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**At-Berth Vessel Emission Reduction
Regulation**

**Innovative Concept Application for Tesoro
Logistics Operations LLC (TLO)
Terminal 1, Terminal 2 and Long Beach
Terminal**

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1 Introduction

This application intends to identify Innovative Concept Compliance Options for TLO to reduce emissions from sources in and around the regulated port or marine terminal in accordance with section 93130.17 of title 17 of the California Code of Regulations, adopted August 27, 2020, and effective January 1, 2021. The primary scope of this application is to allow for the potential use of alternative emission reduction methods that may enhance safety, utilization efficiency, and cost effectiveness of emissions reduction equipment.

Innovative Concepts identified in this application are based on best available information. For many of the proposed strategies, the technology is still under development, therefore, the actual number of emission reductions achieved may vary. Innovative Concepts are important for compliance with the Regulation and TLO has identified instances that may require the use of other parties’ innovative concept reductions for TLO to comply with the Regulation. TLO has also identified instances where TLO may offer to third parties the reductions TLO has demonstrated by use of an Innovative Concept.

As such, TLO is submitting this application to satisfy the Innovative Concept Application due date of December 1, 2021. As a result of this, TLO may request CARB amend or issue a new Executive Order for additional or modified Innovative Concepts in the future. TLO is not obligating itself to control the emissions sources described under this proposal at this time nor is TLO indicating the ability to safely control emissions sources on tanker vessels has been determined feasible. Concerns with the timeline of technology development and the ability to comply with the regulation are outlined in TLO’s Terminal Plans.

Text in red was added to the application in response to CARB’s request to TLO for additional information dated November 14, 2023.

Text in green was added to the application in response to CARB’s request to TLO for additional information dated August 21, 2024.

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2 Owner Background

TLO is a wholly owned subsidiary of MPLX, a diversified, large-cap master limited partnership formed by Marathon Petroleum Corporation (MPC) that owns and operates midstream energy infrastructure and logistics assets and provides fuels distribution services.

TLO operates three marine oil terminals in the Port of Long Beach which serve tanker vessels subject to the California Air Resources Board (CARB) Control Measure for Ocean-Going Vessels At Berth. Vessel traffic at the three terminals is related to TLO's petroleum products supply business as well as offloading crude petroleum that supports 3 major refineries in the LA Basin.

Identification and control of emissions not otherwise required to be controlled is provided in the regulation as a means of compliance. This application is for TLO to be able to use emission reductions that are not otherwise required as one of several strategies employed for compliance.

Primary Owner Contact

Tesoro Logistics Operations LLC

1300 Pier B St,

Long Beach, CA 90813

Attention, Lynnea Giordani

Operational Description

TLO operates three marine oil terminals in the Port of Long Beach, California. These terminals with their associated pipelines and tankage receive crude petroleum or import/export finished fuels via 3rd party tankers or barges. These marine terminals and associated tankers will be regulated under CARB's current At-Berth vessel emission reduction regulation upon the compliance date.

The innovative concepts presented in this application provide alternative methods for TLO to comply with the At-Berth emission reductions. The creation of emission credits by reducing emissions not required by the At-Berth vessel emissions reduction regulation or any other regulation provides for actual emission reductions in the areas within three nautical miles of the berths and adjacent communities.

Terminal 1 (Berth 121), in Latitude 33-45-25 N Longitude 118-13-05 W is located in the northeast corner of Long Beach Harbor, at Pier T. Berth 121 is located on the west side of the Back Channel. The Terminal is approximately 2 miles west of Long Beach city center. Distance from the breakwater is about 3.0 nm. Terminal 1 receives crude petroleum for three major Southern California Refiners (TRMC, P66 and Valero).

Terminal 2 (Berths 76, 77 and 78) is located in Channel 2 of the Long Beach Harbor. The terminal has three berths. Berth 76 is limited to barge operations only. Berths 77 and 78 can accommodate both

tankers and barges. The terminal is capable of offloading and loading crude petroleum, intermediate feedstocks and finished products.

Long Beach Terminal (Berths 86 and 84a) is located across from Pier S at the entrance to Channel 2 in the Long Beach Harbor. The terminal receives and loads crude petroleum, intermediate feedstocks, finished products and lube oils by tanker or barge.

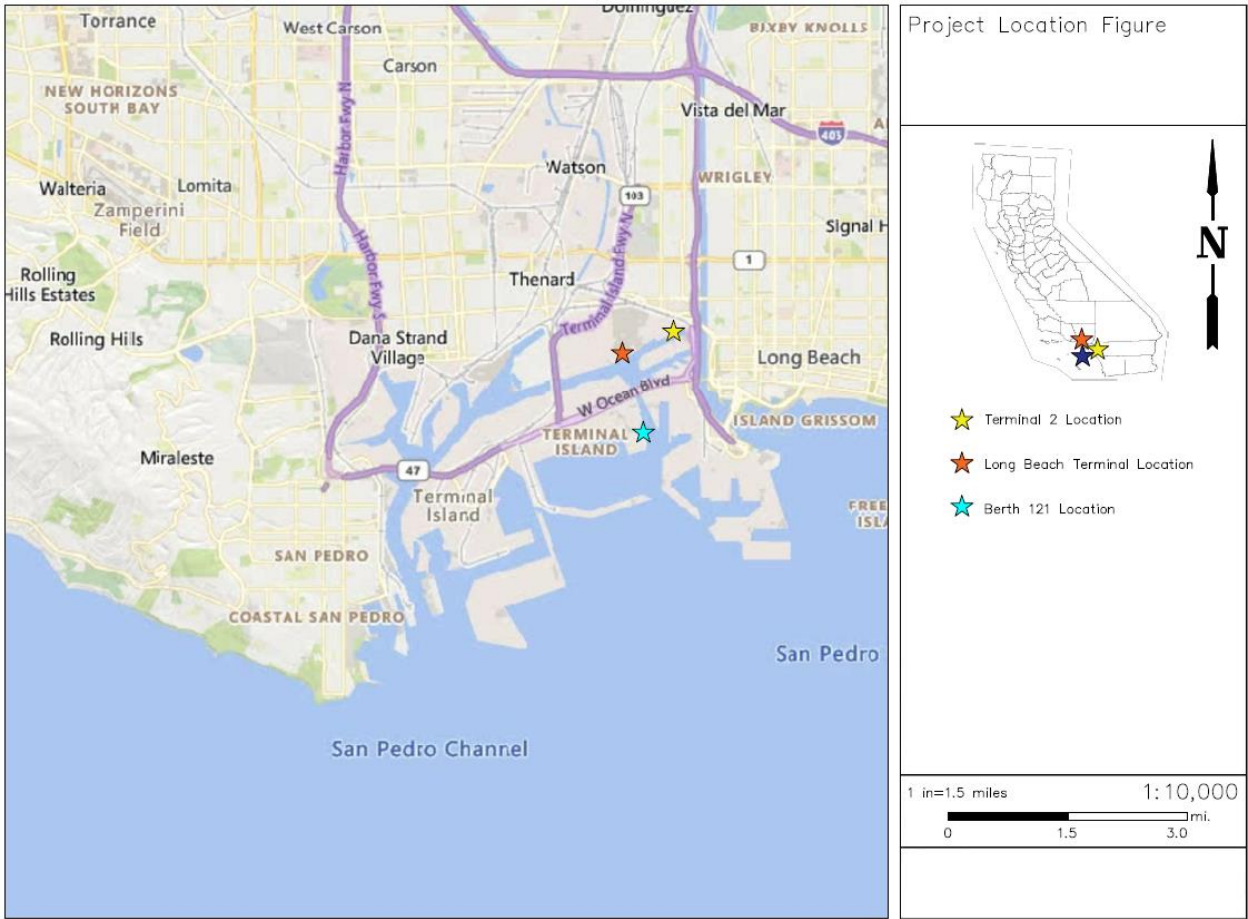


Figure 2.3.1

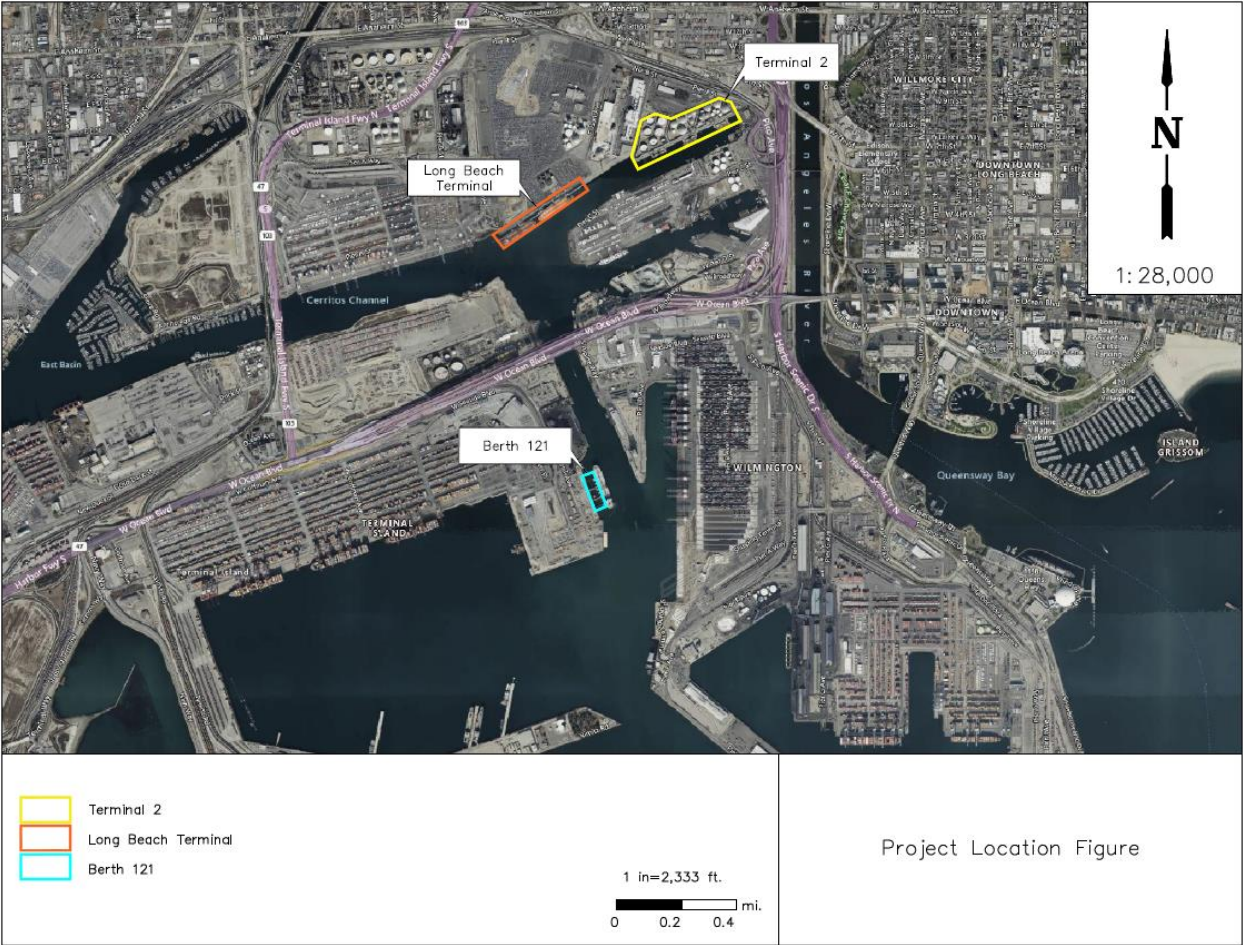


Figure 2.3. 2

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3 Potential Emission Reductions Not Otherwise Required

Emission reductions from the following source categories have been identified for potential credit generation using the guidelines in Section 93130.17 of the At-Berth regulation. The emission reductions described below are an attempt to identify possible source categories that could be available when Section 93118.3 of Title 17 and Section 2299.3 of Title 13 of the California Code of Regulations are superseded by Sections 93130 through 93130.22.

Sub-concept 1: Pre-Compliance Emissions (Tankers – Terminal 1, Terminal 2 and Long Beach Terminal)

Emissions controlled from the auxiliary engines and/or boilers of tankers in the Southern California area prior to the compliance date. The tankers would be serviced by a CARB approved emissions control strategy while At-Berth. The vessels serviced would be those calling into Terminal 1, Terminal 2 and Long Beach Terminal which represent the berths used by TLO that service both tankers and barges.

93130.17 (b)(1)

(A): Company contact information is provided in Section 2.1 of this application.

(B): The proposed innovative concept is to treat emissions from tanker vessels (the source) at TLO berths prior to the compliance date of the control measure. This concept will require the development of capture and control technology to be suitable for tankers or the installation of shore power along with adoption of shore power by vessels calling at the berths. Capture and Control technology is currently in development and TLO is supporting the effort through participating as the demonstration partner in a CARB sponsored technology development grant. For shore power, engineering studies for vessel adaptation to cold ironing have been initiated by vessel operators with the engagement of TLO. Emission reductions would occur per the Executive Order for the given technology. A map of the location of the project is found in section 2.3 of this application.

(C): Emission reductions anticipated to be achieved will be dependent on the vessels calling at the TLO berths. The estimate of vessel calls that would be subject to this innovative concept is still to be determined. Sample calculations of emission reductions are found in appendix D-1. **Please refer to “Attachment A – Innovative Concept Reporting, Emissions Estimates, and Calculations” (excel document) for reference to the annual reporting methodology, compliance inputs, and emissions reduction calculations.**

(D): Recordkeeping and reporting for early control of tanker emissions at TLO berths will be done as described in Section 4 of this application. Monitoring of performance will utilize instrumentation on the capture and control equipment. Testing procedures will be per the Executive Order for the equipment utilized.

(E): Agreements between TLO and capture and control providers have not been developed as the technology does not yet exist to successfully capture and process tanker exhaust emissions. No agreements have yet been developed supporting the development of shore power as a solution. **As technology is developed and proven, MOU’s will be executed as necessary. MOU’s which may need to be established to execute the concepts include, but are not limited to, barge capture and control vendors,**

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vessel owners, vessel operators, and or affiliates of TLO. TLO is actively working with service providers to support the development of technology. TLO's opportunity to put this concept into action and treat emissions from tanker vessels prior to the start of compliance is dependent on the capability and timeliness to develop technology which meets the safety requirements established through previously conducted safety assessments.

Shore Power is a CAECS. TLO has a shore power system in operation at Terminal 1. This system has been providing pre-compliance emissions control for a compatible tanker vessel since the Innovative Concept provision was made available on January 1, 2021.

(F): The innovative concept is proposed for a duration up to the compliance date of the rule for Long Beach and Los Angeles berths.

(G): For capture and control, a CARB Executive Order will be necessary for the system to be considered a CAECS. Local mobile source permits are expected to be required from the South Coast Air Quality Management District. These permits will be the responsibility of the capture and control service providers. Shore power is already considered an approved CAECS. For the implementation of additional shore power systems, CEQA, SCAQMD, and applicable harbor permits may be required.

(H): For barge-based capture and control systems, local mobile source permits are expected to be required from the South Coast Air Quality Management District. These permits will be the responsibility of the capture and control service provider or TLO should TLO elect to purchase a barge-based capture and control unit. For shore-based capture and control systems, air permitting would be through the SCAQMD. For shore-based capture and control systems and shore power systems, California Environmental Quality Act (CEQA) permitting is anticipated with The Port of Long Beach County serving as the lead agency.

(I): Demonstration of eligibility and applicability per 93130.17(a):

(1) The application was submitted prior to December 1, 2021

(2) Deploying a CARB-Approved Emissions Control Strategy (CAECS) on tankers at TLO operated marine terminals prior to the compliance date of the control measure will remove emissions not otherwise required. Early compliance is explicitly identified in Section 93130.17(a)(3) of the control measure as being a reduction in excess of the requirement. The requirement to not increase GHGs is part of the Executive Order certification for the CAECS. Please refer to 'Attachment A – Innovative Concept Reporting, Emissions Estimates, and Calculations' (excel document) for reference to the annual reporting methodology, compliance inputs, and emissions reduction calculations. TLO's CARB Vessel Visit Report will be used to collect the necessary data inputs for calculating reductions achieved by the innovative concept. The emissions reduction values will then be recorded on the Annual Reporting Log for submission by February 1 of the proceeding year.

(3) Early compliance with this control measure is in excess of other requirements. A search for state, federal, international rule, regulation, statute, or any other legal requirements which may currently exist for tanker vessel emission reductions was conducted. While the search did not identify such requirements for

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emissions reductions, aside from CARB's Control Measure for Ocean-Going Vessels At Berth, some of the concepts reviewed include:

- Regulation (EU) 2023/1805
- The Port of Long Beach's Vessel Speed Reduction Program
- Port of Los Angeles Vessel Speed Reduction Program
- Port Authority of New York & New Jersey Clean Vessel Incentive (CVI) Program
- 2023 IMO Strategy on Reduction of GHG Emissions from Ships

(4) The emissions controlled as part of this project will be at the TLO berths.

(5) Deployment of a CAECS at TLO operated terminals will only reduce emissions and not increase emissions at the terminal where deployed, nor elsewhere. For early compliance utilizing a capture and control system, all emissions generated by the system will have demonstrated its ability to treat emissions without increasing emissions during its Executive Order certification process. For early compliance using shore power, shore power is already listed in the control measure as an approved CAECS.

(6) Deployment of a CAECS at TLO operated terminals that result in early compliance are not business as usual as described in 93130.17(a)(6). Emission reductions will be validated by one of two means: (1) For a capture and control system, the measurement of incoming emissions combined with the measurement of process unit outflow, documenting emission reduction performance. (2) For a shore power system, which is already recognized as a CAECS, the documented power usage will be converted to lbs of emissions reduced using the CARB-provided emissions factors in the control measure.

(7) Information provided is for emissions prior to the first compliance period.

(8) This project is not eligible for another compliance period.

(9) Early compliance does not apply to VIEs, TIEs, or Remediation Fund

(10) Reductions will be applied per the control measure and used per section 8 of this application.

(11) This project is for early reductions.

(12) No public incentive programs are planned to be used to lease, purchase, or pay for a service.

(13) An internal system is setup for managing records in accordance with the Control Measure for Ocean-Going Vessels At Berth. There are efforts underway to evaluate the capability of leveraging a vessel management system to streamline at-berth operations and the management of data specific to the Control Measure. The internal site, along with any future systems, allow for records to be properly maintained and available for reporting if needed. TLO acknowledges records and reports shall be retained for a period of not less than five years and shall be submitted to the Executive Officer in the manner specified in the approved innovative concept and upon request by the Executive Officer, either within 10 calendar days or by a later date approved by the Executive Officer on a case-by-case basis.

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(14) Early emission capture will be done utilizing a CAECS which will have already demonstrated the ability to comply with the control measure during its certification process and upon receipt of its CARB Executive Order.

(15) The timeline for implementation of early compliance emissions reduction is dependent on the ability of the capture and control industry to develop equipment to sufficiently accommodate demand. For this build-out to occur the capture and control industry must develop a means to treat tanker vessels, something that does not yet exist. TLO believes the first critical milestone to the implementation of capture and control technology is the development of a safe solution which can service all applicable tanker vessels. Once developed, the second major milestone includes demonstrating and testing the technology on tanker vessels. When an Executive Order is obtained, the last major milestone is to scale the solution to meet market demand. TLO believes there needs to be more than one service provider approved and available to prevent monopolization of services. For shore-based capture and control, the timeline for treating emissions early will be dependent on similar factors but also including CEQA permitting. Presently, TLOs estimate for developing projects for compliance exceed the implementation schedule of the control measure. For shore power, additional vessel conversions and potential additional construction of shoreside infrastructure is required depending on the location shore power is applied. TLO has an existing shore power system at Terminal 1 B121 which can be used for early compliance. Use of the system is dependent on shore power enabled tanker vessels. Timelines for when vessels may convert is outside of TLO’s control. To implement shore power systems at additional TLO facilities, the projected date for implementation is 9/1/2028. However, there are many risks which could impact this timeline. These risks are identified in TLO’s Terminal Plans. Critical project milestones for shore power schedules rely on the electric utility provider to meet the required power demands and construction schedule. Applicable permitting, such as CEQA, is also a variable which could influence the timeline above. Industry standards and guidance do not currently exist for shore power, and TLO believes vessels will rely on the development of such standards before they consider conversion.

Sub-concept 2: Utilizing Shore Side Infrastructure to Reduce Tanker Vessel Discharge Emissions

*On August 21, 2024, CARB indicated the innovative concept of Utilizing Shore Side Infrastructure to Reduce Tanker Vessel Discharge Emissions is ineligible for consideration.

