

State of California  
AIR RESOURCES BOARD

**PUBLIC HEARING TO CONSIDER THE PROPOSED CONTROL MEASURE  
FOR OCEAN-GOING VESSELS AT BERTH**

**STAFF REPORT: INITIAL STATEMENT OF REASONS**

**DATE OF RELEASE: OCTOBER 15, 2019  
SCHEDULED FOR CONSIDERATION: DECEMBER 5, 2019**

Location:

**DeFremery Park Recreation Center  
1651 Adeline Street  
Oakland, California 94607**

This report has been reviewed by the staff of the California Air Resources Board and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the California Air Resources Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

This Page Intentionally Left Blank.

# Contents

|   |          |
|---|----------|
| <b>EXECUTIVE SUMMARY .....</b>  | <b>1</b> |
| 1. What is an ocean-going vessel? .....   | 1        |
| 2. What emissions and air pollution burdens are associated with ocean-going vessels? .....  | 2        |
| 3. Why do we need to reduce emissions from ocean-going vessels at California ports? 3   |          |
| 4. What specific air pollution burdens are associated with emissions from ocean-going vessels? .....  | 6        |
| 5. Are there already regulations to reduce emissions from ocean-going vessels in California? .....  | 7        |
| 6. Why do we need further emissions reductions beyond what is required in the Existing At-Berth Regulation? .....   | 8        |
| 7. What is CARB staff's proposal to further reduce health impacts in port communities from ocean-going vessels? .....                                     | 11       |
| 8. What constitutes a vessel visit and how long are ocean-going vessel allowed to operate at berth with uncontrolled emissions? .....                     | 13       |
| 9. Is CARB proposing to regulate facilities? .....  | 14       |
| 10. What communities are most impacted by air pollution from ocean-going vessels? .....   | 15       |
| 11. How did CARB staff determine which ports and marine terminals to include in the Proposed Regulation? .....  | 15       |
| 12. What are the potential benefits of CARB staff's proposal to further reduce emissions from ocean-going vessel at berth? .....                          | 16       |
| 13. Why did CARB staff propose to include emissions control requirements for new vessel categories? .....   | 16       |
| 14. Why are there boiler emissions control requirements for tanker vessels that use steam-driven pumps but not for other vessel categories? .....         | 20       |
| 15. What technologies can be used to reduce emissions from ocean-going vessels? .....   | 22       |
| 16. What emissions control technologies already exist at California ports to reduce emissions from ocean-going vessel? .....                              | 25       |
| 17. Do alternative emissions control technologies achieve the same emissions reduction benefits as shore power? .....                                     | 26       |
| 18. Does CARB staff's new proposal allow a vessel or terminal operator to use any emissions control technology they choose to reduce emissions? .....     | 27       |
| 19. What amount of new equipment and infrastructure do CARB staff estimate will be necessary to support reducing emissions from every vessel visit? ..... | 27       |

|   |             |
|---|-------------|
| 20. Will every vessel visiting California have to reduce emissions? .....   | 28          |
| 21. When can communities expect additional emissions reductions from vessels to begin?29  |             |
| 22. Why is CARB staff proposing requirements for tanker vessels in two separate years?30  |             |
| 23. How will CARB staff determine progress is being made towards the implementation dates for ro-ro and tanker vessels and terminals? ..... | 31          |
| 24. How will CARB staff ensures ports and terminals are prepared to reduce emissions from ocean-going vessels? .....                        | 32          |
| 25. What happens if a vessel is not able to reduce emissions while at berth? .....  | 32          |
| 26. What is the remediation fund and when can it be used? .....   | 34          |
| 27. When a vessel is unable to reduce emissions at berth, who is at fault?.....   | 35          |
| 28. How will CARB ensure the necessary reductions are being achieved? .....   | 35          |
| <b>I. BACKGROUND AND INTRODUCTION .....</b>   | <b>I-1</b>  |
| A. CARB's Authority and Responsibility to Reduce Air Pollution from Vessels At Berth I-1  |             |
| B. Background on Affected Categories.....   | I-3         |
| 1. Basics on Ports and Independent Marine Terminals.....  | I-3         |
| 2. Basics on Ocean-Going Vessel Operations.....   | I-8         |
| 3. Air Pollution from Vessels .....   | I-9         |
| 4. Vessel Characteristics .....   | I-11        |
| 5. At Berth Emissions Control Strategies .....  | I-30        |
| C. Background of Existing Regulation .....  | I-34        |
| 1. Affected Vessels and Ports .....   | I-34        |
| 2. Compliance with Existing Regulation .....  | I-35        |
| D. Purpose of the Proposed Regulation .....   | I-35        |
| 1. Achieve Public Health and Air Quality Benefits.....  | I-36        |
| 2. Address Implementation Challenges with Existing Regulation .....   | I-37        |
| <b>II. THE PROBLEM THAT THE PROPOSAL IS INTENDED TO ADDRESS .....</b>   | <b>II-1</b> |
| A. Need to Reduce Exposure in Impacted Communities.....   | II-1        |
| 1. Cargo Growth Will Increase Emissions.....  | II-2        |
| 2. Need to Reduce NOx, PM, and ROG Emissions .....  | II-3        |
| 3. Need to Reduce Greenhouse Gas and Black Carbon Emissions .....   | II-4        |
| B. State Policy and Plans Direct CARB to Secure Further Reductions From Vessels At Berth .....  | II-6        |
| 1. Assembly Bill 32/Senate Bill 32 .....  | II-6        |

|             |  |              |
|-------------|--|--------------|
| 2.          | Sustainable Freight Pathways to Zero and Near-Zero Discussion Document | II-6         |
| 3.          | Executive Order B-32-15  | II-7         |
| 4.          | 2016 State Strategy for the State Implementation Plan                  | II-7         |
| 5.          | Assembly Bill 617  | II-8         |
| 6.          | March 2017 Addendum to Board Resolutions 17-7 and 17-8                 | II-8         |
| C.          | Implementation Challenges with the Existing Regulation                 | II-9         |
| 1.          | Shore Power Berth Availability and Positioning                         | II-10        |
| 2.          | Three/Five Hour Rule   | II-11        |
| 3.          | Compliance Using CARB Approved Emissions Control Strategies            | II-13        |
| 4.          | Required Commissioning Visits  | II-14        |
| 5.          | Quarterly Visit Requirement  | II-14        |
| 6.          | Short Visit Difficulties   | II-14        |
| <b>III.</b> | <b>DESCRIPTION OF THE PROPOSED REGULATION</b>                          | <b>III-1</b> |
| A.          | Emissions Reduction Goal   | III-1        |
| 1.          | Auxiliary Engine Control Requirements                                  | III-2        |
| 2.          | Tanker Boiler Control Requirements                                     | III-2        |
| B.          | Affected Vessel Categories   | III-4        |
| 1.          | Exclusion of Bulk and General Cargo Vessels from Control Requirement   | III-4        |
| C.          | Affected Ports and Marine Terminals                                    | III-6        |
| D.          | Implementation Timeline  | III-8        |
| 1.          | Developing the Implementation Schedule                                 | III-9        |
| 2.          | Container, Reefer, and Cruise Implementation Dates                     | III-10       |
| 3.          | Ro-Ro Implementation Date  | III-14       |
| 4.          | Tanker Implementation Dates  | III-16       |
| E.          | Interim Evaluation   | III-22       |
| F.          | Responsibilities for Compliance  | III-23       |
| 1.          | Vessel and Terminal Requirements                                       | III-24       |
| G.          | CARB Approved Emissions Control Strategy Operator Requirements         | III-26       |
| 1.          | Obtaining CARB Approval for an Emissions Control Strategy              | III-26       |
| 2.          | CARB Approved Emissions Control Strategy Compliance Checklist          | III-26       |
| 3.          | Port Requirements  | III-27       |
| 4.          | Reporting and Record-keeping Requirements                              | III-28       |
| H.          | Additional Compliance Options  | III-29       |

|  |             |
|--|-------------|
| 1. Safety, Research, and Vessel Commissioning Exceptions.....                                  | III-29      |
| 2. Terminal and Vessel Incident Exceptions (TIE/VIE).....                                      | III-30      |
| 3. Optional Remediation Fund .....   | III-31      |
| I. Terminal and Port Plans.....  | III-33      |
| 1. Terminal Plans.....   | III-33      |
| 2. Port Plans .....  | III-34      |
| <b>IV. THE SPECIFIC PURPOSE AND RATIONALE FOR EACH ADOPTION,<br/>AMENDMENT, OR REPEAL.....</b> | <b>IV-1</b> |
| Section 93130. Control Measure For Ocean-Going Vessels At Berth.....                           | IV-2        |
| Section 93130.1. Purpose and Intent.....   | IV-3        |
| Section 93130.2. Section Summary, and Definitions .....  | IV-4        |
| Section 93130.3. Applicability .....   | IV-31       |
| Section 93130.4. Exceptions .....  | IV-32       |
| Section 93130.5. CARB Approved Emission Control Strategy .....                                 | IV-35       |
| Section 93130.6. Opacity Requirement .....   | IV-48       |
| Section 93130.7. Vessel Operator Requirements.....   | IV-48       |
| Section 93130.8. Vessel Visit Exceptions.....  | IV-60       |
| Section 93130.9. Terminal Operator Requirements.....   | IV-63       |
| Section 93130.10. Terminal Exceptions.....   | IV-72       |
| Section 93130.11. Vessel Incident Exceptions and Terminal Incident Exceptions .                | IV-76       |
| Section 93130.12. CARB Approved Emission Control Strategy Operator .....                       | IV-81       |
| Section 93130.13. Port Requirements .....  | IV-86       |
| Section 93130.14. Terminal and Port Plans and Interim Evaluation .....                         | IV-88       |
| Section 93130.15. Remediation Fund Use .....   | IV-91       |
| Section 93130.16. Remediation Fund Administration .....  | IV-97       |
| Section 93130.17. Summary of Responsibilities.....   | IV-104      |
| Section 93130.18. Violations .....   | IV-104      |
| Section 93130.19. Sunset.....  | IV-105      |
| Section 93130.20. Severability .....   | IV-106      |
| <b>V. AIR QUALITY.....</b>   | <b>V-1</b>  |
| A. Objective .....   | V-1         |
| B. Emissions Inventory Methods .....   | V-1         |
| C. Air Quality Impacts .....   | V-3         |

|              |  |               |
|--------------|--|---------------|
| D.           | Health Analyses to Assess the Impact of Emissions from Ocean-Going Vessels At Berth..... | V-9           |
| 1.           | Potential Exposures and Health Risks From Ocean-Going Vessel Engine DPM Emissions .....  | V-10          |
| 2.           | Regional Non-Cancer Health Impacts.....  | V-15          |
| <b>VI.</b>   | <b>BENEFITS ANTICIPATED FROM REGULATORY ACTION .....</b>                                 | <b>VI-1</b>   |
| A.           | Health Benefits.....   | VI-1          |
| 1.           | Reduction in Potential Cancer Risk.....  | VI-1          |
| 2.           | Non-Cancer Health Impacts and Valuations .....   | VI-2          |
| 3.           | Reduced Ambient Ozone Levels.....  | VI-3          |
| 4.           | Greenhouse Gases and Black Carbon .....  | VI-3          |
| B.           | Additional Benefits .....  | VI-4          |
| 1.           | Technology Providers .....   | VI-4          |
| 2.           | Construction.....  | VI-4          |
| 3.           | Technology Research and Development.....   | VI-5          |
| 4.           | Out-of-State and International Impacts .....   | VI-5          |
| <b>VII.</b>  | <b>ENVIRONMENTAL ANALYSIS .....</b>  | <b>VII-1</b>  |
| <b>VIII.</b> | <b>ENVIRONMENTAL JUSTICE .....</b>   | <b>VIII-1</b> |
| <b>IX.</b>   | <b>ECONOMIC IMPACTS ASSESSMENT .....</b>   | <b>IX-1</b>   |
| A.           | Changes Since the Release of the SRIA .....  | IX-1          |
| B.           | Direct Costs.....  | IX-7          |
| 1.           | Cost Inputs.....   | IX-8          |
| 2.           | Total Statewide Costs .....  | IX-18         |
| C.           | Direct Costs on Business and Individuals .....   | IX-22         |
| 1.           | Direct Cost on Typical Business .....  | IX-22         |
| 2.           | Direct Cost on Small Businesses and Individuals .....                                    | IX-22         |
| D.           | Benefits .....   | IX-23         |
| 1.           | Benefits to Terminal and Vessel Operators .....  | IX-23         |
| 2.           | Benefits to Other California Businesses.....   | IX-23         |
| 3.           | Benefits to Small Businesses.....  | IX-24         |
| 4.           | Benefits to Individuals .....  | IX-24         |
| 5.           | Social Cost of Carbon .....  | IX-24         |
| E.           | Fiscal Impacts .....   | IX-25         |
| 1.           | Local Government.....  | IX-25         |
| 2.           | State Government.....  | IX-26         |

|              |  |               |
|--------------|--|---------------|
| 3.           | Total Personnel Costs to Local, State, and Federal Government .....  | IX-27         |
| F.           | Macroeconomic Impacts .....  | IX-29         |
| 1.           | California Employment Impacts .....  | IX-29         |
| 2.           | California Business Impacts.....   | IX-29         |
| 3.           | Gross State Product (GSP).....   | IX-29         |
| G.           | Alternatives .....   | IX-30         |
| <b>X.</b>    | <b>EVALUATION OF REGULATORY ALTERNATIVES .....</b>   | <b>X-1</b>    |
| A.           | Alternative 1: Implementation Fixes through an Amendment to Existing Regulation Only (No Addition of Other Vessel Categories or Ports/Terminals) .....   | X-2           |
| B.           | Alternative 2: Shore Power Only Compliance Pathway for Container/Reefer, Cruise, Auto/Ro-Ro and Tanker Vessels (Applying the Same Terminal Threshold as the Proposed Regulation) .....   | X-4           |
| C.           | Alternative 3: “Alternative Proposal for Amendments to At-Berth Regulations” provided by California Association of Port Authorities (CAPA), Cruise Lines International Association (CLIA), Pacific Merchant Shipping Association (PMSA), Western States Petroleum Association (WSPA), and World Shipping Council (WSC) on February 15, 2019..... | X-8           |
| 1.           | Feasibility Studies .....  | X-8           |
| 2.           | Regulated Vessels and Associated Terminals/Ports (Subject to the Existing Regulation) .....  | X-8           |
| 3.           | Recordkeeping and Reporting Requirements .....   | X-9           |
| D.           | Small Business Alternative.....  | X-10          |
| E.           | Performance Standards in Place of Prescriptive Standards.....  | X-10          |
| F.           | Health and Safety Code section 57005 Major Regulation Alternatives .....   | X-10          |
| <b>XI.</b>   | <b>JUSTIFICATION FOR ADOPTION OF REGULATIONS DIFFERENT FROM FEDERAL REGULATIONS CONTAINED IN THE CODE OF FEDERAL REGULATIONS.....</b>  | <b>XI-1</b>   |
| <b>XII.</b>  | <b>PUBLIC PROCESS FOR DEVELOPMENT OF THE PROPOSED ACTION (PRE-REGULATORY INFORMATION) .....</b>  | <b>XII-1</b>  |
| A.           | Public Engagement for Rulemaking Process .....   | XII-1         |
| B.           | Public Workshops .....   | XII-2         |
| C.           | Community Meetings .....   | XII-4         |
| D.           | Work Group and Informational Meetings.....   | XII-5         |
| E.           | Port/Terminal Tours and Site Visits.....   | XII-6         |
| <b>XIII.</b> | <b>References .....</b>  | <b>XIII-1</b> |



## List of Tables

|  |        |
|--|--------|
| Table I-1: 2017 California Port and Marine Terminal Vessel Visits .....  | I-7    |
| Table I-2: New Engine NOx Emissions Limits Under IMO Annex VI .....  | I-11   |
| Table III-1: Average Auxiliary Engine and Boiler Load At Berth By Vessel Type .....  | III-3  |
| Table III-2: Tanker Vessel Average Auxiliary Engine and Boiler Load At Berth By Size Classification .....  | III-3  |
| Table III-3: California Terminal Thresholds .....  | III-6  |
| Table III-4: Ports and Independent Marine Terminals Anticipated to be Included in Proposed Regulation By Vessel Type .....   | III-7  |
| Table III-5: Implementation Schedule .....   | III-9  |
| Table III-6: Number of Increased Vessel Calls With Control Requirements as a Result of the Proposed Regulation (Based on 2017 Vessel Visit Activity) .....   | III-11 |
| Table III-7: Summary of Responsibilities .....   | III-23 |
| Table III-8: TIE and VIE Percentages .....   | III-31 |
| Table V-1: POLA and POLB Estimated At Berth DPM Emissions <sup>1,2</sup> .....   | V-11   |
| Table V-2: Richmond Complex Estimated At Berth DPM Emissions <sup>1,2</sup> .....  | V-12   |
| Table V-3: Population Exposed and Elevated Cancer Risk Levels for POLA and POLB Comparing the Existing Regulation and Proposed Regulation in 2031 <sup>1</sup> .....                                   | V-13   |
| Table V-4: Population Exposed and Elevated Cancer Risk Levels for Richmond Complex Comparing the Existing Regulation and Proposed Regulation in 2031 <sup>1</sup> .....                                | V-13   |
| Table V-5: Regional and Statewide Avoided Premature Deaths, Hospital Admissions and Emergency Room Visits from 2021 to 2032 under the Proposed Regulation for Total PM2.5 and NOx <sup>1,2</sup> ..... | V-17   |
| Table V-6: Valuation Per Incident for Avoided Health Outcomes .....  | V-18   |
| Table V-7: Statewide Valuation from Avoided Adverse Health Outcomes Between 2021 and 2032 as a Result of the Proposed Regulation .....   | V-19   |
| Table VI-1: Statewide Valuation from Avoided Adverse Health Outcomes Between 2021 and 2032 as a Result of the Proposed Regulation .....  | VI-3   |
| Table VII-1: Summary of Potential Environmental Impacts .....  | VII-2  |
| Table IX-1: TIEs and VIEs by Vessel Category per Year under the Proposed Regulation in the SRIA .....  | IX-3   |
| Table IX-2: VIEs and TIEs by Vessel Category per Year under the Proposed Regulation .....  | IX-3   |
| Table IX-3: Hourly Remediation Cost for Terminal and Vessel per Vessel Category in the SRIA .....  | IX-4   |
| Table IX-4: Hourly Remediation Cost for Terminal and Vessel per Vessel Category under the Proposed Regulation .....  | IX-4   |
| Table IX-5: Annual Industry Growth Factors .....   | IX-9   |
| Table IX-6: Annual and Total Direct Costs or Cost Savings to Terminal and Vessel Operators as a Result of the Proposed Regulation from 2020 to 2032 (Thousands) .....                                  | IX-19  |
| Table IX-7: Annual and Total Direct Costs to Ports as a Result of the Proposed At-Berth Regulation from 2020 to 2032 (Thousands) .....   | IX-20  |
| Table IX-8: Annual and Total Direct Costs and Cost Savings to Terminal and Vessel Operators and Ports as a Result of the Proposed Regulation from 2020 to 2032 (Thousands) .....                       | IX-21  |

|  |       |
|--|-------|
| Table IX-9: Estimated Net Costs to Individuals from the Proposed Regulation.....                       | IX-23 |
| Table IX-10: Annual and Total Personnel Costs to Local, State, and Federal Government (thousands)..... | IX-28 |

## List of Figures

|  |        |
|--|--------|
| Figure I-1: Description of the Relationship Between the Port, Terminal, and Berth at a Typical Public Landlord Port.....                                 | I-4    |
| Figure I-2: Map of California Large Seaports .....   | I-6    |
| Figure I-3: Container Vessel.....  | I-12   |
| Figure I-4: Container Vessel Growth .....  | I-13   |
| Figure I-5: Reefer Vessel .....  | I-14   |
| Figure I-6: Percent of Visits to California by Vessel Type in 2017 .....   | I-15   |
| Figure I-7: 2021 Projected Statewide At Berth NOx Emissions – Auxiliary Engines and Boilers .....  | I-16   |
| Figure I-8: 2021 Projected Statewide At Berth PM2.5 Emissions – Auxiliary Engines and Boilers .....  | I-16   |
| Figure I-9: 2021 Projected Statewide At Berth DPM Emissions – Auxiliary Engines .....  | I-17   |
| Figure I-10: 2021 Projected Statewide At Berth ROG Emissions – Auxiliary Engines and Boilers .....   | I-17   |
| Figure I-11: 2021 Projected Statewide At Berth GHG (CO2, CH4, and N2O) Emissions in Metric Tons Per Year (MT/Year) – Auxiliary Engines and Boilers ..... | I-18   |
| Figure I-12: Cruise Vessel.....  | I-19   |
| Figure I-13: Size of Cruise Vessels Over the Years .....   | I-20   |
| Figure I-14: Ro-Ro Carrier.....  | I-21   |
| Figure I-15: Bulk Vessel .....   | I-22   |
| Figure I-16: Tanker Vessel .....   | I-24   |
| Figure I-17: 2021 Projected Statewide At Berth NOx Emissions - Tanker Auxiliary Engines vs. Boilers.....   | I-27   |
| Figure I-18: 2021 Projected Statewide Tanker Vessel PM2.5 Emissions - Auxiliary Engines vs. Boilers.....   | I-28   |
| Figure I-19: 2021 Projected Statewide Tanker Vessel ROG Emissions - Auxiliary Engine vs. Boilers.....  | I-29   |
| Figure I-20: 2021 Projected Statewide Tanker Vessel GHG Emissions - Auxiliary Engine vs. Boilers.....  | I-29   |
| Figure I-21: Vessel Side Shore Power .....   | I-30   |
| Figure I-22: Barge-Based Capture and Control System.....   | I-32   |
| Figure I-23: Land-Based Capture and Control System.....  | I-33   |
| Figure II-1: Example of a Container Vessel AMP Box Positioning .....   | II-13  |
| Figure III-1: Ro-Ro Vessel At Berth.....   | III-15 |
| Figure III-2: “T”-shaped Marine Oil Terminal in Northern California .....  | III-17 |
| Figure III-3: Port-Based Marine Oil Terminal in Southern California .....  | III-17 |
| Figure V-1: Projected Annual NOx Emissions from All Vessels At Berth Statewide.....  | V-3    |
| Figure V-2: Projected Annual DPM Emissions from All Vessels At Berth Statewide....   | V-4    |
| Figure V-3: Projected Annual PM2.5 Emissions From All Vessels At Berth Statewide .....   | V-5    |
| Figure V-4: Projected Annual GHG Emissions From All Vessels At Berth Statewide .....   | V-6    |

|  |      |
|--|------|
| Figure V-5: Projected Annual ROG Emissions From All Vessels At Berth Statewide ..        | V-7  |
| Figure V-6: 2016 Statewide At-Berth NOx and PM 2.5 Emissions by Port.....                | V-8  |
| Figure V-7: 2016 Statewide At Berth PM2.5 Emission by Vessel Type.....                   | V-9  |
| Figure V-8: Maximum Exposed Individual Resident Potential Cancer Risk <sup>1</sup> ..... | V-14 |
| Figure X-1: Alternative 2 - NOx Emissions Estimates .....                                | X-5  |
| Figure X-2: Alternative 2 - DPM Emissions Estimates.....                                 | X-5  |
| Figure X-3: Alternative 2 – PM2.5 Emissions Estimated .....                              | X-6  |
| Figure X-4: Alternative 2 - GHG Emissions Estimates .....                                | X-7  |
| Figure X-5: Alternative 4 - ROG Emissions Estimates .....                                | X-7  |

## **Appendices:**

- A.** Proposed Control Measure for Ocean-Going Vessels At Berth Regulation Order
- B.** Existing Regulation: Airborne Toxic Control Measure for Auxiliary Diesel Engines Operated on Ocean-Going Vessels At-Berth in a California Port
- C.** Proposed Control Measure for Ocean-Going Vessels At Berth Standardized Regulatory Impact Assessment (SRIA)
- D.** Draft Environmental Analysis Prepared for the Proposed Control Measure for Ocean-Going Vessels At Berth
- E.** Berth Analysis
- F.** List of Public Workshops, Meetings, Phone Calls, Conferences, Site Visits, and Vessel Tours Supporting the Public Process for Development of the Proposed Regulation
- G.** Health Analyses: Control Measure for Ocean-Going Vessels At Berth
- H.** 2019 Update to Inventory for Ocean-Going Vessels At Berth: Methodology and Results

## ISOR ACRONYMS AND ABBREVIATIONS

|                 |  |
|-----------------|--|
| AB              | Assembly Bill  |
| AMP             | Alternative Marine Power   |
| ATCM            | Air Toxic Control Measure  |
| CalEPA          | California Environmental Protection Agency   |
| CAPP            | Community Air Protection Program   |
| CARB or Board   | California Air Resources Board   |
| CEQA            | California Environmental Quality Act   |
| CH <sub>4</sub> | Methane  |
| CO              | Carbon Monoxide  |
| CO <sub>2</sub> | Carbon Dioxide   |
| CPUC            | California Public Utilities Commission   |
| CSLS            | California State Lands Commission  |
| DPM             | Diesel Particulate Matter  |
| DWT             | Dead Weight Ton  |
| EA              | Environmental Analysis   |
| ECA             | Emissions Control Area   |
| EGR             | Exhaust Gas Recirculation  |
| EMFAC           | EMission FACtors   |
| EO              | Executive Order  |
| U.S. EPA        | U.S. Environmental Protection Agency   |
| FAH             | Fraction of time   |
| FEU             | Forty-foot Equivalent Unit   |
| FRRS            | Freight Regulations Reporting System   |
| GHG             | Greenhouse Gas   |
| HFO             | Heavy Fuel Oil   |
| HRA             | Health Risk Analysis   |
| HSC             | Health and Safety Code   |
| IEEE            | Institute of Electrical and Electronic Engineers                                   |
| IMO             | International Maritime Organization  |
| IMTT            | International Matex Tank Terminals   |
| IPT             | Incidence per Ton  |
| ISOR            | Initial Statement of Reasons   |
| kW              | Kilowatt   |
| LCFS            | Low Carbon Fuel Standards  |
| LF              | Load Factor  |
| LNG             | Liquefied Natural Gas  |
| LPG             | Liquefied Petroleum Gas  |
| m/m             | Mass/Mass  |
| MARAD           | Maritime Administration  |
| MARPOL          | Annex VI to the International Convention on the Prevention of Pollution from Ships |
| MDO             | Marine Diesel Oil  |
| MEIR            | Maximum Exposed Individual Resident  |
| MGO             | Marine Gas Oil   |

|        |   |
|--------|---|
| MOTEMS | Marine Oil Terminal Engineering and Maintenance Standards   |
| MOU    | Memorandum of Understanding   |
| MT     | Metric Ton  |
| MTC    | Marine Terminal Complex   |
| MW     | Megawatt  |
| MWh    | Megawatt-hour   |
| NAAQS  | National Ambient Air Quality Standards  |
| NF3    | Nitrogen Trifluoride  |
| NO     | Nitric Oxide  |
| NO2    | Nitrogen dioxide  |
| NOx    | Nitrogen oxides or oxides of nitrogen   |
| N2O    | Nitrous Oxide   |
| OEHHA  | Office of Environmental Health Hazard Assessment  |
| OEM    | Original Equipment Manufacturers  |
| OGV    | Ocean-going Vessel  |
| PFC    | Perfluorocarbons  |
| PM     | Particulate Matter  |
| PM2.5  | Particulate Matter (particles with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers) |
| PM10   | Particulate Matter (particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers)  |
| POLA   | Port of Los Angeles   |
| POLB   | Port of Long Beach  |
| Ppb    | Parts per Billion   |
| Reefer | Refrigerated Cargo Vessel   |
| RMP    | Risk Management Policy  |
| Ro-ro  | Roll on-roll off vessel   |
| ROG    | Reactive Organic Gas  |
| SB     | Senate Bill   |
| SCR    | Selective Catalytic Reduction   |
| SF6    | Sulfur Hexafluoride   |
| SIP    | State Implementation Plan   |
| SLCP   | Short Lived Climate Pollutant   |
| SO2    | Sulfur Dioxide  |
| SOx    | Sulfur Oxides   |
| SRIA   | Standardized Regulatory Impact Assessment   |
| TAC    | Toxic Air Contaminant   |
| TEU    | Twenty-foot Equivalent Unit   |
| TIE    | Terminal Incident Events  |
| TPD    | Tons per Day  |
| TPY    | Tons per Year   |
| ULCC   | Ultra Large Crude Carrier   |
| U.S.   | United States   |
| UVLCC  | Very Large Crude Carrier  |
| VIE    | Vessel Incident Events  |
| WSC    | World Shipping Council  |

This Page Intentionally Left Blank.

## EXECUTIVE SUMMARY

### 1. What is an ocean-going vessel?

An ocean-going vessel (“vessel”) as referred to in this Initial Statement of Reasons (“ISOR” or “Staff Report”) is a large commercial vessel designed to transport cargo or passengers between ports.<sup>1</sup> Ocean-going vessels are generally greater than 400 feet, weigh more than 10,000 gross tons, and have per-cylinder engine displacement of greater than 30 liter/cylinder, and can be a U.S. or foreign owned vessel. Most ocean-going vessels are owned by foreign companies due to the international nature of shipping, but are still subject to California ocean-going vessel regulations.

The main categories of ocean-going vessels that this Staff Report will discuss are: container, refrigerated cargo (“reefer”), cruise (or “passenger”), auto carrier, roll on-roll off (“ro-ro”), tanker, bulk, and general cargo. This list of vessel categories represents the most typical ocean-going vessels visiting California. For the purposes of this Staff Report, discussions about container and reefer vessels will often be grouped together, as will bulk and general cargo vessels, due to similarities in berth operations and at berth power loads. Auto carrier and ro-ro vessels will be collectively referred to as ro-ro vessels throughout this Staff Report.

- Container vessels: designed to carry cargo stored in standardized containers, and container vessel size is classified by how many 20 foot equivalent units (TEU) can be carried onboard. Dimensions of a single TEUs are 20 feet x 8 feet x 8.5 feet. However, a modern standard shipping container is 40 feet long, which is two TEUs, and may be referred to as a 40-foot equivalent unit (FEU).
- Reefer vessels: typically used to transport perishable commodities that require temperature-controlled transportation, such as fruits and vegetables, meats, and pharmaceuticals. Due to refrigeration, and crane or other onboard equipment operations, a reefer vessel’s electrical load can be considerable, and similar to a traditional container vessel several times its size. Most reefer vessels are now refrigerated container vessels that are specifically designed to carry containers that are each individual refrigerated units sized in the same manner as traditional container TEUs and FEUs.
- Cruise vessels: transport passengers for pleasure voyages. Powering a cruise vessel’s various comforts, including air-conditioning systems, movie theaters, casinos, restaurants, and heating the water in the swimming pools and Jacuzzis requires a significant amount of power while at berth, several times that of most cargo vessels.
- Ro-ro vessels: a type of ocean-going vessel designed to carry wheeled cargo, including vehicles, which “roll-on and roll-off” the vessel via a built-in ramp.

---

<sup>1</sup> For the purpose of this document the terms “ocean-going vessel” and “vessel” will be used interchangeably.



California's most frequent visitors from the ro-ro vessel category are auto carriers, which haul exclusively automobiles.

- Tanker vessels: designed to carry liquid or gaseous products, including crude oil or other hydrocarbon products, such as Liquid Liquefied Petroleum Gas (LPG), Liquid Natural Gas (LNG); chemicals, such as ammonia, chlorine, and styrene monomer, asphalt, and even fresh water.
- Bulk and general cargo vessels: designed to carry material that is not easily placed into containers. These types of vessels typically transport goods such as, rolls of steel, gypsum, mineral ore, fertilizer, wood chips, and grains.

## **2. What emissions and air pollution burdens are associated with ocean-going vessels?**

There are four main modes of operation for an ocean-going vessel: maneuvering, transiting, at berth, and at anchor.<sup>2</sup> The majority of emissions from an ocean-going vessel occur as a vessel transits through open waters and maneuvers in and out of port as the vessel's large main engines are in operation, along with the auxiliary engines and boilers. Additionally, when stopped at berth and anchor, vessels operate smaller auxiliary engines and boilers, which produce emissions as the vessel sits idle.

Emissions from ocean-going vessels include criteria pollutants, air toxic contaminants, and GHGs. One of the main pollutants emitted from the exhaust stack of an ocean-going vessel is NO<sub>x</sub>. NO<sub>x</sub> consists of a grouping of highly reactive gases, including nitric oxide (NO) and nitrogen dioxide (NO<sub>2</sub>). Short-term exposure to elevated concentrations of NO<sub>x</sub> is known to irritate the respiratory system and aggravate respiratory diseases, particularly asthma, leading to respiratory symptoms (such as coughing, wheezing or difficulty breathing), hospital admissions and visits to emergency rooms. Longer term exposures to elevated concentrations of NO<sub>2</sub> can contribute to the development of asthma and potentially increase susceptibility to respiratory infections. Not only does NO<sub>2</sub> and other NO<sub>x</sub> chemicals cause human respiratory ailments, when NO<sub>x</sub> molecules interact with water, oxygen and other chemicals in the atmosphere they can form acid rain. This acid rain harms sensitive ecosystems and NO<sub>x</sub> in the atmosphere contributes to nutrient pollution in coastal waters. According to the U.S. Environmental Protection Agency ("U.S. EPA"), NO<sub>2</sub> and NO<sub>x</sub> molecules also react with other chemicals in the air to form both PM and ozone.<sup>3</sup>

PM, which includes DPM, is emitted from a vessel's exhaust stack as a complex mixture of suspended particles and aerosols varying in size, shape and chemical composition.

---

<sup>2</sup> A vessel is considered "at berth" when it is docked at berth, the main engines are shut down and large lines are used to secure the vessel to the wharf or dock to keep it in place; a vessel approaching a port or marine terminal may stop "at anchor" a short distance off-shore while waiting for a berth or labor to become available, or to off-load products or passengers if a deep water port is not available for the vessel.

<sup>3</sup> U.S. EPA, What is NO<sub>2</sub>, accessed September 8, 2019, <https://www.epa.gov/no2-pollution/basic-information-about-no2#>.

These particles can either be directly emitted into the atmosphere (primary particles) or formed by chemical reactions of gases (secondary particles) from natural or man-made sources such as SO<sub>2</sub>, NO<sub>x</sub>, and certain organic compounds. PM can be inhaled into the upper airways and lungs, creating respiratory ailments leading to public health concerns. Exposure can increase premature mortality, hospital admissions for cardiopulmonary causes, acute and chronic bronchitis, asthma attacks, and respiratory symptoms, and the health effects are of particular concern for sensitive groups such as infants, children, the elderly, and those with preexisting heart or lung disease.<sup>4</sup> Additionally, in 1998, DPM was identified as a toxic air contaminant. Long-term exposures to DPM can increase the risk of developing lung cancer and shares many of the same non-cancer health effects as PM<sub>2.5</sub>.<sup>5</sup>

Ocean-going vessels also produce GHGs and black carbon (a potent short-lived climate pollutant). GHGs contribute to the greenhouse effect by absorbing reflected solar energy and warming Earth's atmosphere, contributing to global climate change.<sup>6</sup> Presently, the maritime industry as a whole accounts for around 2 percent of global GHG emissions, but this percentage is projected to increase by up to 250 percent by 2050 due to industry growth associated with increasing global trade demands.<sup>7</sup> California has set GHG emissions reductions goal of 40 percent below 1990 levels by 2030<sup>8</sup> and this target is expected to enable California to reach the ultimate goal of reducing emissions by 80 percent under 1990 levels by 2050, which aligns with scientifically established levels to limit global warming below 2 degrees Celsius.<sup>9</sup> Limiting auxiliary diesel engine and boiler emissions from vessels at berth would help to achieve California's goals in reducing both GHG emissions and short-lived climate pollutants, such as black carbon.

### **3. Why do we need to reduce emissions from ocean-going vessels at California ports?**

California has a vibrant economy in which the movement of freight plays a significant role. However, this economic benefit comes at a cost to the health of the many Californians living and working in neighborhoods that are heavily impacted by air

---

<sup>4</sup> CARB, Inhalable Particulate Matter and Health (PM<sub>2.5</sub> and PM<sub>10</sub>), August 10, 2017 (accessed September 8, 2019), <https://ww3.arb.ca.gov/research/aags/common-pollutants/pm/pm.htm>.

<sup>5</sup> CARB, Overview: Diesel Exhaust & Health, accessed September 8, 2019, <https://ww2.arb.ca.gov/resources/overview-diesel-exhaust-and-health>.

<sup>6</sup> IMO, Greenhouse Gas Emissions, accessed September 8, 2019, <http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/GHG-Emissions.aspx>.

<sup>7</sup> Stefanini, S., Climate Change News, "Countries Inch Towards 'Bare Minimum' Climate Target For Shipping", April 10, 2018, <https://www.climatechangenews.com/2018/04/10/countries-inch-towards-bare-minimum-climate-target-shipping/>.

<sup>8</sup> California Health and Safety Code § 38566, Division 25.5, Senate Bill No. 32, September 8, 2016, [https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160SB32](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB32).

<sup>9</sup> United Nations Climate Change, The Paris Agreement, accessed September 8, 2019, <https://unfccc.int/process/the-paris-agreement/what-is-the-paris-agreement>.

pollution associated with this freight activity. Freight activity, which can include trucks, locomotives, port equipment used for handling cargo, and the large commercial ocean-going vessels that visit our ports, accounts for roughly half of California's air pollution.<sup>10</sup> California's combination of unique geography and robust freight transportation network contributes to our state experiencing some of the worst air quality in the nation. According to the American Lung Association's 2019 State of the Air report, cities in California took the top three spots for the nation's worst ozone and particle pollution (Los Angeles, Fresno-Madera-Hanford, and Bakersfield, respectively).<sup>11</sup>

Many of the communities surrounding California's seaports ("ports") are recognized as disadvantaged by the California Environmental Protection Agency ("CalEPA"). Disadvantaged communities are identified using a tool called the California Communities Environmental Health Screening Tool, Version 3.0.<sup>12</sup> This tool is often referred to as "CalEnviroScreen" and it was developed by the Office of Environmental Health Hazard Assessment. CalEnviroScreen uses various factors to score California communities based on environmental pollution burdens and socio-economic indicators, including factors such as community exposure to toxic air contaminants such as DPM from freight related sources. Exposure to cancer-causing DPM from trucks, locomotives, and ocean-going vessels moving in and out of our ports is a primary contributor to classifying many California port communities as disadvantaged.

Numerous efforts are already in place to reduce exposure to air pollutants and toxic air contaminants, including DPM from the freight sector. As a result, exposure to cancer-causing DPM has decreased substantially across all communities statewide. However, exposure to diesel particles in disadvantaged communities remains on average twice that experienced in non-disadvantaged communities.<sup>13</sup> Recent legislation, such as Assembly Bill (AB) 617 aims to address some of this disparity through programs focusing on developing community specific monitoring and action plans to further reduce health burdens from air pollution in disadvantaged communities.<sup>14</sup> In response to AB 617, the California Air Resources Board (CARB) created the Community Air Protection Program (CAPP), which is tasked with achieving emissions reductions in disadvantaged communities. As part of this effort, new

---

<sup>10</sup> California Air Resources Board, Update On California Actions to Minimize Community Health Impacts From Freight, March 21, 2019, <https://ww3.arb.ca.gov/board/books/2019/032119/19-3-2pres.pdf>

<sup>11</sup> American Lung Association, State of the Air 2019, accessed September 8, 2019, <https://www.lung.org/assets/documents/healthy-air/state-of-the-air/sota-2019-full.pdf>.

<sup>12</sup> Office of Environmental Health Hazard Assessment, CalEnviroScreen 3.0, June 25, 2018, <https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30>.

<sup>13</sup> California Air Resources Board, Draft Community Air Protection Blueprint For Selecting Communities, Preparing Community Emissions Reduction Programs, Identifying Statewide Strategies, and Conducting Community Air Monitoring, June 7, 2018, [https://ww2.arb.ca.gov/sites/default/files/2018-06/draft\\_community\\_air\\_protection\\_blueprint.pdf](https://ww2.arb.ca.gov/sites/default/files/2018-06/draft_community_air_protection_blueprint.pdf).

<sup>14</sup> California Health and Safety Code § 40920.6, 42400, 42402, 39607.1, 40920.8, 42411, 42705.5, and 44391.2, Division 26, Assembly Bill No. 617, Nonvehicular Air Pollution: Criteria Air Pollutants and Toxic Air Contaminants, July 26, 2017, [https://leginfo.ca.gov/faces/billNavClient.xhtml?bill\\_id=201720180AB617](https://leginfo.ca.gov/faces/billNavClient.xhtml?bill_id=201720180AB617).

statewide actions are in development, including new regulations, new incentive grant funding, and new exposure reduction resources and tools.

Reducing port related emissions also helps California meet Federal clean air laws, which require regions in the state with unhealthy levels of ozone, PM, NOx, and other key pollutants to develop State Implementation Plans (SIP). These SIPs are used to inform the Federal government and the public about how a region will reach their clean air goals. Further reductions from ocean-going vessels at berth have been identified as a key measure to accomplish these goals, particularly for regions of California that contain large port complexes, such as Los Angeles and Long Beach.

Lastly, achieving additional emissions reductions from freight related sources at California's ports is expected to assist with meeting the State's climate change goals by reducing GHG and black carbon emissions.<sup>15,16,17</sup> California is already feeling the impacts of climate change, and projections from the Office of Environmental and Health Hazard Assessment (OEHHA) indicate that these effects will continue and worsen over the coming centuries.<sup>18</sup> In 2006, California enacted AB 32 to address global climate change by requiring cost-effective reductions in GHG emissions and by codifying a target of reducing California GHG emissions to 1990 levels by 2020. AB 32 directed CARB to continue its leadership role on climate change and to develop a scoping plan identifying integrated and cost-effective regional, national, and international GHG reduction programs.<sup>19</sup> In 2015, California's Governor issued Executive Order (EO) B-30-15, which set a goal of reducing statewide GHG emissions to 40 percent below 1990 levels by 2030.<sup>20</sup> In 2016, the Legislature passed, and Governor Brown signed, Senate Bill (SB) 32, which codified the 40 percent reduction goal from 1990 levels by 2030.<sup>21</sup> Further reducing emissions from all freight sources statewide is essential to achieving California's climate change goals.

---

<sup>15</sup> California Health and Safety Code § 38500 - 38599, Division 25.5, Assembly Bill No. 32, California Global Warming Solutions Act of 2006, September 27, 2006, [http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab\\_0001-0050/ab\\_32\\_bill\\_20060927\\_chaptered.pdf](http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001-0050/ab_32_bill_20060927_chaptered.pdf)

<sup>16</sup> California Health and Safety Code § 38566, Division 25.5, Senate Bill No. 32, September 8, 2016, [https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160SB32](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB32).

<sup>17</sup> California Health and Safety Code § 39730, Division 26, Senate Bill No. 605, Short-lived climate pollutants, September 21, 2014, [http://leginfo.ca.gov/pub/13-14/bill/sen/sb\\_0601-0650/sb\\_605\\_bill\\_20140921\\_chaptered.htm](http://leginfo.ca.gov/pub/13-14/bill/sen/sb_0601-0650/sb_605_bill_20140921_chaptered.htm).

<sup>18</sup> Office of Environmental Health Hazard Assessment, Indicators of Climate Change in California, May 2018, <https://oehha.ca.gov/media/downloads/climate-change/report/2018caindicatorsreportmay2018.pdf>

<sup>19</sup> California Health and Safety Code § 38500 – 38599, Division 25.5, Assembly Bill No. 32, California Global Warming Solutions Act of 2006, September 27, 2006, [http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab\\_0001-0050/ab\\_32\\_bill\\_20060927\\_chaptered.pdf](http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001-0050/ab_32_bill_20060927_chaptered.pdf)

<sup>20</sup> Executive Order B-30-15, July 17, 2015, <https://www.ca.gov/archive/gov39/2015/07/17/news19046/>.

<sup>21</sup> California Health and Safety Code § 38566, Division 25.5, Senate Bill No. 32, September 8, 2016, [https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160SB32](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB32).

#### 4. What specific air pollution burdens are associated with emissions from ocean-going vessels?

Emissions from ocean-going vessels include criteria pollutants, air toxic contaminants, and GHGs. One of the main pollutants emitted from the exhaust stack of an ocean-going vessel is NO<sub>x</sub>. NO<sub>x</sub> consists of a grouping of highly reactive gases, including nitric oxide (NO) and nitrogen dioxide (NO<sub>2</sub>). Short-term exposure to elevated concentrations of NO<sub>x</sub> is known to irritate the respiratory system and aggravate respiratory diseases, particularly asthma, leading to respiratory symptoms (such as coughing, wheezing or difficulty breathing), hospital admissions and visits to emergency rooms. Longer term exposures to elevated concentrations of NO<sub>2</sub> can contribute to the development of asthma and potentially increase susceptibility to respiratory infections. Not only does NO<sub>2</sub> and other NO<sub>x</sub> chemicals cause human respiratory ailments, when NO<sub>x</sub> molecules interact with water, oxygen and other chemicals in the atmosphere they can form acid rain. This acid rain harms sensitive ecosystems and NO<sub>x</sub> in the atmosphere contributes to nutrient pollution in coastal waters. According to the U.S. Environmental Protection Agency (“U.S. EPA”), NO<sub>2</sub> and NO<sub>x</sub> molecules also react with other chemicals in the air to form both PM and ozone.<sup>22</sup>

PM, which includes DPM, is emitted from a vessel’s exhaust stack as a complex mixture of suspended particles and aerosols varying in size, shape and chemical composition. These particles can either be directly emitted into the atmosphere (primary particles) or formed by chemical reactions of gases (secondary particles) from natural or man-made sources such as sulfur dioxide (SO<sub>2</sub>), NO<sub>x</sub>, and certain organic compounds. PM can be inhaled into the upper airways and lungs, creating respiratory ailments leading to public health concerns. Exposure can increase premature mortality, hospital admissions for cardiopulmonary causes, acute and chronic bronchitis, asthma attacks, and respiratory symptoms, and the health effects are of particular concern for sensitive groups such as infants, children, the elderly, and those with preexisting heart or lung disease.<sup>23</sup> Additionally, in 1998, DPM was identified as a toxic air contaminant. Long-term exposures to DPM can increase the risk of developing lung cancer and shares many of the same non-cancer health effects as PM<sub>2.5</sub>.<sup>24</sup>

Ocean-going vessels also produce GHGs and black carbon (a potent short-lived climate pollutant). GHGs contribute to the greenhouse effect by absorbing reflected solar energy and warming Earth’s atmosphere, contributing to global climate change.<sup>25</sup> Presently, the maritime industry as a whole accounts for around 2 percent of global

---

<sup>22</sup> U.S. EPA, What is NO<sub>2</sub>, accessed September 8, 2019, <https://www.epa.gov/no2-pollution/basic-information-about-no2#>.

<sup>23</sup> CARB, Inhalable Particulate Matter and Health (PM<sub>2.5</sub> and PM<sub>10</sub>), August 10, 2017 (accessed September 8, 2019), <https://ww3.arb.ca.gov/research/aaqs/common-pollutants/pm/pm.htm>.

<sup>24</sup> CARB, Overview: Diesel Exhaust & Health, accessed September 8, 2019, <https://ww2.arb.ca.gov/resources/overview-diesel-exhaust-and-health>.

<sup>25</sup> IMO, Greenhouse Gas Emissions, accessed September 8, 2019, <http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/GHG-Emissions.aspx>.



GHG emissions, but this percentage is projected to increase by up to 250 percent by 2050 due to industry growth associated with increasing global trade demands.<sup>26</sup> California has set GHG emissions reductions goal of 40 percent below 1990 levels by 2030<sup>27</sup> and this target is expected to enable California to reach the ultimate goal of reducing emissions by 80 percent under 1990 levels by 2050, which aligns with scientifically established levels to limit global warming below 2 degrees Celsius.<sup>28</sup> Limiting auxiliary diesel engine and boiler emissions from vessels at berth would help to achieve California's goals in reducing both GHG emissions and short-lived climate pollutants, such as black carbon.

## **5. Are there already regulations to reduce emissions from ocean-going vessels in California?**

Yes, existing regulations designed to reduce emissions from ocean-going vessels were adopted by CARB in 2007 and 2008: the At-Berth Regulation and the Vessel Fuel Regulation, respectively. Both existing regulations have delivered significant emissions reductions from ocean-going vessels, providing California's port communities a significant reduction in potential cancer risk and other non-cancer health impacts.

The existing Vessel Fuel Regulation, which reached full implementation in 2014, requires all ocean-going vessels to use cleaner distillate marine fuels in order to reduce DPM, PM, NOx, and sulfur oxides (SOx) from ocean-going vessel main propulsion diesel engines, auxiliary diesel engines, diesel-electric engines, and auxiliary boilers on ocean-going vessels. Vessels must switch to CARB-compliant distillate marine fuels anytime the vessel is within Regulated California Waters, or within 24 nautical miles of the California coast (including islands).<sup>29</sup>

The existing At-Berth Regulation reduces DPM and NOx emissions (and GHG emissions as a co-benefit) by requiring a certain percentage of container and refrigerated cargo ("reefer") vessel fleets making 25 or more visits to a regulated port, and cruise vessel fleets making 5 or more visits to a regulated port, to reduce emissions by turning off their auxiliary engines at berth and plugging into grid-based electricity. These requirements apply at the six largest ports in California: the Ports of Los Angeles (POLA), Long Beach (POLB), Oakland, Hueneme, San Francisco, and San Diego. In

---

<sup>26</sup> Stefanini, S., Climate Change News, "Countries Inch Towards 'Bare Minimum' Climate Target For Shipping", April 10, 2018, <https://www.climatechangenews.com/2018/04/10/countries-inch-towards-bare-minimum-climate-target-shipping/>.

<sup>27</sup> California Health and Safety Code § 38566, Division 25.5, Senate Bill No. 32, September 8, 2016, [https://leginfo.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160SB32](https://leginfo.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB32).

<sup>28</sup> United Nations Climate Change, The Paris Agreement, accessed September 8, 2019, <https://unfccc.int/process/the-paris-agreement/what-is-the-paris-agreement>.

<sup>29</sup> California Code of Regulations Title 17 §93118.2, Airborne Toxic Control Measure for Fuel Sulfur and Other Operational Requirements for Ocean-Going Vessels Within California Waters and 24 Nautical Miles of the California Baseline, Amended October 27, 2011, <https://ww3.arb.ca.gov/ports/marinevess/documents/fuelogv17.pdf>.

addition to shore power, regulated vessels can use alternative CARB approved technologies to comply with the regulation. If using shore power to comply with the existing At-Berth Regulation, a regulated vessel fleet must plug into shore power for a certain percentage of visits, while also reducing the power consumption across their fleet by the same percentage. For vessels using alternative controls instead of shore power, emissions must be reduced by a certain percentage from the fleet's baseline emissions. Implementation of the existing At-Berth Regulation began in 2014 with a 50 percent requirement, then increased to 70 percent in 2017, and will reach full implementation at an 80 percent requirement in 2020.<sup>30</sup>

## **6. Why do we need further emissions reductions beyond what is required in the Existing At-Berth Regulation?**

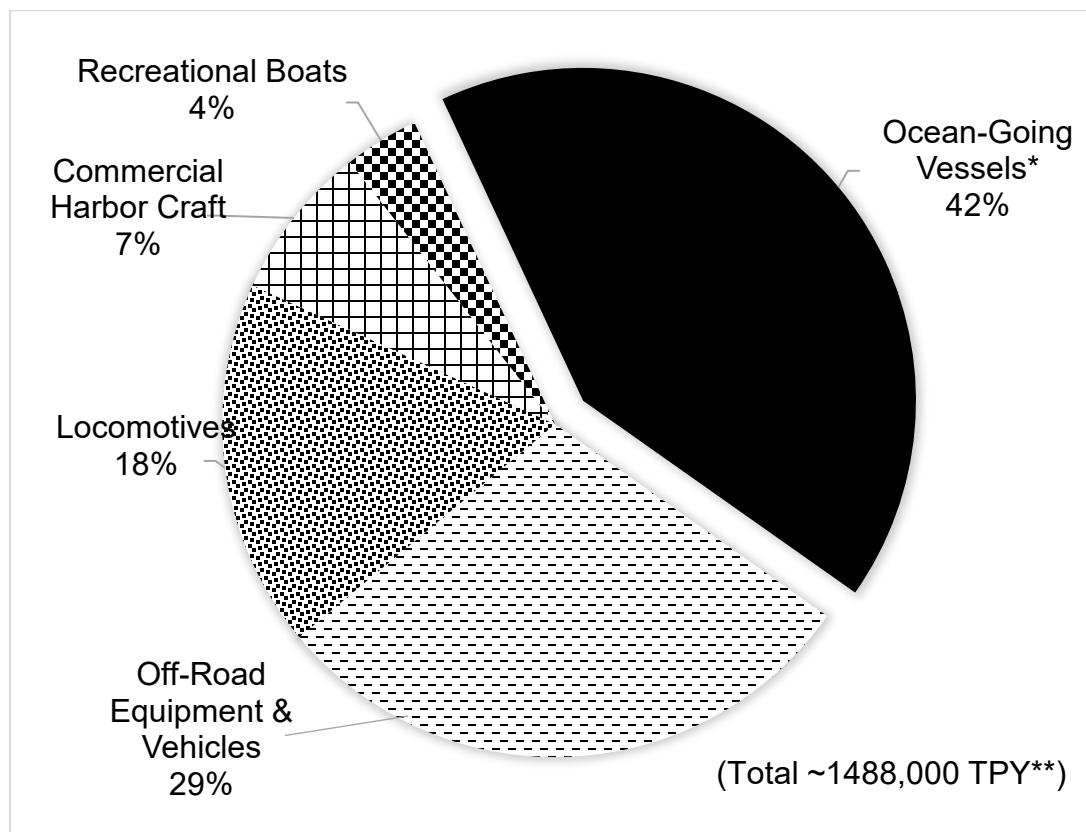
The existing At-Berth Regulation will reach full implementation in the year 2020, and despite the significant emissions reductions achieved through this regulation, emissions from ocean-going vessels are expected to increase beyond 2020 due to a projected growth in activity (Appendix H). Even with existing regulations in place, ocean-going vessels are projected to make up the largest portion of NOx emissions for off-road port related mobile sources, with at berth the second highest source of NOx and PM2.5 emissions after in-transit emissions, as shown in Figures ES-1, ES-2 and ES-3.<sup>31</sup>

---

<sup>30</sup> California Code of Regulations Title 17 § 93118.3, Airborne Toxic Control Measure for Auxiliary Diesel Engines Operated on Ocean-Going Vessels At-Berth in a California Port, December 3, 2008, <https://ww3.arb.ca.gov/regact/2007/shorepwr07/93118-t17.pdf>.

<sup>31</sup> CARB, Emissions Inventory, CEPAM: 2016 SIP - Standard Emission Tool, Accessed September 8, 2019, <https://www.arb.ca.gov/app/emsmv/fcemssumcat/fcemssumcat2016.php>.

**Figure ES-1: Projected 2020 NOx Emissions from Off-Road Port Related Mobile Sources**

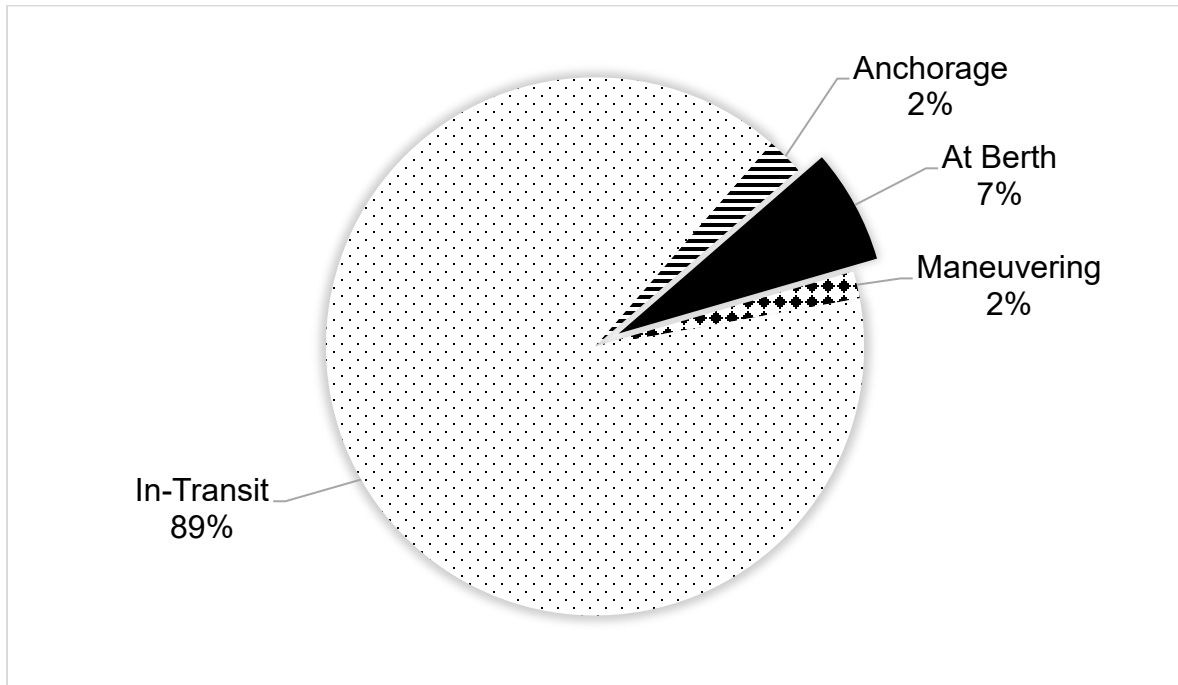


\*Includes ocean-going vessel emissions within California Regulated Waters (24 nautical miles from shore)

\*\*TPY = Tons per year

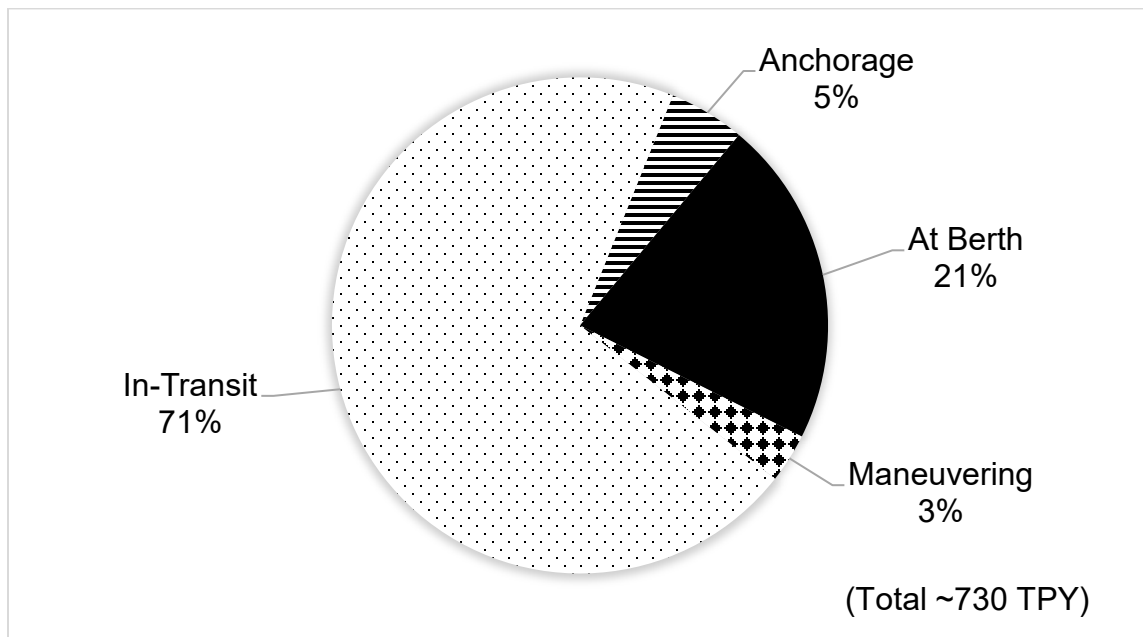


**Figure ES-2: 2020 Projected NOx Emissions from Ocean-Going Vessels By Mode Of Operation**



\*Includes ocean-going vessel emissions within California Regulated Waters (24 nautical miles from shore)

**Figure ES-3: 2020 Projected PM2.5 Emissions from Ocean-Going Vessels By Mode Of Operation**



\*Includes ocean-going vessel emissions within California Regulated Waters (24 nautical miles from shore)

PM2.5 (which includes cancer-causing DPM) emissions from vessels at berth is particularly important when considering near-source cancer risk to surrounding port communities. CARB staff also completed health analyses to examine the health benefits of CARB staff's proposal for POLA and POLB as a representative large port complex, and the Richmond Complex, which includes the Port of Richmond and the Richmond area tanker terminals as a representative small port complex. Staff's analysis (Appendix G, pp. 30-49) determined that without additional regulations to further reduce emissions from ocean-going vessels, the potential cancer risk for residents living near both the POLA and POLB complex and the Richmond complex would increase due to a projected growth in cargo activity as follows:

- Residents near POLA and POLB could see an increased potential cancer risk from at berth operations of about 37 percent between 2020 and 2031.
- Residents near the Richmond complex could see an increased potential cancer risk of about 14 percent between 2021 and 2031.

#### **7. What is CARB staff's proposal to further reduce health impacts in port communities from ocean-going vessels?**

CARB staff propose a new At Berth Regulation ("Proposed Regulation") to build upon the success of the existing At-Berth Regulation (hereafter referred to as "Existing Regulation"). The Proposed Regulation would replace the Existing Regulation beginning January 1, 2021. Under this proposal, all container, reefer, cruise, ro-ro, and tanker vessels visiting a regulated terminal would be required to use a CARB approved emissions control strategy that achieves at least an 80 percent reduction in auxiliary engine emissions during a visit at berth.<sup>32</sup> The Proposed Regulation would also include those vessels in container, reefer, and cruise fleets that fall below the threshold for inclusion in the Existing Regulation (these vessels are also referred to as "previously unregulated vessels"). Certain types of tanker vessels would also be required to use a CARB approved emissions control strategy that achieves at least an 80 percent reduction in boiler emissions at berth. Boiler control requirements would apply only to tanker vessels that use large onboard auxiliary boilers to power large pumps on the vessel to off-load products, such as crude oil.

Likewise, a regulated terminal would have obligations to ensure emissions reductions are achieved from any container, reefer, cruise, ro-ro, and tanker vessel visiting their terminal. CARB staff also propose to reinforce existing opacity standards as well, to ensure vessels are maintaining existing standards for visible emissions at berth and anchor.<sup>33</sup>

---

<sup>32</sup> A regulated terminal is any container, reefer, cruise, ro-ro, or tanker terminal received 20 visits or more from a regulated vessel category.

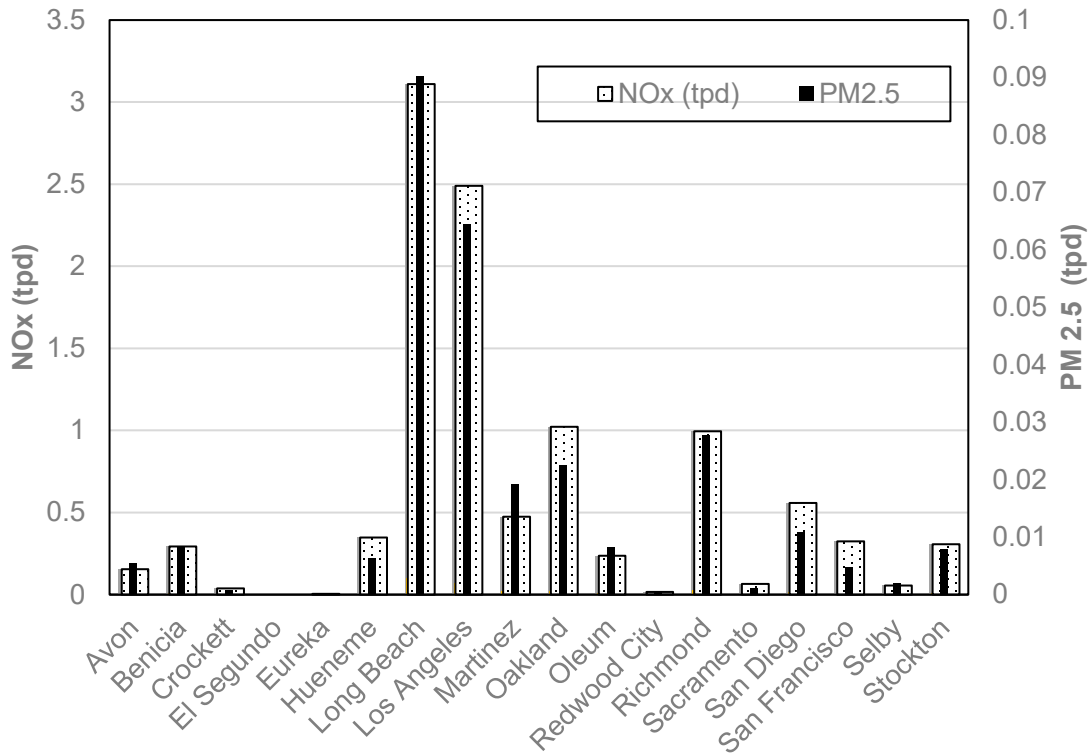
<sup>33</sup> California Health and Safety Code § 41701, Division 26, General Limitations, 1975, [https://leginfo.ca.gov/faces/codes\\_displayText.xhtml?lawCode=HSC&division=26.&title=&part=4.&chapter=3.&article=1](https://leginfo.ca.gov/faces/codes_displayText.xhtml?lawCode=HSC&division=26.&title=&part=4.&chapter=3.&article=1).

Container, reefer, and cruise vessels would have emissions control obligations beginning January 1, 2021, while control requirements for ro-ro vessels would phase into the regulation in 2025. Tanker vessel control obligations would then follow in 2027 at POLA and POLB, and in 2029 for the remainder of the state's regulated tanker terminals. Since ro-ro and tanker vessel categories are not regulated under the Existing Regulation, emissions control requirements for these vessels and terminals would start at a later date to allow them time to purchase and install equipment and build supporting infrastructure.

Reducing emissions from the previously unregulated container, reefer, and cruise vessels along with the new ro-ro and tanker vessel categories would increase the total amount of vessel visits required to reduce emissions while at California ports from around 4,000 visits under the Existing Regulation to around 6,300 visits. Adding new vessel types would also provide emissions reductions in new communities around ports and independent marine terminals where reductions are not required under the Existing Regulation.

Despite being impacted by at berth emissions and considered disadvantaged, many of California's smaller port communities, such as those in close proximity to vessel berths in Stockton and the Richmond and Carquinez areas, were not included in the Existing Regulation because they do not receive vessel visits from the currently regulated vessel types (container, reefer, and cruise). As such, CARB staff propose emissions reductions requirements for new vessel types (ro-ro and tanker vessels), in addition to increasing the emissions reductions from container, reefer, and cruise vessels. Reductions from currently unregulated ro-ro and tanker vessels are needed as quickly as possible in order to achieve the air quality improvements that are necessary to protect public health in California's disadvantaged communities. Figure ES-4 (from Appendix H) highlights the contribution ocean-going vessels make to NO<sub>x</sub> and PM<sub>2.5</sub> emissions at berth by port.

**Figure ES-4: 2016 Statewide At Berth NOx and PM2.5 Emissions by Port**



\* TPD = Tons per day

**8. What constitutes a vessel visit and how long are ocean-going vessel allowed to operate at berth with uncontrolled emissions?**

CARB staff propose a vessel “visit” to be defined as the time period at berth from when a vessel is declared “Ready to Work” to “Pilot on Board”. Many of the requirements for compliance with the Proposed Regulation center around controlling the emissions during a vessel’s “visit”. Under the Proposed Regulation, vessels must connect to a CARB approved emissions control strategy (including shore power) within one hour after being declared “Ready to Work”, and must remain connected until at least one hour before the pilot boards and takes navigational control of the vessel.

This definition of “visit” is a change from the Existing Regulation, which defined “visit” as the time period beginning when an ocean-going vessel is initially tied to a berth and ends when it casts off the lines at the end of a visit. With the Existing Regulation, vessels were able to operate their auxiliary engines for a total of three hours while at berth. During implementation of the Existing Regulation, CARB staff were made aware of numerous events that can occur between the time a vessel is first tied to a berth and when the vessel is ready to be worked, which is typically the time in which the process can start to connect the vessel to an emissions control technology. Some of the delays, including events such as clearance by U.S. Customs and Border Protection, may

prevent a vessel from plugging in are outside of the control of the vessel and terminal operators, as well as outside the control of the Port. As such, CARB staff revised the definition of a visit for the Proposed Regulation to account for some of the uncertainties associated with operational events that can occur before a vessel is declared “ready to work” and is able to start the process of connecting to an emissions control technology.

## 9. Is CARB proposing to regulate facilities?

No, CARB staff are proposing to reduce emissions from ocean-going vessel visits, on an individual basis, not from all aspects of port or terminal operations. CARB has the authority to regulate toxic air contaminants from non-vehicular sources in order to reduce public exposure and risk (California Health and Safety Codes [HSC] 39660 et seq.<sup>34</sup>); to control criteria air pollutants from mobile sources to attain air quality standards (HSC 43013<sup>35</sup> and 43018<sup>36</sup>); to reduce GHGs to specific levels to combat climate change (AB 32<sup>37</sup> and SB 32<sup>38</sup>); and to develop a comprehensive strategy to reduce short-lived climate pollutants, such as black carbon, in coordination with other state agencies and local air quality management and air pollution control districts to reduce emissions of short-lived climate pollutants (SB 605<sup>39</sup>).

CARB staff are not proposing to place any limitations on a total amount of emissions that a facility, such as a port or terminal, can emit or cap the amount of vessel visits and activity that a facility can accept. CARB staff proposed that regulated ports and terminals share responsibility for reducing emissions from ocean-going vessels to reduce the impact their business is having on their surrounding communities.

---

<sup>34</sup> California Health and Safety Code § 39660 et seq., Division 26, Identification of Toxic Air Contaminants, 1983, [https://leginfo.legislature.ca.gov/faces/codes\\_displayText.xhtml?lawCode=HSC&division=26.&title=&part=2.&chapter=3.5.&article=3](https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=HSC&division=26.&title=&part=2.&chapter=3.5.&article=3).

<sup>35</sup> California Health and Safety Code § 43013, Division 26, General Provisions, 1975, [https://leginfo.legislature.ca.gov/faces/codes\\_displaySection.xhtml?lawCode=HSC&sectionNum=43013](https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=HSC&sectionNum=43013).

<sup>36</sup> California Health and Safety Code § 43018, Division 26, General Provisions, 1975, [https://leginfo.legislature.ca.gov/faces/codes\\_displaySection.xhtml?lawCode=HSC&sectionNum=43018](https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=HSC&sectionNum=43018).

<sup>37</sup> California Health and Safety Code § 38500 - 38599, Division 25.5, Assembly Bill No. 32, California Global Warming Solutions Act of 2006, September 27, 2006, [http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab\\_0001-0050/ab\\_32\\_bill\\_20060927\\_chaptered.pdf](http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001-0050/ab_32_bill_20060927_chaptered.pdf)

<sup>38</sup> California Health and Safety Code § 38566, Division 25.5, Senate Bill No. 32, September 8, 2016, [https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160SB32](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB32).

<sup>39</sup> California Health and Safety Code § 39730, Division 26, Senate Bill No. 605, Short-lived climate pollutants, September 21, 2014, [http://leginfo.ca.gov/pub/13-14/bill/sen/sb\\_0601-0650/sb\\_605\\_bill\\_20140921\\_chaptered.htm](http://leginfo.ca.gov/pub/13-14/bill/sen/sb_0601-0650/sb_605_bill_20140921_chaptered.htm).

## **10. What communities are most impacted by air pollution from ocean-going vessels?**

Any community near a port or independent marine terminal can be affected by air pollution from freight activity. However, communities located near large ports and large clusters of independent marine terminals with numerous vessel calls per day bear proportionally higher health risks.<sup>40</sup> To determine what communities were at the biggest risk of health impacts from ocean-going vessels in particular, CARB staff used vessel visit activity provided by the California State Lands Commission (CSLC) and the State's ports to identify the port communities with the highest potential risk and need for additional emissions reductions from ocean-going vessels operating at berth.

## **11. How did CARB staff determine which ports and marine terminals to include in the Proposed Regulation?**

CARB staff's proposal to further reduce emissions from ocean-going vessels would require emissions control requirements at any port or independent marine terminal exceeding a specific visit activity threshold. If a port or marine terminal surpasses the 20 visit threshold, they must submit a plan to CARB by the end of the following calendar year describing how they will control emissions from the vessel activity at their facility. If the port or marine terminal exceeds the 20 visit threshold for a second calendar year in a row, the vessel visits will become subject to control requirements. This approach is designed to ensure that any port or marine terminal (currently or newly included) that has significant activity or is considering a significant growth in vessel visit activity must consider the impacts to air quality and potential health burdens the current or increased business would have on surrounding communities.

CARB staff gathered visit activity from CSLC and port Wharfinger data from calendar year 2017, which represented the most up to date visit information available to staff at the time of the analysis to help develop the terminal thresholds. Staff explored multiple thresholds for the different vessel types during the regulatory development process in consideration of visit activity per vessel category and costs to install emissions control technologies and associated infrastructure. After careful evaluation, CARB staff propose a 20 visit terminal threshold for all vessel categories; setting a 20 visit threshold includes the largest active container, reefer, and cruise, ro-ro, and tanker terminals in California, while omitting the smallest, most cost-prohibitive sources of at berth emissions. Where terminal vessel activity is lower than 20 visits, the cost effectiveness of installing emissions control equipment worsens, as there are fewer vessels calling at the terminal to use the equipment and to help recoup the costs of installing, operating, and maintaining the equipment. Setting a 20 visit terminal threshold for the Proposed Regulation also ensures all the ports regulated under the Existing Regulation still have control requirements, which has a positive effect by both preserving emissions reductions already occurring for the currently regulated port communities and prevents

---

<sup>40</sup> An independent marine terminal is a terminal that operates independently from a port or port authority. For example, the automobile and marine oil terminals located in the Carquinez Straits area of Northern California are considered to be independent marine terminals.

emissions control equipment investments already in use at ports for compliance with the Existing Regulation from becoming stranded assets.

## **12. What are the potential benefits of CARB staff's proposal to further reduce emissions from ocean-going vessel at berth?**

CARB staff's proposal would directly facilitate health benefits for California communities, costs for regulated entities and other businesses in California, and a number of other local and international benefits, including:

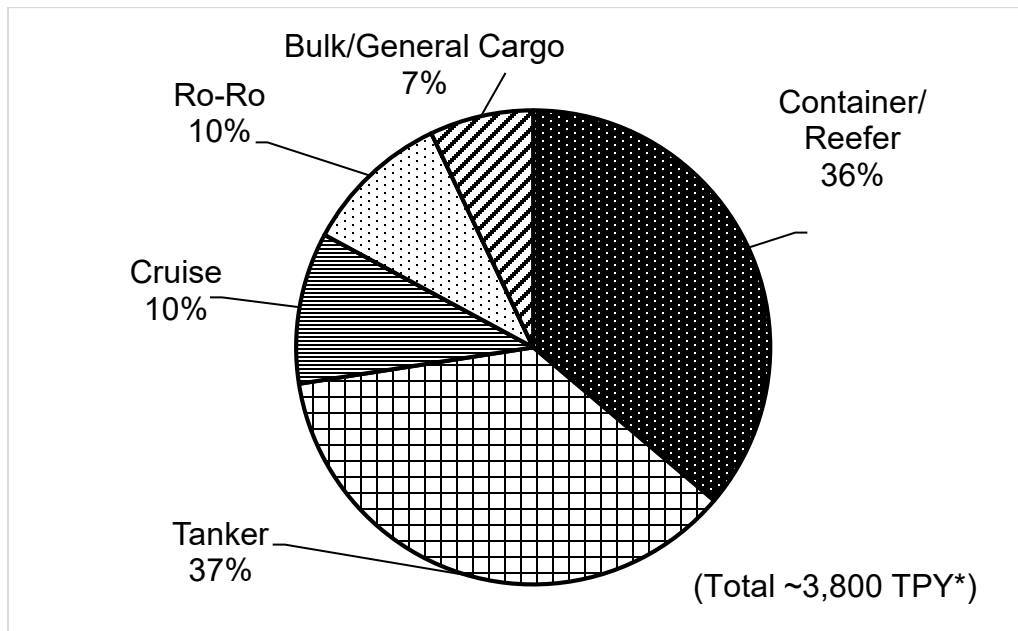
- Total costs for all entities exceeding \$2.2 billion through 2032, with a statewide valuation of avoided health impacts valued around \$2.3 billion from 230 fewer premature deaths, 72 fewer hospital admissions, and 116 fewer emergency room visits statewide.
- Reduction in potential cancer risk due to at berth emission reductions by about 60 percent. Specifically, CARB staff's health analyses determined that:
  - For communities around POLA and POLB, the population's exposure to a potential cancer risk level of greater than 50 chances per million would be eliminated with the Proposed Regulation, and would result in around 2.4 million residents having a reduced potential cancer risk around POLA and POLB.
  - For communities around the Richmond Complex, the population's exposure to a potential cancer risk level of greater than 20 chances per million would be eliminated by the Proposed Regulation, and would result in around 14,000 residents having a reduced potential cancer risk around the Richmond complex.
- Provide job opportunities for emissions control equipment manufacturers and installers, as well as engineering and construction companies.
- Encourage research and development of new emissions control technologies.
- Promote shore power and other cleaner vessel initiative programs worldwide.

## **13. Why did CARB staff propose to include emissions control requirements for new vessel categories?**

Container and reefer cargo vessels are the most frequent vessels to visit California in a given year, making up roughly half of the vessel visits to California ports. However, smaller communities receive much of their vessel visit activity from ro-ro and tanker vessels, which make up around 30 percent of the vessel activity to California yearly, and contribute to emissions and public health impacts in these regions. Tanker vessels, in particular, are projected to make up the largest source of emissions for ozone-causing

NOx, PM2.5, and GHGs after the Existing Regulation reaches full implementation and the second highest DPM emissions after the container and reefer vessels. Figures ES-5 through ES-9 show the percentage breakdown for the projected 2021 statewide emissions at berth for all ocean-going vessels.<sup>41</sup> These figures highlight the need to reduce tanker emissions at berth.

**Figure ES-5: 2021 Projected Statewide At Berth NOx Emissions - Auxiliary Engines and Boilers**

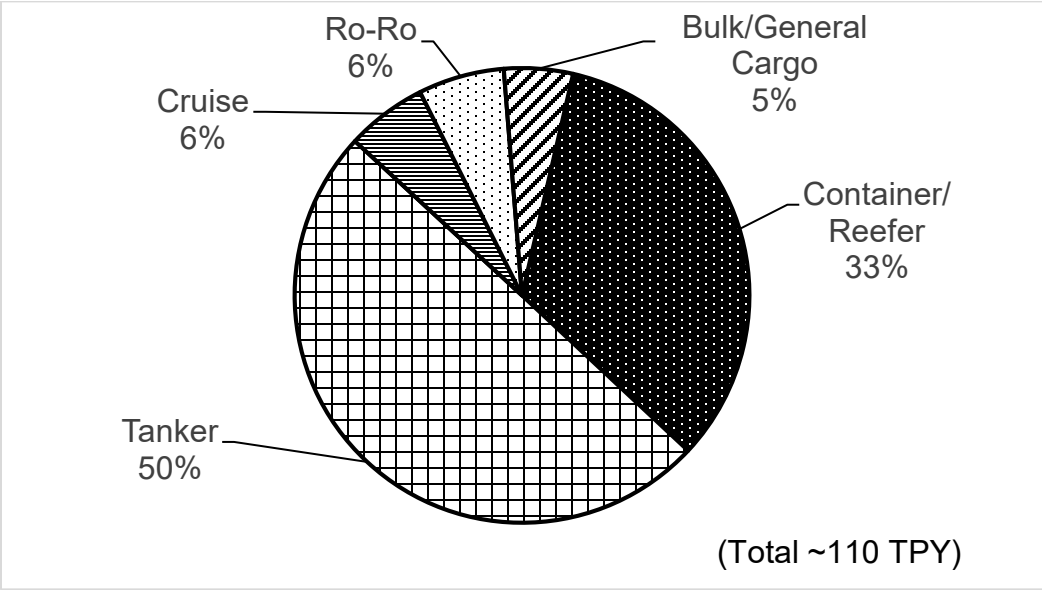


\*TPY = Tons per year

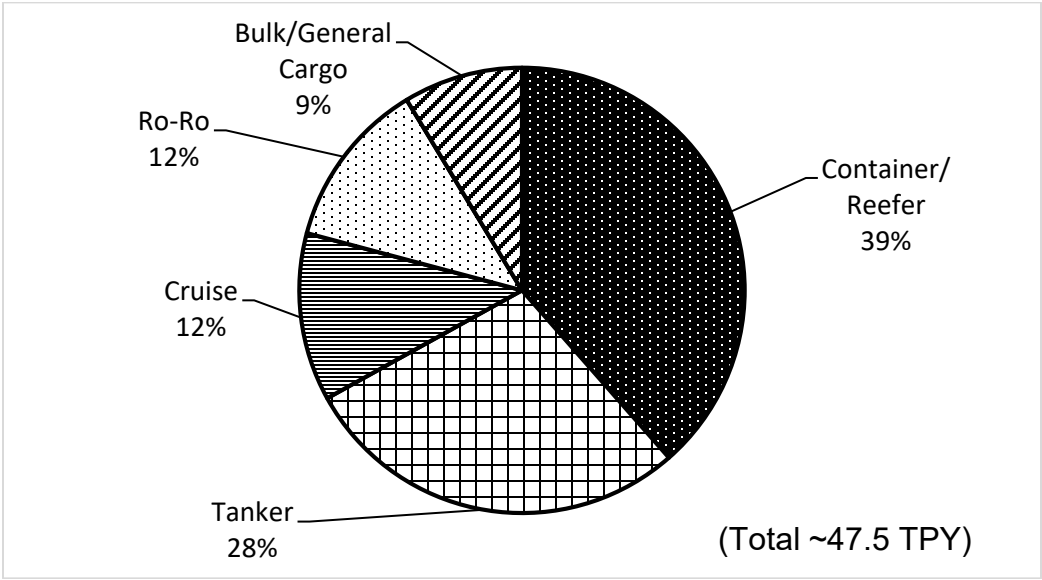
<sup>41</sup> California Air Resources Board, Mobile Source Emissions Inventory, Draft 2019 OGV Emissions Inventory Model, Last Updated March 1, 2019 (accessed September 8, 2019), <https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-documentation-offroad-0>.



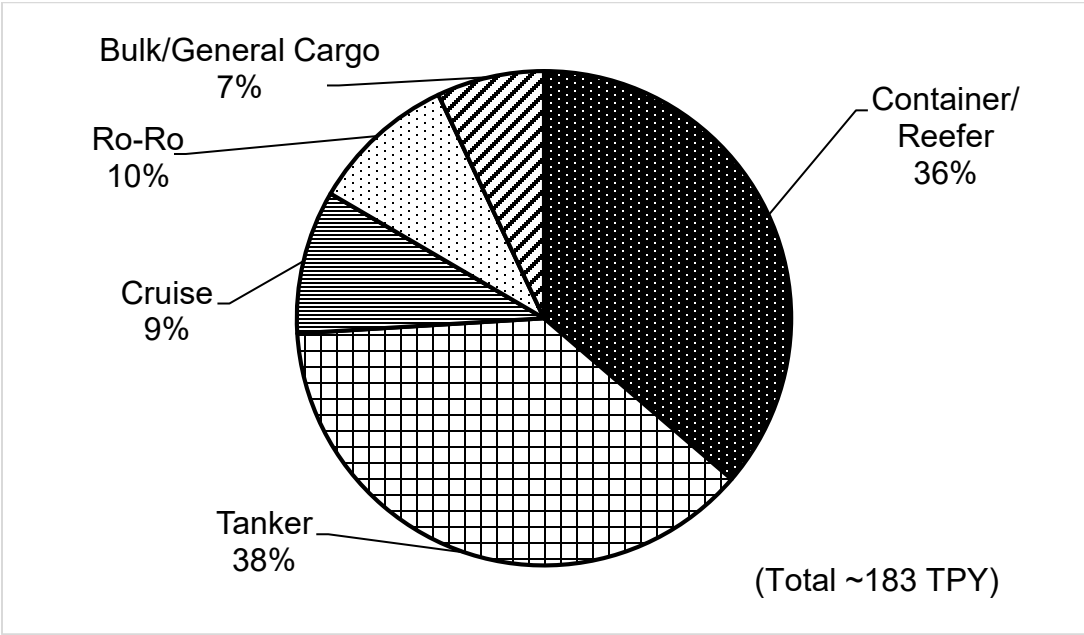
**Figure ES-6: 2021 Projected Statewide At Berth PM2.5 Emissions - Auxiliary Engines and Boilers**



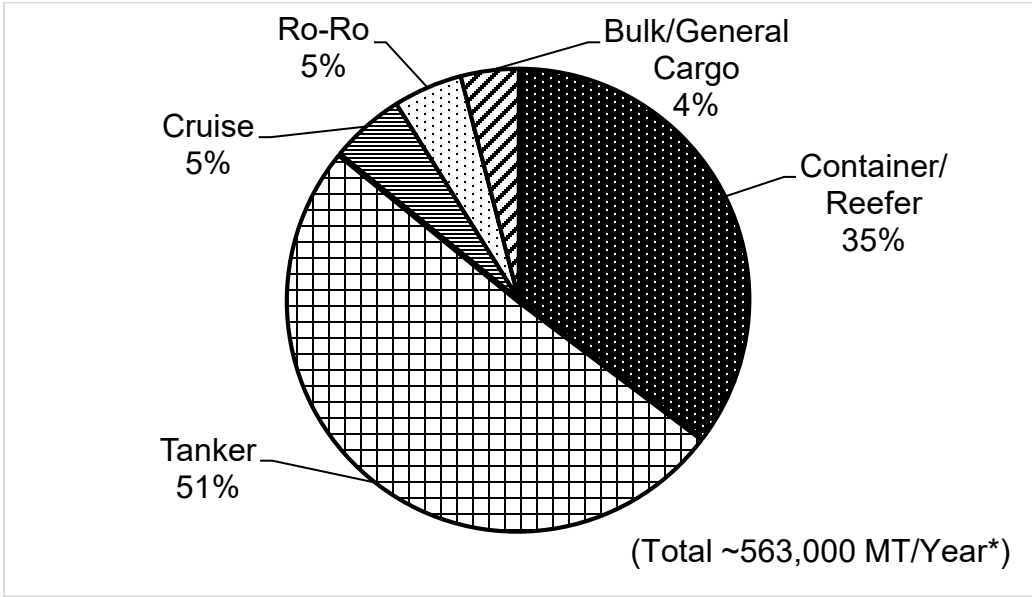
**Figure ES-7: 2021 Projected Statewide At Berth DPM Emissions - Auxiliary Engines**



**Figure ES-8: 2021 Projected Statewide At Berth ROG Emissions - Auxiliary Engines and Boilers**



**Figure ES-9: 2021 Projected Statewide At Berth GHG (CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O) Emissions in Metric Tons Per Year (MT/Year) – Auxiliary Engines and Boilers**



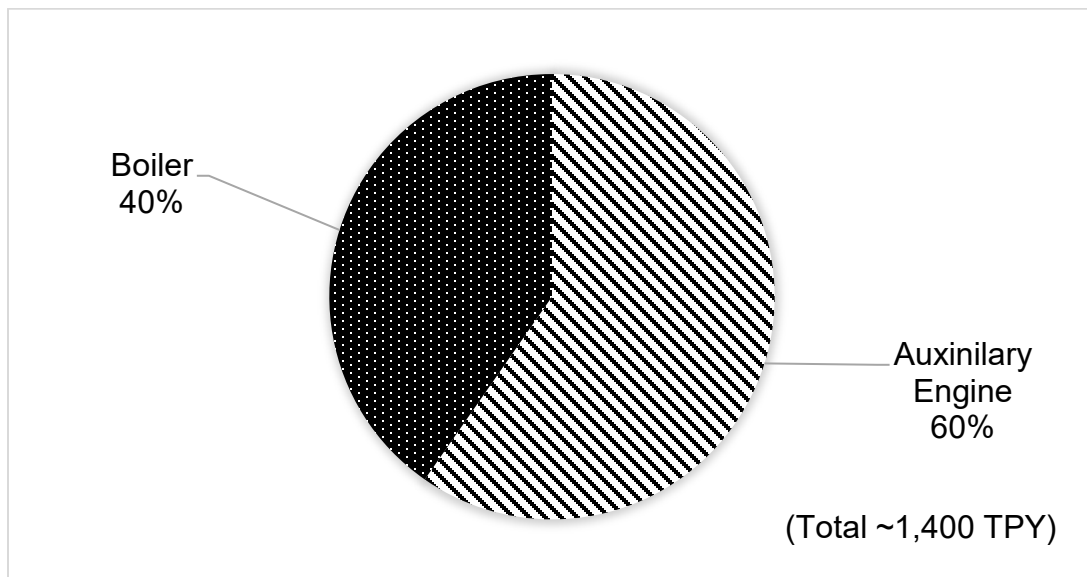
\*MT/Year = Metric tons per year

#### 14. Why are there boiler emissions control requirements for tanker vessels that use steam-driven pumps but not for other vessel categories?

Most ocean-going vessels have small on-board auxiliary boilers that do not significantly contribute to the emissions profile of an ocean-going vessel at berth. However, some tanker vessels (often carrying crude oil) use onboard auxiliary boilers to produce steam that drives pumps used to off-load cargo. Tanker vessels using steam-driven pumps to discharge cargo may have a boiler power usage at berth that is several magnitudes higher than other vessels at berth (around 5-6 MW for the larger crude tankers versus less than 1 MW for non-tank vessels, as shown in Appendix H, Table 10). The majority of emissions from tanker vessels using steam-powered pumps result from the use of the vessel's auxiliary boiler to power pumps during cargo off-loading. Boilers operate differently than diesel engines, and as such, the highest emissions from tankers are primarily PM<sub>2.5</sub> and GHGs instead of NO<sub>x</sub> and DPM. The PM emissions from boilers are not categorized as DPM due to the differences in combustion processes, although CARB staff recognize there may be potential cancer risk health impacts from boiler emissions due to the air toxics that are released in their operations.

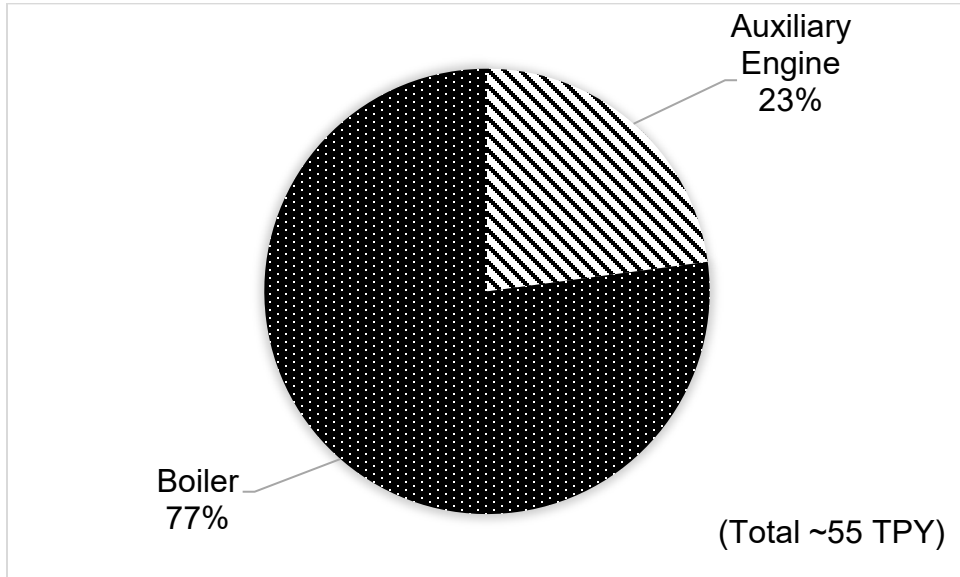
Figures ES-10 through ES-13 show the contribution of emissions from a tanker auxiliary engine versus a boiler, highlighting that the need for boiler reductions is critical to reducing the health impacts from tanker vessels, particularly in disadvantaged communities around California.<sup>42</sup>

**Figure ES-10: 2021 Projected Statewide Tanker Vessel At Berth NO<sub>x</sub> Emissions - Auxiliary Engines vs. Boilers**

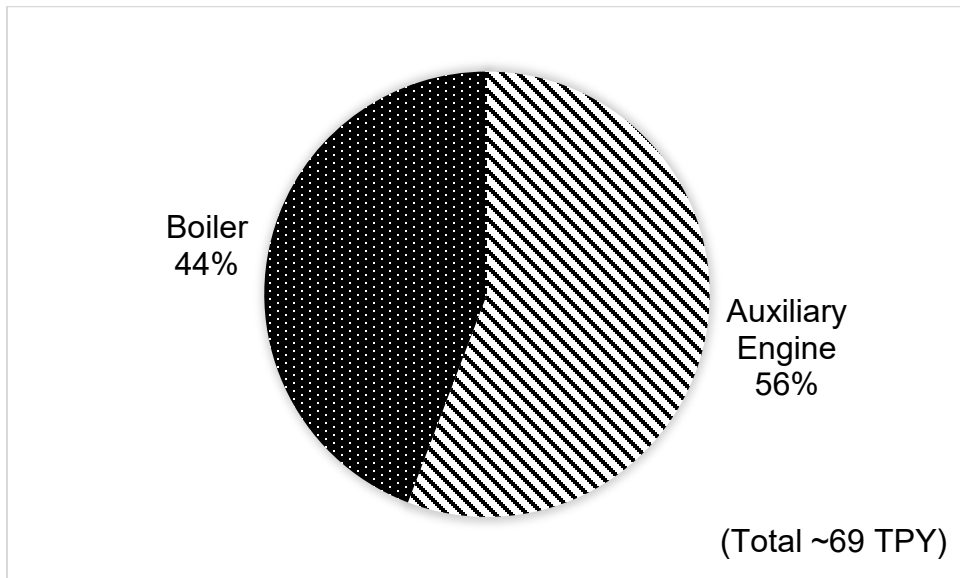


<sup>42</sup> California Air Resources Board, Mobile Source Emissions Inventory, Draft 2019 OGV Emissions Inventory Model, Updated March 1, 2019 (accessed September 8, 2019), <https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-documentation-offroad-0>.

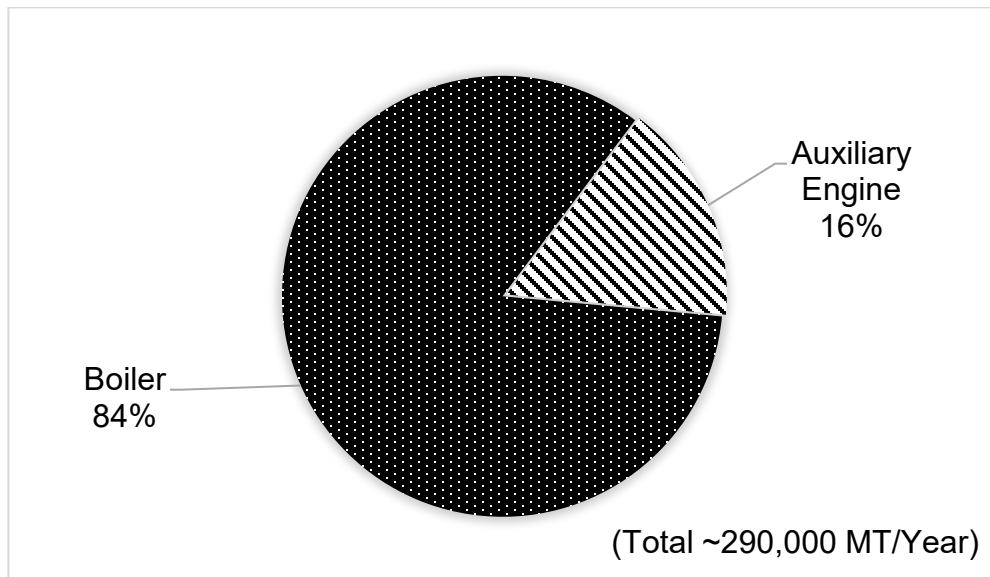
**Figure ES-11: 2021 Projected Statewide Tanker Vessel At Berth PM2.5 Emissions - Auxiliary Engines vs. Boilers**



**Figure ES-12: 2021 Projected Statewide Tanker Vessel At Berth ROG Emissions - Auxiliary Engine vs. Boilers**



**Figure ES-13: 2021 Projected Statewide Tanker Vessel At Berth GHG Emissions - Auxiliary Engine vs. Boilers**

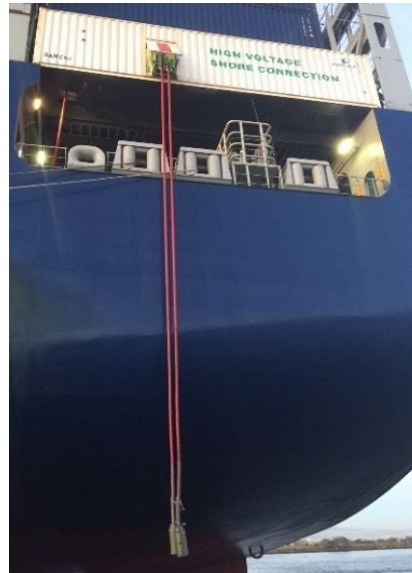


**15. What technologies can be used to reduce emissions from ocean-going vessels?**

The primary method ocean-going vessels use under the Existing Regulation to reduce emissions while at berth in California is through the use of shore power. Shore power involves a vessel using high voltage cables to connect to shore-based electrical power; once connected, the auxiliary engines on the vessel can be turned off for the duration of the visit, eliminating the vessel's auxiliary engine emissions.<sup>43</sup> Figure ES-14 shows an example of a typical shore power arrangement for a container vessel, where high voltage cables are lowered from a container onboard a vessel and plugged into an electrical vault at the terminal.

