB OGV emissions inventory

2020 OGV Operating Mode Activity (CARB's SIP Inventory)

Geographic Domain - South Coast



San Pedro Bay OGV Activity

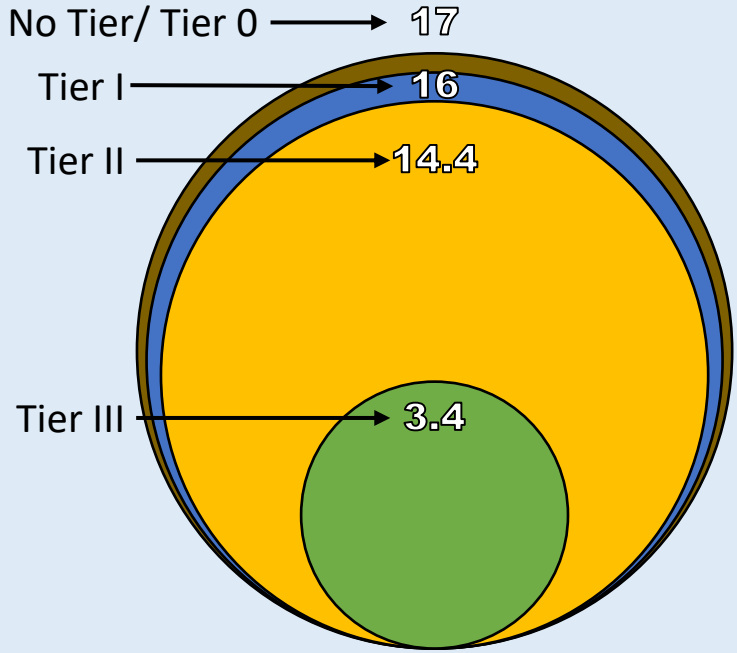


Sources: 2020 POLA/POLB Emission Inventories

OGV Activity in 2020 by Main Engine Tier

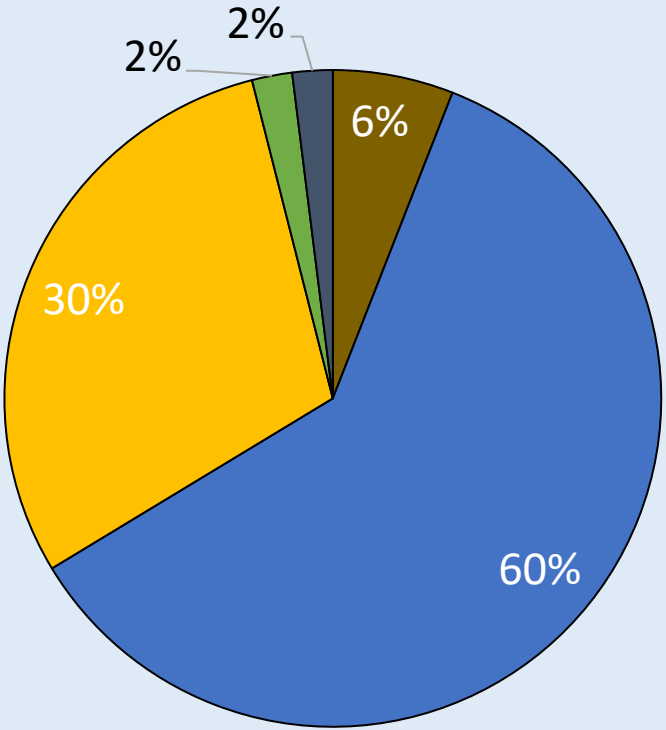
NOx Emission Rates

(g/kW-hr)

