

















































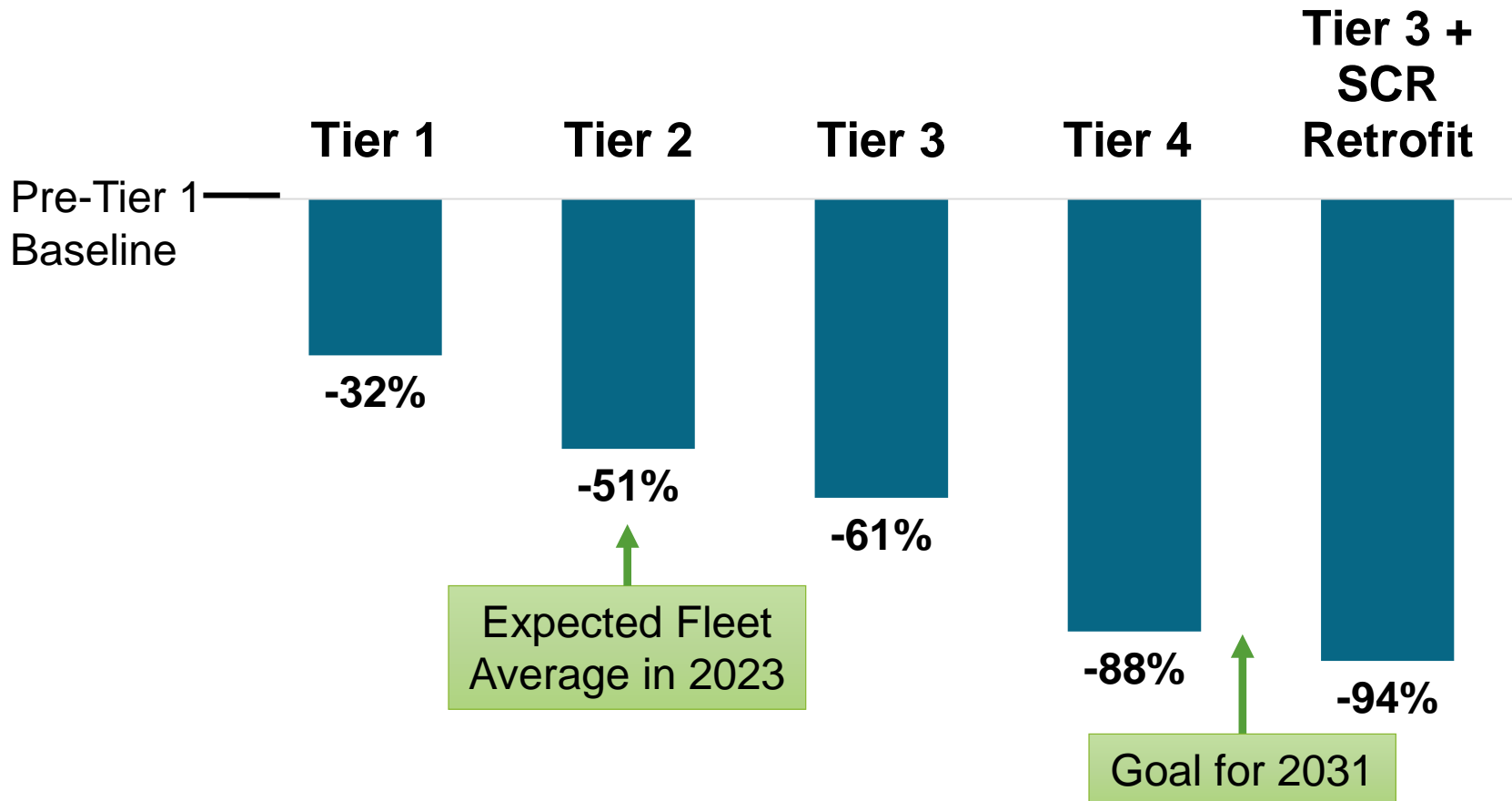








# NOx Emission Trends for Harbor Craft Engines and Future Retrofits from a Pre-Tier 1 Baseline



Trends based on NOx emissions from a pre-Tier 1 baseline of 11 g/bhp-hr, and marine engine standards for a 1000-hp Category 1 engine. Retrofit assumed to achieve an 85% reduction from Tier 3 standards.

# Tier 4 Feasibility Study

- CARB-funded study by Cal Maritime Academy to evaluate feasibility of Tier 4 and VDECS retrofits
- For each participating vessel, identify or assess:
  - Available Tier 4 or equivalent control options
  - Vessel changes necessary to accommodate equipment
  - Vessel stability analysis by naval architect
  - Cost information on procurement, installation, maintenance, or vessel replacement
- Report release in mid-2019

# Zero Emission and Other Advanced Technologies

- Emerging technologies to help achieve 2031 emission targets for NO<sub>x</sub>, PM<sub>2.5</sub>, diesel PM, and GHG
- Goal: simplify process for emerging technologies to be approved as a compliance pathway
- Hybrid diesel-electric vessels would reduce fuel use and emissions; a few hybrid tugs operate today
- Battery-electric technology now deployed in marine sector; hydrogen fuel-cell under development today
- Alternative fuels such renewable diesel and liquefied natural gas (LNG) likely not standalone pathways