<sup>43</sup> California Air Resources Board, Draft Technology Assessment: Ocean-Going Vessels, pg. 68, May 2018, [https://ww3.arb.ca.gov/msprog/tech/techreport/ogv\\_tech\\_report.pdf](https://ww3.arb.ca.gov/msprog/tech/techreport/ogv_tech_report.pdf).

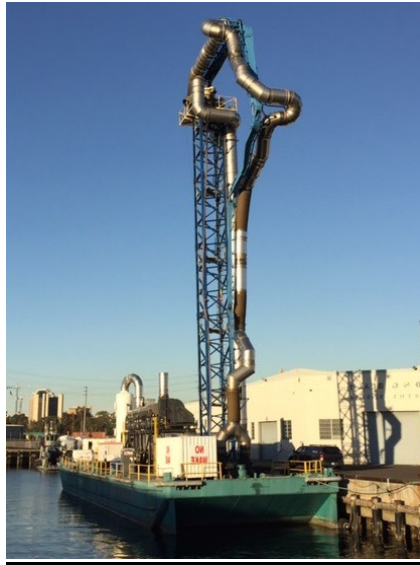
**Figure ES-14: Vessel-side shore power equipment**



Shore power is only effective at reducing auxiliary engine emissions at berth, and cannot be used to power boilers, because boilers are not configured to operate on electricity. As such, shore power does not reduce tanker boiler emissions, which make up most of the tanker vessel at berth emissions statewide. However, shore power remains the gold standard in air pollution control because it eliminates all on-site auxiliary engine emissions while the vessel is at berth, including cancer-causing DPM emissions. It also offers the opportunity to significantly reduce GHG emissions, because California law requires increased use of renewable power sources over time, resulting in a progressively cleaner electricity grid that has a lower carbon footprint than burning liquid fuel onboard a vessel.

For some vessel categories, alternatives to shore power, which include capture and control systems and onboard technologies, may be an effective way to reduce at berth emissions. An emissions capture and control system is an exhaust gas cleaning system that uses flexible ducting to connect to the exhaust stack of an ocean-going vessel to capture and treat the vessel's auxiliary engine emissions while at berth. A small engine on the control system creates a vacuum to pull the vessel exhaust through the duct and route it down to the exhaust gas cleaning technology, before emitting the cleaned air back into the atmosphere. A capture and control system can be located on a moveable barge or as a shore-side unit (mobile or stationary). The control element of the system is very similar to control technology in place for many years at stationary sources of air pollution. Figure ES-15 shows a barge-based capture and control system, while Figure ES-16 shows a land-based system.

**Figure ES-15: Barge-based Capture and Control System**



**Figure ES-16: Land-based Capture and Control System**



Existing capture and control technologies are unique strategies adopted for the marine environment to control emissions from vessels at berth, but rely upon well-established control technologies that are widely used to control air pollution from mobile and stationary sources alike. Because California is on the leading edge of reducing emissions from ocean-going vessels at berth, many of the technology demonstrations are occurring at California's ports. CARB staff's proposal would encourage further use of these emerging technologies.

Onboard emissions control technologies may also be an option for reducing emissions from an ocean-going vessel at berth. Many emissions control technologies, including exhaust gas scrubbers, exhaust gas recirculation (EGR), and selective catalytic reduction (SCR), have long been effective for reducing emissions from land-based diesel-fueled engines, but there is still limited use and experience applying these

technologies to marine ocean-going vessel engines.<sup>44</sup> Although there are currently no onboard emissions control strategies verified by CARB for marine ocean-going applications, CARB staff believes they could be developed more widely on a global scale in the coming years as international air quality regulations tighten.

Interest in alternative fuels, such as liquid natural gas, methanol, biofuels, or hydrogen, and alternative power sources, such as batteries and fuel cells, is growing in the maritime sector as a way to reduce emissions from ocean-going vessels.<sup>45</sup> Vessels may be able to utilize some of these alternative fuels and power sources and/or onboard emissions controls as part of a strategy to reduce emissions at berth, but further testing is needed to prove the actual level of emissions reductions of each pollutant when using these strategies alone or in combination.

CARB approval is necessary for using any emissions control strategy that is not already approved by CARB for use with the Existing Regulation, including new capture and control systems, onboard technologies, or alternative fuels.

## **16. What emissions control technologies already exist at California ports to reduce emissions from ocean-going vessel?**

Shore power equipment and infrastructure is already installed on the majority of container, reefer, and cruise vessels visiting California and at the terminals and ports they visit in order to comply with the Existing Regulation. Shore power is generally the most cost effective option for container, reefer, and cruise vessels, as these vessels typically make regular calls to the same ports in California. Ro-ro and tanker vessels could use shore power, but numerous vessel operators and industry representatives for these vessel types have stated during public workshops and meetings with CARB staff that capture and control systems are more attractive than shore power. This is largely because shore power requires an infrastructure change to the vessel, and there are far fewer vessels in the ro-ro and tanker categories that make regular or frequent calls to California.<sup>46</sup>

For non-shore power emissions control options (“alternative emissions control strategies”), there are two barge-based capture and control systems (the METS-1<sup>47</sup> and AMECS<sup>48</sup> systems) currently in operation, one at POLA and one at POLB, respectively. These systems are approved by CARB for use on container vessels, and are approved by CARB for use in compliance with the Existing Regulation. There is also a

---

<sup>44</sup> California Air Resources Board, Draft Technology Assessment: Ocean-Going Vessels, pg. 68, May 2018, [https://ww3.arb.ca.gov/msprog/tech/techreport/ogv\\_tech\\_report.pdf](https://ww3.arb.ca.gov/msprog/tech/techreport/ogv_tech_report.pdf).

<sup>45</sup> DNV-GL, Alternative Fuels: The Options, October 9, 2018, <https://www.dnvgl.com/expert-story/maritime-impact/alternative-fuels.html>.

<sup>46</sup> World Shipping Council, Comment Letter to CARB: Suggestions on Possible California At-Berth Regulation Allowances, Incentives or Operational Considerations, dated July 26, 2018.

<sup>47</sup> Maritime Emissions Treatment System, Clean Air Engineering, accessed September 8, 2019, <http://caemaritime.com/>.

<sup>48</sup> Advanced Maritime Emissions Control System (AMECS), Advanced Environmental Group, accessed September 8, 2019, <http://advancedemissioncontrol.com/>



land-based capture and control system in demonstration at POLA. Based on conversations with industry, CARB staff anticipate this type of land-based capture and control system to be the compliance option of choice for tanker vessels, which are anticipated to require wharf infrastructure improvements. To accommodate future innovations, CARB staff propose to allow the use of alternative control technologies and provide a process to approve the technologies if they meet the required emissions reductions of the Proposed Regulation.

### **17. Do alternative emissions control technologies achieve the same emissions reduction benefits as shore power?**

Shore power is the gold standard in air pollution control at berth because it eliminates all on site auxiliary engine emissions from a vessel at berth, including cancer-causing DPM emissions. Additionally, there are GHG emission benefits with shore power because auxiliary engines are not operating and instead the vessel's onboard power needs are met by lower carbon grid electricity. At present, there is not a single alternative emissions control technology that achieves the same emissions reductions as shore power; however, CARB staff believe a strategy of multiple control technologies could be developed for a vessel to achieve emissions reductions similar to shore power.

Capture and control systems are an effective option to reduce emissions of DPM, PM2.5, NOx, ROG, and black carbon, and would be required to achieve at least an 80 percent reduction of all these pollutants to received CARB approval. CARB staff do not expect capture and control systems to reduce or affect GHG emissions from the vessel's auxiliary engines. To minimize GHG increases of a capture and control system while positioning, operating, and treating the auxiliary engine and/or boiler exhaust of a vessel at berth, CARB staff propose to require the strategies to not increase GHG emissions by more than if the strategy were powered by the California electricity grid. Capture and control systems could utilize renewable fuels to reduce their carbon footprint. Advancements in battery and fuel cell technologies also indicate these technologies could be adapted for use on capture and control systems to reduce their GHG impact.<sup>49,50</sup> Overall, the Proposed Regulation would result in decreased GHG emissions since reductions vessels complying with shore power will more than offset any small increases from capture and control systems.

Onboard technologies have been developed and installed on vessels. These onboard systems often target one or two pollutants; for example, a cleaner tier engine on a vessel would address NOx emissions, but not PM or SOx emissions, while an exhaust scrubber might reduce SOx and PM emissions, but not NOx.

---

<sup>49</sup> Fehrenbacher, K., The future of ferries is electric, too, GreenBiz, June 5 2019, <https://www.greenbiz.com/article/future-ferries-electric-too>.

<sup>50</sup> Geuss, M., Group to fund and operate first hydrogen fuel ferry fleet in the US, ARS Technica, June 12, 2019, <https://arstechnica.com/information-technology/2019/06/group-to-fund-and-operate-first-hydrogen-fuel-ferry-fleet-in-the-us/>.

**18. Does CARB staff's new proposal allow a vessel or terminal operator to use any emissions control technology they choose to reduce emissions?**

Yes, CARB staff proposed flexibility for vessel and/or terminal operators to choose whichever emissions control technology works best for their unique operations, as long as that technology is CARB approved – meaning the technology is verified by CARB as capable of achieving the necessary emissions reductions required to meet the goals of the Proposed Regulation. This is referred to as a “CARB approved emissions control strategy”. Given that shore power is considered the “gold standard” for reducing emissions from ocean-going vessels, shore power is identified as a CARB approved emissions control strategy, and no additional approval is needed to use it for compliance. Operators of alternative non-shore power technologies would be required to obtain CARB approval through submittal of a test plan and application. Once approved, that technology can be used for compliance with the Proposed Regulation for whichever vessel and/or engine power load(s) for which it is certified.

**19. What amount of new equipment and infrastructure do CARB staff estimate will be necessary to support reducing emissions from every vessel visit?**

CARB staff evaluated a berth-specific analysis (“Berth Analysis”) for California ports to project the most likely method emissions control technology to be used at terminals meeting the proposed terminal visit threshold (Appendix E). This analysis is not prescriptive; terminals and vessels are free to choose whichever method of emissions reductions technology best fits their specific operations. However, CARB staff made assumptions based on extensive conversations with industry members and representatives; these assumptions were used to determine implementation timelines and cost estimates as well.

Shore power is expected to be the most likely method of reducing emissions for container, reefer, and cruise vessels, as the majority already utilize shore power to comply with the Existing Regulation. Since the Existing Regulation will be at an 80 percent requirement as of 2020, CARB staff do not anticipate significant additional equipment or infrastructure upgrades to be necessary for most vessels or terminals/ports that would be subject to requirements for the Proposed Regulation. The one exception to the previous statement is that some amount of additional vessel-side equipment installations may be necessary for the small number of visits made by vessel fleets not subject to emissions reduction requirements under the Existing Regulation, which would be handled by a temporary exception for these specific vessels through 2023 due to the limited number of visits impacted.

Based on the Berth Analysis, staff estimated at least one additional barge-based capture and control system will be needed to service container and reefer vessels by 2021; 6 barge- and 3 land-based capture and control systems would be necessary by 2025 to handle the emissions reductions from the ro-ro vessel category; 9 land-based capture and control systems would be needed at the POLA and POLB by 2027; and 12 land-based capture and control systems would be needed for the remainder of the

tanker terminals statewide by 2029.<sup>51</sup> This analysis did not take into consideration onboard technologies and/or alternative fuels or power systems, as these are not yet used for compliance with the Existing Regulation and are conceptual at this point.

CARB staff spoke with manufactures and operators of the capture and control systems in operation for the Existing Regulation about their ability to meet the potential demand, and have received assurances that this level of production can be met.<sup>52</sup>

## **20. Will every vessel visiting California have to reduce emissions?**

CARB staff proposed that every container, reefer, cruise, ro-ro, and tanker vessel visiting a terminal that receives 20 or more visits per calendar year must reduce emissions during a visit at a berth. CARB staff are not proposing control requirements at this time for bulk and general cargo, as bulk and general cargo vessels combined make up the smallest portion of ocean-going vessel emissions.<sup>53</sup> These vessels often carry low value products, such as grains and aggregates or large cargo not easily loaded on other vessel types, which may be highly subject to market volatility. Many of these small ports receiving bulk and general cargo vessels would face physical constraints if trying to install emissions control technologies, including line-hauling operations and narrow waterways and may require a change in loading/off-loading operations in some locations. Bulk and general cargo vessels will be required to maintain opacity standards at berth and at anchor, and would also have reporting requirements so that CARB staff could monitor for any significant change in activity that might warrant future regulatory action.

There are certain circumstances where controlling emissions at berth may not be possible, such as during severe weather conditions or equipment breakdowns. CARB staff propose to account for these circumstances through a combination of limited alternative compliance options (such as a remediation fund for mitigating uncontrolled emissions).

---

<sup>51</sup> CARB staff's Berth Analysis estimates the number of capture and control systems needed for a terminal based on total vessel visit activity and the assumption that systems could be shared between multiple berths in some locations. Note that the total number of land-based systems identified in the Berth Analysis (24 terminal systems) may not match the number represented in staff's cost analysis, as the cost analysis is based on the number of berths (33 berth systems) at a terminal in order to account for scaled-up control systems at terminals where more capacity is required.

<sup>52</sup> Letter from Clean Air Engineering – Maritime to CARB, dated August 12, 2019

<sup>53</sup> California Air Resources Board, Mobile Source Emissions Inventory, Draft 2019 OGV Emissions Inventory Model, Last Updated March 1, 2019 (accessed September 8, 2019),

<https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-documentation-offroad-0>.

**21. When can communities expect additional emissions reductions from vessels to begin?**

CARB staff proposes the new At Berth Regulation to replace the Existing Regulation effective January 1, 2021. Table ES-1 reflects the implementation schedule dates for control requirements for all regulated vessel categories:

**Table ES-1: Implementation Schedule**

| 2021                          | 2025  | 2027                          | 2029                                    |
|-------------------------------|-------|-------------------------------|---|
| Container, Reefer, and Cruise |       |                               |   |
|                               | Ro-Ro |                               |   |
|                               |       | Tankers - POLA/POLB Terminals |   |
|                               |       |                               | Tankers – Remaining Statewide Terminals |

Container, reefer, and cruise vessels would be required to control emissions for every visit to any California terminal above the 20-visit threshold beginning January 1, 2021. No additional terminals outside of the currently regulated Ports are expected to be impacted for the container, reefer, and cruise vessel categories. Due to existing requirements to reduce vessel emissions, staff anticipate minimal additional equipment or infrastructure development needed to meet this compliance date for these vessel categories. The one exception is the small number of visits made by steam ships<sup>54</sup> and container, reefer, and cruise vessels fleets that are not subject to the Existing Regulation due to the low number of visits they make to California ports (around 300 of the over 4,000 visits statewide from these vessel categories in 2017).<sup>55</sup> CARB staff refer to these vessels as “previously unregulated vessels”, and any vessel meeting this definition would have control requirements beginning January 1, 2023. This would give vessels the necessary time to install shore power equipment or procure an alternative technology.

For communities near ro-ro terminals, additional reductions would occur from ro-ro vessels beginning January 1, 2025. CARB staff anticipate the primary method of reducing emissions from a ro-ro vessel will be capture and control technology, based on staff’s conversations with industry members and representatives. Because ro-ro

<sup>54</sup> In the context of this Staff Report, a steam ship is a type of steam-powered ocean-going vessel that is propelled by one or more steam engines that typically move the ship’s propellers.

<sup>55</sup> California State Lands Commission, 2017 Vessel Visit Database.

vessels have similar operational power requirements as container vessels, the existing capture and control systems are expected to be well suited to reduce emissions on a ro-ro vessel. However, a development and construction period is needed for the manufacturers to produce and install these systems. As such, CARB staff propose a period of four years from the effective date of the Proposed Regulation for ro-ro vessels to comply.

For tanker vessels, CARB staff assume the preferred approach to reducing emissions at berth will involve capture and control systems based on conversations with industry members and representatives. Tanker vessel operators have expressed safety concerns with barge systems and indicate the method of capture and control would be land-based, which may require significant infrastructure improvements to the existing tanker terminals across the state. Controlling the auxiliary engines and boilers at berth also mean that the existing capture and control systems will likely need to be able to handle a higher amount of exhaust gas, and as a result may need to be re-designed and scaled up accordingly. Because of the extent of engineering and infrastructure work needed to adapt the existing technologies for use on tanker vessels, CARB staff propose a January 1, 2027, compliance date for tankers visiting regulated terminals at POLA and POLB, and a January 1, 2029 compliance date for the remainder of the tanker terminals across California.

## **22. Why is CARB staff proposing requirements for tanker vessels in two separate years?**

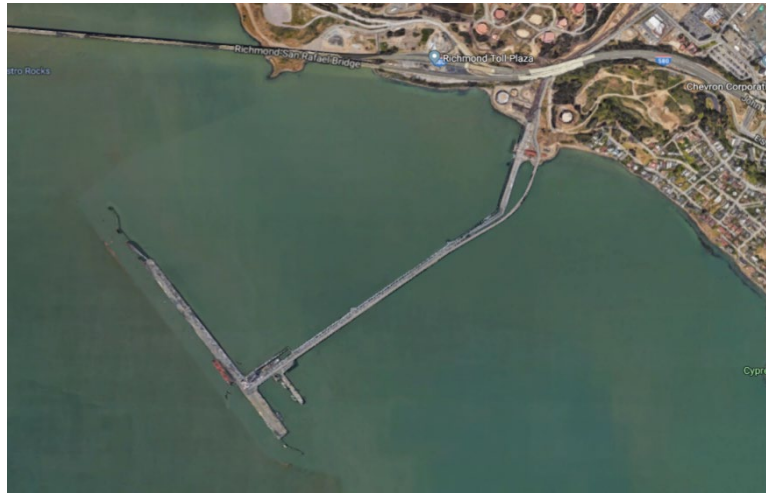
CARB staff recognizes the need for relief from air pollution in all communities near tanker terminals and refineries, and share the desire to reduce tanker emissions as quickly as possible. Staff held several meetings and conversations with equipment manufacturers and technology providers, community and industry members (including vessel and terminal operators), U.S. Coast Guard, CSLC, and harbor pilots in both Northern and Southern California to set a timeline that is both aggressive and technically feasible for implementation.

During these conversations, CARB staff learned that the process of improving infrastructure at the POLA and POLB was typically faster than in Northern California, due to additional permitting and conservation requirements placed on terminals in the San Francisco Bay.<sup>56</sup> The terminal infrastructure in Northern California may require more complex infrastructure improvements as the Northern California marine oil terminals (also referred to as “long wharves” can stretch out over a mile into the San Francisco Bay and Carquinez Straits, and can be affected by harsher weather conditions and stronger currents than their Southern California counterparts. Figures ES-17 and ES-18 show an example of the two main tanker terminal types in California.

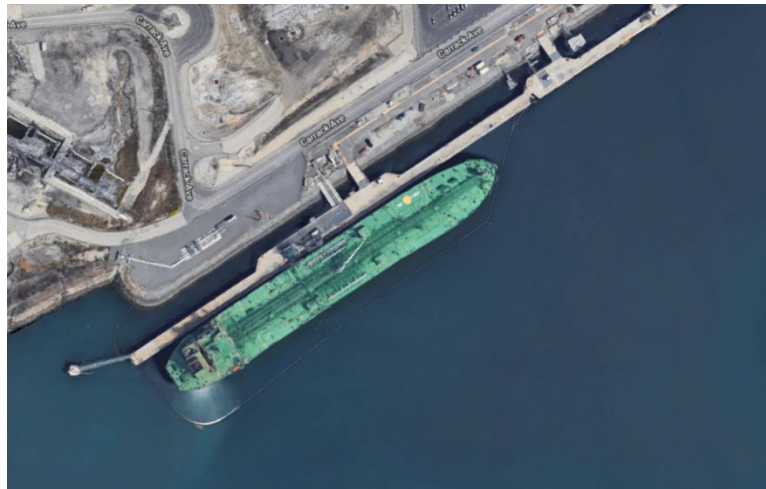
---

<sup>56</sup> Phone conversation with California State Lands Commission staff on March 27, 2019.

**Figure ES-17: Example of a “T”-shaped Marine Oil Terminal in Northern California**



**Figure ES-18: Example of a Port-Based Marine Oil Terminal in Southern California**



CARB staff proposes January 1, 2027 as the earliest feasible date that the tanker terminals at POLA and POLB could complete infrastructure improvements to support a land-based capture and control system, with an additional two years for the Northern California terminals.

**23. How will CARB staff determine progress is being made towards the implementation dates for ro-ro and tanker vessels and terminals?**

CARB staff recognize that with any new equipment development and infrastructure project, there is a potential for delay from a variety of sources outside the control of the

vessel and/or terminal operators, including permitting and construction work. Because of the long timeline for implementation, CARB staff propose an interim evaluation in 2023 to assess the progress made in adopting control technologies for use with tanker and ro-ro vessels, as well as the status of landside infrastructure improvements that may be needed to support emissions reductions at tanker terminals. By July 1, 2023, staff commit to publishing an analysis and findings in a report, which will be available for public review at least 30 calendar days prior to presenting the report to the Board at a public meeting. Part of staff's report to the Board could include information gathered from port and terminal plans that would be required information submitted to CARB staff as part of the Proposed Regulation.

#### **24. How will CARB staff ensures ports and terminals are prepared to reduce emissions from ocean-going vessels?**

The Proposed Regulation would require regulated ports and terminals to each provide separate plans to CARB prior to the implementation date for specific vessel categories. The terminal and port plans would be used to demonstrate the preparation of ports and terminals for reducing vessel emissions by the implementation date. These plans must detail the chosen methods for reducing emissions at berth at each terminal and port, as well as if any additional emissions control equipment is necessary to meet the control requirements. Submitting the plans is crucial because they require both ports and terminals to list the division of responsibilities between the terminal and the ports in regards to any infrastructure and equipment installation, maintenance, and operation necessary to meet the control requirements at each terminal. This is a key detail for CARB's enforcement staff, as the delineation of responsibility for installing, maintaining, and operating emissions control equipment at berth is not consistent and uniform at all terminals and ports. Ports would be required to show proof that the necessary infrastructure modifications are being developed or have been completed and/or report any modifications still required in order for all of the Port's terminals with control requirements to reduce emissions of vessels at berth.

Regulated terminals receiving container, reefer, and cruise vessels would be required to submit plans to CARB staff by July 1, 2021, and initial plans from ro-ro and tanker terminal operators would be due to CARB staff by December 1, 2021. Regulated ports would also be required to submit separate plans to CARB staff for their container, reefer, and cruise terminals by July 1, 2021, and ro-ro and tanker terminals by December 1, 2021. The goal of the port and terminal plans is to show that each terminal at a port has a planned path towards compliance at every berth. The plans would also provide CARB enforcement with a tool to use during inspections and audits of reported compliance information, and may also feed into the interim evaluation scheduled to occur in 2023 for tanker and ro-ro and vessels.

#### **25. What happens if a vessel is not able to reduce emissions while at berth?**

When a vessel is unable to reduce emissions at berth for any reason, the uncontrolled emissions impact the health of surrounding communities. However, CARB staff

understand that due to the complex nature of port operations, there will be circumstances in which an unforeseeable event occurs that results in a vessel or terminal operator not being able to connect a vessel to an emissions control technology.

Vessels experiencing certain circumstances involving safety or emergency events, such as severe weather or a utility being unable to provide shore power to the berth, would be eligible for an exception from the requirement to reduce emissions under the Proposed Regulation for only as long as emergency conditions persist.

For unforeseeable, non-emergency operational circumstances that may prevent a vessel from reducing emissions, CARB staff proposed a limited number of Vessel Incident Events (VIE) and Terminal Incident Events (TIE) that could be used by vessel and terminal operators without being considered out of compliance. VIEs and TIEs are compliance options that could be used to address any situation where the operational needs of a terminal or vessel result in a vessel not being able to connect to an emissions control strategy as required during a visit. This compliance option recognizes the uncertainty that may surround vessel movements and cargo operations while a vessel is at berth, and reduces cost by eliminating the need for redundant emissions control systems. Table ES-2 shows the breakdown of VIE and TIE percentages for vessels and terminals by year.

**Table ES-2: TIE and VIE Percentages**

| VIEs and TIEs Percentages by Vessel Type per Year |                          |      |      |      |      |      |      |      |      |      |       |
|---|--------------------------|------|------|------|------|------|------|------|------|------|-------|
|   |                          | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030+ |
| <b>TIEs</b>                                       | <i>All Terminals</i>     | 15%  | 15%  | 15%  | 15%  | 5%   | 5%   | 5%   | 5%   | 5%   | 5%    |
|   | <i>Container/ Reefer</i> | 5%   | 5%   | 5%   | 5%   | 5%   | 5%   | 5%   | 5%   | 5%   | 5%    |
| <b>VIEs</b>                                       | <i>Cruise</i>            | 5%   | 5%   | 5%   | 5%   | 5%   | 5%   | 5%   | 5%   | 5%   | 5%    |
|   | <i>Ro-Ro</i>             |      |      |      |      | 5%   | 5%   | 5%   | 5%   | 5%   | 5%    |
|   | <i>LA/LB Tankers</i>     |      |      |      |      |      |      | 5%   | 5%   | 5%   | 5%    |
|   | <i>Other Tankers</i>     |      |      |      |      |      |      |      |      | 5%   | 5%    |

Providing for a higher percentage of TIEs in the initial few years of implementation allows for additional time for further infrastructure build out, potentially including new vessel retrofits, additional shore power vaults, cable management systems, and additional barge-based capture and control systems. Approval of these events is not



necessary prior to use, but must be reported to CARB staff with the vessel visit information for tracking and auditing purposes. VIEs and TIEs will expire annually, with no banking or rolling over to the next year or trading between fleets or terminals. The number of TIEs and VIEs are capped to maintain a high level of emissions controlled for vessel visits to protect the surrounding port communities.

For more foreseeable longer-term periods of uncontrolled emissions, staff propose a remediation fund that could be used to mitigate the uncontrolled emissions. Longer term periods of uncontrolled emissions could include events such as berth construction projects or extended equipment repairs at a berth that has already made investments in shore power or another emissions reduction technology, or at a berth with physical constraints that is physically unable to use existing emissions control technologies. Any funds paid into the remediation fund would be required to be spent on projects that reduce emissions in the communities impacted by the uncontrolled vessel emissions.

These options are designed to recognize the uncertainty that comes with doing business in a dynamic port environment, while achieving the health benefits needed by the surrounding communities.

## **26. What is the remediation fund and when can it be used?**

The remediation fund is a compliance option that allows vessels to comply with the Proposed Regulation by remediating uncontrolled emissions at berth through a hourly-based fee that is based on the cost of securing equivalent emissions reductions. The remediation fund compliance option was developed for use in limited circumstances where investments to reduce emissions have already occurred, but reductions are not achievable during a vessel's visit at berth.

Qualifying circumstances are limited to:

- Extended vessel and terminal equipment repair.
- Terminal construction projects.
- Delays in connecting to control strategy.
- Physical constraints identified in the terminal plan.

Any remediation funds received would be required to be put back into projects in the communities impacted by the uncontrolled emissions. CARB staff propose that the dollar amount paid into the remediation fund for uncontrolled emissions would be based on the vessel type and number of hours of uncontrolled emissions during the vessel's visit. Staff would also propose a lower hourly dollar amount for vessels with lower emissions at berth. This could be due to smaller vessels with lower power needs (and consequently lower emissions) at berth or vessels with cleaner engines (i.e., auxiliary engines certified to meet IMO Tier III standards). Table ES-3 shows the breakdown of hourly remediation fund amounts:

**Table ES- 3: Remediation Fund Hourly Amount Beginning in 2021**

| <b>Vessel Type</b>   | <b>Normal Rate</b> | <b>Tier III Rate*</b> |
|--|--------------------|-----------------------|
| Container, Reefer, Ro-ro   | \$1,900            | \$1,100               |
| Tanker with electric pumps   | \$1,600            | \$1,000               |
| Tanker with steam driven pumps   | \$3,400            | \$2,700               |
| Cruise vessels with capacity under 1,500 combined passengers and crew      | \$5,300            | \$3,200               |
| Cruise vessels with capacity of 1,500 or more combined passengers and crew | \$12,000           | \$7,100               |

\* Remediation payments used by vessel operators shall be reduced by 20 percent for IMO Tier III tanker vessels with steam driven pumps, and 40 percent for all other IMO Tier III vessels.

If the emissions from a vessel visit are not controlled for the entire visit, the dollar amount required to mitigate the uncontrolled emissions would be the dollar amount for the vessel category in Table ES-3 multiplied by the number of uncontrolled hours. The party responsible for paying for mitigation is the party responsible for the lack of connection, which could be the operator of the vessel, terminal, and/or CARB approved emissions control strategy (if a third party).

**27. When a vessel is unable to reduce emissions at berth, who is at fault?**

Vessel operators, terminal operators, ports, and CARB approved emissions control strategy operators all share responsibility to reduce emissions from a vessel’s visit at berth. Reducing emissions from ocean-going vessels is a collaborative effort between the vessel crew/operators, the terminal operators, the port, and a third-party emissions control technology operator in some cases, depending on the technology being used (such as a barge-based capture and control system). Terminal operators and ports have a complex relationship with one another, and that relationship is potentially different at every port. Both parties, however, play an essential role in the connection process for technologies such as shore power and direct responsibilities of each party will vary depending on the contractual agreements in place. While implementing the Existing Regulation, CARB staff became aware of numerous situations where vessels arrived to California ready to connect to shore power or an alternative capture and control system, but were unable to due to shore-side or third-party control equipment and/or operational issues. To resolve this, CARB staff propose placing shared responsibilities on all parties involved in the connection process to ensure that if emissions are not being reduced, enforcement action for non-compliance can be taken against the appropriate party.

**28. How will CARB ensure the necessary reductions are being achieved?**

The simplified requirements of the Proposed Regulation require a vessel to use a CARB approved emissions control strategy during a visit at berth. As long as a vessel utilizes an emissions control strategy that is CARB approved, the assumption is that the

required reductions are being met. CARB staff periodically monitor and review data from CARB approved emissions control technologies to ensure the equipment continues to achieve the approved level of emissions reductions. All vessels, terminals, ports, and CARB approved emissions control strategy operators would have record-keeping and reporting requirements for the Proposed Regulation. Having both parties report allows each entity to report the information to CARB that they deem accurate and appropriate for their visits. This also provides a way for CARB enforcement staff to corroborate data being submitted by the two parties.

To assist with streamlining reporting, an online tool called the Freight Regulations Reporting System (FRRS) is in development by CARB. FRRS is a reporting tool designed to group many of CARB's freight related reporting needs, with the goal of eventually replacing the individual freight reporting systems currently in use. FRRS is anticipated to be completed and ready for use by mid-2020.

## I. BACKGROUND AND INTRODUCTION

This Initial Statement of Reasons (“ISOR” or “Staff Report”) is an evaluation of: 1) the existing Airborne Toxic Control Measure for Auxiliary Diesel Engines Operated on Ocean-Going Vessels At-Berth in a California Port (“Existing Regulation”) of the challenges observed during implementation; and 2) the need for additional emissions reductions from ocean-going vessels at berth in California ports that goes above and beyond existing regulations. For the purpose of this document the terms “ocean-going vessel” and “vessel” will be used interchangeably.

In addition to evaluating the need for further reducing health impacts associated with vessel emissions at berth, this Staff Report also provides a summary of the:

- Proposed new Control Measure for Ocean-Going Vessels At Berth Regulation (“Proposed Regulation”).
- Projected additional emissions reductions.
- Associated reduction in health impacts.
- Estimated costs of regulatory compliance for both industry and local governments.
- Alternative proposals considered.

### A. CARB’s Authority and Responsibility to Reduce Air Pollution from Vessels At Berth

The California Air Resources Board (CARB) implements regulations to improve public health protection for local port communities as authorized by the California Health and Safety Code (HSC) and by other State legislation as follows:

- HSC 39660 et seq.<sup>57</sup> directs CARB to regulate toxic air contaminants (TAC) from non-vehicular sources to reduce public exposure and risk.

---

<sup>57</sup> California Health and Safety Code § 39660 et seq., Division 26, Identification of Toxic Air Contaminants, 1983,  
[https://leginfo.ca.gov/faces/codes\\_displayText.xhtml?lawCode=HSC&division=26.&title=&part=2.&chapter=3.5.&article=3](https://leginfo.ca.gov/faces/codes_displayText.xhtml?lawCode=HSC&division=26.&title=&part=2.&chapter=3.5.&article=3).

- HSC 43013<sup>58</sup> and 43018<sup>59</sup> direct CARB to control criteria air pollutants from mobile sources to attain air quality standards. Assembly Bill (AB) 32 (Chapter 488, Statutes of 2006)<sup>60</sup> and Senate Bill (SB) 32 (Chapter 249, Statutes of 2016)<sup>61</sup> direct CARB to reduce greenhouse gases (GHGs) to specific levels to combat climate change.
- SB 605 (Chapter 523, Statutes of 2014)<sup>62</sup> directs CARB to develop a comprehensive strategy to reduce short-lived climate pollutants, such as black carbon, in coordination with other state agencies and local air quality management and air pollution control districts.

More specifically, this regulatory action is proposed under the authority granted in California HSC sections 38560, 38562, 39600, 39601, 39650, 39658, 39659, 39666, 43013, and 41511. This action is proposed to implement, interpret, and make specific sections 38510, 38530, 38562, 38566, 38580, 39600, 39650, 39658, 39659, 39666, 39674, 41510, 41511, 41701, and 43016.

CARB has authority under California law to adopt the proposed regulations. HSC section 43013 provides broad authority for CARB to adopt emission standards and other regulations to reduce emissions from new and in-use vehicular, non-vehicular and other mobile sources. CARB is expressly authorized to adopt emission standards and other regulations for marine vessels, to the extent permitted by federal law (HSC section 43013(b).) The Legislature has also directed CARB to “act as expeditiously as is feasible to reduce nitrogen oxide emissions from diesel vehicles, marine vessels, and other categories of vehicular and mobile sources which significantly contribute to air pollution problems” (HSC section 43013(h)).

CARB is further mandated to reduce air toxics emissions under California’s air toxics laws. HSC section 39666 directs CARB to adopt Air Toxic Control Measures (ATCM) to “reduce emissions of toxic air contaminants from non-vehicular sources” for identified TACs such as diesel particulate matter (DPM), formaldehyde, benzene, and 1,3 butadiene.

CARB is also mandated under HSC section 38500 et seq. to reduce GHG emissions, which are emitted at substantial levels by ships hotelling at California ports. For

---

<sup>58</sup> California Health and Safety Code § 43013, Division 26, General Provisions, 1975, [https://leginfo.ca.gov/faces/codes\\_displaySection.xhtml?lawCode=HSC&sectionNum=43013](https://leginfo.ca.gov/faces/codes_displaySection.xhtml?lawCode=HSC&sectionNum=43013).

<sup>59</sup> California Health and Safety Code § 43018, Division 26, General Provisions, 1975, [https://leginfo.ca.gov/faces/codes\\_displaySection.xhtml?lawCode=HSC&sectionNum=43018](https://leginfo.ca.gov/faces/codes_displaySection.xhtml?lawCode=HSC&sectionNum=43018).

<sup>60</sup> California Health and Safety Code § 38500 - 38599, Division 25.5, Assembly Bill No. 32, California Global Warming Solutions Act of 2006, September 27, 2006, [http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab\\_0001\\_0050/ab\\_32\\_bill\\_20060927\\_chaptered.pdf](http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001_0050/ab_32_bill_20060927_chaptered.pdf)

<sup>61</sup> California Health and Safety Code § 38566, Division 25.5, Senate Bill No. 32, September 8, 2016, [https://leginfo.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160SB32](https://leginfo.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB32).

<sup>62</sup> California Health and Safety Code § 39730, Division 26, Senate Bill No. 605, Short-lived climate pollutants, September 21, 2014, [http://leginfo.ca.gov/pub/13-14/bill/sen/sb\\_0601-0650/sb\\_605\\_bill\\_20140921\\_chaptered.htm](http://leginfo.ca.gov/pub/13-14/bill/sen/sb_0601-0650/sb_605_bill_20140921_chaptered.htm).

example, HSC section 38560 mandates CARB to adopt rules and regulations “to achieve the maximum technologically feasible and cost-effective GHG emission reductions from sources or categories of sources, subject to the criteria and schedules set forth in this part.”

Additionally, other statutes mandate CARB to do all things necessary and proper to achieve its statutory mandates. HSC section 39600 requires CARB to “do such acts as may be necessary for the proper execution of the powers and duties granted to, and imposed upon, the state board by this division and by any other provision of law.” HSC section 39601 requires CARB to adopt “standards, rules, and regulations” which are “necessary for the proper execution of the powers and duties granted to, and imposed upon, the state board by this division and by any other provision of law.”

While the Existing Regulation primarily placed the program’s compliance obligations on vessel operators, the past five years of program implementation have demonstrated that the Existing Regulation’s visit requirements can be challenging to achieve by regulating vessel operators alone. Ensuring a connection to shore power or alternative control technology frequently involves more than one entity, and those entities must work together to successfully control a vessel’s emissions. Furthermore, the marine freight logistics industry is complex and dynamic, resulting in many initially unforeseen circumstances and interests that may complicate a vessel’s ability to connect to emission controls. CARB’s experience in implementing the Existing Regulation has shown that the only way to ensure a vessel is able to connect is by regulating not just the vessel, but also the other parties that have provided, operate, or own the facilities at which vessels call, and thus also control the vessel’s ability to connect, and who are therefore essential to successfully reducing the vessel’s emissions. CARB’s statutory mandates, particularly its air toxics and GHG related mandates, are not limited to vehicular/mobile sources. Therefore, CARB has determined that assigning certain compliance obligations to the ports, terminals, and alternative control technology providers, in addition to the vessel operators, is necessary and proper for satisfying CARB’s statutory mandates to reduce air pollution from marine vessels.

## **B. Background on Affected Categories**

Ocean-going vessels are large vessels designed for deep water navigation and the transport of cargo or passengers. Many different types of commercial ocean-going vessels visit California, including container and refrigerated cargo vessels, roll on-roll off (“ro-ro”) vessels, bulk carriers, tankers, and cruise (or “passenger”) vessels. Ocean-going vessels visit many different ports in California. In the context of this Staff Report, ocean-going vessels are ships that stop at, or “visit”, affected California ports or independent marine terminals during their voyage.

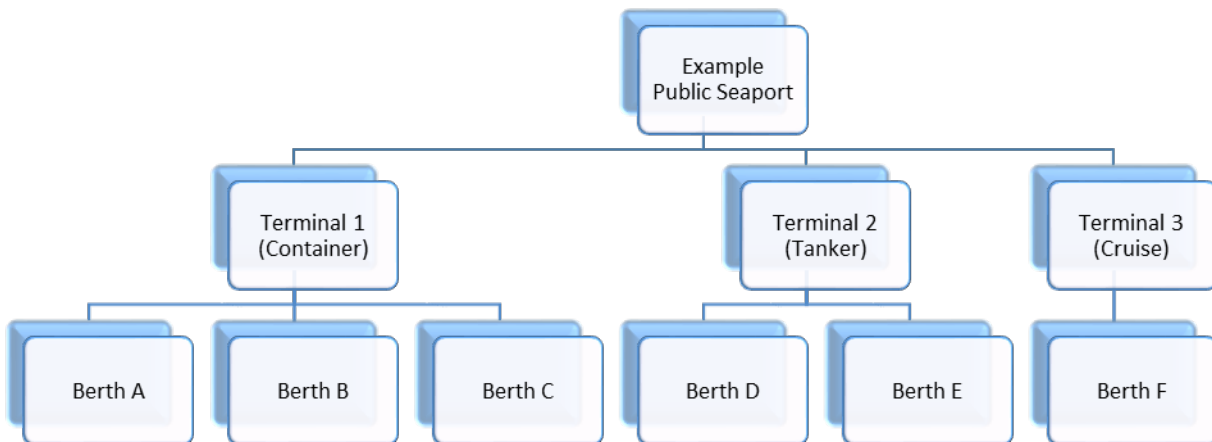
### **1. Basics on Ports and Independent Marine Terminals**

This section will give an introduction to the various types of ports and terminals in California that ocean-going vessels visit.

## a) Seaports and Port Terminals

Ports are semi-autonomous local public entities operating under the auspices of the California State Lands Commission (CSLC), which oversees the State's public tidelands. Each port can have one to several terminals and each terminal can have one or multiple berths. Terminals are facilities consisting of wharves, piers, docks, and other berthing locations in addition to adjacent storage, which are used primarily for loading and unloading of passengers, cargo, or material from vessels or for the temporary storage of cargo or material on-site. Figure I-1 below shows a simplistic representation of a public seaport providing services for container, tanker, and cruise vessels.

**Figure I-1: Description of the Relationship Between the Port, Terminal, and Berth at a Typical Public Landlord Port**



There are two primary types of public seaports. The largest ports in California typically use the “landlord port”<sup>63,64</sup> model that provides long-term leases or rental of entire terminals to private companies referred to as “terminal operators”. Those terminal operators then offer services to the vessel fleets and cargo owners using that terminal. In the world of international cargo, there is a complex and frequently shifting web of alliances between different vessel fleets (also known as ocean carriers) that may have cooperative agreements to share space on vessels to maximize efficiency, and between individual vessel fleets or fleet alliances and terminal operators for services. California’s smaller ports use an “operational port” model; they also act as the terminal operator and directly serve vessel fleets.<sup>65</sup>

<sup>63</sup> Port of Los Angeles, Port 101, accessed September 8, 2019, <https://www.portoflosangeles.org/about/port-101>.

<sup>64</sup> Port of Long Beach, FAQs - Does The Port Receive Funding From The City of Long Beach, accessed September 8, 2019, <http://www.polb.com/about/faqs.asp#530>.

<sup>65</sup> Hoppe-Spiers, J., Port of Stockton, Transportation and Logistics International, accessed September 8, 2019, <http://www.tlimagazine.com/sections/shipping-and-ports/2359-port-of-stockton>.

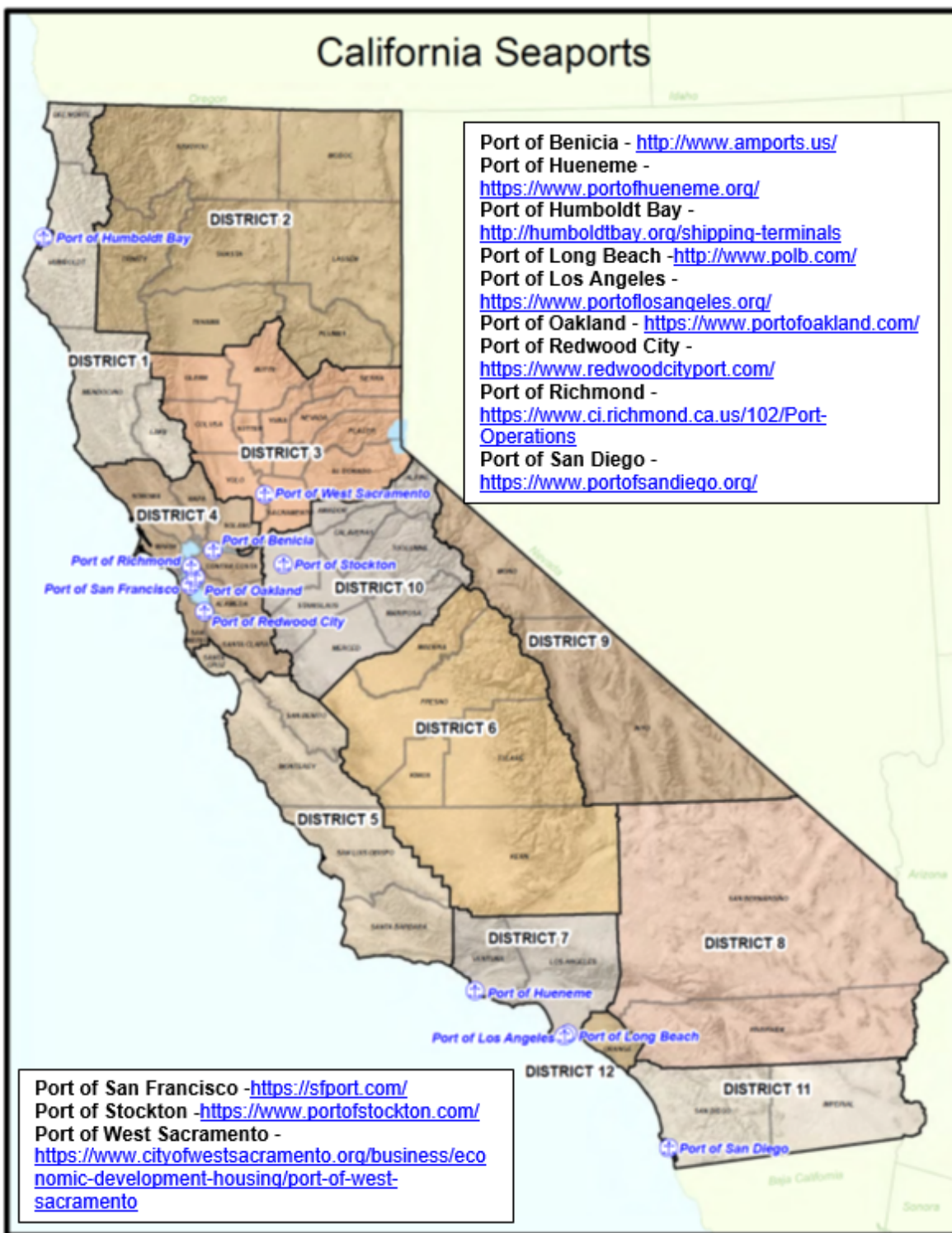
A port may also employ a combination of these models. For example, in Figure I-1, the container terminal (Terminal 1) may be leased to a private company that contracts with specific vessel fleets, while the tanker and cruise terminals (Terminals 2 and 3) are operated by the port directly and accept visits by a wider range of vessel fleets.

Public seaports typically have substantial wharf or dock structures on or attached to the terminal land, with electrical connections. Emissions control equipment can typically be installed on these wharves to reduce vessel emissions at berth.

The Ports of Los Angeles (POLA) and Long Beach (POLB) make up the largest port complex in the State of California, with the majority of calls from all vessel types in California occurring at these two ports. The Port of Oakland has the third most vessel visits in the state, and all other ports account for the 30 percent of remaining vessel visits. Figure I-2 shows the locations of all of California's large seaports for reference.



Figure I-2: Map of California Large Seaports<sup>66</sup>



<sup>66</sup> Department of Transportation, Seaports, accessed October 18, 2018.

Table I-1 shows the number of vessel visits by port based on CSLC and Wharfinger data from 2017.

**Table I-1: 2017 California Port and Marine Terminal Vessel Visits<sup>67</sup>**

| Location                     | Container and Reefer | Bulk and General Cargo | Cruise     | Ro-Ro        | Tanker       | Total        |
|------------------------------|----------------------|------------------------|------------|--------------|--------------|--------------|
| Avalon-Catalina              | 0                    | 0                      | 112        | 0            | 0            | 112          |
| Carquinez Area <sup>68</sup> | 0                    | 45                     | 0          | 123          | 352          | 520          |
| El Segundo                   | 0                    | 0                      | 0          | 0            | 160          | 160          |
| Hueneme                      | 155                  | 0                      | 0          | 239          | 12           | 406          |
| Humboldt                     | 0                    | 5                      | 0          | 0            | 0            | 5            |
| POLA <sup>65</sup>           | 1,300                | 143                    | 109        | 99           | 224          | 1,875        |
| POLB <sup>69</sup>           | 934                  | 336                    | 261        | 176          | 370          | 2,077        |
| Monterey                     | 0                    | 0                      | 6          | 0            | 0            | 6            |
| Oakland                      | 1,593                | 26                     | 0          | 0            | 0            | 1,619        |
| Redwood City                 | 0                    | 59                     | 0          | 0            | 0            | 59           |
| Richmond Area <sup>70</sup>  | 0                    | 108                    | 0          | 71           | 392          | 571          |
| San Diego                    | 53                   | 21                     | 95         | 267          | 10           | 446          |
| Santa Barbara                | 0                    | 0                      | 15         | 0            | 0            | 15           |
| San Francisco                | 0                    | 8                      | 72         | 25           | 0            | 105          |
| Stockton                     | 0                    | 145                    | 0          | 0            | 63           | 208          |
| Sacramento                   | 0                    | 39                     | 0          | 0            | 2            | 41           |
| <b>Total:</b>                | <b>4,035</b>         | <b>935</b>             | <b>670</b> | <b>1,000</b> | <b>1,585</b> | <b>8,225</b> |

<sup>67</sup> Vessel visit numbers are based on 2017 CSLC data and will look different than inventory visit information shown in Appendix H, which is based on a different data source for vessel visit activity (IHS-Markit). Source: California State Lands Commission, 2017 Vessel Visit Database

<sup>68</sup> Carquinez Area includes: AmPorts Coke Dock, Crockett, C & H Sugar, Pittsburg, Bay Bulk, US Steel-POSCO (USS-POSCO), Dow Chemicals, Chemical Dock, AmPorts Car Dock, Benicia - Valero Terminal, Martinez – Tesoro Terminals, Martinez – Shell Terminal, Martinez - Pacific Atlantic Company / old Shore Terminals, Rodeo – Oleum, Rodeo – Selby, Rodeo - Pacific Refining Company

<sup>69</sup> In the Existing Regulation, POLA and POLB were considered one port complex for the purposes of the regulation. In the Proposed Regulation, POLA and POLB are considered separate ports.

<sup>70</sup> Richmond Area includes: Chevron Long Wharf, BP/ARCO Terminal, Phillips 66 Terminal, IMTT Terminal, Pacific Atlantic Terminal.

## **b) Independent Marine Terminals**

In Northern California, there are also independent marine terminals that are located and operate separate from any port. Most of these are marine oil terminals owned and operated by the oil companies with nearby refining operations. The physical structure at these oil terminals are markedly differently from a typical port. Vessels dock at long wharves that may extend hundreds of feet into the Bay; these are insubstantial structures with limited electrical power capacity. Many of these wharves cannot accommodate pollution control equipment without extensive construction (on land and in the water) to support additional weight and demand for power.

## **2. Basics on Ocean-Going Vessel Operations**

This section will provide an introduction to vessel operations and various types of vessels that visit California ports and independent marine terminals. Vessels have four main modes of operation: in transit, maneuvering, at berth, and at anchor.

### **a) In Transit**

When a vessel is underway (or “in transit”), the main engines provide power for propulsion, while the auxiliary engines power the onboard electrical systems for navigation and communication, climate control, and lights. The vessel’s boilers provide heat to keep the very viscous bunker fuel used in the main engines in liquid form, as well as to heat the interior of the vessel for crew comfort, and provide hot water onboard. On oil tankers, boilers also serve a safety function for flammable liquids and generate steam to power the pumps that move product to and from shore.

### **b) Maneuvering**

When a vessel is ready to enter the immediate area of the port or terminal, a local pilot typically boards and assumes navigation control, while tugboats push or pull the vessel to maneuver it into position at the assigned berth. In the San Francisco Bay Area, pilots board the vessels farther out at sea, beyond the Golden Gate Bridge, for safety purposes. Similar to in transit, the main engine, auxiliary engines and boilers are all in use while maneuvering.

### **c) At Berth**

A vessel may be berthed in a “port” or “starboard” orientation, which can affect the ability of the vessel to connect with an emissions control system. Staff understands that the decision about which orientation to use rests in the hands of the pilot, the vessel master, and the terminal operator, based on factors such as the physical structure of the channel and wharf, the presence of vessels at adjacent berths, and the tides. This decision can impact the ability of a vessel to successfully connect to an emissions control system, depending on the vessel and berth configurations.

When the vessel is docked at berth, the main engines are shut down and large lines are used to secure the vessel to the wharf or dock. This step is called securing the vessel. Then the gangway of the vessel is lowered, a net is put in place for safety purposes, and U.S. Customs and Border Protection inspectors board the vessel. These inspectors must clear the vessel before anyone else can board or disembark, and before a cargo vessel can be worked by labor. Therefore, delays during this procedure delay the ability to connect the vessel to any emission controls not solely on the vessel.

The auxiliary engines and boilers continue to operate while a typical vessel is at berth to provide onboard electrical power, steam and other operations. Once a vessel is “ready to work”, the chosen emissions control system can be connected to the vessel.

#### **d) At Anchor**

A vessel approaching a port or marine terminal may stop “at anchor” a short distance off-shore while waiting for a berth or labor to become available. Similar to at berth, when at anchor the auxiliary engines and boilers are in use and the main engines are shut down.

### **3. Air Pollution from Vessels**

Ocean-going vessels generate air pollution from the exhaust stack of the vessel any time the main engine, auxiliary engines, or boiler is operating to power some aspect of the vessel or its operations. A single large, slow-speed, two-stroke direct drive diesel engine propels most vessels, with smaller medium-speed four-stroke auxiliary engines that provide electrical power for lighting, navigation equipment, and other shipboard uses. An exception to this configuration are diesel-electric vessels, such as those on cruise and a subset of tanker vessels. Diesel-electric vessels use large four-stroke medium speed engines coupled to generators to provide electrical power for both main propulsion and shipboard electrical power.

The majority of vessels are also equipped with auxiliary boilers. Boilers are fuel-fired combustion equipment designed primarily to produce steam for uses other than propulsion, such as heating of residual fuel and liquid cargo, heating of water for crew and passengers, powering steam turbine discharge pumps, freshwater generation, and space heating of cabins. Most of these onboard auxiliary boilers are small, and do not significantly contribute to the emissions profile of a vessel at berth. However, a subset of tanker vessels use large auxiliary boilers to generate steam to power pumps used for off-loading cargo, such as crude oil, while at berth. These larger auxiliary boilers produce significantly higher levels of emissions, as they create steam used to power pumps.

Vessels operate in either liner or tramper shipping schedules. A liner schedule is essentially a service, which transports goods (cargo) by regular routes on fixed schedules. According to the World Shipping Council (WSC), there are approximately

400 liner services in operation globally today.<sup>71</sup> Most liner vessels are in the form of container, reefer, or ro-ro vessels. A vessel engaged in the tramp shipping trade does not have a fixed schedule or ports of call. Tramp vessels trade on the on-demand shipping market, and does not return to the same ports of call regularly.

The International Maritime Organization (IMO), which is the United Nations agency with authority over maritime safety, security and the prevention of marine pollution from vessels, largely regulates emissions from vessels due to their global nature. Annex VI to the International Convention on the Prevention of Pollution from Ships (MARPOL) lists the international air pollution standards for vessels.

While at sea (outside California waters), a vessel's main and auxiliary engines and auxiliary boilers typically operate on heavy fuel oil (HFO). Currently the global maximum limit for sulfur content of a vessels' fuel oil is 3.50 percent mass/mass (m/m), but starting in January 1, 2020 the limit will reduce to 0.5 percent m/m. Certain countries have Emissions Control Areas (ECA) that further restrict vessel fuel sulfur limits within certain distances off their coastlines. The U.S. and Canada require vessels to use fuel with no more than 0.1 percent sulfur content. This area is referred to as the North American ECA, and the 0.1 percent sulfur requirement has been in effect since January 1, 2015. In California, CARB's Vessel Clean Fuel Regulation, which was enacted in 2014, goes a step further and requires vessels to use distillate grade fuels with a maximum sulfur content of 0.1 percent m/m for all vessels operating within 24 nautical miles off the California coastline in the main engines, axillary engines and boilers. Significantly more emissions reductions occur when vessels use marine distillate fuel as opposed to HFO.

Lowering the combustion temperature in an engine can reduce emissions of oxides of nitrogen (NOx) generated from the combustion of fuel. Ocean-going vessels often achieve NOx reductions through the use of cleaner engines, which use techniques such as exhaust gas recirculation (EGR) and selective catalytic reduction (SCR). IMO has regulations in place governing NOx emissions from vessels; Table I-2 lists IMO new engine NOx standards under MARPOL Annex VI.<sup>72</sup>

---

<sup>71</sup> World Shipping Council, How Liner Shipping Works, accessed September 25, 2019, <http://www.worldshipping.org/about-the-industry/how-liner-shipping-works>

<sup>72</sup> IMO, Prevention of Air Pollution from Ships Annex VI and New Engine NOX Emissions Limits Under IMO Annex VI, accessed September 8, 2019, [http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Nitrogen-oxides-\(NOx\)—Regulation-13.aspx](http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Nitrogen-oxides-(NOx)—Regulation-13.aspx).

**Table I-2: New Engine NOx Emissions Limits Under IMO Annex VI**

| <b>Emissions Tier</b> | <b>Keel Laid Date</b> | <b>NOx Limit (g/kW-hr)*<br/>n &lt; 130</b> | <b>NOx Limit (g/kW-hr)*<br/>130 ≤ n &lt; 2000</b> | <b>NOx Limit (g/kW-hr)*<br/>n ≥ 2000</b> |
|-----------------------|-----------------------|--|---|--|
| Tier I                | 2000                  | 17   | 45n <sup>-0.2</sup>                               | 9.8                                      |
| Tier II               | 2011                  | 14.4                                       | 44n <sup>-0.23</sup>                              | 7.7                                      |
| Tier III**            | 2016                  | 3.4  | 9n <sup>-0.2</sup>                                | 2.0                                      |

\*Where n is the rated engine revolutions per minute.

\*\*Tier III standards apply only within NOx Emissions Control Areas.

Tier II marine engine standards are estimated to achieve approximately a 20 percent reduction in NOx emissions compared to Tier I standards, while Tier III standards achieve around an 80 percent reduction from the Tier I emissions levels.

Particulate matter (PM) emissions (including PM2.5 and DPM) from vessels can be reduced through the use of cleaner fuels and technologies such as exhaust gas scrubbers, which can be either onboard a vessel or as a barge or land-based capture and control system. Reducing PM emissions from vessels is a particular focus for CARB, as there are no IMO regulations directly governing vessel PM emissions at this time.

Work is progressing on the international level for vessel GHG emissions reductions. As of April 2018, IMO introduced an initial strategy, which proposes a reduction in total annual GHG emissions by at least 50 percent by 2050 as compared to 2008.<sup>73</sup>

IMO has no regulations specifically governing emissions from ocean-going vessels at the time of this report.

#### **4. Vessel Characteristics**

This section will discuss each of the main categories of ocean-going vessels that visit California.

##### **a) Container and Reefer Vessels**

Container vessels (Figure I-3) are designed to carry cargo stored in standardized containers. Vessel size is classified by how many 20-foot-equivalent units (TEU) can be carried onboard. Dimensions of a single TEUs are 20 feet x 8 feet x 8.5 feet. However, a modern standard shipping container is 40 feet long, which is two TEUs, and may be referred to as a 40-foot equivalent unit (FEU).

<sup>73</sup> IMO, UN body adopts climate change strategy for shipping, April 13 2018, <http://www.imo.org/en/MediaCentre/PressBriefings/Pages/06GHGinitialstrategy.aspx>.

**Figure I-3: Container Vessel**



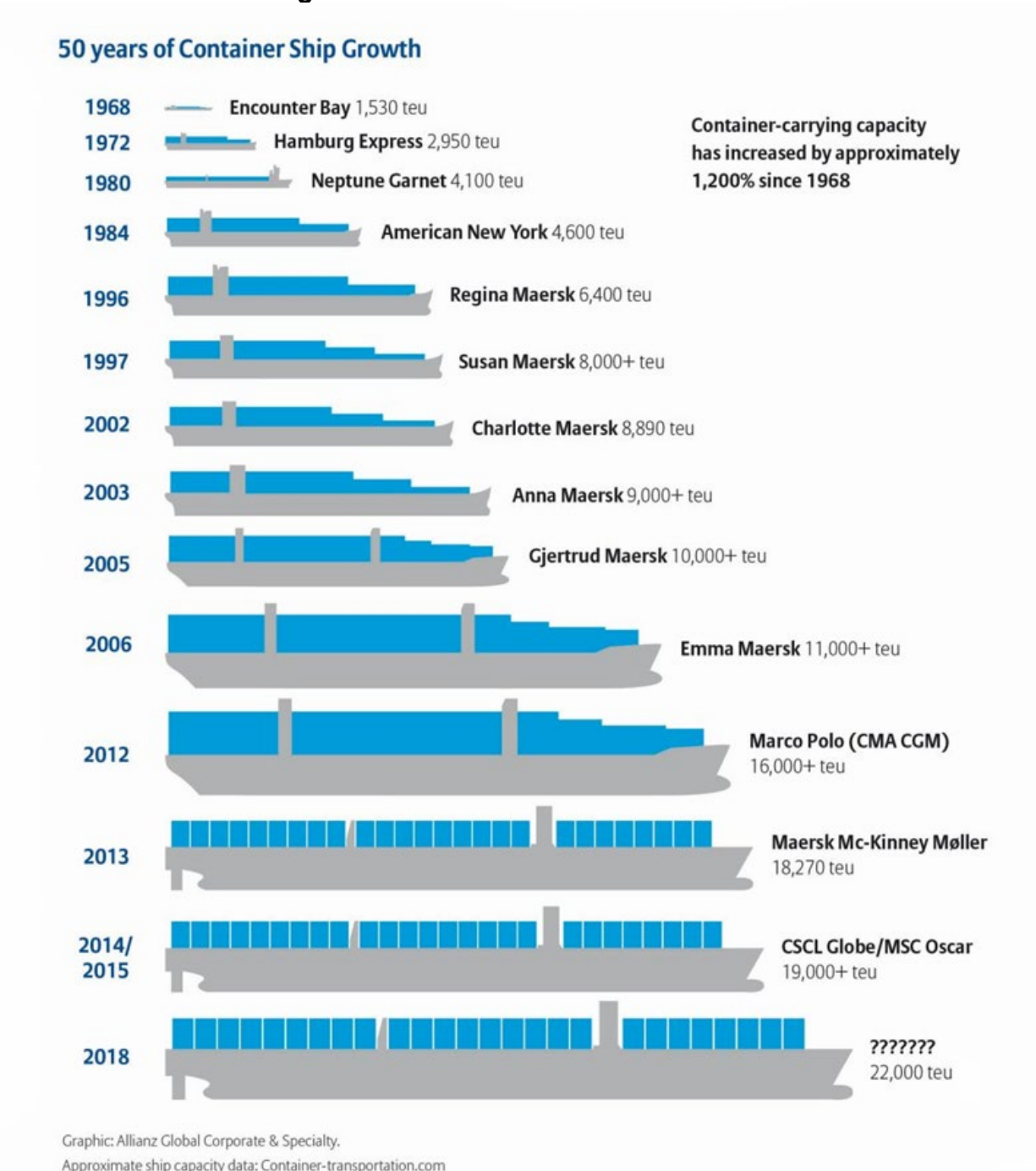
Size classifications for container vessels can be broken out into the following:

- Ultra Large Container Vessel – 14,501 TEU plus.
- New (or 'Neo') Panamax – 10,001 TEU to 14,500 TEU.
- Post Panamax – 5,101 TEU to 10,000 TEU.
- Panamax – 3,001 TEU to 5,100 TEU.
- Feedermax – 2,001 TEU to 3,000 TEU.
- Feeder and Small Feeder – 2,000 TEU and below.

As seen in Figure I-4, container vessels have steadily increased in size over time, a trend forecast to continue.



Figure I-4: Container Vessel Growth<sup>74</sup>



Reefer vessels (Figure I-5) are a type of vessel typically used to transport perishable commodities that require temperature-controlled transportation. Cargo often carried on reefer vessels are items such as fruits and vegetables, fish and seafood, meats, and

<sup>74</sup> World Shipping Council, Container Ship Design, accessed October 18, 2018, <http://www.worldshipping.org/about-the-industry/liner-ships/container-ship-design>.



pharmaceuticals. Due to refrigeration, and crane or other onboard equipment operations, a reefer vessel's electrical load can be considerable, and similar to a traditional container vessel several times its size. Most reefer vessels are now refrigerated container vessels that are specifically designed to carry containers that are each individual refrigerated units. These containers are nearly always TEUs that are the size of "standard" cargo containers that are loaded and unloaded at container terminals and aboard container vessels. These vessels require additional equipment to power each container's cooling system, and differ from conventional container vessels in their design, power generation, and electrical distribution equipment. Because of their ease of loading and unloading cargo, many container vessels are now being built or redesigned to carry refrigerated containers.

**Figure I-5: Reefer Vessel**



Container and reefer vessels made more visits to California than any other type of vessel. As shown in Table I-1, container and reefer vessels made 4,035 visits in 2017, or roughly 48 percent of all California vessel visits, as can be seen in Figure I-6.<sup>75</sup> Carrying capacity for these vessels can range from a few hundred TEUs to over 20,000 TEUs. According to the 2017 Emissions Inventory for POLA, the average container vessel calling the port in the Panamax class ranging in size from 4,000 TEUs to 13,000 TEUs. POLA receives more container vessel visits than any other port in California and provides a good representation of the average size of container vessels that call California.<sup>76</sup> POLA, POLB, and Oakland receive large numbers of containers through their terminals each year. Reefer vessels most frequently visit the ports of San Diego and Hueneme.

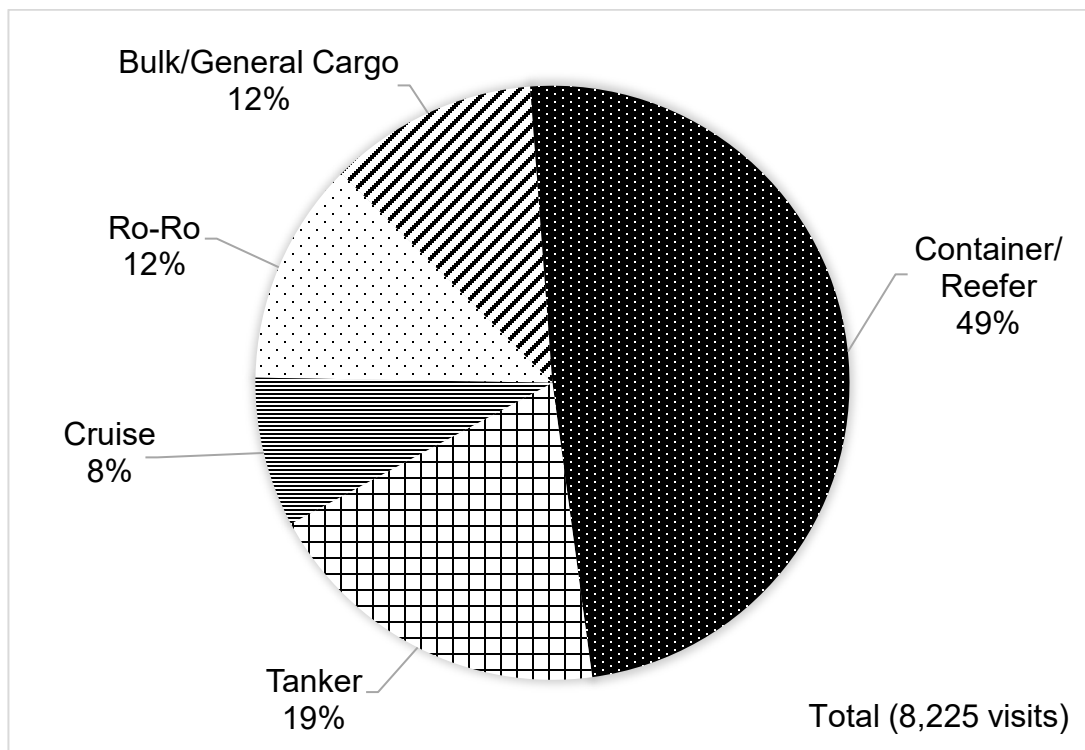
---

<sup>75</sup> California State Lands Commission, 2017 Vessel Visit Database.

<sup>76</sup> Starcrest Consulting Group, LLC, Port of Los Angeles Inventory of Air Emissions - 2016, July 2017, [https://kentico.portoflosangeles.org/getmedia/880bc597-84bc-4ae6-94e2-59a2e6027f42/2017\\_Air\\_Emissions\\_Inventory](https://kentico.portoflosangeles.org/getmedia/880bc597-84bc-4ae6-94e2-59a2e6027f42/2017_Air_Emissions_Inventory).

Container and reefer vessels are the most common vessel to call California ports, making up nearly half of the vessel visits. This is reflected in Figure I-6, which shows the breakdown of vessel visits to California by vessel type in 2017:

**Figure I-6: Percent of Visits to California by Vessel Type in 2017**



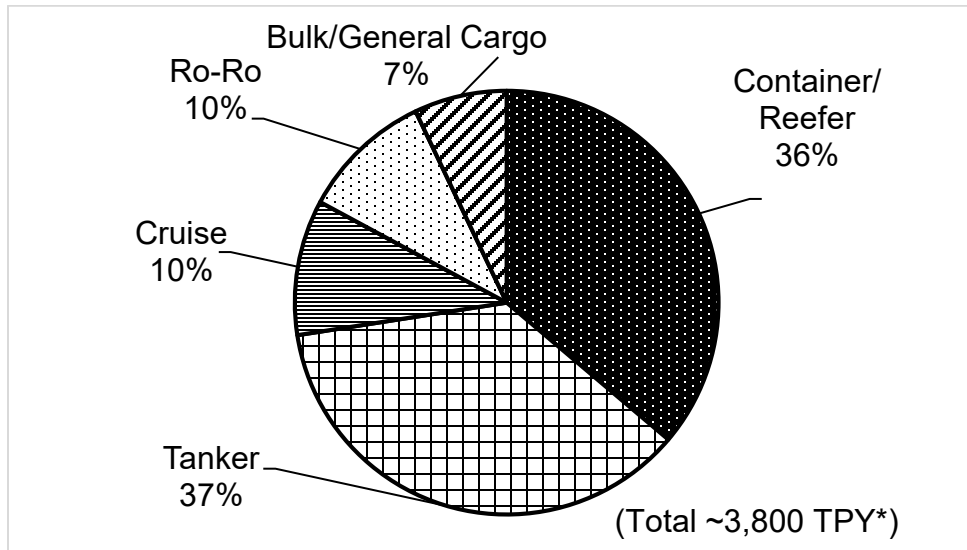
While docked at berth, container and reefer vessels do not typically require all auxiliary engines to be operating. Most often, one or two auxiliary engines will be operational and their average container and reefer auxiliary engine loads will vary between 450 kilowatts (kW) and 1,000 kW depending on size of the vessel and their operations at berth. Typical container and reefer vessels stays range between 35 and 40 hours.<sup>77</sup> Hotelling time for container and reefer vessels is dependent on the vessels cargo, wharf configuration, and berthing position.

As seen in Figures I-7 through I-11, container and reefer vessels are projected to account for approximately 33 to 39 percent of DPM, PM<sub>2.5</sub>, NO<sub>x</sub>, reactive organic gases (ROG), GHG emissions from vessel auxiliary engines and boilers statewide

<sup>77</sup> California Air Resources Board, Mobile Source Emissions Inventory, Draft 2019 OGV Emissions Inventory Model, Last Updated March 1, 2019 (accessed September 8, 2019), <https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-documentation-offroad-0>.

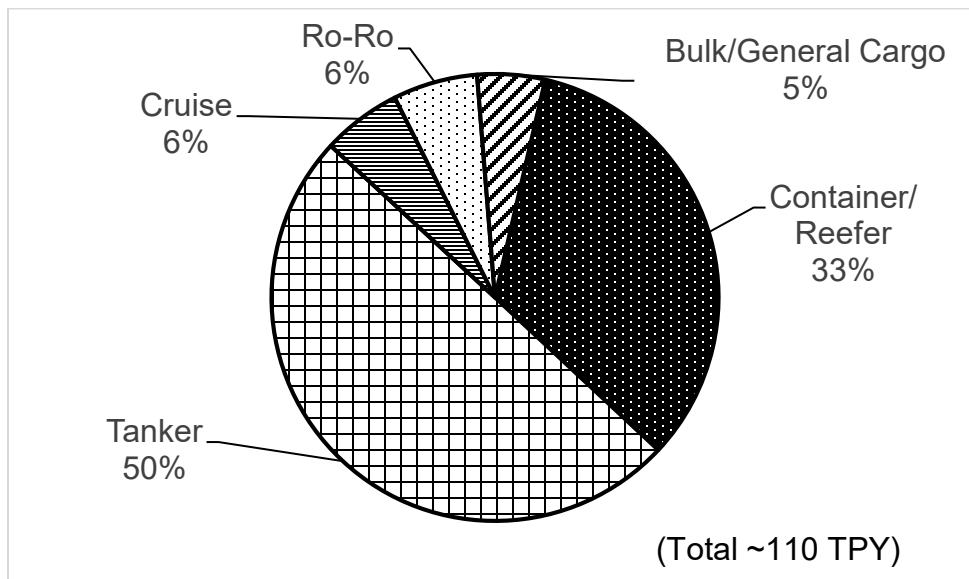
in 2021.<sup>78</sup> DPM and PM2.5 are represented separately to show the relative contribution of tanker vessel boilers to statewide ocean-going vessel PM2.5 emissions.

**Figure I-7: 2021 Projected Statewide At Berth NOx Emissions – Auxiliary Engines and Boilers**



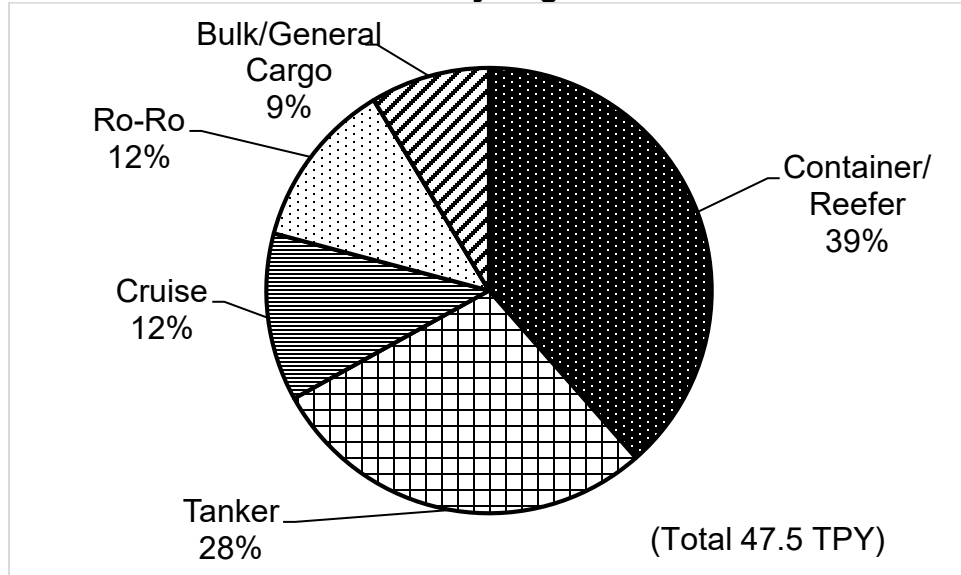
\*TPY = Tons per year

**Figure I-8: 2021 Projected Statewide At Berth PM2.5 Emissions – Auxiliary Engines and Boilers**

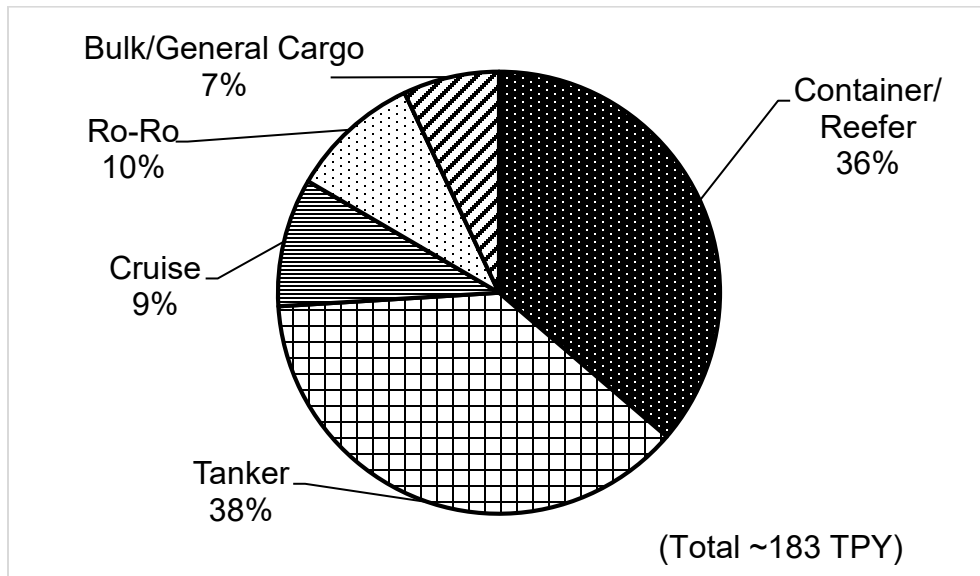


<sup>78</sup> California Air Resources Board, Mobile Source Emissions Inventory, Draft 2019 OGV Emissions Inventory Model, Last Updated March 1, 2019 (accessed September 8, 2019), <https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-documentation-offroad-0>.

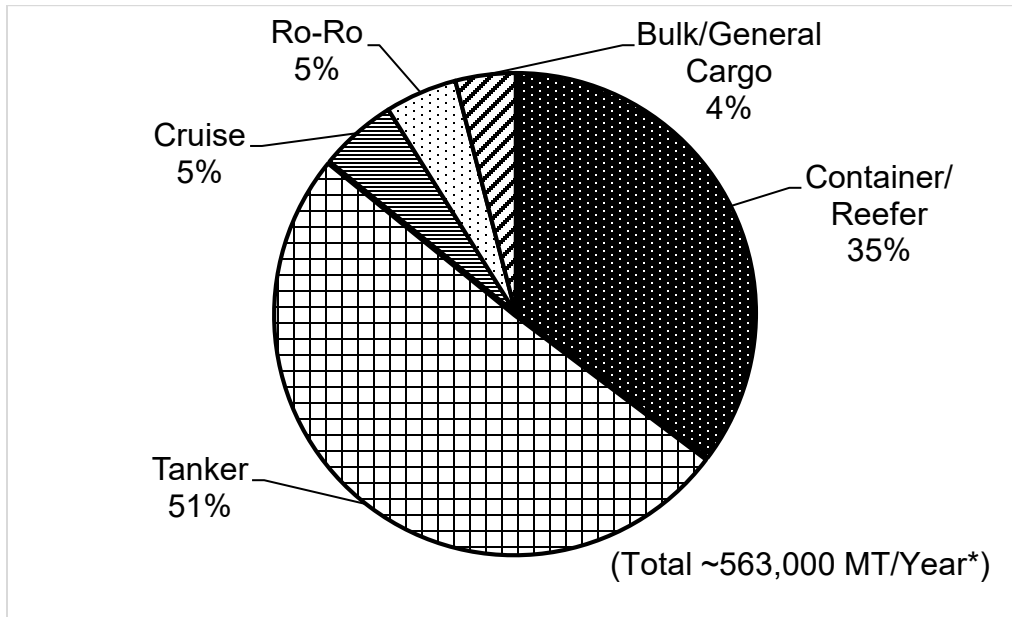
**Figure I-9: 2021 Projected Statewide At Berth DPM Emissions – Auxiliary Engines**



**Figure I-10: 2021 Projected Statewide At Berth ROG Emissions – Auxiliary Engines and Boilers**



**Figure I-11: 2021 Projected Statewide At Berth GHG (CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O) Emissions in Metric Tons Per Year (MT/Year) – Auxiliary Engines and Boilers**



\*MT/Year = Metric ton per year

### **b) Cruise Vessel**

Cruise (or “passenger”) vessels (Figure I-12) are vessels used for pleasure voyages. Cruise vessels provide a number of onboard entertainment options for their passengers. Powering a vessel’s air-conditioning systems, exercise and recreation facilities, movie theaters, dance halls, casinos, restaurants, and heating the water in the swimming pools and Jacuzzis requires a significant amount of power.

**Figure I-12: Cruise Vessel**



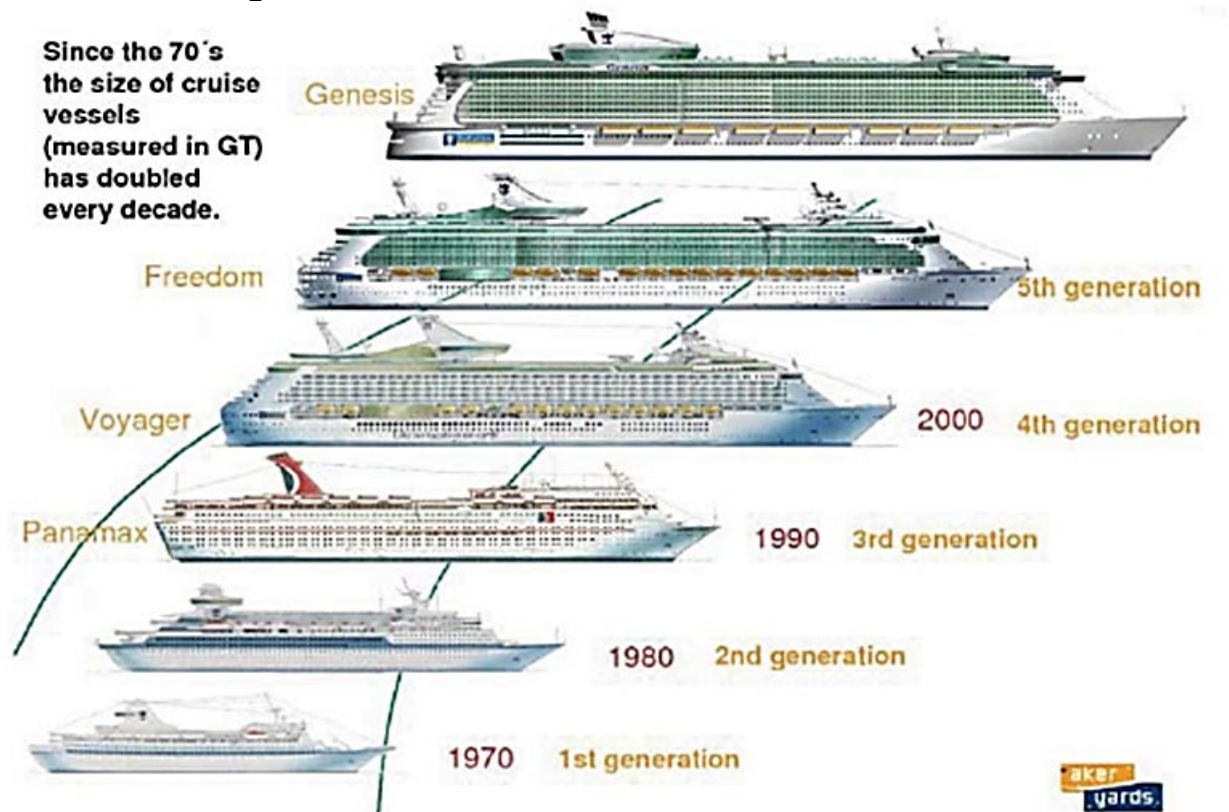
Similar to container vessels, the size of cruise vessels has steadily increased over time, as shown in Figure I-13, with passenger counts rising from fewer than 1,000 passengers on 1st generation cruise vessels to between 5,000 and 6,000 passengers on the newest Genesis class vessels.<sup>79,80</sup>

---

<sup>79</sup> Cruise Industry News, Song of Norway Sold, August 30, 1996, accessed September 4, 2019, <https://www.cruiseindustrynews.com/cruise-news/14621-song-of-norway-sold.html>

<sup>80</sup> World Cruise Network, Genesis Class, Accessed September 4, 2019, <https://www.worldcruise-network.com/projects/genesis-class/>.

Figure I-13: Size of Cruise Vessels Over the Years<sup>81</sup>



\*GT = Gross tons

Multiple diesel engines coupled to generators supply propulsion for cruise vessels. These generators produce electrical power that drives electric motors used for the vessel's propellers. This engine arrangement is optimal for the cruise industry as it provides the option to run the vessel at slower speeds by using fewer engines rather than operating one large single engine running at a low and inefficient load. The engines used in propulsion also generate auxiliary power.<sup>82</sup>

In 2017, approximately 670 cruise vessels visited California ports. As can be seen in Figure I-6, they accounted for 8 percent of the total vessel visits to California. Pleasure cruises have become increasingly popular and significant growth in the cruise-line industry is forecast to continue. Most cruise vessels visiting California come to the Ports of San Diego, San Francisco, POLA, and POLB. A handful of cruise vessels visit Monterey, Catalina, and Santa Barbara, where they moor off-shore. This means they do not berth at a dock. At the time of developing this Staff Report, CARB staff is not aware of any emissions control strategies available to cruise vessels moored at sea. As

<sup>81</sup> Apostolos, P., GOALDS – Goal Based Damage Stability of Passenger Ships Conference Paper, January 2013, [https://www.researchgate.net/publication/259693087 GOALDS - Goal Based Damage Stability for Passenger Ships](https://www.researchgate.net/publication/259693087_GOALDS_-_Goal_Based_Damage_Stability_for_Passenger_Ships).

<sup>82</sup> CARB, ISOR for Proposed Rulemaking: Fuel Sulfur and Other Operational Requirements for Ocean Going Vessels within California Waters and 24 Nautical Miles of the California, June 2008, <https://www.arb.ca.gov/regact/2008/fuelogv08/ISORfuelogv08.pdf>.

such, vessels at anchor do not have control strategy requirements in the Proposed Regulation.

As shown in Figures I-7 through I-11, cruise vessels are projected to make up around 5 to 12 percent of the NO<sub>x</sub>, PM<sub>2.5</sub>, DPM, ROG, and GHG emissions from vessel auxiliary engines and boilers statewide in 2021. As mentioned before, the power requirements for cruise vessels can be substantial at berth; a typical cruise vessel can require a power load anywhere from 3,000 kW to 15,000 kW while at berth.<sup>83</sup> Cruise vessels routinely stay in port less than 24 hours. In 2016, on average cruise vessels stayed at a California port 16 hours.<sup>84</sup>

### c) Ro-ro Vessels

Ro-ro vessels (Figure I-14) include auto carriers; these vessels haul wheeled cargo, which “roll-on and roll-off” the vessel via a built-in ramp. California’s most frequent visitors from this category are auto carriers, which haul exclusively automobiles. The largest car carriers in service, some that also call California, can carry up to 8,000 car equivalent units.<sup>85</sup>

**Figure I-14: Ro-Ro Carrier**



Ro-ro vessels use a large low-speed diesel engine for propulsion, and have three to five auxiliary diesel engines onboard, which are available to provide electrical

<sup>83</sup> Starcrest Consulting Group, LLC, Port of Los Angeles Inventory of Air Emissions - 2016, July 2017, [https://kentic.portoflosangeles.org/getmedia/880bc597-84bc-4ae6-94e2-59a2e6027f42/2017\\_Air\\_Emissions\\_Inventory](https://kentic.portoflosangeles.org/getmedia/880bc597-84bc-4ae6-94e2-59a2e6027f42/2017_Air_Emissions_Inventory).

<sup>84</sup> California Air Resources Board, Mobile Source Emissions Inventory, Draft 2019 OGV Emissions Inventory Model, Last Updated March 1, 2019 (accessed September 8, 2019), <https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-documentation-offroad-0>.

<sup>85</sup> Babicz, J., Wärtsilä Encyclopedia of Ship Technology, 2nd Ed., 2015, <https://www.wartsila.com/docs/default-source/marine-documents/encyclopedia/wartsila-o-marine-encyclopedia.pdf>.



power to the vessel at all times. Power loads for ro-ro vessels average around 1,000 kW at berth and their average hotelling time is approximately 34 hours (Appendix H).

In 2017, approximately 1,000 ro-ro vessels visited California ports and accounted for around 12 percent of the total vessel visits to California. Ro-ro vessels most frequently visit the Ports of Benicia, Hueneme, San Diego, POLA, and POLB.

As shown in Figures I-7 through I-11, ro-ro vessels are projected to account for approximately 5 to 12 percent of the total NO<sub>x</sub>, PM<sub>2.5</sub>, DPM, ROG and GHG emissions from vessel auxiliary engines and boilers at berth statewide.

#### **d) Bulk and General Cargo Vessels**

Bulk and general cargo vessels (Figure I-15) carry material that is not easily placed into containers. These types of vessels typically transport goods such as, rolls of steel, gypsum, mineral ore, fertilizer, wood chips, and grain.

**Figure I-15: Bulk Vessel**



Bulk and general cargo vessels are regularly equipped with cranes, conveyors or other equipment capable of loading or unloading cargo. If no vessel equipment is available for cargo movement, a shore-side crane will be used. At berth, dry bulk vessels may undergo a process called “line-hauling”, where a vessel shifts up and down a berth using the vessel’s mooring lines and an onboard wench. Line-hauling allows for the loading or unloading of a bulk vessel’s hatches in a proportional manner, and this technique is used at berths with a fixed loading arm or spout. Line-hauling is used to properly distribute cargo weight while loading and off-loading; too much cargo loaded into any one hatch without proper weight distribution could cause the vessel to sink.

Any uneven loading to the front or back may cause potential damaging structural stresses on the vessel.<sup>86</sup>

Bulk Vessel Size Classifications by Deadweight Tonnage (DWT):<sup>87</sup>

- Capesize bulk carrier 100,000 DWT and above.
- Panamax bulk carrier 65,000–99,999 DWT.
- Handymax bulk carrier 40,000–64,999 DWT.
- Handysize bulk carrier 10,000–39,999 DWT.

Bulk and general cargo vessels are propelled by a large low-speed diesel engine, and have an average of three medium-speed four stroke auxiliary diesel engines that provide electrical power. Bulk and general cargo vessels' effective at berth power usage averages between 180 kW/hr to 660 kW/hr. Stay times for bulk and general cargo vessels docked at berths in California range between 38 hours and 270 hours (Appendix H).

In 2017, approximately 935 bulk and general cargo vessels visited California ports and accounted for nearly 12 percent of the total vessel visits to California. More than any other vessel category, bulk and general cargo vessels operate on a non-liner service, meaning very few are frequent visitors to California ports. Bulk and general cargo vessels most frequently visit the Ports of Stockton, Richmond, POLA, and POLB.

Bulk and general cargo vessels account for the lowest source of emissions for most pollutants due to the generally low power requirements onboard these types of vessels while at berth. As shown in Figures I-7 through I-11, bulk and general cargo vessels are projected to account for 5 to 9 percent of the total DPM, PM2.5, NOx, ROG, and GHG emissions from vessel auxiliary engines and boilers at berth statewide.

### **e) Tanker Vessels**

Tanker vessels (Figure I-16) are designed to carry liquid or gaseous products. Most tankers have specialized tanks to hold liquids that present a high pollution risk, some of which require special heating/cooling systems. There are many different types of tankers that specialize in the transport of various goods. Tankers carry a wide range of products, including crude oil or other hydrocarbon products, such as Liquid Liquefied

---

<sup>86</sup> International Association of Classification Societies, Bulk Carriers - Guidance and Information on Bulk Cargo Loading and Discharging to Reduce the Likelihood of Over-stressing the Hull Structure, July 2018, [https://safety4sea.com/wp-content/uploads/2018/09/IACS-Guidance-on-Bulk-Cargo-loading-and-discharging-2018\\_07.pdf](https://safety4sea.com/wp-content/uploads/2018/09/IACS-Guidance-on-Bulk-Cargo-loading-and-discharging-2018_07.pdf).

<sup>87</sup> United Nations, Review of Marine Transport, 2018, [https://unctad.org/en/PublicationsLibrary/rmt2018\\_en.pdf](https://unctad.org/en/PublicationsLibrary/rmt2018_en.pdf).

Petroleum Gas (LPG), Liquid Natural Gas (LNG); chemicals, such as ammonia, chlorine, and styrene monomer, asphalt, and even fresh water. Different products require different handling and transport; specialty types of tankers are built for this purpose, and include chemical tankers, crude oil tankers, product tankers, and LNG/LPG carriers.<sup>88</sup>

**Figure I-16: Tanker Vessel**



Tanker Classifications by DWT:

- Seawaymax 10,000 – 60,000.
- Panamax 60,000 – 80,000.
- Aframax 80,000 – 120,000.
- Suezmax 120,000 – 200,000.
- Very Large Crude Carrier (VLCC) 200,000 – 315,000.
- Ultra Large Crude Carrier (ULCC) 315,000 – 520,000.

Tanker vessels operate on liner or tramp schedules. In some rare cases, the oil trading industry owns and operates their own tankers, which they operate in a liner schedule bringing crude oil from Alaska and the Middle East to California refineries. The majority of tankers are operated on tramp schedules, which are unfixed and available on an as-needed basis.

---

<sup>88</sup> California Air Resources Board, Draft Technology Assessment: Ocean-Going Vessels, pg. 68, May 2018, [https://ww3.arb.ca.gov/msprog/tech/techreport/ogv\\_tech\\_report.pdf](https://ww3.arb.ca.gov/msprog/tech/techreport/ogv_tech_report.pdf).

In 2017, over 1,500 tankers visited California ports, accounting for around 20 percent of the total vessel calls to California. Major California ports and terminals tankers frequent include Benicia, Carquinez, El Segundo, Los Angeles, Long Beach, Martinez, and Richmond. Most of this activity supports the operation of California's oil and gas refineries.

Tanker vessels make up the second largest vessel category visiting California and are the largest emitting category not subject to the Existing Regulation. Tanker vessels are projected to represent the largest source of remaining NO<sub>x</sub>, PM<sub>2.5</sub>, DPM, ROG, and GHG emissions for vessels statewide as shown in Figures I-7 through I-11. In 2021, they are projected to account for approximately 37 percent of the total NO<sub>x</sub> emissions, 28 percent of the total DPM emissions, 50 percent of PM<sub>2.5</sub> emissions, 38 percent of ROG emissions, and 51 percent of GHG emissions from vessel auxiliary engines and boilers at berth in California.

### **1) Tanker Operations At Berth**

For many vessels, boilers are primarily operated at or near port. This is because the exhaust heat generated by the main engine at cruising speeds is sufficient for heat exchangers (economizers) to provide necessary heat for operations (except driving steam turbines). Tankers are a special case in that they may have small boilers for heating crude and other uses, and very large boilers used only at dockside to off-load crude or other petroleum products.<sup>89</sup>

Tanker vessels that specialize in transporting crude and LNG/LPG typically have a different design than vessels dedicated to transporting refined products, chemicals, or food grade oils. Crude oil and LNG/LPG tankers generally carry only one type of product, crude oil and LNG/LPG, and are designed so that one pumping system can unload the tanks on the vessel simultaneously. Crude oil is the most common cargo carried by vessels using large auxiliary boilers to produce steam that powers on board pumps used to off-load cargo at marine oil terminals in California, and is typically transported in tanker vessels Panamax size and larger.

### **2) Tanker Off-Loading Characteristics**

Most tankers transporting crude oil typically use auxiliary diesel engines to provide power for lights and ballast pumps while a vessel is at berth, and a boiler powered/steam turbine combination to drive the pump that moves the cargo off the vessel. It is important to note that the majority of the power load requirements for a tanker using steam-powered pumps to off-load cargo is for operating the large auxiliary boiler that produces the steam. As such, the lights and ballast pump activities can be shore powered, but the pumping activities powered by the boiler cannot be. The majority of vessels transporting crude oil use boilers to produce steam that powers

---

<sup>89</sup> California Air Resources Board, Draft Technology Assessment: Ocean-Going Vessels, pg. 68, May 2018, [https://ww3.arb.ca.gov/msprog/tech/techreport/ogv\\_tech\\_report.pdf](https://ww3.arb.ca.gov/msprog/tech/techreport/ogv_tech_report.pdf).

pumps to off-load crude off the vessel, meaning this portion of a tanker's operation cannot be electrified. The auxiliary engine hotelling power load requirements for tankers using steam powered pumps to off-load cargo typically ranges from 1,000 kW to 3,000 kW, while the boiler power load requirements range from 5,000 kW to 6,000 kW. For diesel-electric tankers, where electric motors drive the cargo pumps, the auxiliary engine power load requirements are between 5,000 kW to 6,000 kW. Meanwhile, a product or chemical tanker is designed with a more elaborate pumping system that enables each hatch to be loaded and unloaded independently.<sup>90</sup> Product and chemical tankers can carry refined petroleum products, chemicals, or food grade oils, and typically use steam-driven pumps if Aframax size or larger, and diesel-electric pumps if Panamax or smaller. The remaining subset of tankers use electrically-driven pumps powered by the vessel's auxiliary engine to off-load products.