Emission reductions associated with (1) the use of shore side infrastructure capable of using grid power to reduce cargo transfer load on the vessel, (2) the debottlenecking of shore side infrastructure to reduce time at berth, (3) the improvement of shore side infrastructure to reduce total number of vessel calls; and (4) improvements of shore side infrastructure to improve electrical efficiency and reduce total electricity used.

Some terminals may have the capability of adding new or adjusting the use of shore side electric pumps to move liquid cargoes from the berth to the tankage located miles away from the dock. The use of these pumps may allow for the vessel to discharge cargo at reduced loads thus lowering vessel emissions generated from fuel burned in either main engines, boilers or auxiliary engines. The vessel only needs to provide enough flow and pressure to move the liquid to the shore pumps.

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For Shore Side pumping

1. Flow is established by the vessel to the tank farm.
2. Shoreside pumps are started allowing vessel operators to reduce engine output from the vessel pumping systems, thus reducing emissions.
3. Towards end of discharge when the volume from the vessel drops, the shoreside pumps are shut down and the vessel completes the last portion of cargo unload.

For shore side infrastructure debottlenecking, TLO may continue to identify projects which improve performance in shore side infrastructure that reduce time spent at berth and the corresponding emissions generated, or reduce electricity demand for shore side pumping.

For shore side improvements to reduce vessel visits, TLO may elect to make improvements to shore side infrastructure, such as pumps, piping, and tankage additions or modifications, which reduces the number of visits a vessel would need to fully discharge a cargo. These improvements would result in fewer vessel visits, resulting in reduced emissions created in-transit and during embarking and disembarking the berth.

Related to shore side infrastructure changes, TLO has identified potential projects and anticipates additional projects will be developed in the future under this innovative concept.

The emissions reduction credit would be calculated based on the required fuel usage for a vessel only discharge and the amount of fuel burned during the time the shore side pumps are operating. The emissions reduction credit may also consider efforts made to the shore side system to increase energy efficiency and reduce total electrical consumption.

93130.17 (b)(1)

(A): Company contact information is provided in Section 2.1 of this application.

(B): The proposed innovative concept is to improve usage of shore side infrastructure to reduce emissions as described in the project description above. A map of the location of the project is found in section 2.3 of this application.

(C): Emission reductions anticipated to be achieved will be dependent on the vessels calling at the TLO berths. The estimate of vessel calls that would be subject to this innovative concept is still to be determined. Sample calculations of emission reductions are found in appendices D-2A, D-2B, D-2C, and D-2D. **Please refer to “Attachment A – Innovative Concept Reporting, Emissions Estimates, and Calculations’ (excel document) for reference to the annual reporting methodology, compliance inputs, and emissions reduction calculations.**

(D): Recordkeeping and reporting for early control of tanker emissions at TLO berths will be done as described in Section 4 of this application. Calculations of emissions reductions will be as described above.

(E): No agreements have been signed regarding this innovative concept. None are anticipated to be necessary.

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(F): The innovative concept is proposed for a duration up to the compliance date and through the first period of the rule for Long Beach and Los Angeles berths. Extension requests are expected for this concept while eligible.

(G): No governmental approvals are expected at this time. **The following approvals were considered; SCAQMD, California State Lands Commissions, and the Port of Long Beach.**

(H): No environmental review is anticipated at this time.

(I): Demonstration of eligibility and applicability per 93130.17(a):

(1) The application was submitted prior to December 1, 2021

(2) Utilizing shore side infrastructure to reduce vessel cargo transfer pumping emissions will partially replace tanker cargo energy requirements with shore supplied energy for cargo operations. The electricity will be calculated utilizing the California e-Grid emissions factors. **Please refer to 'Attachment A – Innovative Concept Reporting, Emissions Estimates, and Calculations' (excel document) for reference to the annual reporting methodology, compliance inputs, and emissions reduction calculations. TLO's CARB Vessel Visit Report will be used to collect the necessary data inputs for calculating reductions achieved by the innovative concept. The emissions reduction values will then be recorded on the Annual Reporting Log for submission by February 1 of the proceeding year.**

(3) Emissions reductions will only be applied when not subject to other requirements and are in excess of those requirements. **A search for state, federal, international rule, regulation, statute, or any other legal requirements which may currently exist for tanker vessel emission reductions was conducted. While the search did not identify such requirements for emissions reductions, aside from CARB's Control Measure for Ocean-Going Vessels At Berth, some of the concepts reviewed include:**

- Regulation (EU) 2023/1805
- The Port of Long Beach's Vessel Speed Reduction Program
- Port of Los Angeles Vessel Speed Reduction Program
- Port Authority of New York & New Jersey Clean Vessel Incentive (CVI) Program
- 2023 IMO Strategy on Reduction of GHG Emissions from Ships

(4) The emissions controlled as part of this project will be at the TLO berths.

(5) Utilization of shore side infrastructure to reduce emissions will be utilizing grid electricity and will not increase emissions at other ports.

(6) Reducing emissions through shore side infrastructure utilization is verifiable through vessel fuel consumption as well as electrical metering at berth. **Regarding infrastructure, preventive maintenance plans ensure assets are fit for service and provide the reliability required to support operations. Personnel are trained and equipped to support maintenance of the assets. Operational performance and preventive measures validate assets perform within their designed tolerances. No replacements are scheduled for existing TLO infrastructure.**

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(7) Information provided is best understood for emissions prior to the first compliance period and the first compliance period.

(8) This project is eligible for another compliance period.

(9) Vessel calls using improved shore side infrastructure will not apply to VIEs, TIEs, or Remediation Fund.

(10) Reductions will be applied per the control measure and used per section 8 of this application.

(11) This project is capable of early reductions.

(12) No public incentive programs are planned to be used to lease, purchase, or pay for a service.

(13) An internal system is setup for managing records in accordance with the Control Measure for Ocean-Going Vessel At Berth. There are efforts underway to evaluate the capability of leveraging a vessel management system to streamline at-berth operations and the management of data specific to the Control Measure. The internal site, along with any future systems, allow for records to be properly maintained and available for reporting if needed. TLO acknowledges records and reports shall be retained for a period of not less than five years and shall be submitted to the Executive Officer in the manner specified in the approved innovative concept and upon request by the Executive Officer, either within 10 calendar days or by a later date approved by the Executive Officer on a case-by-case basis.

(14) All provisions of the control measure in 93130.7 and 93130.9 will be followed.

(15) The timeline for enhancement of / improvements to shore side infrastructure is dependent on the nature of the work necessary. In some cases, the infrastructure in place may be able to be more efficiently used, which would expedite the opportunity. Shore side infrastructure projects are dependent on their approval as an innovative concept. TLO estimates implementation could occur within the next two years upon receipt of approval. For infrastructure already in place, implementation timelines will be much shorter (less than one year) as the innovative concept will trigger an operational change rather than a physical change.

Sub-concept 3: Pre-Compliance Emissions (Tankers – Ports of Long Beach and Los Angeles)

Emissions controlled from the auxiliary engines and/or boilers of tankers in Southern California ports other than Terminal 1, Terminal 2 and Long Beach Terminal prior to the compliance date. The tankers would be serviced by a CARB approved emissions control strategy while At-Berth.

93130.17 (b)(1)

(A): Company contact information is provided in Section 2.1 of this application.

(B): The proposed innovative concept is to treat emissions from tanker vessels (the source) at non-TLO berths prior to the compliance date of the control measure. This concept will require the development of

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capture and control technology to be suitable for tankers. Capture and Control technology is currently in development and TLO is supporting the effort through participating as the demonstration partner in a CARB sponsored technology development grant. Emission reductions would be per the Executive Order for the given technology. Maps of the locations for these projects are found in Appendix C, figure C.1.

(C): Emission reductions anticipated to be achieved will be dependent on the vessels calling at eligible Marine Oil Terminals near TLO Berths. The actual emission reductions will be dependent on the number of vessel calls treated and the performance of the CAECS employed in controlling emissions. As the technology does not yet exist to treat tankers, no agreements are in place to treat vessels TLO does not control. Given these restrictions, it is not feasible to estimate actual emissions at this time, however, sample calculations of emission reductions are found in appendix D-3. **Please refer to “Attachment A – Innovative Concept Reporting, Emissions Estimates, and Calculations” (excel document) for reference to the annual reporting methodology, compliance inputs, and emissions reduction calculations.**

(D): Recordkeeping and reporting for early control of tanker emissions at non-TLO berths will be done as described in Section 4 of this application. Monitoring of performance will utilize instrumentation on the capture and control equipment. Testing procedures will be per the Executive Order for the equipment utilized.

(E): Agreements between TLO and capture and control providers have not been developed as the technology does not yet exist to successfully capture and process tanker exhaust emissions. No agreements have yet been signed between TLO and any terminal operator who may have vessels available for early emissions control. **As technology is developed and proven, MOU’s will be executed as necessary. MOU’s which may need to be established to execute the concepts include, but are not limited to, barge capture and control vendors, vessel owners, vessel operators, and or affiliates of TLO. TLO is actively working with service providers to support the development of technology. TLO’s opportunity to put this concept into action and treat emissions from tanker vessels prior to the compliance deadline is dependent on the capability and timeliness to develop technology which meets the safety requirements established through previously conducted safety assessments.**

(F): The innovative concept is proposed for a duration up to the compliance date of the rule for Long Beach and Los Angeles berths.

(G): For capture and control, a CARB Executive Order will be necessary for the system to be considered a CAECS. **Local mobile source permits are expected to be required from the South Coast Air Quality Management District. These permits will be the responsibility of the capture and control service providers.**

(H): For barge-based capture and control systems, local mobile source permits are expected to be required from the South Coast Air Quality Management District. These permits will be the responsibility of the capture and control service provider or TLO should TLO elect to purchase a barge-based capture and control unit.

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(I): Demonstration of eligibility and applicability per 93130.17(a):

(1) The application was submitted prior to December 1, 2021

(2) Deploying a CARB-Approved Emissions Control Strategy (CAECS) on tankers at non-TLO operated marine terminals prior to the compliance date of the control measure will remove emissions not otherwise required. Early compliance is explicitly identified in Section 93130.17(a)(3) of the control measure as being a reduction in excess of the requirement. The requirement to not increase GHGs is part of the Executive Order certification for the CAECS. Please refer to 'Attachment A – Innovative Concept Reporting, Emissions Estimates, and Calculations' (excel document) for reference to the annual reporting methodology, compliance inputs, and emissions reduction calculations. TLO's CARB Vessel Visit Report will be used to collect the necessary data inputs for calculating reductions achieved by the innovative concept. The emissions reduction values will then be recorded on the Annual Reporting Log for submission by February 1 of the proceeding year.

(3) Early compliance with this control measure is in excess of other requirements. A search for state, federal, international rule, regulation, statute, or any other legal requirements which may currently exist for tanker vessel emission reductions was conducted. While the search did not identify such requirements for emissions reductions, aside from CARB's Control Measure for Ocean-Going Vessels At Berth, some of the concepts reviewed include:

- Regulation (EU) 2023/1805
- The Port of Long Beach's Vessel Speed Reduction Program
- Port of Los Angeles Vessel Speed Reduction Program
- Port Authority of New York & New Jersey Clean Vessel Incentive (CVI) Program
- 2023 IMO Strategy on Reduction of GHG Emissions from Ships

(4) The emissions controlled as part of this project will be at the non-TLO berths within required proximity. Locations are identified on the maps in Appendix C, Figure C.1.

(5) Deployment of a CAECS at non-TLO operated marine terminals will only reduce emissions and not increase emissions at the terminal where deployed, nor elsewhere. For early compliance utilizing a capture and control system, all emissions generated by the system will have demonstrated its ability to treat emissions without increasing emissions during its Executive Order certification process.

(6) Deployment of a CAECS at non-TLO operated terminals that result in early compliance are not business as usual as described in 93130.17(a)(6). Emission reductions will be validated by the measurement of incoming emissions combined with the measurement of process unit outflow, documenting emission reduction performance.

(7) Information provided is for emissions prior to the first compliance period.

(8) This project is not eligible for another compliance period.

(9) Early compliance does not apply to VIEs, TIEs, or Remediation Fund

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(10) Reductions will be applied per the control measure and used per section 8 of this application.

(11) This project is for early reductions.

(12) No public incentive programs are planned to be used to lease, purchase, or pay for a service.

(13) An internal system is setup for managing records in accordance with the Control Measure for Ocean-Going Vessel At Berth. There are efforts underway to evaluate the capability of leveraging a vessel management system to streamline at-berth operations and the management of data specific to the Control Measure. The internal site, along with any future systems, allow for records to be properly maintained and available for reporting if needed. TLO acknowledges records and reports shall be retained for a period of not less than five years and shall be submitted to the Executive Officer in the manner specified in the approved innovative concept and upon request by the Executive Officer, either within 10 calendar days or by a later date approved by the Executive Officer on a case-by-case basis.

(14) Early emission capture will be done utilizing a CAECS which will have already demonstrated the ability to comply with the control measure during its certification process and upon receipt of its CARB Executive Order.

(15) The timeline for implementation of early compliance emissions reduction is dependent on the ability of the capture and control industry to develop equipment to sufficiently accommodate demand. For this build-out to occur the capture and control industry must develop a means to treat tanker vessels, something that does not yet exist. Presently, TLOs estimate for developing projects for compliance exceed the implementation schedule of the control measure. TLO believes the first critical milestone to the implementation of capture and control technology is the development of a safe solution which can service all applicable tanker vessels. Once developed, the second major milestone includes demonstrating and testing the technology on tanker vessels. When an Executive Order is obtained, the last major milestone is to scale the solution to meet market demand. TLO believes there needs to be more than one service provider approved and available to prevent monopolization of services.

Sub-concept 4: Pre-Compliance Emissions (Roll-on Roll-off (RoRo) Vessels–Southern California Ports)

*On September 19, 2024, TLO elected to no longer pursue Pre-Compliance Emissions (Roll-on Roll-off (RoRo) Vessels – Southern California) as an innovative concept.

Emissions captured and controlled from the auxiliary engines of RoRo vessels in Southern California ports prior to the compliance date. The RoRo vessels would be serviced by a CARB approved barge-based capture and control system while At-Berth. The potential RoRo vessels serviced would be those calling into any berth located in a Southern California port.

93130.17 (b)(1)

(A): Company contact information is provided in Section 2.1 of this application.

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(B): The proposed innovative concept is to treat emissions from auto carrier vessels, or RoRos, (the source) at berth prior to the compliance date of the control measure. This concept will require the development of capture and control technology to be suitable for RoRos. Capture and Control technology is currently in development and TLO is supporting the effort through participating as the demonstration partner in a CARB sponsored technology development grant. Emission reductions would be per the Executive Order for the given technology. Maps of the location for these projects are found in Appendix C, figures C.2.

(C): Emission reductions anticipated to be achieved will be dependent on the vessels calling at eligible RoRo terminals near TLO Berths. The actual emission reductions will be dependent on the number of vessel calls treated and the performance of the CAECS employed in controlling emissions. No agreements are yet in place to treat vessels TLO does not control. Given these restrictions it is not feasible to estimate actual emissions at this time, however, sample calculations of emission reductions are found in appendix D-4. **Please refer to “Attachment A – Innovative Concept Reporting, Emissions Estimates, and Calculations” (excel document) for reference to the annual reporting methodology, compliance inputs, and emissions reduction calculations.**

(D): Recordkeeping and reporting for early control of RoRo emissions at berth will be done as described in Section 4 of this application. Monitoring of performance will utilize instrumentation on the capture and control equipment. Testing procedures will be per the Executive Order for the equipment utilized.

(E): Agreements between TLO and capture and control providers have not been developed. No agreements have yet been signed between TLO and any RoRo terminal operator who may have vessels available for early emissions control. **As technology is developed and proven, MOU’s will be executed as necessary. MOU’s which may need to be established to execute the concepts include, but are not limited to, barge capture and control vendors, vessel owners, vessel operators, and or affiliates of TLO.**

(F): The innovative concept is proposed for a duration up to the compliance date of the rule for Long Beach and Los Angeles berths.

(G): For capture and control, a CARB Executive Order will be necessary for the system to be considered a CAECS. **Local mobile source permits are expected to be required from the South Coast Air Quality Management District. These permits will be the responsibility of the capture and control service providers.**

(H): For barge-based capture and control systems, local mobile source permits are expected to be required from the South Coast Air Quality Management District. These permits will be the responsibility of the capture and control service provider or TLO should TLO elect to purchase a barge-based capture and control unit.

(I): Demonstration of eligibility and applicability per 93130.17(a):

(1) The application was submitted prior to December 1, 2021

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(2) Deploying a CARB-Approved Emissions Control Strategy (CAECS) on RoRos at non-TLO operated marine terminals prior to the compliance date of the control measure will remove emissions not otherwise required. Early compliance is explicitly identified in Section 93130.17(a)(3) of the control measure as being a reduction in excess of the requirement. The requirement to not increase GHGs is part of the Executive Order certification for the CAECS. Please refer to 'Attachment A – Innovative Concept Reporting, Emissions Estimates, and Calculations' (excel document) for reference to the annual reporting methodology, compliance inputs, and emissions reduction calculations. TLO's CARB Vessel Visit Report will be used to collect the necessary data inputs for calculating reductions achieved by the innovative concept. The emissions reduction values will then be recorded on the Annual Reporting Log for submission by February 1 of the proceeding year.

(3) Early compliance with this control measure is in excess of other requirements. A search for state, federal, international rule, regulation, statute, or any other legal requirements which may currently exist for tanker vessel emission reductions was conducted. While the search did not identify such requirements for emissions reductions, aside from CARB's Control Measure for Ocean-Going Vessels At Berth, some of the concepts reviewed include:

- Regulation (EU) 2023/1805
- The Port of Long Beach's Vessel Speed Reduction Program
- Port of Los Angeles Vessel Speed Reduction Program
- Port Authority of New York & New Jersey Clean Vessel Incentive (CVI) Program
- 2023 IMO Strategy on Reduction of GHG Emissions from Ships

(4) The emissions controlled as part of this project will be at the non-TLO berths within required proximity. Locations are identified on the maps in Appendix C, Figure C.2.

(5) Deployment of a CAECS at non-TLO operated marine terminals will only reduce emissions and not increase emissions at the terminal where deployed, nor elsewhere. For early compliance utilizing a capture and control system, all emissions generated by the system will have demonstrated its ability to treat emissions without increasing emissions during its Executive Order certification process.

(6) Deployment of a CAECS at non-TLO operated terminals that result in early compliance are not business as usual as described in 93130.17(a)(6). Emission reductions will be validated by the measurement of incoming emissions combined with the measurement of process unit outflow, documenting emission reduction performance.

(7) Information provided is for emissions prior to the first compliance period.

(8) This project is not eligible for another compliance period.

(9) Early compliance does not apply to VIEs, TIEs, or Remediation Fund.

(10) Reductions will be applied per the control measure and used per section 8 of this application.

(11) This project is for early reductions.

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(12) No public incentive programs are planned to be used to lease, purchase, or pay for a service.

(13) An internal system is setup for managing records in accordance with the Control Measure for Ocean-Going Vessel At Berth. There are efforts underway to evaluate the capability of leveraging a vessel management system to streamline at-berth operations and the management of data specific to the Control Measure. The internal site, along with any future systems, allow for records to be properly maintained and available for reporting if needed. TLO acknowledges records and reports shall be retained for a period of not less than five years and shall be submitted to the Executive Officer in the manner specified in the approved innovative concept and upon request by the Executive Officer, either within 10 calendar days or by a later date approved by the Executive Officer on a case-by-case basis.

(14) Early emission capture will be done utilizing a CAECS which will have already demonstrated the ability to comply with the control measure during its certification process and upon receipt of its CARB Executive Order.

(15) The timeline for implementation of early compliance emissions reduction is dependent on the ability of the capture and control industry to develop equipment to sufficiently accommodate demand. For this build-out to occur the capture and control industry must develop a means to treat RoRo vessels, something that has not yet been done or proven. Presently, TLOs estimate for developing projects for compliance exceed the implementation schedule of the control measure. TLO believes the first critical milestone to the implementation of capture and control technology is the development of a safe solution which can service all applicable Ro-Ro vessels. Once developed, the second major milestone includes demonstrating and testing the technology on Ro-Ro vessels. When an Executive Order is obtained, the last major milestone is to scale the solution to meet market demand. TLO believes there needs to be more than one service provider approved and available to prevent monopolization of services.