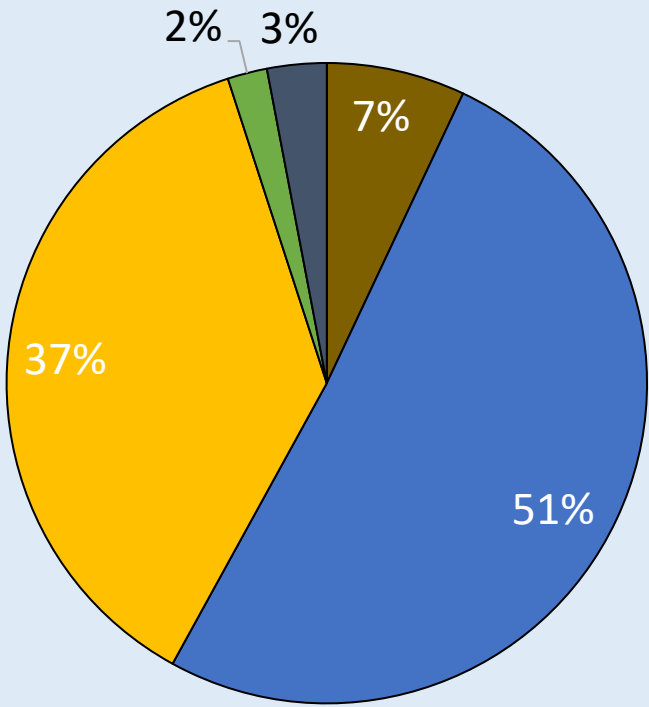


Sources:
<https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10102U0.pdf>;
 2021 California Ocean-Going Vessels Emissions Inventory