For tankers with pumps powered by the vessel's auxiliary diesel engines (also called diesel-electric tankers), the diesel auxiliary engines provide the vessel's electrical power needs and product pumping requirements while the vessel is at berth. Many of the product pumps on the vessel are either hydraulically driven or directly connected to the auxiliary engine. Electric motor-driven pumping systems (i.e., diesel-electric) are suitable for shore power, but the hydraulic or direct-drive pumps cannot be shore powered. As with tankers utilizing steam-powered pumps, pumping the cargo from the vessel uses significantly more power than general power consumption for lights and ballast pumps.

### 3) Tanker Vessel Emissions

Tanker vessels are unique in their emissions profile compared to other vessel types, with the majority of tanker emissions resulting from the use of the vessel's auxiliary boiler to power pumps during cargo off-loading. Because these steam-producing boilers operate at a lower temperature and under less pressure than an internal combustion engine (such as the vessel's auxiliary engine), the most significant emissions from tankers are PM<sub>2.5</sub> and GHGs instead of NO<sub>x</sub>. And although PM emissions from boilers are not categorized as DPM due to the differences in combustion processes, CARB staff recognizes that there may be potential exposure-related health impacts from other air pollutants that are released in their operations. The combustion of fossil fuels in boilers has the potential to emit several air toxics both in the particulate and gaseous phases.<sup>91</sup> Some of the constituents of PM<sub>2.5</sub> include toxic trace metals such as mercury, arsenic, nickel, cadmium, and chromium. VOCs, or unburned vapor phase hydrocarbons, are also emitted during the combustion process and may include air toxics such as benzene, toluene, ethylbenzene, xylenes (BTEX), and aldehydes such as formaldehyde. Several of these compounds are known to cause or are

---

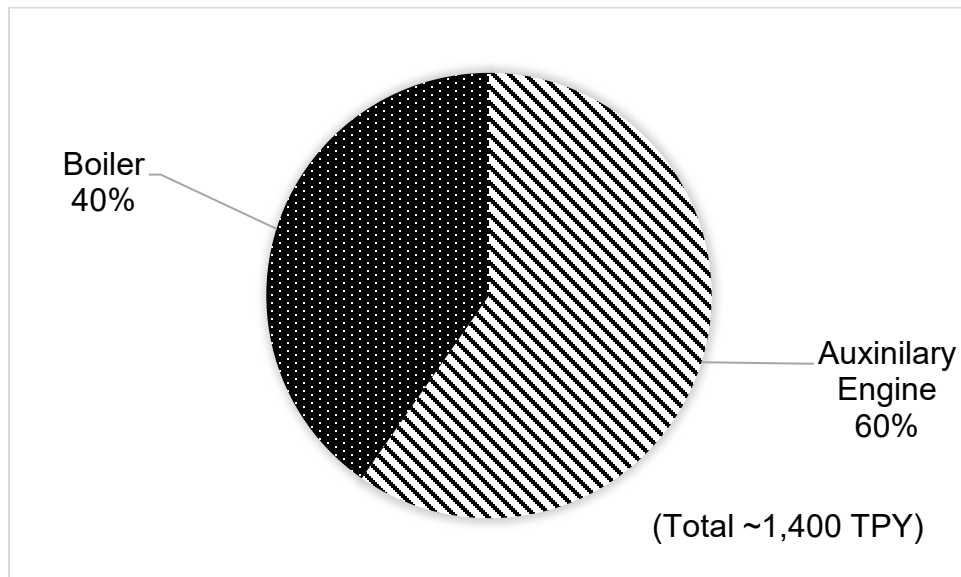
<sup>90</sup> Babicz, J., Wärtsilä Encyclopedia of Ship Technology, 2nd Ed., 2015, <https://www.wartsila.com/docs/default-source/marine-documents/encyclopedia/wartsila-o-marine-encyclopedia.pdf>.

<sup>91</sup> Agrawal, H., Welch, W., Miller, J.W., & Cocker, D., Emission Measurements from a Crude Oil Tanker at Sea, Environmental Science & Technology, Vol. 42, May 28, 2008 <https://pubs.acs.org/doi/pdf/10.1021/es703102y>

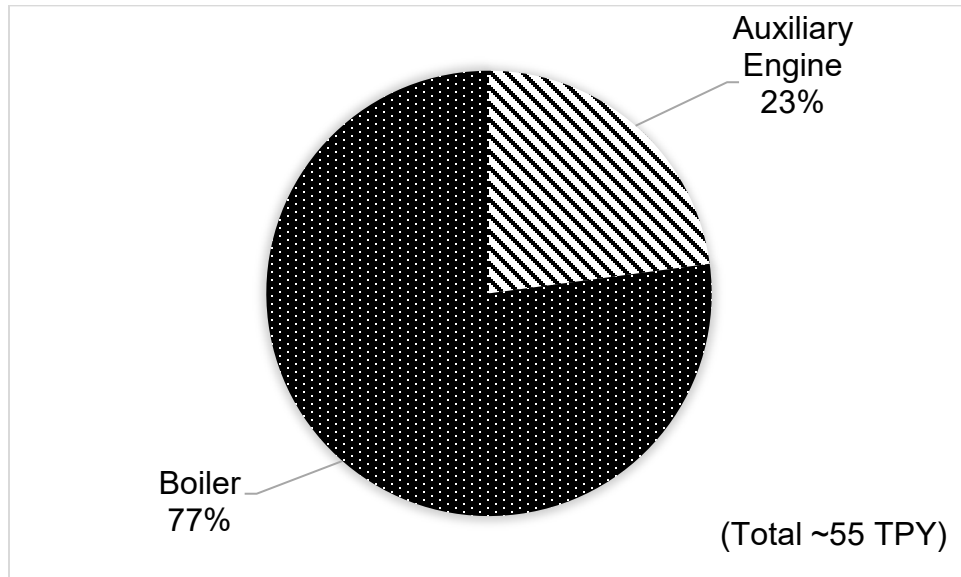
suspected of causing adverse health effects in humans and the environment. The different health risks to surrounding port communities, and the associated health risks from boilers are further detailed in the Health Risk Assessment in Appendix G.

Tanker vessels operate their auxiliary engines for typical hotelling activities at berth similarly to all other vessel types. The loads on these auxiliary engines are typically much smaller than the boilers used for off-loading. The subset of tanker vessels that use diesel-electric pumps in place of boiler steam-powered pumps to off-load product, have higher auxiliary engine loads. Since tanker auxiliary engines emit NOx and DPM, the auxiliary engines on tankers present a health risk to the surrounding communities, regardless of boiler activity on the vessel. The breakdown of tanker vessel auxiliary engine emissions versus boiler emissions projected for 2021 can be seen in Figures I-17 through I-20 (for more detail refer to in Appendix H).

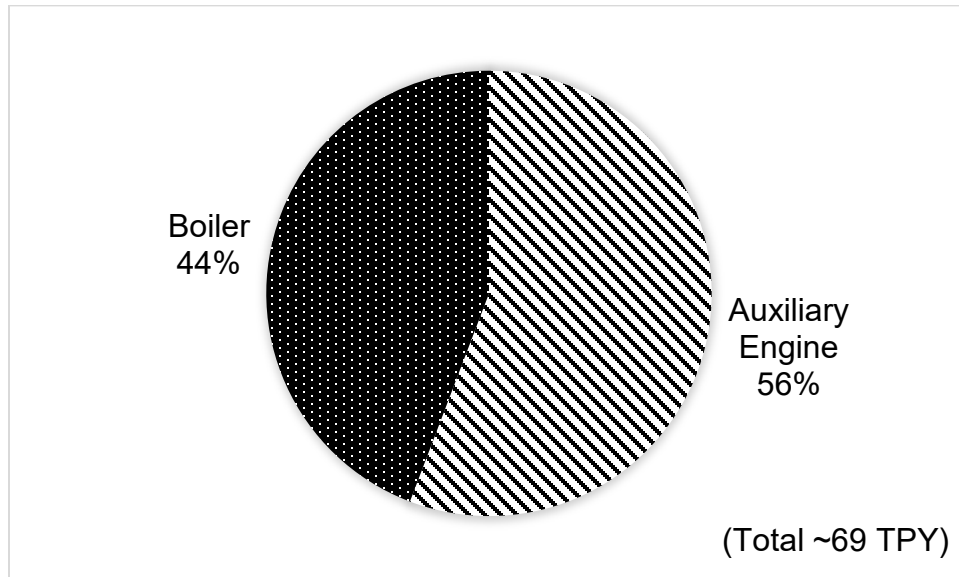
**Figure I-17: 2021 Projected Statewide At Berth NOx Emissions - Tanker Auxiliary Engines vs. Boilers**



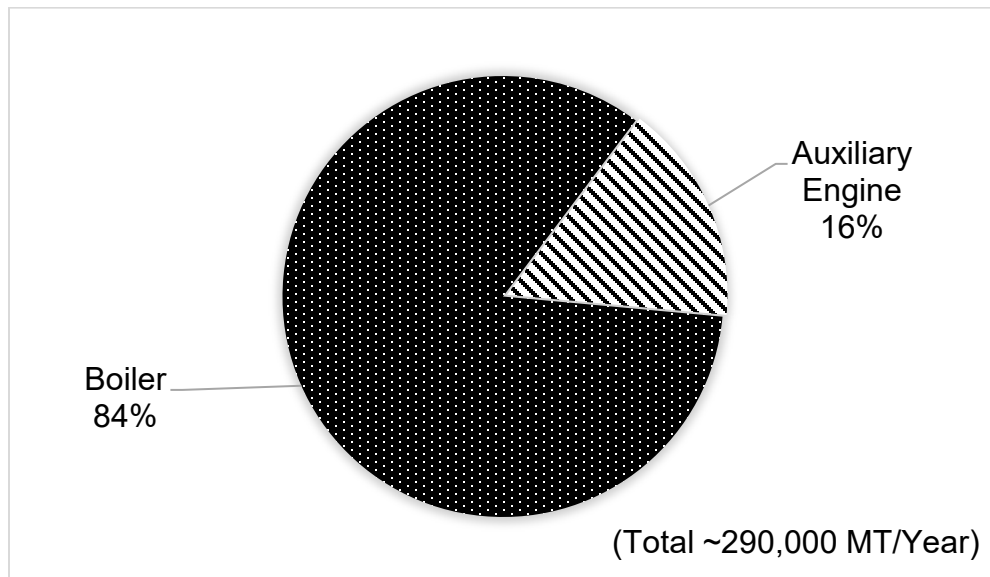
**Figure I-18: 2021 Projected Statewide Tanker Vessel PM2.5 Emissions - Auxiliary Engines vs. Boilers**



**Figure I-19: 2021 Projected Statewide Tanker Vessel ROG Emissions - Auxiliary Engine vs. Boilers**



**Figure I-20: 2021 Projected Statewide Tanker Vessel GHG Emissions - Auxiliary Engine vs. Boilers**



On average, a tanker's auxiliary boiler can require one to several thousand kW of power during pumping operations, while auxiliary power load consumption for regular hotelling operations generally ranges between 700 kW to 1,000 kW per hour (Appendix H). Hotelling times for tankers transporting crude oil range between 5 to 173 hours per visit



and the average berthing time for a product tanker is around 48 hours. While the hotelling times appear long, a single visit by a product tanker to POLA/POLB may include stops at one to three different berths. This hotelling time also includes time necessary for the safety and operations conference, connecting and disconnecting from the shore piping system, and loading ballast as well as discharging the cargo.

## 5. At Berth Emissions Control Strategies

### a) Shore Power

Under this approach, once a vessel is at berth and ready to be worked, the vessel's electrical system is connected to shore-based electrical power ("shore power", as shown in Figure I-21) and the auxiliary engines onboard the vessel are shut down for the duration of that connection. The U.S. Navy pioneered this system decades ago, and a subset of commercial vessels visiting California have been using it since about 2010 under environmental mitigation requirements and CARB's Existing Regulation.<sup>92</sup> Vessels require a range of electrical power when connected. For example, a container vessel may draw 1,000 kW of electricity to replace its auxiliary engine operation at berth, while a large cruise vessel may draw 5,000 kW or more.

**Figure I-21: Vessel Side Shore Power**



Shore power utilizes California's electricity grid, which is expected to increase use of renewable energy sources over the next 10 to 25 years. SB 100 was signed into law in 2018 and requires 60 percent of the State's electricity to come from renewable energy

<sup>92</sup> Mahier, L., Kozma, N., & Chavdarian, P., the First Permitted Cold Ironing Project at the Port of Long Beach, Pier G Phase 2 Wharf, ASCE, 2007.

sources by 2030, with a longer-term requirement of sourcing all State's electricity from carbon-free resources by 2045.<sup>93</sup> All CARB emissions estimates for the Proposed Regulation account for the GHG emissions generated to produce grid power.

Shore power is the gold standard in air pollution control because it eliminates all on-site emissions (of all auxiliary engine pollutants) from a vessel at berth, rather than controlling a portion of those emissions. It also offers the opportunity to significantly reduce GHG emissions because the California grid has a lower carbon footprint than burning liquid fuel onboard the vessel. However, it requires installation of electrical infrastructure both on the vessel and at the berth, as well as union labor to connect and disconnect the two.

Shore power cannot be used in place of boiler operations because boilers are not electrical systems. However, electrically-driven, on-shore pumps can be used to augment or replace boiler operations on tankers to move liquid product to or from a vessel.

CARB staff expects shore power to be the compliance option of choice at container, reefer, and cruise terminals under the Proposed Regulation. Since most vessels fleets have already invested in the vessel side infrastructure to comply with the Existing Regulation, the more they can connect (and save fuel that would otherwise be burned by running the auxiliary engines), the better the return on their investment. Ro-ro and tanker vessels could use shore power, but industry representatives have indicated to CARB staff that they are not prepared to make the vessel side investments because there are far fewer vessels that make regular or frequent calls to California (compared to container, reefer, and cruise vessels on regular or "liner" routes).<sup>94</sup>

## **b) Capture and Control Systems**

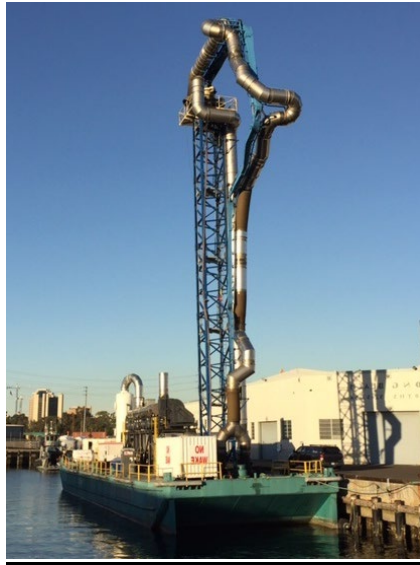
This approach involves a system on a movable barge to capture and control emissions (Figure I-22) from the auxiliary engines (which continue to operate for the full period at berth) and boilers. Once a vessel is at berth and ready to be worked, a tug moves the barge alongside the vessel, a small crane on the barge lifts a duct up and connects it to the top of the vessel's exhaust stack to "capture" the emissions. Then a small engine on the barge creates a vacuum to pull the vessel exhaust through the duct and route it down to pollution "control" technology on the barge. The control element of the system is very similar to control technology that has been in place for many years at stationary sources.

---

<sup>93</sup> CPUC, California Renewables Portfolio Standard (RPS), accessed September 8, 2019, <https://www.cpuc.ca.gov/rps/>.

<sup>94</sup> World Shipping Council, Comment Letter to CARB: Suggestions on Possible California At-Berth Regulation Allowances, Incentives or Operational Considerations, dated July 26, 2018.

**Figure I-22: Barge-Based Capture and Control System**



This compliance option captures emissions from both auxiliary engines and boilers at berth. It reduces emissions of DPM, PM2.5, NOx, ROG, and black carbon. It can result in a slight increase in GHG emissions if a combustion engine is used to power the system. Future versions could be zero-emissions on-site, powered by batteries or fuel cells. These systems are dispatched to reduce emissions from specific vessels based on contracts between vessel fleets and the third-party technology providers. They offer the opportunity to reduce emissions from vessels not equipped for shore power and to back up shore power systems in case of breakdown. The third-party system provider typically has its own staff on the barge to support this operation.

Thus far, CARB staff has issued Executive Orders formally approving two barge-based system designs (by two manufacturers), consistent with the provisions of the Existing Regulation. Approval required “real world” demonstration of the effectiveness of each system in both capturing and controlling emissions on a number of vessels at berth. The calculated performance of the system must consider the emissions from the small engine on the barge. Each system has continuous emissions monitoring to detect any problems with performance over time.

Terminals with wider channels may readily accommodate a barge alongside a vessel at berth, but terminals with narrow channels may not be able to physically fit a barge without blocking navigation in the channel. At many of Northern California’s independent marine terminals, there are also potential constraints resulting from the impacts of tidal flows and from prohibitions on impeding the transit of other vessels in designated shipping lanes (between the supports of an adjacent bridge, for example).

Some ports are also pursuing development of barge-based systems to capture emissions at berth from the bulk and general cargo vessel fleets. This use could

achieve additional emissions reductions to meet environmental mitigation obligations for new port projects or to augment strategies for attainment of air quality standards.

This approach is essentially a land-based version of the barge-based system described above. There is one prototype unit in operation (Figure I-23) that is semi-mobile (the system can be moved along the dock by truck). Once the unit is in place on the dock, the system's articulated arm raises and places the ducting over the vessel stack. The system captures and routes the vessel exhaust emissions from auxiliary engines and boilers to the landside control technology.

**Figure I-23: Land-Based Capture and Control System**



Like the barge-based system, this compliance option would capture emissions from both auxiliary engines and boilers at berth. It reduces emissions of DPM, PM2.5, NOx, ROG, and black carbon. However, it can result in a slight increase in GHG emissions if a combustion engine is used to power the system. Future versions could be zero-emissions on-site, powered by grid electricity, batteries, or fuel cells.

### **c) On board Technologies**

Many control technologies have been effective in reducing emissions of NOx, PM2.5, DPM, ROG, GHG, and black carbon from land-based diesel-fueled engines, but there is still limited use and experience applying these technologies to marine vessel engines. Although there are currently no on board emissions control strategies verified by CARB for marine applications, CARB staff believes they will be developed.

For example, exhaust gas scrubbers are allowed by IMO for as an alternative equivalent to meet the sulfur oxide (SOx) limit requirement. Scrubbers are exhaust after-treatment devices that remove pollutants in the exhaust stream through contact with a sorbent material. While there are both wet and dry types of scrubbers, the designs used for marine vessels are generally wet scrubbers. Wet scrubbers deliver a fine spray of fresh or seawater that mixes with the exhaust gases and dissolves SOx. Scrubbers can also be either an “open” type, a process where water is taken from the sea, used for scrubbing, and treated and discharged back to sea, or can be a “closed” type system,

where freshwater treated with an alkaline chemical such as caustic soda is used for neutralization and scrubbing. Open scrubber systems have faced restrictions, in places such as Singapore, Fujairah, and China, over concerns that these devices pollute the water. The continued use of scrubbers depends on the successful completion of monitoring specified in IMO guidelines, that recommend continuous monitoring and long-term scientific studies to prove they do not negatively affect the environment.

Although these systems are primarily designed to remove SO<sub>x</sub>, they also remove PM and, to a lesser degree, NO<sub>x</sub> emissions. Rigorous emissions reduction tests of scrubber performance have shown SO<sub>x</sub> reductions, similar to manufacturer claims and PM reductions somewhat lower than expected.

#### **d) Alternative Fuels**

Available research indicates that LNG could significantly reduce SO<sub>x</sub>, NO<sub>x</sub>, carbon dioxide (CO<sub>2</sub>), and PM emissions, although methane slip (when methane introduced into the atmosphere when it fails to burn completely or leaking while bunkering) and an increase in GHG emissions can vary depending on the engine type.<sup>95</sup> However, currently there is minimal emissions data available for marine engines running on LNG. As such, CARB staff support and recognize the need for further testing. The Existing Regulation exempts vessels using natural gas in their auxiliary engines from the requirements of the Regulation. In consideration of limited emissions data for LNG as a marine fuel, staff has removed this exemption from the new Proposed Regulation.

### **C. Background of Existing Regulation**

In December 2007, CARB's Board approved the Existing Regulation. All vessels currently subject to the Existing Regulation are required to turn off their diesel auxiliary engines and plug in to a shore-based electrical power system running off California's electricity grid or utilize alternative technologies approved by CARB to achieve comparable emissions reductions. The purpose of the Existing Regulation is to reduce NO<sub>x</sub> and DPM emissions with GHG reductions as a co-benefit.

#### **1. Affected Vessels and Ports**

The Existing Regulation reduces emissions at berth from auxiliary engines on container and reefer vessel fleets making more than 25 visits per calendar year and cruise vessel fleets with more than 5 visits per year to a regulated California port. Six of California's major ports are included in the Existing Regulation: Port of Hueneme, POLA, POLB, Port of Oakland, Port of San Diego, and the Port of San Francisco. No other California ports are included in the Existing Regulation.

---

<sup>95</sup> California Air Resources Board, Draft Technology Assessment: Ocean-Going Vessels, pg. 68, May 2018, [https://ww3.arb.ca.gov/msprog/tech/techreport/ogv\\_tech\\_report.pdf](https://ww3.arb.ca.gov/msprog/tech/techreport/ogv_tech_report.pdf).

## 2. Compliance with Existing Regulation

With the Existing Regulation, vessels operators can choose one of two different pathways to comply: the Reduced Onboard Power Generation option or the Equivalent Emissions Reduction option. The Reduced Onboard Power Generation pathway has two separate requirements:

- A percentage of a fleet's visits have to use shore power.
- A percentage reduction in a fleet's total power usage from the fleet's baseline power usage.

After approval of the Existing Regulation in 2007, fleets had several years to develop and install the necessary shore power infrastructure and equipment needed on vessels and at terminals and ports. Compliance requirements for the Reduced Onboard Power Generation option pathway began in 2014 with 50 percent visit and power reduction requirements. The reduction requirement then increased to 70 percent in 2017, and will increase to 80 percent in 2020, which will represent full implementation of the Existing Regulation.

The Equivalent Emissions Reduction pathway requires a percent of emissions reduction over a fleet's baseline emissions. Fleets following this pathway can comply using shore power or a CARB approved alternative control technology, such as a barge-based capture and control system. Compliance under this option began in 2010 with a 10 percent reduction and phased in to 50 percent in 2014 to match the Reduced Onboard Power pathway. Since 2014, the reduction requirements for both pathways have aligned.

Delays and challenges that fleets experienced with the installation of shore power infrastructure and compliance difficulties that are outside the control of the vessel operator prompted staff to issue three regulatory Marine Advisories.<sup>96</sup> The regulatory Marine Advisories helped provide a path to compliance for vessels who were unable to use or had a delay in connecting to shore power due to circumstances, such as equipment failure, lack of a shore power berths availability, labor delays, etc.

### D. Purpose of the Proposed Regulation

The Proposed Regulation, as discussed in this Staff Report, would supersede the Existing Regulation effective January 1, 2021. The Proposed Regulation seeks to accomplish two main goals: achieve public health and air quality benefits, and address implementation challenges with the Existing Regulation.

---

<sup>96</sup> CARB, Advisories for CARB Airborne Toxic Control Measure for Auxiliary Diesel Engines Operated on Ocean-Going Vessels At-Berth in a California Port, accessed September 8, 2019, <https://www.arb.ca.gov/ports/shorepower/forms/forms.htm>.



The Proposed Regulation would accomplish emissions reduction goals by introducing emissions control requirements to: additional ports and marine terminals that operate independently from a port or port authority, and vessels not covered by the Existing Regulation, including ro-ro and tanker vessels.

## 1. Achieve Public Health and Air Quality Benefits

Existing regulations, port initiatives, and incentive programs have already resulted in emissions reductions from vessels at berth. However, more action is necessary to further reduce DPM and the localized cancer risk in communities surrounding ports and marine terminals, cut NO<sub>x</sub> and PM<sub>2.5</sub> emissions to support regional attainment of health-based air quality standards for ozone and PM<sub>2.5</sub>, and reduce the GHG emissions that contribute to global climate change.

To address these concerns, CARB is acting to further protect public health and reduce the air quality impacts throughout the state by:

- Reducing exposure in communities most impacted by air pollution as required under AB 617.<sup>97</sup>
- Minimizing near-source exposure and health risk from identified toxic air contaminants, including DPM, produced by fuel combustion pursuant to the Toxic Air Contaminant Identification and Control Act, which established California's program to reduce exposure to air toxics.<sup>98,99</sup>
- Attaining the National Ambient Air Quality Standards (NAAQS) for Ozone and PM in all regions of California, as required by the Federal Clean Air Act. The current standards are 80 parts per billion (ppb) 8-hour ozone by 2023, 75 ppb 8-hour ozone by 2031, 12 micrograms per cubic meter annual PM<sub>2.5</sub> by 2021 to 2025, and lastly the new federal ozone standard of 70 ppb with attainment dates through 2037.<sup>100</sup>

---

<sup>97</sup> California Health and Safety Code § 40920.6, 42400, 42402, 39607.1, 40920.8, 42411, 42705.5, and 44391.2, Division 26, Assembly Bill No. 617, Nonvehicular Air Pollution: Criteria Air Pollutants and Toxic Air Contaminants, July 26, 2017,

[https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201720180AB617](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180AB617).

<sup>98</sup> California Health and Safety Code § 36950 - 36975, Assembly Bill No. 1807, 1983,

[https://leginfo.legislature.ca.gov/faces/codes\\_displayText.xhtml?lawCode=HSC&division=26.&title=&part=2.&chapter=3.5.&article=1](https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=HSC&division=26.&title=&part=2.&chapter=3.5.&article=1).

<sup>99</sup> California Air Resources Board, California Air Toxics Program – Background, December 13, 2017 (accessed September 8, 2019), <https://ww3.arb.ca.gov/toxics/background.htm>.

<sup>100</sup> California Air Resources Board, Revised Proposed 2016 State Strategy for the State Implementation Plan, March 7, 2017, <https://www.arb.ca.gov/planning/sip/2016sip/rev2016statesip.pdf>.

- Ensuring vessels at berth and at anchorage are complying with existing opacity standards set forth in California's HSC section 41701 in California's regulated waters.<sup>101</sup>

## **2. Address Implementation Challenges with Existing Regulation**

While implementing the Existing Regulation, CARB staff became aware of numerous operational challenges that make compliance with the visit requirement of the Existing Regulation difficult to achieve in some cases, despite best efforts to comply from vessel crews and operators. Shore power connections require the terminal to provide a shore power capable vessel with an equally equipped shore power capable berth and appropriate labor to connect the vessel in a timely manner. If the terminal fails to provide a shore power connection for any reason, the vessel crew or operator has little recourse. If the vessel operates its auxiliary engines for longer than three hours, a compliant visit is not achievable due to the way the Existing Regulation is constructed.

Some of the main operational issues impacting compliance with the Existing Regulation include:

- Unavailability of shore power berths for shore power equipped vessels.
- Failure to meet the three hour/five hour time limit for connecting and disconnecting due to labor delays, U.S. Customs and Border Protection clearance procedures, and/or other unexpected situations.
- Safe connection of vessels to shore power requires commissioning visits, but no exception exists for these visits in the Existing Regulation.
- Challenge meeting compliance due to short visit calls.

Several changes to the structure of the Existing Regulation are necessary to maximize emissions reductions from currently regulated vessel categories.

---

<sup>101</sup> California Health and Safety Code § 41701, Division 26, General Limitations, 1975, [https://leginfo.legislature.ca.gov/faces/codes\\_displayText.xhtml?lawCode=HSC&division=26.&title=&part=4.&chapter=3.&article=1](https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=HSC&division=26.&title=&part=4.&chapter=3.&article=1).



## II. THE PROBLEM THAT THE PROPOSAL IS INTENDED TO ADDRESS

Communities around California's port complexes bear a disproportionate health burden due to their close proximity to the emissions generated from freight activity associated with the seaports, including truck, train, and vessel traffic in and around the ports. Despite regulations already in place to reduce emissions at seaports, the diesel-powered freight sources that operate in and around California's ports still heavily impact many disadvantaged communities around California ports. To further protect communities most heavily impacted by California's freight sector, additional emissions reductions are necessary at seaports, including emissions from vessels at berth.

Urban growth of coastal regions is expanding significantly not only within California, but also throughout the United States. With over 68 percent of California's population density being within coastal counties there is an ever-increasing need for reductions in maritime sectors. Staff anticipates an increase in cargo shipping activity in upcoming years, which would result in an increase in emissions at California's ports for the foreseeable future, even as the Existing Regulation reaches full implementation.

### A. Need to Reduce Exposure in Impacted Communities

Many of California's port communities are classified as disadvantaged by the California Environmental Protection Agency (CalEPA), using the California Communities Environmental Health Screening Tool (CalEnviroScreen), Version 3.0,<sup>102</sup> developed by the Office of Environmental Health Hazard Assessment. CalEnviroScreen uses various factors to score California communities based on environmental pollution burden and socio-economic indicators. Exposure to DPM is a main contributor to many port communities scoring in the top 10<sup>th</sup> percentile statewide on CalEnviroScreen.

The elevated air pollution burden in these communities can be measured. For example, while exposure to cancer-causing diesel particles has decreased substantially across all communities statewide in California overall, exposure to diesel particles in disadvantaged communities remains on average twice that experienced in non-disadvantaged communities.<sup>103</sup> Emissions from vessels are a significant contributor to air pollution, including toxic DPM, in many impacted port communities.

Since 2005, health analyses conducted to quantify the excess cancer risk posed by the concentration of diesel-fueled engines operating in and around California's ports have consistently shown elevated localized risks to significant numbers of nearby

---

<sup>102</sup> Office of Environmental Health Hazard Assessment, CalEnviroScreen 3.0, June 25, 2018, <https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30>.

<sup>103</sup> CARB, Draft Community Air Protection Blueprint For Selecting Communities, Preparing Community Emissions Reduction Programs, Identifying Statewide Strategies, and Conducting Community Air Monitoring, June 7, 2018, [https://ww2.arb.ca.gov/sites/default/files/2018-06/draft\\_community\\_air\\_protection\\_blueprint.pdf](https://ww2.arb.ca.gov/sites/default/files/2018-06/draft_community_air_protection_blueprint.pdf).

residents.<sup>104,105,106</sup> Because of this, the Board supported staff's recommendation to prioritize additional new controls on vessels at berth due to their significant contribution to public health impacts including localized potential cancer risk.

CARB staff performed a health risk assessment to evaluate the localized cancer risk impacts attributable solely to vessel emissions at berth at three California ports. Staff selected three ports to analyze based on port size, vessel activity, emissions, and proximity to disadvantaged communities. Staff selected POLA and POLB, and combined them in the analysis to represent large ports. The Richmond Complex was selected to represent small ports and tanker marine terminals. POLA and POLB combined represent more than half of the at berth emissions in California, while the Richmond Complex represents the second largest emissions for tanker vessels in California.

The health risk assessment estimates the increase in potential cancer risk that would result from cargo growth under a business-as-usual scenario (Appendix G). The results of the Health Risk Assessment emphasize the need for further emissions reductions from ocean-going vessels to provide public health benefits and reduce the cancer risk burden to communities surrounding ports and marine terminals.

## **1. Cargo Growth Will Increase Emissions**

Staff anticipates an increase in cargo shipping activity in upcoming years, which would result in an increase in emissions at California's ports for the foreseeable future, even as the Existing Regulation reaches full implementation.

A report published by Mercator International in 2016 estimates that cargo activity in the United States will grow 50 percent between 2021 and 2032, as measured in TEUs, with activity at POLA and POLB projected to grow by 57 percent.<sup>107</sup> Based on these growth estimates, CARB staff expect that DPM emissions from vessels at berth would increase by approximately 20 percent statewide through 2032 without additional regulations to reduce emissions. An increase in cargo shipping activity in upcoming years would result in an increase in emissions at California's ports for the foreseeable future, even as the Existing Regulation reaches full implementation.

---

<sup>104</sup> California Air Resources Board, Diesel Particulate Matter Exposure Assessment Study For The Ports Of Los Angeles and Long Beach, April 2006, <https://www.arb.ca.gov/ports/marinevess/documents/portstudy0406.pdf>.

<sup>105</sup> California Air Resources Board, Diesel Particulate Matter Health Risk Assessment For The West Oakland Community, December 2008, <https://ww3.arb.ca.gov/ch/communities/ra/westoakland/documents/westoaklandreport.pdf>.

<sup>106</sup> Air Resources Board, Diesel Particulate Matter Exposure Assessment Study For The Ports Of Los Angeles and Long Beach, April 2006, <https://www.arb.ca.gov/ports/marinevess/documents/portstudy0406.pdf>.

<sup>107</sup> Mercator International LLC, San Pedro Bay Long-term Unconstrained Cargo Forecast, July 12, 2016.

## 2. Need to Reduce NOx, PM, and ROG Emissions

Substantial progress has been achieved in reducing NOx emissions from mobile sources statewide through implementation of CARB's existing programs. These programs are expected to continue providing further emissions reductions through 2031, helping the state to meet necessary air quality standards. However, challenges remain in meeting the ambient air quality standards for ozone and PM2.5 in two areas of the state with the most critical air quality challenges; the South Coast Air Basin and the San Joaquin Valley Air Basin. The South Coast Air Basin has the highest ozone levels in the nation, while the San Joaquin Valley has the greatest PM2.5 challenge. To meet the 2023 and 2031 ambient air quality standards for ozone, the South Coast Air Basin will require an approximate 70 percent NOx reduction by 2023 and an overall 80 percent NOx reduction by 2031.<sup>108</sup>

Since NOx is a precursor to secondary PM2.5 formation, reductions in NOx emissions will also provide benefits for meeting the PM2.5 standards. In addition, in October 2015, the United States Environmental Protection Agency (U.S. EPA) adopted a more stringent 70 ppb ozone standard with an attainment date of 2037. This ozone standard will likely result in additional areas being classified as nonattainment areas, as well as require even further emissions reductions in California's existing nonattainment areas.<sup>109</sup>

Mobile sources, such as cars, trucks, locomotives and off-road equipment (including ocean-going vessels), and the fossil fuels that power them are the largest contributors to the formation of ozone, PM2.5, DPM, and GHG emissions in California. They are responsible for approximately 80 percent of smog-forming NOx emissions, 90 percent of DPM emissions, and nearly 50 percent of GHG emissions. Although engine standards have become more stringent over time, existing equipment tends to remain in operation for a long period of time, which slows the rate of potential emissions reductions.

Under the Clean Air Act, California is required to submit air quality management plans for areas that exceed the health-based NAAQS illustrating how the state will attain the standards by certain dates. As part of the 2016 air quality management plans, CARB included a State Implementation Plan Strategy (SIP) which was approved by U.S. EPA that describes CARB's commitment to achieve the mobile source and consumer products reductions needed to meet federal air quality standards over the next 15 years.<sup>110</sup> The SIP provides CARB's commitment to bring proposed statewide control

---

<sup>108</sup> California Air Resources Board, Staff Report: ARB Review of the 2016 Air Quality Management Plan for the South Coast Air Basin and Coachella Valley, March 7, 2017, [https://ww3.arb.ca.gov/planning/sip/planarea/scabsip/2016aqmp\\_arbstaffreport.pdf](https://ww3.arb.ca.gov/planning/sip/planarea/scabsip/2016aqmp_arbstaffreport.pdf).

<sup>109</sup> California Air Resources Board, Staff Report: ISOR for Proposed Amendments to Emissions Control System Warranty Regulations and Maintenance Provisions for 2022 and Subsequent Model Year On-Road Heavy-Duty Vehicles and Heavy-Duty Engines with Gross Vehicle Weight Greater than 14,000 Pounds and Heavy Duty Diesel Engines in Such Vehicles, May 8, 2018, <https://www.arb.ca.gov/regact/2018/hdwarranty18/isor.pdf>.

<sup>110</sup> California Air Resources Board, Revised Proposed 2016 State Strategy for the State Implementation Plan, March 7, 2017, <https://www.arb.ca.gov/planning/sip/2016sip/rev2016statesip.pdf>.

measures to the Board for adoption and to achieve the NOx and ROG reductions needed for attainment by 2023 and 2031. The Proposed Regulation is one of the control measures that is committed in the SIP to be brought before the Board for adoption to achieve the reductions necessary for the State to attain its ambient air quality standards. Under the SIP, the Proposed Regulation is expected to achieve NOx reductions of 0.3 TPD by 2023 and 1.0 TPD by 2031.

### **3. Need to Reduce Greenhouse Gas and Black Carbon Emissions**

To reduce the mounting impacts of climate change, it is also important to cut emissions of GHG and short-lived climate pollutants such as black carbon from vessels. GHG emissions contribute to the greenhouse effect by absorbing reflected solar energy and warming Earth's atmosphere, contributing to global climate change. Presently, the maritime industry as a whole accounts for around 2 to 3 percent of global GHG emissions, but this percentage is projected to increase by up to 250 percent by 2050 due to industry growth associated with increasing global trade demands.<sup>111</sup> California has set a GHG emissions reduction goal of 40 percent below 1990 levels by 2030.<sup>112</sup> This target is expected to enable California to reach the ultimate goal of reducing emissions by 80 percent under 1990 levels by 2050, and aligns with scientifically established levels to limit global warming below 2 degrees Celsius.<sup>113</sup>

Black carbon (soot) is emitted from burning fuels such as coal, diesel, and biomass, as well as from various forms of non-fuel biomass combustion. Black carbon is classified as a short-lived climate pollutant, a category which also includes methane (CH<sub>4</sub>) and fluorinated gases (F-gases, including hydrofluorocarbons, or HFCs). Short-lived climate pollutants are powerful climate forcers that can have an immediate and powerful impact on climate change, compared to longer-lived GHGs such as CO<sub>2</sub>. Short-lived climate pollutants are estimated to be responsible for about 40 percent of current net climate forcers. SB 605 (Lara, Chapter 523, Statutes of 2014) requires CARB to develop a plan to reduce emissions of short-lived climate pollutants, and SB 1383 (Lara, Chapter 395, Statutes of 2016) requires the Board to approve and begin implementing the plan by January 1, 2018. SB 1383 also sets targets for statewide reductions in short-lived climate pollutant (SLCP) emissions of 40 percent below 2013 levels by 2030 for methane and HFCs, and 50 percent below 2013 levels by 2030 for black carbon.<sup>114</sup>

---

<sup>111</sup> Stefanini, S., Climate Change News, "Countries Inch Towards 'Bare Minimum' Climate Target For Shipping", April 10, 2018, <https://www.climatechangenews.com/2018/04/10/countries-inch-towards-bare-minimum-climate-target-shipping/>.

<sup>112</sup> California Health and Safety Code § 38500 - 38599, Division 25.5, Assembly Bill No. 32, California Global Warming Solutions Act of 2006, September 27, 2006, [http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab\\_0001-0050/ab\\_32\\_bill\\_20060927\\_chaptered.pdf](http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001-0050/ab_32_bill_20060927_chaptered.pdf).

<sup>113</sup> United Nations Climate Change, The Paris Agreement, accessed September 8, 2019, <https://unfccc.int/process/the-paris-agreement/what-is-the-paris-agreement>.

<sup>114</sup> CARB, Short-Lived Climate Pollutant Reduction Strategy, March 2017, [https://ww2.arb.ca.gov/sites/default/files/2018-12/final\\_slcp\\_report%20Final%202017.pdf](https://ww2.arb.ca.gov/sites/default/files/2018-12/final_slcp_report%20Final%202017.pdf).

Since ocean-going vessels burn diesel to power their auxiliary engines, they contribute to statewide black carbon emissions levels.

Climate scientists agree that global warming and other shifts in the climate system observed over the past century are caused by human activities. These recorded changes are occurring at an unprecedented rate.<sup>115</sup> According to new research, unabated GHG emissions could cause sea levels to rise up to ten feet by the end of this century - an outcome that could devastate coastal communities in California and around the world.<sup>116</sup> California is already feeling the effects of climate change, and projections show that these effects will continue and worsen over the coming centuries. The impacts of climate change on California have been documented by the Office of Environmental Health Hazard Assessment (OEHHA) in *Indicators of Climate Change in California*<sup>117</sup>, which details the following changes that are occurring already:

- A recorded increase in annual average temperatures, as well as increases in daily minimum and maximum temperatures.<sup>118</sup>
- An increase in the occurrence of extreme events, including wildfire<sup>119</sup> and heat waves.<sup>120</sup>
- A reduction in spring runoff volumes, as a result of declining snowpack.<sup>121</sup>
- A decrease in winter chill hours, necessary for the production of high-value fruit and nut crops.<sup>122</sup>

---

<sup>115</sup> Cook, J., et al., Consensus on consensus: a synthesis of consensus estimates on human-caused global warming, *Environ. Res. Lett.* 11 (2016) 048002, doi:10.1088/1748-9326/11/4/048002, April 13, 2016, <http://iopscience.iop.org/article/10.1088/1748-9326/11/4/048002/pdf>.

<sup>116</sup> California Ocean Protection Council, *Rising Seas in California: An Update On Sea-Level Rise Science*, April 2017, [www.opc.ca.gov/webmaster/ftp/pdf/docs/rising-seas-in-california-an-update-on-sealevel-rise-science.pdf](http://www.opc.ca.gov/webmaster/ftp/pdf/docs/rising-seas-in-california-an-update-on-sealevel-rise-science.pdf).

<sup>117</sup> Office of Environmental Health Hazard Assessment, *Indicators of Climate Change in California*, May 9 2018, <https://oehha.ca.gov/media/downloads/climate-change/report/2018caindicatorsreportmay2018.pdf>

<sup>118</sup> Office of Environmental Health Hazard Assessment, *Indicators of Climate Change in California*, May 9 2018, page S-4, <https://oehha.ca.gov/media/downloads/climate-change/report/2018caindicatorsreportmay2018.pdf>.

<sup>119</sup> Office of Environmental Health Hazard Assessment, *Indicators of Climate Change in California*, May 9 2018, page 185, <https://oehha.ca.gov/media/downloads/climate-change/report/2018caindicatorsreportmay2018.pdf>.

<sup>120</sup> Office of Environmental Health Hazard Assessment, *Indicators of Climate Change in California*, May 9 2018, page 62, <https://oehha.ca.gov/media/downloads/climate-change/report/2018caindicatorsreportmay2018.pdf>.

<sup>121</sup> Office of Environmental Health Hazard Assessment, *Indicators of Climate Change in California*, May 9 2018, page 109, <https://oehha.ca.gov/media/downloads/climate-change/report/2018caindicatorsreportmay2018.pdf>.

<sup>122</sup> Office of Environmental Health Hazard Assessment, *Indicators of Climate Change in California*, May 9 2018, page S-5, <https://oehha.ca.gov/media/downloads/climate-change/report/2018caindicatorsreportmay2018.pdf>.

- Changes in the timing and location of species sightings.

The Proposed Regulation would help to achieve California's goals in reducing both GHG emissions and short-lived climate pollutants by limiting auxiliary diesel engine emissions from vessels at berth.

## **B. State Policy and Plans Direct CARB to Secure Further Reductions From Vessels At Berth**

State agencies over recent years have made numerous plans and commitments to reduce air pollution from freight sources.

### **1. Assembly Bill 32/Senate Bill 32**

In 2006, California enacted AB 32 to address global climate change by requiring cost-effective reductions in GHG emissions and by codifying a target of reducing California GHG emissions to 1990 levels by 2020. AB 32 directed CARB to continue its leadership role on climate change and to develop a scoping plan identifying integrated and cost-effective regional, national, and international GHG reduction programs.<sup>123</sup> In 2015, Governor Brown issued Executive Order (EO) B-30-15,<sup>124</sup> which set a goal of reducing statewide GHG emissions to 40 percent below 1990 levels by 2030. In 2016, the Legislature passed, and Governor Brown signed, SB 32, which codified the 40 percent reduction goal from 1990 levels by 2030.<sup>125</sup>

### **2. Sustainable Freight Pathways to Zero and Near-Zero Discussion Document**

In April 2015, CARB released the "*Sustainable Freight Pathways to Zero and Near-Zero Discussion Document* (Discussion Document)"<sup>126</sup> in response to Board Resolution 14-2,<sup>127</sup> which directed CARB to engage with stakeholders to identify and prioritize actions to move California toward a sustainable freight transport system. The Discussion Document set out CARB's vision of a clean freight system, and listed immediate and potential near-term CARB actions that staff would develop for future Board consideration. The near-term CARB measures identified in the Discussion Document included amending the Existing Regulation to include other vessel types to achieve additional emissions reductions.

---

<sup>123</sup> California Health and Safety Code § 38500 - 38599, Division 25.5, Assembly Bill No. 32, California Global Warming Solutions Act of 2006, September 27, 2006, [http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab\\_0001-0050/ab\\_32\\_bill\\_20060927\\_chaptered.pdf](http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001-0050/ab_32_bill_20060927_chaptered.pdf)

<sup>124</sup> Executive Order B-30-15, April 29, 2015, <https://www.ca.gov/archive/gov39/2015/07/17/news19046/>.

<sup>125</sup> California Health and Safety Code § 38566, Division 25.5, Senate Bill No. 32, September 8, 2016, [https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160SB32](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB32).

<sup>126</sup> California Air Resources Board, Sustainable Freight Pathways to Zero and Near-Zero Emissions Discussion Document, April 23, 2015, <https://www.arb.ca.gov/gmp/sfti/sustainable-freight-pathways-to-zero-and-near-zero-emissions-discussion-document.pdf>.

<sup>127</sup> California Air Resources Board, Board Resolution 14-2, Sustainable Freight Strategy Update, January 23, 2014, <https://arb.ca.gov/board/res/2014/res14-2.pdf>.



### **3. Executive Order B-32-15**

In July 2015, EO B-32-15 directed the secretaries of the California State Transportation Agency, CalEPA, and Natural Resources Agency to lead other relevant State departments in developing an integrated action plan by July 2016 that "establishes clear targets to improve freight efficiency, transition to zero-emissions technologies, and increase competitiveness of California's freight system." In response to the directive, California State Transportation Agency, California Environmental Protection Agency, Natural Resources Agency, California Air Resources Board, California Department of Transportation, California Energy Commission, and Governor's Office of Business and Economic Development developed the "California Sustainable Freight Action Plan".<sup>128</sup> The plan identifies strategies and actions to achieve a sustainable freight transportation system that meets California's environmental, energy, mobility, safety and economic needs. The plan also identifies and initiates corridor-level freight pilot projects within the State's primary trade corridors that integrate advanced technologies, alternative fuels, freight and fuel infrastructure, and local economic development opportunities. The 2016 California Sustainable Freight Action Plan includes strengthening the Existing Regulation as a State agency action to advance the objectives of the EO and the Sustainable Freight Action Plan.

### **4. 2016 State Strategy for the State Implementation Plan**

On May 16, 2016, CARB staff released the 2016 State Strategy for the State Implementation Plan (SIP), which described CARB's proposed commitment to achieve the mobile source and consumer products reductions needed to meet federal air quality standards over the next 15 years.<sup>129</sup> Federal clean air laws require areas with unhealthy levels of ozone, PM (includes both PM2.5 and PM10), CO2, NOx, and SOx to develop SIPs. SIPs describe how an area will attain NAAQS. As part of the "Proposed Measures: Off-Road Federal and International Sources", amendments to, or redevelopment of the Existing Regulation, were identified as a prospective measure to further reduce emissions from vessels that visit California ports. The proposed measure directs CARB staff to consider increasing reductions by including additional vessel fleets, types, and operations. CARB staff are proceeding with the Proposed Regulation in order to accomplish these goals on a much broader scope than the Existing Regulation would be able to achieve.

---

<sup>128</sup> California Department of Transportation et al., California Sustainable Freight Action Plan, Appendix C, July 2016.

<sup>129</sup> California Air Resources Board, Revised Proposed 2016 State Strategy for the State Implementation Plan, March 7, 2017, <https://www.arb.ca.gov/planning/sip/2016sip/rev2016statesip.pdf>.

## 5. Assembly Bill 617

The State of California has also recently placed additional emphasis on protecting local communities from harmful effects of air pollution through the passage of AB 617<sup>130</sup> (Garcia, Chapter 136, Statutes of 2017). AB 617 is a significant piece of air quality legislation that highlights the need for further emissions reductions in communities with high exposure burdens, such as those near ports. Additional information on AB 617 and its impact on the At Berth Regulation can be found in Chapter VII (Environmental Justice). AB 617 requires CARB to pursue new community-focused and community-driven actions to reduce air pollution and improve public health in communities that experience disproportionate burdens from exposure to air pollutants. In response to AB 617, CARB created the Community Air Protection Program (CAPP). CAPP is tasked with achieving emissions reductions in disproportionately burdened communities as directed by AB 617, and includes new statewide actions as a core element of the program. These statewide actions reflect a coordinated suite of strategies including new regulations, new incentive grant funding, and new exposure reduction resources and tools. The Proposed Regulation described in this Staff Report for cleaner vessel operations while at ports is one of the new statewide regulatory measures that is included under the CAPP to help reduce air pollution in impacted communities. Several of the ports included in the Proposed Regulation are located in and around communities identified by CAPP as priority for the deployment of community air monitoring systems and/or community emissions reduction programs. Those port communities identified as priority include Richmond, West Oakland, San Diego Portside Environmental Justice Neighborhoods (Barrio Logan, West National City, Logan Heights, and Sherman Heights), Wilmington, and West Long Beach.<sup>131</sup>

## 6. March 2017 Addendum to Board Resolutions 17-7 and 17-8

As part of the March 23, 2017, Addendum to Board resolutions 17-7 and 17-8, CARB staff were directed to consider changes to the Existing Regulation that achieve up to 100 percent compliance by 2030 for Los Angeles Ports and Ports that are in or adjacent to areas in the top 10 percent of those defined as most impacted by CalEnviroScreen.<sup>132,133</sup>

---

<sup>130</sup> California Health and Safety Code § 40920.6, 42400, 42402, 39607.1, 40920.8, 42411, 42705.5, and 44391.2, Division 26, Assembly Bill No. 617, Nonvehicular Air Pollution: Criteria Air Pollutants and Toxic Air Contaminants, July 26, 2017,

[https://leginfo.ca.gov/faces/billNavClient.xhtml?bill\\_id=201720180AB617](https://leginfo.ca.gov/faces/billNavClient.xhtml?bill_id=201720180AB617).

<sup>131</sup> California Air Resources Board, Community Recommendations Staff Report, Revised September 11, 2018, [https://ww2.arb.ca.gov/sites/default/files/2018-09/2018\\_community\\_recommendations\\_staff\\_report\\_revised\\_september\\_11.pdf](https://ww2.arb.ca.gov/sites/default/files/2018-09/2018_community_recommendations_staff_report_revised_september_11.pdf).

<sup>132</sup> California Air Resources Board, Addendum to Resolution No. 17-7 and 17-8, March 23, 2017, <https://ww3.arb.ca.gov/board/res/2017/addendum17-8.pdf>.

<sup>133</sup> California Air Resources Board, Addendum to Resolution No. 17-7 and 17-8, March 23, 2017, <https://ww3.arb.ca.gov/board/res/2017/addendum17-8.pdf>.



### C. Implementation Challenges with the Existing Regulation

While implementing the Existing Regulation, CARB staff became aware of numerous operational challenges that can make compliance with the visit requirement of the Existing Regulation difficult to achieve in some cases. Shore power connections require the terminal to provide a shore power capable vessel with a shore power capable berth, and appropriate labor to connect the vessel in a timely manner. When the terminal fails to provide a shore power connection for any reason, including during long-term construction projects or equipment repairs, the vessel crew or operator has little recourse if the vessel is unable to meet their compliance obligations. If a vessel fleet frequently experiences delays connecting to shore power or a capture and control system at berth and operates its auxiliary engines for longer than three hours, compliance may be difficult to achieve under the Existing Regulation.

The Existing Regulation requires regulated vessel fleets to: 1) reduce emissions via shore power or a CARB approved alternative technology for a specified percentage of a fleet's visits, and 2) reduce power used at berth by the same percentage. Several definitions and provisions in the Existing Regulation may not allow for vessel operators to easily meeting compliance obligations in all situations. Some of the main challenges that regulated vessel fleets have expressed with the Existing Regulation are:

- Unavailability of a shore power berth for shore power equipped vessels.
- Difficulty meeting the three hour/five hour time limit for connecting and disconnecting due to other parties' actions (labor delays, U.S. Customs and Border Protection clearance procedures), and other unexpected situations.
- Reduced Onboard Power Generation Option does not allow vessels to use an approved alternative control technology or a CARB approved testing plan to comply with the Existing Regulation.
- Commissioning visits are required by safety as per international regulations, yet do not count as a compliant visit under the Existing Regulation.
- Quarterly basis for compliance requirements.
- Challenge meeting compliance due to short visit calls.

All of these concerns from stakeholders regarding compliance have been discussed with CARB staff at numerous meetings over several years of regulation implementation. As a result, staff issued three regulatory Marine Advisories in 2013, 2015, and 2017 to address the operational challenges seen in the Existing Regulation, and inform affected fleets of how enforcement would proceed.<sup>134</sup> The Marine Advisories helped vessels

---

<sup>134</sup> CARB, Advisories for CARB Airborne Toxic Control Measure for Auxiliary Diesel Engines Operated on Ocean-Going Vessels At-Berth in a California Port, accessed September 8, 2019, <https://www.arb.ca.gov/ports/shorepower/forms/forms.htm>.

achieve compliance in some situations where some of the visit requirements may not be met, but the overall power reduction (and resulting emissions reductions) were achieved.

## **1. Shore Power Berth Availability and Positioning**

Arriving at a regulated California port and not having access to a shore power berth has proven to be a challenge for connecting some vessels to shore power. Shore power unavailability can result from various operational issues including scheduling conflicts, shore power equipment misalignment, and vessel-side or shore-side equipment failures. In the Existing Regulation, staff anticipated that vessel requirements alone would put enough pressure on the ports and terminals to ultimately provide the infrastructure that the vessels needed. This resulted in the Existing Regulation being structured in a way that put all the requirements on the vessels, with no direct responsibilities on the ports and/or terminals. However, the implementation of the Existing Regulation quickly proved that a shore power connection is a multi-party process that takes several key players to make it successful. The lack of direct accountability on the ports and terminals has played a role in missed opportunities for vessels to use shore power, representing emissions reductions that otherwise could have been achieved. While many ports, terminals, and State agencies have spent millions of dollars on infrastructure at California berths, there remains numerous operational challenges in successful shore power connections for many vessels.

### **a) Berth Positioning**

One common issue reported by container and reefer fleets that prevents a shore power connection and can result in a noncompliant visit occurs when a vessel is berthed on a side or in a position which the vessel's shore power equipment cannot reach the shore-side connection. Berth positioning issues are complex and can be affected by harbor pilots, terminal operations, and even the size and number of vessels calling at a terminal.

In order to connect to shore-side power, vessels need to have vessel-side shore power equipment on board; this can be installed as a retrofit on existing vessels or installed on new build vessels. Vessel-side shore power equipment consists of an additional electrical switchboard, cables connecting it to the vessel's main switchboard, a step-down transformer in many cases, and sometimes a cable management system if the terminal does not provide it.<sup>135</sup> On most vessels, the vessel-side shore power equipment is typically put inside a standard forty-foot container box, also called an Alternative Marine Power (AMP) box, to protect the sensitive electrical equipment from the harsh marine environment while the vessel is at sea. In the case of AMP boxes, the cables are lowered from the vessel to the shore-side and plugged into a vault located on the berth. Lowering of the cable from the vessel requires accuracy in alignment with the vault on the berth, as the high voltage cable cannot be swung or moved horizontally

---

<sup>135</sup> ABB, Shore-to-Ship Power, Reprinted April 2010, <https://library.e.abb.com/public/8f916bbe49d92d1ac12579680032f273/Shore-to-ship-power-2010-low.pdf>.

from the vessel. This adds a challenge in lining up the vessel to the shore power vault and successfully connecting.

Cruise vessels use a slightly different system. The high voltage cables are typically kept on the berth, and a crane is used to raise the cables into place, which are then plugged into a vault on board the vessel.

With both types of vessel-side shore power, the AMP box or on board shore power vault is typically installed only on one side of the vessel due to the extra cost associated with installing equipment on both sides. With shore power equipment on only one side of a vessel, this often presents an additional berthing position challenge to have the vessel be on the correct side and in the correct position to ensure the cables are properly aligned with the vault.

### **b) Vessel Size Changes**

Another part of the berthing position challenge results from changing vessel sizes. When the original infrastructure was installed for compliance with the Existing Regulation, infrastructure was installed in specific ways at different terminals to serve the vessels calling those berths. However, the industry has undergone significant changes over the past decade, with the largest container vessel size doubling from around 11,000 TEUs in 2006 to over 22,000 TEUs by 2018.<sup>136</sup> These larger vessels take up more space at a berth, causing difficulties with alignment in positioning vessels at berth.

CARB staff has engaged throughout the implementation of the Existing Regulation with both vessel operators and terminal operators about the berthing position issue. Vessel fleet operators have informed CARB staff that terminal operators have influence where the vessel will berth. At times, this decision can place the vessel in a position where plugging into shore power is impossible because the shore power equipment is on the opposite side from the berth, or a poor alignment that does not allow the cables to reach the shore-side vault. Berth positioning can also be affected by congestion at the berths, and delayed departures of vessels occupying the scheduled shore power berth. These challenges stress the importance of both parties working together to achieve a successful shore power visit.

## **2. Three/Five Hour Rule**

In an effort to ensure shore power was connected and disconnected in a timely manner with maximum emissions reductions achieved, the Existing Regulation required a time limits for the amount of time auxiliary engines could operate during visit. These time limits are three hours for synchronous power transfers and a maximum of five hours for non-synchronous power transfers. Synchronous power transfer is where the vessel-based power is switched over to the shore-based power without a loss in power,

---

<sup>136</sup> World Shipping Council, Container Ship Design, accessed October 18, 2018, <http://www.worldshipping.org/about-the-industry/liner-ships/container-ship-design>.

while non-synchronous power transfer involves a period of time when the auxiliary engine is powered down.

However, many shore power vessel visits are failing to meet this three/five-hour time limit due to delays lowering the gangway, securing the vessel, waiting for clearance from U.S. Customs and Border Protection, or waiting for labor to connect and disconnect the vessel.

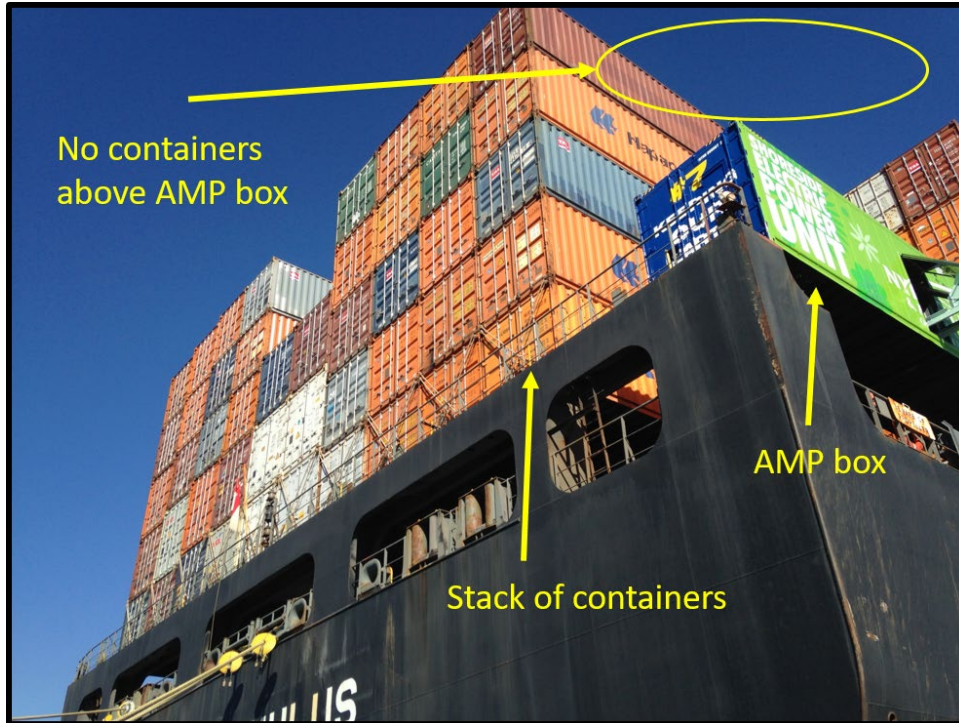
There is also an additional time constraint for vessels using a removable AMP box that is lifted on and off the vessel at the beginning and end of a vessel's visit, respectively. These removable AMP boxes are often referred to as "lift-on/lift-off" AMP boxes. Lift-on/lift-off AMP boxes typically use the same type of equipment as fixed AMP boxes used for shore power connections, except for the AMP box is removable. When not being used to connect a vessel to shore power, the lift-on/lift-off AMP box is typically housed at the terminal and does not travel on board the vessel. This allows for one AMP box to service many different shore power capable vessels.

#### **a) Lift On-Lift Off AMP Box**

Vessels using lift-on/lift-off AMP boxes require the AMP box to be lifted on board by terminal labor and connected to the vessel before it can connect to shorepower. At the end of a vessel's visit, the AMP box must then also be disconnected and removed from the vessel before departure. Vessels who use a lift-on/lift-off AMP box often store containers in the reserved space for the AMP box. As such, prior to loading the AMP box onto the vessel at the beginning of a visit, terminal labor must first off-load any containers occupying the AMP box space. The amount of time this process takes can depend on many factors, including how many containers need to be moved out of the way and how quickly labor is available to move the containers and position the AMP box. As such, using lift-on/lift-off AMP box often results in vessels not being able to meet the three/five hour time limit, even if no unforeseen incidents occur.

Figure II-1 shows an example of an AMP box on the aft (or rear) of a container vessel. On a vessel with a lift-on/lift-off AMP box, a stack of containers would likely be stored where this AMP box is located, and would have to be removed while the vessel was at berth in order to connect the AMP box to plug into shore power.

**Figure II-1: Example of a Container Vessel AMP Box Positioning**



Typically, visits that experience issues meeting the three/five-hour time limit are often ultimately able to successfully connect to shore power and achieve emissions reductions. However, due to not meeting the three/five-hour time limit, these visits are considered noncompliant under the visit requirement which has proven problematic for fleets trying to obtain compliance with the Existing Regulation as it was written.

### **3. Compliance Using CARB Approved Emissions Control Strategies**

Another challenge that staff are addressing with the Proposed Regulation is the issue of the Reduced Onboard Power Generation pathway not allowing for approved alternative control technologies as an option for compliance with the Existing Regulation. As detailed in Chapter I, the Existing Regulation was structured with vessel fleets required to pick one of two options: 1) Reduced Onboard Power Generation option, or 2) Equivalent Emissions Reduction option. For fleets that chose the Reduced Onboard Power Generation option, they are required to use shore power for their compliance requirements. For fleets that chose the Equivalent Emissions Reduction option, they may use shore power or a CARB approved alternative control technology for compliance. The challenge for fleets following the Reduced Onboard Power Generation path is that they do not have the option to use another emissions control strategy when shore power is unavailable.

#### **4. Required Commissioning Visits**

Commissioning of a shore power vessel is undertaken to ensure that the vessel is compatible with the shore-side power hardware and that there are no safety issues for both the equipment and the personnel handling the connection. Commissioning requirements can vary between ports, but generally, the first visit made by a shore power capable vessel to a terminal will involve commissioning of the vessel's shore power equipment. Some terminals will accept vessels that have successfully commissioned at other California ports, but some require terminal or port specific commissioning visits. Commissioning in most cases can usually be executed on one visit, however sometimes there are situations that require the commissioning to be performed on a subsequent visit such as if the commissioning wasn't completed successfully, or if the terminal requests additional commissioning for their safety protocols. The Existing Regulation does not have a provision for vessel commissioning.

#### **5. Quarterly Visit Requirement**

The Existing Regulation includes a dual requirement for a percentage of fleet's visits to be controlled and a percent power reduction requirement. Both percent requirements are averaged on a quarterly basis for affected vessel fleets. Meeting a quarterly compliance period has presented a hardship for many fleets due to vessel redeployment and scheduling changes,<sup>137</sup> making the average visit and overall power reduction requirements on a quarterly basis very difficult to meet.

The structure of the Existing Regulation, required vessel fleets to report compliance annually on March 1 of the following calendar year (i.e., for 2018 calendar year visits, the annual compliance report was due to CARB staff by March 1, 2019). As a result, fleet compliance is often left uncertain for several months until CARB enforcement staff receives and audits the annual data.

#### **6. Short Visit Difficulties**

Vessel fleets that make short visits to California ports can have difficulty meeting the percent power reduction requirement necessary for compliance. For example, at Port of Oakland, typical stays for container vessels are shorter compared to the stays for container vessels at POLA and POLB.<sup>138,139</sup> This is largely due to a difference in the amount of cargo that is loaded/off-loaded at the different ports. Short stays also affect certain vessel types in particular, such as small reefer vessels that carry perishable

---

<sup>137</sup> Vessel redeployment (the moving of a vessel from one service or port rotation to another) and schedule changes occur for a wide variety of reasons, including vessels going to dry-dock for maintenance or repairs, extra vessels needed due to increased cargo demands, and weather or congestion events that may restrict a vessel from calling an originally intended port.

<sup>138</sup> Port of Oakland, Maritime e-News, April 2017,

<https://www.portofoakland.com/files/PDF/newsroom/Maritime%20Newsletter%20-%20April%202017.pdf>.

<sup>139</sup> Starcrest Consulting Group, LLC, Port of Los Angeles Inventory of Air Emissions - 2016, July 2017,

[https://kentico.portoflosangeles.org/getmedia/880bc597-84bc-4ae6-94e2-59a2e6027f42/2017\\_Air\\_Emissions\\_Inventory](https://kentico.portoflosangeles.org/getmedia/880bc597-84bc-4ae6-94e2-59a2e6027f42/2017_Air_Emissions_Inventory).

goods or cruise vessels, which bring passengers to port for a day trip. Regardless of the reason, when a vessel's total visit time at berth is short, the time necessary to connect and disconnect from shore power will make up a fairly large percent of that vessel's visit time, shortening the period of time the vessel is connected to shore power relative to the overall stay time. This results in a lower percentage reduction in power and/or emissions, which makes it harder to achieve the average annual percent reduction requirement for fleets.

Once the requirement increases to 80 percent in 2020, it may become even more difficult for fleets with mostly short visits to California ports to achieve compliance, even if all visits meet the three/five hour rule and the vessel/fleet controls emissions for the entirety of their stay. As an example, if a fleet only has vessel visits with 10 hours or less stay time, and it takes 3 hours to connect/disconnect the vessels to shore power with synchronous power transfer, then the maximum reduction that fleet can get on any of their visits is 70 percent, which would not allow them to achieve the 80 percent fleet requirement. In these short visit cases, it is extremely challenging for fleets to comply with the existing power reduction requirement in the Existing Regulation.

In the Proposed Regulation this is addressed by removing the percent power reduction requirement for compliance.

Compliance requirements under the Proposed Regulation are based on visits using a CARB approved emissions control strategy while at berth. CARB approved emissions control strategies would be required to achieve a reduction of at least 80 percent in emissions to ensure that the necessary emissions reductions at berth are achieved.



### III. DESCRIPTION OF THE PROPOSED REGULATION

CARB staff propose that the Board approve adoption of the Proposed Regulation, pursuant to its authority under HSC sections 39660 et seq. and 43013 et seq., which would apply to the emissions from auxiliary engines on ocean-going vessels docked at California ports, as well as auxiliary boilers for tanker vessels using boilers to power steam-driven pumps for off-loading cargoes while at berth.<sup>140,141</sup> The Proposed Regulation would supersede the Existing Regulation effective January 1, 2021.

The Proposed Regulation was drafted to replace and change the structure of the Existing Regulation. The Proposed Regulation would achieve further emissions reductions and assist with challenges in meeting compliance obligations due to operational difficulties that were unforeseeable at the time the Existing Regulation was written. The need for achieving additional emissions reductions and the operational challenges with the Existing Regulation are discussed in detail in Chapter II of this Staff Report.

The Proposed Regulation would achieve additional emissions reductions through an increase in the number of controlled visits from the currently regulated vessel categories (container, reefer, and cruise vessels) and through the inclusion of new vessel categories (ro-ro and tankers) and subsequent new ports and independent marine terminals. The overall strategy of the Proposed Regulation relies on a blend of existing emissions control technologies and new technologies, including stationary emissions control technologies that are in the process of being adapted for use in a marine environment.

The following sections in this chapter provide a summary of the Proposed Regulation. The specific purpose and rationale for the adoption of each section of the Proposed Regulation will be discussed in depth in Chapter IV.

#### A. Emissions Reduction Goal

The primary goal of the Proposed Regulation is to reduce NO<sub>x</sub>, DPM, PM<sub>2.5</sub>, ROG, GHG and black carbon emissions from vessels at berth in California ports to reduce the health burdens on California's port communities. The health impacts and associated need for these emissions reductions are discussed in Chapter II. To accomplish the necessary reductions, specific vessels and terminals would be required to reduce emissions from auxiliary engines while at regulated berths in California through use of a CARB approved emissions control strategy. Certain tanker vessels would also be required to control emissions from boilers used to off-load cargo while at berth. Vessels

---

<sup>140</sup> California Health and Safety Code § 39660 et seq., Division 26, Identification of Toxic Air Contaminants, 1983,  
[https://leginfo.ca.gov/faces/codes\\_displayText.xhtml?lawCode=HSC&division=26.&title=&part=2.&chapter=3.5.&article=3](https://leginfo.ca.gov/faces/codes_displayText.xhtml?lawCode=HSC&division=26.&title=&part=2.&chapter=3.5.&article=3).

<sup>141</sup> California Health and Safety Code § 43013, Division 26, General Provisions, 1975,  
[https://leginfo.ca.gov/faces/codes\\_displaySection.xhtml?lawCode=HSC&sectionNum=43013](https://leginfo.ca.gov/faces/codes_displaySection.xhtml?lawCode=HSC&sectionNum=43013).



with the assistance of terminals may reduce emissions at berth using any strategy that works best for the vessel and/or terminal operations (including shore power, barge- or land-based capture and control, onboard technology, etc.), as long as the strategy receives CARB approval.

## **1. Auxiliary Engine Control Requirements**

For an emissions control strategy to receive CARB approval, the technology (or combination of technologies) must achieve at least an 80 percent reduction of DPM, PM2.5, NOx, and ROG emissions from the default emissions rates of auxiliary engines on ocean-going vessels.<sup>142</sup> The strategies would also reduce black carbon emissions through the reduction in DPM, as black carbon is a component of DPM. To receive CARB approval, the GHG emissions of a control strategy must be less than or equal to using grid electricity to power the system (referred to in this Staff Report as “grid-neutral”). For the purposes of the Proposed Regulation, grid-neutral is defined as emitting no more GHG emissions than if the strategy were powered by the California grid as represented in the most recent eGRID Summary Table for State Output Emissions Rates<sup>143</sup> as the California Carbon Dioxide Equivalents (CO2e) emissions rate.

The Proposed Regulation is projected to see a decrease in overall GHG emissions as a result of increased use of shore power. Expanded use of alternative CARB approved emissions control strategies such as capture and control systems are anticipated to result in a reduction of black carbon emissions, which is considered a major contributor to global climate change.<sup>144</sup> Section 93130.5 of the Proposed Regulation text (Appendix A) includes detailed criteria for obtaining CARB approval of an emissions control strategy.

## **2. Tanker Boiler Control Requirements**

Certain tanker vessels using steam-driven pumps to off-load products must also achieve an 80 percent reduction from the default emissions rates for tanker auxiliary boilers, unless the vessel is complying with the Proposed Regulation using shore power for its auxiliary engines.<sup>145</sup> Shore power cannot reduce emissions from boilers, but gets the highest level of reductions of GHGs and cancer-causing DPM emitted from the auxiliary engine; as such, the Proposed Regulation provides an alternative pathway to comply by utilizing shore power in lieu of reducing auxiliary boiler emissions for tanker vessels.

---

<sup>142</sup> The default emission rates for NOx, PM2.5, DPM, and ROG for auxiliary engines for all vessel categories can be found in Section 93130.5 of the regulation text (Appendix A of this Staff Report).

<sup>143</sup> U.S. EPA, eGRID Summary Tables 2016, February 15, 2018, [https://www.epa.gov/sites/production/files/2018-02/documents/egrid2016\\_summarytables.pdf](https://www.epa.gov/sites/production/files/2018-02/documents/egrid2016_summarytables.pdf).

<sup>144</sup> Center for Climate and Energy Solutions, What Is Black Carbon?, April 2010, <https://www.c2es.org/document/what-is-black-carbon/>.

<sup>145</sup> The default emission rates for NOx, PM2.5, DPM, and ROG for tanker auxiliary boilers can be found in Section 93130.5 of the proposed Regulation Order (Appendix A of this Staff Report).

As discussed in Chapter I, most ocean-going vessels have small on board auxiliary boilers that do not significantly contribute to the emissions profile of an ocean-going vessel at berth. On the other hand, tanker vessels using on board auxiliary boilers to off-load cargo have significantly higher boiler power usage at berth. Table III-1 shows average hotelling loads at berth for all vessel types (Appendix H).

**Table III-1: Average Auxiliary Engine and Boiler Load At Berth By Vessel Type**

| <b>Vessel Type</b> | <b>Average Auxiliary Engine Load At Berth (kW)</b> | <b>Average Boiler Load At Berth (kW)</b> |
|--------------------|--|--|
| Bulk/General Cargo | 284  | 132                                      |
| Ro-Ro              | 1,122  | 309                                      |
| Container/Reefer   | 1,060  | 565                                      |
| Cruise             | 5,620  | 612                                      |
| Tanker             | 932  | 3,132                                    |

As shown in Table III-1, tanker boiler loads while at berth are considerably higher on average than any of the other vessel categories. Table III-2 shows a breakdown of average boiler load for tanker vessels specifically, based on vessel size (see Appendix H). CARB staff assumed tanker vessels typically use steam-driven pumps if the vessels are Aframax size or larger (likely crude oil carriers), and diesel-electric pumps if the vessels are Panamax size or smaller (likely to be carrying non-crude oil products).

**Table III-2: Tanker Vessel Average Auxiliary Engine and Boiler Load At Berth By Size Classification**

| <b>Tanker Vessel Size Classification</b> | <b>Average Auxiliary Engine Load At Berth (kW)</b> | <b>Average Boiler Load At Berth (kW)</b> |
|--|--|--|
| Seawaymax                                | 784  | 2,050                                    |
| Panamax                                  | 654  | 3,102                                    |
| Aframax                                  | 724  | 4,735                                    |
| Suezmax                                  | 2,509  | 5,293                                    |
| VLCC                                     | 1,171  | 6,000                                    |
| ULCC                                     | 1,171  | 6,000                                    |

Table III-2 highlights that tankers using boilers to off-load cargo have a significantly higher average boiler load while at berth. As a result, CARB staff is proposing boiler emissions control requirements only for tankers using auxiliary boilers to off-load cargo (unless the tanker vessel is using shore power to control emissions from its auxiliary engines).

## **B. Affected Vessel Categories**

The Proposed Regulation aims to reduce auxiliary engine emissions from container, reefer, cruise, ro-ro, and tanker vessels, and emissions from certain tanker boilers, while at berth when visiting terminals that exceed vessel category-specific thresholds, which will be discussed in Section C of this chapter.

The Proposed Regulation would apply to every container, reefer, cruise, ro-ro, and tanker visit calling a regulated terminal in California, regardless of the number of vessel visits made. This structure is an “every vessel, every visit” approach that would result in increased emissions reductions through the inclusion of new vessel categories and the inclusion of previously exempt small container, reefer, and cruise vessel fleets that call at the six already regulated ports. In addition, individual vessel-based compliance would also ensure faster compliance determination for regulated entities.

### **1. Exclusion of Bulk and General Cargo Vessels from Control Requirement**

Bulk and general cargo vessels and associated berths, terminals, and ports receiving only bulk and/or general cargo vessels are not subject to the at berth emissions control requirements associated with the Proposed Regulation. The decision to exclude bulk and general cargo vessels from control requirements is due to a combination of factors, including low emissions’ contribution when compared to other vessel categories, high costs, and complicating factors for controlling emissions while at berth.

Firstly, bulk cargo vessels generally have low power requirements at berth as seen in Table III-1. This low-power demand is largely because bulk vessels often utilize on-shore cranes (which are covered under other CARB diesel regulations) for off-loading cargo. This results in minimal power needs for the vessel, and consequently, low emissions. Some bulk vessels and general cargo vessels have onboard cranes for off-loading, with higher power loads, however, the number of these vessels visiting California is relatively small. Despite accounting for nearly 12 percent of the total vessel visits to California in 2017, bulk and general cargo vessels made up the smallest amount of collective statewide emissions for any ocean-going vessel category, as shown in Chapter I, Figures I-7 through I-11.

Secondly, bulk and general cargo vessels also call a number of small ports in California, and typically carry low-value cargos, such as aggregates or bulk dry grains. Due to the nature of the cargo that bulk and general cargo vessels carry, their operations are more volatile than other vessel categories and visit activity is more likely to be subject to market fluctuations.<sup>146</sup> Geopolitical factors can also impact the nature and amount of bulk cargo being imported and exported through California ports. For example, an

---

<sup>146</sup> Qu, L., Analysis on the Volatility of Global Dry Bulk Shipping Market, 2013-2014 (accessed September 6, 2019), <https://thesis.eur.nl/pub/41212/Qu-L.-Bullwhip-Effect-Research-on-Global-Dry-Bulk-Maritime-Market.pdf>

economic downturn in California led the Mitsubishi cement bulk terminal at POLB to stop receiving vessel visits completely in 2010, and ongoing tariffs on steel import/export ports may result in a significant decline in visit activity to California's bulk ports.<sup>147, 148</sup>

Bulk and general cargo vessels also tend to be on tramper-type schedules, with a majority not making multiple return trips to California. For example, according to 2017 CSLC data, bulk vessels visiting California ports for a single visit made up 58 percent of all bulk and general cargo visits. This compares to around 12 percent of container and reefer vessels, 20 percent of cruise vessels, 23 percent of ro-ro vessels, and 37 percent of tanker vessels from the same 2017 calendar year.<sup>149</sup>

Some bulk cargo vessels also face operational challenges at berth due to the way in which cargo is loaded on and off the vessel, particularly those vessels carrying dry bulk goods. As discussed in Chapter I, some dry bulk vessels load and off-load cargo using a technique called "line-hauling", where a bulk vessel uses an onboard winch to pull the vessel along the wharf face using the lines tied to the dock. Line-hauling may be performed multiple times during a vessel's stay at a port, and would make connecting to shore power or a capture and control system difficult, as the connection would have to be interrupted every time the vessel shifted along the berth. CARB staff was unable to obtain statistics on the percentage of bulk vessel visits that utilize line-hauling, however the practice and associated complications were noted by multiple industry stakeholders during public workshops, and the need for line-hauling was demonstrated to CARB staff during tours and site visits to bulk terminals across California.

After substantial analysis, CARB staff determined that due to the combined factors listed above, bulk and general cargo vessels make a poor candidate for controlling emissions at berth with this rulemaking. However, these two vessel categories are not exempt from the overall regulation, as they still have reporting requirements and opacity requirements at berth and anchor.<sup>150</sup>

---

<sup>147</sup> Cement Americas, Mitsubishi Cement to Reopen Long Beach Terminal, July 1, 2015, <http://www.cementamericas.com/cement-scope/1023-mitsubishi-cement-to-reopen-long-beach-terminal.html>.

<sup>148</sup> Zarroli, J., For One California Company, Trump's Tariffs Have Unintended Consequences, NPR, April 19, 2018, <https://www.npr.org/2018/04/19/603298380/for-one-california-company-trumps-tariffs-have-unintended-consequences>.

<sup>149</sup> California State Lands Commission, 2017 Vessel Visit Database.

<sup>150</sup> Opacity and vessel reporting requirements are detailed in Sections 93130.6 and 93130.7(e)(4) of the proposed Regulation Order (Appendix A).

### C. Affected Ports and Marine Terminals

With the Existing Regulation, six specific ports are identified as having emissions control requirements, which limited potential for future expansion of the Existing Regulation to non-defined ports, even if a significant growth in activity occurred. The Proposed Regulation would instead use a terminal-based visit threshold to determine which ports and independent marine terminals have emissions control obligations at their berths. As a result, any terminal that exceeds the visit threshold would have control requirements under the Proposed Regulation. For vessels, any container, reefer, cruise, ro-ro, or tanker vessel visiting a regulated terminal would have requirements to reduce emissions while at that berth.

The Proposed regulation would place requirements on any container, reefer, cruise, ro-ro, or tanker terminal in California that receives 20 or more visits from any of these specific vessel types, as shown in

Table III-3. If the terminal visit threshold is exceeded, then all berths at that specific terminal are included in the Proposed Regulation.

**Table III-3: California Terminal Thresholds**

| <b>Vessel Type</b>   | <b>Annual Terminal Threshold</b> |
|----------------------|----------------------------------|
| Container and Reefer | 20 or more visits                |
| Cruise               | 20 or more visits                |
| Ro-Ro                | 20 or more visits                |
| Tanker               | 20 or more visits                |

Table III-4 shows the ports and independent marine terminals projected to be included in the Proposed Regulation for each vessel category, based on the proposed 20 visit threshold.

**Table III-4: Ports and Independent Marine Terminals Anticipated to be Included in Proposed Regulation By Vessel Type**

| Vessel Category  | Ports and Independent Marine Terminals  |
|------------------|---|
| Container/Reefer | Hueneme, Long Beach, Los Angeles, Oakland, San Diego  |
| Cruise           | Long Beach, Los Angeles, San Diego, San Francisco   |
| Ro-Ro            | Hueneme, Carquinez-Benicia Terminal, Long Beach, Los Angeles, Richmond, San Diego, San Francisco  |
| Tanker           | Carquinez Area Marine Oil Terminals, Long Beach, Los Angeles, Richmond (including Richmond Long Wharf), Rodeo Area Marine Oil Terminals, Stockton |

To develop the terminal thresholds, CARB staff gathered visit activity from CSLC and Port Wharfing data from calendar year 2017, which represented the most up-to-date visit information available to staff at the time of the analysis. CARB staff explored multiple thresholds for the different vessel types during the regulatory development process, and after careful evaluation, is proposing a 20-visit terminal threshold for all vessel categories. Setting a 20-visit terminal threshold for the Proposed Regulation also ensures all the currently regulated ports still have control requirements. This preserves emissions reductions, which are already occurring in the currently regulated port communities, and prevents emissions control equipment investments that are already in use at ports for compliance with the Existing Regulation from becoming stranded assets.

At some smaller operating ports, such as the Port of Stockton, berths may not be separated into terminals. In these cases, berths may be offered for lease from the Port directly to vessel operators rather than arranging a lease through a terminal operator. For these arrangements, the Proposed Regulation would define berths leased directly to specific customers to act as terminals, making them subject to the terminal visit threshold. The goal of this provision is to allow smaller operating ports to prioritize the purchase of emissions control technologies for their high activity berths.

One exception of note, the terminal threshold does not include off-shore anchorage-only port calls for cruise or tanker vessels, such as Catalina Island or Santa Barbara for cruise vessels or El Segundo for tanker vessels. Cruise vessels stopping at anchorage locations drop anchor in a specified location off-shore, and use tender boats to ferry passengers ashore; this can allow cruise vessels to visit ports where the water depth is too shallow or the berth infrastructure does not exist to support large cruise vessels.<sup>151</sup> For tankers, off-shore sites such as El Segundo allow vessels to anchor at sea and use

<sup>151</sup> Kosciolk, A., Docked vs. Tendered: Two Ways to Get Ashore, Cruise critic, August 21, 2018, <https://www.cruisecritic.com/articles.cfm?ID=1900>.

underwater pipes to off-load cargo from the vessel.<sup>152</sup> Anchorage locations are not considered for control requirements, as there is typically little to no wharf infrastructure available to support emissions control equipment. Anchorage locations can be located off-shore around a mile to a mile and a half, and are subsequently subject to harsher weather conditions, including higher wind speeds and wave heights than vessels at berth, which can make connecting to emissions control technologies difficult, if not impossible.

The 20-visit terminal threshold includes the largest active container, reefer, cruise, ro-ro, and tanker terminals in California, with the exception of anchorage-only ports of call including Avalon-Catalina and El Segundo. As terminal visits decrease, so does the cost effectiveness of installing emissions control equipment, as there are fewer vessels calling the terminal to use the equipment and to help recoup the costs of installing, operating, and maintaining the equipment. Thus, the 20-visit threshold is designed to be the most health protective option while also reducing cost impacts on the state's smallest terminals, where visit activity and health impacts to surrounding communities are lowest. A detailed list of anticipated terminals and berths that CARB staff expect to be included in the Proposed Regulation can be found in the document titled "Berth Level CARB Staff Analysis of Potential Emissions Reduction Strategies" (Berth Analysis) located in Appendix E. CARB staff also used this list of anticipated terminals and berths to analyze cost impacts for the Standardized Regulatory Impact Assessment, which is included in Appendix C-1.

Specific ports and terminals subject to control requirements may vary over the years as vessel visit activity changes with the economy. The Proposed Regulation would ensure that terminals that are increasing in vessel activity, and consequently placing a higher health burden on nearby communities, would be included in the Proposed Regulation automatically after exceeding the thresholds for two consecutive years. This ensures that terminals that are planning to grow their business must also plan how to reduce the emissions impact and associated health risks to their nearby communities at the same time. Once a terminal has been subject to control requirements as part of the Proposed Regulation, then the terminal will remain subject to regulatory control requirements even if a drop in activity occurs to prevent terminals from fluctuating in and out of the visit threshold. This "once in, always in" concept also helps to protect against stranded assets in the future; if a terminal spends the money to install expensive emissions control equipment, this provision provides assurance that the equipment will continue to be used.

#### **D. Implementation Timeline**

The Proposed Regulation would supersede the Existing Regulation on January 1, 2021, and would phase vessels into the Proposed Regulation from 2021 through 2029, as shown in Table III-5:

---

<sup>152</sup> Marine Exchange of Southern California, Executive Summaries of Terminal Operations Manuals for Offshore Marine Terminals - Appendix F, August 31, 2015.

**Table III-5: Implementation Schedule**

| <b>2021</b>                   | <b>2025</b> | <b>2027</b>                   | <b>2029</b>                             |
|-------------------------------|-------------|-------------------------------|---|
| Container, Reefer, and Cruise |             |                               |   |
|                               | Ro-ro       |                               |   |
|                               |             | Tankers - POLA/POLB Terminals |   |
|                               |             |                               | Tankers – Remaining Statewide Terminals |

Currently unregulated container, reefer, and cruise vessels in fleets that have not been subject to the Existing Regulation as of December 31, 2020, would receive an exception for control requirement until January 1, 2023. This provision would allow additional time for vessel-side infrastructure build out and/or time to procure an alternative emissions control system.

### **1. Developing the Implementation Schedule**

CARB staff undertook two major analyses in order to develop the proposed implementation dates in Table III-3. Staff undertook an extensive analysis of the berths anticipated to be included in the Proposed Regulation based on the proposed terminal visit threshold. The analysis included an assessment on what additional shore power infrastructure improvements and potential emissions control technologies (land- or barge-based alternative capture and control systems) would be necessary to support the Proposed Regulation for container, reefer, cruise, ro-ro, and tanker vessels. This document is titled the CARB Staff Analysis of Potential Emissions Reduction Strategies by Port/Terminal/Berth (Berth Analysis) and can be found in Appendix E).

For the development of the Berth Analysis, CARB staff relied on numerous sources, including:

- Port maps.
- Google Earth maps.
- Vessel visit information from Wharfinger, San Francisco Marine Exchange, and CSLC Commission data.



- Comment letters received from industry stakeholders in response to the regulatory concepts released during the regulatory process (including public workshops, workgroup meetings, etc.).
- Numerous port/terminal site visits and tours.
- Extensive discussions with terminal operators, port staff, and harbor pilots servicing the Northern and Southern California Ports.

The Berth Analysis was a crucial document in framing the development of the implementation timeline for the Proposed Regulation. The Berth Analysis contains CARB staff's best assumptions of likely compliance pathways for different vessel types at specific terminals and the projected timeframe that these projects can be accomplished in. It is critical to note that any of the assumptions made in the Berth Analysis do not in any way limit a vessel or terminal's compliance pathways, but were used as best estimates to assess potential costs and timeframes.

In addition to the Berth Analysis, CARB staff also closely analyzed numerous project timelines for shore power installations, barge- and land-based capture and control system development and deployment schedules, and wharf infrastructure projects (including Marine Oil Terminal Engineering and Maintenance Standards<sup>153</sup> (MOTEMS) compliance upgrades). During this analysis, staff was able to identify general steps that these times of infrastructure development projects must follow when installing an emissions control technology at a berth. The process varies greatly depending on the type of control equipment being installed, as well as the location of the terminal and the vessel category the system will be used on.

## **2. Container, Reefer, and Cruise Implementation Dates**

Starting the Proposed Regulation requirements for container, reefer, and cruise vessels that are subject to the Existing Regulation in 2021 is critical, as it would shift currently regulated vessels as quickly as possible to the new regulatory structure. This would address the implementation challenges (as mentioned in Chapter II).

When evaluating the earliest feasible phase-in date for container, reefer, and cruise vessels, CARB staff used the Berth Analysis to determine that minimal additional infrastructure would be required to support the increased regulatory requirements. No new ports or terminals receiving container and/or reefer vessels are expected to be subject to control requirements beyond what is already covered under the Existing Regulation. A result of the Existing Regulation, significant shore power infrastructure is already in place at all of the container, reefer, and cruise terminals that staff anticipated being subject to the Proposed Regulation. Also, because most container, reefer, and cruise vessel fleets calling California are subject to the Existing Regulation, operators of these vessel fleets have already installed shore power infrastructure on a large majority of the vessels visiting the State's regulated ports.

---

<sup>153</sup> California State Lands Commission, Marine Oil Terminal Engineering and Maintenance Standards (MOTEMS), accessed September 8, 2019. <https://slc.ca.gov/motems/>.

Table III-6 shows the number of increased vessel calls with control requirements as a result of the Proposed Regulation, based on vessel visit activity data gathered from the CSLC.<sup>154</sup>

**Table III-6: Number of Increased Vessel Calls With Control Requirements as a Result of the Proposed Regulation (Based on 2017 Vessel Visit Activity)**

| <b>Vessel Type/Port</b> | <b>Existing Regulation</b> | <b>Proposed Regulation</b> | <b>New Visits With Control Requirements</b> |
|-------------------------|----------------------------|----------------------------|---|
| <b>Container/Reefer</b> | <b>3281</b>                | <b>3528</b>                | <b>252</b>                                  |
| Hueneme                 | 108                        | 108                        | 0   |
| POLB                    | 809                        | 854                        | 45  |
| POLA                    | 959                        | 1039                       | 80  |
| Oakland                 | 1354                       | 1481                       | 127   |
| San Diego               | 51                         | 51                         | 0   |
| <b>Cruise</b>           | <b>447</b>                 | <b>477</b>                 | <b>30</b>                                   |
| POLB                    | 256                        | 256                        | 0   |
| POLA                    | 85                         | 85                         | 0   |
| San Diego               | 56                         | 70                         | 14  |
| San Francisco           | 50                         | 66                         | 16  |

\*These estimates do not reflect the inclusion of TIEs, VIEs or remediation or any additional Proposition 1B requirements.

CARB staff do recognize there are a small number of container, reefer, and cruise vessels (around 36 total in 2017) that are in fleets not subject to the Existing Regulation, and those vessels may require additional time to install shore power equipment or procure an alternative CARB approved emissions control strategy in order to comply with the Proposed Regulation. As such, staff propose providing an exception until January 1, 2023 to vessels that were not part of a regulated fleet before January 1, 2021 and have never been subject to the 2014 to 2020 requirements of the Existing Regulation.

<sup>154</sup> California State Lands Commission, 2017 Vessel Visit Database.

### **a) Proposition 1B Funded Berths**

Infrastructure at 44 of the existing container and reefer berths were paid for using CARB administered Proposition 1B<sup>155</sup> funds in support of the Existing Regulation, which represents nearly three quarters of the 61 container and reefer berths statewide anticipated to be included in the Proposed Regulation based on the proposed visit thresholds. Any berth that received Proposition 1B funding is required to connect at a higher rate than the requirements of the Existing Regulation. Cruise berths were not eligible for Proposition 1B fund, as the monies were limited to berths moving cargo. Any berth that received Proposition 1B is required to plug in 90 percent of all vessel visits in 2020, which is 10 percent higher than the requirement under the Existing Regulation. Information on which berths with existing infrastructure were funded by Proposition 1B can be found in CARB staff's Berth Analysis (Appendix E).

The large amount of existing infrastructure that already exists at the Ports that are subject to the Existing Regulation, combined with the additional percentage requirements that exist for Proposition 1B funded berths as of 2020, were the primary reasons behind CARB staff's decision to bring the currently regulated vessels (container, reefer, and cruise) into the new proposed regulatory structure, starting January 1, 2021.

### **b) Terminal Operator Conversations**

Part of CARB staff's process for determining the amount of infrastructure needed to comply with the Proposed Regulation involved conversations with multiple terminal operators at POLA, POLB, and Oakland who currently receive visits from regulated vessels. Terminal operators are generally responsible for the daily operations at a port, including scheduling which berth a vessel will call at. CARB staff asked terminal operators about their existing shore power infrastructure, and if they believed additional infrastructure (such as vaults or cable management reels) would be required to meet the proposed regulatory requirements. The majority of terminal operators expressed to CARB staff that the shore power infrastructure already in existence would be sufficient to connect every vessel, except for a few additional or re-positioned vaults and potentially a few cable management systems to help with flexibility. Because terminal operators are the parties actually making the connections to shore power, CARB staff weighted these conversations with the terminal operators heavily in determining the earliest feasible implementation date for the already regulated vessel categories.

---

<sup>155</sup> Proposition 1B was a ballot proposition passed by voters in 2006. It authorized the state to sell \$20 billion in bonds to fund transportation related projects including the movement of goods and \$1 billion was allocated to reduce emissions from goods movement. Proposition 1B funding has been awarded for shore-side infrastructure/control equipment costs at container-vessel and refrigerated-cargo vessel terminals. Source: California Air Resources Board, Shore Power Frequently Asked Questions (FAQ), accessed September 8, 2019, <https://www.arb.ca.gov/ports/shorepower/faq/faq.htm#45>.

### **c) Ports of Los Angeles and Long Beach Infrastructure Analysis**

POLA and POLB performed infrastructure analyses and submitted a joint public comment letter, which expressed the opinion that CARB staff's Berth Analysis under-represented the amount of infrastructure needed at each port to comply with the Proposed Regulation. Port analyses estimate that at container terminals 42 new vaults (in addition to the 75 already in place) and 22 cable management systems would be necessary to handle the increased requirements of the Proposed Regulation, and that the necessary infrastructure could not be completed until late 2025.<sup>156</sup> The Ports' analyses also stated that least 26 barge-based systems would be needed between the two ports to connect 95 percent of container/reefer vessel calls, assuming visit activity remains similar to 2017.

In light of the existing Proposition 1B requirements and conversations with terminal operators discussed above, CARB staff had different findings compared to the Ports' assessments regarding the amount of infrastructure that needs to be installed to move from connecting 80 percent or 90 percent of visits (for Proposition 1B funded berths) in 2020 to every visit in 2021. After multiple conversations with Port staff, CARB staff understand the infrastructure challenges with regard to construction timing facing the Ports in the face of a January 1, 2021 effective date. However, instead of delaying implementation dates, CARB staff have provided flexibility in the form of Terminal Incident Events (TIE) and Vessel Incident Events (VIE), which give terminals and fleets a higher percentage of visit exceptions for the initial four years of the Proposed Regulation.

### **d) Alternatives to Shore Power**

There are currently two existing barge-based capture and control systems approved for use at POLA and POLB (AMECS<sup>157</sup> and METS-1<sup>158</sup> systems). A small subset of newly regulated and infrequent visiting container vessels visiting POLA and POLB may rely on alternative control technologies such as these capture and control systems (described in Chapter I) to comply with the Proposed Regulation, as shore power may be cost prohibitive if the vessel does not make frequent calls to ports that require the use of shore power. Due to the small number of newly anticipated vessel visits that are considered infrequent, only one additional barge-based system at POLA and POLB is anticipated by staff for the container/reefer sector based on CARB staff's Berth Analysis (Appendix E). The existing and future potential systems are primarily projected to be used for vessels with no shore power equipment installed, as well as during times where a vessel or terminal's shore power equipment may not be operational.

---

<sup>156</sup> Ports of Long Beach and Los Angeles comment letters to CARB: Port of Los Angeles and Port of Long Beach comments on Proposed Draft Regulatory Language, "Control Measure for Ocean-Going Vessels Operating At Berth and At Anchor", dated February 6, 2019 and May 20, 2019.

<sup>157</sup> Advanced Maritime Emissions Control System (AMECS), Advanced Environmental Group, accessed September 8, 2019, <http://advancedemissioncontrol.com/>

<sup>158</sup> Maritime Emissions Treatment System, Clean Air Engineering, accessed September 8, 2019, <http://caemaritime.com/>.

Cruise vessels have a considerably higher power load than container and reefer vessels as discussed in Chapter I, which would likely significantly increase the size and cost of a capture and control system required to control emissions from the vessel's exhaust stack. Industry stakeholders have expressed aesthetic and passenger safety concerns that have resulted in the industry largely choosing shore power as a compliance pathway over capture and control systems. As such, cruise vessels are not anticipated to use capture and control systems and only shore power installations were evaluated for the feasibility of cruise vessel implementation dates.