Sub-concept 5: Bulk Liquid Barges

*On September 19, 2024, TLO elected to no longer pursue Bulk Liquid Barges as an innovative concept.

Emissions captured and controlled from the auxiliary engines on liquid bulk barges that are used to offload cargo and provide power for other miscellaneous equipment on the barge. The barges would be serviced by a CARB approved capture and control system in Southern California while At-Berth. The barges serviced would be those calling into any berth located in Southern California.

93130.17 (b)(1)

(A): Company contact information is provided in Section 2.1 of this application.

(B): The proposed innovative concept is to treat emissions from bulk liquid barges (the source) at both TLO non-TLO berths prior to the compliance date of the control measure. This concept will require the development of capture and control technology to be suitable for liquid bulk barges. Capture and Control technology is currently in development and TLO is supporting the effort through participating as the demonstration partner in a CARB sponsored technology development grant. Emission reductions would

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be per the Executive Order for the given technology. Maps of the locations for these projects are found in Appendix C, figure C.1.

(C): Emission reductions anticipated to be achieved will be dependent on the barges calling at eligible Marine Oil Terminals at and near TLO Berths. The actual emission reductions will be dependent on the number of barge calls treated and the performance of the CAECS employed in controlling emissions. For TLO berths the estimate of vessel calls that would be subject to this innovative concept is still to be determined. For non-TLO berths, as the technology does not yet exist to treat liquid bulk barges, no agreements are in place to treat barges that TLO does not control. Given these restrictions it is not feasible to estimate actual emissions at this time, however sample calculations of emission reductions are found in appendix D-5. **Please refer to “Attachment A – Innovative Concept Reporting, Emissions Estimates, and Calculations’ (excel document) for reference to the annual reporting methodology, compliance inputs, and emissions reduction calculations.**

(D): Recordkeeping and reporting for early control of tanker emissions at non-TLO berths will be done as described in Section 4 of this application. Monitoring of performance will utilize instrumentation on the capture and control equipment. Testing procedures will be per the Executive Order for the equipment utilized.

(E): Agreements between TLO and capture and control providers have not been developed as the technology does not yet exist to successfully capture and process liquid bulk exhaust emissions. No agreements have yet been signed between TLO and any terminal operator who may have vessels available for early emissions control. **As technology is developed and proven, MOU’s will be executed as necessary. MOU’s which may need to be established to execute the concepts include, but are not limited to, barge capture and control vendors, vessel owners, vessel operators, and or affiliates of TLO.**

(F): The innovative concept is proposed for a duration of up to the compliance date of the rule for Long Beach and Los Angeles berths and for the first 5 years following the compliance date. TLO anticipates application extensions for subsequent periods while liquid bulk barge emissions remain eligible for this innovative concept.

(G): For capture and control, a CARB Executive Order will be necessary for the system to be considered a CAECS. **Local mobile source permits are expected to be required from the South Coast Air Quality Management District. These permits will be the responsibility of the capture and control service providers.**

(H): For barge-based capture and control systems, local mobile source permits are expected to be required from the South Coast Air Quality Management District (SCAQMD). These permits will be the responsibility of the capture and control service provider or TLO should TLO elect to purchase a barge-based capture and control unit. For shore-based capture and control systems, air permitting is under the jurisdiction of the SCAQMD and for CEQA review the lead agency is The Port of Long Beach County.

(I): Demonstration of eligibility and applicability per 93130.17(a):

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(1) The application was submitted prior to December 1, 2021

(2) Deploying a CAECS on bulk liquid barges at both TLO and non-TLO operated marine terminals prior to the compliance date of the control measure will remove emissions not otherwise required. The requirement to not increase GHGs is part of the Executive Order certification for the CAECS. **Please refer to 'Attachment A – Innovative Concept Reporting, Emissions Estimates, and Calculations' (excel document) for reference to the annual reporting methodology, compliance inputs, and emissions reduction calculations. TLO's CARB Vessel Visit Report will be used to collect the necessary data inputs for calculating reductions achieved by the innovative concept. The emissions reduction values will then be recorded on the Annual Reporting Log for submission by February 1 of the proceeding year.**

(3) Liquid bulk barges are not required to control emissions. Controlling of these emissions will be in excess of other requirements. **A search for state, federal, international rule, regulation, statute, or any other legal requirements which may currently exist for tanker vessel emission reductions was conducted. While the search did not identify such requirements for emissions reductions, aside from CARB's Control Measure for Ocean-Going Vessels At Berth, some of the concepts reviewed include:**

- Regulation (EU) 2023/1805
- The Port of Long Beach's Vessel Speed Reduction Program
- Port of Los Angeles Vessel Speed Reduction Program
- Port Authority of New York & New Jersey Clean Vessel Incentive (CVI) Program
- 2023 IMO Strategy on Reduction of GHG Emissions from Ships

(4) The emissions controlled as part of this project will be at the non-TLO berths within required proximity. Locations are identified on the maps in Appendix C, Figure C.1.

(5) Deployment of a CAECS at TLO and non-TLO operated marine terminals will only reduce emissions and not increase emissions at the terminal where deployed, nor elsewhere. For early compliance utilizing a capture and control system, all emissions generated by the system will have demonstrated its ability to treat emissions without increasing emissions during its Executive Order certification process.

(6) Deployment of a CAECS at TLO and non-TLO operated terminals that result in the reduction of emissions not otherwise regulated are not business as usual as described in 93130.17(a)(6). Emission reductions will be validated by the measurement of incoming emissions combined with the measurement of process unit outflow, documenting emission reduction performance.

(7) Information provided is best understood to date and includes the first compliance period.

(8) This project is eligible for additional compliance periods.

(9) Emissions not otherwise required do not apply to VIEs, TIEs, or Remediation Fund

(10) Reductions will be applied per the control measure and used per section 8 of this application.

(11) This project will apply for early reductions.

(12) No public incentive programs are planned to be used to lease, purchase, or pay for a service.

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(13) An internal system is setup for managing records in accordance with the Control Measure for Ocean-Going Vessel At Berth. There are efforts underway to evaluate the capability of leveraging a vessel management system to streamline at-berth operations and the management of data specific to the Control Measure. The internal site, along with any future systems, allow for records to be properly maintained and available for reporting if needed. TLO acknowledges records and reports shall be retained for a period of not less than five years and shall be submitted to the Executive Officer in the manner specified in the approved innovative concept and upon request by the Executive Officer, either within 10 calendar days or by a later date approved by the Executive Officer on a case-by-case basis.

(14) Early emission capture will be done utilizing a CAECS which will have already demonstrated the ability to comply with the control measure during its certification process and upon receipt of its CARB Executive Order.

(15) The timeline for implementation of emissions reduction is dependent on the ability of the capture and control industry to develop equipment to sufficiently accommodate demand. For this build-out to occur the capture and control industry must develop a means to treat liquid bulk barges, something that does not yet exist. Presently, TLOs estimate for developing projects for compliance exceed the implementation schedule of the control measure. TLO believes the first critical milestone to the implementation of capture and control technology is the development of a safe solution which can service all applicable bulk liquid vessels. Once developed, the second major milestone includes demonstrating and testing the technology on bulk liquid vessels. When an Executive Order is obtained, the last major milestone is to scale the solution to meet market demand. TLO believes there needs to be more than one service provider approved and available to prevent monopolization of services.

Sub-concept 6: Bulk and General Cargo Vessels

*On September 19, 2024, TLO elected to no longer pursue Bulk and General Cargo Vessels as an innovative concept.

Emissions captured and controlled from the auxiliary engines on bulk and general cargo vessels which are exempted from the At-Berth regulation as stipulated in Section 93130.8(b). Vessels would not be included for which other rules or requirements stipulate control of the emissions as outlined in Section 93130.17(a)(3). These vessels would be serviced by a CARB approved barge-based or dock-based capture and control system while At-Berth. The vessels serviced would be those calling into any berth located in Southern California.

93130.17 (b)(1)

(A): Company contact information is provided in Section 2.1 of this application.

(B): The proposed innovative concept is to treat emissions from bulk or general cargo vessels, (the source) at berth. This concept will require the development of capture and control technology to be suitable for bulk and general cargo vessels. Capture and control technology is currently in development and TLO is supporting the effort through participating as the demonstration partner in a CARB sponsored technology development grant. Emission reductions would be per the Executive Order for the given technology.

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These projects will be located within the required proximity of the TLO terminals shown in Figures 2.3.1 and 2.3.2.

(C): Emission reductions anticipated to be achieved will be dependent on the vessels calling at eligible bulk and general terminals near TLO Berths. The actual emission reductions will be dependent on the number of vessel calls treated and the performance of the CAECS employed in controlling emissions. No agreements are yet in place to treat vessels TLO does not control. Given these restrictions it is not feasible to estimate actual emissions at this time, however sample calculations of emission reductions are found in appendix D-6. **Please refer to “Attachment A – Innovative Concept Reporting, Emissions Estimates, and Calculations” (excel document) for reference to the annual reporting methodology, compliance inputs, and emissions reduction calculations.**

(D): Recordkeeping and reporting for control of bulk and general cargo emissions at berth will be done as described in Section 4 of this application. Monitoring of performance will utilize instrumentation on the capture and control equipment. Testing procedures will be per the Executive Order for the equipment utilized.

(E): Agreements between TLO and capture and control providers have not been developed. No agreements have yet been signed between TLO and any bulk and general cargo terminal operator who may have vessels available for emissions control. **As technology is developed and proven, MOU’s will be executed as necessary. MOU’s which may need to be established to execute the concepts include, but are not limited to, barge capture and control vendors, vessel owners, vessel operators, and or affiliates of TLO.**

(F): The innovative concept is proposed for a duration of up to the compliance date of the rule for Long Beach and Los Angeles berths and for the first 5 years following the compliance date. TLO anticipates application extensions for subsequent periods while liquid bulk barge emissions remain eligible for this innovative concept.

(G): For capture and control, a CARB Executive Order will be necessary for the system to be considered a CAECS. **Local mobile source permits are expected to be required from the South Coast Air Quality Management District. These permits will be the responsibility of the capture and control service providers.**

(H): For barge-based capture and control systems, local mobile source permits are expected to be required from the South Coast Air Quality Management District. These permits will be the responsibility of the capture and control service provider or TLO should TLO elect to purchase a barge-based capture and control unit.

(I): Demonstration of eligibility and applicability per 93130.17(a):

(1) The application was submitted prior to December 1, 2021

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(2) Deploying a CARB-Approved Emissions Control Strategy (CAECS) on bulk and general cargo vessels at non-TLO operated marine terminals will remove emissions not otherwise required. The requirement to not increase GHGs is part of the Executive Order certification for the CAECS. Please refer to 'Attachment A – Innovative Concept Reporting, Emissions Estimates, and Calculations' (excel document) for reference to the annual reporting methodology, compliance inputs, and emissions reduction calculations. TLO's CARB Vessel Visit Report will be used to collect the necessary data inputs for calculating reductions achieved by the innovative concept. The emissions reduction values will then be recorded on the Annual Reporting Log for submission by February 1 of the proceeding year.

(3) Bulk and general cargo vessels are not required to control emissions while at-berth as part of the control measure. The performance of the CAECS will be continually monitored through instrumentation on the capture and control system and all emission reductions will be in excess of requirements. A search for state, federal, international rule, regulation, statute, or any other legal requirements which may currently exist for tanker vessel emission reductions was conducted. While the search did not identify such requirements for emissions reductions, aside from CARB's Control Measure for Ocean-Going Vessels At Berth, some of the concepts reviewed include:

- Regulation (EU) 2023/1805
- The Port of Long Beach's Vessel Speed Reduction Program
- Port of Los Angeles Vessel Speed Reduction Program
- Port Authority of New York & New Jersey Clean Vessel Incentive (CVI) Program
- 2023 IMO Strategy on Reduction of GHG Emissions from Ships

(4) The emissions controlled as part of this project will be at the non-TLO berths within required proximity. Maps of the locations of the TLO berths are found in figures 2.3.1 and 2.3.2.

(5) Deployment of a CAECS at non-TLO operated marine terminals will only reduce emissions and not increase emissions at the terminal where deployed, nor elsewhere. The system will have demonstrated its ability to treat emissions without increasing emissions during its Executive Order certification process.

(6) Deployment of a CAECS at non-TLO operated terminals that result the reduction of emissions that are not otherwise required are not business as usual as described in 93130.17(a)(6). Emission reductions will be validated by the measurement of incoming emissions combined with the measurement of process unit outflow, documenting emission reduction performance.

(7) Information provided is best understood to date and includes the first compliance period.

(8) This project is eligible for additional compliance periods.

(9) Emissions not otherwise required do not apply to VIEs, TIEs, or Remediation Fund

(10) Reductions will be applied per the control measure and used per section 8 of this application.

(11) This project will apply for early reductions also.

(12) No public incentive programs are planned to be used to lease, purchase, or pay for a service.

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(13) An internal system is setup for managing records in accordance with the Control Measure for Ocean-Going Vessel At Berth. There are efforts underway to evaluate the capability of leveraging a vessel management system to streamline at-berth operations and the management of data specific to the Control Measure. The internal site, along with any future systems, allow for records to be properly maintained and available for reporting if needed. TLO acknowledges records and reports shall be retained for a period of not less than five years and shall be submitted to the Executive Officer in the manner specified in the approved innovative concept and upon request by the Executive Officer, either within 10 calendar days or by a later date approved by the Executive Officer on a case-by-case basis.

(14) Early emission capture will be done utilizing a CAECS which will have already demonstrated the ability to comply with the control measure during its certification process and upon receipt of its CARB Executive Order.

(15) The timeline for implementation of emissions reduction is dependent on the ability of the capture and control industry to develop equipment to sufficiently accommodate demand. For this build-out to occur the capture and control industry must develop a means to treat bulk and general cargo vessels, something that has not yet been done or proven. Presently, TLOs estimate for developing projects for compliance exceed the implementation schedule of the control measure. TLO believes the first critical milestone to the implementation of capture and control technology is the development of a safe solution which can service all applicable bulk and general cargo vessels. Once developed, the second major milestone includes demonstrating and testing the technology on bulk liquid vessels. When an Executive Order is obtained, the last major milestone is to scale the solution to meet market demand. TLO believes there needs to be more than one service provider approved and available to prevent monopolization of services.

Sub-concept 7: Container Ships At-Anchor (capture and control)

*On September 19, 2024, TLO elected to no longer pursue Container Ships at Anchor (capture and control) as an innovative concept.

Emissions from the auxiliary engines on container vessels which are at anchor in the Southern California port area are not required to be captured and controlled pursuant to the At-Berth regulation or any other regulation. Vessels at anchor are not covered by the rule as only vessels at berth are identified in Section 93130.1. Vessels would not be included for which other rules or requirements stipulate control of the emissions as outlined in Section 93130.17(a)(3). These vessels would be serviced by a CARB approved barge-based system while at anchor.

93130.17 (b)(1)

(A): Company contact information is provided in Section 2.1 of this application.

(B): The proposed innovative concept is to treat emissions from container vessels at anchor, (the source) at berth. This concept will require the proving of barge-based capture and control technology suitable for operations in open water environments. Emission reductions would be per the Executive Order for the

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given technology. These projects will be located at anchorage locations such as the anchorages around the ports of Long Beach and Los Angeles.

(C): Emission reductions anticipated to be achieved will be dependent on the vessels at anchor with barge capture and control equipment availability. The actual emission reductions will be dependent on the number of vessel calls treated and the performance of the CAECS employed in controlling emissions. No agreements are yet in place to treat vessels TLO does not control. Given these restrictions it is not feasible to estimate actual emissions at this time, however sample calculations of emission reductions are found in appendix D-7. **Please refer to “Attachment A – Innovative Concept Reporting, Emissions Estimates, and Calculations” (excel document) for reference to the annual reporting methodology, compliance inputs, and emissions reduction calculations.**

(D): Recordkeeping and reporting for control of container vessel emissions at anchor will be done as described in Section 4 of this application. Monitoring of performance will utilize instrumentation on the capture and control equipment. Testing procedures will be per the Executive Order for the equipment utilized.

(E): Agreements between TLO and capture and control providers have not been developed. No agreements have yet been signed between TLO and any container vessel operator who may have vessels available for emissions control. **As technology is developed and proven, MOU’s will be executed as necessary. MOU’s which may need to be established to execute the concepts include, but are not limited to, barge capture and control vendors, vessel owners, vessel operators, and or affiliates of TLO.**

(F): The innovative concept is proposed for a duration of up to the compliance date of the rule for Long Beach and Los Angeles berths and for the first 5 years following the compliance date. TLO anticipates application extensions for subsequent periods while container vessel emissions at anchor remain eligible for this innovative concept.

(G): For capture and control, a CARB Executive Order will be necessary for the system to be considered a CAECS. **Local mobile source permits are expected to be required from the South Coast Air Quality Management District. These permits will be the responsibility of the capture and control service providers.**

(H): For barge-based capture and control systems, local mobile source permits are expected to be required from the South Coast Air Quality Management District. These permits will be the responsibility of the capture and control service provider or TLO should TLO elect to purchase a barge-based capture and control unit.

(I): Demonstration of eligibility and applicability per 93130.17(a):

(1) The application was submitted prior to December 1, 2021

(2) Deploying a CARB-Approved Emissions Control Strategy (CAECS) on container vessels at anchor will remove emissions not otherwise required. The requirement to not increase GHGs is part of the Executive

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Order certification for the CAECS. Please refer to 'Attachment A – Innovative Concept Reporting, Emissions Estimates, and Calculations' (excel document) for reference to the annual reporting methodology, compliance inputs, and emissions reduction calculations. TLO's CARB Vessel Visit Report will be used to collect the necessary data inputs for calculating reductions achieved by the innovative concept. The emissions reduction values will then be recorded on the Annual Reporting Log for submission by February 1 of the proceeding year.

(3) Container vessels at anchor are not required to control emissions as part of the control measure. The performance of the CAECS will be continually monitored through instrumentation on the capture and control system and all emission reductions will be in excess of requirements. A search for state, federal, international rule, regulation, statute, or any other legal requirements which may currently exist for tanker vessel emission reductions was conducted. While the search did not identify such requirements for emissions reductions, aside from CARB's Control Measure for Ocean-Going Vessels At Berth, some of the concepts reviewed include:

- Regulation (EU) 2023/1805
- The Port of Long Beach's Vessel Speed Reduction Program
- Port of Los Angeles Vessel Speed Reduction Program
- Port Authority of New York & New Jersey Clean Vessel Incentive (CVI) Program
- 2023 IMO Strategy on Reduction of GHG Emissions from Ships

(4) The emissions controlled as part of this project will be at anchorage in San Pedro Bay or adjoining anchorages.

(5) Deployment of a CAECS at anchor will only reduce emissions and not increase emissions at the anchor where deployed, nor elsewhere. The system will have demonstrated its ability to treat emissions without increasing emissions during its Executive Order certification process.

(6) Deployment of a CAECS at anchor that result in the reduction of emissions not otherwise regulated are not business as usual as described in 93130.17(a)(6). Emission reductions will be validated by the measurement of incoming emissions combined with the measurement of process unit outflow, documenting emission reduction performance.

(7) Information provided is best understood to date and includes the first compliance period.

(8) This project is eligible for additional compliance periods.

(9) Emissions not otherwise required do not apply to VIEs, TIEs, or Remediation Fund

(10) Reductions will be applied per the control measure and used per section 8 of this application.

(11) This project will apply for early reductions also.

(12) No public incentive programs are planned to be used to lease, purchase, or pay for a service.

(13) An internal system is setup for managing records in accordance with the Control Measure for Ocean-Going Vessel At Berth. There are efforts underway to evaluate the capability of leveraging a vessel

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management system to streamline at-berth operations and the management of data specific to the Control Measure. The internal site, along with any future systems, allow for records to be properly maintained and available for reporting if needed. TLO acknowledges records and reports shall be retained for a period of not less than five years and shall be submitted to the Executive Officer in the manner specified in the approved innovative concept and upon request by the Executive Officer, either within 10 calendar days or by a later date approved by the Executive Officer on a case-by-case basis.

(14) Emission control will be done utilizing a CAECS which will have already demonstrated the ability to comply with the control measure during its certification process and upon receipt of its CARB Executive Order.

(15) The timeline for implementation of emissions reduction is dependent on the ability of the capture and control industry to develop equipment to sufficiently accommodate demand. For this build-out to occur the capture and control industry must prove an ability to operate in the open water environment, something that has not yet been done. Presently, TLOs estimate for developing projects for compliance exceed the implementation schedule of the control measure. TLO believes the first critical milestone to the implementation of capture and control technology is the development of a safe solution which can service all applicable container vessels in the open water environment. Once developed, the second major milestone includes demonstrating and testing the technology. When an Executive Order is obtained, the last major milestone is to scale the solution to meet market demand.