POLA



POLB

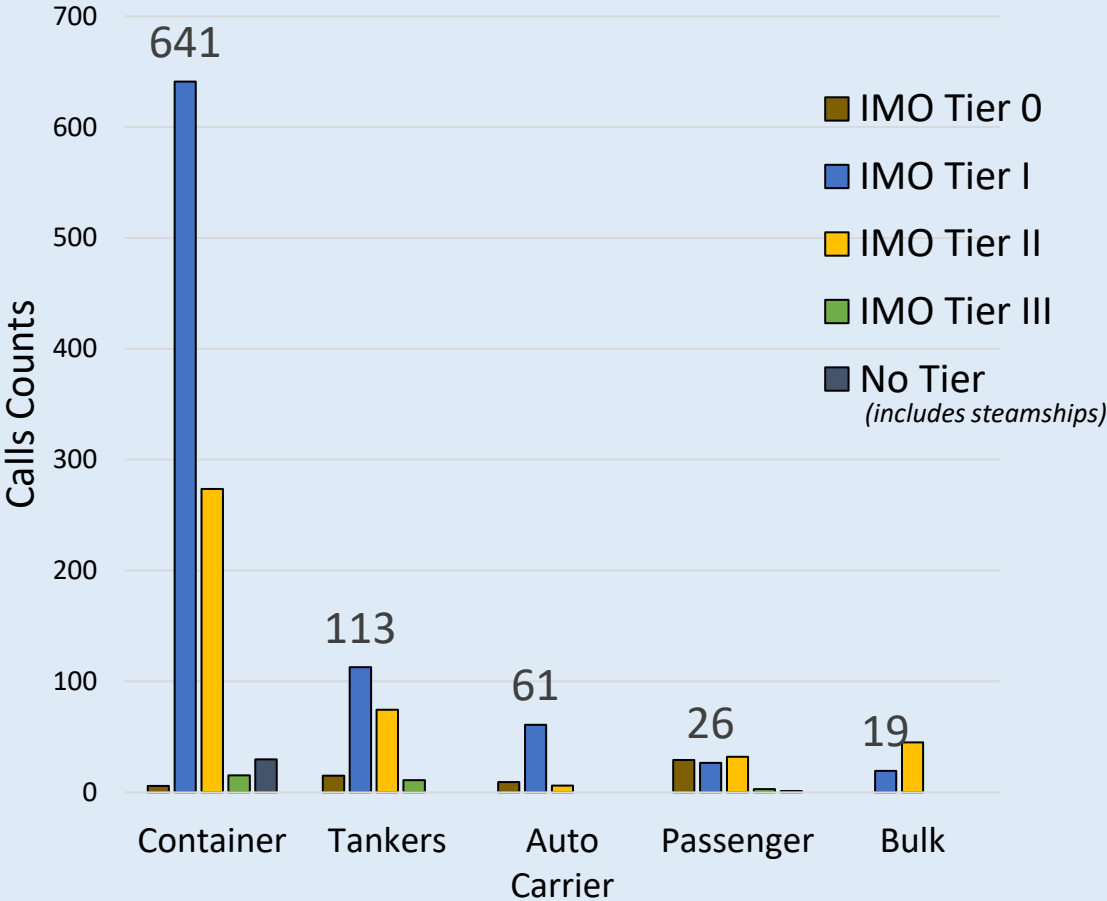


"No Tier" refers to steamships

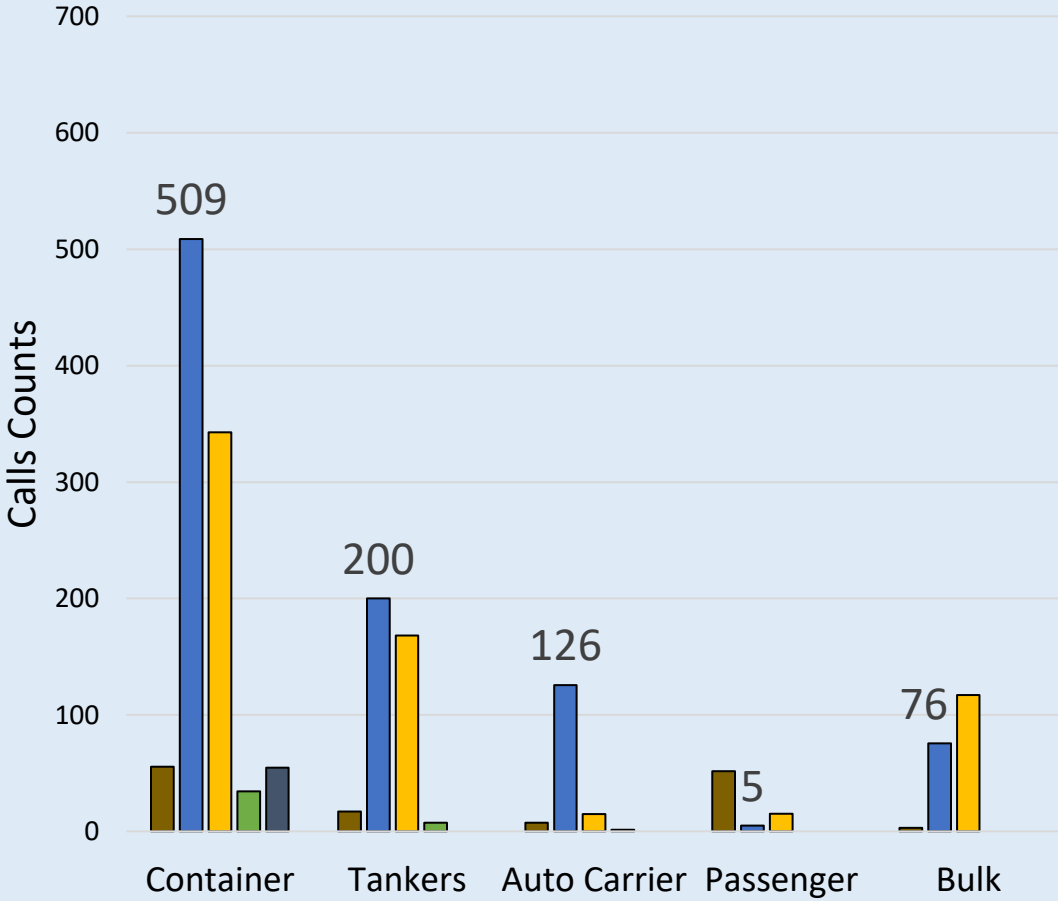
Sources: 2020 POLA/POLB Emission Inventories