### **3. Ro-Ro Implementation Date**

Ro-ro vessels are scheduled to phase into the Proposed Regulation beginning on January 1, 2025. When considering the implementation date for ro-ro vessels, CARB staff assessed both technical and operational feasibilities of control technologies for ro-ro vessels, along with conversations with vessel operators, terminal operators, and Port staff.

#### **a) Shore Power Use On Ro-Ro Vessels**

Shore power is technically feasible for ro-ro vessels, and is in use in Northern Europe for combination passenger/ro-ro vessels. However, in CARB staff conversations with industry, the majority of ro-ro vessels that call California are used as part of a global fleet and operations differ from container, reefer, and cruise vessels in that they travel on a global route and are not on a dedicated loop (e.g., going back and forth multiple times to shore power-equipped berths).<sup>159</sup> This means that to utilize shore power, every vessel in a fleet would have to be retrofitted for shore power to maintain maximum flexibility. Shore power installations would also require significant electrical infrastructure upgrades. Most ro-ro terminals resemble large parking lots and do not have a large amount of existing electrical equipment at the wharf (whereas container/reefer berths have equipment such as electric gantry cranes and reefer plugs, and thus have some element of existing electric infrastructure, even where shore power is not installed). Figure III-1 shows an example of the type of minimalistic wharf a ro-ro vessel visits; because all of the cargo onboard is on wheels, the cargo is rolled off the vessel, and no additional electrical equipment is needed on the shore-side to off-load.

---

<sup>159</sup> World Shipping Council, Comment Letter to CARB: Suggestions on Possible California At-Berth Regulation Allowances, Incentives or Operational Considerations, dated July 26, 2018.

**Figure III-1: Ro-Ro Vessel At Berth**



Based on the above and conversations CARB staff have had with industry stakeholders, staff anticipates that capture and control systems (a mixture of both barge- and land-based) will be the primary pathway for compliance for ro-ro vessels. However, CARB staff's evaluation of existing shore power installations (which typically are completed in about 5 years) indicate that the timeline would accommodate the use of shore power.

### **b) Development of Capture and Control Systems for Ro-Ro Vessels**

In order to set the implementation date for ro-ro vessels, CARB staff evaluated the timelines for developing existing capture and control systems, both barge- and land-based, in order to project the amount of time needed to design, build, install and test systems for a ro-ro terminal. Projects staff evaluated the existing barge-based capture and control systems at POLA and POLB (METS-1 and AMECS systems), as well as the ShoreKat land-based capture and control system in demonstration at POLA at the time of this Staff Report, as part of the Green Omni Terminal Demonstration Project.<sup>160</sup>

Staff analyzed the amount of time it took for capture and control system manufacturers to design and build the system, submit a test plan for CARB approval, apply for and receive the necessary permits, assemble the system, and test and commission the system. The first-of-its-kind barge-based capture and control system took approximately 5 years to complete. The next barge based system was completed in approximately 2 years. The first land-based ShoreKat system, which derived from the existing barge-based system took about three years to complete, which may have been

<sup>160</sup> Port of Los Angeles, Port of Los Angeles and California Air Resources Board Partner On Green Omni Terminal Demonstration Project, May 26, 2016, [https://www.portoflosangeles.org/references/news\\_052616\\_green\\_omni](https://www.portoflosangeles.org/references/news_052616_green_omni).



attributed to the fact that the demonstration project is part of a broader initiative that comprise multi-source facility demonstration projects. CARB staff projects that new barge- and land-based capture and control systems are expected to take similar amounts of time to manufacture, although staff anticipate the process for building, testing, and approving these systems may become more streamlined as more of the systems come to market. Land-side systems may require some wharf infrastructure improvements due to the weight of the system (around 120,000 pounds) if existing wharf infrastructure is not adequate, which may impact the length of time it takes to install a capture and control unit.<sup>161</sup>

Because ro-ro berths are generally large, wide-open spaces with sufficient wharf strength to support the off-loading of cars and other large equipment on wheels, wharf infrastructure improvements are not anticipated to be necessary for ro-ro terminals. No specific infrastructure needs were expressed to CARB staff during conversations with terminal operators and port staff for any of the ro-ro berths anticipated to be included in the Proposed Regulation. As such, CARB staff assumes that the timeline for acquiring emissions control technologies for ro-ro terminals will depend on the technology manufacturer's ability to increase production of the existing barge- and land-based systems. Through conversations with capture and control manufacturers and evaluation of project timelines of existing projects, CARB staff determined that a 2025 phase-in date is achievable for ro-ro vessels, as existing technologies (shore power and capture and control systems) are capable of achieving the required emissions reductions from these vessel types.<sup>162</sup>

Based on information gathered from this process, a phase-in date of 2025 is proposed for this vessel category in order to allow enough time for vessel and terminal operators to obtain a CARB approved emissions control strategy and/or complete necessary construction.

#### **4. Tanker Implementation Dates**

Tanker vessels have unique characteristics that distinguish them from the other vessel types. The main differences include a number of safety issues and federal and international regulations that other vessel categories are not subject to due to the hazardous nature of the cargo onboard most tanker vessels (including the need to be able to break away from the berth within 30 minutes in the event of an emergency).<sup>163</sup> These additional safety concerns and regulations pose additional considerations and complexities for connecting emissions control technologies to these types of vessels. Tanker berths and terminals also differ structurally from container, reefer, cruise, and ro-ro berths and terminals as a direct result of safety issues.

---

<sup>161</sup> Conversation with Clean Air Engineering Maritime, California State Lands Commission, and tanker industry members on April 16, 2019 at Cal EPA Headquarters.

<sup>162</sup> Letter from Clean Air Engineering – Maritime, Dated August 12, 2019

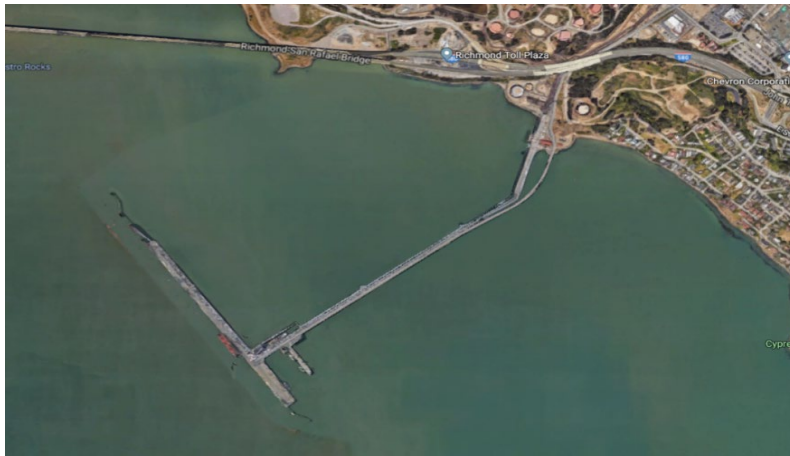
<sup>163</sup> California Code of Regulations, Title 2 § 2340, subsection (c)(28), Requirements for all Transfer Operations,

[https://govt.westlaw.com/calregs/Document/I163FFEA0D49211DEBC02831C6D6C108E?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=\(sc.Default\)](https://govt.westlaw.com/calregs/Document/I163FFEA0D49211DEBC02831C6D6C108E?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default)).

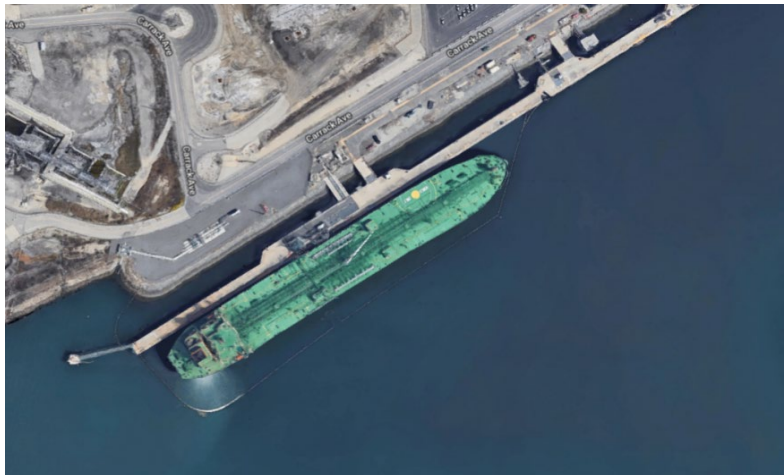
### a) Tanker Berths and Terminals

There are two main tanker terminal types, “T”-shaped wharves that are typically seen in Northern California (Figure III-2) and more traditional terminals that are seen at ports complexes, such as POLA and POLB (Figure III-3).

**Figure III-2: “T”-shaped Marine Oil Terminal in Northern California**



**Figure III-3: Port-Based Marine Oil Terminal in Southern California**



Existing tanker terminal operators indicated to CARB staff that they will need significant infrastructure improvements to handle the weight of new emissions control equipment, as well as additional piping and pilings to sufficiently support the control equipment. Marine oil terminals in Northern California have additional complicating factors when considering infrastructure improvements. Northern California marine oil terminals (also referred to as “long wharves” can stretch out over a mile into the San Francisco Bay and Carquinez Straits, and can be affected by harsher weather conditions and stronger



currents than their Southern California counterparts. The structure of the long-wharf style terminals can result in more difficulties in performing infrastructure upgrades.

### **b) Shore Power Use On Tanker Vessels**

Shore power is technically feasible for tanker vessels, and is currently in use at POLB Pier T, Berth T121. Pier T, currently the first berth where the use of shore power occurs for tanker vessels, and two vessels (the Alaska Frontier and Alaska Navigator, both operated by Alaska Tanker Company) were equipped for shore power use at this berth.

CARB staff analyzed the timeline for the development of shore power at Pier T and found that the project took about four years from the point of project design to operation and the timeline is generally in line with the shore power installation timelines for other existing container/reefer berths.<sup>164</sup> In 2005, cooperation between POLB Green Port Program and British Petroleum (BP) voluntarily started to work on a shore power project at Berth T121. The project included land-side shore power infrastructure and vessel infrastructure for two tankers. Power demand analysis determined that the electrical grid infrastructure was sufficient to meet the anticipated shore power demands and did not warrant additional expansion. In 2008 the installation was finished and completed. After extensive testing, required by strict regulations for tanker vessels, the official use of the shore-side power began in 2009.<sup>165</sup>

CARB staff also evaluated other shore power berth projects (POLB Pier A and Pier J) that were illustrative of the 33 shore power berth upgrades at POLA and POLB funded by Proposition 1B to install shore power at container berths. For many of the shore power projects, environmental clearance began in 2009, with preliminary design in 2010 and 2011. Construction began in mid-2012 and the projects were required by the Proposition 1B deadline to be completed by December 31, 2013.<sup>166</sup> The Proposition 1B projects typically span about 5 years from 2009-2013.

Another shore power project at POLA consisted of the development and operation of a new container terminal for the China Shipping Lines. City of Los Angeles Harbor Department developed the terminal in three phases of construction. Phase I began around early 2002 and included wharf improvements and backlands construction, and was completed in 2003 and operations started in 2004. As a component of this project, all wharves are shore power capable, thus allowing vessels to "plug in" to shore-side

---

<sup>164</sup> Gamette, S., et al, Challenges Associated with Implementing Operations for the First Cold Ironing of Oil Tanker Vessels, Port of Long Beach Pier T Berth T121 BP Cold Ironing Project For Alaska Class Tanker, Published date unknown (presented at the 12th Triennial International Conference in Jacksonville, Florida, April 25-28, 2010) (accessed July 23, 2019).

<sup>165</sup> European Union, TRAINMOS 2 Project, On Shore Power Supply and LNG available at <https://www.onthemosway.eu/wp-content/uploads/2015/06/2-OPS-LNG-.pdf>, Accessed September 9, 2019.

<sup>166</sup> Port of Long Beach, Attachment 1A, Project Schedule FY 2008-2009, Proposition 1B: Goods Movement Emissions Reduction Program.

electrical power while at dock instead of using auxiliary engines. Phases II and III included elements such as; new wharf construction and lengthening and the addition of 10 shore-side A-frame cranes which staff considers to be similar to the types of components that could be necessary for land-side capture and control systems for tanker vessels. Phase II and III began approximately in 2008 and was largely completed by 2013.<sup>167</sup>

Despite shore power being a proven technology to reduce emissions from tanker auxiliary engines at berth, a lack of global interest in the development of shore power for tanker vessels has led CARB staff to anticipate that compliance with the Proposed Regulation will likely involve capture and control systems at tanker terminals. Capture and control systems can also treat boiler emissions whereas shore power cannot be used to operate boilers in order to reduce emissions, as discussed in detail in Chapter I. As a result, for the purpose of this Staff Report, it is assumed that tankers will use land-based capture and control systems (as reflected in staff's Berth Analysis in Appendix E).

### **c) Development of Capture and Control Systems for Tanker Vessels**

Staff assumed the majority of tanker visits will use land-based capture and control systems based on industry feedback. As such, the proposed implementation dates for tanker vessels are reflective of the necessary amount of time needed to develop and install land-based capture and control systems and the associated infrastructure to support the system. However, that does not preclude a tanker vessel from selecting other options for compliance, including a barge-based capture and control system, where feasible.

CARB staff assumed a land-based capture and control systems for tanker vessels would be more complex than the existing system in demonstration at POLA. Based on conversations with the tanker industry and capture and control technology manufacturers, a land-based capture and control system for tanker vessels would likely consist of a large centralized exhaust gas treatment system on-shore, with ducting on the wharf connecting to a positioning boom located on the berth or nearby platform constructed to house the positioning boom. Existing capture and control systems would also need to be scaled up from the existing systems in order to handle the higher exhaust flow from tanker vessels, as tanker vessels have a higher combined power demand for both auxiliary engines and boilers at berth when compared to other all other vessel categories except cruise vessels, as shown in Table III-1.

#### **1) Timeline for Building Supporting Wharf Infrastructure**

In evaluating the application of land-based capture and control systems at tanker berths, infrastructure development stands out as the most time-consuming and

---

<sup>167</sup> Notice of Preparation (NOP) of a Draft Supplemental Environmental Impact Report and Public Scoping Meeting for the Berths 97-109 [China Shipping] Container Terminal Project, September 2015.

complex. In order to better understand what a potential timeframe for development of a land-based capture and control system would be, CARB staff analyzed numerous tanker infrastructure projects, including Chevron Richmond Long Wharf MOTEMS and Wharf Maintenance and Efficiency projects,<sup>168,169</sup> the Port of Richmond International-Matex Tank Terminals (IMTT) Wharf Modification project,<sup>170</sup> the POLA Berths (Shell) Marine Oil Terminal Wharf Improvements project<sup>171</sup> and the ShoreKat land-side capture and control demonstration project.

The Chevron project at the Richmond Long Wharf consisted of two projects that took place sequentially. The first project was a four-part construction project that lasted from 2009 to 2013. This project consisted of four concurrent construction components in order to: comply with the current MOTEMS seismic and safety requirements for marine oil terminals; improve safety conditions for crews and operators; and accommodate all sizes of vessels that visit the Long Wharf. Each of the construction components lasted between one to three years. This included fender, platform, and deck edge improvements for two berths, upgrades to the mooring hardware, as well as additional rock filling to the foundation. In addition, the construction components during this phase rehabilitated, repaired, and recoated the piling and piping on the Long Wharf.<sup>172</sup>

The second project was a wharf efficiency and maintenance project (WMEP) at the Chevron Richmond Long Wharf that started from 2014 and is estimated for completion by 2023. CARB staff believes this project is a continuation of the previous 2009-2013 MOTEMS project since the report refers to the continuation of the MOTEMS related upgrades to one of the wharf's berth. This project consists of two components, the first is the continuation seismically retrofits through the replacement of older piles, in order to support updates to berth components such as crew access, fire safety, vessel mooring, and vapor hose handling infrastructure. The second component was to replace the fender at one of the berths. The project's initial design, permit submittal and approval phase lasted from 2014 to 2017. The construction phase for the one of the berth improvements began in 2018 and estimated for completion by 2022. The construction phase for the other berth improvements began in 2018 and estimated for completion by

---

<sup>168</sup> Boven, K., Chevron Richmond Long Wharf – A MOTEMS Journey, Chevron, October 2014, [https://www.slc.ca.gov/wp-content/uploads/2018/08/PF2014\\_MOTEMS-Chevron.pdf](https://www.slc.ca.gov/wp-content/uploads/2018/08/PF2014_MOTEMS-Chevron.pdf).

<sup>169</sup> California State Lands Commission, Mitigated Negative Declaration - Chevron Long Wharf Maintenance and Efficiency Project, Recirculated October 2016, <https://www.slc.ca.gov/wp-content/uploads/2018/09/MND-1.pdf>.

<sup>170</sup> California State Lands Commission, International-Matex Tank Terminals, IMTT Wharf Modification Project Prevention First 2014, October 7, 2014, [https://www.slc.ca.gov/wp-content/uploads/2018/08/PF2014\\_MOTEMS-IMTT.pdf](https://www.slc.ca.gov/wp-content/uploads/2018/08/PF2014_MOTEMS-IMTT.pdf).

<sup>171</sup> Port of Los Angeles, Final Environmental Impact Report - Berths 167-169 [Shell] Marine Oil Terminal Wharf Improvements Project, July 2018, [https://kentico.portoflosangeles.org/getmedia/3a7e6ce5-41ab-4d09-9e6f-c9b2f6d63559/Shell-MOTEMS\\_FEIR](https://kentico.portoflosangeles.org/getmedia/3a7e6ce5-41ab-4d09-9e6f-c9b2f6d63559/Shell-MOTEMS_FEIR).

<sup>172</sup> Boven, K., Chevron Richmond Long Wharf – A MOTEMS Journey, Chevron, October 2014, [https://www.slc.ca.gov/wp-content/uploads/2018/08/PF2014\\_MOTEMS-Chevron.pdf](https://www.slc.ca.gov/wp-content/uploads/2018/08/PF2014_MOTEMS-Chevron.pdf).

2023. There will be a 2 month period after construction for operation evaluation of the new components.<sup>173,174</sup>

CARB staff evaluated the International-Matex Tanker Terminal (IMTT) wharf modification project at the Port of Richmond. A 2010 MOTEMS compliance audit determined the wharf had insufficient seismic capacity, a deficient fender system, and a lack of fire water supply. A project was undertaken to correct the problems, which created opportunities to also improve the general operational life of the terminal, eliminate timber maintenance issues, improve operational safety, and provide for a better overall path to protect the environment. Based on the available information, CARB staff assessed that the project started in late 2011 and was completed by early 2015.<sup>175</sup>

The Shell Marine Oil Terminal at POLA is in the process of undergoing wharf improvements to comply with MOTEMS requirements. The project also include the installation of a volatile organic compound (VOC) vapor control system, which CARB believes shares similar elements to a tanker emissions capture and control system. The installation would include updates such as, piping modifications, 1,000-gallon above ground propane tanks (one for enriching product and one to supply pilot burners), a dockside safety unit, and a vapor destruction unit. The construction for this project began in 2017 and scheduled to be completed in 2020.<sup>176</sup>

The Port of Los Angeles' Green Omni Terminal ShoreKat demonstration project can be used as an example of the process to develop a land-based capture and control system for a tanker terminal. This demonstration project is designed for use on bulk vessels and the technology is based on the existing barge-based systems currently used to capture and control auxiliary engine emissions from container vessels under the Existing Regulation. CARB staff believes a similar land-side configuration could be scaled up to accommodate the higher flow rates of tanker vessels and be adapted to treat both auxiliary engine and boiler emissions. The ShoreKat project started in 2016 and is scheduled for completed in late 2019.<sup>177</sup>

Timelines based on the above projects ranged roughly from five to seven years for completion, with varying timelines for each of element of a project. Project components

---

<sup>173</sup> California State Lands Commission, Mitigated Negative Declaration - Chevron Long Wharf Maintenance and Efficiency Project, Recirculated October 2016, <https://www.slc.ca.gov/wp-content/uploads/2018/09/MND-1.pdf>.

<sup>174</sup> California State Lands Commission, Chevron Long Wharf Maintenance and Efficiency Project, Addendum to MND, June 2017.

<sup>175</sup> California State Lands Commission, International-Matex Tank Terminals, IMTT Wharf Modification Project Prevention First 2014, October 7, 2014, [https://www.slc.ca.gov/wp-content/uploads/2018/08/PF2014\\_MOTEMS-IMTT.pdf](https://www.slc.ca.gov/wp-content/uploads/2018/08/PF2014_MOTEMS-IMTT.pdf).

<sup>176</sup> Port of Los Angeles, Final Environmental Impact Report - Berths 167-169 [Shell] Marine Oil Terminal Wharf Improvements Project, July 2018, [https://kentico.portoflosangeles.org/getmedia/3a7e6ce5-41ab-4d09-9e6f-c9b2f6d63559/Shell-MOTEMS\\_FEIR](https://kentico.portoflosangeles.org/getmedia/3a7e6ce5-41ab-4d09-9e6f-c9b2f6d63559/Shell-MOTEMS_FEIR).

<sup>177</sup> Port of Los Angeles, Air Quality Improvement Program and Low Carbon Transportation Greenhouse Gas Reduction Fund Investments Multi-Source Facility, Accessed September 27, 2019.

typically include a feasibility study; design and engineering of equipment; bidding and contracting; permitting; fabrication of materials; construction; audits and inspections; and testing and commissioning of the equipment. Some of these steps in a project can be completed simultaneously, while others must occur linearly after the completion of certain steps. For example, some permitting can begin after a percentage of the design work is done.<sup>178</sup>

The projects evaluated by CARB staff indicated a range of time to complete different tanker terminal upgrade projects, with permitting being one of the primary drivers for schedule variations. Staff assessment indicates the permitting process alone can extend as long as three years for large projects; this is particularly true at Northern California, as numerous state and local agencies (such as the California State Lands Commission, the San Francisco Bay Conservation and Development Commission, and California Department of Fish and Wildlife, among others) may be involved in the permitting process.<sup>179</sup>

## **2) Phase-In Dates for Northern and Southern California Tanker Terminals**

Staff proposed to split the implementation schedule into two phases for tankers. Tanker terminals at POLA and POLB would phase in first in 2027 due to fewer infrastructure upgrade challenges. The earlier date for POLA and POLB tanker terminals also highlights the pressing need for NOx reductions in the South Coast Air Basin. All other tanker terminals including the Northern California terminals would be scheduled to phase in at 2029. Combining the challenges of installing significant infrastructure and unique permitting requirements placed on terminals in the San Francisco Bay region, a longer timeline is expected for any infrastructure project being undertaken for the Northern California tanker terminals.

Regardless of location, safety studies need to be performed to ensure all safety consideration are met, given that the tanker vessels carry explosive cargos. In addition, comprehensive site-specific engineering and design work needs to be accomplished prior to implementation.

A staggered implementation schedule also seeks to reduce the burden on emissions control technology providers and contractors that specialize in wharf improvements, as bringing all tanker terminals and ro-ro terminals in at the same time would stress the ability of the existing equipment manufacturers to design, build, and deploy their systems, and would likely result in backorders and delays.

### **E. Interim Evaluation**

The dates reflected in Table III-5 represent the earliest timeframe that staff has determined is technically feasible for implementation. However, continuous evaluation

---

<sup>178</sup> Phone conversation with Marathon Petroleum staff on June 6, 2019.

<sup>179</sup> Phone conversation with California State Lands Commission staff on March 27, 2019.

after implementation will be needed as time progresses to determine if technology is keeping pace with the implementation dates outlined in the Proposed Regulation text. Because of the long timeline for implementation, CARB staff acknowledges requests from community and industry members for an interim evaluation to assess the regulated ro-ro and tanker industry’s ability to comply with the respective implementation dates in the Proposed Regulation. CARB staff will assess the progress made in adopting control technologies for use with tanker and ro-ro vessels, as well as the status of landside infrastructure improvements that may be needed to support emissions reductions at tanker terminals. By July 1, 2023, staff will publish an analysis and findings in a report and make it available for public review at least 30 calendar days prior to presenting the report to the Board at a public meeting.

**F. Responsibilities for Compliance**

In the Proposed Regulation, vessels, terminals, ports, and emissions reduction technology operators (which may be vessel, terminal, port, or third party entity) will all have responsibilities for compliance. As discussed in detail in Chapter II, adding responsibilities to all of the key parties playing a role in reducing emissions from a vessel while at berth is crucial to achieving the emissions reductions and health benefits goals of the Proposed Regulation.

Table III-7 shows a high-level summary of CARB staff’s proposal of responsibilities for controlling emissions in the Proposed Regulation. Specific vessel and terminal requirements for controlling emissions are described in the following subsections.

**Table III-7: Summary of Responsibilities**

| Circumstance                         |                           | Responsible Parties    |
|--------------------------------------|---------------------------|------------------------|
| Berth                                | Vessel                    |                        |
| Has shore power                      | Does not have shore power | Vessel                 |
| No shore power, but has other CAECS* | Has shore power           | Terminal, Port         |
| No shore power, but has other CAECS* | Does not have shore power | Terminal, Port, Vessel |
| Has other CAECS*                     | Doesn’t allow CAECS*      | Vessel                 |

\*CAECS=CARB Approved Emissions Control Strategy.

If a vessel and a berth that the vessel is calling both have functional, commissioned shore power equipment, then shore power must be used to control emissions for that visit. Shore power is the preferred method for controlling emissions at berth in California ports, as shore power gets the highest reductions of NOx, cancer-causing DPM, and also GHG emissions reductions due to the clean California electricity grid.

## **1. Vessel and Terminal Requirements**

Vessels would be required to use a CARB approved emissions control strategy to reduce emissions from auxiliary engines (and boilers for certain tanker vessels) while at a regulated berth in California. Additionally, terminal operators would be required to ensure that a CARB approved emissions control strategy is available at any regulated berth at their terminal.

### **a) Determining Compliance Responsibly**

If a commissioned shore power equipped vessel calls a compatible shore power berth, then the vessel must use shore power as the compliance method for that visit. In this case, the terminal must either plug the vessel into shore power or provide an alternative CARB approved emissions control strategy for compliance during that visit.

Any non-shore power capable vessel that calls a shore power berth must arrange for an alternative emissions control strategy, such as a barge-based capture and control strategy. However, if a non-shore power capable vessel visits a non-shore power berth, then the vessel and terminal must work together to arrange an appropriate CARB approved control strategy. In the event emissions are uncontrolled and the visit is not eligible for an exceptional event, both parties could be held liable. Assigning responsibility to the terminal to plug in a shore power equipped vessel that is already commissioned pushes the terminal to resolve operational issues and labor delays (such as berth misalignments) where able.

### **b) Vessel Compliance Checklist**

Vessel-side compliance for each vessel visit is based on a vessel compliance checklist provided for each specific CARB approved technology. Each item of the checklist is a requirement under the Proposed Regulation, and failure to do any of the specific items would result in a separate violation.

Elements of the vessel compliance checklist include:

- Communicate in writing with the terminal before arrival to coordinate the use of a CARB approved emissions control strategy.
- Commission the vessel's shore power equipment as required by the terminal operator, if applicable.
- Use shore power or another CARB approved emissions control strategy during the vessel visit.
  - Begin using shore power or another CARB approved emissions control strategy within one hour after "Ready to Work".

- Disconnect from shore power or another CARB approved emissions control strategy no earlier than one hour before “Pilot on Board”.
- Report the required visit information to CARB electronically within seven calendar days of departure.

By following the checklist, a vessel operator would be able to expedite their compliance determination by adhering to the checklist, compared to the more complex fleet reporting evaluation under the Existing Regulation.

### **c) Terminal Compliance Checklist**

Terminal-side compliance for each vessel visit is based on a checklist provided for each specific CARB approved technology. Each item of the checklist is a requirement under the Proposed Regulation, and failure to do any of the specific items would result in a separate violation.

Elements of the terminal compliance checklist include:

- Communicate in writing with the vessel and, if necessary, third party operators of CARB approved emissions control strategy before arrival to coordinate the use of a CARB approved emissions control strategy.
- Ensure shore power vessels are commissioned for shore power.
- Position vessel appropriately to enable use of shore power or the CARB approved emissions control strategy.
  - For shore power:
    - Record power meter reading before starting shore power.
    - Plug in vessel within one hour of vessel “Ready to Work”.
    - Disconnect shore power no more than one hour before “Pilot onboard”.
    - Record power meter reading after disconnecting from shore power.
- Report the required visit information within seven calendar days of the vessel’s departure.

Similarly to the vessel checklist, a terminal operator the compliance checklist is a tool to quickly gauge the terminal’s compliance status by adhering to the checklist.



#### **d) Vessel Opacity Requirements**

CARB staff are also proposing a provision that would require any vessel at berth or anchor inside California's regulated waters, regardless of control requirement obligations under the Proposed Regulation, to maintain opacity standards as specified in HSC section 41701.<sup>180</sup> This provision would reinforce existing opacity standards and assist CARB enforcement staff with the authority to enforce the standards while a vessel is at berth or anchor in California regulated waters.

This provision would apply to all ocean-going vessels, regardless of whether or not they have control requirements at berth under this Proposed Regulation.

#### **G. CARB Approved Emissions Control Strategy Operator Requirements**

Separately, operators of CARB approved emissions control strategies would have responsibilities in certain situations under the Proposed Regulation, including the responsibility of ensuring the technology being used for compliance has received CARB approval. This would include operators or developers of any CARB approved, non-shore power equipment used to control emissions from a vessel at berth, including a capture and control system, onboard technology, or future alternative technology.

##### **1. Obtaining CARB Approval for an Emissions Control Strategy**

The requirements for receiving CARB approval involve demonstrating to CARB that the technology being used is capable of demonstrating the required emissions reductions through source testing; development, submittal, and approval of a test plan; and submittal of an application along with any relevant application fees. Certain provisions must be followed by operators or developers of CARB approved emissions control strategies to maintain CARB approval status, including notifying CARB of any modifications made to the system and reporting any malfunctions along with a corrective action report to ensure the system is continuing to achieve the emissions reductions as certified.

Operators of CARB approved emissions control strategies would also have compliance checklists to follow. Each item of the checklist is a requirement under the Proposed Regulation, and failure to do any of the specific items would result in a separate violation.

##### **2. CARB Approved Emissions Control Strategy Compliance Checklist**

Elements of the vessel compliance checklist include:

---

<sup>180</sup> California Health and Safety Code § 41701, Division 26, General Limitations, 1975, [https://leginfo.legislature.ca.gov/faces/codes\\_displayText.xhtml?lawCode=HSC&division=26.&title=&part=4.&chapter=3.&article=1](https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=HSC&division=26.&title=&part=4.&chapter=3.&article=1).

- Communicate in writing with the vessel operator and terminal operator prior to the vessel's arrival for the use of the strategy and supply the vessel operator with information about the compatibility of the CARB approved emissions control strategy.
- Control emissions within one hour of vessel "Ready to Work".
- Record emissions reductions during visit.
- Disconnect emissions control strategy if necessary to ensure the strategy does not interfere with vessel movement or departure capabilities, within one hour of "Pilot on Board".
- Report the required visit information within seven calendar days of vessel departure.
- Report any malfunctioning equipment as required to CARB within 24 hours, if necessary; if malfunctioning equipment is reported, CARB approved emissions control strategy operators must then submit a corrective action report to CARB within seven calendar days of the malfunction.

### **3. Port Requirements**

Ports would be required to build any necessary infrastructure on port property (including, but not limited to, shore power vaults and substations, utility lines, wharf improvements and strengthening, etc.) that the terminal is contractually unable to address due to specific terms in their lease agreement with the port. CARB staff is proposing a provision that specifies that if a terminal operator and/or vessel operator elects to purchase and use CARB approved emissions control equipment to comply with the regulatory requirements that does not need port assistance or infrastructure to operate, then the port has no additional responsibility for that equipment.

As discussed in Chapter I of this Staff Report, many of California's ports are landlord ports so a terminal may not be contractually allowed to install infrastructure that improves the property without direct approval, and often funds, from the port itself. For operating ports, the Proposed Regulation would treat operating ports like terminal operators if the port is involved in the day to day operation of their terminals or berths. At some small ports, Stockton for example, certain berths are leased out to specific customers; for the purposes of the Proposed Regulation, these berths are treated as terminals with the port acting as the terminal operator.

All California ports and independent marine terminals would also be required to submit wharfing data to CARB annually by January 31 of the following calendar year, regardless of whether they are subject to control requirements in the Proposed Regulation. CARB staff will utilize this data set to corroborate visit information sent in by terminal and vessel operators. Ports subject to the Existing Regulation already have

a requirement to submit wharfinger data to CARB; the Proposed Regulation would move the deadline for that information to January 31 (in order to corroborate terminal and vessel visit information for the granting of terminal or vessel incident events (TIEs/VIEs).

#### **4. Reporting and Record-keeping Requirements**

All vessels, terminals, ports, and CARB approved emissions control strategy operators would have record-keeping and reporting requirements for the Proposed Regulation. Having both parties report allows each entity to report the information to CARB that they deem accurate and appropriate for their visits, while also providing a way for CARB enforcement staff to corroborate data being submitted by the two parties. Certain reporting and record-keeping requirements extend to all vessels and terminals, including those not subject to control requirements under the Proposed Regulation, such as bulk and general cargo vessels/terminals and low activity terminals.

To assist with streamlining reporting, an online tool called the Freight Regulations Reporting System (FRRS) is in development by CARB. The FRRS is a reporting tool designed to group many of CARB's freight-related reporting needs under the FRRS umbrella, with the goal of eventually replacing the individual freight reporting systems currently in use. The FRRS is anticipated to be completed and ready for use by mid-2020 for this regulation.

The FRRS system will perform several key functions in service of the Proposed Regulation:

- Permit all parties involved with vessel visits to report required information for each vessel visit into California. Currently only the vessel operator is responsible for compliance in the Existing Regulation; however, the Proposed Regulation has reporting requirements for additional responsible parties. The FRRS provides a mechanism to allow for multiple reporting parties. This would provide CARB staff a more complete picture if a non-compliant visit is detected by the system, and CARB enforcement staff would have access to the documented explanations provided by all stakeholders.
- FRRS will also maintain a record on each berth's status with respect to construction and emergency repair activities that would hinder the operation of emissions compliance strategies for a certain period. This would provide CARB staff the opportunity to update the TIE/VIE calculations for each year, as well as remind terminals to adhere to berth construction timelines as much as possible.
- FRRS will also enable third party technology providers (or the terminals which choose to operate these technologies) to report their compliance strategy information. This would include planned periods of maintenance/repairs that would take the compliance strategy out of service and the number of available compliance strategies available and their usage at any point in time.

- FRRS would also maintain a centralized record of application for CARB approval of new compliance strategies looking to gain CARB approval to meet the requirements of the Proposed Regulation. This would also include documenting within FRRS of any changes or modifications to the system that change the approved parameters of an emissions control strategy (which requires CARB staff written approval).

## **H. Additional Compliance Options**

CARB staff is proposing additional compliance options for instances of: equipment break downs, commissioning events, or scheduling and congestion issues. CARB staff propose these additional compliance options in order to:

- Maintain high levels of emissions reductions.
- Support port and terminal investments into one primary emissions control strategy to avoid the need for redundant control technologies.
- Recognize the need to address operational challenges to remediate excess emissions during prolonged repairs of emissions control equipment.

Certain exceptions to control requirements would be offered in the Proposed Regulation for safety/emergency events, successful commissioning events, and for CARB approved research projects. Other reasonably unforeseeable complications that may prevent normal operation or connection to an intended emissions control strategy are expected to be handled by use of a TIE or VIE, or through an optional remediation fund, depending on the reason for a lack of connection. These options are discussed below.

### **1. Safety, Research, and Vessel Commissioning Exceptions**

CARB staff understand there are a few situations where achieving emissions reductions may not be feasible, including safety (such as weather events), vessel commissioning, and CARB approved research projects.

Safety events include circumstances where the vessel's Master reasonably determines that compliance with the Proposed Regulation would endanger the safety of the vessel, its crew, its cargo or its passengers because of severe weather conditions, emergency event or other extraordinary reasons beyond the Master's reasonable control.

Vessel commissioning is required by ports to ensure the high voltage shore power equipment may be safely used. The first commissioning visit made by a vessel to a terminal may be considered an exception, as long as the vessel was able to successfully connect to shore power during that visit. Additional vessel commissioning visits qualify for an exception, if approved by CARB in writing where the vessel operator demonstrates that the commissioning process could not be accomplished in a single visit or that the terminal requires that the vessel be recommissioned.

Research projects are critical for advancing emissions control technologies for vessels at berth. An exception from the control requirements may be utilized to allow vessels to test new technology at berth without risk of violation. The research exception will have time limitations according to the test plan agreed upon with CARB and may only be used while actively conducting research and testing on the agreed upon technology.

## **2. Terminal and Vessel Incident Exceptions (TIE/VIE)**

TIEs and VIEs are compliance options that address instances when the operational needs of a terminal or vessel result in a vessel not being able to connect to an emissions control strategy. This compliance option recognizes the uncertainty that may surround vessel movements and cargo operations while a vessel is at berth. This compliance option reduces cost by eliminating the need for redundant emissions control systems. The number of TIEs and VIEs are capped to maintain a high level of emissions controlled for vessel visits to protect the surrounding port communities.

TIEs are for unexpected situations encountered on the terminal side. The number of available TIEs are determined by number of vessel visits to a terminal in a calendar year. Terminal operators would be able to assign a TIE to a visit made by a vessel in the event that the terminal was unable to fulfill their requirements to reduce emissions from a vessel visit.

Likewise, VIEs are for unexpected situations encountered on the vessel side, and are determined by the number of visits a vessel fleet makes to a port in a single calendar year. Vessel fleets are self-designated by the vessel or vessel operator when submitting the required visit report, and vessel fleet operators would then be able to assign a VIE to a visit made by vessels in their fleet. This gives the vessel operator added flexibility to determine what constitutes their fleet of vessels; a fleet could be designated as a single company or combination of companies including vessel alliances.

### **a) Determining the Number of Available TIEs and VIEs**

For terminals and vessels subject to control requirements under the Proposed Regulation beginning on January 1, 2021, visit activity (based on compliance reports and Wharfinger reports submitted to CARB for the Existing Regulation) from the 2019 calendar year would be used to determine the number of TIEs/VIEs for the first year of implementation. Following the initial year of implementation, visit reporting information submitted to FRRS would be used to calculate the available number of TIEs/VIEs. CARB staff would grant TIEs and VIEs to vessels and terminals by February 1 of each following calendar year.

### **b) Use of TIEs and VIEs**

TIEs and VIEs are capped at a specific percentage of visits and split between the terminal and the vessel, and can be used on any vessel visit the terminal or fleet

operator chooses. CARB staff propose providing terminals with a higher percentage of TIEs (15 percent, and 20 percent total when combined with VIEs) during the first four years of implementation.

If all TIEs/VIEs are used by both terminals and vessels in these four years, the Proposed Regulation would capture no less than 80 percent of the visits, which aligns with the Existing Regulation at full implementation in 2020. This allows for some additional time for further infrastructure build out, potentially including new vessel retrofits, additional shore power vaults, cable management systems, and additional barge-based capture and control systems.

Table III-8 shows the breakdown of TIE and VIE percentages for vessels and terminals:

**Table III-8: TIE and VIE Percentages**

|             |                          | <b>VIEs and TIEs Rates by Vessel Type per Year</b> |             |             |             |             |             |             |             |             |              |
|-------------|--------------------------|--|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|
|             |                          | <b>2021</b>  | <b>2022</b> | <b>2023</b> | <b>2024</b> | <b>2025</b> | <b>2026</b> | <b>2027</b> | <b>2028</b> | <b>2029</b> | <b>2030+</b> |
| <b>TIEs</b> | <i>All Terminals</i>     | 15%  | 15%         | 15%         | 15%         | 5%          | 5%          | 5%          | 5%          | 5%          | 5%           |
| <b>VIEs</b> | <i>Container/ Reefer</i> | 5%   | 5%          | 5%          | 5%          | 5%          | 5%          | 5%          | 5%          | 5%          | 5%           |
|             | <i>Cruise</i>            | 5%   | 5%          | 5%          | 5%          | 5%          | 5%          | 5%          | 5%          | 5%          | 5%           |
|             | <i>Ro-ro</i>             |  |             |             |             | 5%          | 5%          | 5%          | 5%          | 5%          | 5%           |
|             | <i>LA/LB Tankers</i>     |  |             |             |             |             |             | 5%          | 5%          | 5%          | 5%           |
|             | <i>Other Tankers</i>     |  |             |             |             |             |             |             |             | 5%          | 5%           |

TIEs/VIEs are meant to be used for exceptional circumstances, cannot be banked or used to allow for an extended period of uncontrolled emissions. TIEs/VIEs will expire annually, with no banking or rolling over to the next year or trading between fleets or terminals. Use of TIEs/VIEs would be electronically tracked through CARB’s FRRS.

### **3. Optional Remediation Fund**

A remediation fund option allows vessels to comply with the Proposed Regulation by remediating uncontrolled emissions at berth through an hourly fee that is based on the cost of securing equivalent emissions reductions. The remediation fund compliance option is intended for use in limited circumstances where investments have already occurred to try and reduce emissions, but reductions are not achievable during a vessel’s visit at berth.

Qualifying circumstances are limited to extended vessel and terminal equipment repair, terminal construction projects, delays in connecting to control strategy, and physical constraints identified in the terminal plan. Any remediation funds received would be

required to be invested in projects in the communities impacted by the uncontrolled emissions.

**a) Remediation Fund Hourly Amount**

CARB staff propose that the dollar amount paid into the remediation fund for uncontrolled emissions would be based on the vessel type and number of hours of uncontrolled emissions during the vessel’s visit. Staff also propose a lower hourly dollar amount for vessels with lower emissions at berth. This could be due to smaller vessels with lower power needs (and consequently lower emissions) at berth or vessels with a cleaner engines (i.e., auxiliary engines certified to meet IMO Tier III standards).

Table III-9 shows the breakdown of hourly remediation fund amounts:

**Table III-9: Remediation Fund Hourly Amount Beginning in 2021\***

| Vessel Type  | Normal Rate | Tier III rate |
|--|-------------|---------------|
| Container, Reefer, Ro-ro   | \$1,900     | \$1,100       |
| Tanker with electric pumps   | \$1,600     | \$1,000       |
| Tanker with steam driven pumps   | \$3,400     | \$2,700       |
| Cruise vessels with capacity under 1,500 combined passengers and crew      | \$5,300     | \$3,200       |
| Cruise vessels with capacity of 1,500 or more combined passengers and crew | \$12,000    | \$7,100       |

\* Remediation payments used by vessel operators shall be reduced by 20 percent for IMO Tier III tanker vessels with steam driven pumps, and 40 percent for all other IMO Tier III vessels.

If the emissions from a vessel visit are not controlled for the entire visit, the dollar amount required to mitigate the uncontrolled emissions would be the dollar amount for the vessel category multiplied by the number of hours the vessel was required to control emissions. If only part of a visit would be uncontrolled, then the dollar amount would be multiplied only by the amount of uncontrolled hours. The party responsible for paying for mitigation is the party responsible for the lack of connection, which could be the operator of the vessel, terminal, and/or CARB approved emissions control strategy (if a third party).

**b) Administration of the Remediation Fund**

To utilize the remediation fund, there must be a third party administrator with a Memorandum of Understanding (MOU) executed with CARB that permits the entity to manage the funds generated at that port or independent marine terminal. The fund administrator would ideally be a local air district; however, if a local air district does not wish to enter into an MOU with CARB to administer the fund, then CARB may ask a non-profit organization in the region with the demonstrated capacity and substantial experience running incentive programs to apply to administer the remediation fund. The monies from the remediation fund must achieve emissions reductions not otherwise

required by law or regulation by funding incentive projects that comply with adopted CARB guidelines on existing incentive programs.

## **I. Terminal and Port Plans**

Ports and terminals would be required to provide separate plans to CARB prior to the implementation date for specific vessel categories. The terminal and port plans would be used to demonstrate ports and terminals are prepared for reducing vessel emissions by the implementation date. CARB staff propose that these plans detail the chosen methods for reducing emissions at berth at each terminal and port, as well as if any additional emissions control equipment is necessary to meet the control requirements. The plans would also provide CARB enforcement with a tool to use during inspections and audits of reported compliance information. These terminal plans will also inform the interim evaluation scheduled to occur in 2023 for tanker and ro-ro and vessels.

### **1. Terminal Plans**

The first terminal plans for the Proposed Regulation would be due by July 1, 2021 from terminals receiving container, reefer, and cruise vessels. CARB staff proposes this date in order to provide terminal operators and ports six months to develop and submit plans after the effective date of the Proposed Regulation. The initial terminal plans for ro-ro and tanker vessels would be due by December 1, 2021.

CARB staff recognizes that the submission date for container, reefer, and cruise terminals is six months into the regulatory requirements for currently regulated container, reefer, and cruise vessels; however, submitting the plans for these vessel types is still crucial to CARB because they require both ports and terminals to list the division of responsibilities between the terminal and the ports in regards to any infrastructure and equipment installation, maintenance, and operation necessary to meet the control requirements at each terminal. This is a key detail for CARB's enforcement staff, as the delineation of responsibility for installing, maintaining, and operating emissions control equipment at berth is not consistent and uniform at all terminals and ports.

Any low-use terminal that exceeds the terminal threshold shall submit a terminal plan by July 1 of the following year. Any terminal that is claiming a physical and/or operational constraint in their terminal plan must also conduct a feasibility study to determine if there are any other technologies available that could be implemented at the terminal.

After submittal of a terminal plan, CARB staff have 30 calendar days to notify the applicable terminal operator or port of any deficiencies in the contents of the plan and/or in the plan's demonstration that the terminal or port is making good faith efforts to facilitate use of a CARB approved control strategy at each berth.



### **a) Terminal plan information**

The terminal plan shall include discussion of necessary infrastructure modifications needed to reduce emissions from ocean-going vessels at a terminal. For each strategy implemented at a terminal, the terminal plan must include:

- Identification and description of all necessary equipment, including whether it will be located on the vessel, wharf, shore, or elsewhere.
- Number of vessels expected to visit the terminal using the strategy.
- List of each berth with geographic boundary coordinates.
- Identity of berth(s) where equipment will be used.
- Terminal/port specific berthing restrictions.
- Schedule for implementing equipment.
- Division of responsibilities between the terminal operator and the port, including contractual limitations applicable to the terminal, relevant to enacting the infrastructure required by each terminal's plan.

### **b) Revised Terminal Plans**

Ro-ro and tanker terminals have later implementation dates; as such, terminal operators receiving these vessels would be required to revise and resubmit terminal plans for ro-ro terminals by February 1, 2024, POLA and POLB tanker terminals by February 1, 2026, and all other tanker terminals by February 1, 2028.

## **2. Port Plans**

Port would be required to submit a port plan showing proof that the necessary terminal infrastructure modifications are being developed or have been completed and/or report any modifications still required in order for all of the port's terminals with control requirements to reduce emissions of vessels at berth. Ports should use terminal plans as the basis for developing port plans, and may submit terminal plans on behalf of one or more of the port's terminal operators. Like with the terminal plans, ports must submit plans for container, reefer, and cruise terminals by July 1, 2021, and ro-ro and tanker terminals by December 1, 2021.

The goal of the port plans is to show that each terminal at a port has a planned path towards compliance at every berth; the plans can be submitted independently to CARB or the port may submit on behalf of the terminals as part of the port plan. Any changes in the plan will require a resubmittal of an updated plan to CARB.

The port plan shall include discussion of necessary infrastructure modifications needed to reduce emissions from ocean-going vessels at a terminal. For each strategy implemented at a terminal, the terminal plan must include:

- Identification and description of which strategy each applicable terminal will use for compliance.
- Identify any equipment purchases and/or construction that are in progress or must still be completed to reduce emissions.
- Provide a schedule for installing equipment and/or any necessary construction projects.
- Identify terminals where equipment will be used.
- List each terminal with geographic boundary coordinates.
- Specify any port specific berthing restrictions.
- List the division of responsibilities between the terminal and the ports for enacting the infrastructure required by each terminal's plan.
- All port plans shall be signed by the applicable port's Responsible Official under penalty of perjury and are subject to verification by enforcement staff. If port plan schedules are not met, they are subject to enforcement actions.

#### **IV. THE SPECIFIC PURPOSE AND RATIONALE FOR EACH ADOPTION, AMENDMENT, OR REPEAL**

The need for further emissions reductions from California's freight transportation system is urgent, with reductions from all areas of the freight sector necessary to reduce the high health burdens associated with freight sources in the state, including ocean-going vessels. Ocean-going vessels play a key role in the movement of freight to and from California's ports, and remain a large source of pollution affecting California's port communities, despite existing regulations requiring the use of low sulfur distillate fuel in the engines of nearly all ocean-going vessels and requirements mandating certain levels of emissions reductions at berth through shore power and alternative technologies (such as capture and control systems).

Numerous changes and additions to the Existing Regulation, which was adopted under both Section 93118.3, Title 17 and Section 2299.3, title 13 in the California Code of Regulations, are necessary in order to increase the emissions reductions from ocean-going vessels at berth. Due to the significant structural nature of the changes, CARB staff is proposing that the Proposed Regulation, titled "Control Measure for Ocean-Going Vessels At Berth", be adopted as a new regulation into Sections 93130 through 93130.20, title 17 and Section 2299.4, title 13, in the California Code of Regulations.

CARB staff is proposing that the Board approve adoption of the Proposed Regulation, pursuant to its authority under HSC Sections 38500 et seq., 43013 and 43018, which would apply to the emissions from diesel auxiliary engines on ocean-going vessels docked at California ports and to specific auxiliary boilers on ocean-going tanker vessels. The requirements of the Proposed Regulation would then supersede the requirements of Section 93118.3 of title 17 and Section 2299.3 of title 13 of the California Code of Regulations beginning January 1, 2021.

The information in this chapter provides information regarding CARB staff's determination that each provision of the Proposed Regulation is: (1) reasonably necessary to carry out the purpose of the regulation; and (2) reasonably necessary to address the problem for which the regulation is proposed.

#### **Section 2299.3(c). Airborne Toxic Control Measure for Auxiliary Diesel Engines Operated on Ocean-Going Vessels At-Berth in a California Port**

##### Purpose of Section 2299.3(c)

This section was included to notify anyone viewing section 2299.3 that the Proposed Regulation supersedes the Existing Regulation, as specified.

### Rationale for Section 2299.3(c)

This section is necessary for CARB to notify the public regarding how the Proposed Regulation would supersede the Existing Regulation. The Existing Regulation is set forth in 17 CCR § 93118.3 and 13 CCR § 2299.3. To ensure that members of the public viewing those sections are aware that the Proposed Regulation supersedes the Existing Regulation, CARB has amended those sections to describe how those sections are affected by the Proposed Regulation.

### **Section 93118.3(b)(4). Control Measure for Ocean-Going Vessels At Berth.**

#### Purpose of Section 93118.3(b)(4)

This section was included to notify anyone viewing section 93118.3(b)(4) that the Proposed Regulation supersedes the Existing Regulation, as specified.

#### Rationale for Section 93118.3(b)(4)

This section is necessary for CARB to notify the public regarding how the Proposed Regulation would supersede the Existing Regulation. The Existing Regulation is set forth in 17 CCR § 93118.3 and 13 CCR § 2299.3. To ensure that members of the public viewing those sections are aware that the Proposed Regulation supersedes the Existing Regulation, CARB has amended those sections to describe how those sections are affected by the Proposed Regulation.

### **Section 93130. Control Measure For Ocean-Going Vessels At Berth**

#### Purpose of Section 93130

This section defines where the “Control Measure For Ocean-Going Vessels At Berth” will be set forth in the California Code of Regulations, and states when the control requirements of the Proposed Regulation, if approved by the Board, will supersede the Existing Regulation. This section also states that certain reporting and recordkeeping requirements from the Existing Regulation would remain in effect for the 2020 calendar year, and are due to CARB’s Executive Officer on March 1, 2021.

This provision also states that should the Proposed Regulation be repealed or deemed invalid in its entirety by a final court decision, then the control requirements for the Existing Regulation would again become operative.

#### Rationale for Section 93130

This section is necessary to establish the intended location of the Proposed Regulation in the California Code of Regulations, and to inform the general public and regulated entities of the date in which the new requirements for the Proposed Regulation will take effect.

It is necessary to establish that certain 2020 reporting and recordkeeping requirements for the Existing Regulation remain in place and are due to CARB's Executive Officer on March 1, 2021, in order to maintain the enforceability of the Existing Regulation for the 2020 calendar year when the requirements step up to an 80 percent visit and power reduction requirements. Without this provision, there would be no direction for regulated parties under the Existing or Proposed Regulations to report or record their 2020 visit information. This would result in CARB enforcement staff being unable to audit or enforce on non-compliance actions, and staff could not ensure the required reductions of the Existing Regulation were being met.

This section also ensures that the requirements of the Existing Regulation will be effective in the event the Proposed Regulation is repealed or deemed invalid in its entirety. This is essential to preserving the existing level of emissions reductions from container, reefer, and cruise vessels. Not including this provision could cause undue health burdens on impacted port communities who are benefiting from emissions reductions associated with the Existing Regulation, in the event the Proposed Regulation is struck down. This is critical to ensure that there is no confusion as to which control requirements should be followed. It is important for currently regulated container, reefer, and cruise vessel operators to know that the existing level of emissions control requirements will exist, even if the Proposed Regulation is repealed or deemed invalid.

### **Section 93130.1. Purpose and Intent**

#### Purpose of Section 93130.1

This section describes the purpose and intent of the Proposed Regulation, which is to reduce criteria pollutants, toxic contaminants, and GHG emissions from ocean-going vessels at berth in California ports in order to reduce health impacts on California's port communities, and to ensure that ocean-going vessels are meeting visible emissions standards as specified in HSC, section 41701. The specific need for additional emissions reductions from ocean-going vessels is detailed in Chapter II.

This section also specifically identifies which pollutants and emissions would be reduced from ocean-going vessels while docked at berth at California ports, and establishes that the reductions achieved by the Proposed Regulation contribute to California's health and air quality goals.

#### Rationale for Section 93130.1

This section is necessary to set forth the purpose and intent of the requirements of the Proposed Regulation. CARB fleet rules contain purpose sections and the inclusion of this is consistent with other CARB regulations contained in the California Code of Regulations.

## **Section 93130.2. Section Summary, and Definitions**

### Purpose of Section 93130.2

This section provides a table of contents and definitions of specific terms used in the Proposed Regulation.

### Rationale for Section 93130.2

This section is necessary to make navigation through the document easier for the general public, and for CARB to define terms with particular meanings in the regulatory text. This section also establishes which definitions in the Proposed Regulation are unchanged from the Existing Regulation, while others are modified or new definitions.

## **Section 93130.2(a) Section Summary**

### Purpose of Section 93130.2

This section provides a table of contents and definitions of specific terms used in the Proposed Regulation.

### Rationale for Section 93130.2

This section is necessary to make navigation through the document easier for the general public, and for CARB to define terms with particular meanings in the regulatory text. This section also establishes which definitions in the Proposed Regulation are unchanged from the Existing Regulation, while others are modified or new definitions.

## **Section 93130.2(a) Section Summary**

### Purpose of Section 93130.2(a)

This section proposes a table of contents that would make navigating through the document easier for the general public.

### Rationale for Section 93130.2(a)

Including a table of contents allows members of the general public to more quickly and easily reference sections of the Proposed Regulation text that pertain specifically to their area of interest.

## **Section 93130.2(b) Definitions**

### Purpose of Section 93130.2(b)

This section establishes that all definitions from HSC Sections 39010 through 39060 apply to the Proposed Regulation, except as otherwise specified in this section.

### Rationale for Section 93130.2(b)

This section is necessary for CARB to define terms with particular meanings in the Proposed Regulation that differ or are not included in HSC Sections 39010 through 39060. This section is also necessary for establishing definitions that were not included in the Existing Regulation or have been significantly modified. Inclusion of this definitions section is consistent with existing CARB off-road vehicle regulations contained in the California Code of Regulations, including the Existing Regulation.

### **(1) Alternative Control Technologies**

#### Purpose and Rationale for Section 93130.2(b)(1)

Section 93130.2(b) defines “Alternative Control Technologies” as technologies, techniques, or measures that reduce the emissions of NO<sub>x</sub>, PM, ROG, or GHG from an auxiliary engine and/or tanker auxiliary boiler other than shutting it down.

Alternative control technologies are anticipated as the primary way for many of the new vessel types (particularly ro-ro and tanker vessels) to comply with the Proposed Regulation. Consequently, CARB is defining this term to establish what an alternative control technology consists of. This definition is expanded from the Existing Regulation (Section 93118.3(c)), and is necessary to highlight that the scope of targeted pollutants to be controlled at berth has expanded to include ROG and GHG.

### **(2) Anchorage**

#### Purpose and Rationale for Section 93130.2(b)(2)

Section 93130.2(b) defines “Anchorage” to mean a vessel’s allotted place to moor in place or drop anchor in California waters. The definition for anchorage is necessary to clarify the applicability of the opacity requirements in Section 93130.6 of the Proposed Regulation. This definition was not included in the Existing Regulation, as there were no requirements specified in the Existing Regulation for vessels at anchorage.

### **(3) Applicant**

#### Purpose and Rationale for Section 93130.2(b)(3)

Section 93130.2(b) defines “Applicant” to mean any person who requests an approval from CARB for an emissions control strategy. This is a new definition, which was not

included in the Existing Regulation. The term is used repeatedly throughout the proposed Regulation Order to refer to the party submitting for approval of a CARB approved emissions control strategy; as such, it is necessary to establish what an applicant is, so that the person wishing to submit an application for CARB approval knows that those portions of the proposed Regulation Order refers to them.

#### **(4) Application**

##### Purpose and Rationale for Section 93130.2(b)(4)

Section 93130.2(b) defines “Application” to mean a formal request from an applicant using the process outlined in section 93130.5 of the control measure. This is a new definition, which was not included in the Existing Regulation. This term is used repeatedly throughout the proposed Regulation Order in reference to submitting for approval of a CARB approved emissions control strategy. As such, it is necessary to establish what this term means so that applicants applying for CARB approval knows that those portions of the proposed Regulation Order referring to an application apply to them.

#### **(5) Articulated Tug Barge**

##### Purpose and Rationale for Section 93130.2(b)(5)

Section 93130.2(b) defines “Articulated Tug Barge” as a tanker barge that is mechanically linked with a paired tug that functions as one vessel.

This definition is necessary to specifically establish that articulated tug barges will not be subject to the Proposed Regulation. When an articulated tug barge is fully connected, it may meet the definition of an ocean-going vessel, as defined in this chapter (Section 93130.2(b)). However, despite being defined as a subcategory of tankers, articulated tug barges are considered a barge and a tug separately. As such, they are considered a harbor craft instead of an ocean-going vessel, and must comply with the requirements of CARB’s Commercial Harbor Craft Regulation and not of this Proposed Regulation.

A definition for articulated tug barges was not included in the Existing Regulation, as tanker vessels were not included in any requirements at that time. However, since tanker vessels are now subject to control requirements as part of the Proposed Regulation, this section is necessary to ensure articulated tug barges operators are clear that they have no obligation under the Proposed Regulation.

#### **(6) Auxiliary Boiler**



#### Purpose and Rationale for Section 93130.2(b)(6)

Section 93130.2(b) defines “Auxiliary Boiler” as a steam generator on an ocean-going vessel designed primarily to provide steam for uses other than propulsion or pumping cargo.

This definition is necessary because the control requirements of the Proposed Regulation require emissions reductions from auxiliary boilers for certain tanker vessels. As such, it is critical to define what a tanker auxiliary boiler is. This definition was not included in the Existing Regulation, as the Existing Regulation had no boiler emissions control requirements.

#### **(7) Auxiliary Engine**

##### Purpose and Rationale for Section 93130.2(b)(7)

Section 93130.2(b) defines “Auxiliary Engine” as an engine on an ocean-going vessel designed primarily to provide power for uses other than propulsion, except that all diesel-electric engines shall be considered “auxiliary engines”.

This definition is necessary because the control requirements of the Proposed Regulation require emissions reductions from auxiliary engines. As such, it is critical to define what an auxiliary engine is, and that diesel-electric engines are also considered auxiliary engines. This definition is unchanged from the Existing Regulation.

#### **(8) Berth**

##### Purpose and Rationale for Section 93130.2(b)(8)

Section 93130.2(b) defines “Berth” as a vessel's allotted place at a wharf, pier, or dock. This does not include anchorages such as at the off-shore tanker terminal at El Segundo, or where passenger vessels tender at anchor such as at Santa Barbara, or Catalina.

The Proposed Regulation is designed to reduce emissions at berth, and the regulatory text refers to “berth” numerous times. As such, it is essential to establish what a berth is in order for the reader to understand the requirements of the Proposed Regulation and where emissions must be controlled. This definition was not included in the Existing Regulation, but was added to the Proposed Regulation to provide clarity.

## **(9) Bulk Vessel**

### Purpose and Rationale for Section 93130.2(b)(9)

Section 93130.2(b) defines “Bulk Vessel” as a self-propelled ocean-going vessel constructed or adapted primarily to carry unpackaged dry bulk cargo. A bulk vessel may use vessel-based or shore-based equipment for loading and discharging of cargo.

Bulk vessels are excluded from control requirements in the Proposed Regulation. As such, this definition is necessary to define which vessels that exclusion applies to. This definition was not included in the Existing Regulation, as bulk vessels were not subject to the Existing Regulation.

## **(10) Calendar Year**

### Purpose and Rationale for Section 93130.2(b)(10)

Section 93130.2(b) defines “Calendar Year” as the time period beginning on January 1 through December 31 of a single year.

Many of the requirements of the Proposed Regulation are based on a calendar year, not a fiscal year. As such, this definition is necessary to define to readers what constitutes a calendar year. This definition was not included in the Existing Regulation, as the requirements were based on a quarterly compliance requirements.

## **(11) California Ports (Ports)**

### Purpose and Rationale for Section 93130.2(b)(11)

Section 93130.2(b) defines “California Ports (Ports)” as any port or independent marine terminal in California that receives an ocean-going vessel including:

- (A) Landlord ports where the port owns the wharves, which it rents, or leases to a terminal operator.
- (B) Operational ports where the port functions as a terminal operator.
- (C) Marine terminals which operates independently of a port.

The Existing Regulation only included six ports, the Ports of Hueneme, POLA, POLB, Oakland, San Diego, and San Francisco. The Proposed Regulation would expand the definition to include new ports and marine terminals that receive the additional vessel types (ro-ro and tanker) that were not subject to the Existing Regulation.

## **(12) California Time Aggregate Method**

### Purpose and Rationale for Section 93130.2(b)(12)

Section 93130.2(b) defines “California Time Aggregate Method” as the California State Implementation Plan method of calculating opacity emissions. The California time aggregate method is virtually identical to US EPA method 9 in the procedures the observer follows, but most notably differs in that the data are analyzed by counting the readings that exceeded the limit, rather than averaging all readings in a set.

The California time aggregate method is one of the methods used by CARB enforcement staff to analyze opacity readings to determine compliance. As such, it is necessary to establish what that method is and how it differs from U.S. EPA Opacity Test Method 9.

## **(13) CARB**

### Purpose and Rationale for Section 93130.2(b)(14)

Section 93130.2(b) defines “CARB” to mean the California Air Resources Board. CARB is the agency responsible for developing regulations and programs to reduce emissions from mobile sources such as ocean-going vessels by the State of California, and would be responsible for enforcing the Proposed Regulation. The term “CARB” appears frequently throughout the Proposed Regulation text, including as part of “CARB approved emissions control strategy” (discussed in 93130.2(14)). As such, understanding the meaning of “CARB” is critical for a reader to understand what is written in the Proposed Regulation.

## **(14) CARB Approved Emissions Control Strategy (CAECS)**

### Purpose and Rationale for Section 93130.2(b)(14)

Section 93130.2(b) defines “CARB Approved Emissions Control Strategy” as a method of reducing emissions from an ocean-going vessel at berth to a satisfactory level for compliance with the Control Measure and is verified and approved by CARB.

One of the main control requirements of the Proposed Regulation is to use a CARB approved emissions control strategy to reduce emissions from a vessel at berth. As such, this definition is necessary to establish what constitutes a CARB approved emissions control strategy.

This definition was not necessary in the Existing Regulation as compliance with that regulation is based on vessels were explicitly required to use shore power or an alternative control technology, with compliance calculated based on hours of usage of that specific equipment. Alternatively, the Proposed Regulation would base compliance on use of a CARB approved emissions control strategy during a defined time period.

## **(15) CARB Approved Emissions Control Strategy Operator**

### Purpose and Rationale for Section 93130.2(b)(15)

Section 93130.2(b) defines “CARB Approved Emissions Control Strategy Operator” as any party who operates a CARB approved emissions control strategy to reduce emissions for compliance with this Control Measure.

The Proposed Regulation places specific requirements on operators of CARB approved emissions control strategies. As such, this definition is necessary in order to define who is subject to those requirements. This definition was not in the Existing Regulation as CARB approved emissions control strategy was not defined, thus no CARB approved emissions control strategy operator definition was needed.

## **(16) Charter or Charter Agreement**

### Purpose and Rationale for Section 93130.2(b)(16)

Section 93130.2(b) defines “Charter” or “Charter Agreement” as an agreement or contract where one person rents, leases, hires, or uses ocean-going vessels from another person to convey or transport goods or passengers to one or more designated locations.

The requirements of the Proposed Regulation applies to parties who charter ocean-going vessels, as defined in Section 93130.3(a). As such, this definition is necessary to establish which parties are involved in chartering a vessel. This definition was updated from the Existing Regulation to expand the definition to include agreements or contracts to rent, lease, hire, or use an ocean-going vessel, but is fundamentally similar to the Existing Regulation in its usage.

## **(17) Charter Company**

### Purpose and Rationale for Section 93130.2(b)(17)

Section 93130.2(b) defines “Charter Company” as any person that is in the business of leasing, renting, or lending ocean-going vessel(s) to other companies or persons to convey or transport goods or passengers to one or more designated locations.

This term is used in the definition of “Person”, which is used in turn to define the general applicability of the Proposed Regulation. As such, it is necessary to establish which parties are subject to the requirements of the Proposed Regulation. This definition was not in the Existing Regulation but is necessary for the Proposed Regulation in order to expand the scope of responsible parties subject to compliance. The necessity for expanding the scope of responsible parties is discussed in Chapter II (Section C).

## **(18) Commissioned Shore Power Vessel**

### Purpose and Rationale of Section 93130.2(b)(18)

Section 93130.2(b) defines “Commissioned Shore Power Vessel” as a shore power equipped vessel that visits a compatible shore power berth at a terminal and has completed vessel commissioning at that terminal.

The vessel and terminal operator requirements in the Proposed Regulation refer frequently to commissioned shore power vessels. Commissioning events are eligible for an exception from the Proposed Regulation, making it critical to define what that means in Section 93130.2(b). Commissioning is a necessary step to ensure the high voltage shore power equipment onboard a vessel is compatible with a terminal’s equipment and may be safely used to reduce emissions. The Existing Regulation did not take commissioning into account for shore power capable vessels. A detailed discussion on the impacts of the challenges this caused can be found in Chapter II, Section C.

## **(19) Container Vessel**

### Purpose and Rationale for Section 93130.2(b)(19)

Section 93130.2(b) defines “Container Vessel” as a self-propelled ocean-going vessel constructed or adapted primarily to carry uniformly sized ocean freight containers.

Container vessels are subject to the Proposed Regulation; as such, it is necessary to define what constitutes a container vessel. This definition is unchanged from the Existing Regulation.

## **(20) Diesel-Electric Engine**

### Purpose and Rationale for Section 93130.2(b)(20)

Section 93130.2(b) defines “Diesel-Electric Engine” as a diesel engine connected to a generator that is used as a source of electricity for propulsion or other uses.

Diesel-electric engines on ocean-going vessels are subject to control requirements for the Proposed Regulation. As such, it is necessary to define what a diesel-electric engine is. This definition is unchanged from the Existing Regulation.

## **(21) Diesel Engine**

### Purpose and Rationale for Section 93130.2(b)(21)

Section 93130.2(b) defines “Diesel Engine” an internal combustion, compression-ignition engine with operating characteristics substantially similar to the

theoretical diesel combustion cycle. Regulating power by controlling fuel supply in lieu of a throttle indicates a compression ignition engine.

Diesel engines on ocean-going vessels are subject to control requirements for the Proposed Regulation. As such, it is necessary to define what a diesel engine is. This definition is unchanged from the Existing Regulation.

## **(22) Diesel Particulate Matter (DPM)**

### Purpose and Rationale for Section 93130.2(b)(22)

Section 93130.2(b) defines “Diesel Particulate Matter (DPM)” as the particles found in the exhaust of diesel engines, which may agglomerate and adsorb other species to form structures of complex physical and chemical properties.

DPM is one of the pollutants the Proposed Regulation is targeting for reductions while ocean-going vessels are at berth. As such, it is necessary to define what DPM is. This definition is unchanged from the Existing Regulation.

## **(23) Distributed Generation**

### Purpose and Rationale for Section 93130.2(b)(23)

Section 93130.2(b) defines “Distributed Generation” as electrical generation technologies that produce electricity near the place of use.

The Proposed Regulation establishes emissions standards for electricity generated through distributed generation. As such, it is essential to define that distributed generation is so that any parties utilizing it to supply shore power are aware of the emissions standards they would be required to meet in order to comply with the Proposed Regulation. This definition is consistent with the definition of distributed generation in the Existing Regulation, as well as the California Code of Regulations, title 17, section 94202.

## **(24) Docked at Berth (at berth)**

### Purpose and Rationale for Section 93130.2(b)(24)

Section 93130.2(b) defines “Docked at Berth (at berth)” as the state of being secured to a berth.

Reducing emissions from vessels docked at berth is mentioned as a key purpose and intent of the Proposed Regulation. As such, the meaning of the term is necessary to establish in this section. The definition is consistent with the definition from the Existing Regulation.

## **(25) Executive Officer**

### Purpose and Rationale for Section 93130.2(b)(2425)

Section 93130.2(b) defines “Executive Officer” as the Executive Officer of CARB, or his or her designee.

CARB’s Executive Officer is ultimately responsible for numerous provisions in the Proposed Regulation, including approving and revoking CARB approved emissions control strategy test plans and applications and approving vessel safety and emergency events. As such, it is necessary to establish which entity has this crucial responsibility. This definition is consistent with the definition in the Existing Regulation.

## **(26) Excess Emissions**

### Purpose and Rationale for Section 93130.2(b)(26)

Section 93130.2(b) defines “Excess Emissions” as air pollution emitted by a vessel at berth during a time period when the vessel operator is required to reduce emissions, but does not achieve the full reductions. Periods of “excess emissions” can result in non-compliance with the Proposed Regulation or can impact an emissions control strategy operator’s CARB approval status as written in the Proposed Regulation. As such, it is critical to define what constitutes excess emissions, so that regulated parties are able to determine when they are occurring and act accordingly.

## **(27) Exception**

### Purpose and Rationale for Section 93130.2(b)(27)

Section 93130.2(b) defines “Exception” as a situation that results in a compliant visit with or without emissions reductions.

Exceptions are used by regulated entities to remain compliant in limited situations where requirements of the Proposed Regulation cannot be met. As such, this definition is necessary so that regulated entities are aware of what constitutes an exception. This definition was not included in the Existing Regulation, as the structure of the Existing Regulation relied on an annual fleet averaging structure for compliance, and did not have a need to define specific exceptions.

## **(28) First Line**

### Purpose and Rationale for Section 93130.2(b)(28)

Section 93130.2(b) defines “First Line” as the time when a vessel’s line is first attached to a berth in the process berthing the vessel. “First Line” is used in the definition of “Vessel Arrival”, which is information a vessel and terminal operator would be required

to submit to CARB as visit information for the Proposed Regulation. As such, it is necessary to establish what “First Line” means so that regulated parties have a thorough understanding of what information they would be required to report.

## **(29) Fleet**

### Purpose and Rationale for Section 93130.2(b)(29)

Section 93130.2(b) defines “Fleet” as a group of vessels that have agreed to utilize their combined awarded VIEs at a port or marine terminal.

Vessel fleets are used to determine one of the critical exceptions in the Proposed Regulation. As such, it is necessary to establish what criteria make up a vessel fleet. This definition has been updated from the Existing Regulation, largely as a result of the significant structural changes in how a vessel complies with the Proposed Regulation. Compliance with the Existing Regulation was based on fleet averages, but the Proposed Regulation would base compliance on a per visit basis. Fleets would only be used for Terminal and Vessel Incident Events (as described in Section 93130.11).

## **(30) Foreign-flag vessel**

### Purpose and Rationale for Section 93130.2(b)(30)

Section 93130.2(b) defines “Foreign-flag vessel” as any vessel of foreign registry including vessels owned by United States citizen(s) but registered in a nation other than the United States.

The requirements of the Proposed Regulation applies to parties who own, operate, charter, or lease any U.S. or foreign-flag ocean-going vessel, as defined in Section 93130.3(a). As such, this definition is necessary to establish which vessels are subject to the requirements of the Proposed Regulation. This definition was not in the Existing Regulation, but is included in the Proposed Regulation for clarification.

## **(31) General Cargo Vessel**

### Purpose and Rationale for Section 93130.2(b)(31)

Section 93130.2(b) defines “General Cargo Vessel” as a self-propelled ocean-going vessel constructed or adapted primarily to carry cargo that must be loaded individually, and that may or may not be in uniform-sized ocean freight containers. May use vessel-based or shore-based equipment for loading and discharging of cargo.

General cargo vessels are excluded from control requirements in the Proposed Regulation. As such, this definition is necessary to define which vessels that exclusion applies to. This definition was not included in the Existing Regulation, as general cargo vessels were not subject to the Existing Regulation.



### **(32) Government or Military Vessel**

#### Purpose and Rationale for Section 93130.2(b)(32)

Section 93130.2(b) defines “Government or Military Vessel” as vessels operated by any branch of local, state, federal government military service, or by a foreign government, when such vessels are operated on government or military non-commercial service. This definition includes Coast Guard vessels. A commercial vessel that also carries some military cargo is not a government or military vessel unless the military is the vessel operator.

Government and military operated vessels are excluded from the requirements of the Proposed Regulation. As such, this definition is necessary to make clear what constitutes a government or military operated vessel. CARB staff were asked during multiple public workshops if commercial vessels carrying government or military cargo would be exempt from the requirements of the Proposed Regulation. This definition includes a provision establishing that a commercial vessel carrying government or military cargo is not excluded from the Proposed Regulation unless a government or military entity is operating the vessel. This is fundamentally the same as the Existing Regulation, but the definition was added for clarity in the Proposed Regulation.

### **(33) Greenhouse Gas**

#### Purpose and Rationale for Section 93130.2(b)(33)

Section 93130.2(b) defines “Greenhouse Gas” (GHG) as carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrogen trifluoride (NF<sub>3</sub>), nitrous oxide (N<sub>2</sub>O), sulfur hexafluoride (SF<sub>6</sub>), hydrofluorocarbons (HFC), perfluorocarbons (PFC), and other fluorinated greenhouse gases.

GHGs are one of the pollutants the Proposed Regulation is targeting for reductions from ocean-going vessels at berth. As such, it is necessary to define what constitutes GHGs for the purposes of the Proposed Regulation. This is a new definition; the Existing Regulation did not target GHG emissions reductions, thus did not previously define GHGs in the regulatory text.

### **(34) Grid-neutral**

#### Purpose and Rationale for Section 93130.2(b)(34)

Section 93130.2(b) defines “Grid-neutral” as emitting no more GHG emissions than if the strategy were powered by the California grid as represented in the most recent eGRID Summary Table for State Output Emissions Rates as the California CO<sub>2</sub>e emissions rate.

The Proposed Regulation requires that CARB approved emissions control strategies, included distributed generation, must be grid-neutral for the year that the technology is granted an Executive Order. As such, this definition is necessary to define what that grid-neutral standard means. This is a new definition; the Existing Regulation claimed GHG emissions reductions as a co-benefit to the increased use of shore power, not a directly targeted pollutant, thus did not require CARB approved emissions control strategies to reduce their GHG emissions.

### **(35) Independent Marine Terminal**

#### Purpose of Section 93130.2(b)(35)

Section 93130.2(b) defines “Independent Marine Terminal” as a terminal that operates independently from a port or port authority. An Independent Marine Terminal has all the responsibilities of a terminal and a port.

The proposed regulation achieves additional emissions reductions through the inclusion of new ports and independent marine terminals. This definition is necessary to inform which regulated entities are subject under the Proposed Regulation.

### **(36) Last Line**

#### Purpose and Rationale for Section 93130.2(b)(36)

Section 93130.2(b) defines “Last Line” as the time when the vessel is untied from the berth and the last line from the berth to the vessel is released. “Last Line” is used in the definition of “Vessel Departure”, which is information a vessel and terminal operator would be required to submit to CARB as visit information for the Proposed Regulation. As such, it is necessary to establish what “Last Line” means so that regulated parties have a thorough understanding of what they are being required to report.

### **(37) Lease**

#### Purpose and Rationale for Section 93130.2(b)(37)

Section 93130.2(b) defines “Lease” as a contract where one person conveys property or services to another person for a specific duration. “Lease” is used in the definition of a “Terminal” to establish that operating ports may treat their berths as terminals. As such, it is necessary to define what constitutes a “lease” for the purposes of the Proposed Regulation.

### **(38) Low Activity Terminal**

#### Purpose and Rationale for Section 93130.2(b)(38)

Section 93130.2(b) defines “Low Activity Terminal” as a terminal that has not previously exceeded the terminal thresholds in section 93130.10(a) of this control measure.

Low activity terminals are excluded from the requirements of the Proposed Regulation. As such, this definition is necessary to make clear what constitutes a low activity terminal. CARB staff’s justification for setting the terminal visit threshold for the Proposed Regulation is discussed in detail in the rationale for Section 93130.10(a).

### **(39) Marine Gas Oil (MGO)**

#### Purpose and Rationale for Section 93130.2(b)(39)

Section 93130.2(b) defines “Marine Gas Oil (MGO)” as any fuel that meets all the specifications for DMX or DMA grades as defined in Table I of the International Organization for Standardization (ISO) 8217, as revised in 2005, which is incorporated herein by reference, or DMX, DMA, or DMZ grades as defined in Table I of ISO 8217, as revised on June 15, 2010, which is incorporated herein by reference. This definition is the same as defined in the Existing At-Berth Regulation.

Use of marine gas oil is required for ocean-going vessels in California regulated waters as a direct result of CARB’s Ocean-Going Vessel Fuel Rule.

### **(40) Master**

#### Purpose and Rationale for Section 93130.2(b)(40)

Section 93130.2(b) defines “Master” as the person who operates an ocean-going vessel or is otherwise in charge of the vessel’s operations.

The Master of a vessel has the responsibility for the safety of his or her vessel; the Proposed Regulation grants exceptions to vessels when the Master reasonably determines that compliance with the requirements of section 93130.7 would endanger the safety of the vessel, its crew, its cargo or its passengers.

As such, it is necessary to define who has the ability to make this determination and apply for the “Vessel safety and emergency event” as specified in section 93130.8(a) of the text of the Proposed Regulation. This definition is unchanged from the Existing Regulation.

## **(41) Malfunction**

### Purpose and Rationale for Section 93130.2(b)(41)

Section 93130.2(b) defines "Malfunction" as any sudden and unavoidable failure to operate in a normal manner by air pollution control equipment, process equipment, or a process that affects emissions.

The Proposed Regulation contains requirements in section 93130.12(e) for operators of CARB approved emissions control strategies when equipment malfunctions. As such, it is necessary to establish what constitutes a malfunction so operators of a CARB approved emissions control strategy are aware if section 93130.12(e) is applicable to them. This is a new definition, as the Existing Regulation did not have specific requirements for operators of CARB approved emissions control strategies.

## **(42) Ocean-going Vessel**

### Purpose and Rationale for Section 93130.2(b)(42)

Section 93130.2(b) defines "Ocean-going Vessel" as a commercial, government, or military vessel, excluding articulated tug barges, meeting any of these criteria:

- (A) A vessel greater than or equal to 400 feet in length overall as defined in 50 CFR § 679.2, as adopted June 19, 1996.
- (B) A vessel greater than or equal to 10,000 gross tons under the convention measurement (international system) as defined in 46 CFR § 69.51-.61, as adopted September 12, 1989.
- (C) A vessel propelled by a marine compression ignition engine with a per-cylinder displacement of greater than or equal to 30 liters.

This definition is necessary to inform regulated parties of the specific type of vessels that are subject to the control requirements. This definition of ocean-going vessels is necessary to ensure that all vessels that are noncommercial, under 400 feet in length, less than 10,000 gross tons or have a marine compression ignition engine with cylinder displacement of less than 30 liters are not subject to the control requirements. Such vessels include harbor craft and personal use watercraft.

## **(43) Own**

### Purpose and Rationale for Section 93130.2(b)(43)

Section 93130.2(b) defines "Own" as having the incidents of ownership, including the legal title whether or not that person lends, or pledges an item; having or being entitled

to the possession of the item as the purchaser under a conditional sale contract; or being the mortgagor of an item.

The Proposed Regulation sets forth specific requirements for parties who own either regulated vessels or terminals and/or equipment used as part of a CARB approved emissions control strategy. This definition is necessary to establish what it means to “own” something in the Proposed Regulation. This definition is the same as defined in the Existing Regulation.

#### **(44) Oxides of Nitrogen (NO<sub>x</sub>)**

##### Purpose and Rationale for Section 93130.2(b)(44)

Section 93130.2(b) defines “Oxides of Nitrogen (NO<sub>x</sub>)” as compounds of nitric oxide (NO), nitrogen dioxide (NO<sub>2</sub>), and other oxides of nitrogen, which are typically created during combustion processes and are major contributors to smog formation and acid deposition.

NO<sub>x</sub> is one of the pollutants the Proposed Regulation is targeting for reductions while ocean-going vessels are at berth. As such, it is necessary to define what NO<sub>x</sub> is. This definition is unchanged from the Existing Regulation.

#### **(45) Particulate Matter (PM)**

##### Purpose and Rationale for Section 93130.2(b)(45)

Section 93130.2(b) defines PM as any airborne finely divided material, except uncombined water, which exists as a liquid or solid at standard conditions (e.g., dust, smoke, mist, fumes, or smog).

PM is one of the pollutants the Proposed Regulation is targeting for reductions while ocean-going vessels are at berth. As such, it is necessary to define what PM is. This definition is unchanged from the Existing Regulation.

#### **(46) Particulate Matter 2.5 (PM<sub>2.5</sub>)**

##### Purpose and Rationale for Section 93130.2(b)(46)

Section 93130.2(b) defines PM<sub>2.5</sub> as any particulate matter with a diameter of less than 2.5 micrometers.

PM<sub>2.5</sub> is one of the pollutants the Proposed Regulation is targeting for reductions while ocean-going vessels are at berth. PM<sub>2.5</sub> is a distinct subset of PM, and regulatory text refers to both “PM” and “PM<sub>2.5</sub>” specifically at times. As such, it is necessary to define what PM<sub>2.5</sub> is. This definition expands on the definition of PM from the Existing Regulation, which only defined PM.

## **(47) Passenger Vessel**

### Purpose and Rationale for Section 93130.2(b)(47)

Section 93130.2(b) defines “Passenger Vessel” as a self-propelled vessel constructed or adapted primarily to carry people. Passenger vessels are also referred to as cruise vessels for the purposes of the Proposed Regulation. Cruise vessels are one of the vessel types subject to the Proposed Regulation, as such it is necessary to define what constitutes a passenger (cruise) vessel. This definition is unchanged from the Existing Regulation.

## **(48) Person**

### Purpose and Rationale for Section 93130.2(b)(48)

Section 93130.2(b) defines “Person” as the same meaning as set in the California Code, HSC section 39047.

This term is used to define general applicability of the Proposed Regulation. As such, it is necessary to establish which parties are subject to the requirements of the Proposed Regulation. This definition is the same as defined in the Existing At-Berth Regulation.

## **(49) Physical Constraint**

### Purpose and Rationale for Section 93130.2(b)(49)

Section 93130.2(b) defines “Physical Constraint” at a terminal as an unavoidable barrier to provide a service due to the layout of a terminal or waterway where, a state or federal public agency with jurisdiction over the resources effected by this control measure has made a safety determination that prevents the use of a CARB approved control strategy.

Terminal operators may pay into the remediation fund to mitigate required emissions reductions from vessel visits that cannot be controlled due to a physical constraint. As such, it is necessary to define “physical constraint” to enable terminal operators to determine if this provision applies to their facility.

## **(50) Pilot on Board**

### Purpose and Rationale for Section 93130.2(b)(50)

Section 93130.2(b) defines “Pilot on Board” as the vessel’s pilot has boarded the vessel to assume navigational control to prepare for vessel departure. The term “Pilot on Board” is used to reference a point in time in which control requirements are no longer required for a vessel at berth.

As such, it is necessary to establish what constitutes the time a pilot arrives on board a vessel. This is a new definition that is related to the restructuring of the definition of a “Visit” (see Section 93130.2(b)(81)).

### **(51) Port**

#### Purpose and Rationale for Section 93130.2(b)(51)

Section 93130.2(b) defines “Port” as the same definition of “California Port”.

The term “Port” has the same meaning as “California Port” for the purposes of the Proposed Regulation. As such, it is necessary to define them as the same so that readers of the Proposed Regulation are aware the term may be used interchangeably.

### **(52) Previously Unregulated Vessels**

#### Purpose and Rationale for Section 93130.2(b)(52)

Section 93130.2(b) defines “Previously Unregulated Vessels” as container, refrigerated cargo, or passenger vessels that were part of a fleet before January 1, 2021, where the fleet did not exceed the annual visit thresholds specified in California Code of Regulations, title 17, section 93118.(b)(3)(E) for any year between 2014 and 2020 or the vessel is a steamship.

The Proposed Regulation sets a later implementation date for those vessels who are part of a fleet that was never subject to the requirements of the Existing Regulation as of December 31, 2020, as well as vessels that are steamships, as steamships were exempt from the Existing Regulation. As such, this section is critical to define which container, reefer, and cruise vessels do not have control requirements until January 1, 2023.

### **(53) Privately owned U.S.-flag commercial vessel**

#### Purpose and Rationale for Section 93130.2(b)(53)

Section 93130.2(b) defines “Privately owned U.S.-flag commercial vessel” as a vessel that is:

- (A) Registered and operated under the laws of the United States.
- (B) Used in commercial trade of the United States.
- (C) Owned and operated by U.S. citizens, including a vessel under voyage or time charter to the Government.

- (D) Government-owned vessel under bareboat charter to, and operated by, U.S. citizens.

“Privately owned U.S.-flag commercial vessel” is used in the definition of “United States flag Vessel”; as such, it is necessary to establish what “this is so that regulated parties have a thorough understanding of what they are being required to report.

#### **(54) Reactive Organic Gases (ROG)**

##### Purpose and Rationale for Section 93130.2(b)(54)

Section 93130.2(b) defines “Reactive Organic Gases (ROG)” as the same as set forth in subsection (a)(23) of section 2752 of title 13 of the California Code of Regulations.

ROG is one of the pollutants the Proposed Regulation is targeting for reductions from ocean-going vessels at berth. As such, it is necessary to define what constitutes ROG for the purposes of the Proposed Regulation. This is a new definition; the Existing Regulation did not target ROG emissions reductions, thus did not previously define ROG in the regulatory text.

#### **(55) Ready to Work**

##### Purpose and Rationale for Section 93130.2(b)(55)

Section 93130.2(b) defines “Ready to Work” as the time when the vessel is tied to the berth, the gangway has been lowered with netting down, and the U.S. Coast Guard, U.S. Customs and Border Protection, and other government authorities have cleared the vessel.

This definition is necessary as “Ready to Work” represents the start time of a vessel’s visit at berth. As discussed in the Executive Summary beginning on page ES-8, CARB staff has re-defined a visit as “Ready to Work” until one hour prior to “Pilot on Board”. The Ready to Work definition describes a point in time that is used to determine a visit for compliance purposes. The rationale for the new definition of a “Visit” as discussed in Section 93130.2(b)(82).

#### **(56) Refrigerated Cargo Vessel**

##### Purpose and Rationale for Section 93130.2(b)(56)

Section 93130.2(b) defines “Refrigerated Cargo Vessel” (commonly known as “reefer”) as a self-propelled vessel constructed or adapted primarily to carry refrigerated cargo. Refrigerated cargo vessels include vessels where the cargo may be stored in large refrigerated rooms within the vessel or vessels that primarily carry refrigerated cargo containers.



Reefer vessels are one of the vessel types subject to the Proposed Regulation, as such it is necessary to define what constitutes a reefer vessel. This definition is unchanged from the Existing Regulation.

### **(57) Regulated California Waters**

#### Purpose and Rationale for Section 93130.2(b)(57)

Section 93130.2(b) defines “Regulated California Waters” as any and all of the following:

- (A) All California internal waters.
- (B) All California estuarine waters.
- (C) All California ports, roadsteads, and terminal facilities (collectively “ports”).
- (D) All waters within 3 nautical miles of the California baseline, starting at the California-Oregon border and ending at the California-Mexico border at the Pacific Ocean, inclusive.
- (E) All waters within 12 nautical miles of the California baseline, starting at the California-Oregon border and ending at the California-Mexico border at the Pacific Ocean, inclusive.
- (F) All waters within 24 nautical miles of the California baseline, starting at the California-Oregon border to 34.43 degrees North, 121.12 degrees West, inclusive.
- (G) All waters within the area, not including any islands, between the California baseline and a line starting at 34.43 degrees North, 121.12 degrees West; thence to 33.50 degrees North, 118.58 degrees West; thence to 32.65 degrees North, 117.81 degrees West; and ending at the California-Mexico border at the Pacific Ocean, inclusive.

As a State agency, CARB’s ocean-going vessel regulations are enforceable within California’s regulated waters only. As such, it is necessary to define what constitutes Regulated California Waters. This definition is consistent with the Existing Regulation.

### **(58) Remediation Fund**

#### Purpose and Rationale for Section 93130.2(b)(58)

Section 93130.2(b) defines “Remediation fund” as an account established by a CARB approved fund administrator under the terms of a Memorandum of Understanding with CARB to provide incentive monies to projects that achieve emissions reductions, not

otherwise required by law or regulation, in communities impacted by excess emissions from vessels at berth. The remediation fund is necessary to define because it is a compliance pathway for regulated parties.

### **(59) Responsible Official**

#### Purpose and Rationale for Section 93130.2(b)(59)

Section 93130.2(b) defines “Responsible Official” as any person(s) with the authority to determine the existence of emergency and safety events, and to certify that a vessel, terminal, port, or control equipment complies with requirements of this Control Measure. “Responsible officials” have obligations under the Proposed Regulation; as such, this definition is necessary to establish what defines this entity.

### **(60) Responsible Party**

#### Purpose and Rationale for Section 93130.2(b)(60)

Section 93130.2(b) defines “Responsible Party” as any person with an obligation under this Control Measure. The Regulation Order makes mention of obligations of a “Responsible party” under the Proposed Regulation; as such, this definition is necessary to establish what defines this entity party.

### **(61) Roll-On/Roll-Off Vessel (Ro-Ro)**

#### Purpose and Rationale for Section 93130.2(b)(61)

Section 93130.2(b) defines “Roll-On-Roll-Off Vessel” (commonly known as “ro-ro” or “vehicle carrier”) as a self-propelled vessel constructed or adapted primarily to carry wheeled cargo that can be rolled on and off. Ro-ro vessels may carry exclusively automobiles (commonly known as a “pure car carrier”) and/or a mixture of bulk equipment on wheels.

Ro-ro vessels are subject to the Proposed Regulation; as such, it is necessary to establish what constitutes a ro-ro vessel. This definition was not in the Existing Regulation because ro-ro vessels were not a regulated vessel category. As such, it was critical to add this definition to the Proposed Regulation.

### **(62) Safety and Emergency Events**

#### Purpose and Rationale for Section 93130.2(b)(62)

Section 93130.2(b) defines “Safety and Emergency Event” as an event where responsible official reasonably determines that compliance with this control measure would endanger the safety of the vessel, crew, cargo, or passengers because of severe weather conditions, equipment failure, or other extraordinary reasons beyond the control of the terminal operator or vessel operator.

Under the Proposed Regulation, vessels and/or terminals may qualify for an exception to the control requirements of the Proposed Regulation during safety and emergency events. As such, it is critical to define what those instances are.

### **(63) Selective Catalytic Reduction (SCR)**

#### Purpose and Rationale for Section 93130.2(b)(63)

Section 93130.2(b) defines SCR as an emissions control system that reduces NO<sub>x</sub> emissions through the catalytic reduction of NO<sub>x</sub> in diesel exhaust by injecting nitrogen-containing compounds into the exhaust stream, such as ammonia or urea.

Some existing emissions control technologies, such as barge and land-based capture and control systems, utilize SCR to reduce NO<sub>x</sub> emissions from ocean-going vessels at berth. Since SCR systems can be used for compliance with the Proposed Regulation as part of a CARB approved emissions control strategy and there are specific ammonia exhaust gas concentration limits for SCR reductions systems included in section 93130.5(a), it is necessary to establish what a SCR system is. Identical ammonia exhaust gas concentration limits for SCR were established in the Existing Regulation, however SCR was not included in the definitions and is included in the Proposed Regulation for clarity.

### **(64) Shore Power**

#### Purpose and Rationale for Section 93130.2(b)(64)

Section 93130.2(b) defines “Shore Power” as electrical power being provided by either the local utility or by distributed generation to a vessel at berth.

The Proposed Regulation establishes shore power as the “gold standard” for reducing auxiliary engine emissions from ocean-going vessels at berth. CARB staff anticipate shore power being the primary method the container, reefer, and cruise vessels, as most are using shore power to comply with the Existing Regulation. The increased use of shore power is critical to ensuring GHG emissions reductions are realized from the Proposed Regulation. As such, it is necessary to define what constitutes shore power.

This definition is consistent with the Existing Regulation.

### **(65) Tanker Auxiliary Boiler**

#### Purpose and Rationale for Section 93130.2(b)(65)

Section 93130.2(b) defines “Tanker Auxiliary Boiler” as a steam generator on a tanker vessel that is used to off-load liquid product.

This definition is necessary because the control requirements of the Proposed Regulation require emissions reductions from tanker auxiliary boilers. As such, it is critical to define what an auxiliary boiler is. This definition was not included in the Existing Regulation, as the Existing Regulation had no boiler emissions control requirements.

## **(66) Tanker Vessel**

### Purpose and Rationale for Section 93130.2(b)(66)

Section 93130.2(b) defines “Tanker Vessel” as a self-propelled vessel constructed or adapted primarily to carry liquid bulk cargo. Tanker vessels may carry petroleum crude, petroleum products, or non-petroleum based products, and are classified as either non-edible and dangerous or edible and non-dangerous.

Tanker vessels are subject to the Proposed Regulation; as such, it is necessary to establish what constitutes a tanker vessel. This definition was not in the Existing Regulation because tanker vessels were not a regulated vessel category. As such, it was critical to add this definition to the Proposed Regulation.

## **(67) Terminal**

### Purpose and Rationale for Section 93130.2(b)(67)

Section 93130.2(b) defines “Terminal” as a terminal operator’s facility consisting of adjacent wharves, piers, docks, other berthing locations and storage, which are used primarily for loading and unloading of passengers, cargo or material from vessels or for the temporary storage of this cargo or material on site. Operational ports that rent a berth to vessel operators rather than lease to terminal operators shall treat that berth as a terminal.

Additional clarification for operating ports was added to the definition to ensure that berths that service specific customers are treated as terminals in the rule rather than the entire port being treated as a terminal. As discussed in Chapter III (section C) this definition is necessary because in the cases of smaller operating ports, berths may not be separated into terminals, and berths may be leased directly to a single customer. The Proposed Regulation would define berths leased individually to specific customers to act as terminals, making them subject to the terminal visit threshold. This goal with this provision is to provide smaller operating ports some leeway to make capital expenses in emissions control technologies for their high activity berths only. This definition was not included in the Existing Regulation, as there was no requirement that depended specifically on the definition of a berth.

## **(68) Terminal Incident Exception (TIE)**

### Purpose and Rationale for Section 93130.2(b)(68)

Section 93130.2(b) defines “Terminal Incident Exception (TIE)” as an exception provided to terminal operators to allow for a limited number of incidents where a vessel does not reduce emissions during a visit. A “Terminal Incident Exception” is necessary to define because it is a compliance pathway for regulated parties under the Proposed Regulation.

## **(69) Terminal Operator**

### Purpose and Rationale for Section 93130.2(b)(69)

Section 93130.2(b) defines “Terminal Operator” as a person who leases terminal property from a port to load and unload passengers, cargo or material from vessels or for the temporary storage of this cargo or material on-site. Operational ports that use a single berth to service an individual customer are the terminal operator and the customer’s berth is a terminal.

The Proposed Regulation places specific requirements on “Terminal Operators”. As such, this definition is necessary in order to define who is subject to those requirements. This definition was modified from the Existing Regulation to specify that berths rented to tenants rather than operators may be treated as terminals (e.g., Stockton berths) to address unique situations that may occur at operating ports (see definition of “Terminal” for more details).