Sub-concept 8: Minimizing Emissions Control Connect and Disconnect Times

*On November 14, 2023, CARB indicated the innovative concept of Minimizing Emissions Control Connect and Disconnect Times is ineligible for consideration.

Emissions associated with the emissions control system connecting and disconnecting at times reduced from those stipulated Section 93130.7(e)(3)(A) and (B). The "Reduced Time to Connect" will be determined by subtracting the time between Ready to Work and Successful Connection from the two-hour stipulated limit. The definition of Successful Connection is defined by the items listed below.

1. Capture hood(s) are physically in place on the stack(s) and the system is indicating capture efficiency equal to or in excess of the requirements of the Executive Order that covers the capture and control system being used.
2. Outlet emission levels for PM, NOx, and ROG are at or below the requirements of the Executive Order that covers the capture and control system being used.
3. The on-board Manager of the capture and control system being used declares the system is Ready for Operations according to the operations manual of the system.

For capture and control, the total mass emissions associated with the Reduced Connection Time will be determined by subtracting the total measured inlet mass emissions from the total measured outlet mass emissions over the period of the Reduced Connection Time.

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The “Reduced Time to Disconnect” will be determined by subtracting the time between Pilot on Board and Successful Disconnect from the one-hour stipulated limit. The definition of Successful Disconnect is defined by the items listed below.

Capture hood(s) have been physically removed from the stack(s) and the capture booms are stowed for transport.

The treatment system has been purged and shutdown.

The on-board Manager of the capture and control system being used declares the system is Ready for Transport according to the operations manual of the system.

For capture and control the total mass emissions associated with the Reduced Disconnect Time will be determined by subtracting the total measured inlet mass emissions from the total measured outlet mass emissions over the period of the Reduced Disconnect Time.

For Shore Power Systems

For shore power systems, the “Reduced Time to Connect” will be determined by subtracting the time between Ready to Work and Successful Connection from the two-hour stipulated limit. A successful Connection is defined by the electrical connection being complete, and vessel is operating on shore power

The “Reduced Time to Disconnect” will be determined by subtracting the time between Pilot on Board and Successful Disconnect from the one-hour stipulated limit. A successful disconnect is defined by the electrical disconnection is complete between vessel and shore, and vessel is no longer operating on shore power

For both “Reduced Time to Connect”, and “Reduced Time to Disconnect” for shore power systems, the emissions controlled will be calculated based on anticipated fuel consumption during the “Reduced Time to Connect” and “Reduced Time to Disconnect”.

These calculations will be performed as part of the standard vessel call report generated for regulated pollutants as discussed in Section 5.1 of this application.

93130.17 (b)(1)

(A): Company contact information is provided in Section 2.1 of this application.

(B): The proposed innovative concept is to treat emissions from tanker vessels, (the source) at berth more effectively than what is required by the control measure. The concept is described in detail in the “Project Description” at the beginning of this section. This concept will require the development of capture and control technology to be suitable for tanker vessels. Capture and control technology is currently in development and TLO is supporting the effort through participating as the demonstration partner in a CARB sponsored technology development grant. Emission reductions would be per the Executive Order for the given technology. These projects will be located at the TLO terminals shown in Figures 2.3.1 and 2.3.2.

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(C): Emission reductions anticipated to be achieved will be dependent on the vessels calling at TLO berths, the number of vessel calls treated, the reduced time to connect and disconnect, and the performance of the CAECS employed in controlling emissions. The estimate of vessel calls that would be subject to this innovative concept is still to be determined. Sample calculations of emission reductions are found in appendix D-8. **Please refer to “Attachment A – Innovative Concept Reporting, Emissions Estimates, and Calculations” (excel document) for reference to the annual reporting methodology, compliance inputs, and emissions reduction calculations.**

(D): Recordkeeping and reporting for control of tanker emissions at TLO berths will be done as described in Section 4 of this application. Monitoring of performance will utilize instrumentation on the capture and control equipment. Testing procedures will be per the Executive Order for the equipment utilized.

(E): Agreements between TLO and capture and control providers have not been developed as the technology does not yet exist to successfully capture and process tanker exhaust emissions. No agreements have yet been developed supporting the development of shore power as a solution. **As technology is developed and proven, MOU’s will be executed as necessary. MOU’s which may need to be established to execute the concepts include, but are not limited to, barge capture and control vendors, vessel owners, vessel operators, and or affiliates of TLO.**

(F): The innovative concept is proposed for a duration of up to the compliance date of the rule for Long Beach and Los Angeles berths and for the first 5 years following the compliance date. TLO anticipates application extensions for subsequent periods while over-compliance emissions remain eligible for this innovative concept.

(G): For capture and control, a CARB Executive Order will be necessary for the system to be considered a CAECS. **Local mobile source permits are expected to be required from the South Coast Air Quality Management District. These permits will be the responsibility of the capture and control service providers.**

(H): For barge-based capture and control systems, local mobile source permits are expected to be required from the South Coast Air Quality Management District. These permits will be the responsibility of the capture and control service provider or TLO should TLO elect to purchase a barge-based capture and control unit. For shore-based capture and control systems, air permitting would be through the SCAQMD. For shore-based capture and control systems and shore power systems, California Environmental Quality Act (CEQA) permitting is anticipated with The Port of Long Beach County serving as the lead agency.

(I): Demonstration of eligibility and applicability per 93130.17(a):

(1) The application was submitted prior to December 1, 2021

(2) Deploying a CARB-Approved Emissions Control Strategy (CAECS) on tanker vessels at TLO operated marine terminals and performing in excess of the requirements in the control measure will remove emissions not otherwise required. The requirement to not increase GHGs is part of the Executive Order certification for the CAECS. **Please refer to ‘Attachment A – Innovative Concept Reporting, Emissions**

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Estimates, and Calculations’ (excel document) for reference to the annual reporting methodology, compliance inputs, and emissions reduction calculations. TLO’s CARB Vessel Visit Report will be used to collect the necessary data inputs for calculating reductions achieved by the innovative concept. The emissions reduction values will then be recorded on the Annual Reporting Log for submission by February 1 of the proceeding year.

(3) The performance of the CAECS will be continually monitored through instrumentation on the capture and control system and all emission reductions will be in excess of requirements. A search for state, federal, international rule, regulation, statute, or any other legal requirements which may currently exist for tanker vessel emission reductions was conducted. While the search did not identify such requirements for emissions reductions, aside from CARB’s Control Measure for Ocean-Going Vessels At Berth, some of the concepts reviewed include:

- Regulation (EU) 2023/1805
- The Port of Long Beach’s Vessel Speed Reduction Program
- Port of Los Angeles Vessel Speed Reduction Program
- Port Authority of New York & New Jersey Clean Vessel Incentive (CVI) Program
- 2023 IMO Strategy on Reduction of GHG Emissions from Ships

(4) The emissions controlled as part of this project will be at the TLO berths. Maps of the locations of the TLO berths are found in figures 2.3.1 and 2.3.2.

(5) Deployment of a CAECS at TLO operated marine terminals will only reduce emissions and not increase emissions at the terminal where deployed, nor elsewhere. Increased operational efficiency will result in emission reductions beyond the requirement of the control measure. The system will have demonstrated its ability to treat emissions without increasing emissions during its Executive Order certification process.

(6) Deployment of a CAECS at TLO operated terminals that result in the reduction of emissions that are in excess of the requirements of the control measure are not business as usual as described in 93130.17(a)(6). Meeting the time requirements set forth in the Regulation results in emissions reductions required by law and constitutes business as usual. There is no requirement in the law or the Regulation that requires exceeding the time requirements in order to ensure compliance. In the event TLO operated strictly to a business-as-usual scenario, the additional emissions proposed would not be reduced. Emission reductions will be validated by the measurement of incoming emissions combined with the measurement of process unit outflow, documenting emission reduction performance.

(7) Information provided is best understood to date and includes the first compliance period.

(8) This project is eligible for additional compliance periods.

(9) Emissions not otherwise required do not apply to VIEs, TIEs, or Remediation Fund

(10) Reductions will be applied per the control measure and used per section 8 of this application.

(11) This project will apply for early reductions also.

(12) No public incentive programs are planned to be used to lease, purchase, or pay for a service.

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(13) An internal system is setup for managing records in accordance with the Control Measure for Ocean-Going Vessel At Berth. There are efforts underway to evaluate the capability of leveraging a vessel management system to streamline at-berth operations and the management of data specific to the Control Measure. The internal site, along with any future systems, allow for records to be properly maintained and available for reporting if needed. TLO acknowledges records and reports shall be retained for a period of not less than five years and shall be submitted to the Executive Officer in the manner specified in the approved innovative concept and upon request by the Executive Officer, either within 10 calendar days or by a later date approved by the Executive Officer on a case-by-case basis.

(14) Emission capture will be done utilizing a CAECS which will have already demonstrated the ability to comply with the control measure during its certification process and upon receipt of its CARB Executive Order.

(15) The timeline for implementation of emissions reduction is dependent on the ability of the capture and control industry to develop equipment to sufficiently accommodate demand as well as the adoption of shore power by both vessels and terminals. For this build-out to occur the capture and control industry must develop a means to treat tanker vessels, something that has not yet been created. Presently, TLOs estimate for developing projects for compliance exceed the implementation schedule of the control measure. TLO believes the first critical milestone to the implementation of capture and control technology is the development of a safe solution which can service all applicable tanker vessels. Once developed, the second major milestone includes demonstrating and testing the technology on tanker vessels. When an Executive Order is obtained, the last major milestone is to scale the solution to meet market demand. TLO believes there needs to be more than one service provider approved and available to prevent monopolization of services.

Sub-concept 9: Vessel Speed Reduction

*On September 19, 2024, TLO elected to no longer pursue Vessel Speed Reduction as an innovative concept.

Emissions reductions associated with vessel speed reductions are an available source of non-regulated emissions. Presently, TLO participates in the Port of Long Beach Green Flag program to reduce vessel speeds to 12 knots. Reductions in speed below 12 knots within three nautical miles of the terminals may be possible. Emission reductions associated with vessel speed reductions can be calculated utilizing one of the following methods

- A. U.S. Environmental Protection Agency. 2020. Ports Emissions Inventory Guidance: Methodologies for Estimating Port Related and Goods Movement Mobile Source Emissions. [Port Emissions Inventory Guidance: Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emissions \(EPA-420-B-20-046, September 2020\)](#) Appendix Table E-1. Accessed 3-5-2021.
- B. Reduction in fuel usage from 12 knots to actual vessel speed reduction.

These calculations will be performed as part of the standard vessel call report generated for regulated pollutants as discussed in Section 5.1.

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93130.17 (b)(1)

(A): Company contact information is provided in Section 2.1 of this application.

(B): The proposed innovative concept is to slow vessels in transit to reduce emissions. See project description above.

(C): Emission reductions anticipated to be achieved will be dependent on the vessels calling at TLO berths, the number of vessel calls and the ability of vessels to safely slow beyond business as usual today. The estimate of vessel calls that would be subject to this innovative concept is still to be determined. **Please refer to “Attachment A – Innovative Concept Reporting, Emissions Estimates, and Calculations” (excel document) for reference to the annual reporting methodology, compliance inputs, and emissions reduction calculations.**

(D): Recordkeeping and reporting for emission reductions due to slowing vessel speeds will be done as described above and in Section 4.

(E): Agreements between TLO and vessel operators have not been developed for emission reductions due to slowing vessel speeds. **Upon review and/or approval of this concept, MOU’s will be executed as necessary. MOU’s which may need to be established to execute the concepts include, but are not limited to, vessel owners, vessel operators, and or affiliates of TLO.**

(F): The innovative concept is proposed for a duration of up to the compliance date of the rule for Long Beach and Los Angeles berths and for the first 5 years following the compliance date. TLO anticipates application extensions for subsequent periods while slowing vessels remain eligible for this innovative concept.

(G): No governmental approvals are necessary for this concept. **Vessel Speed Reduction programs were considered with this review.**

(H): No environmental review is necessary for this concept.

(I): Demonstration of eligibility and applicability per 93130.17(a):

(1) The application was submitted prior to December 1, 2021

(2) Reducing fuel consumption by slowing vessel speeds results in emission reductions while also reducing GHG emissions. **TLO Response: Please refer to ‘Attachment A – Innovative Concept Reporting, Emissions Estimates, and Calculations’ (excel document) for reference to the annual reporting methodology, compliance inputs, and emissions reduction calculations. TLO’s CARB Vessel Visit Report will be used to collect the necessary data inputs for calculating reductions achieved by the innovative concept. The emissions reduction values will then be recorded on the Annual Reporting Log for submission by February 1 of the proceeding year. Specific to tracking vessel speed geographically, the Vessel Visit Report contains data inputs for vessel speed within 3 nautical miles of the berth. TLO acknowledges input data for the**

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emissions reductions would have to be monitored and tested to demonstrate reductions meet the values put forth by the EPA.

(3) The control measure does not require emissions reductions while not at berth. Emissions reductions in transit are in excess of requirements. A search for state, federal, international rule, regulation, statute, or any other legal requirements which may currently exist for tanker vessel emission reductions was conducted. While the search did not identify such requirements for emissions reductions, aside from CARB's Control Measure for Ocean-Going Vessels At Berth, some of the concepts reviewed include:

- Regulation (EU) 2023/1805
- The Port of Long Beach's Vessel Speed Reduction Program
- Port of Los Angeles Vessel Speed Reduction Program
- Port Authority of New York & New Jersey Clean Vessel Incentive (CVI) Program
- 2023 IMO Strategy on Reduction of GHG Emissions from Ships

(4) Slower vessel speeds would be attempted from anchorage all the way to the berth where practical.

(5) Slowing vessel speeds reduces fuel consumption and does not increase emissions at other ports.

(6) Vessel speed reductions to generate credits for this innovative concept will only be applied when not business as usual. Applicable vessels calling to TLO berths will be offered the opportunity to participate in the innovative concept for vessel speed reduction. Since this concept is still under review, TLO has not established agreements with vessels who may be willing to participate. This effort will be conducted following approval of the innovative concept.

(7) Information provided is best understood to date and includes the first compliance period.

(8) This project is eligible for additional compliance periods.

(9) Emissions not otherwise required do not apply to VIEs, TIEs, or Remediation Fund

(10) Reductions will be applied per the control measure and used per section 8 of this application.

(11) This project will apply for early reductions also.

(12) No public incentive programs are planned to be used to lease, purchase, or pay for a service.

(13) An internal system is setup for managing records in accordance with the Control Measure for Ocean-Going Vessel At Berth. There are efforts underway to evaluate the capability of leveraging a vessel management system to streamline at-berth operations and the management of data specific to the Control Measure. The internal site, along with any future systems, allow for records to be properly maintained and available for reporting if needed. TLO acknowledges records and reports shall be retained for a period of not less than five years and shall be submitted to the Executive Officer in the manner specified in the approved innovative concept and upon request by the Executive Officer, either within 10 calendar days or by a later date approved by the Executive Officer on a case-by-case basis.

(14) Agreements have not yet been formulated with vessel operators regarding this concept.

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(15) The timeline for implementation of this innovative concept is immediately pursuant to the approval of the application, study of risks associated with further slowing vessels, completion of the reporting structure, and development of any necessary agreements with vessel operators. **The first major milestone to commencing this concept is CARB approval. A risk study, followed by a review of applicable agreements with vessels, would be conducted thereafter.**

Sub-concept 10: Capture and Control Performance Exceeds the Requirements of the Rule

***On November 14, 2023, CARB indicated the innovative concept of Capture and Control Performance Exceeds the Requirements of the Rule is ineligible for consideration.**

Emissions associated with the capture and control system exceeding the performance requirements stipulated in Sections 93130.17(5)(d)(1) and (2). The actual measured mass emissions would be calculated based on the total measured emissions at the outlet of the capture and control system over the duration of the vessel call. Emissions will be measured continuously for PM, NOx, and ROG along with volumetric flow rate and temperature, and then the mass emissions will be calculated in total kg for the vessel call. The vessel call would begin two hours after ready to work [Section 93130.2(b)(63)] and would complete at one hour before pilot on board [Section 93130.2(b)(58)] as defined in Section 93130.7(e)(3)(A) and (B).

The excess emission reductions will be the difference between the maximum allowable emission and the actual measured mass emissions. The maximum allowable mass emissions for the vessel call will be calculated for the auxiliary engine(s) and boiler(s) individually based on fuel consumption records from the vessel according to the method outlined in Section 93130.17(d)(1)(B). The actual measured mass emissions will be subtracted from the maximum allowable emissions for both auxiliary engines and boilers to determine the additional emission reduction for PM, NOx, and ROG and will be reported in total pounds for each pollutant.

These calculations will be performed as part of the standard vessel call report generated for regulated pollutants as discussed in Section 5.1 of this application.

93130.17 (b)(1)

(A): Company contact information is provided in Section 2.1 of this application.

(B): The proposed innovative concept is to treat emissions from tanker vessels, (the source) at berth more effectively than what is required by the control measure. The concept is described in detail in the "Project Description" at the beginning of this section. This concept will require the development of capture and control technology to be suitable for tanker vessels. Capture and control technology is currently in development and TLO is supporting the effort through participating as the demonstration partner in a CARB sponsored technology development grant. Emission reductions would be per the Executive Order for the given technology. These projects will be located at the TLO terminals shown in Figures 2.3.1 and 2.3.2.

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(C): Emission reductions anticipated to be achieved will be dependent on the vessels calling at TLO berths, the number of vessel calls treated, and the performance of the CAECS employed in controlling emissions. The estimate of vessel calls that would be subject to this innovative concept is still to be determined. Sample calculations of emission reductions are found in appendix D-10. **Please refer to ‘Attachment A – Innovative Concept Reporting, Emissions Estimates, and Calculations’ (excel document) for reference to the annual reporting methodology, compliance inputs, and emissions reduction calculations.**

(D): Recordkeeping and reporting for early control of tanker emissions at TLO berths will be done as described in Section 4 of this application. Monitoring of performance will utilize instrumentation on the capture and control equipment. Testing procedures will be per the Executive Order for the equipment utilized.

(E): Agreements between TLO and capture and control providers have not been developed as the technology does not yet exist to successfully capture and process tanker exhaust emissions. **As technology is developed and proven, MOU’s will be executed as necessary. MOU’s which may need to be established to execute the concepts include, but are not limited to, barge capture and control vendors, vessel owners, vessel operators, and or affiliates of TLO.**

(F): The innovative concept is proposed for a duration of up to the compliance date of the rule for Long Beach and Los Angeles berths and for the first 5 years following the compliance date. TLO anticipates application extensions for subsequent periods while over-compliance emissions remain eligible for this innovative concept.

(G): For capture and control, a CARB Executive Order will be necessary for the system to be considered a CAECS. **Local mobile source permits are expected to be required from the South Coast Air Quality Management District. These permits will be the responsibility of the capture and control service providers.**

(H): For barge-based capture and control systems, local mobile source permits are expected to be required from the South Coast Air Quality Management District. These permits will be the responsibility of the capture and control service provider or TLO should TLO elect to purchase a barge-based capture and control unit. For shore-based capture and control systems, air permitting would be through the SCAQMD and CEQA permitting is anticipated with The Port of Long Beach County serving as the lead agency.

(I): Demonstration of eligibility and applicability per 93130.17(a):

(1) The application was submitted prior to December 1, 2021

(2) Deploying a CARB-Approved Emissions Control Strategy (CAECS) on tanker vessels at TLO operated marine terminals and performing in excess of the requirements in the control measure will remove emissions not otherwise required. The requirement to not increase GHGs is part of the Executive Order certification for the CAECS. **Please refer to ‘Attachment A – Innovative Concept Reporting, Emissions Estimates, and Calculations’ (excel document) for reference to the annual reporting methodology, compliance inputs, and emissions reduction calculations. TLO’s CARB Vessel Visit Report will be used to**

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collect the necessary data inputs for calculating reductions achieved by the innovative concept. The emissions reduction values will then be recorded on the Annual Reporting Log for submission by February 1 of the proceeding year.