2020 OGV Vessel Call Counts by Main Engine Tier

POLA

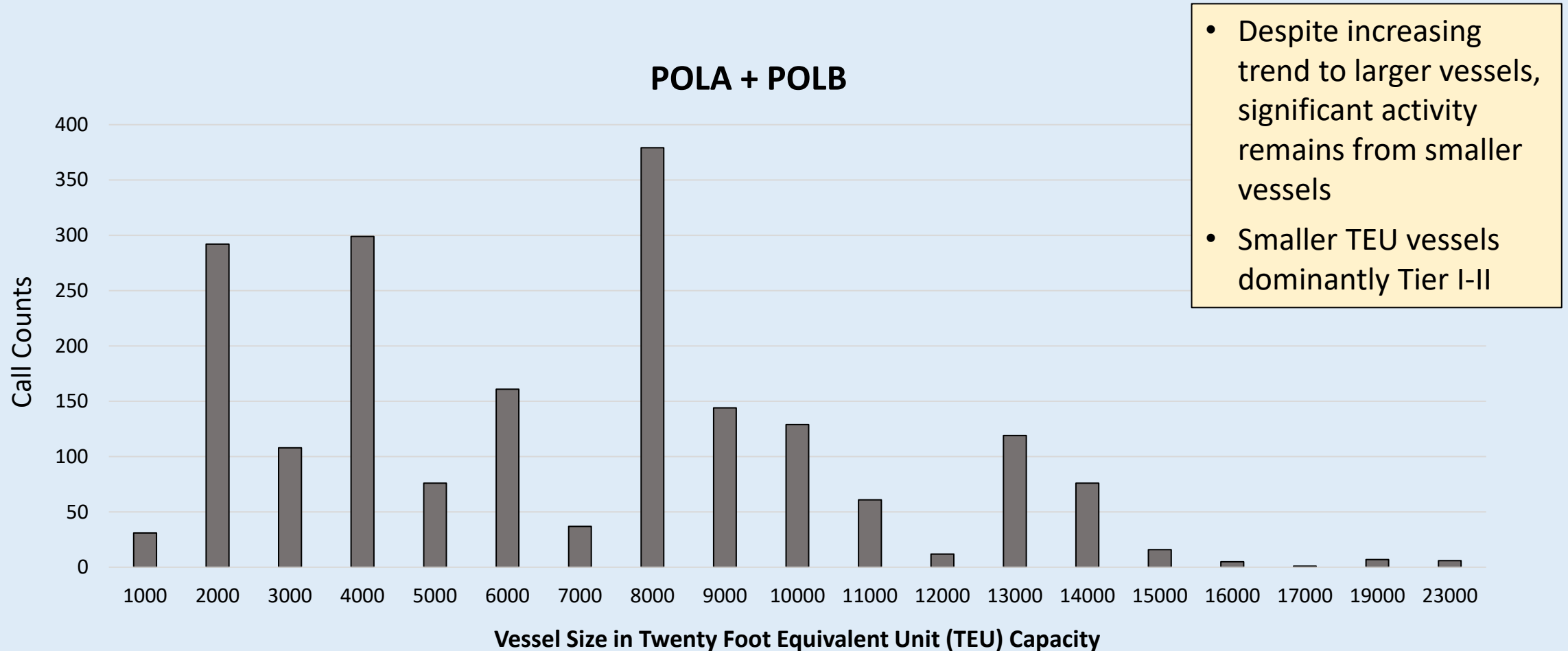


POLB



Sources: 2020 POLA/POLB Emission Inventories

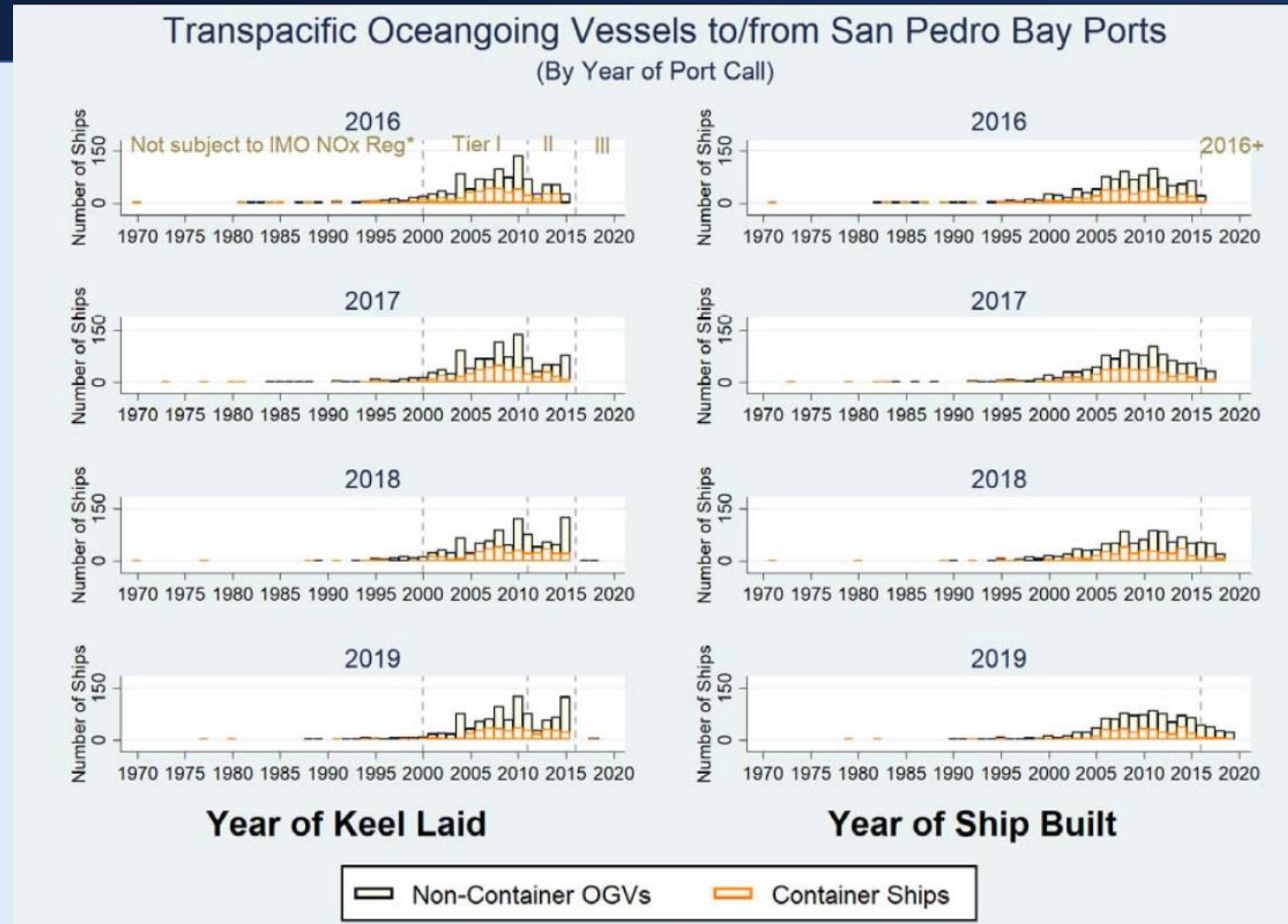
2020 OGV Port Call Count by Containership Size



Slow Deployment of Tier III OGVs

International Maritime Organization (IMO) requires marine diesel engines installed on ships constructed on or after January 1, 2016, meet Tier III standard

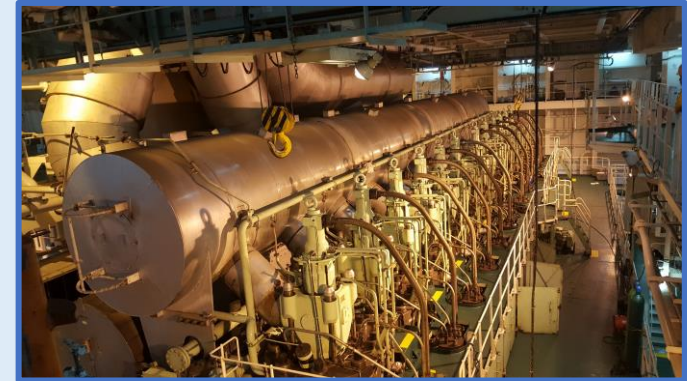