## **(70) This Control Measure**

### Purpose and Rationale for Section 93130.2(b)(70)

Section 93130.2(b) defines “This Control Measure” as the Control Measure for Ocean-Going Vessels At Berth, California Code of Regulations, title 17, Sections 93130-93130.20. This phrase is used extensively throughout the Regulation Order to refer to the Regulation Order itself; as such, it is necessary to define what this phrase means.

## **(71) Utility**

### Purpose and Rationale for Section 93130.2(b)(71)

Section 93130.2(b) defines “Utility” as having the same meaning and be used interchangeably with the term “Electric Utility” and means any person engage in or, authorized to engage in, generating, transmitting, or distributing electric power by any facilities, including, but not limited to, any such person who is subject to the Proposed

Regulation of the Public Utilities Commission Pub Resource Code, section 25108 as it read on January 7, 1975.

The term “Utility” is used frequently throughout the Regulation Order in regards to shore power. As such, it is necessary to define what constitutes a “Utility”. This definition is the same as defined in the Existing At-Berth Regulation.

## **(72) Utility Event**

### Purpose and Rationale for Section 93130.2(b)(72)

Section 93130.2(b) defines “Utility Event” the period of time during which any of the following events occurs; the utility event begins when such an event begins and ends when the event is over:

- (A) The utility serving the port or terminal cannot provide electrical power to the port because of utility equipment failure, a transmission emergency, distribution emergency, a California Independent System Operator (CAISO) or Los Angeles Department of Water and Power (LADWP) Stage 3 emergency, or the utility needs to reduce power to the port and/or terminal because of a sudden and reasonably unforeseeable natural disaster, such as, but not limited to, an earthquake, flood, or fire; or
- (B) When the utility providing electrical power notifies the terminal operator(s) to reduce the use of grid-based electrical power in response to a transmission or distribution emergency, a CAISO or LADWP Stage 3 emergency, or to avoid a Stage 3 emergency if one is anticipated. The emergency event ends when CAISO or LADWP cancels the Stage 3 emergency or the utility notifies the terminal operator(s) that reduction in the use of grid-based electrical power is no longer necessary. The port may contact the terminal operator(s) on behalf of the utility if such an agreement exists between the utility and the port.

The Proposed Regulation defines a utility event as a qualifying scenario for a “Safety and Emergency Event”, in which vessels and/or terminals may qualify for an exception to the control requirements of the Proposed Regulation. As such, it is critical to define what a “Utility Event” is.

## **(73) United States Flag Vessel**

### Purpose and Rationale for Section 93130.2(b)(73)

Section 93130.2(b) defines “U.S.-flag Vessel”, when used independently, as either a United States government vessel or a privately owned U.S.-flag commercial vessel. A U.S.-flag vessel is referenced in Section 93130.3 Applicability to avoid ambiguity. As such, it was necessary to define this term so readers are clear who is subject to the requirements of the Proposed Regulation.

## **(74) Vessel**

### Purpose and Rationale for Section 93130.2(b)(74)

Section 93130.2(b) defines “Vessel” as a watercraft or other artificial contrivance used, or capable of being used, as a means of transportation. For the purposes of this control measure, “vessel” is used interchangeably with the term “ocean-going vessel”. The Proposed Regulation places specific requirements on vessels; as such, this definition is necessary in order to define who is subject to those requirements.

## **(75) Vessel Arrival**

### Purpose and Rationale for Section 93130.2(b)(75)

Section 93130.2(b) defines “Vessel Arrival” as the date and time that a vessel is initially tied to a berth with first line. “Vessel Arrival” is required information for vessel and terminal operators to report with the visit information; as such, it is necessary to define what information that is.

## **(76) Vessel Commissioning**

### Purpose and Rationale for Section 93130.2(b)(76)

Section 93130.2(b) defines “Vessel Commissioning” as the process undertaken by the vessel operator and terminal operator to ensure that the shore power equipment on the vessel is compatible with the shore power equipment on the terminal and that there are no safety issues for both the equipment and the personnel handling the connection. Under the Proposed Regulation, vessels and/or terminals may qualify for an exception to the control requirements of the Proposed Regulation during vessel commissioning events. As such, it is critical to define what those instances are.

## **(77) Vessel Departure**

### Purpose and Rationale for Section 93130.2(b)(77)

Section 93130.2(b) defines “Vessel Departure” as the date and time that a vessel casts off the last line. “Vessel Departure” is required information for vessel and terminal operators to report with the visit information; as such, it is necessary to define what information that is.

## **(78) Vessel Incident Exception (VIE)**

### Purpose and Rationale for Section 93130.2(b)(78)

Section 93130.2(b) defines “Vessel Incident Exception (VIE)” as an exception provided to vessel fleets to allow for a limited number of incidents where a vessel operator does

not reduce emissions during a vessel visit. A “Vessel Incident Exception” is necessary to define because it is a compliance pathway for regulated parties under the Proposed Regulation.

### **(79) Vessel Operator**

#### Purpose and Rationale for Section 93130.2(b)(79)

Section 93130.2(b) defines “Vessel Operator” as any person who decides where a vessel is to call or who is in direct control of the vessel. The party in direct control of the vessel may be a third party hired to carry cargo or passengers for the person under a charter agreement to operate the vessel. Direct control does not include the vessel master or any other member of the vessel crew, unless the vessel master or crewmember is also the owner of the vessel or decides where a vessel is to call. An operator may or may not be the owner of the vessel.

The Proposed Regulation places specific requirements on “Vessel Operators”. As such, this definition is necessary in order to define who is subject to those requirements.

### **(80) Vessel Owner**

#### Purpose and Rationale for Section 93130.2(b)(80)

Section 93130.2(b) defines “Vessel Owner” as any party with an ownership interest in the vessel. The owner may be an individual or multiple parties. The owner may or may not be the operator of the vessel. Vessel owners are subject to the requirements of the Proposed Regulation (as defined in Section 93130.3(a)). As such, it is necessary to establish what constitutes a vessel owner, so that readers understand who has compliance obligations under the Proposed Regulation.

### **(81) Visible Emissions**

#### Purpose and Rationale for Section 93130.2(b)(81)

Section 93130.2(b) defines “Visible Emissions” as any particulate or gaseous matter, which can be detected by the human eye. “Visible Emissions” is referenced in the requirements for meeting opacity standards (section 93130.6); as such, it is necessary to define what constitutes “visible emissions”.

### **(82) Vessel Type**

#### Purpose and Rationale for Section 93130.2(b)(82)

Section 93130.2(b) defines “Vessel Type” as a categorization of ocean-going vessels distinguished by the main cargo the vessel carries into the following types: bulk/general cargo, container, passenger, refrigerated cargo, ro-ro, and tanker vessels. The



Proposed Regulation uses vessel type to establish control requirements; as such, understanding what “Vessel Type” means is necessary for the reader to understand how and when the control requirements of the Proposed Regulation apply.

### **(83) Visit**

#### Purpose and Rationale for Section 93130.2(b)(83)

Section 93130.2(b) defines “Visit” as the time period from when the vessel is “Ready to Work” to “Pilot on Board”. Many of the requirements for compliance with the Proposed Regulation center around the controlling the emissions from a vessel’s visit. As such, it is critical to define what constitutes a visit.

The definition of a visit is changed from the Existing Regulation, which defined “Visit” the time period that being when an ocean-going vessel initially tied to a berth and ends when it casts off the lines and the end of a visit. As discussed in detail in Chapter II (section C), there are numerous operational events that can occur between the time the vessel is first tied to a berth and when the vessel is ready to be worked, which is typically the time the process can start to connect the vessel to an emissions control technology.

As such, CARB staff adjusted the definition of a visit for the Proposed Regulation to account for many of the uncertain operational events (including events such as clearance by U.S. Customs and Border Patrol) that can delay a vessel from controlling emissions that are outside of the control of the vessel, terminal operators, and the Port.

### **Section 93130.3. Applicability**

#### Purpose of Section 93130.3

This section, in its entirety, establishes the applicability of the Proposed Regulation by specifying which owners and/or operators of vessels, ports, terminals, and berths are subject to the Proposed Regulation.

#### Rationale for Section 93130.3

Each of the provisions within section 93130.3 is necessary to establish which fleet owners or operators are subject to the Proposed Regulation.

### **Section 93130.3(a)(1) through (4) General Applicability**

#### Purpose of Section 93130.3(a)(1) through (3)

This section establishes the applicability of the Proposed Regulation by specifying which owners and/or operators of vessels, ports, terminals, and berths are subject to the Proposed Regulation. This section specifies that, unless exempt under Section

93130.4, the Proposed Regulation applies to any person who owns, operates, charters, or leases any U.S. or foreign-flag ocean-going vessel that visits a California port, terminal or berth; any person who owns, operates, or leases a port, terminal or berth located where ocean-going vessels visit; and any person who owns, operates, or leases CARB approved emissions control equipment for ocean-going vessel auxiliary engines or tanker auxiliary boilers would be subject to the Proposed Regulation.

#### Rationale for Section 93130.3(a)(1) through (3)

This section is necessary to define which owners and/or operators of vessels, ports, terminals, and berths are subject to the Proposed Regulation. This represents a change from the Existing Regulation, which limits the scope of regulated entities to any person who owns, operates, charters, rents, or leases any U.S. or foreign-flagged ocean-going vessel that visits a California port. In addition, this section also applies to any person who owns or operates a port or terminal located at a port where ocean-going vessels visit.

In order to achieve the emissions reductions necessary to achieve the health and climate goals of this Proposed Regulation (as discussed in detail in Chapter II, section A), the scope of regulated entities is widened to include ro-ro and tanker vessels, along with ports and terminals that receive ro-ro and tanker vessel visits.

#### **Section 93130.3(b) Federal Requirements**

##### Purpose of Section 93130.3(b)

This section establishes that the Proposed Regulation shall not be construed to amend, repeal, modify, or change in any way any applicable federal regulations, including any U.S. Coast Guard regulations or requirements.

##### Rationale for Section 93130.3(b)

This section is consistent with the same provision from the Existing Regulation. Because ocean-going vessels trade both domestically in the United States and internationally, this section is necessary to establish that nothing in this regulation shall be construed to amend, repeal, modify, or change in any way any applicable federal regulations, including any U.S. Coast Guard regulations or requirements.

#### **Section 93130.4. Exceptions**

##### Purpose of Section 93130.4

This section establishes certain situations in which ocean-going vessels are not subject to the requirements of the Proposed Regulation.

#### Rationale for Section 93130.4

This section is necessary to define the ocean-going vessel visits that are not subject to the requirements of the Proposed Regulation.

#### **Section 93130.4(a) Non-stop Voyages**

##### Purpose of Section 93130.4(a)(1) and (2)

This section establishes that any ocean-going vessel that does not stop at a regulated California port, terminal, or berth is not subject to the requirements of the Proposed Regulation, including stopping and anchoring required by the U.S. Coast Guard, stopping that is necessary by force majeure or distress, or a stop that is made for the sole purpose of rendering assistance to persons, vessel, or aircraft in danger or distress.

##### Rationale for Section 93130.4(a)(1) and (2)

This section is necessary to exclude vessels that are not originally intending to call a regulated California port or anchor in California regulated waters but are required to do so due to unforeseen circumstances, and as a result, are not prepared to comply with California specific ocean-going vessel regulations. If a vessel is scheduled to call a California port and does not meet the qualifications listed in Section 93130.4(a)(1), then the vessel would be expected to comply with all regulatory requirements.

Vessels that do not qualify for an exception under this section also include voyages that engage in prejudicial activities as defined by the United Nations Convention on the Law of the Seas 1982, Article 19, subpart 2.<sup>181</sup> Prejudicial activities are defined as those activities that engage in any of the following:

- Any threat or use of force against the sovereignty, territorial integrity or political independence of the coastal State, or in any other manner in violation of the principles of international law embodied in the Charter of the United Nations;
- Any exercise or practice with weapons of any kind;
- Any act aimed at collecting information to the prejudice of the defense or security of the coastal State;
- Any act of propaganda aimed at affecting the defense or security of the coastal State;
- The launching, landing or taking on board of any aircraft;

---

<sup>181</sup> United Nations Convention on the Law of the Sea,  
[https://www.un.org/Depts/los/convention\\_agreements/texts/unclos/unclos\\_e.pdf](https://www.un.org/Depts/los/convention_agreements/texts/unclos/unclos_e.pdf)

- The launching, landing or taking on board of any military device;
- The loading or unloading of any commodity, currency or person contrary to the customs, fiscal, immigration or sanitary laws and regulations of the coastal State;
- Any act of willful and serious pollution contrary to this Convention; any fishing activities;
- The carrying out of research or survey activities;
- Any act aimed at interfering with any systems of communication or any other facilities or installations of the coastal State;
- Any other activity not having a direct bearing on passage.

### **Section 93130.4(b) Government and Military Vessels**

#### Purpose of Section 93130.4(b)

This section is necessary to establish that government and military vessels being operated by any branch of local, state, federal government military service, or by a foreign government are not subject to the requirements of the Proposed Regulation, when such vessels are operated on government or military non-commercial service.

#### Rationale for Section 93130.4(b)

This section is necessary to exclude government or military vessels operating on non-commercial operations are not subject to the requirements of the Proposed Regulation. Section 93130.2(b) also specifies that a commercial vessel carrying some military cargo is not a government or military vessel unless the military is the vessel operator.

This provision is also necessary to clarify that the Proposed Regulation does not exempt vessels carrying military or government-owned cargo on those grounds alone. There are vessels hired by the United States and foreign governments to carry some military-owned cargoes, such as military vehicles and ammunition, into California ports and terminals. When these voyages are operated by a shipping line (not a government or military entity), and the vessel is acting in a commercial capacity, the vessel is not exempt from the Proposed Regulation.

## **Section 93130.5. CARB Approved Emission Control Strategy**

### Purpose of Section 93130.5

This section establishes shore power as a CARB approved emissions control strategy, defines the emissions standards that a CARB approved emissions control strategy must meet, and sets the criteria and process for obtaining CARB approval for an emissions control strategy.

### Rationale for Section 93130.5

Compliance via use of a CARB approved emissions control strategy is the main requirement of the Proposed Regulation. As such, this section is necessary to define what constitutes a CARB approved emissions control strategy and the process for obtaining CARB approval for an emissions control strategy.

CARB approval for an emissions control strategies are a necessary part of the Proposed Regulation. Chapter II (section C) of this staff report also details why not having the ability to use a CARB approval for an emissions control strategy in lieu of shore power has presented a challenge for vessels trying to comply with the Existing Regulation. By allowing CARB approval for an emissions control strategies to be used, the Proposed Regulation is projected to achieve additional emissions reductions in a more cost effective manner than using only shore power for all vessel types, including those that are infrequent visitors to California.

## **Section 93130.5(a) Executive Order Requirement**

### Purpose for Section 93130.5(a)

This section establishes that no person may operate an emissions control strategy at a port or terminal for compliance with the Proposed Regulation unless it receives approval by CARB through an Executive Order. The Executive Order shall provide compliance instructions for each emissions control strategy and include requirements that each responsible party must follow in order to use that strategy.

### Rationale for Section 93130.5(a)

This section is critical to ensuring that the required emissions reductions for the Proposed Regulation are met, by ensuring that control technologies that only emissions control strategies that meet the required emissions reductions of the Proposed Regulation are used for compliance. This provision is also necessary to set forth that the Executive Order is where compliance instructions and requirements for each emissions control strategy operators would be located.

## **Section 93130.5(b) Requirement to Reduce Emissions**

### Purpose for Section 93130.5(b)(1) through (3)

This section establishes that emissions from all vessel visits must be reduced to the levels required by the Proposed Regulation, unless an exceptional event occurs (as identified in Sections 93130.4, 93130.8, or 93130.10), an alternative compliance option such as a Terminal Incident Event (TIE) or Vessel Incident Event (VIE) (as identified in section 93130.11), or remediation fund is used (as provided in section 93130.15).

### Rationale for Section 93130.5(b)(1) through (3)

This provision is necessary to ensure that the emissions reductions necessary for achieving the goals of the Proposed Regulation (as discussed in Chapter II) by requiring vessel emissions reductions on every visit, unless the visit qualifies for an exceptional event as identified in the Proposed Regulation.

## **Section 93130.5(c) Shore Power**

### Purpose for Section 93130.5(c)(1) through (4)

This section establishes shore power as a CARB approved emissions control strategy and defines emissions standards that must be met for any vessel or terminal utilizing shore power through electricity generated from distributed generation.

### Rationale for Section 93130.5(c)(1) through (4)

This provision in the Proposed Regulation is necessary to ensure that any vessel relying on shore power can use that pathway for compliance with the Proposed Regulation. If the source of the electricity is distributed generation, then this provision provides an emissions standard that provides reductions similar to what we would see with shore power. As a result of this provision, any vessel or terminal using shore power as their intended compliance pathway does not need to apply for approval, since shore power is already an approved pathway.

Establishing shore power as an approved emissions control strategy is necessary to obtain the projected emissions reductions and health benefits associated with this regulation. Shore power eliminates all emissions from the vessel's stack while the vessel is plugged in, and plugging into shore power is also the primary way to reduce GHG emissions from ocean-going vessels at berth. As mentioned in Chapter II (section A), additional GHG reductions are necessary to help California reach its climate goals.

## **Section 93130.5(d) Requirements for CARB Approval of an Emission Control Strategy**

### Purpose for Section 93130.5(d)

This section establishes the requirements that an emissions control strategy must meet in order to a CARB approved strategy for compliance with the Proposed Regulation.

### Rationale for Section 93130.5(d)

This section is necessary for manufacturers, owners, operators, and users of an emissions control strategy to know what benchmarks they must meet to gain approval for use of a control strategy.

## **Section 93130.5(d)(1), Section 93130.5(d)(2)**

### Purpose for Sections 93130.5(d)(1) and (2)

This section is necessary to define NO<sub>x</sub>, PM<sub>2.5</sub>, and ROG emission levels for ocean-going vessels auxiliary engines tanker boilers; these are emissions levels that an emission controls strategy must demonstrate to obtain CARB approval and meet the control requirements of this regulation. This section also sets a standard for GHG emissions that the strategy must meet.

This section defines default emissions rates for ocean-going vessel auxiliary engines and tanker auxiliary boilers emissions.

### Rationale for Sections 93130.5(d)(1) and (2)

Auxiliary engines are the primary engines operating onboard ocean-going vessels while they are docked at berth, and as such, are responsible for the majority of emissions from most vessel activities at berth. The notable exception of this is tanker vessels utilizing auxiliary boilers to generate steam that powers onboard pumps used to off-load cargo (such as crude oil) while at berth.

As such, defined values for auxiliary engine emissions are necessary so developers, operators, and users of emissions control technologies know what emissions standards they must meet for compliance with the Proposed Regulation. Tanker vessel boilers have different emissions profile from vessel auxiliary engines, so this section is also necessary to define those emissions rates. Knowing the percent emissions reduction needed helps developers, operators, and users of emissions control technologies tailor an emissions control strategy to one that best fits their vessel engine and/or boiler specifications.

This section is also necessary to establish that CARB approved emissions control strategies must be grid-neutral to reduce their GHG contribution. Without a grid-neutral

provision, non-shore power CARB approved emissions control strategies may generate an increase in GHG emissions due to fuel burned to power the control technology. Chapter II (Section A) details the need for GHG emissions reductions that could be achieved through the use of grid-neutral CARB approved emissions control strategies.

### **Section 93130.5(d)(3)**

#### Purpose for Section 93130.5(d)(3)

This provision establishes that if CARB has already issued an Executive Order for an emissions control strategy for compliance with the Existing Regulation, then these systems can continue to be used for compliance without having to re-apply for CARB approval. These strategies can operate under their Executive Order until 2025 before an operator needs to apply for an extension and demonstrate the strategies ability to meet all the requirements of this section, which include being grid-neutral.

#### Rationale for Section 93130.5(d)(3)

This section is necessary in order to allow existing capture and control systems to continue operating until 2025 without having to become grid-neutral. This is critical to helping reduce the cost burden on the operators/manufacturers of these systems as they prepare to invest capital to ramp up development to meet the anticipated demand of the additional vessel categories CARB staff expect to utilize non-shore power emissions control technologies.

### **Section 93130.5(d)(4)**

#### Purpose for Section 93130.5(d)(4)

This section sets limits to the amount of excess ammonia that an emissions control strategy can emit.

#### Rationale for Section 93130.5(d)(4)

CARB staff's 2018 draft of the Technology Assessment for Ocean-Going Vessels states that SCR requires ammonia to operate, and the amount of NO<sub>x</sub> reductions achieved by SCR systems depend, in part, on the amount of ammonia or urea injected. If there is insufficient ammonia or urea, the system may not achieve maximum control of NO<sub>x</sub> emissions, while an excess may result in ammonia slip. Ammonia slip refers to emissions of unreacted ammonia that result from incomplete reaction of the NO<sub>x</sub> and the reagent. Ammonia slip may cause formation of ammonium sulfates, which can plug or corrode downstream components. In the U.S., permitted ammonia slip levels are typically two to ten ppm. Ammonia slip at these levels do not result in plume formation or human health hazards.<sup>182</sup>

---

<sup>182</sup> California Air Resources Board, Draft Technology Assessment: Ocean-Going Vessels, pg. 63, May 2018, [https://ww3.arb.ca.gov/msprog/tech/techreport/ogv\\_tech\\_report.pdf](https://ww3.arb.ca.gov/msprog/tech/techreport/ogv_tech_report.pdf).



For the Proposed Regulation, staff have set the amount of allowable ammonia slip for a CARB approved emissions control strategy at no greater than 5 ppmdv. This limit was used in the Existing Regulation and is consistent with the requirement already in the Proposed Regulation for SCR used with non-grid shore power equipment.

### **Section 93130.5(d)(5)**

#### Purpose for Section 93130.5(d)(5)(A) and (B)

This section establishes that applicants applying for CARB approval of an emissions control strategy must warranty their equipment to ensure the equipment functions as approved.

#### Rationale for Section 93130.5(d)(5)(A) and (B)

This section is necessary to ensure that applicants applying for CARB approval are able to guarantee their chosen emissions control technology can meet the emissions reduction requirements of the Proposed Regulation for a set period of time. This is critical in ensuring the health goals of the Proposed Regulation are met. Ten years was chosen for warranty based on the useful life of emissions control equipment to remain consistent with other CARB funding program warranty requirements, such as the Proposition 1B funding guidelines.

### **Section 93130.5(d)(6)**

#### Purpose of Section 93130.5(d)(6)

This section ensures that each CARB approved emissions control strategy is functioning at the level it was approved at the point of sale or lease, and requires the results to be reported to the CARB Executive Officer.

#### Rationale of Section 93130.5(d)(6)

This provision is necessary to ensure that other parties buying or leasing the emissions control strategy and relying on that technology for compliance purposes will have equipment that meets the requirements of the Proposed Regulation. CARB staff consider the 30 day reporting requirement as adequate time to report to the Executive Officer and is consistent with other reporting timelines in the Proposed Regulation.

### **Section 93130.5(e) Application Process**

#### Purpose for Section 93130.5(e)(1) through (3)

This section provides an overview of the process for applying for a CARB approved emission control strategy and establishes the elements that must be accomplished prior to submitting for CARB approval of an emissions control strategy.

### Rationale for Section 93130.5(e)(1) and (2)

The submittal and approval of a test plan prior to submitting an application for CARB approval is necessary to minimize time wasted on both the part of CARB staff and technology manufacturers/operators. Requiring those seeking approval for an emission control technology to submit a test plan allows CARB staff to ensure that the standard of testing of a control technology will adequately meet CARB standards, which is important to ensure the quality of the testing results.

### Rationale for Section 93130.5(e)(3)

This section is necessary to confirm that once a technology is approved by CARB's Executive Officer, the technology can be used for compliance with the Proposed Regulation in the manner for which it was approved for compliance with the regulation.

## **Section 93130.5(f) Test Plan Requirements**

### **Section 93130.5(f)(1)**

#### Purpose and Rationale for Section 93130.5(f)(1)

This section defines the elements of a test plan, including applicant information, a description of the emissions control strategy, and a description and estimated timeline of testing.

#### Rationale for Section 93130.5(f)(1)

Submission of a test plan to CARB's Executive Officer is required prior to beginning the CARB approval process for an emissions control strategy; as such, this section is necessary to establish the proper procedures for submitting a test plan. This section is necessary to ensure that the applicant's testing will provide CARB staff with the necessary information to evaluate their emissions control strategy to the requirements of the Proposed Regulation.

#### Rationale for Section 93130.5(f)(1)(A)

This information is necessary so that CARB staff is aware who is submitting the test plan and requires the submitter to provide contact information, which enables CARB staff to follow up with the submitting party about any questions regarding the test plan information.

#### Rationale for Section 93130.5(f)(1)(B) through (D)

These sections are necessary to set forth that a test plan must include a detailed description of the emissions control technology that will be tested, a description of the testing to be conducted to demonstrate emission reductions and durability of the

technology; and a timeline for testing, along with the number of vessel visits needed to complete the testing. This information is essential for CARB staff to properly analyze the test plan to see if it meets CARB testing standards. Without reviewing this information, CARB staff would not be able to issue a testing plan approval.

### **Section 93130.5(f)(2)**

#### Purpose for Section 93130.5(f)(2)

This section establishes durability requirements requires applicants of a CARB approved emissions control strategy to conduct in-use demonstrations to prove the equipment functions properly over multiple cycles.

#### Rationale for Section 93130.5(f)(2)

This provision is necessary to ensure that the emissions control strategy seeking approval can meet and maintain the required emissions reductions in-use during real-time use and not only at one point in time.

### **Section 93130.5(f)(3)**

#### Purpose for Section 93130.5(f)(3)

This section sets forth the procedures for disapproving a test plan for a CARB approved emissions control strategy.

#### Rationale for Section 93130.5(f)(3)

This provision is essential to advise the test plan submitter that CARB staff has 30 days from the date of receipt to determine if the test plan is sufficient. CARB staff consider the 30 day time frame as adequate time to review the plan for deficiencies and report to the Executive Officer if there are problems with the test plan.

### **Section 93130.5(f)(4)**

#### Purpose for Section 93130.5(f)(4)

This section sets forth the procedures for approving a test plan for a CARB approved emissions control strategy.

#### Rationale for Section 93130.5(f)(4)

This provision is essential to advise the test plan submitter that CARB staff has 45 days from the time the test plan is deemed satisfactory notify an applicant in writing of the approval of the test plan. CARB staff consider the 45 day time frame as adequate time to review the test plan for deficiencies, then draft an approval letter to be signed by the

Executive Officer. The time frame for approving a test plan is slightly longer than disapproving a plan due to the drafting of a formal letter of approval. If an applicant has not heard of a test plan disapproval within the 30 day window of submittal, it should be assumed that CARB has accepted the test plan and is in the process of drafting an approval letter.

## **Section 93130.5(g) Source Testing**

### Purpose for Section 93130.5(g)

This section establishes the requirements and specifications for source testing, including measurement standards for NO<sub>x</sub>, N<sub>2</sub>O, CO<sub>2</sub>, CO, CH<sub>4</sub>, total organic gas (TOG) and DPM, calculations for PM<sub>2.5</sub>, ROG and CO<sub>2</sub>E, test procedures to measure ammonia slip. This section also establishes the standard of sulfur content for any fuels used to power an emissions control strategy, the measurement standard for exhaust flow rates and engine work.

### Rationale for Section 93130.5(g)

This section is necessary to define measurement standards needed for source testing, which is required as part of an application to gain CARB approval for an emissions control strategy.

### Purpose and Rationale for Section 93130.5(g)(1)

This section is necessary to define that NO<sub>x</sub>, N<sub>2</sub>O, CO<sub>2</sub>, CO, CH<sub>4</sub>, and DPM should be measured using ISO 8178 test procedures. This test method was used in previous regulation to measure PM emissions on ocean-going vessels. The ISO method has additional provisions for measuring many other gases that are needed for source testing.

### Purpose and Rationale for Section 93130.5(g)(2)

This section is necessary to define what weight fraction is used for PM<sub>2.5</sub> measurements. This factor was selected because PM<sub>2.5</sub> can be estimated based on PM emissions with known speciation profiles for internal combustion engines and external combustion boilers on distillate.

### Purpose and Rationale for Section 93130.5(g)(3)

This section is necessary to define how ROG will be calculated. This specific method was selected because ROG can be estimated based on TOG emissions with known speciation profiles for internal combustion engines and external combustion boilers on distillate. TOG is measured using Method 25A.

#### Purpose and Rationale for Section 93130.5(g)(4)

This section is necessary to establish how CO<sub>2</sub>E will be calculated. This specific method was selected to align with the 100-year global warming potential (GWP) from IPCC AR4. This section also establishes that strategies using a fuel with a CARB Low Carbon Fuel Standard (LCFS) certified pathway may apply a reduction to CO<sub>2</sub>E by the factor of the carbon intensity of the fuel to the carbon intensity of the standard fuel. This is necessary to permit CARB approved emissions control strategy operators to use certified LCFS pathways to meet GHG requirements of the Proposed Regulation.

#### Purpose and Rationale for Section 93130.5(g)(5)

This section is necessary to establish how “GHG neutral” should be calculated. This specific method was selected to compare the control strategies GHG emission rate to the eGRID average for the State.

#### Purpose and Rationale for Section 93130.5(g)(6)

This section is necessary to establish that ammonia slip should be measured using the Bay Area Air Quality Management District Source Test Procedure ST-1B, Ammonia Integrated Sampling, dated January 1982, or another equivalent CARB or district approved test method(s). This specific method was used in previous regulations.

#### Purpose and Rationale for Section 93130.5(g)(7)

This section is necessary to establish that the sulfur content of fuels should be determined using ISO 8754 (as adopted in 2003). This specific method was used in previous regulations.

#### Purpose and Rationale for Section 93130.5(g)(8)

This section is necessary to establish that “Exhaust Flow Rate” should be measured using Method 100. This specific method was used in previous regulations.

#### Purpose and Rationale for Section 93130.5(g)(9)

This section is necessary to establish that “Engine Work” should be determined by measuring the generators electrical output during testing. This provides the total power used by the control strategy for purpose of determining that the strategy is grid-neutral.

### **Section 93130.5(h) Application and Other Submittals to CARB**

#### Purpose for Section 93130.5(h)

This section establishes the steps for submitting an application for CARB approval of an emissions control strategy.

#### Rationale for Section 93130.5(h)

This section is necessary for applicants to understand how to properly submit an application for CARB consideration.

#### Purpose and Rationale for Section 93130.5(h)(1)

This section establishes how parties applying for CARB approval for an emissions control strategy should submit their information to CARB. This section is necessary to inform applicants how to submit information to CARB.

#### Purpose and Rationale for Section 93130.5(h)(2)

This section establishes that verbal submissions do not constitute acceptable application formats. This section is necessary to ensure that applicants understand verbal communication is not a substitute for submitting an application for an emissions control strategy to receive consideration for approval.

#### Purpose and Rationale for Section 93130.5(h)(3)

This section establishes that electronic submittals are acceptable formats to submit an application or supporting documentation at the discretion of CARB's Executive Officer. This section is necessary to let applicants know they can electronically submit their application and supporting documentation, which can save time and resources over submitting written copies of information. This section is also necessary to allow CARB's Executive Officer to approve various methods of electronic submittal.

#### Purpose and Rationale for Section 93130.5(h)(4)

This section establishes that applications should follow the format described in CARB's Recommended Emissions Testing Guidelines for Ocean-Going Vessels (dated June 20, 2012). This section is necessary to ensure applications submitted to CARB staff follow a familiar format in order to assist with expediting review and processing of the application documentation.

#### Purpose and Rationale for Section 93130.5(h)(5)

This section establishes that CARB may allow electronic or e-mail submittals with instructions on the CARB website. This section is necessary to advise applicants that they may use electronic methods to submit their application and supporting documentation, and that CARB can provide instructions on how to do so via CARB's website.

### Purpose and Rationale for Section 93130.5(h)(6)

This section is necessary to establish that the Executive Officer is the party at CARB that would determine if an application is complete, and will notify the applicant within 30 days requesting additional information about what is needed to complete the application. This section is necessary to inform applicants which party at CARB is ultimately responsible for determining the completeness of an application, and the time frame in which additional information would be requested by. CARB staff consider the 30 day reporting requirement as adequate time for the Executive Officer to evaluate the application for any deficiencies, and is consistent with other reporting timelines in the Proposed Regulation.

### **Section 93130.5(i) CARB approval of the control strategy**

#### Purpose for Section 93130.5(i)

This section establishes the process for receiving an Executive Order for an emissions control technology, and how to apply for an extension or modification to an existing Executive Order, and conditions in which CARB can revoke an Executive Order.

#### Rationale for Section 93130.5(i)

This provision is necessary to set a reasonable timeframe of 90 days for applicants to expect an Executive Order after submitting a complete application. The 90 days provides CARB staff time to review and analyze the application and source test report and prepare an Executive Order. The Executive Order is valid for 5 years, before needing to apply for an extension, as CARB staff considers 5 years to be an appropriate amount of time for emissions control technology to function at approved levels before re-evaluating and assessing the equipment to see if any improvements or upgrades to the system are necessary.

### **Section 93130.5(i)(1)**

#### Purpose for Section 93130.5(i)(1)

This section establishes the timeline for extending approval of a CARB approved emission control strategy.

#### Rationale for Section 93130.5(i)(1)

This section is necessary to provide operators of a CARB approved emissions control strategy with an expedited pathway to keep their technology registered as CARB approved as long as there are no changes or modifications to the system. CARB staff consider three months adequate time to perform a thorough review of past performance data for a CARB approved emissions control technology seeking an extension, then draft a letter of approval if the Executive Officer determines that the modifications have

no material effect on the control strategy, or if the modifications are found to affect the control strategy but the strategy's emission reductions still meet the requirements in section 93130.5(d) of this Control Measure.

### **Section 93130.5(i)(2)(A) through (E)**

#### Purpose and Rationale for Section 93130.5(i)(2)

This section is necessary to lay out criteria for modifying a technology that has an existing CARB approval, and ensure that CARB has a mechanism to revoke an Executive Order for strategies that are modified without approval or no longer meet the approved reduction levels. This section is necessary to allow for changes to a strategy while also ensuring that the strategy's emissions reductions levels are maintained.

#### Purpose and Rationale for Section 93130.5(i)(2)(A)

This section establishes that any modification to the design or operation of a CARB approved emission control strategy that have any potential to affect the emissions control effectiveness or operational performance must be reviewed and approved by the Executive Officer before they are implemented. This section is necessary to ensure changes are not made to a system that negatively affect the emissions reductions the technology is achieving, which is essential to ensuring the required emissions reductions for the regulation are being achieved.

#### Purpose and Rationale for Section 93130.5(i)(2)(B)

This section establishes that a failure to obtain Executive Officer approval before modifying the design or operation of a CARB approved emission control strategy is a violation, and may also be grounds for revocation of CARB's approval. This section is necessary to ensure operators of a CARB approved emissions control strategy may have their CARB approval status revoked if they make unauthorized design or operational modifications for the reasons stated in the Purpose and Rationale for Section 93130.5(i)(2)(A).

#### Purpose and Rationale for Section 93130.5(i)(2)(C)

This section establishes the requirements of what an applicant must describe and submit to CARB staff for review if making any modifications to the operation or performance of a CARB approved emissions control strategy. This section is necessary to ensure that applicants are submitting appropriate information to CARB staff to enable staff to determine if the changes to the CARB approved emissions control strategy would affect the performance of the technology. This section also ensures that proposed changes can be made to allow for clarification to the EO, to enable changes of ownership, or other minor changes that do not modify the design or operation of the strategy.



#### Purpose and Rationale for Section 93130.5(i)(2)(D)

This section establishes that a modification to a CARB approved emissions control strategy includes (but is not limited to): any change of materials used in, or specifications of, the control strategy; any change to the components, component design, composition, materials, or reagent usage; any change to the sensors, part sizes, or sizing methodology; any change to the monitoring and notification system control; logic, algorithms, operating parameters; or any proposed change to a portion of the approval. This section is necessary to inform operators of a CARB approved emissions control strategy what types of changes would be required to be reported to CARB as a modification.

#### Purpose and Rationale for Section 93130.5(i)(2)(E)

This section establishes that CARB's Executive Officer will reissue the approval with updates to reflect the modifications if he or she determines that the modifications have no material effect on the control strategy, or if the modifications are found to affect the control strategy but the strategy's emission reductions still meet the requirements of the Proposed Regulation. This section is necessary to inform operators of a CARB approved emissions control strategy of the procedure once a modification notification has been submitted to CARB.

### **Section 93130.5(i)(3) Revoking a CARB Approved Emissions Control Strategy**

#### Purpose and Rationale for Section 93130.5(i)(3)

This section is necessary to establish that if an applicant modifies the design or operation of a CARB approved emission control strategy without review and approval pursuant to subsection 93130.5(i)(2), CARB's Executive Officer may revoke approval of the emission control strategy. To resume compliance using the strategy, the applicant must re-submit an application and receive a new approval. This section is necessary to ensure that if changes are made to a system that CARB is not made aware of that negatively affect the emissions reductions the technology is achieving, then CARB has the ability to revoke approval of the emissions control strategy. This provision is essential to ensuring the required emissions reductions for the regulation are being achieved.

### **Section 93130.5(j) Review of CARB Approved Emissions Control Strategy**

#### Purpose of Section 93130.5(j)

This section sets testing requirements for emissions control strategies, and sets forth that applicants will provide a report demonstrating the results to CARB annually. This provision also establishes that CARB's Executive Officer may modify the testing frequency as he or she deems appropriate, and may also request that the owner or operator of a CARB approved emission control strategy conduct periodic emission

source testing or other types of monitoring to verify the proper operation of a control technology or emission rates of an auxiliary engine.

#### Rationale for Section 93130.5(j)

This provision is necessary to provide a check point for CARB to have in writing that the strategy remains effective each year. Applicants would be required to submit testing by December 31 each year to ensure that CARB receives the results each calendar year.

### **Section 93130.5(k) Records Retention**

#### Purpose of Section 93130.5(k)

This section sets the timeline of 5 years for retaining records and an expected delivery time of 30 days to supply CARB with records when requested.

#### Rationale for Section 93130.5(k)

This provision is necessary to ensure that regulated parties maintain records for a sufficient amount of time for CARB to enforce the regulation. The records retention for 5 years and expected delivery of records in 30 days is consistent with other recordkeeping requirements.

### **Section 93130.6. Opacity Requirement**

#### Purpose for Section 93130.6

This section requires all ocean-going vessels visiting a California port or terminal or at anchorage in California waters to adhere to California's general opacity standards under HSC section 41701.3.

#### Rationale for Section 93130.6

This section is necessary to allow CARB staff a clear mechanism to enforce opacity violations on ocean-going vessels at port or anchorage in California waters. The opacity provision is the only portion of the Proposed Regulation that applies to vessel at anchorage. These standards are consistent with California's general opacity standards.

### **Section 93130.7. Vessel Operator Requirements**

#### Purpose for Section 93130.7

This section defines the requirements that vessels visiting a terminal in California must meet in order to comply with the Proposed Regulation.

### Rationale for Section 93130.7

This section is necessary to explain what a vessel and/or vessel operator must do to comply with the Proposed Regulation and is necessary in order to hold vessel operators responsible for reducing emissions at berth. Without the ability to hold vessel operators responsible for their role in reducing pollutants at berth, the emissions reductions and health benefits goals of the Proposed Regulation could not be achieved.

### **Section 93130.7(a) Shore Power Requirements For At Berth Emissions Reductions**

#### Purpose for Section 93130.7

This section defines the requirements that vessels visiting a terminal in California must meet in order to comply with the Proposed Regulation.

#### Rationale for Section 93130.7

This section is necessary to explain what a vessel and/or vessel operator must do to comply with the Proposed Regulation and is necessary in order to hold vessel operators responsible for reducing emissions at berth. Without the ability to hold vessel operators responsible for their role in reducing pollutants at berth, the emissions reductions and health benefits goals of the Proposed Regulation could not be achieved.

### **Section 93130.7(a) Shore Power Requirements For At Berth Emissions Reductions**

#### Purpose for Section 93130.7(a)

This section establishes that vessels with operational and commissioned shore power equipment must plug in to shore power on each visit to a compatible shore power berth.

#### Rationale for Section 93130.7(a)

This section is necessary to ensure that if a vessel is shore power capable and has functional and commissioned shore power equipment, then shore power will be the method used to reduce the vessel's emissions at berth. This provision also prevents an alternative strategy from being used in lieu of shore power when both terminal and vessel have compatible shore power equipment.

Chapter II (Section A) explains the need for additional NO<sub>x</sub>, PM, ROG, and GHG emissions from ocean-going vessels. Section 93130.7(a) is critical to achieving these emissions reductions goals, and consequently the health benefits, of this regulation. Shore power eliminates emissions at the stack of a vessel, giving the highest emissions reductions from the auxiliary engine possible for a control strategy at berth.

Ocean-going vessel auxiliary engines emit cancer-causing DPM, and as such, reducing DPM emissions from vessels at berth is critical to reducing cancer risk in affected port

communities. This provision is also critical to achieving expected additional GHG reductions through the increased use of shore power at berth, helping the state to make progress with its reduction goals and reduce the impacts of climate change.

Based on CARB staff analysis, container, reefer, and cruise vessels are the most likely vessel categories to use shore power. Because the majority of these vessel types are already regulated, achieving the GHG emissions reductions goals of this regulation depends on continued and increased in shore power use from these three vessel types. This provision would require shore power to be used wherever feasible, versus allowing for alternatives that may not reach the emissions reductions level of shore power.

## **Section 93130.7(b) Requirements For Vessel Auxiliary Engines**

### Purpose for Section 93130.7(b)

This section establishes the dates by which specific vessel types must control auxiliary engine emissions through a CARB approved emission control strategy while at berth.

### Rationale for Section 93130.7(b)

This section is necessary to identify the dates in which compliance obligations begin for reducing vessel auxiliary engines emissions, unless otherwise exempt from the Proposed Regulation as per Sections 93130.4, 93130.8, or 93130.10. As discussed in Chapter II, there is a need for emissions reductions from ocean-going vessels to occur as quickly as possible in order to help California meet necessary goals to reduce air pollution related health burdens throughout the state. This provision is necessary to inform to vessels, terminals, and ports when they must be ready to comply with the Proposed Regulation in order to help further California's goals for protecting public health, particularly those communities in and around the state's commercial ports.

Chapter III contains an additional detailed description of all the analyses performed by CARB staff in determining these implementation dates.

### **1. Determining Container, Reefer, and Cruise Vessel Implementation Dates**

An implementation date of January 1, 2021, is necessary for container, reefer, and cruise vessels that are subject to the Existing Regulation in order to shift the currently regulated vessels as quickly as possible to the new regulatory structure. The prompt transition to the new regulation is necessary to address as quickly as possible the challenges currently regulated vessels face with the Existing Regulation, including short stays and meeting the three/five hour time limit for operating auxiliary engines. These challenges and need to address them are discussed in detail in Chapter II (Section C). CARB staff determined that January 1, 2021, is the earliest feasible effective date possible based on the timing of the regulatory process.

When evaluating the earliest feasible phase in date for container, reefer, and cruise vessels, CARB staff used the Berth Analysis Prop 1B berths and extensive conversations with terminal operators to determine that minimal additional infrastructure would be required to support the increased regulatory requirements. CARB staff's analysis reflects significant shore power infrastructure already in place at all of the container, reefer, and cruise terminals as a result of the Existing Regulation. Most container, reefer, and cruise vessel fleets calling California are subject to the Existing Regulation, and as such, already have shore power infrastructure on a large majority of the vessels visiting the State's regulated ports.

CARB staff recognize there are a small number of container, reefer, and cruise vessels (around 36 total in 2017) that are in fleets not subject to the Existing Regulation, and those vessels may require additional time to install shore power equipment or procure an alternative CARB approved emissions control strategy in order to comply with the Proposed Regulation. As such, staff propose offering an exception to vessels that were never part of a fleet before January 1, 2021, that was subject to the requirements of the Existing Regulation between the years 2014 to 2020.

## **2. Determination for Setting Ro-Ro Vessel Implementation Date**

Ro-ro vessels are set to phase into the Proposed Regulation beginning on January 1, 2025. Based on information gathered during the regulatory development process, a phase in period of four years is anticipated to allow enough time for ro-ro vessel and terminal operators to obtain a CARB approved emissions control strategy.

Conversation with industry thus far demonstrate to CARB staff that capture and control systems (a mixture of both barge and land-based) will be the primary pathway for compliance for ro-ro vessels. CARB staff analyzed the amount of time it took for capture and control system manufacturers to submit a test plan, design and build the system, apply for and receive the necessary permits, component assemble the system, then test and commission the system. This development process took on average 12 months to 18 months for the existing systems but as long as 4 years, which staff assume is an over-estimate due to these systems being the first of their kind. New barge and land based capture and control systems are expected to take similar amounts of time to manufacture, however, land-side systems may require some amount of wharf infrastructure improvements due to the weight of the system (around 120,000 lbs.).

No wharf infrastructure improvement needs (such as wharf strengthening or additional platforms) were expressed to CARB staff during conversations with terminal operators and port staff for any of the ro-ro berths anticipated to be included in the Proposed Regulation. As such, CARB staff assumes that the timeline for acquiring emissions control technologies for ro-ro terminals will depend solely on the technology manufacturer's ability to scale up production of the existing barge and land-based systems. Through conversations with capture and control manufacturers, CARB staff determined that a 2025 phase-in date is achievable for ro-ro vessels, as existing

technologies (shore power and capture and control systems) are capable of achieving the required emissions reductions from these vessel types.

### **3. Determination for Setting Tanker Vessel Implementation Date**

This section is necessary to bifurcate the implementation dates for tanker vessels calling traditional ports versus marine oil terminals.

CARB staff propose implementation for tanker vessels visiting POLA and POLB to begin January 1, 2027, and for tanker vessels visiting all remaining terminals to begin on January 1, 2029. Similarly, to the ro-ro vessel category, staff assumes the majority of tanker visits will use capture and control systems based on industry feedback. Based on conversations with the industry throughout the regulatory development period, CARB staff assume that tanker vessels would comply with the Proposed Regulation using land-based capture and control systems for the purpose of this Staff Report (as reflected in staff's Berth Analysis in Appendix E). Capture and control systems are established technologies that are adapted for marine use on container and bulk vessels already, and plans are in development to adapt the existing technologies for use on tanker vessels.

As discussed in Chapter III (Section D), existing tanker terminals are designed to have minimal wharf space, and most terminals have identified to CARB staff that they will need significant infrastructure improvements to handle the weight of new emissions control equipment including positioning booms, as well as additional piping and pilings to sufficiently support the control equipment. Marine oil terminals in Northern California have additional complicating factors when considering infrastructure improvements, with terminals called "long wharves" that can stretch out over a mile into the San Francisco Bay and Carquinez Straits. The structure of these long-wharf style terminals can result in more complexities in performing infrastructure upgrades.

CARB staff assume a land-based capture and control systems for tanker vessels would be more complex for tanker vessels than the existing land-based system in demonstration at POLA. Based on conversations with the tanker industry and capture and control technology manufacturers, a land-based capture and control system for tanker vessels would likely consist of a large centralized exhaust gas treatment system on-shore, with ducting on the wharf connecting to a positioning boom located on the berth or nearby platform constructed to house the positioning boom. Existing capture and control systems would also need to be scaled up from the existing systems in order to handle higher exhaust flow rates from tanker vessels (as shown in Chapter III, Table III-1).

Infrastructure development and the permit process stand out as the most time consuming and complex parts of utilizing land-based capture and control technology to control emissions from a tanker vessel. A longer timeline is expected for any infrastructure project being undertaken in Northern California due to the "long wharf" structure of these terminals. For these reasons, staff propose that implementation for

tanker vessels would begin in 2027 at POLA and POLB, which would account for roughly 40 percent of the State's tanker visits (Appendix E), and 2029 for all other tanker terminals statewide, due to the generally large amount of anticipated wharf improvements needed to install land-based capture and control systems at most tanker terminals. The earlier date for POLA and POLB tanker terminals also highlights the pressing need for NOx reductions in the South Coast Air Basin.

A staggered implementation schedule also seeks to reduce the burden on emissions control technology providers, bringing all tanker terminals and ro-ro terminals in at the same time would stress the ability of the existing equipment manufacturers to design, build, and deploy their systems, and would likely result in backorders and delays.

### **Section 93130.7(c) Requirement for Boilers on Tanker Vessels with Steam Driven Product Pumps**

#### Purpose for Section 93130.7(c)

This section establishes the dates by which tankers using boilers to power steam-driven pumps to off-load cargo must control auxiliary boiler emissions through a CARB approved emission control strategy while at berth.

#### Rationale for Section 93130.7(c)

This section is necessary to identify the dates in which compliance obligations begin for reducing auxiliary boiler emissions from tankers using boilers to power steam-driven pumps at berth, unless otherwise exempt from the Proposed Regulation as per Sections 93130.4, 93130.8, or 93130.10.

This provision is necessary to achieve significant reductions of NOx and PM from tanker auxiliary boilers. As discussed in Chapter I (Section B), tanker auxiliary boilers are the predominant source of pollution from tanker vessels using boilers to power steam-driven pumps at berth. As mentioned in the discussion for Section 93130.7(b), there is a need for emissions reductions from ocean-going vessels to occur as quickly as possible in order to help California meet necessary goals to reduce air pollution related health burdens throughout the state. Section 93130.7(c) is critical to helping achieve those goals in regions of the state that have numerous marine oil terminals with collectively high tanker vessel activity, such as the Richmond and Carquinez regions in Northern California and POLA and POLB in Southern California.

The implementation dates for tankers boilers used to power steam-driven pumps were selected to line up with the requirement for reducing auxiliary engine emissions. Aligning these requirements prevents vessels and terminals from having to make multiple investments in control requirements for auxiliary engines and boilers. As discussed in Section 93130.7(b), there is a need to bifurcate the implementation dates due to anticipated longer infrastructure improvement timelines at marine terminals.

## **Section 93130.7(d) Visits By Vessels with Onboard Control Strategies**

### Purpose for Section 93130.7(d)

This section states that if a vessel utilizes a CARB approved emission control strategy that is operated solely on the vessel, then vessel operators would be required to confirm with terminal operator that the equipment is operational and will be used, prior to the vessel's arrival at a California berth.

### Rationale for Section 93130.7(d)

This section is necessary to establish communication and use requirements for a vessel using an onboard emissions control strategy. Because terminals also have requirements under this regulation, this provision is critical to making sure all parties are informed of which emissions control strategy a vessel will use. This allows a terminal to take the appropriate steps to ensure their own compliance with the Proposed Regulation, and to prevent the terminal from unnecessary costs from labor to connect a vessel to shore power or an alternative emissions control strategy to reduce the vessel's emissions at berth.

## **Section 93130.7(e) Vessel Compliance Checklists**

### Purpose for Section 93130.7(e)

This section provides compliance checklists that a regulated vessel must follow in order to ensure a compliant visit at a regulated berth, and failure to perform any of the specific items constitutes a separate violation of the Proposed Regulation.

### Rationale for Section 93130.7(e)

This section is necessary to provide clear tangible steps that a vessel can follow to ensure their own compliance with the Proposed Regulation. This addresses concerns with the Existing Regulation, as discussed in Chapter II (Section C), where compliance may not be determinable for several months due to the annual fleet averaging compliance requirement.

## **Section 93130.7(e)(1)**

### Purpose for Section 93130.7(e)(1)(A) and (B)

This section establishes the timeframe that a vessel must communicate with the terminal about how the vessel intends to comply with the Proposed Regulation.



### Rationale for Section 93130.7(e)(1)(A) and (B)

This provision is necessary to ensure that both the vessel and terminal operators have adequate time to agree upon a CARB approved emissions control strategy to reduce emissions for the visit, and that the vessel is taking an active role in reducing their emissions at berth. This section also ensures that this communication is documented in writing for CARB staff enforcement purposes. Some preparation time is needed for terminal operators to arrange a shore power connection or alternative emissions control strategy for all the vessels at their terminal on the date of the vessel's arrival. As such, CARB staff consider seven days an appropriate amount of time for vessel and terminal operators to agree on a emissions control strategy to be used for a vessel's visit at berth.

### **Section 93130.7(e)(2)**

#### Purpose for Section 93130.7(e)(2)

This section protects both the vessel and terminal/port infrastructure by requiring the equipment on both the vessel and shore-side to be commissioned to ensure compatibility.

#### Rationale for Section 93130.7(e)(2)

This provision is necessary to ensure safe operation of high voltage equipment on the vessel and terminal side. Section 93130.7(e)(2) is also critical in specifying that commissioning requirements are dictated by the terminal operator. In the Existing Regulation, vessels are not excused from control requirements for commissioning visits. The Proposed Regulation will provide exceptions for some commissioning visits, and this section of the Proposed Regulation text is necessary to establish that a vessel must comply with the terminal's requirements for commissioning.

### **Section 93130.7(e)(3)**

#### Purpose for Section 93130.7(e)(3)(A) and (B)

This section sets operational requirements for a vessel using a CARB approved emissions control strategy.

#### Rationale for Section 93130.7(e)(3)(A) and (B)

This section is necessary in order to ensure that a vessel begins using an emissions control strategy to achieve the required emissions reductions. This provision is critical to achieving the expected emissions reductions required from the Proposed Regulation.

A one hour connection window, after "ready to work", was chosen by CARB staff after considering successful shore power and barge-based capture and control system

connections from the beginning of implementation for the Existing Regulation (January 1, 2014) through 2018. This period was the most up to date compliance information available at the time of this Staff Report.

The Existing Regulation resulted in difficulties with vessels being able to connect within three hours of arrival due to uncertainties in the time to reach “ready to work”. In the proposed regulation, the one-hour connection window after “ready to work” is tied to the revised definition of a visit. By using a control period beginning one hour after “ready to work”, the proposed regulation eliminates the potential issues with the vessel being available within the three hours of arrival. With the change in what constitutes a visit for the Proposed Regulation, up to one hour to connect and one hour to disconnect is anticipated to be adequate time for most vessels. For those vessels that do experience connection delays or early disconnections, the Proposed Regulation offers a mechanism for vessel or terminal operators (depending on the reason for delayed connection or early disconnection) to deal with those instances in the form of an optional remediation fund (Section 93130.15).

### **Section 93130.7(e)(4)(A) through (R)**

#### Purpose and Rationale for Section 93130.7(e)(4)(A) through (R)

This section defines which information a vessel needs to provide following a visit to a California port, as well as the due date for this information. This section is necessary to ensure vessels are providing all of the necessary information to CARB enforcement staff for compliance audits, and ensures the information is received in a timely manner. Without this information, CARB staff would not be able to ensure that a vessel is compliant with the Proposed Regulation.

#### Purpose and Rationale for Section 93130.7(e)(4)(A), (B), and (C)

This section establishes that a vessel operator must report the vessel name, IMO number, and vessel type when submitting a visit report. This information is necessary in order for CARB staff to be able to verify which vessel visited the berth.

#### Purpose and Rationale for Section 93130.7(e)(4)(D)

This section establishes that a vessel operator must report their contact information, including fleet, name, address, email address, and telephone number. This information is necessary to report in case CARB staff need to reach out to the vessel operator to confirm reported information for the visit, request missing information, or investigate discrepancies between vessel and terminal operator reports.

#### Purpose and Rationale for Section 93130.7(e)(4)(E)

This section establishes that a vessel operator must report the port, terminal, and berth(s) that the vessel visited during the timeframe that is being reported. This

information is necessary to enable CARB staff to know where the vessel visited, which assists with accurate tracking of vessel activity and provides necessary information in the event that any incidents of non-compliance occur.

#### Purpose and Rationale for Section 93130.7(e)(4)(F)

This section establishes that a vessel operator must report the vessel's arrival time and departure time to the berth. This information is necessary to enable CARB staff to know when the vessel arrived and departure for an accurate tracking of vessel activity and to determine the emissions associated with the visit. Knowing the arrival and departure time of a vessel allows CARB staff to calculate the amount of uncontrolled emissions emitted during a visit, which helps staff to calculate the reductions achieved during a visit.

#### Purpose and Rationale for Section 93130.7(e)(4)(G)

This section establishes that a vessel operator must report if a vessel shifts to another berth (when applicable). Vessel shift berths for different operational reasons including the need to load or off-load cargo at a specific location, or to move out of the way for a larger vessel coming into the berth. Shifting berths represents a separate stay at berth, and so this information is necessary to report so that CARB staff can accurately track the vessels activity and also account for the uncontrolled emissions that occur during the berth shifting activities. As with Section 93130.7(e)(F), knowing the arrival and departure time of a vessel allows CARB staff to calculate the amount of uncontrolled emissions emitted during a visit, which helps staff to calculate the reductions achieved during a visit.

#### Purpose and Rationale for Section 93130.7(e)(4)(H)

This section establishes that a vessel operator must report the type of CARB approved emissions control strategy being used to reduce emissions at berth for compliance. Because each emissions control strategy has specific operational differences, it is essential for CARB staff to know which control technology is being used during a visit in order to properly audit the visit, and to be able to calculate the amount of emissions reduced from the visit.

#### Purpose and Rationale for Section 93130.7(e)(4)(I)

This section establishes that a vessel operator must report the time that the vessel was declared "Ready to Work". As discussed in Section 93130.2(b), "Ready to Work" marks the beginning of a vessel's visit. Being declared "Ready to Work" starts the one-hour clock for a vessel to connect to a CARB approved emissions control strategy and is used to determine compliance

#### Purpose and Rationale for Section 93130.7(e)(4)(J)

This section establishes that a vessel operator must report the date and time when a CARB approved emissions control strategy begins and stops reducing emissions. This information is necessary to report so that CARB staff can determine if the visit is compliant or not, and so that staff can calculate the amount of emissions reduced during a visit.

#### Purpose and Rationale for Section 93130.7(e)(4)(K), (L), and (M)

This section establishes that a vessel operator must report the type, sulfur content, and amount of fuel used in the auxiliary engine(s) and boiler(s) during a visit. Knowing the fuel specifics used in the auxiliary engines(s) and boiler(s) is necessary for CARB staff to determine the emissions generated by the vessel while at berth.

#### Purpose and Rationale for Section 93130.7(e)(4)(N)

This section establishes that a vessel operator must report the time that the pilot boarded the vessel prior to departure. As discussed in Section 93130.2(b), "Pilot On Board" marks the end of a vessel's visit. To remain compliant with the Proposed Regulation, a vessel must control emissions until no earlier than one hour before the pilot boards the vessel to take navigational control. As such, this information is necessary to report to CARB staff as the time the pilot boards the vessel is a factor in determining if the visit was compliant.

#### Purpose and Rationale for Section 93130.7(e)(4)(O)

This section establishes that a vessel operator must report the compliance instructions specified in the CARB approved emissions control strategy's Executive Order. This information is necessary for CARB staff to have access to any specific parameters that might guide proper operation of a CARB approved emissions control strategy. Having this information reported upfront allows CARB enforcement staff to more efficiently and quickly audit vessel visits to determine compliance.

#### Purpose and Rationale for Section 93130.7(e)(4)(P)

This section establishes that a vessel operator must report if a vessel uses an exception in place of controlling emissions during a visit to a regulated berth, including the type of exception and detailed information about the use of the exception. Reporting of this information is critical, as CARB staff would not be able to make a determination of compliance without it.

#### Purpose and Rationale for Section 93130.7(e)(4)(Q)

This section establishes that a vessel operator must report if the vessel intends to use the remediation fund in place of controlling emissions, including a detailed description

that proves the vessel's visit is eligible for remediation (as specified in Section 93130.15). Reporting of this information is critical; without it, CARB staff would not be able to determine if a vessel's visit qualifies for remediation.

#### Purpose and Rationale for Section 93130.7(e)(4)(R)

This section establishes that a vessel operator must report if the vessel visit uses a TIE or VIE for the visit, as well as report the person who authorized the use of the TIE or VIE. This information is essential to report in order for CARB staff to properly and accurately track use of TIEs and VIEs. Without this information being reported, CARB staff would not be able to ensure that TIEs and VIEs were being used appropriately.

### **Section 93130.7(f) Sending Accurate and Complete Reporting to CARB**

#### Purpose for Section 93130.7(f)(1) through (2)

This section specifies to properly submit reporting information to CARB.

#### Rationale for Section 93130.7(f)(1) through (2)

This section is necessary to ensure that vessel operators are aware of the proper way to submit data to CARB. This provision is necessary to ensure that compliance data received by CARB is able to be easily processed by CARB staff. Being able to easily process reports is essential to helping CARB enforcement staff make a quick determination of compliance, which helps to resolve concerns with the Existing Regulation about the length of time it takes to determine compliance certainty (as discussed in Chapter II, Section C).

### **Section 93130.7(g) Records Retention**

#### Purpose of Section 93130.7(g)

This section sets the timeline of 5 years for retaining records and an expected delivery time of 30 days to supply CARB with records when requested.

#### Rationale for Section 93130.7(g)

This provision is necessary to ensure that regulated parties maintain records for a sufficient amount of time for CARB to enforce the regulation. The records retention for 5 years and expected delivery of records in 30 days is consistent with other recordkeeping requirements.

## **Section 93130.8. Vessel Visit Exceptions**

### Purpose for Section 93130.8

This section establishes specific situations in which vessel operators are exempt from the control requirements of the Proposed Regulation.

### Rationale for Section 93130.8

This section is necessary to address specific circumstances in which it may not be feasible to reduce a vessel's emissions using a CARB approved emissions control strategy as required by the Proposed Regulation. This provision addresses certain situations that the Existing Regulation did not address, which left compliance uncertainty for the regulated parties. As a result of this provision, vessel operators would have compliance certainty during specific infrequent events where no emissions reductions are achieved.

## **Section 93130.8(a) Vessel Safety and Emergency Events**

### Purpose for Section 93130.8(a)

This section establishes that the requirements of the Proposed Regulation does not apply during safety and emergency events and the elements that a vessel master must fulfill to qualify the vessel for an exception.

### Rationale for Section 93130.8(a)

This section is necessary to allow for a vessel to have a visit at a regulated berth that does not control emissions in specific safety and emergency situations outside of the control of the vessel that make compliance with the Proposed Regulation unobtainable. This provision is also necessary to set requirements for what a master must do to qualify for the exception to prevent an excess of unnecessary emissions reductions from occurring. This section is consistent with a similar provision in the Existing Regulation.

## **Section 93130.8(b) Bulk and General Cargo Vessels**

### Purpose for Section 93130.8(b)

This section sets forth that bulk and general cargo vessels are excluded from the control requirements at berth, but are still subject to visit reporting requirements.

### Rationale for Section 93130.8(b)

This provision is necessary to allow bulk and general cargo vessels to operate without control requirements at California berths. CARB staff analyses indicate that bulk and

general cargo vessels staff determined that the low emissions impacts combined with the difficult operational challenges at berth make bulk and general cargo vessels a poor candidate for controlling emissions at berth. This provision would prevent potential emissions increases and operational feasibility concerns that would potentially result from the placement of control requirements on bulk and general cargo vessels.

This section is also critical to explain that even without control requirements at berth, bulk and general cargo vessels are still subject to opacity requirements at berth and reporting requirements as detailed in Section 93130.7(e)(7) of the Regulation (Appendix A). This provision is necessary to get an idea of actual visit activity for the most accurate ocean-going vessel emissions inventory statewide.

Chapter III (Section B) discusses in detail why bulk and general cargo vessels and berths, terminals, and ports receiving only bulk and general cargo vessels are not subject to the at berth emissions control requirements associated with the Proposed Regulation.

### **Section 93130.8(c) Vessel Commissioning**

#### Purpose for Section 93130.8(c)

This section allows the first commissioning visit made by a vessel to a terminal to be an exception from the control requirements of the Proposed Regulation, as long as the vessel is able to successfully commission and the vessel operator submits documentation of the successful vessel commissioning. This section also permits vessel operators to submit to CARB staff for approval of additional exceptions for vessel commissioning visits if commissioning could not be accomplished in a single visit or the terminal requires that the vessel be re-commissioned.

#### Rationale for Section 93130.8(c)

This provision is necessary to address an issue with the Existing Regulation that does not take into account required commissioning of emissions control equipment. Without Section 93130.8(c), a vessel operator would be considered noncompliant with the Proposed Regulation. As discussed in Chapter II (Section C), commissioning of a shore power vessel is necessary to ensure that the vessel is compatible with the shore-side power hardware and that there are no safety issues for both the equipment and the personnel handling the connection, and subsequent commissioning visits are necessary at times.

### **Section 93130.8(d) Research**

#### Purpose for Section 93130.8(d)

This section establishes that vessels participating in testing emissions control technology at berth are entitled to an exception from the control requirements of this

regulation, only as long as the test program specifies. This exception requires that the vessel receive CARB approval or their test plan for the emissions control technology prior to arrival, participate in testing according to the approved test plan, keep a copy of the approved test plan on the vessel at all times, provide a copy of the approved test plan to CARB staff upon request, and adhere to all reporting requirements in section 93130.7 of the Proposed Regulation.

#### Rationale for Section 93130.8(d)

This section is necessary for the development of new emissions control technologies for reducing vessel emissions at berth. Without this provision, vessels would not be able to comply with the Proposed Regulation if testing new technologies; as such, vessel operators would be discouraged from testing and improving existing or newly developed control technologies, slowing technology advancement and availability of newly approved systems. It is necessary that the test plan is CARB approved to ensure testing is appropriate for the technology and application. It is necessary that the testing is conducted according with the test plan to ensure it can be used for approval. It is necessary that the vessel keep a copy of the test plan onboard to ensure that all parties involved are well aware of the testing requirements. It is necessary that CARB enforcement staff receive a copy of the test plan, if requested, so that they can verify that testing is appropriate. It is necessary that the vessel operator report the use of the exception so that enforcement can verify the documented testing occurred.

#### **Section 93130.8(e) Previously Unregulated Vessels**

##### Purpose for Section 93130.8(e)

This section establishes that previously unregulated vessels are not subject to the vessel auxiliary engine requirements in Section 93130.7(b) until January 1, 2023, and are only required to report their vessel visit activity as per Section 93130.7(e)(4) until that date.

##### Rationale for Section 93130.8(e)

This portion of the provision is necessary to enable previously unregulated vessels to delay implementation from the control requirements of the Proposed Regulation for a period of two years to allow for vessel infrastructure build out or the procurement and installation of alternative technologies.

#### **Section 93130.8(f) Vessels Visiting A Low Activity Terminal**

##### Purpose for Section 93130.8(f)

This section establishes that vessels calling terminals with low activity as specified in Section 93130.10(a) have an exception from the control requirements of the Proposed Regulation.



#### Rationale for Section 93130.8(f)

This provision is necessary to prevent vessels visiting low use terminals from being in violation with the control requirements of the control measure.

#### **Section 93130.8(g) Vessel Incident Event and Terminal Incident Event**

##### Purpose for Section 93130.8(g)

This section establishes that vessels using a vessel incident event (VIE), or calling a terminal in which a terminal operator uses a terminal incident event (TIE) for that visit, are in compliance with the requirements of this regulation as long as the VIE or TIE is used as specified in section 93130.11 of the Proposed Regulation.

##### Rationale for Section 93130.8(g)

This provision is necessary to ensure that vessels using a VIE, or at berth where the terminal operator uses a TIE for that visit, are not considered in violation of the control requirements of the Proposed Regulation if emissions are not reduced from the vessel while it is at berth.

#### **Section 93130.8(h) Remediation**

##### Purpose for Section 93130.8(h)

This section sets forth that vessels using the remediation fund option, or calling a terminal in which a terminal operator uses the remediation fund option for that visit, are in compliance with the Proposed Regulation as long as the remediation fund is used as specified in section 93130.15 of the Proposed Regulation.

##### Rationale for Section 93130.8(h)

This provision is necessary to ensure that vessels using the remediation fund option, or at berth where the terminal operator uses the remediation fund for that visit, are in compliance with the Proposed Regulation.

#### **Section 93130.9. Terminal Operator Requirements**

##### Purpose for Section 93130.9

This section defines the requirements that the terminal operators in California that receive ocean-going vessels must meet in order to comply with the Proposed Regulation.

### Rationale for Section 93130.9

This section is necessary to explain what a terminal operator must do to comply with the Proposed Regulation and is critical to holding terminal operators responsible for their role in the process of connecting a vessel to shore power or any other terminal-based emissions control technology. Without the ability to hold terminal operators responsible for their role in reducing pollutants from vessels at berth, the emissions reductions and health benefits goals of the Proposed Regulation could not be achieved.

### **Section 93130.9(a) Shore Power Requirements For At Berth Emissions Reductions**

#### Purpose for Section 93130.9(a)(1), (2), and (3)

This section establishes that operators of terminals with berths equipped to receive vessels with operational and compatible shore power equipment are responsible for connecting that vessel to shore power; commissioning vessels equipped with compatible shore power; and providing an alternative CARB approved emissions control strategy that is compatible with the vessel, if unable to connect the vessel to shore power.

#### Rationale for Section 93130.9(a)(1)

This section is necessary to establish that it is the responsibility of the terminal operator to plug in a vessel that has successfully commissioned at their terminal. This provision is critical to ensuring that shore power is used to reduce emissions at berth whenever feasible in order to achieve the emissions goals of the Proposed Regulations, and prevents an alternative strategy from being used in lieu of shore power when both terminal and vessel have compatible shore power equipment. As discussed in the vessel operator requirements section of this Chapter III (Section F), shore power achieves the highest emissions reductions from ocean-going vessels at berth, including GHG emissions reductions. Ensuring continued and increased levels of shore power connections is critical to accomplishing the emissions reductions goal set forth in this Proposed Regulation.

#### Rationale for Section 93130.9(a)(2)

This section is necessary to establish that it is the responsibility of the terminal operator to commission a vessel that is equipped with compatible shore power and visiting a shore power capable berth at their terminal. Commissioning ensures the equipment on the terminal and vessel will work safely together and allows the vessel to utilize shore power on subsequent visits, as long as no changes are made that require re-commissioning, increasing the chance for quick shore power connections.

As discussed in the vessel operator requirements section of this Chapter III (Section F), the Existing Regulation does not consider the need to commission a vessel for shore

power use. This section addresses the need for commissioning visits to be considered in the Proposed Regulation by placing the responsibility on the party that requires the commissioning visit(s).

#### Rationale for Section 93130.9(a)(3)

This section ensures that if terminal operators are scheduling and positioning vessels who have made the investment in shore power in such a way that the shore power connection onboard the vessel will not line up with the shore power connection point at the berth, then emissions reductions are still being achieved through an alternative CARB approved emissions control strategy.

This addresses a challenge with the Existing Regulation as documented in Chapter II (Section C), in which vessel fleets are frequently unable to meet their compliance obligations to reduce emissions at berth due to operational issues that are outside of their control. This section of the Proposed Regulation is necessary to put the responsibility for compliance on the terminal operator for events that are outside of the vessel's control when it comes to connecting a shore power vessel.

#### **Section 93130.9(b) Visits to Terminals without Shore Power**

##### Purpose for Section 93130.9(b)

This section establishes that terminals without shore power capable berths are responsible for arranging an alternative CARB approved emissions control strategy for a vessel visit. And if neither the vessel or the terminal have shore power, then both parties are responsible to arrange for an alternative CARB approved emissions control strategy for a visit.

##### Rationale for Section 93130.9(b)

This provision is necessary to ensure that the emissions reductions goals of the Proposed Regulation are being met, and is critical to placing responsibilities on that play a role in reducing emissions from ocean-going vessels at berth. This is key to addressing instances where vessel shore power connection do not happen because of an event on the terminal side; as discussed in chapter II (Section C), with the Existing Regulation, vessels are held responsible for missed connections, even if the missed connection is the fault of terminal operations. This provision of the Proposed Regulation shifts that responsibility to terminal operators in order to better achieve the emissions reductions expected from vessels at berth.

## **Section 93130.9(c) Visits By Vessels with Onboard Control Strategies**

### Purpose for Section 93130.9(c)

This section establishes a terminal operator's requirements for any vessel visit using an onboard CARB approved emissions control strategy during a visit.

### Rationale for Section 93130.9(c)

This provision is necessary to establish that a terminal operator does not have a responsibility to provide a technology to reduce emissions from a vessel during a visit if an onboard CARB approved emissions control strategy is used by a vessel.

## **Section 93130.9(d) Terminal Operator Compliance Checklist**

### Purpose for Section 93130.9(d)

This section provides compliance checklists that a regulated vessel must follow in order to ensure a compliant visit at a regulated berth, and failure to perform any of the specific items constitutes a separate violation of the Proposed Regulation.

### Rationale for Section 93130.9(d)

This section is necessary to provide clear tangible steps that a vessel can follow to ensure their own compliance with the Proposed Regulation. This addresses concerns with the Existing Regulation, as discussed in Chapter II (Section C), where compliance may not be determinable for several months due to the annual fleet averaging compliance requirement. This provision is also necessary to give CARB enforcement staff the ability to hold terminal operators responsible for not meeting key responsibilities necessary to achieve emissions reductions as required from a vessel visiting a berth at their terminal.

### **Section 93130.9(d)(1)**

#### Purpose for Section 93130.9(d)(1)

This section establishes the timeframe of 7 days before a vessel's arrival that a terminal operator must let an incoming vessel's operator know if the terminal can comply with the vessel's intended CARB approved emission control strategy.

#### Rationale for Section 93130.9(d)(1)

This provision is necessary to ensure that a vessel does not arrive at a terminal ready to connect to shore power or another CARB approved emission control strategy, and is unable to do so because the terminal is not prepared or able to use the intended emissions reduction technology. Some preparation time is needed for terminal

operators to arrange a shore power connection or alternative emissions control strategy for all the vessels at their terminal on the date of the vessel's arrival. As such, CARB staff consider seven days an appropriate amount of time for vessel and terminal operators to agree on a emissions control strategy to be used for a vessel's visit at berth.

### **Section 93130.9(d)(2)**

#### Purpose for Section 93130.9(d)(2)

This section establishes operating requirements for the terminal operator when using shore power to reduce emissions during a vessel's visit.

#### Rationale for Section 93130.9(d)(2)

This section is necessary to set forth the requirements a terminal operator must follow when using shore power to comply with the Proposed Regulation.

### **Section 93130.9(d)(2)(A)**

#### Purpose for Section 93130.9(d)(2)(A)

This section establishes that it is the terminal's responsibility to ensure vessels are commissioned for shore power at their facility.

#### Rationale for Section 93130.9(d)(2)(A)

This section is necessary to ensure that the terminal and associated labor, who is ultimately responsible for the connection of the vessel's shore power to shore-side equipment, has the right and responsibility to ensure proper commissioning procedures.

This section protects both the vessel and terminal/port infrastructure by ensuring the equipment on both the vessel and shore-side are compatible. This provision is necessary to ensure each shore power capable vessel is commissioned for shore power. As discussed in Chapter II (Section C), commissioning visits are required for safe operation of high-voltage shore power equipment. Recognizing commissioning visits as an exception from the Proposed Regulation is designed to resolve challenges with the Existing Regulation, where vessels are not excused from control requirements despite the necessity of the commissioning.

### **Section 93130.9(d)(2)(B) through (F)**

#### Purpose for Section 93130.9(d)(2)(B) through (F)

This section establishes the procedures a terminal operator must follow when connecting a vessel to shore power in order to comply with the Proposed Regulation.

These operating procedures include requiring terminal operators to properly position the vessel at the berth in order to connect to an emissions control strategy, time limits for connecting and disconnecting the vessel, and recording the power meter reading at the time of connection/disconnection.

#### Rationale for Section 93130.9(d)(2)(B) through (F)

This section is necessary to ensure that shore power is being used according to CARB staff's expectations; this is critical to achieving and determining if the emissions reductions and health goals of the Proposed Regulation are being obtained. This section is also critical to addressing the berth positioning and shore power time limit connection challenges seen with the Existing Regulation, as discussed in Chapter II (Section C). With the Existing Regulation, a shore power capable vessel can arrive ready to plug into shore power, but if terminal staff or labor is not ready, willing, or able to position the vessel properly to connect, then the vessel risks being in noncompliance. This is despite the vessel doing everything in its power to comply with the Existing Regulation. As such, placing this responsibility on the terminal is anticipated to resolve the majority of berth positioning issues.

One hour to connect a vessel to shore power from the time a vessel is declared "Ready to Work" was determined to be the earliest feasible moment the shore power connection process could start. This determination was based on numerous conversations with industry during meetings and public workshops by CARB staff after considering successful shore power connections from 2014 (beginning of implementation for the Existing Regulation) and 2018 (the most up to date compliance information available at the time of this Staff Report). Average times to connect and disconnect a vessel are in the range of three hours when no exceptional circumstances occur.

CARB staff are aware of the challenges some vessels experienced during implementation of Existing Regulation in regards to vessels being able to connect within three hours; however, this one-hour connection beginning at "ready to work" and disconnection window is tied to the revised definition of a visit. With the change in what constitutes a visit for the Proposed Regulation, a two-hour maximum window (one hour to connect, one hour to disconnect) is anticipated to be adequate time for a connection and disconnection to occur. For connection delays or early disconnections, the Proposed Regulation offers a mechanism to deal with those instances in the form of an option remediation fund (Section 93130.15).

#### **Section 93130.9(d)(3)**

##### Purpose and Rationale for Section 93130.9(d)(3)

This section defines the general information a terminal needs to report following a visit to a California port, as well as the due date for this information. This provision is necessary to ensure terminal operators are providing all of the necessary information to

CARB enforcement staff for compliance audits, and also ensures the information is received in a timely manner.

#### Purpose and Rationale for Section 93130.9(d)(3)(A) and (B)

This section establishes that a terminal operator must report the vessel name and IMO number when submitting a visit report. This information is necessary in order for CARB staff to be able to verify which vessel visited the berth.

#### Purpose and Rationale for Section 93130.7(e)(3)(C)

This section establishes that a terminal operator must report which port, terminal, and berth(s) that vessel visit occurred at during the timeframe that is being reported. This information is necessary to enable CARB staff to corroborate the vessel information as to where the vessel visited, which assists with accurate tracking of vessel activity and provides necessary information in the event that any incidents of non-compliance occur.

#### Purpose and Rationale for Section 93130.7(e)(D)

This section establishes that a terminal operator must report their contact information, including name, address, email address, and telephone number. This information is necessary to report in case CARB staff need to reach out to the vessel operator to confirm reported information for the visit, request missing information, or investigate discrepancies between vessel and terminal operator reports.

#### Purpose and Rationale for Section 93130.7(e)(3)(E) and (F)

This section establishes that a terminal operator must report the vessel's arrival time and departure time to the berth. This information is necessary to enable CARB staff to corroborate the vessel's reported information about when a vessel arrived and departed for an accurate tracking of vessel activity and to determine the emissions associated with the visit. Knowing the arrival and departure time of a vessel allows CARB staff to calculate the amount of uncontrolled emissions emitted during a visit, which helps staff to calculate the reductions achieved during a visit.

#### Purpose and Rationale for Section 93130.7(e)(3)(G)

This section establishes that if a terminal operator must report the type of CARB approved emissions control strategy being used to reduce emissions at berth for compliance. Because each emissions control strategy has specific operational differences, it is essential for CARB staff to know which control technology is being used during a visit in order to properly audit the visit, and to be able to calculate the amount of emissions reduced from the visit.

#### Purpose and Rationale for Section 93130.7(e)(3)(H)

This section establishes that if a terminal operator is involved in any way in providing a CARB approved emissions control strategy for use during a vessel's visit, the terminal operator must report the date and time when a CARB approved emissions control strategy begins and stops reducing emissions. This information is necessary to corroborate the vessel's reporting information so that CARB staff can determine if the visit is compliant or not, and so that staff can calculate the amount of emissions reduced during a visit.

This section is also necessary to establish that terminal operators are not responsible for reporting start and end date and time information about emissions control technologies when the terminal does not play a role in helping the vessel connect to the technology, such as when barge-based capture and control technologies or onboard emissions control technologies are used.

#### Purpose and Rationale for Section 93130.7(e)(3)(I)

This section establishes that for shore power visits, a terminal operator must report the power meter readings at the time of shore power connection and disconnection. Without this information, CARB staff would not know the power used on the vessel during a visit. This information also provides a necessary data point about how much power is being offset from auxiliary engines, and is also something that CARB staff can verify that shore power was used during a vessel's visit.

#### Purpose and Rationale for Section 93130.7(e)(3)(J)

This section establishes that a terminal operator must report the compliance instructions specified in the CARB approved emissions control strategy's Executive Order. This information is necessary for CARB staff to have access to any specific parameters that might guide proper operation of a CARB approved emissions control strategy. Having this information reported upfront allows CARB enforcement staff to more efficiently and quickly audit vessel visits to determine compliance.

#### Purpose and Rationale for Section 93130.7(e)(3)(K)

This section establishes that a terminal operator must report the use of any exception claimed by the terminal in place of using a CARB approved emissions control strategy to reduce a vessel's emissions during a visit to a regulated berth, including the type of exception and detailed information about the use of the exception. Reporting of this information is critical, as CARB staff would not be able to make a determination of compliance without it.



#### Purpose and Rationale for Section 93130.7(e)(3)(L)

This section establishes that a terminal operator must report if they intend to use the remediation fund in place of using a CARB approved emissions control strategy to reduce a vessel's emissions during a visit, including a detailed description that proves the visit is eligible for remediation (as specified in Section 93130.15). Reporting of this information is critical; without it, CARB staff would not be able to determine if a vessel's visit qualifies for remediation.

#### Purpose and Rationale for Section 93130.7(e)(3)(M)

This section establishes that a terminal operator must report if a vessel visit uses a TIE or VIE for the visit, as well as report the person who authorized the use of the TIE or VIE. This information is essential to report in order for CARB staff to properly and accurately track use of TIEs and VIEs. Without this information being reported, CARB staff would not be able to ensure that TIEs and VIEs were being used appropriately.

### **Section 93130.9(e) Sending accurate and complete reporting to CARB**

#### Purpose for Section 93130.9(e)(1) and (2)

This section specifies how to properly submit reporting information to CARB.

#### Rationale for Section 93130.9(e)(1) and (2)

This section is necessary to ensure that terminal operators are aware of the proper way to submit data to CARB. This provision is necessary to ensure that compliance data received by CARB is able to be easily processed by CARB staff. Being able to easily process reports is essential to helping CARB enforcement staff make a quick determination of compliance, which helps to resolve concerns with the Existing Regulation about determining compliance certainty (as discussed in Chapter II, Section C).

### **Section 93130.9(f) Construction or repair**

#### Purpose for Section 93130.9(f)

This section establishes that a terminal operator is responsible for providing a vessel with a CARB approved emissions control strategy in the event that the terminal's shore power equipment or alternative CARB approved emissions control strategy is unavailable due to construction or repair activities at the terminal.

#### Rationale for Section 93130.9(f)

This section is necessary to ensure that terminal operators are achieving the emissions reductions required by the Proposed Regulation during periods of extended uncontrolled emissions.

#### **Section 93130.9(g) Records Retention**

##### Purpose of Section 93130.9(g)

This section sets the timeline of 5 years for retaining records and an expected delivery time of 30 days to supply CARB with records when requested.

##### Rationale for Section 93130.9(g)

This provision is necessary to ensure that regulated parties maintain records for a sufficient amount of time for CARB to enforce the regulation. The records retention for 5 years and expected delivery of records in 30 days is consistent with other recordkeeping requirements.

#### **Section 93130.10. Terminal Exceptions**

##### Purpose for Section 93130.10

This section establishes specific situations in which terminal operators are exempt from the control requirements of the Proposed Regulation.

##### Rationale for Section 93130.10

This section is necessary to address specific circumstances in which it may not be feasible to reduce a vessel's emissions using a CARB approved emissions control strategy as required by the Proposed Regulation. Section 93130.8 addresses the small number of situations that the Existing Regulation did not address, which left compliance uncertainty for the regulated parties. As a result of this provision, vessel operators would have compliance certainty during limited occurrences where no emissions reductions are achieved.

#### **Section 93130.10(a) Vessel Visits to a Low Activity Terminal**

##### **Section 93130.10(a)(1) and (2)**

##### Purpose for Section 93130.10(a)(1) and (2)

This section establishes that the control requirements of this regulation do not apply to vessels calling low activity terminals, which are defined as any terminal receiving fewer than 20 visits in a calendar year.

## Rationale for Section 93130.10(a)(1) and (2)

This section is necessary to exclude terminals that are not a major source of pollution from the regulated vessel categories.

As discussed in Chapter III (Section C), a terminal visit threshold was set in order to include any terminals, which exceed a certain growth threshold and introduce more health burdens on their surrounding communities. This solves an indirect concern with the Existing Regulation, in which six specific ports were defined as included in the Proposed Regulation. This effectively limited potential for future expansion of the Proposed Regulation to non-defined ports without regulatory amendments, even if a significant growth in activity occurred.

The Proposed Regulation would instead use this terminal-based visit threshold to determine which ports and independent marine terminals have emissions control obligations at their berths. For the regulated vessel types, vessels visiting a terminal that exceeded the visit threshold would have requirements to reduce emissions while at that berth. Terminals included in the existing regulation already have activity above the terminal threshold. These terminals will continue to be included in Proposed Regulation.

To develop the terminal visit threshold, CARB staff gathered visit activity from California State Lands and Port Wharfinger data from calendar year 2017, which represented the most up to date visit information available to staff at the time of the analysis. CARB staff explored multiple thresholds for the different vessel types during the regulatory development process. The 20 visit terminal threshold includes the largest active container, reefer, and cruise, ro-ro, and tanker terminals in California. Where terminal activity is lower, the emissions impacts and the cost effectiveness of installing emissions control equipment are also lower. There are fewer vessels making emissions, and fewer vessels to help recoup the costs of installing, operating, and maintaining the control equipment. Thus, the 20 visit threshold is designed to be the most health protective option while also reducing cost impacts on the state's smallest terminals, where visit activity and health impacts to surrounding communities are lowest.

This section is necessary to provide a simplified approach to inclusion in the Proposed Regulation versus the Existing Regulation, in which inclusion depending solely on whether or not a fleet made a certain amount of visits to a port. With the existing regulation, vessel fleets could avoid having to comply by remaining right below the visit threshold for inclusion in the Proposed Regulation. Setting a terminal-based visit threshold, instead of a fleet-based threshold, would ensure that all container, reefer, cruise, ro-ro, and tanker vessels who call a regulated terminal will be subject to the control requirements of the Proposed Regulation.

This provision also ensures all the currently regulated ports still have control requirements, which has a dually positive effect by both preserving emissions reductions already occurring for the currently regulated port communities and

preventing emissions control equipment investments that are already in use at ports for compliance with the Existing Regulation from becoming stranded assets.

### **Section 93130.10(a)(3)**

#### Purpose for Section 93130.10(a)(3)

This section establishes that any terminal increasing in vessel activity, and consequently placing a higher health burden on nearby communities, would be included in the Proposed Regulation automatically after exceeding the thresholds for two consecutive years.

#### Rationale for Section 93130.10(a)(3)

This section is necessary to hold terminals that are planning to grow their business accountable for the increased emissions impact and associated health risks their facility has on their nearby communities.

Once a terminal has been subject to control requirements as part of the Proposed Regulation, then the terminal will remain subject to regulatory control requirements even if a drop in activity occurs to prevent terminals from fluctuating in and out of the visit threshold. This provision is necessary to ensure continued high levels of emissions reductions from vessels at berth, while also helping to protect against stranded assets for both vessel and terminal operators in the future. If a terminal operator invests in installing expensive emissions control equipment at a berth, this provision provides continued certainty that the equipment will be used.

#### Purpose and Rationale for Section 93130.10(a)(4)

This section establishes that terminal operators would be required to report visit information as described in Section 93130.9(d)(3). This section is necessary to ensure that terminal operators who do not have control requirements are still aware of the obligation to report vessel visit information, even if there is no control requirement to reduce emissions for a vessel's visit at berth.

### **Section 93130.10(b) Bulk and general cargo vessels**

#### Purpose for Section 93130.10(b)

This section establishes that bulk and general cargo vessels are not subject to the control requirements of the Proposed Regulation, but are subject to reporting requirements of the regulation as found in Sections 93130.(d)(3) beginning January 1, 2021.

#### Purpose for Section 93130.10(b)

This section is necessary to inform bulk and general cargo vessel operators and terminals receiving these vessel types that there are no emissions control requirements under the Proposed Regulation for bulk and general cargo vessels. This section is also necessary to advise these same parties that there are reporting requirements for bulk and general cargo vessels, which is necessary for CARB staff to accurately track vessel visits made by this vessel category in order to monitor their impact on California port communities. The rationale for not requiring emissions reductions at berth for bulk and general cargo vessels can be found in Chapter III, Section B.

#### **Section 03130.10(c) Terminal Safety and Emergency Events**

##### Purpose for Section 93130.10(c)(1) and (2)

This section establishes that the requirements of the Proposed Regulation do not apply during safety or emergency events and the elements that a terminal operator must fulfill to qualify that visit for an exception.

##### Rationale for Section 93130.10(c)(1) and (2)

This section is similar to a provision in the Existing Regulation, and is necessary to allow for a vessel to have a visit at a regulated berth that does not control emissions in specific safety and emergency situations outside of the control of the terminal that make compliance with the Proposed Regulation unobtainable. This provision is also necessary to set requirements for what a terminal operator must do to qualify for the exception to prevent an excess of unnecessary emissions reductions from occurring.

#### **Section 93130.10(d) Research**

##### Purpose for Section 93130.10(d)(1) through (3)

This section establishes that vessel visits which are participating in the testing of emissions control technology at berth are entitled to an exception from both the shore power preference and control requirements of this regulation for the duration of testing. The vessel must receive CARB approval of their test plan for the emissions control technology prior to arrival, participate in testing according to the approved test plan, keep a copy of the approved test plan on the vessel at all times, provide a copy of the approved test plan to CARB staff upon request, and adhere to all reporting requirements in section 93130.7(d)(5) of the Proposed Regulation.

##### Rationale for Section 93130.10(d)(1) through (3)

This section is necessary for the development of new emissions control technologies for reducing vessel emissions at berth. Without this provision, vessel and/or terminal operators would not be able to comply with the Proposed Regulation if testing new

technologies. That could discourage terminals operators from doing things to advance new technology, such as testing and improving existing or newly developed control technologies, which could slow technology advancement and availability of newly approved systems.

### **Section 93130.10(e) Terminal Incident Event and Vessel Incident Event**

#### Purpose for Section 93130.10(e)

This section establishes that terminals using a TIE, or with a vessel visit where the vessel operator is using a VIE, are in compliance with the Proposed Regulation as long as the TIE or VIE is used as specified in section 93130.11 of the control measure.

#### Rationale for Section 93130.10(e)

This provision is necessary to ensure that terminals using a TIE, or have vessels at a berth where the vessel operator is using a VIE for that visit, are not considered in violation of the control requirements of the Proposed Regulation if emissions are not reduced from the vessel while it is at berth.

### **Section 93130.10(f) Remediation**

#### Purpose for Section 93130.10(f)

This section sets forth that terminal operators using the remediation fund option, or who have a vessel visiting a berth in which the vessel operator uses the remediation fund option for that visit, are in compliance as long as the remediation fund is used as specified in section 93130.15 of the Proposed Regulation.

#### Rationale for Section 93130.10(f)

This provision is necessary to ensure that vessels using the remediation fund option, or at berth where the terminal operator uses the remediation fund for that visit, are in compliance with the Proposed Regulation.

### **Section 93130.11. Vessel Incident Exceptions and Terminal Incident Exceptions**

#### Purpose for Section 93130.11

This section establishes that there are a limited number of terminal and vessel incident events (called TIEs and VIEs, respectively) for both vessel and terminal operators in which a vessel is not able to reduce emissions during a visit. This provision addresses instances when the operational needs of a terminal or vessel result in a vessel not being able to connect to an emissions control strategy without resulting in a violation of the control measure. This section defines how those situations are granted, how many

events vessel and terminal operators will have per calendar year, the timeframe for utilizing these events, and how these events are reported to CARB.

#### Rationale for Section 93130.11

This section is a necessary to provide an optional compliance pathway that recognizes the uncertainty that may surrounds vessel movements and cargo operations while a vessel is at berth by accounting for situations such as terminal congestion, misalignment issues, or vessels that are berthed with the shore power plug on the opposite side from the vault. TIEs/VEs would also to account for the operational need for vessel redeployment (when a vessel operator needs to swap out a vessel previously in California service for a new vessel for any reason) by allowing vessel fleets to bring in a small number of infrequently visiting non-shore power vessels without needing redundant control systems.

This provision is necessary to address the challenges of the Existing Regulation in dealing with these operational events. As discussed in Chapter II (Section C), challenges with connecting a vessel to CARB approved emissions control strategy at berth can occur on the vessel or terminal side (or both), and having a mechanism to deal with limited occurrences in the Proposed Regulation without sacrificing significant emissions reductions makes for a more successful regulation. The number of TIEs/VEs are capped to keep emissions reductions high for surrounding port communities, thus not sacrificing significant emissions reductions.

TIEs/VEs are meant to be used for exceptional circumstances, not banked and not used to allow for an extended period of uncontrolled emissions. TIEs/VEs will expire annually, with no banking or rolling over to the next year or trading between fleets or terminals. Use of TIEs/VEs would be tracked through CARB's Freight Regulations Reporting System.

To grant TIEs/VEs for the initial year of implementation, CARB staff will calculate TIEs/VEs based on 2019 visit activity. 2019-visit activity is due to CARB staff under the Existing Regulation on April 1, 2020, which gives staff ample time to calculate TIEs/VEs for the initial year of the Proposed Regulation.

#### **Section 93130.11(a) Granting VIEs and TIEs**

##### Purpose for Section 93130.11(a)(1)

This section establishes which parties will receive VIEs and TIEs, the process in which VIEs and TIEs are granted each calendar year and when VIEs and TIEs will be formally granted by CARB

##### Rationale for Section 93130.11(a)(1)

This section is necessary to explain how VIEs and TIEs are granted each calendar year.

For terminals, TIEs are granted to the terminal operator that is designated in a vessel's visit report, and are based on a percentage of the terminal's total vessel visits for that calendar year. TIEs are designed for unexpected situations encountered on the terminal side, and are determined by number of vessel visits to a terminal in a calendar year.

Likewise, VIEs are granted to the fleet operator that is designated in a vessel's visit report, and are based on a percentage of that fleet's vessel visits to each port. VIEs are for unexpected situations encountered on the vessel side, and are determined by the number of visits a vessel fleet makes to a port in a single calendar year. The amount of VIEs would be based on the number of visits a fleet makes to a port. Vessel fleets are self-designated by the vessel in the required visit report, and vessel fleet operators would be able to assign a VIE to a visit made by vessels in their fleet. Terminal operators would be able to assign a TIE to a visit made by a vessel to the terminal.

This provision was structured so that both vessel and terminal operators would have a mechanism to deal with operational challenges at berth, while not requiring redundant control systems in order to remain in compliance with the Proposed Regulation.

Because vessels make visits to California ports every day of the year, CARB staff will not have access to all visit information for a given calendar year until at least the first week of January of the following calendar year. A calendar year was chosen to remain consistent with the reporting requirements of the Existing Regulation. CARB staff consider February 1 of each calendar year as the earliest feasible date staff can grant the VIEs and TIEs for the year, as staff will need time to collect and corroborate vessel reporting data against port wharfinger data to ensure the accurate number of VIEs and TIEs are assigned. CARB staff consider this three to four week time period in January to be sufficient time to process vessel visit and wharfinger information in order to grant VIEs and TIEs.

#### Purpose for 93130.11(a)(2)

This section establishes that the number of VIEs and TIEs granted is rounded to the nearest whole number when calculating the percentage based on the number of vessel visits by a fleet and to a terminal, respectively. This section also sets forth that the VIEs and TIEs for the initial year of the regulation will be based on 2019 visit activity information.

#### Rationale for 93130.11(a)(2)

CARB staff consider rounding to the nearest whole number reasonable to determine the number of VIEs and TIEs a vessel or terminal operator receives, as a partial VIE or TIE cannot be used. CARB staff chose 2019 to base the VIE and TIE amounts on for the first year of the regulation in order to give vessel and terminal operators advance information about the number of VIEs and TIEs they will be eligible for the first year of



the regulation. After the initial year of the regulation, CARB staff will base VIEs and TIEs on visit information reported by the vessels and ports (via wharfinger data) for the previous calendar year.

#### Purpose for 93130.11(a)(3)

This section establishes that fleet operators would be able to assign each VIE to a visit made by a vessel in the operator's fleet. The same goes for the terminal; the terminal operator would be able to assign a TIE to a visit made by any vessel to their terminal that they chose.

#### Rationale for 93130.11(a)(3)

This section is necessary to inform vessel and terminal operators that they make the decision as to who a VIE or TIE would be used for, and what situations a VIE or TIE would be used in. CARB staff consider this provision to be an option that provides the most amount of flexibility to vessel and terminal operators to use VIEs and TIE as they best fit each specific fleet or terminal.

### **Section 93130.11(b) Table of VIEs and TIEs Rates By Vessel Category Per Year**

#### Purpose for Section 93130.11(b)

This section sets forth a table of percentages used to calculate the number of VIEs and TIEs a vessel or terminal operator is eligible for each year. This section is necessary to define what that percentage is. VIEs and TIEs are capped at a specific percentage each year, and assigned separately to the terminal and the vessel. VIEs and TIEs can be used on any vessel visit the terminal or fleet operator chooses.