(3) The performance of the CAECS will be continually monitored through instrumentation on the capture and control system and all emission reductions will be in excess of requirements. A search for state, federal, international rule, regulation, statute, or any other legal requirements which may currently exist for tanker vessel emission reductions was conducted. While the search did not identify such requirements for emissions reductions, aside from CARB's Control Measure for Ocean-Going Vessels At Berth, some of the concepts reviewed include:

- Regulation (EU) 2023/1805
- The Port of Long Beach's Vessel Speed Reduction Program
- Port of Los Angeles Vessel Speed Reduction Program
- Port Authority of New York & New Jersey Clean Vessel Incentive (CVI) Program
- 2023 IMO Strategy on Reduction of GHG Emissions from Ships

(4) The emissions controlled as part of this project will be at the TLO berths. Maps of the locations of the TLO berths are found in figures 2.3.1 and 2.3.2.

(5) Deployment of a CAECS at TLO operated marine terminals will only reduce emissions and not increase emissions at the terminal where deployed, nor elsewhere. Increased operational efficiency will result in emission reductions beyond the requirement of the control measure. The system will have demonstrated its ability to treat emissions without increasing emissions during its Executive Order certification process.

(6) Deployment of a CAECS at TLO operated terminals that result in the reduction of emissions that are in excess of the requirements of the control measure are not business as usual as described in 93130.17(a)(6). Meeting the emissions requirements set forth in the Regulation results in emissions reductions required by law and constitutes business as usual. There is no requirement in the law or the Regulation that requires exceeding the emissions requirements in order to ensure compliance. In the event TLO operated strictly to a business-as-usual scenario, the additional emissions proposed would not be reduced. Emission reductions will be validated by the measurement of incoming emissions combined with the measurement of process unit outflow, documenting emission reduction performance.

(7) Information provided is best understood to date and includes the first compliance period.

(8) This project is eligible for additional compliance periods.

(9) Emissions not otherwise required do not apply to VIEs, TIEs, or Remediation Fund

(10) Reductions will be applied per the control measure and used per section 8 of this application.

(11) This project will apply for early reductions also.

(12) No public incentive programs are planned to be used to lease, purchase, or pay for a service.

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(13) An internal system is setup for managing records in accordance with the Control Measure for Ocean-Going Vessel At Berth. There are efforts underway to evaluate the capability of leveraging a vessel management system to streamline at-berth operations and the management of data specific to the Control Measure. The internal site, along with any future systems, allow for records to be properly maintained and available for reporting if needed. TLO acknowledges records and reports shall be retained for a period of not less than five years and shall be submitted to the Executive Officer in the manner specified in the approved innovative concept and upon request by the Executive Officer, either within 10 calendar days or by a later date approved by the Executive Officer on a case-by-case basis.

(14) Emission capture will be done utilizing a CAECS which will have already demonstrated the ability to comply with the control measure during its certification process and upon receipt of its CARB Executive Order.

(15) The timeline for implementation of emissions reduction is dependent on the ability of the capture and control industry to develop equipment to sufficiently accommodate demand as well as the adoption of shore power by both vessels and terminals. For this build-out to occur the capture and control industry must develop a means to treat tanker vessels, something that has not yet been created. Presently, TLOs estimate for developing projects for compliance exceed the implementation schedule of the control measure. TLO believes the first critical milestone to the implementation of capture and control technology is the development of a safe solution which can service all applicable tanker vessels. Once developed, the second major milestone includes demonstrating and testing the technology on tanker vessels. When an Executive Order is obtained, the last major milestone is to scale the solution to meet market demand. TLO believes there needs to be more than one service provider approved and available to prevent monopolization of services.

4 Emission Measurements and Estimates

The emission reductions achieved for all source categories listed in Section 3 of this application, except for the sources described in Section 3.2, 3.7b, and 3.9, will be monitored on a continuous basis. These continuous measurements will be on the inlet and outlet of the capture and control system being used and will include individual measurements for PM, NOx, and ROG. The operations of these measurement systems will be operated according to the requirements of the Executive Order issued for the capture and control system being used.

Measurement of Emission Reductions Not Otherwise Required from Capture and Control Equipment

Any emissions associated with a capture and control system will be directly measured and the results of those measurements will be included in the Captured and Controlled Emissions report discussed in Section 5.2 of this application.

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Vessels Utilizing Emission Reduction Credits – Emission Estimates

All emission estimates utilized for the purpose of applying collected emissions not otherwise required will be performed utilizing the Vessels Utilizing Emission Reduction Credits Report discussed in Section 5.3 of this application.

5 Vessel Call Reports

The reports described below will be used to manage the collection of emission reductions not otherwise required and the distribution of those emissions to regulated vessels. One of these reports would be generated for each vessel call, or in some cases portion of a vessel call, that require compliance as defined in Section 93130.3(a).

Captured and Controlled Regulated Emissions – Vessel Call Report

A report will be developed for each vessel call, or portion of a vessel call, which will require the use of a CARB approved capture and control system for compliance. This report will incorporate data from the vessel, the terminal, and capture and control system. The data to be collected, source of the data, calculations, and outputs of those calculations are shown in Appendix A of this application.

Captured and Controlled Emissions Not Otherwise Required – Vessel Call Report

A report will be developed for each vessel call, or portion of a vessel call, which will utilize a CARB approved capture and control system collect emissions from sources not required to be controlled. This report will incorporate data from the vessel, the terminal, and capture and control system.

Vessels Utilizing Emission Reduction Credits – Vessel Call Report

A report will be developed for each vessel call, or portion of a vessel call, which will require the application of emission reduction credits for compliance. This report will incorporate data from the vessel, the terminal, and will utilize emission factors that are defined in Section 93130.17(d)(1)(B) of the rule.

As an alternative to the default emission factors, TLO requests as part of this application to be able to apply the emission factors per the appropriate MARPOL Annex VI engine Tier as reported by the vessel owner / operator.

The data to be collected, source of the data, calculations, and outputs of those calculations are shown in Appendix B of this application.

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6 Executive Order Timing

The purpose of this application is to develop emission reduction credits through controlling emissions from sources that are not otherwise required under The Control Measure for Ocean-Going Vessels at Berth set forth in Sections 93130 through 93130.22, title 17, California Code of Regulations.

It is assumed that amendments to current regulations and development of new regulations will change the types and quantities of source categories not required to be controlled. Any renewal application will incorporate amendments to existing or new regulations for the sources identified in this application.

Initial Duration

The initial duration requested is for the maximum of 5 years as stipulated in Section 93130.17(a)(7).

Renewals

It is anticipated that renewals will be requested as specified in Section 93130.17(a)(7). The renewal duration will be for the maximum allowed, 5 years, and the new application will update Section 2 of this application based on the development of new regulations or the identification of yet to be identified source categories.

7 Agreements, Government Approvals, and Environmental Review

This section addresses the items listed in Section 93130.17(b)(1)(E), (G), and (H).

Memorandum of Understanding

Memoranda of Understanding (MOUs) do not currently exist due to the early stage of development of the technology and programmatic components that are required for the implementation of the innovative concept plan. As technology is developed and proven the MOUs will be executed as needed with the appropriate counterparty. Counterparties may include affiliates of TLO.

Government Approvals

The requirement in this section is acknowledged and understood and no government approvals are required other than the one issued by CARB in response to this application.

Environmental Review

The requirement in this section is acknowledged and understood and no environmental reviews are required as part of this application.

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8 Emission Reduction Credits Use

The purpose of this application is to develop a system by which emission reductions not otherwise required can be used to aid in compliance with the regulation. The intent of this system is to allow for better utilization of a CARB approved emissions control strategy, which will produce the intended emissions reduction of the regulation while minimizing the cost to achieve those reductions on a dollars per ton of pollutant treated basis. There will be instances for which the available CARB approved emissions control strategies will not be adequate to service the number of vessels which are at berth simultaneously.

It is proposed that emissions credits may be able to be transferred or traded with other parties which have an emission reduction obligation under the regulation. The ability to transfer or trade credits will allow for more efficient use of CARB approved emissions control strategies by allowing equipment, terminal, and vessel operators and to optimize the deployment of emission control equipment.

It is proposed that all emission trading be accomplished in the units of actual pounds of either PM, NOx, or ROG.

Data Management Methods

Each of the vessel call reports described in Section 5 will be identified with a unique serial number. An Emission Reduction Credit Database will be developed to manage the data from each vessel call report and will also contain trading accounts for PM, NOx, and ROG. The data which populates the emission reduction credit accounts will be transferred from the vessel call reports which are governed by the Executive Orders for the capture and control systems or, in the case of the “Vessels Utilizing Emission Reduction Credits” report, the Executive Order issued in approval of this application will validate the content. The Emission Reduction Credit database will be developed and presented to the Executive Officer for approval prior to it being utilized. This approval would be documented in the Executive Order.

Data Entry

Data entry to the Emissions Emission Reduction Credit Database will be accomplished by reading the vessel call reports electronically and the accuracy of that electronic transfer will be validated as described in Section 11 of this application. The data entry process will only be initiated by individuals that have been trained in the process and will follow the guidelines established in a written procedure that describes the process. That procedure will be developed by the same entity that will develop the Emission Reduction Credit Database software.

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Data Access

The Emission Reduction Credit Database will be password protected and its contents will be audited as described in Section 11 of this application. The individuals with access will be controlled by TLO or its designated representative, and the passwords will be changed and managed by methods considered to be Best Practices within the data management profession.

Data Storage and Backup

Data storage and backup will be accomplished by methods considered to be Best Practices within the data storage and backup industry.

Data Reporting to CARB

Data reporting to CARB will occur on an annual basis consistent with the requirements of the regulation, Section 93130.17(d), unless a different reporting frequency is specified in the Executive Order issued as approval of this application. The entirety of the Emission Reduction Credit Database and summaries of the data contained in the database will be provided electronically.

9 Emission Reduction Credit - Administration

The Emissions Emission Reduction Credit System will be administered by designated individual(s) within the TLO organization or individuals associated with another business entity that is contracted by TLO for the task of managing and operating the Emission Reduction Credit System.

Designated Individual Roles and Responsibilities

The designated individual will be responsible for the timely entry of data to the Emissions Emission Reduction Credit System, auditing the accuracy of data entry, reporting to CARB, and overall distribution of the emission reduction credits either internally to TLO or to external parties that want the emission reduction credits for compliance with the regulation. The administrator of the system should have qualifications that are consistent with the Best Practices for database development, data entry, data storage and backup, and data reporting in the data management profession.

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10 Program Auditing and Quality Control

As in other emission reduction programs across industries it is expected that the CARB-issued Executive Order would contain the requirements for program auditing and quality control for the various emission reduction scenarios. Since early capture and control of vessel emissions prior to the Rule compliance date is being considered, an independent review of the program prior to the regulatory implementation date would provide assurances that all the proper processes are in place for a longer-term emission reduction credit program. This review would at a minimum cover the actual emissions reduction services and reporting, data flow to the TLO or 3rd party administrator, data entry and data backup, calculation verification for the “unverified” emissions and reporting back to CARB.

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11 Appendices

APPENDIX A

Compliance Call Form for Vessel Using Capture and Control

Event Summary Sample Report						
Event Name:						
Vessel Information						
Carrier:						
Vessel Name:						
Vessel IMO Number:						
IMO NOx Tier						
Vessel Type						
Terminal Information						
Terminal Name						
Port						
Berth Number:						
Vessel Contact Info						
Name						
Phone #						
Email						
Terminal Contact Info						
Name						
Phone #						
Email						
CAECS Information						
CAECS Contact Info						
Name						
Phone #						
Email						
Event: Start End HH:MM:SS						
Time: Start End Duration						
Emission Control Time Start End Duration						
Process Flows						
Units PRID # Ave Min Max						
Inlet scfm						
Outlet scfm						
System Temperatures						
Ship Stack F						
Process Inlet F						
Filters A F						
Filters B F						
Filters C F						
Box A Outlet F						
Box B Outlet F						
Box C Outlet F						
Process Outlet F						
System Pressures						
Ship Stack Pressure ³ H ₂ O						
ICF-144-A D.P. ³ H ₂ O						
ICF-144-B D.P. ³ H ₂ O						
ICF-144-C D.P. ³ H ₂ O						
System Air Pressure psi						
DSI Feed						
DSI Injection Rate lb/hr						
DSI Blower Pressure psi						
DSI Blower Temperature F						
Main Fan						
Fan Speed Hz						
Fan Current Amps						
Other						
Burner Set Point %						
Ammonia						
NH ₃ ppmv						
H ₂ O %w						
Ammonia Flow Rate slpm						
NO _x						
Inlet NO _x ppmv						
Outlet NO _x ppmv						
Inlet O ₂ %w						
Outlet O ₂ %w						
PM						
PM ₁₀ Inlet mg/m ³						
PM ₁₀ Outlet mg/m ³						
ROG						
ROG ₁ Inlet ppmv						
ROG ₁ Outlet ppmv						
System Performance						
Capture Efficiency %						
NO _x Efficiency %						
PM Efficiency %						
ROG Efficiency %						
Vessel Emissions during CAECS						
NO _x g/kwhr						
PM 2.5 g/kwhr						
ROG g/kwhr						

APPENDIX B

Innovative Concept - Vessel Call Utilizing Emission Reduction Credits

Data Report - Vessel Call Utilizing Emission Credits

	Units	Value	Primary Source	Secondary Source	Comments
1 Port Data					
2 Port		Example	Terminal Scheduling	Agent ?	
3 Terminal		Example	Terminal Scheduling	Agent ?	
4 Berth		Example	Terminal Scheduling	Agent ?	
5 Terminal Contact Data					
6 Phone Number - Duty Operator		Example	Terminal Guide	Vessel	
7 Terminal Person in Charge (TPIC)		Example	Terminal Operations	Vessel	
8 TPIC - Telephone		Example	Terminal Operations	Vessel	
9 TPIC - Email		Example	Terminal Operations	Vessel	
10 Vessel Contact Data					
11 Phone Number		Example	Q-88	Terminal	
12 Email		Example	Q-88	Terminal	
13 Vessel Data					
14 Registered Owner		Example	Q-88	Vessel	
15 Vessel Name		Example	Q-88	Vessel	
16 Vessel IMO Number		Example	Q-88	Vessel	
17 Vessel Type		Example	Q-88	Vessel	
18 IMO NOx Tier		Example			
19 Vessel Commercial Operator Contact Information					
20 Name		Example	Q-88	Vessel	
21 Address 1		Example	Q-88	Vessel	
22 Address 2		Example	Q-88	Vessel	
23 City		Example	Q-88	Vessel	
24 State/Province		Example	Q-88	Vessel	
25 Postal Code		Example	Q-88	Vessel	
26 Country		Example	Q-88	Vessel	
27 Telephone		Example	Q-88	Vessel	
28 Email		Example	Q-88	Vessel	
29 Date and Time Data - Vessel					
30 Finished with Engines (FWE)	Date & Time	8/28/21 14:00	Terminal	Vessel	
31 Ready to Work (RTW)	Date & Time	8/28/21 16:27	Terminal	Vessel	
32 Begin Cargo Transfer (BCT)	Date & Time	8/29/21 20:00	Terminal	Vessel	
33 Cargo Transfer Complete (CTC)	Date & Time	8/29/21 13:30	Terminal	Vessel	
34 Pilot On Board (POB)	Date & Time	8/30/21 15:10	Terminal	Vessel	
35 Departure	Date & Time	8/30/21 16:00	Terminal	Vessel	
36 Total Time, At-Berth	hrs	50.0	Calculation		
37 Total Time, RTW to POB	hrs	46.7	Calculation		
38 Total Time, FWE to BCT	hrs	6.0	Calculation		
39 Total Time, BCT to CTC	hrs	41.5	Calculation		
40 Connection Allowance after RTW	hrs	2.0	Calculation		
41 Disconnection Allowance prior to POB	hrs	1.0	Calculation		
42 Total CAECS Required Hours - Aux	hrs	43.7	Calculation		
43 Total CAECS Required Hours - Boiler	hrs	41.5	Calculation		
44 Fuel Data					
45 Type Used (Auxiliary & Boilers)		Diesel	Vessel	Terminal	
46 Sulfur Content	%	0.1	Vessel	Terminal	
47 Bunker ROB (finished with engines) FWE	m3	250.0	Vessel	Terminal	
48 Bunker ROB (begin cargo transfer) BCT	m3	249.0	Vessel	Terminal	
49 Bunker ROB (transfer complete) CTC	m3	229.0	Vessel	Terminal	
50 Bunker ROB (departure)	m3	229.0	Vessel	Terminal	
51 Fuel Density	kg/m3	850.8	MPLX		Technical Reference and to be agreed upon by CARB in the EO
52 Fuel to Energy Ratio - Auxiliary Engines	kg fuel/kW	0.27	CARB		Stipulated by CARB, Section 17(f)(1)(B)
53 Fuel to Energy Ratio - Boilers	kg fuel/kW	0.27	MPLX		This value needs to be developed and agreed to by CARB
54 Fuel Usage Rate (Aux) FWE to BCT	kg/hr	141.8	Calculation		Assumes all fuel is being used by aux engines only, in reality there is some boiler load
55 Fuel Usage Rate (Aux + Boilers) BCT to CTC	kg/hr	389.5	Calculation		Represents fuel used by the aux engines and boilers during cargo transfer
56 Fuel Usage Rate (Boilers) BCT to CTC	kg/hr	247.7	Calculation		Assumes the aux engine usage is continuous during transfer and all remaining fuel is associated with cargo transfer
57 Average Power (Aux) FWE to BCT	kWh	525.2	Calculation		Fuel usage converted to kWh for aux engines
58 Average Power (Boiler) BCT to CTC	kWh	917.5	Calculation		Fuel usage converted to kWh for boilers associated with transfer
59 Total Power Aux Power - CAECS	kW	22,959	Calculation		
60 Total Power Boiler Power - CAECS	kW	38,076	Calculation		
61 Machinery Configuration					
62 Auxiliary Engine, count		3	Q-88	Vessel	Section 10.5 of the Q-88
63 Auxiliary Engine, capacity	kW	680	Q-88	Vessel	Section 10.5 of the Q-88
64 Boiler, count		2	Q-88	Vessel	Section 10.5 of the Q-88
65 Boiler, capacity	MThr	22	Q-88	Vessel	Section 10.5 of the Q-88
66 Cargo Pump, count		3	Q-88	Vessel	Section 8.3 of the Q-88
67 Cargo Pump, type		Centrifugal	Q-88	Vessel	Section 8.3 of the Q-88
68 Cargo Pump, capacity	m3/hr	3,000	Q-88	Vessel	Section 8.3 of the Q-88
69 Cargo Pump, capacity	bbls/hr	18,870			
70 ICS Supply		Flue Gas			Section 8.3 of the Q-88
71 Operations Data					
72 Anticipated Load At-Berth, Aux 1	kW	0	Vessel		This is just an estimate from the vessel and will help with system setup
73 Anticipated Load At-Berth, Aux 1	kW	400	Vessel		This is just an estimate from the vessel and will help with system setup
74 Anticipated Load At-Berth, Aux 1	kW	0	Vessel		This is just an estimate from the vessel and will help with system setup
75 Anticipated Load At-Berth, Boiler 1	ton steam/hr	6	Vessel		This is just an estimate from the vessel and will help with system setup
76 Anticipated Load At-Berth, Boiler 1	ton steam/hr	0	Vessel		This is just an estimate from the vessel and will help with system setup
77 Emission Factors					
78 PM, auxiliary engines	g/kWh	0.14	EO	Regulation	Net reduction required based on values in Section 17.5(d)(1)
79 NOx, auxiliary engines	g/kWh	11.0	EO	Regulation	Net reduction required based on values in Section 17.5(d)(1)
80 ROG, auxiliary engines	g/kWh	0.42	EO	Regulation	Net reduction required based on values in Section 17.5(d)(1)
81 PM, boilers	g/kWh	0.14	EO	Regulation	Net reduction required based on values in Section 17.5(d)(2)
82 NOx, boilers	g/kWh	1.6	EO	Regulation	Net reduction required based on values in Section 17.5(d)(2)
83 ROG, boilers	g/kWh	0.09	EO	Regulation	Net reduction required based on values in Section 17.5(d)(2)
84 PM, auxiliary engines	g	3,214	Calculation		
85 NOx, auxiliary engines	g	252,553	Calculation		
86 ROG, auxiliary engines	g	9,643	Calculation		
87 PM, boilers	g	5,331	Calculation		
88 NOx, boilers	g	60,921	Calculation		
89 ROG, boilers	g	3,427	Calculation		
90 Emissions Requiring IC Credits					
91 PM	lb	19	Calculation		
92 NOx	lb	691	Calculation		
93 ROG	lb	29	Calculation		