- Vessels built in 2016 or later may still have Tier II engines installed due to earlier keel laid date
- Widespread introduction of Tier III vessels in California ports was forecasted by the Ports to be delayed until 2030's*



* Mercator Report, Starcrest 2017 Tier Forecast Analysis, <http://www.cleanairactionplan.org/documents/vessel-forecast-draft.pdf/>

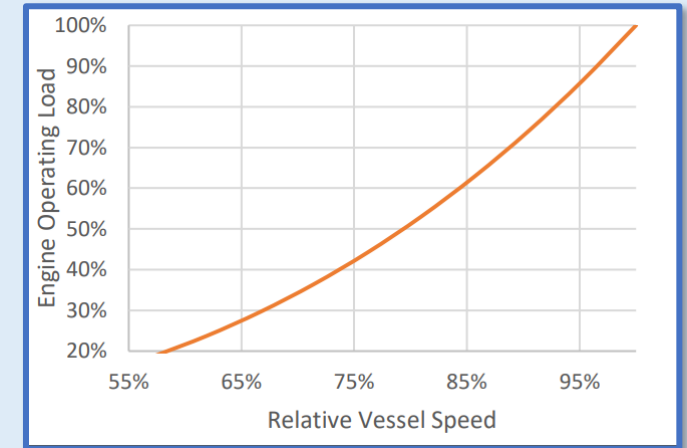
OGV Main Engine Emissions during Low Load Operations