CARB staff propose to give container, reefer, and cruise vessels a higher combined percentage of TIEs and VIEs (20 percent total) during first 4 years of implementation to assist with quick transition from the Existing Regulation. These VIEs and TIEs would be assigned separately with all regulated terminals receiving 15 percent TIEs the years 2021 through 2024, and vessels receiving 5 percent VIEs.

#### Rationale for Section 93130.11(b)

The basis for choosing 15 percent TIEs for terminals is a result of numerous conversations with terminal operators and port staff, as well as CARB staff's own analyses in the form of an extensive berth analysis (Appendix E). During the course of this analysis, discussions with terminal operators revealed only a small amount of infrastructure need to plug in every container, reefer, and cruise vessel calling the terminals that are expected to be included in this regulation. However, conversations and analyses provided by currently regulated ports POLA and POLB indicated that the necessary infrastructure needed to control emissions from every container and reefer vessel visit from could not be accomplished until 2025.

The Existing Regulation will be at an 80 percent requirement for plugging into shore power as of 2020, and certain berths that received state Proposition 1B (Prop 1B) funding are at a higher requirement of 90 percent. Terminals often have a mixture of Prop 1B and non-Prop 1B funded berths; as such, a compromise of 15 percent TIEs was determined to be a fair and achievable percentage that would allow the implementation date of January 1, 2021, to be broadly achievable. This provision also encourages high levels of emissions reductions while recognizing that 2021 is a short timeline for implementation, and allows for some additional time for further infrastructure build out, potentially including new vaults, cable management systems, and additional barge-based capture and control systems by 2025 when the total TIEs and VIEs decrease.

The basis for choosing five percent VIEs for vessel operators is based on the need to give an ability to handle operational challenges on the vessel side as well, in order to provide some compliance certainty for vessel operators. As discussed in Chapter II (Section C), many of the operational constraints that prevent a vessel from utilizing a CARB approved emissions control strategy at berth stem from issues on the terminal side. Because of that, this Proposed Regulation shifts many of the responsibilities for connecting vessels to a CARB approved emissions control strategy to the terminal operator. As such, it is necessary to give the terminal operators a higher percentage of the operational flexibility. When combined, the 15 percent TIEs and 5 percent VIEs equal 20 percent, which is similar to the Existing Regulation's 80 percent requirement. By allowing for this combined 20 percent flexibility with the implementation start date of January 1, 2021, the Proposed Regulation resolves the difficulties with meeting compliance with the Existing Regulation as discussed in Chapter II (Section C), while achieving similar emissions reductions.

### **Section 93130.11(c) Expiring VIEs and TIEs**

#### Purpose and Rationale for Section 93130.11(c)

This section establishes that VIEs and TIEs are available for a limited time only, and cannot be stockpiled and used an undetermined time in the future. January 31 was chosen as the date for VIE and TIE expiration in order to give vessel and terminal operators time to submit their December visit data for the previous calendar year to CARB, so that CARB may determine the amount of VIEs and TIEs each entity is granted for the next calendar year.

#### Rationale for Section 93130.11(c)

This provision is necessary to ensure each entity receives confirmation of how many VIEs and/or TIEs they will have to use for a calendar year.

## **Section 93130.11(d) Retiring VIEs and TIEs**

### Purpose for Section 93130.11(d)

This section establishes that the use of a VIEs or TIEs must be reported with the vessel visit report.

### Rationale for Section 93130.11(d)

This provision is necessary to allow CARB enforcement staff to quickly determine compliance. This section also expressly prohibits trading VIEs or TIEs to any other entity, including other fleets that the vessel is not part of, or other terminals.

This section is critical to preserving that the expected emissions reductions are being achieved in all years for communities around terminals subject to the control requirements of this regulation.

## **Section 93130.12. CARB Approved Emission Control Strategy Operator**

### Purpose for Section 93130.12

This section defines the requirements for operators of a CARB approved emissions control strategy being used for compliance with the Proposed Regulation. The operator of a CARB approved emissions control strategy may be a vessel operator, terminal operator, or an independent third party.

### Rationale for Section 93130.12

This section is necessary to explain what the operator of a CARB approved emissions control strategy must do to comply with the Proposed Regulation and is necessary in order to hold control strategy operators responsible for reducing emissions at berth. Without the ability to hold CARB approved emissions control strategy operators responsible for their role in reducing pollutants at berth, the emissions reductions and health benefits goals of the Proposed Regulation could not be achieved.

## **Section 93130.12(a)(1) and (2) Responsibilities for CARB approved emission control strategy operators**

### Purpose for Section 93130.12(a)(1) and (2)

This section establishes general guidelines for vessel and terminal operators contracting with a third party CARB approved emissions control strategy operator.

### Rationale for Section 93130.12(a)(1) and (2)

This section is necessary to ensure that vessel and terminal operators are aware that they should do their due diligence to ensure a contract is in place guaranteeing performance of a technology before selecting and relying upon a CARB approved emissions control strategy operator for compliance. Vessel and terminal operators may be held in non-compliance if the CARB approved emissions control strategy they have chosen to use for compliance fails to properly operate while at berth.

### **Section 93130.12(b) CARB approved emission control strategy checklist**

#### Purpose for Section 93130.12(b)

This section provides compliance checklists that an operator of a CARB approved emissions control strategy must follow in order to ensure a compliant visit at a regulated berth, and failure to perform any of the specific items in constitutes a separate violation of the Proposed Regulation.

#### Rationale for Section 93130.12(b)

This section is necessary to provide clear tangible steps that an operator of a CARB approved emissions control strategy can follow to ensure their compliance with the Proposed Regulation. This addresses concerns with the Existing Regulation, as discussed in Chapter II (Section C), where compliance may not be determinable for several months due to the annual fleet averaging compliance requirement.

### **Section 93130.12(b)(1)**

#### Purpose for Section 93130.12(b)(1)

This section establishes that an operator of a CARB approved emissions control strategy must communicate in writing with a vessel and terminal operators at least seven calendar days in advance about how the vessel intends to reduce complying with the Proposed Regulation.

#### Rationale for Section 93130.12(b)(1)

This provision is necessary to ensure that all parties have at least a week's notice to arrange for appropriate emissions control technologies for a vessel's visit, and that this information is in writing for CARB enforcement staff to view if a dispute arises. Some preparation time is needed for operators of a CARB approved emissions control strategy to confirm availability and arrange schedules in order to provide service to a vessel. As such, CARB staff consider seven days an appropriate amount of advance notice to arrange for a CARB approved emissions control strategy for a vessel's visit at berth.

## **Section 93130.12(b)(2)**

### Purpose for Section 93130.12(b)(2)(A) through (C)

This section sets operational requirements for operator of a CARB approved emissions control strategy.

### Rationale for Section 93130.12(b)(2)(A) through (C)

This provision is critical to ensure that the expected emissions reductions required from the Proposed Regulation are achieved by stipulating the number of hours a vessel can operate their auxiliary engines uncontrolled at berth.

One hour to connect after “ready to work” and one hour to disconnect an emissions control technology was chosen by CARB staff after considering successful connections of existing barge-based capture and control systems to container vessels. Based on compliance data received for the Existing Regulation, average times to connect and disconnect a barge-based capture and control system to a vessel are similar to the timeline for shore power connection. It is necessary to require a similar connection window for CARB approved emission control strategies in order to ensure similar emissions reductions as shore power.

The Existing Regulation resulted in difficulties with vessels being able to connect within three hours of arrival due to uncertainties in the time to reach “ready to work”. The one-hour connection after “ready to work” is achieved and one-hour disconnection window is tied to the revised definition of a visit. With the change in what constitutes a visit for the Proposed Regulation, a two-hour maximum window (one hour to connect, one hour to disconnect) is anticipated to be adequate time for a connection and disconnection to occur. For connection delays or early disconnections, the Proposed Regulation offers a mechanism to deal with those instances in the form of an optional remediation fund (Section 93130.15).

A detailed discussion on why one hour connection/disconnection window was chosen and how challenges with the Existing Regulation are being addressed can be found in Chapter II (Section C) and Chapter IV under the rationale for Section 93130.9(d)(5).

## **Section 93130.12(b)(3)**

### Purpose for Sections 93130.12(b)(3)(A) through (J)

This section as a whole defines the general information a CARB approved emissions control strategy operator needs to provide following a vessel’s visit to a California port where this technology is used, as well as the timeframe for providing this information.

### Rationale for Sections 93130.12(b)(3)(A) through (J)

This provision is necessary to ensure operators of a CARB approved emissions control strategy are providing all of the necessary information to CARB enforcement staff for compliance audits, and also ensures the information is received in a timely manner. CARB staff consider seven days an appropriate amount of time for operators of a CARB approved emissions control strategy to collect and report information about a controlled visit. A timeline for submitting this information is necessary to ensure CARB staff receive this data in a timely fashion in case there were problems during the visit that CARB enforcement staff needs to audit and investigate.

### **Section 93130.12(b)(4)**

#### Purpose for Section 93130.12(b)(4)

This section requires that operators of a CARB approved emissions control strategy notify CARB within 24 hours of a malfunction that is 1) expected to create emissions in excess of the approved emission limit for the strategy or 2) expected to occur for a period greater than one hour. This section also details the required information that operators of a CARB approved emissions control strategy must supply to CARB.

#### Rationale for Section 93130.12(b)(4)

The first part of this provision is critical to ensure that the emissions reductions are being achieved as guaranteed by the use of the strategy. If the strategy is unable to meet the approved limits for any length of time, then CARB staff need to be able to analyze both the situation that occurred and data from the system to determine how to proceed.

The second part of this provision is necessary to address any malfunction that is expected to persist over a more extended period of time, regardless of whether emissions levels are anticipated to exceed the approved emission limit for the strategy. The reason for this is two-fold; for extended malfunctions, CARB staff would need to determine whether or not the malfunction is severe enough to affect the emissions reductions achieved by the technology. On the opposite side, one hour allows for a brief window of time for operators of a CARB approved emissions control strategy to correct minor malfunctions that do not significantly impact the emissions reductions achieved by the strategy without having to notify CARB, thus reducing the administrative burden on these operators.

It is critical that operators of a CARB approved emissions control strategy report thorough information to CARB regarding malfunctioning equipment, including identifying the equipment causing the excess emissions; the magnitude, nature, and cause of the excess emissions; the duration of the excess emissions to the extent known, the corrective actions to be taken, and sufficient information to demonstrate that the malfunction was not a result of negligence, poor maintenance or design, or other

preventable situation; and any continuous emission monitor readings and ambient air readings at or near the emission point. All of this information would be necessary for CARB staff to properly evaluate the potential impacts of the malfunction.

### **Section 93130.12(b)(5)**

#### Purpose for Section 93130.12(b)(5)

This section establishes that an operator of a CARB approved emissions control strategy must submit a corrective action report for any malfunction reported to CARB if any malfunction of the system occurs.

#### Rationale for Section 93130.12(b)(5)

This section is necessary to establish the timeline and criteria for submitting the report, and is critical to ensuring that any malfunctions which may reduce the amount of emissions reductions a control strategy is capable of achieving is addressed promptly.

Requiring the documentation in writing is necessary to have documentable proof of the corrected actions. This information is critical for CARB enforcement staff to have for auditing and compliance purposes. It is also necessary to assure members of the general public and vessel operators using the technology that the required emissions reductions are being achieved by the emissions control strategy.

### **Section 93130.12(b)(6)**

#### Purpose for Section 93130.12(b)(6)

This section establishes that operators of a CARB approved emissions control strategy must keep records for a minimum of five years, and that information must be submitted to CARB's Executive Officer within 30 days upon request from CARB staff.

#### Rationale for Section 93130.12(b)(6)

This section is necessary to ensure that operators of a CARB approved emissions control strategy are retaining records for five years, which CARB staff consider an appropriate amount of time for CARB enforcement staff to complete and resolve any compliance concerns. This section is also necessary to require operators of a CARB approved emissions control strategy to submit records on request of CARB staff, which is necessary to allow CARB staff to view records in the case of any concerns that the emissions control strategy is not performing up to the standards to which it was approved. CARB staff consider 30 days an appropriate amount of time for operators of a CARB approved emissions control strategy to locate and transmit the requested records to CARB's Executive Officer, and is similar to other communication timelines in the Proposed Regulation.

## **Section 93130.12(b)(7)**

### Purpose for Section 93130.12(b)(7)

This section specifies how operators of a CARB approved emissions control strategy should submit reporting information to CARB.

### Rationale for Section 93130.12(b)(7)

This section is necessary to ensure that operators of a CARB approved emissions control strategy are aware of the proper way to submit data to CARB. This provision is necessary to help ensure that compliance data received by CARB is able to be easily processed by CARB staff. Being able to easily process reports is essential to helping CARB enforcement staff make a quick determination of compliance, which helps to resolve concerns with the Existing Regulation about determining compliance certainty (as discussed in Chapter II, Section C).

## **Section 93130.13. Port Requirements**

### Purpose for Section 93130.13

This section defines the requirements that Ports in California receiving ocean-going vessels must meet in order to comply with the Proposed Regulation.

### Rationale for Section 93130.13

This section is necessary to explain what a California Port must do to comply with the Proposed Regulation. Introducing compliance responsibilities for California Ports is essential to ensure that the necessary infrastructure needed to control emissions from vessels at berth is present at all regulated terminals overseen by a port. Without the ability to hold ports responsible for their role in reducing pollutants from vessels at berth, the emissions reductions and health benefits goals of the Proposed Regulation could not be achieved.

## **Section 93130.13(a) Port Infrastructure**

### Purpose for Section 93130.13(a)

This section establishes that a port must install equipment or infrastructure at their regulated terminals if it is outside of a terminal operators' contractual ability to provide and is necessary to comply with the Proposed Regulation.

### Rationale for Section 93130.13(a)

This provision is necessary to ensure that terminal operators have the equipment and infrastructure needed from their landlord port entities to comply with the Proposed



Regulation. Because port and terminal contractual relationships vary widely at California's ports, there is no one simple way to define a port versus terminal responsibility when it comes to installing infrastructure or equipment necessary for compliance with the Proposed Regulation. As such, section 93130.13(a) is critical to placing the responsibility for installing infrastructure and equipment on the port, unless the terminal's contract expressly permits improvements to the port's infrastructure.

### **Section 93130.13(b) Cessation of obligation**

Purpose for Section 93130.13(b)

This section establishes that the port has no responsibilities for any control equipment if the terminal and/or vessel operator elect to purchase or contract with a CARB approved emissions control strategy that does not need port assistance or infrastructure, such as a barge-based capture and control system.

Rationale for Section 93130.13(b)

This section is necessary to release ports from compliance liability if the terminal and/or vessel operators elect to use a CARB approved emissions control strategy that does not need port assistance or infrastructure to operate.

### **Section 93130.13(c) Wharfinger data**

Purpose for Section 93130.13(c)

This section requires all public or private California Ports and independent marine terminals to submit Wharfinger data to CARB by April 1 of the following calendar year, regardless of visit activity and regardless of whether or not the port or marine terminal is subject to control requirements under this regulation.

Rationale for Section 93130.13(c)

This section is necessary to require all ports and marine terminals to provide visit activity information to CARB staff, so that staff may monitor for increased activity. This serves as an annual check for CARB staff to see if any new terminals should be complying with control measures at berth based on updated activity levels. Requiring wharfinger data for all vessel also allows CARB staff an additional verification to monitor vessel activity of unregulated vessel categories, such as bulk and general cargo, in order to monitor for any significant growth or activity changes that may trigger regulation amendments in order to reduce associated health burdens on surrounding communities.

## **Section 93130.13(d) Send Accurate and Complete Reporting to CARB**

### Purpose for Section 93130.12(d)(1) through (4)

This section specifies how operators of a CARB approved emissions control strategy should submit reporting information to CARB.

### Rationale for Section 93130.12(d)

This provision is necessary to ensure that ports are aware of the proper way to submit data to CARB, including wharfing data. This ensures that information received from the ports is able to be easily processed by CARB staff. Being able to easily process reports is essential to helping CARB enforcement staff make a quick determination of compliance, which helps to resolve concerns with the Existing Regulation about determining compliance certainty (as discussed in Chapter II, Section C).

## **Section 93130.14. Terminal and Port Plans and Interim Evaluation**

### Purpose for Section 93130.14

This section sets forth requirements for terminal and port plans, as well as sets CARB staff's requirements for an interim evaluation that would evaluate the progress towards meeting implementation dates of ro-ro and tanker vessels.

### Rationale for Section 93130.14

This section is necessary to require terminals and ports to submit plans to CARB staff. These plans would then allow CARB staff to evaluate the progress each terminal is making towards installing the necessary equipment and/or infrastructure necessary to comply with the Proposed Regulation. The terminal and port plans would also provide CARB enforcement staff with a tool to use during inspections and audits of reported compliance information. Lastly, these plans are an essential element that would feed into the assessment performed for the interim evaluation scheduled to occur in 2023 for tanker and ro-ro and vessels.

### **Section 93130.14(a) Terminal plans**

#### Purpose for Section 93130.14(a)(1) through (3)

This section sets forth requirements for terminal plans, including specifying specific due dates for plans and the necessary information a plan must contain to be considered complete.

### Rationale for Section 93130.14(a)(1) through (3)

This section is necessary to establish that operators of terminals receiving visits from regulated vessel categories that also exceed the terminal visit threshold must submit a terminal plan to CARB. These plans would inform the State what is being done at their regulated terminal to ensure compliance with the Proposed Regulation.

It is critical to require all terminals to submit these plans in 2021, regardless of implementation date, as these plans give CARB staff an idea of what actions are being taken at a terminal level, and what the division of responsibilities between terminals and port will be. This is a key detail for CARB's enforcement staff, as the delineation of responsibility for installing, maintaining, and operating emissions control equipment at berth is not consistent and uniform at all terminals and ports. Some ports act only as landlords, managing the infrastructure installations of any equipment that requires major construction on the wharf, but none of the maintenance and operation of terminal equipment, while others act as operating ports and are involved in every aspect of the emissions control equipment, including daily operations. There is a wide range of scenarios, hence requiring terminals and ports to specifically list out and agree upon the division of responsibilities is a key element to holding the proper parties accountable and not allowing for unresolved issues with no party held responsible for uncontrolled emissions.

July 1, 2021, was chosen as the earliest feasible date of submission for terminals receiving currently regulated vessels based on an anticipated effective date for the Proposed Regulation of January 1, 2021. This date would give currently regulated container, reefer, and cruise terminals six months from the effective date of the Proposed Regulation to develop their plans. Despite already being subject to control requirements at berth, submitting terminal plans for currently regulated vessel types is still crucial. As mentioned, the terminal plan requires terminal operators to list which party is responsible for installing any necessary infrastructure and/or equipment in order to comply with the Proposed Regulation, as well as responsibilities for maintenance and operations. For vessel categories with compliance dates after 2021, the terminal operator must submit plans with the most likely control strategy by December 1, 2021.

Operators of ro-ro and tanker vessel terminals would then be required to resubmit a revised terminal plan by Feb 1 of the calendar year prior to the implementation of new requirements. The revisions should reflect any changes to the terminal since the initial plan. For ro-ro terminals, this is due February 1, 2024. For LA/LB tanker terminals, this is due February 1, 2026. For all other tanker terminals, this is due February 1, 2028.

This provision also establishes that an operator of a low-use terminal that exceeds the terminal threshold during a calendar year must submit a terminal plan by July 1 the following year that the threshold is exceeded. This is necessary to ensure that terminal operators who are seeing their visit activity grow are accounting for how they will control the additional emissions generated by the new vessel activity.

This section also sets forth that any terminal that is claiming a physical and/or operational constraint in their terminal plan must also conduct a feasibility study to determine if there are any other technologies available that could be implemented at the terminal. This is necessary to ensure that terminals are continuing to assess and explore new technologies that could achieve emissions reductions at their berths, not simply using a physical constraint to avoid having to reduce emissions from vessels at berth.

### **Section 93130.14(b) Port plans**

#### Purpose for Section 93130.14(b)(1) through (4)

This section sets forth requirements for port plans, including specific due dates for plan submittal and the necessary information a plan must contain to be considered complete. This section is necessary to establish that ports with terminals receiving visits from regulated vessel categories that exceed the terminal visit threshold must submit a terminal plan to CARB. These plans would inform the State that all infrastructure and equipment that is within the ports' contractual obligation to provide is being planned for in order to allow their regulated terminals to be able to comply with the Proposed Regulation.

#### Rationale for Section 93130.14(b)(1) through (4)

It is critical to require all ports to submit these plans in 2021, regardless of implementation date, as these plans inform CARB staff an idea of what actions are being taken to ensure terminals will be able to comply with the Proposed Regulation. The plans also give CARB staff information about the division of responsibilities between the port and terminal operators. As discussed previously in Section 93130.14(a), the delineation of responsibilities is a key detail for CARB's enforcement staff, as some ports act only as landlord ports while others act as operating ports.

As with terminal plans, July 1, 2021 was chosen as the earliest feasible date of submission for ports with container, reefer, and cruise terminals. The date is based on an anticipated effective date for the Proposed Regulation of January 1, 2021, and would give ports six months from the effective date of the Proposed Regulation to update their plans. For terminals receiving vessel categories with compliance dates after 2021, ports must submit plans with the most likely control strategy by December 1, 2021.

This section also establishes that the port must submit a revised plan if by July 1 of the following calendar year should any low-activity terminal exceed the terminal threshold during a calendar year. This is necessary to ensure that terminal operators who are seeing their visit activity grow are accounting for how they will control the additional emissions generated by the new vessel activity.

## **Section 93130.14(c) Approval of terminal or port plans**

### Purpose for Section 93130.14(c)

This section establishes a timeframe for CARB staff to notify submitters of terminal and/or port plans of any deficiencies in their submitted plans, and if no notice is received from CARB in the established timeframe, then the plan shall be deemed acceptable.

### Rationale for Section 93130.14(c)

This section is necessary to give CARB staff the opportunity to advise terminals and/or ports if the submitted plan is not adequate to provide the information CARB staff need to ensure the necessary infrastructure is in place to achieve the emissions reductions required by the Proposed Regulation. This section is also critical to providing certainty to terminal operators and ports; if no notification is received from CARB staff within the 30-day window, the terminal operator or port can be sure that they have provided an adequate plan.

## **Section 93130.14(d) Interim evaluation for tanker and ro-ro technology**

### Purpose for Section 93130.14(d)

Section 93130.14(c) establishes requirements for CARB staff to do an interim evaluation to assess the progress being made towards the adoption of existing control technologies for use with tanker and ro-ro vessels, as well as the progress of landside infrastructure improvements needed to support land-side emissions control technologies.

### Rationale for Section 93130.14(d)

This section is necessary to ensure regulated parties that CARB staff will evaluate the validity of the 2025 implementation date for ro-ro vessels, and the 2027 and 2029 implementation dates for tanker vessels. The information in this interim evaluation is critical for CARB staff to make a future recommendation to the Board if amendments are needed to the implementation timeline.

## **Section 93130.15. Remediation Fund Use**

### Purpose for Section 93130.15

This section sets forth conditions for using the remediation fund for compliance with the Proposed Regulation. Terminal and/or vessel operators who have made commitments to controlling emissions at berth can pay into a fund during limited specific circumstances to mitigate periods of uncontrolled emissions that may occur during a regulated vessel visit. The remediation fund provides another pathway for compliance that addresses circumstances where vessels or terminals who have already made an

investment in a control technology and may not be able to reduce emissions from a vessel's visit for a limited period of time, such as construction projects, terminal and/or vessel equipment repairs, or delays in connecting to an emissions control strategy.

#### Rationale for Section 93130.15

This section is necessary to establish the criteria for using the remediation fund. This section is critical to ensuring that the remediation fund may only be used in qualifying circumstances. Proper use of the remediation fund is critical to ensure the emissions reductions necessary to achieve the health and air quality goals of the Proposed Regulation are met.

This provision is necessary in order to provide a way to handle unforeseen situations, while not sacrificing the necessary emissions reductions needed for impacted communities around the port through mitigation. The Existing Regulation did not need a mechanism to deal with these situations because compliance was based on a fleet averaging structure. However, with every regulated vessel visit needing to control emissions at berth; this provision is necessary to make the Proposed Regulation successful.

#### **Section 93130.15(a)**

##### Purpose for Section 93130.15(a)

This section establishes that a remediation fund administrator must be established via a Memorandum of Understanding (MOU) with CARB. Conditions of this MOU are detailed in Section 93130.16.

##### Rationale for Section 93130.15(a)

This section is necessary to inform regulated parties that there must be an entity in place to administer any monies collected by the remediation fund at that port or independent marine terminal in which the uncontrolled emissions occurred.

#### **Section 93130.15(b)**

##### Purpose for Section 93130.15(b)

This section establishes the criteria in which a regulated vessel operator, terminal operator and/or port may request to use the remediation fund in order remain compliant when periods of uncontrolled emissions occur during a vessel's visit at berth.

##### Rationale for Section 93130.15(b)

This section is necessary to define in which limited circumstances the remediation fund can be used, and to advise regulated entities that they may apply to CARB for approval

to mitigate uncontrolled emissions and remain compliant with the Proposed Regulation in the event a circumstance is not covered under Section 93130.15(b).

### **Sections 93130.15(b)(1) and (2)**

#### Purpose for Sections 93130.15(b)(1) and (2)

This section provides terminal operators that invest and properly maintain shoreside control equipment the ability to utilize the remediation fund to remediate uncontrolled emissions if control equipment has failed and is being repaired, or new or replacement equipment has been ordered in a timely manner, but has not been received. Likewise, section 93130.15(b)(2) provides vessel operators that invest and properly maintain shore power or other onboard control equipment the ability to utilize the remediation fund to remediate uncontrolled emissions if that equipment has failed and is being repaired, or new or replacement equipment has been ordered in a timely manner, but has not been received.

High voltage shore power electrical equipment and other control technologies being used in a harsh marine environment can suffer from breakdowns on both the vessel and/or terminal side. Control technologies for ocean-going vessels are large, expensive, and complex pieces of equipment that can take up to several weeks to repair or install, depending on the technology. Often the manufacturers of vessel control technologies are located outside of California, often in Europe or Asia, and engineers may need to be flown into California for repairs or installations. Parts may also be limited in availability, since use of ocean-going vessel emissions control technologies at berth are not required for most large commercial ocean-going vessels outside of California. As a result, repairs or new installations of terminal or vessel-side emissions control equipment may result in an extended period of time where emissions are unable to be controlled at a regulated berth. This provision is necessary to provide a path to compliance during periods of unavoidable and extended uncontrolled emissions, while ultimately achieving emissions reductions for the surrounding communities.

The Existing Regulation did not need a mechanism to deal with these situations because compliance was based on a fleet averaging structure. However, with every vessel visit needing to comply, this provision is necessary to make the Proposed Regulation successful and address the implementation challenges discussed in Chapter II (Section C).

### **Section 93130.15(b)(3)**

#### Purpose for Section 93130.15(b)(3)

This section establishes that if a vessel visit experiences a delay in connecting to a CARB approved emissions control strategy during a visit and fails to achieve the full emission reductions required under the Proposed Regulation, the responsible party or

parties may utilize the remediation fund to remain compliant with the Proposed Regulation. This provision also stipulates that a CARB approved emission control strategy operator under contract to reduce emissions from a vessel visit must report any malfunction that causes or contributes to a delay or interruption in emissions control to CARB as required by the Proposed Regulation in order to qualify to use the remediation fund as a compliance option.

During implementation of the Existing Regulation, numerous instances of connection delays were reported including delays lowering the gangway, securing the vessel, waiting for vessel clearance, waiting for labor to connect or disconnect the vessel, and added logistics of using lift on/lift off shore power boxes. While CARB staff expect many of the connection delays associated with the Existing Regulation to be resolved with the re-defining of when a visit starts and ends, some delays in connection are inevitable given the challenges of working in an operational marine environments. These challenges and the reason they may result in delayed connections to emissions control technologies are discussed in more detail in Chapter II (Section C).

#### **Section 93130.15(b)(4)**

##### Purpose for Section 93130.15(b)(4)

This section establishes that a terminal may pay into the optional remediation fund in lieu of reducing emissions from a vessel's visit if the terminal has a planned upgrade or construction project which has CARB approval to temporarily halt use of terminal side control equipment to facilitate the project.

This provision is necessary to include in the Proposed Regulation in order to provide a pathway for compliance during construction projects, which are inevitable as new emissions control technologies are installed at berths across the state. Without this provision, terminals would have to use TIEs (as discussed in Section 93130.11) for compliance during these construction periods. As these projects may take many months to years to complete, being able to pay into the optional remediation fund allows terminals to save their TIEs for unforeseen events, while mitigating uncontrolled emissions through other projects in and around the port community.

#### **Section 93130.15(b)(5)**

##### Purpose for Section 93130.15(b)(5)

This section recognizes terminals with a physical constraint, as identified and approved in the terminal plan submitted to CARB (as discussed in Section 93130.14), are delaying implementation and able to comply with the use of the remediation fund. Physical constraints could potentially include situations such as narrow waterways that might prevent the use of a barge-based capture and control system, if the terminal operator can successfully demonstrate to CARB that the system is the only reasonable compliance pathway available.



### **Section 93130.15(c)**

#### Purpose for Section 93130.15(c)

This section lays out the process and timeline for submitting a request to use the remediation fund and CARB's timeline for approving a request. This section also informs readers that if a request is not approved, the ineligible request would result in the visit being considered non-compliant with the Proposed Regulation.

#### Rationale for Section 93130.15(c)

This section is necessary to establish a process for submitting requests to use the remediation fund to CARB staff and to advise regulated entities what occurs if their request is denied. CARB staff consider seven days to be consistent with the other reporting requirements of this Proposed Regulation.

### **Section 93130.15(d)**

#### Purpose for Section 93130.15(d)

This section establishes that CARB staff shall evaluate each request for use of the remediation fund.

#### Rationale for Section 93130.15(d)

This section is necessary to ensure that parties wishing to use the remediation fund are aware that CARB staff must approve use of the remediation fund for the visit to count as a compliant visit. Review of remediation fund use is necessary to ensure that the situation resulting in no emissions reductions at berth is eligible for the remediation fund and that the remediation fund option is not being abused by a single party. CARB staff consider 30 days to be an appropriate amount of time for CARB staff to review each situation and inform the requestor of their eligibility to use the remediation fund.

### **Section 93130.15(e)**

#### Purpose for Section 93130.15(e)

This section instructs remediation fund users as to the process for submitting their applicable remediation fund payment amount and establishes that administrator's cost to mitigate the uncontrolled emissions through incentive activities in the exposed communities are recouped through the remediation fund payment.

#### Rationale for Section 93130.15(e)

This section is necessary to include so that regulated entities know how to submit their remediation fund payment in order to comply with the Proposed Regulation. CARB staff

consider 30 days to be an appropriate amount of time for a party to arrange for and submit a payment to the administrator of the remediation fund where the excess uncontrolled emissions occurred.

### **Section 93130.15(f)**

#### Purpose for Section 93130.15(f)

This section establishes the hourly rates that each vessel operator, terminal operator, or port would pay into the remediation fund to appropriately mitigate uncontrolled emissions.

#### Rationale for Section 93130.15(f)

Setting fixed amounts is necessary in order to ensure the amount paid into the optional remediation fund is capable of mitigating equivalent emissions to the uncontrolled vessel visit.

Basing the remediation fund payment on an hourly rate encourages vessels reduce the number of uncontrolled hours of operation, thus reducing the amount paid into the remediation fund. The lesser number of hours, the lower the emissions will be at berth and the fewer health impacts that vessel will have on port communities.

The hourly rate was calculated based on the Carl Moyer Advanced Technology Limit for cost effectiveness for consistency with other CARB programs. Staff estimated the typical hourly emissions of pollutants that would need to be mitigated by vessel type, using default power and emission factors. The hourly pollutants were weighted by the Moyer formula,  $\text{NO}_x + \text{ROG} + 20 \cdot \text{PM}$  to determine an hourly rate. The rate was further increased by 10 percent to cover potential administrative costs.

Container, reefer, and ro-ro vessels have the same dollar amount due to similar power loads and emissions profiles at berth. Within the tanker vessel category, tankers using boilers to power steam pumps used to off-load cargo have a higher power load at berth than tankers using electric pumps; as such, the tanker vessel hourly rate is also bifurcated between the two different types of cargo off-loading methods. Cruise vessels use the highest power loads of all ocean-going vessel at berth, as they essentially operate as floating hotels. As a result, the remediation fund payment must be correspondingly higher. Cruise vessels with more than 1,500 total passengers and crew had significantly higher emissions than smaller cruise vessels making it necessary to require a higher payment to appropriately mitigate the uncontrolled emissions.

Hourly remediation payments would also be reduced by 20 percent for IMO Tier III tanker vessels with steam driven pumps, and 40 percent for all other IMO Tier III vessels. Vessels with IMO Tier III auxiliary engines achieve significant NO<sub>x</sub> reductions (nearly to the levels required by the Proposed Regulation). As such, this provision is necessary to recognize the lower NO<sub>x</sub> contributions of Tier III vessels, while also

encouraging cleaner vessels to visit California. Since IMO Tier III only limits NOx reductions on auxiliary engines, the payment is reduced by a smaller amount for tankers with requirements to reduce both auxiliary and boiler emissions. Payment to mitigate the remaining portion of the NOx and required PM reductions of the emissions is still necessary. As discussed in Chapter I (Section B) of this Staff Report, IMO Tier III engines do not address PM emissions, only NOx emissions.

### **Section 93130.15(g)**

#### Purpose for Sections 93130.15(g)

This section establishes that every odd numbered year, the remediation payment amount will be automatically adjusted based on the California Consumer Price Index as published by the Bureau of Labor Statistics relative to 2019.

#### Rationale for Sections 93130.15(g)

This section is necessary in order to ensure that the monies paid into the remediation fund appropriately increase as inflation decreases the purchasing power of the dollar. Every odd year was chosen to prevent changes to the remediation fund payment amount from being adjusted too frequently.

### **Section 93130.15(h)**

#### Purpose for Sections 93130.15(h)

This section establishes a process for a vessel operator, terminal operator, or port (as applicable) to apply to CARB for approval to use the remediation fund for multiple vessel visits when an extended period of uncontrolled emissions meeting the criteria of Section 93130.15 is anticipated.

#### Rationale for Sections 93130.15(h)

This section is necessary in order to streamline the process for using the remediation fund and reduce the burden on both regulated entities and CARB staff in preparing, submitting, and approving requests to use the remediation fund in the event of long-term construction projects or equipment repairs.

### **Section 93130.16. Remediation Fund Administration**

#### Purpose for Section 93130.16

This section sets forth the criteria for CARB approval of an entity to administer a remediation fund for individual ports and independent marine terminals, and the requirements for approved administrators to manage those funds.

### Rationale for Section 93130.16

The remediation fund is necessary to mitigate the community impact of the excess emissions from vessel visits that did not reduce emissions at berth to the required levels, as set forth under section 93130.15. This section is necessary to set up the process for specifying who can be a remediation fund administrator, and how an entity would apply to be a fund administrator. This section also includes specifications for a Memorandum of Understanding (MOU) with a remediation fund administrator. It is CARB's intention that the monies from the remediation fund achieve emissions reductions not otherwise required by law or regulation by funding incentive activities that comply with adopted CARB guidelines on existing incentive programs.

### **Sections 93130.16(a) and (b)**

#### Purpose for Sections 93130.16(a) and (b)

These sections provides local air districts with the priority to administer the remediation funds, allowing 120 days to notify CARB of their intent participate. Local air districts are well suited to administer the funds being a governmental agency with air quality goals aligned with this control measure and knowledge of the area effected by the control measure.

#### Rationale for Sections 93130.16(a) and (b)

These sections are necessary to put limits on the districts application timeframe to ensure that a suitable administrator can be identified in a timely manner. CARB staff consider 120 days an appropriate amount of time for district staff to draft, approve, and submit a letter of application to CARB for remediation fund administration rights.

### **Section 93130.16(c)**

#### Purpose for Section 93130.16(c)(1) through (6)

This section outlines the information that an applicant for remediation fund administrator must submit to CARB. Applicants must include relevant experience managing incentive funding programs, knowledge of relevant technologies that would be eligible for incentives, description of incentive program structure, plan for administering the fund, ability to receive and track fund deposits and payments, and a plan for dispersing the funds. With this information, CARB staff will be able to review the application for capacity to successfully administer the remediation fund and execute a Memorandum of Understanding with the applicant.

#### Rationale for Section 93130.16(c)(1)

This section is necessary in order for CARB staff to determine that the applicant has the knowledge and past experience necessary to run a successful program that would achieve the emissions reductions necessary to make up for the lost reductions.

#### Rationale for Sections 93130.16(c)(2)

This section is necessary in order for CARB staff to determine that the applicant has a sufficient technical understanding of technologies to be able to administer a remediation fund.

#### Rationale for Sections 93130.16(c)(3)

This section is necessary in order for CARB staff to determine that the applicant has a sufficient strategy to oversee remediation projects from concept to completion.

#### Rationale for Sections 93130.16(c)(4)

This section is necessary in order for CARB staff to determine that the applicant has sufficient resources to administer a remediation fund.

#### Rationale for Sections 93130.16(c)(5)

This section is necessary in order for CARB staff to determine that the applicant has the ability to handle accounting for a remediation fund properly including establishing a separate account to separate the remediation fund from other activities.

#### Rationale for Sections 93130.16(c)(6)

This section is necessary in order for CARB staff to determine the readiness of an applicant to being managing a remediation fund, including their ability to align the fund with existing solicitations.

### **Section 93130.16(d)**

#### Purpose of Section 93130.16(d)(1) through (3)

This section outlines the criteria that CARB will review submitted applications to determine that the applications are complete and the applicant is able, ready and, willing to manage the funds.

#### Rationale of Section 93130.16(d)(1)

This section is necessary to allow CARB to verify that the applicant is able to administer the remediation fund by meeting all application requirements in section 93130.16(c).

#### Rationale of Section 93130.16(d)(2)

This section is necessary to allow CARB to verify that the applicant is ready to administer the remediation fund by reviewing all application responses and determining whether they are complete.

#### Rationale of Section 93130.16(d)(3)

This section is necessary to allow CARB to verify that the applicant is willing to administer the remediation fund by ensuring that the applicant is authorized by their governing board to participate in the program.

#### **Section 93130.16(e)**

##### Purpose of Section 93130.16(e)

This section describes the notification process whereby CARB issues a Memorandum of Understanding with the applicant to serve as the remediation fund administrator.

##### Rationale of Section 93130.16(e)

This section is necessary to inform applicants of the process by which CARB will approve a fund administrator by issuing a Memorandum of Understanding.

#### **Section 93130.16(f)**

##### Purpose for Section 93130.16(f)

This section enables CARB to invite nonprofits to apply to administer the remediation funds in the event that the local air district and CARB do not execute an MOU.

##### Rationale for Section 93130.16(f)

This section is necessary to ensure there are other options to administer the remediation funds besides the districts. CARB cannot dictate that an air district participate in administering the remediation fund; as such, this provision is necessary to allow other nonprofit entities to apply in case the districts opt to not participate in administration of the remediation fund.

#### **Section 93130.16(g)**

##### Purpose for Section 93130.16(g)

This section requires CARB to publish executed MOU online.

### Rationale for Section 93130.16(g)

This section is necessary for entities with compliance obligations have a single resource to identify remediation fund administrators.

### **Section 93130.16(h)**

#### Purpose for Section 93130.16(h)(1) through (19)

This section outlines the minimum requirements for an MOU between CARB and a remediation fund administrator. Remediation fund administrators agree to use the funds for incentive activities that directly benefit communities impacted by excess emissions from the port or independent marine terminal and achieve emissions reductions consistent with existing incentive programs. The intent is to reduce the burden on the administrator by using existing incentive programs to the extent possible. The MOU must also describe specifics on how the fund will be run including limiting administration expenses, performance metrics, provisions to remedy non-performance, and standard legal provisions such as indemnification, entitlements, severability, and force majeure. The MOU can be amended through mutual agreement in writing, signed by all parties. CARB intends to allow amendments to the MOU if mutually agreed upon changes could better facilitate the reduction of emissions through fund utilization.

#### Rational for Section 93130.16(h)(1)

This information is necessary to identify the parties and the effective date and term of MOU and requires the submitter to provide contact information, which enables follow up with the MOU applicant.

#### Rationale for Section 93130.16(h)(2)

This section is necessary to ensure that the MOUs address environmental justice principles to address fair treatment of all people in the state.

#### Rationale for Section 93130.16(h)(3)

This section is necessary to ensure that the remediation funds are used in communities that are directly impacted by excess emissions from the port or independent marine terminal and to prioritize eligible activities in communities that are also identified by CARB under the AB 617 Community Air Protection Program or disadvantaged communities as defined by the Secretary for Environmental Protection. This section identifies applicable CARB incentive program guidelines that can be used to administer the remediation fund and that the remediation funds cannot be used as matching funds in any other incentive programs.

#### Rationale for Section 93130.16(h)(4)

This section is necessary to ensure that projects are selected in a manner that is consistent with allowable CARB incentive program guidelines.

#### Rationale for Section 93130.16(h)(5)

This section is necessary to identify the major milestones for implementing emission reduction projects.

#### Rationale for Section 93130.16(h)(6)

This provision is necessary to ensure that remediation fund administrators submit semi-annual reports that included fiscal activities, project types, locations and emissions reductions achieved. This information allows CARB to track funds and ensure that projects meet the requirements of the remediation fund program.

#### Rationale for Section 93130.16(h)(7)

This section is necessary as it defines for the fund administrators how long remediation fund documents must be retained. CARB staff considers three years of recordkeeping an appropriate amount of time for staff to complete an audit of the remediation fund usage if needed.

#### Rationale for Section 93130.16(h)(8)

This section is necessary to ensure that the fund administrator agrees to evaluations, reviews and audits by CARB or other State agencies.

#### Rationale for Section 93130.16(h)(9)

This section is necessary to ensure that CARB has access to remediation fund records. Recordkeeping is necessary to determine if the remediation fund is in compliance with the regulation.

#### Rationale for Section 93130.16(h)(10)

This section is necessary because it provides authority for CARB to inspect remediation fund activities to ensure that the remediation fund is being administered in compliance with the regulation.

#### Rationale for Section 93130.16(h)(11)

This section is necessary to provide remediation fund administrators monies to cover direct and reasonable expenses incurred to implement the remediation fund program.



Ten percent for administrative expenses was chosen for consistency with similar CARB programs.

Rationale for Section 93130.16(h)(12)

This section is necessary to direct the how the fund administrators will record, report and expend earned interest on remediation funds.

Rationale for Section 93130.16(h)(13)(A) through (I)

This section describes the circumstances including failure to comply with provisions of this regulation, failure to expend remediation funds within established timelines or in a timely manner, deficiencies with record keeping inspections or other elements, misuse of funds, funding ineligible activities, and exceeding administrative costs or insufficient documentation. This section is necessary to define some of the circumstances that constitute non-conformance with a MOU and is necessary to ensure that funds are administered properly.

Rationale for Section 93130.16(h)(14)(A) through (D)

This section is necessary to establish provisions to remedy non-performance, including a corrective action plan, transfer of collected remediation monies to an alternative fund administrator s identified by CARB, constraints on opportunities to administer future remediation funds, and/or termination of the MOU. These provisions are necessary to give CARB staff a method to remedy non-performance in case a remediation fund administrator is deemed not to be performing as outlined by the MOU.

Rationale for Section 93130.16(h)(15)

This section is necessary to ensure that prospective remediation fund administrators agree to indemnify and hold the State and hold harmless for liability that may arise from administering the fund.

Rationale for Section 93130.16(h)(16)

This section is necessary to ensure that the fund administrators agree to follow all laws ordinances regulations and standards while administering the fund. This is necessary to ensure that the administrators do not violate a federal, state or local law, regulation, or ordinance.

Rationale for Section 93130.16(h)(17)

This section is necessary to ensure that that if one provision of the regulations is declared invalid by a court or other authority, the remaining provisions will remain in full force and effect.

#### Rationale for Section 93130.16(h)(18)

This section is necessary to ensure that neither CARB nor the fund administrator are held liable for performance failures that results from acts beyond their control such as war or natural disasters.

#### Rationale for Section 93130.16(h)(19)

This section is necessary to ensure that a MOU can be amended through mutual agreement in writing, signed by all parties. The ability to amend a MOU allows opportunities to better facilitate the reduction of emissions through fund utilization.

### **Section 93130.17. Summary of Responsibilities**

#### Purpose for Section 93130.17

This section provides a table summarizing situations in which situations vessel, terminal, and CARB approved emissions control strategy operators can utilize exceptions and additional compliance pathways as discussed in Sections 93130.8 and 93130.10. The table also outlines the anticipated responsible party in each situation.

#### Rationale for Section 93130.17

This section is necessary to provide a measure of transparency to the Proposed Regulation by making it clear which parties are responsible for claiming exceptions for specific events and which parties are responsible for compliance.

### **Section 93130.18. Violations**

#### **Section 93130.18(a)**

#### Purpose for Section 93130.18(a)

This section establishes the authority for violations that parties may receive if found to not be complying with any provision of the Proposed Regulation.

#### Rationale for Section 93130.18(a)

This provision is necessary in order to identify the consequences for not complying the any portion of the Proposed Regulation for regulated entities. This section sets forth that nothing in the control measure shall limit or affect any penalties or remedies available under federal law.

## **Section 93130.18(b)**

### Purpose for Section 93130.18(b)

This section sets forth that the failure to meet any provision, prohibition, limit, standard, duty, criteria, or requirement of the Proposed Regulation would constitute a single and separate violation of the Proposed Regulation.

### Rationale for Section 93130.18(b)

This provision is necessary in order to ensure that non-compliance is not less expensive than compliance with the Proposed Regulation. This is in large part due to the high costs of compliance for the Proposed Regulation versus the penalty limit that CARB enforcement staff must abide by. Penalties for violations for the Proposed Regulation are limited by statute to \$37,500 per action. Because ocean-going vessel emissions reduction technologies and associated necessary infrastructure improvements are expensive, typically running in the millions of dollars for complete projects, CARB enforcement staff need the ability to cite individual actions in the Proposed Regulation in order to make a violation high enough to deter non-compliance.

## **Section 93130.18(c)**

### Purpose for Section 93130.18(c)

This section establishes that not fulfilling the reporting and/or record keeping requirements would constitute a violation of the Proposed Regulation for each day that the applicable requirements are not met.

### Rationale for Section 93130.18(c)

Reporting visit information and retaining vital information about a visit is critical to CARB enforcement staff determining if the goals of the Proposed Regulation. As such, this provision is necessary to ensure sufficient motivation for regulated parties to submit visit reports and other required information promptly.

## **Section 93130.19. Sunset**

### Purpose for Section 93130.19

This section sets forth that the requirements specified in the Proposed Regulation cease to apply if the United States adopts and enforces requirements that achieve emissions reductions within the Regulated California Waters equivalent to those from the Proposed Regulation. This section requires that CARB's Executive Officer issue written findings before a sunset could occur.

### Rationale for Section 93130.19

This provision is necessary to give CARB the ability to quickly and easily harmonize with any newly-developed federal regulations that achieve equivalent emissions reductions in Regulated California Waters. Requiring CARB's Executive Officer to issue written findings requires the agency to be transparent about its findings by sharing them with the public.

### **Section 93130.20. Severability**

#### Purpose for Section 93130.20

This section establishes a severability clause for the Proposed Regulation, and sets forth that if any portion or provisions of the document are held invalid, unconstitutional, or unenforceable by any court of competent jurisdiction, then that specific portion or portions shall be deemed as a separate, distinct, and independent provision(s) and will not affect the validity of the remaining portions of the control measure.

#### Rationale for Section 93130.20.

A severability clause is necessary to ensure that the portion of the control measure affected by a successful and final legal challenge is severed, and does not affect the validity of the remaining portions of the control measure. CARB staff has carefully drafted each portion of the regulatory text to ensure that each portion is severable. As noted throughout this Staff Report, the Proposed Regulation provides flexibility to regulated entities in various ways. This flexibility helps ensure that even if a portion of the Proposed Regulation is held invalid, other compliance pathways will remain, and the Proposed Regulation may continue to be implemented.

The regulatory text also provides that if the Proposed Regulation is held invalid *in its entirety*, then the Existing Regulation again becomes effective by operation of law.

## **V. AIR QUALITY**

### **A. Objective**

CARB programs focus on three distinct emission reduction goals: (1) reduce localized potential cancer risk from toxic air contaminants (TACs), (2) control NOx and criteria pollutants to meet local, regional, State, and Federal Ambient Air Quality Standards, and (3) GHGs that contribute to the global burden of climate change.

The Proposed Regulation is intended to further protect the health of California's residents by reducing auxiliary diesel engine emissions from ocean-going vessels and boiler emissions from selected tanker vessels while at berth in a California port. This chapter summarizes the potential air quality impacts in California in response to the Proposed Regulation. This chapter includes the following elements: (1) an overview of the emission inventory methods; (2) description of the baseline used to estimate emission benefits of the Proposed Regulation; (3) summary of health analyses, and (4) changes in emissions due to the Proposed Regulation. For an explanation of the specific benefits resulting from the air quality impacts, see Chapter VI.

### **B. Emissions Inventory Methods**

CARB staff has updated the emissions inventory for ocean-going vessels to reflect new information and improved methodologies. The 2019 inventory is a revision to the emissions inventory developed by staff in 2014. The most significant changes to the inventory were a reduction to the PM emission factors for auxiliary boilers, and an increase to the NOx emission factors for auxiliary engines. As compared to previous inventories, the PM factors has been reduced by approximately 33 percent for boilers, based on research and methodology. For auxiliary engines, the NOx emissions factors have been increased slightly based on the values used by Starcrest for the POLA and POLB emission inventory. A description of the methodology and estimates are provided in this chapter. For full details of the 2019 Update to Inventory for Ocean-Going Vessels At Berth: Methodology and Results, see Appendix H. Additional changes to the inventory include:

- Update the inventory to reflect recent activity data.
- Inclusion of more specific information on vessel and port calls.
- Alignment of the inventory to reflect recent port inventories.
- Revision of growth assumptions and methods.
- Update the effective engine power and emissions factors.

- Update the vessel compliance with adopted regulations (CARB’s Ocean-Going Vessel Fuel and At-Berth Regulations, see Appendix H for additional information).

The 2019 inventory also focused on updating emissions of PM and NOx for at berth activity in detail to support the health risk analysis for POLA and POLB and the Richmond Port Complex. Emissions at anchorage, maneuvering and transiting activity were not included in the emission inventory update. For full detail of the Health Analyses: Control Measure for Ocean-Going Vessels at Berth, see Appendix G.

CARB’s emissions inventory estimates rely on the best available data for ocean-going vessels. The updated inventory methodology used a 2016 baseline and forecasts emissions for future years for each vessel type, engine type (i.e., auxiliary engine or boiler) and pollutant. The development of the 2019 emissions inventory required modeling over a couple of years, therefore the base year for the current update was the 2016 calendar year as a modeling baseline.

The basic equation used to calculate per engine or boiler emissions is as follows:

$$E = EF \times EP \times hr$$

Where:

- E* is the amount of emissions of a pollutant (NOx, PM2.5, DPM, ROG and GHGs) emitted during one at berth visit;
- EF* is the auxiliary engine or boiler emission factor;
- EP* is effective power, average power output for an engine; and
- hr* is the at berth visit stay time.

The 2016 base year inventory is determined by calculating engine and boiler emissions per vessel visit and summing the emissions for all the vessel visits at each port using the following data sources: IHS-Markit and the Marine Exchange data provided vessel-specific information for vessel visits to California including visit locations, duration of stays, vessel type, vessel size, and rated main engine power. Effective power is the product of rated power and load factor.<sup>183,184</sup> Auxiliary engine and boiler power and load were derived from POLA and POLB inventories per vessel type and vessel size.<sup>185,186</sup> Emission factors for ocean-going vessels were selected to be consistent with IMO and U.S. EPA.

---

<sup>183</sup> IHS-Markit California Vessel Registration and Movement Information for 2016, accessed January 11, 2018

<sup>184</sup> Marine Exchange of Southern California Arrival/Departure Information for 2016, accessed November 30, 2017

<sup>185</sup> Starcrest Consulting Group, LLC, Port of Los Angeles Inventory of Air Emissions - 2016, July 2017, [https://kentico.portoflosangeles.org/getmedia/880bc597-84bc-4ae6-94e2-59a2e6027f42/2017\\_Air\\_Emissions\\_Inventory](https://kentico.portoflosangeles.org/getmedia/880bc597-84bc-4ae6-94e2-59a2e6027f42/2017_Air_Emissions_Inventory).

<sup>186</sup> Starcrest Consulting Group, LLC, Port of Long Beach Air Emissions Inventory – 2016, July 2017, <http://www.polb.com/civica/filebank/blobdload.asp?BlobID=14109>.

### C. Air Quality Impacts

CARB projected NO<sub>x</sub>, DPM, PM<sub>2.5</sub>, GHG, and ROG emissions from auxiliary engine and boilers for two scenarios from all regulated and unregulated ocean-going vessel categories (i.e., container, cruise, reefer ro-ro, tanker, and bulk cargo vessels) from 2020 to 2032, using CARB's updated 2019 emissions inventory. The two scenarios assume:

1. No further requirements were imposed beyond the Existing Regulation after calendar year 2020 (baseline).
2. The Proposed Regulation takes effect January 1, 2021 and is phased in through 2029. Container, reefer and cruise vessel would be subject to the requirements on January 1, 2021. The implementation of the Proposed Regulation phase-in requirements for ro-ro would start in 2025 and tanker vessels in 2027 and 2029 for POLA and POLB and the remainder of the state, respectively.

The projected emissions for each scenario are listed below. Comparing the scenarios with one another provides a quantitative demonstration of the changes of emissions associated with the Existing Regulation (baseline) and the Proposed Regulation.

**Figure V-1: Projected Annual NO<sub>x</sub> Emissions from All Vessels At Berth Statewide**

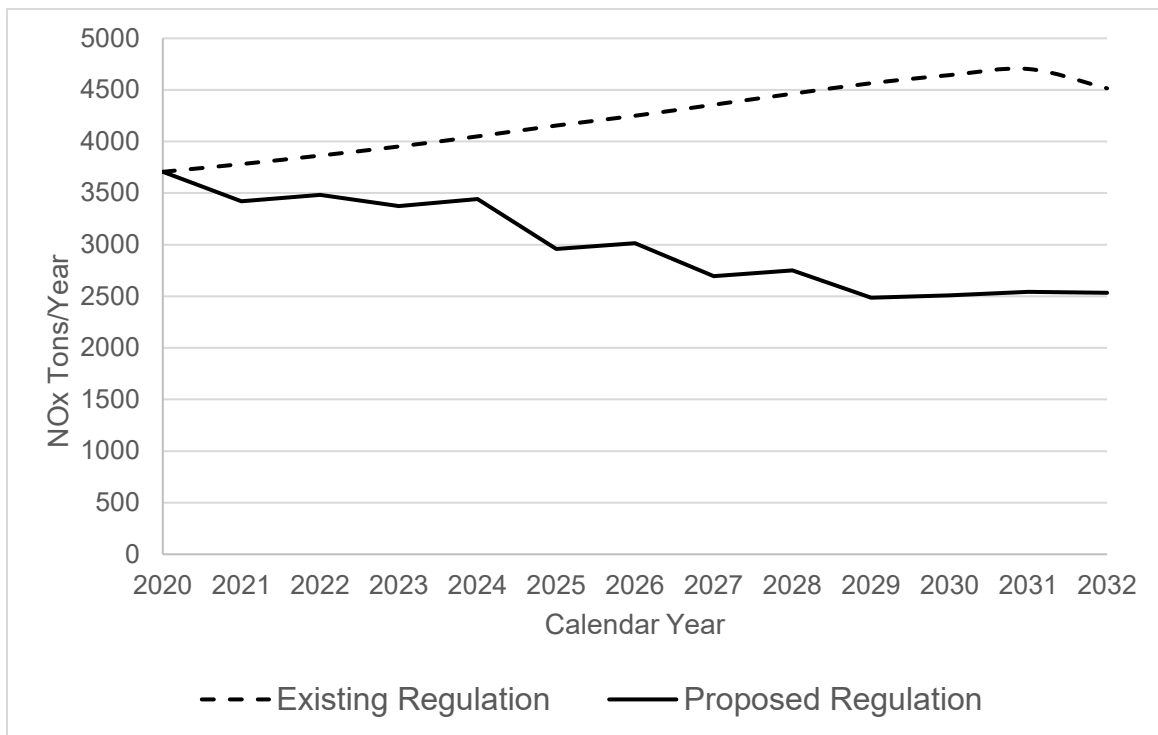


Figure V-1 presents projected NOx emissions from 2020 to 2032 for the two scenarios. Relative to the Existing Regulation, the Proposed Regulation is projected to reduce a cumulative total of 16,000 tons of NOx from 2021 to 2032. In 2032, when comparing the Proposed Regulation to the Existing Regulation, NOx emissions would be reduced by about 44 percent, from 4,250 TPY to 2,530 TPY.

Note, the slight drop in NOx emissions between 2031 and 2032 reflects projected adoption of auxiliary engines certified to IMO Tier III standard, which results in substantially lower NOx emissions relative to auxiliary engines certified to IMO Tier II standard. Besides 2021, the first year the Proposed Regulation takes effect, calendar years 2025, 2027, and 2029 represent the steepest year-over-year declines in NOx emissions. This is due to implementation of the Proposed Regulation phase in requirements for ro-ro (2025) and tanker vessels (2027 and 2029 for POLA and POLB and the remainder of the state, respectively).

**Figure V-2: Projected Annual DPM Emissions from All Vessels At Berth Statewide**

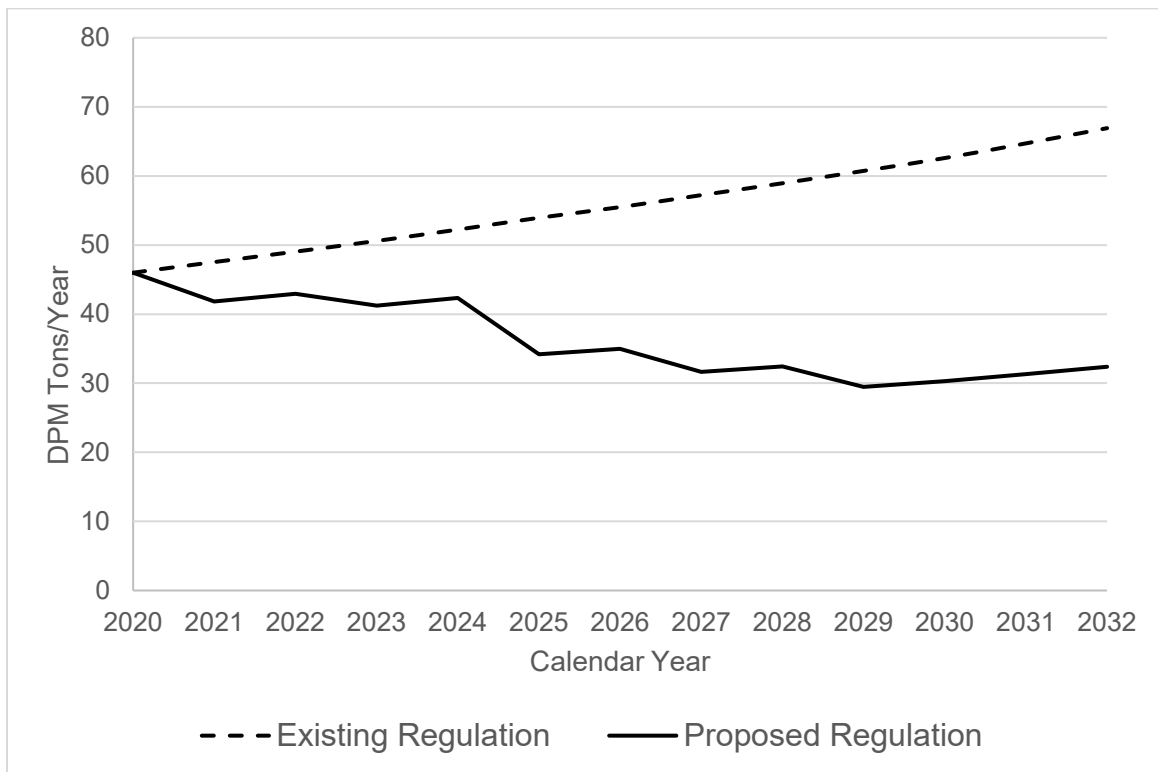


Figure V-2 presents projected DPM emissions from 2020 to 2032 for the two scenarios. Relative to the Existing Regulation, the Proposed Regulation is projected to reduce approximately 260 tons of DPM from 2021 to 2032. In 2032, when comparing the Proposed Regulation to the Existing Regulation, DPM emissions would be reduced about 52 percent, from 67 TPY to 32 TPY.

Calendar years 2025, 2027, and 2029 represent the steepest year-over-year declines in DPM emissions. This would be due to the combination of regulatory phase in dates for



tanker vessels (2027 and 2029 for POLA and POLB and the remainder of the state, respectively) which represents the second largest source of DPM emissions outside of container vessels, as well as reductions in ro-ro vessel DPM emissions with an implementation date of 2025.

**Figure V-3: Projected Annual PM2.5 Emissions From All Vessels At Berth Statewide**

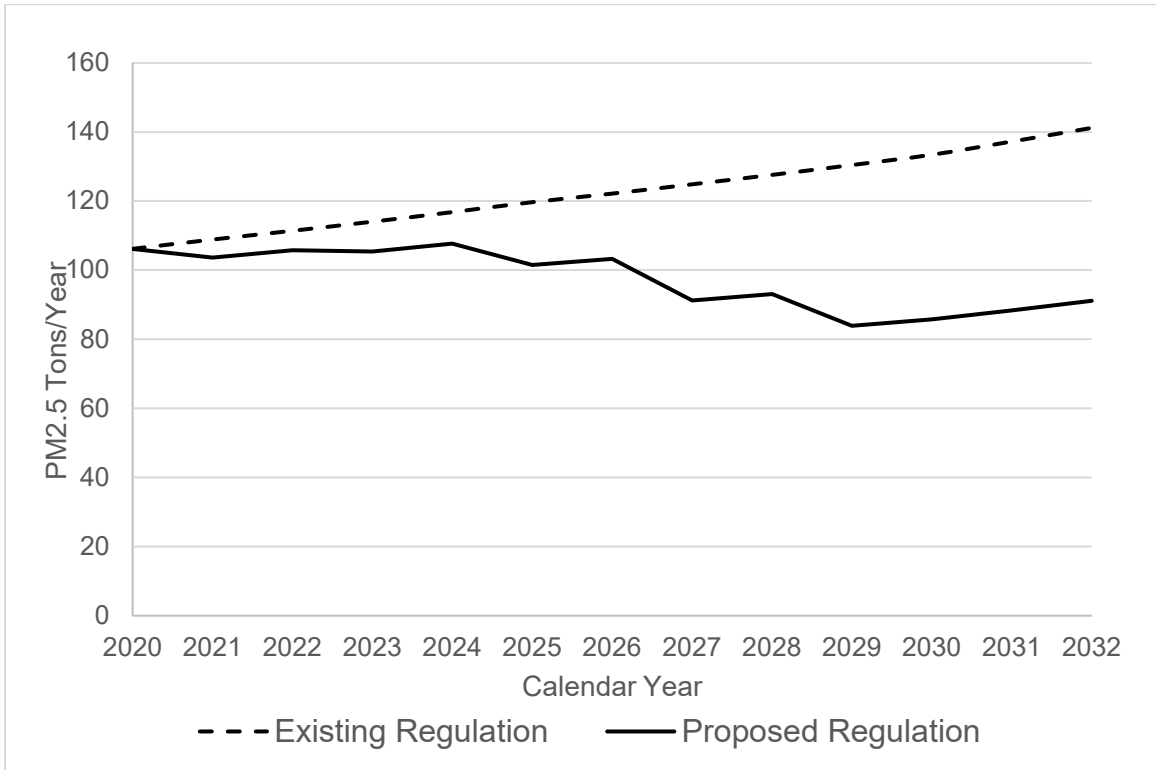


Figure V-3 presents projected PM2.5 emissions from 2020 to 2032 for the two scenarios. Relative to the Existing Regulation, the Proposed Regulation is projected to reduce approximately 330 tons of PM2.5 from 2021 to 2032. In 2032, when comparing the Proposed Regulation to the Existing Regulation, PM2.5 emissions would be reduced by about 35 percent, from 141 TPY to 91 TPY.

For the Proposed Regulation, calendar years 2027 and 2029 represent the steepest year-over-year declines in PM2.5 emissions, owing to the regulatory phase in dates for tanker vessels (2027 and 2029 for POLA and POLB and the remainder of the state, respectively), and that tankers are the biggest contributor to PM2.5 emissions outside of container vessels based on CARB Emissions Inventory.

**Figure V-4: Projected Annual GHG Emissions From All Vessels At Berth Statewide**

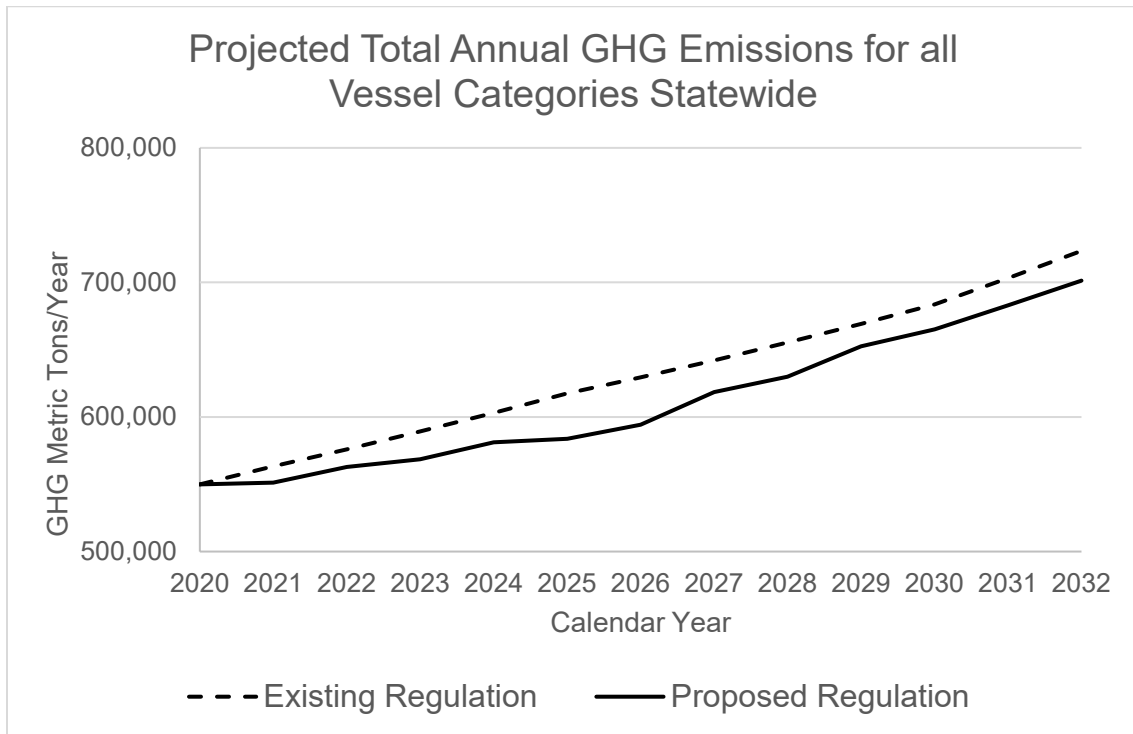


Figure V-4 presents projected GHG (CO<sub>2</sub>, N<sub>2</sub>O, and CH<sub>4</sub>) emissions from 2020 to 2032 for the two scenarios. The overall trend of annual GHG emissions in all cases is expected to increase between 2020 to 2032 due to increased vessel activity. Relative to the Existing Regulation, the Proposed Regulation is projected to reduce approximately 263,000 metric tons of GHG from 2021 to 2032. The year-to-year reductions between the Proposed Regulation and Existing Regulation are far less substantial compared to the reductions in NO<sub>x</sub>, DPM, PM<sub>2.5</sub>, and ROG. In 2032, when comparing the Proposed Regulation with the Existing Regulation, GHG emissions would be reduced by about 3 percent, from 723,000 to 701,000 metric tons per year.

Overall, the Proposed Regulation achieves GHG emissions reductions despite slight increases in GHG emissions for some vessel categories that staff anticipate will comply by using land- and barge-based capture and control devices. While using a capture and control device, auxiliary engines onboard a vessel are still servicing the vessel with the required energy it needs for operations. Therefore, the vessel still emits GHG emissions and there are no reductions associated with turning off the auxiliary engines and using shore power. In addition, operation of capture systems requires power, either from a generator or the electric grid, both of which generate additional GHG emissions. To minimize the additional GHG emissions from these devices, the Proposed Regulation would require the operation of capture and control systems to be grid-neutral by 2025. Grid-neutral means emitting no more GHG emissions than if the strategy were

powered by the California grid as represented by the most recent eGRID Summary Table for State Output Emission Rates<sup>187</sup> as the California CO<sub>2</sub>e emissions rate.

**Figure V-5: Projected Annual ROG Emissions From All Vessels At Berth Statewide**

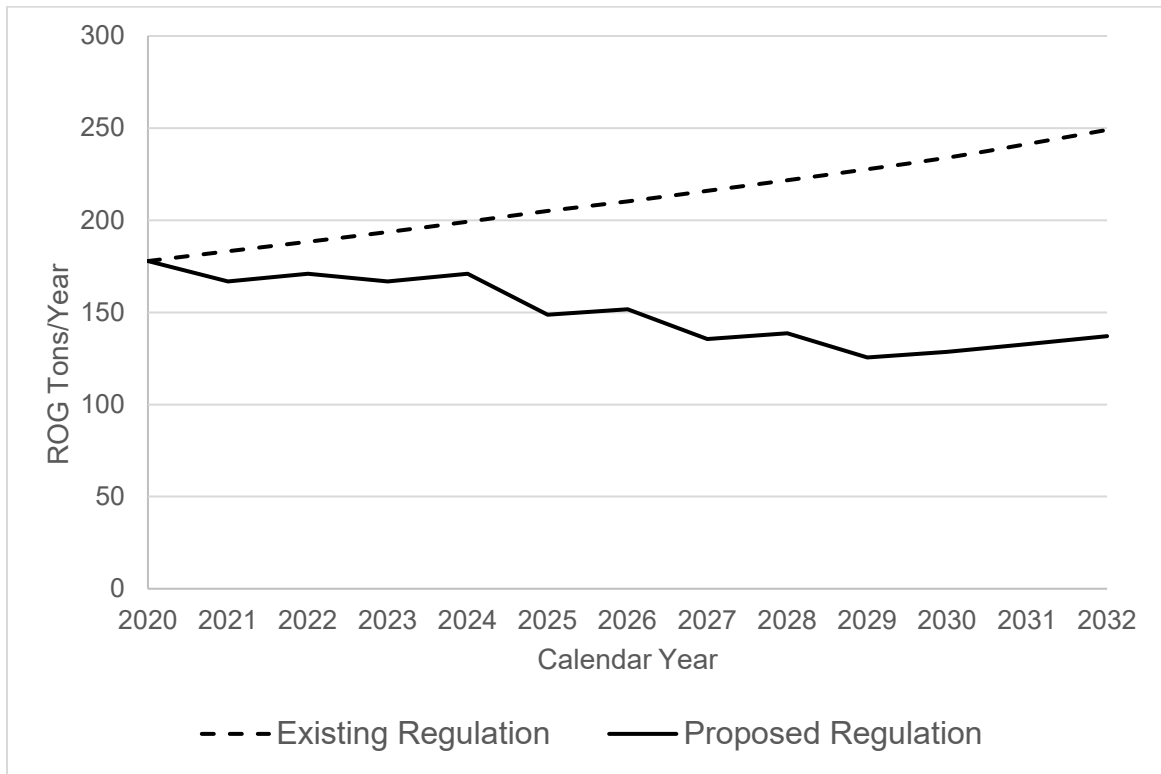


Figure V-5 presents projected ROG emissions from 2020 to 2032 for the two scenarios. ROG emissions tend to decline in proportion with PM<sub>2.5</sub> emissions associated with the Proposed Regulation. Relative to the Existing Regulation, the Proposed Regulation is projected to reduce approximately 800 tons of ROG from 2021 to 2032. In 2032, when comparing the Proposed Regulation to the Existing Regulation, ROG emissions would be reduced about 45 percent, from 249 TPY to 137 TPY.

In terms of reduction trends for the Proposed Regulation, calendar years 2027 and 2029 represent the steepest year-over-year declines in ROG emissions, owing to the regulatory phase in dates for ro-ro (2025) and tanker vessels (2027 and 2029 for POLA and POLB and the remainder of the state, respectively).

<sup>187</sup> U.S. EPA, eGRID Summary Tables 2016, February 15, 2018, [https://www.epa.gov/sites/production/files/2018-02/documents/egrid2016\\_summarytables.pdf](https://www.epa.gov/sites/production/files/2018-02/documents/egrid2016_summarytables.pdf).

## Statewide At Berth Criteria Pollutant Emissions (NOx and PM2.5)

The contribution to statewide at berth criteria emission for each port and marine terminal complex is shown below in Figure V-6. The Proposed Regulation expands requirements to additional ports and marine terminal complexes to reduce significant high emissions from auxiliary engines and boilers at these locations. In most cases, the relative contribution of NOx and PM2.5 to the statewide inventory for each port and marine terminal complex are comparable in magnitude (i.e., visually this means the black and white bars for the port are of a similar height). In some cases such as Richmond, the relative contribution to PM2.5 is higher than the contribution to NOx. This can largely be attributed to the tanker activity in the Richmond Complex, and the fact that tanker boilers have a higher PM2.5 contribution than NOx. In other areas, such as San Francisco, the relative contribution to PM2.5 is lower than NOx, as the area sees very few tankers.

**Figure V-6: 2016 Statewide At-Berth NOx and PM 2.5 Emissions by Port**

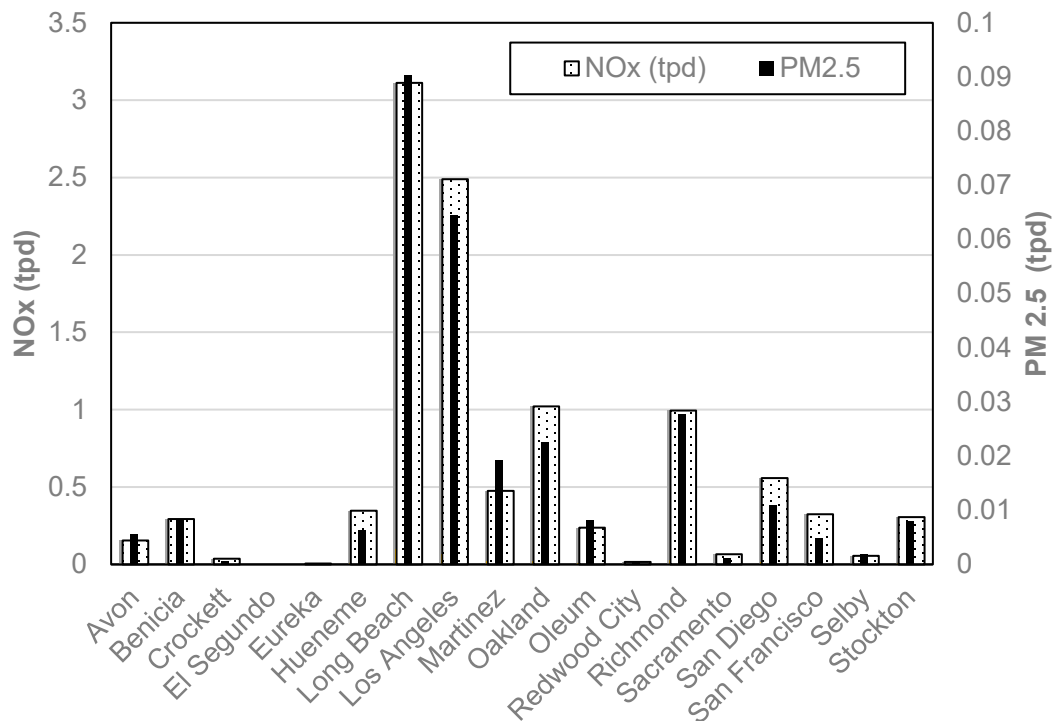
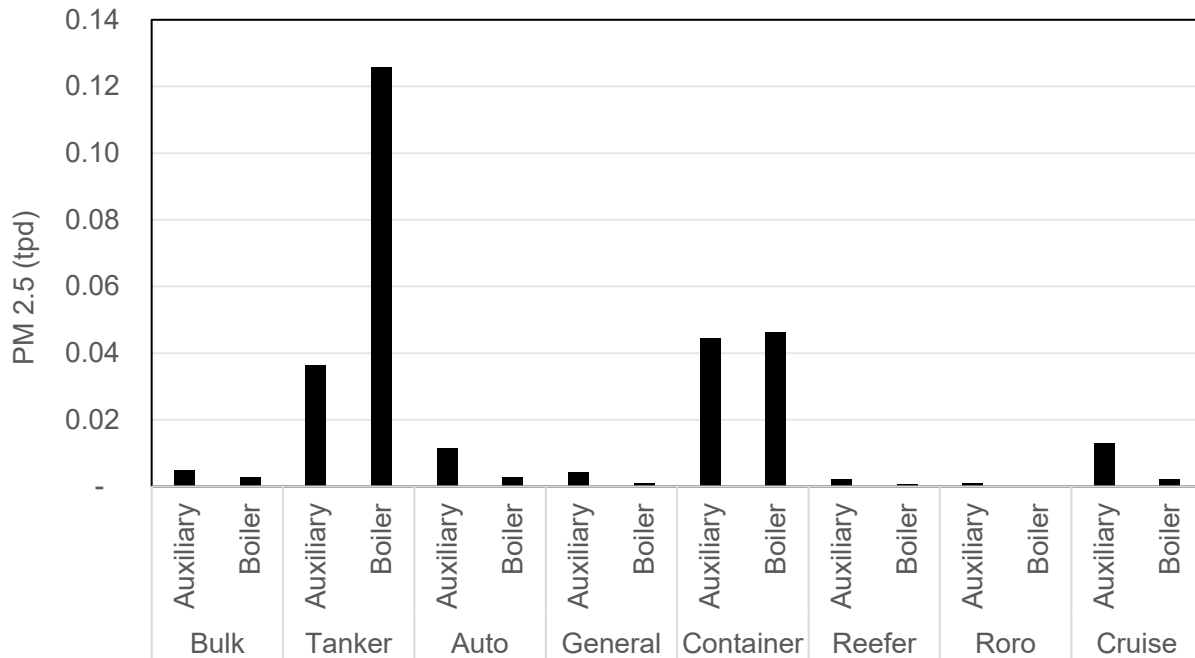


Figure V-7 below shows the contribution to statewide at berth PM2.5 emissions by each vessel type and each engine type on the vessel. Tanker and container vessels are by far the largest overall contributors to statewide PM 2.5 by vessel type. In particular, boiler emissions on tanker vessels are the highest source of PM 2.5 emissions.

**Figure V-7: 2016 Statewide At Berth PM2.5 Emission by Vessel Type**



**D. Health Analyses to Assess the Impact of Emissions from Ocean-Going Vessels At Berth**

CARB staff evaluated the health impacts attributable to vessel emissions at berth using two different methods: a health risk assessment (HRA) that considers the localized impacts in communities around three ports, and regional assessments of premature death and illness in each air basin. The localized HRA uses air quality modeling to estimate the concentration of DPM at specific locations near the ports, estimates DPM exposure to people living in those communities, and quantifies the health effects (potential cancer risk, and acute and chronic non-cancer impact) that would be expected to result from that exposure. The HRA further projects how those impacts would change with implementation of the Proposed Regulation.

The regional assessments use the results of air quality monitoring and emissions inventory data, and county-specific statistics on health outcomes (premature death due to cardiac or respiratory effects, plus hospitalizations and emergency room visits attributed to those causes) attributable to emissions from ocean-going vessels at berth. CARB staff’s analysis focused on the impacts of regional PM2.5 pollution, either directly emitted from vessel engines and boilers, or formed in the atmosphere from NOx emissions from the same sources. Details of the localized HRA and regional mortality and illness assessments can be found in the Health Analyses: Control Measure for Ocean-Going Vessels at Berth document in Appendix G.

In addition to diesel fueled auxiliary engines, auxiliary boilers operate at berth to provide power to heat residual fuel, viscous cargo, and water, as well as to generate steam to provide power. PM emissions from these boilers are not categorized as DPM due to the differences in combustion processes, and are not included in the DPM related potential cancer risk analysis portion of the health analysis. However, the boiler PM2.5 is included in the regional non-cancer health impacts.

### **1. Potential Exposures and Health Risks From Ocean-Going Vessel Engine DPM Emissions**

As part of CARB's HRA, staff conducted a risk assessment to estimate the potential cancer health benefits of reducing DPM emitted from diesel-fueled auxiliary engines from vessels operating at berth.

In the HRA, staff evaluated the health impacts at three ports. Staff selected the three ports, based on port size, vessel activity, emissions, and proximity to disadvantaged communities. Staff selected POLA and POLB, and combined them in the analysis, to represent large ports. The Richmond Complex was selected to represent small ports and tanker marine terminals. POLA and POLB combined represent more than half of the at berth emissions in California while the Richmond Complex represents the second largest emissions for tanker vessels in California. Staff used air dispersion modeling to estimate the DPM concentrations for the communities surrounding the ports and estimated cancer risks from the modeled results. The estimated cancer risks were calculated for the broader population surrounding the ports, as well as the risk to maximum exposed individual resident (MEIR).

When comparing the Proposed Regulation to the Existing Regulation at each phase, implementation in 2021 would reduce the total DPM emissions by approximately 17 percent, implementation in 2025 would reduce the DPM emissions by approximately 42 percent, and implementation in 2027 would reduce the DPM emissions by approximately 56 percent at POLA and POLB, as shown in Table V-1 below.

**Table V-1: POLA and POLB Estimated At Berth DPM Emissions<sup>1,2</sup>**

| Vessel Type      | 2020     | 2021     |          | 2023 <sup>2</sup> |          | 2025     |          | 2027     |          | 2031 <sup>3</sup> |          |
|------------------|----------|----------|----------|-------------------|----------|----------|----------|----------|----------|-------------------|----------|
|                  | Existing | Existing | Proposed | Existing          | Proposed | Existing | Proposed | Existing | Proposed | Existing          | Proposed |
| <b>Container</b> | 12.80    | 13.40    | 9.32     | 14.69             | 8.50     | 16.11    | 5.90     | 17.37    | 6.12     | 20.44             | 6.86     |
| <b>Tanker</b>    | 6.29     | 6.38     | 6.38     | 6.46              | 6.46     | 6.55     | 6.55     | 6.63     | 2.49     | 6.78              | 2.55     |
| <b>Cruise</b>    | 2.90     | 3.01     | 2.83     | 3.24              | 2.85     | 3.48     | 2.50     | 3.74     | 2.69     | 4.32              | 3.10     |
| <b>Ro-Ro</b>     | 1.59     | 1.68     | 1.68     | 1.84              | 1.84     | 2.02     | 0.84     | 2.16     | 0.90     | 2.36              | 0.98     |
| <b>Bulk</b>      | 0.83     | 0.86     | 0.86     | 0.87              | 0.87     | 0.88     | 0.88     | 0.88     | 0.88     | 0.90              | 0.90     |
| <b>General</b>   | 0.73     | 0.76     | 0.76     | 0.83              | 0.83     | 0.90     | 0.90     | 0.97     | 0.97     | 1.12              | 1.12     |
| <b>Reefer</b>    | 0.28     | 0.29     | 0.08     | 0.32              | 0.08     | 0.34     | 0.05     | 0.37     | 0.06     | 0.43              | 0.07     |
| <b>Total:</b>    | 25.42    | 26.38    | 21.91    | 28.24             | 21.42    | 30.27    | 17.60    | 32.11    | 14.10    | 36.36             | 15.57    |

1. Bulk and general cargo vessels are not subject to control requirements in the Proposed Regulation.
2. DPM emissions are from auxiliary engines and do not include boilers.
3. Although 2023 and 2031 are not implementation years in the Proposed Regulation, they are provided for informational purposes because they are key attainment deadlines for the South Coast Air Basin under the SIP.

For the Richmond Complex, compared to the Existing Regulation, implementation of the Proposed Regulation in 2025 (for ro-ro vessels) and 2029 (tanker vessels) would reduce the total DPM emissions by approximately 11 percent and 55 percent, respectively. Tanker vessel emissions would be the largest contributor to the total remaining DPM emissions under the Proposed Regulation, accounting for approximately 67 percent in 2029 as shown in Table V-2 below.

**Table V-2: Richmond Complex Estimated At Berth DPM Emissions<sup>1,2</sup>**

| Vessel Type   | 2020     | 2021     | 2023 <sup>3</sup> | 2025     |          | 2029     |          | 2031 <sup>3</sup> |          |
|---------------|----------|----------|-------------------|----------|----------|----------|----------|-------------------|----------|
|               | Existing | Existing | Existing          | Existing | Proposed | Existing | Proposed | Existing          | Proposed |
| Tanker        | 2.38     | 2.40     | 2.43              | 2.47     | 2.47     | 2.60     | 1.05     | 2.68              | 1.08     |
| Ro-Ro         | 0.55     | 0.57     | 0.60              | 0.63     | 0.26     | 0.69     | 0.29     | 0.73              | 0.31     |
| Bulk          | 0.19     | 0.19     | 0.20              | 0.21     | 0.21     | 0.22     | 0.22     | 0.23              | 0.23     |
| <b>Total:</b> | 3.13     | 3.16     | 3.23              | 3.30     | 2.94     | 3.52     | 1.57     | 3.64              | 1.62     |

1. Bulk and general cargo vessels are not subject to control requirements in the Proposed Regulation.
2. DPM emissions are only from auxiliary engines and do not include boilers.
3. Although 2023 and 2031 are not implementation years in the Proposed Regulation, they are provided for informational purposes because they are key attainment deadlines for the South Coast Air Basin under the SIP.

As a result of the DPM emissions reductions from the Proposed Regulation, in 2031, CARB staff estimates the potential cancer risks would be significantly reduced in nearby communities. Tables V-3 and V-4 show the estimated affected population around POLA, POLB, and the Richmond Complex that fall within the potential cancer risk levels of greater than: 5 chances per million, 10 chances per million, 20 chances per million, 30 chances per million, and 50 chances per million. When compared to the Existing Regulation, the Proposed Regulation would provide significant risk reductions by reducing the number of people exposed to each of the specified risk levels.

For POLA and POLB, the population's exposure to a potential cancer risk level of greater than 50 chances per million would be eliminated with the Proposed Regulation. Overall, at POLA and POLB in 2031, when comparing the Existing Regulation to the Proposed Regulation, more than 2.4 million people would have their potential cancer risk reduced, of which about 1.5 million live in disadvantaged communities.



**Table V-3: Population Exposed and Elevated Cancer Risk Levels for POLA and POLB Comparing the Existing Regulation and Proposed Regulation in 2031<sup>1</sup>**

| Risk Level (chances/million) | Existing Regulation | Proposed Regulation | Percent Decrease |
|------------------------------|---------------------|---------------------|------------------|
| >50                          | 110,500             | 0                   | 100%             |
| >30                          | 367,500             | 26,500              | 93%              |
| >20                          | 612,500             | 150,200             | 75%              |
| >10                          | 1,654,200           | 511,900             | 69%              |
| >5                           | 3,711,800           | 1,295,100           | 65%              |

1. Population-wide cancer risk estimates are based on a 70-year exposure duration using the Risk Management Policy Risk Management Policy (RMP) method (95<sup>th</sup>/80<sup>th</sup> percentile daily breathing rates). Fraction of time at home (FAH) equals 1 for all age bins. All numbers are rounded.

For the Richmond Complex, the population’s exposure to a potential cancer risk level of greater than 20 chances per million would be eliminated by the Proposed Regulation. Overall, at the Richmond Complex in 2031, when comparing the Existing Regulation to the Proposed Regulation, more than 14,000 people would have their potential cancer risk reduced, of which about 13,000 live in disadvantaged communities.

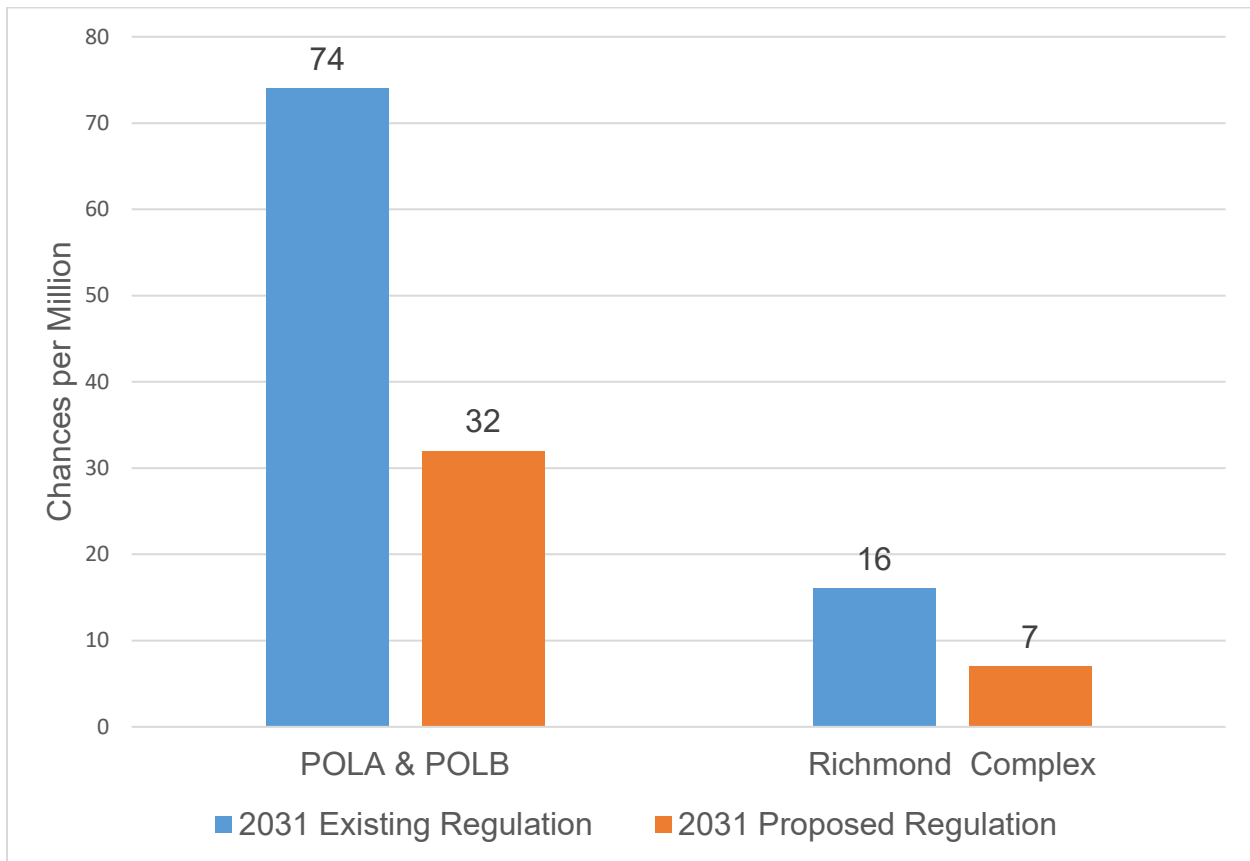
**Table V-4: Population Exposed and Elevated Cancer Risk Levels for Richmond Complex Comparing the Existing Regulation and Proposed Regulation in 2031<sup>1</sup>**

| Risk Level (chances/million) | Existing Regulation | Proposed Regulation | Percent Decrease |
|------------------------------|---------------------|---------------------|------------------|
| >50                          | 0                   | 0                   | 0%               |
| >30                          | 0                   | 0                   | 0%               |
| >20                          | 10                  | 0                   | 100%             |
| >10                          | 760                 | 10                  | 99%              |
| >5                           | 15,200              | 950                 | 94%              |

1. Population-wide cancer risk estimates are based on a 70-year exposure duration using the Risk Management Policy (RMP) method (95<sup>th</sup>/80<sup>th</sup> percentile daily breathing rates). Fraction of time at home (FAH) equals 1 for all age bins. All numbers are rounded.

In addition to evaluating the population cancer health impacts, staff evaluated the potential cancer risk for the MEIR around POLA and POLB, as well as the MEIR around the Richmond Complex. The MEIR demonstrates the highest exposure at a location where an individual would live. Figure V-8 shows that with full implementation of the Proposed Regulation, the potential cancer risk would be reduced significantly compared to the Existing Regulation.

**Figure V-8: Maximum Exposed Individual Resident Potential Cancer Risk<sup>1</sup>**



<sup>1</sup> MEIR cancer risk estimates are based on a 30-year exposure duration using the RMP method (95<sup>th</sup>/80<sup>th</sup> percentile daily breathing rate). FAH equals 1 for age bin <16 years, and 0.73 for age bin 16-70 years. All numbers are rounded.

For POLA and POLB, comparing the potential cancer risks with and without the Proposed Regulation in 2031, the MEIR potential cancer risk would decrease from approximately 74 chances per million to approximately 32 chances per million. This represents a reduction in potential cancer risk of close to 60 percent.

Similarly, for the Richmond Complex, comparing the potential cancer risks with and without the Proposed Regulation in 2031, the MEIR potential cancer risk would decrease from approximately 16 chances per million to approximately 7 chances per million. Again, this represents a reduction in potential cancer risk of close to 60 percent.

## 2. Regional Non-Cancer Health Impacts

California experiences some of the highest concentrations of PM<sub>2.5</sub> in the nation.<sup>188</sup> Individuals who live in high-risk areas near ports are exposed to higher PM<sub>2.5</sub> concentrations from vessels at berth than other California residents. These individuals are at a higher risk of developing respiratory impairments as a result of auxiliary engine and boiler emissions, especially those individuals within sensitive groups.

The Proposed Regulation would reduce NO<sub>x</sub> and PM<sub>2.5</sub> emissions from vessels operating at berth, resulting in health benefits for individuals in California. Primary PM<sub>2.5</sub> is emitted directly from the vessel auxiliary engines and boilers. Secondary PM<sub>2.5</sub> is formed in the atmosphere as a result of chemical reactions. NO<sub>x</sub> emissions from the vessel auxiliary engines and boilers are converted by atmospheric processes to secondary ammonium nitrate PM<sub>2.5</sub>. Reductions in both NO<sub>x</sub> and primary PM<sub>2.5</sub> emissions from the Proposed Regulation would result in a greater reduction in PM<sub>2.5</sub> exposure to the communities and regional air basins. Benefits from the reductions include fewer hospital and emergency room visits and avoided premature deaths.

CARB staff used two methods to estimate the health benefits of the Proposed Regulation. For the South Coast Air Basin, health benefits were estimated using the air dispersion results from the HRA. For all other air basins, where basin-wide air dispersion results were unavailable, staff used the incidence-per-ton (IPT) methodology. The two methodologies are summarized in the following sections.

### a) Direct Estimation of Health Outcomes from Air Dispersion Modeling

For the South Coast Air Basin, CARB staff used air dispersion modeling to estimate the changes in primary PM<sub>2.5</sub> concentrations resulting from the Proposed Regulation over a gridded modeling domain covering portions of Los Angeles and Orange Counties surrounding POLA and POLB. The modeling approach is described in Appendix G. Using a methodology developed by U.S. EPA,<sup>189</sup> CARB staff used a health model to estimate the impacts of the estimated PM<sub>2.5</sub> concentrations in each modeled grid cell, and results were aggregated over the domain.

---

<sup>188</sup> U.S. EPA, Fine Particle Concentrations Based on Monitored Air Quality From 2009 – 2011, July 15, 2012, [https://www.epa.gov/sites/production/files/2016-04/documents/current\\_pm\\_table.pdf](https://www.epa.gov/sites/production/files/2016-04/documents/current_pm_table.pdf).

<sup>189</sup> U.S. EPA, Environmental Benefits Mapping and Analysis Program: Community Edition (BenMAP-CE) User Manual and Appendices, 2017 (accessed September 6, 2019), [www.epa.gov/benmap](http://www.epa.gov/benmap).

## b) Incidents-Per-Ton Methodology

CARB used the IPT methodology to quantify the health benefits of emission reductions in cases where dispersion modeling results are not available. The IPT methodology is based on a methodology similar to one developed by U.S. EPA.<sup>190,191,192</sup> It is used to estimate the benefits of reductions in primary PM<sub>2.5</sub> emitted directly from sources and secondary PM<sub>2.5</sub> formed from precursors by chemical processes in the atmosphere. More information on the IPT methodology can be found on CARB's web site.<sup>193</sup>

Under the IPT methodology, changes in emissions are approximately proportional to changes in health outcomes. IPT factors are derived by calculating the number of health outcomes associated with exposure to PM<sub>2.5</sub> for a baseline scenario using measured concentrations, and dividing by the emissions of PM<sub>2.5</sub> or a precursor. The calculation is performed separately for each air basin:

$$IPT = \frac{\text{number of health outcomes in air basin}}{\text{annual emissions in air basin}}$$

Multiplying the emission reductions from a regulation in an air basin by the IPT factor then yields an estimate of the reduction in health outcomes achieved by the Proposed Regulation. For future years, the number of outcomes is adjusted to account for population growth. CARB's current IPT factors are based on a 2014-2016 baseline scenario, which represents the most recent data available at the time the current IPT factors were computed. IPT factors are computed for two types of PM<sub>2.5</sub>: Primary PM<sub>2.5</sub> and secondary ammonium nitrate aerosol.