APPENDIX C

Innovative Concept Project Maps

Figure C.1: Marine Oil Terminals in Long Beach, Los Angeles

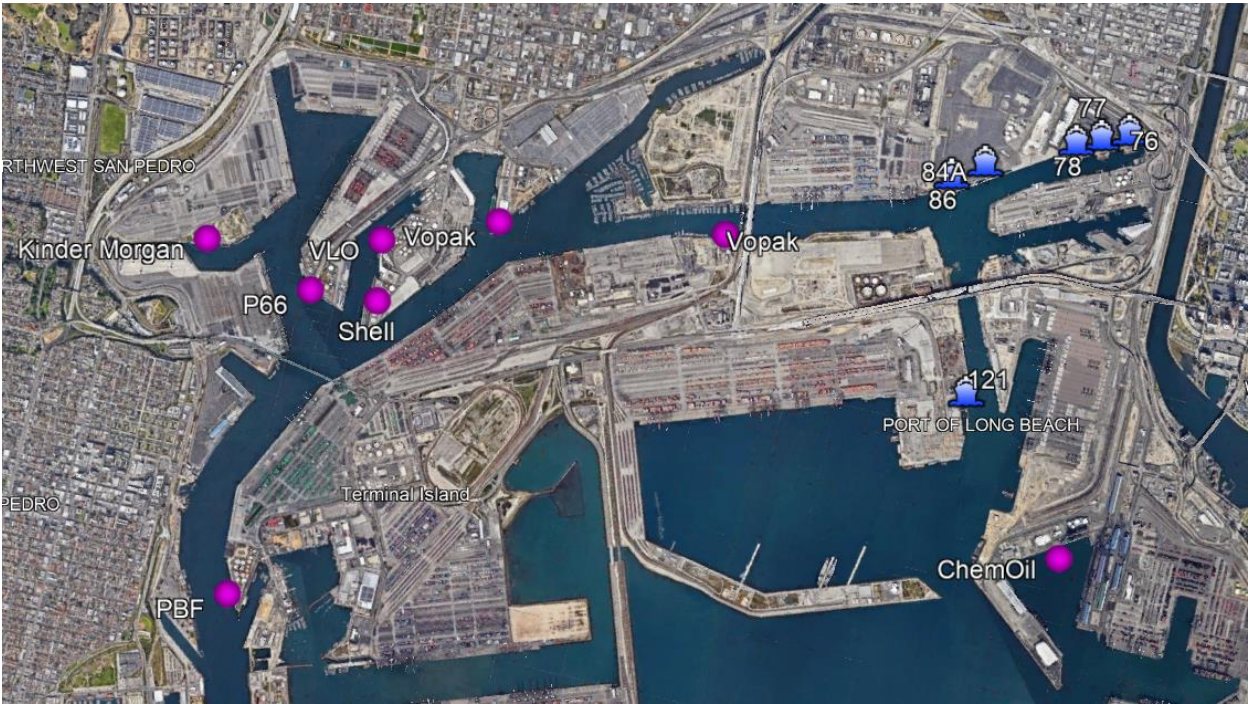
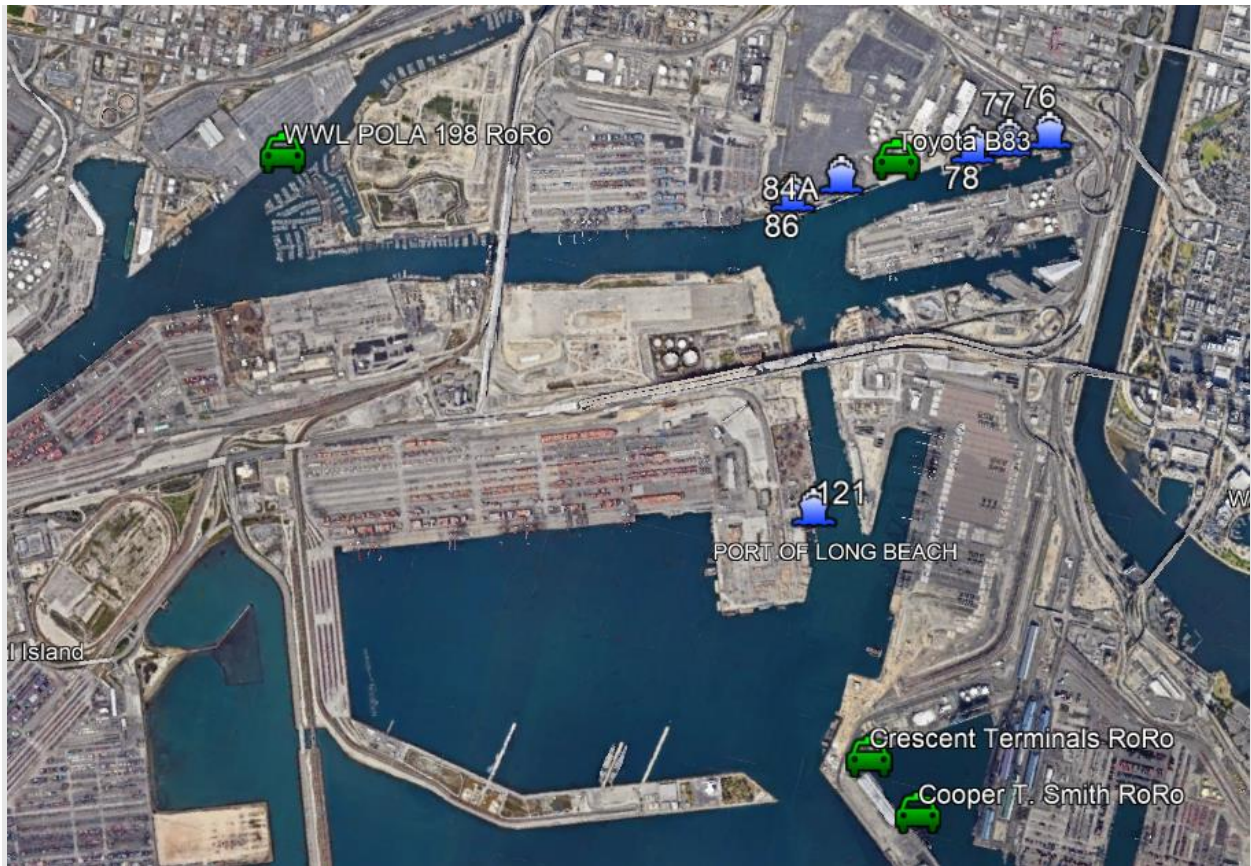


Figure C.2: RoRo Terminals in Long Beach and Los Angeles



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APPENDIX D

Innovative Concept Emission Reduction Calculations

Appendix D-1: Pre-Compliance Emissions Reduction Calculations

Sample Calculation - Early Compliance Emissions Reduction

Sample Calculation to show methodology. Actual emission reduction results will be dependent on operations

	Units	Value	Primary Source	Comments
1 Port Data				
2 Port		Example	Terminal Scheduling	
3 Terminal		Example	Terminal Scheduling	
4 Berth		Example	Terminal Scheduling	
5 Terminal Contact Data				
6 Phone Number - Duty Operator		Example	Terminal Guide	
7 Terminal Person in Charge (TPIC)		Example	Terminal Operations	
8 TPIC - Telephone		Example	Terminal Operations	
9 TPIC - Email		Example	Terminal Operations	
10 Vessel Contact Data				
11 Phone Number		Example	Q-88	
12 Email		Example	Q-88	
13 Vessel Data				
14 Registered Owner		Example	Q-88	
15 Vessel Name		Example	Q-88	
16 Vessel IMO Number		Example	Q-88	
17 Vessel Type		Example	Q-88	
18 IMO NOx Tier		Example		
19 Vessel Commercial Operator Contact Information				
20 Name		Example	Q-88	
21 Address 1		Example	Q-88	
22 Address 2		Example	Q-88	
23 City		Example	Q-88	
24 State/Province		Example	Q-88	
25 Postal Code		Example	Q-88	
26 Country		Example	Q-88	
27 Telephone		Example	Q-88	
28 Email		Example	Q-88	
29 Date and Time Data - Vessel				
30 Finished with Engines (FWE)	Date & Time	1/1/27 0:00	Terminal	
31 Ready to Work (RTW)	Date & Time	1/1/27 2:12	Terminal	
32 Begin Cargo Transfer (BCT)	Date & Time	1/1/27 3:20	Terminal	
33 Cargo Transfer Complete (CTC)	Date & Time	1/1/27 23:30	Terminal	
34 Pilot On Board (POB)	Date & Time	1/2/27 1:00	Terminal	
35 Departure	Date & Time	1/2/27 2:15	Terminal	
36 Total Time, At-Berth	hrs	26.3	Calculation	
37 Total Time, RTW to POB	hrs	22.8	Calculation	
38 Total Time, FWE to BCT	hrs	3.3	Calculation	
39 Total Time, BCT to CTC	hrs	20.2	Calculation	
40 Connection Allowance after RTW	hrs	2.0	Calculation	
41 Disconnection Allowance prior to POB	hrs	1.0	Calculation	
42 Total CAECS Required Hours - Aux	hrs	19.8	Calculation	
43 Total CAECS Required Hours - Boiler	hrs	19.8	Calculation	
44 Vessel Equipment Emission Factors				
45 EPA Engine Tier		2	Vessel	
46 Auxiliary Engine NOx Emission Factor	g/kWh	10.5	CARB	
47 Auxiliary Engine PM 2.5 Emission Factor	g/kWh	0.168	CARB	
48 Auxiliary Engine ROG Emission Factor	g/kWh	0.52	CARB	
49 Boiler NOx Emission Factor	g/kWh	2	CARB	
50 Boiler PM 2.5 Emission Factor	g/kWh	0.151	CARB	
51 Boiler ROG Emission Factor	g/kWh	0.11	CARB	
52 Date and Time Data - CAECS				
53 CAECS Utilized (Shore Power or C&C)		Shore Power		
54 CAECS Connected	Date & Time	1/1/27 2:00	Terminal	
55 CAECS Disconnected	Date & Time	1/2/27 0:30	Terminal	
56 Total Time Controlling Emissions	hrs	22.5	Calculation	
57 CAECS Performance - Capture & Control (C&C)				
58 Inlet NOx	kg	500	Measured Real Time	Instrumentation on CAECS measured for each vessel visit
59 Outlet NOx	kg	5	Measured Real Time	Instrumentation on CAECS measured for each vessel visit
60 NOx Reduction	kg	495.0	Calculation	
61 NOx Reduction Percent	percent	99%	Calculation	
62 Inlet PM 2.5	kg	15	Measured post-visit	Instrumentation on CAECS measured for each vessel visit
63 Outlet PM 2.5	kg	1	Measured post-visit	Instrumentation on CAECS measured for each vessel visit
64 PM 2.5 Reduction	kg	14.0	Calculation	
65 PM 2.5 Reduction Percent	percent	93%	Calculation	
66 Inlet ROG	kg	15	Measured Real Time	Instrumentation on CAECS measured for each vessel visit
67 Outlet ROG	kg	1	Measured Real Time	Instrumentation on CAECS measured for each vessel visit
68 ROG Reduction	kg	14.0	Calculation	
69 ROG Reduction Percent	percent	93%	Calculation	
70 CAECS Performance - Shore Power				
71 Shore Power kWh used	kWh	75,000	Terminal	Metered power
72 Was Shore Power Used for Cargo Operations	Yes/No	Yes	Vessel	
73 Does the Vessel Use Steam Power for Cargo Operations?	Yes/No	Yes	Vessel	
74 Average Cargo Discharge Pressure	psi	150	Vessel	
75 Cargo Barrels Discharged	bbbls	500,000	Vessel	
76 Average Cargo Discharge Flow Rate	bbbls/hr	24,793	Calculation	
77 Cargo Transfer Pump Efficiency		85%	Vessel	
78 Steam Turbine Efficiency		80%	Vessel	
79 Boiler Efficiency		80%	Vessel	
80 Boiler Cargo Transfer Power Used	kWh	41,980	Calculation	
81 Boiler NOx Emissions Eliminated	kg	84.0	Calculation	
82 Boiler PM 2.5 Emissions Reduced	kg	6.3	Calculation	
83 Boiler ROG Emissions Reduced	kg	4.6	Calculation	
84 Auxiliary Engine Power Reduced	kWh	33,020	Calculation	
85 Auxiliary Engine NOx Emissions Reduced	kg	346.7	Calculation	
86 Auxiliary Engine PM 2.5 Emission Reduced	kg	5.5	Calculation	
87 Auxiliary Engine ROG Emission Reduced	kg	17.2	Calculation	
88 Emission Credits Generated				
89 NOx	kg	346.7	Calculation	
90 PM 2.5	kg	5.5	Calculation	
91 ROG	kg	17.2	Calculation	

Appendix D-2A: Shore Side Pumps Infrastructure Emissions Reduction Calculations

Sample Calculation - Shore Side Pumps

Sample Calculation to show methodology. Actual emission reduction results will be dependent on operations

	Units	Value	Primary Source	Comments
1 Port Data				
2 Port		Example	Terminal Scheduling	
3 Terminal		Example	Terminal Scheduling	
4 Berth		Example	Terminal Scheduling	
5 Terminal Contact Data				
6 Phone Number - Duty Operator		Example	Terminal Guide	
7 Terminal Person in Charge (TPIC)		Example	Terminal Operations	
8 TPIC - Telephone		Example	Terminal Operations	
9 TPIC - Email		Example	Terminal Operations	
10 Vessel Contact Data				
11 Phone Number		Example	Q-88	
12 Email		Example	Q-88	
13 Vessel Data				
14 Registered Owner		Example	Q-88	
15 Vessel Name		Example	Q-88	
16 Vessel IMO Number		Example	Q-88	
17 Vessel Type		Example	Q-88	
18 IMO NOx Tier		Example		
19 Vessel Commercial Operator Contact Information				
20 Name		Example	Q-88	
21 Address 1		Example	Q-88	
22 Address 2		Example	Q-88	
23 City		Example	Q-88	
24 State/Province		Example	Q-88	
25 Postal Code		Example	Q-88	
26 Country		Example	Q-88	
27 Telephone		Example	Q-88	
28 Email		Example	Q-88	
29 Date and Time Data - Vessel				
30 Finished with Engines (FWE)	Date & Time	1/1/27 0:00	Terminal	
31 Ready to Work (RTW)	Date & Time	1/1/27 2:12	Terminal	
32 Begin Cargo Transfer (BCT)	Date & Time	1/1/27 3:20	Terminal	
33 Cargo Transfer Complete (CTC)	Date & Time	1/1/27 23:30	Terminal	
34 Pilot On Board (POB)	Date & Time	1/2/27 1:00	Terminal	
35 Departure	Date & Time	1/2/27 2:15	Terminal	
36 Total Time, At-Berth	hrs	26.3	Calculation	
37 Total Time, RTW to POB	hrs	22.8	Calculation	
38 Total Time, FWE to BCT	hrs	3.3	Calculation	
39 Total Time, BCT to CTC	hrs	20.2	Calculation	
40 Connection Allowance after RTW	hrs	2.0	Calculation	
41 Disconnection Allowance prior to POB	hrs	1.0	Calculation	
42 Total CAECS Required Hours - Aux	hrs	19.8	Calculation	
43 Total CAECS Required Hours - Boiler	hrs	20.2	Calculation	
44 Vessel Equipment Emission Factors				
45 EPA Engine Tier		2	Vessel	
46 Auxiliary Engine NOx Emission Factor	g/kWh	10.5	CARB	
47 Auxiliary Engine PM 2.5 Emission Factor	g/kWh	0.168	CARB	
48 Auxiliary Engine ROG Emission Factor	g/kWh	0.52	CARB	
49 Boiler NOx Emission Factor	g/kWh	2	CARB	
50 Boiler PM 2.5 Emission Factor	g/kWh	0.151	CARB	
51 Boiler ROG Emission Factor	g/kWh	0.11	CARB	
52 Shore Side Pumps Use				
53 Vessel Steam Cargo Pumps or Electric?		electric		
54 kWh Metered for Shore Side Pumps	kWh		Terminal	Leave blank if not metered
55 Barrels Discharged	bbbls	500,000	Vessel	
56 Average Suction Pressure	psi	35	Terminal	
57 Average Discharge Pressure	psi	150	Terminal	
58 Pressure Supplied by Shore Side Pumps	psi	115		
59 Average Barrels per Hour	bbbls/hr	24,793		
60 Energy Supplied by Shore Side Pumps	kWh	17,508		
61 Vessel Cargo Transfer Pump Efficiency		85%	Vessel	
62 Steam Turbine Efficiency		80%	Vessel	
63 Boiler Efficiency		80%	Vessel	
64 Boiler Cargo Transfer Power Used	kWh	0	Calculation	
65 Auxiliary Engine Cargo Transfer Power Used	kWh	20,598	Calculation	
66 Emission Credits Generated				
67 NOx	kg	216.3	Calculation	
68 PM 2.5	kg	3.5	Calculation	
69 ROG	kg	10.7	Calculation	

Appendix D-2B: Reduced Time at-berth Emissions Reduction Calculations

Sample Calculation - Reduced Time at Berth, Infrastructure Improvements

Sample Calculation to show methodology. Actual emission reduction results will be dependent on operations

	Units	Value	Primary Source	Comments
1 Port Data				
2 Port		Example	Terminal Scheduling	
3 Terminal		Example	Terminal Scheduling	
4 Berth		Example	Terminal Scheduling	
5 Terminal Contact Data				
6 Phone Number - Duty Operator		Example	Terminal Guide	
7 Terminal Person in Charge (TPIC)		Example	Terminal Operations	
8 TPIC - Telephone		Example	Terminal Operations	
9 TPIC - Email		Example	Terminal Operations	
10 Vessel Contact Data				
11 Phone Number		Example	Q-88	
12 Email		Example	Q-88	
13 Vessel Data				
14 Registered Owner		Example	Q-88	
15 Vessel Name		Example	Q-88	
16 Vessel IMO Number		Example	Q-88	
17 Vessel Type		Example	Q-88	
18 IMO NOx Tier		Example		
19 Vessel Commercial Operator Contact Information				
20 Name		Example	Q-88	
21 Address 1		Example	Q-88	
22 Address 2		Example	Q-88	
23 City		Example	Q-88	
24 State/Province		Example	Q-88	
25 Postal Code		Example	Q-88	
26 Country		Example	Q-88	
27 Telephone		Example	Q-88	
28 Email		Example	Q-88	
29 Date and Time Data - Vessel				
30 Finished with Engines (FWE)	Date & Time	1/1/27 0:00	Terminal	
31 Ready to Work (RTW)	Date & Time	1/1/27 2:12	Terminal	
32 Begin Cargo Transfer (BCT)	Date & Time	1/1/27 3:20	Terminal	
33 Cargo Transfer Complete (CTC)	Date & Time	1/1/27 23:30	Terminal	
34 Pilot On Board (POB)	Date & Time	1/2/27 1:00	Terminal	
35 Departure	Date & Time	1/2/27 2:15	Terminal	
36 Total Time, At-Berth	hrs	26.3	Calculation	
37 Total Time, RTW to POB	hrs	22.8	Calculation	
38 Total Time, FWE to BCT	hrs	3.3	Calculation	
39 Total Time, BCT to CTC	hrs	20.2	Calculation	
40 Connection Allowance after RTW	hrs	2.0	Calculation	
41 Disconnection Allowance prior to POB	hrs	1.0	Calculation	
42 Total CAECS Required Hours - Aux	hrs	19.8	Calculation	
43 Total CAECS Required Hours - Boiler	hrs	20.2	Calculation	
44 Vessel Equipment Emission Factors				
45 EPA Engine Tier		2	Vessel	
46 Auxiliary Engine NOx Emission Factor	g/kWh	10.5	CARB	
47 Auxiliary Engine PM 2.5 Emission Factor	g/kWh	0.168	CARB	
48 Auxiliary Engine ROG Emission Factor	g/kWh	0.52	CARB	
49 Boiler NOx Emission Factor	g/kWh	2	CARB	
50 Boiler PM 2.5 Emission Factor	g/kWh	0.151	CARB	
51 Boiler ROG Emission Factor	g/kWh	0.11	CARB	
52 Reduced Time at berth				
53 Barrels Discharged	bbbls	500,000	Vessel	
54 Average Barrels per Hour Following Improvement	bbbls/hr	24,793	Terminal	
55 Prior to Infrastructure Improvements Avg. Barrels per Hour	bbbls/hr	20,000	Terminal	
56 Increased Discharge Rate	bbbls/hr	4,793		
57 Reduced Time at Berth	hrs	4.8		
58 Fuel Data				
59 Type Used (Auxiliary & Boilers)		Diesel	Q-88	
60 Sulfur Content	%	0.1	Vessel	
61 Bunker ROB (finished with engines) FWE	m3	250.0	Vessel	
62 Bunker ROB (departure)	m3	229.0	Vessel	
63 Fuel Density	kg/m3	850.8	Vessel	
64 Fuel to Energy Ratio - Auxiliary Engines	kg fuel/kWh	0.27	Vessel	Technical Reference and to be agreed upon by CARB in the EO Stipulated by CARB, Section 17(f)(1)(B)
65 Fuel Consumed per Hour	m3/hr	0.80	Calculation	
66 Reduced Fuel Usage	m3	3.87	Calculation	
67 Energy Usage Reduction	kWh	12,184	Calculation	
68 Emission Reductions				
69 Emission Credits Generated				
70 NOx	kg	127.9	Calculation	
71 PM 2.5	kg	2.0	Calculation	
72 ROG	kg	6.3	Calculation	