- NOx emission rate observed to increase during low load operations (e.g., from decreased engine efficiency)
 - Low load adjustment factors included in emissions inventory, mostly from emissions testing of Tier 0-I ships
 - Greater uncertainties in emissions profile for Tier II-III ships
 - Limited evidence suggests higher NOx emission rates for Tier II than Tier I at low loads for at least some 2-stroke engines
- Certified NOx emission limits for Tier III engines are ~80% lower than for Tier I, but most common technologies have load limits:
 - Selective catalytic reduction (SCR): emission reduction efficacy may be reduced or erased at engine loads below 25% due to low exhaust gas temperature, despite common pre-heating
 - Exhaust gas recirculation (EGR): operational limit at very low loads to maintain stable combustion process
 - Common simplifying assumption: Tier III main engines operating below 25% load operate at Tier II levels



Vessel Speed Reduction (VSR)

- POLA/POLB implement voluntary VSR programs where vessels reduce their speed to ≤ 12 knots within 40 miles of Point Fermin
 - Purpose of VSR is to reduce emissions and fuel use
- Vessels operate at estimated 10% – 27% load when entering VSR zone
 - Over 90% of all POLA/POLB calls participate in the VSR program
- Emission reduction benefits may be limited from Tier II and III main engines when operating within VSR
 - Lack of sufficient information to apply evidence-based adjustments to the current inventory assumptions
 - Staff will continue to evaluate scientific evidence on emission impacts associated with lower loads/speed reductions



<https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockkey=P10119QQ.pdf>

Overview of Existing NOx and PM Framework for OGVs

IMO

- NOx Engine Standards
 - Tier III currently applies to vessels operating in certain Emission Control Areas (ECA)*
- Fuel Requirements
 - Global: 0.5% sulfur, or exhaust scrubber
 - ECA: 0.1% sulfur, or exhaust scrubber
- Recent priority on greenhouse gas reduction: minimum 50% by 2050

CARB

- Operational Requirements
 - At-Berth Regulation
 - Fuel Requirements
 - Distillate-only 0.1% sulfur (no scrubbers)
 - Applies to vessels operating within 24 miles from shoreline

U.S. EPA

- NOx Engine Standards
 - Adopted Tier 3 standard akin to IMO Tier III standard
 - Applies to U.S.-flagged vessels
- Fuel Requirements
 - 0.5% sulfur
 - Applies to U.S.-sold fuels

POLA/POLB

- Voluntary Incentive Programs
 - Vessel Speed Reduction within 40 miles from Point Fermin
 - Incentives for cleaner ships with plus-ups for Tier III

* North American ECA extends up to 200 nm from coast

Recent CARB OGV Rulemaking

At-Berth Regulation (2020) – Reduces emissions from vessel auxiliary engines at berth

- Regulation expanded in 2020 to increase emissions reductions up to 90% annually
 - Effective January 1, 2023 for container, reefer, and cruise vessels
 - Effective January 1, 2025 for tanker and auto carrier vessels
 - Includes Innovative Concepts option up to five years to achieve earlier or greater emission reductions in port communities
 - Interim technology assessment anticipated in 2022 to evaluate inclusion of bulk and general cargo vessels and requirements for anchorage emissions



Identifying Opportunities for OGVs Relative to Existing Regulations and Incentive Programs

Emission Source	Existing Regulation or Program
Main Engines	<p><u>IMO and EPA Tier III Standards</u></p> <p>Opportunity #1: Address low-load emissions and strengthen post-certification enforcement</p> <p>Opportunity #2: Emission reductions beyond Tier II for pre-2016 in-use ships</p>
	<p>POLB Green Ship Incentive Program / POLA Tier III Incentive Program</p> <p>Opportunity #3: Increase/prioritize incentives for ships achieving criteria pollutant reductions</p>
Auxiliary Engines	<p><u>CARB At-Berth Regulation</u></p> <p>Opportunity #4: Earlier implementation and extend to other vessel types and vessels at anchorage</p>
In Transit	<p><u>Vessel Speed Reduction (VSR) Programs</u></p> <ul style="list-style-type: none"> • POLA/POLB: 12 knots or less when entering 40 nm mark (all year) • SoCal Blue Whales and Blue Skies: 10 knots or less when transiting large parts of South Coast and neighboring air basins (May – Nov; containers and auto carriers only) <p>Opportunity #5: Explore technological solutions for NOx reduction at low loads</p>
Congestion	<p>PMA, PMSA, and Marine Exchange Queuing System (2021) – Reduce Anchorage Activity and Emissions Close to Shore</p> <ul style="list-style-type: none"> • Ships wait 150 miles off coastline and/or slow steam across Pacific <p>Opportunity #6: Ensure program persists over long-term and seek further anchorage emission reductions</p>