## c) Results

The largest estimated health benefits correspond to regions in California with the most vessel visits, which are the South Coast Air Basin and the San Francisco Bay Air Basin. Table V-5 shows the estimated avoided premature deaths, avoided hospital admissions and avoided emergency room visits that would result from the Proposed Regulation, summed over the years 2021 through 2032 by California air basin, relative to the

---

<sup>190</sup> Fann, N., Fulcher, C., & Hubbell, B., The influence of location, source, and emission type in estimates of the human health benefits of reducing a ton of air pollution, *Air Quality, Atmosphere & Health*, 2:169-176, June 9, 2009, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2770129/>.

<sup>191</sup> Fann N, Baker K., & Fulcher C., Characterizing the PM<sub>2.5</sub>-related health benefits of emission reductions for 17 industrial, area and mobile emission sectors across the U.S. *Environ Int.*, 49:141-51, November 12, 2012, <https://www.sciencedirect.com/science/article/pii/S0160412012001985>.

<sup>192</sup> Fann, N., Baker, K., Chan, E., Eyth, A., Macpherson, A., Miller, E., & Snyder J., Assessing Human Health PM<sub>2.5</sub> and Ozone Impacts from U.S. Oil and Natural Gas Sector Emissions in 2025, *Environ. Sci. Technol.* 52 (15), pp 8095–8103, July 13, 2018, <https://pubs.acs.org/doi/abs/10.1021/acs.est.8b02050>.

<sup>193</sup> California Air Resources Board, Methodology for Estimating the Health Effects of Air Pollution, accessed on September 9, 2019, <https://www.arb.ca.gov/resources/documents/carbs-methodology-estimating-health-effects-air-pollution>.

Existing Regulation. Staff used the range of years from 2021-2032 rather than the 2020-2032 period evaluated in the cost analysis because there would be no emissions reductions or associated health benefits prior to the first control requirement in 2021. As detailed in Appendix G, the Proposed Regulation is estimated to reduce overall emissions of PM2.5 and NOx in all years, and lead to a net reduction in adverse health outcomes statewide, relative to the Existing Regulation.

**Table V-5: Regional and Statewide Avoided Premature Deaths, Hospital Admissions and Emergency Room Visits from 2021 to 2032 under the Proposed Regulation for Total PM2.5 and NOx<sup>1,2</sup>**

| <b>Air Basin</b>    | <b>Avoided Premature Deaths</b> | <b>Hospital Admissions</b> | <b>Emergency Room Visits</b> |
|---------------------|---------------------------------|----------------------------|------------------------------|
| North Coast         | 0 (0 - 0)                       | 0 (0 - 0)                  | 0 (0 - 0)                    |
| Sacramento Valley   | 0 (0 - 0)                       | 0 (0 - 0)                  | 0 (0 - 0)                    |
| San Diego County    | 7 (5 - 8)                       | 2 (0 - 3)                  | 3 (2 - 4)                    |
| San Francisco Bay   | 28 (22 - 34)                    | 9 (1 - 17)                 | 16 (10 - 22)                 |
| San Joaquin Valley  | 0 (0 - 0)                       | 0 (0 - 0)                  | 0 (0 - 0)                    |
| South Central Coast | 2 (1 - 2)                       | 0 (0 - 1)                  | 1 (0 - 1)                    |
| South Coast         | 194 (151 - 236)                 | 61 (8 - 114)               | 96 (61 - 132)                |
| <b>Total</b>        | <b>230 (180 - 281)</b>          | <b>73 (9 - 135)</b>        | <b>116 (73 - 158)</b>        |

<sup>1</sup> PM2.5 estimates for the South Coast Air Basin were obtained by direct estimation of health outcomes. Other estimates were obtained using ITP factors.

<sup>2</sup> Values in parenthesis represent the 95 percent confidence intervals around the estimated mean, which is the range of values that would be 95 percent certain to contain the true mean value.

In addition to its role in the formation of secondary PM2.5, NOx is also a precursor to the formation of ozone. However, when the valuations for NOx and PM2.5 are monetized, the monetary impacts of secondary PM2.5 tend to be larger than the monetized impacts of increased from NOx emissions. As a result, this analysis only monetizes the value of reductions in PM2.5. In accordance with U.S. EPA practice, health outcomes were monetized by multiplying incidence by a standard value derived from economic studies.<sup>194</sup> This valuation per incident is provided in Table V-6. The valuation for avoided premature mortality is based on willingness to pay.<sup>195</sup> This value is a statistical construct based on the aggregated dollar amount that a large group of

<sup>194</sup> U.S. EPA, National Center for Environmental Economics et al., Appendix B: Mortality Risk Valuation Estimates, Guidelines for Preparing Economic Analyses, U.S. EPA 240-R-10-001, Dec. 2010, <https://www.epa.gov/sites/production/files/2017-09/documents/ee-0568-22.pdf>.

<sup>195</sup> U.S. EPA, Science Advisory Board (U.S. EPA-SAB), An SAB Report on EPA's White Paper Valuing the Benefits of Fatal Cancer Risk Reduction, EPA-SAB-EEAC-00-013, July 2000, [http://yosemite.epa.gov/sab%5CSABPRODUCT.NSF/41334524148BCCD6852571A700516498/\\$File/ee\\_acf013.pdf](http://yosemite.epa.gov/sab%5CSABPRODUCT.NSF/41334524148BCCD6852571A700516498/$File/ee_acf013.pdf).

people would be willing to pay for a reduction in their individual risks of dying in a year. This is not an estimate of how much any single individual would be willing to pay to prevent a certain death of any particular person,<sup>196</sup> nor does it consider any specific costs associated with mortality such as hospital expenditures.

Unlike premature mortality valuation, the valuation for avoided hospitalizations and emergency room visits is based on a combination of typical costs associated with hospitalization and the willingness of surveyed individuals to pay to avoid adverse outcomes that occur when hospitalized. These include hospital charges, post-hospitalization medical care, out-of-pocket expenses, and lost earnings for both individuals and family members, lost recreation value, and lost household protection (e.g., valuation of time-losses from inability to maintain the household or provide childcare).<sup>197</sup>

**Table V-6: Valuation Per Incident for Avoided Health Outcomes**

| Outcome                                    | Valuation per Incident (2019\$) |
|--|---------------------------------|
| Avoided Premature Deaths                   | \$9,744,000                     |
| Avoided Cardiovascular Hospitalizations    | \$59,000                        |
| Avoided Acute Respiratory Hospitalizations | \$51,000                        |
| Avoided ER Department Visits               | \$840                           |

Statewide valuation of health benefits were calculated by multiplying the avoided health outcomes by valuation per incident. The total statewide valuation due to avoided health outcomes between 2021 and 2032, which totaled \$2.2 billion. These values are summarized in Table V-7. The spatial distribution of these benefits follow the distribution of emissions reductions and avoided adverse health outcomes, therefore most cost savings associated with avoided health outcomes for individuals would occur in the South Coast and San Francisco air basins.

<sup>196</sup> U.S. EPA, Mortality Risk Valuation – What does it mean the place a value on a life?, accessed August 29, 2019, <https://www.epa.gov/environmental-economics/mortality-risk-valuation#means>.

<sup>197</sup> Chestnut, L., et. al., The Economic Value Of Preventing Respiratory And Cardiovascular Hospitalizations (Contemporary Economic Policy, 24: 127–143. doi: 10.1093/CEP/BYJ007, Jan. 2006, <http://onlinelibrary.wiley.com/doi/10.1093/cep/byj007/full>.

**Table V-7: Statewide Valuation from Avoided Adverse Health Outcomes Between 2021 and 2032 as a Result of the Proposed Regulation**

| <b>Outcome</b>           | <b>Valuation<sup>1</sup></b> |
|--------------------------|------------------------------|
| Avoided Premature Deaths | \$2,241,110,000              |
| Avoided Hospitalizations | \$4,000,000                  |
| Avoided ER Visits        | \$97,000                     |
| <b>Total Valuation:</b>  | <b>\$2,245,207,000</b>       |

<sup>1</sup>Values are for the 2019 dollar year.

## **VI. BENEFITS ANTICIPATED FROM REGULATORY ACTION**

### **A. Health Benefits**

#### **Reduced Ambient Particulate Matter (PM) Levels**

A substantial number of epidemiologic studies have found a strong association between exposure to ambient PM and adverse health effects. For this Staff Report, CARB staff evaluated the impacts the Proposed Regulation would have on potential cancer risks (DPM) and conducted non-cancer health impacts associated with exposures to ambient levels of directly emitted and secondary PM (PM 2.5) (formed in the atmosphere as a result of chemical reactions). Communities around California's ports and marine terminals bear a disproportionate health burden due to their close proximity to emissions from vessels (at berth, at anchor, during maneuvering, and while in transit) and other emission sources including trucks, locomotives, and terminal equipment serving the ports. Most California ports are in urban areas and located near where people live, work, and go to school. Emissions from ocean-going vessels operating at berth are significant and growing contributor to community air pollution and associated health impacts.

#### **1. Reduction in Potential Cancer Risk**

The HRA used potential cancer risk as a metric to determine the localized health impacts for the nearby communities. Potential cancer risks were expressed as the chance an individual has of developing cancer if a million people were exposed to a toxic air contaminant continuously for a specified duration of exposure. CARB characterized potential cancer risks in terms of: a) risk to the broader population and b) location of the highest residential exposure (MEIR).

##### **a) Population Impacted by Potential Cancer Risk**

The risk to the broader population (based on a 70-year exposure duration) is expressed in terms of the population numbers associated with each cancer risk level. Implementing the Proposed Regulation at POLA and POLB would eliminate the potential cancer risk levels of greater than 50 chances per million, beginning in 2025. At the Richmond Complex, potential cancer risk levels of greater than 20 chances per million would be eliminated beginning in 2031.

##### **b) Maximum Exposed Individual Resident**

The Proposed Regulation would provide significant cancer risk reductions by reducing the potential cancer risk to the MEIR. The MEIR represents the highest potential cancer risk to an individual residential receptor, which assumes that a resident is exposed to the emission source for 30 years. At POLA and POLB in 2031 at full implementation, the MEIR potential cancer risk would be reduced approximately 60 percent, from 74 chances per million to 32 chances per million compared to the Existing Regulation.



For the Richmond Complex, by 2031 with full implementation, the MEIR would be reduced by about 60 percent, from 16 chances per million to 7 chances per million.

Based on staff's evaluation for the Proposed Regulation, full implementation would benefit millions of people living next to large ports and tens of thousands of people living next to small ports and marine terminals in California. Although staff's HRA only evaluated exposure to receptors and workers off-site of port property, it is expected that significant potential cancer risk reduction would also occur due to reductions in DPM to on-site workers, including, but not limited to longshoremen, crane operators, mechanics, truck drivers, guards, construction workers, and other individuals who work at the ports.

## **2. Non-Cancer Health Impacts and Valuations**

CARB staff estimated the potential statewide PM mortality and illness impacts associated with exposure to PM<sub>2.5</sub> from the Proposed Regulation. These health outcomes include cardiopulmonary mortality, hospital admissions, and emergency room visits. Based on the analysis, staff estimates that the total number of cases that would be reduced (2021 to 2032) from implementation of the Proposed Regulation are as follows:

- 230 premature deaths (180 to 281, 95 percent confidence interval (CI)).
- 72 hospital admissions (9 to 135, 95 percent CI).
- 116 emergency room visits (73 to 158, 95 percent CI).

### **a) Monetization of Health Outcomes**

In accordance with U.S. EPA practice, CARB staff monetized the health outcomes above by multiplying incidence by a standard value derived from economic studies resulting in a valuation per incident. This results in valuations for avoided premature mortality, avoided hospitalizations, and emergency room visits were described in Chapter V.

Statewide valuations of health benefits were calculated by multiplying the avoided health outcomes by the valuation per incident. Staff quantified the total statewide valuation due to avoided health outcomes between 2021 and 2032. These values are summarized in Table VI-1. The spatial distribution of these benefits follow the distribution of emissions reductions and avoided adverse health outcomes; therefore, most benefits to individuals would occur in the South Coast and San Francisco Bay Area (see additional details in Chapter V).

**Table VI-1: Statewide Valuation from Avoided Adverse Health Outcomes Between 2021 and 2032 as a Result of the Proposed Regulation**

| <b>Outcome</b>                | <b>Valuation<sup>1</sup></b> |
|-------------------------------|------------------------------|
| Avoided Premature Deaths      | \$2,241,110,000              |
| Avoided Hospitalizations      | \$4,000,000                  |
| Avoided Emergency Room Visits | \$97,000                     |
| <b>Total Valuation:</b>       | <b>\$2,245,207,000</b>       |

<sup>1</sup>Values are for the 2019 dollar year.

### **3. Reduced Ambient Ozone Levels**

Although CARB staff did not quantify reduced adverse health outcomes associated with lower ozone levels, the Proposed Regulation would further reduce emissions of NOx and ROG that are precursors to the formation of ozone in the lower atmosphere. Exhaust from diesel engines and boilers, including auxiliary engines on vessels at berth, contributes to the basin-wide inventory of ozone-formation precursors. Consequently, the Proposed Regulation would provide reductions to support attainment of the NAAQS for ozone, which are health-based standards set to minimize prevalence of respiratory problems, particularly asthma and lung damage.

### **4. Greenhouse Gases and Black Carbon**

The Proposed Regulation will achieve GHG and black carbon emissions reductions, both of which have the potential to help combat global climate change (see discussion in Chapter V). A component of DPM is black carbon, a potent climate-warming component formed by the incomplete combustion of fossil and other fuels. Black carbon is a short-lived climate pollutant, which can have significant direct and indirect impacts on climate and human health. Reductions of DPM will provide reductions in black carbon emissions. Climate scientists agree that global warming and other shifts in the climate system observed over the past century are caused by human activities. These recorded changes are occurring at an unprecedented rate. According to new research, unabated GHG emissions could cause sea levels to rise up to ten feet by the end of this century—an outcome that could devastate coastal communities in California and around the world. California is already feeling the effects of climate change, and projections show that these effects will continue and worsen over the coming centuries. The impacts of climate change on California have been documented by OEHHA in the Indicators of Climate Change Report.<sup>198</sup>

<sup>198</sup> Office of Environmental Health Hazard Assessment, Indicators of Climate Change in California, May 2018, <https://oehha.ca.gov/media/downloads/climate-change/report/2018caindicatorsreportmay2018.pdf>

## **B. Additional Benefits**

### **1. Technology Providers**

Compliance with the Existing Regulation is currently limited to shore power and alternative barge-based emissions capture and control systems. With the Proposed Regulation, CARB anticipates economic benefits associated with vessel owners or operators utilizing these alternative compliance options.

Vessels complying with shore power would provide additional opportunities for electrical infrastructure original equipment manufacturers (OEM) as well as equipment installers to enter the market to install shore power equipment at the ports.

Vessels complying with the Proposed Regulation by using capture and control systems would provide substantial economic benefit to technology companies operating and developing these systems. Based on CARB's estimates, more than 30 capture and control (either land or barge-based) systems needed to control emissions from approximately 2,300 vessel visits annually. At the time of drafting this Staff Report, there are currently two companies who each own and operate a single barge-based emission capture system: Advanced Environmental Group at POLB, and Clean Air Engineering Maritime at POLA. CARB foresees both the opportunity for growth of these two existing companies to build, deploy, and operate additional systems, and a new market for additional entrants to develop technologies to meet demand to comply with the Proposed Regulation. Anticipated growth of the development and deployment of capture and control systems would also provide benefits to OEMs of ancillary equipment such as flatbed trailers, barges, tugs, gantry cranes, boom lifts, and any other equipment required to build and operate the systems.

### **2. Construction**

The Proposed Regulation would provide opportunities for both large and small engineering, construction, and design firms to redesign and expand existing port infrastructure to accommodate CARB approved compliance strategies to be developed. The Proposed Regulation would also benefit alternative fuel suppliers or utilities to construct additional pipeline networks to feed directly to the ports, providing additional benefits for other freight equipment.

### 3. Technology Research and Development

Although the current compliance strategies for the Existing Regulation are limited to shore power and emission capture and control technologies, CARB anticipates the timing of the Proposed Regulation would further accelerate the development of innovative technologies and strategies for newly regulated vessel categories to meet the requirements. This would provide an incentive for both university research centers and OEMs to expand into this market. In addition, the Proposed Regulation may accelerate the development of alternative fuels such as renewable diesel, renewable natural gas, and renewable hydrogen to power the CARB approved compliance strategies. This would have an additional benefit of meeting CARB's Low Carbon Fuel Standards (LCFS) requirements.

### 4. Out-of-State and International Impacts

California has been a world leader in establishing clean air policies and programs. Unlike source categories that operate more locally, ocean-going vessels operate around the globe. Consequently, California programs for ocean-going vessels directly benefit other regions of the world where vessels travel. The Existing Regulation has required use of shore power on many vessels visiting California, and regions around the world have also begun to use shore power.

Growing interest in the use of shore power, namely for container, cruise, and ro-ro vessels, is occurring at other ports both in the U.S. and globally (including major ports in Canada, China, and Northern Europe). This may positively benefit shipping companies calling California, if they are able to utilize shore power equipment used for compliance with regulatory or incentive programs in other ports.<sup>199,200,201</sup> Several ports in China have taken action to install shore power infrastructure for container terminals (including Shenzhen, Yantian, Ningbo-Zhoushan, Hong Kong, among others) as an emissions reductions strategy to combat air pollution.<sup>202</sup> The development of shore power in China is particularly beneficial due to the large number of container vessel fleets traveling back and forth between California and China. The utilization of shore power beyond California may not only help the cost impact for a given ocean carrier, but could also contribute to added health benefits for port communities in other countries. Successful adoption of the Proposed Regulation would incentivize more countries to adopt shore power, which provides enormous potential for additional health benefits in port communities worldwide.

---

<sup>199</sup> U.S. EPA, Shore Power Technology Assessment at U.S. Ports, March 2017.

<https://www.epa.gov/sites/production/files/2017-05/documents/420r17004-2017-update.pdf>.

<sup>200</sup> World Maritime News, New Shore Power Facilities at Port Metro Vancouver, July 23, 2015,

<https://worldmaritimeneeds.com/archives/167358/new-shore-power-facilities-at-port-metro-vancouver/>.

<sup>201</sup> Stansfield, J., Port of Bergen Granted 50 Million NOK for Shore Power Facilities, December 8, 2018

<https://www.cruisemapper.com/news/4916-port-bergen-granted-50-million-nok-for-shore-power-facilities>.

<sup>202</sup> U.S. EPA, Email conversations with Penny McDaniel on shore power initiative in China, October 31, 2018.

Furthermore, when ports outside of the United States adopt CARB approved compliance strategies, there is more motivation to harmonize design and performance standards by governing organizations. These organizations include IMO and the Institute of Electrical and Electronic Engineers (IEEE). Harmonization would streamline the approval process for maritime industry stakeholders by developing uniform compliance strategies.

## VII. ENVIRONMENTAL ANALYSIS

CARB, as the lead agency for the Proposed Regulation, has prepared an environmental analysis under its certified regulatory program (Cal. Code Regs., title 17, sections 60000 through 60005) to comply with the requirements of the California Environmental Quality Act (CEQA). CARB's regulatory program, which involves the adoption, approval, amendment, or repeal of standards, rules, regulations, or plans for the protection and enhancement of the State's ambient air quality has been certified by the California Secretary for Natural Resources under Public Resources Code section 21080.5 of CEQA (Cal. Code Regs., title 14, section 15251(d)). As a lead agency, CARB prepares a substitute environmental document (referred to as an "Environmental Analysis" or "EA") as part of the Staff Report to comply with CEQA (Cal. Code Regs., title 17, section 60004.2).

When the Existing Regulation was first approved in December 2007, CARB Staff Reports included a chapter that was the substitute equivalent of a negative declaration, which analyzed the reasonably foreseeable environmental impacts of the methods of compliance (PRC section 21159, 14 CCR section 15187). The analysis concluded that the adoption of the Existing Regulation, as written, and the reasonably foreseeable compliance with the Proposed Regulation would not result in significant adverse environmental impacts. In addition, the analysis determined the Existing Regulation would lead to significant health benefits from the reduction in NO<sub>x</sub>, DPM, and GHG. When the Board approved the Existing Regulation in 2007, it found that no significant adverse impacts would result. The previous analysis is incorporated by reference.<sup>203</sup>

CARB has prepared this EA to assess the potential for significant adverse and beneficial environmental impacts associated with the Proposed Regulation, as required by CARB's certified regulatory program (Cal. Code Regs., title 17, section 60004.2). The resource areas from the CEQA Guidelines Environmental Checklist were used as a framework for assessing the potential for significant impacts.

While many impacts associated with compliance with the Proposed Regulation could be reduced to less-than-significant levels through conditions of approval applied and mitigation measures to project-specific development, the authority to apply that mitigation lies with land use agencies or other agencies approving the development projects, not with CARB. Consequently, the EA takes a conservative approach in its significance conclusions and discloses for CEQA compliance purposes, that impacts from the development of new facilities or modification of existing facilities and/or ocean-going vessels associated with reasonably foreseeable compliance responses to the Proposed Regulation, could be potentially significant and unavoidable.

---

<sup>203</sup> California Air Resources Board, Staff Report: Initial Statement of Reasons for the Proposed Rulemaking Regulations to Reduce Emissions from Diesel Auxiliary Engines on Ocean-Going Vessels While At-Berth at a California Port, October 2007 (accessed July 16, 2019), <https://www.arb.ca.gov/regact/2007/shorepwr07/isor.pdf>

Table VII-1 below summarizes the potential impacts that could occur as a result from the approval of the Proposed Regulation.

**Table VII-1: Summary of Potential Environmental Impacts**

|       | <b>Resource Area Impact</b>   | <b>Significance</b>                     |
|-------|---|---|
| 1.A-1 | Short-Term Construction-Related Impacts on Aesthetics - Land  | Potentially Significant and Unavoidable |
| 1.A-2 | Long-Term Operational-Related Impacts on Aesthetics - Land  | Potentially Significant and Unavoidable |
| 1.B-1 | Short-Term Construction-Related Impacts on Aesthetics - Vessel  | Less than Significant                   |
| 1.B-2 | Long-Term Operational-Related Impacts on Aesthetics Vessel  | Less than Significant                   |
| 2.A-1 | Short-Term Construction-Related and Long-Term Operational-Related Impacts on Agricultural and Forest Resources - Land | Potentially Significant and Unavoidable |
| 2.B-1 | Short-Term Construction and Long-Term Operational Impacts on Agricultural and Forest Resources –Vessel                | No Impact                               |
| 3.A-1 | Short-Term Construction-Related Impacts on Air Quality  | Potentially Significant and Unavoidable |
| 3.A-2 | Long Term Operational-Related Impacts on Air Quality  | Less than Significant                   |
| 4.A-1 | Short-term Construction-Related Impacts on Biological Resources - Land  | Potentially Significant and Unavoidable |
| 4.A-2 | Long-term Operational-Related Impacts on Biological Resources - Land  | Potentially Significant and Unavoidable |
| 4.B-1 | Short-Term Construction-Related and Long-Term Operational-Related Impacts on Biological Resources - Vessel            | No Impact                               |
| 5.A-1 | Short-Term Construction-Related and Long-Term Operational-Related Impacts on Cultural Resources - Land                | Potentially Significant and Unavoidable |
| 5.B-1 | Short-Term Construction-Related and Long-Term Operational-Related Impacts on Cultural Resources – Vessel              | Less than Significant                   |
| 6.A   | Short-Term Construction-Related Impacts on Energy Demand  | Less than Significant                   |
| 6.B   | Long-Term Operational-Related Impacts on Energy Demand  | Less than Significant                   |
| 7.A-1 | Short-Term Construction-Related and Long-Term Operational-Related Impacts on Geology and Soils - Land                 | Potentially Significant and Unavoidable |

|        | <b>Resource Area Impact</b>  | <b>Significance</b>                     |
|--------|--|---|
| 7.B-1  | Short-Term Construction-Related and Long-Term Operational-Related Impacts on Geology and Soils - Vessels | No Impact                               |
| 8.A-1  | Short-Term Construction-Related Impacts on Greenhouse Gases  | Less than Significant                   |
| 8.A-2  | Long-Term Operational Related Impacts on Greenhouse Gases  | Less than Significant                   |
| 9.A-1  | Short-Term Construction-Related Impacts to Hazards and Hazardous Materials - Land                        | Potentially Significant and Unavoidable |
| 9.A-2  | Long-Term Operational-Related Impacts to Hazards and Hazardous Materials - Land                          | Potentially Significant and Unavoidable |
| 9.B-1  | Short-Term Construction-Related Impacts to Hazards and Hazardous Materials – Vessel                      | Less than Significant                   |
| 9.B-2  | Long-Term Operational-Related Impacts to Hazards and Hazardous Materials - Vessel                        | Less than Significant                   |
| 10.A-1 | Short-Term Construction-Related Impacts to Hydrology and Water Quality – Land                            | Potentially Significant and Unavoidable |
| 10.A-2 | Long-Term Operational-Related Impacts to Hydrology and Water Quality – Land                              | Potentially Significant and Unavoidable |
| 10.B-1 | Short-Term Construction-Related to Hydrology and Water Quality - Vessel                                  | Less than Significant                   |
| 10.B-2 | Long-Term Operational-Related Impacts on Hydrology and Water Quality - Land                              | Less than Significant                   |
| 11.A-1 | Short-Term Construction-Related and Long-Term Operational-Related Impacts to Land Use - Land             | No Impact                               |
| 11.B-1 | Short-Term Construction-Related and Long-Term Operational-Related Impacts to Land Use – Vessel           | No Impact                               |
| 12.A-1 | Short-Term Construction-Related and Long-Term Operational-Related Impacts to Mineral Resources - Land    | Potentially Significant and Unavoidable |
| 12.B-1 | Short-Term Construction-Related and Long-Term Operational-Related Impacts to Mineral Resources -Vessel   | No Impact                               |
| 13.A-1 | Short-Term Construction-Related Impacts to Noise and Vibration – Land                                    | Potentially Significant and Unavoidable |
| 13.A-2 | Long-Term Operational-Related Impacts to Noise and Vibration – Land                                      | Potentially Significant and Unavoidable |
| 13.B-1 | Short-Term Construction-Related Impacts to Noise and Vibration – Vessel                                  | Less than Significant                   |
| 13.B-2 | Long-Term Operational-Related Impacts to Noise and Vibration – Vessel                                    | Less than Significant                   |



|        | <b>Resource Area Impact</b>   | <b>Significance</b>                     |
|--------|---|---|
| 14.A-1 | Short-Term Construction-Related and Long-Term Operational-Related Impacts to Population, Employment, and Housing – Land   | Less than Significant                   |
| 14.B-1 | Short-Term Construction-Related and Long-Term Operational-Related Impacts to Population, Employment, and Housing - Vessel | Less than Significant                   |
| 15.A-1 | Short-Term Construction-Related and Long-Term Operational-Related Impacts to Public Services – Land                       | Less than Significant                   |
| 15.B-1 | Short-Term Construction-Related and Long-Term Operational-Related Impacts to Public Services – Vessel                     | Less than Significant                   |
| 16.A-1 | Short-Term Construction-Related and Long-Term Operational-Related Impacts to Recreation - Land                            | Less than Significant                   |
| 16.B-1 | Short-Term Construction-Related and Long-Term Operational-Related Impacts to Recreation - Vessel                          | Less than Significant                   |
| 17.A-1 | Short-Term Construction-Related Impacts to Transportation and Traffic - Land  | Potentially Significant and Unavoidable |
| 17.A-2 | Long-Term Operational-Related Impacts to Transportation and Traffic - Land  | Potentially Significant and Unavoidable |
| 17.B-1 | Short-Term Construction-Related Impacts to Transportation and Traffic -Vessel   | Less than Significant                   |
| 17.B-2 | Long-Term Operational-Related Impacts to Transportation and Traffic   | Less than Significant                   |
| 18.A-1 | Long-Term Operational-Related Impacts to Utilities and Service Systems - Land   | Potentially Significant and Unavoidable |
| 18.B-1 | Long-Term Operational-Related Impacts to Utilities and Service Systems – Vessel   | Less than Significant                   |

Written comments on the Draft EA will be accepted starting October 18, 2019, through December 2, 2019. The Board will consider the final EA and responses to comments received on the Draft EA before taking action to adopt the Proposed Regulation. The full Draft EA can be found in Appendix D. If comments received during the public review period raise significant environmental issues, staff will summarize and respond to the comments. The written responses to environmental comments will be approved prior to final action on the Proposed Regulation (Cal. Code Regs., title 17, section 60004.2(b)). If the Proposed Regulation is adopted, a Notice of Decision will be posted on CARB’s website and filed with the Secretary of the Natural Resources Agency for public inspection (Cal. Code Regs., title 17, section 60004.2(d)).

## VIII. ENVIRONMENTAL JUSTICE

Despite the dramatic progress made in improving air quality in California, there still exists disparities in air pollution exposure, susceptibility, and health, particularly for people of color and low-income communities. This disparity reflects the disproportionate siting of stationary sources and highways in and near their communities, some of which were historically and intentionally segregated. Although GHGs are global pollutants that do not themselves harm local neighborhoods that host sources of GHGs, the effects of climate change caused by GHGs disproportionately impact low-income communities and communities of color. Furthermore, sources of GHGs often emit criteria pollutants and toxic air contaminants, which can impact the health of residents who live, work, and go to school near these sources.

State law defines environmental justice as the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies, Government Code, section 65040.12, subdivision (c). Environmental justice calls for transparency, inclusivity, and systemic change.

Environmental justice is one of CARB's core values and fundamental to achieving its mission. The Board approved its Environmental Justice Policies and Actions on December 13, 2001, to establish a framework for incorporating environmental justice into CARB's programs consistent with the directives of State law (CARB 2001). Since then, CARB has prioritized environmental justice when adopting, implementing, and enforcing regulations, when providing technical support, and when allocating funding. CARB strives for equity in the implementation of all its programs.

Further advancing environmental justice in California, AB 617 was signed into law on July 2017. AB 617 requires CARB to address neighborhood-scale air pollution through new community-focused and community-driven actions to reduce exposure and improve public health in communities that experience disproportionate burdens from exposure to air pollutants. Most of the ports that are expected to meet the thresholds for inclusion in the Proposed Regulation are also in and around communities that have been identified by CARB's CAPP as priority for the deployment of community air monitoring systems and/or community emissions reduction programs. Those port communities that have been identified as priority include Richmond, West Oakland, San Diego Portside Environmental Justice Neighborhoods (Barrio Logan, West National City, Logan Heights, Sherman Heights), Wilmington, and West Long Beach.

California's air quality programs are responsible for significant public health improvements through statewide and regional air quality planning requirements, advancement of technology-based solutions, and risk reduction efforts near industrial facilities. Over the last 25 years, ozone levels have dropped over 40 percent throughout the greater Los Angeles region, and the number of unhealthy ozone days has decreased 40 percent in the San Joaquin Valley. Levels of lead measured in the air are

now 90 percent lower, and DPM, which accounts for over two-thirds of the total known cancer risk in the state, has dropped nearly 70 percent statewide.<sup>204</sup>

Since the adoption of the Existing Regulation, there has been a significant reduction of criteria pollutants from vessels at California seaports. Starting in 2014, all container, reefer and cruise fleets had to reduce their auxiliary engine power generation while at berth by at least 50 percent, resulting in significant NOx and PM emissions reductions and co-benefit GHG emission reductions. The auxiliary engine emissions reduction requirement increased to 70 percent in 2017, furthering the use of shore power and other control technologies, and will increase to 80 percent in 2020.

However, certain communities continue to experience environmental and health inequities from air pollution, particularly those near ports, rail yards, warehouses, and freeways. Communities near seaports experience a higher concentration of air pollution associated with California's freight system and are impacted by high levels of emissions from not only vessels, but also cars, diesel trucks, cargo handling equipment, harbor craft, and locomotives due to activity around the ports. Many of the same communities also experience pollution impacts from large industrial facilities such as oil refineries that are often located near seaports. The impacts of this elevated air pollution burden in these communities can be measured. For example, while exposure to cancer-causing diesel particles has decreased substantially across all communities statewide in California, exposure to diesel particles in disadvantaged communities is on average twice that experienced in non-disadvantaged communities.

New statewide actions are one of the core aspects along with several other elements included as part of CAPP, CARB's program to implement AB 617 to help achieve emissions reductions in disproportionately burdened communities. These statewide actions reflect a coordinated suite of strategies including new regulations, new incentive grant funding, and new exposure reduction resources and tools. The Proposed Regulation described in this Staff Report for cleaner vessel operations while at ports is one of the new statewide regulatory measures that is included under the CAPP to help reduce air pollution in impacted communities.

The Proposed Regulation described in this Staff Report is consistent with CARB's environmental justice goal of reducing exposure to air pollutants and reducing adverse health impacts from toxic air contaminants in all communities, especially those historically over-burdened by air pollution sources. As discussed in Chapter III of this Staff Report, the Proposed Regulation would expand the requirements to additional vessels, ports and marine terminals throughout the state, achieving additional NOx, DPM and PM2.5 emissions reductions in surrounding port communities. This ensures that air pollutants and associated health risks are reduced above and beyond the goals of the Existing Regulation. The additional reductions and associated improvements to

---

<sup>204</sup> California Air Resources Board, Draft Community Air Protection Blueprint For Selecting Communities, Preparing Community Emissions Reduction Programs, Identifying Statewide Strategies, and Conducting Community Air Monitoring, June 7, 2018, [https://ww2.arb.ca.gov/sites/default/files/2018-06/draft\\_community\\_air\\_protection\\_blueprint.pdf](https://ww2.arb.ca.gov/sites/default/files/2018-06/draft_community_air_protection_blueprint.pdf).

air quality are designed to help protect all Californians, and would be of particular benefit in environmental justice communities.

## IX. ECONOMIC IMPACTS ASSESSMENT

Sections 11346.3 and 11346.5 of the Government Code require State agencies to assess the potential for adverse economic impacts on California business enterprises and individuals when proposing to adopt or amend any administrative regulation. The assessment will include consideration of the impact of the Proposed Regulation on California jobs, business expansion, elimination, or creation, and the ability of California businesses to compete. State agencies are also required to estimate the cost or savings to any State or local agency and school districts under instruction adopted by the DOF. This estimate is to include any nondiscretionary costs or savings to local agencies and the costs or savings in federal funding to the State.

Government Code section 11346.36(f) requires a state agency to perform a Standardized Regulatory Impact Assessment (SRIA) before adopting any major regulation. Because the estimated cost of the Proposed Regulation exceeds \$50 million in most of years during the implementation, the Proposed Regulation constitutes a major regulation.

This chapter summarizes results from analyses that estimate the cost and benefit impacts of the Proposed Regulation. While the direct compliance costs of the regulation are large, they are also borne by large industries. By the time the impacts of the regulation work their way through the economy, the macroeconomic modeling shows a small impact on economic indicators such as gross State product, employment, output, and the personal income of individuals in California, as described in detail in this chapter. Thus, this regulatory action will not have a significant adverse economic impact on businesses.

Details on the calculations and assumptions used to perform this analysis are included in the SRIA, which is attached as Appendix C-1 and available on the Department of Finance's (DOF) website.<sup>205</sup> CARB's responses to comments from the DOF are attached as Appendix C-2.

### A. Changes Since the Release of the SRIA

The Proposed Regulation and cost assumptions have been updated since the release of the SRIA on August 1, 2019. These changes and their potential impacts on the economic analysis are summarized as follows:

- Grandfathering of existing technology. Since the SRIA, the Proposed Regulation was modified to allow existing alternative capture and control systems to continue to operate until 2025. In 2025, these systems would need to meet all the standards for new alternative control technologies as required in the Proposed Regulation. This

---

<sup>205</sup> California Air Resources Board, Control Measure for Ocean-Going Vessels At Berth. Standardized Regulatory Impact Assessment (SRIA), August 1, 2019, [http://www.dof.ca.gov/Forecasting/Economics/Major\\_Regulations/Major\\_Regulations\\_Table/documents/SRIA\\_with\\_Appendices-Proposed\\_Control\\_Measure\\_for\\_Ocean-Going\\_Vessels\\_At\\_Berth-080119.pdf](http://www.dof.ca.gov/Forecasting/Economics/Major_Regulations/Major_Regulations_Table/documents/SRIA_with_Appendices-Proposed_Control_Measure_for_Ocean-Going_Vessels_At_Berth-080119.pdf)

change would require control technology providers to adopt new power systems or operate on fuels with significantly lower carbon intensities, such as renewable diesel. Staff assumed that the equipment will be operated with renewable fuels as the cost on average is about the same as traditional diesel. Based on information provided by Industrial Strategies Division staff<sup>206</sup>, recent prices for renewable diesel and diesel shows an average price per gallon of \$3.80 for renewable diesel and \$3.94 for diesel.

- Unregulated container, reefer and cruise vessel in phase-in. The SRIA analysis assumed all container, reefer, and cruise vessels would be subject to the requirements of the Proposed Regulation on January 1, 2021. Vessels which were previously unregulated, including steam ships and vessels that were not part of an Existing Regulation fleet as of December 31, 2020, would have two years, until January 1, 2023, to reduce emissions under the Proposed Regulation. This change will reduce the amount of emissions the Proposed Regulation achieves in the years 2021 and 2022 when compared to the SRIA proposal. This change will also reduce costs to industry and the ports in 2021 and 2022 as these costs will begin in 2023.
- TIE and VIE rates change. The Proposed Regulation includes an increase and change in the distribution of TIEs/VIEs. The Proposed Regulation includes a higher percentage of TIEs and VIEs and allows terminals a longer transition time to comply with stricter control requirements.

Table IX-1 shows the percentage of TIEs and VIEs as analyzed in the SRIA with the number split equally between terminal and vessel operators. Beginning in 2021, container, reefer and cruise vessels would be awarded 5 percent VIEs and terminals awarded 5 percent TIEs. This represents an approximate 10 percent level of flexibility. The flexibility of the VIEs and TIEs will be decreased in 2023 to 3 percent VIEs and 3 percent TIEs (totaling 6 percent TIEs and VIEs).

The first year of implementation for each additional vessel category (ro-ro, tankers at POLA and POLB, and all other tankers) would allow the newly regulated vessels 5 percent VIEs and newly regulated terminals 5 percent TIEs or a total of 10 percent flexibility. After one year, the percentage of visits awarded as VIEs and TIEs is decreased to 3 percent each for a total of 6 percent.

Table IX-2 shows the updated percentages. The result of this change is lower emission reductions and lower costs as more visits are not controlled. Additionally, this change results in fewer cost savings in the form of fuel and LCFS credits.

Additionally, the longer transition time to comply is expected to provide vessels and terminals with more time to build out necessary infrastructure or make vessel modifications.

---

<sup>206</sup> Email from Alexander Mitchell to Barbara Van Gee titled "Renewable diesel prices", dated September 5, 2019.

**Table IX-1: TIEs and VIEs by Vessel Category per Year under the Proposed Regulation in the SRIA**

| Vessel Category               | 2021 - 2022 | 2023 - 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 - 2032 |
|-------------------------------|-------------|-------------|------|------|------|------|------|-------------|
| Container/ Reefer             | 10%         | 6%          | 6%   | 6%   | 6%   | 6%   | 6%   | 6%          |
| Cruise                        | 10%         | 6%          | 6%   | 6%   | 6%   | 6%   | 6%   | 6%          |
| Ro-Ro                         | --          | --          | 10%  | 6%   | 6%   | 6%   | 6%   | 6%          |
| Tankers (POLA/POLB)           | --          | --          | --   | --   | 10%  | 6%   | 6%   | 6%          |
| Tankers (all other terminals) | --          | --          | --   | --   | --   | --   | 10%  | 6%          |

\* Percentages split equally among terminal and vessel operators.

**Table IX-2: VIEs and TIEs by Vessel Category per Year under the Proposed Regulation**

| Category    |                   | 2021 - 2024 | 2025 - 2026 | 2027 - 2028 | 2029+ |
|-------------|-------------------|-------------|-------------|-------------|-------|
| <b>TIEs</b> | All Terminals*    | 15%         | 5%          | 5%          | 5%    |
| <b>VIEs</b> | Container/ Reefer | 5%          | 5%          | 5%          | 5%    |
|             | Passenger         | 5%          | 5%          | 5%          | 5%    |
|             | Ro-Ro             | --          | 5%          | 5%          | 5%    |
|             | POLA/POLB Tankers | --          | --          | 5%          | 5%    |
|             | Other Tankers     | --          | --          | --          | 5%    |

\* All terminal with control requirements.

- Remediation fund payment amounts. The remediation fund under the Proposed Regulation has been adjusted since the SRIA. The Proposed Regulation changes the cost to vessel categories to reflect differences in emissions; the more emissions created, the higher the hourly payment. Smaller cruise vessels and larger cruise vessels are separated by those that carry less than 1,500 passengers and crew and those that carry 1,500 passengers and crew or more. Staff also separated tanker vessels as those that use electric pumps and those that use steam driven pumps to reflect a difference in reduction in emissions for tanker vessels with steam driven pumps. In addition, CARB staff included a reduction to the remediation payment for

vessels using an auxiliary engine that meets the IMO Tier III standard<sup>207</sup> to recognize the NOx reductions achieved by cleaner Tier III engines. A significant portion of emissions on these tanker vessels with steam driven pumps is from the boilers, which do not have an emissions limit under IMO Tier III. Table IX-3 shows the hourly cost provided in the SRIA and Table IX-4 shows the revised hourly cost under the Proposed Regulation. This change will reduce costs to vessel and terminal operators by a small amount as the percentage of vessel visits that are anticipated to use the remediation fund is less than 1 percent.

**Table IX-3: Hourly Remediation Cost for Terminal and Vessel per Vessel Category in the SRIA**

| Vessel Category  | Hourly Cost |
|------------------|-------------|
| Container/Reefer | \$2,395     |
| Cruise           | \$12,879    |
| Auto/Ro-Ro       | \$1,515     |
| Product Tankers  | \$1,783     |
| Crude Tankers    | \$9,873     |

**Table IX-4: Hourly Remediation Cost for Terminal and Vessel per Vessel Category under the Proposed Regulation**

| Vessel Type  | Hourly Cost*  |               |
|--|---------------|---------------|
|  | Standard Rate | Tier III Rate |
| Container, Reefer, Ro-Ro   | \$1,900       | \$1,100       |
| Cruise vessels with capacity under 1,500 combined passengers and crew  | \$5,300       | \$3,200       |
| Cruise vessels with capacity of 1,500 or more combined passengers and crew   | \$12,000      | \$7,100       |
| Tanker with electric pumps   | \$1,600       | \$1,000       |
| Tanker with steam driven pumps   | \$3,400       | \$2,700       |
| * Remediation payments used by vessel operators reflect reductions of 20 percent for IMO Tier III tanker vessels with steam driven pumps, and 40 percent for all other IMO Tier III vessels. |               |               |

<sup>207</sup> IMO, Prevention of Air Pollution from Ships Annex VI and New Engine NOX Emissions Limits Under IMO Annex VI, accessed September 8, 2019, [http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Nitrogen-oxides-\(NOx\)—Regulation-13.aspx](http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Nitrogen-oxides-(NOx)—Regulation-13.aspx).



- Port and terminal plan submission dates. The due dates for the terminal and ports plans have been changed to provide additional time for ports and terminals to develop their plans. The port plans and initial terminal plans for all vessel categories were due by July 1, 2021. The submission dates for the port and terminal plans for ro-ro and tanker terminals have been changed to December 1, 2021. The submission date for the updated terminal plans for ro-ro and tanker terminals was six months prior to the implementation date and has been changed to eleven months prior to the implementation date. The change allows more time for the port and terminal operators to prepare the plans since ro-ros and tankers are new to the Proposed Regulation. It also provides CARB staff additional time to respond to the plan updates prior to the beginning of the compliance requirements. This change has no impact on the cost to terminal and port operators.
- Inventory Updated. Three updates to CARB's ocean-going vessel emissions inventory were made: (1) adjustment of visit length for long visits; (2) change in shore power compliance forecasting; and (3) tanker engine power at berth. The changes were made to improve upon the inventory, after consulting with stakeholders and CARB Enforcement Division, and reviewing updated information and methods.
  - *Adjustment of visit length for long visits.* In the inventory used for the SRIA baseline (Existing Regulation), 47 vessel visits had a visit stay length of 300 hours or more. Staff considered workshop comments and stakeholder feedback indicating that the lengths of stay of these 47 vessel visits did not represent commercial activity instead they were for repairs or other reasons. Staff adjusted the length of stay assumption to reflect average vessel visit length by vessel category and port. This change resulted in a slight decrease in the ocean-going vessel emissions baseline and a slight reduction in the overall amount of emissions reductions captured by the Proposed Regulation.
  - *Change of shore power compliance forecasting.* The growth factor for shore power, which was previously static across all vessel sizes, was adjusted to factor in different growth rates for POLA and POLB, resulting in a more accurate forecast. Additionally, an adjustment to control factors for container vessels at POLA and POLB were made.

The shore power compliance forecasting also includes an increase of shore power usage to meet the requirements of the Existing Regulation. The previous methodology of shore power usage forecasting assumed that the 2016 data reflected the Existing Regulation's 50 percent emissions reduction requirement, i.e. the number of hours of shore power was 50% of all hours. Upon reevaluating enforcement data for shore power participation, it was determined that the 2016 shore power usage was closer to 60 to 70 percent, therefore, the number of hours of shore power usage was actually higher. Because the shore power hours of usage in 2016 were higher, the estimated increase in shore power and

emissions for the Existing Regulation's 70 percent and 80 percent requirements are less than previously shown in the SRIA.

Overall, these changes result in a 10 percent increase in NOx and a 5 percent increase in PM emissions in 2030. As such, this change resulted in an increase in baseline emissions, which slightly increased the overall amount of emissions reductions achieved by the Proposed Regulation.

- *Tanker engine changes.* Industry comments suggested that tanker activity occurring at Richmond area tanker terminals was reflected incorrectly in CARB's emissions inventory regarding that tankers have distinct activities (loading and discharging) when at berth, and their auxiliary engine and boiler power load is much lower than what CARB's inventory states.

After further evaluation, the emissions inventory was updated to reflect splitting tanker vessels' time at berth into loading and off-loading times as a percentage of total time. This methodology was applied to all tanker berth activities statewide. This change resulted in a localized decrease in the emissions baseline in the Richmond area and a slight reduction in the overall statewide amount of emissions reductions captured by the Proposed Regulation.

These three changes in the ocean-going vessel emissions inventory altered the baseline used for the Proposed Regulation and, as a result, slightly reduce the projected total amount of emissions reductions from the Proposed Regulation compared to the reductions in the SRIA.

- Input Assumptions. Adjustments or updates have been made to more accurately reflect costs:
  - *The number of cranes and crane support needed*<sup>208</sup>. Based on initial discussions with terminal operators, it was assumed that only one crane and crane support was needed for land-based capture and control systems at marine terminals located at the POLA and POLB. Based on additional input from a terminal operator who stated that they need two cranes at their terminal at POLA, the assumption has been updated to include the costs of one additional crane and one additional crane support. This increased the costs to the ports by a small amount.
  - *Personnel costs for State government:* The number of Personnel Years (PYs) assumed for the CSLC has been revised from two to one based on follow-up discussions with CSLC. This change results in a small decrease in costs to State Government.

---

<sup>208</sup> The terms "crane" and "positioning boom" are used generically to represent equipment used to lift and position the capture and control system ducting over the vessel emission stack in order to collect the exhaust. These terms do not represent labor classifications or categories, unless specifically noted.

- *Cost Recovery Factor (CRF)*: In this updated analysis, a CRF of 0.0612 has been applied to the Ports amortized costs based on their lower cost of debt compared to industry (CRF of 0.0802 was used), which results in a small decrease in the costs to ports for infrastructure and equipment.
- *Cost apportionment to ports*. The Port of Stockton is an operating port (acts as the terminal operator) and the direct and on-going costs for the land-based capture and control system for the tanker terminal are applicable to the Port and not to the terminal operator. Some of the costs related to the land-based capture and control system at the Port of Hueneme were previously applied to terminal operators but are now applied to the Port. This results in a small increase in costs to ports and a slight decrease in the cost to terminal operators.
- *Remediation costs*: The costs have been revised based on additional information as stated above. This results in slightly lower costs to the regulated entities.
- *GHG emission reductions*. The GHG reductions in the SRIA were in standard tons not metric tons as per the description, therefore the SRIA reported the metric tons by approximately 10%. All GHG reductions are now reflected in metric tons.
- *Electricity Tax*. When calculating the impact to state and local government tax revenue, the SRIA double-counted shore power electricity used by container and reefer vessels, resulting in an overestimate of the local utility use tax and electrical energy surcharge. When combined with the other changes to the Proposed Regulation, the updated analysis projects a small net loss in local government tax revenue instead of the small net increase in local government tax revenue reported in the SRIA.

## **B. Direct Costs**

The direct cost inputs of the Proposed Regulation include:

- Annualized costs for equipment and infrastructure for shore power and capture and control systems;
- Annual costs for labor; maintenance; feasibility, engineering, and permitting; operating; reporting; testing; electricity; operating; and remediation

The statewide direct costs of the Proposed Regulation are determined by the cost input assumptions for each cost category, such as shore power equipment (\$/vessel or berth), labor (\$/system), as well as projected number of systems needed.

## 1. Cost Inputs

### a) Key Cost Analysis Assumptions

#### Annualization of Costs Based on Equipment Lifespan.

Staff assumed that capital costs (including construction and installation) for shore power and capture and control systems and associated infrastructure would be annualized over the expected equipment lifespan. Staff assumed a 20-year life for terminal equipment and a 10-year life for vessel equipment based on feedback provided by multiple terminal operators and vessel operators. Where vessel equipment would reach the end of its operational life prior to 2023, staff assumed that in subsequent years, capital costs would continue to be incurred to conduct major repairs and component replacements at a rate of 50 percent of the calculated annualized cost based on discussions with vessel operators.

#### Application of Annual Industry Growth Factors

The growth factors represent growth in cargo movement, and staff assumed that the growth in costs resulting from the Proposed Regulation would be directly proportional to projected growth in cargo movement. The extent to which an increase in cargo movement would affect the various regulatory costs that would be incurred would depend on a number of factors, including but not limited to: whether or not vessel visits increase over time, or vessel sizes get larger and vessel visits remain constant or decrease; whether the average vessel visit durations change; and whether additional infrastructure is needed to accommodate growth, and resulting maintenance costs increase due to increased utilization of equipment. To account for an increase in costs that would cover the analysis period due to growth in cargo movement, and in consideration of the uncertainty of all of the above variables, staff applied the growth factors to all costs, rather than increasing any of the individual activity inputs such as number of vessel visits over the analysis period.

The cost analysis equations are provided in the ISOR Appendix C-1 (SRIA Appendix E), which also shows which costs staff applied growth factors to. The growth factors used for the cost analysis are based on the same growth factors used to develop the emissions estimates. The source of the growth factors is the Federal Highway Administration's Freight Analysis Framework (FAF)<sup>209</sup> except in two instances where port-specific growth factors were used. The Mercator Group provided growth forecasts for POLA and POLB specifically, including container vessel size trends.<sup>210</sup> For Port of Hueneme, growth trends were forecast based on Port of Hueneme cargo data.<sup>211</sup>

---

<sup>209</sup> US Department of Transportation, Freight Facts and Figures 2017, Freight Analysis Framework v4.3.1 March 2017, <https://www.bts.gov/product/freight-facts-and-figures>.

<sup>210</sup> Mercator International LLC, San Pedro Bay Long-term Unconstrained Cargo Forecast, July 12, 2016.

<sup>211</sup> Port of Hueneme comment letter to CARB: Port of Hueneme Forecasted Future Growth Rates, dated November 27, 2017.

For the cost analysis, staff aggregated the regional FAF or port-specific growth factors, weighted by number of vessel visits, to produce single annual statewide growth factors for each vessel type for each year and then were compounded for each year of the analysis period. The aggregated and compounded annual growth factors used in the cost analysis are provided in Table IX-5.

**Table IX-5: Annual Industry Growth Factors**

| <b>Year</b> | <b>Container/Reefer</b> | <b>Cruise</b> | <b>Ro-Ro</b> | <b>Tanker</b> |
|-------------|-------------------------|---------------|--------------|---------------|
| <b>2019</b> | 8.0%                    | 7.5%          | 7.5%         | 1.0%          |
| <b>2020</b> | 15.3%                   | 16.0%         | 11.5%        | 1.5%          |
| <b>2021</b> | 19.4%                   | 20.2%         | 15.1%        | 2.7%          |
| <b>2022</b> | 23.8%                   | 24.7%         | 18.4%        | 3.5%          |
| <b>2023</b> | 28.5%                   | 29.2%         | 21.9%        | 4.3%          |
| <b>2024</b> | 33.4%                   | 34.0%         | 25.4%        | 5.1%          |
| <b>2025</b> | 41.0%                   | 38.9%         | 29.1%        | 5.9%          |
| <b>2026</b> | 44.4%                   | 44.0%         | 32.9%        | 7.1%          |
| <b>2027</b> | 48.2%                   | 49.3%         | 35.9%        | 8.2%          |
| <b>2028</b> | 52.3%                   | 54.8%         | 39.0%        | 9.4%          |
| <b>2029</b> | 56.7%                   | 60.5%         | 42.2%        | 10.5%         |
| <b>2030</b> | 61.4%                   | 66.5%         | 45.4%        | 11.7%         |
| <b>2031</b> | 69.1%                   | 72.6%         | 48.9%        | 13.0%         |
| <b>2032</b> | 77.2%                   | 78.9%         | 52.3%        | 14.3%         |

**b) Shore Power Costs**

Vessel Equipment Costs

Container, reefer, and cruise vessels are expected to primarily use shore power to comply with the Proposed Regulation. These vessel operators have already made significant capital investments to facilitate use of shore power to comply with the Existing Regulation, with 485 vessels already equipped that have visited California ports. Vessel operators would incur capital costs to install shore power equipment, which includes a cable management system, switchgear, synchronizing switch, and potentially a voltage transformer.

Staff estimated the capital cost based on the June 2018 CARB vessel operators survey for an average cost of \$878,500 per container and reefer vessel and \$1,629,700 per cruise vessel for a total annualized cost of \$182.2 million through 2032.

### Infrastructure Capital Costs

Staff performed a berth analysis to develop estimates about how many additional shore power installations or upgrades may be needed for the incremental increase in shore power for the Proposed Regulation. Infrastructure costs for shore power includes the installation of five shore power vaults that staff estimates would be needed at container and reefer terminals at the Port of Oakland and POLA that are already shore power capable, to accommodate larger vessels, varying berthing positions, and a larger volume of vessel visits. Staff assumed none of the other container and reefer terminals require shore power infrastructure. One cruise vessel berth is assumed to need to be retrofit to provide shore power where none currently exist.

To estimate costs for shore power terminal infrastructure, staff relied primarily on data from surveys of ports conducted in April 2018. Staff used an average of \$2.0 million for the cost of each vault. However, for San Francisco where the infrastructure upgrades to bring electricity to the berth are anticipated to be extensive, staff used the Port of San Francisco's own cost estimate of approximately \$82 million to retrofit the berth and install associated infrastructure. The total annualized cost through 2032 is \$107.6 million.

### Labor Costs

Labor is needed to plug-in and later disconnect the vessel from the shore-side electricity. Based on CARB's April 2018 survey data from ports, staff developed an estimated labor cost of \$2,355 for each shore power visit and applied this cost to the number of vessel visits that would use shore power as a result of the Proposed Regulation. The total cost of \$9.3 million through 2032 is based on the number of annual visits multiplied by the cost multiplied by the growth factor for each year.

### Vessel Equipment Maintenance Costs

Based on the June 2018 CARB vessel operator survey, staff calculated the average annual maintenance cost of \$10,000 per vessel across all vessel types and applied this cost to the number of vessels expected to install shore power as a result of the Proposed Regulation. Staff assumed the vessel equipment maintenance costs would be incurred by the vessel operators for a total cost of \$11.5 million through 2032.

### Terminal Equipment Maintenance Costs

Shore power infrastructure at ports requires annual maintenance. Survey respondents indicated a wide range of costs from which staff calculated an average annual maintenance cost of \$24,300 per each container and reefer berth retrofit and \$50,000 per each cruise berth retrofit. Staff also received verbal information through conversations with terminal operators at POLB that led staff to conclude that the calculated average cost was a reasonable representation of annual maintenance costs.

Across vessel types, maintenance costs would total less than 5 percent of annualized capital costs in a given year. POLA, Oakland, and San Francisco all incur the costs for shore power maintenance. Across vessel types, maintenance costs would be \$0.8 million through 2032.

### Electricity Costs

The cost of electricity for the use of shore power is typically directly incurred by the port or terminal operator, then passed along to the vessel operator.

To estimate the electricity cost, staff surveyed several ports on the cost of electricity specifically provided for shore power, taking into account demand charges and other factors. In some cases, CARB staff analyzed terminal electricity bills provided by the ports to determine the \$/kW-hour rate. Costs range from about 15 to 25 cents per kW-hour, and align with commercial electricity rates averaged for the four largest utilities that serve the ports (Southern California Edison, Los Angeles Department of Water and Power, Pacific Gas and Electric, and San Diego Gas & Electric) provided in the California Energy Commission Mid Case Revised Demand Forecast (California Energy Commission [CEC], updated February 21, 2018).

To estimate the electricity costs, CARB staff multiplied the average vessel stay (hours) by vessel type, the average electrical load (kilowatts) by vessel type, the annual number of vessel visits and electricity cost. The total cost through 2032 would be \$8.1 million.

## **c) Capture and Control System Costs**

### Land-Based Infrastructure and Equipment Costs

Based on discussions with terminal operators, staff anticipates that land-based capture and control systems would be the likely compliance strategy for tanker and ro-ro vessels. At ro-ro terminals, staff assumed that land-based capture and control systems would be similar in design and scale to the land-based and barge-based systems currently in operation. Therefore, staff assumed that infrastructure would not be required at ro-ro terminals.

Tanker terminal operators and ports would need to install infrastructure to support land-based capture and control systems. Staff assumed that POLA and POLB would begin to incur costs for infrastructure in 2024 and tanker terminal operators and the Port of Stockton would begin to incur costs in 2026. The exact design and configuration of each system would be customized to each terminal and berth covered under the Proposed Regulation, based on the engineering analysis described below. Staff received a letter from the Western States Petroleum Association (WSPA) on May 30, 2019, that aggregated input from five tanker terminal operators and provided

cost assumptions for tanker terminal infrastructure projects,<sup>212</sup> and conducted follow-up calls with the WSPA member companies that contributed information. Based on these discussions, staff conservatively assumed for the cost analysis that the following elements would be required:

*Emission control system.* This refers only to the emissions treatment unit itself. Staff used the industry provided \$3.6 million cost value for the land-based system for ro-ro vessels. For tanker vessels, staff assumed a cost of \$6.5 million per system based on an average of the \$5.0 million estimate provided by WSPA in their letter dated May 30, 2019, and an \$8.0 million estimate based on scaling existing capture and control system costs by the required exhaust flow that would be needed for tanker vessels.

*Emission control system connections and foundation support structure.* Terminal operators told staff that they generally believe electrical connections would be needed to operate the emissions control system, as well as foundational support structures for the emissions control systems. Staff assumed a cost of \$7 million per berth provided by WSPA in its letter dated May 30, 2019. Support structures may be needed to reinforce the wharf on which an emissions control system is placed, or be a standalone support structure separate from the wharf. In cases where a support structure is needed, the system would require construction of additional pilings into the sea floor. To account for the uncertainty regarding how many terminals would incur these costs, staff chose to use the mid-range value provided by WSPA in its letter dated May 30, 2019, of \$15 million where the terminal operators are responsible for the costs at the independent marine terminals.

*Piping infrastructure from berth to emission control system.* Hundreds to thousands of feet of piping and associated support structure would be needed to pipe exhaust from the vessel stacks to the emission control system. Staff assumed a cost of \$4.5 million per berth. WSPA members concurred with this value in the WSPA letter dated May 30, 2019.

*Crane(s).* Specially constructed crane(s) would be needed to move the exhaust capture device to the vessel stack(s). Two cranes per berth would be needed at Northern California terminals. Staff used the \$7 million costs provided in the WSPA letter dated May 30, 2019.

*Crane support structure(s).* Similar to the emission control system, support structures would be needed for the crane(s) at each berth, regardless of whether the crane(s) were built on the wharf or on an adjacent standalone support structure. These structures may also require pilings into the sea floor. Since all cranes would need to be constructed either on or adjacent to the wharf, staff assumed the cost of \$10 million per

---

<sup>212</sup> Western States Petroleum Association comment letter to CARB: WSPA Input to CARB At Berth Cost Analysis for SRIA, dated May 2019.



crane support would apply to every berth. The cost was provided by WSPA in their letter dated May 30, 2019.

The total annualized costs are based on the number of berths that need infrastructure, the number of systems, the number of cranes and crane support structures by the cost of each component. The total cost for terminal operators for the land-based capture and control infrastructure is \$601.2 million and equipment is \$138.8 million for a total of \$740.0 million. Ports would incur costs of \$301.3 for infrastructure and \$5.8 million for equipment for a total of \$307.1 million. The total cost to all regulated parties is \$1.05 billion through 2032.

### Feasibility, Engineering, and Permitting Costs

Ports and tanker terminals would need to conduct feasibility assessments, engineering analysis and design, and secure required permits to construct terminal infrastructure projects needed to support the land-based capture and control systems.

A feasibility study would be needed at each terminal to determine how a given technology would be incorporated into the terminal's operations. Based on discussions with terminal operators and control device manufacturers, Tri-Mer Corporation (Tri-Mer), which is a developer of air pollution control systems, and Clean Air Engineering-Maritime (CAEM), staff incorporated a feasibility study cost of \$500,000 per berth.

Staff received estimated engineering costs from two industry stakeholders: Chevron and Marathon Petroleum. Based on this information, staff estimated that engineering costs would equal 12 percent of the total project capital costs.

Staff received estimated permitting costs from three industry stakeholders: Chevron, Marathon Petroleum, and Valero. Based on this information, staff estimated that permitting costs would equal four percent of total project capital costs.

Staff assumed that all of these costs would be spread evenly over a period of seven years prior to the implementation date applicable to each terminal. The total cost for feasibility, engineering, and permitting is estimated to be \$179.6 for terminal operators and \$115.5 million for ports for a total of \$295.1 million through 2032.

### Maintenance Costs

A technology developer provided an annual cost estimate of \$17,500 for maintenance of the emissions control system used for ro-ro vessels.

Tanker terminal operators stated it would be difficult to estimate maintenance costs prior to having a complete understanding of what specific infrastructure would be needed at their terminals. The feedback received was speculative, highly variable, and staff did not receive any information that was supported well enough to use in the cost analysis. Therefore, staff assumed that maintenance costs for tanker terminals would be similar

to maintenance costs for shore power infrastructure and developed a cost input for maintenance costs as 0.3% percent of capital costs or \$162,900 annually per system at POLA and POLB and \$232,100 annually per system at all other tanker terminals. The total maintenance cost is estimated at \$32.5 million through 2032.

### Labor Costs

Staff has assumed no additional labor costs for ro-ro terminals based on information provided by Tri-Mer. Conversations with terminal operators indicated that labor would be required to operate the land-based capture and control systems at tanker terminals to connect and disconnect the units, and to ensure safe operation continuously throughout each vessel visit. Terminal operators also stated the need for labor would vary depending on the site characteristics, such as the number of emissions control systems at each terminal and the distance between berths.

Based on these conversations, staff assumed that one additional full-time-equivalent employee would be needed at each berth to operate the capture and control system during tanker vessel visits. Based on conversations with capture and control technology providers and terminal operators a cost of \$1 million per berth (30 berths) annually was assumed. The cost would be \$118.7 million through 2032 for terminal operators and \$44.5 million for POLA and the Port of Stockton for a total cost of would be \$163.2 million.

### Operating Costs

For systems at ro-ro terminals, a technology developer provided an hourly estimated charge of \$100 per hour to the user for operation of the emissions control system. The charge includes fuel and other consumables required to operate the system.

For systems at tanker terminals, operating costs include costs to operate the emissions control system (fuel or electricity and other consumables) and operating costs for associated infrastructure. Operating costs for associated infrastructure include the energy costs to transport exhaust from the vessel to the emissions control system. Staff assumed that terminal operators would incur costs of \$200 per hour at tanker terminals at POLA and POLB and \$500 per hour at all other tanker terminals. The per hour cost is adjusted for growth factors and terminal operators incur costs at tanker terminals at POLA and POLB beginning in 2027 and all other tanker terminals in 2029.

The total operating cost would be \$96.5 million for terminal operators and \$8 million for ports for a total of \$104.5 million through 2032.

### Testing Costs

The Proposed Regulation would require annual review of emissions control systems performance to ensure they are controlling emissions as designed. Based on information from the capture and control technology providers, staff assumed that

terminal staff would undertake the task of processing and reporting Continuous Emissions Monitoring System (CEMS) data to CARB to meet this requirement, and the terminal operators would incur a monthly cost of \$1,000 per system for the data processing. Terminal operators at ro-ro terminals will incur costs for 2 systems beginning in 2025, terminal operators at POLA and POLB will incur costs for 13 systems beginning in 2027, terminal operators at all other tanker terminals (except at Port of Stockton, which incurs these costs) beginning in 2029 for 16 systems.

The Port of Hueneme and Port of Stockton would incur a monthly cost of \$1,000 starting in 2025 and 2029 respectively for one capture and control system each.

The terminal operators would incur a cost of \$2.2 million and the ports would incur a cost of \$0.2 million for a total cost of \$2.4 million through 2032.

### Barge-Based Operating Costs

This cost is incurred by vessel operators using barge-based capture and control systems. These systems are currently operated as a service provided by a third-party vendor and charged to the vessel operator on a fee per-hour basis. The hourly rate is inclusive of all costs to operate the control system, which include the tugboat operator to move the barge, labor to connect the system ducting to the stack, and reporting costs.

The rate charged to vessel operators can vary depending on the length of the stay, with shorter visits being more costly on an hourly basis. According to one provider, the average rate is \$900 per hour for the container vessels now using the service, and a similar rate would apply to ro-ro vessels.

To estimate the cost, staff used the hourly rate, the average vessel stay (hours) and the number of visits. The number of visits and the related cost are increased by growth factors, with the first use by container and reefer vessels in 2021 with an annual cost of \$2.2 million (based on 63 visits) increasing to \$15.9 million in 2025 (based on 751 visits) when ro-ro vessels start complying with the Proposed Regulation. The total cost to vessel operators is \$149.7 million through 2032.

#### **d) Remediation Fund Costs**

Remediation fund costs would be incurred by terminal and vessel operators who choose to use this option in situations where emissions control cannot be achieved during a vessel visit, where the vessel visit does not qualify for an exception, or where a TIE or VIE is not used for the vessel visit. The remediation costs would be placed into a fund that would be used for local emissions reduction projects to achieve the emissions reductions that did not occur during the vessel visit.

Staff calculated the remediation costs by applying an estimated hourly remediation cost specific to each vessel type to the calculated percentage of vessel visits that staff estimated would use the fee in a year. This number of vessel visits is based on staff analysis of CARB Enforcement data from 2017 documenting the reasons that vessels failed to connect to shore power and documentation of terminal or port construction that prevented shore power connection. Staff assumed that the same percentage of visits would encounter circumstances resulting in use of the remediation option in all analysis years. The percentage of vessel visits assumed to use remediation fund is less than one percent (25 visits in 2021 to 52 visits in 2032). The cost is based on the hourly remediation rate multiplied by the number of visits multiplied by the average number of hours per visit. The total cost to terminal and vessel operators through 2032 is \$36.4 million.

#### **e) Terminal and Port Plan and Reporting Costs**

The Proposed Regulation would require regulated terminals and ports to develop and submit plans to CARB staff for review detailing how they would achieve emissions reductions from vessels visiting each terminal and port. Terminal and port plans would be required to be submitted by July 1, 2021 for container, reefer, and cruise terminals and December 1, 2021 for ro-ro and tanker terminals. The estimated cost per plan is \$2,500 and the cost of the initial terminal plans is \$0.4 million and \$0.6 million for port plans.

Terminals serving ro-ro and tanker vessels would be required to update and resubmit terminal plans by eleven months prior to the implementation deadline for each vessel type and location. For terminals serving ro-ro vessels, this due date would be February 1, 2024. For POLA, POLB, and their terminals serving tanker vessels, the due date would be February 1, 2026. For all other terminals serving tanker vessels, the due date would be February 1, 2028. The cost of the updated terminal plans is \$0.1 million. As operating ports, the Port of Hueneme and Port of Stockton would also incur costs for updating the terminal plans, which would be minimal at \$6,000.

The total cost of the initial and updated plans is \$1.1 million through 2032.

## Reporting Costs

The Proposed Regulation would require vessel and terminal operators to report information on each vessel visit by the vessel operator to the respective terminal to CARB within seven days of the visit. The costs for reporting to CARB would be incurred by both the vessel and terminal operators.

Vessel operators and terminals would submit visit information electronically through CARB's electronic Freight Regulations Reporting System (FRRS), which is currently under development. FRRS is expected to help minimize the administrative costs to vessel operators and terminals by streamlining the reporting of vessel visit information.

For vessel and terminal reporting, staff assumed an administrative cost of \$100 per visit for each party. Staff believes that this is a conservatively high estimate due to the electronic reporting platform and the limited amount of information required to be reported. The total cost for reporting is \$24.3 million for the period 2021 through 2032, which is based on 13,802 initial vessel and terminal reports and increased by the growth factors by vessel types.

As operating ports, the Port of Hueneme and the Port of Stockton would submit the terminal reports for 429 initial visits to the terminals starting in 2021 for a total cost of \$0.7 million through 2032.

The total cost to the regulated parties is estimated at \$25 million through 2032.

## **f) Cost Savings**

### Shore Power Fuel Savings

Staff expects electricity costs incurred by terminal operators and passed along to vessel operators would be offset by the fuel savings from shutting down the vessel's auxiliary engines. To estimate these cost savings, staff estimated marine gas oil (MGO) fuel prices through 2032 by obtaining current MGO prices at POLA and POLB and projecting forward annually through 2032 using 2018 U.S. Energy Information Administration<sup>213,214</sup> projections for transportation diesel fuel, which is the closest surrogate for MGO.

To estimate the fuel savings, CARB staff used the average vessel stay (hours) by vessel type, the average engine power load (kilowatts) by vessel type, the average fuel consumption rate for marine auxiliary engines, and the projected cost of MGO as described above. The cost savings is \$9.0 million through 2032.

---

<sup>213</sup> U.S. Energy Information Administration, Annual Energy Outlook 2018 with Projections to 2050, February 6, 2018, <https://www.eia.gov/outlooks/aeo/pdf/AEO2018.pdf>.

<sup>214</sup> U.S. Energy Information Administration, Table: Petroleum and Other Liquids Prices, Annual Energy Outlook 2018, <https://www.eia.gov/outlooks/aeo/data/browser/#/?id=12-AEO2018&cases=ref2018&sourcekey=0>.

## Low Carbon Fuel Standard Credits (LCFS)

Staff projected annual LCFS credit values of 0.10 to 0.11 \$/kW-hr for shore power electricity throughout the cost analysis period based on analysis from LCFS staff dated April 12, 2019.<sup>215</sup> Staff assumed that the cruise vessel terminal operators would generate credits for shore power with cost savings of \$2.8 million. To estimate the value of the LCFS credits, CARB used the credit value by the number of visits by the number of hours per visit by the vessel auxiliary engine effective power.

### **2. Total Statewide Costs**

Table IX-6 presents a summary of the net annual and total costs and cost savings that terminal and vessel operators incur under the Proposed Regulation. The total statewide net costs that businesses incur to comply with the Proposed Regulation through 2032 is \$1.57 billion.

Table IX-7 presents the same information for ports with total statewide net costs of \$0.6 billion through 2032.

Table IX-8 presents the same information for terminal and vessel operators and ports with total statewide net costs of \$2.16 billion through 2032.

---

<sup>215</sup> Email from Jing Yuan to Tracy Haynes titled "LCFS value for shore power", dated April 12, 2019.

**Table IX-6: Annual and Total Direct Costs or Cost Savings to Terminal and Vessel Operators as a Result of the Proposed Regulation from 2020 to 2032 (Thousands)**

| Year          | Shorepower Costs            |             |                            |                   | Capture and Control Costs          |   |              |             |                 |                        |                                       | Remed. Fund Costs | Terminal Plan Costs | Reporting Costs | Fuel Cost Savings | LCFS Credits | Net Impact  |
|---------------|-----------------------------|-------------|----------------------------|-------------------|------------------------------------|---|--------------|-------------|-----------------|------------------------|---------------------------------------|-------------------|---------------------|-----------------|-------------------|--------------|-------------|
|               | Vessel Equip. Capital Costs | Labor Costs | Vessel Equip. Maint. Costs | Electricity Costs | Capital Costs Infra. and Equipment | Feasibility, Engineering and Permitting Costs | Maint. Costs | Labor Costs | Operating Costs | Perform. Testing Costs | Hourly Cost for Vessels (Barge-Based) |                   |                     |                 |                   |              |             |
| 2020          | \$7,550                     | \$0         | \$0                        | \$0               | \$0                                | \$0   | \$0          | \$0         | \$0             | \$0                    | \$0                                   | \$0               | \$170               | \$0             | \$0               | \$0          | \$7,720     |
| 2021          | \$8,086                     | \$27        | \$612                      | \$0               | \$0                                | \$0   | \$0          | \$0         | \$0             | \$0                    | \$2,211                               | \$2,036           | \$175               | \$1,745         | \$0               | \$0          | \$14,891    |
| 2022          | \$12,573                    | \$28        | \$634                      | \$0               | \$0                                | \$25,652                                      | \$0          | \$0         | \$0             | \$0                    | \$2,290                               | \$2,111           | \$0                 | \$1,790         | \$0               | \$0          | \$45,079    |
| 2023          | \$13,037                    | \$545       | \$869                      | \$676             | \$0                                | \$25,652                                      | \$0          | \$0         | \$0             | \$0                    | \$2,375                               | \$2,190           | \$32                | \$1,838         | -\$636            | -\$239       | \$46,337    |
| 2024          | \$13,523                    | \$566       | \$901                      | \$702             | \$7,846                            | \$25,652                                      | \$0          | \$0         | \$0             | \$0                    | \$2,464                               | \$2,274           | \$33                | \$1,889         | -\$693            | -\$246       | \$54,911    |
| 2025          | \$14,032                    | \$595       | \$935                      | \$732             | \$7,923                            | \$25,652                                      | \$44         | \$0         | \$364           | \$30                   | \$15,940                              | \$2,640           | \$17                | \$1,959         | -\$745            | -\$243       | \$69,877    |
| 2026          | \$14,682                    | \$611       | \$982                      | \$758             | \$100,126                          | \$25,652                                      | \$45         | \$0         | \$374           | \$31                   | \$16,478                              | \$2,711           | \$17                | \$2,000         | -\$792            | -\$254       | \$163,422   |
| 2027          | \$15,135                    | \$629       | \$1,010                    | \$788             | \$101,199                          | \$25,652                                      | \$1,280      | \$7,576     | \$4,989         | \$201                  | \$16,948                              | \$3,191           | \$23                | \$2,042         | -\$849            | -\$267       | \$179,547   |
| 2028          | \$15,615                    | \$647       | \$1,040                    | \$819             | \$102,283                          | \$25,652                                      | \$1,295      | \$7,657     | \$5,047         | \$203                  | \$17,343                              | \$3,275           | \$23                | \$2,087         | -\$911            | -\$280       | \$181,796   |
| 2029          | \$16,121                    | \$667       | \$1,073                    | \$855             | \$103,384                          | \$0   | \$5,415      | \$25,426    | \$21,067        | \$418                  | \$17,751                              | \$3,800           | \$0                 | \$2,135         | -\$979            | -\$294       | \$196,839   |
| 2030          | \$16,654                    | \$688       | \$1,107                    | \$891             | \$104,501                          | \$0   | \$5,474      | \$25,699    | \$21,298        | \$423                  | \$18,173                              | \$3,900           | \$0                 | \$2,185         | -\$1,044          | -\$308       | \$199,640   |
| 2031          | \$17,214                    | \$719       | \$1,143                    | \$926             | \$105,730                          | \$0   | \$5,538      | \$25,999    | \$21,551        | \$428                  | \$18,608                              | \$4,042           | \$0                 | \$2,258         | -\$1,121          | -\$325       | \$202,711   |
| 2032          | \$17,936                    | \$752       | \$1,193                    | \$963             | \$106,944                          | \$0   | \$5,602      | \$26,294    | \$21,801        | \$434                  | \$19,122                              | \$4,191           | \$0                 | \$2,335         | -\$1,193          | -\$343       | \$206,029   |
| <b>Total*</b> | \$182,157                   | \$6,475     | \$11,498                   | \$8,110           | \$739,937                          | \$179,566                                     | \$24,693     | \$118,651   | \$96,491        | \$2,168                | \$149,704                             | \$36,361          | \$490               | \$24,262        | -\$8,963          | -\$2,801     | \$1,568,799 |

\*Totals may not add due to rounding.

**Table IX-7: Annual and Total Direct Costs to Ports as a Result of the Proposed At-Berth Regulation from 2020 to 2032 (Thousands)**

| Year          | Shorepower Costs     |              |             | Capture and Control Costs       |   |             |              |                 |                        | Port Plan Costs | Reporting Costs | Net Impact |
|---------------|----------------------|--------------|-------------|---------------------------------|---|-------------|--------------|-----------------|------------------------|-----------------|-----------------|------------|
|               | Infra. Capital Costs | Maint. Costs | Labor Costs | Infra. And Equip. Capital Costs | Feasibility, Engineering and Permitting Costs | Labor Costs | Maint. Costs | Operating Costs | Perform. Testing Costs |                 |                 |            |
| 2020          | \$6,603              | \$0          | \$0         | \$0                             | \$14,900                                      | \$0         | \$0          | \$0             | \$0                    | \$301           | \$0             | \$21,804   |
| 2021          | \$6,845              | \$0          | \$5         | \$0                             | \$14,900                                      | \$0         | \$0          | \$0             | \$0                    | \$309           | \$50            | \$22,109   |
| 2022          | \$7,097              | \$0          | \$5         | \$0                             | \$16,503                                      | \$0         | \$0          | \$0             | \$0                    | \$0             | \$51            | \$23,657   |
| 2023          | \$7,359              | \$65         | \$235       | \$0                             | \$16,503                                      | \$0         | \$0          | \$0             | \$0                    | \$0             | \$53            | \$24,214   |
| 2024          | \$7,632              | \$67         | \$244       | \$29,353                        | \$16,503                                      | \$0         | \$0          | \$0             | \$0                    | \$3             | \$54            | \$53,855   |
| 2025          | \$7,929              | \$69         | \$256       | \$29,593                        | \$16,503                                      | \$0         | \$22         | \$572           | \$15                   | \$0             | \$56            | \$55,015   |
| 2026          | \$8,210              | \$72         | \$263       | \$34,312                        | \$16,503                                      | \$0         | \$23         | \$588           | \$15                   | \$0             | \$58            | \$60,044   |
| 2027          | \$8,503              | \$75         | \$271       | \$34,680                        | \$1,603                                       | \$6,494     | \$1,081      | \$606           | \$16                   | \$3             | \$59            | \$53,390   |
| 2028          | \$8,807              | \$77         | \$279       | \$35,052                        | \$1,603                                       | \$6,563     | \$1,093      | \$619           | \$16                   | \$0             | \$61            | \$54,171   |
| 2029          | \$9,124              | \$80         | \$288       | \$35,430                        | \$0   | \$7,738     | \$1,361      | \$1,367         | \$30                   | \$0             | \$62            | \$55,480   |
| 2030          | \$9,453              | \$83         | \$297       | \$35,813                        | \$0   | \$7,821     | \$1,376      | \$1,389         | \$30                   | \$0             | \$64            | \$56,327   |
| 2031          | \$9,812              | \$86         | \$310       | \$36,234                        | \$0   | \$7,913     | \$1,392      | \$1,412         | \$31                   | \$0             | \$66            | \$57,257   |
| 2032          | \$10,185             | \$89         | \$324       | \$36,651                        | \$0   | \$8,003     | \$1,409      | \$1,437         | \$32                   | \$0             | \$68            | \$58,196   |
| <b>Total*</b> | \$107,558            | \$764        | \$2,777     | \$307,118                       | \$115,520                                     | \$44,532    | \$7,757      | \$7,990         | \$186                  | \$616           | \$702           | \$595,519  |

\*Totals may not add due to rounding



**Table IX-8: Annual and Total Direct Costs and Cost Savings to Terminal and Vessel Operators and Ports as a Result of the Proposed Regulation from 2020 to 2032 (Thousands)**

| Year          | Shorepower Costs                         |                |   |                   | Capture and Control Costs       |   |                 |                  |                  |                        |                                       | Remed. Fund Costs | Port and Terminal Plan Costs | Reporting Costs | Fuel Cost Savings | LCFS Credits    | Net Impact         |
|---------------|--|----------------|---|-------------------|---------------------------------|---|-----------------|------------------|------------------|------------------------|---------------------------------------|-------------------|------------------------------|-----------------|-------------------|-----------------|--------------------|
|               | Capital Costs - Vessel Equip. and Infra. | Labor Costs    | Maint. Costs - Vessel Equip. and Infra. | Electricity Costs | Capital Costs Infra. and Equip. | Feasibility, Engineering and Permitting Costs | Maint. Costs    | Labor Costs      | Operating Costs  | Perform. Testing Costs | Hourly Cost for Vessels (Barge-Based) |                   |                              |                 |                   |                 |                    |
| 2020          | \$14,153                                 | \$0            | \$0                                     | \$0               | \$0                             | \$14,900                                      | \$0             | \$0              | \$0              | \$0                    | \$0                                   | \$0               | \$471                        | \$0             | \$0               | \$0             | \$29,524           |
| 2021          | \$14,931                                 | \$33           | \$612                                   | \$0               | \$0                             | \$14,900                                      | \$0             | \$0              | \$0              | \$0                    | \$2,211                               | \$2,036           | \$484                        | \$1,795         | \$0               | \$0             | \$37,000           |
| 2022          | \$19,671                                 | \$34           | \$634                                   | \$0               | \$0                             | \$42,155                                      | \$0             | \$0              | \$0              | \$0                    | \$2,290                               | \$2,111           | \$0                          | \$1,842         | \$0               | \$0             | \$68,736           |
| 2023          | \$20,396                                 | \$780          | \$933                                   | \$676             | \$0                             | \$42,155                                      | \$0             | \$0              | \$0              | \$0                    | \$2,375                               | \$2,190           | \$32                         | \$1,891         | -\$636            | -\$239          | \$70,552           |
| 2024          | \$21,154                                 | \$809          | \$968                                   | \$702             | \$37,199                        | \$42,155                                      | \$0             | \$0              | \$0              | \$0                    | \$2,464                               | \$2,274           | \$35                         | \$1,943         | -\$693            | -\$246          | \$108,766          |
| 2025          | \$21,961                                 | \$852          | \$1,005                                 | \$732             | \$37,516                        | \$42,155                                      | \$66            | \$0              | \$935            | \$45                   | \$15,940                              | \$2,640           | \$17                         | \$2,015         | -\$745            | -\$243          | \$124,892          |
| 2026          | \$22,892                                 | \$875          | \$1,054                                 | \$758             | \$134,437                       | \$42,155                                      | \$68            | \$0              | \$963            | \$46                   | \$16,478                              | \$2,711           | \$17                         | \$2,058         | -\$792            | -\$254          | \$223,466          |
| 2027          | \$23,638                                 | \$900          | \$1,085                                 | \$788             | \$135,879                       | \$27,256                                      | \$2,361         | \$14,070         | \$5,595          | \$217                  | \$16,948                              | \$3,191           | \$25                         | \$2,101         | -\$849            | -\$267          | \$232,937          |
| 2028          | \$24,422                                 | \$926          | \$1,118                                 | \$819             | \$137,335                       | \$27,256                                      | \$2,387         | \$14,220         | \$5,666          | \$220                  | \$17,343                              | \$3,275           | \$23                         | \$2,148         | -\$911            | -\$280          | \$235,967          |
| 2029          | \$25,245                                 | \$955          | \$1,153                                 | \$855             | \$138,814                       | \$0   | \$6,776         | \$33,165         | \$22,434         | \$448                  | \$17,751                              | \$3,800           | \$0                          | \$2,197         | -\$979            | -\$294          | \$252,319          |
| 2030          | \$26,107                                 | \$985          | \$1,190                                 | \$891             | \$140,314                       | \$0   | \$6,850         | \$33,520         | \$22,687         | \$453                  | \$18,173                              | \$3,900           | \$0                          | \$2,249         | -\$1,044          | -\$308          | \$255,966          |
| 2031          | \$27,026                                 | \$1,029        | \$1,229                                 | \$926             | \$141,965                       | \$0   | \$6,931         | \$33,911         | \$22,963         | \$459                  | \$18,608                              | \$4,042           | \$0                          | \$2,324         | -\$1,121          | -\$325          | \$259,968          |
| 2032          | \$28,121                                 | \$1,076        | \$1,282                                 | \$963             | \$143,594                       | \$0   | \$7,010         | \$34,297         | \$23,238         | \$465                  | \$19,122                              | \$4,191           | \$0                          | \$2,402         | -\$1,193          | -\$343          | \$264,225          |
| <b>Total*</b> | <b>\$289,715</b>                         | <b>\$9,252</b> | <b>\$12,263</b>                         | <b>\$8,110</b>    | <b>\$1,047,055</b>              | <b>\$295,086</b>                              | <b>\$32,450</b> | <b>\$163,183</b> | <b>\$104,481</b> | <b>\$2,354</b>         | <b>\$149,704</b>                      | <b>\$36,361</b>   | <b>\$1,106</b>               | <b>\$24,964</b> | <b>-\$8,963</b>   | <b>-\$2,801</b> | <b>\$2,164,319</b> |

\*Totals may not add due to rounding

## **C. Direct Costs on Business and Individuals**

### **1. Direct Cost on Typical Business**

The typical business is a vessel operator or a terminal operator. The total cost that these businesses incur to comply with the Proposed Regulation from 2020 through 2032 is \$1.58 billion; \$0.36 billion for vessel operators and \$1.22 billion for terminal operators.

The costs that vessel operators incur depends upon which compliance pathway they use, shore power or a capture and control system. Costs may include the cost to install shore power equipment on their vessels and maintenance; costs to use barge-based capture and control systems, and reporting. Terminal operators may incur costs for infrastructure and equipment for land-based capture and control systems and maintenance; feasibility, engineering, and permitting; operating costs; labor; and reporting.

### **2. Direct Cost on Small Businesses and Individuals**

The Proposed Regulation would not result in any direct costs to small businesses and individuals. However, staff anticipates the Proposed Regulation would result in indirect costs to individuals to the extent that compliance costs are passed through to the ultimate consumers of cargo and cruise vessel passengers.

To estimate these indirect costs to consumers, staff calculated cost ratios in metrics of increased cost per 20-foot equivalent unit (TEU) of cargo for container and reefer vessels, increased cost per cruise vessel passenger, increased cost per automobile imported into or exported from California, and increased cost per gallon of gasoline, diesel fuel, jet fuel, and other crude products produced in California.

Staff performed this analysis for year 2030 because that would be the first full year after the final implementation deadline for the Proposed Regulation. Table IX-9 summarizes the annualized cost in 2030, the total units (TEUs, passengers, automobiles and gallons of gasoline, diesel fuel and jet fuel) in 2030, and the calculated cost increase per unit. The methodologies used to calculate each cost are detailed in Appendix C-1.

**Table IX-9: Estimated Net Costs to Individuals from the Proposed Regulation**

| <b>Vessel Type</b> | <b>Annualized Cost in 2030</b> | <b>Total Units in 2030</b> | <b>Cost per unit in 2030</b> | <b>Unit</b> |
|--------------------|--------------------------------|----------------------------|------------------------------|-------------|
| Container/Reefer   | \$17,344,000                   | 15,590,200                 | \$1.11                       | TEU         |
| Cruise             | \$18,385,000                   | 4,031,800                  | \$4.56                       | Passenger   |
| Ro-Ro              | \$18,244,000                   | 2,437,300                  | \$7.49                       | Automobile  |
| Tanker             | \$203,614,000                  | 27,156,860,100             | \$.008                       | Gallons     |

**D. Benefits**

**1. Benefits to Terminal and Vessel Operators**

There are several benefits to terminal and vessel operators; fuel savings, LCFS credits, and health benefits. Vessel operators may be able to lower their fuel cost if they utilize shore power as their emission control strategy. Fuel cost savings depend on fuel and electricity costs.

Terminal operators that opt into the LCFS program can generate credits through operating shore power at their berths. The credits can be sold to regulated parties in the LCFS program to reduce operating costs for terminal operators.

Lastly, the Proposed Regulation would reduce criteria and toxic air pollutants exposure to the terminal operators as well as the vessel operator’s crew.

**2. Benefits to Other California Businesses**

The Proposed Regulation is expected to result in benefits to several industries. These industries range from capture and control system manufacturers, crane manufacturers, barge manufacturers, component suppliers (including ducts and piping), electrical suppliers, design, engineering, and construction firms.

Due to higher demand for capture and control systems from the Proposed Regulation, production of these systems in California will likely increase, which leads to increases in manufacturing, engineering, and construction related jobs throughout the state.

The increase in the production and usage of the capture and control systems could also benefit various businesses related to the component supply chain, including manufacturers of SCR control equipment.

The Proposed Regulation is also expected to benefit companies that install shore power equipment on vessels and at ports and terminals. The vessel retrofits are typically not

done in California; however, all of the landside shore power installations would take place in California. Some of this equipment may be manufactured in California.

### **3. Benefits to Small Businesses**

Businesses, including construction companies, engineers, electricians, parts and components manufacturers, consulting firms, and others involved in designing, installing, and maintaining equipment for both types of technologies may fall into the category of small businesses. The benefits to capture and control and shore power manufacturers and other related business discussed above also apply to small businesses.

### **4. Benefits to Individuals**

The Proposed Regulation will directly benefit individuals in California. Vessels operate at ports, many being near local communities that suffer from the worst air pollution in the state. Individuals will directly benefit in the form of health benefits from lower levels of PM2.5, DPM, NOx, ROG, GHG, and black carbon at the ports.

The Proposed Regulation will result in a reduction in the risk for premature deaths, hospital visits, emergency room visits, and a variety of other health effects, especially in sensitive receptors including children, elderly, and people with chronic heart or lung disease. Emission reductions also reduce occupational exposure for individuals to workers at ports and terminals and on vessels, and passengers on cruise vessels.

### **5. Social Cost of Carbon**

The Proposed Regulation would result in an estimated cumulative net reduction in GHG emissions between 2021 and 2032 totaling 263,000 metric tons compared with the baseline (Existing Regulation).

The monetary value of these GHG reductions can be estimated using the social cost of carbon (SC-CO2), which provides a dollar valuation of the damages caused by one ton of carbon pollution and represents the monetary benefit today of reducing carbon emissions in the future. If all GHG emissions reductions under the Proposed Regulation are assumed to be CO2 reductions, the SC-CO2 from 2021 through 2032 is the sum of the annual GHG emissions reductions multiplied by the SC-CO2 in each year. The estimated benefits from the Proposed Regulation from 2021 through 2032 are estimated to range from \$4.6 million to \$45.7 million (in 2018\$) relative to the baseline.<sup>216</sup>

---

<sup>216</sup> Staff adjusted the social cost of CO2 in 2007 dollars to 2018 dollars by using the Bureau of Labor Statistics Consumer Price Index (CPI) calculator, adjusting from January 2007 dollars to January 2018 dollars. Source: Bureau of Labor Statistics, Consumer Price Index Calculator, accessed September 6, 2019, [https://www.bls.gov/data/inflation\\_calculator.htm](https://www.bls.gov/data/inflation_calculator.htm)

## **E. Fiscal Impacts**

### **1. Local Government**

#### **a) Ports**

The Proposed Regulation has direct impacts on eight regulated ports (Los Angeles, Long Beach, San Diego, Hueneme, San Francisco, Oakland, Stockton, and Richmond), which are all semi-autonomous public agencies.

The ports are each run by a Board of Commissioners, which are generally appointed by local city and/or county governments, or elected locally. While each port has unique operating characteristics, the ports are generally self-funded and raise their own revenue through terminal leases or berthing fees. These funds are then used for infrastructure development and operational costs.

There are two primary types of public seaports. The largest typically use the “landlord port”<sup>217,218</sup> model that provides long-term leases or rental of entire terminals to private companies referred to as “terminal operators”; those terminal operators then offer services to the vessel fleets and cargo owners using that terminal. California’s smaller ports use an “operational port” model; they also act as the terminal operator and directly serve vessel fleets.<sup>219</sup> The Port of Hueneme and the Port of Stockton are operating ports.

The fiscal impact to ports varies annually and depends upon what type of projects will occur at the port and the responsibilities. For example, not all ports will incur infrastructure costs for shore power or land-based capture and control projects. Additionally, the Port of Hueneme and the Port of Stockton as operating ports incur costs attributed to both the port and the terminal operators.

Staff understands that infrastructure costs for projects occurring at port-based terminals would initially be incurred by the ports, but could be passed on to port tenants through their lease agreements, to vessel operators through berthing fees, or would be absorbed by the ports.

The annual total direct costs to ports from 2020 to 2032 are discussed in Section A of this chapter and summarized in Table IX-7.

---

<sup>217</sup> Port of Los Angeles, Port 101, accessed September 8, 2019, <https://www.portoflosangeles.org/about/port-101>.

<sup>218</sup> Port of Long Beach, FAQs - Does The Port Receive Funding From The City of Long Beach, accessed September 8, 2019, <http://www.polb.com/about/faqs.asp#530>.

<sup>219</sup> Janice Hoppe-Spiers, Transportation and Logistics International, Port of Stockton, <http://www.tlimagazine.com/sections/shipping-and-ports/2359-port-of-stockton>

## **b) Personnel Costs**

Land-based capture and control systems would require local air district permits, or inclusion in the facility's federal Title V operating permit for systems located at major sources of air pollution. District permits would require review by local air district staff. For purposes of the cost analysis, staff assumed that the equivalent of one PY would be needed starting in 2021 and throughout the implementation timeframe of the Proposed Regulation to account for local permitting activities with a total cost of \$2.3 million.

## **c) Tax Revenue**

The Proposed Regulation's impact on local government tax revenue is estimated to be minimal with a decrease of \$0.2 million through 2032. It is estimated that there would be a slight increase (\$0.7 million) in local utility use tax revenue due to the increase in the use of electricity as a result of increased shore power usage and a slight decrease in revenue (\$0.9 million) from California sales and use tax from decreased sales of fuel.

## **2. State Government**

### **a) CARB**

The Proposed Regulation is anticipated to require seven PYs for implementation functions and conducting enforcement activities for an estimated cost of \$12.1 million through 2032.

The implementation resources could include the following positions:

- One Air Resources Engineer, beginning in FY 20-21, for the technical duties on review of plans and technologies, as well as infrastructure development.
- Two Air Pollution Specialists, beginning in FY 21-22, to draft guidance documents, evaluate required At Berth reports submitted in the FRRS and flag/resolve any issues, and work with environmental justice communities near ports.
- One Air Resources Technician II, beginning in FY 20-21, to staff the hotline for industry questions, and respond to industry/port requests for compliance assistance.

The enforcement resources could include the following positions:

- One Air Resources Technician II and one Air Pollution Specialist would be needed beginning in 2021 (FY 20-21), the first year of implementation of the Proposed Regulation.
- One Air Pollution Specialist would be needed in 2027 (FY 2027-28), the first year of implementation at the tanker terminals.

The need for increased enforcement would result from an increase in the number of regulated parties under the Proposed Regulation, the additional responsibilities and reporting requirements for ports, terminal and vessel operators, and the additional vessel types and vessel visits that would be required to reduce emissions under the Proposed Regulation.

### **b) Other State Agencies**

Staff assumed that infrastructure improvements would be needed at locations on State-owned lands (marine and port terminals) and that are under the jurisdiction of CSLC, primarily for infrastructure projects to support land-based capture and control systems at tanker terminals. Discussions with CLSC indicated that one PY would be needed.

State agencies directly involved in permitting may include the San Francisco Bay Conservation and Development Commission (BCDC),<sup>220</sup> applicable to projects in the San Francisco Bay, the applicable Regional Water Quality Control Board, and the California Department of Fish and Wildlife (CDFW).<sup>221</sup> Based on the number of projects to be reviewed, staff estimates that the equivalent of one PY would be needed.

The costs for the two PYs were assumed to be equivalent to an Air Resources Engineer at CARB and are estimated at \$4.5 million through 2032.

### **c) Tax Revenue**

The Proposed Regulation will affect State finances minimally (less than \$20,000) through changes in fees collected through the electrical energy resources surcharge, a tax based on the kilowatt-hours consumed in California.

Similar to the local government impacts, the Proposed Regulation could also affect State finances if decreases in marine gas oil that is used while vessels are at berth impacts revenues from California sales and use tax. The potential impact is a decrease of \$0.7 million through 2032.