Appendix D-2C: Pump Efficiency Increase Emissions Reduction Calculations

Sample Calculation - Infrastructure Improvements, Pump Efficiency

Sample Calculation to show methodology. Actual emission reduction results will be dependent on operations

	Units	Value	Primary Source	Comments
1 Port Data				
2	Port	Example	Terminal Scheduling	
3	Terminal	Example	Terminal Scheduling	
4	Berth	Example	Terminal Scheduling	
5 Terminal Contact Data				
6	Phone Number - Duty Operator	Example	Terminal Guide	
7	Terminal Person in Charge (TPIC)	Example	Terminal Operations	
8	TPIC - Telephone	Example	Terminal Operations	
9	TPIC - Email	Example	Terminal Operations	
10 Pump Data				
11	Average Flow Rate	bbbls/hr20,000		
12	Average Pump Pressure (Discharge minus Suction Pressure)	psi150		
13	Pump Efficiency Prior to Improvements	%80%		
14	Pump Efficiency After Improvements	%90%		
15	Energy Saved	kW127		
16	Hours Run (Annual Average)	hrs4,380.0		
17	Power Saved	kWh555,697		
18 Grid Emission Factors				
19	NOx Emission Factor	g/kWh0.4		e-Grid factor (2019)
20	PM Emission Factor	g/kWh0.024		e-Grid factor (2019)
21	ROG Emission Factor	g/kWh0.027		e-Grid factor (2019)
22 Emission Reductions				
23	Emission Credits Generated			
24	NOx	kg	222.3	Calculation
25	PM 2.5	kg	13.3	Calculation
26	ROG	kg	15.0	Calculation

Appendix D-2D: Reduced Vessel Visits Emissions Reduction Calculations

Sample Calculation Vessel Speed Reduction

Sample Calculation to show methodology. Actual emission reduction results will be dependent on operations

	Units	Value	Primary Source	Secondary Source	Comments
1 Port Data					
2 Port		Example	Terminal Scheduling	Agent ?	
3 Terminal		Example	Terminal Scheduling	Agent ?	
4 Berth		Example	Terminal Scheduling	Agent ?	
5 Terminal Contact Data					
6 Phone Number - Duty Operator		Example	Terminal Guide	Vessel	
7 Terminal Person in Charge (TPIC)		Example	Terminal Operations	Vessel	
8 TPIC - Telephone		Example	Terminal Operations	Vessel	
9 TPIC - Email		Example	Terminal Operations	Vessel	
10 Vessel Contact Data					
11 Phone Number		Example	Q-88	Terminal	
12 Email		Example	Q-88	Terminal	
13 Vessel Data					
14 Registered Owner		Example	Q-88	Vessel	
15 Vessel Name		Example	Q-88	Vessel	
16 Vessel IMO Number		Example	Q-88	Vessel	
17 Vessel Type		Example	Q-88	Vessel	
18 IMO NOx Tier		Example			
19 Vessel Commercial Operator Contact Information					
20 Name		Example	Q-88	Vessel	
21 Address 1		Example	Q-88	Vessel	
22 Address 2		Example	Q-88	Vessel	
23 City		Example	Q-88	Vessel	
24 State/Province		Example	Q-88	Vessel	
25 Postal Code		Example	Q-88	Vessel	
26 Country		Example	Q-88	Vessel	
27 Telephone		Example	Q-88	Vessel	
28 Email		Example	Q-88	Vessel	
29 Date and Time Data - Vessel					
30 Finished with Engines (FWE)	Date & Time	8/28/21 14:00	Terminal	Vessel	
31 Ready to Work (RTW)	Date & Time	8/28/21 16:27	Terminal	Vessel	
32 Begin Cargo Transfer (BCT)	Date & Time	8/28/21 20:00	Terminal	Vessel	
33 Cargo Transfer Complete (CTC)	Date & Time	8/30/21 13:30	Terminal	Vessel	
34 Pilot On Board (POB)	Date & Time	8/30/21 15:10	Terminal	Vessel	
35 Departure	Date & Time	8/30/21 16:00	Terminal	Vessel	
36 Total Time, At-Berth	hrs	50.0	Calculation		
37 Total Time, RTW to POB	hrs	46.7	Calculation		
38 Total Time, FWE to BCT	hrs	6.0	Calculation		
39 Total Time, BCT to CTC	hrs	41.5	Calculation		
40 Connection Allowance after RTW	hrs	2.0	Calculation		
41 Disconnection Allowance prior to POB	hrs	1.0	Calculation		
42 Total CAECS Required Hours - Aux	hrs	43.7	Calculation		
43 Total CAECS Required Hours - Boiler	hrs	41.5	Calculation		
44 Propulsion Engine Operating Power: Admiralty Formula					
45 Vessel Installed Propulsion Power	kw	7,000	Vessel		
46 Vessel Speed	kn	8.0	Vessel		
47 Vessel Maximum Speed	kn	12.0	Vessel		
48 Vessel Draft	m	13.0	Vessel		
49 Vessel Maximum Draft	m	14.5	Vessel		
50 Sea Margin	unitless	1.1	Vessel		1.10 for coastal operations, 1.15 for at-sea operations
51 Vessel Power in Transit	kW	2,121			
52 Hours in Transit, 3 Nautical Miles, Round Trip	hrs	0.75			
53 Energy use in Transit, Round Trip	kWh	1,591			
54 Number of Vessel Visits Saved	visits	3			
55 Emission Factors					
56 NOx Emission Factor - Slow Speed Diesel	g/kWh	14.4	EPA	Regulation	EPA Port Emissions Inventory Guidance, Section 3.5
57 PM Emission Factor	g/kWh	0.14	CARB	Regulation	
58 ROG Emission Factor	g/kWh	0.42	CARB	Regulation	
59 NOx Reduction	kg	68.7	Calculation		
60 PM Reduction	kg	0.7	Calculation		
61 ROG Reduction	kg	2.0	Calculation		
Auxiliary Engines & Fuel Data					
Auxiliary Engine NOx Emission Factor	g/kWh	10.5	CARB		
Auxiliary Engine PM 2.5 Emission Factor	g/kWh	0.168	CARB		
Auxiliary Engine ROG Emission Factor	g/kWh	0.52	CARB		
Type Used (Auxiliary & Boilers)		Diesel	Q-88		
Sulfur Content	%	0.1	Vessel		
Fuel Used	m3	1.0	Vessel		
Fuel Density	kg/m3	850.8	Vessel		
Fuel to Energy Ratio - Auxiliary Engines	kg fuel/kW	0.27	Vessel		
Auxiliary Engines Power Usage	kW	3,151.1	Calculation		
Energy Usage Reduction	kWh	7,090.0	Calculation		
NOx Reduction	kg	74.4	Calculation		
PM Reduction	kg	1.2	Calculation		
ROG Reduction	kg	3.7	Calculation		
62 Emissions Credits					
63 NOx	kg	143.2	Calculation		
64 PM 2.5	kg	1.9	Calculation		
65 ROG	kg	5.7	Calculation		

Appendix D-3: Non TLO Tankers Pre-Compliance Emissions Reduction Calculations

Sample Calculation - Tankers Early Compliance

Sample Calculation to show methodology. Actual emission reduction results will be dependent on operations

		Units	Value	Primary Source	Secondary Source	Comments
1	Port Data					
2	Port		Example	Terminal Scheduling	Agent ?	
3	Terminal		Example	Terminal Scheduling	Agent ?	
4	Berth		Example	Terminal Scheduling	Agent ?	
5	Terminal Contact Data					
6	Phone Number - Duty Operator		Example	Terminal Guide	Vessel	
7	Terminal Person in Charge (TPIC)		Example	Terminal Operations	Vessel	
8	TPIC - Telephone		Example	Terminal Operations	Vessel	
9	TPIC - Email		Example	Terminal Operations	Vessel	
10	Vessel Contact Data					
11	Phone Number		Example	Q-88	Terminal	
12	Email		Example	Q-88	Terminal	
13	Vessel Data					
14	Registered Owner		Example	Q-88	Vessel	
15	Vessel Name		Example	Q-88	Vessel	
16	Vessel IMO Number		Example	Q-88	Vessel	
17	Vessel Type		Example	Q-88	Vessel	
18	IMO NOx Tier		Example			
19	Vessel Commercial Operator Contact Information					
20	Name		Example	Q-88	Vessel	
21	Address 1		Example	Q-88	Vessel	
22	Address 2		Example	Q-88	Vessel	
23	City		Example	Q-88	Vessel	
24	State/Province		Example	Q-88	Vessel	
25	Postal Code		Example	Q-88	Vessel	
26	Country		Example	Q-88	Vessel	
27	Telephone		Example	Q-88	Vessel	
28	Email		Example	Q-88	Vessel	
29	Capture & Control (C&C) Operator					
30	Company		Example	C&C Operator	Vessel	
31	Lead Operator		Example	C&C Operator	Vessel	
32	Telephone		Example	C&C Operator	Vessel	
33	Email		Example	C&C Operator	Vessel	
34	Date and Time Data - Vessel					
35	Finished with Engines (FWE)	Date & Time	1/1/27 0:00	Terminal	Vessel	
36	Departure	Date & Time	1/2/27 2:15	Terminal	Vessel	
37	Total Time, At-Berth	hrs	26.3	Calculation		
38	Date and Time Data - Capture & Control System					
39	CAECS Connected	Date & Time	1/1/27 2:00	C&C Operator		
40	CAECS Disconnected	Date & Time	1/2/27 0:30	C&C Operator		
41	Total Time Controlling Emissions	hrs	22.5	Calculation		
42	CAECS Performance - Capture & Control (C&C)					
43	Inlet NOx	kg	500	C&C Operator	Measured Real Time	
44	Outlet NOx	kg	5	C&C Operator	Measured Real Time	
45	NOx Reduction	kg	495.0	Calculation		
46	NOx Reduction Percent	percent	99%	Calculation		
47	Inlet PM 2.5	kg	15	C&C Operator	Measured post-visit	
48	Outlet PM 2.5	kg	1	C&C Operator	Measured post-visit	
49	PM 2.5 Reduction	kg	14.0	Calculation		
50	PM 2.5 Reduction Percent	percent	93%	Calculation		
51	Inlet ROG	kg	15	C&C Operator	Measured Real Time	
52	Outlet ROG	kg	1	C&C Operator	Measured Real Time	
53	ROG Reduction	kg	14.0	Calculation		
54	ROG Reduction Percent	percent	93%	Calculation		
55	Emission Credits Generated					
56	NOx	kg	495.0	Calculation		
57	PM 2.5	kg	14.0	Calculation		
58	ROG	kg	14.0	Calculation		

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Appendix D-4: RoRo Pre-Compliance Emissions Reduction Calculations

Sample Calculation - RoRo Early Compliance

Sample Calculation to show methodology. Actual emission reduction results will be dependent on operations

	Units	Value	Primary Source	Secondary Source	Comments
1 Port Data					
2	Port	Example	Terminal Scheduling	Agent ?	
3	Terminal	Example	Terminal Scheduling	Agent ?	
4	Berth	Example	Terminal Scheduling	Agent ?	
5 Terminal Contact Data					
6	Phone Number - Duty Operator	Example	Terminal Guide	Vessel	
7	Terminal Person in Charge (TPIC)	Example	Terminal Operations	Vessel	
8	TPIC - Telephone	Example	Terminal Operations	Vessel	
9	TPIC - Email	Example	Terminal Operations	Vessel	
10 Vessel Contact Data					
11	Phone Number	Example	Q-88	Terminal	
12	Email	Example	Q-88	Terminal	
13 Vessel Data					
14	Registered Owner	Example	Q-88	Vessel	
15	Vessel Name	Example	Q-88	Vessel	
16	Vessel IMO Number	Example	Q-88	Vessel	
17	Vessel Type	Example	Q-88	Vessel	
18	IMO NOx Tier	Example			
19 Vessel Commercial Operator Contact Information					
20	Name	Example	Q-88	Vessel	
21	Address 1	Example	Q-88	Vessel	
22	Address 2	Example	Q-88	Vessel	
23	City	Example	Q-88	Vessel	
24	State/Province	Example	Q-88	Vessel	
25	Postal Code	Example	Q-88	Vessel	
26	Country	Example	Q-88	Vessel	
27	Telephone	Example	Q-88	Vessel	
28	Email	Example	Q-88	Vessel	
29 Capture & Control (C&C) Operator					
30	Company	Example	C&C Operator	Vessel	
31	Lead Operator	Example	C&C Operator	Vessel	
32	Telephone	Example	C&C Operator	Vessel	
33	Email	Example	C&C Operator	Vessel	
34 Date and Time Data - Vessel					
35	Finished with Engines (FWE)	Date & Time	1/1/27 0:00	Terminal	Vessel
36	Departure	Date & Time	1/2/27 2:15	Terminal	Vessel
37	Total Time, At-Berth	hrs	26.3	Calculation	
38 Date and Time Data - Capture & Control System					
39	CAECS Connected	Date & Time	1/1/27 2:00	C&C Operator	
40	CAECS Disconnected	Date & Time	1/2/27 0:30	C&C Operator	
41	Total Time Controlling Emissions	hrs	22.5	Calculation	
42 CAECS Performance - Capture & Control (C&C)					
43	Inlet NOx	kg	500	C&C Operator	Measured Real Time
44	Outlet NOx	kg	5	C&C Operator	Measured Real Time
45	NOx Reduction	kg	495.0	Calculation	
46	NOx Reduction Percent	percent	99%	Calculation	
47	Inlet PM 2.5	kg	15	C&C Operator	Measured post-visit
48	Outlet PM 2.5	kg	1	C&C Operator	Measured post-visit
49	PM 2.5 Reduction	kg	14.0	Calculation	
50	PM 2.5 Reduction Percent	percent	93%	Calculation	
51	Inlet ROG	kg	15	C&C Operator	Measured Real Time
52	Outlet ROG	kg	1	C&C Operator	Measured Real Time
53	ROG Reduction	kg	14.0	Calculation	
54	ROG Reduction Percent	percent	93%	Calculation	
55 Emission Credits Generated					
56	NOx	kg	495.0	Calculation	
57	PM 2.5	kg	14.0	Calculation	
58	ROG	kg	14.0	Calculation	

Appendix D-5: Bulk Liquid Barge Emissions Reduction Calculations

Sample Calculation - Bulk Liquid Barges

Sample Calculation to show methodology. Actual emission reduction results will be dependent on operations

	Units	Value	Primary Source	Comments
1 Port Data				
2 Port		Example	Terminal Scheduling	
3 Terminal		Example	Terminal Scheduling	
4 Berth		Example	Terminal Scheduling	
5 Terminal Contact Data				
6 Phone Number - Duty Operator		Example	Terminal Guide	
7 Terminal Person in Charge (TPIC)		Example	Terminal Operations	
8 TPIC - Telephone		Example	Terminal Operations	
9 TPIC - Email		Example	Terminal Operations	
10 Vessel Contact Data				
11 Phone Number		Example	Q-88	
12 Email		Example	Q-88	
13 Vessel Data				
14 Registered Owner		Example	Q-88	
15 Vessel Name		Example	Q-88	
16 Vessel IMO Number		Example	Q-88	
17 Vessel Type		Example	Q-88	
18 IMO NOx Tier		Example		
19 Barge Commercial Operator Contact Information				
20 Name		Example	Q-88	
21 Address 1		Example	Q-88	
22 Address 2		Example	Q-88	
23 City		Example	Q-88	
24 State/Province		Example	Q-88	
25 Postal Code		Example	Q-88	
26 Country		Example	Q-88	
27 Telephone		Example	Q-88	
28 Email		Example	Q-88	
29 Date and Time Data - Vessel				
30 Finished with Engines (FWE)	Date & Time	1/1/27 0:00	Terminal	
31 Ready to Work (RTW)	Date & Time	1/1/27 2:12	Terminal	
32 Begin Cargo Transfer (BCT)	Date & Time	1/1/27 3:20	Terminal	
33 Cargo Transfer Complete (CTC)	Date & Time	1/1/27 23:30	Terminal	
34 Pilot On Board (POB)	Date & Time	1/2/27 1:00	Terminal	
35 Departure	Date & Time	1/2/27 2:15	Terminal	
36 Total Time, At-Berth	hrs	26.3	Calculation	
37 Total Time, RTW to POB	hrs	22.8	Calculation	
38 Total Time, FWE to BCT	hrs	3.3	Calculation	
39 Total Time, BCT to CTC	hrs	20.2	Calculation	
40 Connection Allowance after RTW	hrs	2.0	Calculation	
41 Disconnection Allowance prior to POB	hrs	1.0	Calculation	
42 Total CAECS Required Hours - Aux	hrs	19.8	Calculation	
43 Total CAECS Required Hours - Boiler	hrs	20.2	Calculation	
44 Vessel Equipment Emission Factors				
45 EPA Engine Tier		2	Vessel	
46 Auxiliary Engine NOx Emission Factor	g/kWh	10.5	CARB	
47 Auxiliary Engine PM 2.5 Emission Factor	g/kWh	0.168	CARB	
48 Auxiliary Engine ROG Emission Factor	g/kWh	0.52	CARB	
49 Boiler NOx Emission Factor	g/kWh	2	CARB	
50 Boiler PM 2.5 Emission Factor	g/kWh	0.151	CARB	
51 Boiler ROG Emission Factor	g/kWh	0.11	CARB	
52 Date and Time Data - CAECS				
53 CAECS Utilized (Shore Power or C&C)		C&C		
54 CAECS Connected	Date & Time	1/1/27 2:00	Terminal	
55 CAECS Disconnected	Date & Time	1/2/27 0:30	Terminal	
56 Total Time Controlling Emissions	hrs	22.5	Calculation	
57 CAECS Performance - Capture & Control (C&C)				
58 Inlet NOx	kg	500	Measured Real Time	
59 Outlet NOx	kg	5	Measured Real Time	
60 NOx Reduction	kg	495.0	Calculation	
61 NOx Reduction Percent	percent	99%	Calculation	
62 Inlet PM 2.5	kg	15	Measured post-visit	
63 Outlet PM 2.5	kg	1	Measured post-visit	
64 PM 2.5 Reduction	kg	14.0	Calculation	
65 PM 2.5 Reduction Percent	percent	93%	Calculation	
66 Inlet ROG	kg	15	Measured Real Time	
67 Outlet ROG	kg	1	Measured Real Time	
68 ROG Reduction	kg	14.0	Calculation	
69 ROG Reduction Percent	percent	93%	Calculation	
70 CAECS Performance - Shore Power				
71 Shore Power kWh used	kWh	75,000	Terminal	
72 Was Shore Power Used for Cargo Operations	Yes/No	Yes	Vessel	
73 Does the Vessel Use Steam Power for Cargo Operations?	Yes/No	Yes	Vessel	
74 Average Cargo Discharge Pressure	psi	150	Vessel	
75 Cargo Barrels Discharged	bbls	500,000	Vessel	
76 Average Cargo Discharge Flow Rate	bbls/hr	24,793	Calculation	
77 Cargo Transfer Pump Efficiency		85%	Vessel	
78 Steam Turbine Efficiency		80%	Vessel	
79 Boiler Efficiency		80%	Vessel	
80 Boiler Cargo Transfer Power Used	kWh	41,980	Calculation	
81 Boiler NOx Emissions Eliminated	kg	84.0	Calculation	
82 Boiler PM 2.5 Emissions Reduced	kg	6.3	Calculation	
83 Boiler ROG Emissions Reduced	kg	4.6	Calculation	
84 Auxiliary Engine Power Reduced	kWh	33,020	Calculation	
85 Auxiliary Engine NOx Emissions Reduced	kg	346.7	Calculation	
86 Auxiliary Engine PM 2.5 Emission Reduced	kg	5.5	Calculation	
87 Auxiliary Engine ROG Emission Reduced	kg	17.2	Calculation	
88 Emission Credits Generated				
89 NOx	kg	495.0	Calculation	
90 PM 2.5	kg	14.0	Calculation	
91 ROG	kg	14.0	Calculation	