■ Required
■ Voluntary

Potential Near-Term Technologic Strategies for OGV Emission Reductions



Alternative Fuels

- Low-NOx: Liquefied Natural Gas (LNG)
- Low and zero carbon: methanol, ammonia, hydrogen



Engine Technologies

- Exhaust control retrofit (e.g. Water-in-Fuel Emulsion, Exhaust Gas Recirculation)
- Engine tuning, derating, engine power limitation, etc.
- Engine conversion or replacement for alternative fuels



Operational Improvements

- At-berth and anchorage capture-and-control systems
- Zero emission shore power (e.g. fuel cell)

Alternative Fuels

Some alternative fuels can reduce criteria pollutant emissions, but must consider:

- Retrofit/conversion vs. new engine build
 - LNG can be used as drop-in fuel in dual fuel design
 - Use of zero/low carbon fuels (e.g. ammonia, hydrogen, and methanol) likely require new engine build and can have uncertain criteria pollutant impacts
- Bunkering, fuel storage, and infrastructure requirements
 - Example: Pasha dual-fuel LNG ships expected to be refueled with trucked-in LNG
 - Other dual-fuel LNG ships do not re-fuel at POLA/POLB
 - Example: Maersk is developing new partnerships for methanol bunkering* to support 12 dual-fuel ships on order for 2024-2025
 - Ammonia and hydrogen engines still in research & development



*<https://www.maersk.com/news/articles/2022/08/19/maersk-engages-in-green-bio-methanol-partnership-with-debo>

Potential Near-Term Retrofit Technologies

In order to supplement research on OGV retrofits,^{*} South Coast AQMD is conducting several in-use retrofit studies on Tier II engines

- **Water in Fuel (WiF) Emulsion Retrofit**
 - Emulsifies the fuel with fresh water prior to combustion
 - Offers fuel savings
- **Low Pressure Exhaust Gas Recirculation (EGR)**
 - Recirculates part of cleaned exhaust gas back into engine chamber
- **Conversion of Tier II Engine to Multi-Fuel**

- Project partners: POLA/POLB
- Emissions testing at 10 to 50% loads
- Projected NOx emission reduction: 30% reduction with 30% water-fuel mix
- Anticipated project completion: 2022

- Project partners: POLA/POLB and EPA
- Includes scrubber and diesel particulate filter prior to EGR to control SOx and PM
- Projected NOx emission reduction: 75%
- Anticipated project completion: 2023

- Project partners: POLA/POLB, EPA, and EU
- Test in lab engine then actual vessel with ammonia, LNG, and diesel (as pilot fuel)
- Projected NOx emission reduction: 70-75%
- Anticipated project completion: 2023

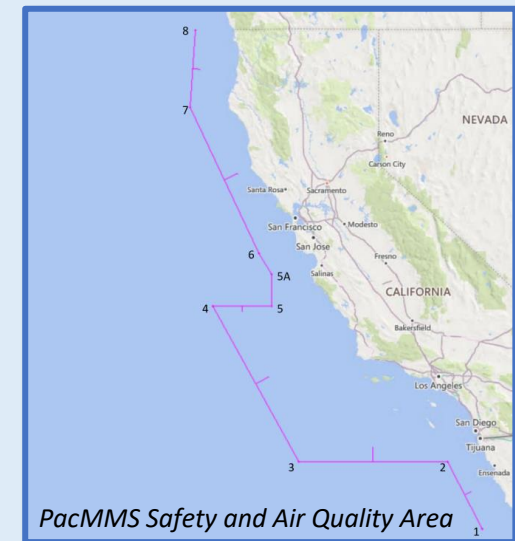
^{*}Examples of other retrofit analyses:

https://glomeep.imo.org/wp-content/uploads/2016/06/Port-Area_web.pdf,

https://www3.weforum.org/docs/WEF_A%20Strategy_for_the_Transition_to_Zero_Emission_Shipping_2021.pdf