# Zero/Near-Zero Emission Vessels



Red and White Fleet  
“*Enhydra*” - battery  
electric plug-in hybrid  
excursion vessel – built  
and operational today



Golden Gate “*Water-Go-Round*” Zero Emission  
hydrogen fuel cell ferry  
demonstration – under  
construction today

# Proposed Concept: In-use requirements for additional vessel categories

Vessel Category	Existing In-Use Engine Requirements	Proposed In-Use Engine Requirements
Ferries, Excursions	Yes	Yes
Crew and Supply	Yes	Yes
Barge and Dredge	Yes	Yes
Tanker Barges	Not Included	Yes
Tugboat, Towboat	Yes	Yes
Pilot Vessels	No	Under Evaluation
Workboats	No	Under Evaluation
Charter Fishing	No	Under Evaluation
Commercial Fishing	No	*
Research, Others	No	Under Evaluation

\*Likely no; however, health impacts still under evaluation

# Proposed Concept: In-use requirements for engines less than 50 horsepower

- Existing CHC regulation in-use requirements do not apply to engines below 50 horsepower
- Staff estimate 23 percent of auxiliary engines are rated below 50 horsepower
- Emissions from engines under 50 horsepower contribute approximately 8 percent of total auxiliary engine PM emissions
- Under proposed concept, all engines on applicable vessel categories would be subject to in-use requirements, regardless of engine power rating

# Proposed Concept: Annual Opacity Testing Requirement

- Every engine would need to meet opacity limits using a defined procedure
- Opacity test limits and procedure under development – will consider original engine certification and engine/retrofit configuration
- Vessel owners or operators could become certified to self-test, or hire a certified tester





# Proposed Concept: Facility Requirements

- Facilities include ports, terminals, marinas, harbors, and private land with docks: any entity that accepts payment for allowing a vessel to dock on a regular and ongoing basis
- Facility responsibilities would increase vessel compliance
- Concept requirements for facilities:
  - Facilities must allow installation and maintenance of on-site infrastructure to support zero and near-zero emission vessels
  - Electronic verification of vessel compliance status in CARB's freight reporting system (currently under development)
  - Report to CARB which vessels permanently or regularly dock

# Presentation Agenda

- Section 1: Harbor Craft and Existing Requirements
- Section 2: Need for Additional Emission Reductions
- Section 3: Updates to Emission Inventory
- Section 4: Health Analyses
- Section 5: Potential Regulatory Concepts
- **Section 6: Incentives**
- Section 7: Next Steps

# Incentives

- Incentives critical to achieve additional reductions beyond regulatory requirements, while providing investments into needed technologies
- **Carl Moyer Program (\$78 million in FY 18/19)**
  - Fundable projects include engine repowers, verified hybrid systems, and hybrid/zero-emission technology infrastructure
  - Over 2,000 engines upgraded from Tier 0/1/2 to Tier 3 or 4 with \$145 million through 2017
- **AB 617 Community Air Protection Funds (\$245 million in FY 18/19)**
  - Projects will be implemented under Carl Moyer Program
  - Focus on emission reductions in communities most impacted by air pollution

# Incentives (Continued)

- **Volkswagen Mitigation Fund**

- Expected available in 2019, funds must be used by 2027

- **Combustion Freight and Marine (\$60 million)**

- Tier 4 or Hybrid Ferry, Tugboat, and Towboat Repowers

- **Zero Emission Freight and Marine (\$70 million)**

- Zero-Emission Ferry, Tugboat, and Towboat Repowers

- Other local air district programs, port programs including San Pedro Ports Technology Advancement Program (TAP) offer additional opportunities

# Presentation Agenda

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# Solicitation of Regulatory Alternatives

- Staff are seeking early feedback on alternatives to proposed concepts
- Stakeholder input is important for Standardized Regulatory Impact Assessment
  - SRIA is required for “major regulations,” pursuant to SB 617 and the California Environmental Quality Act (CEQA)
- CARB encourages public input on alternatives that:
  - Yield the same or greater benefits than proposed regulatory concepts; or
  - Do not yield, or are less likely to yield, the same level of benefits than proposed regulatory concepts

# Ongoing Activities

- Collect survey information from vessel owners/operators, facilities, engine manufacturers, and VDECS manufacturers – early 2019
  - To support environmental and economic analyses
- Complete contracts in progress – early-mid 2019
  - Vessel activity and emissions characterization by UC Berkeley
  - Tier 4 engine and retrofit feasibility study by Cal Maritime
- Outreach to VDECS manufacturers and processing of technology applications – ongoing through 2019

# Key Milestones

- Additional Public Workshops in 2019
  - Discussion of refined regulatory concepts, emission inventory, solicitation of additional feedback
- Staff will post advance materials or draft documents for public input
- Staff Report and Proposed Regulation Order Posted for 45-Day Public Comment Period prior to Board Hearing
  - Includes Staff Report (Initial Statement of Reasons), Proposed Regulation Order, Draft Environmental Analysis, Standardized Regulatory Impact Assessment, Health Risk Assessment
- Board Hearing – 2020



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CARB Commercial Harbor Craft Website:

<https://www.arb.ca.gov/ports/marinevess/harborcraft.htm>