Appendix D-6: Bulk & General Cargo Emissions Reduction Calculations

Sample Calculation - Bulk & General Cargo Vessel Visit

Sample Calculation to show methodology. Actual emission reduction results will be dependent on operations

		Units	Value	Primary Source	Secondary Source	Comments
1 Port Data						
2	Port		Example	Terminal Scheduling	Agent ?	
3	Terminal		Example	Terminal Scheduling	Agent ?	
4	Berth		Example	Terminal Scheduling	Agent ?	
5 Terminal Contact Data						
6	Phone Number - Duty Operator		Example	Terminal Guide	Vessel	
7	Terminal Person in Charge (TPIC)		Example	Terminal Operations	Vessel	
8	TPIC - Telephone		Example	Terminal Operations	Vessel	
9	TPIC - Email		Example	Terminal Operations	Vessel	
10 Vessel Contact Data						
11	Phone Number		Example	Q-88	Terminal	
12	Email		Example	Q-88	Terminal	
13 Vessel Data						
14	Registered Owner		Example	Q-88	Vessel	
15	Vessel Name		Example	Q-88	Vessel	
16	Vessel IMO Number		Example	Q-88	Vessel	
17	Vessel Type		Example	Q-88	Vessel	
18	IMO NOx Tier		Example			
19 Vessel Commercial Operator Contact Information						
20	Name		Example	Q-88	Vessel	
21	Address 1		Example	Q-88	Vessel	
22	Address 2		Example	Q-88	Vessel	
23	City		Example	Q-88	Vessel	
24	State/Province		Example	Q-88	Vessel	
25	Postal Code		Example	Q-88	Vessel	
26	Country		Example	Q-88	Vessel	
27	Telephone		Example	Q-88	Vessel	
28	Email		Example	Q-88	Vessel	
29 Capture & Control (C&C) Operator						
30	Company		Example	C&C Operator	Vessel	
31	Lead Operator		Example	C&C Operator	Vessel	
32	Telephone		Example	C&C Operator	Vessel	
33	Email		Example	C&C Operator	Vessel	
34 Date and Time Data - Vessel						
35	Finished with Engines (FWE)	Date & Time	1/1/27 0:00	Terminal	Vessel	
36	Departure	Date & Time	1/2/27 2:15	Terminal	Vessel	
37	Total Time, At-Berth	hrs	26.3	Calculation		
38 Date and Time Data - Capture & Control System						
39	CAECS Connected	Date & Time	1/1/27 2:00	C&C Operator		
40	CAECS Disconnected	Date & Time	1/2/27 0:30	C&C Operator		
41	Total Time Controlling Emissions	hrs	22.5	Calculation		
42 CAECS Performance - Capture & Control (C&C)						
43	Inlet NOx	kg	500	C&C Operator	Measured Real Time	
44	Outlet NOx	kg	5	C&C Operator	Measured Real Time	
45	NOx Reduction	kg	495.0	Calculation		
46	NOx Reduction Percent	percent	99%	Calculation		
47	Inlet PM 2.5	kg	15	C&C Operator	Measured post-visit	
48	Outlet PM 2.5	kg	1	C&C Operator	Measured post-visit	
49	PM 2.5 Reduction	kg	14.0	Calculation		
50	PM 2.5 Reduction Percent	percent	93%	Calculation		
51	Inlet ROG	kg	15	C&C Operator	Measured Real Time	
52	Outlet ROG	kg	1	C&C Operator	Measured Real Time	
53	ROG Reduction	kg	14.0	Calculation		
54	ROG Reduction Percent	percent	93%	Calculation		
55 Emission Credits Generated						
56	NOx	kg	495.0	Calculation		
57	PM 2.5	kg	14.0	Calculation		
58	ROG	kg	14.0	Calculation		

Appendix D-7: Container Vessels at Anchor Emissions Reduction Calculations

Sample Calculation - Container Vessel at Anchor

Sample Calculation to show methodology. Actual emission reduction results will be dependent on operations

	Units	Value	Primary Source	Secondary Source	Comments
1 Anchorage Data					
2	Port	Example	Terminal Scheduling	Agent ?	
3	Terminal	Example	Terminal Scheduling	Agent ?	
4	Berth	Example	Terminal Scheduling	Agent ?	
5 Terminal Contact Data					
6	Phone Number - Duty Operator	Example	Terminal Guide	Vessel	
7	Terminal Person in Charge (TPIC)	Example	Terminal Operations	Vessel	
8	TPIC - Telephone	Example	Terminal Operations	Vessel	
9	TPIC - Email	Example	Terminal Operations	Vessel	
10 Vessel Contact Data					
11	Phone Number	Example	Q-88	Terminal	
12	Email	Example	Q-88	Terminal	
13 Vessel Data					
14	Registered Owner	Example	Q-88	Vessel	
15	Vessel Name	Example	Q-88	Vessel	
16	Vessel IMO Number	Example	Q-88	Vessel	
17	Vessel Type	Example	Q-88	Vessel	
18	IMO NOx Tier	Example			
19 Vessel Commercial Operator Contact Information					
20	Name	Example	Q-88	Vessel	
21	Address 1	Example	Q-88	Vessel	
22	Address 2	Example	Q-88	Vessel	
23	City	Example	Q-88	Vessel	
24	State/Province	Example	Q-88	Vessel	
25	Postal Code	Example	Q-88	Vessel	
26	Country	Example	Q-88	Vessel	
27	Telephone	Example	Q-88	Vessel	
28	Email	Example	Q-88	Vessel	
29 Capture & Control (C&C) Operator					
30	Company	Example	C&C Operator	Vessel	
31	Lead Operator	Example	C&C Operator	Vessel	
32	Telephone	Example	C&C Operator	Vessel	
33	Email	Example	C&C Operator	Vessel	
34 Date and Time Data - Capture & Control System					
35	CAECS Connected	Date & Time 1/1/27 2:00	C&C Operator		
36	CAECS Disconnected	Date & Time 1/2/27 0:30	C&C Operator		
37	Total Time Controlling Emissions	hrs 22.5	Calculation		
38 CAECS Performance - Capture & Control (C&C)					
39	Inlet NOx	kg 500	C&C Operator		Measured Real Time
40	Outlet NOx	kg 5	C&C Operator		Measured Real Time
41	NOx Reduction	kg 495.0	Calculation		
42	NOx Reduction Percent	percent 99%	Calculation		
43	Inlet PM 2.5	kg 15	C&C Operator		Measured post-visit
44	Outlet PM 2.5	kg 1	C&C Operator		Measured post-visit
45	PM 2.5 Reduction	kg 14.0	Calculation		
46	PM 2.5 Reduction Percent	percent 93%	Calculation		
47	Inlet ROG	kg 15	C&C Operator		Measured Real Time
48	Outlet ROG	kg 1	C&C Operator		Measured Real Time
49	ROG Reduction	kg 14.0	Calculation		
50	ROG Reduction Percent	percent 93%	Calculation		
51	Emission Credits Generated				
52	NOx	kg 495.0	Calculation		Measure performance less required performance
53	PM 2.5	kg 14.0	Calculation		
54	ROG	kg 14.0	Calculation		

Appendix D-8: Quick Connection and Disconnection Times Emissions Reduction Calculations

Sample Calculation - Quick Connection / Disconnection Emissions Reduction

Sample Calculation to show methodology. Actual emission reduction results will be dependent on operations

	Units	Value	Primary Source	Comments
1 Port Data				
2 Port		Example	Terminal Scheduling	
3 Terminal		Example	Terminal Scheduling	
4 Berth		Example	Terminal Scheduling	
5 Terminal Contact Data				
6 Phone Number - Duty Operator		Example	Terminal Guide	
7 Terminal Person in Charge (TPIC)		Example	Terminal Operations	
8 TPIC - Telephone		Example	Terminal Operations	
9 TPIC - Email		Example	Terminal Operations	
10 Vessel Contact Data				
11 Phone Number		Example	Q-88	
12 Email		Example	Q-88	
13 Vessel Data				
14 Registered Owner		Example	Q-88	
15 Vessel Name		Example	Q-88	
16 Vessel IMO Number		Example	Q-88	
17 Vessel Type		Example	Q-88	
18 IMO NOx Tier		Example	Q-88	
19 Vessel Commercial Operator Contact Information				
20 Name		Example	Q-88	
21 Address 1		Example	Q-88	
22 Address 2		Example	Q-88	
23 City		Example	Q-88	
24 State/Province		Example	Q-88	
25 Postal Code		Example	Q-88	
26 Country		Example	Q-88	
27 Telephone		Example	Q-88	
28 Email		Example	Q-88	
29 Date and Time Data - Vessel				
30 Finished with Engines (FWE)	Date & Time	1/1/27 0:00	Terminal	
31 Ready to Work (RTW)	Date & Time	1/1/27 2:12	Terminal	
32 Begin Cargo Transfer (BCT)	Date & Time	1/1/27 3:20	Terminal	
33 Cargo Transfer Complete (CTC)	Date & Time	1/1/27 23:30	Terminal	
34 Pilot On Board (POB)	Date & Time	1/2/27 1:00	Terminal	
35 Departure	Date & Time	1/2/27 2:15	Terminal	
36 Total Time, At-Berth	hrs	26.3	Calculation	
37 Total Time, RTW to POB	hrs	22.8	Calculation	
38 Total Time, FWE to BCT	hrs	3.3	Calculation	
39 Total Time, BCT to CTC	hrs	20.2	Calculation	
40 Connection Allowance after RTW	hrs	2.0	Calculation	
41 Time Required to Control after RTW	Date & Time	1/1/27 4:12	Calculation	
42 Disconnection Allowance prior to POB	hrs	1.0	Calculation	
43 Time Required to Control prior to POB	Date & Time	1/2/27 0:00	Calculation	
44 Total CAECS Required Hours - Aux	hrs	19.8	Calculation	
45 Total CAECS Required Hours - Boiler	hrs	20.2	Calculation	
46 Vessel Equipment Emission Factors				
47 EPA Engine Tier		2	Vessel	
48 Auxiliary Engine NOx Emission Factor	g/kWh	10.5	CARB	
49 Auxiliary Engine PM 2.5 Emission Factor	g/kWh	0.168	CARB	
50 Auxiliary Engine ROG Emission Factor	g/kWh	0.52	CARB	
51 Boiler NOx Emission Factor	g/kWh	2	CARB	
52 Boiler PM 2.5 Emission Factor	g/kWh	0.151	CARB	
53 Boiler ROG Emission Factor	g/kWh	0.11	CARB	
54 Date and Time Data - CAECS				
55 CAECS Utilized (Shore Power or C&C)		C&C		
56 CAECS Connected	Date & Time	1/1/27 2:30	Terminal	
57 CAECS Disconnected	Date & Time	1/2/27 0:30	Terminal	
58 Total Time Controlling Emissions	hrs	22.0	Calculation	
59 Hours of Emissions Controlled Exceeding Requirement (Connection)	hrs	1.7		
60 Hours of Emissions Controlled Exceeding Requirement (Disconnection)	hrs	0.5		
61 Measured Emissions Reductions (Capture & Control)				
62 Measured NOx Reductions due to Quick Connect / Disconnect	kg	500	C&C Operator	
63 Measured PM 2.5 Reductions due to Quick Connect / Disconnect	kg	7	C&C Operator	
64 Measured ROG Reductions due to Quick Connect / Disconnect	kg	15	C&C Operator	
65 Fuel Data				
66 Type Used (Auxiliary & Boilers)		Diesel		
67 Sulfur Content	%	0.1	Calculation	
68 Bunker ROB (finished with engines) FWE	m3	250.0	Calculation	
69 Bunker ROB (departure)	m3	229.0	Calculation	
70 Fuel Density	kg/m3	850.8	Calculation	
71 Fuel to Energy Ratio - Auxiliary Engines	kg fuel/kWh	0.27	Calculation	Technical Reference and to be agreed upon by CARB in the EO
72 Fuel Consumed per Hour	m3/hr	0.80		Stipulated by CARB, Section 17(f)(1)(B)
73 Reduced Fuel Usage	m3	1.76		
74 Reduced Energy Used	kWh	5,546		
75 Emission Credits Generated				
76 NOx	kg	58.2	Calculation	Reduced Energy Used (Line 74) x Fuel to Energy Ratio x Emission Factors
77 PM 2.5	kg	0.9	Calculation	
78 ROG	kg	2.9	Calculation	

Appendix D-9: Vessel Speed Reduction Emissions Reduction Calculations

Sample Calculation Vessel Speed Reduction

Sample Calculation to show methodology. Actual emission reduction results will be dependent on operations

	Units	Value	Primary Source	Secondary Source	Comments
1 Port Data					
2	Port	Example	Terminal Scheduling	Agent ?	
3	Terminal	Example	Terminal Scheduling	Agent ?	
4	Berth	Example	Terminal Scheduling	Agent ?	
5 Terminal Contact Data					
6	Phone Number - Duty Operator	Example	Terminal Guide	Vessel	
7	Terminal Person in Charge (TPIC)	Example	Terminal Operations	Vessel	
8	TPIC - Telephone	Example	Terminal Operations	Vessel	
9	TPIC - Email	Example	Terminal Operations	Vessel	
10 Vessel Contact Data					
11	Phone Number	Example	Q-88	Terminal	
12	Email	Example	Q-88	Terminal	
13 Vessel Data					
14	Registered Owner	Example	Q-88	Vessel	
15	Vessel Name	Example	Q-88	Vessel	
16	Vessel IMO Number	Example	Q-88	Vessel	
17	Vessel Type	Example	Q-88	Vessel	
18	IMO NOx Tier	Example			
19 Vessel Commercial Operator Contact Information					
20	Name	Example	Q-88	Vessel	
21	Address 1	Example	Q-88	Vessel	
22	Address 2	Example	Q-88	Vessel	
23	City	Example	Q-88	Vessel	
24	State/Province	Example	Q-88	Vessel	
25	Postal Code	Example	Q-88	Vessel	
26	Country	Example	Q-88	Vessel	
27	Telephone	Example	Q-88	Vessel	
28	Email	Example	Q-88	Vessel	
29 Date and Time Data - Vessel					
30	Finished with Engines (FWE)	Date & Time 8/28/21 14:00	Terminal	Vessel	
31	Ready to Work (RTW)	Date & Time 8/28/21 16:27	Terminal	Vessel	
32	Begin Cargo Transfer (BCT)	Date & Time 8/28/21 20:00	Terminal	Vessel	
33	Cargo Transfer Complete (CTC)	Date & Time 8/30/21 13:30	Terminal	Vessel	
34	Pilot On Board (POB)	Date & Time 8/30/21 15:10	Terminal	Vessel	
35	Departure	Date & Time 8/30/21 16:00	Terminal	Vessel	
36	Total Time, At-Berth	hrs 50.0	Calculation		
37	Total Time, RTW to POB	hrs 46.7	Calculation		
38	Total Time, FWE to BCT	hrs 6.0	Calculation		
39	Total Time, BCT to CTC	hrs 41.5	Calculation		
40	Connection Allowance after RTW	hrs 2.0	Calculation		
41	Disconnection Allowance prior to POB	hrs 1.0	Calculation		
42	Total CAECS Required Hours - Aux	hrs 43.7	Calculation		
43	Total CAECS Required Hours - Boiler	hrs 41.5	Calculation		
44 Propulsion Engine Operating Power: Admiralty Formula					
45	Vessel Installed Propulsion Power	kw 7,000	Vessel		
46	Vessel Speed Before Reduction	kn 10.0	Vessel		
47	Vessel Speed After Reduction	kn 8.0	Vessel		
48	Vessel Maximum Speed	kn 12.0	Vessel		
49	Vessel Draft	m 13.0	Vessel		
50	Vessel Maximum Draft	m 14.5	Vessel		
51	Sea Margin	unitless 1.1	Vessel		1.10 for coastal operations, 1.15 for at-sea operations
52	Propulsion Engine Operating Power Before Reduction	kW 4,143			
53	Propulsion Engine Operating Power After Reduction	kW 2,121			
54	Engine Power Reduction	kW 2,022			
55	Time for 3 Nautical Miles	hrs 0.4			
56	kWh Reduction Round Trip	kWh 1,516			
57 Emission Factors					
58	NOx Emission Factor	g/kWh 14.4	EPA	Regulation	EPA Port Emissions Inventory Guidance, Section 3.5
59	PM Emission Factor	g/kWh 0.14	CARB	Regulation	Net reduction required based on values in Section 17.5.(d)(1)
60	ROG Emission Factor	g/kWh 0.42	CARB	Regulation	Net reduction required based on values in Section 17.5.(d)(1)
61	NOx Reduction	kg 21.8	Calculation		
62	PM Reduction	kg 0.2	Calculation		
63	ROG Reduction	kg 0.6	Calculation		
64 Emissions Credits					
65	NOx	kg 21.8	Calculation		
66	PM 2.5	kg 0.2	Calculation		
67	ROG	kg 0.6	Calculation		

Appendix D-10: Capture & Control Overperformance Emissions Reduction Calculations

Sample Calculation - Container Vessel at Anchor

Sample Calculation to show methodology. Actual emission reduction results will be dependent on operations

	Units	Value	Primary Source	Secondary Source	Comments
1 Anchorage Data					
2	Port	Example	Terminal Scheduling	Agent ?	
3	Terminal	Example	Terminal Scheduling	Agent ?	
4	Berth	Example	Terminal Scheduling	Agent ?	
5 Terminal Contact Data					
6	Phone Number - Duty Operator	Example	Terminal Guide	Vessel	
7	Terminal Person in Charge (TPIC)	Example	Terminal Operations	Vessel	
8	TPIC - Telephone	Example	Terminal Operations	Vessel	
9	TPIC - Email	Example	Terminal Operations	Vessel	
10 Vessel Contact Data					
11	Phone Number	Example	Q-88	Terminal	
12	Email	Example	Q-88	Terminal	
13 Vessel Data					
14	Registered Owner	Example	Q-88	Vessel	
15	Vessel Name	Example	Q-88	Vessel	
16	Vessel IMO Number	Example	Q-88	Vessel	
17	Vessel Type	Example	Q-88	Vessel	
18	IMO NOx Tier	Example			
19 Vessel Commercial Operator Contact Information					
20	Name	Example	Q-88	Vessel	
21	Address 1	Example	Q-88	Vessel	
22	Address 2	Example	Q-88	Vessel	
23	City	Example	Q-88	Vessel	
24	State/Province	Example	Q-88	Vessel	
25	Postal Code	Example	Q-88	Vessel	
26	Country	Example	Q-88	Vessel	
27	Telephone	Example	Q-88	Vessel	
28	Email	Example	Q-88	Vessel	
29 Capture & Control (C&C) Operator					
30	Company	Example	C&C Operator	Vessel	
31	Lead Operator	Example	C&C Operator	Vessel	
32	Telephone	Example	C&C Operator	Vessel	
33	Email	Example	C&C Operator	Vessel	
34 Date and Time Data - Capture & Control System					
35	CAECS Connected	Date & Time 1/1/27 2:00	C&C Operator		
36	CAECS Disconnected	Date & Time 1/2/27 0:30	C&C Operator		
37	Total Time Controlling Emissions	hrs 22.5	Calculation		
38 CAECS Performance - Capture & Control (C&C)					
39	Inlet NOx	kg 500	C&C Operator		Measured Real Time
40	Outlet NOx	kg 5	C&C Operator		Measured Real Time
41	NOx Reduction	kg 495.0	Calculation		
42	NOx Reduction Percent	percent 99%	Calculation		
43	NOx Reduction Required (80%)	kg 400.0			
44	Inlet PM 2.5	kg 15	C&C Operator		Measured post-visit
45	Outlet PM 2.5	kg 1	C&C Operator		Measured post-visit
46	PM 2.5 Reduction	kg 14.0	Calculation		
47	PM 2.5 Reduction Percent	percent 93%	Calculation		
48	PM 2.5 Reduction Required (80%)	kg 12.0			
49	Inlet ROG	kg 15	C&C Operator		Measured Real Time
50	Outlet ROG	kg 1	C&C Operator		Measured Real Time
51	ROG Reduction	kg 14.0	Calculation		
52	ROG Reduction Percent	percent 93%	Calculation		
53	ROG Reduction Required (80%)	kg 12.0			
54	Emission Credits Generated				
55	NOx	kg 95.0	Calculation		
56	PM 2.5	kg 2.0	Calculation		
57	ROG	kg 2.0	Calculation		