Potential Operational Improvements

- Near-shore
 - Reduce anchorage activity close to shore
 - e.g. PMA, PMSA, and Marine Exchange Queuing System
 - Expand capture-and-control technologies and shore power during at-berth and anchorage operations
 - Increase efficiency of container handling for imports, exports, and empties
- In-transit
 - Slow steaming
 - Engine tuning to reduce criteria pollutant emissions



Potential Longer-Term Emission Reduction Pathways for OGVs

More stringent emission standards for marine vessel engines

- EPA could consider voluntary and/or required standards for in-use and/or retrofit and new vessels
- Ensure any new IMO GHG standards achieve near-shore criteria pollutant reductions

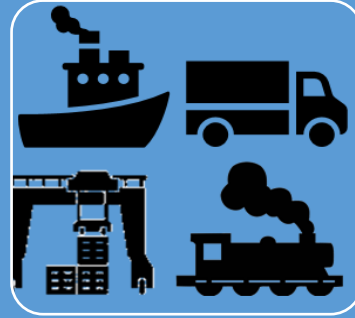
Zero emission (ZE) technology

- Engine manufacturers develop ZE technology that reduces criteria pollutant emissions for near-shore communities (focus on public health)
 - ZE and/or hybrid propulsion technology for short distance trips
 - Auxiliary engines powered by hydrogen fuel cell or hybrid battery
- Mechanisms to push shipping lines to deploy ZE vessels or turnover older Tier vessels

Partnership development between port authorities across Pacific and nationwide to develop uniform approaches for clean ship deployment

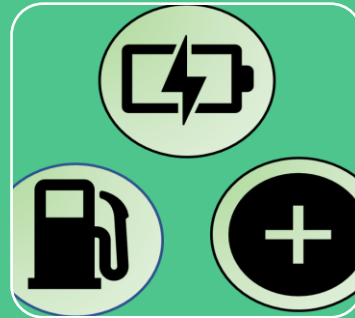
- Determine fueling availability and associated infrastructure needs with shipping lines
- Shared incentive programs
- Green shipping corridors

Ports ISR Topics for Further Assessment



Additional Emission Reduction Opportunities from Other Sources

- Drayage trucks, rail locomotives, harbor craft, and cargo-handling equipment
- Pathway to zero emission technology and potential effect on jobs



Fueling/Charging Infrastructure

- Key to facilitating emission reductions
- On-port and off-port considerations to support technology use
- Electrical demand and grid support
- Fuel availability and storage requirements



Baseline and Forecasted Port Emissions Inventory for Rulemaking

- Will guide overall PR 2304 rule development

Staff will discuss topics in future working group meetings

Next Steps



Continue site visits and information gathering at container and non-container terminals



Stakeholder meetings and other public engagement activities

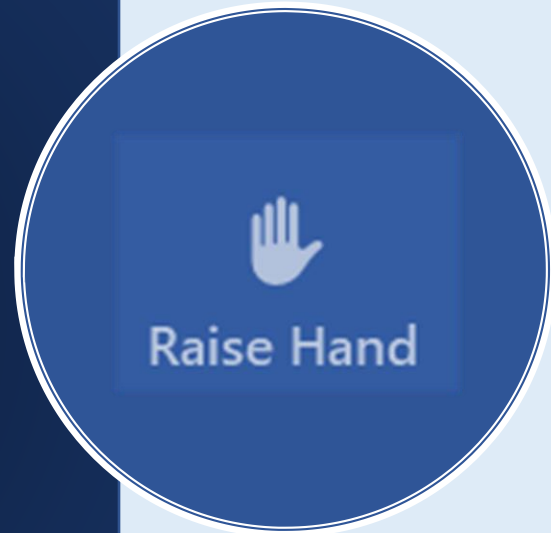


Continue assessment of emission reduction opportunities and infrastructure for rule concept development



Continue to report to Mobile Source Committee Meeting

Open Discussion



ZOOM:

- Click on the “Raise Hand” button at the bottom of your screen.

TELECONFERENCE:

- Dial *9 to “raise your hand”

Your name will be called when it is your turn to speak and the meeting host will unmute your line.

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