## **3. Total Personnel Costs to Local, State, and Federal Government**

In addition to California government agencies, the Proposed Regulation assumed that there will be costs to federal agencies. Staff assumed that certain infrastructure improvements occurring at locations on State-owned lands under the jurisdiction of the CSLC may also require the review of federal agencies in some cases. Staff does not expect the federal agencies to review most improvements solely on land, but they may

---

<sup>220</sup> San Francisco Bay Conservation and Development Commission, Permits, accessed September 8, 2019, <https://bcdc.ca.gov/permits/>

<sup>221</sup> California Department of Fish and Wildlife, Environmental Review and Permitting, accessed September 8, 2019, <https://www.wildlife.ca.gov/Conservation/Environmental-Review>

be involved in some oil terminal land-based capture and control system wharf improvements that extend into navigable waterways.

The extent to which these federal agencies would incur staff time to review projects resulting from the Proposed Regulation depends on various factors including the location, scope, and environmental concerns specific to individual projects. For the purposes of the cost analysis, staff estimates that the equivalent of one PY at a cost equivalent to an Air Resources Engineer at CARB would be needed.

The annual and total personnel costs to all government agencies estimated at \$21.2 million through 2032 is shown in Table IX-10.

**Table IX-10: Annual and Total Personnel Costs to Local, State, and Federal Government (thousands)**

| <b>Year</b>  | <b>Local Agencies</b> | <b>CARB</b> | <b>Other State Agencies</b> | <b>Federal Agencies</b> | <b>Total Cost</b> |
|--------------|-----------------------|-------------|-----------------------------|-------------------------|-------------------|
| <b>2020</b>  | \$0                   | \$277       | \$0                         | \$0                     | \$277             |
| <b>2021</b>  | \$189                 | \$903       | \$378                       | \$189                   | \$1,746           |
| <b>2022</b>  | \$188                 | \$899       | \$376                       | \$188                   | \$1,651           |
| <b>2023</b>  | \$188                 | \$899       | \$376                       | \$188                   | \$1,651           |
| <b>2024</b>  | \$188                 | \$899       | \$376                       | \$188                   | \$1,651           |
| <b>2025</b>  | \$188                 | \$899       | \$376                       | \$188                   | \$1,651           |
| <b>2026</b>  | \$188                 | \$899       | \$376                       | \$188                   | \$1,651           |
| <b>2027</b>  | \$188                 | \$1,079     | \$376                       | \$188                   | \$1,831           |
| <b>2028</b>  | \$188                 | \$1,078     | \$376                       | \$188                   | \$1,830           |
| <b>2029</b>  | \$188                 | \$1,078     | \$376                       | \$188                   | \$1,830           |
| <b>2030</b>  | \$188                 | \$1,078     | \$376                       | \$188                   | \$1,830           |
| <b>2031</b>  | \$188                 | \$1,078     | \$376                       | \$188                   | \$1,830           |
| <b>2032</b>  | \$188                 | \$1,078     | \$376                       | \$188                   | \$1,830           |
| <b>Total</b> | \$2,257               | \$12,144    | \$4,514                     | \$2,257                 | \$21,172          |



## **F. Macroeconomic Impacts**

Regional Economic Models, Inc. (REMI) Policy Insight Plus Version 2.2.8 is used to estimate the macroeconomic impacts of the proposed amendments on the California economy. REMI is a structural economic forecasting and policy analysis model that integrates input-output, computable general equilibrium, econometric and economic geography methodologies.

### **1. California Employment Impacts**

The Proposed Regulation is anticipated to result in a relatively small decrease in total employment growth in most years of the assessment. There is a small, but positive, impact on jobs estimated in 2020 and 2022 associated with additional feasibility studies and vessel and berth retrofits. The majority of the positive impact in 2020 and the larger positive impacts to jobs in 2024 and 2026 are primarily due to increases in construction required for land-based capture and control for vessels. Overall, the change in total employment is small relative to the baseline employment for the California economy, being less than 0.02 percent an all years.

### **2. California Business Impacts**

Gross output is used as a proxy for business impacts because it is principally a measure of an industry's sales or receipts and tracks the quantity of goods or services produced in a given time period. Output growth, as defined in REMI, is the sum of output in each private industry and State and local government as it contributes to the VIII-30 state's gross domestic product (GDP), and is affected by production cost and demand changes.

The Proposed Regulation shows a decrease in output of \$585 million in 2032 for the overall California economy, which is small relative to the larger California economy, corresponding to a change of 0.01 percent. At the industry level, the support activities for transportation industry is estimated to have a decrease in output of \$24 million in 2032. This represents the net impact to ports, terminals, and barge-based capture and control suppliers. The other industries are estimated to see decreases in output that are less than 0.03 percent.

### **3. Gross State Product (GSP)**

GSP is the market value of all goods and services produced in California and is one of the primary indicators used to gauge the health of an economy. Under the Proposed Regulation, GSP growth is anticipated to decline slightly as a result of the increased compliance costs. In 2032, the decrease amounts to 0.01 percent of baseline GSP growth.

## **G. Alternatives**

Staff analyzed two alternatives to the Proposed Regulation. Under Alternative 1, the only allowable strategy to reduce at berth emissions would be the use of shore power for all vessel visits to California (using the same terminal vessel visit thresholds as the Proposed Regulation). Alternative 2 is identical to the Proposed Regulation, with the exception that it does not include emissions control requirements for ro-ro vessels.

Alternative 1 is more stringent than the Proposed Regulation because it requires all vessels to use shore power. Alternative 1 could provide more DPM and GHG emissions reductions and health benefits but results in significantly higher costs (over 70 percent higher or \$1.6 billion additional cost). Alternative 1 would result in fewer PM2.5 emissions reductions because the tanker boilers used to power the product pumps cannot operate on shore power, therefore, the tanker boiler PM2.5 emissions would not be reduced. However, GHG reductions would be significantly greater (by almost 400,000 metric tons) under Alternative 1 because shore power achieves higher reductions of GHGs from the auxiliary engines compared to a capture and control system. Alternative 1 was rejected because it has significantly higher costs and is less cost effective to implement than the Proposed Regulation. A 100 percent shore power mandate would require vessels that make infrequent visits to California ports to make expensive vessel modifications and installing shore power systems at berths or terminals with little utilization would be costly and achieve minimal additional emissions reductions.

Alternative 2 is less stringent and results in lower costs of \$140 million and overall lower emissions reductions except for GHG. Alternative 2 would achieve slightly more GHG reductions because ro-ro vessels are anticipated to control emissions from a majority of visits using capture and control systems, which may result in a minor GHG increase due to powering the control system and running the vessel's auxiliary engines. Alternative 2 was rejected because, while it has a lower cost, it also would result in lower emissions reductions, and it is less cost effective. The lost emissions reductions would have a negative health impact on the communities surrounding the ro-ro terminals due to higher exposure to cancer-causing DPM. It would also provide fewer NOx reductions to aid attainment of the National Ambient Air Quality Standards in the South Coast Air Basin.

## **X. EVALUATION OF REGULATORY ALTERNATIVES**

Government Code section 11346.2, subdivision (b)(4) requires CARB to consider and evaluate reasonable alternatives to the proposed regulatory action and provide reasons for rejecting those alternatives. This section discusses alternatives evaluated and provides reasons why these alternatives were not included in the proposal. As explained below, no proposed alternative was found to be less burdensome and equally effective in achieving the purposes of the Proposed Regulation in a manner that ensures full compliance with the authorizing law. The Board has not identified any reasonable alternatives that would lessen any adverse impact on small business.

During the development process of the Proposed Regulation, CARB staff solicited public input regarding alternatives to achieving the Regulation's goals. Staff evaluated several alternatives to the proposal, including suggestions from both public and industry stakeholders. CARB staff discussed these potential alternatives during workshops and workgroup meetings with stakeholders.

Staff has chosen three alternatives to the Proposed Regulation for formal evaluation, which includes an analysis of cost impacts and health benefits of each alternative and a discussion on why the alternative was rejected. These alternatives are similar to the alternatives discussed in the EA (Appendix D), but while the EA alternatives address reducing the environmental impacts of the Proposed Regulation, the alternatives in this chapter address alternatives that are proposed as less burdensome and equally effective in achieving the purposes of the Proposed Regulation. It is important to note that three of the alternatives listed here are in addition to those that staff considered for the Proposed Regulation's SRIA (Appendix C-1).

### **A. Alternative 1: Implementation Fixes through an Amendment to Existing Regulation Only (No Addition of Other Vessel Categories or Ports/Terminals)**

Alternative 1 would amend the Existing Regulation. For this Alternative, implementation of the amended Regulation would begin in 2021. Alternative 1 would address implementation challenges associated with the Existing Regulation, without adding any additional requirements. As such, this Alternative would affect only the vessel types currently included in the Existing Regulation (container, reefer, and cruise vessels meeting the regulatory threshold). This Alternative would not include many of the substantial expansions under the Proposed Regulation that would further reduce at berth emissions. Alternative 1 would not include ro-ro and tanker vessel visits, vessel visits that are under the threshold of the Existing Regulation, and additional ports and terminals not covered under the Existing Regulation. CARB staff chose to evaluate this Alternative as a result of industry comments requesting amendments to address challenges with the Existing Regulation.

Operational concerns that are often outside the control of the vessel crew and/or vessel and terminal operators may make compliance with the Existing Regulation in some cases challenging, even with successful emissions reductions occurring. In 2013, 2015, and 2017, Regulatory Advisories were issued to inform affected vessel fleets and terminal operators how CARB would proceed with enforcement of the Existing Regulation. Under these advisories, fleets could apply on a case-by-case basis for scenario relief, with the objective of providing flexibility to fleets that have equipped their vessels to use shore power or contracted to use an alternative control technology. All implementation fixes associated with Alternative 1 would help address the challenges and a fleet's ability to comply with the Existing Regulation that are currently accomplished with the advisory scenarios. No additional infrastructure or vessel modifications would be anticipated for vessels, ports, or terminals under this Alternative. Under this Alternative, the following changes and additions to the Existing Regulation would occur:

- Redefine vessel "visit," from the "time period that begins when a vessel initially ties to a berth (the beginning of the visit) and ends when it casts off the lines (the end of the visit) at a berth in a California port" to the time period when the vessel is "Ready to Work." The visit begins once the vessel is tied to the berth with gangway down and netting secured and has been cleared by U.S. Customs and Border Protection. The visit ends when "Pilot on Board", meaning the vessel's pilot has boarded the vessel to assume navigational control to prepare for vessel departure. Revisions to the visit definition would address the time constraints of the three-hour rule, which requires vessels to use the auxiliary engines for a maximum of three hours during a "visit".
- Prescribe responsibilities to terminals, ports, and vessel operators so the requirement is clearly appointed to a responsible party to help execute actions by

all parties needed to facilitate plug in or control emissions and appropriate enforcement actions.

- Allow for vessel commissioning exemptions. Under the Existing Regulation commissioning visits, which are required for shore power are not excluded from the vessel in-use operational requirements.
- Change compliance from quarterly to annually to allow fleets more flexibility if a vessel visit unexpectedly cannot achieve emissions reductions.
- Allow all vessels to use CARB approved alternative emissions control technology.
- Revise and update default power requirements to more accurately reflect the range of vessel hotelling loads by vessel type and vessel size.

Alternative 1 would result in lower costs relative to the Proposed Regulation, as no additional shore power or vessel retrofits would be required by regulated entities. The majority of vessel fleets and ports included in the Existing Regulation have already made the investments required to comply with the Existing Regulation. No new facilities or vessel categories would be affected.

No new jobs would be created or required for Alternative 1, and overall the amendments to the Existing Regulation would not change the air emissions impacts or increase costs of the Existing Regulation. Alternative 1 would result in lower costs to vessel owners, ports, and terminals compared to the Proposed Regulation. This is due to the Proposed Regulation including emissions control requirements for ro-ro, tanker and previously unregulated container, reefer and cruise vessels, and ports and terminals in California receiving 20 or more vessel visits of the same vessel type.

Alternative 1 would be expected to result in improved compliance rates and eliminate the need for the Regulatory Advisories compared to the Existing Regulation. Alternative 1 would address the above listed implementation challenges and would resolve situations where fleets have difficulty meeting the obligations of the Existing Regulation due to operational realities, unforeseen events, and factors outside of the control of the vessel and/or fleet operators. In addition, by including responsibilities to terminals, ports, and alternative technology operators, all entities involved in the process share compliance obligations.

Alternative 1 would provide less NO<sub>x</sub>, ROG, PM<sub>2.5</sub>, DPM, GHG, and black carbon emissions reductions compared to the Proposed Regulation. As a result, Alternative 1 would fail to provide significant additional public health and air quality benefits for California's residents, especially communities adjacent to ports and terminals. Additionally, by not including tanker vessels Alternative 1 fails to capture boiler emissions from tanker vessels that utilize boilers to operate steam-driven pumps for

off-loading crude products. Overall, Alternative 1 would not meet CARB's goals and objectives for the Proposed Regulation, as described in Chapter II of this Staff Report.

**B. Alternative 2: Shore Power Only Compliance Pathway for Container/Reefer, Cruise, Auto/Ro-Ro and Tanker Vessels (Applying the Same Terminal Threshold as the Proposed Regulation)<sup>222</sup>**

Alternative 2 would include container, reefer, and cruise vessels and the addition of ro-ro and tanker vessels visiting regulated California ports and terminals. For Alternative 2, shore power is the only allowable strategy to reduce emissions at berth. Staff evaluated Alternative 2 considering the same implementation timeline and port and terminal thresholds as the Proposed Regulation. Starting in 2021, Alternative 2 would remove existing alternative pathways for compliance including emissions capture and control systems. CARB staff identified and chose to evaluate this Alternative because it would rely exclusively on shore power, the most demonstrated, proven, and effective technology to reduce vessel emissions at berth. In addition, shore power also offers significantly greater reductions in GHG emissions than all other known alternatives.

Shore power has high initial costs for both vessel retrofits and terminal landside infrastructure. Installing shore power systems are most economical when they are utilized frequently. Many vessels that visit California ports are not recurrent visitors (e.g. trampers), particularly ro-ro and tanker vessels, making expensive modifications to their vessels an economic burden.

Alternative 2 is estimated to cost \$1.4 billion more than the Proposed Regulation. This is due to the significantly higher costs for the ro-ro vessel category using shore power (\$1.3 billion) and the slightly higher costs for the tanker vessels to use shore power (\$140 million). A more detailed breakdown of shore power costs and savings can be found in the accompanying SRIA (Appendix C-1).

Shore power reduces a vessel's auxiliary engine NO<sub>x</sub>, ROG, PM<sub>2.5</sub>, DPM, and black carbon emissions by 100 percent while plugged in and also achieves a GHG emissions reduction co-benefit due to California's clean electricity grid. The GHG emissions reductions are anticipated to increase over time as the California electricity grid gets cleaner under the direction of SB 32.<sup>223</sup> During the development of the Proposed Regulation, no other technology is available that is capable of a reduction of NO<sub>x</sub>, ROG, PM<sub>2.5</sub>, DPM, GHG, and black carbon emissions to the levels of shore power.

Figures X-1 through X-5 below show the emissions benefits from Alternative 2 compared to the Proposed Regulation and the Existing Regulation. Alternative 2 projected to result in greater DPM, ROG, and GHG emissions reductions compared to

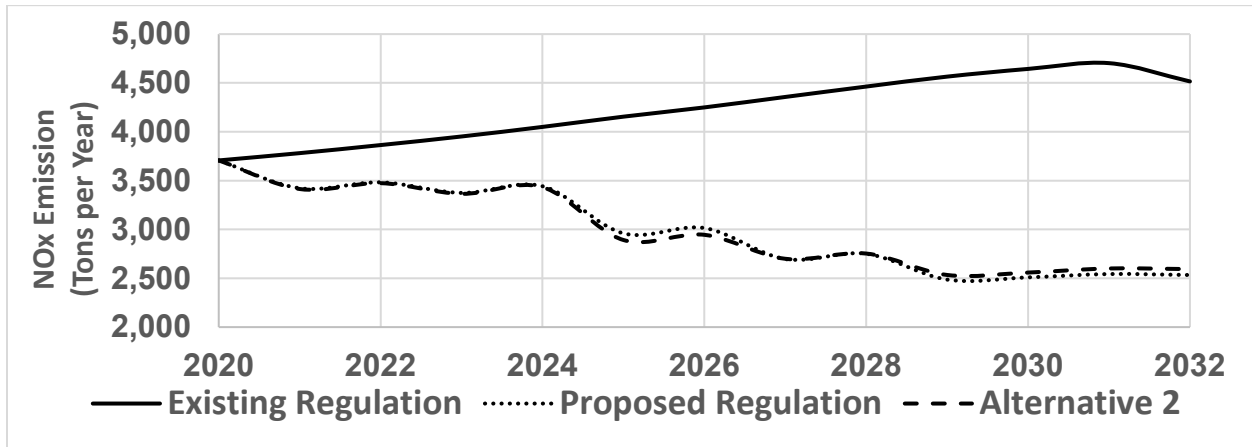
---

<sup>222</sup> Terminal threshold is 20 visits for any container, cruise, reefer, ro-ro, or tanker vessels. For more detailed information, see Chapter III.

<sup>223</sup> California Health and Safety Code § 38566, Division 25.5, Senate Bill No. 32, September 8, 2016, [https://leginfo.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160SB32](https://leginfo.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB32).

the Proposed Regulation and the Existing Regulation. This Alternative would have similar NOx emissions reductions as the Proposed Regulation. Alternative 2 would have fewer PM2.5 emissions reductions due to the inability of shore power to capture boiler emissions from tankers. Boilers are a large emissions source, particularly on tanker vessels that use large boilers to off-load their product. Alternative 2 supports NOx, DPM, ROG, and GHG emissions reduction objectives.

**Figure X-1: Alternative 2 - NOx Emissions Estimates**



**Figure X-2: Alternative 2 - DPM Emissions Estimates**

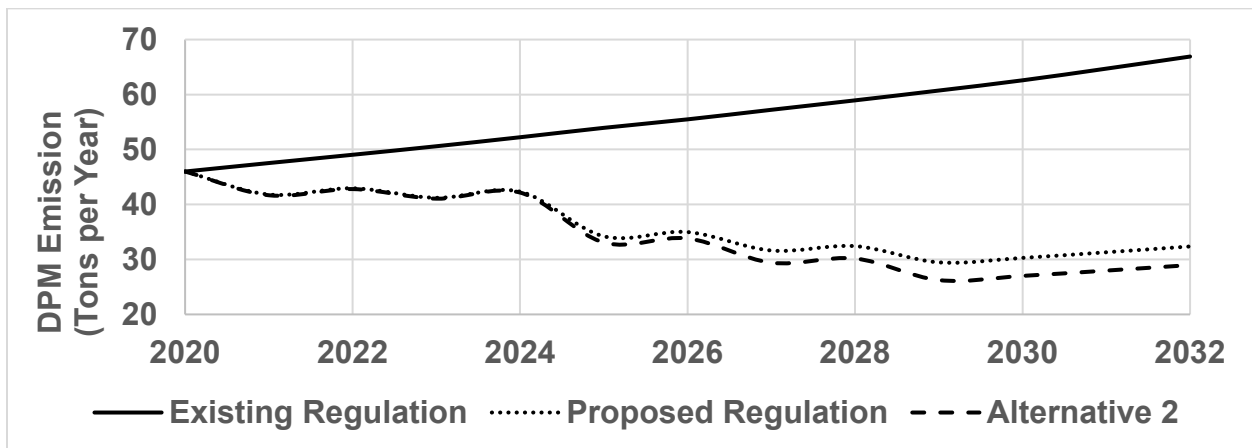
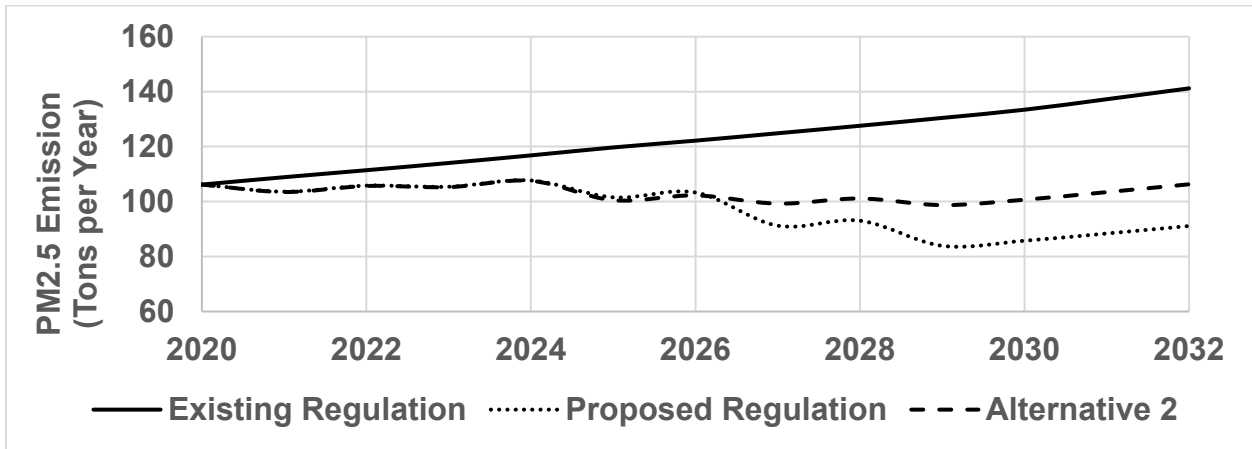
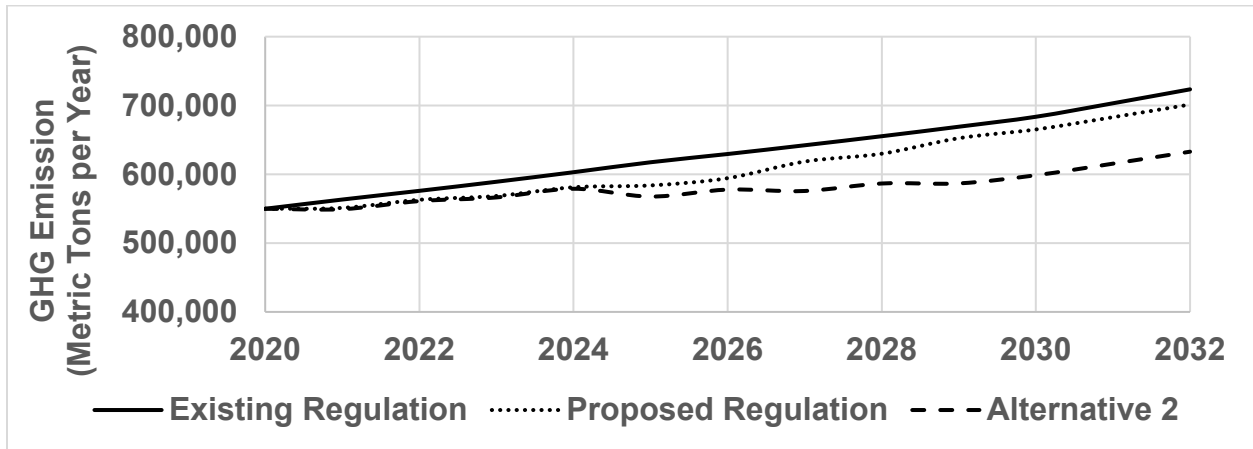


Figure X-3: Alternative 2 – PM2.5 Emissions Estimated

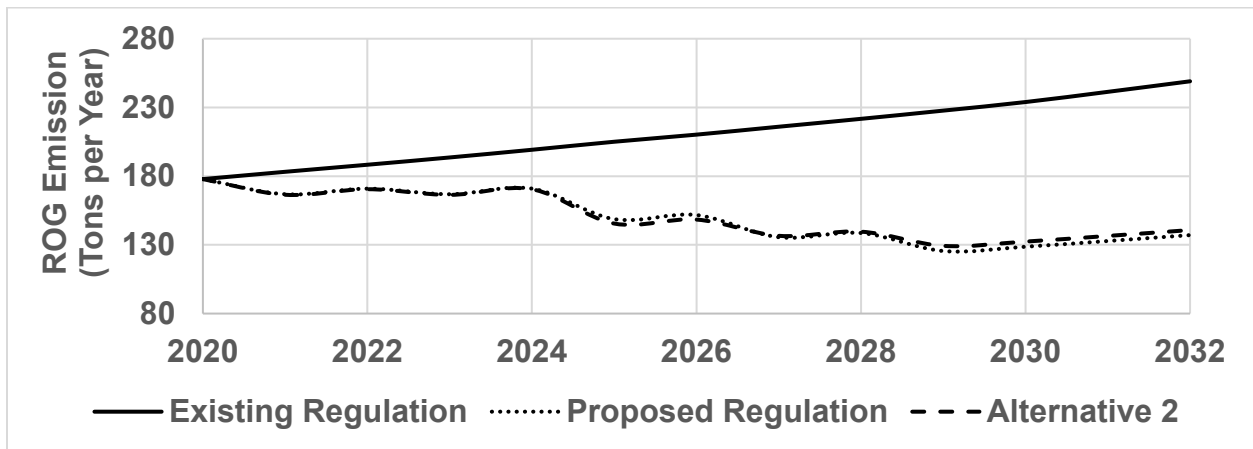




**Figure X-4: Alternative 2 - GHG Emissions Estimates**



**Figure X-5: Alternative 4 - ROG Emissions Estimates**



As discussed in more detail in the accompanying SRIA (Appendix C-1), Alternative 2 would cost more, would be less cost effective to implement than the Proposed Regulation, and provides less flexibility than allowing site-specific selection of most the feasible and cost effective strategies. For vessels that visit California terminals infrequently, requiring vessel modifications would most likely not be economical. Installing shore power systems at berths or terminals where shore power vessels would visit sparingly would be costly and achieve minimal additional emissions reductions. Alternative 2 allows only one compliance pathway and provides no flexibility for a regulated party to select the best control option to best fit their unique operations. While Alternative 2 may achieve more DPM, ROG and GHG emissions reductions than the Proposed Regulation, CARB staff believes shore power is not appropriate for all terminals and vessels and would not result in a less burdensome regulation.

**C. Alternative 3: “Alternative Proposal for Amendments to At-Berth Regulations” provided by California Association of Port Authorities (CAPA), Cruise Lines International Association (CLIA), Pacific Merchant Shipping Association (PMSA), Western States Petroleum Association (WSPA), and World Shipping Council (WSC) on February 15, 2019<sup>224</sup>**

An industry coalition comprising five marine industry groups submitted their proposal to CARB as an alternative to the Proposed Regulation. Alternative 3 would involve amending the Existing Regulation, consisting of addressing implementation challenges for the regulated (container, reefer and cruise vessels) vessel fleets and calls for feasibility and cost effectiveness studies prior to future expansion of the regulation. Specific elements of the Alternative 3 are outlined below.

**1. Feasibility Studies**

Alternative 3 calls for a series of feasibility studies and reports to the Board before any expansion of the Existing Regulation’s requirements or setting regulatory implementation dates. Feasibility studies conducted in cooperation with industry stakeholders would be required. Before any additional vessel types or terminals could be subject to control requirements, feasibility studies must be conducted for ro-ro, bulk/general cargo, and tanker vessel categories and the port/terminals where they visit to establish whether or not these categories would be suitable candidates for inclusion in the Proposed Regulation. These feasibility studies would identify cost effective emissions control programs based on reasonable implementation deadlines, safety concerns associated with the use of potential emissions control strategies, infrastructure readiness, and technological feasibility.

**2. Regulated Vessels and Associated Terminals/Ports (Subject to the Existing Regulation)**

Alternative 3 would maintain the Existing Regulation’s thresholds of 25 or more container or reefer vessel visits and 5 or more cruise vessel visits. This proposal would remove the Existing Regulation’s three-hour requirement for connecting to a CARB approved emissions control strategy and would replace existing visit requirements with a compliance checklist.

Consistent with the Existing Regulation, vessel compliance requirements would remain at 80 percent in 2020 for all vessels covered under the Existing Regulation and would increase to 85 percent in 2031. Terminals that received regulated vessel visits would be given an 80 percent compliance requirement that would begin in 2022 and terminal compliance requirements could increase to 90 percent in 2031. Alternative 3 would rely on feasibility “check-ins” in 2022, 2025, 2028, and 2031 to assess whether vessel

---

<sup>224</sup> California Association of Port Authorities, Cruise Lines International Association, Pacific Merchant Shipping Association, Western States Petroleum Association, and World Shipping Council – Joint Comment Letter to CARB: Alternative Proposal for Amendments to At-Berth Regulations, dated February 15, 2019.

emissions requirements could increase to 85 percent and terminal compliance requirements could increase to 90 percent sooner than 2031. Vessel and terminal compliance would be established through a compliance checklist and be determined on an annual fleet or berth average basis.

### **3. Recordkeeping and Reporting Requirements**

Beginning in 2021, all vessels must report visit information annually (including all bulk, general cargo, ro-ro, and tanker vessel fleets). All ports and marine terminal operators must comply with recordkeeping, reporting requirements and submit port and terminal plans with subsequent updates beginning in 2021 for regulated fleets (covered under the Existing Regulation). Updates must include description and timeline of all infrastructure installations planned at specific-berths. Terminal and vessel fleet compliance reporting would occur annually through an online reporting system.

Ports and marine terminals serving vessel fleets that are not covered by the Existing Regulation would need to comply with recordkeeping, reporting rules and submit terminal plans with subsequent updates starting in 2024.

Alternative 3 may result in reduced costs relative to the Proposed Regulation due to:

- Fewer additional actions would be required for compliance for the regulated entities covered by the Existing Regulation. Alternative 3 would not require vessels that are under the threshold of the Existing Regulation to comply with the regulation. The majority of vessel fleets, terminals and ports included in the Existing Regulation will have already made the investments required to comply with the 80 percent compliance requirement by 2020, therefore it is not expected that these entities would incur significant additional cost under Alternative 3.
- The unregulated vessels and ports/terminals may or may not be included in the Regulation under Alternative 3 as the inclusion is contingent on the outcome of the required feasibility studies. Without specific regulatory commitments for additional vessel categories and port/terminals the cost impacts would be indeterminate.

Compared to the Proposed Regulation, Alternative 3 would achieve substantially less emissions reductions for NO<sub>x</sub>, ROG, PM<sub>2.5</sub>, DPM, GHG, and black carbon. As a result, it would fail to provide significant additional public health benefits including communities adjacent to ports and terminals throughout the state due to:

- More stringent emissions reduction requirements for vessel fleets (85 percent fleet requirements) would not be introduced until 2031 unless a feasibility evaluation would support an earlier implementation date.

- Terminal responsibilities would not be in effect until 2022 and the more stringent requirement (90 percent terminal requirements) would not be introduced until 2031 unless a feasibility evaluation would support an earlier implementation date.
- Alternative 3 would not specify a time limit at berth to connect to shore power or alternative strategies such as capture and control system. As a result, further emissions reductions are uncertain and opportunities could be missed with the delay in promptly connecting to a given CARB approved emissions control strategy.
- Vessel categories under the threshold in the Existing Regulation would not be subject to the regulatory requirements under Alternative 3, therefore would not contribute to further emissions reductions.
- Inclusion of unregulated vessels and ports/terminals is uncertain under Alternative 3 as the inclusion is contingent on the outcome of the feasibility studies. Without commitments to regulate additional vessel categories and port/terminals where they visit, assessing the emissions reduction impacts would be speculative for CARB staff to analyze.

Although Alternative 3 shares some similarities to the Proposed Regulation, such as recordkeeping, reporting and compliance checklists, it does not provide additional health benefits to California residents. Alternative 3 does not meet the requirements of being less burdensome and equally effective in achieving the purposes of the Proposed Regulation.

#### **D. Small Business Alternative**

The Board has not identified any reasonable alternatives that would lessen any adverse impact on small business.

#### **E. Performance Standards in Place of Prescriptive Standards**

With respect to Government Code sections 11346.2(b)(4)(A) and 11346.2(b)(1), the Proposed Regulation does not mandate the use of specific technologies or equipment, or prescribe specific actions for regulated entities.

#### **F. Health and Safety Code section 57005 Major Regulation Alternatives**

CARB estimates the Proposed Regulation will have an economic impact on the State's business enterprises of more than \$10 million in one or more years of implementation. CARB will evaluate alternatives submitted, and consider whether there is a less costly alternative or combination of alternatives that would be equally as effective in achieving increments of environmental protection in full compliance with statutory mandates within the same amount of time as the proposed regulatory requirements, as required by HSC section 57005.

**XI. JUSTIFICATION FOR ADOPTION OF REGULATIONS DIFFERENT FROM FEDERAL REGULATIONS CONTAINED IN THE CODE OF FEDERAL REGULATIONS**

Government Code section 11346.2(b)(6) requires CARB to describe its efforts to avoid unnecessary duplication or conflicts with federal regulations that address the same issues. Currently, there are no federal regulations which address the same issues as CARB's Proposed Regulation, so the Proposed Regulation does not conflict with nor duplicate any federal regulations.

## **XII. PUBLIC PROCESS FOR DEVELOPMENT OF THE PROPOSED ACTION (PRE-REGULATORY INFORMATION)**

Consistent with Government Code sections 11346, subdivision (b), and 11346.45, subdivision (a), and with the Board's long-standing practice, CARB staff held public workshops and had other meetings with interested persons during the development of the proposed regulation. These informal pre-rulemaking discussions provided staff with useful information that was considered during development of the Proposed Regulation that is now being proposed for formal public comment.

### **A. Public Engagement for Rulemaking Process**

The Proposed Regulation was developed based on the public health impacts of freight operations through an extensive public process.

The rulemaking process for the Proposed Regulation began in late 2014. During the course of the rulemaking process, CARB staff conducted more than 150 meetings, phone calls, and site visits with members of impacted communities, environmental justice advocates, air districts, industry stakeholders (including vessel operators, ports, terminal operators, industry associations, and alternative technology operators), U.S. Coast Guard, CSLC, and other agencies. Meeting formats included public workshops, work group meetings, community meetings, and meetings with individual stakeholders.

Staff conducted and participated in various meetings, teleconferences, and webinars with trade associations, technology providers, vessel operators, terminal operators, port authorities, and the communities surrounding the seaports, to discuss staff's proposal and gather input and information. Staff toured many California seaports and independent marine terminals to learn more about their individual business operations and understand the scope of challenges facing the industry and the surrounding community. Additionally, staff also toured multiple vessels including bulk, container, tanker, and ro-ro vessels to learn about their unique layout and operational challenges.

Staff also held numerous meetings and teleconferences with industry associations, individual manufacturers, and groups of industry representatives to gather information and receive input on staff's proposal. Among the industry associations represented were Pacific Merchant Shipping Association, World Shipping Council, Western States Petroleum Association, California Association of Port Authorities, Cruise Lines International Association, and Chamber of Shipping (of United States and Canada). Discussions were also held with representatives from the International Longshore and Warehouse Union, who play a vital role in the shore power connection process for vessels calling at California seaports, manufacturers of engine and emissions reductions technologies for vessels, including MAN Diesel and Turbo, Wärtsilä, and Alfa Laval, and shore power equipment manufacturers including CAVOTEC and Iqus. Staff also consulted with multiple government agencies throughout the development of the Proposed Regulation, including U.S. EPA, U.S. Coast Guard, California Office of

Spill Prevention and Response, California local air districts, California Ports, CSLC, and Harbor Safety Committees in San Francisco, Los Angeles, and Long Beach. Additionally, staff actively engaged with the alternative capture and control system manufacturers, Advanced Cleanup Technologies, Inc.<sup>225</sup> (ACTI) and Clean Air Engineering – Maritime<sup>226</sup>, as well as new emerging companies including Stax Engineering.

Throughout the rulemaking process, access to information including notices, presentations, and contact information was made available on CARB's Shore Power for Ocean-Going Vessels website.<sup>227</sup>

## **B. Public Workshops**

Staff conducted four public workshops to discuss the development of the Proposed Regulation and one workshop to discuss updates to CARB's ocean-going vessel emissions inventory. All the workshops were announced with the issuance of a public workshop notice at least three weeks prior to their occurrence. These notices were posted to the program's website and sent out to over 3,800 subscribers to the "Marine Vessel Activities (Commercial)" and "Shore Power for Ocean-Going Vessels" public email list serves. Each of these workshops were open to all members of the public. CARB staff made documents and/or presentations available in advance of the meetings/workshops to help stakeholders prepare for the discussions.

The first workshop was held on November 6, 2014, in Sacramento, California, shortly after implementation of the Existing Regulation began. The first workshop introduced the idea of potential regulatory amendments to address initial challenges seen during implementation of the Existing Regulation, and discussed approaches to potentially enhance the expected emissions benefits of the Existing Regulation. CARB staff also sought additional public input on implementation challenges, and sought stakeholder feedback on preliminary concepts to modify the Existing Regulation requirements to address these challenges. At this workshop the concept of including additional vessel types and ports was discussed as a possibility for additional reductions under the amendments. The workshop was webcast with the ability to submit questions online to ensure all interested parties would be able to access the information and participate in the discussion.

A second set of public workshops took place on August 28, 2017, in Los Angeles, California and on September 7, 2017, in Sacramento, California. The workshops included a presentation summarizing implementation of the Existing Regulation, an emissions inventory update, and further developed draft regulatory concepts. At these

---

<sup>225</sup>Advanced Maritime Emissions Control System (AMECS), Advanced Environmental Group, accessed September 8, 2019, <http://advancedemissioncontrol.com/>

<sup>226</sup> Maritime Emissions Treatment System, Clean Air Engineering, accessed September 8, 2019, <http://caemaritime.com/>.

<sup>227</sup> California Air Resources Board, Shore Power for Ocean-going Vessels, accessed September 6, 2019, <https://www.arb.ca.gov/ports/shorepower/shorepower.htm>.

workshops the idea of adding additional vessel types, ports and terminals to the At-berth amendments was discussed in more detail and became more definitive. In addition the concept of re-structuring the Existing Regulation from a fleet requirement to an every vessel, every visit requirement took form. The workshop in Los Angeles was attended by 55 participants and an additional 40 participants attended the Sacramento workshop. The Sacramento workshop was webcast to ensure the opportunity for broader public participation.

The third set of public workshops took place on September 6, 2018, in Oakland, California and on September 17, 2018, in San Pedro, California. At these workshops, staff presented draft regulatory language, refined regulatory concepts, preliminary cost analyses, estimates of emissions and health risk reductions, solicited alternatives for the SRIA, and solicited early scoping feedback on the EA that would be prepared for this regulatory action. These workshops therefore also served as a CEQA scoping meeting. At these workshops, a couple noteworthy changes in the rulemaking process took place. The idea of replacing the Existing Regulation with a new regulation rather than making amendments to the Existing Regulation was introduced and the requirement for auxiliary boiler emissions to be reduced in combination with the auxiliary engine emissions were introduced. There were 55 participants that attended the Oakland workshop and 76 participants at the San Pedro workshop. No webcast options were available for either of these workshops, which were held at non-CARB facilities that did not provide webcasting.

A non-regulatory public workshop to discuss updates to CARB's emissions inventory for ocean-going vessels at berth took place on February 26, 2019, in Sacramento, California. At this workshop, CARB staff proposed updates to the ocean-going vessel data sources, modeling methodologies, and presented draft results from these updates. The updated emissions inventory informed the development of the Proposed Regulation, and was webcast to ensure the opportunity for broader public participation.

A fourth set of public workshops took place on May 14, 2019, in Sacramento, California and on May 16, 2019, in Long Beach, California. At these workshops, staff presented updates to the draft regulatory language that was posted to CARB's shore power website in September 2018, refined regulatory concepts, updated cost analyses, and estimates of emissions and non-cancer health valuation benefits. At these workshops, the interim evaluation was introduced in the proposal as a way to address the concern of industry's ability to comply with the implementation dates set forth in the Proposed Regulation. Also, the TIE/VIE and remediation fund were presented as compliance paths under the Proposed Regulation during this workshop. There were 24 participants that attended the Sacramento workshop and 48 participants at the Long Beach workshop. The Sacramento workshop was webcast with the ability to submit questions online to ensure the opportunity for broader public participation.



### C. Community Meetings

Regulatory staff participated in four broader freight-focused community meetings during the week of September 18, 2017, in Lamont, Long Beach, Fontana, and Oakland, California with more than 130 attendees in total, including local residents and more than 70 organizations. The meetings were held using the World Café method, with one to two CARB staff members at a table with multiple community members. The tables were divided into discussion topics for: seaports, rail yards, warehouses, and distribution centers.

Staff also participated in a joint AB 617 community meeting in San Diego, California on November 28, 2017. This meeting was to facilitate discussion and answer questions on concepts to control pollution from freight facilities and reduce exposure in the communities most affected by air pollution. Participants gathered in small groups to discuss their views and raise questions regarding pollution at seaports, border crossings, and warehouses.

Community members voiced their concerns related to impacts on communities from freight facilities, diesel soot, smog/local air quality, and odors, noise, and light. Residents also described the health impacts (e.g., asthma and cancer) they are experiencing, particularly to children and elderly in the affected neighborhoods. Community members emphasized the need to improve enforcement of CARB regulations to reduce smoking from truck, vessel, and locomotive engines. Community members expressed support for zero-emissions operations, such as shore power, and improved infrastructure at local seaports. Advocates also pushed CARB for improved enforceability, more transparency, and better cooperation between State and local agencies.

CARB staff also extended its outreach to communities surrounding seaports and affected by the ocean-going vessel activity by participating in meetings and monthly calls with the California Cleaner Freight Coalition (CCFC). These monthly calls focused on updating community advocacy groups on the development process of CARB's freight-related regulatory activities. In addition, regulatory staff met with representatives from the CCFC on July 13, 2018, in Sacramento, California and on September 21, 2018, in Long Beach, California to hear community advocates' ideas and comments, and to discuss staff's draft concepts for the Proposed Regulation. The CCFC<sup>228</sup>, a member of the Moving Forward Network, is made up of a variety of environmental, public health, and environmental justice groups, including: American Lung Association, Bay Area Healthy Committees, Catholic Charities – Diocese of Stockton, Central California Asthma Collaborative, Center for Community Action and Environmental Justice, Clinica Sierra Vista, Coalition for a Safe Environment, Coalition for Clean Air, Comite Civico del Valle, Communities for a Better Environment, Ditching Dirty Diesel Collaborative, EarthJustice, East Yard Communities for Environmental Justice, End Oil/Communities for Clean Ports, Medical Advocates for Healthy Air, Natural Resources Defense Council, Urban and Environmental Policy Institute at

---

<sup>228</sup> California Cleaner Freight Coalition (CCFC), accessed August 2, 2019, <https://caceanfreight.org/>.

Occidental College, Regional Asthma Management and Prevention, Sierra Club California, Sunflower Alliance, Union of Concerned Scientists, and Valley Improvement Projects.

#### **D. Work Group and Informational Meetings**

Staff held numerous work group and informational meetings, teleconferences, and webinars with trade associations, technology providers, vessel operators, terminal operators, port authorities, and the communities surrounding the seaports, to discuss staff's proposal and gather input and information. In addition to hearing feedback about staff's regulatory concepts, these meetings allowed CARB staff to learn and to share information regarding various types of vessel operations, including the cost, feasibility, and application of various emissions control strategies.

CARB staff hosted a webinar on July 19, 2018, with industry stakeholders to discuss staff's preliminary concepts for the Proposed Regulation. The webinar walked participants through the purpose of the draft regulatory concepts and preliminary implementation schedule, the method for determining which vessels and ports would be included in the Proposed Regulation, and responsibilities for vessel owners/operators, terminals, ports, and alternative technology providers. During this webinar, staff specifically requested stakeholders to submit proposed regulatory alternatives for the economic analysis.

CARB staff also held four work group meetings in August 2018, specifically to discuss the expected costs to industry from the Proposed Regulation.<sup>229</sup> These meetings were held with participants from ports and terminals and container, reefer, cruise, ro-ro, bulk/general cargo, and tanker vessel operators. Staff distributed preliminary cost estimates in advance of the meetings, and met separately with each industry sector. Based on the industry feedback, CARB staff substantially revised its initial cost estimates. At the meetings, staff again requested suggestions for regulatory alternatives from the stakeholders present.

In February 2019, CARB staff hosted three additional work group meetings, one large meeting to discuss updates to staff's regulatory concepts with all industry members and two smaller breakout sessions to discuss staff's initial draft Berth Analysis (Appendix E) with each industry sector. Staff distributed a white paper discussing the changes to the regulatory concepts that had been made between the September 2018 workshops and these February 2019 work group meetings, as well as the draft version of the Berth Analysis in advance of the meetings. CARB staff made substantial changes to some of the regulatory concepts and staff's Berth Analysis (which is used as a basis for staff's cost analysis) as a result of these work group meetings.

In addition to industry work groups focused on regulatory development, CARB staff also held several meetings and phone calls with existing and new technology providers in

---

<sup>229</sup> California Air Resources Board, At-Berth Regulation Preliminary Cost Information, August 14, 2018, <https://ww3.arb.ca.gov/ports/shorepower/meetings/08152018/costinformation.pdf>.

order to learn about opportunities for further development of existing emissions control technologies for marine applications. Staff spoke with providers and manufacturers of both existing and new and promising emissions control technologies, including hybrid systems, cleaner engines, boilers, scrubbers, and new capture and control systems. These meetings allowed CARB staff to further their knowledge of emissions control strategies for ocean-going vessels, and influenced staff's decision to structure the Proposed Regulation in such a way that could allow future emissions control strategies to be used for compliance.

### **E. Port/Terminal Tours and Site Visits**

Staff toured many of California's seaports, terminals, and vessels to learn more about their individual business operations, day-to-day operations and understand the scope of challenges facing the industry and surrounding communities. These tours included visiting multiple container, reefer, ro-ro, tanker, and bulk/general cargo terminals across California. Staff were also able to board container, ro-ro, tanker, and bulk vessels; this gave staff an opportunity to interact with the vessel's crew in order to better understand the vessel-side berth operations and challenges they face during their time at berth.

These site visits and vessel tours helped CARB staff gain a "real world" appreciation for elements such as vessel engine sizes and layouts, the process to berth and then complete a shore power plug in at berth, and the daily operations and potential space constraints at various ports and terminals. This exposure helped CARB staff better understand how the Existing Regulation functions, what operational challenges exist both on the vessel and at the terminal/port and how to address them in the Proposed Regulation, and helped staff to craft the regulatory language in order to incorporate mechanisms to deal with many of these challenges.

For additional information and a comprehensive list of all staff's outreach efforts during the regulatory process, see Appendix F.

### XIII. References

1. Explanatory footnote
2. Explanatory footnote
3. U.S. EPA, What is NO<sub>2</sub>, accessed September 8, 2019, [https://www.epa.gov/no2\\_pollution/basic-information-about-no2#](https://www.epa.gov/no2_pollution/basic-information-about-no2#).
4. CARB, Inhalable Particulate Matter and Health (PM<sub>2.5</sub> and PM<sub>10</sub>), August 10, 2017 (accessed September 8, 2019), <https://ww3.arb.ca.gov/research/aaqs/common-pollutants/pm/pm.htm>.
5. CARB, Overview: Diesel Exhaust & Health, accessed September 8, 2019, <https://ww2.arb.ca.gov/resources/overview-diesel-exhaust-and-health>.
6. IMO, Greenhouse Gas Emissions, accessed September 8, 2019, <http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/GHG-Emissions.aspx>.
7. Stefanini, S., Climate Change News, “Countries Inch Towards 'Bare Minimum' Climate Target For Shipping”, April 10, 2018, <https://www.climatechangenews.com/2018/04/10/countries-inch-towards-bare-minimum-climate-target-shipping/>.
8. California Health and Safety Code § 38566, Division 25.5, Senate Bill No. 32, September 8, 2016, [https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160SB32](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB32).
9. United Nations Climate Change, The Paris Agreement, accessed September 8, 2019, <https://unfccc.int/process/the-paris-agreement/what-is-the-paris-agreement>.
10. California Air Resources Board, Update On California Actions to Minimize Community Health Impacts From Freight, March 21, 2019, <https://ww3.arb.ca.gov/board/books/2019/032119/19-3-2pres.pdf>.
11. American Lung Association, State of the Air 2019, accessed September 8, 2019, <https://www.lung.org/assets/documents/healthy-air/state-of-the-air/sota-2019-full.pdf>.
12. Office of Environmental Health Hazard Assessment, CalEnviroScreen 3.0, June 25, 2018, <https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30>.
13. California Air Resources Board, Draft Community Air Protection Blueprint For Selecting Communities, Preparing Community Emissions Reduction Programs, Identifying Statewide Strategies, and Conducting Community Air Monitoring, June 7, 2018,

[https://ww2.arb.ca.gov/sites/default/files/2018-06/draft\\_community\\_air\\_protection\\_blueprint.pdf](https://ww2.arb.ca.gov/sites/default/files/2018-06/draft_community_air_protection_blueprint.pdf).

14. California Health and Safety Code § 40920.6, 42400, 42402, 39607.1, 40920.8, 42411, 42705.5, and 44391.2, Division 26, Assembly Bill No. 617, Nonvehicular Air Pollution: Criteria Air Pollutants and Toxic Air Contaminants, July 26, 2017, [https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201720180AB617](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180AB617).
15. California Health and Safety Code § 38500 – 38599, Division 25.5, Assembly Bill No. 32, California Global Warming Solutions Act of 2006, September 27, 2006, [http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab\\_0001-0050/ab\\_32\\_bill\\_20060927\\_chaptered.pdf](http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001-0050/ab_32_bill_20060927_chaptered.pdf).
16. California Health and Safety Code § 38566, Division 25.5, Senate Bill No. 32, September 8, 2016, [https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160SB32](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB32).
17. California Health and Safety Code § 39730, Division 26, Senate Bill No. 605, Short-lived climate pollutants, September 21, 2014, [http://leginfo.ca.gov/pub/13-14/bill/sen/sb\\_0601-0650/sb\\_605\\_bill\\_20140921\\_chaptered.htm](http://leginfo.ca.gov/pub/13-14/bill/sen/sb_0601-0650/sb_605_bill_20140921_chaptered.htm).
18. Office of Environmental Health Hazard Assessment, Indicators of Climate Change in California, May 2018, <https://oehha.ca.gov/media/downloads/climate-change/report/2018caindicatorsreportmay2018.pdf>.
19. California Health and Safety Code § 38500 – 38599, Division 25.5, Assembly Bill No. 32, California Global Warming Solutions Act of 2006, September 27, 2006, [http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab\\_0001-0050/ab\\_32\\_bill\\_20060927\\_chaptered.pdf](http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001-0050/ab_32_bill_20060927_chaptered.pdf).
20. Executive Order B-30-15, July 17, 2015, <https://www.ca.gov/archive/gov39/2015/07/17/news19046/>.
21. California Health and Safety Code § 38566, Division 25.5, Senate Bill No. 32, September 8, 2016, [https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160SB32](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB32).
22. U.S. EPA, What is NO<sub>2</sub>, accessed September 8, 2019, [https://www.epa.gov/no2\\_pollution/basic-information-about-no2#](https://www.epa.gov/no2_pollution/basic-information-about-no2#).
23. CARB, Inhalable Particulate Matter and Health (PM<sub>2.5</sub> and PM<sub>10</sub>), August 10, 2017 (accessed September 8, 2019), [https://ww3.arb.ca.gov/research/aaqs/common\\_pollutants/pm/pm.htm](https://ww3.arb.ca.gov/research/aaqs/common_pollutants/pm/pm.htm).

24. CARB, Overview: Diesel Exhaust & Health, accessed September 8, 2019, <https://ww2.arb.ca.gov/resources/overview-diesel-exhaust-and-health>.
25. IMO, Greenhouse Gas Emissions, accessed September 8, 2019, <http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/GHG-Emissions.aspx>.
26. Stefanini, S., Climate Change News, “Countries Inch Towards 'Bare Minimum' Climate Target For Shipping”, April 10, 2018, <https://www.climatechangenews.com/2018/04/10/countries-inch-towards-bare-minimum-climate-target-shipping/>.
27. California Health and Safety Code § 38566, Division 25.5, Senate Bill No. 32, September 8, 2016, [https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160SB32](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB32).
28. United Nations Climate Change, The Paris Agreement, accessed September 8, 2019, <https://unfccc.int/process/the-paris-agreement/what-is-the-paris-agreement>.
29. California Code of Regulations Title 17 §93118.2, Airborne Toxic Control Measure for Fuel Sulfur and Other Operational Requirements for Ocean-Going Vessels Within California Waters and 24 Nautical Miles of the California Baseline, Amended October 27, 2011, <https://ww3.arb.ca.gov/ports/marinevess/documents/fuelogv17.pdf>.
30. California Code of Regulations Title 17 § 93118.3, Airborne Toxic Control Measure for Auxiliary Diesel Engines Operated on Ocean-Going Vessels At-Berth in a California Port, December 3, 2008, <https://ww3.arb.ca.gov/regact/2007/shorepwr07/93118-t17.pdf>.
31. CARB, Emissions Inventory, CEPAM: 2016 SIP - Standard Emission Tool, Accessed September 8, 2019, <https://www.arb.ca.gov/app/emsinv/fcemssumcat/fcemssumcat2016.php>.
32. Explanatory footnote
33. California Health and Safety Code § 41701, Division 26, General Limitations, 1975, [https://leginfo.legislature.ca.gov/faces/codes\\_displayText.xhtml?lawCode=HSC&division=26.&title=&part=4.&chapter=3.&article=1](https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=HSC&division=26.&title=&part=4.&chapter=3.&article=1).
34. California Health and Safety Code § 39660 et seq., Division 26, Identification of Toxic Air Contaminants, 1983, [https://leginfo.legislature.ca.gov/faces/codes\\_displayText.xhtml?lawCode=HSC&division=26.&title=&part=2.&chapter=3.5.&article=3](https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=HSC&division=26.&title=&part=2.&chapter=3.5.&article=3).

35. California Health and Safety Code § 43013, Division 26, General Provisions, 1975, [https://leginfo.legislature.ca.gov/faces/codes\\_displaySection.xhtml?lawCode=HSC&sectionNum=43013](https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=HSC&sectionNum=43013).
36. California Health and Safety Code § 43018, Division 26, General Provisions, 1975, [https://leginfo.legislature.ca.gov/faces/codes\\_displaySection.xhtml?lawCode=HSC&sectionNum=43018](https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=HSC&sectionNum=43018).
37. California Health and Safety Code § 38500 - 38599, Division 25.5, Assembly Bill No. 32, California Global Warming Solutions Act of 2006, September 27, 2006, [http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab\\_0001-0050/ab\\_32\\_bill\\_20060927\\_chaptered.pdf](http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001-0050/ab_32_bill_20060927_chaptered.pdf).
38. California Health and Safety Code § 38566, Division 25.5, Senate Bill No. 32, September 8, 2016, [https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160SB32](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB32).
39. California Health and Safety Code § 39730, Division 26, Senate Bill No. 605, Short-lived climate pollutants, September 21, 2014, [http://leginfo.ca.gov/pub/13-14/bill/sen/sb\\_0601-0650/sb\\_605\\_bill\\_20140921\\_chaptered.htm](http://leginfo.ca.gov/pub/13-14/bill/sen/sb_0601-0650/sb_605_bill_20140921_chaptered.htm).
40. Explanatory footnote
41. California Air Resources Board, Mobile Source Emissions Inventory, Draft 2019 OGV Emissions Inventory Model, Last Updated March 1, 2019 (accessed September 8, 2019), <https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-documentation-offroad-0>.
42. California Air Resources Board, Mobile Source Emissions Inventory, Draft 2019 OGV Emissions Inventory Model, Last Updated March 1, 2019 (accessed September 8, 2019), <https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-documentation-offroad-0>.
43. California Air Resources Board, Draft Technology Assessment: Ocean-Going Vessels, pg. 68, May 2018, [https://ww3.arb.ca.gov/msprog/tech/techreport/ogv\\_tech\\_report.pdf](https://ww3.arb.ca.gov/msprog/tech/techreport/ogv_tech_report.pdf).
44. California Air Resources Board, Draft Technology Assessment: Ocean-Going Vessels, pg. 68, May 2018, [https://ww3.arb.ca.gov/msprog/tech/techreport/ogv\\_tech\\_report.pdf](https://ww3.arb.ca.gov/msprog/tech/techreport/ogv_tech_report.pdf).
45. DNV-GL, Alternative Fuels: The Options, October 9, 2018, <https://www.dnvgl.com/expert-story/maritime-impact/alternative-fuels.html>.



46. World Shipping Council, Comment Letter to CARB: Suggestions on Possible California At-Berth Regulation Allowances, Incentives or Operational Considerations, dated July 26, 2018.
47. Maritime Emissions Treatment System, Clean Air Engineering, accessed September 8, 2019, <http://caemaritime.com/>.
48. Advanced Maritime Emissions Control System (AMECS), Advanced Environmental Group, accessed September 8, 2019, <http://advancedemissioncontrol.com/>.
49. Fehrenbacher, K., The future of ferries is electric, too, GreenBiz, June 5 2019, <https://www.greenbiz.com/article/future-ferries-electric-too>.
50. Geuss, M., Group to fund and operate first hydrogen fuel ferry fleet in the US, ARS Technica, June 12, 2019, <https://arstechnica.com/information-technology/2019/06/group-to-fund-and-operate-first-hydrogen-fuel-ferry-fleet-in-the-us/>.
51. Explanatory footnote
52. Letter from Clean Air Engineering – Maritime to CARB, Dated August 12, 2019
53. California Air Resources Board, Mobile Source Emissions Inventory, Draft 2019 OGV Emissions Inventory Model, Last Updated March 1, 2019 (accessed September 8, 2019), <https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-documentation-offroad-0>.
54. Explanatory footnote
55. California State Lands Commission, 2017 Vessel Visit Database.
56. Phone conversation with California State Lands Commission staff on March 27, 2019.
57. California Health and Safety Code § 39660 et seq., Division 26, Identification of Toxic Air Contaminants, 1983, [https://leginfo.legislature.ca.gov/faces/codes\\_displayText.xhtml?lawCode=HSC&division=26.&title=&part=2.&chapter=3.5.&article=3](https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=HSC&division=26.&title=&part=2.&chapter=3.5.&article=3).
58. California Health and Safety Code § 43013, Division 26, General Provisions, 1975, [https://leginfo.legislature.ca.gov/faces/codes\\_displaySection.xhtml?lawCode=HSC&sectionNum=43013](https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=HSC&sectionNum=43013).
59. California Health and Safety Code § 43018, Division 26, General Provisions, 1975, [https://leginfo.legislature.ca.gov/faces/codes\\_displaySection.xhtml?lawCode=HSC&sectionNum=43018](https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=HSC&sectionNum=43018).



60. California Health and Safety Code § 38500 - 38599, Division 25.5, Assembly Bill No. 32, California Global Warming Solutions Act of 2006, September 27, 2006, [http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab\\_0001-0050/ab\\_32\\_bill\\_20060927\\_chaptered.pdf](http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001-0050/ab_32_bill_20060927_chaptered.pdf).
61. California Health and Safety Code § 38566, Division 25.5, Senate Bill No. 32, September 8, 2016, [https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160SB32](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB32).
62. California Health and Safety Code § 39730, Division 26, Senate Bill No. 605, Short-lived climate pollutants, September 21, 2014, [http://leginfo.ca.gov/pub/13-14/bill/sen/sb\\_0601-0650/sb\\_605\\_bill\\_20140921\\_chaptered.htm](http://leginfo.ca.gov/pub/13-14/bill/sen/sb_0601-0650/sb_605_bill_20140921_chaptered.htm).
63. Port of Los Angeles, Port 101, accessed September 8, 2019, <https://www.portoflosangeles.org/about/port-101>.
64. Port of Long Beach, FAQs - Does The Port Receive Funding From The City of Long Beach, accessed September 8, 2019, <http://www.polb.com/about/faqs.asp#530>.
65. Hoppe-Spiers, J., Port of Stockton, Transportation and Logistics International, accessed September 8, 2019, <http://www.tlimagazine.com/sections/shipping-and-ports/2359-port-of-stockton>.
66. Department of Transportation, Seaports, accessed October 18, 2018.
67. California State Lands Commission, 2017 Vessel Visit Database
68. Explanatory footnote
69. Explanatory footnote
70. Explanatory footnote
71. IMO, Prevention of Air Pollution from Ships Annex VI and New Engine NOx Emissions Limits Under IMO Annex VI, accessed September 8, 2019, [http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Nitrogen-oxides-\(NOx\)---Regulation-13.aspx](http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Nitrogen-oxides-(NOx)---Regulation-13.aspx).
72. IMO, UN body adopts climate change strategy for shipping, April 13 2018, <http://www.imo.org/en/MediaCentre/PressBriefings/Pages/06GHGinitialstrategy.aspx>
73. World Shipping Council, How Liner Shipping Works, accessed September 25, 2019, <http://www.worldshipping.org/about-the-industry/how-liner-shipping-works>

74. World Shipping Council, Container Ship Design, accessed October 18, 2018, <http://www.worldshipping.org/about-the-industry/liner-ships/container-ship-design>.
75. California State Lands Commission, 2017 Vessel Visit Database.
76. Starcrest Consulting Group, LLC, Port of Los Angeles Inventory of Air Emissions – 2016, July 2017, [https://kentico.portoflosangeles.org/getmedia/880bc597-84bc-4ae6-94e2-59a2e6027f42/2017\\_Air\\_Emissions\\_Inventory](https://kentico.portoflosangeles.org/getmedia/880bc597-84bc-4ae6-94e2-59a2e6027f42/2017_Air_Emissions_Inventory).
77. California Air Resources Board, Mobile Source Emissions Inventory, Draft 2019 OGV Emissions Inventory Model, Last Updated March 1, 2019 (accessed September 8, 2019), <https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-documentation-offroad-0>.
78. California Air Resources Board, Mobile Source Emissions Inventory, Draft 2019 OGV Emissions Inventory Model, Last Updated March 1, 2019 (accessed September 8, 2019), <https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-documentation-offroad-0>.
79. Cruise Industry News, Song of Norway Sold, August 30, 1996, accessed September 4, 2019, <https://www.cruiseindustrynews.com/cruise-news/14621-song-of-norway-sold.html>.
80. World Cruise Network, Genesis Class, accessed September 4, 2019, <https://www.worldcruise-network.com/projects/genesis-class/>.
81. Apostolos, P., GOALDS – Goal Based Damage Stability of Passenger Ships Conference Paper, January 2013, [https://www.researchgate.net/publication/259693087\\_GOALDS\\_-\\_Goal\\_Based\\_Damage\\_Stability\\_for\\_Passenger\\_Ships](https://www.researchgate.net/publication/259693087_GOALDS_-_Goal_Based_Damage_Stability_for_Passenger_Ships).
82. CARB, ISOR for Proposed Rulemaking: Fuel Sulfur and Other Operational Requirements for Ocean Going Vessels within California Waters and 24 Nautical Miles of the California, June 2008, <https://www.arb.ca.gov/regact/2008/fuelogv08/ISORfuelogv08.pdf>.
83. Starcrest Consulting Group, LLC, Port of Los Angeles Inventory of Air Emissions - 2016, July 2017, [https://kentico.portoflosangeles.org/getmedia/880bc597-84bc-4ae6-94e2-59a2e6027f42/2017\\_Air\\_Emissions\\_Inventory](https://kentico.portoflosangeles.org/getmedia/880bc597-84bc-4ae6-94e2-59a2e6027f42/2017_Air_Emissions_Inventory).
84. California Air Resources Board, Mobile Source Emissions Inventory, Draft 2019 OGV Emissions Inventory Model, Last Updated March 1, 2019 (accessed September 8, 2019), <https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-documentation-offroad-0>.

85. Babicz, J., Wärtsilä Encyclopedia of Ship Technology, 2nd Ed., 2015, <https://www.wartsila.com/docs/default-source/marine-documents/encyclopedia/wartsila-o-marine-encyclopedia.pdf>.
86. International Association of Classification Societies, Bulk Carriers - Guidance and Information on Bulk Cargo Loading and Discharging to Reduce the Likelihood of Over-stressing the Hull Structure, July 2018, [https://safety4sea.com/wp-content/uploads/2018/09/IACS-Guidance-on-Bulk-Cargo-loading-and-discharging-2018\\_07.pdf](https://safety4sea.com/wp-content/uploads/2018/09/IACS-Guidance-on-Bulk-Cargo-loading-and-discharging-2018_07.pdf).
87. United Nations, Review of Marine Transport, 2018, [https://unctad.org/en/PublicationsLibrary/rmt2018\\_en.pdf](https://unctad.org/en/PublicationsLibrary/rmt2018_en.pdf).
88. California Air Resources Board, Draft Technology Assessment: Ocean-Going Vessels, pg. 68, May 2018, [https://ww3.arb.ca.gov/msprog/tech/techreport/ogv\\_tech\\_report.pdf](https://ww3.arb.ca.gov/msprog/tech/techreport/ogv_tech_report.pdf).
89. California Air Resources Board, Draft Technology Assessment: Ocean-Going Vessels, pg. 68, May 2018, [https://ww3.arb.ca.gov/msprog/tech/techreport/ogv\\_tech\\_report.pdf](https://ww3.arb.ca.gov/msprog/tech/techreport/ogv_tech_report.pdf).
90. Babicz, J., Wärtsilä Encyclopedia of Ship Technology, 2nd Ed., 2015, <https://www.wartsila.com/docs/default-source/marine-documents/encyclopedia/wartsila-o-marine-encyclopedia.pdf>.
91. Agrawal, H., Welch, W., Miller, J.W., & Cocker, D., Emission Measurements from a Crude Oil Tanker at Sea, Environmental Science & Technology, Vol. 42, May 28, 2008 <https://pubs.acs.org/doi/pdf/10.1021/es703102y>
92. Mahier, L., Kozma, N., & Chavdarian, P., the First Permitted Cold Ironing Project at the Port of Long Beach, Pier G Phase 2 Wharf, ASCE, 2007.
93. CPUC, California Renewables Portfolio Standard (RPS), accessed September 8, 2019, <https://www.cpuc.ca.gov/rps/>.
94. World Shipping Council, Comment Letter to CARB: Suggestions on Possible California At-Berth Regulation Allowances, Incentives or Operational Considerations, dated July 26, 2018.
95. California Air Resources Board, Draft Technology Assessment: Ocean-Going Vessels, pg. 68, May 2018, [https://ww3.arb.ca.gov/msprog/tech/techreport/ogv\\_tech\\_report.pdf](https://ww3.arb.ca.gov/msprog/tech/techreport/ogv_tech_report.pdf).
96. CARB, Advisories for CARB Airborne Toxic Control Measure for Auxiliary Diesel Engines Operated on Ocean-Going Vessels At-Berth in a California Port, accessed September 8 2019, <https://www.arb.ca.gov/ports/shorepower/forms/forms.htm>.

97. California Health and Safety Code § 40920.6, 42400, 42402, 39607.1, 40920.8, 42411, 42705.5, and 44391.2, Division 26, Assembly Bill No. 617, Nonvehicular Air Pollution: Criteria Air Pollutants and Toxic Air Contaminants, July 26, 2017, [https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201720180AB617](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180AB617).
98. California Health and Safety Code § 36950 - 36975, Assembly Bill No. 1807, 1983, [https://leginfo.legislature.ca.gov/faces/codes\\_displayText.xhtml?lawCode=HSC&division=26.&title=&part=2.&chapter=3.5.&article=1](https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=HSC&division=26.&title=&part=2.&chapter=3.5.&article=1).
99. California Air Resources Board, California Air Toxics Program – Background, December 13, 2017 (accessed September 8, 2019), <https://ww3.arb.ca.gov/toxics/background.htm>.
100. California Air Resources Board, Revised Proposed 2016 State Strategy for the State Implementation Plan, March 7, 2017, <https://www.arb.ca.gov/planning/sip/2016sip/rev2016statesip.pdf>.
101. California Health and Safety Code § 41701, Division 26, General Limitations, 1975, [https://leginfo.legislature.ca.gov/faces/codes\\_displayText.xhtml?lawCode=HSC&division=26.&title=&part=4.&chapter=3.&article=1](https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=HSC&division=26.&title=&part=4.&chapter=3.&article=1).
102. Office of Environmental Health Hazard Assessment, CalEnviroScreen 3.0, June 25, 2018, <https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30>.
103. California Air Resources Board, Draft Community Air Protection Blueprint For Selecting Communities, Preparing Community Emissions Reduction Programs, Identifying Statewide Strategies, and Conducting Community Air Monitoring, June 7, 2018, [https://ww2.arb.ca.gov/sites/default/files/2018-06/draft\\_community\\_air\\_protection\\_blueprint.pdf](https://ww2.arb.ca.gov/sites/default/files/2018-06/draft_community_air_protection_blueprint.pdf).
104. California Air Resources Board, Diesel Particulate Matter Exposure Assessment Study For The Ports Of Los Angeles and Long Beach, April 2006, <https://www.arb.ca.gov/ports/marinevevess/documents/portstudy0406.pdf>.
105. California Air Resources Board, Diesel Particulate Matter Health Risk Assessment For The West Oakland Community, December 2008, <https://ww3.arb.ca.gov/ch/communities/ra/westoakland/documents/westoaklandreport.pdf>.
106. California Air Resources Board, Diesel Particulate Matter Exposure Assessment Study For The Ports Of Los Angeles and Long Beach, April 2006, <https://www.arb.ca.gov/ports/marinevevess/documents/portstudy0406.pdf>.

107. Mercator International LLC, San Pedro Bay Long-term Unconstrained Cargo Forecast, July 12, 2016.
108. California Air Resources Board, Staff Report: ARB Review of the 2016 Air Quality Management Plan for the South Coast Air Basin and Coachella Valley, March 7, 2017, [https://ww3.arb.ca.gov/planning/sip/planarea/scabsip/2016aqmp\\_arbstaffreport.pdf](https://ww3.arb.ca.gov/planning/sip/planarea/scabsip/2016aqmp_arbstaffreport.pdf).
109. California Air Resources Board, Staff Report: ISOR for Proposed Amendments to Emissions Control System Warranty Regulations and Maintenance Provisions for 2022 and Subsequent Model Year On-Road Heavy-Duty Vehicles and Heavy-Duty Engines with Gross Vehicle Weight Greater than 14,000 Pounds and Heavy Duty Diesel Engines in Such Vehicles, May 8, 2018, <https://www.arb.ca.gov/regact/2018/hdwarranty18/isor.pdf>.
110. California Air Resources Board, Revised Proposed 2016 State Strategy for the State Implementation Plan, March 7, 2017, <https://www.arb.ca.gov/planning/sip/2016sip/rev2016statesip.pdf>.
111. Stefanini, S., Climate Change News, "Countries Inch Towards 'Bare Minimum' Climate Target For Shipping", April 10, 2018, <https://www.climatechangenews.com/2018/04/10/countries-inch-towards-bare-minimum-climate-target-shipping/>.
112. California Health and Safety Code § 38500 - 38599, Division 25.5, Assembly Bill No. 32, California Global Warming Solutions Act of 2006, September 27, 2006, [http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab\\_0001-0050/ab\\_32\\_bill\\_20060927\\_chaptered.pdf](http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001-0050/ab_32_bill_20060927_chaptered.pdf)
113. United Nations Climate Change, The Paris Agreement, accessed September 8, 2019, <https://unfccc.int/process/the-paris-agreement/what-is-the-paris-agreement>.
114. CARB, Short-Lived Climate Pollutant Reduction Strategy, March 2017, [https://ww2.arb.ca.gov/sites/default/files/2018-12/final\\_slcp\\_report%20Final%202017.pdf](https://ww2.arb.ca.gov/sites/default/files/2018-12/final_slcp_report%20Final%202017.pdf).
115. Cook, J., et al., Consensus on consensus: a synthesis of consensus estimates on human-caused global warming, Environ. Res. Lett. 11 (2016) 048002, doi:10.1088/1748-9326/11/4/048002, Apr. 13, 2016, <http://iopscience.iop.org/article/10.1088/1748-9326/11/4/048002/pdf>.
116. California Ocean Protection Council, Rising Seas in California: An Update On Sea-Level Rise Science, April 2017, [www.opc.ca.gov/webmaster/ftp/pdf/docs/rising-seas-in-california-an-update-on-sealevel-rise-science.pdf](http://www.opc.ca.gov/webmaster/ftp/pdf/docs/rising-seas-in-california-an-update-on-sealevel-rise-science.pdf).

117. Office of Environmental Health Hazard Assessment, Indicators of Climate Change in California, May 9 2018, <https://oehha.ca.gov/media/downloads/climate-change/report/2018caindicatorsreportmay2018.pdf>
118. Office of Environmental Health Hazard Assessment, Indicators of Climate Change in California, May 9 2018, page S-4, <https://oehha.ca.gov/media/downloads/climate-change/report/2018caindicatorsreportmay2018.pdf>.
119. Office of Environmental Health Hazard Assessment, Indicators of Climate Change in California, May 9 2018, page 185, <https://oehha.ca.gov/media/downloads/climate-change/report/2018caindicatorsreportmay2018.pdf>.
120. Office of Environmental Health Hazard Assessment, Indicators of Climate Change in California, May 9 2018, page 62, <https://oehha.ca.gov/media/downloads/climate-change/report/2018caindicatorsreportmay2018.pdf>.
121. Office of Environmental Health Hazard Assessment, Indicators of Climate Change in California, May 9 2018, page 109, <https://oehha.ca.gov/media/downloads/climate-change/report/2018caindicatorsreportmay2018.pdf>.
122. Office of Environmental Health Hazard Assessment, Indicators of Climate Change in California, May 9 2018, page S-5, <https://oehha.ca.gov/media/downloads/climate-change/report/2018caindicatorsreportmay2018.pdf>.
123. California Health and Safety Code § 38500 - 38599, Division 25.5, Assembly Bill No. 32, California Global Warming Solutions Act of 2006, September 27, 2006, [http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab\\_0001-0050/ab\\_32\\_bill\\_20060927\\_chaptered.pdf](http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001-0050/ab_32_bill_20060927_chaptered.pdf)
124. Executive Order B-30-15, April 29, 2015, <https://www.ca.gov/archive/gov39/2015/07/17/news19046/>.
125. California Health and Safety Code § 38566, Division 25.5, Senate Bill No. 32, September 8, 2016, [https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160SB32](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB32).
126. California Air Resources Board, Sustainable Freight Pathways to Zero and Near-Zero Emissions Discussion Document, April 23, 2015, <https://www.arb.ca.gov/gmp/sfti/sustainable-freight-pathways-to-zero-and-near-zero-emissions-discussion-document.pdf>.
127. California Air Resources Board, Board Resolution 14-2, Sustainable Freight Strategy Update, January 23, 2014, <https://arb.ca.gov/board/res/2014/res14-2.pdf>.



128. California Department of Transportation et al., California Sustainable Freight Action Plan, Appendix C, July 2016.
129. California Air Resources Board, Revised Proposed 2016 State Strategy for the State Implementation Plan, March 7, 2017, <https://www.arb.ca.gov/planning/sip/2016sip/rev2016statesip.pdf>.
130. California Health and Safety Code § 40920.6, 42400, 42402, 39607.1, 40920.8, 42411, 42705.5, and 44391.2, Division 26, Assembly Bill No. 617, Nonvehicular Air Pollution: Criteria Air Pollutants and Toxic Air Contaminants, July 26, 2017, [https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201720180AB617](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180AB617).
131. California Air Resources Board, Community Recommendations Staff Report, Revised September 11, 2018, [https://ww2.arb.ca.gov/sites/default/files/2018-09/2018\\_community\\_recommendations\\_staff\\_report\\_revised\\_september\\_11.pdf](https://ww2.arb.ca.gov/sites/default/files/2018-09/2018_community_recommendations_staff_report_revised_september_11.pdf).
132. California Air Resources Board, Addendum to Resolution No. 17-7 and 17-8, March 23, 2017, <https://ww3.arb.ca.gov/board/res/2017/addendum17-8.pdf>.
133. California Air Resources Board, Addendum to Resolution No. 17-7 and 17-8, March 23, 2017, <https://ww3.arb.ca.gov/board/res/2017/addendum17-8.pdf>.
134. CARB, Advisories for CARB Airborne Toxic Control Measure for Auxiliary Diesel Engines Operated on Ocean-Going Vessels At-Berth in a California Port, accessed September 8, 2019, <https://www.arb.ca.gov/ports/shorepower/forms/forms.htm>.
135. ABB, Shore-to-Ship Power, Reprinted April 2010, <https://library.e.abb.com/public/8f916bbe49d92d1ac12579680032f273/Shore-to-ship-power-2010-low.pdf>.
136. World Shipping Council, Container Ship Design, accessed October 18, 2018, <http://www.worldshipping.org/about-the-industry/liner-ships/container-ship-design>.
137. Explanatory footnote
138. Port of Oakland, Maritime e-News, April 2017, <https://www.portofoakland.com/files/PDF/newsroom/Maritime%20Newsletter%20-%20April%202017.pdf>.
139. Starcrest Consulting Group, LLC, Port of Los Angeles Inventory of Air Emissions-2016, July 2017, [https://kentico.portoflosangeles.org/getmedia/880bc597-84bc-4ae6-94e2-59a2e6027f42/2017\\_Air\\_Emissions\\_Inventory](https://kentico.portoflosangeles.org/getmedia/880bc597-84bc-4ae6-94e2-59a2e6027f42/2017_Air_Emissions_Inventory).
140. California Health and Safety Code § 39660 et seq., Division 26, Identification of Toxic Air Contaminants, 1983,

[https://leginfo.legislature.ca.gov/faces/codes\\_displayText.xhtml?lawCode=HSC&division=26.&title=&part=2.&chapter=3.5.&article=3.](https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=HSC&division=26.&title=&part=2.&chapter=3.5.&article=3.)

141. California Health and Safety Code § 43013, Division 26, General Provisions, 1975, [https://leginfo.legislature.ca.gov/faces/codes\\_displaySection.xhtml?lawCode=HSC&sectionNum=43013.](https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=HSC&sectionNum=43013.)
142. Explanatory footnote
143. U.S. EPA, eGRID Summary Tables 2016, February 15, 2018, [https://www.epa.gov/sites/production/files/2018-02/documents/eGRID2016\\_summarytables.pdf](https://www.epa.gov/sites/production/files/2018-02/documents/eGRID2016_summarytables.pdf).
144. Center for Climate and Energy Solutions, What Is Black Carbon?, April 2010, <https://www.c2es.org/document/what-is-black-carbon/>.
145. Explanatory footnote
146. Qu, L., Analysis on the Volatility of Global Dry Bulk Shipping Market, 2013-2014 (accessed September 6, 2019), <https://thesis.eur.nl/pub/41212/Qu-L.-Bullwhip-Effect-Research-on-Global-Dry-Bulk-Maritime-Market.pdf>.
147. Cement Americas, Mitsubishi Cement to Reopen Long Beach Terminal, July 1, 2015, <http://www.cementamericas.com/cement-scope/1023-mitsubishi-cement-to-reopen-long-beach-terminal.html>.
148. Zarroli, J., For One California Company, Trump's Tariffs Have Unintended Consequences, NPR, April 19, 2018, <https://www.npr.org/2018/04/19/603298380/for-one-california-company-trumps-tariffs-have-unintended-consequences>.
149. California State Lands Commission, 2017 Vessel Visit Database.
150. Explanatory footnote
151. Kosciolk, A., Docked vs. Tendered: Two Ways to Get Ashore, Cruisecritic, August 21, 2018, <https://www.cruisecritic.com/articles.cfm?ID=1900>.
152. Marine Exchange of Southern California, Executive Summaries of Terminal Operations Manuals for Offshore Marine Terminals - Appendix F, August 31, 2015.
153. California State Lands Commission, Marine Oil Terminal Engineering and Maintenance Standards (MOTEMS), accessed September 8, 2019. <https://slc.ca.gov/motems/>.
154. California State Lands Commission, 2017 Vessel Visit Database.



155. California Air Resources Board, Shore Power Frequently Asked Questions (FAQ), accessed September 8, 2019, <https://www.arb.ca.gov/ports/shorepower/faq/faq.htm#45>.
156. Ports of Long Beach and Los Angeles comment letters to CARB: Port of Los Angeles and Port of Long Beach comments on Proposed Draft Regulatory Language, “Control Measure for Ocean-Going Vessels Operating At Berth and At Anchor”, dated February 6, 2019 and May 20, 2019.
157. Advanced Maritime Emissions Control System (AMECS), Advanced Environmental Group, accessed September 8, 2019, <http://advancedemissioncontrol.com/>
158. Maritime Emissions Treatment System, Clean Air Engineering, accessed September 8, 2019, <http://caemaritime.com/>.
159. World Shipping Council, Comment Letter to CARB: Suggestions on Possible California At-Berth Regulation Allowances, Incentives or Operational Considerations, dated July 26, 2018.
160. Port of Los Angeles, Port of Los Angeles and California Air Resources Board Partner On Green Omni Terminal Demonstration Project, May 26, 2016, [https://www.portoflosangeles.org/references/news\\_052616\\_green\\_omni](https://www.portoflosangeles.org/references/news_052616_green_omni).
161. Conversation with Clean Air Engineering Maritime, California State Lands Commission, and tanker industry members on April 16, 2019 at Cal EPA Headquarters.
162. Letter from Clean Air Engineering – Maritime, Dated August 12, 2019
163. California Code of Regulations, Title 2 § 2340, subsection (c)(28), Requirements for all Transfer Operations, [https://govt.westlaw.com/calregs/Document/I163FFEA0D49211DEBC02831C6D6C108E?viewType=FullText&originationContext=documenttoc&transitionType=Cate-goryPageItem&contextData=\(sc.Default\)](https://govt.westlaw.com/calregs/Document/I163FFEA0D49211DEBC02831C6D6C108E?viewType=FullText&originationContext=documenttoc&transitionType=Cate-goryPageItem&contextData=(sc.Default)).
164. Gamette, S., et al, Challenges Associated with Implementing Operations for the First Cold Ironing of Oil Tanker Vessels, Port of Long Beach Pier T Berth T121 BP Cold Ironing Project For Alaska Class Tanker, Published date unknown (presented at the 12th Triennial International Conference in Jacksonville, Florida, April 25-28, 2010) (accessed July 23, 2019).
165. European Union, TRAINMOS 2 Project, On Shore Power Supply and LNG available at <https://www.onthemosway.eu/wp-content/uploads/2015/06/2-OPS-LNG-.pdf>, Accessed September 9, 2019.

166. Port of Long Beach, Attachment 1A, Project Schedule FY 2008-2009, Proposition 1B: Goods Movement Emissions Reduction Program.
167. Notice of Preparation (NOP) of a Draft Supplemental Environmental Impact Report and Public Scoping Meeting for the Berths 97-109 [China Shipping] Container Terminal Project, September 2015.
168. Boven, K., Chevron Richmond Long Wharf – A MOTEMS Journey, Chevron, October 2014, [https://www.slc.ca.gov/wp-content/uploads/2018/08/PF2014\\_MOTEMS-Chevron.pdf](https://www.slc.ca.gov/wp-content/uploads/2018/08/PF2014_MOTEMS-Chevron.pdf).
169. California State Lands Commission, Mitigated Negative Declaration - Chevron Long Wharf Maintenance and Efficiency Project, Recirculated October 2016, <https://www.slc.ca.gov/wp-content/uploads/2018/09/MND-1.pdf>.
170. California State Lands Commission, International-Matex Tank Terminals, IMTT Wharf Modification Project Prevention First 2014, October 7, 2014, [https://www.slc.ca.gov/wp-content/uploads/2018/08/PF2014\\_MOTEMS-IMTT.pdf](https://www.slc.ca.gov/wp-content/uploads/2018/08/PF2014_MOTEMS-IMTT.pdf).
171. Port of Los Angeles, Final Environmental Impact Report - Berths 167-169 [Shell] Marine Oil Terminal Wharf Improvements Project, July 2018, [https://kentico.portoflosangeles.org/getmedia/3a7e6ce5-41ab-4d09-9e6f-c9b2f6d63559/Shell-MOTEMS\\_FEIR](https://kentico.portoflosangeles.org/getmedia/3a7e6ce5-41ab-4d09-9e6f-c9b2f6d63559/Shell-MOTEMS_FEIR).
172. Boven, K., Chevron Richmond Long Wharf – A MOTEMS Journey, Chevron, October 2014, [https://www.slc.ca.gov/wp-content/uploads/2018/08/PF2014\\_MOTEMS-Chevron.pdf](https://www.slc.ca.gov/wp-content/uploads/2018/08/PF2014_MOTEMS-Chevron.pdf).
173. California State Lands Commission, Mitigated Negative Declaration - Chevron Long Wharf Maintenance and Efficiency Project, Recirculated October 2016, <https://www.slc.ca.gov/wp-content/uploads/2018/09/MND-1.pdf>.
174. California State Lands Commission, Chevron Long Wharf Maintenance and Efficiency Project, Addendum to MND, June 2017.
175. California State Lands Commission, International-Matex Tank Terminals, IMTT Wharf Modification Project Prevention First 2014, October 7, 2014, [https://www.slc.ca.gov/wp-content/uploads/2018/08/PF2014\\_MOTEMS-IMTT.pdf](https://www.slc.ca.gov/wp-content/uploads/2018/08/PF2014_MOTEMS-IMTT.pdf).
176. Port of Los Angeles, Final Environmental Impact Report - Berths 167-169 [Shell] Marine Oil Terminal Wharf Improvements Project, July 2018, [https://kentico.portoflosangeles.org/getmedia/3a7e6ce5-41ab-4d09-9e6f-c9b2f6d63559/Shell-MOTEMS\\_FEIR](https://kentico.portoflosangeles.org/getmedia/3a7e6ce5-41ab-4d09-9e6f-c9b2f6d63559/Shell-MOTEMS_FEIR).

177. Port of Los Angeles, Air Quality Improvement Program and Low Carbon Transportation Greenhouse Gas Reduction Fund Investments Multi-Source Facility, Accessed September 27, 2019.
178. Phone conversation with Marathon Petroleum staff on June 6, 2019.
179. Phone conversation with California State Lands Commission staff on March 27, 2019.
180. California Health and Safety Code § 41701, Division 26, General Limitations, 1975, [https://leginfo.legislature.ca.gov/faces/codes\\_displayText.xhtml?lawCode=HSC&division=26.&title=&part=4.&chapter=3.&article=1](https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=HSC&division=26.&title=&part=4.&chapter=3.&article=1).
181. California Air Resources Board, Draft Technology Assessment: Ocean-Going Vessels, pg. 63, May 2018, [https://ww3.arb.ca.gov/msprog/tech/techreport/ogv\\_tech\\_report.pdf](https://ww3.arb.ca.gov/msprog/tech/techreport/ogv_tech_report.pdf).
182. California Air Resources Board, Draft Technology Assessment: Ocean-Going Vessels, pg. 63, May 2018, [https://ww3.arb.ca.gov/msprog/tech/techreport/ogv\\_tech\\_report.pdf](https://ww3.arb.ca.gov/msprog/tech/techreport/ogv_tech_report.pdf).
183. IHS-Markit California Vessel Registration and Movement Information for 2016, accessed January 11, 2018
184. Marine Exchange of Southern California Arrival/Departure Information for 2016, accessed November 30, 2017
185. Starcrest Consulting Group, LLC, Port of Los Angeles Inventory of Air Emissions - 2016, July 2017, [https://kentico.portoflosangeles.org/getmedia/880bc597-84bc-4ae6-94e2-59a2e6027f42/2017\\_Air\\_Emissions\\_Inventory](https://kentico.portoflosangeles.org/getmedia/880bc597-84bc-4ae6-94e2-59a2e6027f42/2017_Air_Emissions_Inventory).
186. Starcrest Consulting Group, LLC, Port of Long Beach Air Emissions Inventory - 2016, July 2017, <http://www.polb.com/civica/filebank/blobdload.asp?BlobID=14109>.
187. U.S. EPA, eGRID Summary Tables 2016, February 15, 2018, [https://www.epa.gov/sites/production/files/2018-02/documents/eGRID2016\\_summarytables.pdf](https://www.epa.gov/sites/production/files/2018-02/documents/eGRID2016_summarytables.pdf).
188. U.S. EPA, Fine Particle Concentrations Based on Monitored Air Quality From 2009-2011, July 15, 2012, [https://www.epa.gov/sites/production/files/2016-04/documents/current\\_pm\\_table.pdf](https://www.epa.gov/sites/production/files/2016-04/documents/current_pm_table.pdf)

189. U.S. EPA, Environmental Benefits Mapping and Analysis Program: Community Edition (BenMAP-CE) User Manual and Appendices, 2017 (accessed September 6, 2019), [www.epa.gov/benmap](http://www.epa.gov/benmap).
190. Fann, N., Fulcher, C., & Hubbell, B., The influence of location, source, and emission type in estimates of the human health benefits of reducing a ton of air pollution, *Air Quality, Atmosphere & Health*, 2:169-176, June 9, 2009, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2770129/>.
191. Fann N, Baker K., & Fulcher C., Characterizing the PM2.5-related health benefits of emission reductions for 17 industrial, area and mobile emission sectors across the U.S. *Environ Int.*, 49:141-51, November 12, 2012, <https://www.sciencedirect.com/science/article/pii/S0160412012001985>.
192. Fann, N., Baker, K., Chan, E., Eyth, A., Macpherson, A., Miller, E., & Snyder J., Assessing Human Health PM2.5 and Ozone Impacts from U.S. Oil and Natural Gas Sector Emissions in 2025, *Environ. Sci. Technol.* 52 (15), pp 8095–8103, July 13, 2018, <https://pubs.acs.org/doi/abs/10.1021/acs.est.8b02050>.
193. California Air Resources Board, Methodology for Estimating the Health Effects of Air Pollution, accessed on September 9, 2019, <https://www.arb.ca.gov/resources/documents/carbs-methodology-estimating-health-effects-air-pollution>.
194. U.S. EPA, National Center for Environmental Economics et al., Appendix B: Mortality Risk Valuation Estimates, Guidelines for Preparing Economic Analyses, U.S. EPA 240-R-10-001, Dec. 2010, <https://www.epa.gov/sites/production/files/2017-09/documents/ee-0568-22.pdf>.
195. U.S. EPA, Science Advisory Board (U.S. EPA-SAB), An SAB Report on EPA's White Paper Valuing the Benefits of Fatal Cancer Risk Reduction, EPA-SAB-EEAC-00-013, July 2000, [http://yosemite.epa.gov/sab%5CSABPRODUCT.NSF/41334524148BCCD6852571A700516498/\\$File/eeacf013.pdf](http://yosemite.epa.gov/sab%5CSABPRODUCT.NSF/41334524148BCCD6852571A700516498/$File/eeacf013.pdf).
196. U.S. EPA, Mortality Risk Valuation – What does it mean the place a value on a life?, accessed August 29, 2019, <https://www.epa.gov/environmental-economics/mortality-risk-valuation#means>.
197. Chestnut, L., et. al., The Economic Value Of Preventing Respiratory And Cardiovascular Hospitalizations (*Contemporary Economic Policy*, 24: 127–143. doi: 10.1093/CEP/BYJ007, Jan. 2006, <http://onlinelibrary.wiley.com/doi/10.1093/cep/byj007/full>.

198. Office of Environmental Health Hazard Assessment, Indicators of Climate Change in California, May 2018, <https://oehha.ca.gov/media/downloads/climate-change/report/2018caindicatorsreportmay2018.pdf>.
199. U.S. EPA, Shore Power Technology Assessment at U.S. Ports, March 2017. <https://www.epa.gov/sites/production/files/2017-05/documents/420r17004-2017-update.pdf>.
200. World Maritime News, New Shore Power Facilities at Port Metro Vancouver, July 23, 2015, <https://worldmaritimeweb.com/archives/167358/new-shore-power-facilities-at-port-metro-vancouver/>.
201. Stansfield, J., Port of Bergen Granted 50 Million NOK for Shore Power Facilities, December 8, 2018 <https://www.cruisemapper.com/news/4916-port-bergen-granted-50-million-nok-for-shore-power-facilities>.
202. U.S. EPA, Email conversations with Penny McDaniel on shore power initiative in China, October 31, 2018.
203. California Air Resources Board, Staff Report: Initial Statement of Reasons for the Proposed Rulemaking Regulations to Reduce Emissions from Diesel Auxiliary Engines on Ocean-Going Vessels While At-Berth at a California Port, October 2007 (accessed July 16, 2019), <https://www.arb.ca.gov/regact/2007/shorepwr07/isor.pdf>.
204. California Air Resources Board, Control Measure for Ocean-Going Vessels At Berth. Standardized Regulatory Impact Assessment (SRIA), August 1, 2019, [http://www.dof.ca.gov/Forecasting/Economics/Major\\_Regulations/Major\\_Regulations\\_Table/documents/SRIA\\_with\\_Appendices-Proposed\\_Control\\_Measure\\_for\\_Ocean-Going\\_Vessels\\_At\\_Berth-080119.pdf](http://www.dof.ca.gov/Forecasting/Economics/Major_Regulations/Major_Regulations_Table/documents/SRIA_with_Appendices-Proposed_Control_Measure_for_Ocean-Going_Vessels_At_Berth-080119.pdf).
205. California Air Resources Board, Control Measure for Ocean-Going Vessels At Berth. Standardized Regulatory Impact Assessment (SRIA), August 1, 2019, [http://www.dof.ca.gov/Forecasting/Economics/Major\\_Regulations/Major\\_Regulations\\_Table/documents/SRIA\\_with\\_Appendices-Proposed\\_Control\\_Measure\\_for\\_Ocean-Going\\_Vessels\\_At\\_Berth-080119.pdf](http://www.dof.ca.gov/Forecasting/Economics/Major_Regulations/Major_Regulations_Table/documents/SRIA_with_Appendices-Proposed_Control_Measure_for_Ocean-Going_Vessels_At_Berth-080119.pdf)
206. Email from Alexander Mitchell to Barbara Van Gee titled “Renewable diesel prices”, dated September 5, 2019.
207. IMO, Prevention of Air Pollution from Ships Annex VI and New Engine NOX Emissions Limits Under IMO Annex VI, accessed September 8, 2019, [http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Nitrogen-oxides-\(NOx\)---Regulation-13.aspx](http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Nitrogen-oxides-(NOx)---Regulation-13.aspx).
208. Explanatory footnote

209. US Department of Transportation, Freight Facts and Figures 2017, Freight Analysis Framework v4.3.1 March 2017, <https://www.bts.gov/product/freight-facts-and-figures>.
210. Mercator International LLC, San Pedro Bay Long-term Unconstrained Cargo Forecast, July 12, 2016.
211. Port of Hueneme comment letter to CARB: Port of Hueneme Forecasted Future Growth Rates, dated November 27, 2017.
212. Western States Petroleum Association comment letter to CARB: WSPA Input to CARB At Berth Cost Analysis for SRIA, dated May 2019.
213. U.S. Energy Information Administration, Annual Energy Outlook 2018 with Projections to 2050, February 6, 2018, <https://www.eia.gov/outlooks/aeo/pdf/AEO2018.pdf>.
214. U.S. Energy Information Administration, Table: Petroleum and Other Liquids Prices, Annual Energy Outlook 2018, <https://www.eia.gov/outlooks/aeo/data/browser/#/?id=12-AEO2018&cases=ref2018&sourcekey=0>.
215. Email from Jing Yuan to Tracy Haynes titled "LCFS value for shore power", dated April 12, 2019.
216. Bureau of Labor Statistics, Consumer Price Index Calculator, accessed September 6, 2019, [https://www.bls.gov/data/inflation\\_calculator.htm](https://www.bls.gov/data/inflation_calculator.htm).
217. Port of Los Angeles, Port 101, accessed September 8, 2019, <https://www.portoflosangeles.org/about/port-101>.
218. Port of Long Beach, FAQs - Does The Port Receive Funding From The City of Long Beach, accessed September 8, 2019, <http://www.polb.com/about/faqs.asp#530>.
219. Janice Hoppe-Spiers, Transportation and Logistics International, Port of Stockton, <http://www.tlimagazine.com/sections/shipping-and-ports/2359-port-of-stockton>
220. San Francisco Bay Conservation and Development Commission, Permits, accessed September 8, 2019, <https://bcdc.ca.gov/permits/>
221. California Department of Fish and Wildlife, Environmental Review and Permitting, accessed September 8, 2019, <https://www.wildlife.ca.gov/Conservation/Environmental-Review>.

222. Explanatory footnote
223. California Health and Safety Code § 38566, Division 25.5, Senate Bill No. 32, September 8, 2016,  
[https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160SB32](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB32).
224. California Association of Port Authorities, Cruise Lines International Association, Pacific Merchant Shipping Association, Western States Petroleum Association, and World Shipping Council – Joint Comment Letter to CARB: Alternative Proposal for Amendments to At-Berth Regulations, dated February 15, 2019.
225. Advanced Maritime Emissions Control System (AMECS), Advanced Environmental Group, accessed September 8, 2019, <http://advancedemissioncontrol.com/>.
226. Maritime Emissions Treatment System, Clean Air Engineering, accessed September 8, 2019, <http://caemaritime.com/>.
227. California Air Resources Board, Shore Power for Ocean-going Vessels, accessed September 6, 2019, <https://www.arb.ca.gov/ports/shorepower/shorepower.htm>.
228. California Cleaner Freight Coalition (CCFC), accessed August 2, 2019, <https://caceanfreight.org/>.
229. California Air Resources Board, At-Berth Regulation Preliminary Cost Information, August 14, 2018,  
<https://ww3.arb.ca.gov/ports/shorepower/meetings/08152018/costinformation.pdf>.